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MD630-INT Series General-Purpose AC Drive

User Guide

Industrial Automation | New Energy Vehicle | Intelligent Elevator | Intelligent Robot | Digital Energy | Rail Transit

Data code PS00019852B01

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The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

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The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

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Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

Preface

Introduction

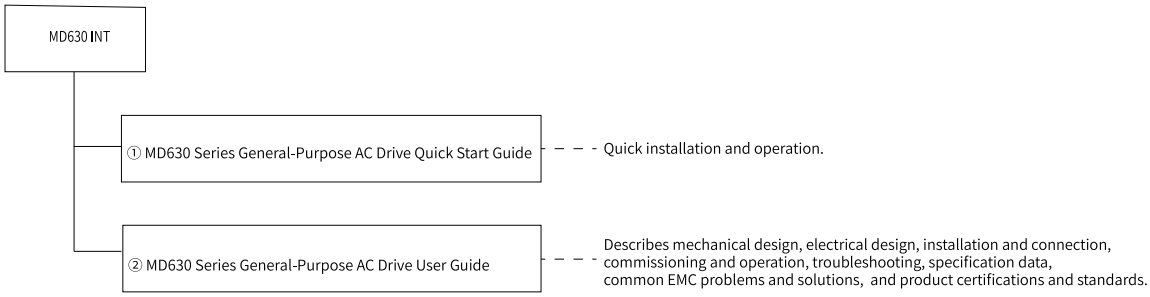
The MD630-INT series AC drive is the new generation of general-purpose AC drive that used to drive loads such as fans, water pumps, rollers, and belts in industries including silicon crystal, lithium-ion battery, 3C, semiconductors, ceramics, glass, rubber & plastic, cables, and textile. The bus-type MD630 AC drive is equipped with three-in-one high-speed bus for communication as standard.

The power range of this series of drives is 0.37 kW to 22 kW, with five structures available.

This user guide covers mechanical design, electrical design, installation and wiring, commissioning, functional application, and troubleshooting of the drive, which mainly intended for mechanical, electrical, and commissioning engineers.

More data

The following shows related documents of the drive.



Name	Code	Description
MD630-INT Series General-Purpose AC Drive Quick Start Guide	PS00019537	Presents quick installation and operation of the drive.
MD630-INT Series General-Purpose AC Drive User Guide (this manual)	PS00019852	Presents mechanical design, electrical design, installation and connection, commissioning and operation, troubleshooting, specifications, common EMC faults and solutions, and certifications/ standards compliance.

Revision History

Date	Version	Description of change(s)
December 2025	B01	**Revision:** • *"1.2 Nameplate and Model" on page 35*. Added 30 kW to 90 kW content to the product model list (three-phase 380 V to 480 V). • *"2.3.2.1 Installation Space" on page 47*. Added content for 30 kW to 90 kW. • *"2.3.2.1 Installation Space" on page 47*. Added content for 30 kW to 90 kW in the tables for installation space requirements (single drive installation), installation space requirements (multi-drive installation), and installation space requirements (side-by-side installation). • *"2.3.2.2 Air Duct Design and Cooling Specifications" on page 51*. Added content related to 30 kW to 90 kW. • *"2.3.4 Installation Tools" on page 57*. Added content for 30 kW to 90 kW in the screw and screwdriver specification table. • *"2.5 Backplate Mounting" on page 58*. Added content for 30 kW to 90 kW in the installation procedure. • *"2.6 Through-hole Mounting" on page 60*. Added content for 30 kW to 90 kW in through-hole installation of the drive. • *"2.9.1 Installing Cable Shield Grounding Bracket" on page 65*. Added content for 30 kW to 90 kW. • *"2.9.2 Installing the Punch Press Vibration Damping Bracket" on page 69*. Added content for 30 kW to 90 kW. • *"2.9.3 Installing Junction Box Accessory" on page 70*. Added content for 30 kW to 90 kW. • *"3.4.3 Cable Preparation" on page 84*. Add 30 kW to 90 kW series cables. • *"3.5.1 Descriptions of Main Circuit Terminals" on page 86*. Added content for 30 kW to 90 kW. • *"3.5.2 Connecting Main Circuit Terminals To the Power Supply, Motor, and Braking Resistor" on page 91*. Added content for 30 kW to 90 kW. • *" Commissioning Instructions" on page 117*. Added steps to the commissioning flowchart. • *"4.2.2.1 Downloading and Installing Software" on page 130*. Updated the entire chapter in *"4.2.2.2 Quick Commissioning Guide" on page 134*. • *" Selecting Frequency Reference as Setting Channel" on page 197*. Updated the content of the frequency reference. • *"5.2.2.5 Setting Frequency Reference Limits" on page 245*. Optimized the content of this chapter. (Continued)

Date	Version	Description of change(s)
December 2025	B01	(Continued) **Revision:** • *"5.2.4.4.2 DC Braking at Stop" on page 286*. Added content to DC braking during stop. • *"5.2.10.8 Analog Input (AI) Terminals" on page 361*. Updated the data flow diagram and updated AI terminal function table. • *"5.2.10.9 Analog Output (AO) Terminals" on page 378*. Updated data flow diagram and updated AO terminal function table. • *"5.2.12.3.1 Industry Macro Introduction" on page 449 " Speed control" on page 471 " V/f Control Mode for Asynchronous Motor" on page 528 " Wiring and Basic Setting of the Encoder" on page 562*. Optimized usability in the entire chapters. • *"5.4.1.1 Function List" on page 607*. Optimized table content. • *"5.4.1.9 Jump Frequency" on page 622*. Updated chapter content. • *"5.4.6.5.1 Description" on page 663*. Updated chapter content. • *"5.7.8 Log Function" on page 883*. Added function introduction. • *"6.10.15 Configuring PROFIDrive AC1 Mode Function" on page 1111*. Added introduction information. • *"6.10.16 Configuring S2 Redundancy Function" on page 1113*. Added configuration content. • *"7.9.1 List of Fault Codes" on page 1176*. Updated list of fault codes. • *" Electrical Specifications" on page 1318*. Updated electrical specifications for T6 to T8 models (three-phase 380 V to 480 V). • *"9.3 Product Dimensions" on page 1330*. Added content for 30 kW to 90 kW in the drilling diagram. (Continued)

Date	Version	Description of change(s)
December 2025	B01	(Continued) • *"9.7.1 Derating Based on Carrier Frequency" on page 1337*. Added content for 30 kW to 90 kW in the table. • *"9.8.1 List of Options" on page 1340*. Added content for 30 kW to 90 kW in the installation accessories. • *"9.8.2 Circuit Breaker And Fuse" on page 1343*. Added content for 30 kW to 90 kW in the circuit breaker and fuse selection table. • *"9.8.3 AC Input Reactor" on page 1345*. Added content for 30 kW to 90 kW in the AC input reactor selection (three-phase 380 V to 480 V) (high-overload G model). • *"9.8.4 AC Output Reactor" on page 1351*. Added content for 30 kW to 90 kW in the AC output reactor selection (three-phase 380 V to 480 V) (high-overload G model). Added other related content. • *"9.8.5 EMI Filter" on page 1356*. Added content for 30 kW to 90 kW in the filter selection table (high-overload G model) (three-phase 380 V to 480 V), filter selection table (low-overload P model) (three-phase 380 V to 480 V), filter selection table (high-overload G model), and filter selection table (low-overload P model). Added other related content. • *"9.8.6 Braking Resistor" on page 1364*. Added content for 30 kW to 90 kW in the braking resistor selection table (three-phase 380 V to 480 V) and braking resistor power recommendation table. • *"9.8.7 EMC Shield Grounding Bracket" on page 1371*. Added content for 30 kW to 90 kW in the MC shield grounding bracket table and MC shield grounding bracket dimension table. • *"9.8.8 Through-hole Mounting Bracket" on page 1374*. Added content for 30 kW to 90 kW in the through-hole mounting bracket table and through-hole mounting bracket dimension table. • *"9.8.10 Punch Press Vibration Damping Bracket" on page 1377*. Added content for 30 kW to 90 kW in the punch press vibration damping bracket table and punch press vibration damping bracket installation dimension table. • *"9.8.11 Junction box accessory" on page 1378*. Added content for 30 kW to 90 kW in the junction box accessory table and junction box accessory installation dimension drawing. • *"9.8.12 Cable" on page 1380*. Added content for 30 kW to 90 kW in the section, input/output/grounding terminal cable specification table (P model), braking terminal cable specification table, and busbar terminal cable specification table.

Date	Version	Description of change(s)
August 2025	B00	**Revision:** • Added Modbus TCP related content. • Added fire mode related content. • Added expansion card related content.
June 2025	A00	First release

Access to the guide

This user guide is not delivered along with the product. You can download the PDF version in the following ways.

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For details, see the Warranty Card.

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Safety Precautions

Safety Disclaimer

- This section describes the safety precautions that help you use this product correctly. Before using this product, read the user guide thoroughly and correctly understand the related safety precautions. Failure to observe the safety precautions may result in serious injuries or death of personnel or device damage.
- "Danger", "Warning", and "Caution" items in this guide do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
- Use this equipment based on the designated environment requirements. Any damage caused by improper usage are not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Categories and Definitions



Indicates that failure to comply with the notice will result in severe personal injuries or even death.



Indicates that failure to comply with the notice may result in severe personal injuries or even death.



Indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage.

Safety Precautions

- Some drawings in this guide show the equipment without covers or protective guards to display more details. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- Product illustrations in this guide are for reference only. Actual products may vary.
- Personnel must take mechanical precautions to protect personal safety. Wear necessary protective safety gear, such as anti-smashing shoes, clothing, glasses, gloves, and sleeves.

Unpacking
 • Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking. • Do not install the equipment if you find water seepage or missing or damaged components upon unpacking. • Do not install the product if the packing list does not match the product you received.
 • Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation. • Unpack the package by following the unpacking sequence. Do not hit the package with force. • Check the surfaces of the equipment and accessories for any damage, rust, and scratches. • Check whether the package contents are consistent with the packing list before unpacking.

Storage and Transportation
 • Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage. • Before hoisting the equipment, ensure the components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injury or equipment damage. • Never stand or stay below the equipment when the equipment is being hoisted. • When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in physical injuries or equipment damage.
 • Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage. • When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries. • Store and transport the equipment strictly based on the requirements. Failure to comply may result in equipment damage. • Avoid storage and transportation in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration. • Avoid storing the product for more than 3 months. When the product needs to be stored for an extended period, take more strict protection and necessary inspection. • Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation. • Do not transport the equipment with other devices or materials that may harm or have negative impacts on the equipment.

Installation
DANGER • The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed to operate on the equipment.
WARNING • Read through the guide and safety instructions before installation. • Do not install the product in places with strong electric or magnetic fields. • Before installation, ensure that the installation position has sufficient mechanical strength to support the weight of the device. Failure to comply will result in a mechanical danger. • Do not wear loose clothes or accessories during installation. Failure to comply may result in electric shock. • When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or fire. • Do not retrofit the equipment. • Do not fiddle with the bolts used to fix equipment components or the bolts marked in red. • When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations. • Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction. • Install the equipment on metal or other incombustible objects. Keep the equipment away from combustible objects. Failure to comply will result in fire.
CAUTION • Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After the installation is completed, remove the protective guard. Failure to comply will block the vent and affect heat dissipation, causing overheat of the product. • Resonance may occur when a machine supposed to run at a constant speed is running at variable speeds. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring
DANGER . Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. . Before wiring, disconnect all the power supplies of the equipment, Wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. Measure the direct voltage of the main circuit and ensure that the voltage is within the safety range. Failure to comply will result in an electric shock. . Do not perform wiring, remove the equipment cover, or touch the circuit board with power on. Failure to comply can result in electric shock. . Ensure the equipment is grounded properly. Failure to comply can result in electric shock.
WARNING . Do not connect the input power supply to the output end of the equipment. Failure to comply will result in equipment damage or even a fire. . When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation. . Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at both ends. . Tighten the terminal screws with the tightening torque specified in the guide. Failure to comply may result in overheat, damage to the connection parts, or fire. . After wiring, check that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply may result in electric shock or equipment damage.
CAUTION . During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply will result in damage to internal equipment circuits. . Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

Power-On
DANGER . Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted. . Check that the power supply meets equipment requirements before power-on to prevent equipment damage or a fire. . After power-on, do not open the cabinet door or protective cover of the equipment. Do not touch any terminals, or remove any part of the equipment at power-on. Failure to comply will result in an electric shock.
WARNING . Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in physical injuries or equipment damage. . Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in fire. . Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in physical injuries or even death.

Operation
 • The equipment must be operated only by professionals. Failure to comply can result in death or personal injury. • Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply can result in an electric shock.
 • Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries. • Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

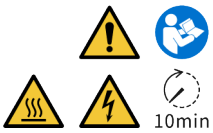
Maintenance
 • Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Do not maintain the equipment with power on. Failure to comply can result in an electric shock. • Before maintenance, cut off all equipment power supplies and wait as specified on the product warning sign. • When a PM motor rotates, its terminals will produce induced voltage even if the motor is powered off. Failure to comply can result in electric shock.
 • Perform daily and periodic inspection and maintenance for the equipment according to maintenance requirements and keep a maintenance record.

Repair
 • Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Do not maintain the equipment with power on. Failure to comply can result in electric shock. • Before inspection and repair, cut off all equipment power supplies and wait as specified on the product warning sign.
 • Require for repair services in accordance with the product warranty agreement. • When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injuries, or equipment damage. • When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly. • Replace quick-wear parts of the equipment in accordance with the replacement instructions. • Do not use damaged equipment. Failure to comply may result in further equipment damage, physical injuries, or even death. • After equipment replacement, check the wiring and set parameters again.

Disposal
 • Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death. • Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Safety Labels

To ensure safe operations, comply with safety signs on the device, and do not damage or remove the safety labels. The following table describes the safety labels.

Safety Sign	Description
	• Before using the product, read the user guide and safety precautions carefully. Failure to comply will result in personnel injuries or death or product damage. • Do not touch the terminals or remove the cover with power ON or within 10 min after power-off. Failure to comply will result in an electric shock.

1 Product Information

1.1 Components

The following figure describes the layout of the drive with the 15 kW T4 model (11 kW to 15 kW) as an example.

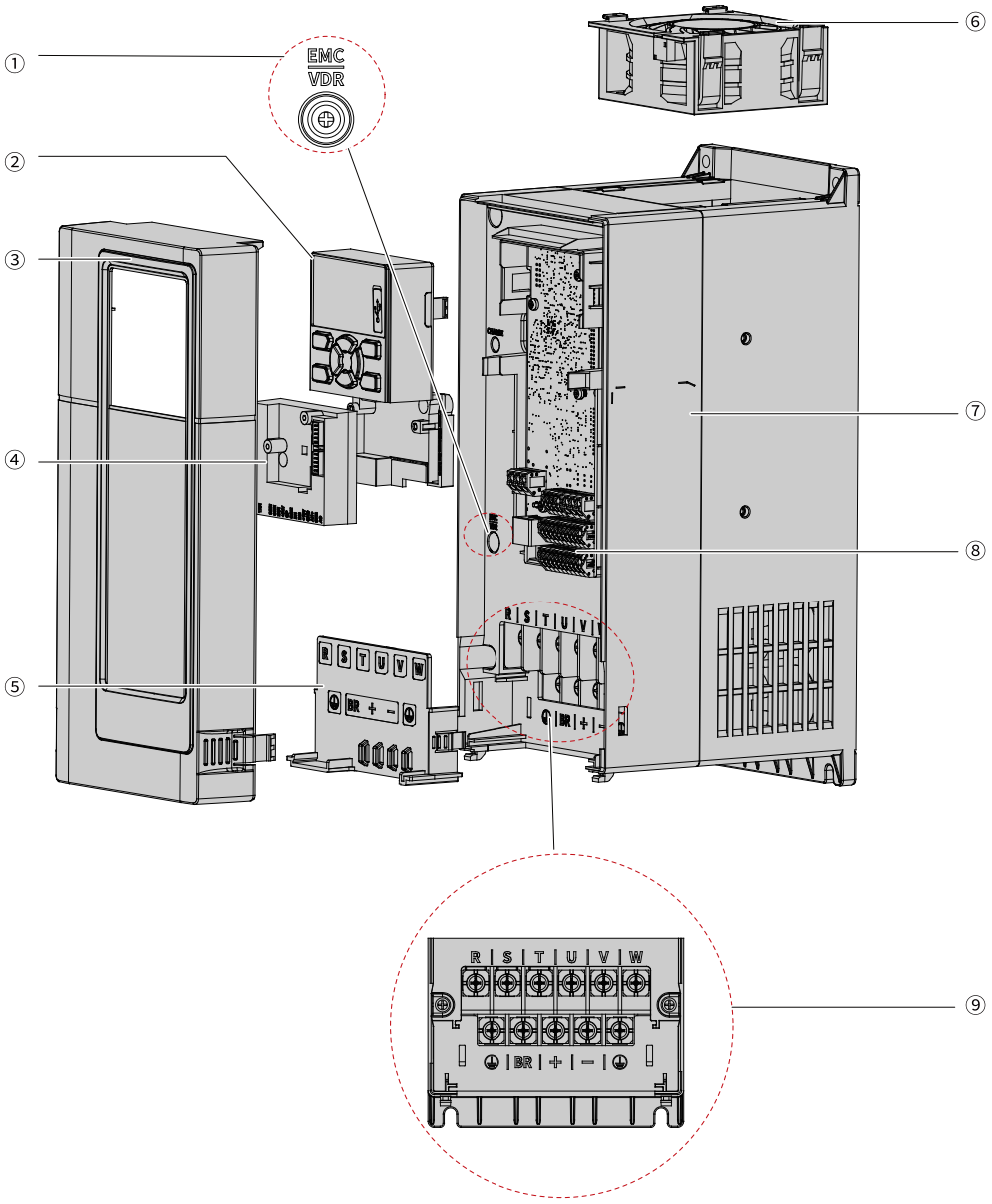


Figure 1-1 Components

No.	Name	Description	Reference
①	EMC/VDR grounding screw	Selective grounding screw	-
②	Operating panel display board assembly	Operating panel display and key operation area	For detailed instructions, see section *"Operator Panel"*.
③	Plastic top cover	Used to protect the control section of the drive.	-
④	Expansion card	Optional card assembly (non-standard)	Reserved function

No.	Name	Description	Reference
⑤	Terminal cover	Used to protect main circuit terminals.	-
⑥	Fan	Used for heat dissipation.	See details in *"2.3.2.2 Air Duct Design and Cooling Specifications" on page 51*.
⑦	Nameplate	Displays the product information.	See details in *"1.2 Nameplate and Model" on page 35*.
⑧	Control circuit terminal	Used to transmit and feed back control signals.	See details in *"3.6.1 Control circuit terminals" on page 100*.
⑨	Main circuit terminal	Used to connect input and output cables.	See details in *"3.5.1 Descriptions of Main Circuit Terminals" on page 86*.

1.2 Nameplate and Model

Model description

Note

Consisting of two-digit numbers and one-digit letters, the rated current in ④ is configured based on the heavy-load model. R represents the decimal point "."

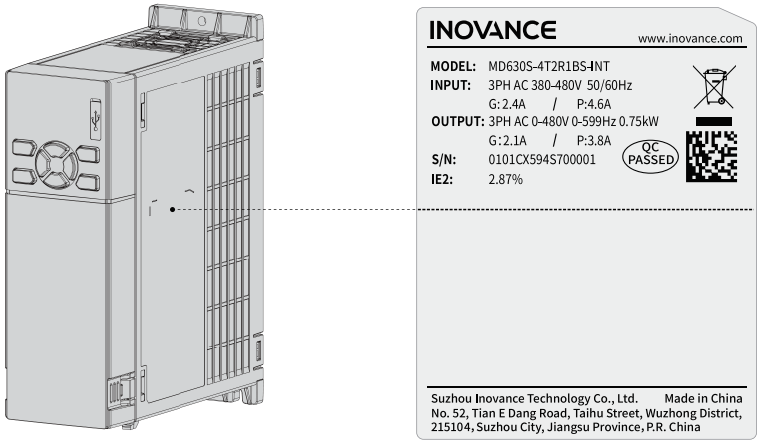
MD630 S - 4T 2R1 B S - INT
① ② ③ ④ ⑤ ⑥ ⑦

①	**Name** MD630: AC drive series	②	**Model** S: Standard N: Bus type	③	**Voltage class (V)** 4T: Three-phase 380 V to 480 V
④	**Output current (A)** 1R5: 1.5 2R1: 2.1 3R8: 3.8 ... 9R0: 9.0 ... 045: 45	⑤	**Braking unit** B: With the braking unit	⑥	**Safety function** S: With the STO function
				⑦	**Model configuration** INT: Global version

Nameplate description

Note

The following nameplate is used as an example. The actual nameplate is subject to the product.



Description of serial number

0101CJ14	4	S	7	00001
①	②	③	④	⑤

①	**Internal code** Material code	②	**Manufacturer code** 4: Suzhou Inovance	③	**Year** S: 2024 T: 2025 U: 2026 V: 2027 W: 2028 X: 2029 Y: 2030 ... Note: I/L/O/Q is not used.
④	**Month** 1: January 2: February 3: March ... A: October C: December	⑤	**Lot number** 00001: First 00002: Second 00003: Third ... Range: 00001 to 99999	-	

1.3 Product Model List

See the following table for the MD630 product model.

Table 1–1 Product models (three-phase 380 V to 480 V)

Appearance Structure	Model	Drive model	Product code	G-type model (150% overload capacity)					P-type machine (110% overload capacity)				
				Power (kW)	Output current (A)	Input current (A)	Power supply capacity under grid conditions (KVA)		Power (kW)	Output current (A)	Input current (A)	Power supply capacity under grid conditions (KVA)	
							400 V	480 V				400 V	480 V
T1	Standard	MD630S-4T1R5BS-INT	0101CQ45	0.37	1.5	1.7	1.43	1.54	0.75	2.1	2.4	2.09	2.2
	Bus type	MD630N-4T1R5BS-INT	0101CQ43										
	Standard	MD630S-4T2R1BS-INT	0101CJ14	0.75	2.1	2.4	1.98	2.2	1.5	3.8	4.6	3.85	3.96
	Bus type	MD630N-4T2R1BS-INT	0101CJ26										
	Standard	MD630S-4T3R8BS-INT	0101CJ15	1.5	3.8	4.6	3.85	3.96	2.2	5.1	6.4	5.39	5.61
	Bus type	MD630N-4T3R8BS-INT	0101CJ27										
T2	Standard	MD630S-4T5R1BS-INT	0101CJ16	2.2	5.1	6.3	5.28	5.5	3	7.2	9	7.59	7.81
	Bus type	MD630N-4T5R1BS-INT	0101CJ28										
	Standard	MD630S-4T7R2BS-INT	0101CJ17	3	7.2	8.9	7.48	7.7	4	9	11.4	9.57	9.9
	Bus type	MD630N-4T7R2BS-INT	0101CJ29										
	Standard	MD630S-4T9R0BS-INT	0101CJ18	4	9	11.4	9.57	9.9	5.5	13	17	14.3	14.63
	Bus type	MD630N-4T9R0BS-INT	0101CJ30										
T3	Standard	MD630S-4T013BS-INT	0101CJ19	5.5	13	16.8	14.08	14.52	7.5	17	22.7	19.03	19.36
	Bus type	MD630N-4T013BS-INT	0101CJ31										
	Standard	MD630S-4T017BS-INT	0101CJ20	7.5	17	22	18.48	19.03	11	25	33.4	28.05	28.49
	Bus type	MD630N-4T017BS-INT	0101CJ32										

Appearance Structure	Model	Drive model	Product code	G-type model (150% overload capacity)					P-type machine (110% overload capacity)				
				Power (kW)	Output current (A)	Input current (A)	Power supply capacity under grid conditions (KVA)		Power (kW)	Output current (A)	Input current (A)	Power supply capacity under grid conditions (KVA)	
							400 V	480 V				400 V	480 V
T4	Standard	MD630S-4T025BS-INT	0101CJ21	11	25	32.4	27.17	27.94	15	32	42.1	35.31	36.08
	Bus type	MD630N-4T025BS-INT	0101CJ33										
	Standard	MD630S-4T032BS-INT	0101CJ22	15	32	41.6	34.87	35.75	18.5	37	49.1	41.14	42.02
	Bus type	MD630N-4T032BS-INT	0101CJ34										
T5	Standard	MD630S-4T037BS-INT	0101CJ23	18.5	37	48.7	40.81	41.8	22	45	60.1	50.38	51.37
	Bus type	MD630N-4T037BS-INT	0101CJ35										
	Standard	MD630S-4T045BS-INT	0101CJ24	22	45	58.5	49.06	50.38	30	60	71.6	60.06	61.71
	Bus type	MD630N-4T045BS-INT	0101CJ36										
T6	Standard	MD630S-4T060BS-INT	0101CA37	30	60	56.3	42.9	44	37	75	68.8	52.4	53.7
	Bus type	MD630N-4T060BS-INT	0101CQ75										
	Standard	MD630S-4T075BS-INT	0101CA38	37	75	70.4	53.7	55.1	45	91	84.7	64.6	66.1
	Bus type	MD630N-4T075BS-INT	0101CQ65										
T7	Standard	MD630S-4T091BS-INT	0101CA39	45	91	86.3	65.8	67.6	55	112	104.2	79.4	81.3
	Bus type	MD630N-4T091BS-INT	0101CQ67										
	Standard	MD630S-4T112BS-INT	0101CA40	55	112	107.6	82	84.1	75	150	139.9	106.6	108.9
	Bus type	MD630N-4T112BS-INT	0101CQ66										
T8	Standard	MD630S-4T150BS-INT	0101CA41	75	150	141.6	107.9	110.7	90	176	165.4	126.1	128.9
	Bus type	MD630N-4T150BS-INT	0101CQ68										
	Standard	MD630S-4T176BS-INT	0101CQ63	90	176	168.4	128.3	131.5	110	210	197.6	150.6	154

Note

The power supply capacity under grid conditions is calculated at 400 VAC and 480 VAC.

2 Mechanical Installation

2.1 Safety Precautions

The equipment can be operated only by professionals with electrical knowledge. Operations by others are prohibited.

Warning

- Thoroughly read the safety instructions and user guide before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply can result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire.
- Do not modify this equipment.
- Do not rotate the equipment components or loosen fixed bolts (especially those marked in red) on equipment components.
- When the equipment is installed in a cabinet or a terminal device, an protective enclosure against file, electrical disturbance, and mechanical damage must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment on an incombustible object such as metal and do not touch or attach the equipment to combustibles. Failure to comply can result in fire.
- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on top of the equipment. Failure to comply can block ventilation holes, resulting in over-temperature caused by poor ventilation.
- Resonance may occur when the equipment operating at a constant speed switches to variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

2.2 Unpacking and Transportation

Unpacking

1. Open the outer box of the drive and remove the inner box of the drive, as shown in figures ①, ②, and ③.
2. Open the inner box of the drive, as shown in figures ④ and ⑤.
3. Remove the PE foam and drive, as shown in figure ⑥.

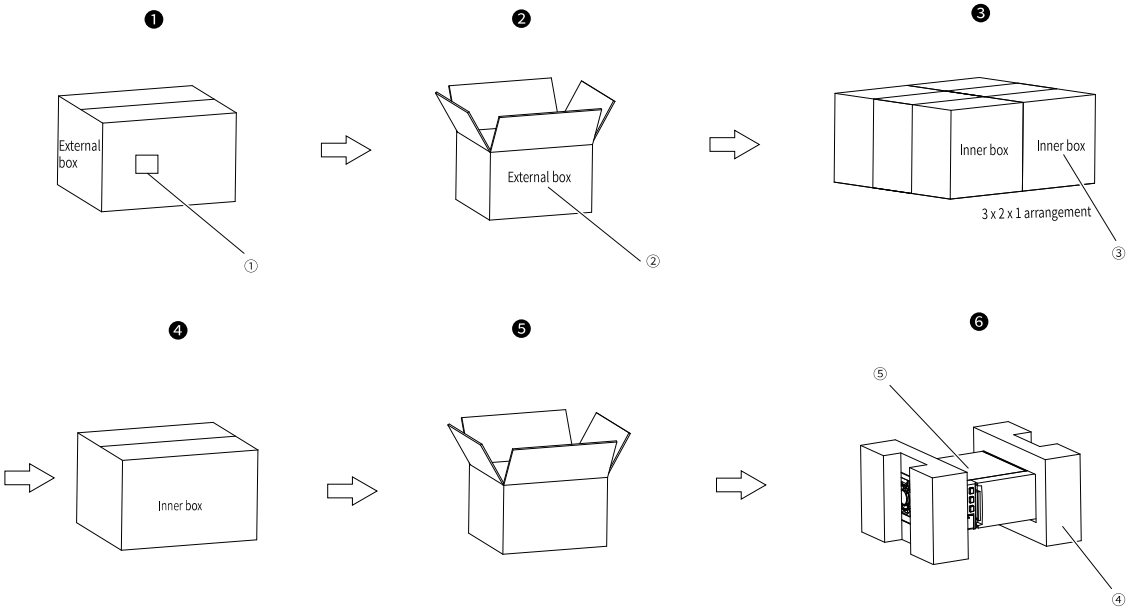


Figure 2-1 Unpacking

Table 2–1 Unpacking list

No.	Name
①	Label set
②	Outer box
③	Inner box
④	PE foam
⑤	AC drive

Inspection

1. Open the drive and check whether it is damaged. If any damage is found on the drive or its accessories, do not operate or install it.
2. Check whether the drive model is consistent with that on the delivery order.
3. Record the model and serial No.

Storage

Caution

Store and transport the equipment as required to prevent damage.

- Store the drive in a clean and dry space, with an ambient temperature ranging from -40°C to +60°C and a temperature change rate less than 1°C/min.
- Do not store or transport the drive in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Do not expose the drive to environments with moisture, high temperature, or strong sunlight for a long time.

- If the drive needs to be stored for a long period of time, cover it or take other appropriate measures to keep it from contamination and environmental influences.
- Pack the drive with the original packing box provided by Inovance.
- Do not store the drive for more than three months. Long-term storage requires stricter protection and necessary inspections.
- The electrolytic capacitor can deteriorate after long-term storage. Therefore, switch on the drive once for at least 5 hours every 6 months. After switch-on, increase the input voltage slowly to the rated value by using a voltage regulator. Contact Inovance for technical support if necessary.
- Pack the drive strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the drive with other device or materials that may harm or have negative impacts on the drive.

Handling



- Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage.
- Before hoisting the equipment, ensure the components such as the front cover and terminal block are secured firmly with screws. Loosely-connected components may fall off and result in personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.
- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.

Note

Before wiring, check and ensure that the voltage of the mains power is compatible with the voltage of the AC drive power supply.

2.3 Installation Instructions

2.3.1 Environment Requirements

In the following environmental conditions, the service life of the G-type model is 5 years, which is an estimated value based on the specified operating conditions and is not a guaranteed value, as the actual service life of the device may be shortened due to harsh installation environments and operating conditions.

- Ambient temperature: Annual average 40°C
- Load rate: 100% rated for G-type models
- Operating time: 24-hour continuous operation per day

- Other factors: humidity lower than 95% RH without condensation, no conductive dust, oil, salt mist, or halogen-containing corrosive gases; balanced three-phase power supply voltage, without other capacitive loads switchover on the same grid

When the following harsh conditions exist, the internal temperature of the drive can rise, leading to a shortened service life of the drive.

- Excessively high operating environment temperature; or air duct blockage caused by dust or flocculent deposits; or improper cabinet cooling design leading to excessively high ambient temperature at the air intake of the drive
- Excessively high output current, frequent overload, or frequent excessive load fluctuation;
- Excessive product service life, natural lifespan degradation, components worn-out
- Conductive dust, oil, salt mist, or halogen-containing corrosive gases can cause premature component failure. Unbalanced grid voltage may lead to abnormal and excessive bus voltage fluctuation.

To extend the service life of the drive, the following measures are recommended.

- Reduce ambient temperature (e.g., install air conditioner in the room). Install air filters to the cabinet and regularly clean the air ducts. Optimize internal cabinet layout and cooling design.
- For applications with excessive loads or frequent overload, it is recommended to replace with a drive of higher power rating.
- For drives used beyond their intended lifespan, to prevent unexpected damage and unnecessary shutdown, it is recommended to perform maintenance in advance or replace the drive. For details, contact Inovance.
- Enhance external environmental protection to reduce the impact of harsh environments on the drive. If three-phase power supply imbalance exists on site, premature drive failure may occur. Therefore, it is recommended to install an input AC reactor.

2.3.1.1 Standard Environmental Resistance Requirements

Standard environmental resistance requirements include standards and requirements for transport of drives with packaging, installation and operation of drives, and long-term storage of drives with packaging. The following table lists standards and specifications for the drive, violation of which can affect the device service life or result in faults. Make sure that the following standards and requirements are met.

Property	Specifications
Environmental conditions during Transport with packaging	
Ambient temperature	Temperature: -20°C to +60°C
	Relative humidity: ≤ 95% RH, without condensation Compliant with IEC60721-3-2 2K1 (GB/T 4798.2 2K1)
Mechanical environmental requirements	Vibration resistance: 5 Hz to 100 Hz 0.01 g^2/Hz, 200 Hz 0.001 g^2/Hz Compliant with EN 60721-3-2 standard 2M3 class
	Shock: Half-sine wave; 15 g/11 ms: 3 shocks per direction Compliant with IEC 60068-2-27 (GB/T 2423.5)

Property	Specifications
Protection requirement	Harmful chemical prevention: 2C2; Compliant with IEC60721-3-2 2C2 (GB/T 4798.2 2C2)
	Mechanically active substance: 2S2; Compliant with IEC60721-3-2 2S2 (GB/T 4798.2 2S2)
Environmental conditions during installation and operation	
Ambient temperature	Temperature: -20°C to +60°C (For temperatures above 50°C, derate 2.5% for every additional 1°C.)
	Relative humidity: ≤ 95% RH, without condensation
Installation altitude	For altitudes equal to or below 1000 m, derating is not required. For altitudes above 1000 m, derate 1% for every additional 100 m. For altitudes above 3000 m, contact Inovance.
Mechanical environmental requirements	Vibration resistance: 5.0 Hz to 8.4 Hz, 3.5 mmp; 8.4 Hz to 200.0 Hz, 1.0 g, 10 cycles per axial direction; Compliant with IEC60721-3-3 3M4 (GB/T 4798.3 3M4)
Overvoltage category of the power grid	OVC III
Protection requirement	Harmful chemical prevention: 3C2; Compliant with IEC60721-3-2 3C2 (GB/T 4798.2 3C2)
	Mechanically active substance: 3S2; Complies with IEC60721-3-2 3S2 (GB/T 4798.2 3S2)
Environmental conditions for long-term storage with packaging	
Ambient temperature	Temperature: -40°C to +60°C
	Relative humidity: ≤ 95% RH, without condensation; Compliant with IEC60721-1-1 1K4 (GB/T 4798.1 1K4)
Protection requirement	Harmful chemical prevention: 1C2 In areas with corrosive gases, the maximum relative humidity cannot exceed 60%. Compliant with IEC60721-1-1 1C2 (GB/T 4798.1 1C2)
	Mechanically active substance: 1S2 Complies with IEC60721-1-1 1S2 (GB/T 4798.1 1S2)

2.3.1.2 Effects and Measures in Special Environmental Conditions

Standards and requirements for special environments with high temperature, low temperature, vibration, or greasy dirt are shown below.

Temperature

Use the drive within the temperature range specified in *"2.3.1.1 Standard Environmental Resistance Requirements" on page 43*. If the specified temperature range is exceeded, the service life of electronic components can be significantly shortened. Therefore, take the following measures to keep the drive temperature within the specified range.

Measures against high temperature:

- Install the drive in an electrical cabinet with temperature adjustable.
- Use forced ventilation in the electrical cabinet.
- Minimize vertical stacking installation of drives. If unavoidable, see guidelines in *"2.3.2.1 Installation Space" on page 47* for installation.

Measures against low temperature:

- Do not switch off the power supply of the drive. Do not start the equipment after it has been thoroughly cooled by low temperature.
- Install heaters inside the electrical control cabinet.

Rapid temperature change:

- Install the drive in an electrical cabinet with temperature adjustable.
- Keep the drive away from high-power devices that generate heat during operation.

Humidity (condensation)

Use the drive within the humidity range specified in *"2.3.1.1 Standard Environmental Resistance Requirements" on page 43*. Excessive humidity may cause corrosion and reduced insulation performance.

Measures against high humidity:

- Install the drive in an electrical cabinet with temperature adjustable.
- Keep the drive away from devices that generate water mist.
- Seal the electrical control cabinet and add desiccant.
- Install heaters in the electrical control cabinet.

Condensation

Frequent start-stop cycles may cause rapid changes in humidity inside the control cabinet, or rapid temperature changes in the environment, which may result in condensation. Condensation may lead to reduced insulation or rusting.

Measures:

- Take the preceding measures against high humidity.
- Do not switch off the power supply of the drive. Do not start the equipment after it has been thoroughly cooled by low temperature.
- In environments with condensation and high humidity, it is recommended to start the heater for at least half an hour before powering on a drive that have been idled for a long time, preventing damage to the drive caused by condensation.

Dust

Dust can result in poor contact at contact points. Accumulated dust can absorb humidity, which degrades the insulation performance and cooling effect. The dust accumulation in the cooling fins can lead to temperature rise inside the drive. In addition, environments with floating conductive powder can cause malfunction, insulation aging, or short circuit within a short period of time.

Measures:

- Use a drive with high IP rating. Contact Inovance for details.
- Install the drive in a sealed control cabinet.
- Install filters at the air intake, and replace the filters regularly.
- Minimize the frequency of door opening/closing operations.
- Purify the air around the drive.

Corrosive liquids

Corrosive liquids adhering to high-voltage positions may induce surface tracking. Alkaline liquids may cause PCBA corrosion and stress cracking in non-metallic materials.

Measures:

- Use a drive with high IP rating. Contact Inovance for details.
- Install the drive in a sealed control cabinet (seal the cabinet door with sealing strips, use high-protection connectors such as glands for cable inlet/outlet holes, or seal with fireproof putty.).
- Minimize the frequency of door opening/closing operations.
- The cabinet door and cable inlet/outlet holes must be sealed.

Corrosive gases

Corrosive gases can easily corrode PCBA, connectors, and metal structural parts, and may cause sulfidation corrosion of surface-mounted resistors.

Measures:

- Use a drive with high IP rating. Contact Inovance for details.
- Install the drive in a sealed control cabinet (seal the cabinet door with sealing strips, use high-protection connectors such as glands for cable inlet/outlet holes, or seal with fireproof putty.).
- It is recommended to install electrical products in an indoor environment with temperature and humidity control, and where indoor and outdoor air does not circulate.

Cotton lint

Cotton lint can block the air duct of the drive, leading to overtemperature or shortening the service life of power components.

Measures:

- Use a drive with high IP rating. Contact Inovance for details.
- Install the drive in a sealed control cabinet (seal the cabinet door with sealing strips, use high-protection connectors such as glands for cable inlet/outlet holes, or seal with fireproof putty.).
- Install filters at the air intake and clean the filters regularly.

Conductive fibers

Conductive fiber-like substances may cause electrical short circuit at exposed high-voltage parts of the product.

Measures:

- Use a drive with high IP rating. Contact Inovance for details.
- Use air conditioners for heat dissipation in the cabinet.
- Install the drive in a sealed control cabinet (seal the cabinet door with sealing strips, use high-protection connectors such as glands for cable inlet/outlet holes, or seal with fireproof putty.).
- Install filters at the air intake and clean the filters regularly.
- Use a vacuum cleaner for routine cleaning in the cabinet. Do not use an air gun to blow dust off the cabinet.

Conductive powder

Conductive powder may accumulate on exposed high-voltage parts, causing electrical short circuit.

Measures:

- Use a drive with high IP rating. Contact Inovance for details.
- Install the drive in a sealed control cabinet (seal the cabinet door with sealing strips, use high-protection connectors such as glands for cable inlet/outlet holes, or seal with fireproof putty.).
- Use air conditioners for heat dissipation in the cabinet.

Vibration/Shock

Use the drive within the vibration level range specified in *"2.3.1.1 Standard Environmental Resistance Requirements" on page 43*. Exceeding the vibration range may cause loosening of structural parts, poor contact of the connector, and detachment of large components. Pay special attention in environments with continuous shocks.

Measures:

Use a drive of high IP rating, with vibration damping bracket installed (*"9.8.10 Punch Press Vibration Damping Bracket" on page 1377*). Contact the sales staff for details.

- Install the inverter in a floor-mounted cabinet.
- Do not install the drive in locations with strong vibrations, and keep it away from vibration sources.

2.3.2 Heat Dissipation Design

2.3.2.1 Installation Space

Note

- Before installing the AC drive in the cabinet, design the cabinet to ensure sufficient clearances for installation and heat dissipation. Take the following factors into consideration:
- When multiple AC drives are required to work together, install them side by side. Keep their tops level with each other, especially for those of different sizes.
- In applications requiring AC drives to be installed side by side, install an air guide plate to prevent overtemperature/overload fault that may occur due to heat dissipated from the lower row to the upper row.
- Reserve sufficient clearance according to the power rating of the AC drive. The recommended installation methods of the MD600 include single-layer installation and multi-layer installation.

Installation space for an individual drive

When installing an individual drive, reserve sufficient clearance around the drive, as shown in the following figure.

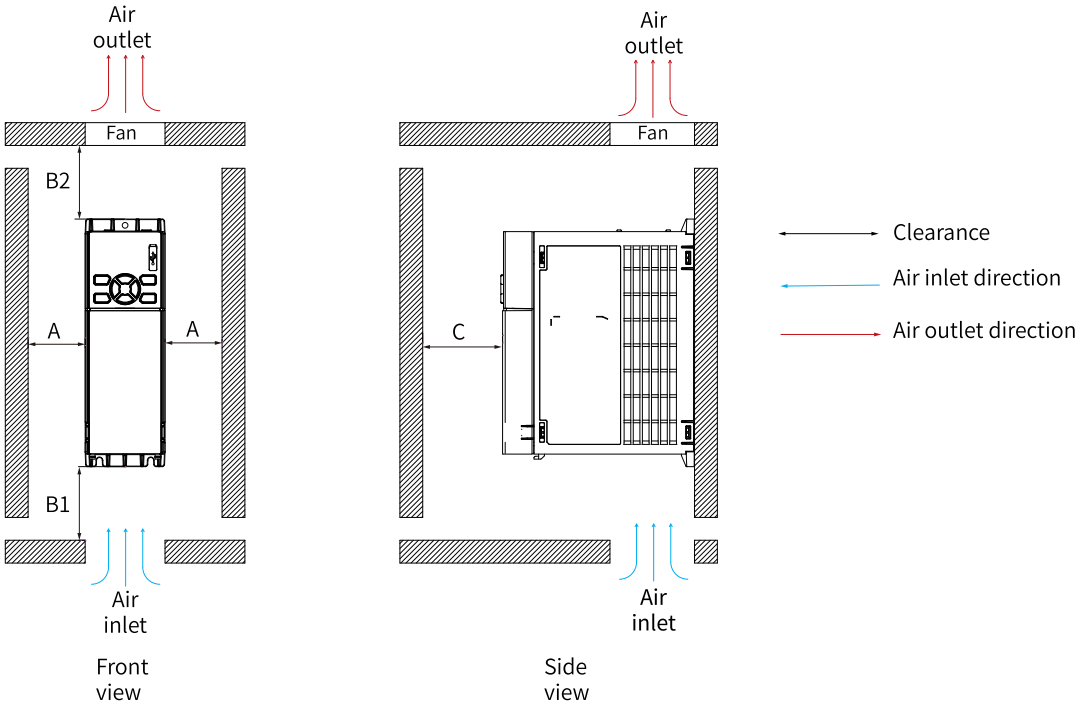


Figure 2-2 Installation space for an individual drive

Table 2–2 Installation space requirement for an individual drive

Power rating (kW)	Distance requirement mm (in.)			
	A	B1	B2	C
0.37 to 2.2	20 (0.79)	100 (3.94)	100 (3.94)	40 (1.57)
3 to 7.5	30 (1.18)	100 (3.94)	100 (3.94)	40 (1.57)
11 to 15	30 (1.18)	150 (5.91)	150 (5.91)	40 (1.57)
18.5 to 22	30 (1.18)	200 (7.87)	150 (5.91)	40 (1.57)
30 to 37	50	200	200	50
45 to 55	50	300	300	50
75 to 90	50	300	300	50

Installation space for multiple drives

When installing multiple drives side by side, reserve sufficient clearance around the drive, as shown in the following figure.

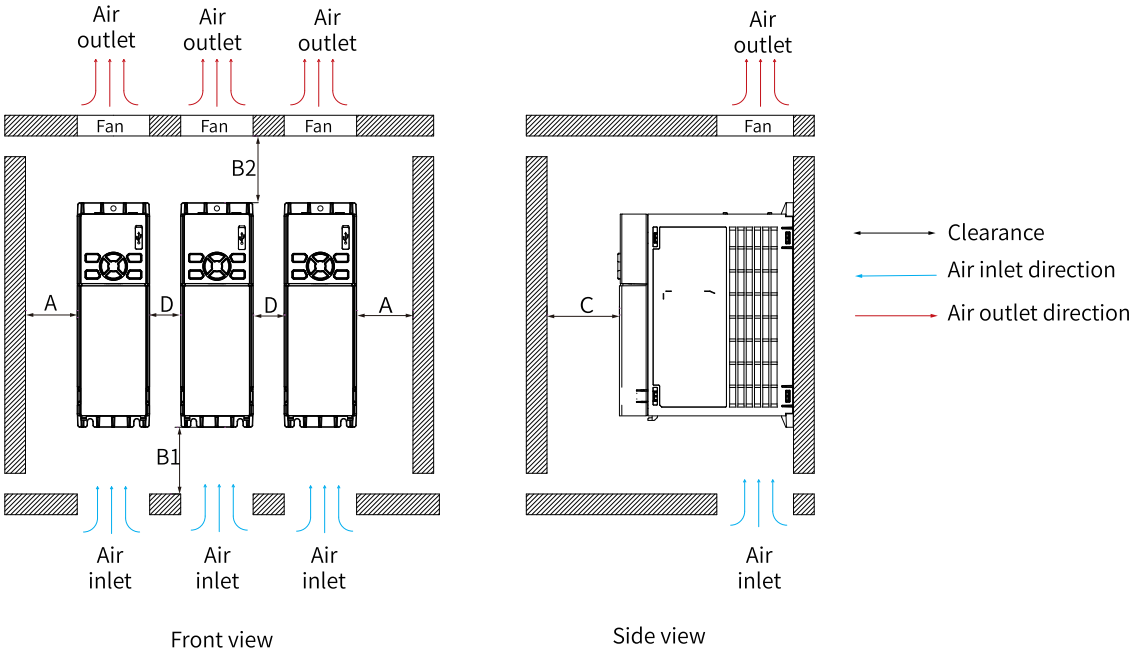


Table 2–3 Installation space requirements (side-by-side installation of drives)

Power rating (kW)	Distance requirement mm (in.)				
	A	B1	B2	C	D
0.37 to 2.2	20 (0.79)	100 (3.94)	100 (3.94)	40 (1.57)	30 (50℃ ambient temperature)
					0 (40℃ ambient temperature)
3 to 7.5	30 (1.18)	100 (3.94)	100 (3.94)	40 (1.57)	30 (50℃ ambient temperature)
					0 (40℃ ambient temperature)
11 to 15	30 (1.18)	150 (5.91)	150 (5.91)	40 (1.57)	30 (50℃ ambient temperature)
					0 (40℃ ambient temperature)
18.5 to 22	30 (1.18)	200 (7.87)	150 (5.91)	40 (1.57)	30 (50℃ ambient temperature)
					0 (40℃ ambient temperature)
30 to 37	50	200	200	50	50 (50℃ ambient temperature)
					0 (40℃ ambient temperature)
45 to 55	50	300	300	50	50 (50℃ ambient temperature)
					0 (40℃ ambient temperature)
75 to 90	50	300	300	50	50 (50℃ ambient temperature)
					0 (40℃ ambient temperature)

Minimum peripheral clearance requirements for multi-tier installation of multiple drives are shown in the following diagram.

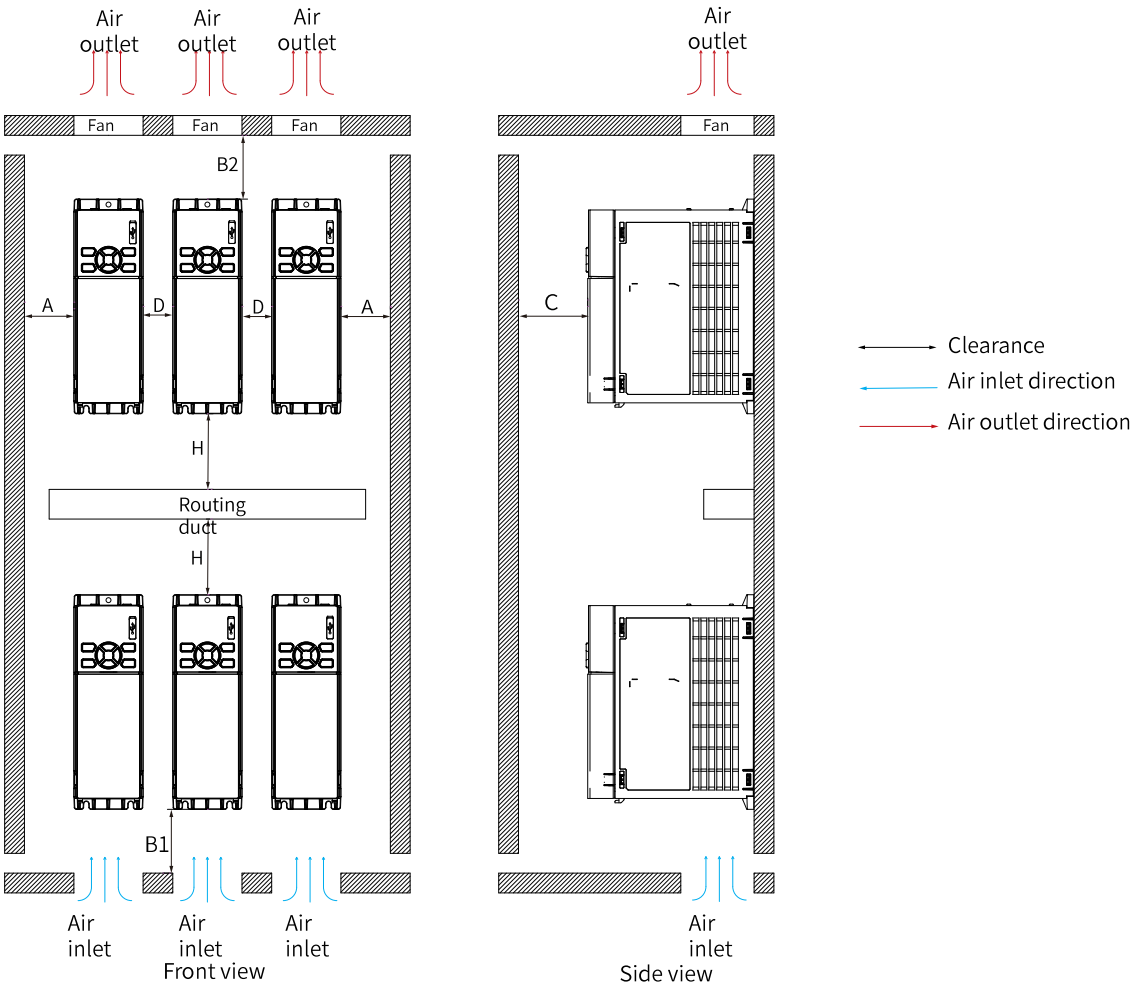


Figure 2-3 Installation space (multi-row installation of drives)

Table 2–4 Installation space (multi-row installation of drives)

Power rating (kW)	Distance requirement mm (in.)					
	A	B1	B2	C	D	H
0.37 to 2.2	20 (0.79)	100 (3.94)	100 (3.94)	40 (1.57)	30 (50℃ ambient temperature)	125
					0 (40℃ ambient temperature)	
3 to 7.5	30 (1.18)	100 (3.94)	100 (3.94)	40 (1.57)	30 (50℃ ambient temperature)	125
					0 (40℃ ambient temperature)	
11 to 15	30 (1.18)	150 (5.91)	150 (5.91)	40 (1.57)	30 (50℃ ambient temperature)	150
					0 (40℃ ambient temperature)	

Power rating (kW)	Distance requirement mm (in.)					
	A	B1	B2	C	D	H
18.5 to 22	30 (1.18)	200 (7.87)	150 (5.91)	40 (1.57)	30 (50℃ ambient temperature) 0 (40℃ ambient temperature)	150
30 to 37	50	200	200	50	50 (50℃ ambient temperature) 0 (40℃ ambient temperature)	400
45 to 55	50	300	200	50	50 (50℃ ambient temperature) 0 (40℃ ambient temperature)	400
75 to 90	50	300	300	50	50 (50℃ ambient temperature)	400

2.3.2.2 Air Duct Design and Cooling Specifications

Air duct design for the naturally-ventilated cabinet

- Air intake requirements
  - The air intake of the cabinet must be at least 50 mm (1.97 in.) lower than that of the drive.
  - If multiple drives of different dimensions are installed in the cabinet, the air intake of the cabinet must be lower than the air intake of the lowermost drive.

  The following figure shows the air intake channel of a naturally-ventilated cabinet

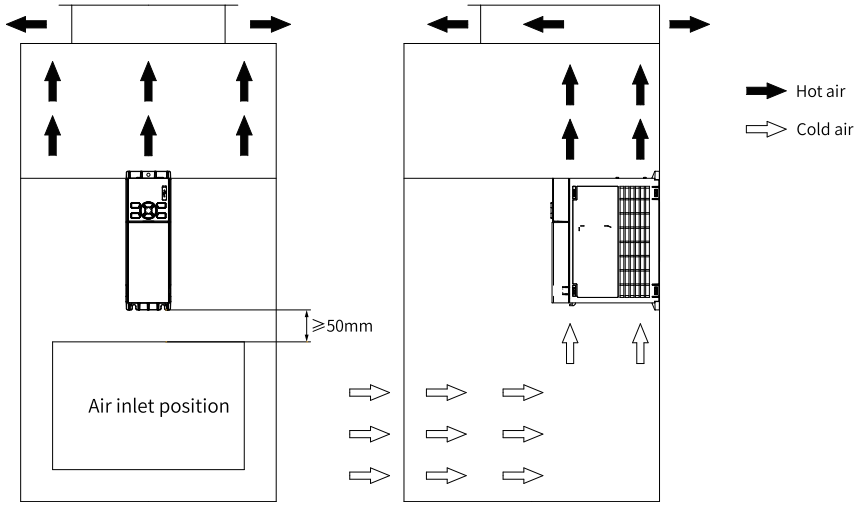


Figure 2-4 Air intake channel of a naturally-ventilated cabinet

- Air outlet requirements
  - The hot air flows upward. Therefore, open the air outlet at the top of the cabinet and make the outlet face the air outlet of the drive, so that hot air can be discharged from the cabinet.
  - If exhaust ducts are used, the air outlet can be located around the cabinet, but must be higher than the air outlet of the drive.

The following figure shows the exhaust duct of a naturally-ventilated cabinet

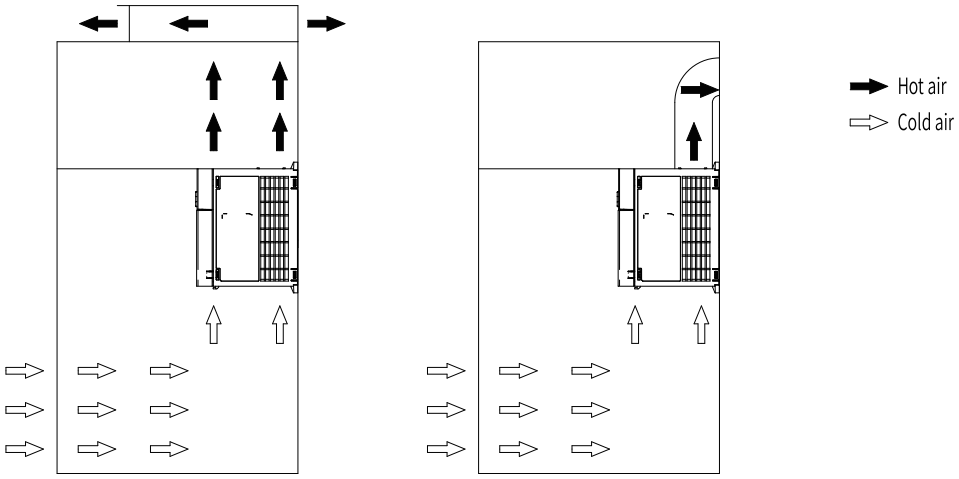


Figure 2-5 Exhaust duct of a naturally-ventilated cabinet

Air duct design for the fan-cooled cabinet:

- Air intake requirements:
  - The air intake of the cabinet must be at least 50 mm (1.97 in.) lower than that of the drive.
  - If multiple drives of different dimensions are installed in the cabinet, the air intake of the cabinet must be lower than the air intake of the lowermost drive.
  - In most scenarios, installing a fan at the air intake blows the air into the cabinet, which may lead to uneven airflow distribution across drive. Therefore, do not install a fan at the air intake.

  The following figure shows the air intake channel of a fan-cooled cabinet

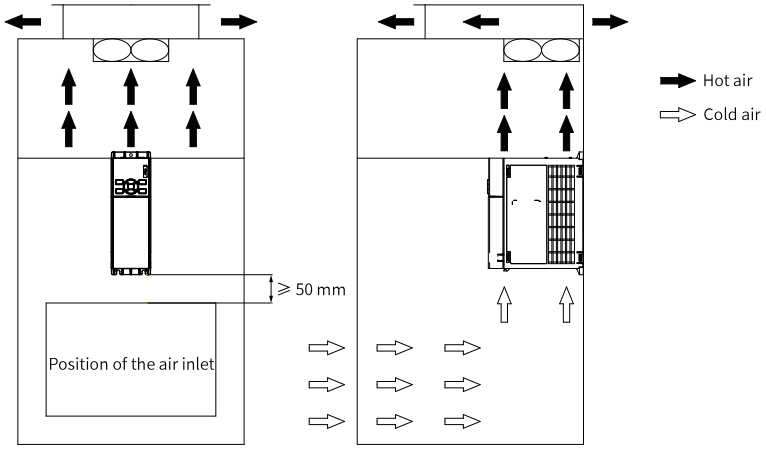


Figure 2-6 Air intake channel of the fan-cooled cabinet

- Air outlet requirements:
  Install the exhaust fan at the top of the cabinet or on the side near the top of the cabinet, and make the fan face the air outlet of the drive, as shown below.

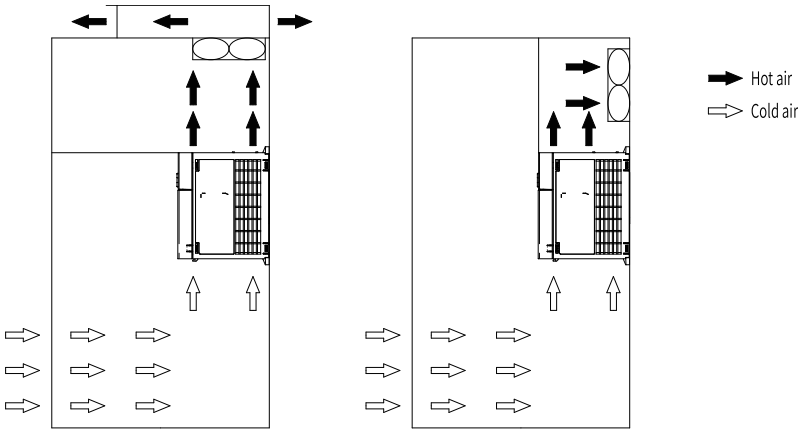


Figure 2-7 Air outlet channel diagram 1 for the fan-cooled cabinet

If the air outlet top cover of the cabinet is too close to the air outlet of the exhaust fan, the performance of the fan will be degraded, resulting in significant increase in resistance and decrease in air volume. In this case, the air volume of the drive will be decreased and the drive will be heated up. Therefore, ensure that the air outlet top cover is at least 200 mm (7.87 in.) away from the air outlet of the exhaust fan, as shown below.

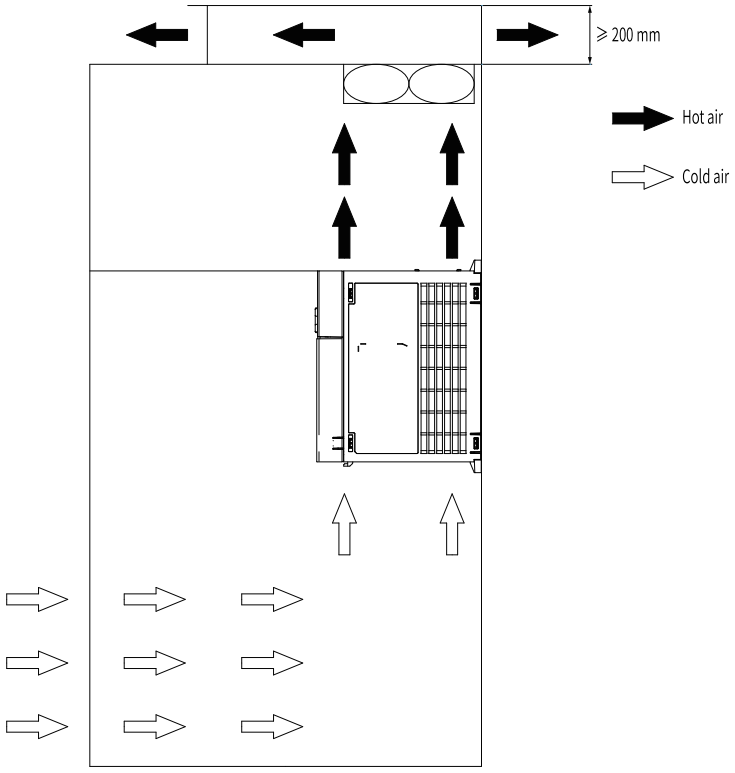


Figure 2-8 Air outlet channel diagram 2 for the fan-cooled cabinet

Cooling specifications:

Power	Airflow		Rated output heat dissipation of G model		Rated output heat dissipation of P model		Effective area of the cabinet air intake:	Effective area of the cabinet air outlet:	Minimum required nominal airflow for cabinet fan
(kW)	(CFM)	(m^3/hr)	(W)	(BTU/hr)	(W)	(BTU/hr)	CM^2	CM^2	CFM
0.37	/	/	29	99	35	119.4	24	32	22.7
0.75	/	/	34	116	54	184.3	24	32	22.7
1.5	12.6	21.42	58	197.9	76	259.3	24	32	22.7
2.2	23	39.1	74	252.5	103	351.4	37.5	50	41.4
3	17	28.9	100	341.2	129	440.2	37.5	50	30.6
4	17	28.9	114	389	174	593.7	37.5	50	30.6
5.5	31	52.7	174	593.7	242	825.7	54	72	55.8
7.5	31	52.7	210	716.5	344	1173.8	54	72	55.8
11	55.7	94.7	349	1190.8	491	1675.3	96	128	100.3
15	57.5	97.8	391	1334.1	482	1644.6	96	128	103.5
18.5	91.8	156.1	513	1750.4	674	2299.8	127	170	165.2
22	85	144.5	571	1948.3	856	2920.8	127	170	153
30	130	221	612.2	2089	807.2	2755	216	290	260
37	130	221	755.1	2577	948.9	3238	216	290	260
45	150	255	824.8	2815	1057.5	3609	216	290	300
55	150	255	1008.1	3440	1436.6	4902	216	290	300
75	167	285	1297	4426	1613.1	5504	435	580	335
90	190	325	1556.5	5311	1862.8	6356	435	580	380

For example, on the cut-out plate shown in the following figure, the size of each hole is C x C, and there are 9 holes in total. Therefore, the effective area of the air intake is 9 x C x C.

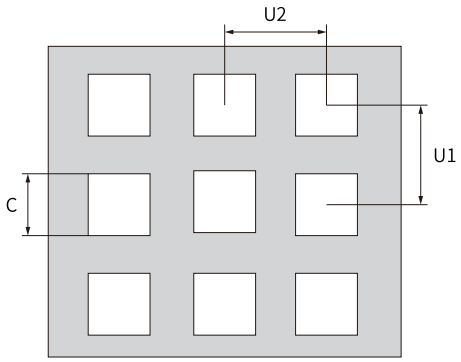


Figure 2-9 Cut-out board of air intake

The preceding tables apply to only an individual product. When multiple drives are installed in the cabinet, the total ventilation area is the sum of all the above-mentioned ventilation areas. If the air outlet is installed with a filter screen, the air outlet resistance increases substantially. In this case, the minimum effective area of the air outlet is 1.2...1.5 x values listed in the preceding table. The ventilation area in the preceding tables refers to the actual through-hole area of the opening. The ventilation area is calculated by the following: opening area x opening rate.

When multiple drives are installed in the same cabinet, the cabinet ventilation area is the sum of the intake or outlet area of each drive. For example, if a 22 kW and an 11 kW drives are installed in the cabinet, the required intake area is 126.96 + 96 = 222.96 cm^2, and the required outlet area is 128 + 169.28 = 297.28 cm^2.

In the active air ventilation mode, a fan is installed at the top of the cabinet to draw hot air out of the cabinet. This is a commonly used ventilation mode. To ensure that the hot air can be exhausted to the outside, the total air volume of the fan cannot be smaller than that of all drives in the cabinet. When a 22 kW and an 11 kW drives are installed in the cabinet, the required nominal airflow for cabinet fan is 100.3 + 153 = 253.3 CFM, meaning the fan must have a nominal airflow equal to or higher than 253.3 CFM.

2.3.2.3 Cooling Method for the Drive Cabinet

Hot air back flow is the most common problem in the drive control cabinet. The mechanism of hot air back flow is as follows:

- Due to suction of the fan, the air pressure at the control cabinet air intake is lowered down. However, the hot air discharged from the drive accumulates at the top of the control cabinet, causing the air pressure to rise.
- Due to the pressure difference between the intake and outlet of the control cabinet, the air in the cabinet flows from the high pressure area to the low pressure area. The air speed is related to the area of the air intake and outlet of the control cabinet and the air flow volume.
- If the hot air is not isolated from the cold air, the hot air discharged by the drive will again be drawn into the drive by the fan, heating the drive significantly.

Solutions to prevent hot air recirculation inside the control cabinet include the air deflector solution and the exhaust duct solution, both of which can isolate the hot air discharged by the drive from the cold air at the air intake of the drive, ensuring that the air intake temperature during operation of the drive is within the allowable range.

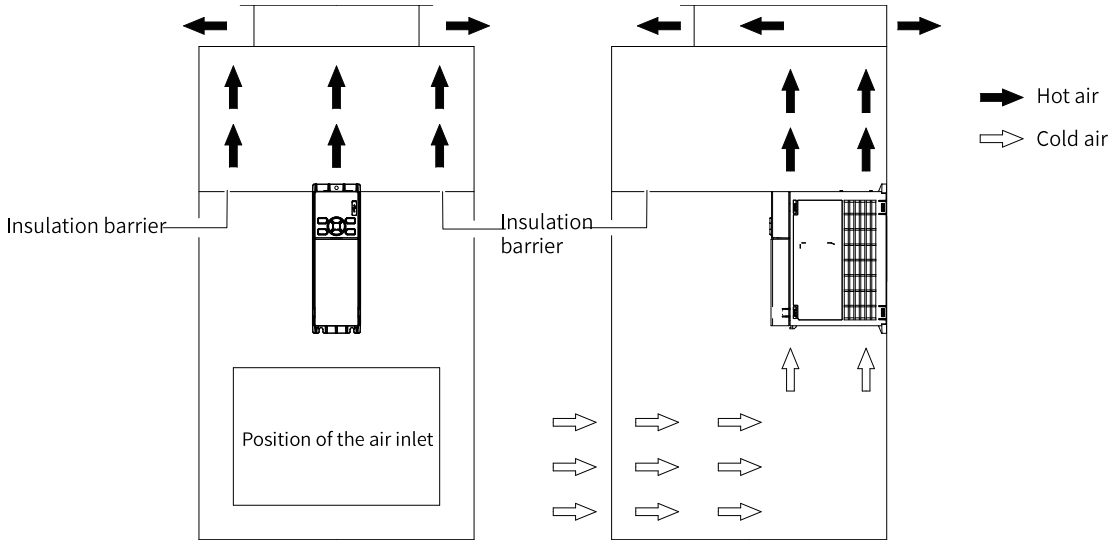


Figure 2-10 Using air deflector to prevent hot air recirculation

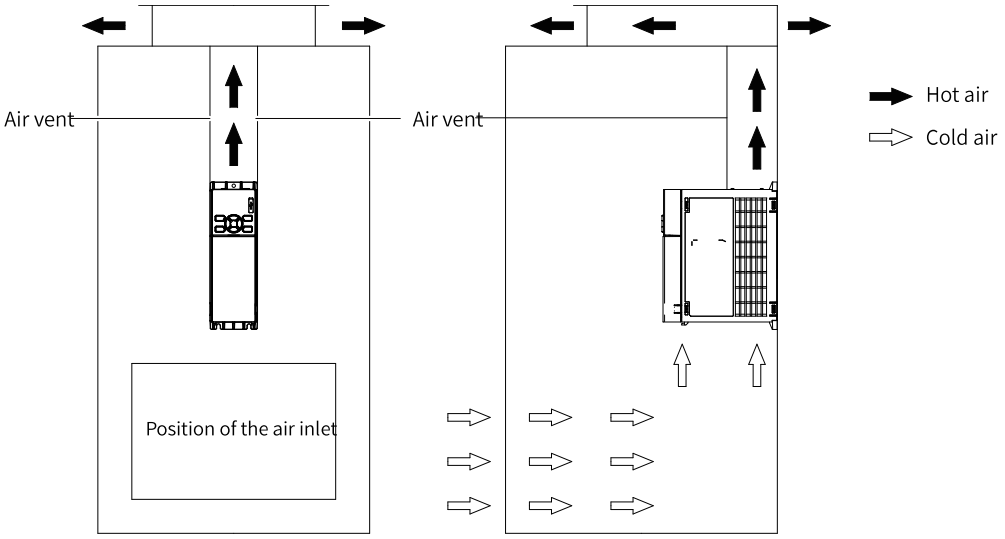


Figure 2-11 Using exhaust duct to prevent hot air recirculation

2.3.3 Installation Direction

Warning

- Incorrect installation direction may cause overtemperature alarm or damage.
- Install the AC drive upright, as shown in the following figure. Do not lie the AC drive on its back or side, or install it in the upside-down direction.

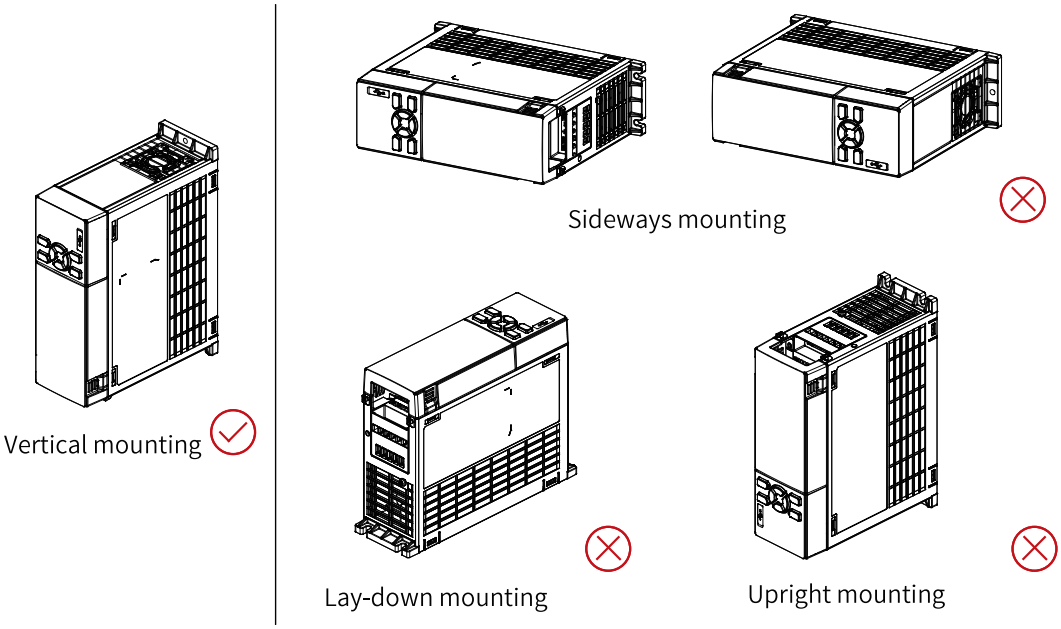


Figure 2-12 Installation direction

2.3.4 Installation Tools

Table 2–5 Mechanical installation tools

Tool	Description	Illustration
Electric drill and drilling bit	Used to drill mounting holes on the mounting surface.	
Phillips screwdriver	Used to tighten or loosen screws. For screwdriver models corresponding to different power ratings, see Table 2-6.	
Straight screwdriver	Used to disassemble the top cover and the knock-out holes.	
Tape measure	Used to measure the mounting dimensions of the equipment.	
Gloves	Used to prevent static electricity.	
Torque wrench	Used to verify the torque during installation.	
Socket wrench	Used to adapt to different bolt models.	
Extension bar	Used to operate a torque wrench in narrow spaces.	

In backplate mounting, the screw specifications required for installing the drive with screws are shown in the table below.

Table 2–6 Specifications of the screw and screwdriver

Structure	Power rating (kW)	Screwdriver model	Spec. and qty of screw	Tightening torque (N•m)
T1	0.37 to 1.5	Phillips slot PH2	M4 SEMS screw x 3	1.2
T2	2.2 to 4	Phillips slot PH2	M4 SEMS screw x 3	1.2
T3	5.5 to 7.5	Phillips slot PH2	M4 SEMS screw x 4	1.2
T4	11 to 15	Phillips slot PH2	M5 SEMS screws x 4	2.8
T5	18.5 to 22	Phillips slot PH2	M5 SEMS screws x 4	2.8
T6	30 to 37	Phillips slot PH2	M5 SEMS screws x 4	2.8

Structure	Power rating (kW)	Screwdriver model	Spec. and qty of screw	Tightening torque (N•m)
T7	45 to 55	Phillips slot PH3/10# socket	M6 SEMS screw x 4	4.8
T8	75 to 90	13# socket	M8 SEMS screw x 4	13

2.4 Checklist Before Installation

Check the following items before installation:

- Check the installation environment, installation clearance, and Installation orientation.
- Prepare the installation tools and accessories.
- Packaging confirmation, unpacking inspection and handling to meet the installation requirements.
- Check the following items before installation.

Table 2–7 Checklist before installation

No.	Item	Checked
1	The mechanical strength of the mounting position can bear the weight of the device.	☐
2	The environment and load-bearing capacity of the mounting position fulfill the installation requirements.	☐
3	Sufficient clearance is reserved for heat dissipation, including for heat dissipation of other devices in the cabinet.	☐
4	The mounting bracket (if needed) is made of incombustible materials.	☐
5	If the application site is exposed to metal dust, install the device in an enclosed cabinet to isolate the device from the metal dust. In this case, the space inside the cabinet needs to be as large as possible.	☐
6	Before installing the AC drive, install the bottom mounting bracket in the cabinet and guide rails (optional), and prepare mounting beams with holes reserved to fix the AC drive.	☐
7	Keep flammables or explosives away from the drive.	☐

2.5 Backplate Mounting

Applicable models

T1 to T8 models support backplate mounting.

Installation procedure

1. For T1 (0.37–1.5 kW) and T2 (2.2–4 kW) models, follow the steps below to install the drive:
   a. Use a Phillips screwdriver to secure the bolt located directly above the drive (M4 bolt), as shown in Figure 1.
   b. Repeat this step to secure the two bolts located at the lower left and lower right of the drive (M4 bolt), as shown in Figures 2 and 3.

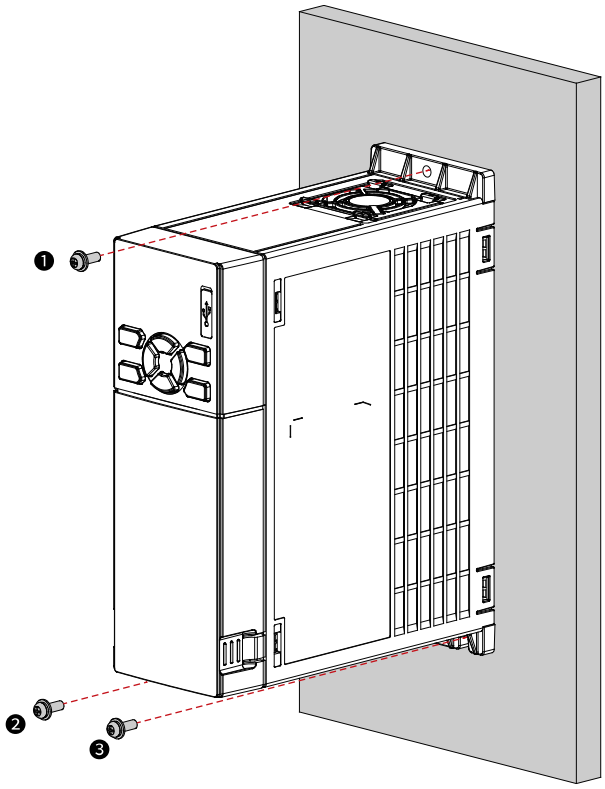


Figure 2-13 Screw installation diagram (T1 to T2)

2. For T3 (5.5–7.5 kW) to T8 (75–90 kW) models, follow the steps below to install the drive:
   a. Use a Phillips screwdriver to secure the bolts located at the upper left and upper right of the drive [T3 (5.5–7.5 kW): M4 bolt; T4 (11–15 kW) to T8 (18.5–22 kW): M5 bolt], as shown in figures 1 and 2.
   b. Repeat this step to secure the two bolts located at the lower left and lower right of the drive [T3 (5.5–7.5 kW): M4 bolt; T4 to T8 (11–90 kW): M5 bolt], as shown in Figures 3 and 4.

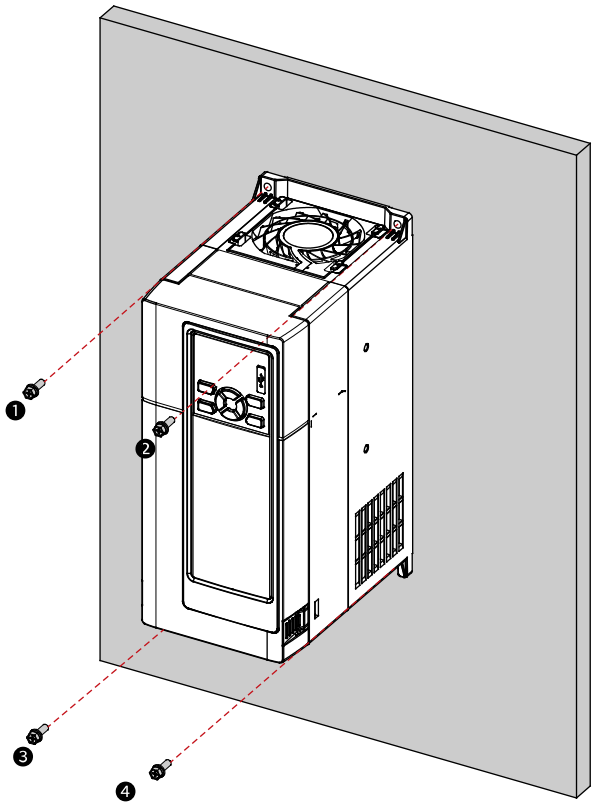


Figure 2-14 Screw mounting diagram [T3 (5.5–7.5kW) to T8 (75–90kW)]

Note

Torque please refer to *"2.3.4 Installation Tools" on page 57*the screw & screwdriver specification table.

2.6 Through-hole Mounting

Applicable models

T4 and T5 models support through-hole mounting. When the drive adopts through-hole mounting, the IP rating can be up to IP20.

Recommended model

Recommended bracket model for T4 model: MD630-AZJ-A1T4

Recommended bracket model for T5 model: MD630-AZJ-A1T5

Recommended bracket model for T6 model: MD630-AZJ-A1T6

Recommended bracket model for T7 model: MD630-AZJ-A1T7

Recommended bracket model for T8 model: MD630-AZJ-A1T8

Installation procedure

For T4 to T8 models, follow the steps below to install the through-hole bracket.

Procedure

1. Remove the pre-installed M4 screw from the bracket to disassemble it into two components, then install the left-side bracket onto the drive housing, as shown by step 1 in the following figure.
2. Tighten the two M4x16 screws on the left side of the drive with a cross screwdriver (use M5x20 screws for T5 models (18.5–22 kW)), as shown by step 2 in the following figure.
3. Slide the right-side bracket onto the housing, ensuring alignment with the left-side bracket using the locating pins. Tighten the two M4x16 screws on the right side of the housing with a Phillips screwdriver (for T5 (18.5–22 kW) models, use M5x20 screws instead). Then, secure the left and right brackets together with two M4x10 screws, as shown by step 2 in the following figure.
4. Tilt the assembled drive with brackets into the mounting opening of the control cabinet mounting surface.
5. Gently push the drive upward so that the bracket lies flat against the control cabinet mounting surface. Tighten the four M5x20 bolts around the bracket with a cross screwdriver, as shown by step 4 in the following figure.

Note

- Discard the removed M4×10 screws and replace them with the supplied M4×10 screws.
- Screw torque: M4: 1.2 N·m, M5: 2.8 N·m.

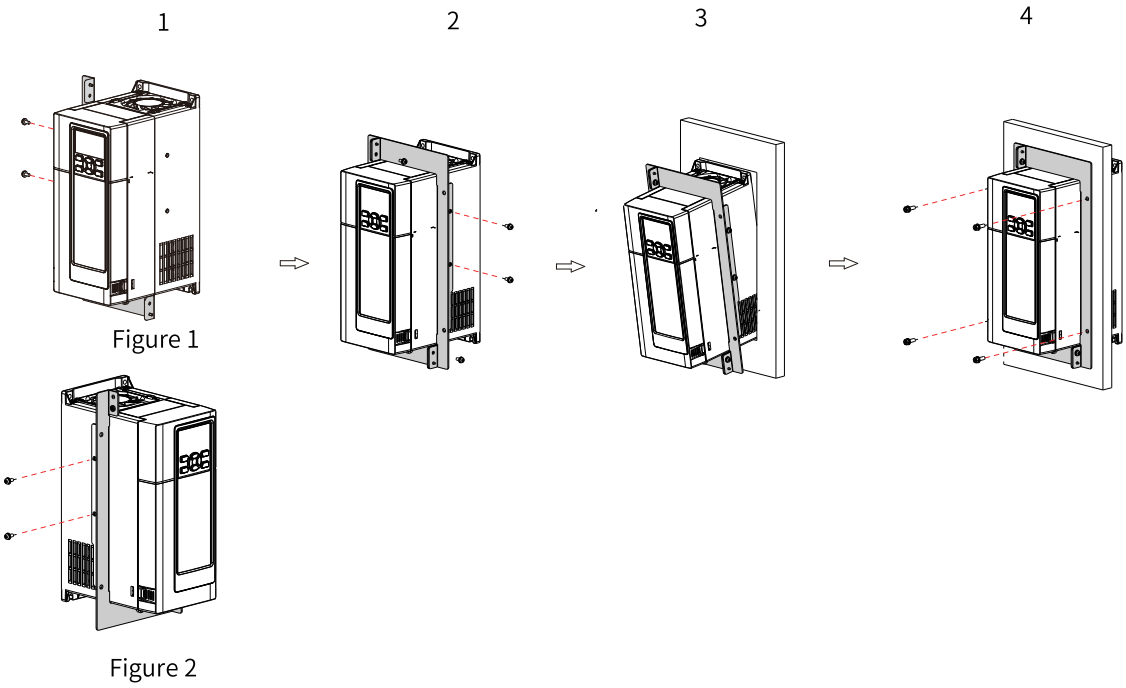


Figure 1

Figure 2

Figure 2-15 Through-hole mounting of T4 to T8 (11 kW to 90 kW) models

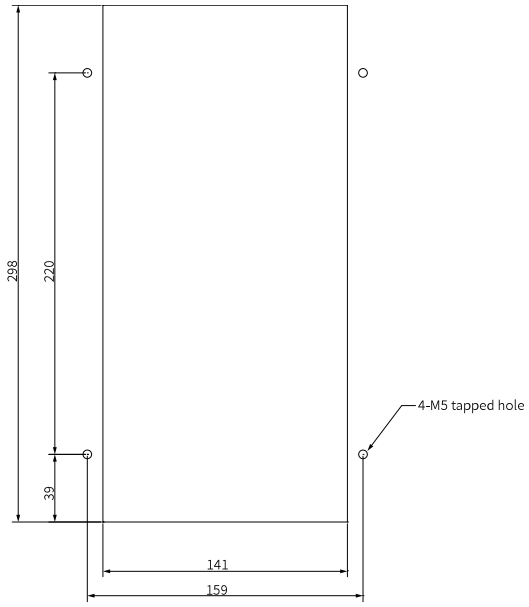


Figure 2-16 Recommended cut-out dimension (mm) for T4 (11 kW to 15 kW) models

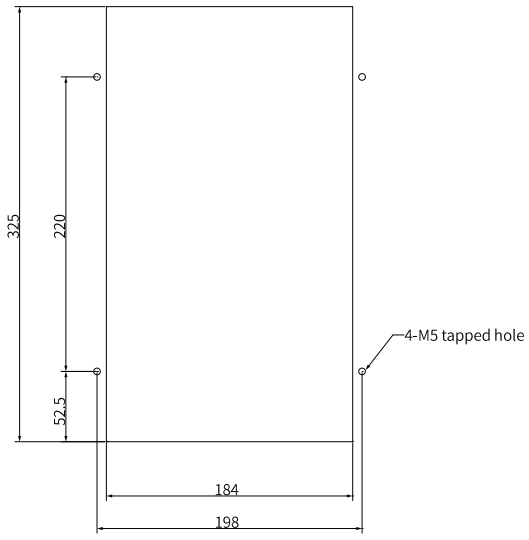


Figure 2-17 Recommended cut-out dimension (mm) for T5 (18.5 kW to 22 kW) models

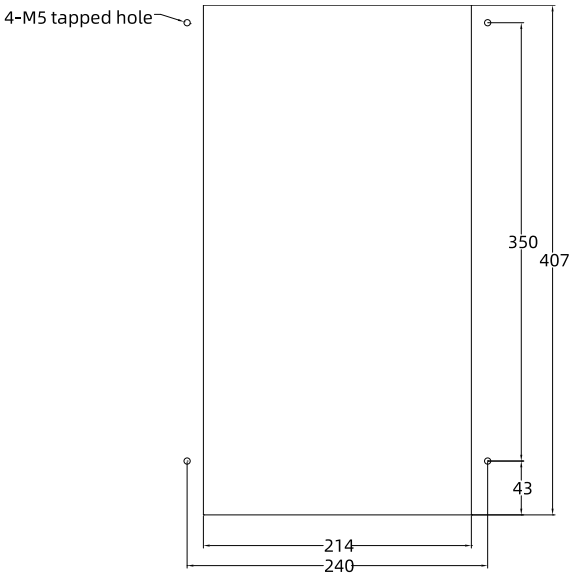


Figure 2-18 Recommended cut-out dimension (mm) for T6 (30 kW to 37 kW) models

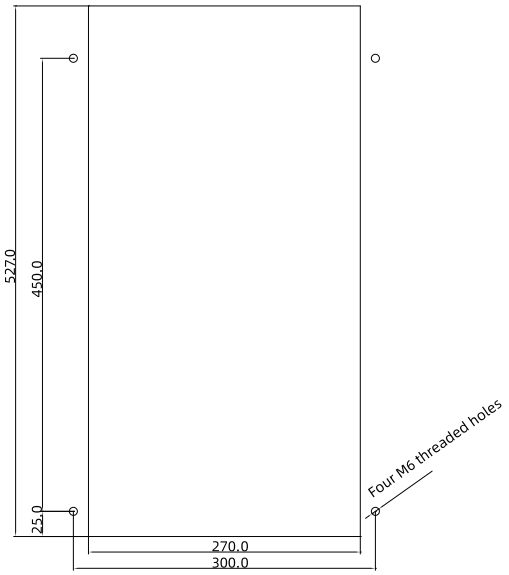


Figure 2-19 Recommended cut-out dimension (mm) for T7 (45 kW to 55 kW) models

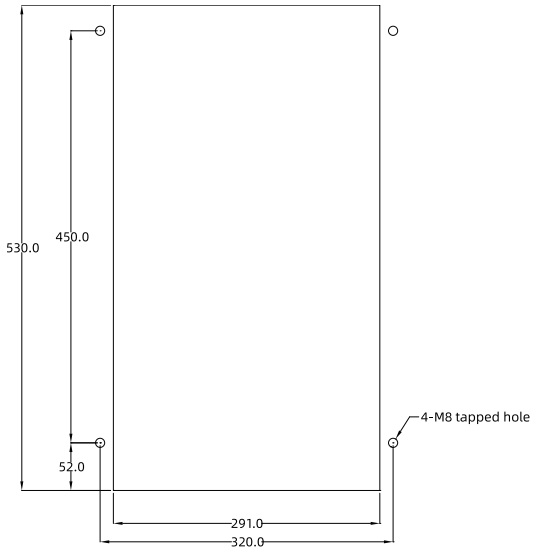


Figure 2-20 Recommended cut-out dimension (mm) for T8 (75 kW to 90 kW) models

2.7 DIN Rail Mounting

Applicable models

T1 and T2 models support DIN rail mounting.

Recommended model

Recommended DIN rail model for T1 and T2 models: MD630-AZJ-A4T1.

Installation procedure

For T1 (0.37–1.5 kW) and T2 (2.2–4 kW) models, install the DIN rail based on the following procedure.

Procedure

1. Use PA4x12 self-tapping screws to install the optional plastic baseplate onto the bottom of the drive, as shown in figure ①.
2. Insert the upper clips of the optional plastic baseplate into the rail, then firmly press diagonally downward (following arrow direction) on the base until the lower clips engage into the rail, as shown in figure ②.

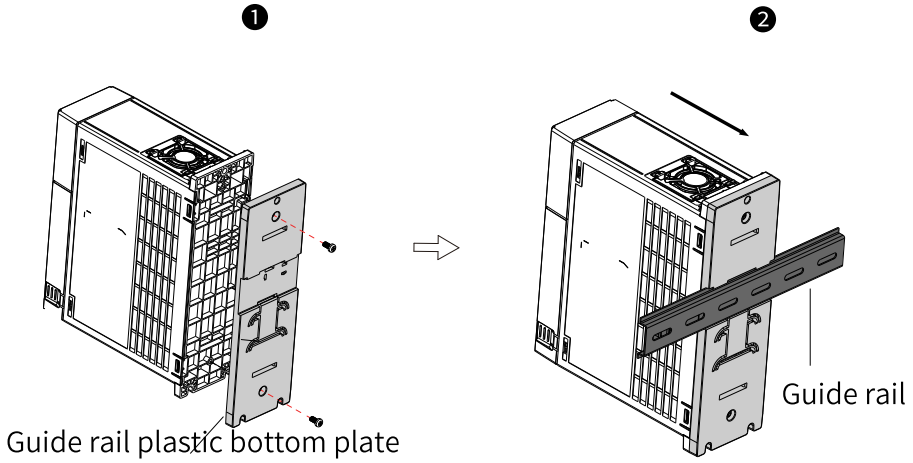


Figure 2-21 DIN rail mounting

Note

- Self-tapping screws are shipped with the rail brackets.
- Screw torque: 1.2 N·m.

2.8 Inspection After Installation

After the installation is done, check the following items.

Table 2–8 Post-installation checklist

No.	Item	Checked
1	The ceiling height meets the minimum requirements for smooth ventilation. The air inlet and air outlet are free of obstruction and have sufficient space. Sufficient space is reserved for safe passing when the cabinet door is opened.	☐
2	All contact protection devices (such as the guard plate) inside and outside the cabinet are installed.	☐

2.9 Mounting Accessories

2.9.1 Installing Cable Shield Grounding Bracket

1. Install the cable shield grounding bracket for T1 to T3 models based on the following procedure.
   a. Press the clips on both sides beneath the plastic top cover. Once the clips disengage, pivot the cover upward and remove it by pulling straight up, then remove the protective plate of the main power terminal, as shown in figure 1.
   b. The product with the plastic cover and main power terminal protective plate removed is shown in the figure 2.
   c. Use a Phillips screwdriver to loosen the two grounding terminal bolts on both sides of the main power terminal block. Insert the bottom bracket of the grounding bracket into the two

grounding terminal positions of the terminal block, then re-tighten the grounding terminal bolts. Meanwhile, secure the bracket to the drive housing using two PT4x8 self-tapping screws at its base, as shown in the figure 3.

d. Connect the main power cable, and connect the PE cable to the grounding mark on the grounding bracket. Use the matching hose clamp to secure the power cable shield and the claw of the grounding bracket to achieve 360° grounding, then re-install the main power terminal protective plate, as shown in figure 4.

e. Connect the control cable to the control terminal, clamp the exposed cable with a stainless steel clip, and secure the stainless steel clip with the M4 screw delivered to achieve 360° grounding, as shown in figure 5.

f. Re-install the product plastic cover, as shown in figure 6.

Note

The torque of the above self-tapping screws is 1.2 N·m. The terminal block screws follow the recommended torque of the terminals.

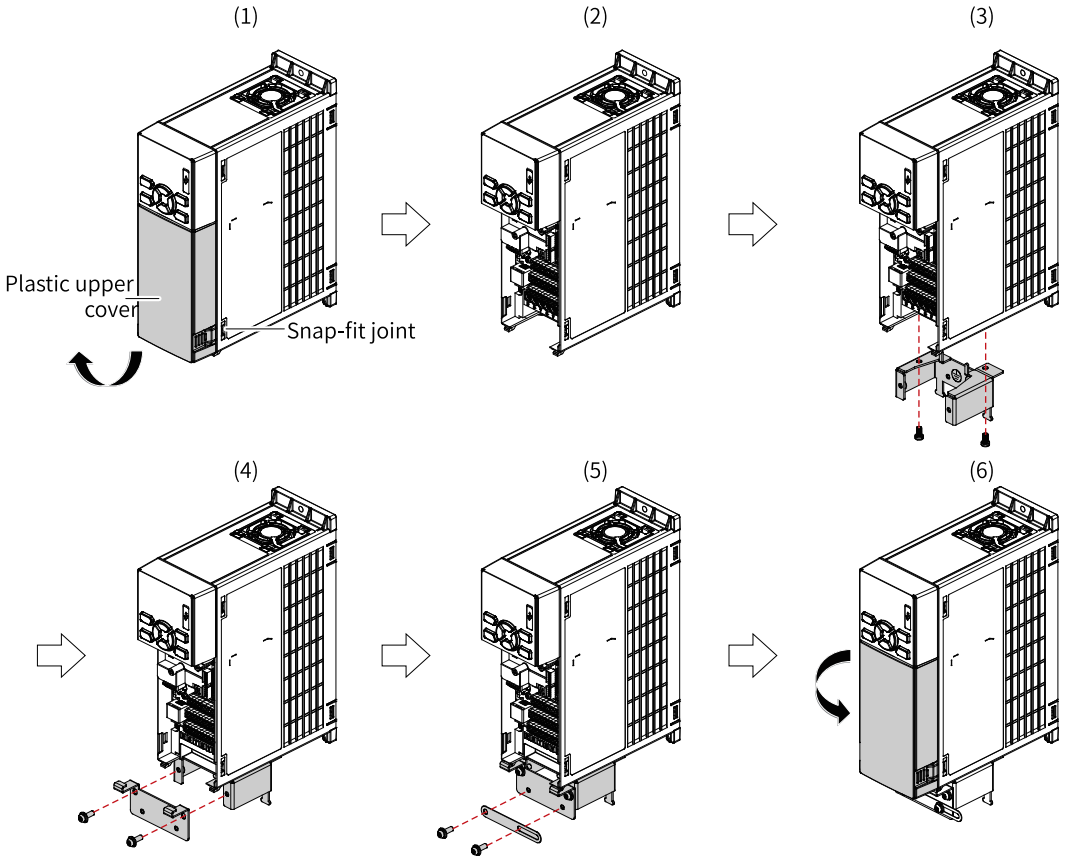


Figure 2-22 Installing cable shield grounding bracket (T1 to T3)

2. Install the cable shield grounding bracket for T4 and T5 models based on the following procedure.

   a. Press the clips on both sides beneath the plastic top cover. Once the clips disengage, pivot the cover upward and remove it by pulling straight up, then remove the protective plate of the main power terminal, as shown in figure 1.

b. The product with the plastic cover and main power terminal protective plate removed is shown in the figure 2.

c. Use a Phillips screwdriver to loosen the two grounding terminal bolts on both sides of the main power terminal block. Insert the bottom bracket of the grounding bracket into the two grounding terminal positions of the terminal block, then re-tighten the grounding terminal bolts. Meanwhile, secure the bracket to the drive housing using two PT4x8 self-tapping screws at its base, as shown in the figure 3 and figure 4.

d. Connect the main power cable, and connect the PE cable to the grounding mark on the grounding bracket. Use the matching hose clamp to secure the power cable shield and the claw of the grounding bracket to achieve 360° grounding, then re-install the main power terminal protective plate. Connect the control cable to the control terminal, clamp the exposed cable with a stainless steel clip, and secure the stainless steel clip with the M4 screw delivered to achieve 360° grounding, as shown in figure 5.

e. Re-install the product plastic cover, as shown in figure 6.

Note

The torque of the above self-tapping screws is 1.2 N·m. The terminal block screws follow the recommended torque of the terminals.

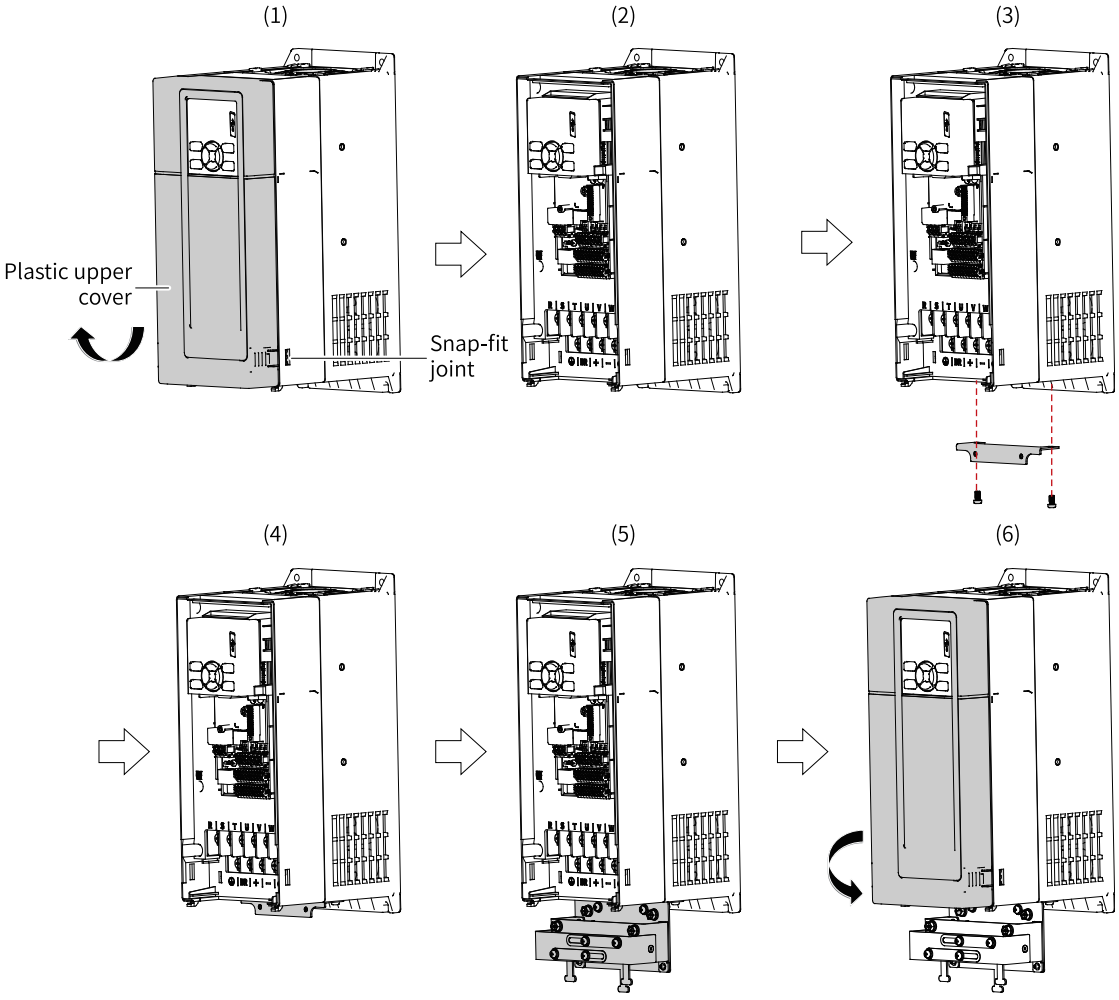


Figure 2-23 Installing the cable shield grounding bracket (T4 and T5)

Note

For wiring, see *"3.5.3 Connecting Built-in EMC Filter" on page 95*.

3. For models T6 (30–37 kW) to T8 (75–90 kW), install the cable shield grounding bracket based on the following procedure.
   a. Press the clips on both sides beneath the plastic top cover. Once the clips disengage, pivot the cover upward and remove it by pulling straight up, then remove the protective plate of the main power terminal, as shown in figure 1.
   b. The product with the plastic cover and main power terminal protective plate removed is shown in the figure 2.
   c. Use Phillips screwdriver for T6 models (30–37 kW), #13 socket for T7 models (45–55 kW), and #17 socket for T8 models (75–90 kW) to remove the grounding terminal bolts on both sides of the main power terminal block as shown in figure 3.
   d. Insert the shield bracket from the bottom wiring position into the space between the two grounding terminals of the terminal block, as shown in figure 4. Re-install the grounding terminal bolts, and fix the bracket to the drive using two PT4x8 self-tapping screws at the front and bottom of the bracket, as shown in figure 5.
   e. Re-install the product plastic cover, as shown in figure 6.

Note

Tightening torque for self-tapping screws PT4X8 and SEMS screws M4X10 is 1.2 N·m. The torque for T6 (30 kW to 37 kW) (M6) is 2.5 N·m. The torque for T7 (45 kW to 55 kW) (M8) model is 13 N·m. The torque for T8 (75 kW to 90 kW) (M10) is 20 N·m.

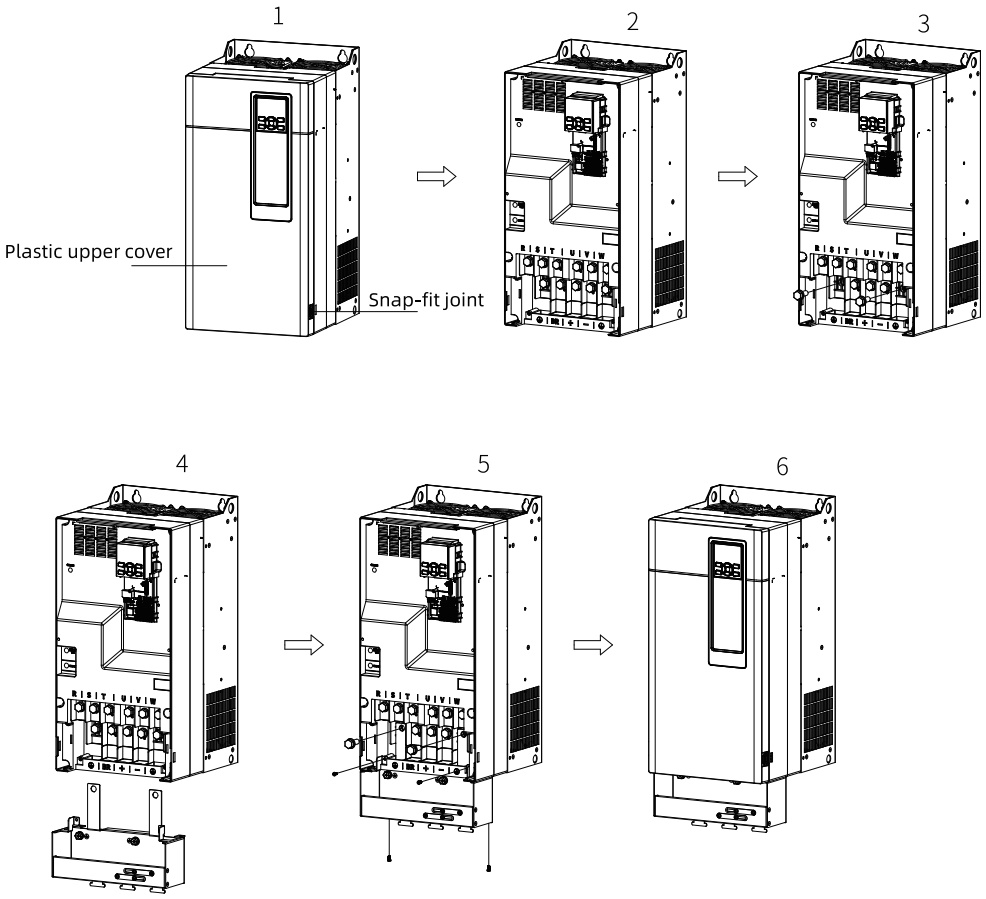


Figure 2-24 Installing the cable shield grounding bracket [T6 (30–37 kW) to T8 (75–90 kW)]

2.9.2 Installing the Punch Press Vibration Damping Bracket

Application scenarios

This bracket is suitable for punch press operations.

Installation procedure

For models T1 (0.37-1.5 kW) to T8 (75-90 kW), install the punch press vibration damping bracket based on the following procedure.

1. For models T1 (0.37-1.5 kW) to T6 (30-37 kW), secure the drive to the punch press vibration damping bracket using a cross screwdriver. The screw specifications are as follows.
   - For T1 (0.37-1.5 kW) and T2 (2.2-4 kW) models, use three M4x16 bolts to secure the drive, as shown in figure 1.
   - For model T3 (5.5-7.5 kW), use four M4x16 bolts to secure the drive, as shown in Figure 2.
   - For models T4 (11-15 kW) to T6 (30-37 kW), use four M5x25 bolts to secure the drive, as shown in figure 2.
2. For models T7 (45-55 kW) and T8 (75-90 kW), use a socket (#10 socket for T7 and #13 socket for T8) to secure the drive to the punch press vibration damping bracket. The screw specifications are as follows:

- For model T7 (45–55 kW), use four M6x25 bolts, as shown in figure 2.
- For model T8 (75–90 kW), use four M8x20 bolts, as shown in figure 2.

Note

The torque of the above screws is M4-1.2 N.m and M5-2.8 N.m.

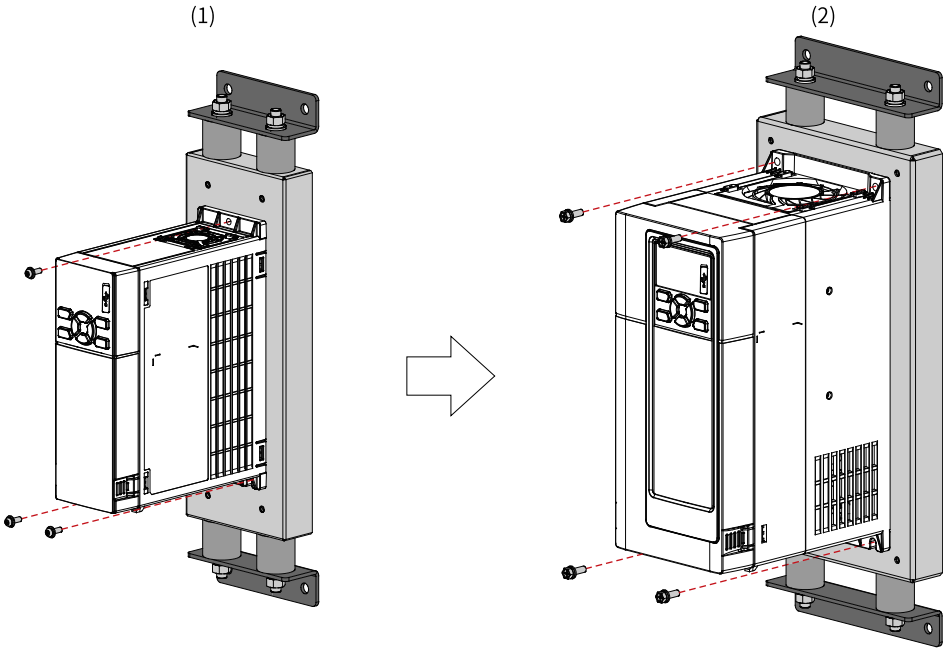


Figure 2-25 Installation of punch press vibration damping bracket

2.9.3 Installing Junction Box Accessory

Application scenarios

The junction box prevents foreign objects from entering the terminals. The IP rating of a cabinet with junction box can be up to IP20.

Installation procedure

1. Install the junction box accessory for T1 to T3 models based on the following procedure.
   a. Press the clips on both sides beneath the plastic top cover. Once the clips disengage, pivot the cover upward and remove it by pulling straight up, as shown in the figure 1.
   b. The product with the plastic top cover and main power terminal protective plate removed is shown in the figure 2.
   c. Remove the four M4 screws, then separate the bottom bracket and cover of the junction box accessory from the main body.
   d. Use a Phillips screwdriver to loosen the two grounding terminal bolts on both sides of the main power terminal block. Insert the bottom bracket of junction box accessory into the two grounding terminal positions of the terminal block, then re-tighten the grounding terminal bolts.

Meanwhile, secure the bracket to the drive housing using two PT4x8 self-tapping screws at its base, as shown in the figure 3.

e. After inserting the bracket of junction box accessory into the plastic middle shell hanger, secure the accessory to the bottom bracket using the M4 screws delivered. Route the main power cable and control cable through separate grommets, then mount the grommets onto the entry plate of the junction box accessory. Align and engage the entry plate with the four positioning pin holes on the bracket.

f. After connecting the main power cable to the terminal block (connect the PE cable to the grounding mark on the junction box accessory), re-install the main power terminal protective plate. Connect the control cable to the control board terminal, then re-install the plastic cover, as shown in figure 5.

g. Use the M4 screws delivered to tighten the cover of the junction box accessory, as shown in figure 6.

Note

- Discard the screws removed in step 4 and replace them with the M4×10 screws provided with the shipment.
- The screw torque is 1.2 N·m, and the terminal block screw specifications are based on the recommended torque of the terminal.

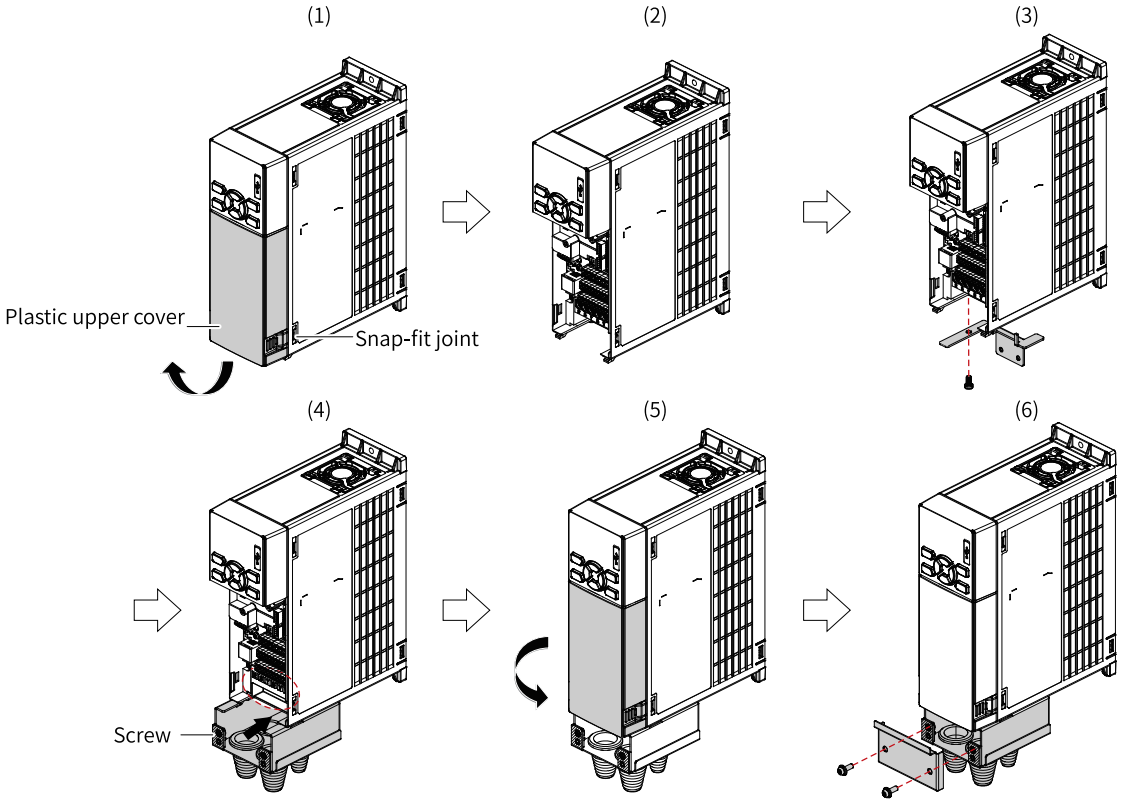


Figure 2-26 Mounting diagram of the junction box accessory (T1 to T3)

2. Install the junction box accessory for T4 and T5 models based on the following procedure.

a. Press the clips on both sides beneath the plastic top cover. Once the clips disengage, pivot the cover upward and remove it by pulling straight up, as shown in the figure 1.

b. The product with the plastic top cover and main power terminal protective plate removed is shown in the figure 2.

c. Remove the four M4 screws, then separate the bottom bracket and cover of the junction box accessory from the main body.

d. Use a Phillips screwdriver to remove the two grounding terminal bolts on both sides of the main power terminal block. Insert the bottom bracket of junction box accessory into the two grounding terminal positions of the terminal block, then re-tighten the grounding terminal bolts. Meanwhile, secure the bracket to the drive housing using two PT4x8 self-tapping screws at its base, as shown in the following figure 3.

e. After inserting the junction box accessory into the plastic middle shell hanger, secure the accessory to the bottom bracket using the M4 screws delivered, as shown in the following figure 4.

f. Pass the main power cable through the grommet, and mount the grommet onto the junction box accessory. Secure the cable to the terminal block (connect the PE cable to the grounding mark on the junction box accessory), and re-install the main power terminal cover. Pass the control cable through the grommet, and mount the grommet onto the junction box accessory. Connect the cable to the control board terminal, and re-install the plastic top cover, as shown in figure 5.

g. Use the M4 screws delivered to tighten the cover of the junction box accessory, as shown in figure 6.

Note

- Discard the screws removed in step 4 and replace them with the M4×10 screws provided with the shipment.
- The screw torque is 1.2 N·m, and the terminal block screw specifications are based on the recommended torque of the terminal.

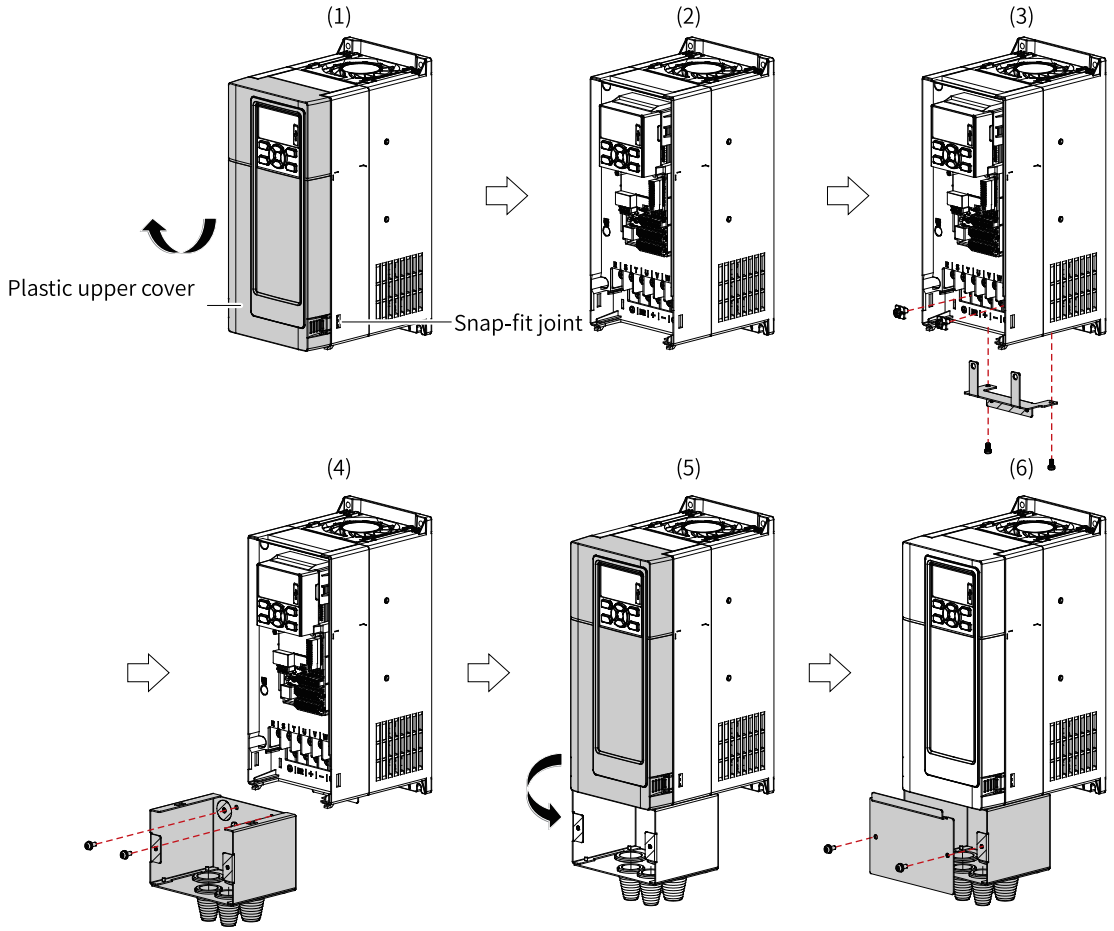


Figure 2-27 Mounting diagram of the junction box accessory (T4 and T5)

3. Install the junction box accessory for T6 and T8 models based on the following procedure.
   a. Press the clips on both sides beneath the plastic top cover. Once the clips disengage, pivot the cover upward and remove it by pulling straight up, as shown in the figure 1.
   b. The product with the plastic top cover and main power terminal protective plate removed is shown in the figure 2.
   c. Remove the four M4 screws, then separate the bottom bracket and cover of the junction box accessory from the main body.
   d. Remove the grounding terminal bolts on both sides of the main power terminal block using (T6: Phillips screwdriver; T7: #13 socket; T8: #17 socket), as shown in figure 3.
   e. Insert the junction box from the bottom wiring position into the space between the two grounding terminals of the terminal block, as shown in figure 4. Re-install the grounding terminal bolts, and fix the bracket to the drive using two PT4x8 self-tapping screws at the front and bottom of the bracket, as shown in figure 5.
   f. Pass the main power cable through the grommet, and mount the grommet onto the junction box accessory. Secure the cable to the terminal block (connect the PE cable to the grounding mark on the junction box accessory), and re-install the main power terminal protective plate. Pass the control cable through the grommet, and mount the grommet onto the junction box accessory. Connect the cable to the control board terminal, and re-install the plastic upper cover, as shown in figure 6.

g. Use the M4x10 screws delivered to tighten the top cover of the junction box accessory, as shown in figure 7.

Note

The tightening torque for self-tapping screws PT4X8 and SEMS screws M4X10 is 1.2 N·m. The torque for T6 (M6) model is 2.5 N·m. The torque for T7 (M8) model is 13 N·m. The torque for T8 (M10) model is 20 N·m.

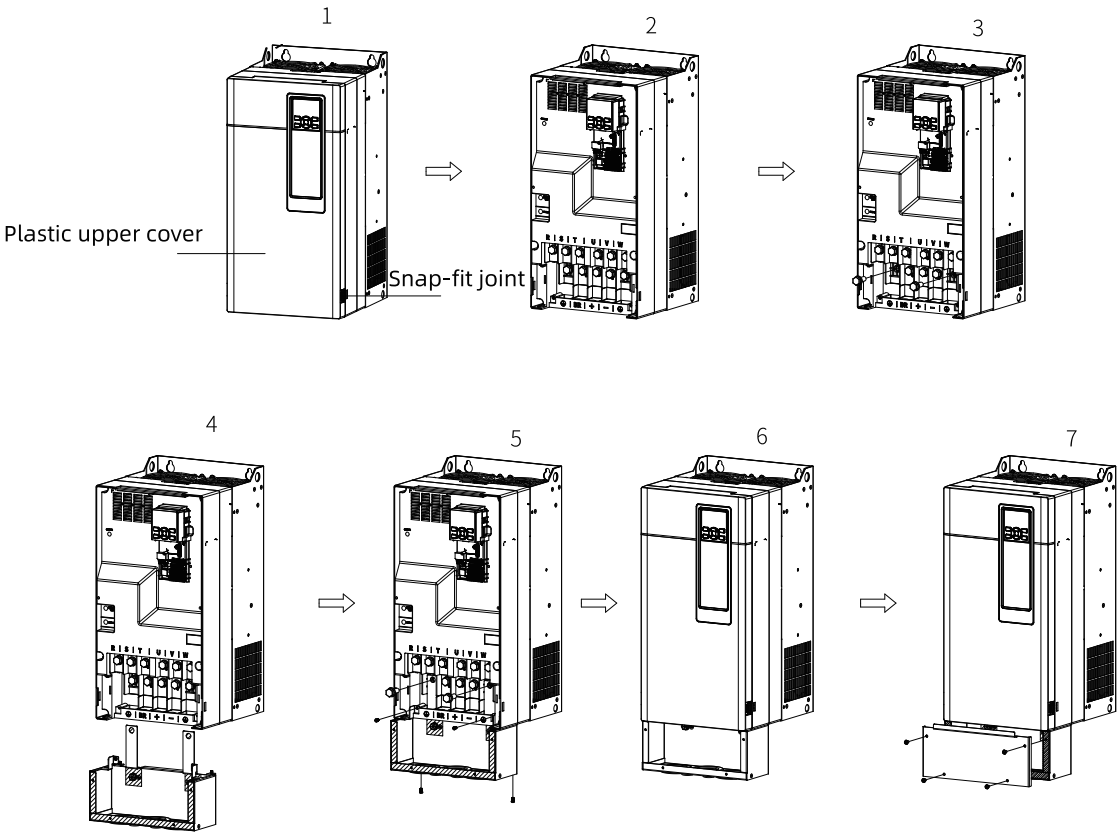


Figure 2-28 Mounting diagram of the junction box accessory (T6 to T8)

3 Electrical Wiring

3.1 AC Drive and Peripherals

When the drive is used to control motors, you must install a variety of electrical devices on the input and output sides of the drive to ensure system safety and stability. The following figure shows the system composition.

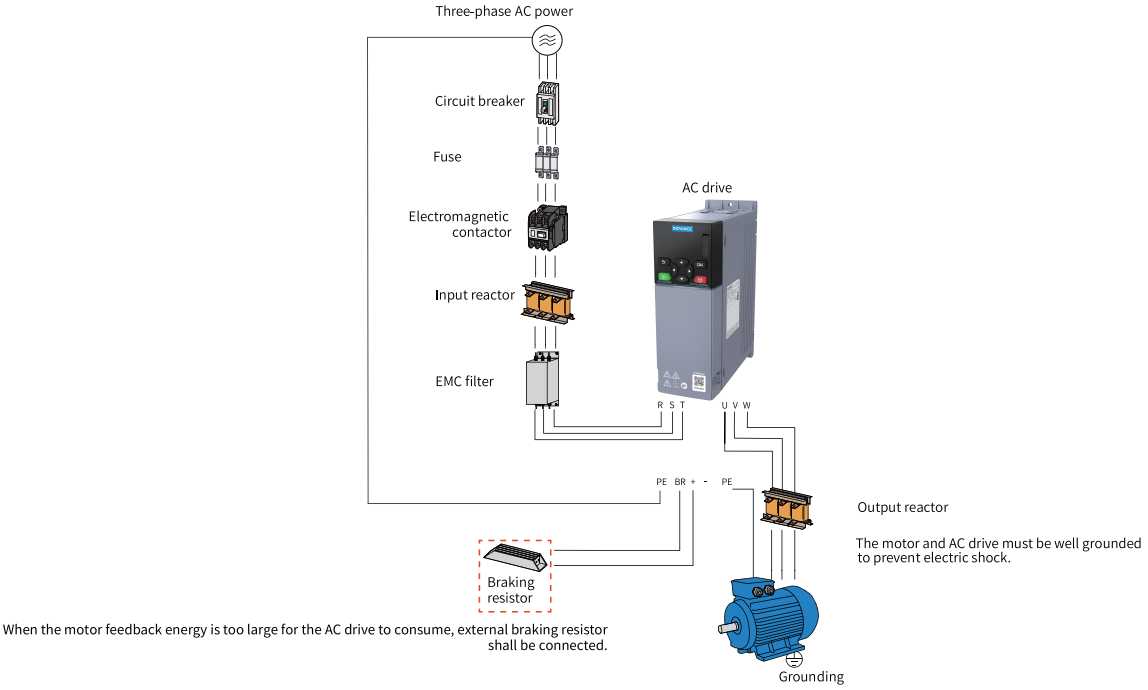


Figure 3-1 System connection diagram

Table 3–1 Description of electrical peripherals

Name	Installation position	Function
Circuit breaker	Input side of the drive	Installed between the power supply and input side of the drive. Circuit breaker: Cuts off the power supply when overcurrent occurs on downstream devices, preventing accidents. Leakage breaker: Provides protection against potential high-frequency leakage current during operation of the drive, preventing electric shock and even fire accidents. Choose proper leakage breaker according to the actual applications.
Fuse	Input side of the drive	Provides protection in case of short circuit to protect downstream semiconductors.
Electromagnetic contactor	Input side of the drive	Used to power on or off the drive. Do not use the contactor to power on or off the drive frequently (ON/OFF interval must be at least one hour).
AC input reactor	Input side of the drive	1. Improves the power factor on the input side. 2. Effectively eliminates high-order harmonics on the input side, preventing damage to other equipment caused by voltage waveform distortion, therefore eliminating input current imbalance caused by power phase imbalance.
EMC filter	Input side of the drive	Reduces the conduction and radiation interference output by the drive, as well as the conduction interference from the power end to the drive, improving the anti-interference capability of the drive.

Name	Installation position	Function
Braking resistor	Input side of the drive	A drive with the model name containing letter B is equipped with a built-in braking unit. After the braking resistor is connected to the braking unit, the braking resistor consumes regenerative energy during motor deceleration.
Output reactor	Output side of the drive	Harmonics are present in the output side of the drive. When motor is far from drive, excessive distributed capacitance exists in the circuit. Certain harmonics may cause resonance in the circuit, which can: • Degrade the motor insulation performance and damages the motor in the long time. • Generate significant leakage current, causing frequent protection trips in the drive. An output reactor can protect motor insulation and reduce bearing current.
Motor	Output side of the drive	Select an applicable motor.
Note: For selection of electrical peripherals, see *" Accessory Specifications" on page 1340*.		

3.2 Electrical Wiring Diagram

Wiring of standard MD630S-INT AC drive

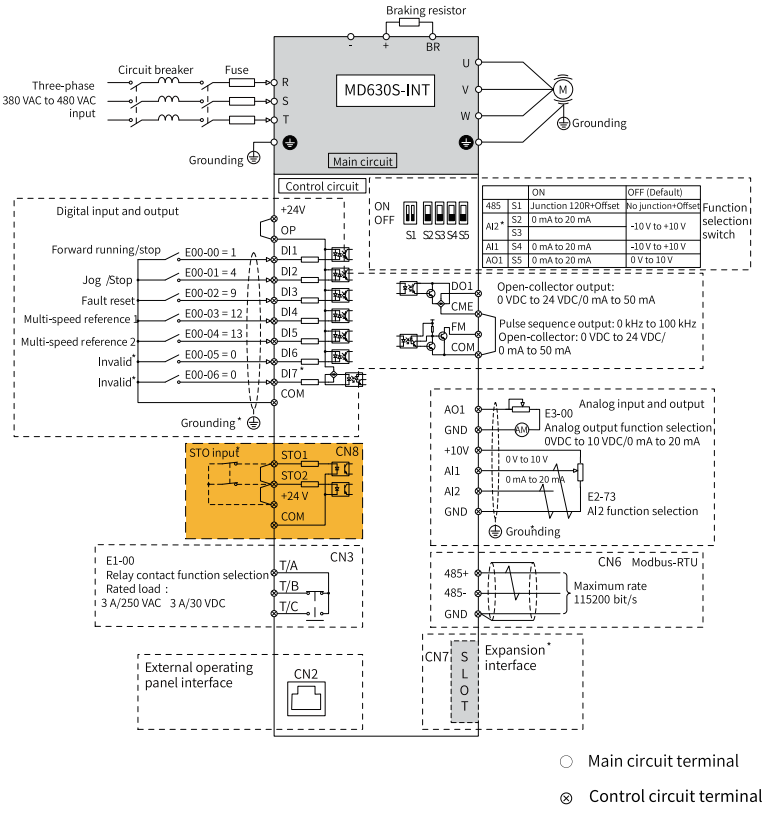


Figure 3-2 Wiring of standard MD630S-INT AC drive

Note

- DI7*: DI7 supports 20 kHz high-speed pulse input.
- Grounding*: Connect the cable shield to the grounding bracket when the signal cable is too long or interfered.
- STO input *: STO models +24V/STO1/STO2 are shorted by default. If external function safety wiring is required, remove the shorting wiring.
- AI2*: S2 and S3 DIP switch ON status are mutually exclusive. Do not switch to the ON status at the same time. The temperature sampling supports PT100/PT1000/KTY84-130/PTC130.
- Expansion interface *: Reserved interface.
- No function *: No other functions are preset by default. The function of each terminal is determined by the parameters of the related function code.

Wiring of bus-type MD630S-INT AC drive

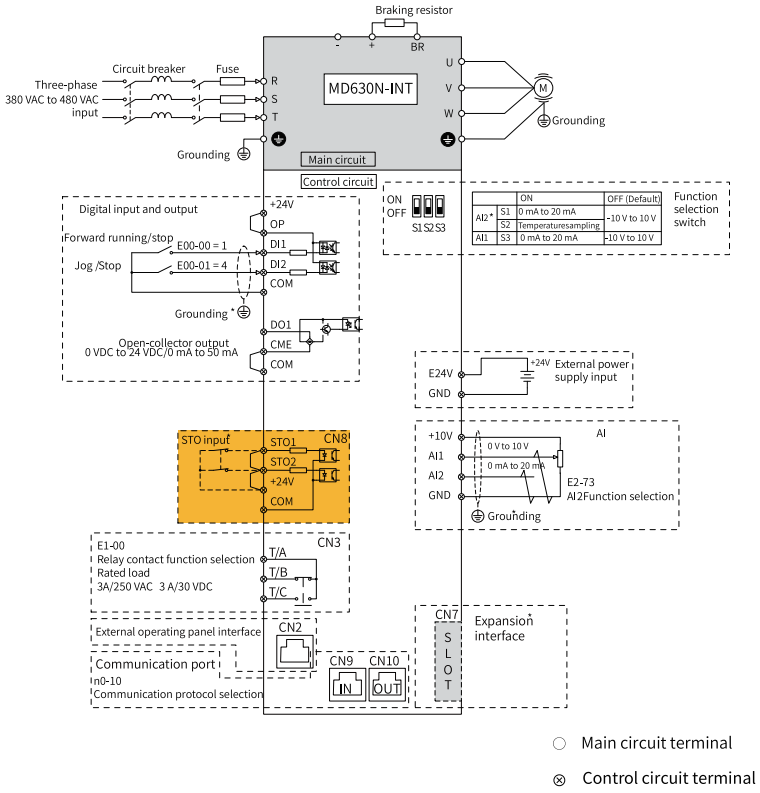


Figure 3-3 Wiring of bus-type MD630S-INT AC drive

Note

- Grounding*: Connect the cable shield to the grounding bracket when the signal cable is too long or interfered.
- STO input *: STO models +24V/STO1/STO2 are shorted by default. If external function safety wiring is required, remove the shorting wiring.
- AI2*: S2 and S3 DIP switch ON status are mutually exclusive. Do not switch to the ON status at the same time. The temperature sampling supports PT100/PT1000/KTY84-130/PTC130.
- Expansion interface *: Reserved interface.

3.3 Requirements on Power Grid System Compatibility

The MD630-INT series drive is suitable for TN, TT, and IT power systems, and does not support delta-connected power grid systems.

Note

As the AC drive contains a grounded Y capacitor and a voltage resistor to ground, if the AC drive is installed in an IT system (floating ground system) or angle-grounded TN system (asymmetric grounding system), the voltage of any PE may exceed the withstand voltage of the internal grounding device. In this case, disconnect the EMC/VDR grounding screw of the ground Y capacitor and ground voltage resistor. Failure to comply may result in damage to the drive.

3.4 Wiring Requirements and Cable Preparation

3.4.1 EMC-Compliant Cabinet Design

Installation precautions for the control cabinet

- The fewer and smaller the holes in the cabinet, the better the anti-interference capacity can be. The maximum diameter of holes on metal contact surfaces in the cabinet structure is 100 mm (3.94 in.). Pay special attention to the size of the grid holes at the cold air intake and outlet.
- Weld the steel panels together without holes to achieve the optimal electrical connection. If welding is not possible, do not paint the gap between panels and install special conductive EMC bars to realize galvanic connection. Generally, reliable conductive bars are made of flexible silicon with the surface covered by a metal mesh. Additional conductive gaskets are needed between metal surfaces to enhance the contact between them. The maximum distance between assembly screws is 100 mm (3.94 in.).
- Make sure that a high-frequency grounding system has been established in the cabinet. This is to prevent voltage difference, forming a structure that can shield against radiation. Use short and flat low-inductance copper braids to achieve a high-frequency grounding system. High-frequency single-point grounding cannot be used due to the long distance in the cabinet.
- Use of only conductive EMC shield gaskets is not enough to achieve protective grounding. To ensure electrical safety of the parts, a low-frequency grounding system is required. Follow local regulations when designing protective grounding.

Recommended wiring requirements of the cabinet system

- Install the control devices and drive devices into two separate cabinets.
- For installation involving multiple cabinets, use the grounding cable with a cross-sectional area of at least 16 mm² to connect the cabinets. This is to ensure equipotentiality between cabinets.
- For installation involving only one cabinet, install different devices into different areas inside the cabinet according to the signal intensity.
- Apply equipotential bonding to devices in different areas inside the cabinet.
- Shield all the communication (such as RS485) cables and signal cables that routed out from the electric cabinet.

- Install the power supply input filter inside the cabinet to a place near the input interface of the cabinet.
- Protect each grounding point in the cabinet by spray coating.

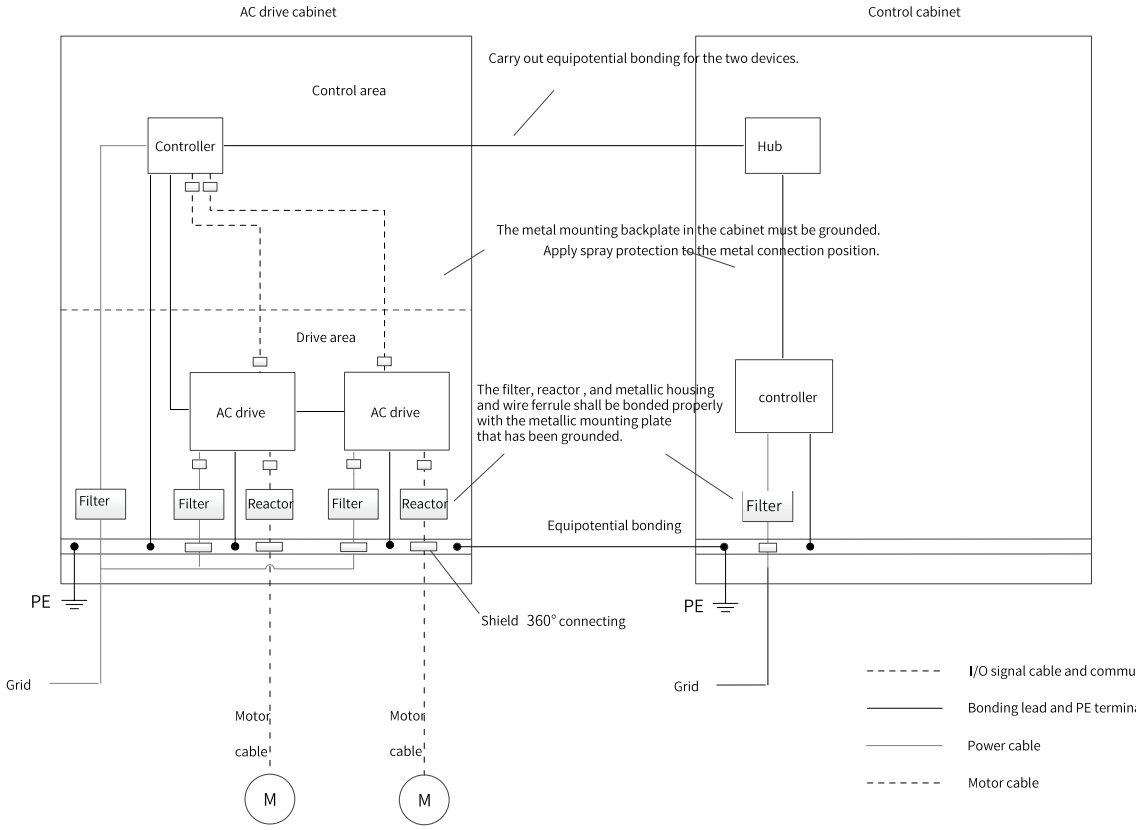


Figure 3-4 Recommended wiring of the cabinet system

3.4.2 Cable Routing

The following cables are used for the drive.

- Input/Output (grounding) cables
- Busbar cable
- Braking cable
- Signal cable

For detailed cable selection information, see *"9.8.12 Cable" on page 1380*.

Routing requirements:

- Routing signal cables and power cables through different routes
  To remotely control the drive speed using analog signals, route the signal cables and high-current cables (such as power input cables, drive output cables, braking resistor cables) through different routes with a distance of at least 50 cm (19.69 in.) to reduce interference from the drive or other equipment. The above requirements must also be followed for wiring inside the control cabinet.
- Wiring requirements on analog control signal cables

Use shielded twisted pair cables for analog control signal cables. Minimize the length of the stripped part of the cable to a value between 5 mm (0.2 in.) to 7 mm (0.28 in.), and wrap the shield with the insulation tape to prevent the shield from coming into contact with other equipment and incurring interference.

- Requirements on motor cables
  Use shielded cables as motor cables. Minimize the distance between the cabinet module and the motor. Route the motor cable independently of other cables, and avoid long-distance parallel routing of the motor cables and other cables to reduce electromagnetic interference caused by rapid changes in the output voltage of the drive.
- Requirements on control cables and power supply cables
  If the control cables and power supply cables must be cross-connected, make them be cross-connected at 90 degrees, preventing interference caused by parallel routing.

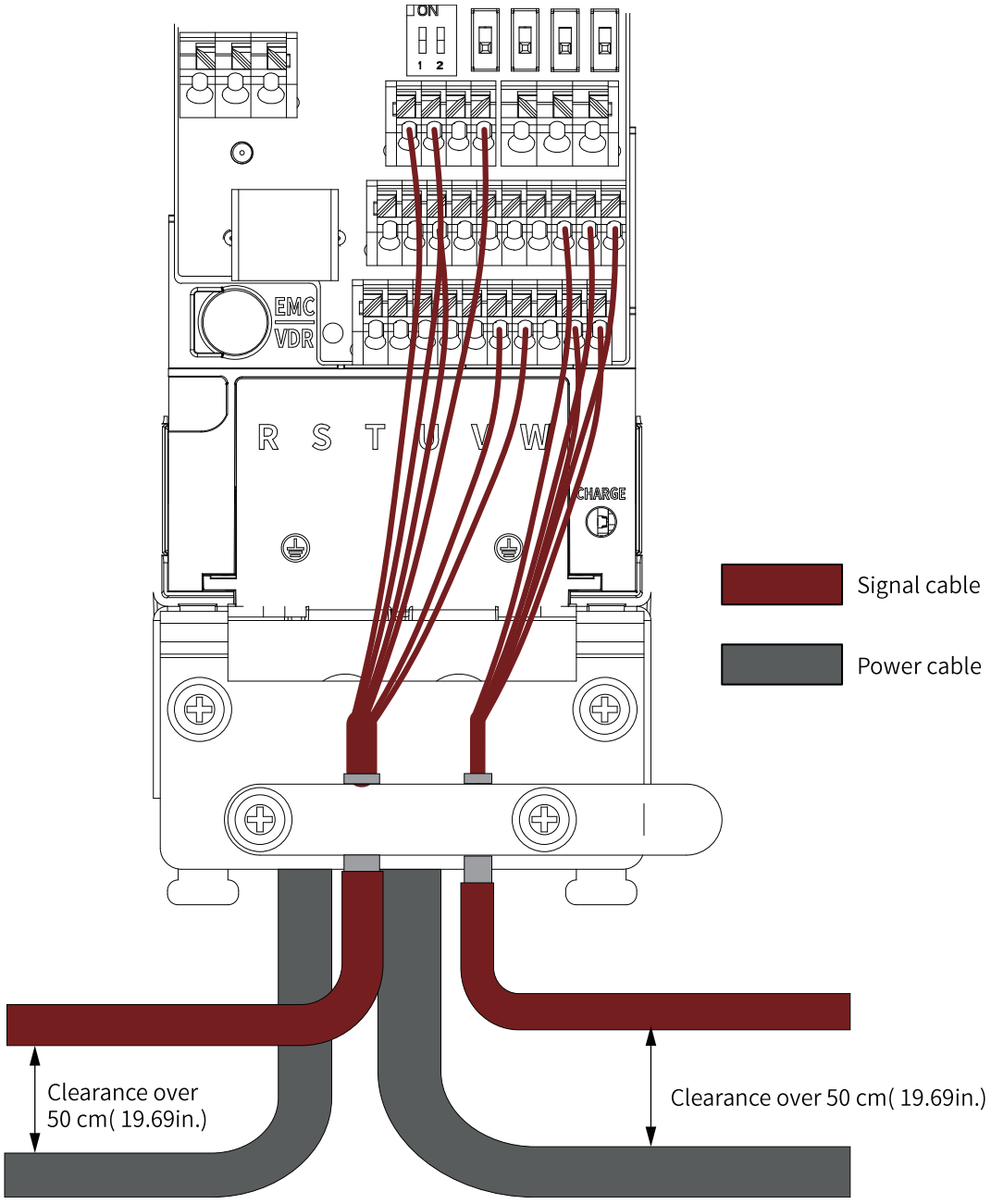


Figure 3-5 Routing diagram

Routing recommendations

- **Routing of disturbing cables and sensitive cables**
  Route cables that transmit different types of signals through different routes. Separate the disturbing cables from sensitive cables by a distance of at least 20 cm (7.87 in.). If these two types of cables must be cross-connected, make them be cross-connected at 90 degrees to avoid interference, as shown in the following figure.

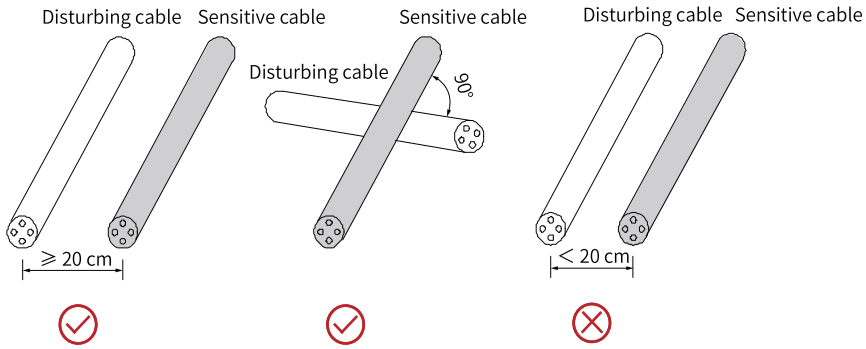


Figure 3-6 Routing of disturbing cables and sensitive cables

- **Routing of cables transmitting different types of signals**

  Route cables that transmit different types of signals through different routes and separate them with equipotential signal cables. When routing cables that transmit the same type of signals, lay equipotential signal cables at the outer layer and lay equipotential signal cables as many as possible in the middle, as shown in the following figure.

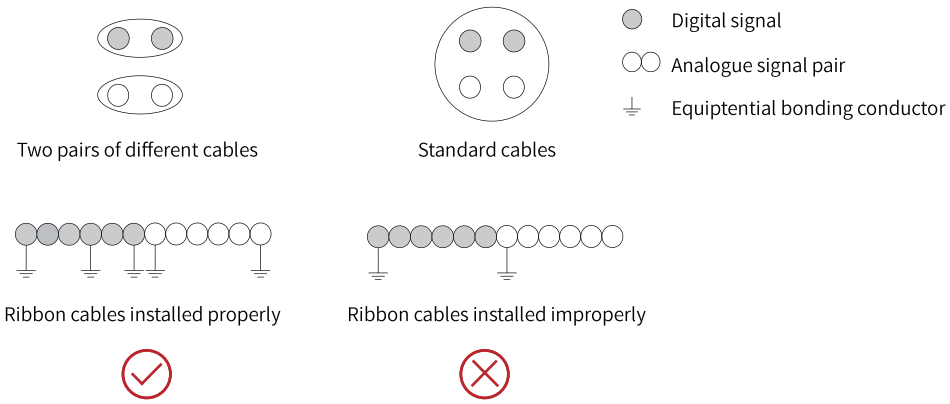


Figure 3-7 Routing of different types of signal cables

- **Routing of multi-conductor cables**

  Use one multi-conductor cable to transmit one type of signals. If you need to use one multi-conductor cable to transmit different types of signals, isolate the conductors that transmit one type of signals, as shown in the following figure.

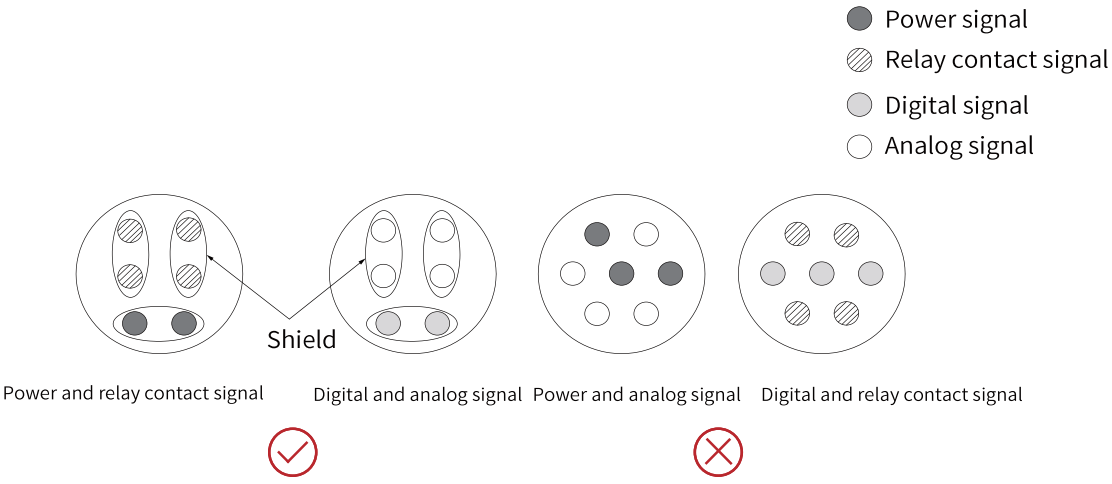


Figure 3-8 Routing of multi-conductor cables

If certain conductors in a multi-conductor cable are reserved or unused, connect these conductors to the equipotential bonding point, as shown below.

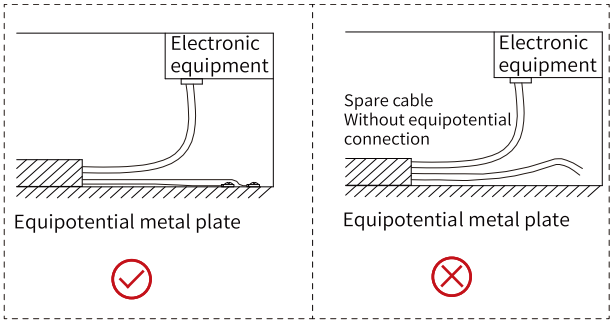


Figure 3-9 Handling of unused conductors in a multi-conductor cable

- **Requirements on the wiring loop area**
  For cables that transmit low-level sensor signals and shared cables that transmit relay signals, lay them close to each other to avoid a large loop area. Use twisted pair cables for analog signals. Lay digital signal cables close to each other, as shown below.

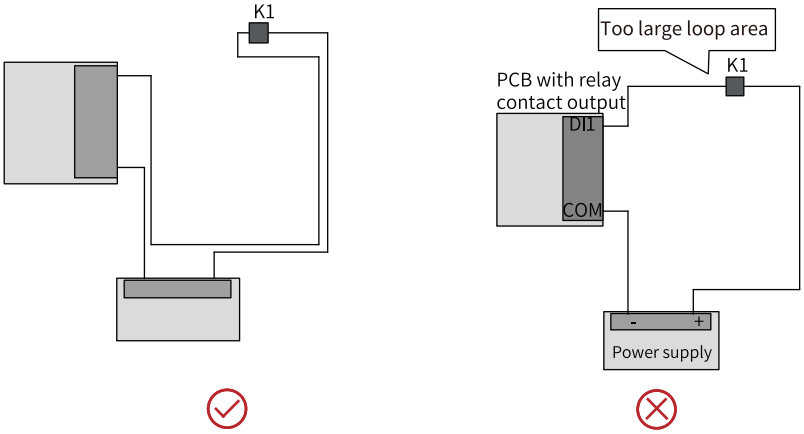


Figure 3-10 Recommended wiring loop area

- **Laying multiple types of cables**
  For cables of different types, route the cables along the equipotential metal plate. To enhance the internal EMC performance, separate different types of cables or separate cables with metal separators (recommended) in the same metal (zinc-iron or stainless steel) duct, as shown below.

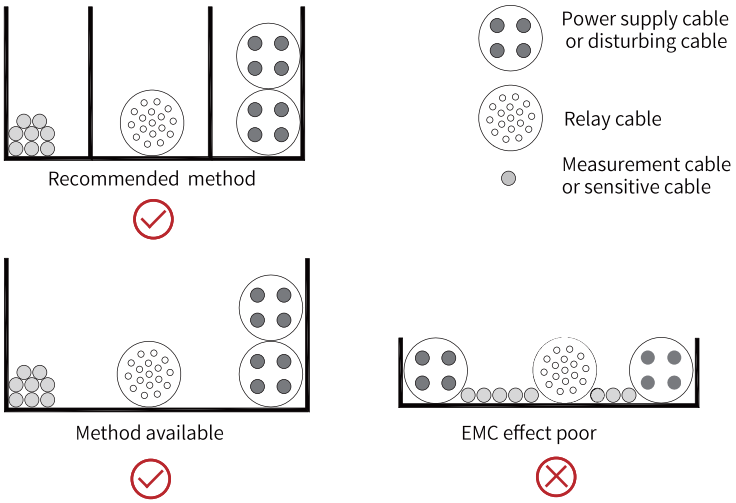


Figure 3-11 Laying multiple types of cables

- **Requirements on handing of shielded cables**
  Minimize the length of the unshielded part of a shielded cable, and connect the shield to the nearest PE terminal. If the unshielded part is too long, the cable conductor is prone to signal interference. There is no dedicated PE terminal on the drive enclosure. In this case, connect the shield to an external PE terminal, as shown below.

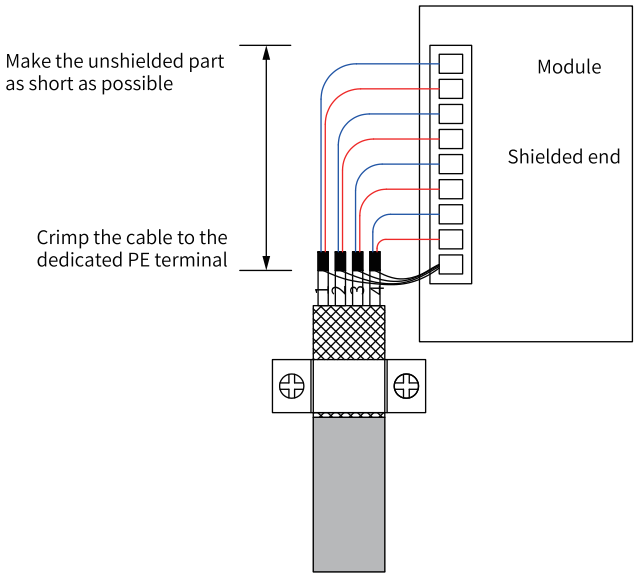


Figure 3-12 Requirements on shielded cable

3.4.3 Cable Preparation

Cable series for T1 (0.37 W ~1.5 kW)~T3 (5.5 kW ~7.5 kW)

- Input/Output cable

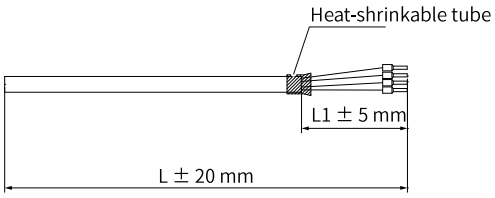


Figure 3-13 Input/Output cable for T1 (0.37 kW ~1.5 kW)~T3 (5.5 kW ~7.5 kW)

- DC bus input cables

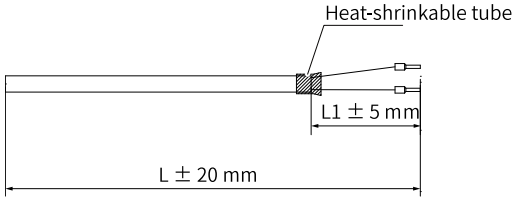


Figure 3-14 DC bus input cables

- Braking cable

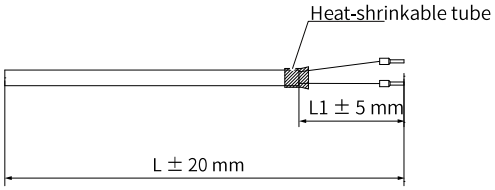


Figure 3-15 Braking cable

Cable series for T4 (11 kW ~15 kW)~T8 (75 kW ~90 kW)

- Input/Output cable

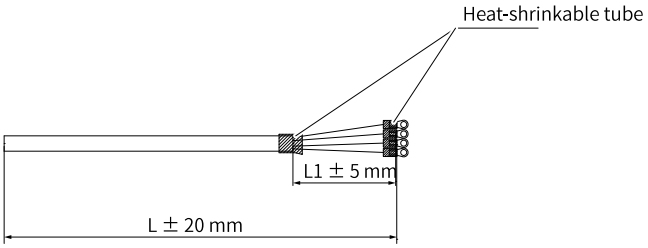


Figure 3-16 Input/Output cable for T4 (11 kW ~15 kW)~T8 (75 kW~90 kW)

- DC bus input cables

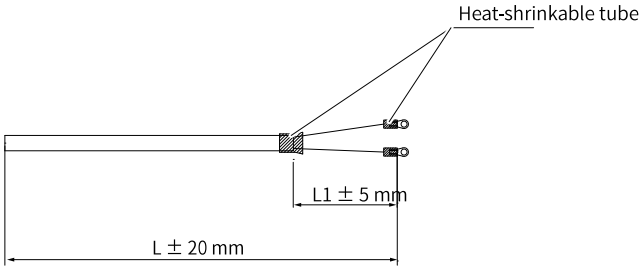


Figure 3-17 DC bus input cables

- Braking cable

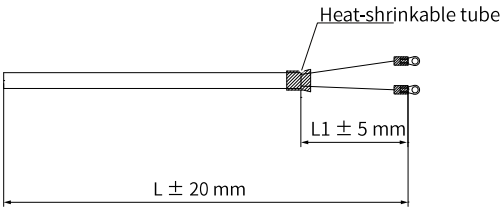


Figure 3-18 Braking cable

Note

- The total power cable length (L) and stripping length (L1) are adjusted according to the actual working conditions on site.
- The power ring tongue terminals are heat-shrink tubing with suitable heat-shrink sleeves.
- The control cables can be customized according to actual demand.

3.5 Main Circuit Connection

3.5.1 Descriptions of Main Circuit Terminals

The main circuit terminals of the AC drive are in a double-row layout. The layout of main circuit terminals of each model are as shown below.

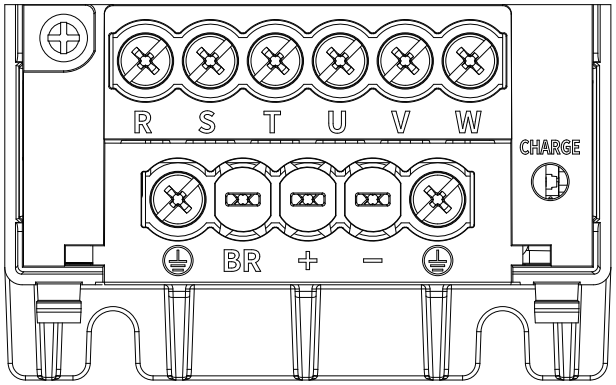


Figure 3-19 Main circuit terminal layout diagram for T1 (0.37kW–1.5kW) to T2 (2.2kW–4kW) models

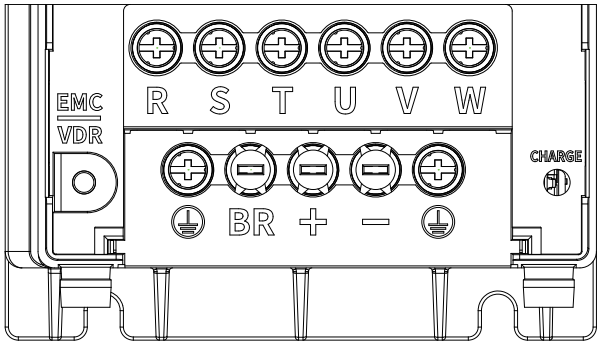


Figure 3-20 Main circuit terminal layout diagram for T3 (5.5kW–7.5kW) models

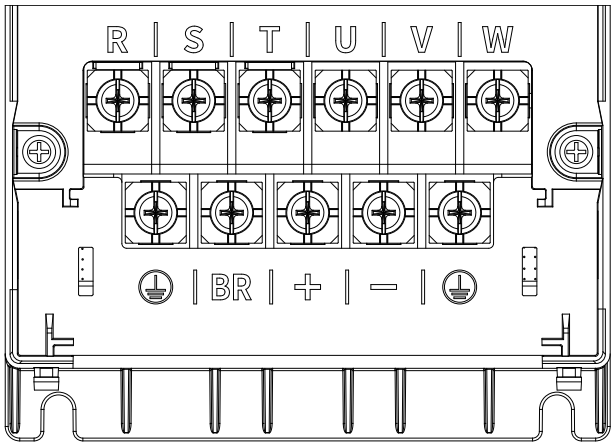


Figure 3-21 Main circuit terminal layout diagram for T4 (11kW–15kW) to T5 (18.5kW–22kW) models

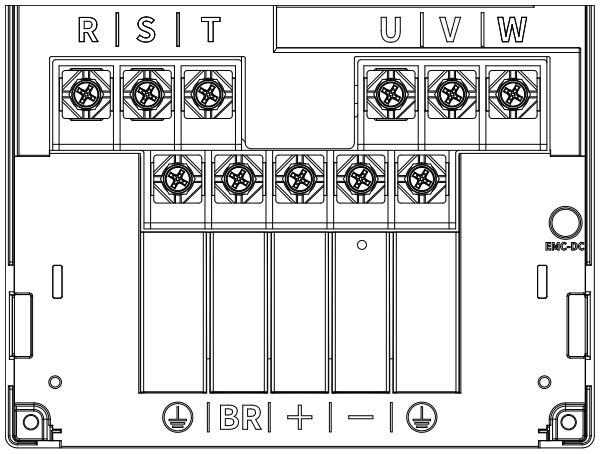


Figure 3-22 Main circuit terminal layout diagram for T6 (30kW–37kW) models

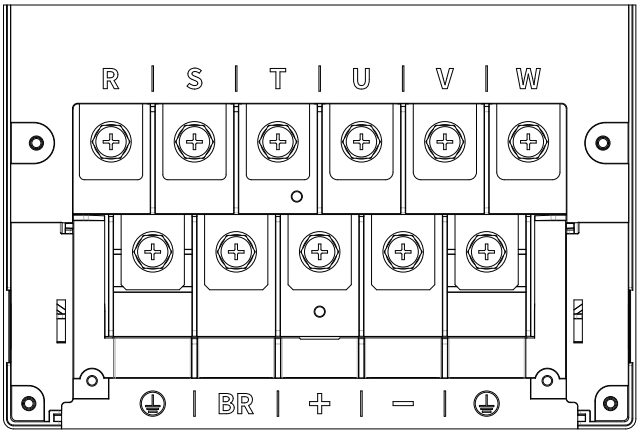


Figure 3-23 Main circuit terminal layout diagram for T7 (45kW–55kW) models

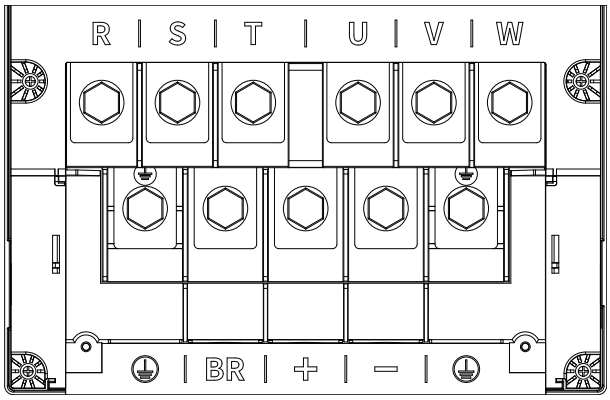


Figure 3-24 Main circuit terminal layout diagram for T8 (75kW–90kW) models

The following table describes the function of main circuit terminals.

Table 3–2 Main circuit terminal description for T1 (0.37kW–1.5kW) to T8 (75kW–90kW) models

Mark	Name	Function
R, S, T	Input terminals of three-phase power supply	Connected to the three-phase AC input power supply.
BR, +	Braking resistor connection terminals	Connected to the braking resistor.
+, -	Positive and negative terminals of DC bus	Used as the input point of the common DC bus.
U, V, W	Output terminal	Connected to a three-phase motor.
⏚	Grounding terminal (PE)	Protective grounding

Note

When installing the main circuit terminals for T4 (11kW~15 kW) ~ T5 (18.5 kW) models, screws may easily fall off; please install with caution.

The following diagram shows the dimensions of the main circuit terminals of each structure.

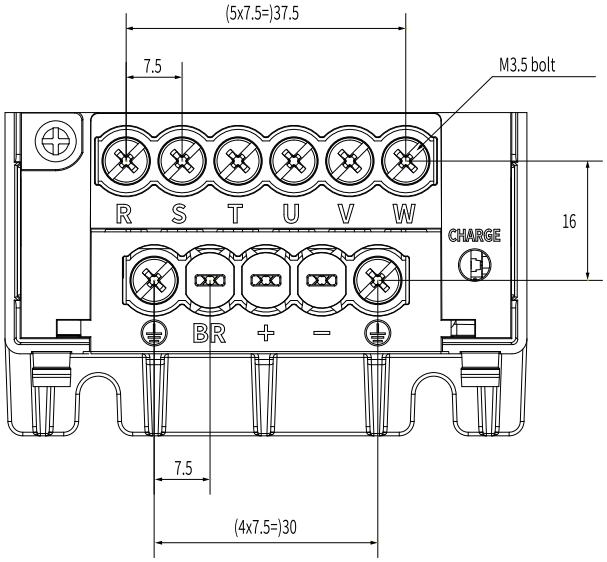


Figure 3-25 Main circuit terminal dimension diagram for T1 (0.37 kW–1.5 kW) to T2 (2.2 kW–4 kW) (unit: mm)

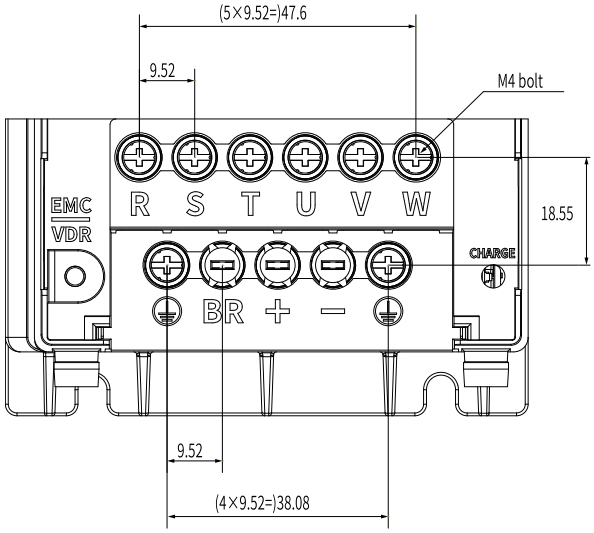


Figure 3-26 Main circuit terminal dimension diagram for T3 (5.5 kW–7.5 kW) (unit: mm)

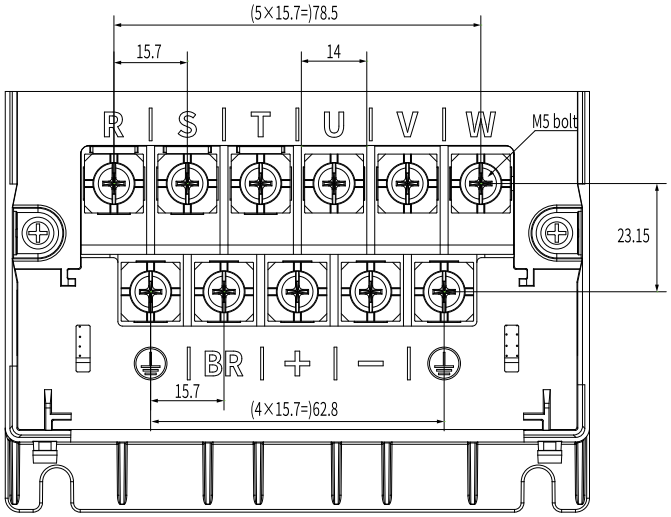


Figure 3-27 Main circuit terminal dimension diagram for T4 (11 kW–15 kW) (unit: mm)

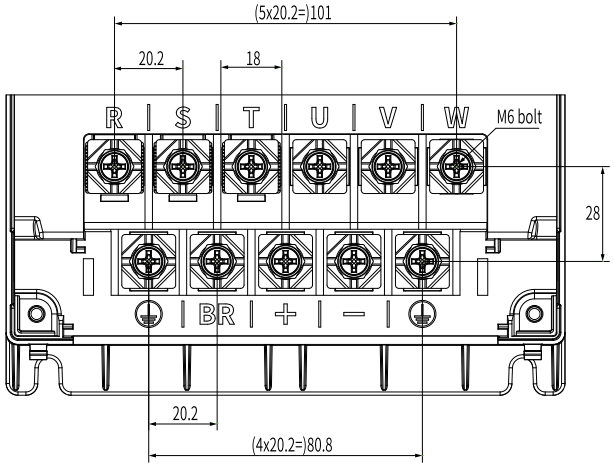


Figure 3-28 Main circuit terminal dimension diagram for T5 (18.5 kW–22 kW) (unit: mm)

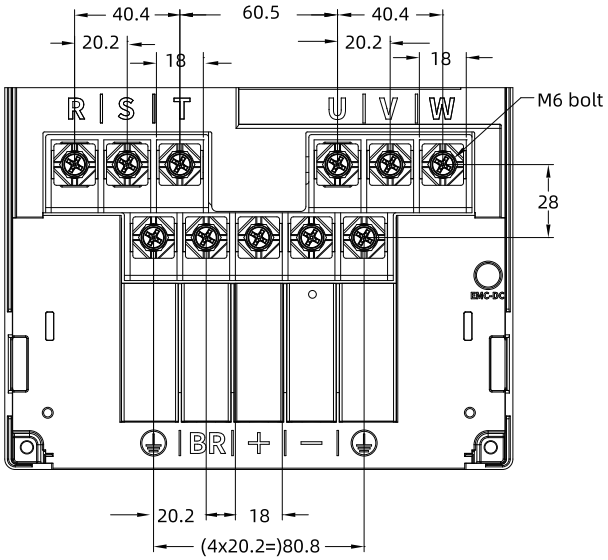


Figure 3-29 Main circuit terminal dimension diagram for T6 (30 kW–37 kW) (unit: mm)

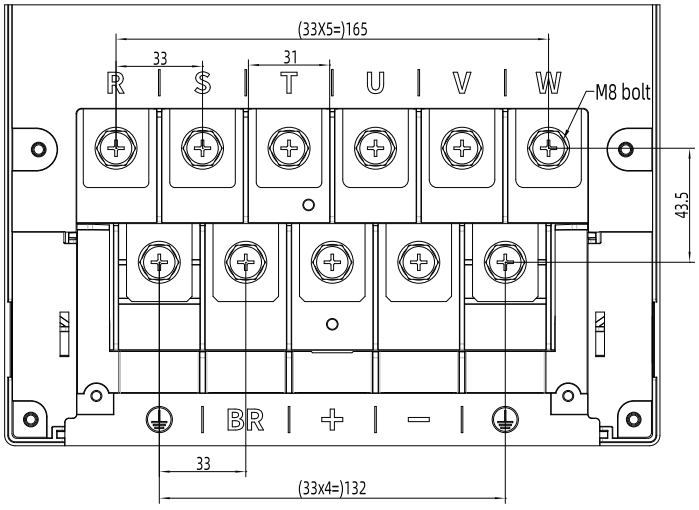


Figure 3-30 Main circuit terminal dimension diagram for T7 (45 kW–55 kW) (unit: mm)

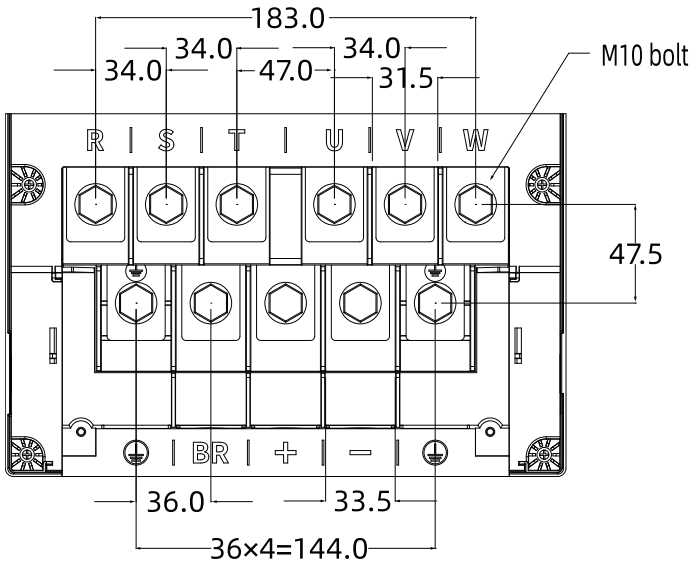


Figure 3-31 Main circuit terminal dimension diagram for T8 (75 kW–90 kW) (unit: mm)

3.5.2 Connecting Main Circuit Terminals To the Power Supply, Motor, and Braking Resistor

Wiring requirements for main circuit terminals

- The input power cables and output motor cables of the drive can generate strong electromagnetic interference. When these cables are routed in parallel with control circuit cables for a long distance, electromagnetic coupling can be generated, which affects normal operation of the drive. Therefore, keep a separation distance of at least 30 cm between main circuit cables and signal cables.
- Main circuit cables include the input R/S/T cable, output U/V/W cable, DC bus (positive and negative), and braking cable. Signal cables include the I/O signal cable and communication cable. Cable ducts must be connected and grounded properly. Aluminum cable trays ensure equipment equipotential bonding. The filter, drive, and motor must be properly bonded to the system (machine or device). All conductive metal contact surfaces at these bonding interfaces must achieve full surface contact, and the mounting areas must be applied with spray coating.

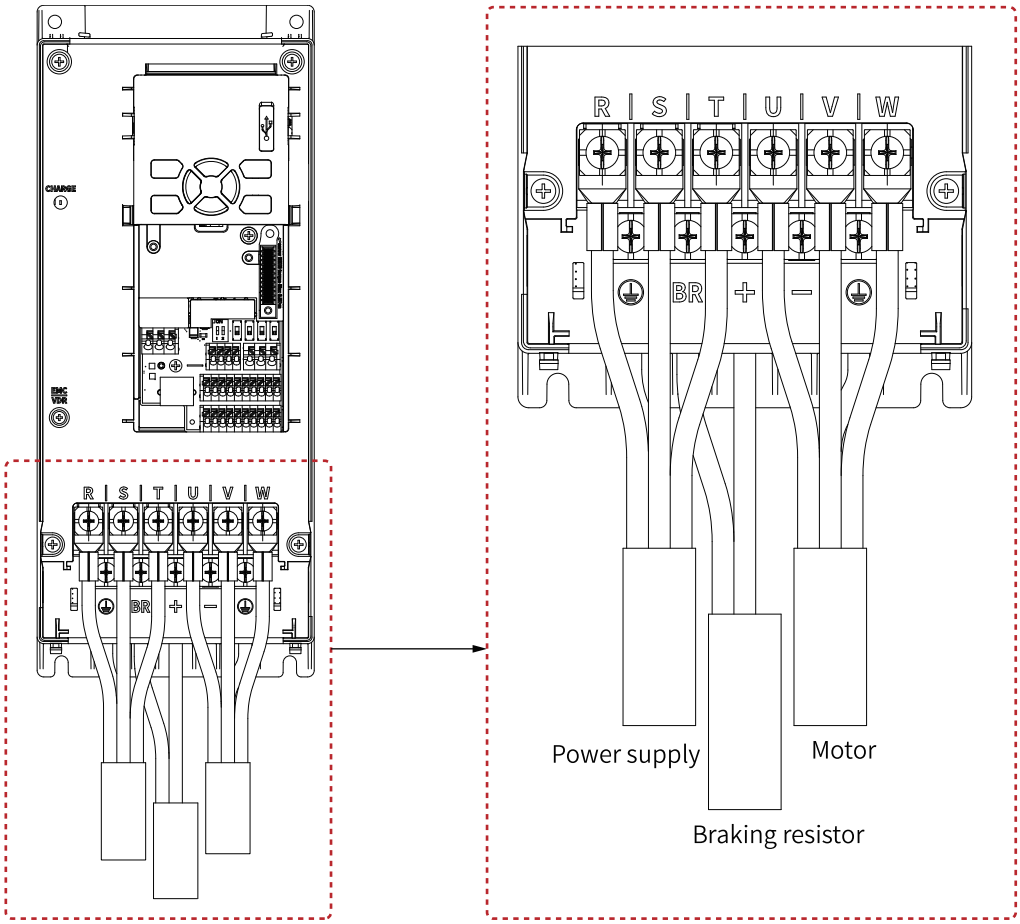


Figure 3-32 Wiring of the terminal block in the main circuit

Wiring in an IT grid system

In an IT grid system, disconnect the EMC/VDR selective grounding screw. Failure to comply can damage the drive, as shown below.

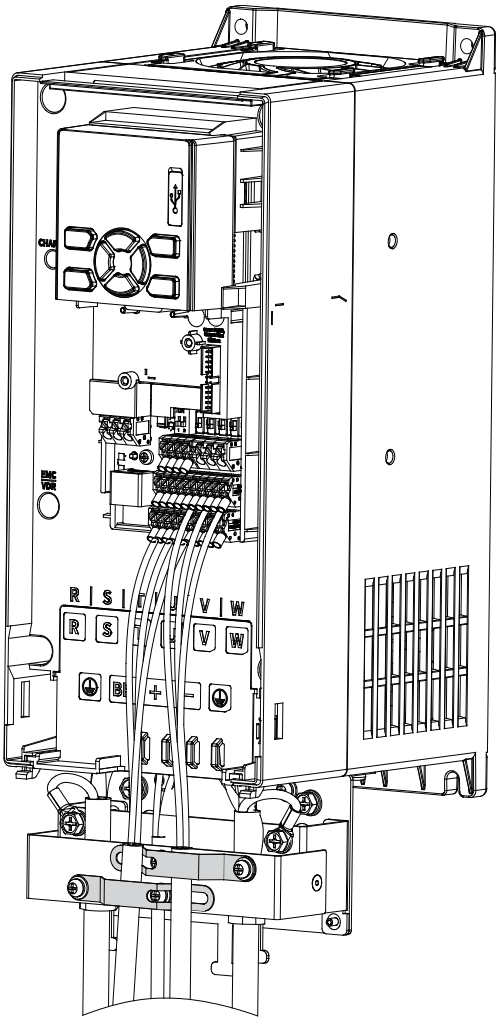


Figure 3-33 Disconnecting EMC selective grounding screw for T1 (0.37 kW to 1.5 kW) to T5 (18.5 kW to 22 kW) models

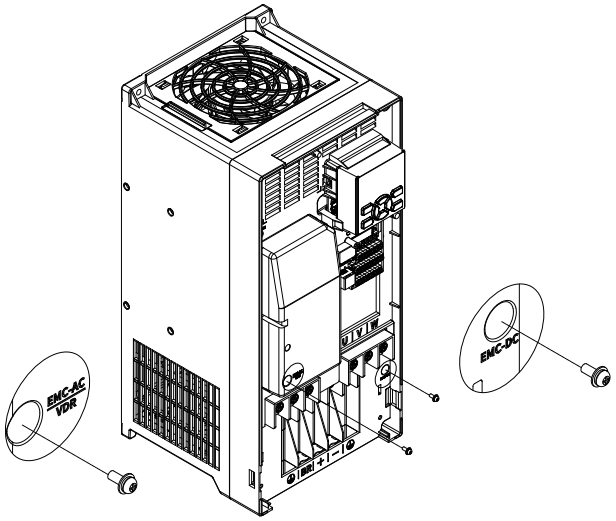


Figure 3-34 Disconnecting EMC selective grounding screw for T6 (30 kW to 37 kW) models

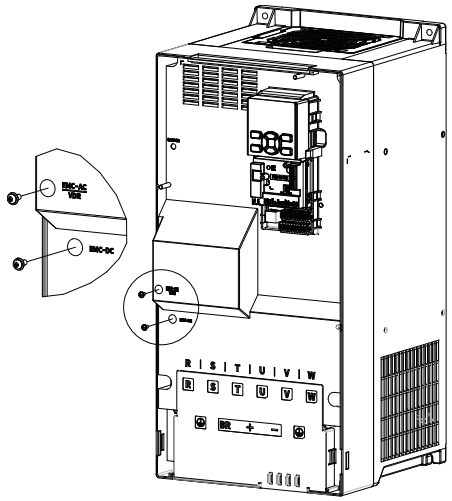


Figure 3-35 Disconnecting EMC selective grounding screw for T7 (45 kW to 55 kW) models

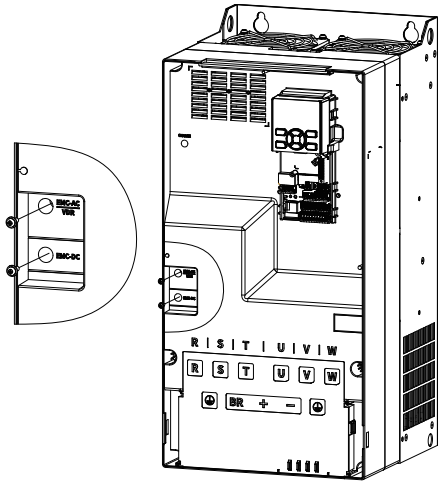


Figure 3-36 Disconnecting EMC selective grounding screw for T8 (75 kW to 90 kW) models

Motor cable length requirements

During operation of the drive, the quick on-off of the power switching transistor can lead to excessive dv/dt on the output side. Therefore, when the motor cable is too long, excessive voltage stress can be imposed on the motor winding, leading to insulation breakdown. Use motors that comply with IEC60034-25 IVIC B or motors with excellent insulation performance and high voltage resistance. In addition, when the cable length increases, the distributed capacitance of the cable increases linearly, resulting in high harmonic current.

When the motor cable is longer than the maximum length recommended in the following table, install an output reactor on the output side of the drive, or use a motor conforming to technical specifications in IEC60034-25 IVIC B. The output reactor can reduce the voltage stress on the motor winding.

Rated power of the drive	Regular asynchronous motor cable length (non-shielded cable in V/f mode)	
	Without output reactor	With output reactor
0.37 kW	≤ 200 m (carrier frequency reduced to 1 kHz)	> 200 m
0.75 kW	≤ 300 m (carrier frequency reduced to 1 kHz)	> 300 m
1.5 kW	≤ 500 m (carrier frequency reduced to 1 kHz)	> 500 m
≥ 2.2 kW	≤ 500 m (default carrier frequency)	> 500 m

Note

- In SVC control mode, the maximum length of ordinary asynchronous motor cables without an reactor is 100 m.
- The length of the shielded cable is 2/3 of the length of the shielded cable.

Requirements on the motor cable shield

It is recommended to use shielded cables for motor wiring. Ground the shield using a power cable shield grounding bracket with a 360° structural connection, and crimp the shield drain wire to the PE terminal. For details of grounding bracket of the power cable shield, see *"9.8.7 EMC Shield Grounding Bracket" on page 1371*.

Keep the drain wire of the motor cable shield as short as possible, with its width not shorter than 1/5 of its length.

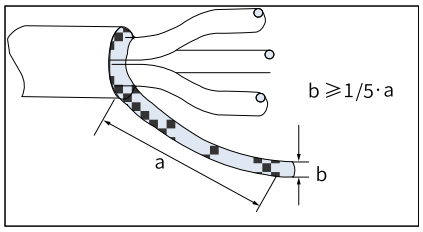


Figure 3-37 Drain wire of the motor cable shield

3.5.3 Connecting Built-in EMC Filter

This product is equipped with a built-in EMC filter that meets the C3 class limits. To comply with the standard requirements, use shielded motor cables, with a maximum length of 10 m, and ensure a 360° reliable connection at the drive side using a shielding bracket.

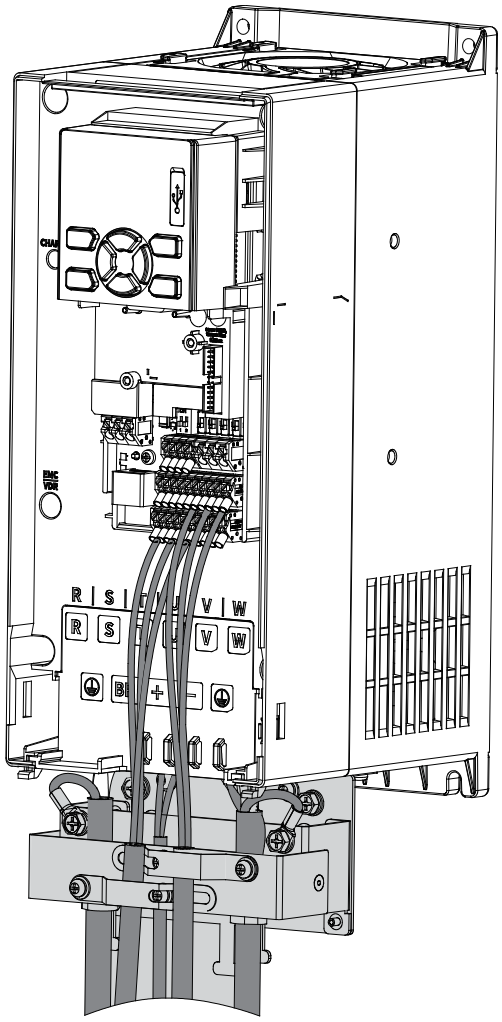


Figure 3-38 360° connection of the shielding bracket

3.5.4 Connecting External EMC Filter

Install the filter close to the input terminal of the drive. The cable between the filter and the drive must be shorter than 30 cm. Connect the grounding terminals of the filter and the grounding terminal of the drive together, and install the filter and drive on the same conductive surface that is connected to the main grounding terminal of the cabinet.

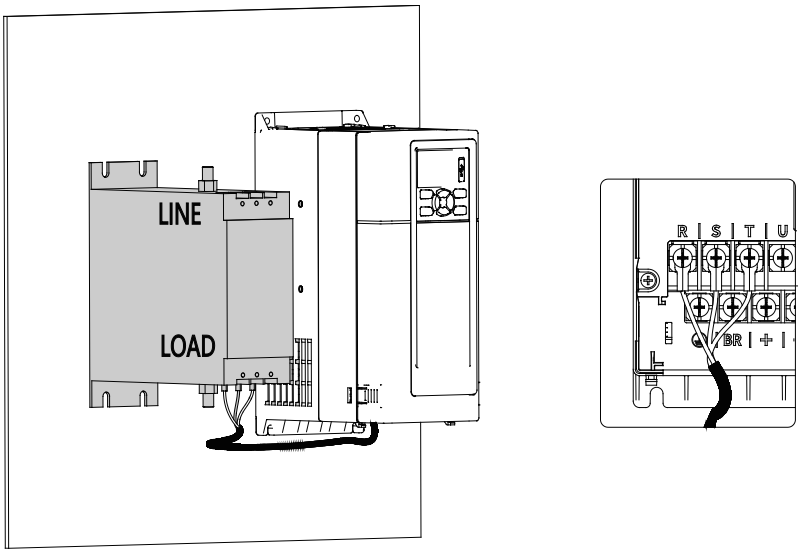


Figure 3-39 EMC filter installation

3.5.5 Power Cable Selection

For power cable selection and specifications, refer to *"9.8.12 Cable" on page 1380*.

3.5.6 Requirements for Protective Grounding Cables

Observe the following requirements to ensure a proper grounding of the drive.

Caution

- To prevent an electric shock: Ground the grounding terminal properly. Observe related national or regional regulations during grounding.
- To prevent electric shock, ensure the protective grounding conductor complies with technical specifications and local safety standards. Keep the grounding cable as short as possible. As the leakage current of the drive may exceed 3.5 mA, use a copper protective grounding conductor with a cross-sectional area of at least 10 mm^2 according to IEC/EN 61800-5-1, or two protective grounding conductors with the same cross-sectional area.
- To comply with EMC standards, ground the neutral point of the power supply. When the neutral grounding is not conducted or the large resistance is grounded, if the optional grounding screw of the EMC filter is not removed, there is a risk of electric shock.
- When using multiple devices, follow the instructions for grounding all devices. Incorrect grounding will cause misoperation of devices.
- For drives equipped with optional VDR grounding screws, remove the grounding screw before voltage resistance test. Failure to comply may cause the drive to fail the test.
- The dimensions of the grounding cable must comply with the electrical device technical standards. Keep the length of the grounding cable as short as possible. Failure to comply will lead to unstable potential in the grounding terminals away from the grounding point due to leakage current, resulting in an electric shock.
- Do not share the same grounding cable with other devices (such as welding machines or high-current electrical devices). Improper grounding of the device will lead to AC drive or device faults caused by electrical interference.
- For use of multiple AC drives, observe all the grounding instructions for the AC drive. Improper grounding of the device will lead to malfunction of the drive and the device.

Purpose of grounding

Typically, circuits are insulated by insulating materials and enclosed within a housing. However, insulating materials are not capable of preventing leakage current entirely, a minimal residual current will inherently flow into the enclosure. The purpose of grounding is to prevent electric shock caused by current leakage during direct touch with the electrical device enclosure.

The drive can generate strong interference during operation. Proper grounding can mitigate electromagnetic interference emissions from the drive.

Grounding requirements

- The protective grounding conductor must be a yellow-green cable comprised of copper conductors. Do not connect the protective grounding conductor to a switching device (such as a circuit breaker) in series.
- Ground the grounding terminal properly. Improper grounding can result in device malfunction or damage.
- The grounding terminal cannot be shared with the neutral terminal (N) of the power supply.
- Install the device on a conductive metal surface. Ensure that the whole conductive bottom of the drive is bonded properly with the mounting surface.
- Tighten the grounding screw with specified tightening torque to prevent the protective grounding conductor from being secured improperly.

Grounding method

The following three grounding methods are used generally.

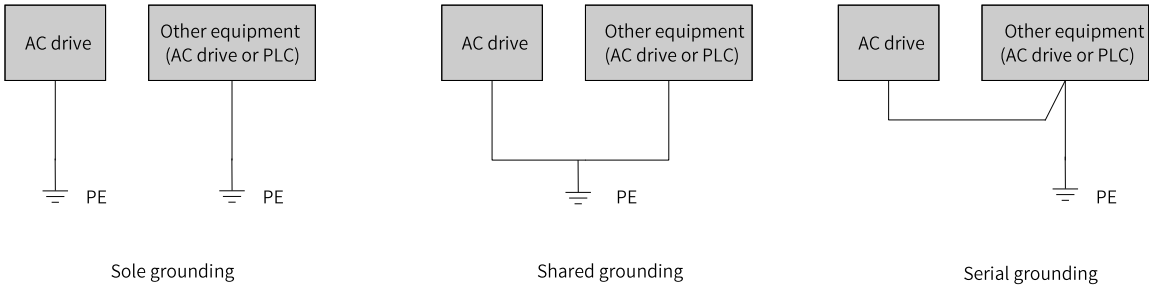


Figure 3-40 Grounding diagram

- Separate grounding: The drive and other devices are connected to the protective ground separately, which is the optimal grounding method recommended.
- Common grounding: The grounds of the drive and other devices are connected to the same protective ground, which is an acceptable grounding method.
- Series grounding: The grounding cables of other devices are connected to the grounding point of a grounded drive, or the ground of the drive is connected to the grounding point of other grounded devices. This method can easily incur common ground impedance interference, which is not recommended.

It is recommended to use parallel grounding method for the drive in the electric cabinet, as shown below.

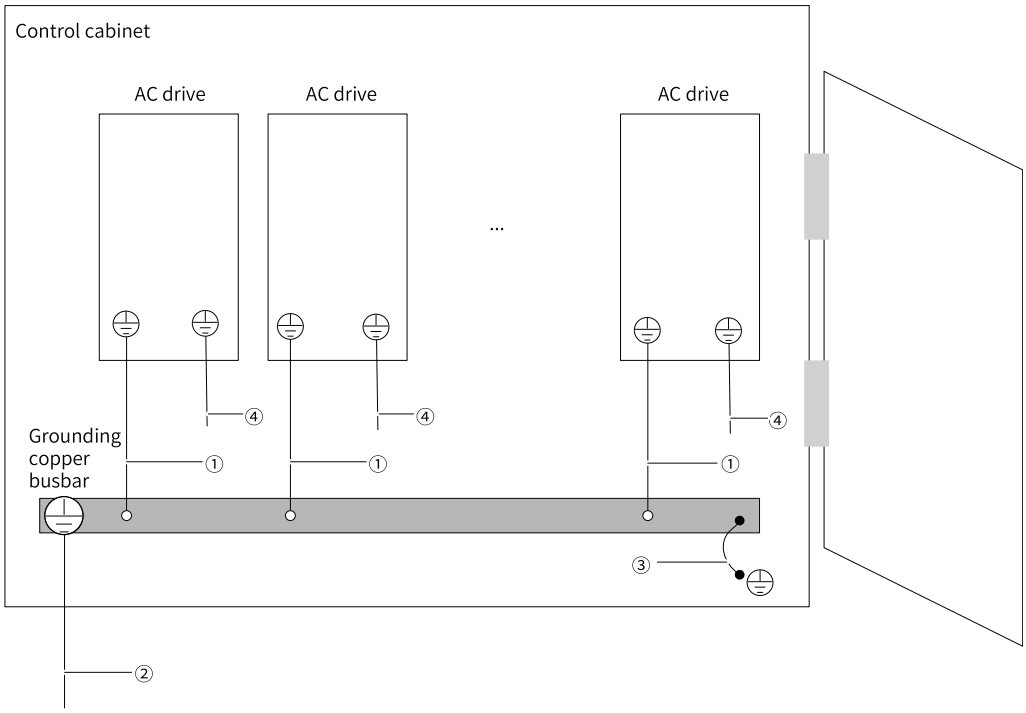


Figure 3-41 Parallel grounding of multiple drives

Description of parallel grounding	
No.	Wiring description
①	Connect the main circuit input PE terminal to the grounding copper busbar of the control cabinet through the protective grounding conductor.
②	Connect the PE cable on the input power supply end to the grounding copper busbar of the control cabinet.
③	Connect the grounding copper busbar of the control cabinet to the metal enclosure of the control cabinet through the protective grounding conductor.
④	Connect the motor output cable shield to the output PE terminal of the drive.

3.5.7 Connecting Power Cables

Pre-wiring Inspection

Check the following items before wiring.

Table 3–3 Pre-wiring checklist

No.	Item	Compliance
1	Cables used during wiring comply with the requirements on the cross-sectional area and the shield.	☐
2	The equipment and the drive are grounded properly.	☐
3	Proper electrostatic discharge (ESD) procedures are followed and antistatic wrist straps are worn.	☐

Wiring procedure

Before connecting the power cable, ensure that the input power supply is disconnected. Connect power cables based on the following procedure.

1. Remove the top cover in the arrow direction, as shown by figure ①.
2. Remove the power terminal protective plate in the arrow direction, as shown in figure ②.
3. Connect the cables in sequence to the drive input power cables (R, S, T) and output motor cables (U, V, W). If an external braking resistor is used, connect the braking resistor cables (BR, +) at the same time. Secure them using the torque recommended in *"9.8.12 Cable" on page 1380* (tighten the screws of the main circuit terminals), as shown in figure ③.

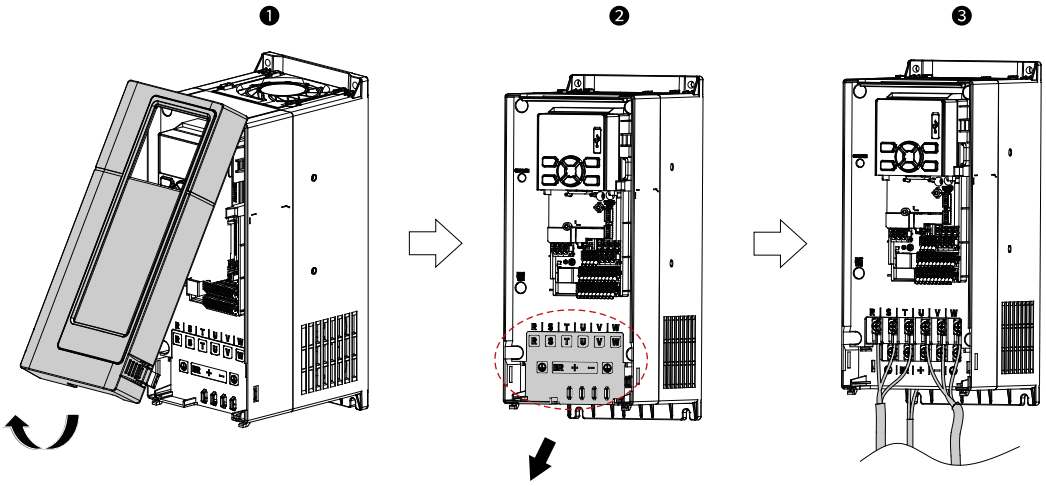


Figure 3-42 Connecting the power cables

3.6 Control Circuit Connection

3.6.1 Control circuit terminals

The following takes the standard STO function of a standard drive model as an example.

Terminal layout of the standard model

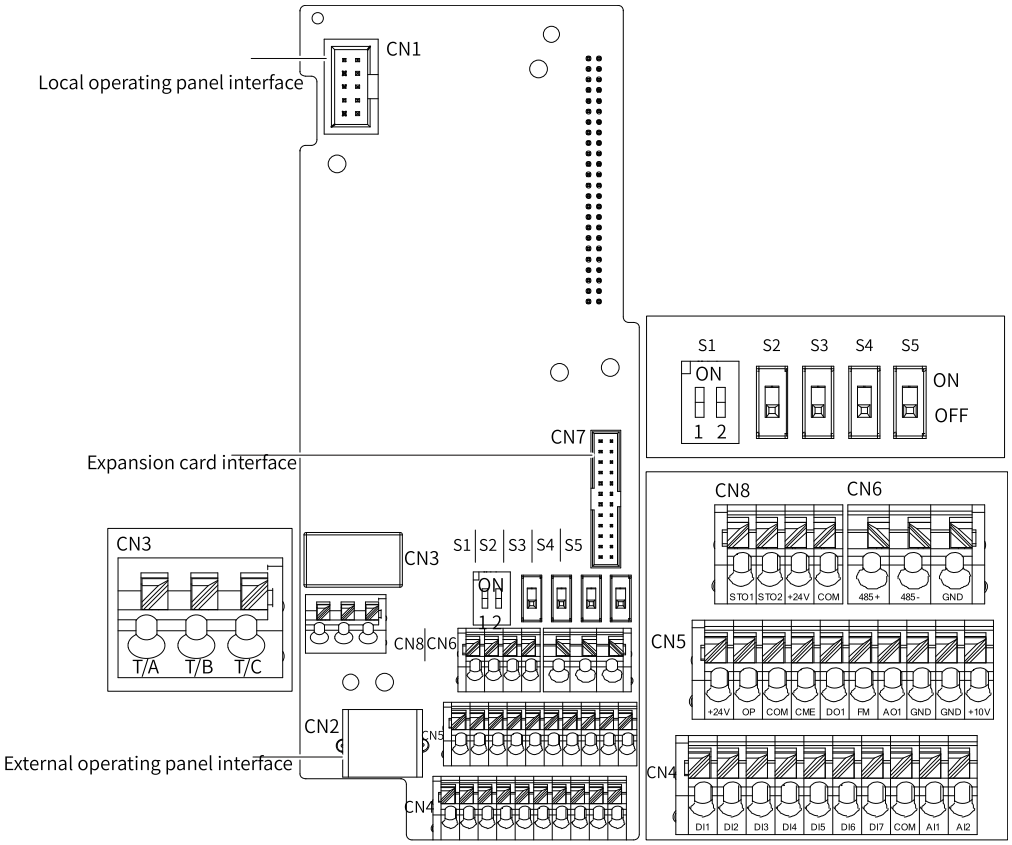


Figure 3-43 Control circuit terminal layout of standard model

Table 3–4 Description of control circuit terminal layout of standard model

External terminal	Type	Type of information transmitted	Mark	Name	Function
CN1	2x5P horn terminal	Local operating panel terminal	-	-	-
CN2	RJ45 terminal	External operating panel terminal	-	-	This terminal can be used to connect an LCD operating panel (SOP20).
CN3	3P crimping terminal block - 5 mm	Relay output	T/A	Common terminal	Contact driving capability (from T/A to T/B, or T/A to T/C): 3 A/250 VAC, COSØ = 0.4 3 A/30 VDC
			T/B	Normally closed terminal	
			T/C	Normally open terminal	

External terminal	Type	Type of information transmitted	Mark	Name	Function
CN4	10P crimping terminal block - 3.5 mm	DI/AI	DI1	Digital input 1	Optocoupler isolation, compatible with dual-polarity input: • Input impedance: 3.5 kΩ • Maximum input frequency: 100 Hz • Operating voltage range: 15 V to 30 V; invalid voltage: < 5 V; valid voltage: >15 V
			DI2	Digital input 2	
			DI3	Digital input 3	
			DI4	Digital input 4	
			DI5	Digital input 5	
			DI6	Digital input 6	
			DI7	Digital input 7	Besides functions of DI1 to DI6, it can also be used as high-speed pulse input. • Input impedance: 1.49 kΩ • Maximum input frequency: 20 kHz • Operating voltage range: 15 V to 30 V; invalid voltage: < 5 V; valid voltage: >15 V
			COM	DI reference ground	Internally isolated from GND
			AI1	Analog input 1	Select the input signal type through DIP switch S4: • S4 = OFF: -10 V to +10 V (default) • S4 = ON: 0 mA to 20 mA 12-bit resolution; accuracy after calibration: 0.3%; response time: < 2 ms; input impedance in voltage mode: 22 kΩ; input impedance in current mode: 500 Ω
			AI2	Analog input 2	Select the input signal type through DIP switches S1 & S2. • S1 & S2 = OFF: -10 V to +10 V (default) • S1 = ON & S2 = OFF: 0 mA to 20 mA • S1 = OFF & S2 = ON: Temperature sampling When voltage/current input is used, specifications are the same as AI1. When switching to temperature sampling input, select the corresponding thermistor type through E2-73. 选择对应的热敏电阻类型： • PT100 (-25°C to +200°C, ±8°C) • PT1000 (-25°C to +200°C, ±8°C) • KTY84-130 (-40°C to +260°C, ±15°C) • PTC130 (Single-core): 25°C to +180°C; accuracy ±15°C • PTC130 (Three-core): 30°C to +180°C; accuracy ±15°C • PTC150 (Single-core): 24°C to +180°C; accuracy ±15°C • PTC150 (Three-core): 24°C to +180°C; accuracy ±15°C

External terminal	Type	Type of information transmitted	Mark	Name	Function
CN5	10P crimping terminal block - 3.5 mm	Power/DO/AO	+24 V	24 V digital power supply output	Provides external 24 V power supply for DI/DO and external sensors. The maximum output current is 200 mA[Note 1].
			OP	Digital input common terminal	Shorted to +24 V through a jumper by default. When the DI is powered up by an external power supply, the jumper must be removed.
			COM	Digital power supply reference GND of 24 V	Internally isolated from GND.
			CME	Digital output common terminal	Shorted to COM through a jumper bar by default. When the DO is powered up by an external power supply, the jumper bar must be removed.
			DO1	Digital output 1	Optocoupler isolation; bipolar open collector output; maximum output frequency 100 Hz. Do not connect DO directly to a power supply. A load must be connected in series between the DO and power supply. Output voltage range: 0 V to 24 V Output current range: 0 mA to 50 mA
			FM	High-speed pulse output	Set high-speed pulse output through E5-00, which is set to 0 [HDO pulse output] by default. The maximum frequency is 100 kHz. When E5-00 is set to 1, it is used as a regular DO, with the same specification as DO1.
			AO1	Analog output 1	Select the output signal type through DIP switch S5. • S5 = OFF: 0 V to 10 V (default) • S5 = ON: 0 mA to 20 mA 12-bit resolution; accuracy after calibration: 0.5%; maximum load current output in voltage mode: 2 mA; load impedance in voltage mode: 5 kΩ; load impedance in current mode: < 500 Ω
			GND	Analog reference ground	Internally isolated from COM.
			GND	Analog reference ground	Internally isolated from COM.
			+10 V	10 V analog power supply output	Used as an external 10 V analog power supply for external potentiometers. The potentiometer resistance range is 1 kΩ to 5 kΩ.

External terminal	Type	Type of information transmitted	Mark	Name	Function
CN6	3P crimping terminal block - 5 mm	RS485 commu-nication	485+	RS485 differential pair signal (+)	Maximum baud rate: 115200 bps Maximum communication distance: 1 km Maximum number of nodes: 128
			485-	RS485 differential pair signal (-)	
			GND	RS485 differential pair reference ground	For the derating relationship between the baud rate and communication distance, see RS485 communication wiring.
CN7	2x12P horn terminal	Expansion port	-	-	Reserved function
CN8	4P crimping terminal block - 3.5 mm	STO functional safety	STO1	STO input 1	STO1/STO2/+24 V is shorted by default. If you need to use external function safety wiring, remove the jumper bar and connect the STO terminal correctly.
			STO2	STO input 2	
			+24 V	STO power supply	
			COM	STO reference ground	

Note

Note 1: The +24 V power supply on the control board and I/O expansion card (reserved function) is the same. When using the +24 V power supply of the AC drive, note that the total load current cannot exceed 200 mA.

Table 3–5 Description of control circuit DIP switches of standard model

Name	DIP switch function
S1	DIP switch for RS485 communication termination and bias resistor selection • When both are ON, termination resistance is applied to the 485± signals. • When both are OFF, termination resistance is not applied to the 485± signals. **Note: The S1 DIP switch is a 2-bit switch. Both bits must be ON or OFF simultaneously.**
S2/S3	DIP switch for AI2 input mode selection • When S2 = OFF/S3 = OFF (default), AI2 is in voltage input mode, with an input range of -10 V to +10 V. • When S2 = ON/S3 = OFF, AI2 is in current input mode with an input range of 0 mA to 20 mA. • When S2 = OFF/S3 = ON, AI2 is in temperature sampling mode, with thermistors PT100/PT1000/KTY84-130/PTC130/PTC150 supported, which can be selected through E2-73. **Note: Do not set both S2 or S3 to ON simultaneously. Failure to comply can result in AI2 function errors.**

Name	DIP switch function
S4	DIP switch for AI1 input mode selection • When S4 = OFF (default), AI1 is in voltage input mode with an input range of -10 V to +10 V. • When S4 = ON, AI1 is in current input mode with an input range of 0 mA to 20 mA.
S5	DIP switch for AO1 output mode selection • When S5 = OFF (default), AO1 is in voltage output mode with an output range of 0 V to 10 V. • When S5 = ON, AO1 is in current output mode with an output range of 0 mA to 20 mA.

Terminal layout of bus model

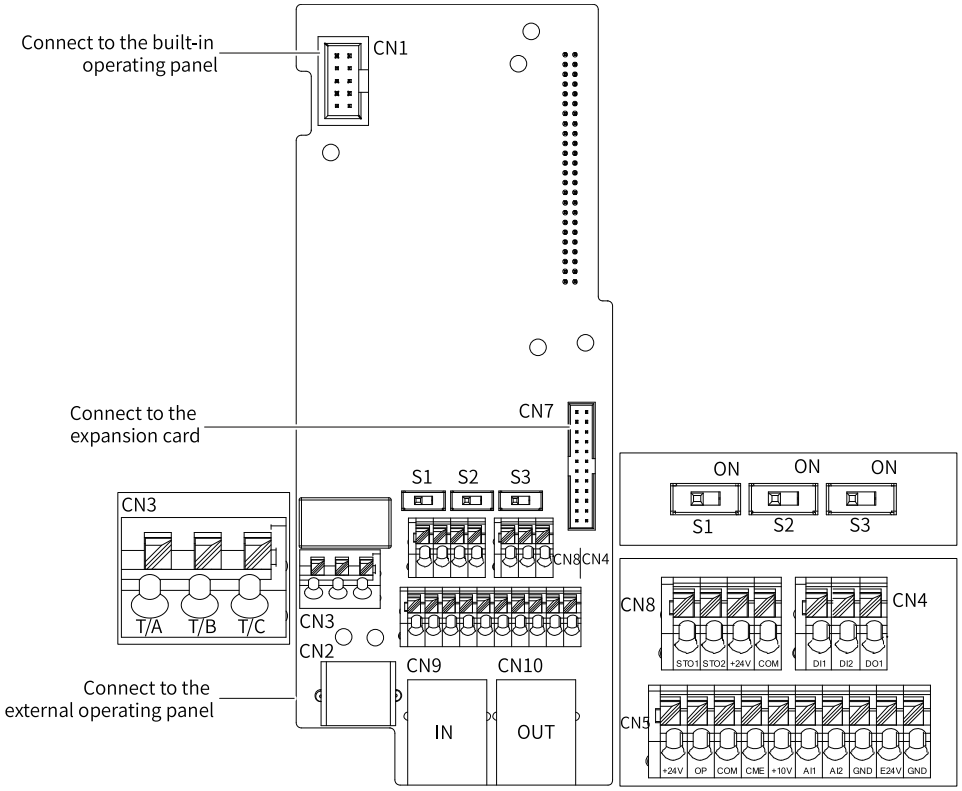


Figure 3-44 Control circuit terminal layout of bus model

Table 3–6 Description of control circuit terminal layout of bus model

External terminal	Type	Type of information transmitted	Mark	Name	Function
CN1	2x5P horn terminal	Local operating panel terminal	-	-	-
CN2	RJ45 terminal	External operating panel terminal	-	-	This terminal can be connected to an LCD operating panel (reserved function).

External terminal	Type	Type of information transmitted	Mark	Name	Function
CN3	3P crimping terminal block - 5 mm	Relay output	T/A	Common terminal	Contact driving capability (from T/A to T/B, or T/A to T/C): 3 A/250 VAC, COSØ = 0.4 3 A/30 VDC
			T/B	Normally closed terminal	
			T/C	Normally open terminal	
CN4	3P crimping terminal block - 3.5 mm	DI/DO	DI1	Digital input 1	Optocoupler isolation, compatible with dual-polarity input: • Input impedance: 3.5 kΩ • Maximum input frequency: 100 Hz • Operating voltage range: 15 V to 30 V; invalid voltage: < 5 V; valid voltage: >15 V
			DI2	Digital input 2	
			DO1	Digital output 1	Optocoupler isolation; bipolar open collector output; maximum output frequency 100 Hz. Do not connect DO directly to a power supply. A load must be connected in series between the DO and power supply. • Output voltage range: 0 V to 24 V • Output current range: 0 mA to 50 mA

External terminal	Type	Type of information transmitted	Mark	Name	Function
CN5	10P crimping terminal block - 3.5 mm	Power supply/ AI	+24 V	24 V digital power supply output	Provides external 24 V power supply for DI/DO and external sensors. The maximum output current is 200 mA[Note 1].
			OP	Digital input common terminal	Shorted to +24 V through a jumper bar by default. When the DI is powered up by an external power supply, the jumper bar must be removed.
			COM	Digital power supply reference GND of 24 V	Internally isolated from GND
			CME	Digital output common terminal	Shorted to COM through a jumper bar by default. When the DO is powered up by an external power supply, the jumper bar must be removed.
			E24V	External 24 V input	Used as an internal 24V-GND power supply. When the drive is not connected to a power supply, it can be used to power up the control board. External power supply converter specification: 24 V±10%/>1 A
			AI1	Analog input 1	Select the input signal type through DIP switch S3. • S3 = OFF: -10 V to +10 V (default) • S3 = ON: 0 mA to 20 mA 12-bit resolution; accuracy after calibration: 0.3%; response time: < 2 ms; input impedance in voltage mode: 22 kΩ; input impedance in current mode: 500 Ω
			AI2	Analog input 2	Select the input signal type through DIP switches S1 & S2. • S1 & S2 = OFF: -10 V to +10 V (default) • S1 = ON & S2 = OFF: 0 mA to 20 mA • S1 = OFF & S2 = ON: Temperature sampling When voltage/current input is used, specifications are the same as AI1. When switching to temperature sampling input, select the corresponding thermistor type through E2-73. 选择对应的热敏电阻类型: • PT100 (-25°C to +200°C, ±8°C)• PT1000 (-25°C to +200°C, ±8°C)• KTY84-130 (-40°C to +260°C, ±15°C)• PTC130 (Single-core): 25°C to +180°C; accuracy ±15°C• PTC130 (Three-core): 30°C to +180°C; accuracy ±15°C• PTC150 (Single-core): 24°C to +180°C; accuracy ±15°C• PTC150 (Three-core): 24°C to +180°C; accuracy ±15°C
			GND	Analog reference ground	Internally isolated from COM.
			GND	E24V reference ground	Internally isolated from COM.
			+10 V	10 V analog power supply output	Used as an external 10 V analog power supply for external potentiometers. The potentiometer resistance range is 1 kΩ to 5 kΩ. Maximum output current: 10 mA

External terminal	Type	Type of information transmitted	Mark	Name	Function
CN7	2x12P horn terminal	Expansion port	-	-	Reserved function
CN8	4P crimping terminal block - 3.5 mm	STO functional safety	STO1	STO input 1	STO1/STO2/+24 V is shorted by default. If you need to use external function safety wiring, remove the jumper bar and connect the STO terminal correctly.
			STO2	STO input 2	
			+24 V	STO power supply	
			COM	STO reference ground	
CN9	RJ45 terminal	100 M bus	IN	100 M bus cascading terminal	Supports three communication protocols: EtherCAT, EtherNet/IP, and PROFINET. Select the protocol type through N0-10. When EtherCAT is selected, it is the IN port. EtherNet/IP and PROFINET are direction-insensitive.
CN10	RJ45 terminal	100 M bus	OUT	100 M bus cascading terminal	Supports three communication protocols: EtherCAT, EtherNet/IP, and PROFINET. Select the protocol type through n0-10. When EtherCAT is selected, it is the OUT port. EtherNet/IP and PROFINET are direction-insensitive.

Note

Note 1: The +24 V power supply on the control board and I/O expansion card (reserved function) is the same. When using the +24 V power supply of the AC drive, note that the total load current cannot exceed 200 mA.

Table 3–7 Description of control circuit DIP switches of bus model

Name	DIP switch function
S1/S2	DIP switch for AI2 input mode selection • When S1 = OFF/S2 = OFF (default), AI2 is in voltage input mode, with an input range of -10 V to +10 V. • When S1 = ON/S2 = OFF, AI2 is in current input mode, with an input range of 0 mA to 20 mA. • When S1 = OFF/S2 = ON, AI2 is in temperature sampling mode, with thermistors PT100/PT1000/ KTY84-130/PTC130/PTC150 supported, which can be selected through E2-73. **Note: Do not set both S1 or S2 to ON simultaneously. Failure to comply can result in AI2 function errors.**
S3	DIP switch for AI1 input mode selection • When S3 = OFF (default), AI1 is in voltage input mode, with an input range of -10 V to +10 V. • When S3 = ON, AI1 is in current input mode, with an input range of 0 mA to 20 mA.

3.6.2 Wiring of I/O Terminals

DIP switch for different functions

Model	Voltage/Current mode selection for AI1	Al2 voltage/current mode	AI2 temperature mode
MD630S-INT	S4	S2	S3
MD630N-INT	S3	S1	S2

Wiring of AI1 terminal

S4	Mode	Remarks
OFF	Wiring for AI1 voltage mode	AI1 is typically used as an external potentiometer input.
ON	Wiring for AI1 current mode	The input impedance of AI1 is 500 Ω. Current input of 0 mA to 20 mA is supported.

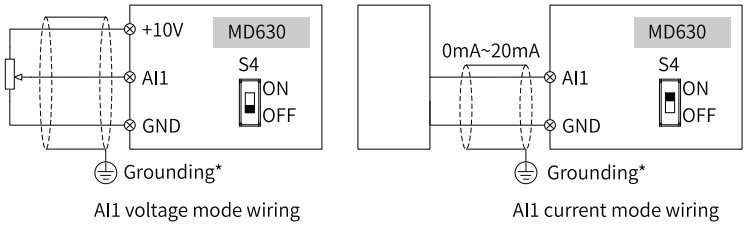


Figure 3-45 Wiring of AI1 terminal (MD630S-INT as an example)

Wiring of AI2 terminal

S2	S3	Mode	Remarks
OFF	OFF	Wiring for AI2 voltage mode	-
ON	OFF	Wiring for AI2 current mode	-
OFF	ON	Wiring for AI2 temperature mode	AI2 supports external temperature sensor input: 1 .Connect the two-wire temperature sensor (PT100/PT100/KTY84-130/PTC130) to AI2 and GND terminals. 2 .Select the DIP switch position as required. 3 .Set the correct temperature sensor type through E2-73.

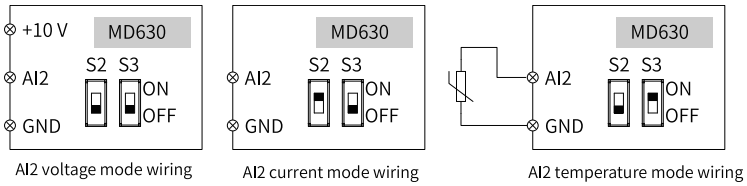


Figure 3-46 Wiring of AI2 terminal (MD630S-INT as an example)

CAUTION

The AI1/AI2 input signal type must correspond to the DIP switches. Failure to comply can result in analog input error.

Wiring of the AO terminal

S5	Mode
OFF	Wiring for AO voltage mode
ON	Wiring for AO current mode

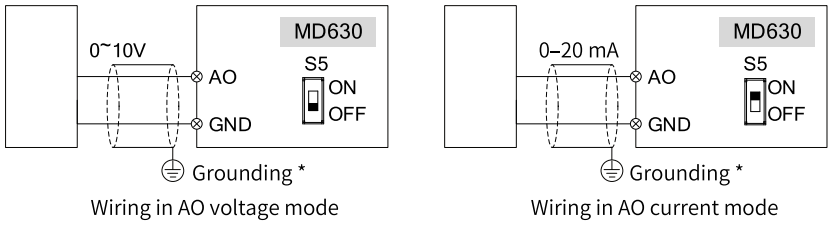


Figure 3-47 Wiring of AO terminal

Measures against analog signal interference

Analog signals are prone to external interference. It is recommended to use shielded cables and keep the wiring distance as short as possible (< 20 m). Ground the cable shield at the drive side by connecting it to the grounding bracket, as shown in the figure below.

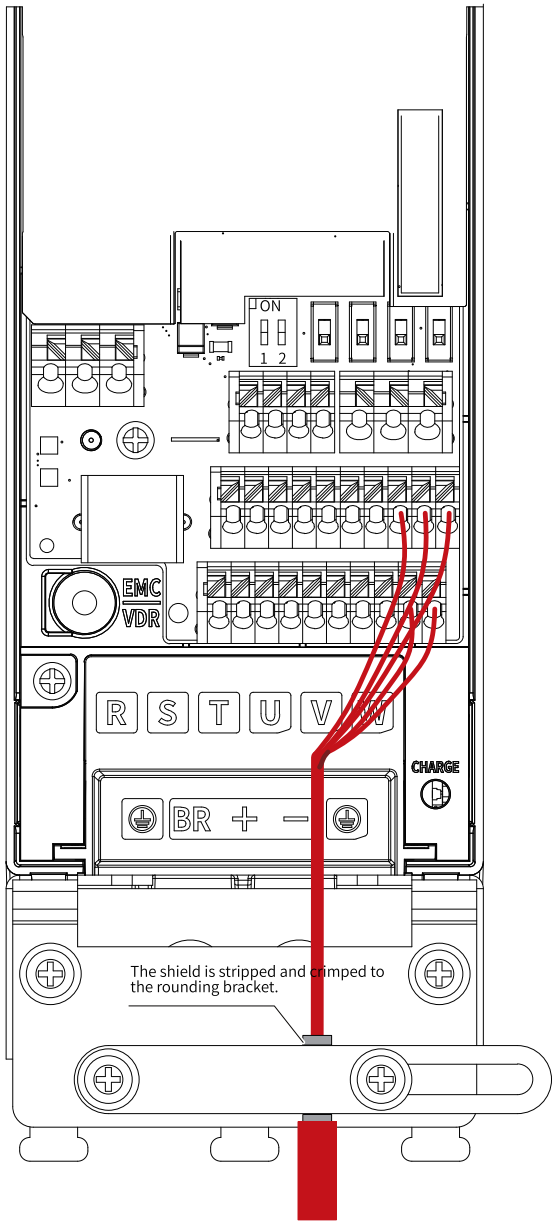


Figure 3-48 Grounding of the AI cable shield

In applications where analog signals are disturbed severely, install a filter capacitor or ferrite core to the analog signal cable on the drive side, as shown below.

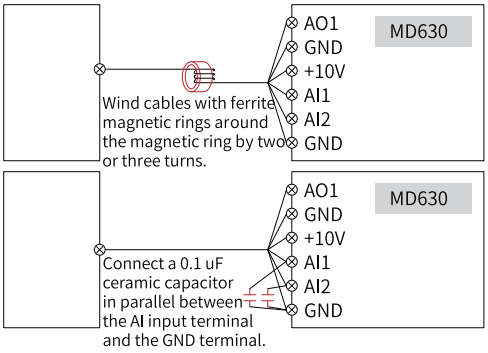


Figure 3-49 Filtering of analog signal cable

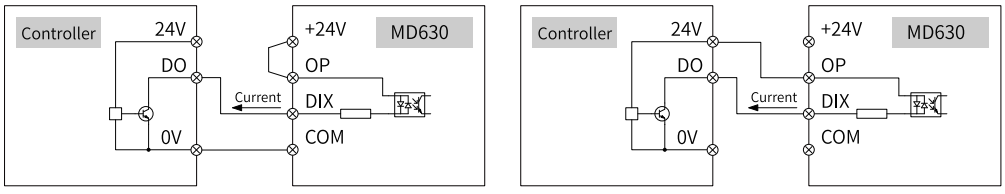
Wiring of the DI terminal

The DI supports bidirectional current input, compatible with both sink-type and source-type input logic. In practical applications, the following methods can be used to quickly distinguish between sink-type and source-type logic.

- Sink-type logic (active low): The output transistor of the external controller turns on to the reference ground, the current flows out from the DI terminal of the drive, causing the internal optocoupler to conduct.
- Source-type logic (active high): The output transistor of the external controller turns on to the power supply, the current flows into the DI terminal of the drive, causing the internal optocoupler to conduct.

Sink-type wiring

The drive adopts sink-type wiring with the internal 24 V power supply by default, which means the OP and +24V terminals are shorted with a jumper bar by default. To use an external 24 V power supply, remove the jumper bar between OP and +24 V terminals first, and then connect the external 24 V power supply to the OP terminal, in which the current flows back to the external 0V after passing through the external controller contact.



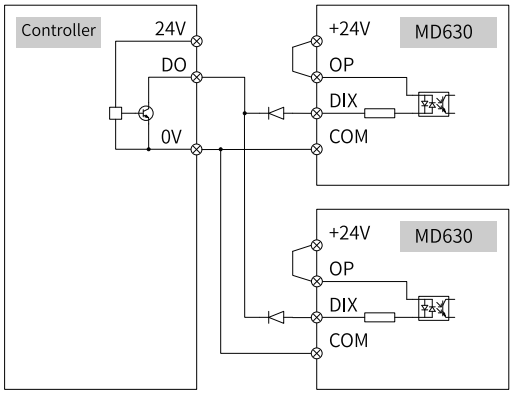
Multi-drive DI parallel sink wiring method with an internal 24 V power supply

Multi-drive DI parallel sink wiring method with an external 24 V power supply

Figure 3-50 Sink-type wiring of the DI

When the DI is powered up by the internal power supply of the drive, and one DO terminal of the controller is used to control multiple DI terminals of the drive, do not connect DI terminals of different drives in parallel. Failure to comply can result in malfunction of the DI. If such wiring mode

is needed on site, connect a diode (IF > 40 mA and VR > 40 V) at the DI terminal in series, as shown below.

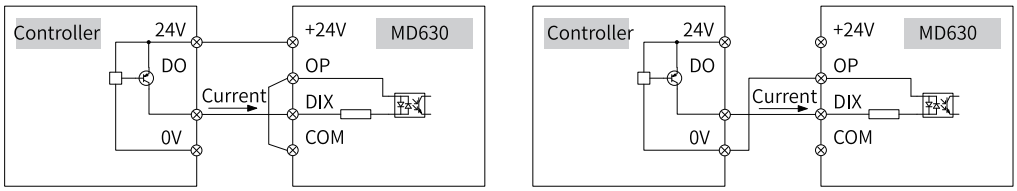


Multi-drive DI parallel sink wiring method
with an internal 24 V power supply

Figure 3-51 Parallel sink-type wiring of the DI

Source-type wiring

For source-type wiring with internal 24 V power supply of the drive, move the jumper bar to a position between the OP and COM terminals, and connect 24V to the common output terminal of the controller. To use an external 24 V power supply, remove the jumper bar between OP and +24V terminals, and connect 0V of the external power supply to the OP terminal, in which the current flows back to the external 0V after passing through the internal optocoupler of the drive.



Source wiring with an internal 24 V power supply

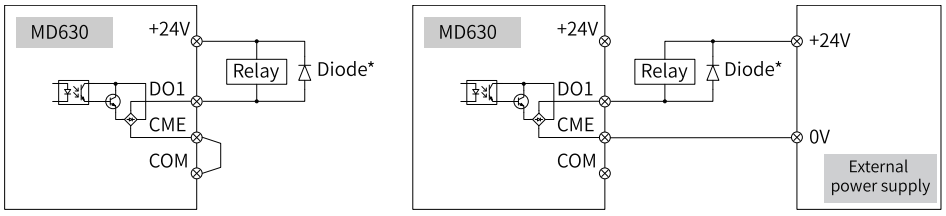
Source wiring with an external 24 V power supply

Figure 3-52 Source-type wiring of the DI

Wiring of the DO terminal

The DO of MD630-INT is driven by the internal +24V by default. The CME and COM terminals are shorted with a jumper bar by default. To drive the DO with an external 24V, remove the jumper bar between CME and COM.

When the DO terminal needs to drive a relay, install snubber diodes on both sides of the relay coil. Failure to comply may damage the DO terminal. When selecting a relay, the rated current must be lower than 50 mA.



Wiring through a DO drive controller with an internal 24 V

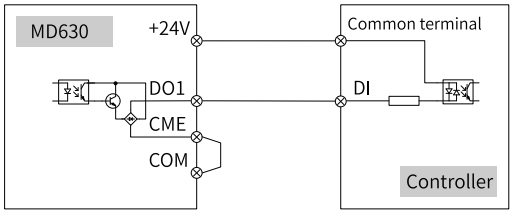
Wiring through a DO drive controller with an external 24 V

Figure 3-53 Wiring for driving relay with DO

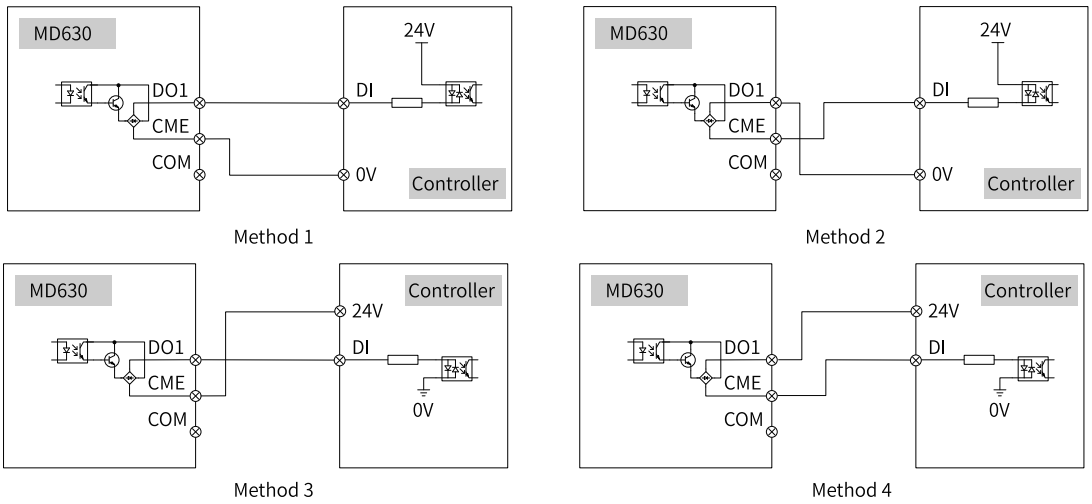
CAUTION

Diode*: The snubber diode polarity must be correctly oriented during installation. Failure to comply can result in overcurrent and damage the diode when the internal transistor of the DO terminal is turned on.

The DO1 supports bidirectional output and the following five wiring methods.



Wiring through a DO drive controller with an internal 24 V



Wiring through a DO drive controller with an external 24 V power supply

Wiring of the high-speed digital output terminal FM

The FM terminal of the drive only supports open-drain output, with current entering from the FM terminal, then passing through the internal transistor, and finally returning to the reference ground of the controller through the COM terminal. The FM terminal can be assigned with the FMP continuous pulse output function through E5-00, with the maximum output frequency up to 100 kHz.

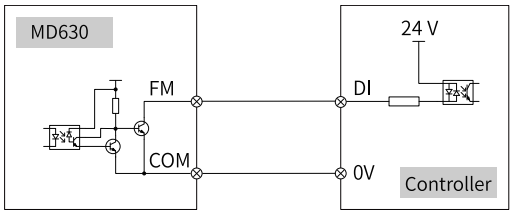


Figure 3-54 Wiring of FM terminal

3.6.3 Wiring of the Relay Output Terminals

Inductive loads (relays, contactors, and motors) can cause voltage spikes when current is interrupted. If the spike voltage exceeds the rated value of the relay, the relay contacts may be damaged permanently. It is recommended to protect the relay output contacts by connecting a varistor in parallel, or install a snubber circuit on the inductive load, such as a varistor, RC snubber circuit, or diode, to reduce the voltage spike generated when the load is switched off, as shown below.

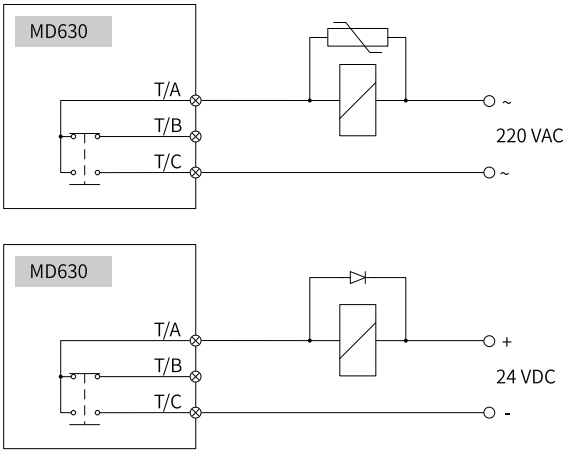


Figure 3-55 Wiring of the relay output terminals

3.6.4 Wiring of STO Terminals

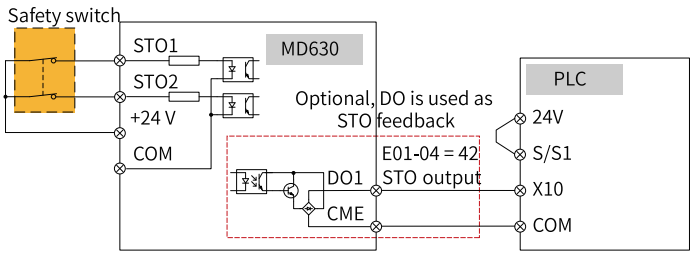


Figure 3-56 STO wiring (internal 24 V)

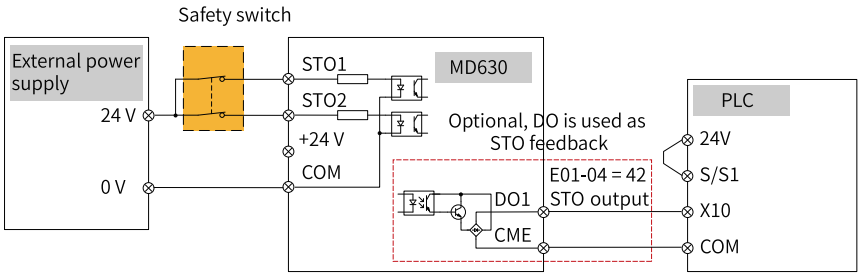


Figure 3-57 STO wiring (external 24 V)

Figure 3-58 External controller PNP output used as STO input

EMC requirements for STO wiring:

- Ensure that the cable between the drive and safety switch does not exceed 30 m.
- It is recommended to use double-shielded or single-shielded multi-pair cables and crimp the STO cable shield to the grounding bracket to enhance the STO cable resistance to electromagnetic interference.

3.6.5 Control Cable Selection

For requirements on control cables, see *"9.8.12 Cable" on page 1380*.

3.6.6 Connecting Control Cable

Pre-wiring inspection

Check the following items before wiring.

Table 3–8 Pre-wiring checklist

No.	Item	Compliance
1	Cables used during wiring comply with the requirements on the cross-sectional area and the shield.	☐
2	The equipment and the drive are grounded properly.	☐
3	Take proper electrostatic discharge (ESD) measures and wear an antistatic wrist strap.	☐

Connecting control cables

1. Remove the front cover in the direction indicated by the arrow, as shown in figure ①.
2. Find the terminal to be connected according to the definition in *"3.6.1 Control circuit terminals" on page 100*, insert the cable into the terminal, and confirm whether the connection is secure, as shown in figure ②.
   It is recommended to use crimped cable terminals. However, if bare wires are used for connection, press the terminal buttons in step 2, as shown in figure ③.

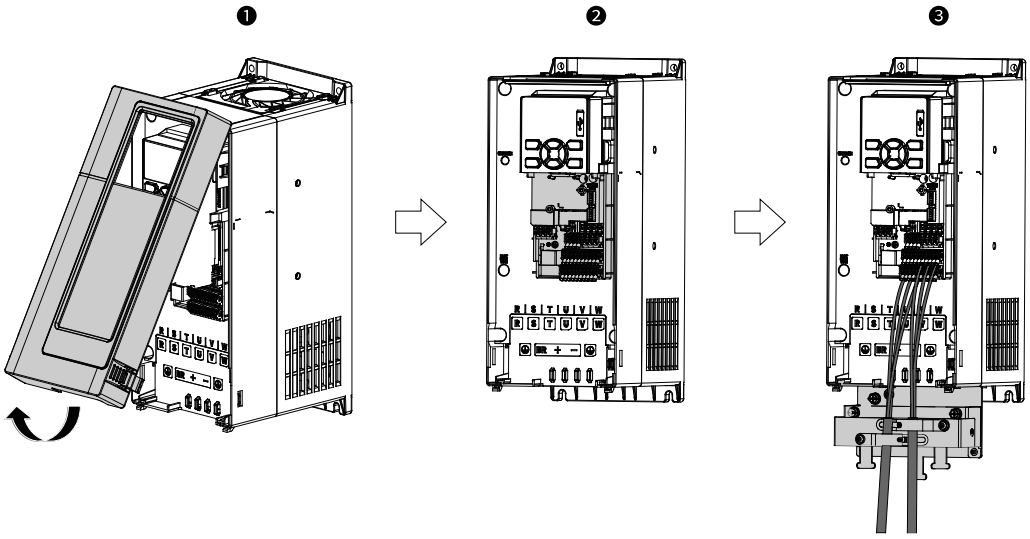


Figure 3-59 Connecting the control cables

I/O connection

See the I/O connection diagram in *"3.2 Electrical Wiring Diagram" on page 76*. See detailed information on I/O connections supported by the drive in *"3.6.2 Wiring of I/O Terminals" on page 108*.

For communication protocols supported by the drive and wiring procedure, see *" Communication" on page 897*.

3.7 Post-wiring Inspection

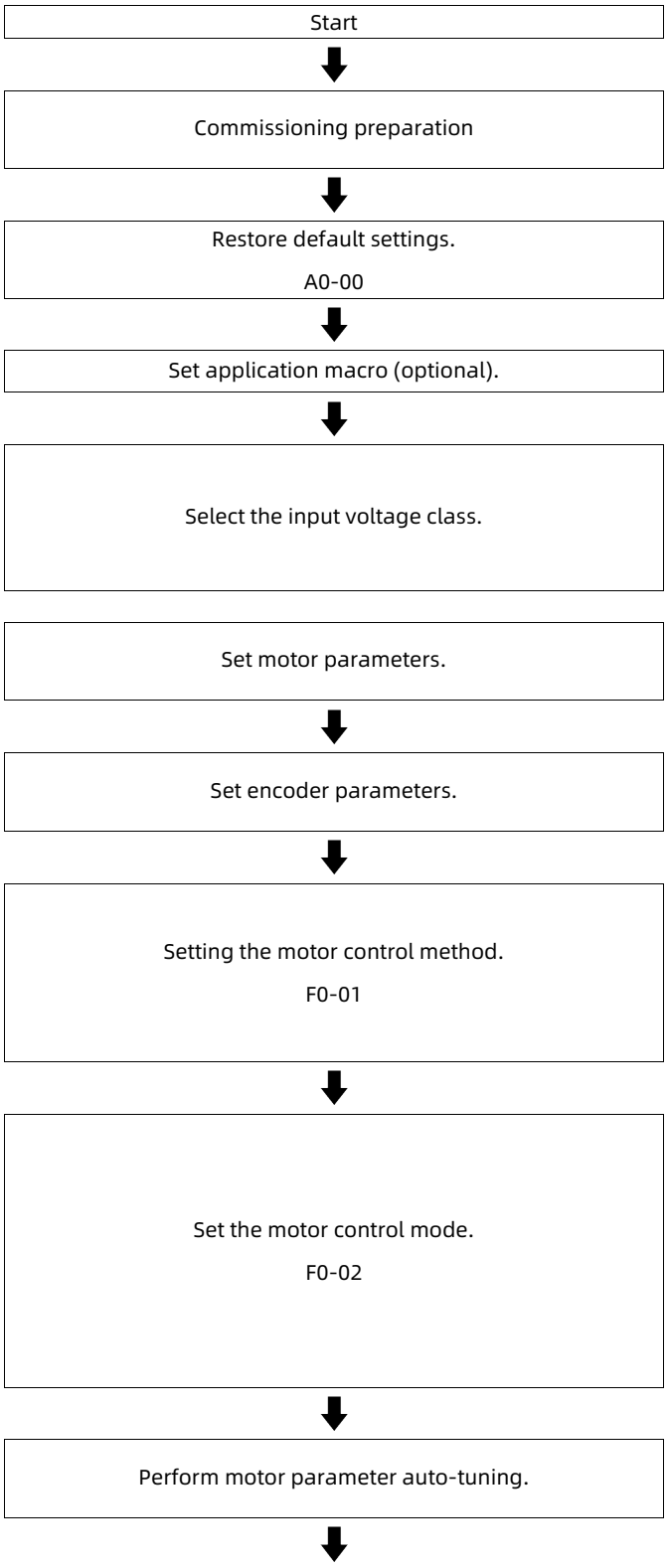
After wiring is done, check the following items and tick compliant items.

No.	Item	Compliance
1	Power supply input cables are connected to R, S, and T terminals.	☐
2	Motor input cables are connected to the U, V, and W terminals.	☐
3	The cross-sectional area of the main circuit cables meet the requirements.	☐
4	Check that heat shrink tubing has been applied to the copper tube for main circuit lugs and the cable conductors, ensuring complete coverage of all conductors.	☐
5	The motor output cable does not exceed 50 m. If the motor output cable exceeds 50 m, reduce the carrier frequency through F2-50.	☐
6	The grounding cable is connected properly.	☐
7	The output terminals and control cable terminals are connected properly.	☐
8	Ensure the wiring is correct, and the resistance and power of the braking resistor are within the proper range when using the braking resistor and braking unit.	☐
9	The control circuit signal cables are shielded twisted pair cables.	☐
10	Control cables and power cables are routed through different routes (do not route control cables and power cables through the same route). If cross-connection is needed between control cables and power cables, make them be cross-connected at 90 degrees.	☐
11	There are no screws, gaskets, or exposed cables left inside the product.	☐

4 Commissioning and Trial Run

4.1 Quick Commissioning Guide

Commissioning flowchart



" Commissioning Preparation" on page 142

" A0-00" on page 119

" Application Macro" on page 414

"4.4 Selecting Input Voltage Class" on page 145
Only three-phase 380 V models require setting of the voltage class.

"4.5.1 Setting Motor Parameters" on page 146

" Setting Encoder Parameters" on page 153

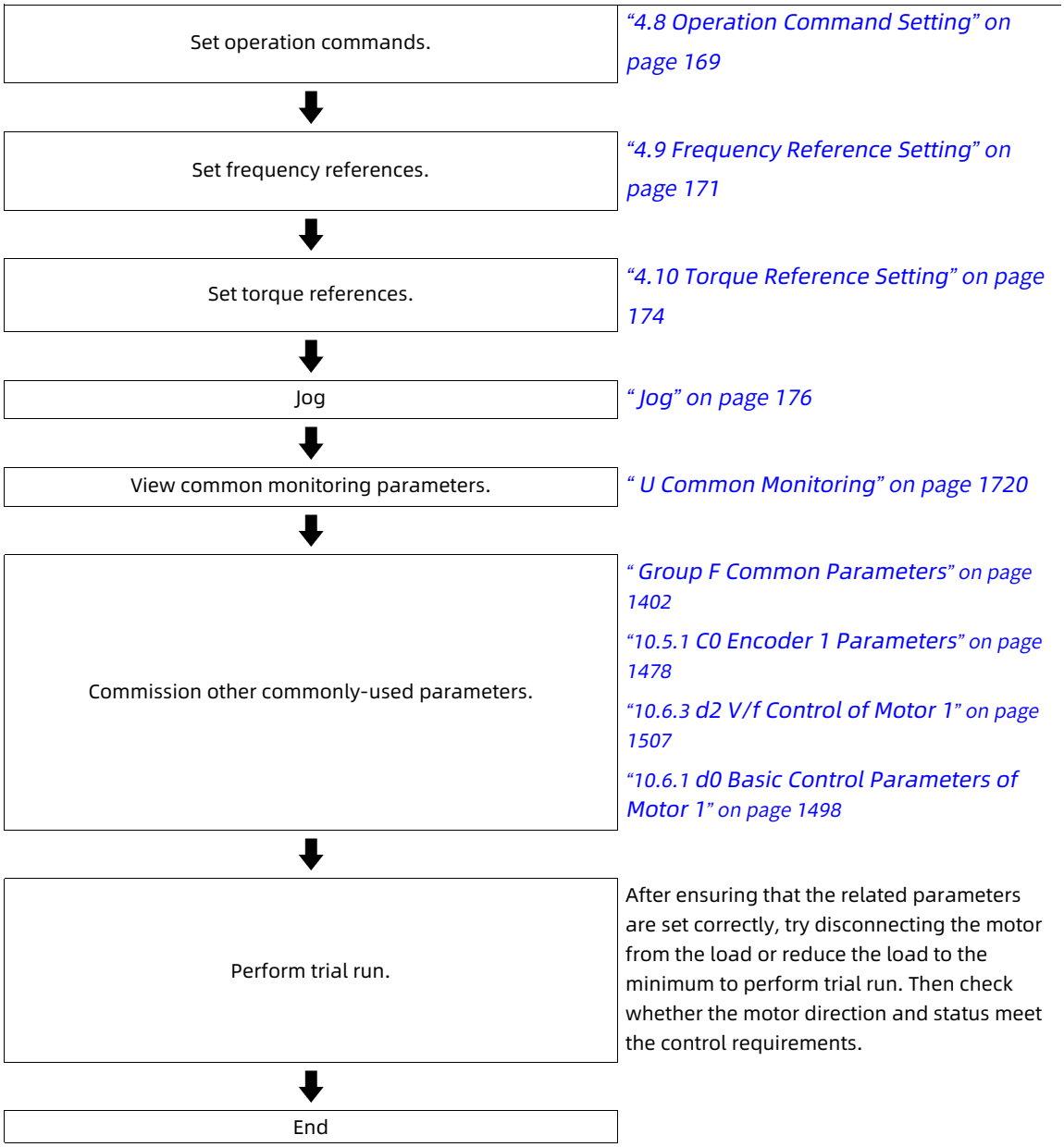
" F0-01 (d0-00)" on page 120
For a permanent magnet synchronous motor, SVC mode is recommended.

If one drive is used to drive multiple motors, only V/f control can be used.

" F0-02 (d0-01)" on page 120
In V/f mode, only speed control is supported.

If torque control mode applies under normal operating conditions, switch to the speed control mode during initial commissioning for motor auto-tuning. After the auto-tuning is done, adjust the operating direction and switch to the torque control mode again.

"4.7.1 Auto-Tuning Procedure" on page 158


Set operation commands.
"4.8 Operation Command Setting" on page 169
Set frequency references.
"4.9 Frequency Reference Setting" on page 171
Set torque references.
"4.10 Torque Reference Setting" on page 174
Jog
" Jog" on page 176
View common monitoring parameters.
" U Common Monitoring" on page 1720
Commission other commonly-used parameters.
" Group F Common Parameters" on page 1402
"10.5.1 C0 Encoder 1 Parameters" on page 1478
"10.6.3 d2 V/f Control of Motor 1" on page 1507
"10.6.1 d0 Basic Control Parameters of Motor 1" on page 1498
Perform trial run.
After ensuring that the related parameters are set correctly, try disconnecting the motor from the load or reduce the load to the minimum to perform trial run. Then check whether the motor direction and status meet the control requirements.
End

Related parameters

Param.	Name	Default	Value range	Description
A0-00	Parameter initialization	0: No action	0: No action 1: Restore parameters (excluding motor parameters) to default values 2: Clear log information 3: Restore parameters (including motor parameters) to default values 4: Back up current user parameters 5: Clear fault information 501: Restore backup parameters 503: Restore parameters (including motor parameters) to default values and clear records	0: No action 1: Restore parameters (excluding motor parameters) to default values - Most function parameters are restored to default values, except manufacturer parameters, motor parameters, and log parameters. 2: Clear log information - Fault log, cumulative operating time, cumulative power-on time, and cumulative power consumption are cleared. 3: Restore parameters (including motor parameters) to default values - Most function parameters are restored to default values, except manufacturer parameters and log parameters. 4: Back up current user parameters - The current parameter settings are backed up, which is the same as the function when A0-39 is set to 400. 5: Clear fault information - The fault information recorded in group H6 to Hb is cleared. 501: Restore backup parameters - Parameters backed up by setting A0-00 to 4 are restored, which is the same as the function when A0-38 (Restore backup parameters) is set to 500. 503: Restore parameters (including motor parameters) to default values and clear records - Most function parameters are restored to default values, except manufacturer parameters. Factory parameters include the model parameters, AI/AO correction parameters. Record information parameters include the fault record, cumulative running time, and cumulative power-on time.

Param.	Name	Default	Value range	Description
F0-01 (d0-00)	Motor control method	2	0: SVC 1: FVC 2: V/f	Sets the motor control mode based on the application scenario and motor type. d0-00 (Motor control method) is mapped to F0-01 in group F. These two parameters have the same function. **Value description:** 0: SVC, which is an open-loop vector control mode that is applicable to high-performance control applications. In this mode, one drive can drive only one motor. This mode applies to load applications, such as machine tools, centrifuges, wire drawing machines, and injection molding machines. Parameter auto-tuning is required in this mode. Vector control requires accurate motor parameter tuning. 1: FVC, which requires the motor to be configured with an encoder and the AC drive to be installed with a PG card matching the encoder type. This mode is applicable to high-accuracy speed control or torque control applications. One AC drive can drive only one motor. Applicable scenarios include high-speed papermaking machinery, hoisting machinery, and elevators. Parameter auto-tuning is required in this mode. Vector control requires accurate motor parameter tuning. 2: V/f, which is an open-loop control mode based on constant voltage and frequency ratios. This mode is applicable to scenarios without high requirements on load control performance, such as fans and water pumps and scenarios without high requirements on accuracy of parameters. This mode is simply and easy to use. The dynamic performance of the V/f control mode is not as good as that of the SVC mode.

Param.	Name	Default	Value range	Description
F0-02 (d0-01)	Motor control mode	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines the motor control target according to the actual operating conditions. d0-01 (Motor control mode) is mapped to F0-02 in group F. These two parameters have the same function. **Value description:** 0: Speed control - The speed is controlled. 1: Torque control - The torque is controlled. 3 to 9: DI1 to DI7 - The mode depends on the final terminal state of the DI. 0: Speed control. 1: Torque control. Other: B connector. The mode depends on the status of B connector. 0: Speed control. 1: Torque control. **Note:** Torque control is invalid in V/f mode. MD630 remains in speed control mode even if the torque control mode is enabled in V/f mode.

4.2 Commissioning Tools

Three types of commissioning tools are supported: the built-in local operating panel of the drive and the iFA Drive commissioning software.

Table 4–1 Commissioning tool list

Tool type	Function	Application scenario
Operating panel	The MD630-INT series AC drive is equipped with an operating panel as standard. • It provides functions such as status and data display, parameter settings, and fault information prompts. • It is installed on the drive by default and does not support external extension.	Applicable to simple commissioning of an individual drive
iFA Drive commissioning software	iFA Drive commissioning software is independently developed by Inovance with full proprietary intellectual property rights. It supports commissioning, fault diagnosis, and operation status monitoring of the drive. Products supported by iFA Drive commissioning software include AC drives, servo drives, and electro-hydraulic servo drives.	It is applicable to complex commissioning with a PC.

4.2.1 Operating Panel

4.2.1.1 Overview

The standard operating panel of MD630-INT adopts the LED+key structure, with the following functions supported.

- Value display: The LED displays parameters, monitoring data, and fault codes. The indicators indicate the current status and the unit of parameters.
- Parameter setting: In each level of menu, the data bit you are operating on will flash. You can use the UP and DOWN keys to increase or decrease numerical values, and switch between the bits through the left and right keys.
- Status monitoring: In the stop or operation state of the drive, the operating panel displays the status information of the drive based on parameter settings (A6-03 to A6-05).

4.2.1.2 Components

The operating panel is shown in the following figure, including the status display area, parameter display area, and key area.

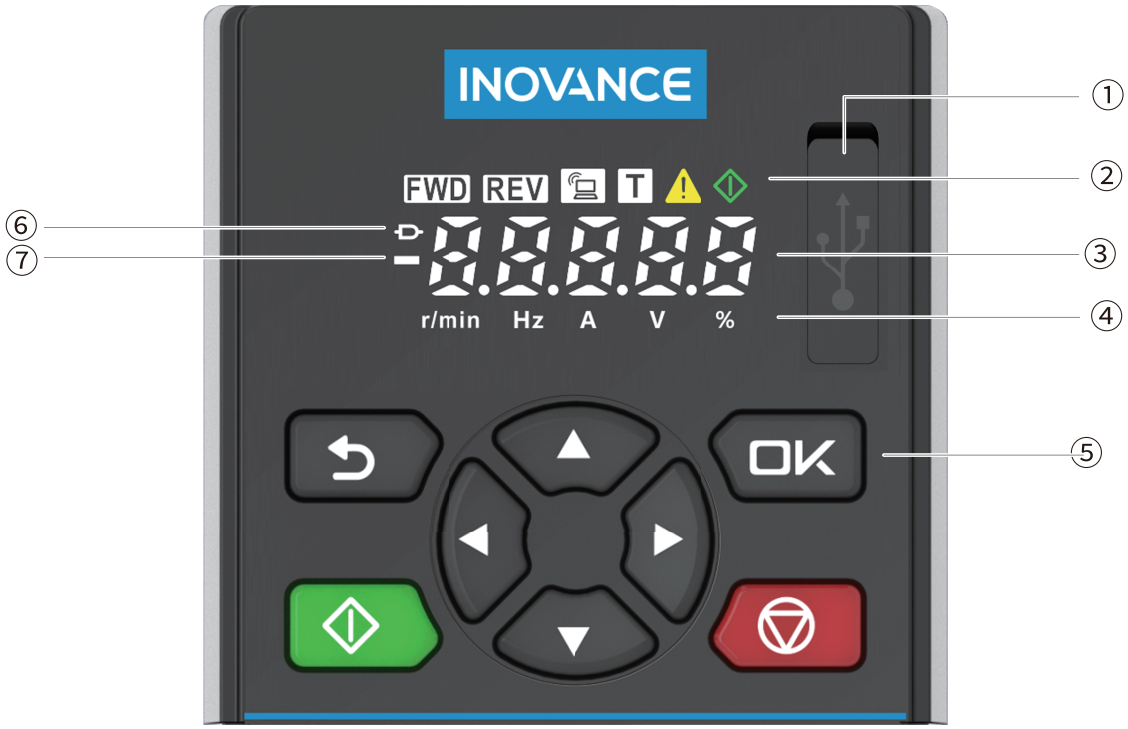


Figure 4-1 Operating panel

Table 4–2 Panel description

No.	Name	Description
①	Commissioning interface	The commissioning tool supported is iFA commissioning software.
②	Status display area	Displays the operation state of the drive. For details, see *"Table 4-3 Description of status bar" on page 122*.
③	Parameter display	Displays parameters of the drive. For details, see *"4.2.1.3 Display on the Operating Panel" on page 123*.
④	Unit display area	Displays the unit of the currently displayed data.
⑤	Key area	For details, see *"Table 4-4 Description of keys" on page 123*.
⑥	Connector sign	Steady ON: Indicates that the parameters accessed currently are connector parameters.
⑦	Minus sign	Steady ON: Indicates that the current parameter value is negative or reverse direction applies.

Table 4–3 Description of status bar

Symbol	Name	Function	Status
FWD	Forward (FWD)	Forward run	Steady ON: Indicates that the speed reference direction or the operating direction of the drive is forward.
REV	Reverse (REV)	Reverse run	Steady ON: Indicates that the speed reference direction or the operating direction of the drive is reverse.
	Local/Remote	Local/remote connection mode	Steady OFF: Local (operating panel) control Steady ON: Terminal control Flashing: Communication control Flashing quickly: Custom control

Symbol	Name	Function	Status
	Torque control	Torque control mode	Steady OFF: Speed control mode Steady ON: Torque control mode
	Alarm	Alarm state	Steady ON: A fault or an alarm occurs.
	Operation	Operation state	Steady OFF: The drive does not run. Steady ON: The drive is running.
	Minus sign	Value sign	Steady ON: Indicates that the current parameter value is negative or the direction is reverse.
	Connector	Connector sign	Steady ON: Indicates that the parameters accessed currently are connector parameters.

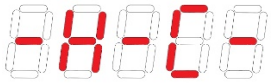
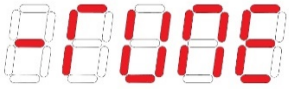
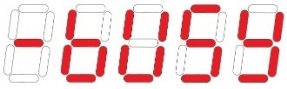
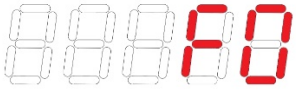
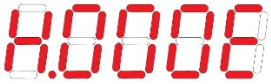
Table 4–4 Description of keys

Key	Name	Function
	Menu/Back	• Used to return to the previous page or undo the operation. • Menu switchover • Holding down this key enters the multi-function menu.
	Enter	• Used to enter the setting page or confirm the settings.
	UP	• Used to increase the parameter value you are operating on.
	DOWN	• Used to decrease the parameter value you are operating on.
	Shift	• Used to switch monitored values in the monitoring page. • Used to switch data bits in the parameter page. • Used to switch basic menus, user menus, and calibrate menus and fault log menus in multi-function menu page. • Used to switch fault log in fault log menu.
	Run	• Used for start operations in operating panel control mode.
	Stop button	• Used for stop operations in the operation state. • Used for reset operations in the fault/alarm state.

4.2.1.3 Display on the Operating Panel

The main display area of the operating panel consists of five 8-segment LEDs, which display various monitoring data such as the set frequency and output frequency, as well as the current operating state of the AC drive.

Table 4–5 Description of the displayed contents

Type	Panel display	Definition
Status display		Initializing
		The drive is in the auto-tuning state.
		Busy
		The drive is in the self-test state.
Parameter display		Parameter group F0
		A0-10
Connector display		The connector is L2202.
Parameter value display		The parameter value is 321.5 (decimal).
		The parameter value is 0x000E (hexadecimal).
Fault display		Fault code E027.1
		Alarm code A028.1
		Minor fault code L028.3
		Prompt code N028.2

4.2.1.4 Viewing and Setting Parameters

The operating panel adopts a three-level menu to perform operations such as parameter setting. The three levels of menus are shown below.

- Level-1 menu: Parameter group
- Level-2: Parameter
- Level-3: Parameter value

After entering each level of the menu, when the displayed bit flashes, you can press and to change the value of this bit. You can also switch to other data bits through and .

In the level-3 menu, if the parameter is displayed without flashing bits, this parameter cannot be modified. This may be caused by the following reasons.

- This parameter is a read-only parameter such as the product model, detection value, and operation log.
- This parameter can be changed only after the drive stops.

You can return to the level-2 menu from level-3 menu by pressing or . The difference between these two keys is as follows.

- After you press , the drive saves the parameter value and returns to the level-2 menu and shifts to the next parameter automatically.
- After you press , the drive returns to the previous level menu corresponding to this parameter, without saving the current parameter value.

The following shows how to set b5-01 [Digital setting of main frequency] to 30.00 Hz through the operating panel.

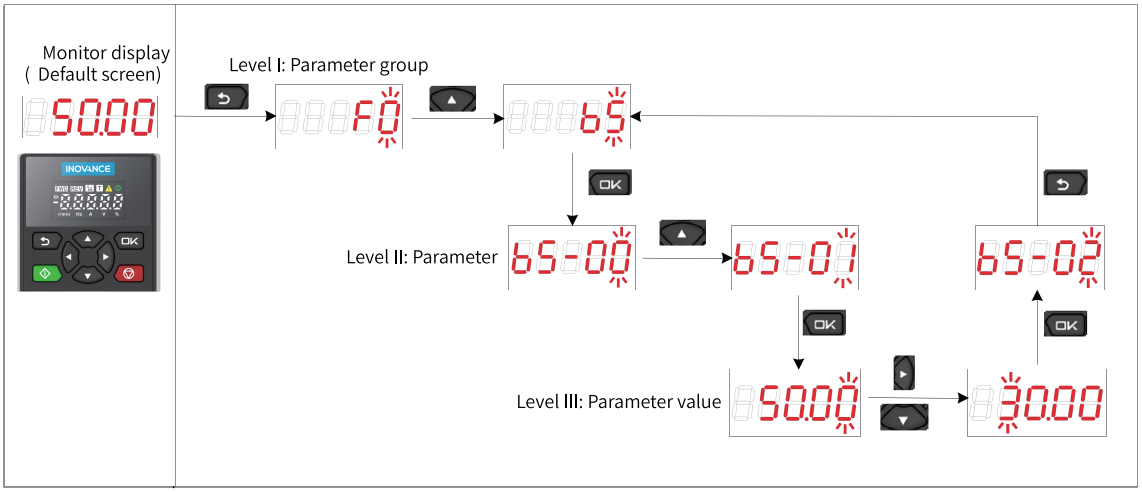


Figure 4-2 Parameter setting procedure

4.2.1.5 Status Monitoring

The operating panel provides a monitoring page that displays status information of the drive in the stop or operation state.

In the stop or operation state, the operating panel displays the status information of the drive according to the parameter settings (A6-03 to A6-05).

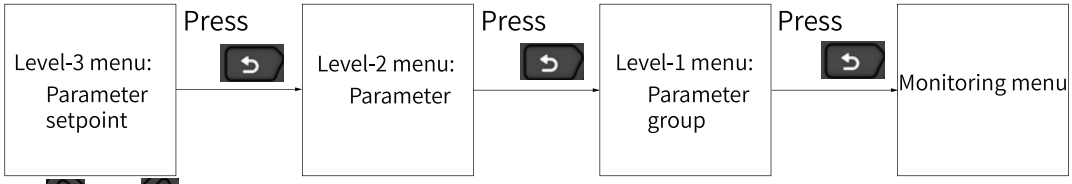
Viewing Monitoring Parameters in Stop State

When the drive is in stop state, four default parameters are displayed: frequency reference (Hz), bus voltage (V), AI1 voltage (V), and AI2 voltage (V). You can select monitoring parameters in the stop state through A6-05 [Parameter displayed on the LED operating panel at stop].

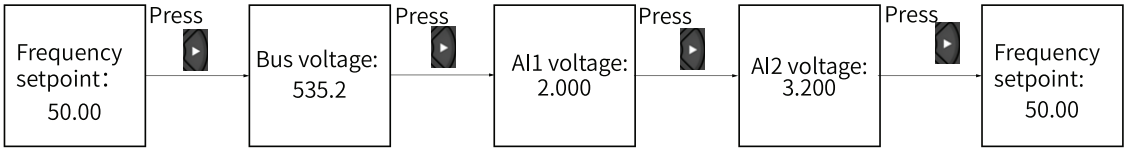
Procedure

1. Enter the monitoring page.
   The monitoring page is displayed by default. If 50.00 is displayed without flashing, it indicates the monitoring page at stop, where 50.00 represents the set frequency in the stop state.

   For example, if the level-3 menu (parameter value) is displayed, you can press  to return to the monitoring page.



2. Press  and  to switch monitoring parameters and view other states.
   By default, the displayed value 50.00 represents the set frequency.



   The unit of the current monitoring parameter can be viewed in the unit display area of the operating panel. See the operating panel in *"4.2.1.2 Components" on page 121*.

3. To modify the default monitoring parameters in the stop state, adjust the corresponding bit in A6-05 [Parameters displayed on the LED operating panel at stop].
   If the bit is set to 1, the parameter can be displayed on the monitoring page of the operating panel. If the bit is set to 0, the parameter cannot be displayed on the monitoring page of the operating panel. For details, see *"5.6.1 Setting Monitoring Parameters Displayed on Operating Panel" on page 806*.

Related parameter

Table 4–6 Monitoring parameter selection in stop state

Param.	Name	Default	Value range
A6-05	Parameter displayed on LED operating panel at stop	0x0033	bit0: Frequency reference (Hz) bit1: Bus voltage (V) bit2: DI input status bit3: DO output status bit4: AI1 voltage (V) bit5: AI2 voltage (V) bit9: PLC phase bit11: PID reference bit12: HDI input pulse frequency (kHz) (active only for MD630S) bit14: Free mapping 0 bit15: Free mapping 1 Bit values are shown below. 0: Hidden 1: Displayed

Note

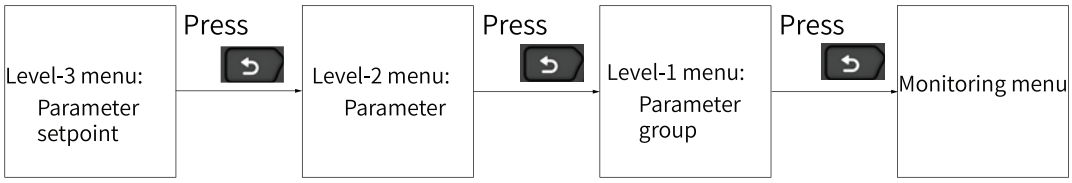
This parameter is an extended parameter, which can be accessed only when A0-10 [Current system parameter access level] is set to a non-zero value.

Viewing Monitoring Parameters during Operation

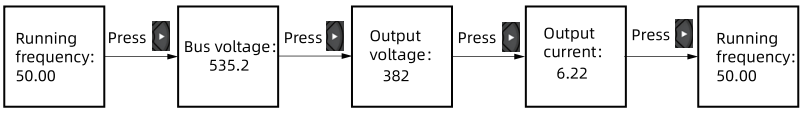
When the drive is in the operation state, five default monitoring parameters are provided: operating frequency (Hz), set frequency (Hz), bus voltage (V), output voltage (V), and output current (A). You can select monitoring parameters in the operation state through A6-03 [Parameter 1 displayed on the LED operating panel during operation] and A6-04 [Parameter 2 displayed on the LED operating panel during operation].

Procedure

1. If the status display area  on the operating panel is highlighted, it indicates that the drive is in the operation state.
2. Enter the monitoring page.
   The monitoring page is displayed by default. If 50.00 is displayed without flashing, it indicates the monitoring page during operation, where 50.00 represents the current operating frequency.
   For example, if the level-3 menu (parameter value) is displayed, you can press  to return to the monitoring page.



3. Press and to switch monitoring parameters and view other states.
   By default, the displayed value 50.00 represents the operating frequency.



   The unit of the current monitoring parameter can be viewed in the unit display area on the operating panel.

4. To modify the default monitoring parameters during operation, adjust the corresponding bit in A6-03 [Parameter 1 displayed on the LED operating panel during operation] and A6-04 [Parameter 2 displayed on the LED operating panel during operation].
   If the bit is set to 1, the parameter can be displayed on the monitoring page of the operating panel. If the bit is set to 0, the parameter cannot be displayed on the monitoring page of the operating panel.

Related parameter

Table 4–7 Monitoring parameter selection in operation state

Param.	Name	Default	Value range
A6-03	Parameter 1 displayed on LED operating panel during operation	0x001F	bit0: Operating frequency (Hz) bit1: Frequency reference (Hz) bit2: Bus voltage (V) bit3: Output voltage (V) bit4: Output current (A) bit5: Output power (kW) bit6: Output torque (%) bit7: DI input status bit8: DO output status bit9: AI1 voltage (V) bit10: AI2 voltage (V) bit14: Load speed bit15: PID reference Bit values are shown below. 0: Hidden 1: Displayed
A6-04	Parameter 2 displayed on LED operating panel during operation	-	bit0: PID feedback bit1: PLC stage bit2: HDI input pulse frequency (kHz) (active only for MD630S) bit3: Operating frequency 2 (Hz) bit4: Remaining operating time bit5: Non-calibrated AI1 voltage (V) bit6: Free mapping 0 bit7: Free mapping 1 bit8: Motor speed bit9: Current power-on time (min) bit10: Current operating time (min.) bit11: Reserved bit12: Communication reference value bit13: Encoder feedback speed bit14: Main frequency X bit15: Auxiliary frequency Y Bit values are shown below. 0: Hidden 1: Displayed

Note

This parameter is an extended parameter, which can be accessed only when A0-10 is set to a non-zero value.

4.2.2 Commissioning Software

4.2.2.1 Downloading and Installing Software

Introduction to the software

iFA Drive (abbreviated as iFA) is a software product independently developed and wholly owned by Inovance with full independent intellectual property rights. As a universal configuration software for Inovance general-purpose products, it enables users to perform device commissioning, system troubleshooting, real-time operational monitoring, and waveform sampling.

Access to the software

The iFA software can be downloaded and installed through the following methods.

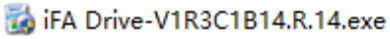
1. Visit the official website of Inovance (*https://www.inovance.com/global*).

2. Click "Services & Support" - "Documentation Download." Enter "iFA" in the search field on this page to find the software, then download the software installation package.

3. After the installation package is downloaded, extract the files, open the installation software, and follow the instructions to complete the software installation.

Software installation

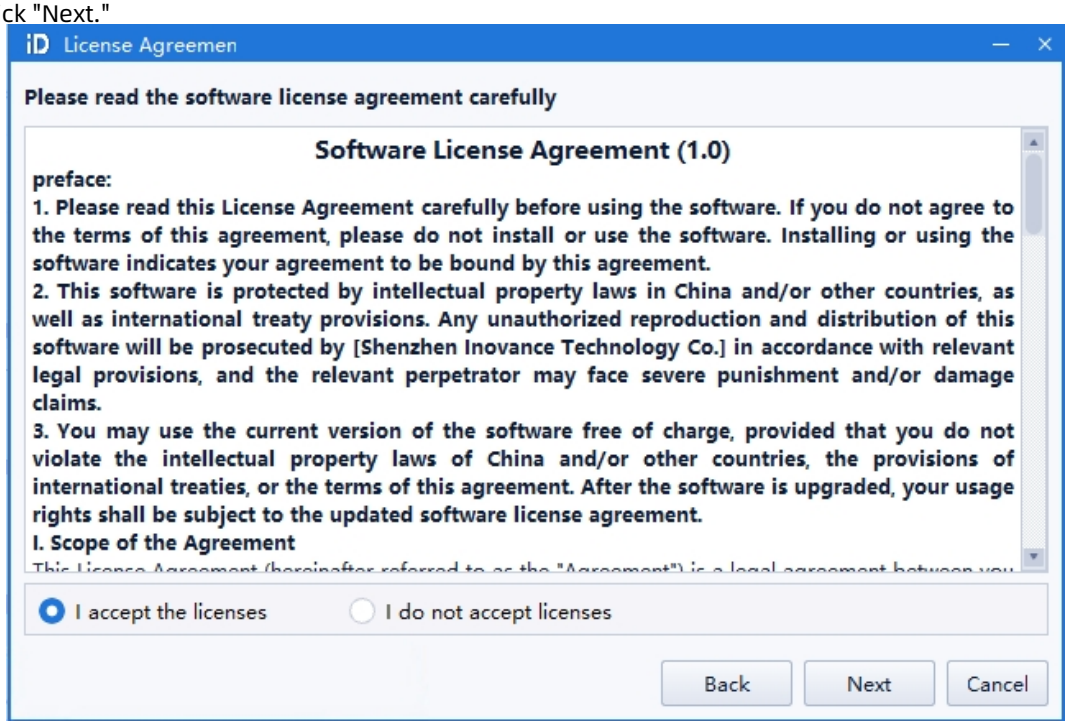
Take installing iFA Drive on Windows 10 x64 operating system as an example, it is recommended to use the latest software installation package. The installation page is subject to the latest software version.

1. Double-click 

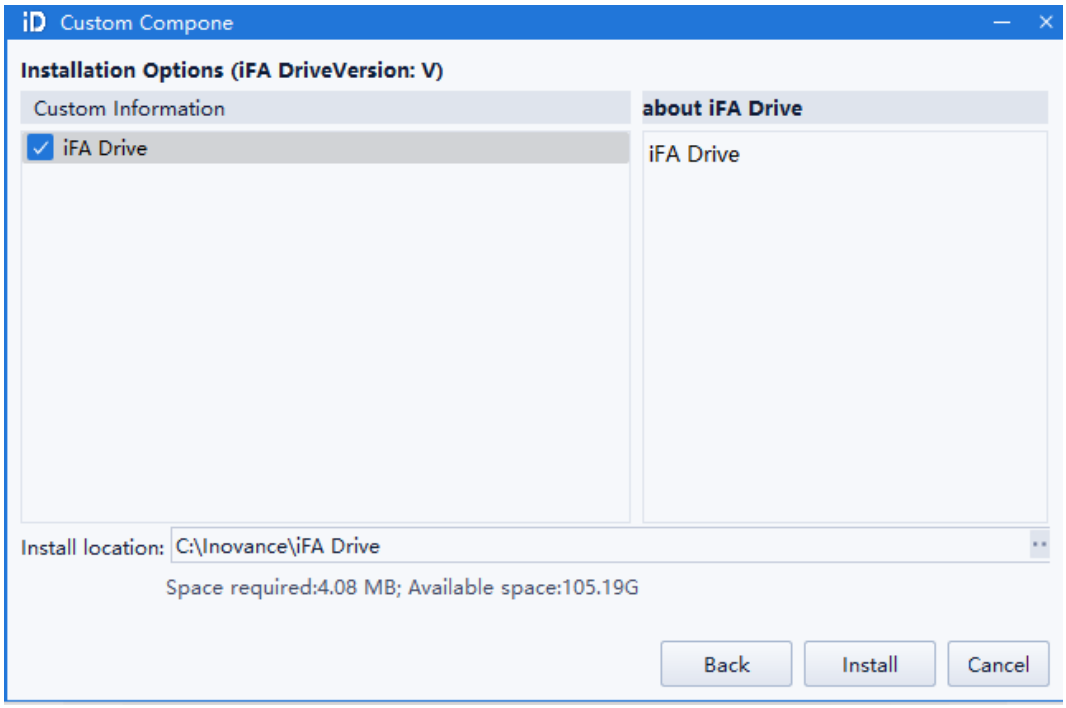
to enter the iFA Drive installation wizard.



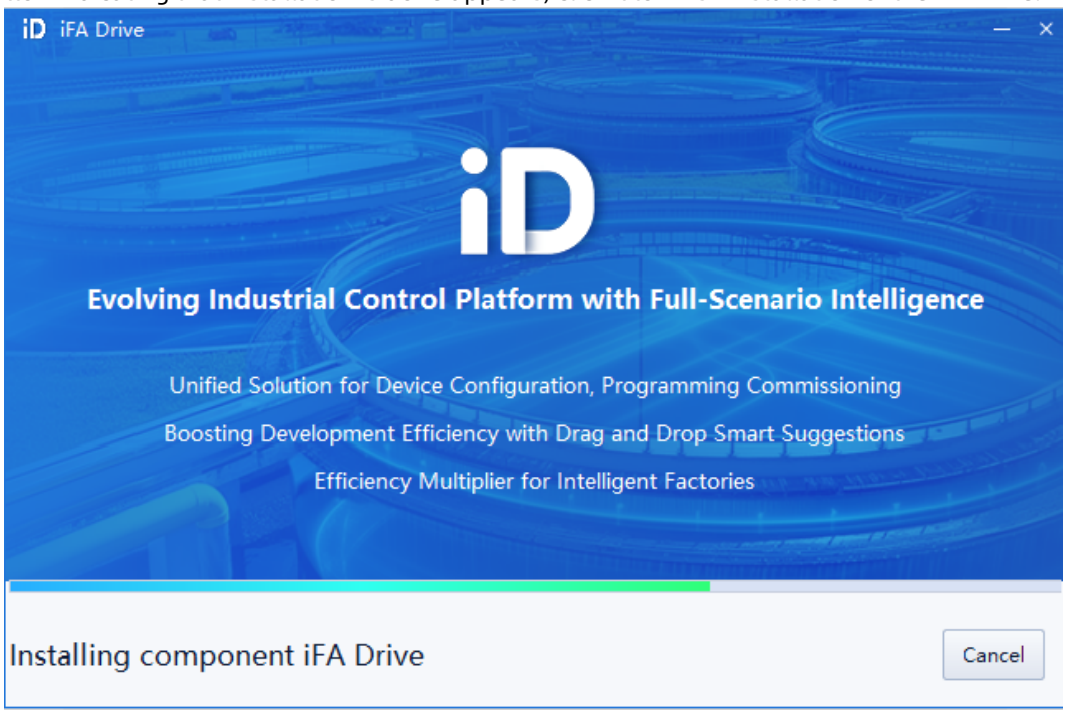
2. After reading the license agreement, if you agree to the terms, select "I accept the licenses," then click "Next."

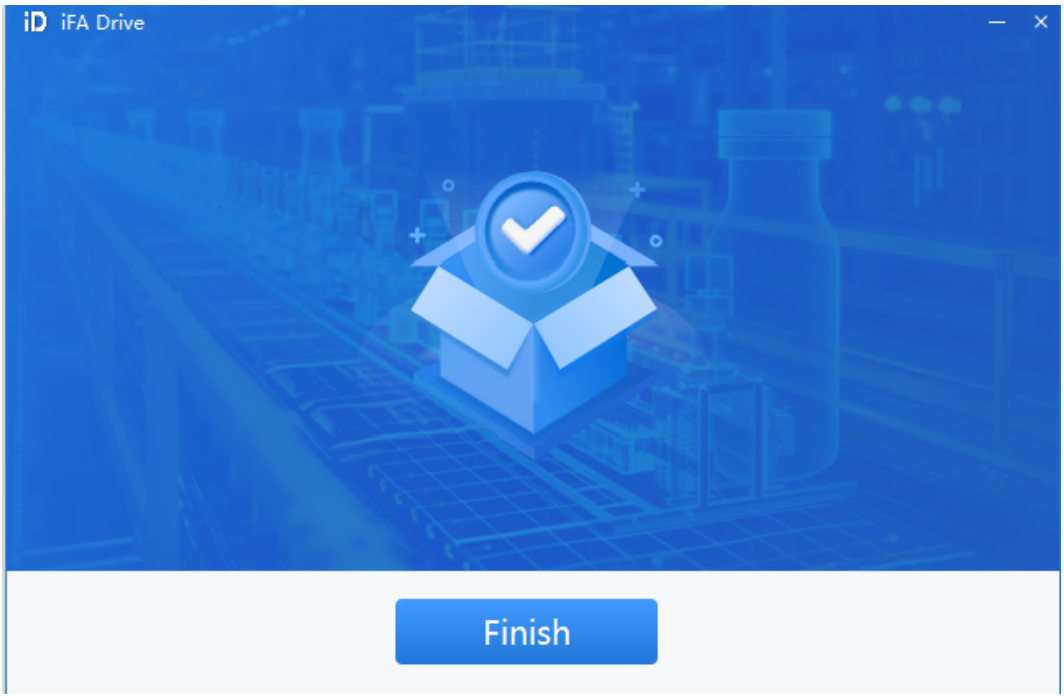


3. After setting the installation path, click "Install."



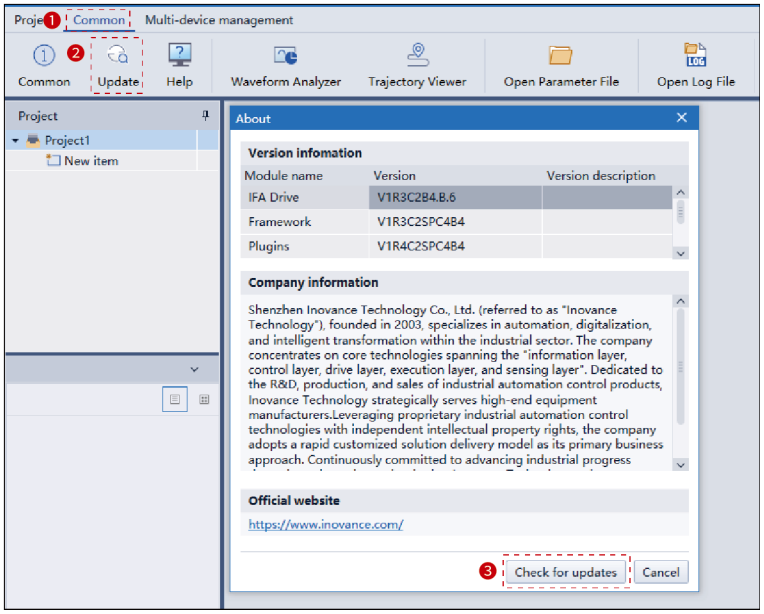
4. After the following page appears, wait for the installation progress bar to complete. When the button indicating that installation is done appears, click it to finish installation of the iFA Drive.





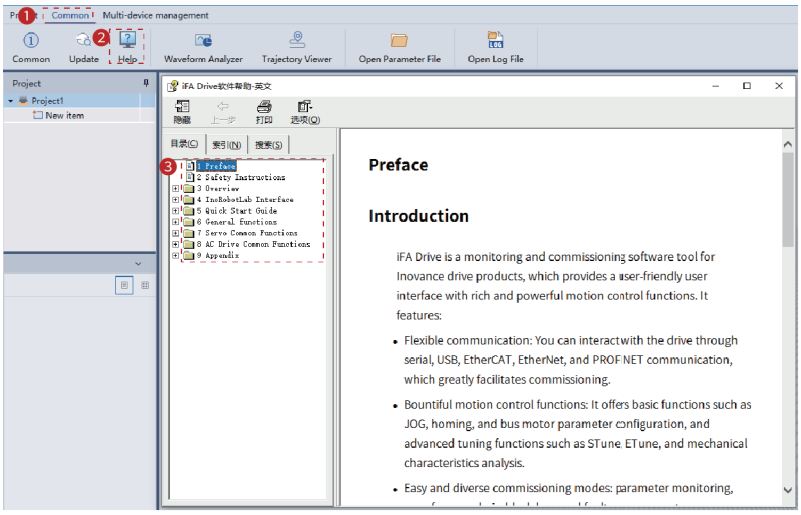
Software upgrade

Click the "General" option in the toolbar → click the "Check for updates" option. In the "About" pop-up window, click the "Check for updates" button.



Use of the software

For detailed information about the software page, quick start guide, and functions, see *iFA Drive Software Help* file. Access to the user guide: Click the "General" option in the toolbar → click the "Help" option. You can get the relevant information in the pop-up window.



4.2.2.2 Quick Commissioning Guide

Note

For information about how to download, install, update, and use the iFA Drive, see *"4.2.2.1 Downloading and Installing Software" on page 130*.

Connect to backend software

Installation environment

The personal computer (PC) installing iFA Drive software shall meet the requirements shown in the following table:

Item	Requirement
Operating system	Windows10 x64
CPU	Intel Core i5 or higher version
Memory	8GB and above
Hard disk capacity	50G above
Display	1366 × 768 or higher resolution, optimal resolution: 1920 × 1080
Interface	1 USB port, 1 Ethernet port

The following connection methods are available to connect to the backend software: USB connection, relay mode via external operating panel connection, network cable connection.

USB connection

Prepare a connecting cable, connect its USB end to the PC, and connect its Type-C end to the AC drive.

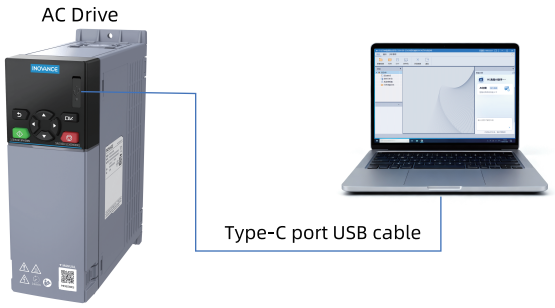


Figure 4-3 PC connection diagram

Relay mode via external operating panel connection

Set the SOP-20 external operating panel to relay mode and connect as shown in the diagram.

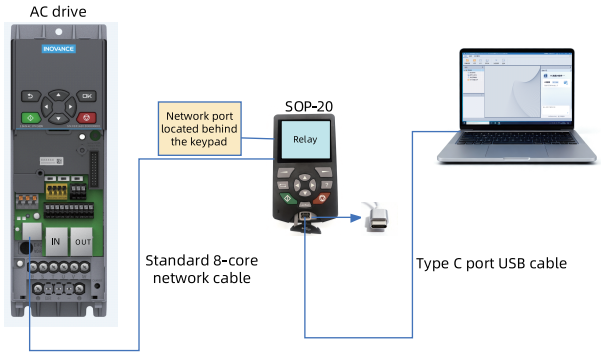


Figure 4-4 Relay mode via external operating panel connection

Ethernet port connection

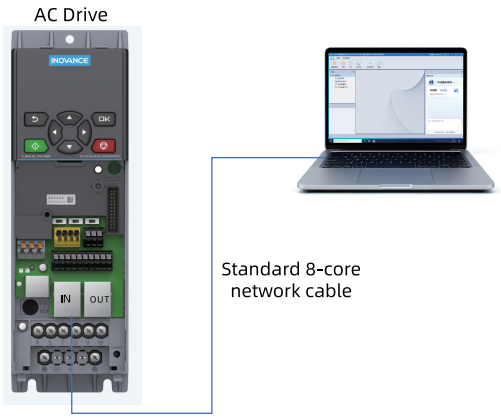
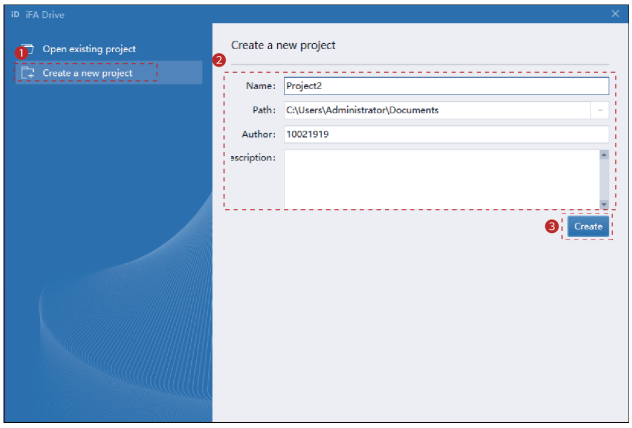
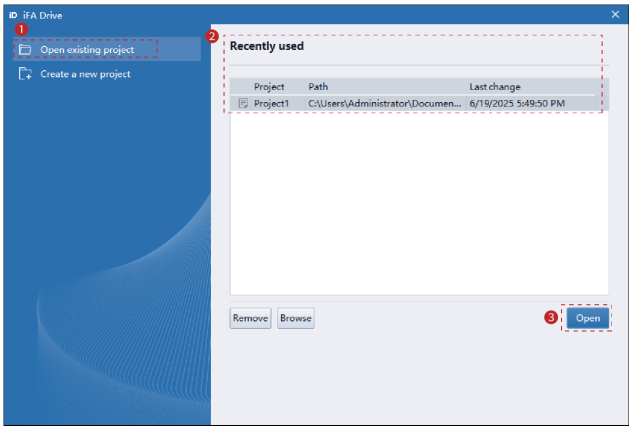


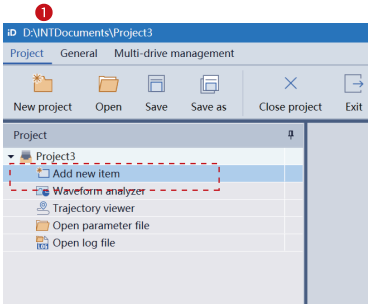
Figure 4-5 Ethernet port connection

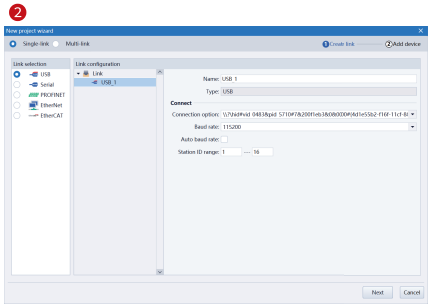
Enter project

Create New Project	Open Existing Project
1. Click "New a new project" (①). 2. Set "Name," "Path" for project storage, and "Description" (②). 3. Click "Create" (③) to complete the new project creation.	1. Click "Open existing project" (①). 2. Select the desired existing project (②). 3. Click the "Open (③)" button to open the selected existing project.
	

Create project

1. After double-clicking the "Add new item" button on the left (①), the "New project wizard" window appears (②).





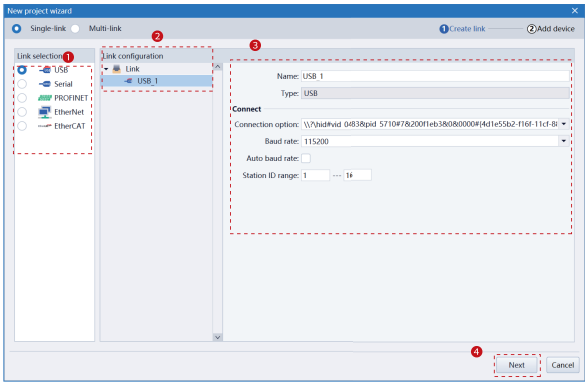
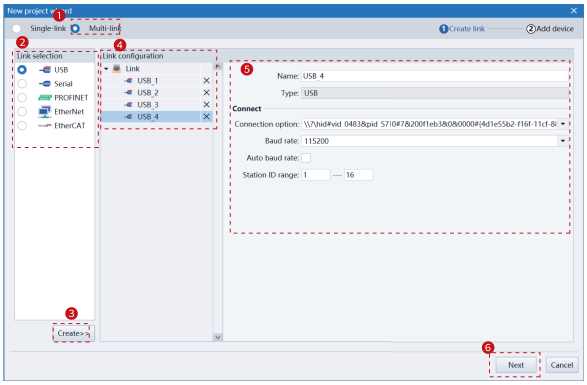
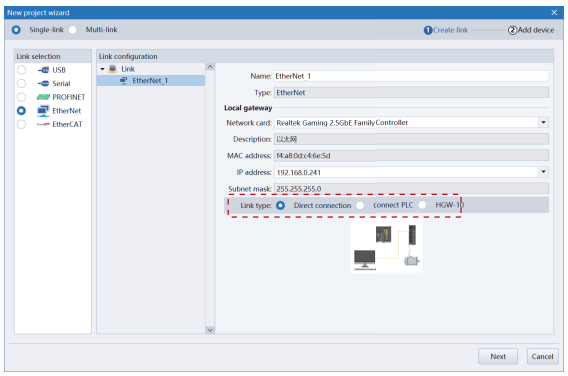
2. Link selection and configuration:

   The iFA backend supports five types of links: USB, Serial, PROFINET, EtherCAT, and EtherNet.

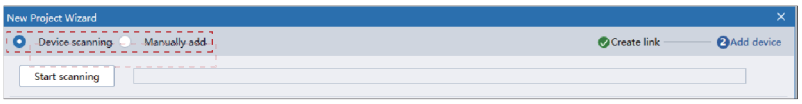
   Among them, the MD630N supports all five types of links, and the MD630S only supports USB link and Serial link.

   When creating a link, you can choose either a single link or multiple links. Creating multiple links allows you to perform device scanning or offline device addition across multiple links:

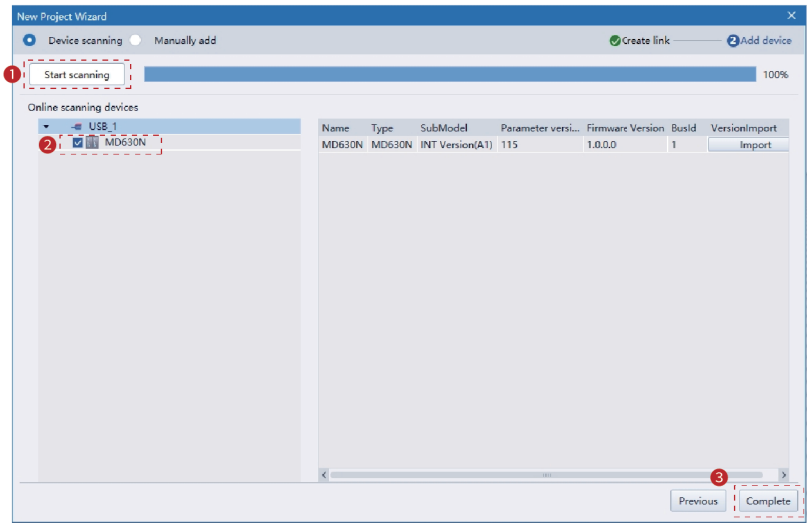
   The following example uses the USB link; the creation process for other links can be referenced accordingly:

<table>
<tr><th>Proce-
dure</th><th>Single Link</th><th>Multiple Links</th></tr>
<tr><td>Step 1
Add link</td><td>1. After selecting the desired link "USB" (①), choose the Link configuration (②), optionally fill in information such as "Connection option, Baud rate, Station ID range" (③), then click the "Next" (④) button to create the corresponding link.
  </td><td>1. Click the "Multi-link (①)" button; select "Link selection(②)"; click the "Create (③)" button; the configuration interface for this link will appear (④); fill in the corresponding link configuration parameters (⑤); then click the "Next" (⑥) button.
  </td></tr>
<tr><td></td><td colspan="2">The EtherNet link (EIP communication) supports two modes: direct connection and connect PLC.
Note: Before using the PLC connection type, first configure the PLC. For detailed configuration instructions, see " Connect PLC" on page 140.
  </td></tr>
</table>

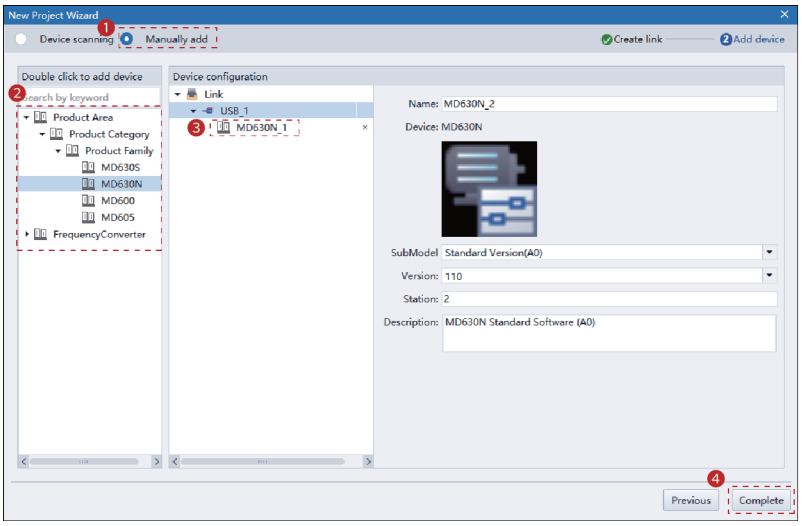
Procedure	Single Link	Multiple Links
Step 2 Adding a Device	2. After completing the above link addition process, proceed to add devices. There are two ways to add devices: online "Device scanning" and offline "Manually add" devices.	

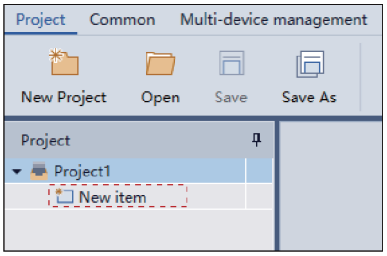
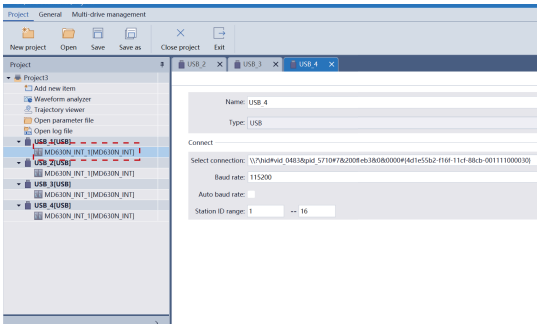


- **Online "Device scanning":** Click the "Start scanning" button and wait for the progress bar to complete. Scanned devices are listed on the left side. Then click the "OK" button at the lower right corner to add the scanned devices to the project tree.
- **Note:** During the USB link creation scanning process, if the scan is manually stopped, only the devices already scanned will display, and the unscanned devices will not be shown. Device scanning requires that the device and the network card are on the same network segment. The device IP address of the MD630N can be set using relevant parameters. For related parameters, refer to "*MD630N device IP setting parameters* on page 142



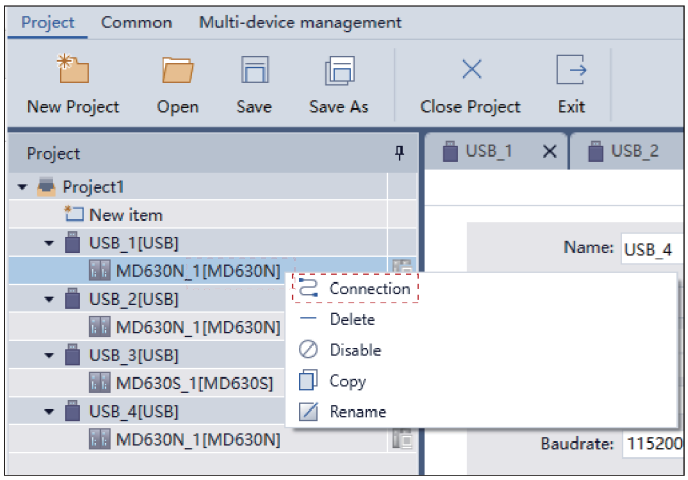
Offline mode "Manually add" devices: Click the "Manually add" (①) button; select the link, then double-click the AC drive to be added (②); the device will be automatically added in the device configuration (③); then click the "Complete" (④) button.



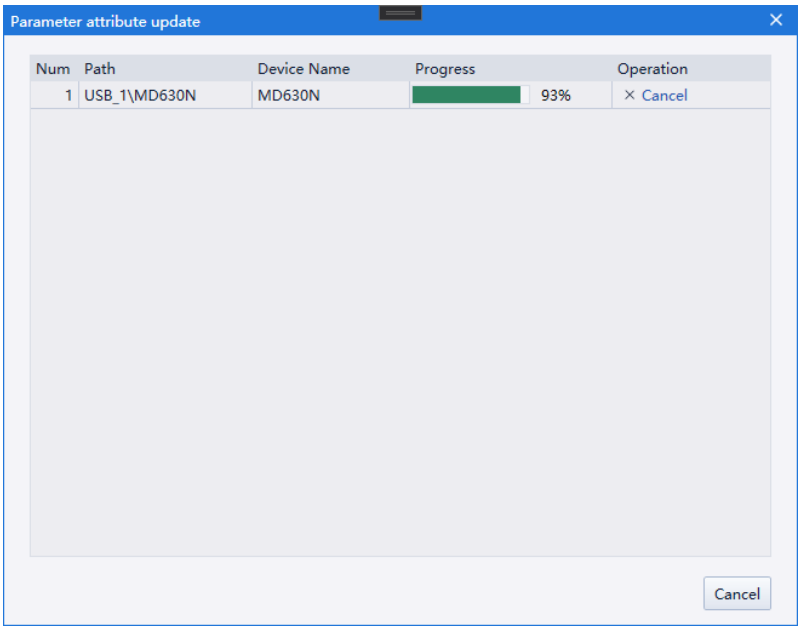
Proce-dure	Single Link	Multiple Links
Step 3 Device addition completed	After adding a new project, automatically return to the iFA main interface. The device name you added is displayed under the project tree. The main display area displays the configured communication link information.	
	Single-link device addition completed. 	Multi-link device addition completed. 

Connect the drive

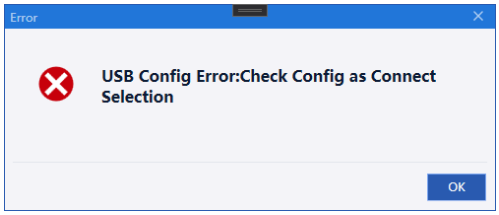
1. After adding the corresponding device, right-click the device name. Click the "Connection" button in the pop-up interface. The drive can only be formally commissioned after the drive connection is successful.



2. For devices supporting attribute updates, if the current device meets the attribute update conditions after successful connection, the attribute update is automatically triggered.



3. If there is no actual device connection or the connection is incorrect, an error message will appear, as shown in the figure below.



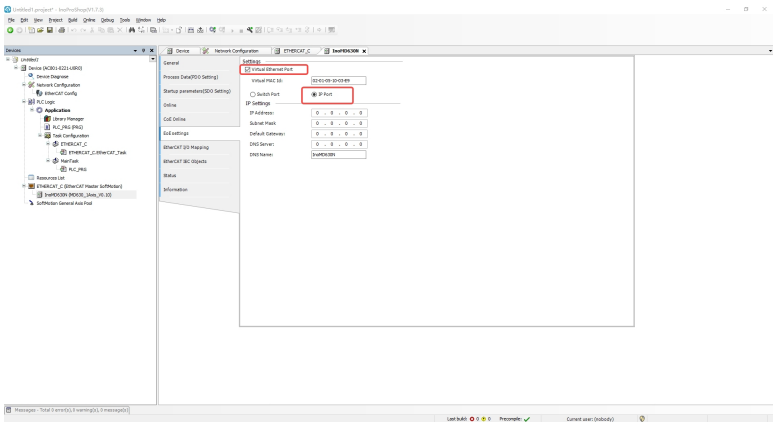
Connect PLC

Note

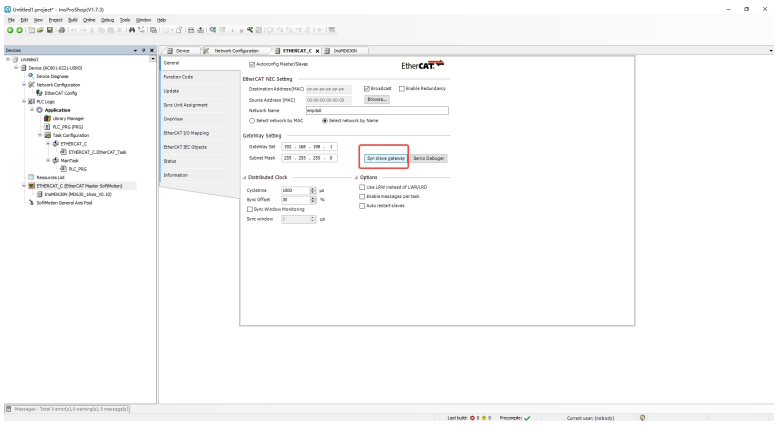
Devices under the EtherCAT_Master communication link require the link nodes of their parent nodes to be online for connection. Devices under other communication links are not subject to this constraint.

When using the connecting PLC mode, ensure the device is online first. The specific configuration method is as follows:

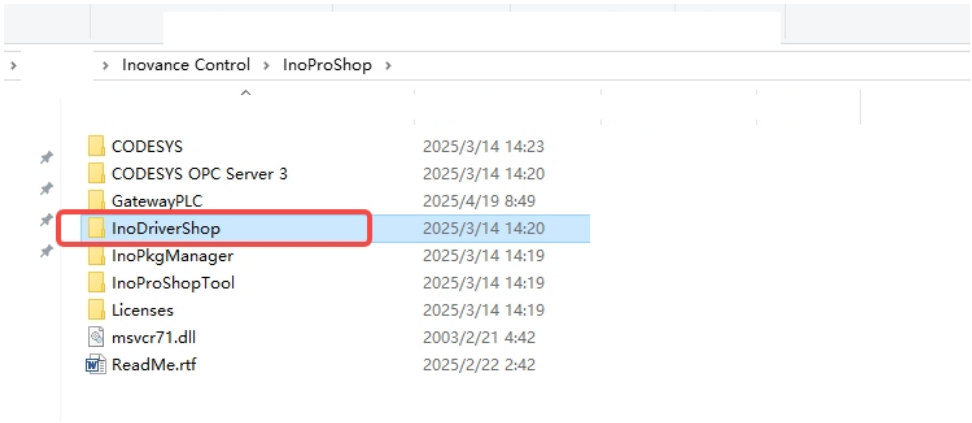
1. First configure EoE, and configure the slave station to be commissioned.



2. Synchronize address

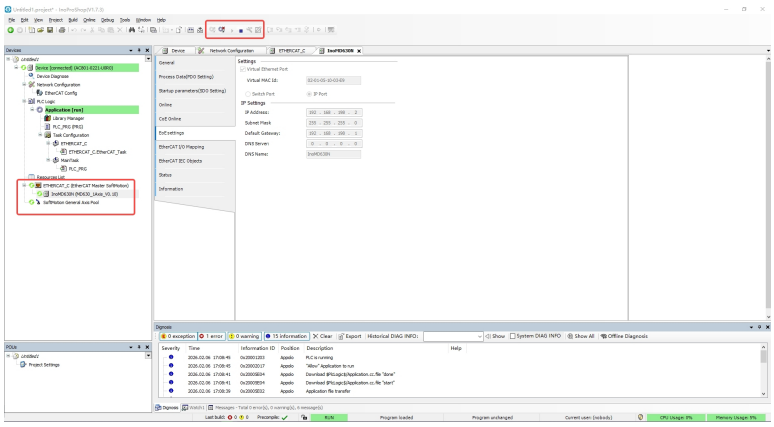


3. If not present, install InoDriverShop in the C:\Inovance Control\InoProShop directory.



Refer to Section "Communication Instance When the MD630N Is Controlled by the Inovance AC801" in *MD630 Series General-Purpose AC Drive User Guide* to configure EtherCAT communication.

As shown in the figure below, the PLC must be in login mode, and all running indicators must be green circles (indicating normal operation).



MD630N device IP setting parameters

Param.	Description	Value
n0-10	Communication type selection 1: EtherCAT 2: EtherNet/IP 3: PROFINET	2
n5-01	IP address first byte	192
n5-02	IP address second byte	168
n5-03	IP address third byte	1
n5-04	IP address fourth byte	2
n5-05	First byte of the subnet mask	255
n5-06	Second byte of the subnet mask	255
n5-07	Third byte of the subnet mask	255
n5-08	Fourth byte of the subnet mask	0

4.3 Commissioning Preparation

4.3.1 Identifying the Motor Type

Check the motor nameplate to identify the motor type. For unknown motor type, identify the motor type through the following ways.

- Method 1: The asynchronous motor has slip, and the synchronous motor has no slip. Rated slip of the motor = Rated frequency x 60/Rated number of pole pairs - Rated speed. If the calculation result is not zero, it is an asynchronous motor.
- Short the UVW cable of the motor. The motor with obvious resistance when it is wobbled manually is synchronous motor. Otherwise, the motor type is asynchronous motor. This method can be used to determine whether the reluctance motor is magnet assisted synchronous reluctance motor. The resistance of the reluctance motor without assisted magnet will not increase.

4.3.2 Selecting Motor Parameter Set on the Nameplate

Some motors may have multiple sets of parameters on the nameplates, as shown below. It is recommended to select the motor parameter set 1 as the rated parameters that input to the drive. See the following for details.

duty type	n (/min)	P (kW)	U (V)	I (A)	f (Hz)	cos/phi
S1	650	200	414	342	22.3	0.89
S1	765	200	480	296	26	0.88
S1	1950	200	480	300	66.5	0.87
S1	3000	130	480	192	101.5	0.87

U/f is directly proportional to the flux. The U/f of motor parameter set 1 and motor parameter set 2 is about 18.5, which is the rated flux coefficient. The U/f of motor parameter set 3 is 7.2, which is the field-weakening parameter. The U/f of motor parameter set 4 is 4.7, which is also the field-

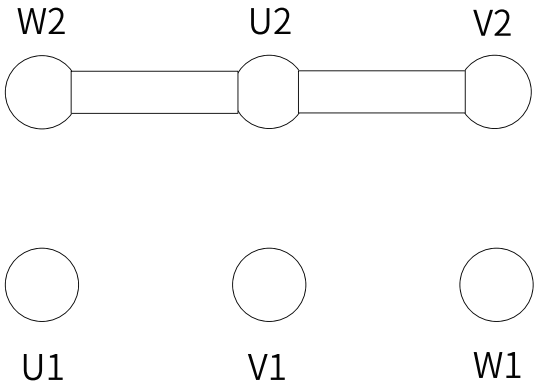
weakening parameter. The rated motor parameters in the drive cannot be used to set the field-weakening parameters. Selecting motor parameter set 3 or 4 can result in insufficient motor output. Therefore, only parameter set 1 or 2 can be selected. If the motor parameter set 2 is selected, the maximum output torque at low frequency cannot meet the design requirements. Therefore, it is recommended to select motor parameter set 1. For the AC drive, the maximum output voltage is related to the bus voltage instead of the rated motor voltage, so setting the 1st parameter set will not result in insufficient output voltage.

4.3.3 Collect Data of AC Drive and Motor

Confirm the following information before commissioning.

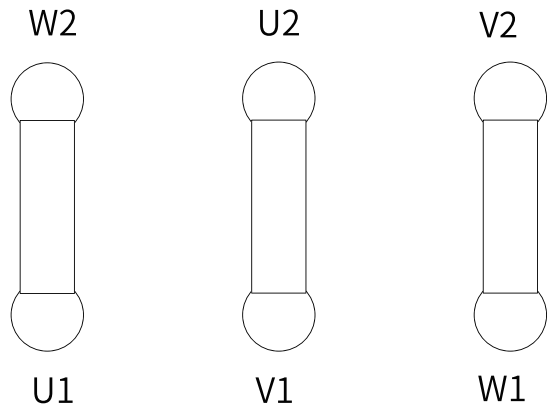
- Collect motor data
  See the information on the motor nameplate: rated power, rated voltage, rated current, rated frequency, and rated speed, as well as motor type.

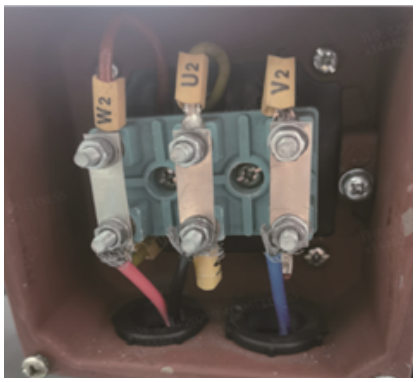
  The motor parameters listed on the nameplate are crucial for successful parameter auto-tuning. Note that the settings for asynchronous and synchronous motors differ. Before setting the motor parameters, confirm the motor type, as shown in *"4.3.1 Identifying the Motor Type" on page 142*.
- Collect AC drive data
  See the information on the AC drive nameplate: product name, model, power, voltage class, and output current to ensure the IO range and power rating of AC drive match those of the motor.
- Check motor connection mode
  Check whether the motor connection method (Y-type or delta type) is consistent with the motor nameplate. Incorrect motor connection can result in low torque output, low load capacity, and high output current.





(a) Y connection





(b) Delta connection

Figure 4-6 Motor connection mode

4.3.4 Inspection on the Wiring Between the Drive and Motor

Connect the drive to the motor. Check the following items before power-on commissioning.

Table 4–8 Procedure

Item	Action	Compliance	completed
1	The power input of the main circuit is correctly connected based on terminal labels (R, S, and T).	☐	☐
2	The main circuit output terminals (U, V, and W) and motor cables (U, V, and W) are connected with the same phase sequence.	☐	☐
3	The power input terminals (R, S, and T) and output terminals (U, V, and W) of the main circuit are correctly connected. For example, the power input cable is not connected to the output end.	☐	☐
4	The drive and motor are grounded properly.	☐	☐
5	The encoder cable and shield are connected properly.	☐	☐
6	The auxiliary circuit power supply is correctly connected.	☐	☐
7	Connect the communication cables properly.	☐	☐
8	Connect external terminals such as I/O terminals properly.	☐	☐

4.3.5 Drive Power-on

After checking that the wiring is correct, connect the main circuit R, S, T to a three-phase AC power supply. Ensure that the drive power supply works properly when checking drive parameters.

4.3.6 Drive Model Verification

Check the following parameters based on the nameplate of the drive.

Table 4–9 Parameters to be checked

Param.	Name	Description
A2-21	Device type	1: MD630S (485 standard version + STO) 4: MD630N (Bus version + STO)
A3-02	Rated power of the drive	Displays the rated power of the drive.
A3-03	Rated current of the drive	Displays the rated current of the drive.
A3-04	Rated voltage of the drive	Displays the rated voltage of the drive.
A3-05	Maximum current of the drive	Defines the maximum current of the drive, which is based on the rated current of the drive.

If the product information such as the rated power, rated voltage, and rated current is not consistent with that on the nameplate, contact the service personnel for technical support.

4.3.7 Software Version Information

If you need to use a specific software version for commissioning, check the software version through the following parameters after software update.

Param.	Name	Display range
A2-22	Performance software version	0.00 to 655.35
A2-23	Function software version	0.00 to 655.35
A2-24	Performance software sub-version	0.00 to 655.35
A2-25	Function software sub-version	0.00 to 655.35

4.4 Selecting Input Voltage Class

Application scenario

This function is required only for three-phase 380 V models.

The overvoltage suppression action voltage and the braking voltage effective value are related to the power supply voltage. The bus voltage is approximately 1.414 times the effective power supply voltage. When the input voltage is high, the input voltage class must be switched to adjust the overvoltage suppression action voltage and the braking unit action voltage to the corresponding values. This can prevent unintended activation of braking and overvoltage suppression.

Description

When the input voltage class is switched through F0-06/A3-07, the overvoltage suppression action voltage and the braking unit action voltage will change according to the table below.

F0-06/A3-07 Input voltage class	F2-40/d1-56 Voltage threshold for overvoltage suppression	A4-00 Braking unit activation voltage
0 (380 V to 415 V)	740 V	670 V
1 (440 V to 480 V)	780 V	750 V

Note

- This parameter needs to be set only for three-phase 380 V models.
- Before commissioning, check the input power supply voltage level, then select the input voltage level through F0-06/A3-07 accordingly.

Application example

If the input voltage class is not set for the grid voltage of three-phase 480 V before commissioning, the default value is 0. In this case, the overvoltage suppression action voltage is 740 V and the braking unit action voltage is 680 V. However, under normal grid input, the bus voltage already reaches approximately 678 V, which is already above the braking point. Therefore, the motor immediately enters the braking state as soon as the motor starts.

To solve the problem, the input voltage class must be set to 1 before commissioning and the corresponding overvoltage suppression action voltage and braking unit action voltage must be selected.

Related parameters

Param.	Name	Default	Value	Description
A3-07	Input voltage class	0	0: 380 V to 415 V 1: 440 V to 480 V	Sets the input voltage class based on the current power supply voltage. Value description: 0: 380 V to 415 V 1: 440 V to 480 V Note: The input voltage class mainly affects the default braking unit action voltage and the overvoltage suppression action voltage.

4.5 Motor Parameter Setting

4.5.1 Setting Motor Parameters

Related parameters

Refer to the motor nameplate and set the following motor parameters.

Table 4–10 Setting motor parameters

Param.	Name	Description	Asynchronous motor	Synchronous motor	Synchronous reluctance motor
F1-00 (C4-00)	Motor type	0: Asynchronous motor or induction motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnet 4: Synchronous reluctance motor with permanent magnet	Mandatory	Mandatory	Mandatory
F1-01 (C4-01)	Rated motor power	Sets the rated motor frequency. For applications where multiple motors of the same type are driven by one AC drive, set the rated power of a single motor and set the number of parallel motors in C4-13 (Number of parallel motors).	Mandatory	Mandatory	Mandatory
F1-03 (C4-03)	Rated motor voltage	Sets the rated motor voltage.	Mandatory	Mandatory	Mandatory
F1-04 (C4-04)	Rated motor current	Sets the rated motor current. For applications where multiple motors of the same type are driven by one AC drive, set the rated current of a single motor and set the number of parallel motors in C4-13 (Number of parallel motors).	Mandatory	Mandatory	Mandatory
F1-06 (C4-06)	Rated motor frequency	Sets the rated motor frequency, which corresponds to the rated motor voltage.	Mandatory	Mandatory	Mandatory
F1-07 (C4-07)	Rated motor speed	Defines the rated rotor speed of the motor. Reserve a slip when setting the rated speed of the asynchronous motor. For motors whose nameplates do not indicate the synchronous speed (which equals rated frequency x 60/number of pole pairs) or rated speed, set the rated speed based on the following references.	Mandatory	Mandatory	Mandatory
F1-10 (C4-10)	Maximum motor frequency	The maximum motor frequency serves as the reference value for system frequency reference and acceleration/deceleration time. When the maximum frequency is set below the rated motor frequency, the active maximum frequency becomes the motor rated frequency. If you want to set the speed limit, set it in F2-22 to F2-27.	Optional	Optional	Optional
F1-11 (C4-11)	Minimum motor frequency	Minimum motor frequency For motors that do not support low-speed operation, this parameter does not need to be set.	Optional	Optional	Optional

Param.	Name	Description	Asynchronous motor	Synchronous motor	Synchronous reluctance motor
F1-12 (C4-12)	Synchronous motor back EMF	The rated back EMF refers to the back EMF (effective value of the line voltage) when the motor rotates at rated speed without load. It has a significant effect on low-speed performance. If the synchronous motor cannot support no-load auto-tuning during rotation, check the motor nameplate or consult the motor manufacturer to set the accurate motor back EMF. F1-12 is the back EMF at rated speed. If the nameplate indicates a back EMF value of 120V/krpm, the rated back EMF equals F1-07/1000 x 120 V. If the back EMF is unknown, disconnect the motor from the load to perform no-load dynamic auto-tuning. The above procedure only needs to be performed once for motors with the same specification. After that, you can manually input the back EMF value.	-	Optional	Optional
F1-14 (C4-14)	Sets the number of motor pole pairs.	The number of pole pairs is usually marked on the motor nameplate. If not, you can calculate the number of pole pairs through the rated speed and rated frequency based on the following formula: Number of pole pairs ≈ (Rated frequency (Hz) x 60)/Rated speed (rpm). The calculated number of pole pairs is not an integer. For example, if the rated frequency of the motor is 50 Hz and the rated speed is 1450 rpm, then the number of pole pairs is 2.07. The decimal value 0.07 is a slip value that can be ignored. Therefore, the number of pole pairs is 2. For the motor whose number of pole pairs does not exceed 12, this parameter does not need to be set. The software calculates the accurate number of pole pairs automatically. Note the difference between the number of poles and the number of pole pairs. The number of pole pairs equals the number of poles/2.	Optional	Optional	Optional

Note

The motor parameters in group F1 in the table are mapped from motor parameters in group C4. The settings of the two groups are equivalent.

Precautions

To set the rated speed of an asynchronous motor based on the synchronous speed, first check the recommended slip rate based on the motor power, as shown in the following table, and then calculate the rated motor speed through the formula: rated speed = synchronous speed - recommended slip rate x synchronous speed.

Power	2.2 kW	3.7 kW	5.5 kW	7.5 kW	11 kW	15 kW	22 kW
Recommend-ed slip rate	6%	5%	4%	4%	3.5%	3%	2.5%

After the settings according to the motor nameplate parameters, the output current may exceed the expected values when the motor is running without load in the V/f mode. You can reduce the rated voltage slightly by 10 V to 20 V before performing parameter auto-tuning. This adjustment can lead to improved control performance.

Note

When setting F1-00 [Motor type] to 3 [Synchronous reluctance motor without permanent magnet] or 4 [Synchronous reluctance motor with permanent magnet], it is recommended to use the default control mode, which is specifically developed for reluctance motors. The following functions are supported: speed control, current limit, torque limit, power limit, overvoltage suppression, undervoltage suppression, and energy-saving control.

4.5.2 Set Asynchronous Motor Parameters

Related Parameter

When the motor type is asynchronous motor, the following motor parameters need to be set according to the motor nameplate.

Table 4–11 Parameter setting for asynchronous motor

Param.	Name	Description	Mandatory or not
F1-00 (C4-00)	Motor type	Set F1-00 to 0 (asynchronous motor) 0: Asynchronous motor, induction motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnet 4: Permanent magnet synchronous reluctance motor	Yes
F1-01 (C4-01)	Rated motor power	For applications where multiple motors are driven by one AC drive (multiple motors must be the same), set the rated power of a motor and set the number of parallel motors in C4-13 (Number of parallel motors).	Yes
F1-03 (C4-03)	Rated motor voltage	Set the rated motor voltage.	Yes
F1-04 (C4-04)	Rated motor current	Set the rated motor current. For applications where multiple motors are driven by one AC drive, set the rated current of a single motor and set the number of parallel motors in C4-13 (Number of parallel motors).	Yes
F1-06 (C4-06)	Rated motor frequency	Set the rated motor frequency, which must match the rated motor voltage.	Yes
F1-07 (C4-07)	Rated motor speed	The parameter indicates the rated rotor speed of the motor. Rated speed shall be smaller than synchronous speed (rated frequency x 60 ÷ number of pole pairs), and for asynchronous motors, slip must be considered. Some motor nameplates do not include a rated speed or only list the synchronous speed, so the rated speed can be set according to the following base value.	Yes
F1-10 (C4-10)	Maximum motor frequency	The maximum motor frequency is the base value of the set frequency and acceleration/deceleration time. Scenarios: When the maximum set frequency is lower than the rated motor frequency, the effective maximum frequency is the rated motor frequency. If you want to set the speed limit, set it in F2-22 to F2-27.	Optional

Param.	Name	Description	Mandatory or not
F1-11 (C4-11)	Minimum motor frequency	Minimum motor frequency Scenarios: This parameter is not required for the motors that do not support low-speed operation.	Optional
F1-14 (C4-14)	Set the number of motor pole pairs.	The number of pole pairs can be found on the motor nameplate. It can also be calculated. Number of pole pairs ≈ (rated frequency x 60) / rated speed (rated frequency unit: Hz, rated speed unit: rpm). For example, if the rated frequency is 50 Hz and the rated speed is 1450 rpm, the calculation would be: Number of pole pairs ≈ (50 Hz x 60) ÷ 1450 rpm = 2.07 In this case, the decimal part (0.07) represents the slip, which can be ignored. Therefore, the number of pole pairs is rounded down to 2. Scenarios: If the number of pole pairs does not exceed 12, the software automatically calculates the correct number of pole pairs. Note: The number of poles is different from the number of pole pairs. Number of pole pairs = number of poles ÷ 2	Optional

Note

The motor parameters in group F1 in the table are mapped from motor parameters in group C4. The settings of the two groups are equivalent.

Precautions

Set the rated speed of the asynchronous motor based on synchronous speed:

1. See the following table for the recommended slip ratio based on the motor power.
2. Rated speed = Synchronous speed – Recommended slip ratio x Synchronous speed.

Power	2.2 kW	3.7 kW	5.5 kW	7.5 kW	11 kW	15 kW	22 kW
Recommend-ed slip ratio	6%	5.0%	4%	4%	3.5%	3%	2.5%

After the settings according to the motor nameplate parameters, the output current may exceed the expected values when the motor is running without load in the V/f mode. You can reduce the rated voltage slightly by 10 V to 20 V before performing parameter auto-tuning. This adjustment can lead to improved control performance.

4.5.3 Set Synchronous Motor /Synchronous Reluctance Motor Parameters

Related Parameter

When the motor type is synchronous motor, the following motor parameters need to be set according to the motor nameplate.

Table 4–12 Parameter Setting for Synchronous Motor

Param.	Name	Description	Mandatory or not
F1-00 (C4-00)	Motor type selection	Set F1-00 [Motor type] = 2 [Permanent magnet synchronous motor], 3 [Synchronous reluctance motor without permanent magnet], 4 [Permanent magnet synchronous reluctance motor] 0: Asynchronous motor, induction motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnet 4: Permanent magnet synchronous reluctance motor	Yes
F1-01 (C4-01)	Rated motor power	Sets the rated motor power. For the synchronous motor, multi-motor drive is not allowed. So synchronous motors with amortisseur winding are recommended to be set as asynchronous motor V/f operation.	Yes
F1-03 (C4-03)	Rated motor voltage	Set the rated motor voltage.	Yes
F1-04 (C4-04)	Rated motor current	Sets rated motor current.	Yes
F1-06 (C4-06)	Rated motor frequency	Sets rated motor frequency.	Yes
F1-07 (C4-07)	Rated motor speed	Motor rated rotor speed. Check whether rated speed equals to synchronous speed (rated frequency × 60 ÷ Number of pole pairs); otherwise the motor parameters may be incorrect. This can lead to abnormal auto-tuning and operation.	Yes
F1-10 (C4-10)	Maximum motor frequency	The maximum motor frequency is the base value of the set frequency and acceleration/deceleration time. Scenarios: When the maximum set frequency is lower than the rated motor frequency, the effective maximum frequency is the rated motor frequency. If you want to set the speed limit, set it in F2-22 to F2-27.	Optional
F1-11 (C4-11)	Minimum motor frequency	Minimum motor frequency Scenarios: This parameter is not required for the motors that do not support low-speed operation.	Optional

Param.	Name	Description	Mandatory or not
F1-12 (C4-12)	Synchro-nous motor back EMF	The rated back EMF is the back EMF (effective value of the line voltage) when the motor rotates at rated speed without load. It has a significant effect on low-speed performance. If the synchronous motor cannot be auto-tuned for no-load rotation, it is recommended to check the motor nameplate or ask the motor manufacturer to set the motor back EMF accurately. F1-12 is the back EMF at rated speed. If the effective value of the back EMF marked on the nameplate is 120 V/krpm, the rated back EMF = F1-07 ÷ 1000 x 120 V. If the effective value of the back EMF on the nameplate is 120 V/krpm, the rated back EMF is F1-07 / 1000 × 120 V. If the back EMF is not known, the motor shaft must be disconnected for no-load dynamic auto-tuning. The above procedures only need to be performed once for motors with the same specification. After that, you can manually input the back EMF value.	Optional
F1-14 (C4-14)	Set the number of motor pole pairs.	The number of pole pairs can be found on the motor nameplate. It can also be calculated. Number of pole pairs ≈ (rated frequency x 60) / rated speed (rated frequency unit: Hz, rated speed unit: rpm). For example, if the rated frequency is 50 Hz and the rated speed is 1450 rpm, the calculation would be: Number of pole pairs ≈ (50 Hz x 60) ÷ 1450 rpm = 2.07. In this case, the decimal part (0.07) represents the slip, which can be ignored. Therefore, the number of pole pairs is rounded down to 2. Scenarios: If the number of pole pairs does not exceed 12, the software automatically calculates the correct number of pole pairs. **Note:** The difference between the number of poles and the number of pole pairs is that the nmber of pole pairs = the number of poles ÷ 2.	Optional

Note: The motor parameters in group F1 in the table are the mapping of motor parameters in group C4. The settings of the two groups are equivalent.

Note

When setting F1-00 [Motor type] to 3 [Synchronous reluctance motor without permanent magnet] or 4 [Synchro-nous reluctance motor with permanent magnet], it is recommended to use the default control mode, which is specifically developed for reluctance motors. The following functions are supported: speed control, current limit, torque limit, power limit, overvoltage suppression, undervoltage suppression, and energy-saving control.

4.5.4 Setting the Carrier Frequency

The carrier frequency of the drive is set by A5-01 [Carrier frequency reference]. In addition to being limited by A5-01 [Carrier frequency reference] and A5-00 [Maximum carrier frequency], the carrier frequency is also controlled by functions such as "Carrier frequency adjustment with synchronous frequency" and "Random PWM". For details, see description of A5-09 to A5-13.

Related parameter

Table 4–13 Parameter for setting carrier frequency

Param.	Name	Default	Value range
A5-01	Carrier frequency reference	4.0	0.8 kHz to 20.0 kHz

Precautions

For high-speed motors, ensure that:

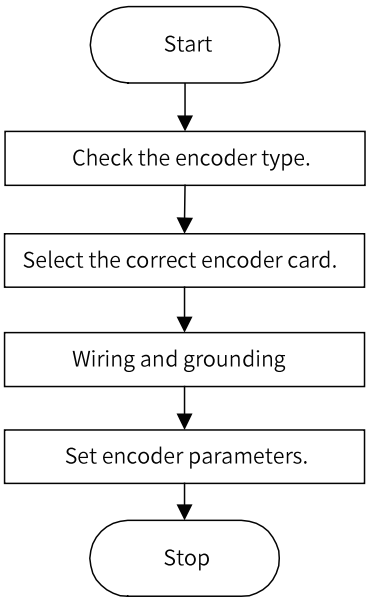
A5-01 [Carrier frequency reference] > (12 x maximum output frequency)

If A5-01 < 12 x maximum output frequency, oscillation and overcurrent may occur due to insufficient control frequency during high-speed operation. A low carrier frequency at high-speed operation may result in high output current harmonics, high motor temperature rise during long-term operation, and even demagnetization of the synchronous motor.

4.6 Set Encoder Parameters

Setting the encoder

The drive supports ABZ encoders, 23-bit encoders, resolvers, SSI encoders, sine-cosine encoders, EnDat encoders, and BiSS encoders. The commissioning procedure for the encoder is as follows.



The specifications of the encoder card and the encoder types supported are as follows.

<table>
<tr><th>Encoder card</th><th>Encoder types supported</th><th>PG expansion card specifications</th><th>Terminal assignment</th></tr>
<tr><td rowspan="6">MD-PG-AU1</td><td>ABZ incremental encoder</td><td>TTL/HTL level supported; differential (500 kHz)/push-pull (100 kHz)/OC (50 kHz) signal input supported; hardware open circuit detection (differential/ push-pull) supported
The ABZ encoder differential signals are applicable to long-cable applications.</td><td><table><tr><td>A-</td><td>B-</td><td>C-</td><td>15V</td><td>COM</td><td>OA</td><td>OB</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>A+</td><td>B+</td><td>C+</td><td>5 V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table>
For details, see “ Encoder Terminal Layout and Definition” on page 155</td></tr>
<tr><td>Inovance communication-type 23-bit encoder</td><td>Resolution: 32-bit (max.)
Data refresh rate: 16 kHz
Communication rate: 8 Mbps (max.)</td><td><table><tr><td>DATA -</td><td>/</td><td>/</td><td>15 V</td><td>COM</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>DATA +</td><td>/</td><td>/</td><td>5V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table>
For details, see “ Encoder Terminal Layout and Definition” on page 155</td></tr>
<tr><td>SSI encoder</td><td>Resolution: 32-bit (max.)
Communication rate: 2 Mbps (max.)</td><td rowspan="3"><table><tr><td>CLK -</td><td>DATA -</td><td>/</td><td>/</td><td>/</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>CLK +</td><td>DATA +</td><td>/</td><td>/</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table>
For details, see “ Encoder Terminal Layout and Definition” on page 155</td></tr>
<tr><td>EnDat encoder</td><td>Resolution: 32-bit (max.)
Communication rate: 10 Mbps (max.)</td></tr>
<tr><td>BiSS encoder</td><td>Resolution: 32-bit (max.)
Communication rate: 10 Mbps (max.)</td></tr>
<tr><td>Magnetic encoder</td><td>Resolution: 32-bit (max.)
Data refresh rate: 16 kHz
Communication rate: 2 Mbps (max.)</td><td><table><tr><td>DATA -</td><td>/</td><td>/</td><td>15 V</td><td>COM</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>DATA +</td><td>/</td><td>/</td><td>5V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table>
For details, see “ Encoder Terminal Layout and Definition” on page 155</td></tr>
<tr><td>MD-PG-R1</td><td>Resolver</td><td>Resolver: SIN/COS/EXC signal
Excitation signal output:
Vrms: 7 V
Excitation frequency:
10 kHz/12 kHz/15 kHz/20 kHz (adjustable)
Feedback transformation ratio: 0.5/ 0.286
For synchronous motors equipped with resolvers, the number of motor pole pairs must be divisible by the number of resolver pole pairs. For example, a motor with 6 pole pairs can be equipped with a resolver with 1, 2, 3, or 6 pole pairs.</td><td><table><tr><td>SIN -</td><td>COS -</td><td>EXC -</td><td>/</td><td>/</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>SIN +</td><td>COS +</td><td>EXC +</td><td>/</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table>
For details, see “ Encoder Terminal Layout and Definition” on page 155</td></tr>
</table>

Encoder card	Encoder types supported	PG expansion card specifications	**Terminal assignment**
MD-PG-S1	Sine-cosine encoder	Differential-mode voltage: Vpp = 0.6 V to 1.0 V to 1.2 V Common-mode voltage: Vcm = 3.0 V (max.); Input frequency: f = 100 kHz (max.)	<table><tr><td>SIN-</td><td>COS-</td><td>Z-</td><td>COM</td><td>/</td><td>OA-</td><td>OB-</td><td>OZ-</td><td>COM</td><td>PE</td></tr><tr><td>SIN+</td><td>COS+</td><td>Z+</td><td>5V</td><td>/</td><td>OA+</td><td>OB+</td><td>OZ+</td><td>VCC</td><td>PE</td></tr></table> For details, see "*Encoder Terminal Layout and Definition*" *on page 155*

Encoder terminal layout and definition

Table 4–14 Layout of encoder terminals

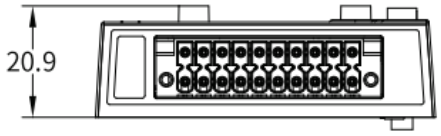
Appearance of the terminal	Pin No.
	<table><tr><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td><td>12</td><td>14</td><td>16</td><td>18</td><td>20</td></tr><tr><td>1</td><td>3</td><td>5</td><td>7</td><td>9</td><td>11</td><td>13</td><td>15</td><td>17</td><td>19</td></tr></table>

Table 4–15 Pin assignment of different encoders

Pin No.	ABZ encoder	23-bit encoder	Resolver	Sine-cosine encoder	EnDat encoder SSI encoder BiSS encoder	Magnetic encoder
1	A signal (+)	DATA+, data signal (+)	SIN signal (+)	SIN signal (+)	CLK+, clock signal (+)	DATA+, data signal (+)
2	A signal (-)	DATA-, data signal (-)	SIN signal (-)	SIN signal (-)	CLK-, clock signal (-)	DATA-, data signal (-)
3	B signal (+)	-	COS signal (+)	COS signal (+)	DATA+, data signal (+)	-
4	B signal (-)	-	COS signal (-)	COS signal (-)	DATA-, data signal (-)	-
5	Z signal (+)	-	EXC+, excitation (+)	Z signal (+)	-	-
6	Z signal (-)	-	EXC-, excitation (-)	Z signal (-)	-	-
7	5 V power supply	5 V power supply	-	5 V power supply	5 V power supply	5 V power supply
8	15 V power supply	15 V power supply	-	COM power supply reference GND	15 V power supply	15 V power supply
9	-	-	-	-	-	-
10	COM power supply reference GND	COM power supply reference GND	-	-	COM power supply reference GND	COM power supply reference GND
19	PE (grounding terminal of the shield)	PE (grounding terminal of the shield)	PE (grounding terminal of the shield)	PE (grounding terminal of the shield)	PE (grounding terminal of the shield)	PE (grounding terminal of the shield)
20	PE (grounding terminal of the shield)	PE (grounding terminal of the shield)	PE (grounding terminal of the shield)	PE (grounding terminal of the shield)	PE (grounding terminal of the shield)	PE (grounding terminal of the shield)

Wiring precautions:

- As the output voltage of the drive is pulse voltage and there is common mode voltage to ground, connect the PE terminal of the motor to the PE terminal of the drive in addition to the U/V/W power cables. Ensure that the grounding busbar of the electrical cabinet is grounded. Otherwise, common-mode voltage and leakage current interference may result in encoder signal interference caused by backflow from the encoder cable.
- The encoder cable has high anti-interference capability. Select a cable with a dense metal mesh shield and connect the shield to the PE terminal. Use twisted pair cables and connect them in pairs. For example, use twisted pairs for A+ and A, which can reduce common-mode interference.
- Minimize use of encoder cable connectors because connectors can generate radiation interference.
- Avoid parallel routing of encoder cables and motor power cables to prevent power cables from disturbing encoder signal.
- For short encoder cables (within 10 m), it is recommended to ground both ends of the cable. For long encoder cables (above 10 m), it is recommended to ground one end of the cable.

Param.	Name	Default	Range	Description	Applicable encoder
C0-00	Encoder type	0	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BiSS encoder	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	All encoders
C0-02	Encoder pulses per revolution	1	1 to 65535	When using ABZ encoders and sine-cosine encoders, set this nameplate parameter, which indicates the number of pulses per revolution.	ABZ encoder Sine-cosine encoder
C0-13	Number of resolver pole pairs	1	1 to 65535	The resolver is an electromagnetic transducer, also known as synchro resolver. It is a small AC motor used to measure angles, and measure shaft angular displacement and angular velocity of a rotating object. It consists of stators and rotors. This parameter indicates the number of pole pairs of a resolver. A larger number of pole pairs indicates higher accuracy. If a resolver is applied, set the number of pole pairs of the resolver properly.	Resolver

Param.	Name	Default	Range	Description	Applicable encoder
C0-18	ABZ encoder level type	1	1: Differential output 2: TTL complementary push-pull output 3: HTL complementary push-pull output 4: TTL single-ended push-pull output 5: HTL single-ended push-pull output 6: OC output	The ABZ encoder supports differential output, TTL complementary push-pull output, HTL complementary push-pull output, TTL single-ended push-pull output, HTL single-ended push-pull output, and OC output. Incorrect configuration may lead to hardware detection faults, including but not limited to failure to identify hardware disconnection signals.	ABZ encoder
C0-23	23-bit encoder communication frequency selection	1	1: 2 MHz 3: 4 MHz 4: 8 MHz	Set the corresponding communication frequency according to the 23-bit encoder nameplate or user guide.	23-bit encoder Magnetic encoder
C0-31	SSI encoder communication baud rate	3	0: 2 M 1: 1.5 M 2: 1 M 3: 0.5 M 4: 0.4 M 5: 0.25 M 6: 0.125 M	Set the corresponding communication baud rate according to the encoder nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	SSI encoder
C0-32	SSI encoder parity mode	0	0: Zero parity 1: Odd parity 2: Even parity	Set the parity mode according to the encoder nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	SSI encoder
C0-33	SSI encoder data encoding format	0	0: Binary 1: Gray code	Set the data encoding format of the SSI encoder according to the encoder nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	SSI encoder
C0-34	Number of SSI encoder status bits	0	0 to 8	Set the number of status bits according to the encoder nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	SSI encoder
C0-41	EnDat encoder communication frequency	1	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	Set the corresponding communication baud rate according to the encoder nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	EnDat encoder
C0-45	BiSS encoder communication frequency	1	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	Set the corresponding communication baud rate according to the encoder nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	BiSS encoder

Param.	Name	Default	Range	Description	Applicable encoder
C0-46	BiSS encoder parity mode	0	0: Calculated CRC inconsistent with the received CRC 1: Calculated CRC same as received CRC	Set the parity mode according to the encoder nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	BiSS encoder
C0-47	Number of BiSS encoder status bits	0	0 to 8	Set the number of status bits according to the encoder nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	BiSS encoder
C0-51	Number of single-turn bits of communication-type encoder	23	1 to 32	Set the number of single-turn bits according to the encoder nameplate or user guide for EnDat, BISS, and SSI encoders.	SSI encoder EnDat encoder BiSS encoder
C0-52	Number of multi-turn bits of communication-type encoder	0	0 to 32	Set the number of multi-turn bits according to the encoder nameplate or user guide for EnDat, BISS, and SSI encoders.	SSI encoder EnDat encoder BiSS encoder

Note

- The encoder type of the magnetic encoder needs to be selected as a 23-bit encoder.
- The magnetic encoder only supports a baud rate of 2 Mbit/s, and C0-23 can only be set to 1.

4.7 Motor Auto-tuning

4.7.1 Auto-Tuning Procedure

Application scenario

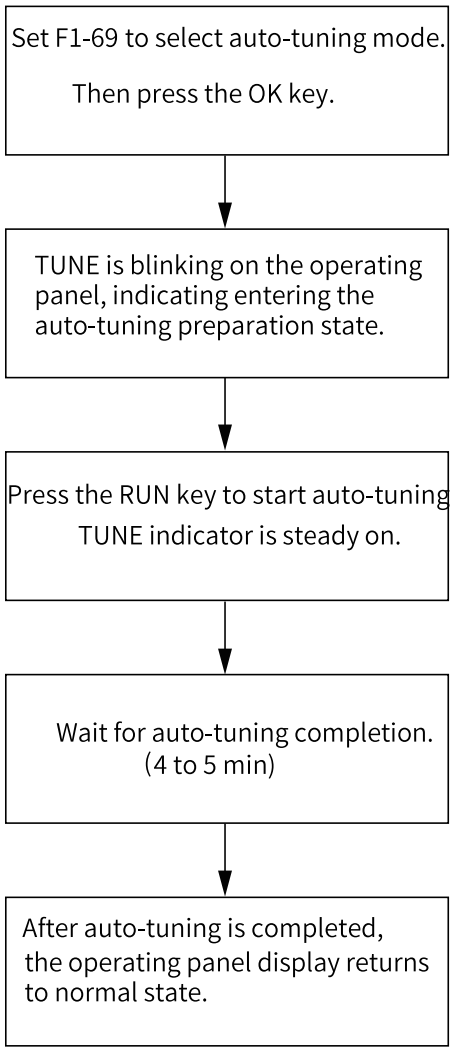
Auto-tuning is used to get the drive and motor parameter values. Perform motor parameter auto-tuning before operation to match the drive to different motors. The following scenarios require motor parameter auto-tuning.

1. Vector control
2. V/f control of asynchronous motor. (Static auto-tuning is required if flying start is needed.)
   Conventional V/f applications. (Parameter auto-tuning is recommended for better performance.)

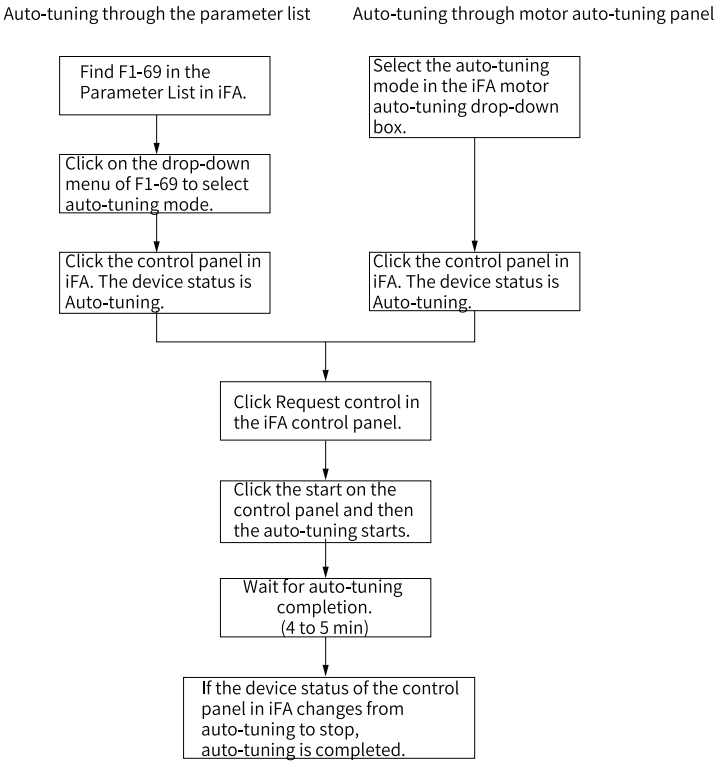
Operation flowchart

The basic steps for parameter auto-tuning through the operating panel or software tool (iFA) are as follows.

Parameter auto-tuning through the operating panel



Parameter auto-tuning through the software tool (iFA Drive)



Related parameter

Table 4–16 Parameters for motor auto-tuning

Param.	Name	Default	Value range	Description
F1-69 (C2-00)	Motor parameter auto-tuning mode	0	0: No action 1: Static partial auto-tuning of asynchronous motor 2: Dynamic auto-tuning of asynchronous motor 3: Static complete auto-tuning of asynchronous motor 4: Inertia auto-tuning 5: Dead zone auto-tuning 11: With-load auto-tuning of permanent magnet motor (back EMF excluded) 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static partial auto-tuning of permanent magnet motor 14: Auto-tuning of UV gain deviation 15: MTPA of synchronous reluctance motor without permanent magnet 21: Static auto-tuning of synchronous reluctance motor 22: Dynamic auto-tuning of synchronous reluctance motor	Defines the motor parameter auto-tuning mode. **Note:** Dynamic auto-tuning and inertia auto-tuning apply to applications where the motor can rotate without load. The motor does not need to be disconnected completely from the load to reach the no-load state. As long as no obvious load torque is detected after rotation, the no-load state applies. Static auto-tuning applies to applications where the motor cannot rotate. In dynamic auto-tuning, all parameters will be auto-tuned to ensure the optimal operation performance. Asynchronous motor: Compared with dynamic auto-tuning, in the complete static auto-tuning mode, inertia or friction torque parameters is not auto-tuned, and the mutual induction and no-load current are less accurate. Compared with the static complete auto-tuning, mutual induction or no-load current is not auto-tuned in static partial auto-tuning. Synchronous motor: Compared with dynamic auto-tuning, back EMF, inertia, or friction torque is not auto-tuned in static auto-tuning.

Note

The parameter F1-69 in the table is the mapping of motor parameter C2-00. The settings of the two parameters are equivalent.

Mechanical systems with inertia load will only output torque during acceleration and deceleration, and the steady-speed load is very small. Parameter auto-tuning is carried out during the steady-speed phase, which does not affect the auto-tuning accuracy. Therefore, the system with inertia load can perform no-load rotation auto-tuning (such as metallurgical rolling mills).

4.7.2 Asynchronous Motor Parameter Auto-Tuning

Mode selection

For better ease of use and control performance, the commissioning priority is as follows: 1 > 2 > 3 > 4. Parameter auto-tuning for asynchronous motors is shown in *"Figure 4-7 Asynchronous motor parameter auto-tuning mode" on page 161*.

1. You can download the updated parameter files with commissioned parameters to the new motors and drives of the same models.

2. During initial commissioning, if the motor can rotate freely, it is recommended to set F1-69 [Motor parameter auto-tuning selection] to 2 [Dynamic parameter auto-tuning of asynchronous motor] to achieve optimal control performance.
3. If dynamic auto-tuning is not available and F1-30 [No-load current of asynchronous motor] and F1-28 [Mutual inductance of asynchronous motor] are known, set F1-69 [Motor parameter auto-tuning selection] to 1 [Static partial parameter auto-tuning of asynchronous motor]. After auto-tuning is done, set the accurate no-load current and mutual inductance. Before applying FVC mode, check that the encoder feedback speed is consistent with the operating direction.
4. In cases where the motor cannot be disconnected from the load and accurate no-load current and inductance are not known, you can set F1-69 [Motor parameter auto-tuning selection] to 3 [Static complete auto-tuning of asynchronous motor]. Before applying FVC mode, check that the encoder feedback speed is consistent with the operating direction.

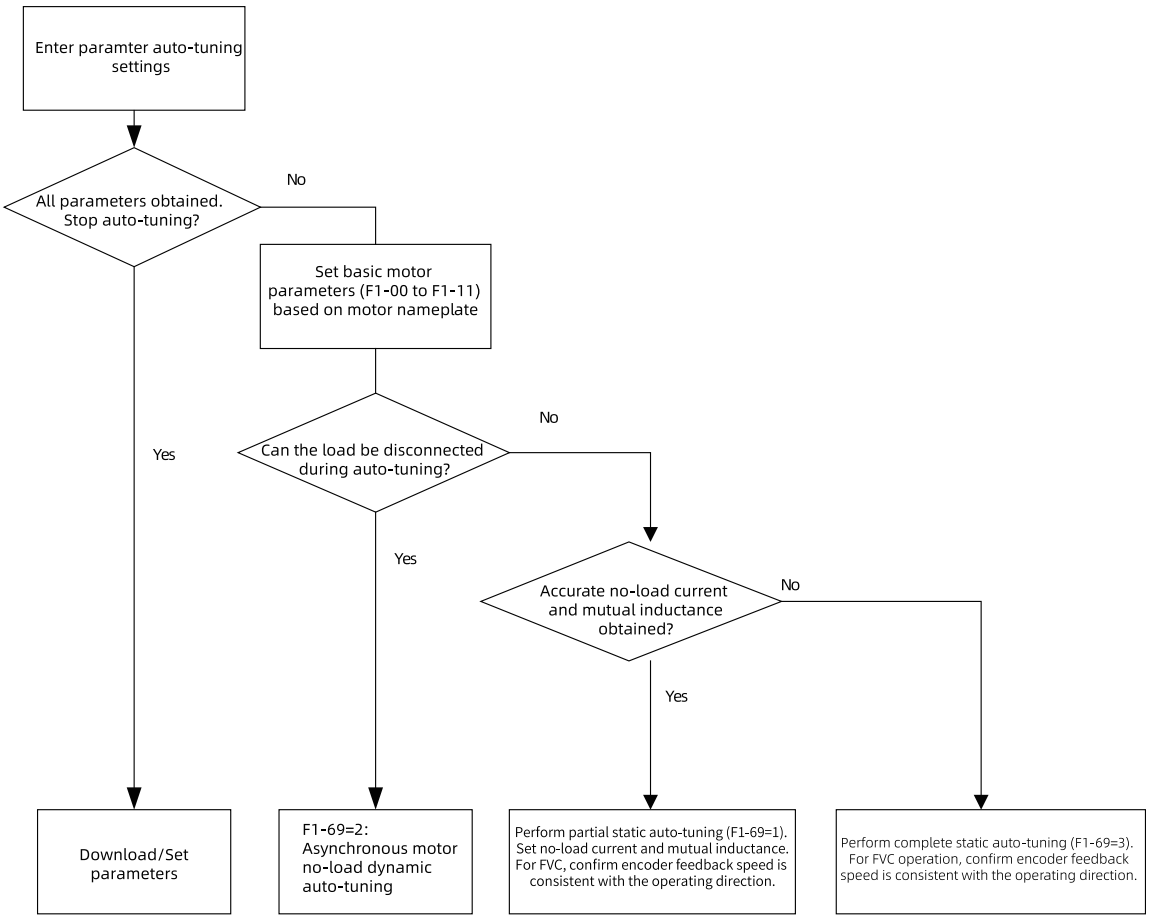


Figure 4-7 Asynchronous motor parameter auto-tuning mode

Related parameter

Table 4–17 Auto-tuned parameters for asynchronous motors

Param.	Name	Static partial auto-tuning of asynchronous motor (C2-00) = 1	No-load dynamic auto-tuning of asynchronous motor (C2-00) = 2	Static complete auto-tuning of asynchronous motor (C2-00) = 3	Inertia auto-tuning (C2-00) = 4	Description of auto-tuning parameters
F1-20	Stator resistance	Yes	Yes	Yes	-	-
F1-22	Asynchronous motor rotor resistance	Yes	Yes	Yes	-	-
F1-24	Asynchronous motor leakage inductance	Yes	Yes	Yes	-	-
F1-28, F1-30	Asynchronous motor mutual inductance and no-load current	- (Calculated value, not for long-term use)	Yes	Yes	-	The no-load current and mutual inductance are critical to the low-speed performance of asynchronous motor in SVC mode. No-load dynamic auto-tuning ensures optimal performance. Static partial auto-tuning cannot detect the no-load current mutual inductance. You need to set the correct value manually. After static complete auto-tuning, the motor can run but the control effect is not optimal.
C5-02 to C5-09	Magnetic field saturation flux curve of asynchronous motor	-	Yes	-	-	-
A3-30 to A3-46	Dead zone compensation curve	Yes	Yes	Yes	-	The dead zone compensation curve is critical to the low-speed performance in SVC mode, which must be included when you set parameters or download parameter files.

Param.	Name	Static partial auto-tuning of asynchronous motor (C2-00) = 1	No-load dynamic auto-tuning of asynchronous motor (C2-00) = 2	Static complete auto-tuning of asynchronous motor (C2-00) = 3	Inertia auto-tuning (C2-00) = 4	Description of auto-tuning parameters
F2-02, F2-03, F1-48	SVC speed loop Kp/Ti, inertia ratio	-	Yes	-	Yes	The system with fixed inertia can execute inertia auto-tuning to obtain accurate moment of inertia. Turning on the acceleration torque feedforward can achieve good acceleration/deceleration follow performance. The auto-tuning can obtain a proper speed loop Kp/Ti, which improves the resistance to load disturbance.
C0-03, C0-02	Encoder direction auto-tuning and verification on encoder pulses per revolution	-	Yes	-	-	In no-load dynamic auto-tuning, the correctness of encoder direction, encoder pulses per revolution, and encoder signals are detected. If dynamic auto-tuning is not available, set an accurate encoder input phase sequence first. After setting the control mode to SVC, run the motor to see whether the encoder feedback speed (U0-29) is consistent with the actual motor speed (U6-00). If not, invert the value of C0-03.

4.7.3 Synchronous Motor Parameter Auto-tuning

Mode selection

The parameter auto-tuning process of synchronous motors is shown in *"Figure 4-8 Synchronous motor parameter auto-tuning mode" on page 164*. The commissioning priority is recommended as follows: 1 > 2 > 3 > 4 > 5.

1. In SVC mode, you can download the updated parameters files with commissioned parameters to the new motors and drives of the same models.
2. During initial commissioning, if the motor can rotate freely, it is recommended to set F1-69 [Motor parameter auto-tuning selection] to 12 [Dynamic parameter auto-tuning of permanent magnet motor] to achieve optimal control performance.
3. If dynamic auto-tuning is not available and FVC mode applies, check whether the encoder feedback speed is consistent with the operating direction, and set F1-69 [Motor parameter auto-tuning selection] to 11 [With-load auto-tuning of synchronous motor].
4. If dynamic auto-tuning is not available but F1-12 [Back EMF of synchronous motor] is known in SVC mode, set F1-12 first, and then set F1-69 [Motor parameter auto-tuning selection] to 13 [Static partial auto-tuning of permanent magnet motor].

5. When the motor cannot rotate and the accurate back EMF is unknown, disconnect the motor from the load to perform no-load dynamic auto-tuning.

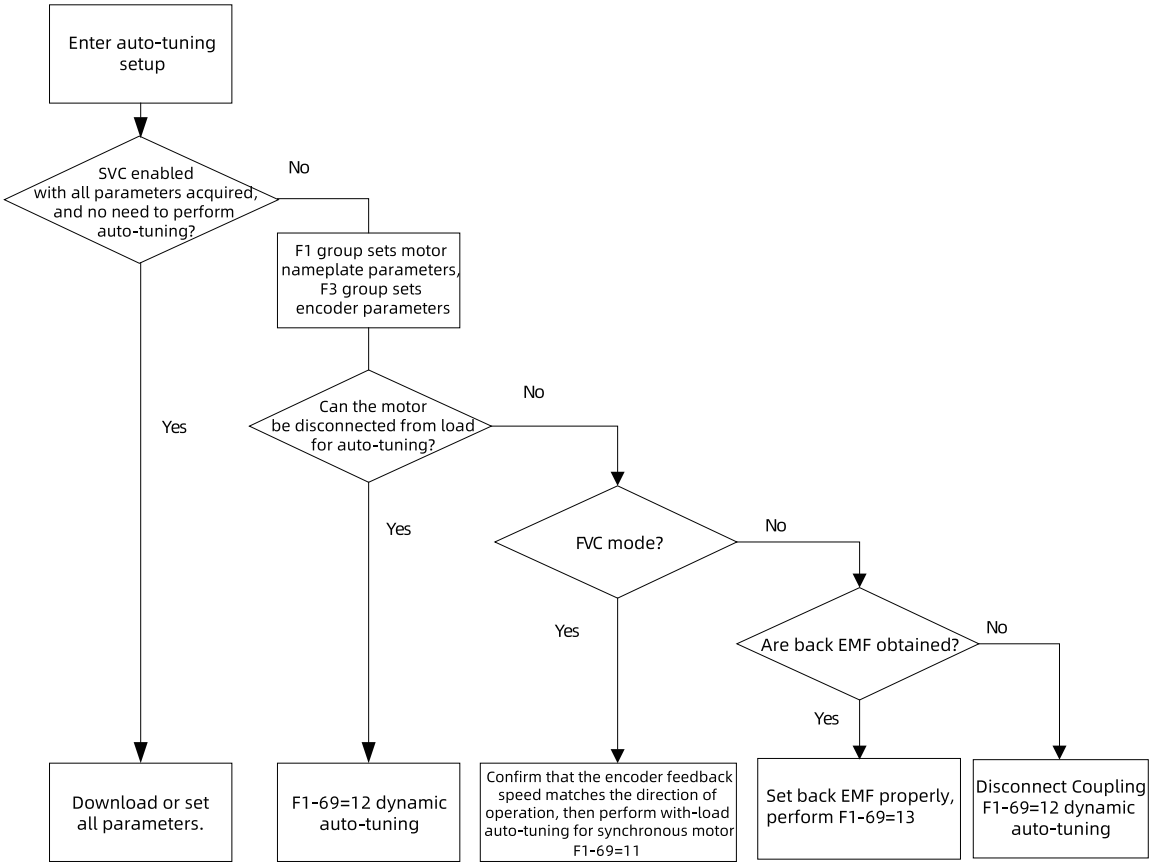


Figure 4-8 Synchronous motor parameter auto-tuning mode

Related parameter

After auto-tuning is done, the auto-tuned motor parameters are automatically saved to corresponding parameters. Parameters to be auto-tuned vary with the auto-tuning methods, as shown in the following table.

Table 4–18 Auto-tuned parameters for synchronous motors

Param.	Name	Synchronous motor with-load auto-tuning (C2-00) = 11	Synchronous motor no-load dynamic auto-tuning (C2-00) = 12	Synchronous motor static partial auto-tuning (C2-00) = 13	Inertia auto-tuning (C2-00) = 4	Description of auto-tuning parameters
F1-12	Back EMF of synchronous motor	-	Yes	-	-	The back EMF refers to the back EMF (effective value of the line voltage) when the motor rotates at rated speed without load. It affects the performance in low-speed operation greatly. For synchronous motors, if no-load dynamic auto-tuning is not available, it is recommended to check the motor nameplate or consult the motor manufacturer to set an accurate motor back EMF. F1-12 indicates the back EMF at rate speed. If the effective back EMF indicated on the nameplate is 120 V/krpm, the rated back EMF = F1-07/1000 x 120 V. The back EMF refers to the effective value of the line voltage. If the back EMF is unknown, disconnect the motor from the load to perform no-load dynamic auto-tuning. The above procedure only needs to be performed once for motors with the same specifications. After that, you can manually input the back EMF value.
F1-20	Motor stator resistance	Yes	Yes	Yes	-	-
F1-32, F1-34	d-axis and q-axis inductance of the motor	Yes	Yes	Yes	-	-
C5-30 to C5-55	Inductance saturation curve	Yes	Yes	Yes	-	The inductance saturation curve is critical to the performance in SVC mode, which must be included when you set parameters or download parameter files.
A3-30 to A3-46	Dead zone compensation curve	Yes	Yes	Yes	-	The dead zone compensation curve is critical to the low-speed performance in SVC mode, which must be included when you set parameters or download parameter files.
F2-02, F2-03, C4-62	SVC speed loop Kp/Ti, inertia ratio	-	Yes	-	Yes	The system with fixed inertia can execute inertia auto-tuning to obtain accurate moment of inertia. Turning on the acceleration torque feedforward can achieve good acceleration/deceleration follow performance. The auto-tuning can obtain a proper speed loop Kp/Ti, which improves the resistance to load disturbance.

Param.	Name	Synchronous motor with-load auto-tuning (C2-00) = 11	Synchronous motor no-load dynamic auto-tuning (C2-00) = 12	Synchronous motor static partial auto-tuning (C2-00) = 13	Inertia auto-tuning (C2-00) = 4	Description of auto-tuning parameters
C0-04	Mounting angle of encoder	Yes	Yes	-	-	If the synchronous motor is used in FVC mode, motor runaway can occur if the encoder installation angle is not auto-tuned. The encoder mounting angle is auto-tuned as long as the encoder type has been selected in SVC or FVC mode during no-load dynamic auto-tuning of synchronous motor (C2-00 = 12) and with-load auto-tuning of synchronous motor (C2-00 = 11). Before executing with-load auto-tuning of synchronous motor, ensure the encoder phase sequence (C0-03) is correct. Otherwise, runaway can occur.
C0-03	Encoder direction auto-tuning	-	Yes	-	-	The encoder input phase sequence is auto-tuned during no-load auto-tuning of synchronous motor. If dynamic auto-tuning is not available, set an accurate encoder input phase sequence first. After setting the control mode to SVC, run the motor to see whether the encoder feedback speed (U0-29) is consistent with the actual motor speed (U6-00). If not, invert the value of C0-03.
C0-02	Verification on the encoder pulses of revolution	-	Yes	-	-	In no-load dynamic auto-tuning of the synchronous motor, the correctness of encoder direction, encoder pulses per revolution, and encoder signals are detected.

Note

Before setting C2-00 to 11 (with load auto-tuning for synchronous motor), you must confirm the encoder phase sequence (C0-03). Otherwise, runaway may occur. The operation is as follows: Set the motor basic parameters and back EMF (if the back EMF is known), set b5-00 to 13 (static partial auto-tuning of synchronous motor), set d0-00 to 0 (operation in SVC mode), and observe whether U0-29 and U6-00 are identical when the motor is running normally.

1. If the values of U0-29 and U6-00 are opposite, change C0-03 (encoder direction).
2. If the values of U0-29 and U6-00 are different, adjust the rotation of the ABZ and sine encoders and adjust the pole pairs of the resolver.
3. If the motor is rotated and the encoder feedback speed is 0, this may be caused by incorrect encoder wiring, incorrect encoder parameter configuration, damaged encoder, and unmatched signal. Make sure that U0-29 and U6-00 are set to the same value and set C2-00 to 11 (with load auto-tuning of synchronous motor).

Back EMF is not tuned when C2-00 is set to 11 (with load auto-tuning of synchronous motor) and C2-00 is set to 13 (static partial auto-tuning of synchronous motor). In the SVC mode, the correct back EMF must be set manually. In the FVC mode, if torque accuracy is required, you must also manually set the correct back EMF or perform no load dynamic auto-tuning.

4.7.4 Auto-tuning of Synchronous Reluctance Motor

Mode selection

The parameter auto-tuning process of reluctance motors is shown in *"Figure 4-9 Reluctance motor parameter auto-tuning mode" on page 167*. The commissioning priority is recommended as follows: 1 > 2 > 3 > 4 > 5.

1. For projects that have been commissioned properly, you can save the commissioned parameters locally in the SVC mode for motors and drives of the same model, and quickly copy the commissioned parameters to other drives to achieve batch commissioning.
2. During initial commissioning, if the motor can rotate freely, it is recommended to set F1-69 [Motor parameter auto-tuning selection] to 22 [Dynamic parameter auto-tuning of synchronous reluctance motor] to achieve optimal control performance.
3. If dynamic auto-tuning is not available and FVC mode applies, check whether the encoder feedback speed is consistent with the operating direction, and set F1-69 [Motor parameter auto-tuning selection] to 21 [Static auto-tuning of synchronous reluctance motor].
4. If dynamic auto-tuning is not available but F1-12 [Back EMF of the synchronous motor] is known in SVC mode, set F1-12 first, and then set F1-69 [Motor parameter auto-tuning selection] to 21 [Static auto-tuning of synchronous reluctance motor].
5. When the motor cannot rotate and the accurate back EMF is unknown, disconnect the motor from the load to perform no-load dynamic auto-tuning.

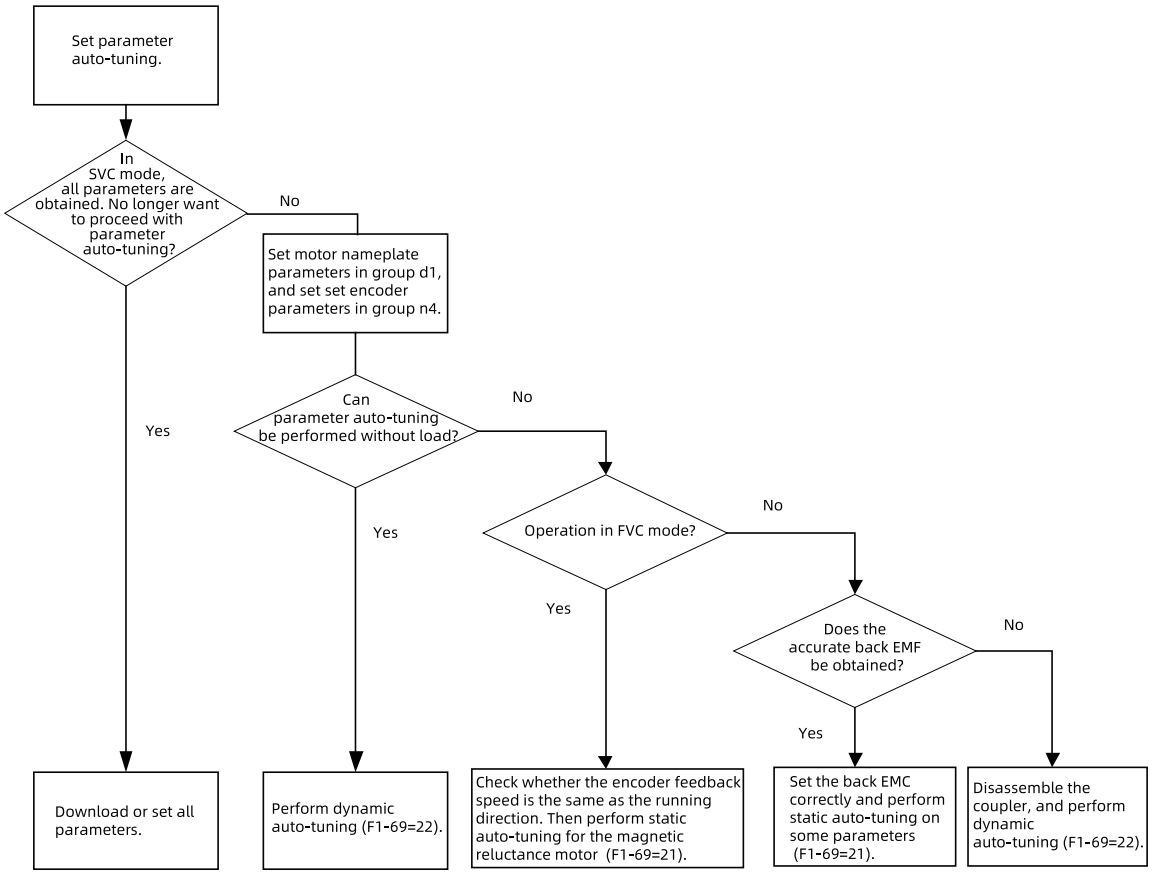


Figure 4-9 Reluctance motor parameter auto-tuning mode

Related parameter

After auto-tuning is done, the auto-tuned motor parameters are automatically saved to corresponding parameters. Parameters to be auto-tuned vary with the auto-tuning methods, as shown in the following table.

Table 4–19 Auto-tuned parameters of reluctance motor

Param.	Name	Static auto-tuning of reluctance motor (C2-00 = 21)	Dynamic auto-tuning of reluctance motor (C2-00 = 22)	Description of auto-tuning parameters
F1-12	Rated back EMF of synchronous motor	-	Yes	The back EMF refers to the back EMF (effective value of the line voltage) when the motor rotates at rated speed without load. It affects the performance in low-speed operation greatly. This parameter does not need to be set for reluctance motors without permanent magnet. For reluctance motors with permanent magnet, if no-load dynamic auto-tuning is not available, it is recommended to check the motor nameplate or contact the motor manufacturer to set the motor back EMF accurately. F1-12 is the back EMF at rated speed. If the effective value of the back EMF marked on the nameplate is 120 V/krpm, the rated back EMF = F1-07/1000 x 120 V. If the back EMF is unknown, disconnect the motor from the load to perform no-load dynamic auto-tuning. The above procedure only needs to be performed once for motors with the same specifications. After that, you can manually input the back EMF value.
F1-20	Motor stator resistance	Yes	Yes	-
F1-32, F1-34	d-axis and q-axis inductance of the motor	Yes	Yes	-
C5-30 to C5-55	Inductance saturation curve	Yes	Yes	The inductance saturation curve is critical to the energy-saving performance, which must be included when you set parameters or download parameter files.
A3-30 to A3-46	Dead zone compensation curve	Yes	Yes	The dead zone compensation curve is critical to the low-speed control performance, which must be included when you set parameters or download parameter files.

Param.	Name	Static auto-tuning of reluctance motor (C2-00 = 21)	Dynamic auto-tuning of reluctance motor (C2-00 = 22)	Description of auto-tuning parameters
C0-04	Mounting angle of encoder	Yes	Yes	In FVC mode, motor runaway can occur if the encoder mounting angle is not auto-tuned. The encoder mounting angle can be auto-tuned when C2-00 is set to 22 [Dynamic auto-tuning of reluctance motor] or 21 [With-load auto-tuning of reluctance motor]. Before setting C2-00 to 21 [With-load auto-tuning of reluctance motor], ensure that the encoder phase sequence (C0-03) is set properly. Otherwise, runaway can occur. If the motor type (C4-00) is set to 3 [Synchronous reluctance motor without permanent magnet], the encoder mounting angle is not auto-tuned during with-load auto-tuning of reluctance motor (C2-00 = 21).
C0-03	Encoder direction auto-tuning	-	Yes	The encoder input phase sequence can be auto-tuned through dynamic auto-tuning of reluctance motor. If dynamic auto-tuning is not available, set an accurate encoder input phase sequence first. After setting the control mode to SVC, run the motor to see whether the encoder feedback speed (U0-29) is consistent with the actual motor speed (U6-00). If not, invert the value of C0-03.
C0-02	Verification on the encoder pulses of revolution	-	Yes	In dynamic auto-tuning of reluctance motor, the correctness of encoder direction, encoder pulses per revolution, and encoder signals are detected.

Note

For the pure reluctance motor, when C2-00 is set to 21 (static auto-tuning for synchronous reluctance motor), the encoder mounting angle is not tuned. When C2-00 is set to 22 (dynamic auto-tuning for synchronous reluctance motor), the synchronous BMF is not tuned but the inertia is tuned.

4.8 Operation Command Setting

Selecting control channel

The command source is the source or input mode of commands to control the start, stop, forward run, reverse run, jog, and fault reset of the drive.

Running command source

This section uses control channel 1 as an example to introduce common setting methods. For detailed settings, see *" Operation Command" on page 185*.

Application scenario	Operation example	Related parameters
Control operation via operating panel (b1-00 or F0-03 = 0)		
Control the drive (such as starting/stopping the drive) through the operating panel.	1. Set b1-00 or F0-03 to 0 and press  to set the command source of control channel 1 to the operating panel. 2. Set F0-30 to 10.00 Hz and press  . The operating panel displays 10 Hz, which is the frequency reference. 3. Press  to enable the AC drive (the RUN indicator is on) to run at the frequency of 10 Hz. 4. When the AC drive is running, press  to stop the AC drive (the RUN indicator is off).	**Related parameters:** *" b5-01 (F0-30)" on page 192*
Control operation through DI terminal (b1-00 or F0-03 = 1)		
Generally, the two groups of modules are configured with different control modes, which can be switched through b9-00.	1. Set b1-00 or F0-03 (Main command source of control channel 1) to 1 (Terminal). 2. Select the terminal as the source. • Six terminal control modes are available, including one-wire mode, two-wire mode 1, two-wire mode 2, two-wire mode 3, three-wire mode 1, and three-wire mode 2. • For example, when you set b9-00 (Terminal start/stop module A/B selection) to 0 (Module A), the terminal start/stop source is module A (two-wire mode 2 by default). • You can switch freely between terminal modules A and B, enabling switchover from terminal module A (configured as two-wire mode 2) to terminal module B (configured as three-wire mode 1). 3. Set the terminal control mode. For example, set b9-01 (Mode of terminal start/stop module A) to 4 (IN1P (rising edge) for start, IN2 for stop). 4. Set the functions of each DI terminal. For example, set E0-00 (DI1 function selection) to 1 (Terminal start/stop module A control_IN1) and E0-01 (DI2 function selection) to 2 (Terminal start/stop module A control_IN2). 5. After the terminal mode and each DI terminal function are configured, you can perform start/stop and fault reset on the AC drive through the DI terminal. For example, when you enable DI1 with DI2 activated, the drive runs at the set frequency. If DI2 opens, the drive stops immediately.	**Description:** • The drive supports two groups of terminal start/stop modules: terminal start/stop module A (b9-01 to b9-08) and terminal start/stop module B (b9-09 to b9-16). • The two groups of terminal start/stop modules have identical functions and can be switched through b9-00 (Terminal start/stop module A/B selection). Only one terminal start/stop module is active at a time. **Related parameters:** *" b9-00 (F4-00)" on page 192* *" b9-01 (F4-01)" on page 193* *" b9-09 (F4-02)" on page 196*
Control operation through communication (b1-00 or F0-03 = 2)		

Application scenario	Operation example	Related parameters
To achieve remote control of the drive, set parameter b1-00 to 2 to select communication as the command source.	The following takes 7311H as an example to show how to set the command source to communication. 1 .Check the supported communication protocol according to the AC drive model and select the correct wiring terminal for communication. 2 .Set the corresponding communication parameters. Set Modbus communication parameters in group n2 or communication parameters in groups n4 to n6. 3 .Set the command source to "Communication". Set b0-02 (Control channel selection) to 0 (Control channel 1) and set b1-00 (Main command source of control channel 1) to 2 (Communication). 4 .Send a write command from the host computer to the drive, and write 1 to 7311H to start the drive, or write 0 to stop the drive.	**Description:** • MD630S-INT: Modbus • MD630N-INT: EtherCAT, EtherNet/IP, PROFINET For communication parameters, see *"10.11.1 n Communication Configuration" on page 1639*. For communication addresses, see *" Communication Address" on page 197*.
Control operation through custom channel (b1-00 or F0-03 = 3)		
The drive supports setting of control channels 1/2 to a custom main command source.	1 .Set F0-03 (Main command source of control channel 1) to 3 (User-defined) to set custom control as the command source. 2 .Set b1-01 (User-defined ON_OFF1 (start/stop) source) to 3 (DI1). 3 .Set E0-00 (DI1 terminal function selection) to 0 (No function). 4 .Set b1-02 (User-defined OFF2 (Coast to stop) source 1) to 1 (Disabled) and b1-03 (User-defined OFF3 (Quick stop) source 1) to 1 (Disabled). After preceding steps are done, the drive starts when DI1 closes. If b1-02 and b1-03 are set to 0 during operation, the drive stops.	**Related parameters:** *" b1-01 to b1-08" on page 190*

4.9 Frequency Reference Setting

Selecting the setting channel

You can change the setting channel through b0-03 (Setting channel selection). See details in *" b0-03" on page 204*.

Frequency reference

This section uses control channel 1 as an example to introduce common setting methods. For detailed settings, see *" Selecting Frequency Reference as Setting Channel" on page 197*.

Application scenario	Operation example	Related parameters
Setting the main frequency through parameter b5-00 (F0-29) = 0		
You can set the frequency directly through parameters.	Set b5-00 or F0-29 (Main frequency source) to 0 (F0-30). 2. Set b5-01 or F0-30 (Digital setting of main frequency) to the frequency reference. 3. When the main frequency source is set to parameter, you can change the value of related parameters to set the frequency. In addition, you can also set the frequency by using the UP/DOWN keys. After preceding settings are done, you can increase the frequency reference by pressing  or decrease the frequency by pressing  on the operating panel in real time when the drive is stopped or running.	" b5-01 (F0-30)" on page 209
Setting frequency through AI (Main frequency: b5-00 or F0-29 = 2 or 3; Auxiliary frequency: b5-02 or F0-31 = 2 or 3)		
AI terminals are used as frequency sources. Five kinds of AI curves can be selected for each terminal. The AI curve is used to define the relationship between the analog input voltage (or current) and the corresponding setting.	Take AI1 as an example: 1. Set AI1 curve to "0 V to 10 V corresponds to 0% to 100%". Example: • Set E2-40 (minimum input of AI curve 1) to 0.00 V. • Set E2-41 (Percentage corresponding to minimum input of AI curve 1) to 0.0%. • Set E2-42 (maximum input of AI curve 1) to 10.00 V. • Set E2-43 (Percentage corresponding to maximum input of AI curve 1) to 100.0 %. 2. Set AI filter time through E2-10 or F4-21 (AI1 filter time). 3. Set b5-00 or F0-29 (Main frequency source) to 2 (AI1) to select AI as the frequency source. 4. The AI terminal defaults to voltage input mode. To switch to current input mode, change the DIP switch. In current input mode, current of 1 mA corresponds to voltage of 0.5 V, namely 20 mA corresponds to 10 V. After the preceding settings, when AI1 inputs 5 V voltage, 50% is obtained from the AI1 curve and the running frequency of the AC drive is 50% of C4-06 (Rated motor frequency). When AI1 input voltage is changed, the running frequency changes according to the AI1 curve.	**Description:** For detailed AI curve setting methods, see "5.2.10.8 Analog Input (AI) Terminals" on page 361. **Parameter configuration:** " Parameter settings when communication is used as the main frequency source" on page 211 **Related parameters:** " E2-40 to E2-43" on page 212 Curve 1 setting: E2-40 (F4-28) to E2-43 (F4-31) " E2-44 to E2-51" on page 213 Curve 2 setting: E2-44 (F4-32) to E2-47 (F4-35) Curve 3 setting: E2-48 (F4-36) to E2-51 (F4-39) " E2-52 to E2-67" on page 215 Curve 4 setting: E2-52 (F4-40) to E2-59 (F4-47) Curve 5 setting: E2-60 (F4-48) to E2-67 (F4-55) AI curve selection: " E2-38" on page 217 AI1 filter time: " E2-10" on page 218
Setting frequency through pulse input (HDI) (Main frequency: b5-00 or F0-29 = 5; Auxiliary frequency: b5-02 or F0-31 = 5)		

Application scenario	Operation example	Related parameters
This setting method applies to scenarios where high-speed digital input is used as the frequency source and the pulse frequency determines the input frequency.	Take HDI two-point curve as an example: 1. Set F4-68 (HDI terminal type selection) to 0 (Use as HDI) to configure DI7 as a pulse input terminal. 2. Set the relationship between the HDI pulse input and the curve with the set ratio to "0 kHz to 20 kHz correspond to 0% to 100%". • Set F4-71 (Minimum input of HDI two-point curve) to 0.00 kHz. • Set F4-72 (Percentage corresponding to minimum input of HDI two-point curve) to 0.0%. • Set F4-73 (Maximum input of HDI two-point curve) to 20.00 kHz. • Set F4-74 (Percentage corresponding to maximum input of HDI two-point curve) to 100.0%. 3. Set HDI filter time through F4-83 (HDI filter time). 4. Set F0-29 (Main frequency source) to 5 (HDI) to select the HDI terminal as the frequency source. After the preceding settings, when HDI inputs 10 kHz, 50% is obtained from the HDI curve and the running frequency of the AC drive is 50% of C4-06 (Rated motor frequency). When HDI input frequency changes, the running frequency changes according to the HDI curve.	**Description:** For detailed HDI curve setting methods, see *"5.2.10.6 High-Speed Digital Input (HDI)" on page 350*. **Parameter configuration:** *" Parameters used to set main frequency through pulse input" on page 218* **Related parameters:** *" E4-08 (F4-71) to E4-11 (F4-74)" on page 218* *" E4-32(F4-83)" on page 219*
Setting frequency through multi-reference (Main frequency: b5-00 or F0-29 = 6; Auxiliary frequency: b5-02 or F0-31 = 6)		
This mode is suitable for applications where the operating frequency of the drive does not require continuous adjustment, and only several frequency values need to be used.	Set F0-29 (Main frequency source) to 6 (Multi-reference). You can assign the multi-reference terminal function to the DI and switch among pre-set multi-references through the DI. Up to 16 multi-references are supported. You can set four groups of multi-references through parameters in group F. The relationship between the number of multi-references and the number of DI terminals is shown below. • Two multi-references: One DI (K1); b8-04 to b8-06 are set to 0. • Three to four multi-references: Two DIs (K1 and K2); b8-05 and b8-06 are set to 0. • Five to eight multi-references: Three DIs (K1, K2, and K3); b8-06 is set to 0. • Nine to sixteen multi-references: Four DIs (K1, K2, K3, and K4)	**Description:** To use multi-reference as the main frequency reference source, assign functions 12 to 15 to the DIs or set b8-03 (Multi-reference selection bit0) to b8-06 (Multi-reference selection bit3). For details, see *" Parameter settings when multi-reference is used as the main frequency source" on page 219* **Related parameters:** *" b8-03 to b8-24" on page 220*
Setting frequency through PID (Main frequency: b5-00 or F0-29 = 8; Auxiliary frequency: b5-02 or F0-31 = 8)		

Application scenario	Operation example	Related parameters
PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value.	1. When setting F0-29 (Main frequency source) to 8 (PID), the PID controller output is set as the active frequency source. 2. To use PID as the frequency source, enable the PID function through setting P2-00 (Process PID enable) to 1 (Enable). 3. Set the PID reference source and feedback source. By default, P2-02 (PID reference source) is set to 0 (Value reference) (defined by P2-03), and P2-04 (PID feedback source) is set to 0 (AI1).	**Description:** See detailed PID function description in *"5.4.6.2 Process PID Control" on page 642*. **Control principle block diagram:** *" Principle of process PID control" on page 230* **Related parameters:** *" P2-00 to P2-27" on page 230*
Setting frequency through communication (Main frequency: b5-00 or F0-29 = 9; Auxiliary frequency: b5-02 or F0-31 = 9)		
Set b5-00 (Main frequency source) to 9 (Communication) to set communication as the main frequency source.	To set communication as the main frequency source of channel 1, do as follows: 1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1. 2. Set n0-14 to select 7310H speed reference configuration. 3. Send a write command to the drive through the host controller.	**Description:** • MD630S-INT: Modbus • MD630N-INT: EtherCAT, EtherNet/IP, PROFINET For communication parameters, see *"10.11.1 n Communication Configuration" on page 1639*. For communication addresses, see *" Communication Address" on page 236*. **Parameter configuration:** *" Parameter settings for using communication as the main frequency reference source" on page 234* **Related parameters:** *" n0-14" on page 235*

4.10 Torque Reference Setting

Selecting Torque Reference

You can change the setting channel through b0-03 (Setting channel selection). See details in *" b0-03" on page 204*.

Setting torque reference

This section uses control channel 1 as an example to introduce common setting methods. For detailed settings, see *"5.2.3.1.1 Selecting Torque Reference as Setting Channel" on page 253*.

Application scenario	Operation example	Related parameters
Set torque reference through parameters (b5-13=0)		
Set the value of b5-14 (Digital torque reference) as the active torque source.	Set b5-13 (Torque reference source) to 0 (b5-14).	"b5-14" on page 261
Set torque reference through AI (b5-13=2 or 3)		
When AI is used as the torque source, the relationship curve between AI and torque setpoint needs to be set.	Take AI1 as an example: 1. Set AI1 curve to "0 V to 10 V (or 0 mA to 20 mA) corresponds to 0% to 100%": • Set E2-40 or F4-28 (Minimum input of AI curve 1) to 0.00 V. • Set E2-41 or F4-29 (Percentage corresponding to minimum input of AI curve 1) to 0.0%. • Set E2-42 or F4-30 (Maximum input of AI curve 1) to 10.00 V. • Set E2-43 or F4-31 (Percentage corresponding to maximum input of AI curve 1) to 100.0%. 2. Set AI filter time through F4-21 (AI1 filter time). 3. Set b5-13 (Torque reference source) to 2 (AI1) to select AI1 as the torque source. After the preceding steps, when AI1 inputs 5 V, 50% is obtained from the AI1 curve and the torque setting is 50%. When AI1 input voltage is changed, the active torque value changes according to the AI1 curve.	**Description:** For detailed AI curve setting methods, see "5.2.10.8 Analog Input (AI) Terminals" on page 361. **Parameter configuration:** "Parameter settings when communication is used as the main frequency source" on page 211 **Related parameters:** "E2-40 to E2-43" on page 212 Curve 1 setting: E2-40 (F4-28) to E2-43 (F4-31) "E2-44 to E2-51" on page 213 Curve 2 setting: E2-44 (F4-32) to E2-47 (F4-35) Curve 3 setting: E2-48 (F4-36) to E2-51 (F4-39) "E2-52 to E2-67" on page 215 Curve 4 setting: E2-52 (F4-40) to E2-59 (F4-47) Curve 5 setting: E2-60 (F4-48) to E2-67 (F4-55) AI curve selection: "E2-38" on page 217 AI1 filter time: "E2-10" on page 218

<table>
<tr><th>Application scenario</th><th>Operation example</th><th>Related parameters</th></tr>
<tr><td colspan="3">Set torque reference through communication (b5-13=9)</td></tr>
<tr><td>Set the torque through communication.</td><td>1. Set b0-03 to 0 and b5-13 to 9 to select communication as the main torque reference source of setting channel 1.
2. Set n0-14 to select 7310H torque reference configuration.
3. Send a write command to the drive through the host controller.
When the torque source is set to communication, you need to configure basic communication parameters to enable the AC drive to communicate with the host controller. The host controller needs to follow the communication address and format specified by the AC drive to write communication commands to the AC drive.
The following example shows how to set the torque through communication, with the Modbus protocol and address 0x7310. For example, to set the torque to 10.00% (actual transmitted value is 1000) through communication, send the following write command: 01 06 73 10 03 E8 92 35. For details, see the following table.
<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>01H (settable)</td><td>Drive address</td></tr>
<tr><td>06H</td><td>Write command</td></tr>
<tr><td>7310H</td><td>Torque reference address</td></tr>
<tr><td>03E8H (1000 in decimal)</td><td>Target torque</td></tr>
<tr><td>9235H</td><td>CRC</td></tr>
</table>
Set n0-14 = 3, and then write 1000 to 7310H to set the torque to 10%. The set torque can be viewed via U6-11.</td><td>Description:
• MD630S-INT: Modbus
• MD630N-INT: EtherCAT, EtherNet/IP, PROFINET
For communication parameters, see “10.11.1 n Communication Configuration” on page 1639.
For communication addresses, see “Communication Address” on page 236.
Related parameters:
“n0-14” on page 235</td></tr>
</table>

4.11 Jog

4.11.1 Selecting the Setting Channel

In some applications, the drive needs to run at a low speed temporarily to facilitate equipment testing. You can use the jog mode in this case. See *“5.2.5.2 Jog Frequency Set Channel” on page 302* for the jog reference setting channel.

Procedure

You can change the setting channel through b0-03 [Setting channel selection]. See details in *“b0-03” on page 204*.

4.11.2 Setting Jog Frequency

Same as the main frequency source, the jog frequency source can be set through the parameter, AI, multi-reference, or communication as defined by F0-56 [Source of jog 1 frequency] and F0-58 [Source of jog 2 frequency].

When the jog command is active, the frequency reference of the drive is defined by the jog frequency.

- When jog 1 command is active, the frequency reference of the drive is the jog 1 frequency.
- When jog 2 command is active, the frequency reference of the drive is the jog 2 frequency.

The jog frequency source can be set through corresponding parameters.

Procedure

1. Set the source of jog frequencies 1 and 2 through F0-56 [Source of jog 1 frequency] and F0-58 [Source of jog 2 frequency].
2. Set other parameters based on the frequency source selected according to *"4.9 Frequency Reference Setting" on page 171*.

When F0-56 [Source of jog 1 frequency] is set to 0 [F0-57] or F0-58 [Source of jog 2 frequency] is set to 0 [F0-59], set the reference value of F0-57 as the source of jog 1 frequency or set the reference value of F0-59 as the source of jog 2 frequency.

Related parameter

Table 4–20 Parameters related to jog frequency

Param.	Name	Default	Value range	Description
b5-07 (F0-56)	Source of jog 1 frequency	0: F0-57	0: b5-08 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of jog 1 frequency. **Value description:** 0: b5-08 - The jog 1 frequency is set through b5-08. b5-08 is used as the source. See the detailed description below for explanations of other options. Note that jog frequency refers to jog 1 frequency.
b5-08 (F0-57)	Digital reference of jog 1 frequency	2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog 1 frequency. It is activated when b5-07 is set to 0 [b5-08].
b5-09 (F0-58)	Source of jog 2 frequency	0 [F0-59]	0: b5-10 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of jog 2 frequency. **Value description:** 0: b5-10 - The jog 2 frequency is set through b5-10. b5-10 is used as the source. See the detailed description below for explanations of other options. Note that jog frequency refers to jog 2 frequency.

Param.	Name	Default	Value range	Description
b5-10 (F0-59)	Digital reference of jog 2 frequency	-2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog 2 frequency. It is activated when b5-09 is set to 0 [b5-10].

Description of other options:

2: AI1 - The jog frequency source is input by current or voltage signal through AI1 and calculated according to the preset AI curve.
3: AI2 - The jog frequency source is input by the current or voltage signal through AI2 and calculated according to the preset AI curve.
5: HDI pulse - The jog frequency source is set by the pulse frequency of DI and calculated according to the corresponding mapping curve. (active only for MD630S)
6: Multi-reference - When multi-reference is used as the jog frequency source, different combinations of DI terminal states correspond to different reference values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 references.
7: Simple PLC - Simple PLC is a multi-speed operation instruction that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds.
8: PID - The jog frequency source is set through PID.
9: Communication - The jog frequency source is set through communication. When selecting the source, you can set the jog frequency source through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices.
Other: F connector - A parameter code is set for a floating-point connector, and the value of the connector is read as the jog frequency. It is used for extension of common sources.

4.11.3 Setting Jog Commands Through Terminals

You can start/stop the drive by setting operation commands through DI state. When jog command is set, the drive runs at the jog frequency.

The jog ramp-up/down time can be defined by F0-63 [Jog ramp-up time], F0-64 [Jog ramp-down time], or b7-04 to b7-27 [Ramp time in normal operation], as selected by F0-62 [Jog ramp source selection].

Procedure

1. Set F0-03 [Main command source of control channel 1] to 1 [Terminal] to select the terminals as the active command source.
2. Set b9-00 [Terminal start/stop module A/B selection] to 0 [Module A].
3. Set F4-03 [DI1 function selection] to 4 [Terminal start/stop module A jog 1] and F4-04 [DI2 function selection] to 5 [Terminal start/stop module A jog 2].
4. Set F0-62 [Jog ramp source selection] to 1 [Jog ramp time].
5. Set F0-63 [Jog ramp-up time] to 20.0s and F0-64 [Jog ramp-down time] to 20.0s.

After preceding settings are done, if DI1 input is active, the drive starts at jog 1 frequency. If DI2 input is active, the drive starts at jog 2 frequency. If both DI1 and DI2 are closed, the drive starts at jog 1 frequency.

Related parameter

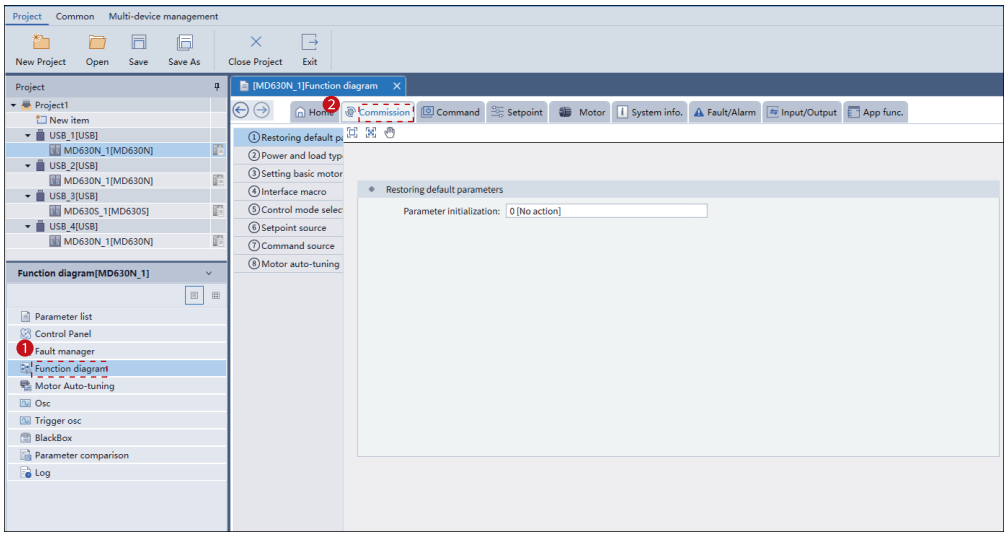
Table 4–21 Parameters related to jog

Param.	Name	Default	Value range	Description
F4-03 (E0-00)	DI1 function selection	1	4: Terminal start/stop module A jog 1 (JOG1) 5: Terminal start/stop module A jog 2 (JOG2)	Defines the function assigned to DI1. If no special description is provided, the terminal function is level-triggered. **Value description:** 4: Terminal start/stop module A jog 1 (JOG1) - The drive operates in jog mode. When terminal start/stop module A is active, the drive runs at low speed for a short period of time in the jog mode 1. The operating frequency and direction are determined by the jog 1 frequency (positive frequency by default). This is typically used for maintenance and commissioning on site. (Active when the command source is terminal control) 5: Terminal start/stop module A jog 2 (JOG2) - The drive operates in jog mode. When terminal start/stop module A is active, the drive runs at low speed for a short period of time in the jog mode 2. The operating frequency and direction are determined by the jog 2 frequency (positive frequency by default). This is typically used for maintenance and commissioning on site. (Active when the command source is terminal control)
F4-04 (E0-01)	DI2 function selection	4		
F4-05 (E0-02)	DI3 function selection	9		
F4-06 (E0-03)	DI4 function selection	12		
F4-07 (E0-04)	DI5 function selection	13		
F4-08 (E0-05)	DI6 function selection	0		
F4-09 (E0-06)	DI7 function selection	0		
E0-16	DI input filter time 1	0.010s	0.000s to 1.000s	Defines the filter time 1 for the drive to respond to changes in DI terminal status.
E0-17	DI input filter time 2	0.010s	0.000s to 1.000s	Defines filter time 2 for the drive to respond to changes in DI status.
F0-62 (b7-31)	Jog ramp source	0	0: Ramp time in normal operation 1: Ramp time in jog	Defines the jog ramp source. **Value description:** 0: Ramp time in normal operation The ramp time in jog is the same as that in normal operation. 1: Ramp time in jog The ramp time in jog is set separately (F0-63, F0-64).

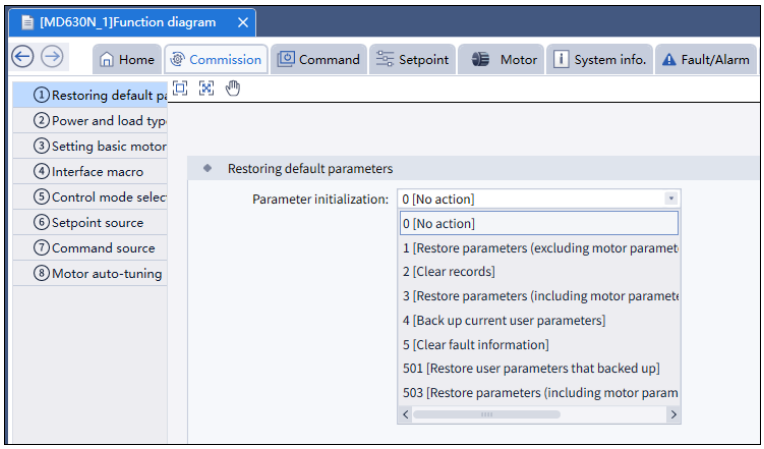
Param.	Name	Default	Value range	Description
F0-63 (b7-32)	Ramp-up time in jog	20	0.00 to 650.00	Defines the time required for the output frequency to ramp up from 0 to F0-46 [Base frequency for ramp-up/down] in the jog mode. **Note:** The ramp-up current must be limited to a value below the overcurrent capacity of the drive, preventing the drive from tripping due to overcurrent stall.
F0-64 (b7-33)	Ramp-down time in jog	20	0.00 to 650.00	Defines the time required for the output frequency to ramp down from F0-46 [Base frequency for ramp-up/down] to 0 in the jog mode. **Note:** The ramp-down time must be set to a value that prevents excessively high smoothing circuit voltage, preventing the drive from tripping due to regenerative overvoltage stall.

4.12 Commissioning with iFA Drive

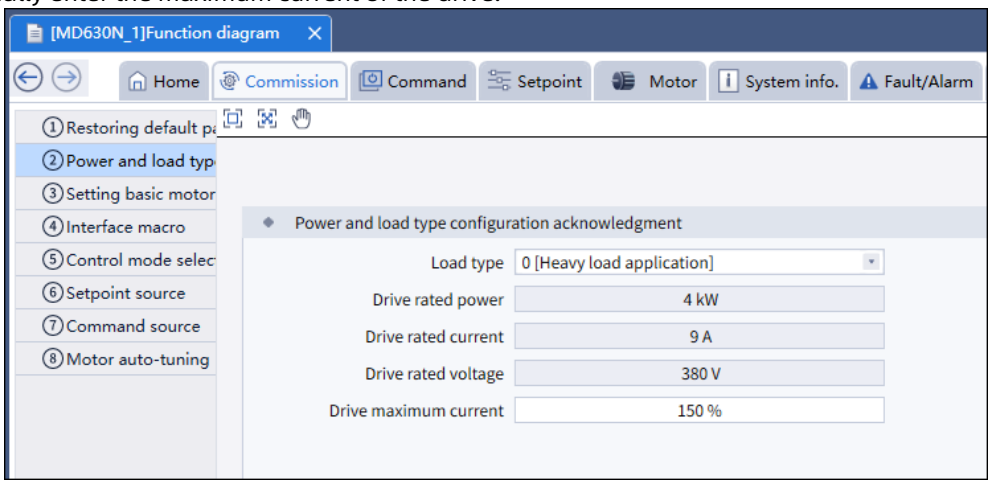
1. Double-click "Function diagram (①)", click "Commission (②)" in the primary function area, and enter the quick commissioning function page.



2. Click "Restoring default parameters", and select the required operation from the drop-down box.

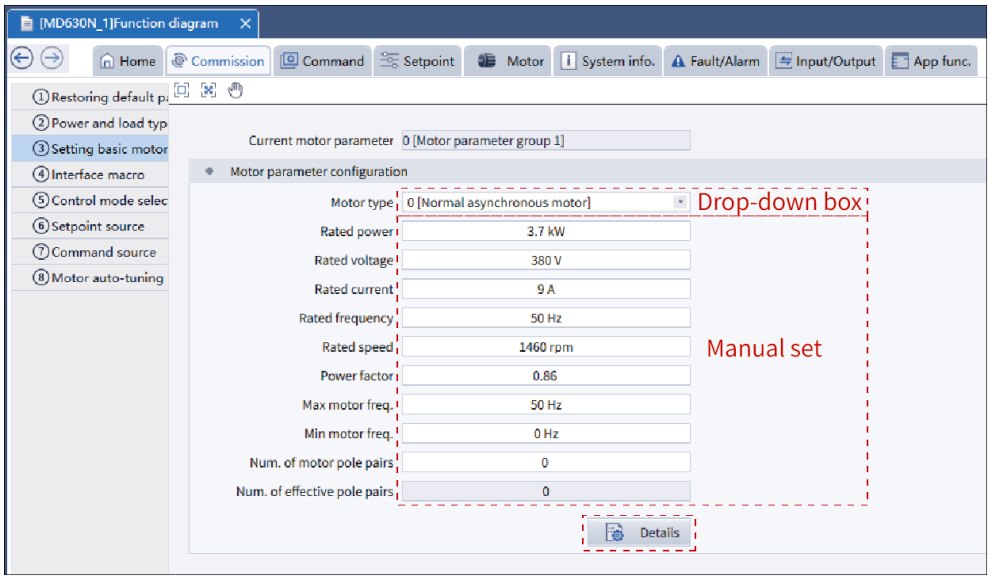


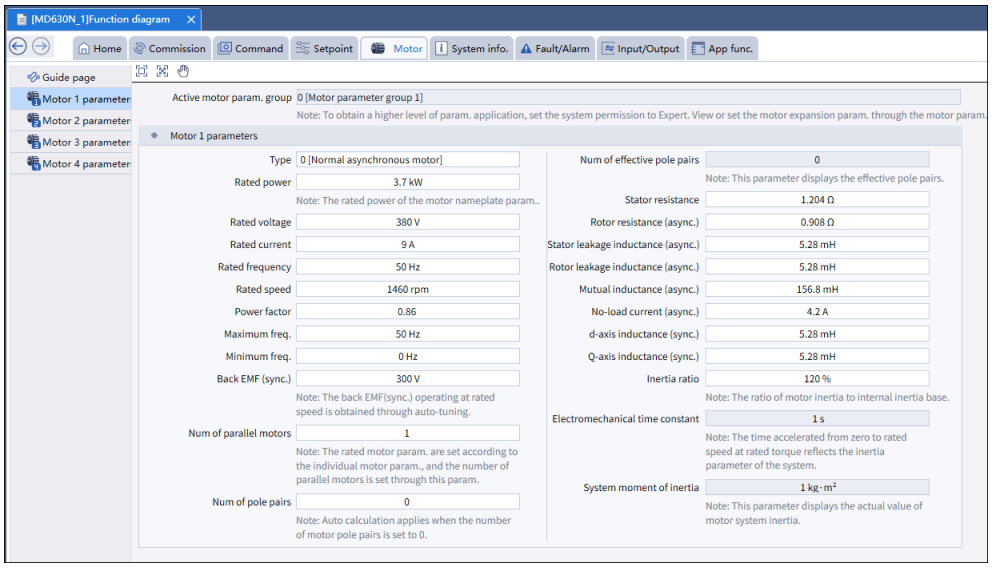
3. Click "Power and load type configuration", select the load type from the drop-down box, and manually enter the maximum current of the drive.



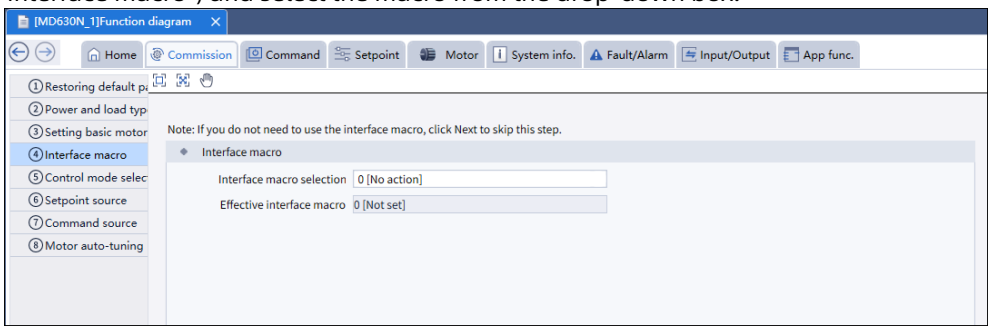
4. Click "Setting basic motor parameters", select the motor type from the drop-down box, and manually enter parameters such as motor rated power.

   Note: If detailed configuration is required, click "Details", and the software will jump to the "Motor" tab for configuration.

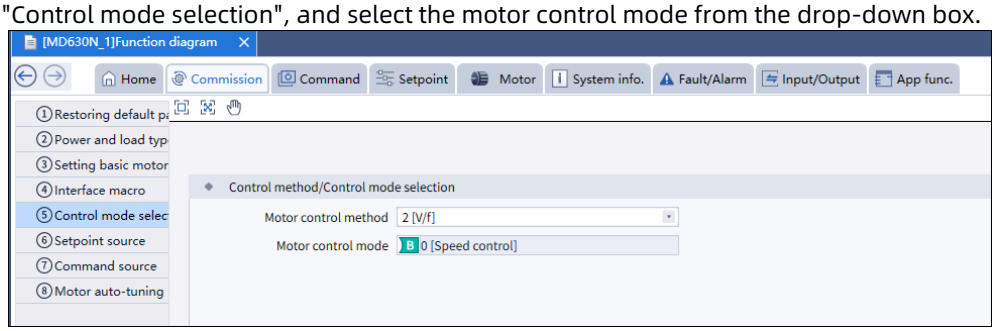




5. Click "Interface macro", and select the macro from the drop-down box.

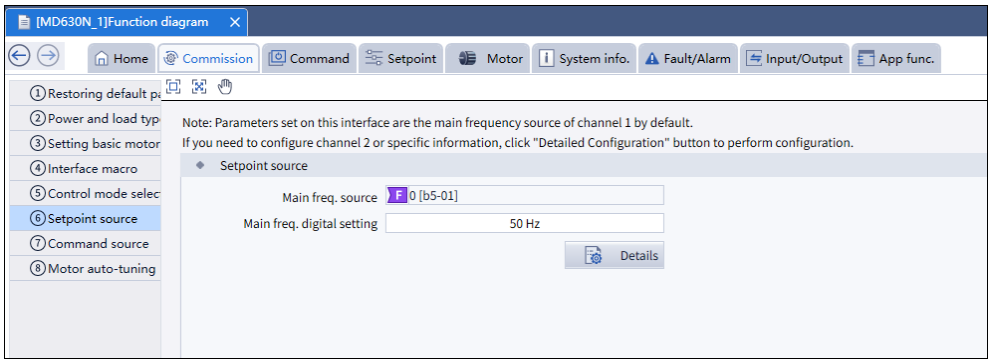


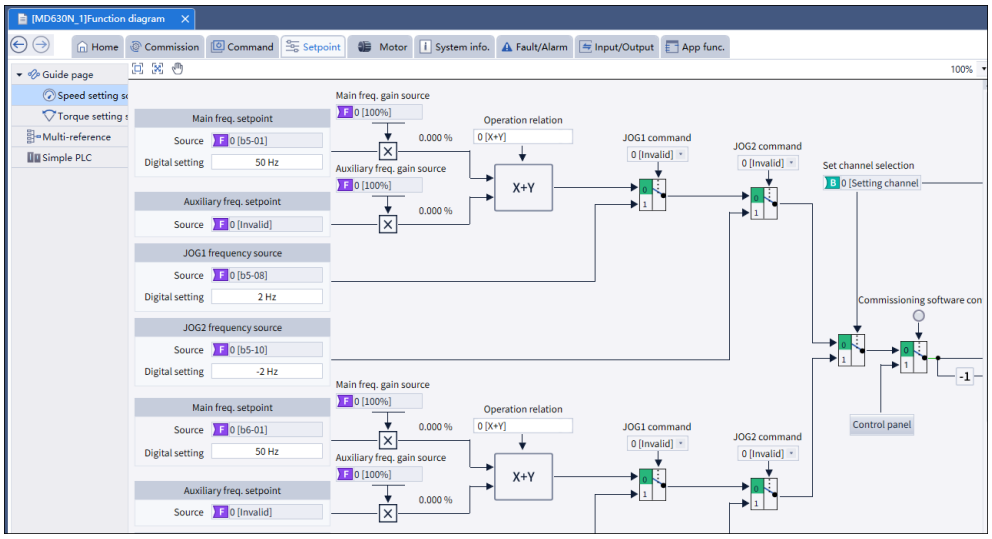
6. Click "Control mode selection", and select the motor control mode from the drop-down box.



7. Click "Setpoint source", and manually enter the digital reference of main frequency.

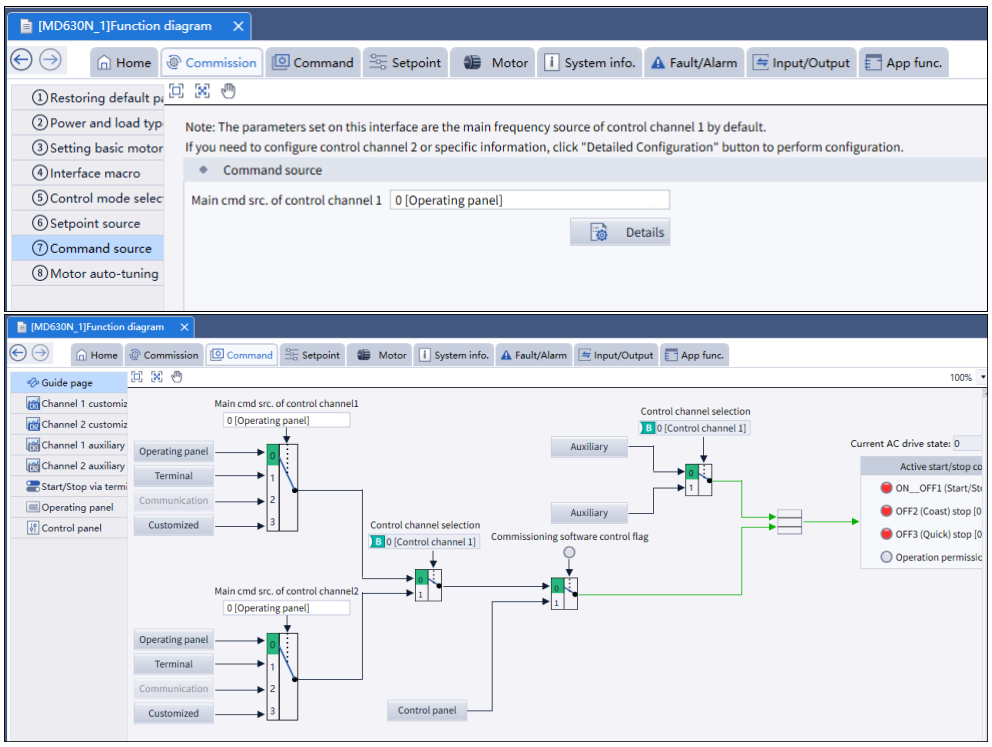
Note: If detailed configuration is required, click "Details", and the software will jump to the "Setpoint" tab for configuration.



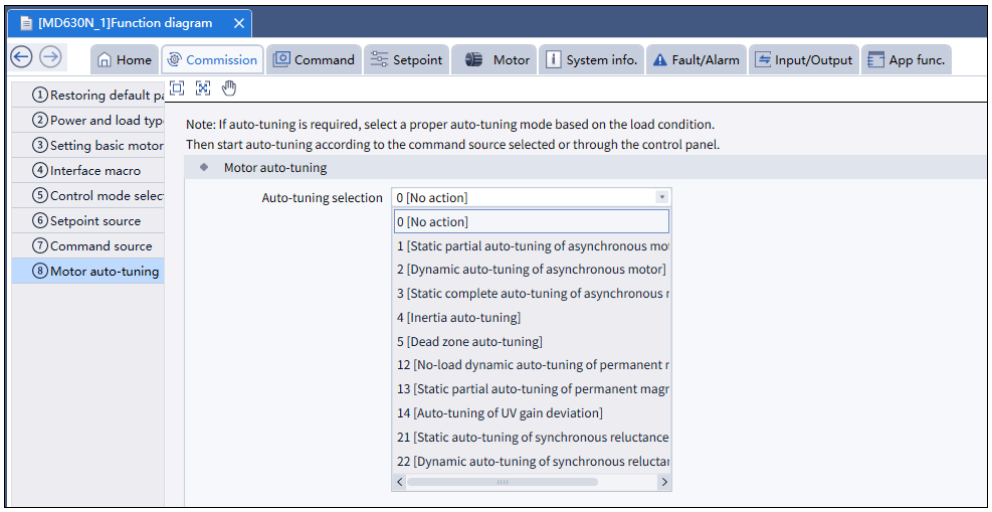


8. Click "Command", and select the main command source for control channel 1 from the drop-down box.

   Note: If detailed configuration is required, click "Details", and the software will jump to the "Command" tab for configuration.



9. Click "Motor auto-tuning", and select the auto-tuning method from the drop-down box.



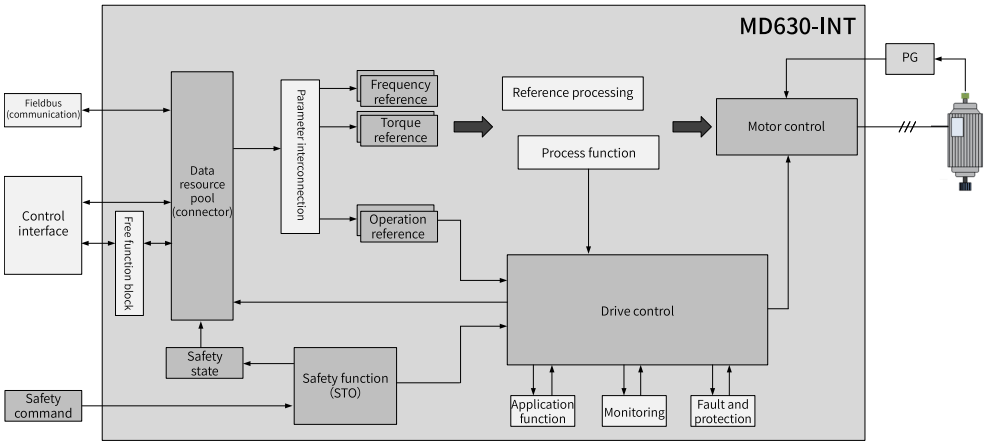
10. Quick commissioning is done.

4.13 Quick Copy after Commissioning

This function is used to copy the commissioned parameters to the other drives quickly to achieve batch commissioning. For details, see *"8.5 Parameter Upload/Download (Based on iFA Drive Software)" on page 1313*.

5 Functions

5.1 Functions



5.2 Common Function

5.2.1 Operation Command

Selecting control channel

The command source is the source or input mode of commands to control the start, stop, forward run, reverse run, jog, and fault reset of the drive.

You can set the active control channel through b0-02 (Control channel selection). For details, see *“ b0-02” on page 188*. By default, control channel 1 is set as the active control channel. Control channel 1 is used as an example in this section if no notes are provided.

Running command source

The running command source is set through b1-00 (F0-03) and b3-00. Refer to *“ b1-00 (F0-03)” on page 189* for control channel 1, and refer to *“ b3-00” on page 192* for control channel 2.

Application scenario	Operation example	Related parameters
Control operation via operating panel (b1-00 or F0-03 = 0)		
Control the drive (such as starting/stopping the drive) through the operating panel.	1. Set b1-00 or F0-03 to 0 and press  to set the command source of control channel 1 to the operating panel. 2. Set F0-30 to 10.00 Hz and press  . The operating panel displays 10 Hz, which is the frequency reference. 3. Press  to enable the AC drive (the RUN indicator is on) to run at the frequency of 10 Hz. 4. When the AC drive is running, press  to stop the AC drive (the RUN indicator is off).	**Related parameters:** "b5-01 (F0-30)" on page 192
Control operation through commissioning software		
Control the drive (such as starting/stopping the drive) through the iFA commissioning software.	For detailed functions, refer to the "iFA Drive Software Help". Refer to "Commissioning software" on page 130 to obtain the manual.	-
Control operation through DI terminal (b1-00 or F0-03 = 1)		
Generally, the two groups of modules are configured with different control modes, which can be switched through b9-00.	1. Set b1-00 or F0-03 (Main command source of control channel 1) to 1 (Terminal). 2. Select the terminal as the source. • Six terminal control modes are available, including one-wire mode, two-wire mode 1, two-wire mode 2, two-wire mode 3, three-wire mode 1, and three-wire mode 2. • For example, when you set b9-00 (Terminal start/stop module A/B selection) to 0 (Module A), the terminal start/stop source is module A (two-wire mode 2 by default). • You can switch freely between terminal modules A and B, enabling switchover from terminal module A (configured as two-wire mode 2) to terminal module B (configured as three-wire mode 1). 3. Set the terminal control mode. For example, set b9-01 (Mode of terminal start/stop module A) to 4 (IN1P (rising edge) start, IN2 stop). 4. Set the functions of each DI terminal. For example, set E0-00 (DI1 function selection) to 1 (Terminal start/stop module A control_IN1) and E0-01 (DI2 function selection) to 2 (Terminal start/stop module A control_IN2). 5. After the terminal mode and each DI terminal function are configured, you can perform start/stop and fault reset on the AC drive through the DI terminal. For example, when you enable DI1 with DI2 activated, the drive runs at the set frequency. If DI2 opens, the drive stops immediately.	**Description:** • The drive supports two groups of terminal start/stop modules: terminal start/stop module A (b9-01 to b9-08) and terminal start/stop module B (b9-09 to b9-16). • The two groups of terminal start/stop modules have identical functions and can be switched through b9-00 (Terminal start/stop module A/B selection). Only one terminal start/stop module is active at a time. **Related parameters:** "b9-00 (F4-00)" on page 192 "b9-01 (F4-01)" on page 193 "b9-09 (F4-02)" on page 196
Control operation through communication (b1-00 or F0-03 = 2)		

Application scenario	Operation example	Related parameters
To achieve remote control of the drive, set parameter b1-00 to 2 to select communication as the command source.	The following takes 7311H as an example to show how to set the command source to communication. 1 .Check the supported communication protocol according to the AC drive model and select the correct wiring terminal for communication. 2 .Set the corresponding communication parameters. Set Modbus communication parameters in group n2 or communication parameters in groups n4 to n6. 3 .Set the command source to "Communication". Set b0-02 (Control channel selection) to 0 (Control channel 1) and set b1-00 (Main command source of control channel 1) to 2 (Communication). 4 .Send a write command from the host computer to the drive, and write 1 to 7311H to start the drive, or write 0 to stop the drive.	**Description:** • MD630S-INT: Modbus • MD630N-INT: EtherCAT, EtherNet/IP, PROFINET For communication parameters, see *"10.11.1 n Communication Configuration" on page 1639*. For communication addresses, see *" Communication Address" on page 197*.
Control operation through custom channel (b1-00 or F0-03 = 3)		
The drive supports setting of control channels 1/2 to a custom main command source.	1 .Set F0-03 (Main command source of control channel 1) to 3 (User-defined) to set custom control as the command source. 2 .Set b1-01 (User-defined ON_OFF1 (start/stop) source) to 3 (DI1). 3 .Set E0-00 (DI1 terminal function selection) to 0 (No function). 4 .Set b1-02 (User-defined OFF2 (Coast to stop) source 1) to 1 (Disabled) and b1-03 (User-defined OFF3 (Quick stop) source 1) to 1 (Disabled). After preceding steps are done, the drive starts when DI1 closes. If b1-02 and b1-03 are set to 0 during operation, the drive stops.	**Related parameters:** *" b1-01 to b1-08" on page 190*

Related parameters

Param.	Name	Default	Value range	Description
b0-02	Control channel selection	0	0: Control channel 1 1: Control channel 2 3: DI1 4: DI2 5 to 9: DI3 to DI7 (valid only for MD630S) Others: B connector	This parameter sets the control channel. The value 0 indicates that control channel 1 is selected and the value 1 indicates that control channel 2 is selected. **Value description:** 0: Invalid - Select channel 1. For details on setting of control channel 1, see *"10.4.2 b1 Main Command of Control Channel 1" on page 1459* and *"10.4.3 b2 Auxiliary Command of Control Channel 1" on page 1461*. 1: Valid - Select channel 2. For details on setting of control channel 2, see *"10.4.4 b3 Main Command of Control Channel 2" on page 1462* and *"10.4.5 b4 Auxiliary Command of Control Channel 2" on page 1464*. 3 to 9: DI1 to DI7 - The channel selected depends on the state of the DI. Other: B connector - Which channel is selected depends on the B connector. You can select B connector through the pop-up window.

Operating principle:

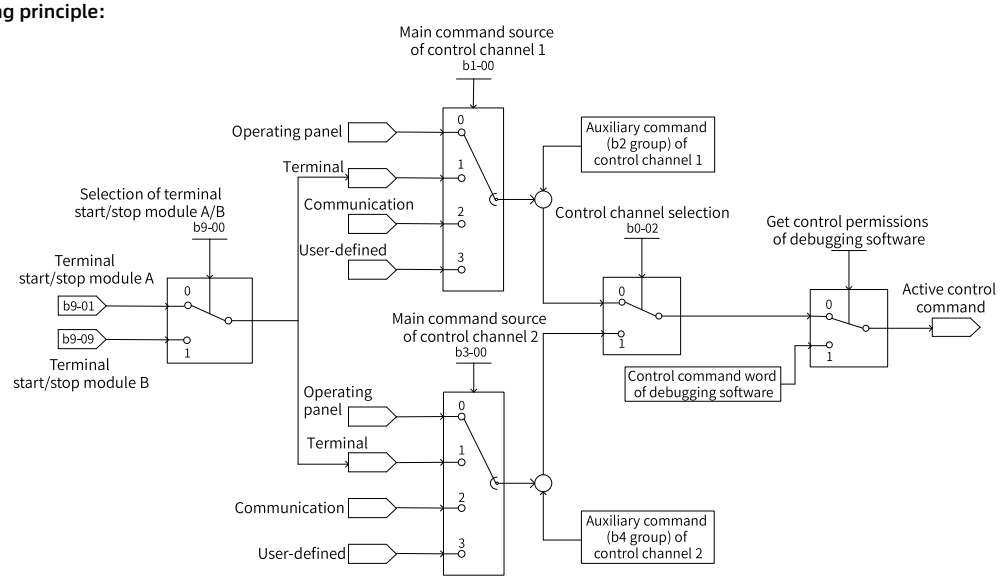


Figure 5-1 Control channel diagram

Note

- The commissioning software can control the start/stop of the AC drive through control in any main command source mode. The commissioning software has the first priority. In this case, the start/stop control mode configured in groups b1/b3 is not effective.
- In any main command source mode (including commissioning software), the auxiliary command word group b2/group b4 corresponding to the effective control channel remains active.

Param.	Name	Default	Value Range	Descriptions
b1-00 (F0-03)	Main command source of control channel 1	0	0: Operating panel 1: Terminal 2: Communication 3: User-defined	It is used to set the main command source of control channel 1. **Value description** 0: Select the main command source of control channel 1 as the LED operating panel or external operating panel. You can control the motor by pressing RUN/STOP keys on the keypad. 1: Terminal - Select the main command source of control channel 1 as terminal. Operation commands are input using the DI of the AC drive. The DI can be assigned with different functions such as start/stop, forward/reverse run, jog, and multi-reference. 2: Select the main command source of control channel 1 as communication, such as Modbus. The AC drive needs to communicate with the host controller. You can input control commands through remote communication. This mode applies to remote control or centralized control of multiple equipment. 3: User-defined. The user-defined control mode is used as the main command source of control channel 1. The control commands can be set by b1-01 to b1-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).

Param.	Name	Default Value	Value Range	Description
b1-01	User-defined ON_ OFF1 (start/stop) source	0	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined ON_OFF (start/stop) source. When the bit signal is 0, this function is disabled. When the bit signal is 1, this function is enabled, indicating the OFF1 start/stop function is active. **Options:** 0: This function is disabled. 3 to 9: DI1 to DI7 - Whether this function is active depends on the terminal state of the DI. Others: B connector - Whether this function is active depends on other B connector. You can select other B connector through the pop-up window.
b1-02	User-defined OFF2 (coast to stop) source 1	1	0: Enable 1: Disable 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined OFF2 (coast-to-stop) source 1. When the bit signal is 0, this function is enabled and OFF2 (coast-to-stop) is active. When the bit signal is 1, this function is disabled. **Options:** 0: Enable OFF2 (coast-to-stop) is enabled. 1: Disable OFF2 (coast-to-stop) is disabled. 3 to 9: DI1 to DI7 - Whether this function is active depends on the terminal state of the DI. Others: B connector - Whether this function is active depends on other B connector. You can select other B connector through the pop-up window. **Additional information:** There are three sources for OFF2 (free stop) of control channel 1: b1-02, b2-00, and b2-01. If any source is active, the OFF2 command is active.
b1-03	User-defined OFF3 (quick stop) source 1	1	Same as b1-02	Sets the user-defined OFF3 (quick stop) source 1. When the bit signal is 0, this function is enabled and OFF3 (coast to stop) is active. When the bit signal is 1, this function is disabled. Options: Same as b1-02. **Additional information:** There are three sources of OFF3 (quick stop) of control channel 1: b1-03, b2-02, and b2-03. If any source is active, the OFF3 command is active.

Param.	Name	Default Value	Value Range	Description
b1-04	User-defined operation permission source	1	0: Operation inhibited 1: Operation allowed 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined operation permission source. When the bit signal is 0, operation is inhibited. When the bit signal is 1, operation is allowed. **Options:** 0: Operation inhibited 1: Operation allowed 3 to 9: DI1 to DI7 - Whether this function is active depends on the terminal state of the DI. Others: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.
b1-05	User-defined issue reset command source 1	0	0: Disabled 1: Enabled 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined fault reset command source 1. When the bit signal is 0, this function is disabled. When the bit signal is 1, this function is enabled. **Options:** 0: Indicates that the issue reset command is disabled. 1: Indicates that the issue reset command is enabled. 3 to 9: DI1 to DI7 - Whether this function is active depends on the terminal state of the DI. Others: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window. **Additional information:** There are three sources of user-defined fault reset for control channel 1: b1-05, b2-04, and b2-05. Any source is valid, and the user-defined fault reset command is valid.
b1-06	User-defined JOG1 (jogging) source	0	0: Disabled 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined jog (JOG1) source. When the bit signal is 0, this function is disabled. When the bit signal is 1, this function is enabled. **Options:** 0: Invalid - The jog command is invalid. 3 to 9: DI1 to DI7 - Whether the jog command is active depends on the terminal state of the DI. Others: B connector - Whether the jog command is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

Param.	Name	Default Value	Value Range	Description
b1-07	User-defined JOG2 (jogging) source	0	Same as b1-06	Sets the user-defined jog (JOG2) source. When the bit signal is 0, this function is disabled. When the bit signal is 1, this function is enabled. Options: Same as b1-06.
b1-08	User-defined speed inversion source	0	0: Disabled 1: Enabled 3: DI1 4: DI2 5 to 9: DI3 (valid only for MD630S) to DI7 (valid only for MD630S) Others: B connector	Sets the user-defined speed inversion source. When the bit signal is 0, this function is disabled and the speed is not inverted. When the bit signal is 1, this function is enabled and the speed is inverted. **Options:** 0: The speed inversion command is invalid. 1: The speed inversion command is valid. 3 to 9: DI1 to DI7 - Whether this function is active depends on the terminal state of the DI. Others: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

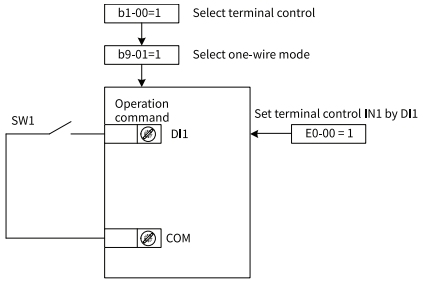
Param.	Name	Default	Value Range	Descriptions
b3-00	Command source of control channel 2	0	Sync control " *b1-00 (F0-03)" on page 189*	It is used to set the main command source of control channel 2. Description " *b1-00 (F0-03)" on page 189*

Param.	Name	Default	Value Range	Descriptions
b5-01 (F0-30)	Digital setting of main frequency	50	0.00 Hz to A2-17	This parameter is used to set the target frequency. It is valid when the main frequency source is set to digital setting.

Parameter	Name	Default Value	Value Range	Description
b9-00 (F4-00)	Terminal start/stop module A/B selection	0	0: Module A 1: Module B. Others: B connector	Select the terminal module based on the set value. 0 indicates terminal module A. 1 indicates terminal module B. 0: Module A - Used to select the terminal start/stop module A. 1: Module B - Used to select the terminal start/stop module B. Other: Connector B - The value of this parameter is derived from the value of connector B. You can select connector B through the pop-up window.

Param.	Name	Default	Value Range	Descriptions
b9-01 (F4-01)	Mode of start/stop module A by terminal	3	0: Disable 1: IN1 start 2: IN1 start, IN2 direction 3: IN1 start in forward direction, IN2 start in reverse direction 4: IN1P (rising edge) start, IN2 stop 5: IN1P (rising edge) start, IN2 stop, IN3 direction 6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop	Sets the mode of terminal start/stop module A. This parameter is valid for IN1/IN2/IN3 in the terminal function. **Value description** 0: The terminal is invalid, and IN1/IN2/IN3 are invalid. 1: IN1 start In this mode, a DI terminal is connected. Set function IN1 to control forward rotation and start/stop. 2: IN1 start, IN2 direction In this mode, two DI terminals are connected - Functions IN1/IN2 are set, and IN1 is used to control forward rotation and start/stop. IN2 is used to control the running direction. 3: IN1 start in forward direction, IN2 start in reverse direction 3: In this mode, two DI terminals are connected - Set functions IN1/ IN2, and IN1 is used to control the forward rotation and start/stop. IN2 is used to control reverse rotation and start/stop. The AC drive stops when IN1 and IN2 are both active. 4: IN1P (rising edge) start, IN2 stop In this mode, two DI terminals are connected - Functions IN1/IN2 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. 5: IN1P (rising edge) start, IN2 stop, IN3 direction In this mode, three DI terminals are connected - Functions IN1/ IN2/ IN3 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. IN3 is used to control the operation direction. 6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop In this mode, three DI terminals are connected - Functions IN1/ IN2/ IN3 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. IN3 is used to control the operation direction. **Operating principle:** See *"Table 5-1 Terminal command control mode (b9-01/b9-09)" on page 194*.

Table 5–1 Terminal command control mode (b9-01/b9-09)

<table>
<tr><th rowspan="2">Value range:</th><th colspan="2">Working Principle</th></tr>
<tr><th>Example</th><th>Sequence diagram</th></tr>
<tr><td>0: Disable</td><td>-</td><td></td></tr>
<tr><td>1: IN1 start</td><td> 

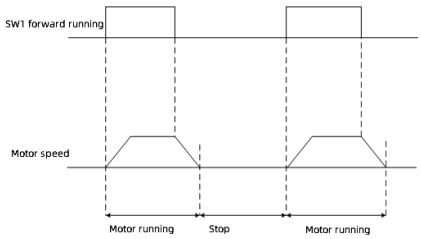
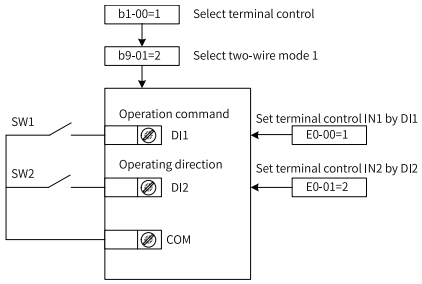
<table>
<tr><th>SW1</th><th>Operation Command</th></tr>
<tr><td>0</td><td>Stop</td></tr>
<tr><td>1</td><td>Run</td></tr>
</table>
Figure 5-2 Wiring and parameter settings for one-wire mode</td><td> 

Figure 5-3 Time sequence for one-wire mode</td></tr>
<tr><td>2: IN1 start, IN2 direction</td><td> 

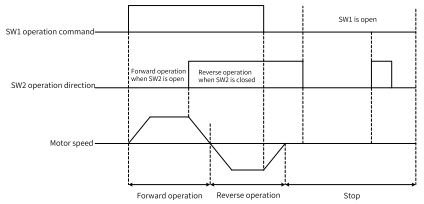
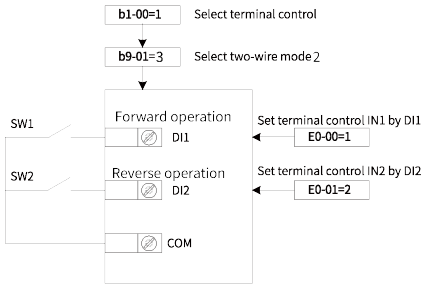
<table>
<tr><th>SW1</th><th>SW2</th><th>Operation Command</th></tr>
<tr><td>1</td><td>0</td><td>Forward running</td></tr>
<tr><td>1</td><td>1</td><td>Reverse running</td></tr>
<tr><td>0</td><td>0</td><td>Stop</td></tr>
<tr><td>0</td><td>1</td><td>Stop</td></tr>
</table>
Figure 5-4 Wiring and parameter settings for two-wire control mode 1</td><td> 

Figure 5-5 Time sequence for two-wire control mode 1</td></tr>
</table>

<table>
<tr><td rowspan="2">Value range:</td><td colspan="2">Working Principle</td></tr>
<tr><td>Example</td><td>Sequence diagram</td></tr>
<tr><td>3: IN1 start in forward direction, IN2 start in reverse direction</td><td>


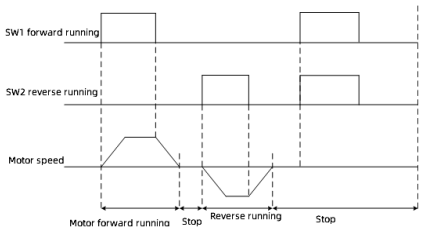
<table>
<tr><th>SW1</th><th>SW2</th><th>Operation Command</th></tr>
<tr><td>1</td><td>0</td><td>Forward running</td></tr>
<tr><td>0</td><td>1</td><td>Reverse running</td></tr>
<tr><td>1</td><td>1</td><td>Stop</td></tr>
<tr><td>0</td><td>0</td><td>Stop</td></tr>
</table>
Figure 5-6 Wiring and parameter settings for two-wire 2
</td><td>


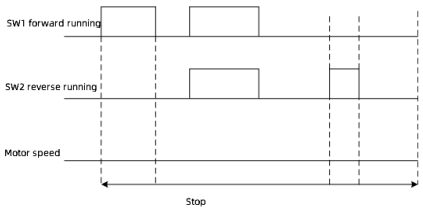
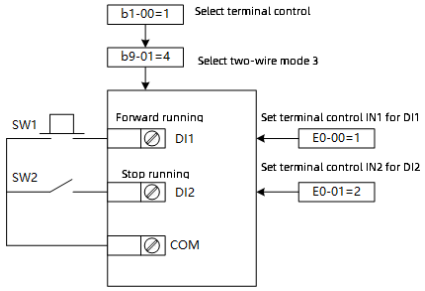
Figure 5-7 Time sequence for two-wire mode 2 (normal)


Figure 5-8 Time sequence for two-wire mode 2 (abnormal)
</td></tr>
<tr><td>4: IN1P (rising edge) start, IN2 stop</td><td>


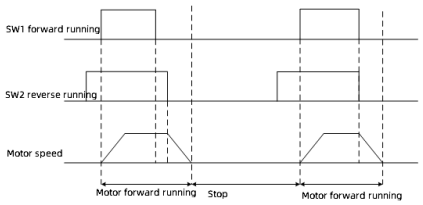
<table>
<tr><th>SW1</th><th>SW2</th><th>Operation Command</th></tr>
<tr><td>X</td><td>0</td><td>Stop</td></tr>
<tr><td>0->1</td><td>1</td><td>Run</td></tr>
</table>
Figure 5-9 Wiring and parameter settings for two-wire control mode 3
</td><td>


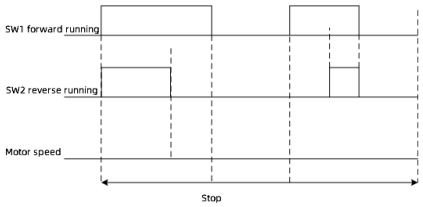
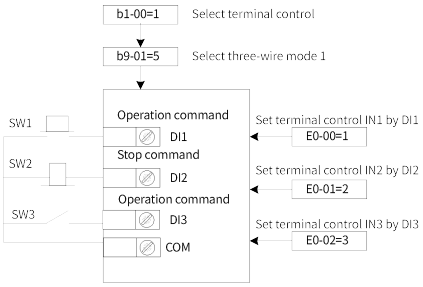
Figure 5-10 Timing sequence for two-wire control mode 3 (normal)


Figure 5-11 Timing sequence for two-wire control mode 3 (abnormal)
</td></tr>
</table>

<table>
<tr><th rowspan="2">Value range:</th><th colspan="2">Working Principle</th></tr>
<tr><th>Example</th><th>Sequence diagram</th></tr>
<tr><td>5: IN1P (rising edge) start, IN2 stop, IN3 direction</td><td>


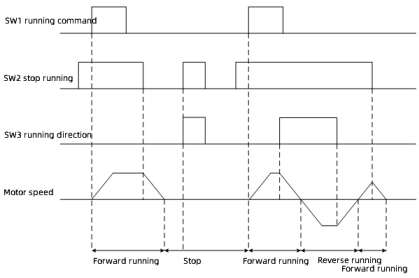
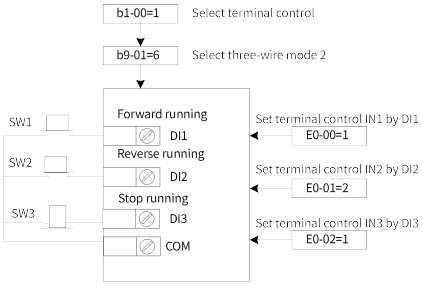
<table>
<tr><th>SW1</th><th>SW2</th><th>SW3</th><th>Operation Command</th></tr>
<tr><td>X</td><td>0</td><td>X</td><td>Stop</td></tr>
<tr><td>0->1</td><td>1</td><td>0</td><td>Forward running</td></tr>
<tr><td>0->1</td><td>1</td><td>1</td><td>Reverse running</td></tr>
</table>
Figure 5-12 Wiring and parameter settings for three-wire control mode 1
</td><td>


Figure 5-13 Time sequence for three-wire mode 1
</td></tr>
<tr><td>6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop</td><td>


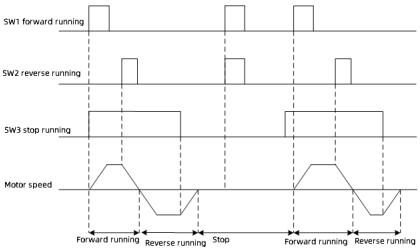
<table>
<tr><th>SW1</th><th>SW2</th><th>SW3</th><th>Operation Command</th></tr>
<tr><td>X</td><td>X</td><td>0</td><td>Stop</td></tr>
<tr><td>0->1</td><td>X</td><td>1</td><td>Forward running</td></tr>
<tr><td>X</td><td>0->1</td><td>1</td><td>Reverse running</td></tr>
</table>
Figure 5-14 Wiring and parameter settings for three-wire control mode 2
</td><td>


Figure 5-15 Time sequence for three-wire mode 2
</td></tr>
</table>

Param.	Name	Default	Value Range	Descriptions
b9-09 (F4-02)	Mode of start/stop module B by terminal	3	Sync control with "*b9-01 (F4-01)*" *on page 193*	Sync control with "*b9-01 (F4-01)*" *on page 193*

Address

Set F0-03 (Main command source of control channel 1) to 2 (Communication) and configure the communication parameters correctly. After sending a command to the control command address of the AC drive according to the communication protocol, you can control the start, stop, forward rotation, reverse rotation, jog, and fault reset of the AC drive. MD630-INT supports the following control command communication addresses.

Address		Description of the communication address
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop according to the stop mode specified by F2-17 7: Reset upon fault 8: Emergency stop For example, write 1 to 7311H to control the forward running of the AC drive.
Communication setting control word 1	7321H	The value format of 7321H is hexadecimal. bit00: ON_OFF1; 0: stop, 0 to 1: run bit01: OFF2; 0: stop bit02: OFF3; 0: stop bit03: Running allowed; 1: enabled bit04: Reset command; 1: reset Bit05: JOG1; 1: enable Bit06: JOG2; 1: enable bit07: opposite to the speed; 1: opposite For example, write 0x000F to 7321H to control the start of the AC drive.

5.2.2 Frequency Reference

5.2.2.1 Select Frequency Reference Source Channel

Selecting the setting channel

You can change the setting channel through b0-03 (Setting channel selection). See details in *" b0-03" on page 204*.

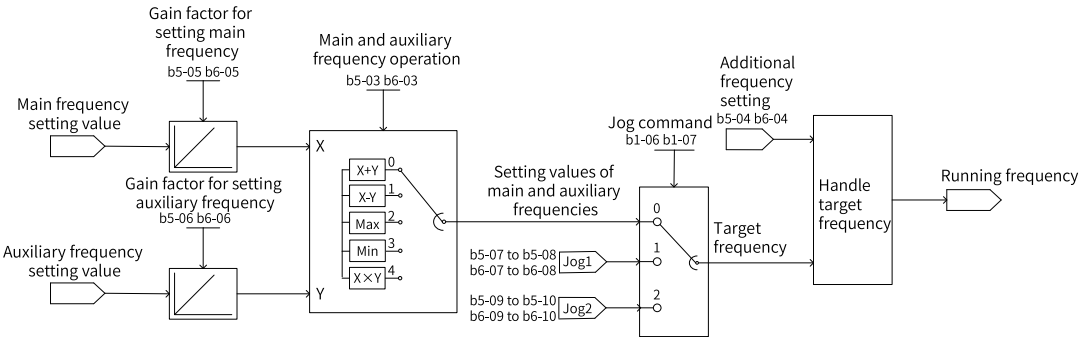


Figure 5-16 Setting channel flowchart

1. Main (auxiliary) frequency reference x Main (auxiliary) frequency reference gain coefficient = Effective main (auxiliary) frequency reference. The value after main and auxiliary frequency operation on the effective main (auxiliary) frequency reference is input to the ramp function generator.
2. Each setting channel has jog frequency 1 and jog frequency 2, which are effective only when jog command 1 or 2 is active.
3. Additional frequency is used for speed adjustment without acceleration/deceleration time. The additional frequency takes effect only during normal operation. The effective value is superimposed directly to the output of the ramp function generator.

Frequency reference

Control channel 1: Set the main frequency source through b5-00, and auxiliary frequency source through b5-02. For details, see *" b5-00 (F0-29)" on page 205* and *" b5-02 (F0-31)" on page 207*.
Control channel 2: Set the main frequency source through b6-00, auxiliary frequency source through b6-02. For details, see *" b6-00" on page 208* and *" b6-02" on page 209*.

Control channel 1 is used as an example in this section if no notes are provided.

Application scenario	Operation example	Related parameters
Setting the main frequency through parameter b5-00 (F0-29) = 0		
You can set the frequency directly through parameters.	Set b5-00 or F0-29 (Main frequency source) to 0 (F0-30). 2. Set b5-01 or F0-30 (Digital setting of main frequency)/b5-30 (Main frequency digital setting (rpm))/b5-31 (Main frequency digital setting (%)) to set the frequency. 3. When the main frequency source is set to parameter, you can change the value of related parameters to set the frequency. In addition, you can also set the frequency by using the UP/DOWN keys. After preceding settings are done, you can increase the frequency reference by pressing ▲ or decrease the frequency by pressing ▼ on the operating panel in real time when the drive is stopped or running.	*" b5-01 (F0-30)" on page 209* *"5.2.2.1.1 b5-30 to b5-31" on page 209*
Setting the frequency through operating panel		

Application scenario	Operation example	Related parameters
You can set the main frequency of the AC drive by pressing the key on the operating panel.	The drive supports the built-in operating panel. You can set the main frequency of the drive through the buttons on the operating panel or the terminal functioning as UP/DOWN keys. b0-03 is used to switch between two setting channels. The main frequency of the setting channel can be adjusted through  and  buttons on the operating panel or the DI terminal functioning as UP/DOWN keys. Set P0-89 (Save setting made by the UP/DOWN buttons on the operating panel or the terminal functioning as UP/DOWN buttons) to 1 (Enable). After the channel is switched, the frequency of the other channel adjusted by the UP/DOWN buttons on the operating panel or the terminal functioning as UP/DOWN buttons is saved. By default, the frequency of the other channel is cleared after the channel is switched. 1. After power-on, press  to enter the parameter setting interface. Use the direction keys to locate b0-03. Set b0-03 to 0 and press  to select channel 1 as the setting channel. 2. Locate b5-00 (Main frequency source) through the operating panel and set it to "0: b5-01" to set the main frequency through digital setting. 3. Locate b5-01 (Digital setting of main frequency) and set it to 20.00 through the operating panel. That is, the output frequency of setting channel 1 is set to 20.00 Hz. In this case, the operating panel LED flashes, displaying 20.00.	• Set P0-89 to 1. After power-off and power-on, the frequency reference changed by the terminal functioning as the UP/DOWN keys can be restored. • You can press buttons to change the frequency during operation. After P0-87 is set to 0, the operating panel LED displays the current running frequency, which allows you to view frequency modification during operation. • P0-88 is used to set whether the frequency changed by the terminal functioning as the UP/DOWN key during operation is retentive upon stop. **Related parameters:** *" b5-01 (F0-30)" on page 209* *" P0-87 to P0-89" on page 210* *"5.2.2.1.2 U0-51, U0-62" on page 211*
Setting frequency through AI (Main frequency: b5-00 or F0-29 = 2 or 3; Auxiliary frequency: b5-02 or F0-31 = 2 or 3)		

Application scenario	Operation example	Related parameters
AI terminals are used as frequency sources. Five kinds of AI curves can be selected for each terminal. The AI curve is used to define the relationship between the analog input voltage (or current) and the corresponding setting.	Take AI1 as an example: 1. Set AI1 curve to "0 V to 10 V corresponds to 0% to 100%". Example: • Set E2-40 (minimum input of AI curve 1) to 0.00 V. • Set E2-41 (Percentage corresponding to minimum input of AI curve 1) to 0.0%. • Set E2-42 (maximum input of AI curve 1) to 10.00 V. • Set E2-43 (Percentage corresponding to maximum input of AI curve 1) to 100.0 %. 2. Set AI filter time through E2-10 or F4-21 (AI1 filter time). 3. Set b5-00 or F0-29 (Main frequency source) to 2 (AI1) to select AI as the frequency source. 4. The AI terminal defaults to voltage input mode. To switch to current input mode, change the DIP switch. In current input mode, current of 1 mA corresponds to voltage of 0.5 V, namely 20 mA corresponds to 10 V. After the preceding settings, when AI1 inputs 5 V voltage, 50% is obtained from the AI1 curve and the running frequency of the AC drive is 50% of C4-06 (Rated motor frequency). When AI1 input voltage is changed, the running frequency changes according to the AI1 curve.	**Description:** For detailed AI curve setting methods, see "5.2.10.8 Analog Input (AI) Terminals" on page 361. **Parameter configuration:** " Parameter settings when communication is used as the main frequency source" on page 211 **Related parameters:** " E2-40 to E2-43" on page 212 Curve 1 setting: E2-40 (F4-28) to E2-43 (F4-31) " E2-44 to E2-51" on page 213 Curve 2 setting: E2-44 (F4-32) to E2-47 (F4-35) Curve 3 setting: E2-48 (F4-36) to E2-51 (F4-39) " E2-52 to E2-67" on page 215 Curve 4 setting: E2-52 (F4-40) to E2-59 (F4-47) Curve 5 setting: E2-60 (F4-48) to E2-67 (F4-55) AI curve selection: " E2-38" on page 217 AI1 filter time: " E2-10" on page 218
Setting frequency through pulse input (HDI) (Main frequency: b5-00 or F0-29 = 5; Auxiliary frequency: b5-02 or F0-31 = 5)		

Application scenario	Operation example	Related parameters
This setting method applies to scenarios where high-speed digital input is used as the frequency source and the pulse frequency determines the input frequency.	Take HDI two-point curve as an example: 1. Set F4-68 (HDI terminal type selection) to 0 (Use as HDI) to configure DI7 as a pulse input terminal. 2. Set the relationship between the HDI pulse input and the curve with the set ratio to "0 kHz to 20 kHz correspond to 0% to 100%". • Set F4-71 (Minimum input of HDI two-point curve) to 0.00 kHz. • Set F4-72 (Percentage corresponding to minimum input of HDI two-point curve) to 0.0%. • Set F4-73 (Maximum input of HDI two-point curve) to 20.00 kHz. • Set F4-74 (Percentage corresponding to maximum input of HDI two-point curve) to 100.0%. 3. Set HDI filter time through F4-83 (HDI filter time). 4. Set F0-29 (Main frequency source) to 5 (HDI) to select the HDI terminal as the frequency source. After the preceding settings, when HDI inputs 10 kHz, 50% is obtained from the HDI curve and the running frequency of the AC drive is 50% of C4-06 (Rated motor frequency). When HDI input frequency changes, the running frequency changes according to the HDI curve.	**Description:** For detailed HDI curve setting methods, see *"5.2.10.6 High-Speed Digital Input (HDI)" on page 350*. **Parameter configuration:** *" Parameters used to set main frequency through pulse input" on page 218* **Related parameters:** *" E4-08 (F4-71) to E4-11 (F4-74)" on page 218* *" E4-32(F4-83)" on page 219*
Setting frequency through multi-reference (Main frequency: b5-00 or F0-29 = 6; Auxiliary frequency: b5-02 or F0-31 = 6)		
This mode is suitable for applications where the operating frequency of the drive does not require continuous adjustment, and only several frequency values need to be used.	Set F0-29 (Main frequency source) to 6 (Multi-reference). You can assign the multi-reference terminal function to the DI and switch among pre-set multi-references through the DI. Up to 16 multi-references are supported. You can set four groups of multi-references through parameters in group F. The relationship between the number of multi-references and the number of DI terminals is shown below. • Two multi-references: One DI (K1); b8-04 to b8-06 are set to 0. • Three to four multi-references: Two DIs (K1 and K2); b8-05 and b8-06 are set to 0. • Five to eight multi-references: Three DIs (K1, K2, and K3); b8-06 is set to 0. • Nine to sixteen multi-references: Four DIs (K1, K2, K3, and K4)	**Description:** To use multi-reference as the main frequency reference source, assign functions 12 to 15 to the DIs or set b8-03 (Multi-reference selection bit0) to b8-06 (Multi-reference selection bit3). For details, see *" Parameter settings when multi-reference is used as the main frequency source" on page 219* **Related parameters:** *" b8-03 to b8-24" on page 220*
Setting frequency through PLC (Main frequency: b5-00 or F0-29 = 7; Auxiliary frequency: b5-02 or F0-31 = 7)		

Application scenario	Operation example	Related parameters
In some industrial applications where functions of start/stop, time- and segment-based speed regulation, and simple automatic forward/reverse run for the AC motor are required (such as concrete mixer, industrial washing machine), using the simple PLC to directly set the running speed, direction, and running time for each stage.	1. Set F0-29 (Main frequency source) to 7 (PLC) to select the simple PLC as the main frequency source. 2. Set multi-reference parameters, including P1-09, P1-12, P1-15, P1-18, P1-21, P1-24, P1-27, P1-30, P1-33, P1-36, P1-39, P1-42, P1-45, P1-48, P1-51, and P1-54. The 16 multi-references correspond to the set frequencies for the 16 stages of the simple PLC, respectively. Set P1-10 (Operating time of multi-reference 0 set by simple PLC) and P1-11 (Ramp-up/down time of multi-reference 0 set by simple PLC) (and so on for other multi-references) to define the operating time and ramp-up/down time of multi-reference 0. 3. Set P1-02 to select the simple PLC operation mode. 4. Set the ones place (retention upon power-off) of P1-03 to configure whether the current STEP and the current STEP operating time of the simple PLC are retentive upon power-off. Set the tens place (calculation enable configuration) of P1-03 to set the simple PLC module status when the calculation is disabled and enabled again. 5. Set the P1-01 (Simple PLC calculation enable source). • If the source is valid, the simple PLC module runs according to the operation mode of the simple PLC and calculates the current STEP based on the running time. It also outputs the current STEP and current STEP running time, as well as the per-unit value obtained in the current step. • If the source is invalid, the current STEP and current STEP operating time (hours and seconds) of the simple PLC are the values when the calculation stops. The per-unit value obtained in the simple PLC step is the value of multi-reference when the calculation stops. 6. Set P1-00 to 1 to enable the simple PLC module. In this case, when the calculation of the simple PLC is enabled, the simple PLC module starts running from STEP0. The main frequency is set to the frequency set by STEP0, that is, multi-reference 0 (defined by P1-09). After the current STEP is performed by the simple PLC, switch to the next STEP, and the main frequency setpoint is also switched to the frequency of the next STEP set by the PLC.	**Parameter configuration:** *"Parameter settings when communication is used as the main frequency source" on page 223* **Related parameters:** *"P1-00 to P1-56" on page 224*
Setting frequency through PID (Main frequency: b5-00 or F0-29 = 8; Auxiliary frequency: b5-02 or F0-31 = 8)		

Application scenario	Operation example	Related parameters
PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value.	1. When setting F0-29 (Main frequency source) to 8 (PID), the PID controller output is set as the active frequency source. 2. To use PID as the frequency source, enable the PID function through setting P2-00 (Process PID enable) to 1 (Enable). 3. Set the PID reference source and feedback source. By default, P2-02 (PID reference source) is set to 0 (Value reference) (defined by P2-03), and P2-04 (PID feedback source) is set to 0 (AI1).	**Description:** See detailed PID function description in *"5.4.6.2 Process PID Control" on page 642*. **Control principle block diagram:** *" Principle of process PID control" on page 230* **Related parameters:** *" P2-00 to P2-27" on page 230*
Setting frequency through communication (Main frequency: b5-00 or F0-29 = 9; Auxiliary frequency: b5-02 or F0-31 = 9)		
Set b5-00 (Main frequency source) to 9 (Communication) to set communication as the main frequency source.	To set communication as the main frequency source of channel 1, do as follows: 1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1. 2. Set n0-14 to select 7310H speed reference configuration. 3. Send a write command to the drive through the host controller.	**Description:** • MD630S-INT: Modbus • MD630N-INT: EtherCAT, EtherNet/IP, PROFINET For communication parameters, see *"10.11.1 n Communication Configuration" on page 1639*. For communication addresses, see *" Communication Address" on page 236*. **Parameter configuration:** *" Parameter settings for using communication as the main frequency reference source" on page 234* **Related parameters:** *" n0-14" on page 235*
Setting the frequency through F connector (Main frequency: b5-00 or F0-29 = Others; Auxiliary frequency: b5-02 or F0-31 = Others)		
This function is applicable to parameter interconnection, expanding the sources for parameter setting. You can select different parameters as the main frequency source as needed.	The following example uses F connector parameter L2244 (AI1 input value) to illustrate the usage method when the main frequency source is F connector. 1. Set b5-00 to Others. 2. In the pop-up options, locate L22 (Floating-point connector 1) and select L2244 (AI1 input value). After setting is done, AI1 input value is used as the main frequency source. After AI1 curve is set, the frequency reference can be calculated based on the AI1 input voltage.	**Description:** Any one of the parameters L22 (Floating connector 1) to L32 (Floating connector 11) can be selected as the frequency source. **Related parameters:** *"10.15.14 L22 Floating-point Connector 1" on page 1772*-*"10.15.20 L32 Floating-point Connector 11" on page 1780*

Related parameters

Param.	Name	Default	Value Range	Description
b0-03	Set channel selection	0	0: Set channel 1 1: Set channel 2 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Set the active set channel. If this parameter is 0, set channel 1 is selected. If this parameter is 1, set channel 2 is selected. **Description** 0: Invalid: Channel 1 is selected, group b5 is activated. 1: Valid - channel 2 is selected. Group b6 is activated. 3 to 9: DI1 to DI7 - Indicates that whether this function is active depends on the terminal state of the DI. The setpoint 0 indicates the value is invalid. The setpoint 1 indicates this value is valid. Others: B connector - The selection depends on the other B connector. You can select the other B connector through the pop-up window. The setpoint 0 indicates the value is invalid. The setpoint 1 indicates this value is valid. **Additional information:** After the DI function is set with 71 [Setting channel selection], the value of b0-03 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).

Param.	Name	Default	Value Range	Descriptions
F0-29 b5-00	Main frequency source	0: Set by the parameter (F0-30)	0: Set by the parameter (F0-30) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter is used to set the main frequency source of set channel 1. F0-29 is the mapping of b5-00 (main frequency source) in group F. The two parameters have the same function.

Description

0: Set by the parameter (F0-29 is set by F0-30; b6-00 is set by b6-01) - The initial frequency reference is the value of the "digital setting of main frequency". The frequency can be changed by using the ▲ and ▼ keys on the keypad or the multi-functional input terminal functioning as the UP/DOWN key. When the AC drive is powered off and then powered on, whether the frequency adjusted by using UP/DOWN keys is saved depends on the configuration of "retain values set by using UP/DOWN keys". The "clear values adjusted by using UP/DOWN keys or multi-functional input terminal functioning as the UP/DOWN key" function of the DI allows you to clear values set by using UP/DOWN keys or multi-functional input terminal functioning as the UP/DOWN key.

2: AI1 – The frequency is input by current or voltage signal through the AI1. The frequency is calculated according to the preset AI curve.

3: AI2 – The frequency reference is input with current or voltage signal through AI2. The frequency is calculated according to the preset AI curve.

5: HDI pulse – The frequency is set through the pulse frequency of the DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency.

6: Multi-reference – When multi-reference is used as the frequency source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies.

7: Simple PLC – Simple PLC is a multi-reference operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the values of each frequency. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set.

8: PID – The main frequency is set through PID.

9: Communication – The main frequency is set through communication. The frequency can be set through remote communication.

Others: F connector – Set a parameter number for a float connector, and the value of this connector is used as the main frequency reference. This mode is used for expansion of common sources.

When the main frequency source is set to 0, the main frequency set by parameters is in the unit of Hz. When the main frequency source is set to other options, the frequency is set in percentage. The base value (100%) is determined by the frequency per unit value of A2-04.

Additional information:

The addresses for the frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0--13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14.

Param.	Name	Default	Value Range	Descriptions

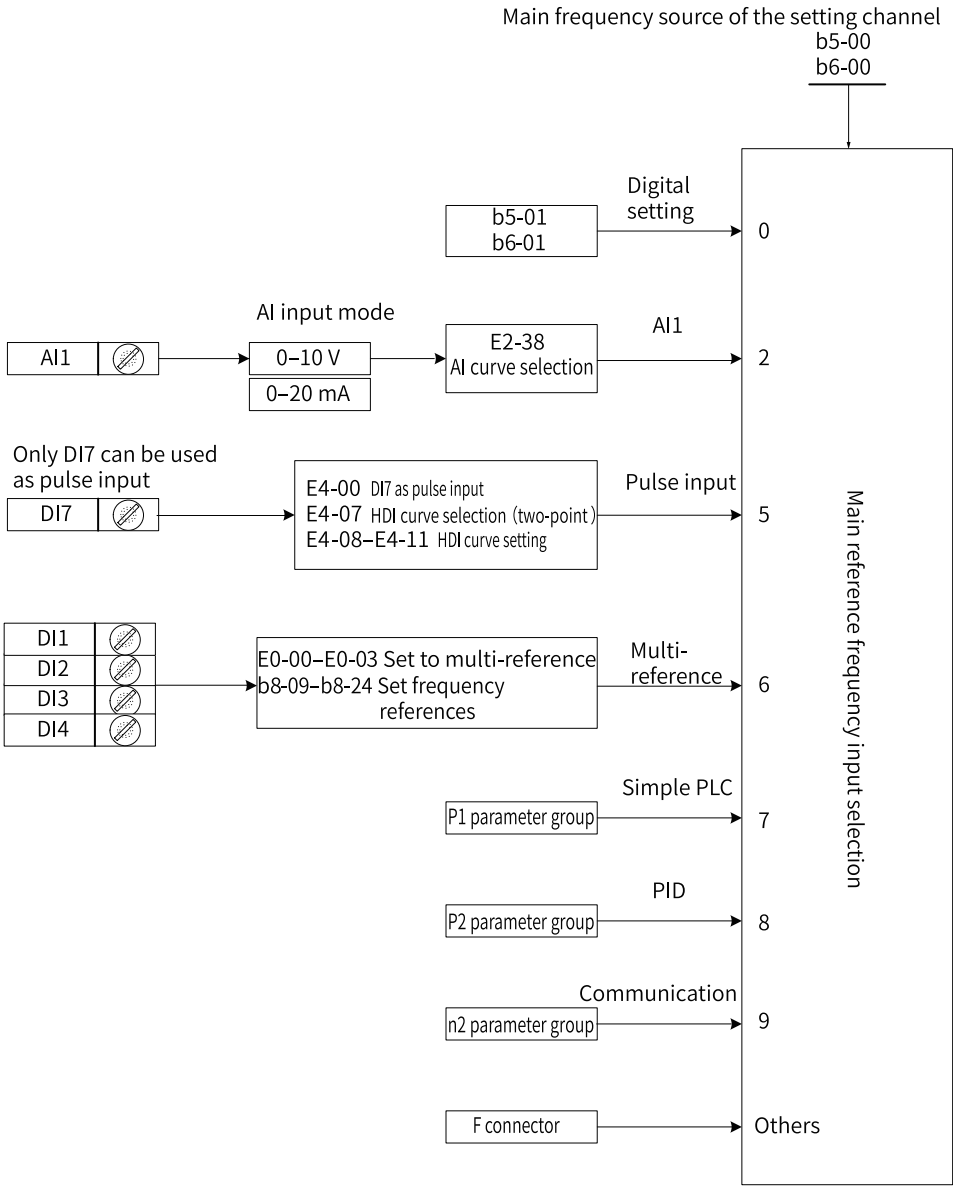


Figure 5-17 Main frequency reference selection

Param.	Name	Default	Value Range	Descriptions
b5-02 (F0-31)	Auxiliary frequency source	0	0: 0 (Inactive) 2: AI1 3: AI2 5: HDI 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the auxiliary frequency source.

Value description

0: 0. The auxiliary frequency is set to 0.

2: AI1. The auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve.

3: AI2. The auxiliary frequency reference is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve.

5: HDI pulse. The frequency is set through the pulse frequency of the DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency.

6: Multi-reference. In the multi-reference mode, combinations of different DI terminal states correspond to different frequency reference. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies.

7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 frequencies can be set.

8: PID. The auxiliary frequency is set through PID.

9: Communication The auxiliary frequency is set through communication. The frequency can be set through remote communication.

Others: F connector

This parameter is set to the number of a floating connector. In this case, the value of the connector is read as an auxiliary frequency reference. This mode is used for expansion of common sources.

Note:

The addresses for the auxiliary frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0-13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14.

Param.	Name	Default	Value Range	Descriptions

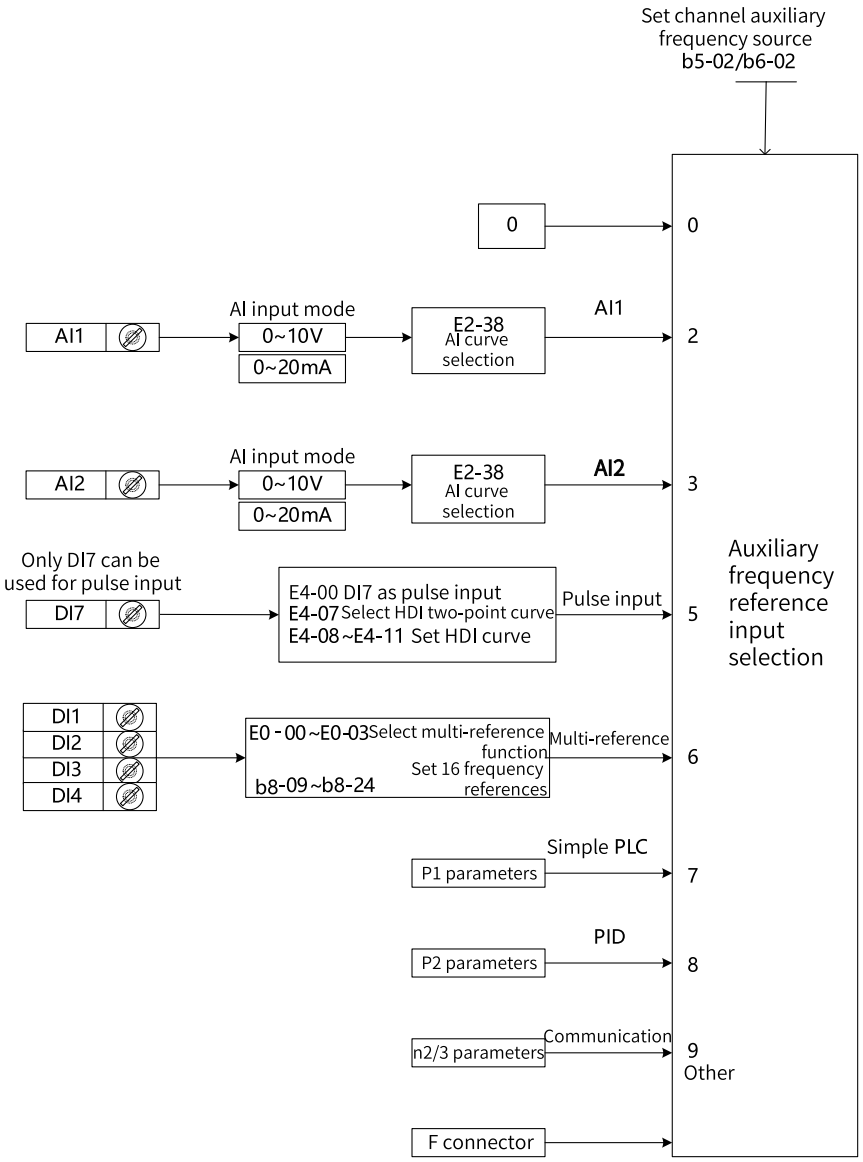


Figure 5-18 Auxiliary frequency reference source selection

Param.	Name	Default	Value Range	Description
b6-00	Main frequency source	0: Set by the parameter (b6-01)	0: Set by the parameter (b6-01) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Set the main frequency source. **Value description and the additional information:** Same as *" b5-00 (F0-29)" on page 205*. Main frequency reference selection, same as *" b5-00 (F0-29)" on page 205*.

Param.	Name	Default	Value Range	Descriptions
b6-02	Auxiliary frequency source	0	0: 0 (Inactive) 2: AI1 3: AI2 5: HDI 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the auxiliary frequency source. **Value description and the additional information:** Same as " *b5-02 (F0-31)" on page 207*. Auxiliary frequency reference source selection: Same as " *b5-02 (F0-31)" on page 207*.

Param.	Name	Default	Value Range	Descriptions
b5-01 (F0-30)	Digital setting of main frequency	50.00 Hz	0.00 Hz to A2-17	This parameter is used to set the target frequency. It is valid only when the main frequency source is set to digital setting. b5-01 and F0-30 are the same parameter. After F0-30 is modified, b5-01 is automatically synchronized.

5.2.2.1.1 b5-30 to b5-31

Param.	Name	Default	Value range	Description
b5-30	Main frequency digital setting (rpm)	1500 RPM	0 rpm~A2-15	Set the target frequency in rpm.
b5-31	Main frequency digital setting (%)	100%	0 rpm~A2-14	Set the target frequency in %.

Param.	Name	Default	Value range	Description
P0-87	Base frequency for target frequency adjusted by UP/DOWN key during operation	0	0: Operating frequency 1: Frequency reference	Defines the base frequency for target frequency adjusted by UP/DOWN key during operation. **Value description:** 0: Operating frequency - When the target frequency is adjusted by UP/DOWN key, it increases or decreases based on the operating frequency. 1: Frequency reference- When the target frequency is adjusted by UP/DOWN key, it increases or decreases based on the frequency reference.
P0-88	Retention of frequency adjusted by UP/DOWN key upon stop	0	0: Non-retentive 1: Retentive	Defines whether the frequency corrected by UP/DOWN key is retentive when the drive stops. **Value description:** 0: Non-retentive - Set b5-01 and b6-01 (Digital setting of main frequency) through the operating panel, and then adjust the frequency using the ▲ and ▼ keys on the operating panel or the terminal functioning as UP/ DOWN terminals. After the drive stops, the adjusted frequency is cleared. 1: Retentive - Set b5-01 and b6-01 (Digital setting of main frequency) through the operating panel, and then adjust the frequency using the ▲ and ▼ keys on the operating panel or the terminal functioning as UP/ DOWN terminals. After the drive stops, the adjusted frequency is reserved.
P0-89	Retention of frequency adjusted by UP/DOWN key upon power failure	0	0: Disable 1: Enable	Defines whether the frequency corrected by UP/DOWN key is retentive upon power failure. **Value description:** 0: Disable - Set b5-01 and b6-01 (Digital setting of main frequency) through the operating panel, and then adjust the frequency using the ▲ and ▼ keys on the operating panel or the terminal functioning as UP/ DOWN terminals. The adjusted frequency is cleared upon power-off. 1: Enable - Set b5-01 and b6-01 (Digital setting of main frequency) through the operating panel, and then adjust the frequency using the ▲ and ▼ keys on the operating panel or the terminal functioning as UP/ DOWN terminals. The adjusted frequency is saved upon power-off.

5.2.2.1.2 U0-51, U0-62

Param.	Name	Default	Value range	Description
U0-51	Channel 1 simple UP/ DOWN key output	0	-32768 to 32767	Displays the offset frequency of channel 1 when UPDOWN is enabled, unit is Hertz (Hz).
U0-62	Channel 2 simple UP/ DOWN key output	0	-32768 to 32767	Displays the offset frequency of channel 2 when UPDOWN is enabled, unit is Hertz (Hz).

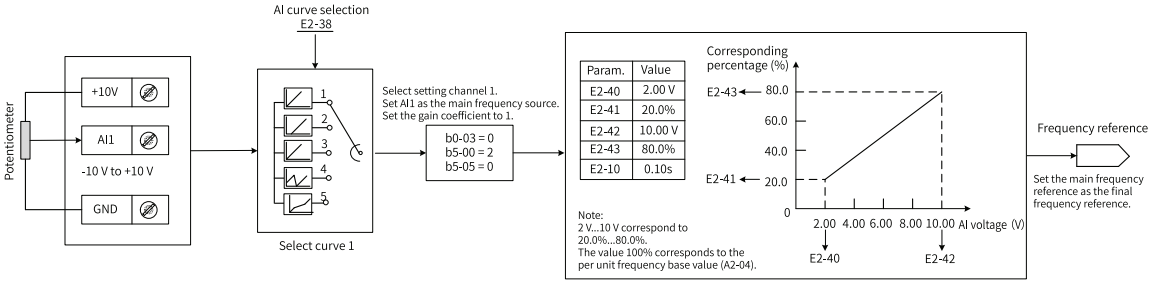


Figure 5-19 Parameter settings for voltage-type AI1 to be used as the main frequency reference source

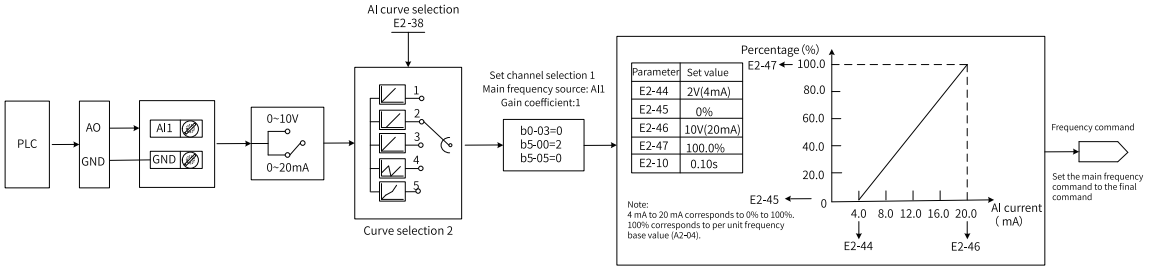


Figure 5-20 Parameter settings for current-type AI1 to be used as the main frequency reference source

Parameter	Name	Default Value	Value Range	Description
E2-40	Minimum input of AI curve 1	0.00	-10.00 to E2-42	Defines the minimum input point of x-axis on AI curve 1, namely the minimum analog input voltage (or minimum analog input current). **Remarks** 1. The x axis of the AI curve indicates the analog input voltage (or analog input current), and the y axis indicates the per-unit percentage of the analog input voltage. The meaning is determined by the AI function. For example, if the AI terminal is selected as the frequency input, the y-axis represents the percentage to the rated frequency of the motor. 2. Five AI curves are provided. Curves 1 to 3 are two-point curves. The two points are the minimum input point and maximum input point, and the relevant parameters are E2-40 to E2-51. Curves 4 and 5 are four-point curves. The four points are the minimum input point, maximum input point, and two inflection points, and the relevant parameters are E2-52 to E2-67.
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0	-800.0 to 800.0	Defines the y-axis that corresponds to AI curve 1 minimum input, which is the per-unit percentage corresponding to the minimum analog input. **Supplementary description:** Same as E2-40.
E2-42	Maximum input of AI curve 1	10.00	E2-40 to 10.00	Defines the maximum input point of x-axis on AI curve 1, namely the maximum analog input voltage (or maximum analog input current). **Supplementary description:** Same as E2-40.

Parameter	Name	Default Value	Value Range	Description
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0	-800.0 to 800.0	Defines the y-axis that corresponds to AI curve 1 maximum input, which is the per-unit percentage corresponding to the maximum analog input. **Supplementary description:** Same as E2-40.

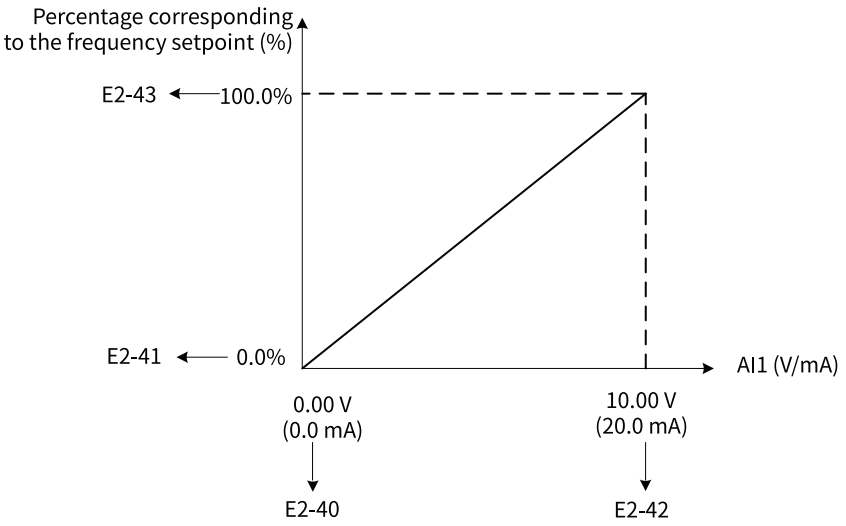


Figure 5-21 Setting AI curve 1

When the AI is used as the frequency setting source, the voltage/current input 100% corresponds to the value of A2-04 (per-unit base value of frequency). When the analog current input is used, 0 mA to 20 mA current corresponds to 0 V to 10 V voltage. For example, if AI1 is used as the frequency reference, and the input voltage of A1 is 0 V to 10 V. When the input is 5 V, the frequency is set to 50 x (A2-04). If A2-04 is set to 50 Hz, the frequency is set to 25 Hz.

Parameter	Name	Default Value	Value Range	Description
E2-44	Minimum input of AI curve 2	0.00	-10.00 to E2-46	Defines the minimum input point of x-axis on AI curve 2, namely the minimum analog input voltage (or minimum analog input current). **Remarks** Same as E2-40.
E2-45	Percentage corresponding to the minimum input of AI curve 2	0.0	-800.0 to 800.0	Defines the y-axis of AI curve 2 minimum input, namely the per-unit value in percentage corresponding to the minimum analog input. **Remarks** Same as E2-40.
E2-46	Maximum input of AI curve 2	10.00	E2-44 to 10.00	Defines the maximum input point of x-axis on AI curve 2, namely the maximum analog input voltage (or maximum analog input current). **Remarks** Same as E2-40.

Parameter	Name	Default Value	Value Range	Description
E2-47	Percentage corresponding to the maximum input of AI curve 2	100.0	-800.0 to 800.0	Defines the y-axis of AI curve 2 maximum input, namely the per-unit value in percentage corresponding to the maximum analog input. **Remarks** Same as E2-40.
E2-48	Minimum input of AI curve 3	0.00	-10.00 to E2-50	Defines the minimum input point of x-axis on AI curve 3, namely the minimum analog input voltage (or minimum analog input current). **Remarks** Same as E2-40.
E2-49	Percentage corresponding to the minimum input of AI curve 3	0.0	-800.0 to 800.0	Defines the y-axis of AI curve 3 minimum input, namely the per-unit value in percentage corresponding to the minimum analog input. **Remarks** Same as E2-40.
E2-50	Maximum input of AI curve 3	10.00	E2-48 to 10.00	Defines the maximum input point of x-axis on AI curve 3, namely the maximum analog input voltage (or maximum analog input current). **Remarks** Same as E2-40.
E2-51	Percentage corresponding to the maximum input of AI curve 3	100.0	-800.0 to 800.0	Defines the y-axis of AI curve 3 maximum input, namely the per-unit value in percentage corresponding to the maximum analog input. **Remarks** Same as E2-40.

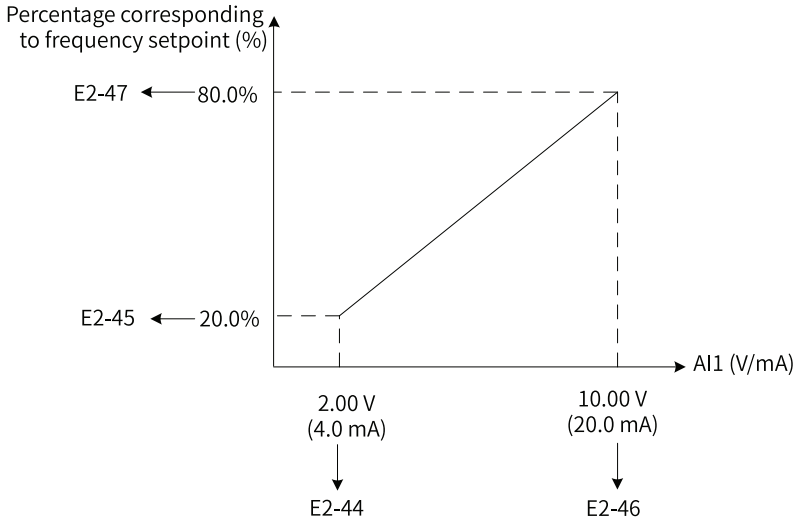


Figure 5-22 Setting AI curve 2 and curve 3

Set curve 2 and curve 3 in the same way as curve 1. For details, see " *E2-40 to E2-43" on page 212*.

Parameter	Name	Default Value	Value Range	Description
E2-52	Minimum input of AI curve 4	0.00	-10.00 to E2-54	Defines the minimum input point of x-axis on AI curve 4, namely the minimum analog input voltage (or minimum analog input current). **Supplementary description:** 1. The x-axis of the AI curve indicates the analog input voltage (or analog input current). The y-axis indicates the per-unit percentage corresponding to the analog input voltage. If AI input is frequency setting, the y-axis is the percentage relative to the maximum frequency (C4-10). 2. Five AI curves are provided. Curves 1 to 3 are two-point curves. The two points are the minimum input point and maximum input point, and the relevant parameters are E2-40 to E2-51. Curves 4 and 5 are four-point curves. The four points are the minimum input point, maximum input point, and two inflection points, and the relevant parameters are E2-52 to E2-67.
E2-53	Corresponding percentage of AI curve 4 minimum input	0.0	-800.0 to 800.0	Defines the y-axis of AI curve 4 minimum input, namely the per-unit value in percentage corresponding to the minimum analog input. **Supplementary description:** Same as E2-40.
E2-54	Inflection point 1 input of AI curve 4	3.00	E2-52 to E2-56	This parameter defines the inflection 1 of x axis on AI curve 4, that is, the analog input voltage (or analog input current) at inflection 1. **Supplementary description:** Same as E2-40.
E2-55	Percentage corresponding to inflection point 1 input of AI curve 4	30.0	-800.0 to 800.0	Defines the y-axis corresponding to inflection point 1 of AI curve 4, namely the per-unit percentage corresponding to the analog input of inflection point 1. **Supplementary description:** Same as E2-40.
E2-56	Inflection point 2 input of AI curve 4	6.00	E2-54 to E2-58	This parameter defines the inflection 2 of x axis on AI curve 4, that is, the analog input voltage (or analog input current) at inflection 1. **Supplementary description:** Same as E2-40.
E2-57	Percentage corresponding to inflection 2 input of AI curve 4	60.0	-800.0 to 800.0	This parameter defines the y-axis corresponding to inflection point 2 of AI curve 4, that is, the per-unit percentage value corresponding to the analog input of inflection point 2. **Supplementary description:** Same as E2-40.
E2-58	Maximum input of AI curve 4	10.00	E2-56 to 10.00	Defines the maximum input point of x-axis on AI curve 4, namely the maximum analog input voltage (or maximum analog input current). **Supplementary description:** Same as E2-40.
E2-59	Percentage corresponding to maximum input of AI curve 4	100.0	-800.0 to 800.0	Defines the y-axis of AI curve 4 maximum input, namely the per-unit value in percentage corresponding to the maximum analog input. **Supplementary description:** Same as E2-40.
E2-60	Minimum input of AI curve 5	-10.00	-10.00 to E2-62	Defines the minimum input point of x-axis on AI curve 5, namely the minimum analog input voltage (or minimum analog input current). **Supplementary description:** Same as E2-40.

Parameter	Name	Default Value	Value Range	Description
E2-61	Percentage corresponding to the minimum input of AI curve 5	-100.0	-800.0 to 800.0	Defines the y-axis of AI curve 5 minimum input, namely the per-unit value in percentage corresponding to the minimum analog input. **Supplementary description:** Same as E2-40.
E2-62	Inflection point 1 input of AI curve 5	-3.00	E2-60 to E2-64	This parameter defines the inflection 1 of x axis on AI curve 5, that is, the analog input voltage (or analog input current) at inflection 1. **Supplementary description:** Same as E2-40.
E2-63	Percentage corresponding to inflection point 1 input of AI curve 5	-30.0	-800.0 to 800.0	Defines the y-axis corresponding to inflection point 1 of AI curve 5, namely the per-unit percentage corresponding to the analog input of inflection point 1. **Supplementary description:** Same as E2-40.
E2-64	Inflection point 2 input of AI curve 5	3.00	E2-62 to E2-66	This parameter defines the inflection 2 of x axis on AI curve 5, that is, the analog input voltage (or analog input current) at inflection 1. **Supplementary description:** Same as E2-40.
E2-65	Percentage corresponding to inflection 2 input of AI curve 5	30.0	-800.0 to 800.0	This parameter defines the y-axis corresponding to inflection point 2 of AI curve 5, that is, the per-unit percentage value corresponding to the analog input of inflection point 2. **Supplementary description:** Same as E2-40.
E2-66	Maximum input of AI curve 5	10.00	E2-64 to 10.00	Defines the maximum input point of x-axis on AI curve 5, namely the maximum analog input voltage (or maximum analog input current). **Supplementary description:** Same as E2-40.

Parameter	Name	Default Value	Value Range	Description
E2-67	Percentage corresponding to the maximum input of AI curve 5	100.0	-800.0 to 800.0	Defines the y-axis of AI curve 5 maximum input, namely the per-unit value in percentage corresponding to the maximum analog input. **Supplementary description:** Same as E2-40.

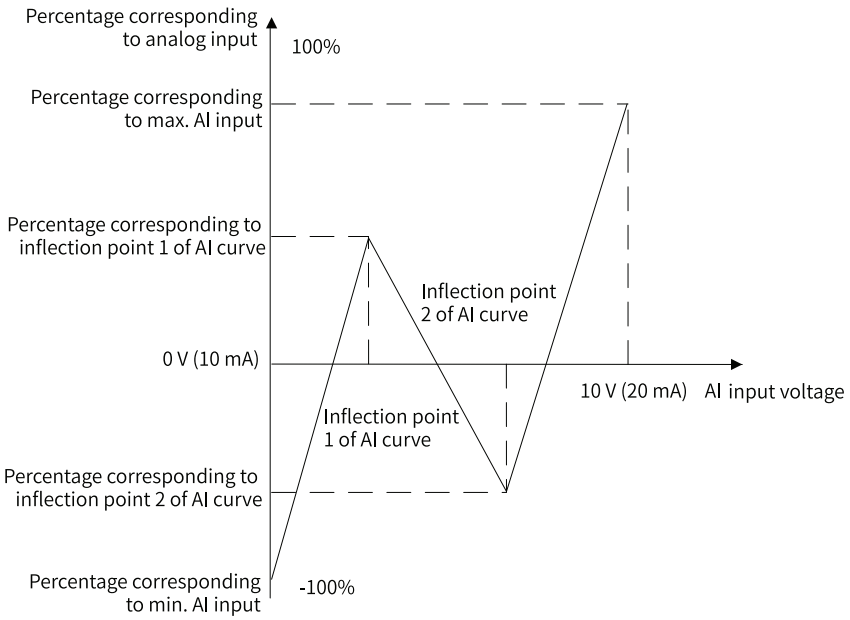


Figure 5-23 Schematic diagram for curve 4 and curve 5

The function of curve 4 and curve 5 is similar to that of curve 1 to curve 3, but curve 1 to curve 3 are straight lines, and curve 4 and curve 5 are 4-point curves. The x axis in AI curves 4 and 5 represents the analog input voltage (or current), and the y axis represents the set value corresponding to the analog input, that is, the percentage relative to the per-unit base value of frequency (A2-04). The four points on curves 4 and 5 are the minimum input point, inflection point 1, inflection point 2, and maximum input point.

When setting curve 4 and curve 5, the minimum input voltage, inflection point 1 voltage, inflection point 2 voltage, and maximum input voltage must be increased in ascending order. E2-52 to E2-59 are used to set curve 4. E2-60 to E2-67 are used to set curve 5.

Parameter	Name	Default	Value Range	Descriptions
E2-38	AI curve	0x21	Ones position: AI1 curve selection 1: Curve 1 (2 points, E2-40 to E2-43) 2: Curve 2 (2 points, E2-44 to E2-47) 3: Curve 3 (2 points, E2-48 to E2-51) 4: Curve 4 (4 points, E2-52 to E2-59) 5: Curve 5 (4 points, E2-60 to E2-67) Tens position: AI2 curve selection 1: Curve 1 (2 points, E2-40 to E2-43) 2: Curve 2 (2 points, E2-44 to E2-47) 3: Curve 3 (2 points, E2-48 to E2-51) 4: Curve 4 (4 points, E2-52 to E2-59) 5: Curve 5 (4 points, E2-60 to E2-67) Hundreds position: Reserved Thousands position: Reserved	Defines the curve selection of AI1 and AI2 (assigned by the ones and tens in sequence).

Parameter	Name	Default Value	Value Range	Description
E2-10	AI1 filter time	0.10	0.00 to 10.00	Defines the software filter time of AI1. **Supplementary explanation:** 1. The filter acts directly on AI hardware sampling. 2. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 3. When on-site analog signals may be easily disturbed, you may increase the AI filter time to enhance the stability of the analog signals.

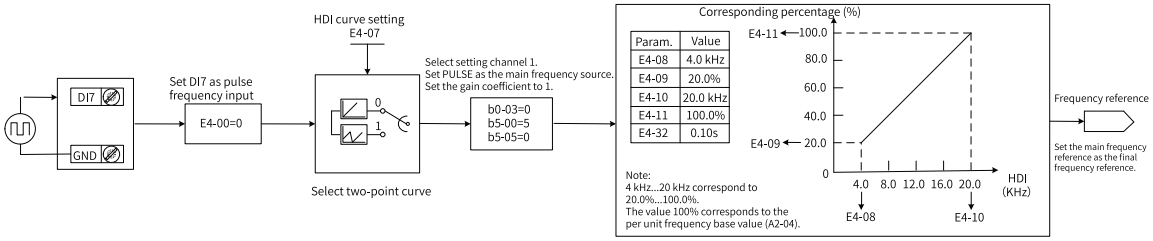


Figure 5-24 Parameters used to set the main frequency through pulse input

Param.	Name	Default	Value Range	Descriptions
E4-08 (F4-71)	Minimum input of two-point HDI curve	0.00 kHz	0.00 kHz to E4-10	Sets the minimum input point of x axis on HDI two-point curve, that is, the minimum pulse input frequency. **Additional information:** When the high-speed pulse at the DI7 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the HDI terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-08 corresponds to the minimum input point on the x axis, that is, the minimum pulse frequency.
E4-09 (F4-72)	Percentage corresponding to minimum input of two-point HDI curve	0.0%	-800.0% to 800.0%	Sets the y axis corresponding to the minimum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the minimum pulse input. **Additional description:**Same as E4-08.

Param.	Name	Default	Value Range	Descriptions
E4-10 (F4-73)	Maximum input of two-point HDI curve	20.00 kHz	E4-08 to 20.00 kHz	Sets the maximum input point of x axis on HDI two-point curve, that is, the maximum pulse input frequency. **Additional description:**Same as E4-08.
E4-11 (F4-74)	Percentage corresponding to maximum input of two-point HDI curve	100.0%	-800.0% to 800.0%	Sets the y axis corresponding to the maximum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the maximum pulse input. **Additional description:**Same as E4-08.

Param.	Name	Default	Value Range	Descriptions
E4-32	HDI filter time	0.10	0: 0 (Inactive) 2: AI1 3: AI2 5: HDI 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Set the HDI filter time 1. Filter the per-unit percentage value obtained after the pulse input is processed by the HDI curve (not filtering the HDI sampling value). 2. When on-site signals are prone to interference, you may increase the HDI filter time to enhance the stability of the per-unit percentage value input to the AC drive.

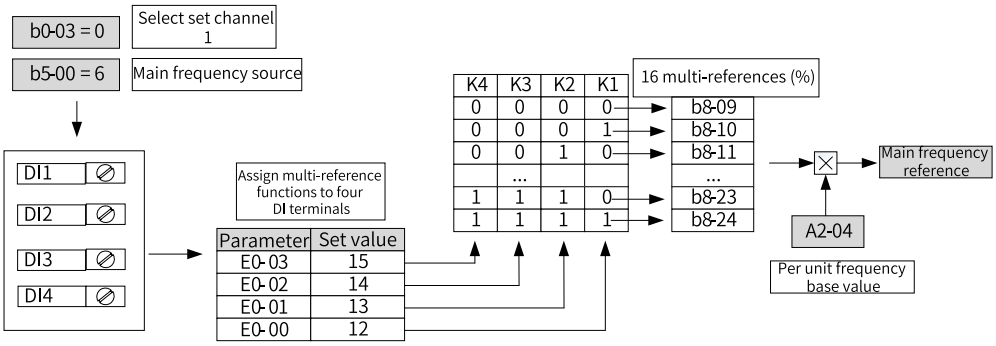


Figure 5-25 Multi-reference setting

The four multi-reference terminals can make up 16 state combinations, corresponding to 16 frequency reference values. For details, see the following table.

Table 5–2 Description of multi-reference function

K4	K3	K2	K1	Reference	Param.
OFF	OFF	OFF	OFF	Multi-reference 0	b8-09 (b8-08=0)
OFF	OFF	OFF	ON	Multi-reference 1	b8-10
OFF	OFF	ON	OFF	Multi-reference 2	b8-11

K4	K3	K2	K1	Reference	Param.
OFF	OFF	ON	ON	Multi-reference 3	b8-12
OFF	ON	OFF	OFF	Multi-reference 4	b8-13
OFF	ON	OFF	ON	Multi-reference 5	b8-14
OFF	ON	ON	OFF	Multi-reference 6	b8-15
OFF	ON	ON	ON	Multi-reference 7	b8-16
ON	OFF	OFF	OFF	Multi-reference 8	b8-17
ON	OFF	OFF	ON	Multi-reference 9	b8-18
ON	OFF	ON	OFF	Multi-reference 10	b8-19
ON	OFF	ON	ON	Multi-reference 11	b8-20
ON	ON	OFF	OFF	Multi-reference 12	b8-21
ON	ON	OFF	ON	Multi-reference 13	b8-22
ON	ON	ON	OFF	Multi-reference 14	b8-23
ON	ON	ON	ON	Multi-reference 15	b8-24

Param.	Name	Default	Value Range	Descriptions
b8-03	Multi-reference selection bit0	0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Defines the source of multi-reference selection bit0. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit1, bit0, bit2, and bit3. **Description** 0: 0 - The value of multi-reference bit0 is 0. 1: The value of multi-reference bit0 is 1. 3 to 9: DI1 to DI7 - Multi-reference bit 0 depending on the final state of DI. The setpoint 0 indicates that the multi-reference bit0 is 0. The setpoint 1 indicates that the multi-reference bit0 is 1. Others: B connector - Indicates whether this function is active depends on others (B connector). You can select others (B connector) through the pop-up window. The setpoint 0 indicates that the multi-reference bit0 is 0. The setpoint 1 indicates that the multi-reference bit0 is 1. **Additional information:** A total of 16 multi-references can be supported through binary combination of b8-03 [Multi-reference selection bit0], b8-04 [Multi-reference selection bit1], b8-05 [Multi-reference selection bit2], and b8-06 [Multi-reference selection bit3]. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected.
b8-04	Multi-reference selection bit 1	0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the source of multi-reference selection bit 1. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit2, and bit3. The value description and the additional information are the same as b8-03.

Param.	Name	Default	Value Range	Descriptions
b8-05	Multi-reference selection bit 2	0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the source of multi-reference selection bit 2. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit1, and bit3. **Value description and the additional information:** Same as b8-03.
b8-06	Multi-reference selection bit 3	0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the source of multi-reference selection bit 3. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit1, and bit2. **Value description and the additional information:** Same as b8-03.
b8-08 (F0-38)	Multi-reference 0 setting mode	0	0: Set by the parameter (F0-39) 1: AI1 2: AI2 4: HDI pulse (valid only for MD630S) 5: PID 6: b5-01/b6-01 (digital setting of the main frequency of the effective set channel) Others: F connector	This parameter sets the multi-reference 0 source. F0-38 is the mapping of b5-08 (Multi-reference 0 setting mode) in group F. The two parameters have the same function. **Description** 0: Set by the parameter (F0-39) - Multi-reference 0 is set by F0-39. 1: AI1 - Multi-reference 0 is input by current or voltage signal through AI1. The corresponding per-unit value is calculated according to the preset AI curve. 2: AI2 - Multi-reference 0 is input by current or voltage signal through AI2. The corresponding per-unit value is calculated according to the preset AI curve. 4: HDI pulse - Multi-reference 0 is set through the pulse frequency of DI7. The corresponding per unit value is calculated according to the curve of the relationship between the pulse frequency and the set frequency. 5: PID - PID output is selected as the source of multi-reference 0. 6: b5-01/b6-01 (digital setting of the main frequency of the effective set channel) - Multi-reference 0 is set through b5-01/b6-01 (digital setting of main frequency). The corresponding frequency per unit value is calculated based on the frequency. Others: F connector. A parameter number is set for a floating-point connector. In this case, the value of the connector is read as main frequency reference. This mode is used for expansion of common sources. **Description:** When b8-02 (Multi-reference unit selection) is not 0, the multi-reference 0 setting mode only supports 0 (Set by the parameter (b8-09)), and the setting is inactive from other sources.

Param.	Name	Default	Value Range	Descriptions
b8-09 (F0-39)	Multi-reference 0	0.00%	b8-43 to b8-42	The source of multi-reference 0 is selected through b8-08. Other multi-references are defined through digital settings of parameters. **Additional information:** 1: The unit of the multi-reference is %. The AC drive provides four multi-reference terminals (b8-03 to b8-06), which provide 16 states, corresponding to 16 frequency setpoints. 2. This parameter defines the frequency reference of each speed when the frequency reference source is set to multi-reference. b8-09 to b8-24 correspond to a total of 16 frequency setpoints for 16 multi-references numbered from 0 to 15. The frequency setpoint is calculated as a percentage to the rated frequency. The value 100% corresponds to the rated motor frequency.
b8-10 (F0-40)	Multi-reference 1	0.00%	b8-43 to b8-42	
b8-11 (F0-41)	Multi-reference 2	0.00%	b8-43 to b8-42	
b8-12 (F0-42)	Multi-reference 3	0.00%	b8-43 to b8-42	
b8-13	Multi-reference 4	0.00%	b8-43 to b8-42	
b8-14	Multi-reference 5	0.00%	b8-43 to b8-42	
b8-15	Multi-reference 6	0.00%	b8-43 to b8-42	
b8-16	Multi-reference 7	0.00%	b8-43 to b8-42	
b8-17	Multi-reference 8	0.00%	b8-43 to b8-42	
b8-18	Multi-reference 9	0.00%	b8-43 to b8-42	
b8-19	Multi-reference 10	0.00%	b8-43 to b8-42	
b8-20	Multi-reference 11	0.00%	b8-43 to b8-42	
b8-21	Multi-reference 12	0.00%	b8-43 to b8-42	
b8-22	Multi-reference 13	0.00%	b8-43 to b8-42	
b8-23	Multi-reference 14	0.00%	b8-43 to b8-42	
b8-24	Multi-reference 15	0.00%	b8-43 to b8-42	

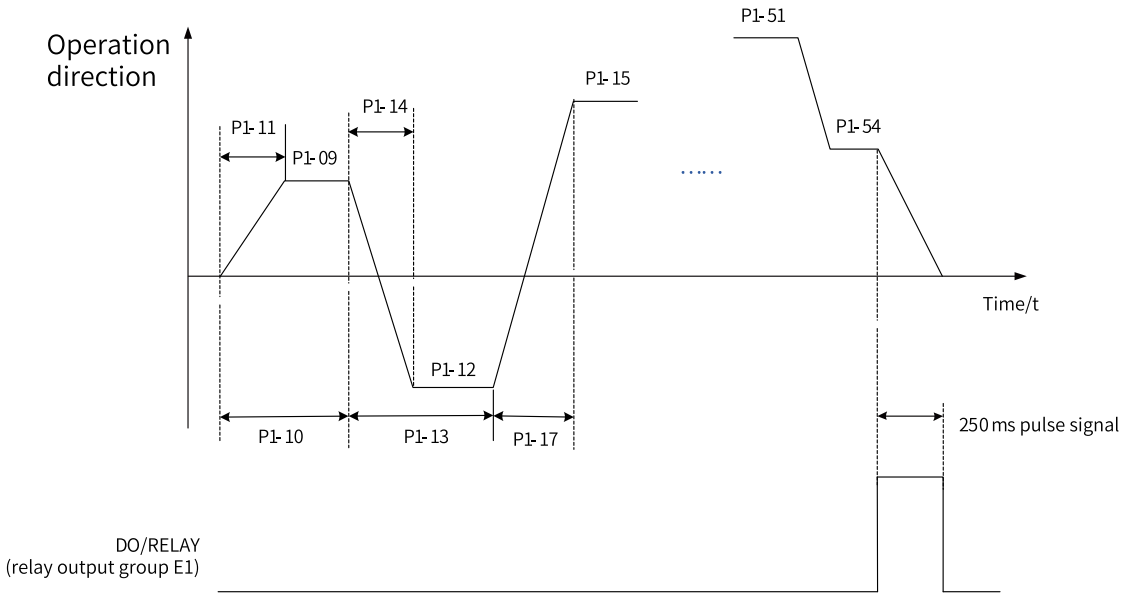


Figure 5-26 Use of simple PLC as the main frequency source

Param.	Name	Default	Value Range	Description
P1-00	Enabling simple PLC module	0	0: Disable 1: Enable	Set whether to enable the simple PLC module. **Value description:** 0: Disable. If the simple PLC module is disabled, the output current STEP and current STEP running time (hours and seconds) of the simple PLC, as well as the output per-unit value obtained in the simple PLC step, are all cleared. 1: Enable. The simple PLC module is enabled, but whether the PLC module is calculated and output is normal depends on P1-01.
P1-01	Simple PLC calculation enable source	36978	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the simple PLC calculation enable source. **Value description:** 0: Invalid. The simple PLC calculation function is invalid. 1: Valid. The simple PLC calculation function is valid. 3 to 9: DI1 to DI7. Whether simple PLC calculation is valid depends on the input state of DI1 to DI7 terminals. 0: Invalid; 1: Valid Others: Connector B - Whether simple PLC calculation is valid depends on the status of the selected connector B. 0: Invalid; 1: Valid **Note:** 1. If the simple PLC calculation is enabled, the simple PLC module runs according to the running mode of the simple PLC and calculates the current STEP based on the running time. It also outputs the current STEP and current STEP running time of the simple PLC, as well as the output per-unit value obtained in the current step. 2. If the simple PLC calculation is disabled, the output current STEP, current STEP running time (hours and seconds) of the simple PLC is the value when the calculation is stopped. The output per-unit value obtained in the simple PLC step is the value of multi-reference i when the calculation is stopped.

Param.	Name	Default	Value Range	Description
P1-02	Simple PLC running mode	0	0: Keep multi-reference 0 output after running for one cycle 1: Keep final values after running for one cycle 2: Repeat after running for one cycle 3: Output 0 after running for one cycle	Sets the running mode of the simple PLC. **Value description:** 0: Keep multi-reference value 0 after running for one cycle. Multi-reference value 0 is output after the simple PLC module runs for one cycle. 1: The final values are output after single-cycle running of the simple PLC module. 2: The simple PLC starts running again from the first stage after completing a cycle. 3: After simple PLC runs for a cycle, the output per-unit value obtained in the simple PLC step is 0. **Note:** 1. If this parameter is set to 0, 1, and 3, the single-cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms. 2. If this parameter is set to 2, the simple PLC cycle completion flag outputs a high level for 250 ms after each cycle is completed.
P1-03	Simple PLC function selection	0	Ones position: Retention selection upon power failure 0: Non-retentive upon power failure 1: Retentive upon power failure Tens position: Calculation enablement configuration 0: Current STEP retained when disabled, and recalculated when enabled 1: Current STEP retained when disabled, and continue when enabled	Sets the simple PLC function. **Value description:** Ones position: Retention selection upon power failure 0: The current STEP and the current STEP running time of the simple PLC are not retentive upon power failure. 1: The current STEP and the current STEP running time of the simple PLC are retentive upon power failure. Tens position: Calculation enablement configuration 0: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from STEP0 and recalculates the running time. 1: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from the current STEP and the current running time.
P1-04	Simple PLC status reset	0	0: Invalid 1: Valid 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the simple PLC status reset. **Value description:** 0: The simple PLC status reset is disabled, and the simple PLC operates according to the setting. 1: The simple PLC status reset is enabled. The simple PLC module is restored to the initial state. Simple PLC running phase is 0, and the simple PLC output is the setpoint of the multi-reference 0 of P1-09. 3 to 9: Whether the simple PLC status reset is enabled depends on the input state of DI1 to DI7 terminals. 0: Invalid; 1: Valid Others: Connector B - Whether the simple PLC status reset is enabled depends on the status of the selected connector B. 0: Invalid; 1: Valid

Param.	Name	Default	Value Range	Description
P1-08	Unit of simple PLC running time	0	0: s (second) 1: h (hour)	Sets the unit of simple PLC running time. **Value description:** 0: Set the unit of simple PLC running time to second. 1: Set the unit of simple PLC running time to hour.
P1-09	Multi-reference 0 set by simple PLC	0	-800.0 to 800.0	Defines the target frequency of multi-reference 0 of the simple PLC, which is a percentage to the rated motor frequency.
P1-10	Running time of multi-reference 0 set by simple PLC	0	0 to 6553.5s(h)	Sets the running time of multi-reference 0 set by simple PLC, which is the sum of acceleration or deceleration time and operating time at constant speed and target frequency. **Note:** It is recommended that the running time of multi-reference i set by simple PLC should be set higher than the acceleration/deceleration time.
P1-11	Acceleration/ Deceleration time of multi-reference 0 set by simple PLC	0	0: Ramp 1 acceleration/ deceleration time b7-04 (ramp 1 acceleration time) and b7-05 (ramp 1 deceleration time) 1: Ramp 2 acceleration/ deceleration time b7-10 (ramp 2 acceleration time) and b7-11 (ramp 2 deceleration time) 2: Ramp 3 acceleration/ deceleration time b7-16 (ramp 3 acceleration time) and b7-17 (ramp 3 deceleration time) 3: Ramp 4 acceleration/ deceleration time b7-22 (ramp 4 acceleration time) and b7-23 (ramp 4 deceleration time)	Sets the acceleration/deceleration time of multi-reference 0 set by simple PLC. **Value description:** 0: Select the acceleration/deceleration time of ramp 1 (b7-04/b7-05) as the acceleration/deceleration time of multi-reference 0 set by simple PLC. 1: Select the acceleration/deceleration time of ramp 2 (b7-10/b7-11) as the acceleration/deceleration time of multi-reference 0 set by simple PLC. 2: Select the acceleration/deceleration time of ramp 3 (b7-16/b7-17) as the acceleration/deceleration time of multi-reference 0 set by simple PLC. 3: Select the acceleration/deceleration time of ramp 4 (b7-22/b7-23) as the acceleration/deceleration time of multi-reference 0 set by simple PLC.
P1-12	Multi-reference 1 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-13	Running time of multi-reference 1 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-14	Acceleration/ Deceleration time of multi-reference 1 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-15	Multi-reference 2 set by simple PLC	0	Same as P1-09	Same as P1-09

Param.	Name	Default	Value Range	Description
P1-16	Running time of multi-reference 2 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-17	Acceleration/ Deceleration time of multi-reference 2 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-18	Multi-reference 3 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-19	Running time of multi-reference 3 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-20	Acceleration/ Deceleration time of multi-reference 3 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-21	Multi-reference 4 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-22	Running time of multi-reference 4 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-23	Acceleration/ Deceleration time of multi-reference 4 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-24	Multi-reference 5 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-25	Running time of multi-reference 5 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-26	Acceleration/ Deceleration time of multi-reference 5 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-27	Multi-reference 6 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-28	Running time of multi-reference 6 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-29	Acceleration/ Deceleration time of multi-reference 6 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-30	Multi-reference 7 set by simple PLC	0	Same as P1-09	Same as P1-09

Param.	Name	Default	Value Range	Description
P1-31	Running time of multi-reference 7 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-32	Acceleration/ Deceleration time of multi-reference 7 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-33	Multi-reference 8 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-34	Running time of multi-reference 8 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-35	Acceleration/ Deceleration time of multi-reference 8 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-36	Multi-reference 9 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-37	Running time of multi-reference 9 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-38	Acceleration/ Deceleration time of multi-reference 9 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-39	Multi-reference 10 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-40	Running time of multi-reference 10 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-41	Acceleration/ Deceleration time of multi-reference 10 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-42	Multi-reference 11 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-43	Running time of multi-reference 11 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-44	Acceleration/ Deceleration time of multi-reference 11 set by simple PLC	0	Same as P1-11	Same as P1-11

Param.	Name	Default	Value Range	Description
P1-45	Multi-reference 12 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-46	Running time of multi-reference 12 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-47	Acceleration/ Deceleration time of multi-reference 12 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-48	Multi-reference 13 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-49	Running time of multi-reference 13 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-50	Acceleration/ Deceleration time of multi-reference 13 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-51	Multi-reference 14 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-52	Running time of multi-reference 14 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-53	Acceleration/ Deceleration time of multi-reference 14 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-54	Multi-reference 15 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-55	Running time of multi-reference 15 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-56	Acceleration/ Deceleration time of multi-reference 15 set by simple PLC	0	Same as P1-11	Same as P1-11

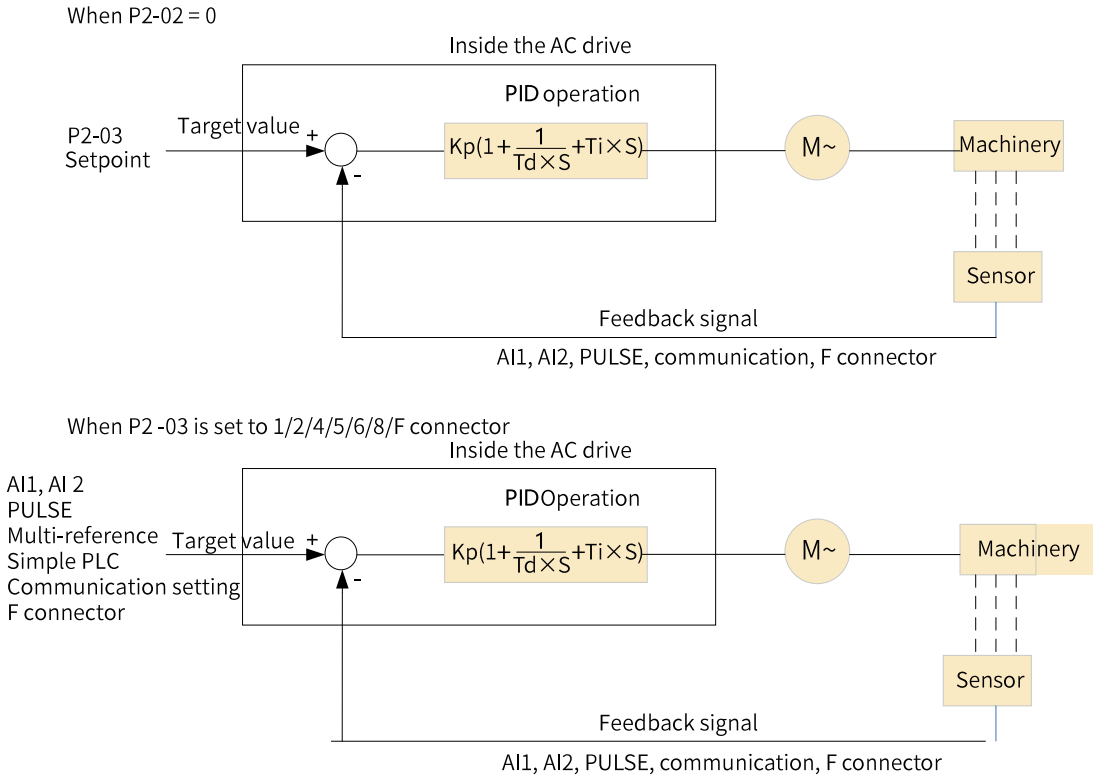


Figure 5-27 Principle of process PID control

Param.	Name	Default	Value Range	Descriptions
P2-00	PID enable	0	0: Disabled 1: Enable Other: B connector	Sets whether PID is enabled 0: Disable. The process PID is not used for calculation and the output is cleared. 1: Enable. PID operation is performed based on parameters. Others: B connector. Whether to enable the PID function is determined by a parameter in the bit connector.
P2-01	PID action direction	0	0: Positive 1: Negative Others: B connector	Sets the PID action direction. 0: Positive. When the feedback value is lower than the PID reference, the output frequency of the AC drive increases. 1: Negative. When the feedback value is lower than the PID reference, the output frequency of the AC drive decreases. Others: B connector. Select the parameter in the bit connector to control PID direction. (The value 0 represents positive action and 1 represents negative action.)

Param.	Name	Default	Value Range	Descriptions
P2-02	PID reference source	0	0: PID digital setting 1: AI1 2: AI2 4: HDI pulse reference (active only for MD630S) 5: Multi-reference 6: Simple PLC 8: Communication Others: F connector	This parameter specifies the PID reference source. **Value description** 0: PID digital setting. The PID target reference is the value of P2-03 (PID digital setting). 1: AI1. The PID reference is set by AI1 input. 2: AI2. The PID reference is set by AI2 input. 4: HDI pulse reference. The PID reference is set by the pulse frequency input through the DI terminal. The frequency is calculated according to the corresponding relationship curve between the pulse frequency and operating frequency. 5: Multi-reference. In the multi-reference mode, combinations of different DI terminal states correspond to different frequency references. The four multi-reference terminals have 16 state combinations, corresponding to 16 target frequency values. Note: When P2-02 is set to 5 (Multi-reference), b8-08 (Source of multi-reference 0) cannot be set to 5 (PID reference). 6: Simple PLC. PID target setting source is simple PLC. 8: Communication. The PID reference is set through remote communication. Others: F connector. The PID target reference is set by the parameter of the float connector. **Additional information:** When P2-00 is set to 5 (multi-reference), b8-08 (multi-reference 0 setting mode) cannot be set to 5 (PID reference).
P2-03	PID digital setting	50.0%	0.0%–800.0%	When P2-02 (PID reference source) is set to 0, this parameter shall be set.
P2-04	PID feedback source	0	0: AI1 1: AI2 4: HDI pulse reference (active only for MD630S) 5: Communication Others: F connector	It is used to select the PID feedback channel. **Value description** 0: AI1. The PID reference is set by AI1 input. 1: AI2. The PID reference is set by AI2 input. 4: HDI setting. The PID reference is set by the pulse frequency input through the DI terminal. The frequency is calculated according to the corresponding relationship curve between the pulse frequency and operating frequency. 5: Communication. The PID reference is set by remote communication.
P2-14	PID parameter 1 proportional gain Kp1	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the first group of parameters in PID control. **Additional information:** The deviation reduction speed depends on the proportional coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction.

Param.	Name	Default	Value Range	Descriptions
P2-15	PID parameter 1 integral time Ti1	2.00	0.01s to 10.00s	Indicates the integral time Ti of the first group of parameters in PID control. **Additional information:** This parameter determines the integral adjustment intensity of the PID controller. The shorter the integral time is, the greater the regulation intensity will be.
P2-16	PID parameter 1 differential time Td1	0.000	0.000s to 10.000s	Defines the derivative time Td of the first group of parameters in PID control. **Additional information:** It decides the regulating intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity will be.
P2-17	PID parameter 2 proportional gain Kp2	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the second group of parameters in PID control. **Additional information:** See P2-14.
P2-18	PID parameter 2 integral time Ti2	2.00	0.01s to 10.00s	Indicates the integral time Ti of the second group of parameters in PID control. **Additional information:** See P2-15.
P2-19	PID parameter 2 differential time Td2	0.000	0.000s to 10.000s	Defines the derivative time Td of the second group of parameters in PID control. **Additional information:** See P2-16.

Param.	Name	Default	Value Range	Descriptions
P2-26	Source of maximum PID output	0	0: 100% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Defines the maximum PID output value, which is the per-unit value in percentage. **Value description** 0: 100%. The maximum PID output value is 100%. 2: AI1. The PID output source is the AI1 input. 3: AI2. The PID output source is the AI2 input. 5: HDI pulse reference. The maximum value of PID output is set through DI. The frequency is calculated based on the relationship curve between the pulse frequency and operating frequency. 6: Multi-reference. When multi-reference is used as the source of the maximum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. The maximum value of PID output is defined by simple PLC output setting. 8: PID. The maximum value of PID output is the current PID output. 9: Communication. The maximum value of PID output is set through communication. The maximum value of PID output can be inputted through remote communication. Others: F connector. The maximum PID output value is the value of the selected float connector.
P2-27	Source of minimum PID output	0	0: -100% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Defines the minimum PID output value, which is the per-unit value in percentage. **Value description** 0: -100%. The minimum PID output value is -100%. 2: AI1. The minimum PID output source is the AI1 input. 3: AI2. The minimum PID output source is the AI2 input. 5: HDI pulse reference. The minimum value of PID output is set through DI. The frequency is calculated based on the relationship curve between the pulse frequency and operating frequency. 6: Multi-reference. When multi-reference is used as the source of the minimum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. The maximum value of PID output is defined by simple PLC output setting. 8: PID. The maximum value of PID output is the current PID output. 9: Communication. The minimum value of PID output is set through communication. The minimum value of PID output can be inputted through remote communication. Others: F connector . The minimum PID output value is the value of the selected float connector.

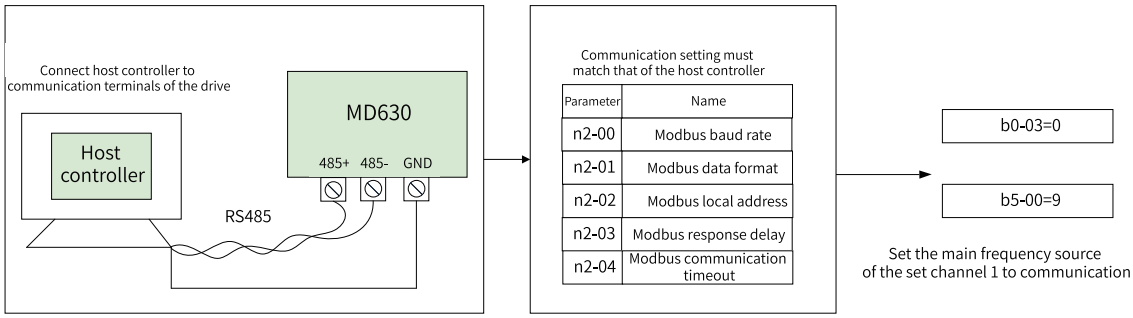


Figure 5-28 Parameter settings for using communication as the main frequency reference source

Param.	Name	Default	Value Range	Descriptions
n0-14	7310H speed setting	1	0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places) 0: Disable 1: Enable	This parameter specifies the target speed written through the 7310H communication address. Value description 0: Frequency (Unsigned 16-bit). When n0-14 is set to 0, the unit is frequency and the value is an unsigned 16-bit number with decimal places defined by A0-70. For example, when decimal 1000 is written and A0-70 is set to 2, the frequency reference is 10.00 Hz. When the decimal value 40000 is written and A0-70 is set to 1, the frequency reference is 4000.0 Hz. 1: Frequency (Int16). When n0-14 is set to 1, the unit is frequency and the value is an Int16 number with the number of decimal places defined by A0-70. For example, when decimal –1000 is written and A0-70 is set to 2, the frequency reference is –10.00 Hz. When the decimal value 20000 is written and A0-70 is set to 1, the frequency reference is 2000.0 Hz. 2: Speed (signed 16-bit). When n0-14 is set to 2, the unit is speed and the value is a signed 16-bit number without decimal places. For example, when decimal 1500 is written and the number of pole pairs is 2, the frequency reference is 50.00 Hz. When the decimal value –3000 is written and the number of pole pairs is 2, the frequency reference is –100.00 Hz. 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places). When n0-14 is set to 3, the unit is percentage and the value is a signed 16-bit number containing two decimal places. The written value is referenced against the rated frequency. For example, when the decimal value 1000 is written and the rated frequency is 50.00 Hz, the frequency reference is 5.00 Hz. When decimal –10000 is written and the rated frequency is 50.00 Hz, the frequency reference is –50.00 Hz. 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places). When n0-14 is set to 4, the unit is percentage and the value is a signed 16-bit number containing two decimal places. The written value is referenced against the maximum frequency. For example, when the decimal value 1000 is written and the rated frequency is 150.00 Hz, the frequency reference is 15.00 Hz. When decimal –10000 is written and the rated frequency is 150.00 Hz, the frequency reference is –150.00 Hz.

Communication Address		Description
Communication setpoint 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0-14 (7310H speed setting). The converted floating point value can also be set as communication of the commonly-used float point connector. When n0-14 is set to 0, the unit is frequency and the value is an unsigned 16-bit number with decimal places defined by A0-70 (frequency decimal place). For example, when decimal 1000 is written and A0-70 is set to 2, the frequency reference is 10.00 Hz. For instance, if you write the decimal value 40000 and set A0-70 (frequency decimal place) to 1, this means the frequency is set to 4000.0 Hz. When n0-14 is set to 1, the unit is frequency and the value is an Int16 number with the number of decimal places defined by A0-70 (frequency decimal place). For example, when decimal -1000 is written and A0-70 is set to 2, the frequency reference is -10.00 Hz. For instance, if you write the decimal value 20000 and set A0-70 (frequency decimal place) to 1, this means the frequency is set to 2000.0 Hz. When n0-14 is set to 2, the unit is speed and the value is an Int16 number without decimal places. For example, when decimal 1500 is written and the number of pole pairs is 2, the frequency reference is 50.00 Hz. When the decimal value -3000 is written and the number of pole pairs is 2, the frequency reference is -100.00 Hz. When n0-14 is set to 3, the unit is percentage and the value is a signed 16-bit number containing two decimal places. When n0-14 is set to 4, the unit is percentage and the value is a signed 16-bit number containing two decimal places.

5.2.2.2 Selecting the Auxiliary Frequency Reference Source

Function description

There are multiple auxiliary frequency reference sources including digital setting, AI1, AI2, pulse input, multi-reference, simple PLC, PID, communication setting, MD-BP-M, and F connector. You can select the source through b5-02 and b6-02.

When the auxiliary frequency source is set to "0: 0", the auxiliary frequency is set to 0. When the auxiliary frequency source is set to other options, the frequency is set in percentage. The base value (100%) is determined by A2-04 [Frequency per-unit base value].

When the auxiliary frequency is used as a reference source, it is set in the same way as the main frequency reference. The setting of the auxiliary frequency is similar to that of main frequency. The main and auxiliary frequency references are outputted after main and auxiliary operations.

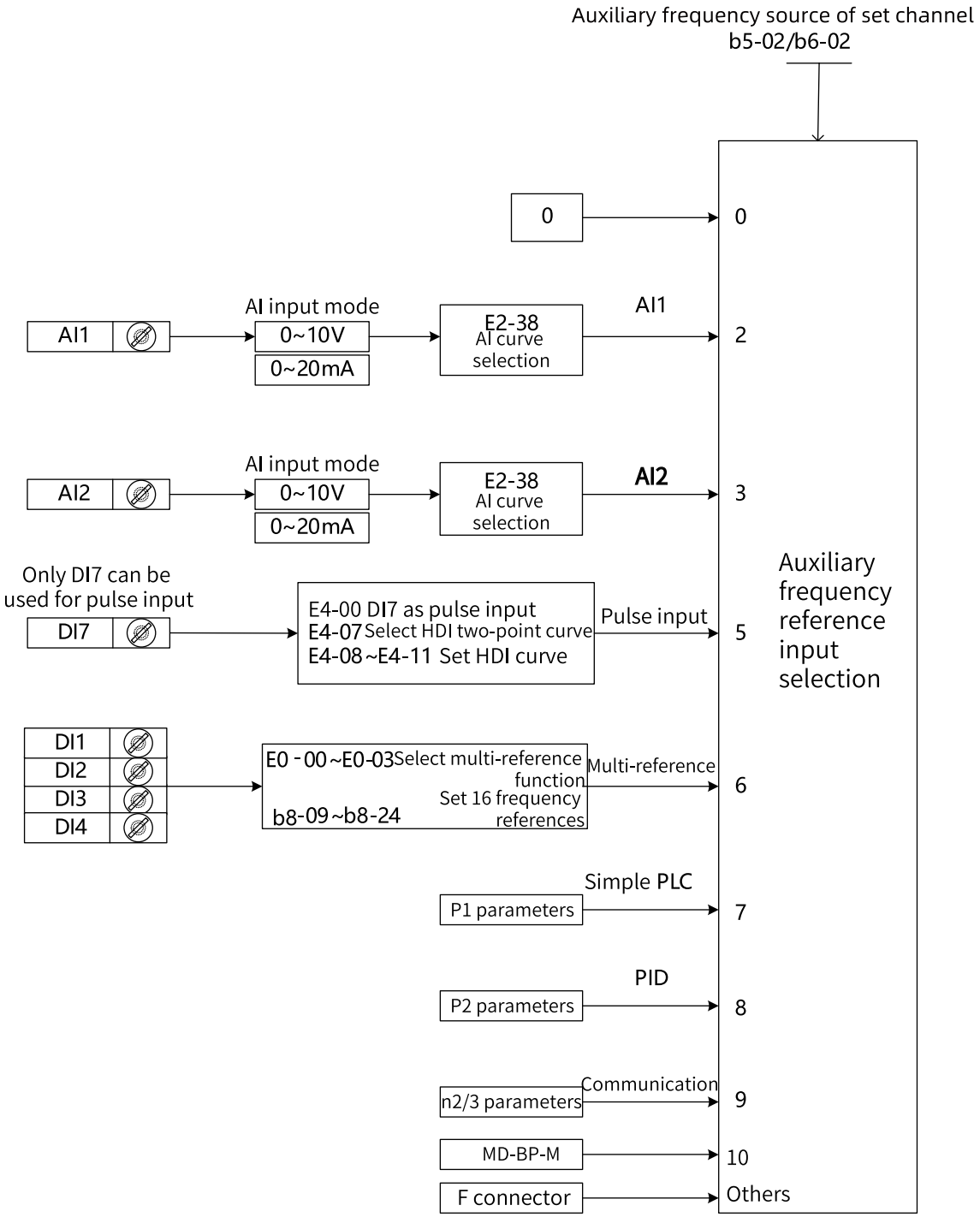


Figure 5-29 Setting auxiliary frequency reference source

There are multiple auxiliary frequency gain coefficient sources including digital setting, AI1, AI2, pulse input, multi-reference, simple PLC, PID, communication setting, MD-BP-M, main frequency, and F connector. You can set through b5-06 and b6-06.

The default source for the auxiliary frequency gain coefficient is selected as "0: 100.0%", meaning the auxiliary frequency gain coefficient is 100.0%. When the auxiliary frequency gain coefficient source is set to any other option, the frequency is set in percentages, with the base value (100%) defined by A2-04 [Per-unit frequency base value].

The method for setting the auxiliary frequency gain coefficient can refer to the main frequency setting. The auxiliary frequency is multiplied by the auxiliary frequency gain coefficient, then limited by the auxiliary frequency limit, and finally output as the auxiliary frequency.

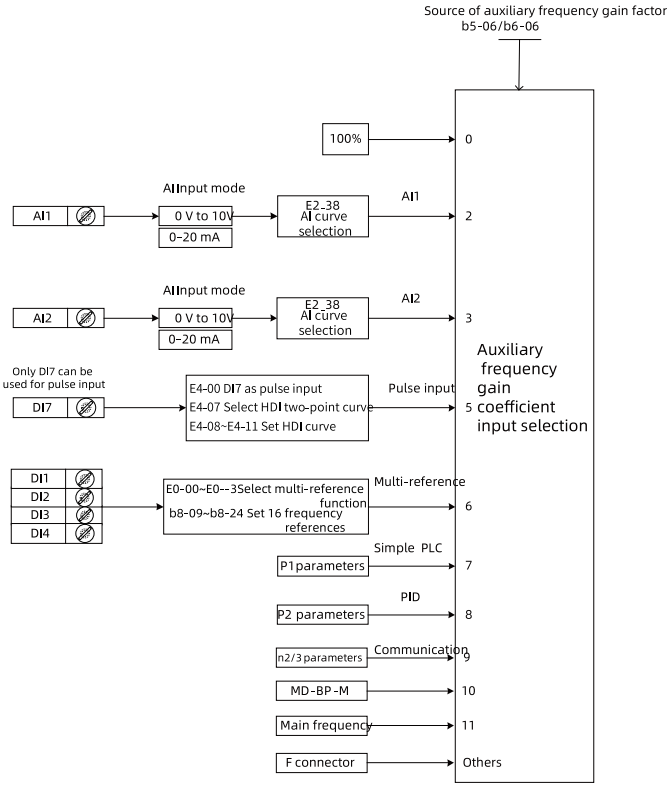


Figure 5-30 Selection of auxiliary frequency gain coefficient source

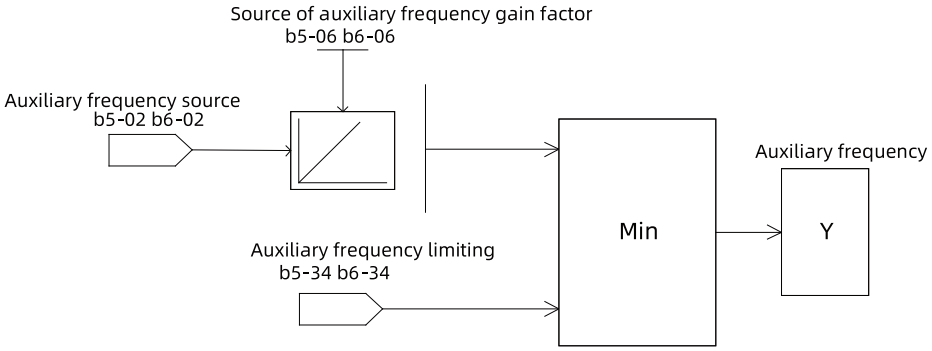


Figure 5-31 Final effective process of auxiliary frequency and auxiliary frequency gain coefficient

Related parameters

Parameter code	Parameter name	Value range	Default	**Description**
b5-02 (b6-02) (F0-31)	Auxiliary frequency source	0: 0 (Invalid) 2: AI1 3: AI2 5: HDI 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M Other: F connector	0	Defines the auxiliary frequency source. Value description: 0: 0. The auxiliary frequency is set to 0. 2: AI1. The frequency is input through current or voltage signal from AI1. The frequency is calculated according to the preset AI curve. 3: AI2. The auxiliary frequency reference is input through using current or voltage signals input from AI2. The corresponding frequency value is calculated according to the preset AI curve. 5: HDI pulse reference. The auxiliary frequency is set through the pulse frequency of DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. In the multi-reference mode, combinations of different DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID. The auxiliary frequency is set through PID. 9: Communication. The auxiliary frequency is set through communication. You can set the frequency through remote communication. 10: Potentiometer MD-BP-M. The the gain coefficient is set through the potentiometer MD-BP-M. Others: F connector A parameter number is set for a floating-point connector, and the value of the connector is read as the reference value. It is used for extension of common sources. Note: The addresses for the auxiliary frequency set through communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0-13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14.

Parameter code	Parameter name	Value range	Default	**Description**
b5-06 (b6-06) (F0-35)	Source of auxiliary frequency gain factor	0: [Rated Frequency (100%)] 2: AI1 3: AI2 5: HDI (MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M 11: Main frequency Other: F connector	0	Defines the auxiliary frequency reference gain factor source. Value description: 0: 100%. The gain factor of auxiliary frequency reference is set to 100%. 2: AI1. The gain coefficient of auxiliary frequency reference is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2. The gain coefficient of the main frequency reference is input by the current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI reference. The gain coefficient of the auxiliary frequency is set by the pulse frequency of DI7 and calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source for the gain factor of auxiliary frequency reference, different combinations of DI terminal states correspond to different gain factors. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source for the gain factor of auxiliary frequency reference. 9: Communication. The gain factor of auxiliary frequency reference is set through communication. In this mode, the gain coefficient is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M. The the gain coefficient is set through the potentiometer MD-BP-M. 11: Main frequency. The auxiliary frequency gain coefficient is derived from the per-unit value of the main frequency source. Note: The effective auxiliary frequency reference is the product of current auxiliary frequency and the auxiliary frequency gain factor. For example, if the current auxiliary frequency is set to 50 Hz, b5-06 is set to "Communication", and the gain factor is set to 50%, the effective auxiliary frequency reference is 50 x 50% = 25 Hz.
b5-34 (b6-34) (F0-36)	Auxiliary frequency limiting	0.0% to 800.0%	800.0%	This parameter limits the final effective auxiliary frequency. The final effective auxiliary frequency is obtained after limiting.

5.2.2.3 Source of Main and Auxiliary Frequency Superposition Reference

Application scenarios

This function applies to cases where the final effective frequency reference is not determined solely by the main frequency, but rather by a combined calculation of main and auxiliary frequencies.

Function description

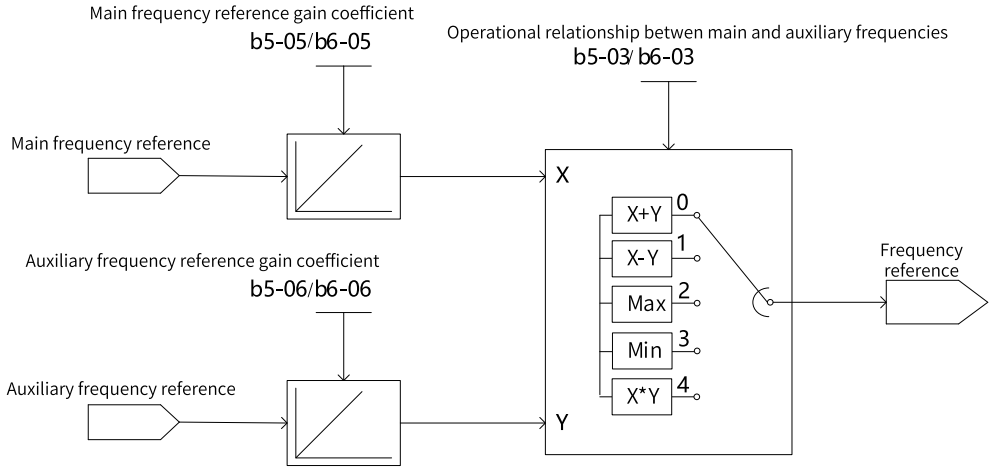


Figure 5-32 Diagram of main and auxiliary frequency reference input

Main and auxiliary frequency operation is used to set the frequency reference by performing operations on the main frequency and auxiliary frequency. Set F0-32 (b5-03) [Main and auxiliary frequency operation] to define the relationship between the target frequency and the main/auxiliary frequency operation. The default value is "0: Main frequency + Auxiliary frequency". The main frequency and auxiliary frequency are calculated in percentage. Multiply the calculation result by A2-04 to obtain the frequency reference.

The following five main and auxiliary calculation relationships are available.

- 0 [Main frequency + Auxiliary frequency]: The main frequency is superimposed by the auxiliary frequency as the target frequency.
- 1 [Main frequency - Auxiliary frequency]: The target frequency is set by subtracting the auxiliary frequency from the main frequency
- 2 [Max (|Main|, |Auxiliary|)]: The target frequency is the higher of the original absolute values of the main and auxiliary frequencies (without the absolute value symbol).
- 3 [Min(|Main|, |Auxiliary|)]: The target frequency is the smaller of the original absolute values of the main and auxiliary frequencies (without the absolute value symbol).
- 4 [Main frequency x Auxiliary frequency]: The target frequency is the product of main frequency and auxiliary frequency.

For example, when the main frequency is 100%, the auxiliary frequency is 30%, and A2-04 [Per-unit base value of frequency] is 50.00 Hz. When b5-03 [Calculation relationship between main and auxiliary frequencies] is set to 1 [Main frequency - Auxiliary frequency], the frequency reference value is (100% - 30%) x 50.00 = 35.00 Hz.

5.2.2.4 Setting Jog Frequency and Additional Frequency

Application scenarios

In addition to the main frequency and auxiliary frequency, each setting channel has two jog frequencies. Jog 1 frequency is active only when jog command 1 is active, and jog 2 frequency is active only when jog command 2 is active.

Set b5-04 and b6-04 to define the additional frequency of two setting channels, which is used for speed adjustment without ramp-up/down time. The additional frequency is active only during normal operation. The effective additional frequency is superimposed directly to the output of the ramp function generator.

Function description

The following figure shows the relationship between the main frequency, auxiliary frequency, jog frequency, and additional frequency.

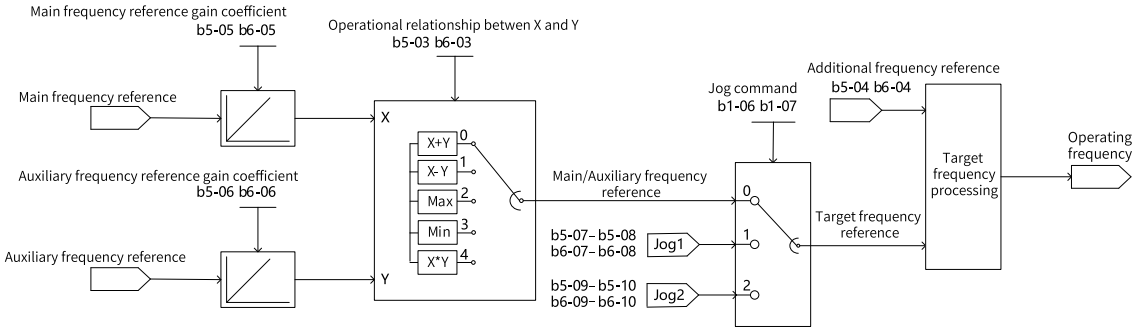


Figure 5-33 Frequency reference channel

Related parameter

Table 5–3 Related parameter

Param.	Name	Default	Value range	Description
b5-04 b6-04	Additional frequency source	0	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the additional frequency source. Value description: 0: Inactive - The additional frequency is set to 0. 2: AI1 - The additional frequency is input through current or voltage signal from AI1. The frequency is calculated according to the preset AI curve. 3: AI2 - The additional frequency is input through current or voltage signal from AI2. The corresponding frequency value is calculated according to the preset AI curve. 5: HDI pulse reference - The additional frequency is set through the pulse frequency of DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - In the multi-reference mode, combinations of different DI terminal states correspond to different frequency reference. The four multi-reference terminals have 16 state combinations, corresponding to 16 reference values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the operating time and acceleration/ deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The additional frequency is set through PID. 9: Communication - The additional frequency is set through communication. In this mode, the additional frequency is set through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter is set for a floating-point connector, and the value of the connector is read as the additional frequency. It is used for extension of common sources. Note: The address for setting additional frequency through communication is 0x1000 (Modbus-specific) and 0x7310 (CAN and Modbus). When writing frequency through communication using address 0x1000, the setting option is determined by n0-13. When writing frequency through communication using address 0x7310, the setting option is determined by n0-14. The additional frequency is superimposed directly to the frequency reference.

Param.	Name	Default	Value range	Description
b5-07 (F0-56) b6-07	Source of jog 1 frequency	0	0: b5-08/b6-08 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of jog 1 frequency. Value description: 0: b5-08/b6-08 - The jog 1 frequency is set through b5-08/b6-08. 2: AI1 - The jog 1 frequency is input through current or voltage signals from AI1 and calculated according to the preset AI curve. 3: AI2 - The jog 1 frequency is input through current or voltage signal from AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The jog 1 frequency is set by using the pulse frequency of DI7 and calculated according to the corresponding mapping curve. 6: Multi-reference - When multi-reference is used as the source of jog 1 frequency, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - The jog 1 frequency is set through PID. 9: Communication - The jog 1 frequency is set through communication. In this mode, the jog 1 frequency is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog 1 frequency. It is used for extension of common sources. b5-07 and F0-56 are the same. b5-07 changes together with F0-56 automatically.
b5-08 (F0-57) b6-08	Digital reference of jog 1 frequency	2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog 1 frequency. When b5-07/b6-07 is set to 0, this parameter is active. b5-08 and F0-57 are the same. b5-08 changes together with F0-57 automatically.

Param.	Name	Default	Value range	Description
b5-09 (F0-58) b6-09	Source of jog 2 frequency	0	0: b5-10/b6-10 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of jog 2 frequency. Value description: 0: b5-10/b6-10 - The jog 2 frequency is set through b5-10/b6-10. 2: AI1 - The jog 2 frequency is input through current or voltage signals from AI1 and calculated according to the preset AI curve. 3: AI2 - The jog 2 frequency is input through current or voltage signal from AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The jog 2 frequency is set by using the pulse frequency of DI7 and calculated according to the corresponding mapping curve. 6: Multi-reference - When multi-reference is used as the jog 2 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - The jog 2 frequency is set through PID. 9: Communication - The jog 2 frequency is set through communication. When selecting the source, you can set the jog 2 frequency through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog 2 frequency. It is used for extension of common sources. b5-09 and F0-58 are the same. b5-09 changes together with F0-58 automatically.
b5-10 (F0-59) b6-10	Digital reference of jog 2 frequency	-2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog 2 frequency. When b5-09/b6-09 is set to 0, b5-10/b6-10 is active. b5-10 and F0-59 are the same. b5-10 changes together with F0-59 automatically.

5.2.2.5 Setting Frequency Reference Limits

Application scenarios

This function is used to limit the motor from operating above or below a certain frequency, which can be achieved by setting frequency limits.

The frequency reference limits include the positive frequency upper limit, positive frequency lower limit, negative frequency upper limit, and negative frequency lower limit.

Operating principles

Frequency upper limit: Defines the maximum running frequency of the motor. Frequency lower limit: Defines the minimum running frequency of the motor. The maximum frequency limits the maximum output frequency. The minimum frequency limits the minimum output frequency.

When C4-06 [Rated motor frequency] is set to a value higher than C4-10 [Maximum motor frequency], the maximum motor frequency is equal to the rated motor frequency.

The frequency reference is also limited by the positive/negative speed limits of the RFG (ramp function generator) after being input into the RFG. The positive speed upper limit of RFG is limited only by the smaller of C4-10 [Maximum motor frequency] and d1-05 [Selection of positive frequency upper limit 2]. The negative speed upper limit of RFG is limited by the higher of C4-10 [Maximum motor frequency] and d1-06 [Selection of negative frequency upper limit 2].

Effective positive upper limit	Effective positive lower limit
The effective positive frequency upper limit is limited by the combination of three parameters: C4-10 [Maximum motor frequency], d1-05 [Source of positive frequency upper limit 2], and d1-03 [Digital setting of positive frequency upper limit 1]. The minimum value among the three parameters is used as the positive frequency upper limit of the frequency reference.	For the positive frequency lower limit, the two limit parameters are C4-11 [Minimum motor frequency] and d1-07 [Digital setting of positive frequency lower limit]. The higher of C4-11 and d1-07 is used as the positive frequency lower limit. The negative frequency limits are similar.
Figure 5-34 Effective positive upper limit	Figure 5-35 Effective positive lower limit
Effective negative upper limit	Effective negative upper limit
Figure 5-36 Effective negative upper limit	Figure 5-37 Effective negative upper limit

Related parameter

Table 5–4 Parameters related to the frequency reference limit

Param.	Name	Default	Value range	Description
F1-06 (C4-06)	Rated motor frequency	50.00 Hz	0.01 Hz to 599.00 Hz	Set this parameter based on the rated frequency on the motor nameplate. C4-06 and F1-06 are the same. C4-06 changes together with F1-06 automatically.
F1-10 (C4-10)	Maximum frequency of the motor	50.00 Hz	C4-06 to 599.00 Hz	Indicates the allowed maximum frequency of the motor. C4-10 and F1-10 are the same. C4-10 changes together with F1-10 automatically.
F1-11 (C4-11)	Minimum frequency of the motor	0	0.00 Hz to C4-10	Indicates the allowed minimum frequency of the motor. C4-11 and F1-11 are the same. C4-11 changes together with F1-11 automatically.
d1-03 (F2-22)	Positive frequency upper limit 1	800.0%	d1-07 to 800.0%	Limits the maximum positive operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. d1-03 and F2-22 are the same. d1-03 changes together with F2-22 automatically.
d1-04 (F2-23)	Negative frequency upper limit 1	-800.0%	800.0% to d1-08	Limits the maximum negative operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. d1-04 and F2-23 are the same. d1-04 changes together with F2-23 automatically.

Param.	Name	Default	Value range	Description
d1-05 (F2-24)	Positive frequency upper limit 2	0	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the maximum positive operating frequency. It is a per-unit value based on the rated motor frequency, that is, the value 100% indicates the rated motor frequency. Value description: 0: 800% - The positive frequency upper limit is set to 800%. 2: AI1 - The positive frequency upper limit is input by using current or voltage signals from AI1 and calculated according to the preset AI curve. 3: AI2 - The positive frequency upper limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The positive frequency upper limit is set through the pulse frequency of the DI7 and calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the positive frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 upper limit values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The positive frequency upper limit is set through PID. 9: Communication - The positive frequency upper limit is set through communication. The positive frequency upper limit can be set through remote communication. Other: F connector - The positive frequency upper limit depends on the value of the selected F connector. Note: The effective positive frequency upper limit is the smaller of d1-03 and d1-05.

Param.	Name	Default	Value range	Description
d1-06 (F2-25)	Negative frequency upper limit selection	1	0: -800% 1: Inverted value of positive frequency upper limit 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Limits the maximum negative operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. Value description: 0: -800% - The upper limit is set to -800%. 1: Inverted value of positive frequency upper limit - The inverted value of d1-03 is used as the upper limit. 2: AI1 - The negative frequency upper limit is input by using current or voltage signals from AI1 and calculated according to the preset AI curve. 3: AI2 - The negative frequency upper limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The negative frequency upper limit is set through the pulse frequency of the DI7 and calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the negative frequency upper limit source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 upper limit values. 7: Simple PLC Simple PLC is a multi-reference used to control the running time and acceleration/deceleration time. Multi-reference parameters are used to set the reverse frequency upper limit. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The negative frequency upper limit is set through PID. 9: Communication - The negative frequency upper limit is set through communication. The negative frequency upper limit can be input through remote communication. Other: F connector - The negative frequency upper limit is set through the F connector. Note: The effective negative frequency upper limit is the smaller of d1-06 and d1-07.
d1-05 (F2-24)	Digital setting of positive frequency lower limit	0	0 to d1-04	Limits the minimum positive operating frequency, which is a per-unit value based on the rated frequency of the motor, that is, the value 100% corresponds to the rated frequency of the motor. d1-05 and F2-24 are the same. d1-05 changes together with F2-24 automatically.

Param.	Name	Default	Value range	Description
d1-08 (F2-27)	Digital setting of negative frequency lower limit	0	d1-07 to 0	Limits the minimum negative operating frequency, which is a per-unit value based on the rated motor frequency, that is, the value 100% corresponds to the rated frequency of the motor. d1-08 and F2-27 are the same. d1-08 changes together with F2-27 automatically.

5.2.2.6 Actions for Setpoints Lower Than Minimum Frequency

Application scenarios

This function is used to set the AC drive state when the frequency reference of the drive is lower than the minimum value.

Function description

The minimum frequency of the motor defines the minimum output frequency.

If the frequency reference of the drive is lower than C4-11 [Minimum frequency of the motor], set P0-11 [Operation mode for frequency references lower than the effective lower limit] to define the corresponding action of the drive. Four actions are supported: run at the minimum frequency of the motor, stop, run at zero speed, and coast to stop.

Related parameter

Param.	Name	Default	Value range	Description
P0-11	Operation mode for frequency references lower than the minimum motor frequency	0	0: Run at effective frequency lower limit 1: Stop 2: Run at zero speed 3: Coast to stop	Defines the operation mode when the frequency reference is lower than the effective frequency lower limit. **Value description:** 0: Run at frequency lower limit - During forward run, if the frequency reference is lower than the effective frequency lower limit (U6-08 Minimum positive frequency), the drive operates at the frequency defined by U6-08. During reverse run, if the frequency reference is lower than the absolute value of the effective frequency lower limit (U6-10 Absolute value of minimum negative frequency), the drive operates at the frequency defined by U6-10. 1: Stop - If the set frequency is lower than the effective frequency lower limit, the drive stops. 2: Run at zero speed - If the frequency reference is lower than the effective frequency lower limit, the drive runs at zero speed. 3: Coast to stop - If the frequency reference is lower than the effective frequency lower limit, the drive coasts to stop.

5.2.2.7 Set Frequency Through Terminal

Scenarios

When controlling the AC drive remotely, the user can set the frequency through the DI terminal rather than communication or analog signal input.

Working principle

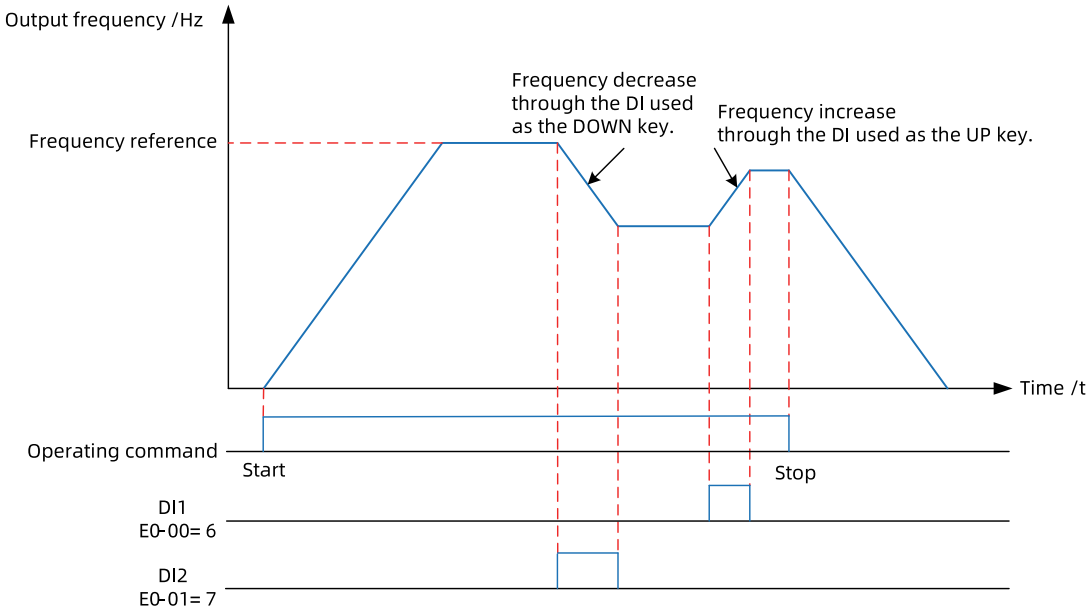


Figure 5-38 Diagram

Set E0-00 (DI1 function selection) to 6 (Function as UP key for frequency adjustment) and E0-01 (DI2 function selection) to 7 (Function as DOWN key for frequency adjustment).

Use P0-87 (Base frequency for target frequency adjusted by UP/DOWN key during operation) to select the base frequency when adjusted by the terminal during running. When P0-87 is set to 0 (operating frequency) by default, the target frequency after terminal adjustment is the current operating frequency (adjustment amount), that is, the operating frequency changes in real time according to the terminal adjustment signal. When DI1 is active at high level, the current frequency increases. When DI2 is active at high level, the current frequency decreases.

In addition, the user can set whether the frequency corrected by UPDOWN is retentive when the AC drive stops through P0-88 (Retention of frequency adjusted by UP/DOWN key upon stop). If you want the frequency reference to be retained at power failure, set P0-88 (Retention of frequency adjusted by UP/DOWN key upon stop) to 1 (Retentive) and P0-89 (Retention of frequency adjusted by UP/DOWN key upon power failure) to 1 (Enable).

Application Example

Set the running AC drive operating frequency as follows.

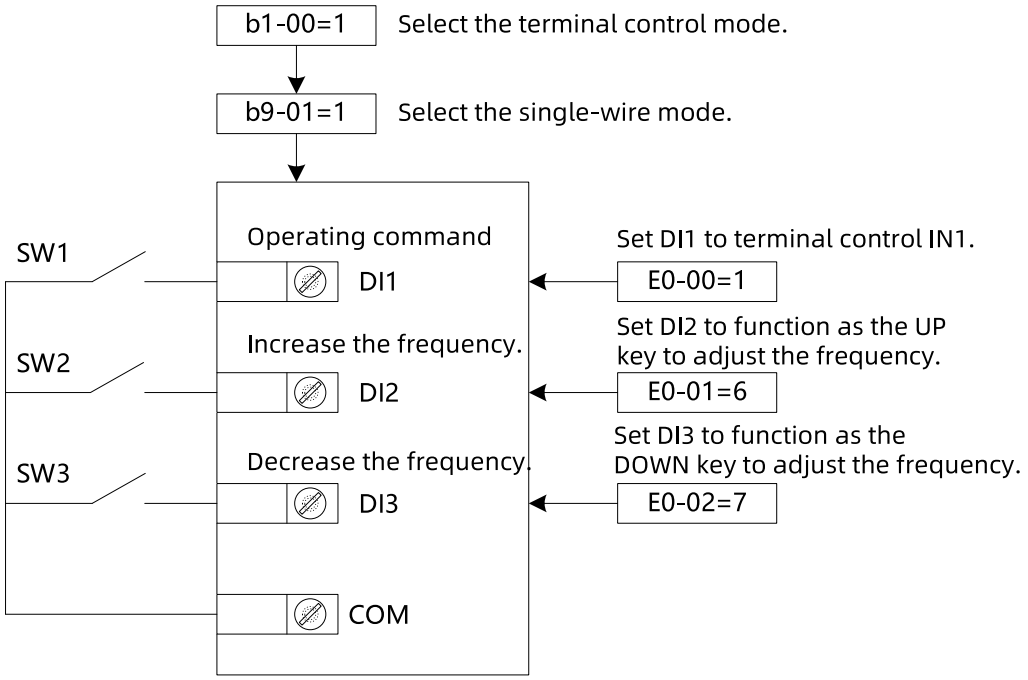


Figure 5-39 Set Frequency Through Terminal

1. Set b1-00 (Main command source of control channel 1) to 1, which is terminal control.
2. Set b9-00 (Terminal start/stop module A/B selection) to 0, which is to select terminal start/stop as module A.
3. Set b9-01 (Mode of terminal start/stop module A), which is to set the terminal control mode to IN1 start.
4. Set E0-00 (DI1 function selection) to select DI1 as the terminal control IN1 function. Set E0-01 (DI2 function selection) and E0-02 (DI3 function selection) to select DI2 and DI3 as frequency adjustment terminals.
5. Set P0-87 (Base frequency for target frequency adjusted by UP/DOWN key during operation) to 0 (operating frequency).

After setting the preceding steps, close DI1 and the AC drive starts running. Close DI3 to decrease the operating frequency. Close DI2 to increase the operating frequency gradually. When DI2 and DI3 are closed at the same time, the command is invalid and the frequency remains unchanged. After the frequency increases to the upper limit or decreases to the lower limit, the frequency does not change.

Related Parameter

Param.	Name	Default	Value range	Description
P0-87	Base frequency for target frequency adjusted by UP/ DOWN key during operation	0	0: Operating frequency 1: Frequency reference	Defines the base frequency for target frequency adjusted by UP/DOWN key during operation. Value description: 0: Running frequency - The target frequency increases or decreases from the operating frequency adjusted by UP/DOWN keys. 1: Frequency reference - The target frequency increases or decreases from the set frequency adjusted by UP/DOWN keys.
P0-88	Retention of frequency adjusted by UP/ DOWN key upon stop	0	0: Non-retentive 1: Retentive	Defines whether the frequency corrected by UP/DOWN key is retentive when the drive stops. Value description: 0: Non-retentive - Set b5-01 and b6-01 (Digital setting of main frequency) through the operating panel, and then adjust the frequency using the ▲ and ▼ keys on the operating panel or the terminal functioning as UP/ DOWN terminals. After the drive stops, the adjusted frequency is cleared. 1: Retentive - Set b5-01 and b6-01 (Digital setting of main frequency) through the operating panel, and then adjust the frequency using the ▲ and ▼ keys on the operating panel or the terminal functioning as UP/ DOWN terminals. After the drive stops, the adjusted frequency is reserved.
P0-89	Retention of frequency adjusted by UP/ DOWN key upon power failure	0	0: Disable 1: Enable	Defines whether the frequency corrected by UP/DOWN is retentive upon power failure. Value description: 0: Disable - Set b5-01 and b6-01 (Digital setting of main frequency) through the operating panel, and then adjust the frequency using the ▲ and ▼ keys on the operating panel or the terminal functioning as UP/ DOWN terminals. The adjusted frequency is cleared upon power-off 1: Enable - Set b5-01 and b6-01 (Digital setting of main frequency) through the operating panel, and then adjust the frequency using the ▲ and ▼ keys on the operating panel or the terminal functioning as UP/ DOWN terminals. The adjusted frequency is saved upon power-off

5.2.3 Torque Reference

5.2.3.1 Select Torque Reference Source Channel

5.2.3.1.1 Selecting Torque Reference as Setting Channel

Selecting Torque Reference

Set b0-03 (Setting channel selection) to modify the currently active setting channel. Refer to *" b0-03" on page 204* for specific parameters. When setting channel 1 is selected, parameters in group b5 are activated, and the torque reference is set by parameters in group b5. When setting channel 2 is selected, parameters in group b6 are activated, and the torque reference is set by parameters in group b6.

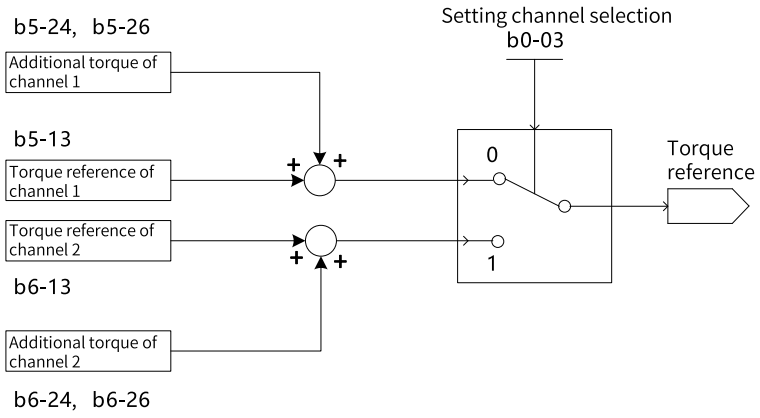


Figure 5-40 Torque reference source

You can also set the additional torque, which is active only during normal operation. The effective additional torque is superimposed directly to the output torque. For details, see *"5.2.3.2 Setting Additional Torque" on page 263*.

Selecting Source for Torque Reference

The setting channel 1 is activated by default. The motor control mode needs to be set to torque control (d0-01 = 1).

Set b5-13 to select the torque reference source for setting channel 1, and set b6-13 to select the torque reference source for setting channel 2. The setting method is similar to frequency reference. Refer to related parameters in *" b513/b613" on page 259* and *" b5-19~b5-23, b6-19~b6-23" on page 259*.

The torque reference is set in percentages, whose base value (100%) is defined by A2-06 (Per-unit torque base value). For detailed parameters, see *" A2-06" on page 261*.

Setting torque reference

Take setting torque reference of control channel 1 as an example.

Application scenario	Operation example	Related parameters
Set torque reference through parameters (b5-13=0)		
Set the value of b5-14 (Digital torque reference) as the active torque source.	Set b5-13 (Torque reference source) to 0 (b5-14).	*" b5-14" on page 261*
Set torque reference through AI (b5-13=2 or 3)		

Application scenario	Operation example	Related parameters
When AI is used as the torque source, the relationship curve between AI and torque setpoint needs to be set.	Take AI1 as an example: 1. Set AI1 curve to "0 V to 10 V (or 0 mA to 20 mA) corresponds to 0% to 100%": • Set E2-40 or F4-28 (Minimum input of AI curve 1) to 0.00 V. • Set E2-41 or F4-29 (Percentage corresponding to minimum input of AI curve 1) to 0.0%. • Set E2-42 or F4-30 (Maximum input of AI curve 1) to 10.00 V. • Set E2-43 or F4-31 (Percentage corresponding to maximum input of AI curve 1) to 100.0%. 2. Set AI filter time through F4-21 (AI1 filter time). 3. Set b5-13 (Torque reference source) to 2 (AI1) to select AI1 as the torque source. After the preceding steps, when AI1 inputs 5 V, 50% is obtained from the AI1 curve and the torque setting is 50%. When AI1 input voltage is changed, the active torque value changes according to the AI1 curve.	**Description:** For detailed AI curve setting methods, see *"5.2.10.8 Analog Input (AI) Terminals" on page 361*. **Parameter configuration:** *" Parameter settings when communication is used as the main frequency source" on page 211* **Related parameters:** *" E2-40 to E2-43" on page 212* Curve 1 setting: E2-40 (F4-28) to E2-43 (F4-31) *" E2-44 to E2-51" on page 213* Curve 2 setting: E2-44 (F4-32) to E2-47 (F4-35) Curve 3 setting: E2-48 (F4-36) to E2-51 (F4-39) *" E2-52 to E2-67" on page 215* Curve 4 setting: E2-52 (F4-40) to E2-59 (F4-47) Curve 5 setting: E2-60 (F4-48) to E2-67 (F4-55) AI curve selection: *" E2-38" on page 217* AI1 filter time: *" E2-10" on page 218*
Set torque reference through pulse (b5-13=5)		

Application scenario	Operation example	Related parameters
This setting method applies to scenarios where high-speed digital input is used as the frequency source and the pulse frequency determines the input frequency.	Take HDI two-point curve as an example: 1. Set E4-00 (HDI terminal type selection) to 0 (Use as HDI). 2. Select HDI pulse as the source of the torque reference of setting channel 1 by setting b0-03 (Setting channel selection) to 0 (Setting channel 1) and b5-13 (Torque reference source) to 5 (HDI pulse). In this mode, the HDI pulse reference must be obtained from multi-functional input terminal DI7. 3. Set the relationship between the HDI frequency input and the two-point curve to "4 kHz to 20 kHz corresponds to 20% to 100%". • Set E4-08 (Minimum input of HDI two-point curve) to 4.00 kHz. • Set E4-09 (Percentage corresponding to minimum input of HDI two-point curve) to 20.0%. • Set E4-10 (Maximum input of HDI two-point curve) to 20.00 kHz. • Set E4-11 (Percentage corresponding to maximum input of HDI two-point curve) to 100.0%. After setting the preceding steps, when the HDI input is 10 kHz, the torque is set to 50%. When the HDI input frequency is changed, the running frequency is processed according to the HDI curve and the torque is changed.	**Description:** For detailed HDI curve setting methods, see *"5.2.10.6 High-Speed Digital Input (HDI)" on page 350*. **Parameter configuration:** *" Parameter setting when torque reference is set through pulse input" on page 261* **Related parameters:** *" E4-08 (F4-71) to E4-11 (F4-74)" on page 218* *" E4-32(F4-83)" on page 219*
Set torque reference through multi-reference (b5-13=6)		
This mode is suitable for applications where the operating frequency of the drive does not require continuous adjustment, and only several frequency values need to be used.	Set b5-13 (Torque reference source) to 6 (Multi-reference) to select the multi-reference as the torque reference. Up to 16 multi-references can be set, which can be selected through b8-03 to b8-06 or combinations of input signals from the four DI terminals. You can also use fewer than four DIs as the multi-reference source. In this case, missing digits are populated with 0. The relationship between the reference quantity and DI quantity is as follows: • Two multi-references: One DI (K1); b8-04 to b8-06 are set to 0. • Three to four multi-references: Two DIs (K1 and K2); b8-05 to b8-06 are set to 0. • Five to eight multi-references: Three DIs (K1, K2, and K3); b8-06 is set to 0. • Nine to sixteen multi-references: Four DIs (K1, K2, K3, and K4)	**Description:** To use multi-reference as the torque reference source, assign functions 12 to 15 to the DIs or set b8-03 (Multi-reference selection bit0) to b8-06 (Multi-reference selection bit3). For details, see *" Parameter settings when multi-reference is torque source" on page 261*. **Related parameters:** *" b8-03 to b8-24" on page 220*
Set torque reference through simple PLC (b5-13=7)		

Application scenario	Operation example	Related parameters
In some industrial applications where functions of start/stop, time- and segment-based speed regulation, and simple automatic forward/reverse run for the AC motor are required (such as concrete mixer, industrial washing machine), using the simple PLC to directly set the running speed, direction, and running time for each stage.	1. Set b0-03 (Setting channel selection) to 0 (Setting channel 1) and b5-13 (Torque reference source) to 7 (Simple PLC) to select PID as the torque reference source of setting channel 1. 2. Set multi-reference parameters, including P1-09, P1-12, P1-15, P1-18, P1-21, P1-24, P1-27, P1-30, P1-33, P1-36, P1-39, P1-42, P1-45, P1-48, P1-51, and P1-54. The 16 multi-references correspond to the set frequencies for the 16 stages of the simple PLC, respectively. Set P1-10 (Operating time of multi-reference 0 set by simple PLC) and P1-11 (Ramp-up/down time of multi-reference 0 set by simple PLC) (and so on for other multi-references) to define the operating time and ramp-up/down time of multi-reference 0. 3. Set P1-02 to select the simple PLC operation mode. 4. Set the ones place (retention upon power-off) of P1-03 to configure whether the current STEP and the current STEP operating time of the simple PLC are retentive upon power-off. Set the tens place (calculation enable configuration) of P1-03 to set the simple PLC module status when the calculation is disabled and enabled again. 5. Set P1-01 (simple PLC calculation enable source). • If the simple PLC calculation is enabled, the simple PLC module runs according to the operation mode of the simple PLC and calculates the current STEP based on the operating time. It also outputs the current STEP and current STEP operating time (hours and seconds) of the simple PLC, as well as the per-unit value obtained in the current STEP. • If the simple PLC calculation is disabled, the current STEP and current STEP operating time (hours and seconds) of the simple PLC are the values when the calculation stops. The per-unit value obtained in the simple PLC step is the value of multi-reference when the calculation stops. 6. Set P1-00 to 1 to enable the simple PLC module. In this case, when the calculation of the simple PLC is enabled, the simple PLC module starts running from STEP 0. The torque reference is set to the reference of STEP 0, that is, multi-reference 0 (P1-09). After the current STEP is performed by the simple PLC, switch to the next STEP, and the torque setpoint is also switched to the torque of the next STEP set by the PLC.	**Parameter configuration:** *"Setting torque through simple PLC" on page 262* **Related parameters:** *"P1-00 to P1-56" on page 224*
Set torque reference through PID (b5-13=8)		

<table>
<tr><th>Application scenario</th><th>Operation example</th><th>Related parameters</th></tr>
<tr><td>PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value.</td><td>1. Set b0-03 (Setting channel selection) to 0 (Setting channel 1) and b5-13 (Torque reference source) to 8 (PID) to select PID as the torque reference source of setting channel 1.
2. Set P2-00 to 1 to enable PID.
3. Set P2-02 to select the target PID reference source. When P2-02 (PID reference source) is set to 0 (PID value reference), set P2-03 (PID value reference). 100% of P2-03 corresponds to the value of P2-05 (PID reference feedback range).
4. Set P2-04 to select the PID feedback source.
5. Set P2-01 to select the PID action direction.
6. Set P2-26 (Maximum output value source) and P2-27 (Minimum output value source) to define the maximum output value and minimum output value of PID respectively. The PID output is between the maximum and minimum values.
In this case, the torque of the drive is set by the PID output value. The PID automatically adjusts the PID output value based on the PID feedback value, with the torque reference of the drive changed accordingly.</td><td>Description:
See detailed PID function description in “5.4.6.2 Process PID Control” on page 642.
Control principle block diagram:
“Diagram of general PID control” on page 263
Related parameters:
“P2-00 to P2-27” on page 230</td></tr>
<tr><td colspan="3">Set torque reference through communication (b5-13=9)</td></tr>
<tr><td>Set the torque through communication.</td><td>1. Set b0-03 to 0 and b5-13 to 9 to select communication as the main torque reference source of setting channel 1.
2. Set n0-14 to select 7310H torque reference configuration.
3. Send a write command to the drive through the host controller.
When the torque source is set to communication, you need to configure basic communication parameters to enable the AC drive to communicate with the host controller. The host controller needs to follow the communication address and format specified by the AC drive to write communication commands to the AC drive.
The following example shows how to set the torque through communication, with the Modbus protocol and address 0x7310. For example, to set the torque to 10.00% (actual transmitted value is 1000) through communication, send the following write command: 01 06 73 10 03 E8 92 35. For details, see the following table.
<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>01H (settable)</td><td>Drive address</td></tr>
<tr><td>06H</td><td>Write command</td></tr>
<tr><td>7310H</td><td>Torque reference address</td></tr>
<tr><td>03E8H (1000 in decimal)</td><td>Target torque</td></tr>
<tr><td>9235H</td><td>CRC</td></tr>
</table>
Set n0-14 = 4, and then write 1000 to 7310H to set the torque to 10%. The set torque can be viewed via U6-11.</td><td>Description:
• MD630S-INT: Modbus
• MD630N-INT: EtherCAT, EtherNet/IP, PROFINET
For communication parameters, see “10.11.1 n Communication Configuration” on page 1639.
For communication addresses, see “Communication Address” on page 236.
Related parameters:
“n0-14” on page 235</td></tr>
</table>

Parameter	Name	Default Value	Value Range	Description
b5-13 b6-13	Torque reference source	0	0: Set by the parameter (b5-14) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0: Digital setting - The torque reference source is the "digital setting of torque reference". 2: AI1 - The torque reference is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2 - The torque reference is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The torque reference is set by the pulse frequency input through DI and calculated according to the corresponding mapping curve. 6: Multi-reference - When multi-reference is used as the torque reference source, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/ deceleration time for each reference and supports up to 16 speeds. 8: PID - The torque reference is set through PID. 9: Communication - The torque reference source is communication. The torque can be input through remote communication. The AC drive must be equipped with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. Others: F connector - A parameter number is set for a float connector, and the value of the connector is read as the torque reference. This mode is used for expansion of common sources.

When set channel 1 is selected, group b5 is activated. In this case, the torque reference is set by group b5. When set channel 2 is selected, group b6 is activated. In this case, the torque reference is set by group b6 parameters.

Param.	Description	Default	Value Range	Descriptions
b5-19 b6-19	Speed limit source in torque mode	0	0: Set by the parameter (b5-20) 1: Speed channel	This parameter sets the speed limit source. **Description** 0：b5-20 - The speed limit source in torque mode is digital setting. The speed limit set by parameter "Digital setting of speed limit" is active. 1：Speed channel - The speed limit in the torque mode is set through the speed channel.
b5-20 b6-20	Digital setting of speed limit in torque control mode	100.0%	-800.0%-800.0%	Defines the digital setting value of the speed limit, which is active when the “Speed limit source” is set to “0：b5-20”.

Param.	Description	Default	Value Range	Descriptions
b5-21 b6-21	Speed limit offset mode in torque mode	0	0: Bidirectional offset 1: Unidirectional offset 2: Overspeed control mode	This parameter sets the speed limit offset mode in the torque mode. **Value description** 0: The offset is valid for both directions. 1: The offset is valid only for unidirectional direction. 2: The offset is valid in both directions. The absolute value of the positive and negative speed limit is the speed limit plus the offset.
b5-22 b6-22	Speed limit offset source in torque mode	0	0: Set by the parameter (b5-23) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter sets the speed limit offset source. **Value description** 0: b5-23 - The speed limit offset source is digital setting. 2: AI1 - The speed limit offset is input by current or voltage signals through AI1 and calculated according to the preset AI curve. 3: AI2 - The speed limit offset is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The speed limit offset is set by using the pulse frequency input through DI4 and calculated according to the corresponding mapping curve. (Only valid for MD630S) 6: Multi-reference - When multi-reference is used as the speed limit offset source, different combinations of DI terminal states correspond to different speed limit offsets. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/ deceleration time for each reference and supports up to 16 speeds. 8: PID - PID is selected as the speed limit offset source. 9: Communication - The speed limit offset source is communication. When selecting the source, you can set the speed limit offset through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector - A parameter number is set for a float connector, and the value of the connector is read as the speed limit offset source. This mode is used for expansion of common sources.
b5-23 b6-23	Digital setting of speed limit offset in torque mode	5.0%	0.0%-800.0%	Defines the speed limit offset as a percentage to the rated speed. This parameter is activated when b5-22 [Speed limit offset source] is set to 0 [b5-23].

When set channel 1 is selected, group b5 is activated. In this case, the torque reference is set by group b5. When set channel 2 is selected, group b6 is activated. In this case, the torque reference is set by group b6 parameters.

Parameter	Description	Default:	Value Range	Descriptions
A2-06	Per-unit base value of torque	0.00	0.0 to 655.35	This parameter indicates the base value of per-unit torque. Base value of per-unit torque = (Rated motor power x 60)/(2PI x Rated motor speed)

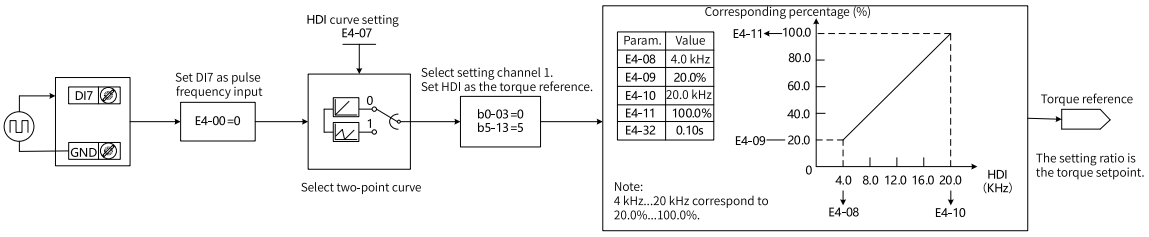


Figure 5-41 Parameter setting when torque reference is set through pulse input

Param.	Description	Default:	Value Range	Descriptions
b5-14	0.0	0.00	-800.0 to 800.0	Defines the digital setting of torque reference.

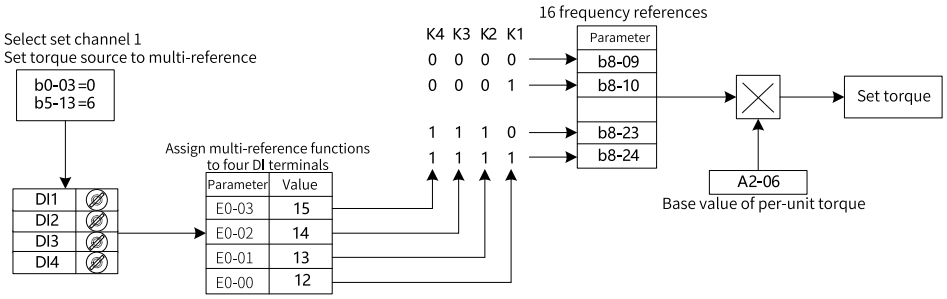


Figure 5-42 Setting torque through multi-reference

The four multi-reference terminals can make up 16 state combinations, corresponding to 16 frequency reference values, as listed in the following table.

Table 5–5 Description of multi-reference function

K4	K3	K2	K1	Reference	Param.
OFF	OFF	OFF	OFF	Multi-reference 0	b8-09 (b8-08=0)
OFF	OFF	OFF	ON	Multi-reference 1	b8-10
OFF	OFF	ON	OFF	Multi-reference 2	b8-11
OFF	OFF	ON	ON	Multi-reference 3	b8-12
OFF	ON	OFF	OFF	Multi-reference 4	b8-13
OFF	ON	OFF	ON	Multi-reference 5	b8-14
OFF	ON	ON	OFF	Multi-reference 6	b8-15
OFF	ON	ON	ON	Multi-reference 7	b8-16
ON	OFF	OFF	OFF	Multi-reference 8	b8-17

K4	K3	K2	K1	Reference	Param.
ON	OFF	OFF	ON	Multi-reference 9	b8-18
ON	OFF	ON	OFF	Multi-reference 10	b8-19
ON	OFF	ON	ON	Multi-reference 11	b8-20
ON	ON	OFF	OFF	Multi-reference 12	b8-21
ON	ON	OFF	ON	Multi-reference 13	b8-22
ON	ON	ON	OFF	Multi-reference 14	b8-23
ON	ON	ON	ON	Multi-reference 15	b8-24

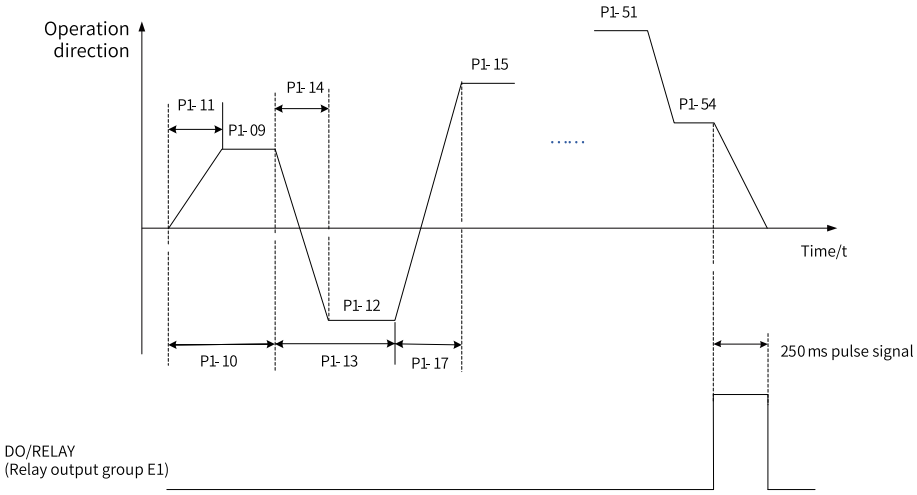


Figure 5-43 Setting torque through simple PLC

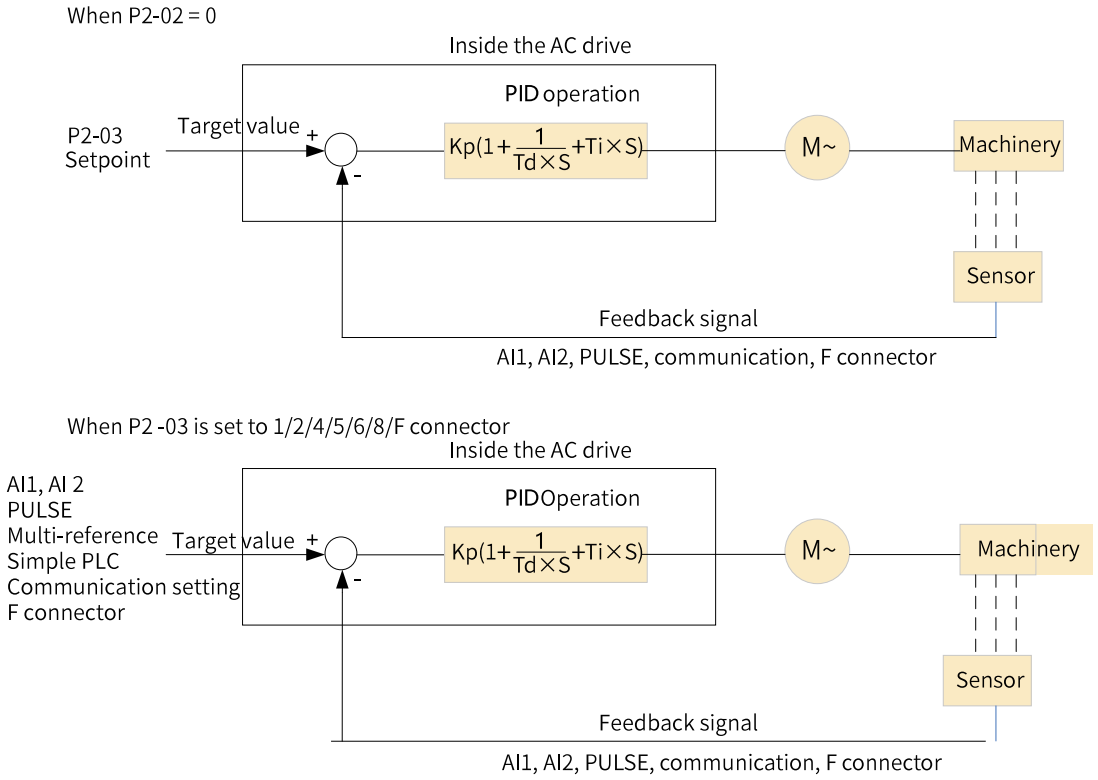


Figure 5-44 Diagram of general PID control

5.2.3.2 Setting Additional Torque

Scenarios

Additional torque (or supplementary torque) is used for scenario that torque adjustment setting is directly effective.

Description

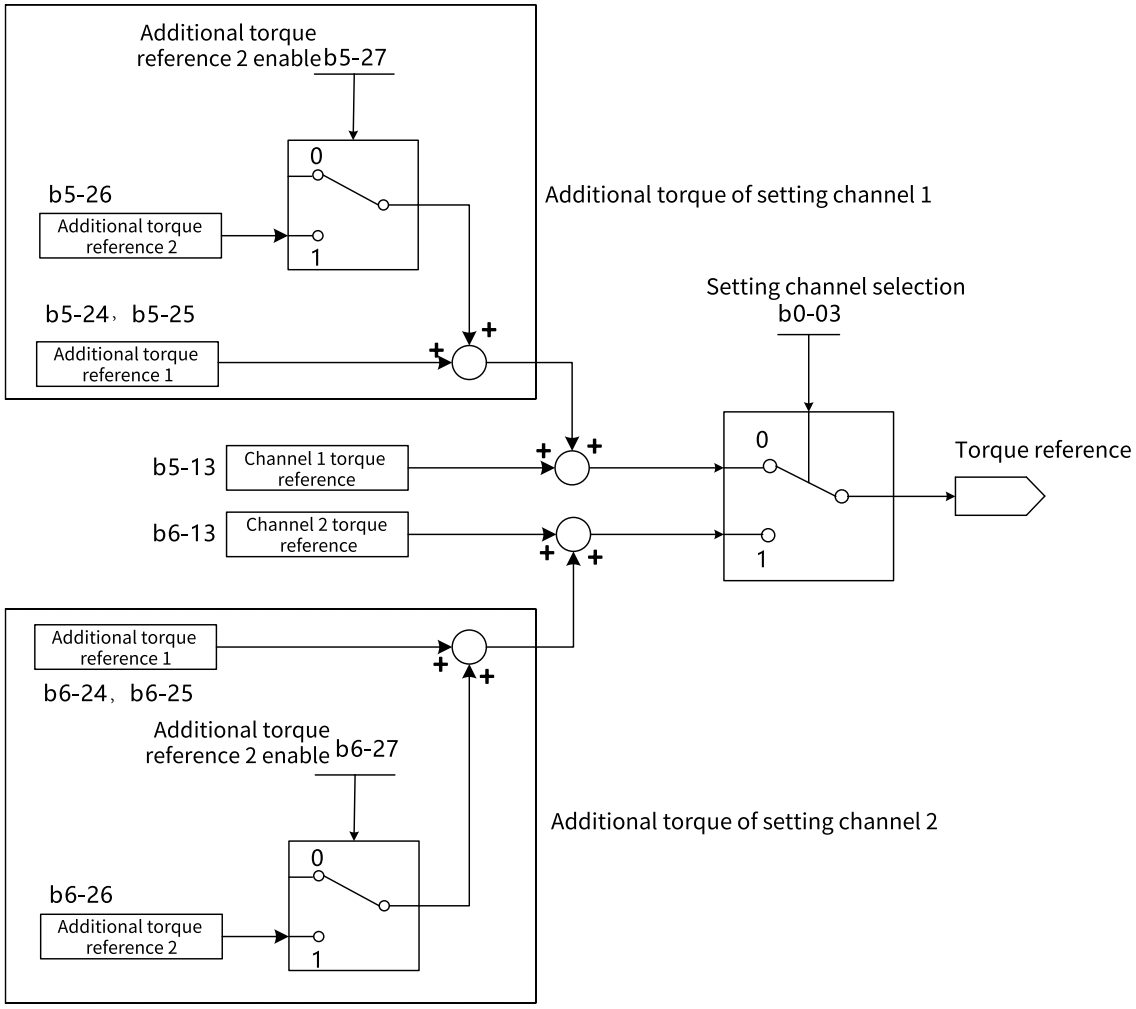


Figure 5-45 Torque reference and additional torque

Related parameters

Table 5–6 Related parameters

Param.	Parameter Name	Default	Value Range	Descriptions
b5-24	Source of additional torque reference 1	0	0: Set by the parameter (b5-25) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the source of additional torque reference 1 Value description 0: b5-25 - The source of additional torque reference 1 is set to "Digital setting of additional torque reference 1". 2: AI1 - The additional torque reference 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The additional torque reference 1 is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse reference - The additional torque reference 1 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference - When multi-reference is used as the source of additional torque reference 1, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID - PID is selected as the source of additional torque reference 1. 9: Communication - The source of additional torque reference 1 is communication. In this mode, the additional torque is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector - A parameter is set for a floating-point connector, and the value of the connector is read as the additional torque reference 1. This mode is used for expansion of common sources.
b5-25	Digital setting of additional torque reference 1	0	-400.0% to 400.0%	Defines the digital value of additional torque reference 1. The value is effective when the source of additional torque reference 1 is set to 0.

Param.	Parameter Name	Default	Value Range	Descriptions
b5-26	Source of additional torque reference 2	0	0: Disabled 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the source of additional torque reference 2 Value description 0: 0 - The source of additional torque reference 2 is set to "0". 2: AI1 - The additional torque reference 2 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The additional torque reference 2 is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse reference - The additional torque reference 2 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference - When multi-reference is used as the source of additional torque reference 2, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID - PID is selected as the source of additional torque reference 2. 9: Communication - The source of additional torque reference 2 is communication. When selecting the source, you can set the additional torque reference 2 through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector - A parameter is set for a floating-point connector, and the value of the connector is read as the additional torque reference 2. This mode is used for expansion of common sources.
b5-27	Additional torque reference 2 enable	0	0: Disabled 1: Enable 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets whether additional torque reference 2 is enabled. When the value is 0, additional torque 2 is disabled. When the value is 1, additional torque 2 is enabled. Value description 0: Additional torque reference 2 is disabled. 1: Additional torque reference 2 is enabled. 3 to 9: DI1 to DI7 - Whether additional torque reference 2 is enabled depends on the terminal state of the DI. Other: B connector - Whether additional torque reference 2 is enabled depends on other B connectors. You can select others (B connector) through the pop-up window.

Param.	Parameter Name	Default	Value Range	Descriptions
b6-24	Source of additional torque reference 1	0	0: Set by the parameter (b6-25) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the source of additional torque reference 1 Value description 0: b6-25 - The source of additional torque reference 1 is set to "Digital setting of additional torque reference 1". 2: AI1 - The additional torque reference 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The additional torque reference 1 is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse reference - The additional torque reference 1 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference - When multi-reference is used as the source of additional torque reference 1, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID - PID is selected as the source of additional torque reference 1. 9: Communication - The source of additional torque reference 1 is communication. In this mode, the additional torque is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector - A parameter is set for a floating-point connector, and the value of the connector is read as the additional torque reference 1. This mode is used for expansion of common sources.
b6-25	Digital setting of additional torque reference 1	0	-400.0% to 400.0%	Defines the digital value of additional torque reference 1. The value is effective when the source of additional torque reference 1 is set to 0.

Param.	Parameter Name	Default	Value Range	Descriptions
b6-26	Source of additional torque reference 2	0	0: Disabled 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Sets the source of additional torque reference 2 Value description 0: 0 - The source of additional torque reference 2 is set to "0". 2: AI1 - The additional torque reference 2 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The additional torque reference 2 is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 5: HDI pulse reference - The additional torque reference 2 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference vWhen multi-reference is used as the source of additional torque reference 2, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID - PID is selected as the source of additional torque reference 2. 9: Communication - The source of additional torque reference 2 is communication. In this mode, the additional torque is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector - A parameter is set for a floating-point connector, and the value of the connector is read as the additional torque reference 2. This mode is used for expansion of common sources.
b6-27	Additional torque reference 2 enable	0	0: Disabled 1: Enable 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets whether additional torque reference 2 is enabled. When the value is 0, additional torque 2 is disabled. When the value is 1, additional torque 2 is enabled. Value description 0: Additional torque reference 2 is disabled. 1: Additional torque reference 2 is enabled. 3 to 9: DI1 to DI7 - Whether additional torque reference 2 is enabled depends on the terminal state of the DI. Other: B connector - Whether additional torque reference 2 is enabled depends on other B connectors. You can select others (B connector) through the pop-up window.

5.2.3.3 Setting Torque Limit

Scenarios

This function is used to limit the motor from running above or below a certain torque by setting the torque limit.

Description

The torque upper limit refers to the maximum torque setting that the motor torque cannot surpass. The torque upper limit refers to the minimum torque. The motor torque setting cannot be lower than the limit.

The torque upper limit is the smaller value of d1-09 (Digital setting of torque upper limit 1) and d1-11 (Source of torque upper limit 2).

The torque lower limit is the larger value of d1-10 (Digital setting of torque lower limit 1) and d1-12 (Source of torque lower limit 2).

Related parameters

Table 5–7 Parameters

Param.	Name	Default	Value Range	Descriptions
d1-09 (F2-30)	Digital setting of torque upper limit 1	200.0	0.0 to 800.0	This parameter limits the positive maximum output torque. It is a per-unit value based on the rated motor torque. **Additional information:** The effective forward torque limit is the smaller value between d1-09 and d1-11.
d1-10 (F2-31)	Digital setting of torque lower limit 1	-200.0	-800.0 to 0.0	This parameter limits the negative maximum output torque. It is a per-unit value based on the rated motor torque. **Additional information:** The effective negative torque limit is the lower value between d1-10 and d1-12.

Param.	Name	Default	Value Range	Descriptions
d1-11 (F2-32)	Torque upper limit 2 selection	0	0: -800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Used to set the torque upper limit 2. It is the per unit value based on the rated torque of the motor. F2-32 is the mapping of d1-11 [Selection of torque upper limit 2] in group F. The two parameters have the same function. The value description is as follows: 0: -800% Set the reverse torque limit to -800%. 2: AI1 - The positive torque limit is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2 - The positive torque limit is input by current or voltage through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The positive torque limit is set through the pulse frequency of the DI7. The corresponding per unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference When multi-reference is used as the forward torque limit source, combinations of different DI states correspond to different forward torque limits. The four multi-reference terminals can provide 16 states, corresponding to 16 limits. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. The positive torque limit is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each frequency reference. Up to 16 speeds can be set. 8: PID - The positive torque limit is set through PID. As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency. 9: Communication - The positive torque limit is set through communication. When selecting the source, you can set the positive torque limit through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector - Set a parameter number for the float connector, and the value of the connector is used as the positive frequency upper limit. This mode is used for expansion of common sources. Note: The effective positive torque limit is the lower one between F2-30 and F2-32.

Param.	Name	Default	Value Range	Descriptions
d1-12 (F2-33)	Torque lower limit 2 selection	1	0: -800% 1: Opposite to the source of torque lower limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Used to set the torque lower limit 2. It is the per-unit value based on the rated torque of the motor. F2-33 is the mapping of d1-12 [Selection of torque lower limit 2] in group F. The two parameters have the same function. The value description is as follows: 0: -800% Set the reverse torque limit to -800%. 1: Inverted value of torque lower limit 2 - The value of d1-11 is inverted. 2: AI1 - The negative torque limit is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2 - The negative torque limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The negative torque limit is set through the pulse frequency of DI7. The corresponding per unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the reverse torque limit, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 states, corresponding to 16 limits. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. The reverse torque limit is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each frequency reference and supports up to 16 references. 8: PID - The negative torque limit is set through PID. As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency. 9: Communication - The negative torque limit is set through communication. When selecting the source, you can set the forward torque limit through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Others: F connector - Set a parameter number for the float connector, and the value of the connector is used as the positive frequency upper limit. This mode is used for expansion of common sources. Note: The effective negative torque limit is the lower one between F2-31 and F2-33.

5.2.4 Start/Stop Mode

5.2.4.1 Startup Mode

The drive supports two startup modes: direct start and flying start. Set d0-02 to select a startup mode of the drive.

Related parameter

Table 5–8 Related parameter

Param.	Name	Default	Value range	Description
d0-02 (F2-15)	Startup mode	0	0: Direct start 1: Flying start	Defines the startup mode of the motor. Value description: 0: Direct start - The drive starts directly. This mode applies to scenarios where the motor starts from a standstill state. 1: Flying start - In this mode, the drive first determines the motor rotation speed and direction, and then starts at the detected frequency of the motor. Select this mode when the motor starts during rotation. For other scenarios, select direct start.

5.2.4.1.1 Flying Start

Application scenarios

If a rotating motor is being started directly, overcurrent may occur due to the inrush current at startup. If it is necessary to restart the motor while the rotor is rotating, the flying start mode can be selected. Flying start is applicable to V/f and SVC modes.

The flying start function is suitable for applications without an encoder, and where it is necessary to track and start a rotating motor.

The flying start mode is usually applied to fields including fans, water pumps, air conditioners, and air compressors.

- For example, after the fan stops, the air inside the air duct can blow the fan blades, causing the motor to rotate.
- After the water pump stops, the water still flows, which can hit the impeller vane, causing the motor to rotate.
- The shutdown time of large equipment lasts for dozens of minutes, so coast-to-stop is usually used for timely stop. In this case, the motor may be still rotating upon next startup.

Function description

In this case, you can set d0-02 [Startup mode] to 1 [Flying start]. See details in *"Table 5-8" on page 272*. Then click the start button. In this case, the drive detects the motor speed and direction first and then starts at the motor frequency tracked.

In this mode, the drive can automatically track the motor speed and direction and achieve bumpless start of a rotating motor.

As shown in the following figure, after startup, the motor synchronous frequency tracks the motor speed in real time. After tracking is done, the normal operation mode applies.

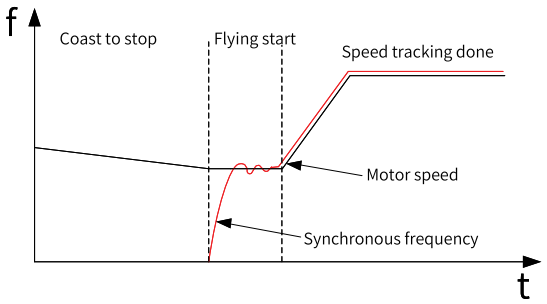


Figure 5-46 Flying start diagram

Note: In field-oriented speed tracking, it is recommended to perform parameter auto-tuning with the motor connected to the drive.

Precautions

1. The preceding four speed tracking modes are available for asynchronous motors in V/f mode. In SVC mode, only field-oriented speed tracking is available.
2. The speed tracking methods 0, 1, and 2 take longer time than the other methods but feature lower requirements on motor parameters.
3. There is no need to change the speed tracking method of synchronous motors.
4. The drive starts after speed tracking, without self-test before startup.

Related parameter

Param.	Name	Default	Value range	Description
d0-03 (F2-16)	Speed tracking mode	4	0: Starting from the stop frequency 1: Starting from the mains frequency 2: Starting from the maximum frequency 4: Field-oriented speed tracking	Defines the speed tracking mode when the drive starts. Value description: 0: Starting from the stop frequency - The speed is searched from the last stop frequency. If an external force drives the motor to a higher speed than the stop speed, this mode is not applicable. 1: Starting from the mains frequency - The current speed is searched from 50 Hz. This mode is suitable for restart after a long power outage. 2: Starting from the maximum frequency - The current speed is searched from F1-10 [Maximum motor frequency]. This mode is generally used for generating loads. 4: Field-oriented speed tracking - The current speed is searched through field-oriented speed tracking. The searching speed is faster than the first three modes. In this mode, the motor parameters need to be auto-tuned. This mode is suitable for fast speed tracking in V/f control.

5.2.4.1.2 Direct Start of Asynchronous Motor (Pre-excitation Start)

Application scenarios

This startup mode is applicable to most load applications. When multiple asynchronous motors need to be started simultaneously, you can use time-based pre-excitation to make multiple asynchronous motors start simultaneously after pre-excitation is done.

The motor, after receiving a start command, runs at the speed defined by RFG and accelerates based on the set acceleration time.

Precautions

1. Pre-excitation start is applicable only to the asynchronous motors in FVC and SVC control modes.
2. Quick start in SVC is equivalent to quick pre-excitation start.
3. The excitation time is defined by d0-18 [Pre-excitation time] only when d0-17 [Pre-excitation mode] is set to 0 [Time-based pre-excitation]. The excitation current is calculated dynamically based on the excitation time. After the excitation time is reached, pre-excitation is done.
4. The excitation current is defined by d0-19 [Pre-excitation current] only when d0-17 [Pre-excitation mode] is set to "Current-based pre-excitation". The excitation time changes dynamically.
5. When pre-excitation start is enabled, the motor speed does not drop upon start. To achieve the same pre-excitation effect for asynchronous motors in V/f mode, apply DC braking start and set the DC braking startup time.

Operating principles

Set d0-02 [Startup mode] to 0 [Direct start] in V/f mode. The motor, after receiving a start command, runs at the speed defined by RFG.

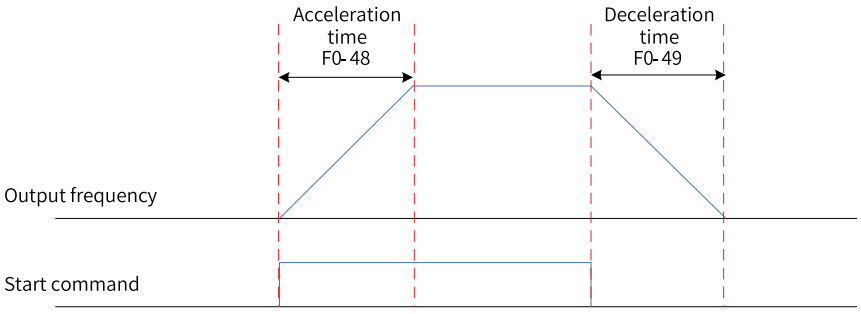


Figure 5-47 Schematic for direct startup

When the asynchronous motor operates in SVC mode, set d0-02 [Startup mode] to 0 [Direct start], and set pre-excitation parameters. The motor needs to enter the pre-excitation state before being started, so that a rotor magnetic field can be established for better control of motor output torque. Pre-excitation can be selected either based on time or current reference. The pre-excitation function is set through d0-17 [Pre-excitation time] to d0-20 [Demagnetization time].

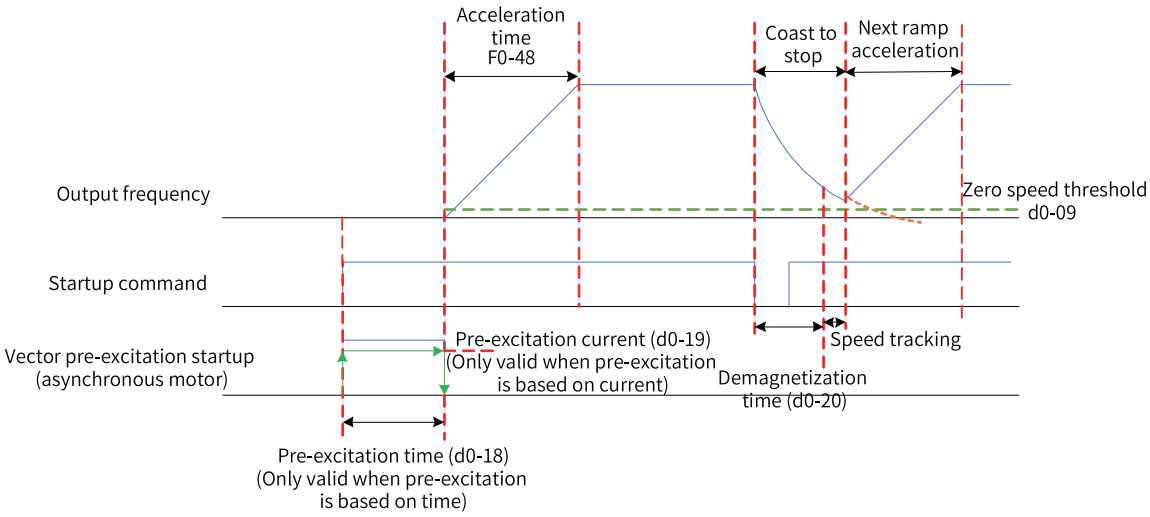


Figure 5-48 Schematic of pre-excitation

Application instance

In applications where multiple asynchronous motors need to be started simultaneously, select time-based pre-excitation (d0-17 = 0) and set the pre-excitation time to the same value through d0-18 so that pre-excitation of multiple asynchronous motors can be completed and started simultaneously. Ensure that the pre-excitation time for each motor is the same. Failure to comply can result in inconsistency in motor startup.

Related parameter

Param.	Name	Default	Value range	Description
d0-17	Pre-excitation mode	1	0: Time-based pre-excitation 1: Current-based pre-excitation 2: Maximum-current-based pre-excitation	Defines the pre-excitation mode for an asynchronous motor in the vector control mode. Value description: 0: Based on time - After the excitation time before start reaches the time set by d0-18, the drive enters the normal operation state. The excitation current reference is calculated by the system automatically. 1: Based on pre-excitation - Excitation is performed based on the setting of d0-19. When the flux reaches the target value, the normal operation state applies. 2: Based on maximum current - The system calculates the maximum current based on the rated drive current and the rated motor current. This mode can realize fast excitation and startup.
d0-18	Pre-excitation time	1000 ms	1 ms to 30000 ms	Defines the pre-excitation time for the asynchronous motor in the vector control mode. Note: This parameter is valid when d0-17 is set to 0.

Param.	Name	Default	Value range	Description
d0-19	Pre-excitation current	100%	1 % to 800%	Defines the pre-excitation current for the asynchronous motor in the vector control mode. Note: 1. The setpoint is a percentage to the rated motor current. 2. This parameter is valid when d0-17 is set to 1.
d0-20	Demag-netization time	0.5s	0s to 5s	Defines the demagnetization time of the asynchronous motor. Note: To restart after coast-to-stop, wait for the time set by d0-20 before the asynchronous motor is demagnetized before start. Note that an excessively short demagnetization time may result in speed tracking failure.

5.2.4.1.3 Direct Start of Synchronous Motor (Magnetic Pole Position Auto-tuning)

Application scenarios

The synchronous motor needs to get the rotor polarity before direct start for driving the motor in the correct direction, preventing overcurrent/overload or stuck upon startup.

Synchronous motors can be divided into salient pole motors and surface-mounted motors. For a salient pole synchronous motor, the magnetic pole position auto-tuning takes about 250 ms. For a surface-mounted synchronous motor, the magnetic pole position auto-tuning takes about 50 ms. The drive switches the magnetic pole position auto-tuning mode based on the motor type detected.

Function description

Direct start of a synchronous motor in SVC mode involves magnetic pole position auto-tuning to obtain the rotor position of the synchronous motor, so that the motor can start running in the correct direction. Auto-tuning helps prevent startup issues such as reverse startup, oscillation, or step loss caused by excessive deviation between the initial pulsing phase angle and the actual position of the motor rotor. In FVC control of a synchronous motor, if an incremental encoder is used, perform magnetic pole position auto-tuning upon initial power-on or initial startup upon fault. If an absolute encoder is used, magnetic pole position auto-tuning is not needed.

The incremental encoders supported are ABZ encoders and sine-cosine encoders. Absolute encoders supported are resolvers, SSI encoders, 23-bit encoders, EnDaT encoders, and BiSS encoders.

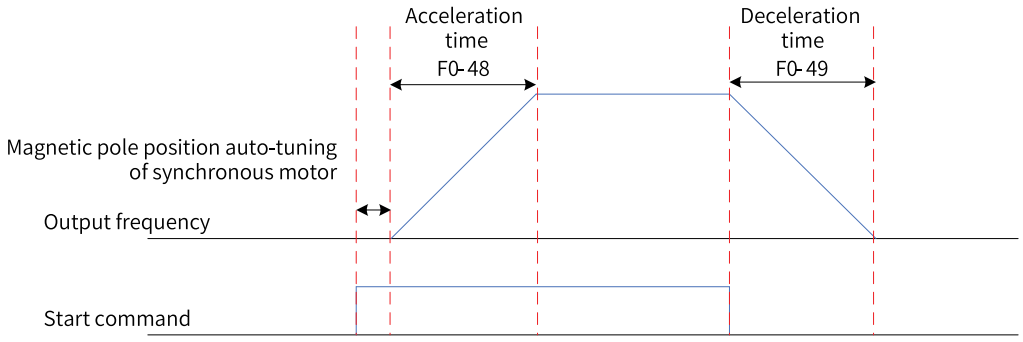


Figure 5-49 Pole position auto-tuning

Precautions

- It is recommended to enable magnetic pole position auto-tuning for direct startup of the synchronous motor. Otherwise, reverse rotation upon startup, oscillation upon sudden acceleration/deceleration, or step loss can occur.
- During detection upon initial power-on, if the motor speed during coast-to-stop is higher than the zero speed threshold, the position is lost. In this case, the position will be auto-tuned again at next direct startup.
- The voltage pulse method is generally suitable for non-salient pole motors, high-frequency injection is suitable for salient pole motors, and pre-positioning is suitable for applications where slight rotation of the motor before startup is acceptable.
- When the voltage pulse method is used, a noticeable sound may occur before startup, which is normal. When high-frequency injection method is used, a "hissing" sound may be generated before startup. In noise-sensitive applications, select the magnetic pole position auto-tuning method before startup based on the motor characteristics.
- Magnetic pole position auto-tuning is performed on the synchronous motor every time upon startup in SVC mode.
- Auto-tuning with voltage pulse lasts about 15 ms.
- Auto-tuning with high frequency injection lasts about 120 ms.
- Auto-tuning with pre-positioning lasts about 2s.

Related parameter

Param.	Name	Default	Value range	Description
d0-70	Magnetic pole position detection upon start of synchronous motor in SVC mode	0	0: Detected every time upon operation 1: Not detected 2: Detected during initial operation upon power-on	Defines the detection mode of the initial position of the synchronous motor before startup. Value description: 0: Detected every time upon operation 1: Not detected 2: Detected during initial operation upon power-on
d0-71	Initial position detection method of synchronous motor before startup	2	0: Voltage pulse 1: High-frequency injection 2: Adaptive 3: Pre-positioning	Defines the initial position detection method of the synchronous motor before start. Value description: 0: Voltage pulse - Voltage pulse is used for magnetic pole position auto-tuning before startup. 1: High-frequency injection - The magnetic pole position is auto-tuned with high-frequency injection before start. 2: Adaptive - Whether to enable high-frequency injection depends on the motor inductance. 3: Pre-positioning - Used to drive the motor to a fixed angle before startup.
d0-75	Initial position detection current of synchronous motor	80	50% to 180%	Defines the target current for magnetic pole position auto-tuning of the synchronous motor. The lower the current, the lower noise is generated during detection. Note that an excessively low setpoint may cause inaccurate position detection. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
d0-76	Initial position compensation angle	0	0.0° to 359.9°	For a synchronous motor, after auto-tuning of the initial magnetic pole position is done, set this compensation angle properly to avoid reverse rotation upon startup. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

5.2.4.2 Stop Mode

Application scenarios

Stop modes specify the actions upon corresponding stop commands, including decelerate to stop, coast to stop, stop at maximum capability,and quick stop. In some special applications, the DC braking at stop is also required.

Operation principles

The drive has three start/stop commands: ON_OFF1 (Start/stop), OFF2 (Coast to stop), and OFF3 (Quick stop).

- ON_OFF1 (Start/Stop): Invalid when the value is 0, valid when the value is 1. The AC drive starts and stops controlled by OFF2 in combination with ON_OFF1 and OFF3. When the OFF2 and OFF3 commands are invalid and no fault exists, the ON_OFF1 command is triggered during the rising edge from 0 to 1. When the stop command is triggered by the falling edge from 1 to 0, the AC drive stops according to the mode set by d0-04 (OFF1 stop mode).
- OFF2 (Coast to stop): Inactive when the value is 1, valid when the value is 0. The AC drive starts and stops controlled by ON_OFF1 in combination with ON_OFF1 and OFF3. When ON_OFF1 is active and the OFF3 command is inactive and no fault occurs, the OFF2 command triggers during the falling edge from 1 to 0. The AC drive stops according to the mode set by d0-05 (OFF2 stop mode).
- OFF3 (Quick stop): Invalid when the value is 1, valid when the value is 0. The AC drive starts and stops controlled by ON_OFF1 in combination with ON_OFF1 and OFF2. When ON_OFF1 is active and the OFF2 command is inactive and no fault occurs, the OFF3 command triggers during the falling edge from 1 to 0. The AC drive stops according to the mode set by d0-06 (OFF3 stop mode).

Operation mode	Command	Value Range	Result
Start	Normal start	ON_OFF1: 0 to 1	The AC drive starts normally.
		OFF2: 1	
		OFF3: 1	
Stop	OFF1 stop command	ON_OFF1: 1 to 0	The drive stops according to the OFF1 setting. The OFF1 stop modes include decelerate to stop, coast to stop, and stop at maximum capability.
		OFF2: 1	
		OFF3: 1	
	OFF2 stop command	ON_OFF1: 1	The drive stops according to the mode set by OFF2 (Coast to stop).
		OFF2: 1 to 0	
		OFF3: 1	
	OFF3 stop command	ON_OFF1: 1	The AC drive stops according to the OFF1 setting. The OFF1 stop mode includes quick stop and stop with maximum capability.
		OFF2: 1	
		OFF3: 1 to 0	

As shown in the preceding table, the stop modes of OFF1 to OFF3 can be set for different commands. The different stop modes are defined as follows:

- Decelerate-to-stop
  d0-04 (OFF1 stop mode) generally selects deceleration to stop. Once the deceleration to stop command is input, the AC drive decreases the output frequency to 0 and then stops based on the RFG deceleration time.

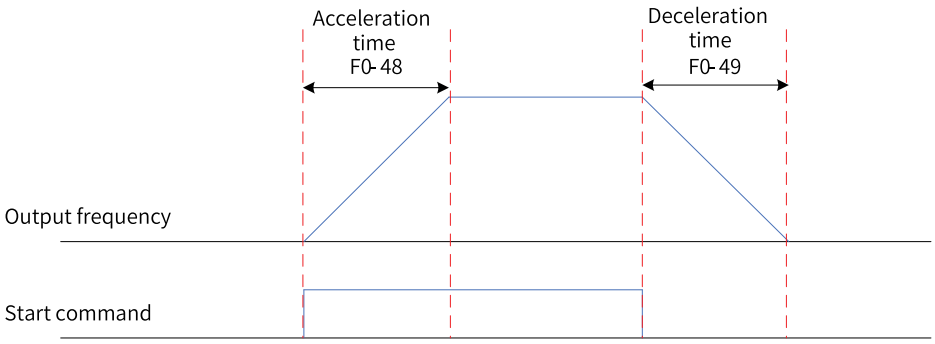


Figure 5-50 Decelerate-to-stop

- Coast to stop
  d0-05 (OFF2 stop mode) is fixed to coast-to-stop. When coast-to-stop is selected, the IGBT output is blocked directly and the motor coasts to stop. For devices with large inertia, it takes long time to be fully stopped. Most faults and OFF2 stop mode can trigger the coast-to-stop mode.

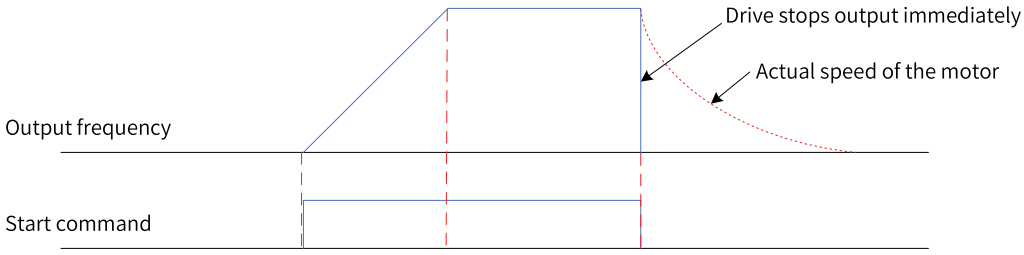


Figure 5-51 Coast to stop

- Stop-at-maximum-capability
  After the stop at maximum capability mode is activated, the speed reference of the motor is forced to be 0. The motor decelerates to 0 based on the maximum output capability. During deceleration, the motor torque or current may reach the limit.
- Quick stop
  d0-06 (OFF3 stop mode) is set to quick stop in general case. The quick stop mode is equivalent to the function of emergency stop assigned to a terminal. The deceleration time is determined by b7-34/b7-35/b7-36.

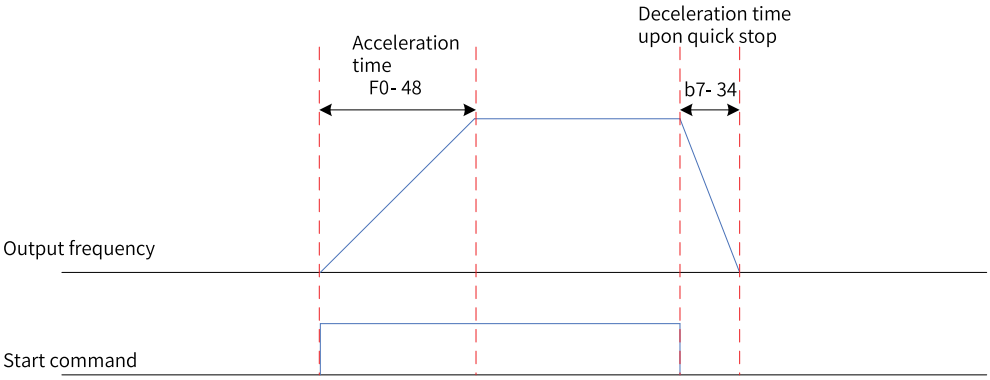


Figure 5-52 Quick stop

If the motor reaches the torque and current limit during deceleration, the corresponding deceleration time will be longer.

Related parameters

Parameter	Parameter name	Default value	Value range	Description
d0-04 (F2-17)	OFF1 stop mode	0	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	Defines the OFF1 stop mode. Value description 0: Decelerate to stop. The stop mode is determined by the valid ramp setting. 1: Coast to stop. The drive stops output to shut down. At this time, the power supply of the motor is cut off and the driving system is in the coast-to-stop state. 2: Stop at maximum capacity. In this mode, the motor speed reference is set to 0 forcibly. The motor decelerates to 0 based on the maximum output capacity. The minimum deceleration time is fixed to 50 ms. The output torque or current may reach the limit value during deceleration.
d0-05	OFF2 (Coast to stop) stop mode	0	0: Coast to stop	This parameter displays the OFF2 stop mode. The default setting is coast to stop.
d0-06	OFF3 (Quick stop) stop mode	0	0: Quick stop 1: Stop at maximum capability	Defines the OFF3 (Quick stop) stop mode. Value description 0: Quick stop. It is equivalent to the function of emergency stop assigned to a terminal. The deceleration time is determined by b7-34/b7-35/b7-36. 1: Stop at maximum capacity. In this mode, the motor speed reference is set to 0 forcibly. The motor decelerates to 0 based on the maximum output capacity. The minimum deceleration time is fixed to 50 ms. The output torque or current may reach the limit value during deceleration.

Parameter	Parameter name	Default value	Value range	Description
d0-07	Stop mode during operation	1	0: OFF1 stop 1: OFF2 (coast to stop) stop mode 2: OFF3 (quick stop) stop mode	This parameter specifies the stop mode after the operation enable signal is deactivated. It is equivalent to the operation pause or operation enable function of the terminal. Value description 0: OFF1 stop mode. The stop mode is determined by d0-04. 1: OFF2 (coast to stop) stop mode. The stop mode is coast-to-stop. 2: OFF3 (quick stop) stop mode. The stop mode is determined by d0-06.
d0-08	Stop mode in torque control	1	0: Forced coast-to-stop 1: Switched to speed control mode and then stop 2: Maintaining torque control mode until zero speed and then block	Defines the stop mode in torque control. Value description 0: Coast to stop forcibly, and the drag system is in the free braking state. 1: Switch to speed mode and stop according to the stop mode active in the current speed mode. 2: The speed limit in the torque mode is reduced to 0 according to the set deceleration time, but the motor is still running in the torque mode. When the actual motor speed reaches 0, the motor stops.

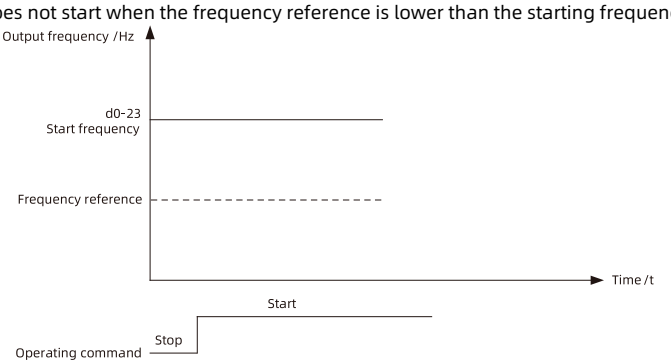
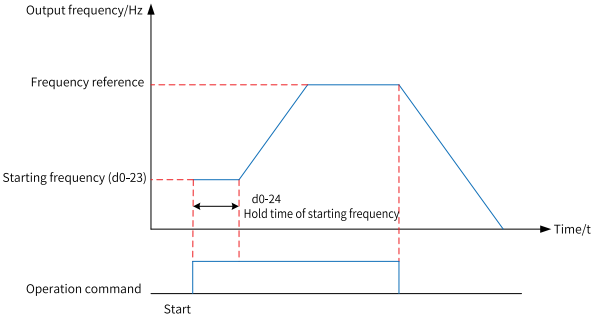
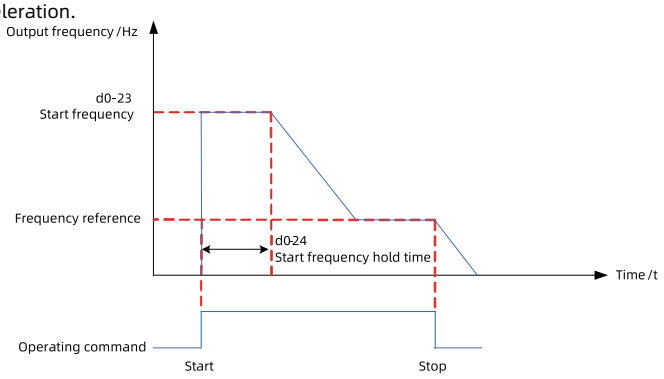
5.2.4.3 Starting Frequency

Application scenarios

When starting torque is needed or when smooth motor startup is needed, the starting frequency can be set, and the set starting frequency can be maintained for a certain period of time.

Function description

Set the starting frequency through d0-22 [Starting frequency function configuration], d0-23 [Starting frequency], and d0-24 [Starting frequency hold time].

<table>
<tr><td>When d0-24 = 0</td><td colspan="2">The starting frequency function is inactive.</td></tr>
<tr><td rowspan="3">When d0-24 ≠ 0</td><td>When d0-22 [Starting frequency function configuration] = 0 [Startup inhibited when frequency reference lower than starting frequency]</td><td>The drive does not start when the frequency reference is lower than the starting frequency.
 
</td></tr>
<tr><td></td><td>When the frequency reference is higher than the starting frequency, the drive outputs the value defined by d0-23 [Starting frequency] directly upon receiving a startup command and keeps the starting frequency within the time defined by d0-24 [Starting frequency hold time] before acceleration.
 
</td></tr>
<tr><td>When d0-22 [Starting frequency function configuration] = 1 [Startup allowed when frequency reference lower than starting frequency]</td><td>No matter whether the frequency reference is lower than the starting frequency, the drive outputs the value defined by d0-23 [Starting frequency] directly upon receiving a startup command and keeps the starting frequency within the time defined by d0-24 [Starting frequency hold time] before acceleration.
 
</td></tr>
</table>

Related parameter

Param.	Name	Default	Value range	Description
d0-23	Starting frequency	0	0.00 Hz to 10.00 Hz	Defines the starting frequency. Note: The starting frequency is outputted once the system is started. After the starting frequency remains unchanged for the time defined by d0-24, the drive accelerates.
d0-24	Starting frequency hold time	0	0.0s to 1000.0s	Defines the hold time of the starting frequency. Note: The setpoint 0 indicates that this function is inactive.

Note: This section only introduces the first set of motor parameters, which also applies to other motor parameter sets.

5.2.4.4 DC Braking

5.2.4.4.1 DC Braking at Start

Application scenarios

The DC braking at start applies to applications where the motor may rotate upon start.

When the asynchronous motor is started in V/f mode, the DC braking function can help increase the starting torque.

For example: Quick acceleration is needed during operation in the V/f modem but the actual motor speed deviates greatly from the speed reference at start due to the lack of flux. In this case, you can apply DC braking at start in V/f mode to all the motors to reduce the speed deviation upon start.

Operating principles

When DC braking is enabled, a DC current is applied to the motor stator winding to generate a braking force that brings the motor to a standstill. Set the start DC braking at startup through d0-25 [DC braking time at startup] and d0-26 [DC braking current at startup]. When d0-25 is set to 0, this function is disabled. Additionally, the current loop during DC braking can be adjusted through d0-31 [Current loop Kp adjustment in DC braking] and d0-32 [Current loop Ti adjustment in DC braking].

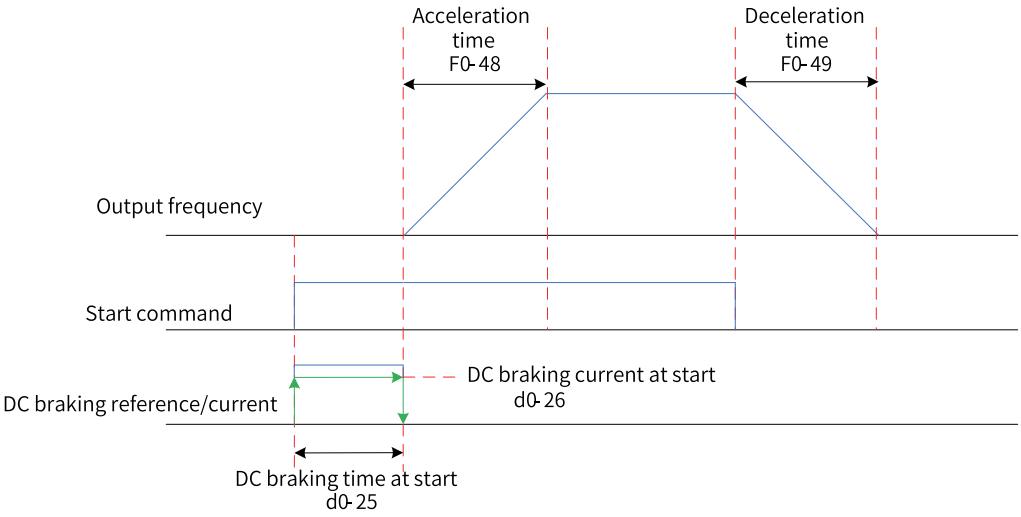


Figure 5-53 Diagram for DC braking at start

Precautions

1. Note that the current and action time of DC braking must be lower than the overload limits of the motor and drive.
2. Long-term braking can keep the asynchronous motor at the zero speed but may result in motor overtemperature.
3. Do not use the DC braking function as a replacement of the brake function configured in the mechanical device.

Warning

Do not use DC braking on traction loads. Pulling the load can cause the motor to rotate, which may result in personal injury or death.

Related parameter

Param.	Name	Default	Value range	Description
d0-25	DC braking time at start	0s	0s to 100s	Defines the DC braking time at startup. Note: This parameter is valid when d0-02 is set to 0 [Direct startup]. The setpoint 0 indicates this function is disabled. When this parameter is set to a non-zero value, the drive outputs DC current (d0-26) continuously to generate a braking force before the motor starts. When the time defined by d0-25 is reached, the normal operation state applies.
d0-26	DC braking current at start	50%	0% to 800%	Defines the DC braking current at startup. The higher the DC braking current, the stronger the braking force can be. Note: The setpoint is a percentage to the rated current of the motor.

Param.	Name	Default	Value range	Description
d0-31	Kp adjustment of DC braking current loop	100.0%	0.1% to 800.0%	Defines the current loop Kp adjustment coefficient during DC braking.
d0-32	Ti adjustment of DC braking current loop	100.0%	0.1% to 800.0%	Defines the current loop Ti adjustment coefficient during DC braking.

5.2.4.4.2 DC Braking at Stop

Application scenarios

In applications where braking with DC current is needed at stop, you can enable DC braking at stop to ensure the load stops properly after the drive stops.

Function description

When DC braking is enabled, a DC current is applied to the motor stator winding to generate a braking force that brings the motor to a standstill.

During decelerate-to-stop, when the operating frequency is reduced to d0-27 [Starting frequency for DC braking at stop], the drive blocks the output. When such state lasts for the time defined by d0-28 [DC braking waiting time at stop], the current defined by d0-30 [DC braking current at stop] is kept outputting for the time defined by d0-29 [DC braking time at stop]. After the time defined by d0-29 elapses, the drive enters the stop state.

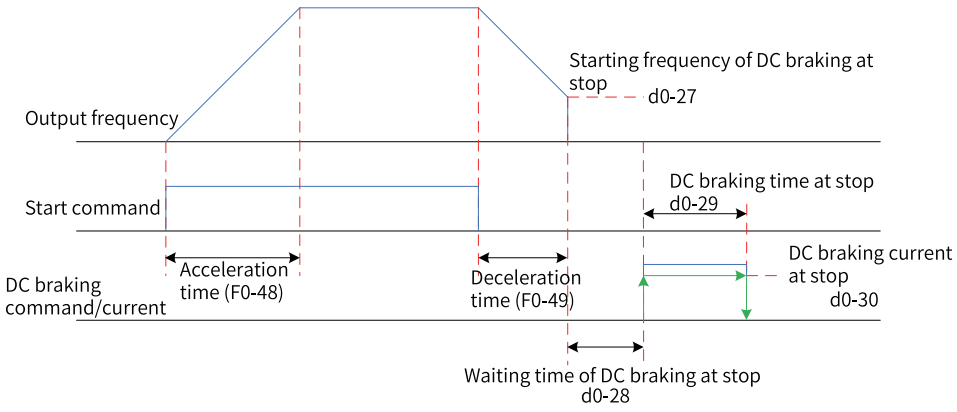


Figure 5-54 DC braking at stop

Precautions

1. The starting frequency for DC braking at stop cannot be set to an excessively high value. Otherwise, overcurrent may occur on the drive.
2. For asynchronous motors, if the waiting time for DC braking at stop is set to an excessively low value, overcurrent may easily occur on the drive.
3. Note that the current and action time of DC braking must be lower than the overload limits of the motor and drive.

DC braking hold at stop

When it is necessary to maintain the DC braking state after stop, enable the DC braking hold function through bit0 of d0-15. After this function is enabled, the DC braking time at stop is set to an infinite value. Upon receiving a startup command, the system can exit the DC braking state normally and enter the operation state.

To exit from the DC braking hold state at stop, you can disable this function through bit0 of d0-15.

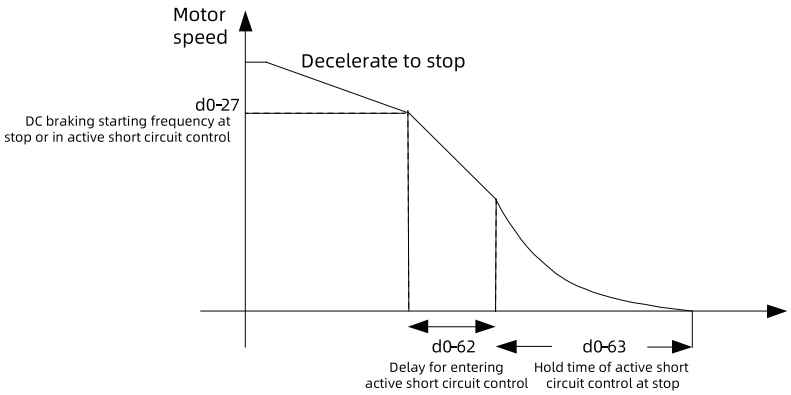


Figure 5-55 DC braking at stop

Related parameter

Param.	Name	Default	Value range	Description
d0-15	Control function configuration at stop	0	0x0000 to 0xFFFF	bit0: DC braking hold at stop 0: Disabled - Whether DC braking at stop is enabled depends on d0-29. In the stop state, the DC braking duration is limited by d0-29. 1: Enabled - DC braking at stop is enabled. In the stop state, DC braking remains is kept active, not limited by d0-29. bit1 to bit15: Reserved 0: Disable 1: Enable
d0-27	Starting frequency of DC braking at stop	0.0 Hz	0.0 Hz to 600.0 Hz	Defines the starting frequency of DC braking at stop. Note: When both the active short circuit control and DC braking are enabled, active short circuit control is responded to first, without executing DC braking. When active short circuit control is enabled: During decelerating to stop, when the operating frequency drops to d0-27, the drive blocks the output until the time defined by d0-62 elapses where the drive enters the active short circuit control state. After the hold time defined by d0-63 elapses, the drive enters the stop state. When only DC braking is enabled: 1. During decelerating to stop, when the operating frequency drops to d0-27, the drive blocks the output until the time defined by d0-28 elapses where the drive outputs the DC braking current defined by d0-30. After the time defined by d0-29 elapses, the drive enters the stop state. 2. Do not set this parameter to an excessively high value. Failure to comply can result in overcurrent of the drive.
d0-28	Waiting time of DC braking at stop	0.0s	0.0s to 100.0s	Defines the waiting time of DC braking at stop. Note: 1. During decelerate-to-stop, when the operating frequency is reduced to d0-27 [Starting frequency for DC braking at stop], the drive blocks the output. When such state lasts for the time defined by d0-28 [DC braking waiting time at stop], the current defined by d0-30 [DC braking current at stop] is kept outputting for the time defined by d0-29 [DC braking time at stop]. After the time defined by d0-29 elapses, the drive enters the stop state. 2. The waiting time is used to allow the asynchronous motor to demagnetize. If the waiting time is too short, overcurrent may easily occur.
d0-29	DC braking time at stop	0.0s	0.0s to 100.0s	Defines the DC braking time at stop. Note: During decelerate-to-stop, when the operating frequency fall to the value of d0-27, the drive blocks the output and stays in this state for the duration specified in d0-28. Then, the drive keeps outputting the DC injection braking current specified in d0-30 for the duration specified in d0-29. Finally, the drive enters the stop state. The value 0 indicates that the function of DC braking at stop is disabled.

Param.	Name	Default	Value range	Description
d0-30	DC braking current at stop	50%	0% to 800%	Defines the DC braking current at stop. Note: 1. During decelerate-to-stop, when the operating frequency is reduced to d0-27 [Starting frequency for DC braking at stop], the drive blocks the output. When such state lasts for the time defined by d0-28 [DC braking waiting time at stop], the current defined by d0-30 [DC braking current at stop] is kept outputting for the time defined by d0-29 [DC braking time at stop]. After the time defined by d0-29 elapses, the drive enters the stop state. 2. The current percentage is based on the rated current of the motor. The higher the setpoint, the higher the braking intensity.
d0-31	Kp adjustment of DC braking current loop	100.0%	0.1% to 800.0%	Defines the current loop Kp adjustment coefficient during DC braking.
d0-32	Ti adjustment of DC braking current loop	100.0%	0.1% to 800.0%	Defines the current loop Ti adjustment coefficient during DC braking.

5.2.4.5 Timed Automatic Stop

Application scenarios

If you want the drive to stop automatically after operation of a certain period, set the timed operation time for the drive through P0-13 (Timing function) to P0-15 (Timed operation duration). The timer starts from 0 upon startup of the drive. When the timing duration expires, the drive automatically stops.

When the RO or DO function is set to 30 (Timing reached) and the operation time of the drive reaches the set time, the RO or DO outputs an active signal.

Operation principles

Set whether to enable timed operation of the drive through P0-13 (Timing function). When timed operation is enabled, the timer starts from 0 upon startup of the drive. When the timing duration expires, the drive automatically stops. The remaining operation time can be viewed through U0-20 (Remaining time of timed operation).

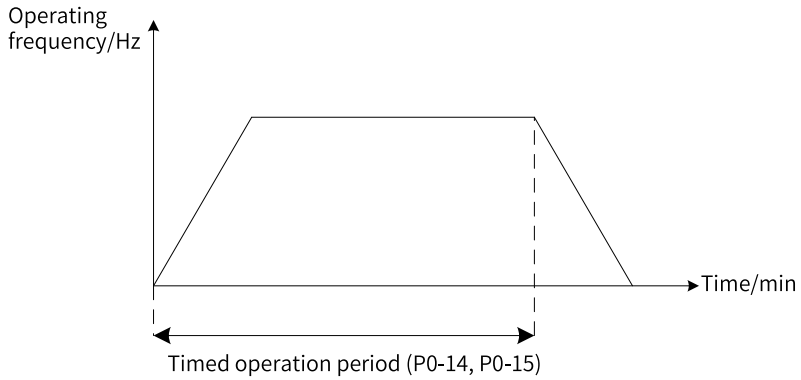


Figure 5-56 Timed operation

Specifically, set the timed operation duration (min) through P0-14 (Timed operation duration source) and P0-15 (Digital setting of timed operation duration). When the timed operation duration is set to 0, the timed operation is not active. Set the source of timed operation duration through P0-14.

1. When P0-14 (Timed operation duration source) is set to 0 (Set by P0-15), the timed operation duration is determined by the value of P0-15.
2. When P0-14 (Timed operation duration source) is set to 1 (AI1) or 2 (AI2), the timed operation duration equals the result of (AI voltage/10 V) x P0-15.
3. When P0-14 (Timed operation duration source) is set to Other (F connector), the timed operation duration equals the result of floating point connector value x P0-15.

By default, P0-14 (Timed operation duration source) is set to 0 (Set by P0-15). Set the timed operation duration through P0-15.

Related parameters

Parameter	Parameter name	Default value	Value range	Description
P0-13	Timing function	0	0: Inactive 1: Active	Used to set whether the timed operation of the drive is active. Value description 0: Inactive 1: Enable. The timer starts upon startup of the AC drive. When the set timing duration is reached, the AC drive stops automatically and meanwhile the corresponding multi-function DO outputs ON signal. Additional information: 1. The timing duration is set by P0-14 and P0-15 in the unit of minute. 2. The AC drive starts timing from 0 each time it starts up and the remaining timing duration can be viewed in U0-20.
P0-14	Timed operation duration source	0	0: P0-15 1: AI1 2: AI2 Others: F connector	Defines the source of the timed operation time. Value description 0: Set by P0-15 The timing operation duration is set by P0-15. 1: AI1 The timing operation duration is set by AI1 input voltage and P0-15. 2: AI2 The timing operation duration is set by AI2 input voltage and P0-15. Others: F connector The timing operation duration is set by the F connector value and P0-15. Additional information: When this parameter is set to 1, the timing operation duration equals the result of (AI voltage/10 V) x P0-15. 100% of the analog input range corresponds to P0-15.
P0-15	Digital setting of timing operation duration	0.0 min	0.0 min to 6500.0 min	Set the local digital value of the timed operation time.
U0-20	Timed remaining running time	0.0	0.0 to 6553.5	This parameter indicates the remaining time for timing operation in the unit of minute.

5.2.4.6 Hibernation and Wakeup

Application scenarios

Hibernation enables you to set any time period within 24 hours, during which the AC drive stops running and hibernates.

Wakeup is a process that the AC drive wakes up from the hibernation state and starts to run.

Operation principles

To use the hibernation and wakeup functions, set the hibernation frequency and wakeup frequency. As shown in the following figure, set the hibernation function through P0-24 (Hibernation frequency)

and P0-25 (Hibernation delay). If the AC drive is running, when the frequency reference is less than or equal to the hibernating frequency (P0-24), after the hibernating delay (P0-25), the AC drive starts to hibernate and decelerates to stop. Set the wakeup function through P0-22 (Wakeup frequency) and P0-23 (Wakeup delay). In hibernating state, when the frequency reference is equal to or greater than P0-22 (Wakeup frequency), the drive wakes up after delay set by P0-23 (Wakeup delay).

Generally, set the wakeup frequency (P0-22) equal to or higher than the hibernation frequency (P0-24). The hibernation and wakeup function is disabled if both the wakeup frequency and hibernation frequency are set to 0.0 Hz.

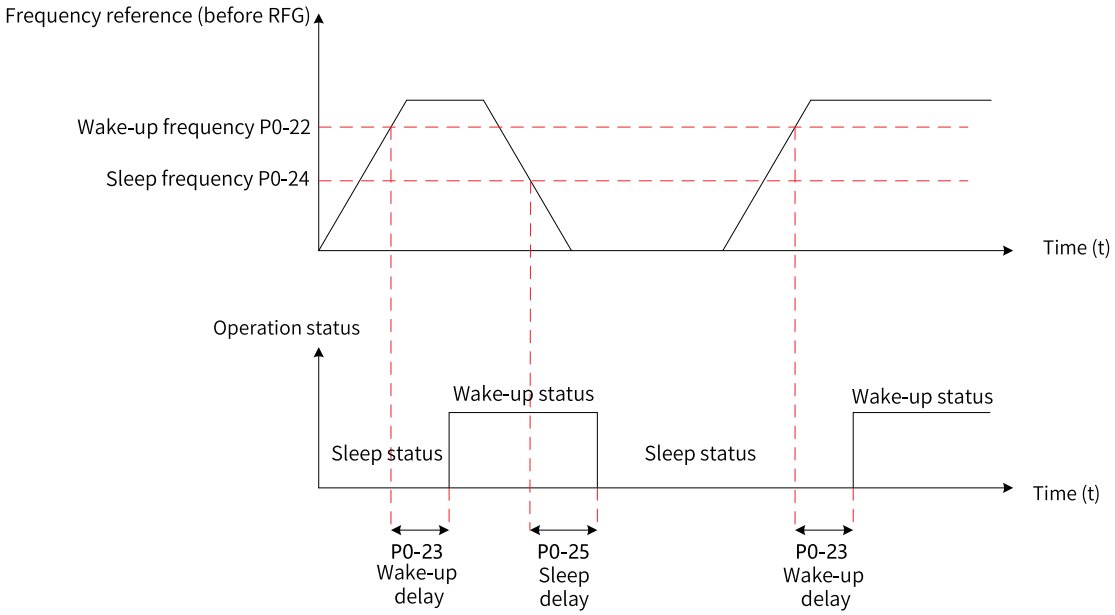


Figure 5-57 Hibernation and wakeup settings

Note:

(1) The upper limit of the hibernation frequency can be set to wakeup frequency. You need to set P0-22 (Wakeup frequency) first and then P0-24 (Hibernation frequency).

(2) When hibernation is enabled during PID operation, you can set P2-33 (selection of PID operation at stop) to 1 to continue the PID operation or to 0 to stop PID operation.

Related parameters

Parameter	Parameter name	Default value	Value range	Description
P0-22	Wakeup frequency	0.00 Hz	P0-24 to A2-17	Sets the wakeup frequency of the drive to exit the hibernation state. Additional information: If the AC drive is hibernating and the current RUN command is active, when the frequency reference is greater than or equal to the wakeup frequency (P0-22), the AC drive starts directly after the wakeup delay (P0-23).
P0-23	Wakeup delay	0.0s	0.0s to 6500.0s	Defines the wakeup delay time of the drive. Additional information: If the AC drive is hibernating and the current RUN command is active, when the frequency reference is greater than or equal to the wakeup frequency (P0-22), the AC drive starts directly after the wakeup delay (P0-23).
P0-24	Hibernation frequency	0.00 Hz	0.00 Hz to P0-22	Sets the hibernating frequency of the drive. The drive enters the hibernation state when the frequency reference in the running state is lower than the hibernating frequency. Additional information: If the AC drive is running, when the frequency reference is less than or equal to the hibernating frequency (P0-24), after the hibernating delay (P0-25), the AC drive starts to hibernate and decelerates to stop.
P0-25	Hibernation delay	0.0s	0.0s to 6500.0s	Defines the hibernation delay of the drive. Additional information: If the AC drive is running, when the frequency reference is less than or equal to the hibernating frequency (P0-24), after the hibernating delay (P0-25), the AC drive starts to hibernate and decelerates to stop.

5.2.4.7 Startup Protection

Application scenarios

The startup protection function is used to apply protection upon start of the drive to prevent dangers caused by inadvertent motor responses to the operation commands. The function can protect the following situations:

1. If the running command is valid when the AC drive is powered on (for example, an input terminal is ON before power-on), the AC drive does not respond to the command. The AC drive responds only after the running command is canceled and becomes valid again.
2. If the running command is valid when the AC drive fault is reset, the AC drive does not respond to the running command. The startup protection can be disabled only after the running command is canceled. The AC drive starts to run when the running command is valid again.

Operation principles

This device uses P0-21 to set whether the startup protection function is active. When P0-21 is set to 1, the function is active. The running command is valid when the AC drive is powered on or fault reset. The AC drive does not respond to the running command. The running command must be removed before the running protection state can be eliminated. The running command is valid again before the AC drive starts running.

Related parameters

Parameter	Parameter name	Default value	Value range	Description
P0-21	Startup protection selection	1	0: Disable 1: Protection	Set the startup protection function of the AC drive. Value description: 0: Disable 1: Protection Additional information: 1. When the parameter is set to 1, if the running command is active when the device is powered on (for example, the terminal running command is closed before power-on), The drive does not respond to the running command. The running command must be removed once, and the running command becomes valid again before the drive responds. 2. When the parameter is set to 1, the drive does not respond to the running command when the fault is reset. The running protection state can be eliminated only after the running command is removed.

Note: This parameter is invalid when the fault is reset and the protection is always active.

5.2.5 Jog

5.2.5.1 Jog

Jog

In some applications, the AC drive needs to run at a low speed temporarily to facilitate equipment testing. In this case, jogging is applied.

Operation principles

The MD630-INT supports up to two jog commands. Take set channel 1 and control channel 1 as an example. Set jog 1 frequency through b5-07 (Jog 1 frequency source selection) and b5-08 (Jog 1 frequency reference). Set jog 2 frequency through b5-09 (Jog 2 frequency source selection) and b5-10 (Jog 2 frequency reference). Set whether jog 1 command is valid through b1-06 (user-defined jog 1 command source) and whether jog 2 command is valid through b1-07 (user-defined jog 2 command source).

Set the base frequency through b7-01 (ramp acceleration/deceleration time base frequency). Set jog acceleration/deceleration time source through b7-31 (jog ramp source). When b7-31 is set to 0, the jog acceleration/deceleration time is the same to that during normal operation. When b7-31 is set to 1, the jog acceleration/deceleration time depends on b7-32 (jog ramp acceleration time, also called jog ramp-up time) and b7-33 (jog ramp deceleration time, also called jog ramp-down time). The following figure shows the relationship between the output frequency and acceleration/deceleration time during jogging.

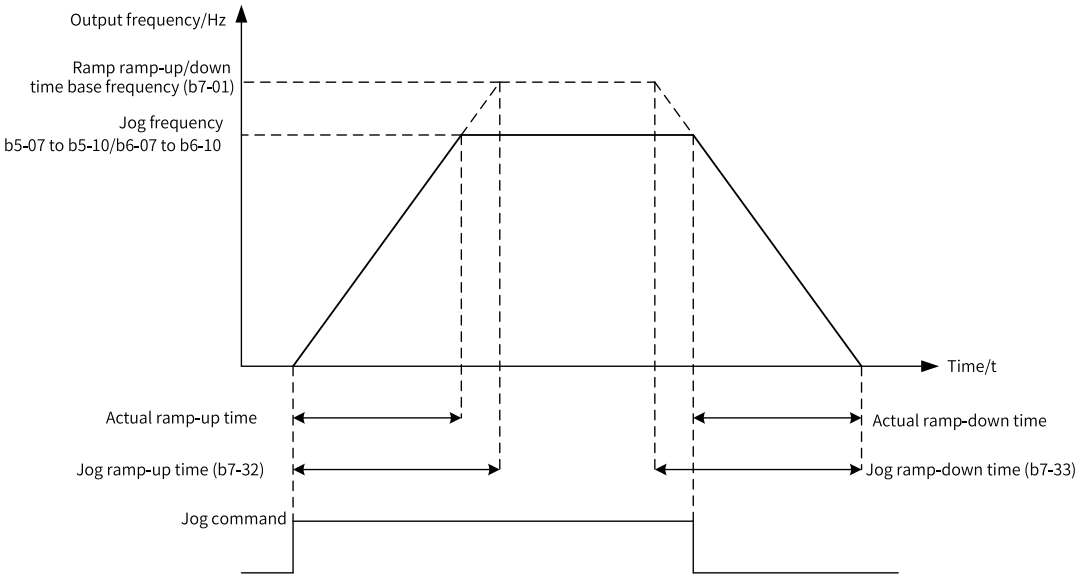


Figure 5-58 Jog

When the jog 1 command and jog 2 command are set simultaneously, the drive responds to jog 1 command first. As shown in the following figure, when the jog 1 command and jog 2 command are simultaneously input, the drive starts at the frequency set by jog 1 through b5-07 (jog 1 frequency source) and b5-08 (jog 1 frequency reference). If the jog 1 command is canceled, the drive starts at the frequency set by jog 2 through b5-09 (jog 2 frequency source) and b5-10 (jog 2 frequency reference).

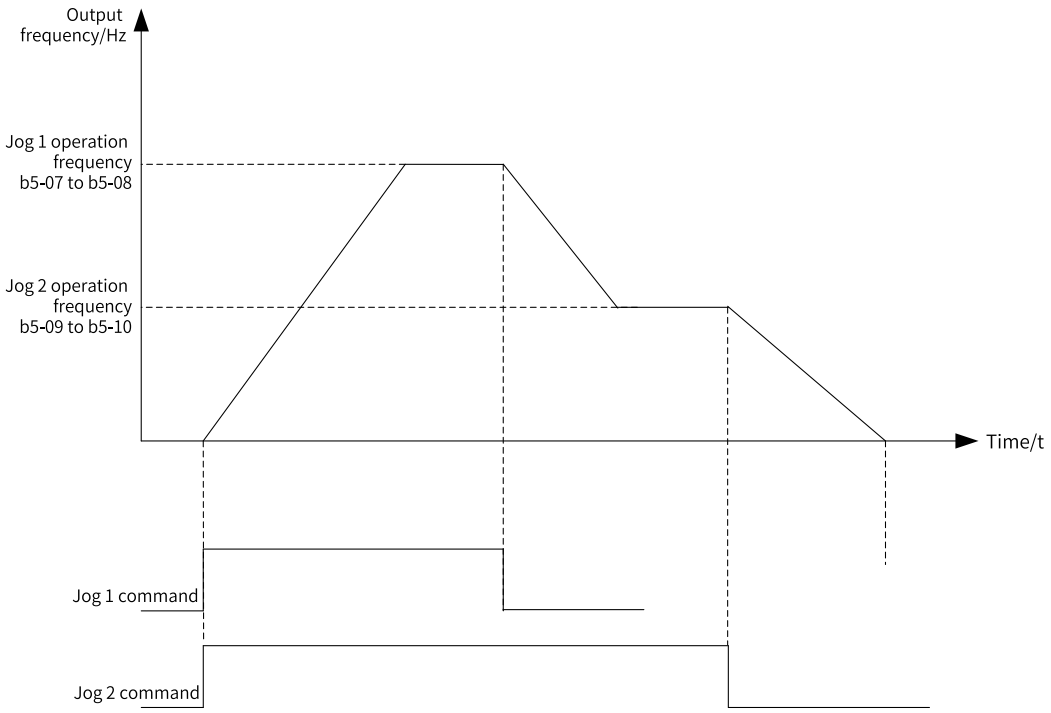


Figure 5-59 Relationship between jog 1 command and jog 2 command

Additionally, you can set the priority of jog command and normal operation command through b1-09 (JOG/ON_OFF1 priority mode selection).

- When b1-09 is set to 0, the priority is not differentiated. The drive responds to the command that arrives first and does not respond to the command that arrives later. As shown in the following figure, the jog 1 command is input first. Therefore, the drive starts at the frequency set by jog 1 through b5-07 (jog 1 frequency source) and b5-08 (jog 1 frequency reference). In this case, while ON_OFF1 (normal operation command) is active, the drive does not respond.

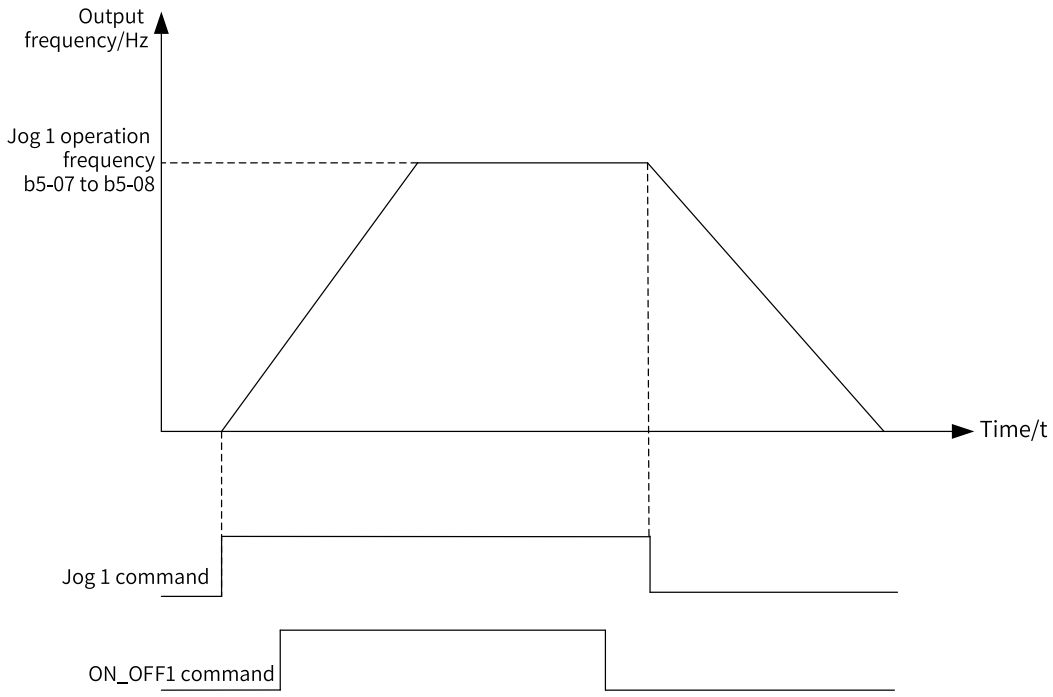


Figure 5-60 Relationship of jog 1 command (input first) and ON_OFF1 command

As shown in the following figure, ON_OFF1 (normal operation command) is input first. Therefore, the drive starts at the frequency set by ON_OFF1 through b5-00 to b5-06. In this case, while the jog 1 command is active, the drive does not respond.

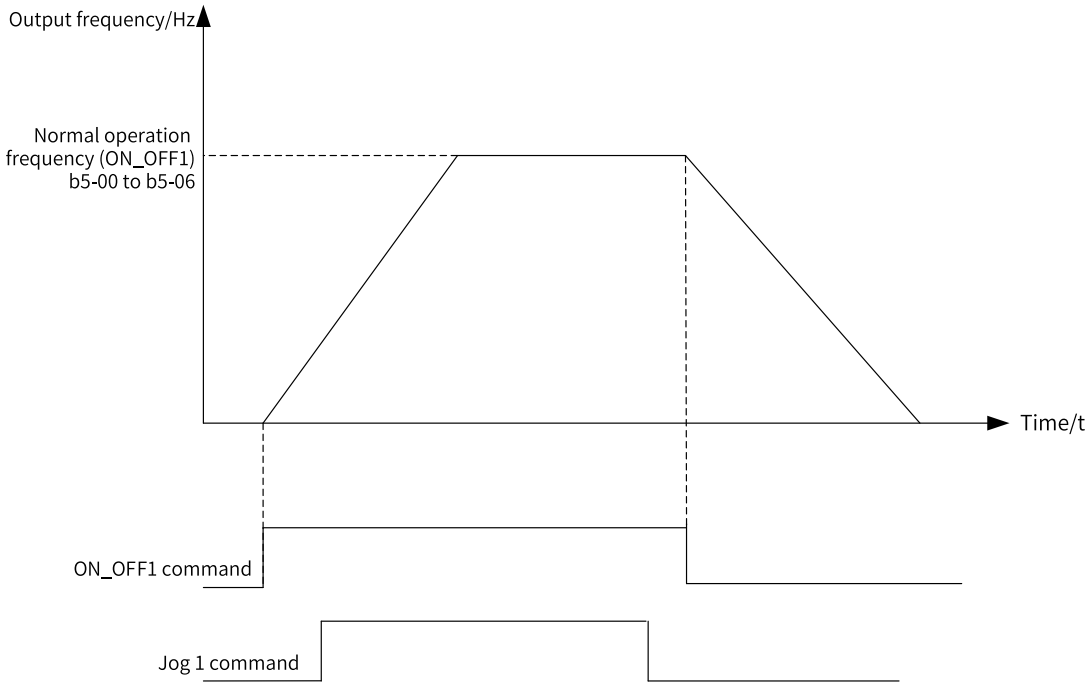


Figure 5-61 Relationship of jog 1 command and ON_OFF1 command (input first)

- When b1-09 is set to 1, jog commands are preferred. Normal operation can be interrupted by the jog command. That is, as long as the jog command is active, the drive runs at the jog frequency set through b5-07 (Jog 1 frequency source) and b5-08 (Jog 1 frequency reference).

As shown in the following figure, the ON_OFF1 command is active and the drive starts at the frequency set through b5-00 to b5-06. However, if the jog 1 command is activated during normal operation, the drive responds immediately and switches to the frequency set by jog 1 through b5-07 (jog 1 frequency source) and b5-08 (jog 1 frequency reference) until the jog 1 command is canceled.

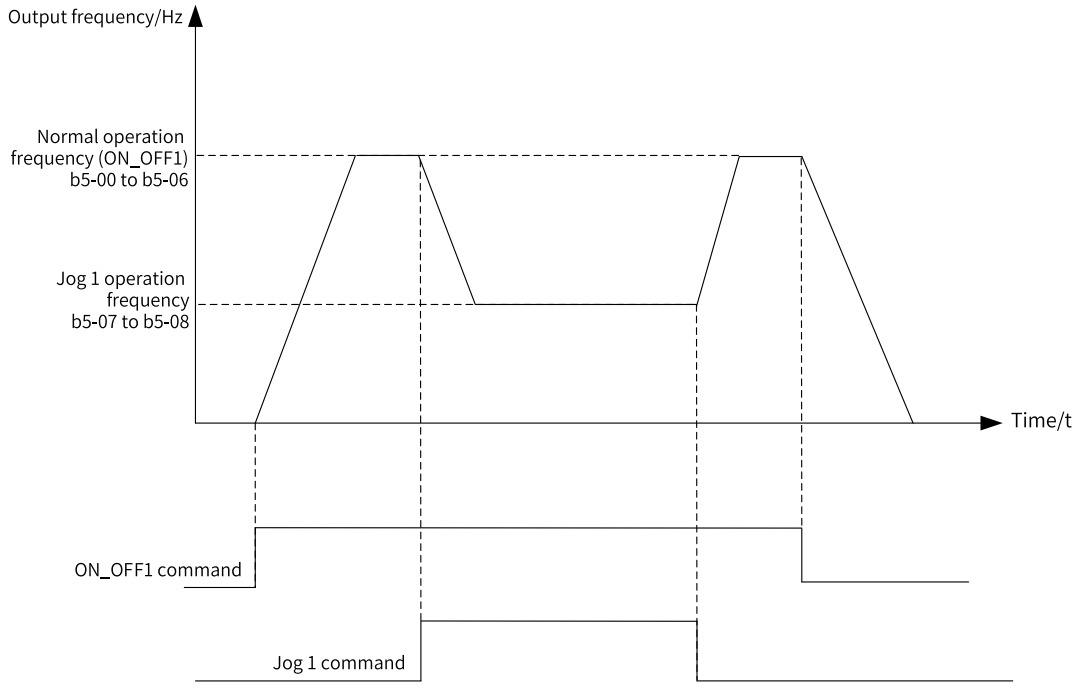


Figure 5-62 Relationship of jog 1 command (prioritized) and ON_OFF1 command

- When b1-09 is set to 2, normal operation commands are preferred. Normal operation can be interrupted by the jog command. That is, as long as the ON_OFF1 command is active, the drive runs at the frequency set through b5-00 to b5-06.
  As shown in the following figure, the jog 1 command is active, and the drive starts at the frequency set by jog 1 through b5-07 (jog 1 frequency source) and b5-08 (jog 1 frequency reference). However, if the ON_OFF1 command is activated during jog operation, the drive responds immediately and switches to the frequency set by ON_OFF through b5-00 to b5-06 until the ON_OFF1 command is canceled.

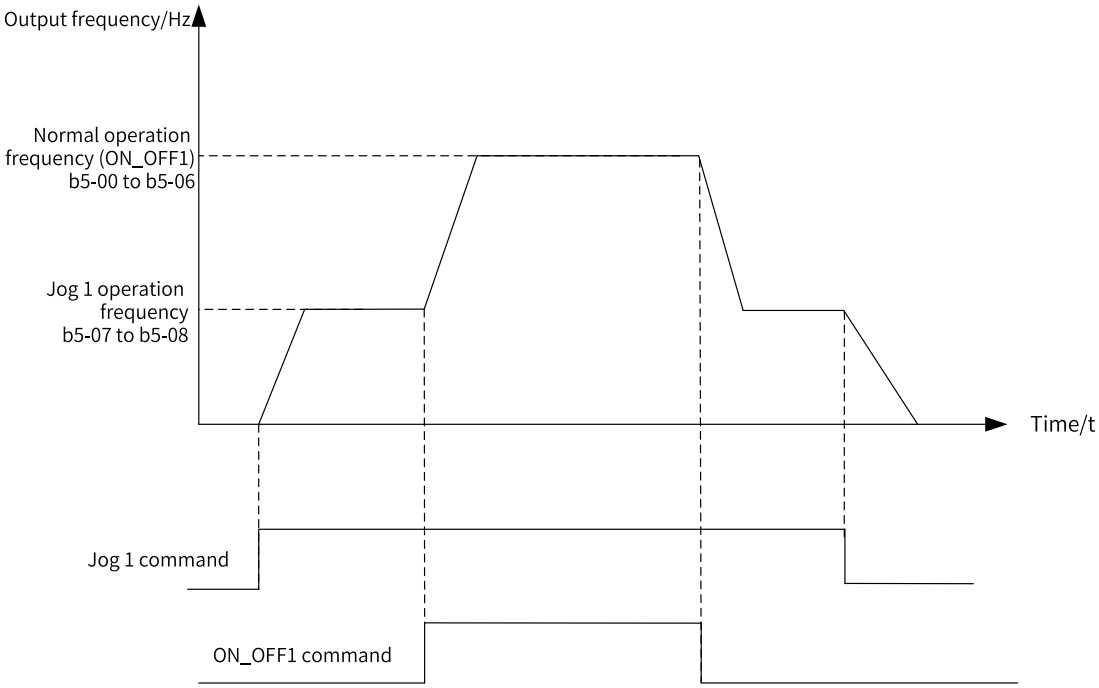


Figure 5-63 Relationship of jog 1 command and ON_OFF1 command (prioritized)

Related parameters

Param.	Name	Default	Value Range	Description
b7-01 (F0-46)	Base for ramp acceleration/ deceleration time	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	Sets ramp acceleration/deceleration time base frequency. Value description 0: Rated frequency - The rated frequency is used as the acceleration/deceleration time base. 1: Maximum frequency - The maximum frequency is used as the acceleration/deceleration time base. 2: 100 Hz - 100 Hz is used as the acceleration/deceleration time base. 3: Frequency reference - The frequency reference is used as the acceleration/deceleration time base. Note: This parameter selects a base frequency for the acceleration/ deceleration time. Acceleration time refers to the time required to accelerate from 0 to the base frequency. Similarly, deceleration time refers to the time required to decelerate from the base frequency to 0.
b7-31 (F0-62)	Jog ramp source	0	0: Ramp time of normal running 1: Ramp time of jogging	Sets the jogging ramp source. Value description 0: Ramp time during normal operation - The ramp time for jogging and normal operation is the same. 1: Jog ramp time - The jog ramp time is set separately (b7-32 and b7-33).

Param.	Name	Default	Value Range	Description
b7-32 (F0-63)	Jog ramp acceleration time	20.00s	0.00s to 650.00s	This parameter defines the time required for the output frequency to rise from 0 to b7-01 (base frequency for acceleration/deceleration) in jog mode. It determines the frequency rise rate in jog mode.
b7-33 (F0-64)	Jog ramp deceleration time	20.00s	0.00s to 650.00s	This parameter defines the time required for the output frequency to fall from b7-01 (base frequency for acceleration/deceleration) to 0 in jog mode. It determines the frequency fall rate in jog mode.
b5-07/b6-07	Jog 1 frequency source	0	0: Set by the parameter (b5-08) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter sets the source of jog 1 frequency. Value description 0: Set by the b5-08 - The jog 1 frequency source is "jog 1 frequency reference". 2: AI1 - The jog 1 frequency is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The jog 1 frequency is input by using current or voltage signals at the AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The jog 1 frequency is set by the pulse frequency of DI and calculated according to the corresponding mapping curve. (Only valiud for MD630S) 6: Multi-reference - When multi-reference is used as the jog 1 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - PID is selected as the jog frequency 1 source. 9: Communication - Communication is selected as the jog 1 frequency source. The jog 1 frequency is input through remote communication. The AC drive must be equipped with a communication card to realize communication with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. This mode is used for expansion of common sources.
b5-08/b6-08	Jog 1 frequency	2.00	-50.00 to 50.00 Hz	This parameter defines the digital setting of jog 1 frequency. Parameter b5-08 is activated when b5-07 is set to 0.

Param.	Name	Default	Value Range	Description
b5-09/b6-09	Jog 2 frequency source	0	0: Set by the parameter (b5-10) 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter sets the source of jog 2 frequency. Value description 0: Set by the b5-10 - The jog 2 frequency source is "jog frequency 2 reference", 2: AI1 - The jog 2 frequency is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The jog 2 frequency is input by using current or voltage signals at the AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The jog 2 frequency is set by the pulse frequency of DI and calculated according to the corresponding mapping curve. (Only valiud for MD630S) 6: Multi-reference - When multi-reference is used as the jog 2 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - PID is selected as the jog 2 frequency source. 9: Communication - Communication is selected as the jog 2 frequency source. The jog 2 frequency is input through remote communication. The AC drive must be equipped with a communication card to realize communication with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog 2 frequency. This mode is used for expansion of common sources.
b5-10/b6-10	Jog 2 frequency	-2.00	-50.00 to 50.00 Hz	This parameter defines the digital setting of jog 2 frequency. Parameter b5-10 is activated when b5-09 is set to 0.

Param.	Name	Default	Value Range	Description
b1-06, b3-06	User-defined jog 1 source	0	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets user-defined jog 1 source. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Value description 0: Invalid - Indicates that jog is invalid. 3 to 9: DI1 to DI7 - Indicates that the jog 1 source depends on the state of the DI terminal. Other: B connector - Whether the jog is enabled depends on other B connectors. You can select other B connectors through the pop-up window.
b1-07/b3-07	User-defined jog 2 source	0	0: Invalid 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets user-defined jog 2 source. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Value description 0: Invalid - Indicates that jog is invalid. 3 to 9: DI1 to DI7 - Indicates that the jog 2 source depends on the state of the DI terminal. Other: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.
b1-09, b3-09	JOG/ON_OFF1 priority mode selection	0	0: No priority 1: Jog preferred 2: ON_OFF1 (start/stop) preferred	This parameter is used to select the priority level of jog and normal operation commands. Value description 0: No priority - The AC drive responds only to the command that arrives first. 1: Jog preferred - The jog command can interrupt normal operation. 2: ON_OFF1 (start/stop) preferred - The normal operation command can interrupt jog operation.

5.2.5.2 Jog Frequency Set Channel

The MD630-INT supports two frequency references for jog 1 and jog 2 and can be controlled independently. The jog frequency is derived from two set channels, as shown in the following figure.

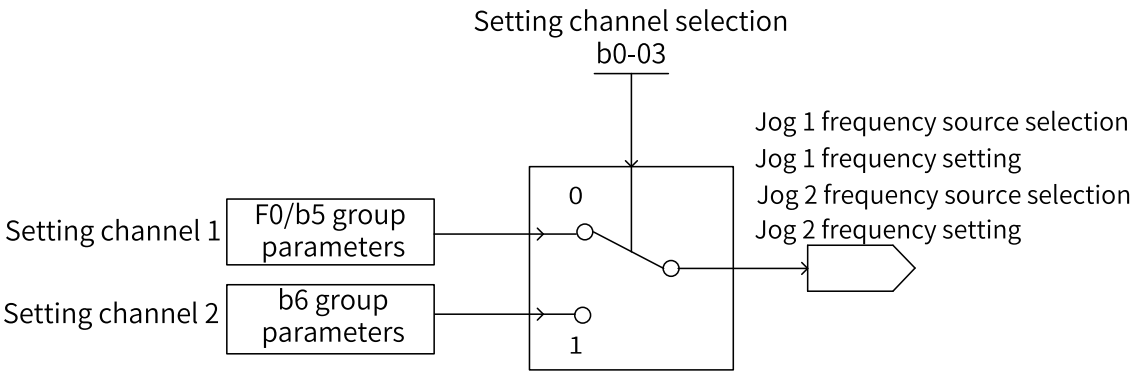


Figure 5-64 Jog frequency channel

5.2.6 Acceleration/Deceleration Time

5.2.6.1 Acceleration/Deceleration Time Setting

Scenarios

In scenarios where gradual acceleration/deceleration is required, set the acceleration/deceleration time to a high value; in scenarios where quick acceleration/deceleration is required, set the acceleration/deceleration time to a low value.

Operation principles

The acceleration time indicates the time required for the AC drive to accelerate from 0 Hz to b7-01 (Base frequency of ramp acceleration/deceleration time). The deceleration time indicates the time required for the AC drive to decelerate from b7-01 (Base frequency of ramp acceleration/deceleration time) to 0 Hz. To set the acceleration/deceleration time properly, set b7-01 (Base frequency of ramp acceleration/deceleration time) first. Then, set the acceleration/deceleration time. By default, the acceleration/deceleration time is set by b7-04 (ramp 1 acceleration time) and b7-05 (ramp 1 deceleration time).

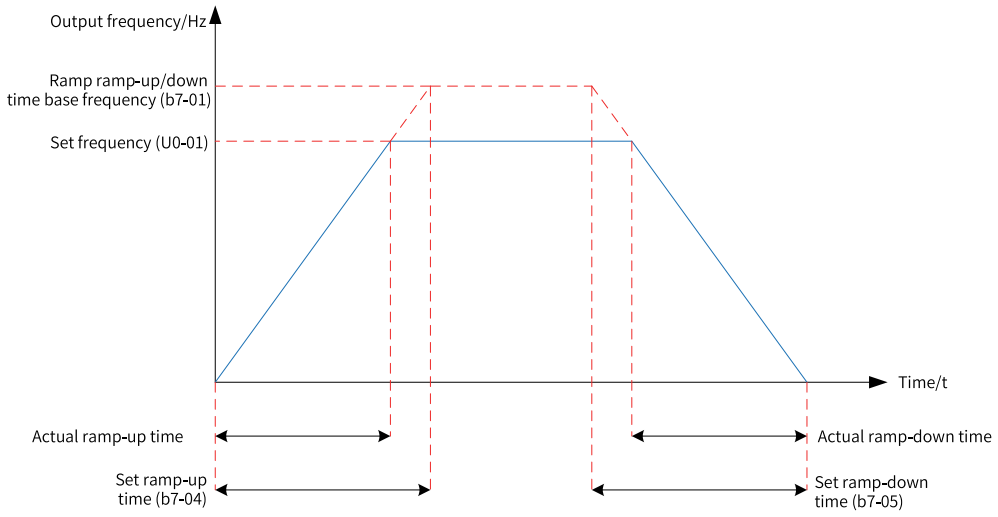


Figure 5-65 Acceleration/deceleration time base frequency

For example, set b7-01 to 1 (maximum frequency 50 Hz) and b7-04 (ramp 1 acceleration time) to 10s. In this case, the accelerated speed during acceleration is 5 Hz/s (50 Hz/10s). Set b7-05 (ramp 1 deceleration time) to 25s. In this case, the accelerated speed during deceleration is 2 Hz/s (50 Hz/25s).

Set the frequency to 25 Hz and start the AC drive. The drive will accelerate to 25 Hz at the speed of 5 Hz/s and then run at the frequency of 25 Hz. The actual acceleration time is 5s. Stop the AC drive. The drive will decelerate to zero frequency at the speed of 2 Hz/s and then stop. The actual deceleration time is 12.5s.

Acceleration/Deceleration time selection

The MD630-INT supports up to four groups of acceleration/deceleration time, which is defined by the following parameters:

1. Group 1: b7-04 (ramp 1 acceleration time) and b7-05 (ramp 1 deceleration time), time unit: 0.1 s.
2. Group 2: b7-10 (ramp 2 acceleration time) and b7-11 (ramp 2 deceleration time), time unit: 0.1 s.
3. Group 3: b7-16 (ramp 3 acceleration time) and b7-17 (ramp 3 deceleration time), time unit: 0.01 s.
4. Group 4: b7-22 (ramp 4 acceleration time) and b7-23 (ramp 4 deceleration time), time unit: 0.01 s.

You can select the effective acceleration/deceleration time by b7-02 (Ramp selection bit0) and b7-03 (Ramp selection bit1). The parameter setting and corresponding acceleration/deceleration time are shown below.

b7-02: Ramp selection bit0	b7-03: Ramp selection bit1	Acceleration/Deceleration time selection
0	0	Group 1 (b7-04, b7-05)
1	0	Group 2 (b7-10, b7-11)
0	1	Group 3 (b7-16, b7-17)
1	1	Group 4 (b7-22, b7-23)

Related parameters

Param.	Name	Default	Value Range	Description
b7-01 (F0-46)	Base frequency of ramp acceleration/ deceleration time	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	Used to set the base frequency for the ramp acceleration/ deceleration time. Value description 0: Rated frequency - The rated frequency is used as the acceleration/deceleration time base. 1: Maximum frequency - The maximum frequency is used as the acceleration/deceleration time base. 2: 100 Hz - 100 Hz is used as the acceleration/deceleration time base. 3: Frequency reference - The frequency reference is used as the acceleration/deceleration time base. Note: This parameter selects a base frequency for the acceleration/ deceleration time. Acceleration time refers to the time required to accelerate from 0 to the base frequency. Similarly, deceleration time refers to the time required to decelerate from the base frequency to 0.
b7-02	Ramp selection bit0	0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Defines ramp selection bit0. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Four groups of acceleration/deceleration time are available, which can be switched by combining the states of ramp (RFG) selection bits 0 and 1 in four ways. Value description 0: 0 - Indicates that the value of ramp selection bit0 is 0. 1: 1 - Indicates that the value of ramp selection bit0 is 1. 3 to 9: DI1 to DI7 - Indicates that the value of ramp selection bit0 depends on the states of terminals DI1 to DI7. Others: B connector - Indicates that the value of ramp selection bit0 depends on B connector, which can be selected through the pop-up window. Note: When the value of b7-28 is 1 and the value of b7-29/b7-30 is not 0, this parameter is invalid.

Param.	Name	Default	Value Range	Description
b7-03	Ramp selection bit1	0	0: 0 1: 1 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets ramp selection bit1. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Four groups of acceleration/deceleration time are available, which can be switched by combining the states of ramp (RFG) selection bits 0 and 1 in four ways. Value description 0: 0 - Indicates that the value of ramp selection bit1 is 0. 1: 1 - Indicates that the value of ramp selection bit1 is 0. 3 to 9: Same as b7-02 Others: Same as b7-02 Note: Same as b7-02
b7-04 (F0-48)	Ramp 1 acceleration time	20.0s	0.0s to 6500.0s	This parameter sets ramp 1 acceleration time. Note: It indicates the time required for the output frequency to increase from 0 to the ramp acceleration/deceleration time base frequency (b7-01). The time is used to set the accelerated speed during acceleration. The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the first group of acceleration time.
b7-05 (F0-49)	Ramp 1 deceleration time	20.0s	0.0s to 6500.0s	This parameter sets ramp 1 deceleration time. Note: It indicates the time required for the output frequency to decrease from the ramp acceleration/deceleration time base frequency (b7-01) to 0. The time is used to set the accelerated speed during deceleration. The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the first group of deceleration time.
b7-10	Ramp 2 acceleration time	20.0s	0.0s to 6500.0s	This parameter sets ramp 2 acceleration time. Note: Same as b7-04 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the second group of acceleration time.

Param.	Name	Default	Value Range	Description
b7-11	Ramp 2 deceleration time	20.0s	0.0s to 6500.0s	This parameter sets ramp 2 deceleration time. Note: b7-05 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter specifies the second group of deceleration time.
b7-16	Ramp 3 acceleration time	20.00s	0.00s to 650.00s	This parameter sets ramp 3 acceleration time. Note: Same as b7-04 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the third group of acceleration time.
b7-17	Ramp 3 deceleration time	20.00s	0.00s to 650.00s	This parameter sets ramp 3 deceleration time. Note: b7-05 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the 3rd group of deceleration time.
b7-22	Ramp 4 acceleration time	20.00s	0.00s to 650.00s	This parameter sets ramp 4 acceleration time. Note: Same as b7-04 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the fourth group of acceleration time.
b7-23	Ramp 4 deceleration time	20.00s	0.00s to 650.00s	This parameter sets ramp 4 deceleration time. Note: b7-05 The AC drive provides four groups of acceleration/deceleration time, which can be selected by using the parameter b7-02 or b7-03, or the DI terminal. This parameter defines the fourth group of deceleration time.

Note: F0-46, F0-48, and F0-49 are the mapping of parameters b7-01, b7-04, and b7-05. The settings of the two groups of parameters are equivalent.

Application instances

The following example uses DI1 and DI2 as the acceleration/deceleration switchover terminals to describe how to set the acceleration/deceleration time.

1. Set E0-00 (DI1 function selection) and E0-01 (DI2 function selection) to select DI1 and DI2 as the acceleration/deceleration switchover terminals.

Param.	Name	Value Range	Description
E0-00	DI1 function selection	16	Acceleration/Deceleration selection terminal 1
E0-01	DI2 function selection	17	Acceleration/Deceleration selection terminal 2

2. Set b7-01 (base frequency of ramp acceleration/deceleration time) to 1 (maximum frequency).
3. Set the four groups of acceleration/deceleration time parameters (b7-04 to b7-23) separately.
4. Select the effective acceleration/deceleration time by switching the DI terminal state.

DI1 State	DI2 State	Acceleration/Deceleration time selection
OFF	OFF	Group 1 (b7-04, b7-05)
ON	OFF	Group 2 (b7-10, b7-11)
OFF	ON	Group 3 (b7-16, b7-17)
ON	ON	Group 4 (b7-22, b7-23)

5.2.6.2 Acceleration/Deceleration Mode Setting

Application scenarios

In linear acceleration/deceleration mode, the output frequency increases or decreases linearly. This mode applies to most working conditions.

In S-curve acceleration/deceleration mode, the target frequency changes dynamically in real time, and the output frequency increases or decreases based on the S-curve. This mode is applicable to applications requiring smooth running and quick response in real time.

Operation principles

Set b7-00 (Ramp acceleration/deceleration mode) to select the frequency change mode during the start and stop process of the AC drive.

When b7-00 (Ramp acceleration/deceleration mode) is set to 0 (Linear acceleration/deceleration), the output frequency changes linearly according to the set acceleration/deceleration time.

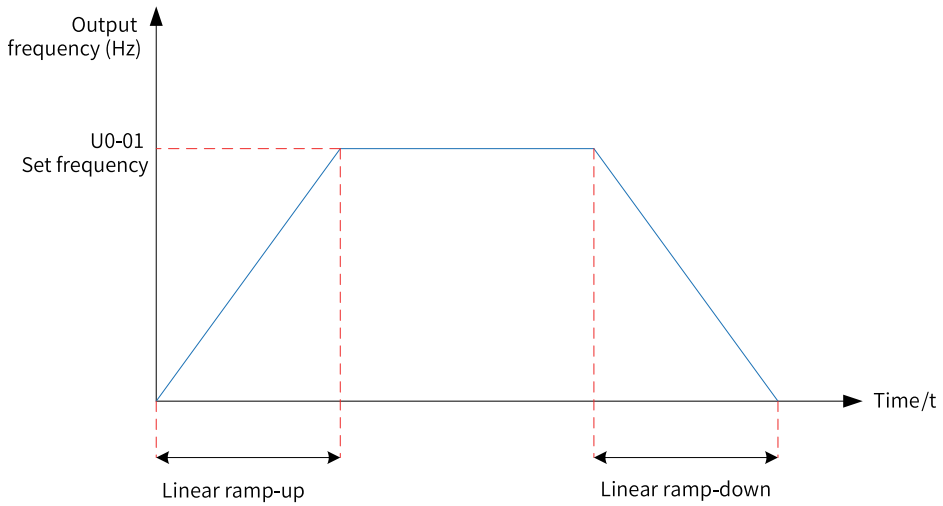


Figure 5-66 Linear acceleration/deceleration

When b7-00 (Ramp acceleration/deceleration mode) is set to 1 (S-curve), the output frequency increases or decreases based on the S-curve. You can set S-curve parameters for each group of acceleration/deceleration time. Take the first group of acceleration/deceleration time as an example. Set the S-curve change time through b7-06 (Ramp 1 acceleration start arc) to b7-09 (Ramp 1 deceleration end arc).

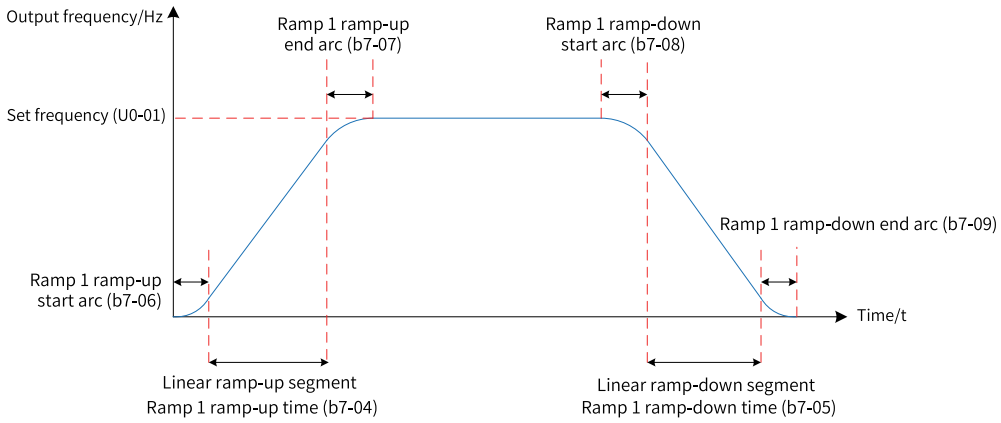


Figure 5-67 S-curve acceleration/deceleration

You can select the arc type through b7-43 (Ramp arc mode). b7-43 set to 0 (Incontinuous smoothing): When the acceleration/deceleration trend changes, the curve switches to the new target direction immediately. b7-43 set to 1 (Continuous smoothing): When the acceleration/deceleration trend changes, the curve follows the end arc of current acceleration/deceleration and then switches to the reference direction.

Related parameters

Parameter	Parameter name	Default value	Value range	Description
b7-00 (F0-45)	Ramp acceleration/ deceleration mode	0	0: Linear acceleration/ deceleration 1: S Curve	Defines the ramp acceleration/deceleration mode. Value description: 0: Linear acceleration/deceleration. The output frequency increases or decreases linearly. 1: S-curve acceleration/deceleration. The target frequency changes dynamically in real time, and the output frequency increases or decreases based on the S-curve. This mode is applicable to applications requiring smooth running and quick response in real time.
b7-06	Ramp 1 acceleration start arc	0.00s	0.00 to 650.00s	Defines the motion time of the ramp 1 acceleration start arc. Additional information: The acceleration start arc time of the output frequency determines the jerk of the set acceleration start arc. It is the first group of acceleration start arc. This function is active only when b7-00 is set to 1. For example, if this parameter is set to 2s and the actual acceleration time to the set frequency is 10s, the first 2s is in arc motion phase and the last 8s is in linear motion phase. In addition, the linear motion is executed according to the set linear acceleration/deceleration time.
b7-07	Ramp 1 acceleration end arc	0.00s	0.00 to 650.00s	Defines the motion time of the ramp 1 acceleration end arc. Additional information: The acceleration end arc time of the output frequency determines the jerk of the acceleration end arc. It is the first group of acceleration end arc. This function is active only when b7-00 is set to 1. For example, if this parameter is set to 2s and 10s is taken in accelerating to the set frequency, then the linear motion applies in the first 8s and arc motion applies in the last 2s during acceleration. In addition, the linear motion is executed according to the set linear acceleration/deceleration time.

Parameter	Parameter name	Default value	Value range	Description
b7-08	Ramp 1 deceleration start arc	0.00s	0.00 to 650.00s	Defines the motion time during increasing deceleration start arc of ramp 1. Additional information: The deceleration start arc time of the output frequency determines the jerk of the deceleration start arc. It is the first group of deceleration start arc. This function is active only when b7-00 is set to 1. For example, if this parameter is set to 2s and 10s is taken in decelerating from the set frequency to 0, then the arc motion applies in the first 2s and linear motion applies in the last 8s during deceleration. In addition, the linear motion is executed according to the set linear acceleration/ deceleration time.
b7-09	Ramp 1 deceleration end arc	0.00s	0.00 to 650.00s	Defines the motion time of increasing deceleration end arc of ramp 1. Additional information: The deceleration end arc time of the output frequency determines the jerk of the deceleration end arc. It is the first group of deceleration end arc. This function is active only when b7-00 is set to 1. For example, if this parameter is set to 2s and 10s is taken in decelerating from the set frequency to 0, then the linear motion applies in the first 8s and arc motion applies in the last 2s during deceleration. In addition, the linear motion is executed according to the set linear acceleration/ deceleration time.
b7-43	Ramp arc mode	0	0: Incontinuous smoothing 1: Continuous smoothing	Defines the ramp arc mode. This means that the arc acceleration changes when the acceleration/ deceleration trend changes. Value description: 0: Incontinuous smoothing. When the acceleration/ deceleration trend changes, the curve switches to the new target direction immediately. 1: Continuous smoothing. When the acceleration/ deceleration trend changes, the curve follows the end arc of current acceleration/deceleration and then switches to the reference direction. Additional information: This parameter is an expansion parameter. It is displayed only when A0-10 (Parameter access level) is set to a level higher than “expansion”.

Note:

1. F0-45, F0-48, and F0-49 are the mapping of parameters b7-00, b7-04, and b7-05. The settings of the two groups of parameters are equivalent.

2. The 2nd, 3rd, and 4th sets of S-curve arc parameters are set in the same way as the 1st set, which is activated when the corresponding acceleration/deceleration time set is selected.

5.2.6.3 Low-speed gain

Application scenarios

In case of a heavy load and high acceleration, acceleration at a high speed is normal but step loss may occur due to insufficient torque at a low speed. Alternatively, the acceleration rate is reduced to ensure stable running at a low speed, but the acceleration time is prolonged.

Operation principles

Set b7-42 (Low-speed segment judgment threshold). When the operating frequency of the AC drive is lower than this threshold, the AC drive is considered to be in the low-speed segment. In this case, the value of b7-41 (Gain coefficient for low-speed acceleration time) takes effect. The acceleration time for low-speed acceleration is the value of the original acceleration time x gain coefficient (b7-41). The default value of b7-41 is 100%. The acceleration time remains unchanged when the speed is in the low speed segment. When the output frequency is higher than b7-42 (low-speed segment threshold), the acceleration time returns to the original setting, and the AC drive accelerates to the set frequency normally.

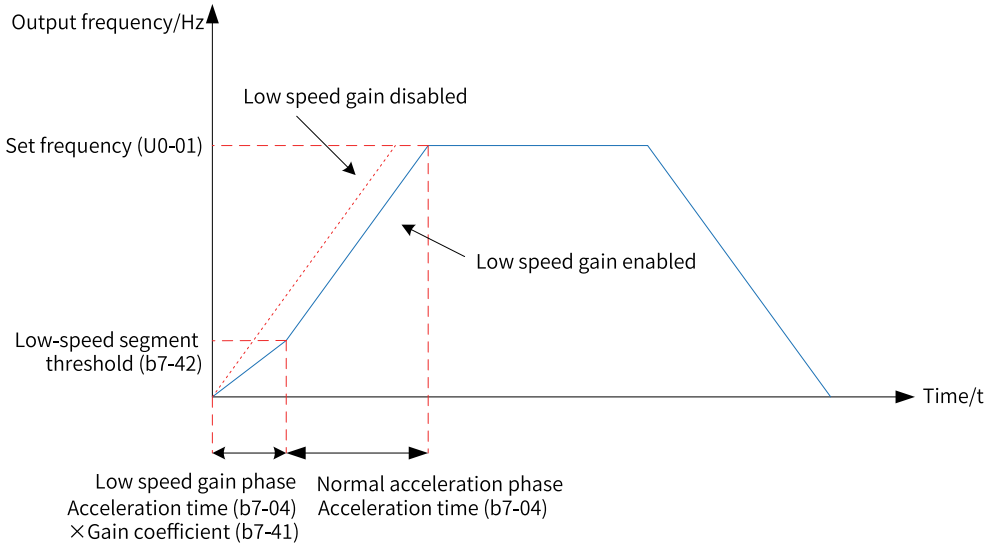


Figure 5-68 Low-speed gain

Related parameters

Parameter	Parameter name	Default value	Value range	Description
b7-41	Low-speed acceleration time gain coefficient	100.0%	1.0% to 1000.0%	Defines the gain coefficient of the acceleration time in the low-speed segment. Additional information: When the output frequency is lower than b7-42 (low-speed threshold), b7-41 takes effect. The time after b7-41 is used as the actual acceleration time of the low-speed segment.
b7-42	Low-speed segment threshold	15.00%	0.00% to 100.00%	Set the low-speed segment judgment threshold. Additional information: When the output frequency is lower than this threshold, b7-41 (Acceleration time gain coefficient in low-speed segment) takes effect.

5.2.6.4 Automatic Switchover of Acceleration/Deceleration Time Based on Running Frequency

Application scenarios

This function enables selection of different acceleration/deceleration time based on the running frequency during running of the AC drive.

Operation principles

Set whether to enable automatic switchover of acceleration/deceleration time through b7-28 (Ramp 1/2 frequency switchover enable). Set the frequency threshold for acceleration/deceleration time switchover through b7-29 (Frequency for ramp 1/2 acceleration switchover) and b7-30 (Frequency for ramp 1/2 deceleration switchover).

Acceleration/deceleration time switchover

During acceleration, if the operating frequency is lower than b7-29 (Frequency for ramp 1/2 acceleration switchover), b7-10 (Ramp 2 acceleration time) is selected. If the operating frequency is higher than b7-29 (Frequency for ramp 1/2 acceleration switchover), b7-04 (Ramp 1 acceleration time) is selected.

During deceleration, if the operating frequency is higher than b7-30 (Frequency for ramp 1/2 deceleration switchover), b7-05 (Ramp 1 deceleration time) is selected. If the operating frequency is lower than b7-30 (Frequency for ramp 1/2 deceleration switchover), b7-11 (Ramp 1 deceleration time) is selected.

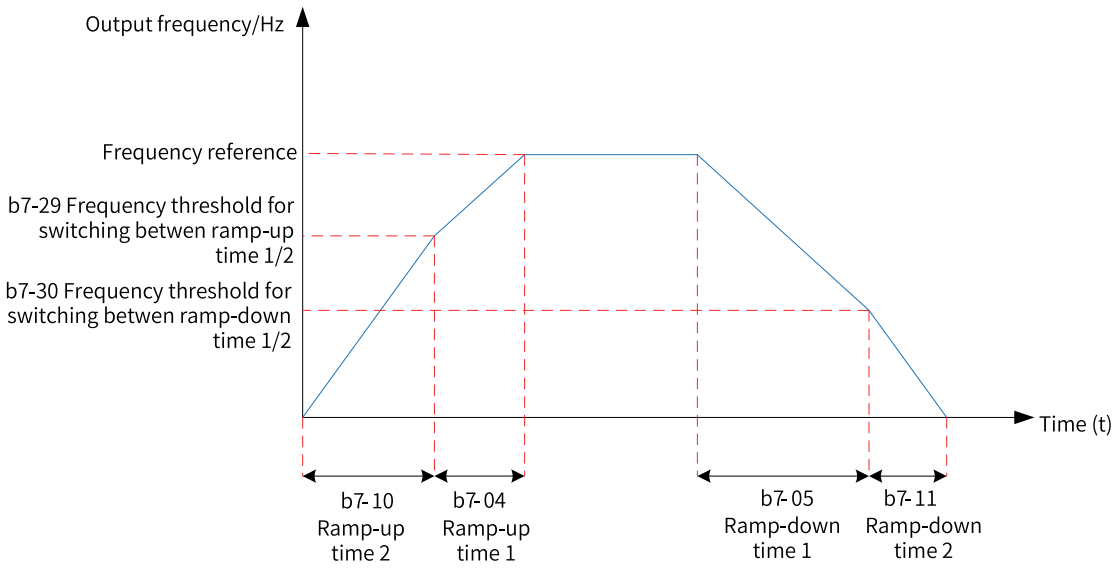


Figure 5-69 Automatic switchover of acceleration/deceleration time

Related parameters

Parameter	Parameter name	Default value	Value range	Description
b7-28	Ramp 1/2 frequency switchover enable	0	0: Disabled 1: Enabled	Defines whether ramp 1/2 frequency switchover is enabled. When this function is enabled, ramp selection bit 1/bit 0 (b7-02/-03) are invalid. Additional information: This parameter is used together with b7-29 and b7-30 to use different acceleration/deceleration time during acceleration/deceleration.
b7-29	Frequency for switching between acceleration time 1 and acceleration time 2	0.0 Hz	0.0 Hz to A2-18	Defines ramp 1/2 acceleration switchover frequency. During acceleration, if the output frequency is greater than or equal to the value of b7-29, ramp 1 acceleration time is valid; otherwise, ramp 2 acceleration time is valid.
b7-30	Frequency threshold for switching between deceleration time 1 and deceleration time 2	0.0 Hz	0.0 Hz to A2-18	Defines ramp 1/2 deceleration switchover frequency. During the deceleration stage, if the output frequency is greater than or equal to this set point, the current effective ramp is ramp 1 deceleration. Otherwise, the current effective ramp is ramp 2 deceleration.
b7-04	Ramp 1 acceleration time	20.0	0.0 to 6500.0	This parameter sets ramp 1 acceleration time. Additional information: It indicates the time required for the output frequency to increase from 0 to the ramp acceleration/deceleration time base frequency (b7-01). The time is used to set the accelerated speed during acceleration. The drive provides four groups of acceleration/deceleration time, which can be selected through b7-02, b7-03, or DI. This parameter defines the first group of acceleration time.

Parameter	Parameter name	Default value	Value range	Description
b7-05	Ramp 1 deceleration time	20.0	0.0 to 6500.0	This parameter sets ramp 1 deceleration time. Additional information: It indicates the time required for the output frequency to decrease from b7-01 [Acceleration/Deceleration base frequency] to 0. The drive provides four groups of acceleration/deceleration time, which can be selected through b7-02, b7-03, or DI. This parameter defines the first group of deceleration time.
b7-10	Ramp 2 acceleration time	20.0	0.0 to 6500.0	This parameter sets ramp 2 acceleration time. Additional information: Same as b7-04 The drive provides four groups of acceleration/deceleration time, which can be selected through b7-02, b7-03, or DI. This parameter defines the second group of acceleration time.
b7-11	Ramp 2 deceleration time	20.0	0.0 to 6500.0	This parameter sets ramp 2 deceleration time. Additional information: Same as b7-05 The drive provides four groups of acceleration/deceleration time, which can be selected through b7-02, b7-03, or DI. This parameter specifies the second group of deceleration time.

5.2.6.5 Ramp tracking enable

Application scenarios

In certain conditions, the actual motor speed cannot match the output speed of the ramp function generator (set target speed) due to the large load torque during acceleration. The ramp tracking function needs to be enabled.

Operation principles

In case of large load torque, when the motor decelerates, the output speed of the ramp function generator is greatly different from the actual speed. Therefore, it takes a long time before the motor decelerates. If the tracking function of the ramp function generator is disabled, the speed is set to n_2 at t_0. At t_1, the speed setpoint is reduced from n_2 to n_1 and the motor still accelerates to t_2. The deceleration command is given at t_1. However, deceleration must be started after $\Delta t = t_2 - t_1$. For details, see *"Figure 5-70 Output speed of ramp function generator (ramp tracking disabled)" on page 316*.

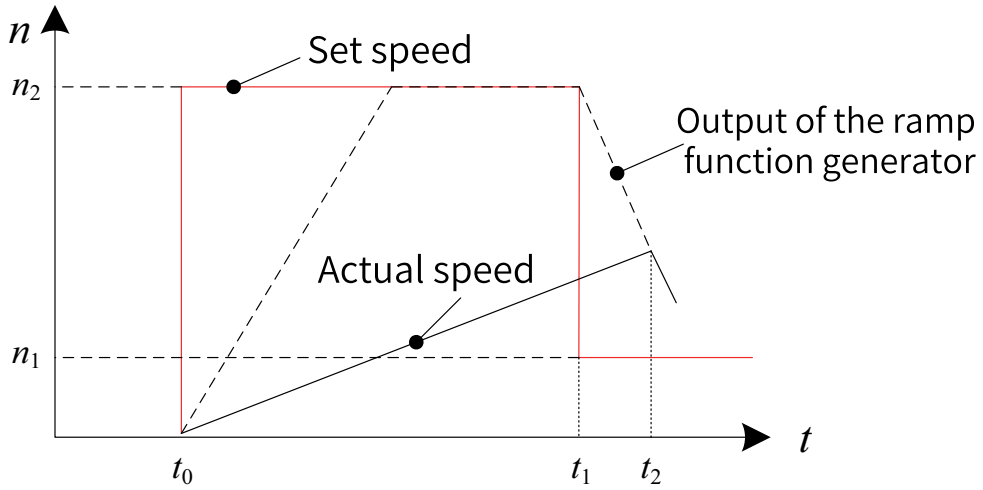


Figure 5-70 Output speed of ramp function generator (ramp tracking disabled)

As shown in *"Figure 5-71 Output speed of ramp function generator (ramp tracking enabled)" on page 316*, when the ramp function generator tracking function is enabled, the ramp function generator output speed actively follows the actual speed when the deviation between the output speed and the actual speed reaches the set error value.

When b7-46 is set to 1 (Enable), the ramp function generator tracking function is activated when the actual speed is lower than the output speed of the ramp function generator Δn (Δn can be set according to actual conditions). The ramp function generator output speed is forced to the actual speed + Δn speed. If the condition is not met, the tracking state is exited.

When b7-46 is set to 2 (Torque limit reached), the ramp function generator tracking function is activated only when the torque reaches the limit. The output speed of the ramp function generator is forced to the actual speed + Δn. If the condition is not met, the tracking state is exited.

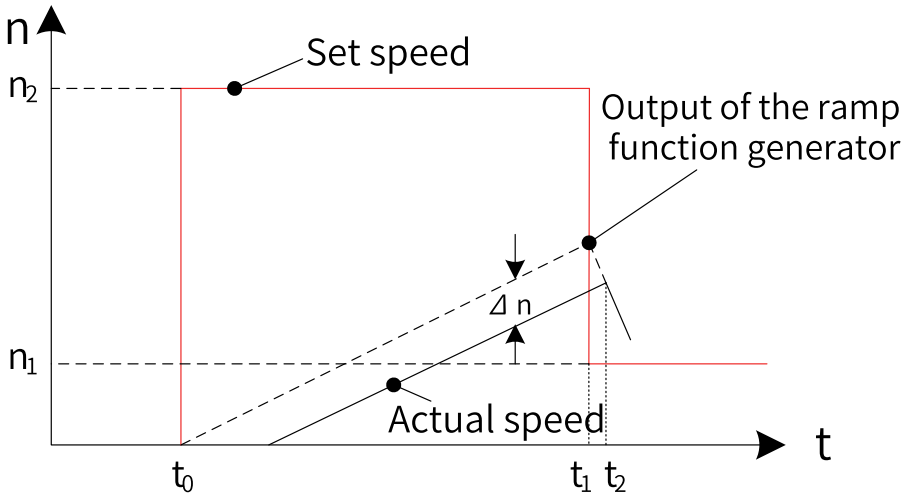


Figure 5-71 Output speed of ramp function generator (ramp tracking enabled)

Related parameters

Parameter	Parameter name	Default value	Value range	Description
b7-46	Ramp tracking enable	0	0: Disabled 1: Enabled 2: Torque limit reached Others: B connector	Sets whether slope tracking is enabled. With this function enabled, when the torque reaches the limit and the deviation between the frequency reference and the feedback frequency is greater than b7-47 (ramp tracking error), the frequency reference is limited to the actual value plus the error. 0: Disabled - Ramp tracking disabled 1: Enable - Ramp tracking enable 2: Torque limit reached – Whether ramp tracking is enabled depends on whether the current motor torque limit is reached Other: Connector B - Whether ramp tracking is enabled depends on the state of connector B.
b7-47	Ramp tracking error	10.0%	0.0% to 100.0%	Set the ramp tracking error value.

5.2.7 Motor Parameter Set

Application scenarios

This function is suitable for applications where one drive is used to drive multiple motors. You can select different motor parameter set and save parameters for different motors to improve usage flexibility, and directly use the pre-set motor parameter sets without reconfiguration or motor parameter auto-tuning.

Function description

The drive supports four motor parameter sets, with each set saving specific motor parameters such as basic parameters and control parameters.

Motor parameter sets are set through b0-00 and b0-01, and the effective motor parameter set is activated through binary bit combination. The effective motor parameter set can also be viewed through U2-00.

Table 5–9 Example for motor parameter set selected by parameters

Parameter setting			Effective motor parameter set
b0-00	b0-01	U2-00	
0	0	0	Motor parameter set 1
1	0	1	Motor parameter set 2
0	1	2	Motor parameter set 3
1	1	3	Motor parameter set 4

Motor parameter set can also be selected through DI terminal functions, using DI terminal functions 41 [Motor selection terminal 1] and 76 [Motor selection terminal 2]. Similar to setting via b0-00 and b0-01, the effective motor parameter set can also be determined using binary bit combination.

Note that the priority of DI terminal selection is higher than that of parameter selection. When DI terminal functions 41 [Motor selection terminal 1] and 76 [Motor selection terminal 2] are assigned, b0-00 and b0-01 are inactive and read-only. For example, when DI1 terminal function is set to 41 [Motor selection terminal 1], b0-00 becomes read-only, and the motor parameter set can only be set via DI terminals, with b0-00 and b0-01 deactivated.

Table 5–10 Selecting motor parameter set through DI terminal

Parameter setting			Effective motor parameter set
DI1 state	DI2 state	U2-00	-
0	0	0	Motor parameter set 1
0	1	1	Motor parameter set 2
1	0	2	Motor parameter set 3
1	1	3	Motor parameter set 4

Related parameter

Param.	Name	Default	Value range	Description
b0-00	Motor parameter set selection 1	0	0: Inactive 1: Active 3: DI1 4: DI2 5 to 9: DI3 (active only for MD630S) to DI7 (active only for MD630S) Other: B connector	Defines motor parameter set selection 1. Value description: 0: Inactive - This function is inactive. 1: Active - This parameter is active. 3 to 9: Depends on the final terminal status of DI1 to DI7 (0: Inactive; 1: Active). Other: B connector - Depends on the B connector. You can select B connector through the pop-up window (0: Inactive; 1: Active). Note: The selection of the motor parameter set is determined by the combination of b0-00 and b0-01 in the form of binary bits. When b0-00 is 0 and b0-01 is 0, the combination is 0x0, indicating that motor parameter set 1 is selected. When b0-00 is 1 and b0-01 is 0, the combination is 0x1, indicating that motor parameter group 2 is selected. When b0-00 is 0 and b0-01 is 1, the combination is 0x2, indicating that motor parameter group 3 is selected. When b0-00 is 1 and b0-01 is 1, the combination is 0x3, indicating that motor parameter set 4 is selected. The latest motor parameter activated can be viewed through U2-00. After the DI terminal is assigned with function 41 [Motor selection terminal 1], the value of b0-00 is automatically switched to the corresponding DI terminal connector parameter (L0484 to L0490).
b0-01	Motor parameter set selection 2	0	0: Inactive 1: Active 3: DI1 4: DI2 5 to 9: DI3 (active only for MD630S) to DI7 (active only for MD630S) Other: B connector	Defines motor parameter set selection 2. Value description: Same as b0-00 Note: Same as b0-00
U2-00	Current motor parameter set	0	-	Displays the effective motor parameter set. Value description: 0 to 3: Motor parameter set 1 to motor parameter set 4

5.2.8 Modify Motor Direction

5.2.8.1 Motor Running Direction Limit

Scenarios

This function is applicable to the scenarios where forward or reverse motor rotation is prohibited and only one direction of motor rotation is allowed.

Function description

The motor running direction can be limited by setting parameters d1-01 (positive speed) and d1-02 (negative speed).

- When d1-01 is set to 0 (Inhibited), the motor runs at zero frequency when a forward run command is input to the AC drive.
- When d1-02 is set to 0 (Inhibited), the motor runs at zero frequency when a reverse run command is input to the AC drive.

Related parameters

Table 5–11 Reverse running inhibited

Param.	Name	Default	Value Range	Descriptions
d1-01	Positive speed enable	1	0: Disallowed 1: Allowed 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	This parameter specifies whether the AC drive allows forward operation. F2-20 is the mapping of d1-01 [Positive speed enable] in group F. The two parameters have the same function. Value description 0: Forward operation is inhibited. 1: Forward operation is allowed. 3 to 9: DI1 to DI7 - Depending on the final state of DI 0 indicates that forward run is prohibited, and 1 indicates that forward run is allowed. Other: B connector - Whether the forward operation is allowed depends on other B connectors. 0 indicates that forward run is prohibited, and 1 indicates that forward run is allowed. Note: After the DI is assigned with function 78 [Forward run allowed], the value of d1-01 is automatically switched to the value of the corresponding DI connector parameter (L0484–L0490 displayed).
d1-02	Negative speed enable	1	0: Disallowed 1: Allowed 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	This parameter specifies whether reverse operation is allowed for the AC drive. F2-21 is the mapping of d1-02 (Negative speed enable) in group F. The two parameters have the same function. Value description 0: Reverse operation is inhibited. 1: Reverse operation is allowed. 3 to 9: DI1 to DI7 - Depending on the final state of DI 0 indicates that reverse run is inhibited, and 1 indicates that reverse run is allowed. Others: B connector - Whether the reverse run is allowed depends on the state of the B connector. 0 indicates that reverse run is inhibited, and 1 indicates that reverse run is allowed. Note: After the DI is assigned with function 79 [Forward run allowed], the value of d1-02 is automatically switched to the value of the corresponding DI connector parameter (L0484–L0490 displayed).

Notes: The MD630-INT supports four groups of motor parameters: d9-01/d9-02 for motor parameter group 2, y1-01/y1-02 for motor parameter group 3, and y9-01/y9-02 for motor parameter group 4.

5.2.8.2 Change Motor Direction Without Changing Motor Wiring

Scenarios

This function is applicable to the scenario when changing the motor running direction without changing motor wiring.

Description

Used to change the motor rotation direction through parameter modification, which equals adjusting any two of UVW cables.

Notes: The MD630-INT supports four groups of motor parameters: d0-14 for motor parameter set 1, d8-14 for motor parameter set 2, y0-14 for motor parameter set 3, and y8-14 for motor parameter set 4.

Related parameters

Table 5–12 Changing motor rotation direction through parameters

Param.	Name	Default	Value Range	Description
F2-14 (d0-14)	Motor running direction selection	0	0: Default direction 1: Opposite to normal direction	It is used to set the motor running direction.

5.2.8.3 Dead Zone Time of Forward/Reverse Run Switchover

Scenarios

When the motor is switched between forward and reverse running, the direction cannot be switched immediately. After a period of buffer time, the switch can be performed. This buffer time is the dead zone time of forward/reverse switchover. During this time, the output frequency is 0 Hz.

Working Principle

This function is used to specify the transition period when the output is 0 Hz during forward/reverse run switchover of the AC drive. The transition period is called dead zone time of forward/reverse run switchover, which can be set through P0-26.

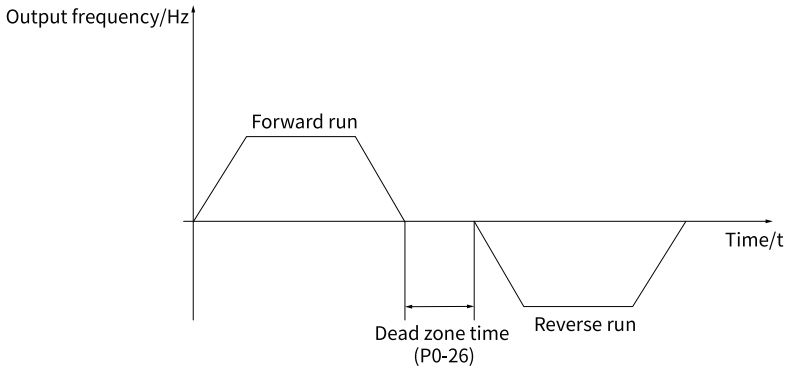


Figure 5-72 Dead zone time of forward/reverse run switchover

Related parameters

Table 5–13 Related parameters of dead-zone time

Param.	Parameter Name	Default	Value Range	Descriptions
P0-26	Dead-zone time of forward/reverse run	0.0s	0.0s to 3000.0s	This parameter defines the transition time at 0 Hz output during switchover between forward running and reverse running.

5.2.9 Speed Control/Torque Control Switchover

Scenarios

The product supports two motor control modes: speed control and torque control modes. This function is applicable to switch between the two control modes.

Description

In speed control, the speed reference is converted to the actual speed reference only after being processed with a series of limits, ramp function generator (RFG), and additional speed reference. Speed Control is applicable to all o control modes (V/f, SVC). In most applications, the motor speed needs to be controlled. In vector control, the speed can be controlled accurately.

Torque control is the control mode that ensures that the motor output torque directly follows the torque reference. Torque control includes torque reference and overspeed contol. The torque reference includes torque reference setting, gain calculation, filtering, and acceleration/ deceleration. Overspeed control includes setting speed limit, filtering, acceleration/deceleration, and speed offset mode.

Torque control must be combined with overspeed control. When the motor output torque is not greater than the motor load, the motor speed is determined by the load. When the motor output torque is greater than the load torque, the motor accelerates to run. To prevent the motor from overspeed, the motor speed must be limited under torque control. When the motor speed exceeds the limit, the motor speed control is used. When the motor speed returns below the limit, the torque control is used.

The two control modes can be switched through d0-01, d8-01, y0-01, and y8-01 (Motor parameter groups 1 to 4).

Related parameters

Table 5–14 Speed / Torque mode switchover related parameters

Item	Parameter Name	Default	Value Range	Descriptions
F0-02 (Motor parameter group 1) d0-01 (Motor parameter group 1) d8-01 (Motor parameter group 2) y0-01 (Motor parameter group 3) y8-01 (Motor parameter group 4)	Motor control mode	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5 to 9: DI3 (Only valid for MD630S) to DI7 (Only valid for MD630S) Others: B connector	Sets the motor control method. Value description 0: Speed control 1: Torque control 3 to 9: DI1 to DI7 - Depends on the terminal state of the DI. 0: speed control; 1: torque control. Others: B connector The control method depends on the status of B connector. 0 indicates speed control and 1 indicates torque control. Additional information: Torque control is invalid in V/f mode.

Notes: F0-02 is the mapping parameter of d0-01. F0-02 changes and d0-01 changes accordingly.

5.2.10 Control Terminal

5.2.10.1 Overview of Control Terminals

Overview of control terminals

The product supports eight control terminals, including digital input (DI), digital output (DO/RO), virtual digital input (VDI), virtual digital output (VDO), high-speed digital input (HDI), high-speed digital output (HDO), analog input (AI), and analog output (AO).

Standard interfaces of MD630S-INT: DI1 to DI7 (DI7 can be used as a common DI, pulse input terminal, or high-speed digital input terminal HDI), RO (relay output terminal), FM (can be used as a common DO or HDO), DO, AI1, AI2, and AO.

Standard interfaces of MD630N-INT: DI1, DI2, RO (relay output terminal), DO, AI1, and AI2.

The control interfaces of the product are described in the table below.

Table 5–15 List of control interfaces

Name	Product hardware	
	MD630S-INT	MD630N-INT
DI1	Yes	Yes
DI2	Yes	Yes
DI3	Yes	-
DI4	Yes	-
DI5	Yes	-
DI6	Yes	-

Name	Product hardware	
	MD630S-INT	MD630N-INT
DI7	Yes	-
RO	Yes	Yes
FM	Yes	-
DO	Yes	Yes
AI1	Yes	Yes
AI2	Yes	Yes
AO	Yes	-

Note

- Yes: Supported
- No: Not supported

5.2.10.2 Digital Input (DI) Terminals

Function List

DI refers to digital input terminals. Each DI can be assigned with one DI function, but DI functions cannot be duplicated.

MD630S-INT is equipped with DI1 to DI7 as standard and MD630N-INT is equipped with DI1 to DI2 as standard. Refer to the table below for the standard functions of DI1 to DI7 terminals. Only DI7 supports high-speed digital input (HDI). However, DI7 is used as a common DI by default. For specific functions, see *"5.2.10.6 High-Speed Digital Input (HDI)" on page 350*.

Table 5–16 List of DI function assignment

Function	DI terminal						
	DI1	DI2	DI3	DI4	DI5	DI6	DI7
DI function selection	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Input filter time 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Input filter time 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Input filter time selection	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Switch-on delay	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Switch-off delay	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Forced enable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Forced data	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Terminal active mode (active level)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
High-speed digital input	-	-	-	-	-	-	Yes

Description

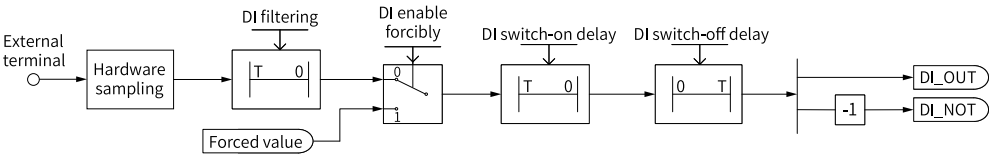


Figure 5-73 DI data flow diagram

For DI terminal layout of MD630S-INT, see CN4 in *"Table 3-6 Description of control circuit terminal layout of bus model" on page 105*. For DI terminal layout of MD630N-INT, see CN4 in *"Table 3-6 Description of control circuit terminal layout of bus model" on page 105*.

For details about the DI terminal wiring, see *" Wiring of the DI terminal" on page 111*.

DI function

Name	Description	Description	Related parameters
1. DI function selection	Each DI terminal can be assigned with a function number through E0-00 to E0-06. Each function number represents a function to be achieved when the DI terminal is closed or opened.	• The function number assigned to each DI must be unique. For example, if DI1 is assigned with function "Terminal start/stop module A_IN1", the function cannot be assigned to other DI terminals. • Multiple DI terminals can be assigned with multiple function numbers to achieve complex functions. For example, for terminal start/stop in two-wire control mode, set E0-00 (DI1 terminal function selection) to 1 (Terminal start/stop module A_IN1) and E0-01 (DI2 terminal function selection) to 2 (Terminal start/stop module A_IN2).	*"Table 5-17 DI terminal function parameter list" on page 327*
2. DI as the input source	The DI is set as the input source, and functions are controlled through the DI terminal state.	When a DI terminal is assigned a function, the value of the corresponding parameter is automatically switched to a parameter in L04 group, and the value cannot be modified. For example, when E0-01 (DI2 function selection) is set to 4 (Terminal start/stop module A jog 1), the value of the corresponding parameter b9-07 (Source of terminal start/stop module A jog 1) is switched to L0485 (DI2, modified by E0-01 forcibly) and the number of connector L0485 is displayed on the operating panel. The value of b9-07 cannot be modified. In this case, DI2 controls whether the jog 1 signal of the terminal start/stop module A is active. After E0-01 (DI2 terminal function selection) is set to another function, b9-07 (Source of terminal start/stop module A jog 1) reverts to the default value, allowing arbitrary selection of input source.	-

Name	Description	Description	Related parameters
3. Terminal status connector	1. The status of the DI terminal is displayed. The value 0 indicates that the DI terminal opens and the value 1 indicates that the DI terminal closes. 2. You can configure the parameter labeled "Other: B connector" in the drop-down menu as the DI terminal status connector.	The DI terminal status connector can be used as input for this type of parameter. That is, when configuring the parameter option as "Other: B connector," the DI terminal status can also be selected as an input through the "Other: B connector" option. See " *Parameter Interconnection" on page 814* for details.	*"Table 5-19 DI terminal status connector" on page 332*
4. Other function setting	-	-	*"Table 5-20 DI parameter list" on page 332*

Related parameters

Table 5–17 DI terminal function parameter list

Terminal	Param.	Drive model	**Function number**	Default	Description
DI1	E0-00 (F4-03)	MD630S-INT MD630N-INT	0 to 80	1	See details in *"Table 5-18 DI terminal function description (E0-00 to E0-06)" on page 327*.
DI2	E0-01 (F4-04)	MD630S-INT MD630N-INT		4	
DI3	E0-02 (F4-05)	MD630S-INT		9	
DI4	E0-03 (F4-06)	MD630S-INT		12	
DI5	E0-04 (F4-07)	MD630S-INT		13	
DI6	E0-05 (F4-08)	MD630S-INT		0	
DI7	E0-06 (F4-09)	MD630S-INT		0	

Table 5–18 DI terminal function description (E0-00 to E0-06)

Value	Function	Description	Related parameters
0	No function	Set 0 for reserved terminals to avoid malfunction.	-
1	Terminal start/stop module A_IN1	Terminal module A input 1, with function defined by terminal module mode. (This function is active in terminal control.)	F0-03 (b1-00), b9-00, b9-01, b9-02
2	Terminal start/stop module A_IN2	Terminal module A input 2, with function defined by terminal module mode. (This function is active in terminal control.)	F0-03 (b1-00), b9-00, b9-01, b9-03
3	Terminal start/stop module A_IN3	Terminal module A input 3, with function defined by terminal module mode. (This function is active in terminal control.)	F0-03 (b1-00), b9-00, b9-01, b9-04

Value	Function	Description	Related parameters
4	JOG1 source of terminal start/stop module A	Used to make the drive operate in forward jog mode. In jog mode, the drive runs at a low speed briefly, which is generally used for maintenance and commissioning of on-site equipment (active only in terminal control).	F0-03 (b1-00), b9-07
5	JOG2 source of terminal start/stop module A	Used to make the drive operate in reverse jog mode. In jog mode, the drive runs at a low speed briefly, which is generally used for maintenance and commissioning of on-site equipment (active only in terminal control).	F0-03 (b1-00), b9-08
6	Function as UP key for frequency adjustment	Used to increase the frequency when the frequency is set through the terminal. Activating the terminal is equivalent to keeping  pressed down. Deactivating the terminal is equivalent to releasing this key.	F0-03 (b1-00), b3-00, P0-87, P0-88, P0-89
7	Function as DOWN key for frequency adjustment	Used to decrease the frequency when the frequency is set through the terminal. Activating the terminal is equivalent to keeping  pressed down. Deactivating the terminal is equivalent to releasing this key.	F0-03 (b1-00), b3-00, P0-87, P0-88, P0-89
8	Coast to stop	In this mode, the drive stops the motor through stopping output, which cuts off the power supply of the motor and brings the driving system to the free braking state. The drive immediately stops output after the terminal is active, and the load coasts to stop based on the mechanical inertia.	b2-00, b4-00
9	Fault reset (RESET)	Used to reset the drive faults (rising edge-triggered). This terminal acts in the same way as the STOP/RES key on the operating panel. This function allows you to reset a fault remotely.	b2-04, b4-04
10	Operation Pause (terminal control)	When the terminal is active, the drive pauses operation and stops as defined by d0-07. When the terminal is inactive, the drive operates normally. (This function is active in terminal control.)	d0-07
11	NO input of external fault	When the terminal is active, it is equivalent to an external fault signal. When the terminal is active, the drive is in normal state. After receiving the external signal, the drive reports E015.1, and acts as defined by H1-02 (Protective action selection upon fault).	H1-02, H2-00
12	Multi-reference terminal 1	Multi-reference is used as the main frequency source. The settings of 16 speeds or 16 references can be implemented through combinations of 16 states of these four terminals. This function is applicable to scenarios that need only several frequency references instead of continuous adjustment of the operating frequency.	F0-29 (b5-00), b6-00, b8-03
13	Multi-reference terminal 2		F0-29 (b5-00), b6-00, b8-04
14	Multi-reference terminal 3		F0-29 (b5-00), b6-00, b8-05
15	Multi-reference terminal 4		F0-29 (b5-00), b6-00, b8-06

Value	Function	Description	Related parameters
16	Ramp-up/down selection terminal 1	Four sets of ramp-up/down time can be selected through combinations of four states of these two terminals. The ramp-up time indicates the time taken to ramp up from 0 Hz to "Ramp-up/down base frequency (F0-46)". The ramp-down time indicates the time taken to ramp down from "Ramp-up/down base frequency (F0-46)" to 0 Hz.	b7-04 to b7-30
17	Ramp-up/down selection terminal 2		b7-04 to b7-30
19	Clear data set by UP/ DOWN key	When the main frequency is set through the operating panel and this function applies, the frequency set by  or  on the operating panel or by terminal functioning as the UP/DOWN key (6 or 7) can be cleared. In this case, the frequency reference will be reset to the value of b5-01 or b6-01.	F0-03 (b1-00), b3-00, P0-87, P0-88, P0-89
21	Acceleration/ Deceleration inhibited	The frequency cannot be adjusted during operation of the drive (except stop commands). The drive runs at the current operating frequency without being affected by external input frequency when the terminal is active.	b7-04 to b7-30
22	PID pause	PID calculation pauses, with the current output maintained. When the terminal is active, the drive maintains the current PID output and stops PID regulation. When the terminal is inactive, PID calculation continues based on the current output.	P2-00 to P2-38
23	Simple PLC status reset	When the terminal is active, the simple PLC is restored to the initial state.	P1-04
24	Swing frequency pause	In the swing process, when the terminal is active, the wobble frequency function is paused and the drive outputs at the center frequency.	P0-94 to P0-98
29	Torque control inhibited	When the terminal is active and the torque control mode applies, the drive switches from the torque control mode to the speed control mode. When the terminal is inactive, the drive switches back the torque control mode.	-
32	Immediate DC braking	When the terminal is active, the drive directly switches to the DC braking state. DC braking indicates that the drive outputs direct current to the stator winding of the asynchronous motor to form a static magnetic field, enabling the motor to brake with energy consumption. In this state, the rotor cuts the static magnetic field to generate braking torque, which stops the motor quickly.	d0-25 to d0-34
33	NC input of external fault	When the terminal is inactive, it is equivalent to an external fault input signal. When the terminal is active, the drive is in normal state. When an external signal is sent to the drive, the drive reports E015.2, and acts as defined by H1-02 (Protective action selection upon fault).	H1-02, H2-01
34	Frequency modification enable	When the terminal is active, the RFG input frequency can be modified. When the terminal is inactive, the RFG input frequency cannot be modified.	-

Value	Function	Description	Related parameters
35	PID action direction inversion	When the terminal is active, the PID action direction is opposite to the direction set by P2-01 (PID action direction).	P2-01
36	External stop terminal 1	When the terminal is active, the drive stops. This terminal functions in the same way as the STOP/RES key on the operating panel.	-
38	PID integral pause	When the terminal is active, the PID integral adjustment function pauses. However, the proportional and derivative adjustment functions are still valid.	P2-34
41, 76	Motor terminal selection	The function is used to select motor parameters. For example, when DI1 is assigned with function 41 and DI2 is assigned with function 76, motor 1 applies when DI1 and DI2 are inactive; motor 2 applies when DI1 is active and DI2 is inactive; motor 3 applies when DI1 is inactive and DI2 is active; motor 4 applies when DI1 and DI2 are both active.	b0-00, b0-01
43	PID parameter switchover	When the PID parameter switchover condition is set to "DI-based switchover" (P2-11 = 1) and the terminal is inactive, P2-14 to P2-16 (proportional gain Kp1, integral time Ti1, derivative time Td1) are used as PID parameters. When the terminal is active, P2-17 to P2-19 (proportional gain Kp2, integral time Ti2, derivative time Td2) are used as PID parameters.	P2-11 to P2-19
44	Source of user-defined fault 1	When the terminal is active, the drive reports E027.1, and acts as defined by H1-04 (Protective action selection upon fault).	H2-02
45	Source of user-defined fault 2	When the terminal is active, the drive reports E027.2, and acts according to the value of H1-04 (Protective action selection upon fault).	H2-03
46	Speed control/Torque control selection	The terminal is used to switch the AC drive between speed control and torque control. F0-02 (Speed/Torque control mode) is set to 0. In this case, the torque control mode is used when the terminal is active, and the speed control mode is used when the terminal is inactive. F0-02 (Speed/Torque control mode) is set to 1. In this case, the speed control mode is used when the terminal is active, and the torque control mode is used when the terminal is inactive.	F0-02
47	Emergency stop	When the terminal is active, the drive stops as defined by d0-06 (OFF3 (Quick stop) mode).	d0-06
49	Decelerate to DC braking	When the terminal is active, the drive decelerates to the value defined by d0-27 (Starting frequency for DC braking at stop) and then enters the DC braking state.	d0-27
50	Clear the current operating time	Used to clear the current operating time of the drive. If the current operating time is shorter than the time (greater than 0) set by P0-18 and P0-19 and the terminal is active, the current operating time is cleared. If the current operating time is longer than or equal to the time (greater than 0) set by P0-18 and P0-19, the current operating time is not cleared even if the terminal is active.	P0-18, P0-19, P0-20
61	Terminal start/stop module B_IN1	Defines input 1 of terminal module B. The function is determined by terminal module mode (active in terminal control).	b3-00, b9-00, b9-09, b9-10

Value	Function	Description	Related parameters
62	Terminal start/stop module B_IN2	Defines the input 2 of terminal module B. The function is determined by terminal module mode (active in terminal control).	b3-00, b9-00, b9-09, b9-11
63	Terminal start/stop module B_IN3	Defines the input 3 of terminal module B. The function is determined by terminal module mode (active in terminal control).	b3-00, b9-00, b9-09, b9-12
64	JOG1 source of terminal start/stop module B	When the terminal is active, the AC drive runs at low speed for a short time in the jog mode 1. The operation frequency and direction are determined by the jog 1 frequency, and the default is positive frequency. This is typically used for maintenance and commissioning on site. (This function is active in terminal control.)	b3-00, b9-15
65	JOG2 source of terminal start/stop module B	When the terminal is active, the AC drive runs at low speed for a short time in the jog mode 2. The operation frequency and direction are determined by the jog 2 frequency, and the default is negative frequency. This is typically used for maintenance and commissioning on site. (This function is active in terminal control.)	b3-00/b9-16
66	Forced local control	In any other control mode, if the terminal is active, forced local control applies.	-
67	Forced terminal control	In any other control mode, if the terminal is active, forced terminal control applies.	-
68	Forced communication control	In any other control mode, if the terminal is active, forced communication control applies.	-
69	Forced custom control	In any other control mode, if the terminal is active, forced custom control applies.	
70	Control channel selection	Used to select the control channel. When the terminal is inactive, control channel 1 applies. When the terminal is active, control channel 2 applies.	b0-02
71	Setting channel selection	Used to select the setting channel. When the terminal is inactive, the setting channel 1 applies. When the terminal is active, the setting channel 2 applies.	b0-03
72	Terminal module A/B selection	Used to select the terminal start/stop module. When the terminal is inactive, terminal start/stop module A applies. When the terminal is active, terminal start/stop module B applies.	b9-00
77	Operation enable (all modes)	When the terminal is active, the drive is allowed to run. When the terminal is inactive, operation is inhibited and the drive stops as defined by d0-07.	d0-07
78	Forward operation permission	When the terminal is active, the frequency reference is allowed to be positive. When the terminal is inactive, if the frequency reference is positive, the drive runs at 0 Hz.	-

Value	Function	Description	Related parameters
79	Reverse operation permission	When the terminal is active, the frequency reference is allowed to be negative. When the terminal is inactive, if the frequency reference is negative, the drive runs at 0 Hz.	-
80	RFG input clear	When the terminal is active, the drive runs at the set frequency. When the terminal is inactive, the target frequency is set to zero, and the drive runs at 0 Hz.	-

Note

The column "Related parameters" indicates the parameters that may need to be configured to implement the function.

Table 5–19 DI terminal status connector

Param.	Name	Default	Value range	Description
L0002	DI1	0	0 to 1	Bit connector: Displays the final level state of DI1 to DI7. **Value description:** 0: Terminal opened 1: Terminal closed **Note:** The options can be used for "Other: B connector".
L0003	DI2	0	0 to 1	
L0004 (MD630S-INT)	DI3	0	0 to 1	
L0005 (MD630S-INT)	DI4	0	0 to 1	
L0006 (MD630S-INT)	DI5	0	0 to 1	
L0007 (MD630S-INT)	DI6	0	0 to 1	
L0008 (MD630S-INT)	DI7	0	0 to 1	

Table 5–20 DI parameter list

Param.	Name	Default	Value range	Description
E0-16	DI input filter time 1	0.010s	0.000 to 1.000	Defines the filter time 1 for the drive to respond to changes in DI terminal status.
E0-17	DI input filter time 2	0.010s	0.000 to 1.000	Defines filter time 2 for the drive to respond to changes in DI status.
E0-18	DI input filter time selection	0	bit0 to bit1: DI1 filter time to DI2 filter time 0: Filter time 1 1: Filter time 2 bit2 to bit6: DI3 filter time to DI7 filter time (valid only for MD630S) 0: Filter time 1 1: Filter time 2 bit7 to bit15: Reserved	This parameter sets which DI filter time takes effect. **Value description:** bit0 to bit6: DI1 filter time to DI7 filter time 0: Filter time 1 - The filter time of DI1 to DI7 is defined by E0-16. 1: Filter time 2 - The filter time of DI1 to DI7 is defined by E0-17.

Param.	Name	Default	Value range	Description
E0-20	DI1 switch-on delay	0.0s	0.0 to 3600.0	Defines the delay variation coefficient when each terminal is switched on/off. **Note:** 1. It can be superimposed with the filter time. 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E0-21	DI1 switch-off delay	0.0s	0.0 to 3600.0	
E0-22	DI2 switch-on delay	0.0s	0.0 to 3600.0	
E0-23	DI2 switch-off delay	0.0s	0.0 to 3600.0	
E0-24	DI3 switch-on delay (MD630S)	0.0s	0.0 to 3600.0	
E0-25	DI3 switch-off delay (MD630S)	0.0s	0.0 to 3600.0	
E0-26	DI4 switch-on delay (MD630S)	0.0s	0.0 to 3600.0	
E0-27	DI4 switch-off delay (MD630S)	0.0s	0.0 to 3600.0	
E0-28	DI5 switch-on delay (MD630S)	0.0s	0.0 to 3600.0	
E0-29	DI5 switch-off delay (MD630S)	0.0s	0.0 to 3600.0	
E0-30	DI6 switch-on delay (MD630S)	0.0s	0.0 to 3600.0	
E0-31	DI6 switch-off delay (MD630S)	0.0s	0.0 to 3600.0	
E0-32	DI7 switch-on delay (MD630S)	0.0s	0.0 to 3600.0	
E0-33	DI7 switch-off delay (MD630S)	0.0s	0.0 to 3600.0	
E0-56	Set DI value to forced value	0	bit0 to bit1: Source of DI1 to DI2 0: Hardware 1: Forced value bit2 to bit6: Source of DI3 to DI7 0: Hardware 1: Forced value bit7 to bit15: Reserved	Defines the source of DI1 to DI7 (in bit sequence). **Value description:** bit0 to bit6: Source of DI1 to DI7 0: Hardware – The DI1 to DI7 input source is the hardware terminal. 1: Forced value – The DI1 to DI7 input source is E0-57. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

Param.	Name	Default	Value range	Description
E0-57	Force DI data	0	bit0 to bit1: Setting of DI1 to DI2 0: Low level 1: High level bit2 to bit5: Setting of DI3 to DI6 (valid only for MD630S) 0: Low level 1: High level bit6: DI7/HDI setting (valid only for MD630S) 0: Low level 1: High level bit7 to bit9: Reserved bit10 to bit15: Setting of VDI1 to VDI6 0: Low level 1: High level	Used to set the level state of forced data for DI1 and DI7 according to the bit sequence. **Value description:** Defines the level state of forced data for DI1 to DI7 and VDI1 to VDI6 (in bit sequence). **Note:** 1. For DI terminals, when the corresponding bit of E0-56 is set to 1, the parameter is valid. 2. For VDI, when E0-50 to E0-55 are set to 1, the parameter is valid. 3. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E0-58	DI active mode selection	0	bit0 to bit1: active mode of DI1 to DI2 0: Active high 1: Active low bit2 to bit6: Active mode of DI3 to DI7 (valid only for MD630S) 0: Active high 1: Active low bit7 to bit9: Reserved bit10 to bit15: Active mode of VDI1 to VDI6 0: Active high 1: Active low	Defines the active mode of DI1 to DI7 (in bit sequence). **Value description:** bit0 to bit6: Active mode of DI1 to DI7 0: Active high - Active level when the DI terminal is connected to the COM terminal 1: Active low - Active level when the DI terminal is disconnected from the COM terminal

Application example

When the DI1 and DI2 active mode (E0-58) is set to "Active high" (0x0000), to implement the function "DI1 for forward start and DI2 for reverse start", do as follows:

1. Set b9-01 to 3 (IN1 for forward start, IN2 for reverse start).
2. Set the DI1 function to "Terminal control IN1" (E0-00 = 01).
3. Set the DI2 function to "Terminal control IN2" (E0-01 = 02).
4. Set terminals as the main command source of control channel (b1-00 = 1).
5. Set the DI terminal active mode (E0-58 = 0), which is active when the terminal is closed and inactive when the terminal is opened. If opposite logic is required, set the corresponding bit of E0-58 to 1.

After preceding steps are done, when DI1 input is at active level and DI2 input is at inactive level, the drive is in forward run. When DI2 input is at active level and DI1 input is at inactive level, the drive is in reverse run.

5.2.10.3 Digital Output (DO) Terminal

Function List

The following table describes the standard functions of the RO, FM, and DO terminals. Only FM supports high-speed digital output (HDO), which is the default high-speed digital output (HDO). For details about HDO functions, see *"5.2.10.7 High-Speed Digital Output (HDO)" on page 356*.

Table 5–21 List of terminal functions

Function	Terminal		
	RO	FM	DO
Output function selection	Yes	Yes	Yes
Switch-on delay	Yes	Yes	Yes
Switch-off delay	Yes	Yes	Yes
Output source	Yes	Yes	Yes
Forced data	Yes	Yes	Yes
Output terminal polarity selection	Yes	Yes	Yes
Communication output	Yes	Yes	Yes
High-speed digital output	-	Yes	-

Description

The MD630S-INT is equipped with one relay output terminal (RO), one multi-functional output terminal FM, and one digital output terminal as standard. FM can be used as a normal DO (FMR) or HDO (FMP).

The MD630N-INT is equipped with one relay output terminal (RO) and one digital output terminal (DO) as standard. Each DO/RO terminal can be assigned with a specific function.

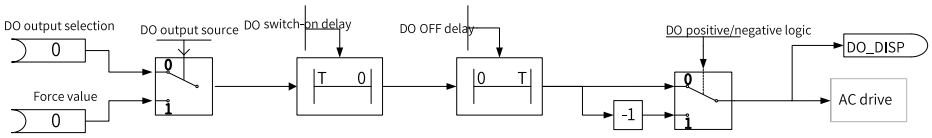


Figure 5-74 DO data flow diagram

DO terminal layout

For RO terminal layout of MD630S-INT, see CN3 in *"3.6.1 Control circuit terminals" on page 100*. For RO terminal layout of MD630N-INT, see CN3 in *"3.6.1 Control circuit terminals" on page 100*.

For DO terminal layout of MD630S, see CN5 in *"Table 3-6 Description of control circuit terminal layout of bus model" on page 105*. For DO terminal layout of MD630N, see CN5 in *"Table 3-6 Description of control circuit terminal layout of bus model" on page 105*.

For wiring of RO terminals, see *"3.6.3 Wiring of the Relay Output Terminals" on page 114*. For wiring of DO terminals, see *" Wiring of the DO terminal" on page 112*.

DO function

Name	Description	Related parameters
1. DO terminal function selection	The DO/RO terminals can be set through parameter groups E1-00 to E1-38. The FM terminal is used as HDO (FMP) by default. When E5-00 [FM multi-function terminal output selection] is set to 1 [Digital output (FMR)], This terminal can be used as an ordinary DO (FMR). In this case, the function is determined by E1-08.	*"10.8.2 E1: DO or RO" on page 1569*E1-00 to E1-38 Terminal function selection: *"Table 5-22 Setting the RO1/DO1/FMR terminal" on page 336*
2. Other function setting	-	*"Table 5-24 List of DO/RO-related parameters" on page 339*
3. Terminal status connector	1 .Displays current DO state. The value 0 indicates no output from the DO terminal. The value 1 indicates that output is generated from the DO terminal. 2 .You can configure the parameter labeled "Other: B connector" in the drop-down menu as the DO terminal status connector.	The DO terminal only supports two states, namely 0 (No output) and 1 (With output), which can be configured through the drop-down menu in parameters with option "Other: Connector B", as shown in *"5.7.1.1.1 Connector Introduction" on page 814*. *"Table 5-25 DO terminal status connector" on page 342*

Table 5–22 Setting the RO1/DO1/FMR terminal

Param.	Name	Default	Value range	Description
E1-00	RO1 function selection	2	0 to 44	See . *"Table 5-23 DO terminal functions" on page 336*.
E1-04	DO1 function selection	0		
E1-08	FMR output function selection (for MD630S)	0		

DO/RO terminals can be configured with the following functions.

Table 5–23 DO terminal functions

Value	Function	Description	Related parameters
0	No function	The terminal is not assigned with any function.	-
1	Drive operating	When the drive is operating and outputs frequency (can be zero), an active signal is outputted.	-
2	Fault	When the drive stops due to a fault (coast to stop, stop with maximum capability, quick stop, or decelerate to stop), an active signal is outputted.	-
3	Frequency level detection (FDT1)	When the operating frequency exceeds the frequency detection value, an active signal is outputted. When the running frequency falls below the result of the frequency detection value minus the FDT hysteresis (P0-34 x P0-35), the DO terminal stops outputting the active signal.	P0-34/P0-35
4	Frequency arrival	When the operating frequency of the drive is within the (target frequency±P0-38 x A2-04), the DO outputs an active signal.	P0-38

Value	Function	Description	Related parameters
5	Operating at zero speed (no output at stop)	When the output frequency is 0 during operation of the drive, an active signal is outputted. When the drive is in the stop state, this signal is inactive.	-
6	Motor overload pre-alarm	Before motor overload protection, the drive determines whether the motor load exceeds the overload pre-alarm threshold according to the overload pre-alarm coefficient (d1-47). If the threshold is exceeded, an active signal is outputted. (For calculation of the pre-alarm threshold, see the description of motor overload protection.)	d1-47
7	Drive overload pre-alarm	When the cumulative overload value of the drive reaches the pre-overload threshold (A3-53), an active signal is outputted.	A3-53
11	Cyclic operation of simple PLC	When simple PLC completes one cycle, the terminal outputs a pulse signal with width of 250 ms.	P1-00
12	Cumulative operating time arrival	If the cumulative operating time of the drive exceeds the time set by the combination of P0-18 and P0-19, an active signal is outputted.	P0-18, P0-19
13	Swing frequency limited	In swing frequency function, an active signal is outputted when the set frequency exceeds the upper or lower limit of frequency and the output frequency of drive reaches the upper or lower limit of frequency.	P0-94 to P0-96 F1-10, F1-11 F2-22 to F2-27
14	Torque limited	When the output torque of the drive reaches the torque limit in the speed control mode, an active signal is outputted.	F2-30 to F2-33
15	Ready to run	When no exception occurs on the drive after power-on, an active signal is outputted.	-
16	AI1 > AI2	When the per-unitized value of AI1 is higher than the per-unitized value of AI2 (L2244 AI1 input value higher than L2246 AI2 input value), an active signal is outputted.	E2-07 to E2-83
17	Frequency upper limit arrival	In forward run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or greater than the maximum positive frequency (L3068) multiplied by the per-unit frequency, an active signal is outputted. In reverse run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or greater than the maximum negative frequency (L3072) multiplied by the per-unit frequency, an active signal is outputted.	U0-00 to U0-01 F1-10 F2-22 to F2-25 L3068/L3072
18	Frequency lower limit arrival (no output at stop)	When P0-11 [Operation mode when frequency reference < frequency lower limit] is set to 1 [Stop], an inactive signal is outputted no matter whether the operating frequency reaches the lower limit. When P0-11 [Operation mode when frequency reference lower than the lower limit] is set to 0 [Operating at the frequency lower limit] or 2 [Operating at zero speed] and the operating frequency reaches the effective lower limit, an active signal is outputted. In forward run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or lower than the minimum positive frequency (L3070) multiplied by the per-unit frequency, an active signal is outputted. In reverse run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or lower than the minimum negative frequency (L3074) multiplied by the per-unit frequency, an active signal is outputted.	U0-00 to U0-01 F1-10 F2-26/F2-27 L3070/L3074
19	Undervoltage state	When undervoltage occurs on the drive, an active signal is outputted.	-
20	Communication reference	The terminal state is controlled by the setpoint of communication address 0x2001 or 0x7312. (n0-12 (Compatibility mode) must be enabled to write address 0x2001.)	n0-12 U3-18

Value	Function	Description	Related parameters
23	Operating at zero speed 2 (output generated even at stop)	When the output frequency is 0 during operation or when the drive is in the stop state, an output signal is outputted.	-
24	Cumulative power-on time arrival	When the cumulative power-on time of the drive (Ad-02/Ad-03) exceeds the time defined by P0-16/P0-17, an output signal is outputted.	Ad-02/Ad-03 P0-16, P0-17
25	Frequency level detection (FDT2)	When the operating frequency is higher than the frequency detection value, the DO outputs an "active" signal. When the operating frequency is lower than the result of the detection value minus the FDT hysteresis value (P0-36 x P0-37), the active signal outputted by the DO terminal is canceled.	P0-36/P0-37
26	Frequency 1 arrival	When the operating frequency of the drive is within the detection range of P0-39 (Frequency detection value 1), an active signal is outputted. Frequency detection range = (P0-39 to P0-40) x A2-04 (Per-unit frequency base value) to (P0-39 + P0-40) x A2-04 (Per-unit frequency base value)	P0-39/P0-40
27	Frequency 2 arrival	When the operating frequency of the drive is within the detection range of P0-41 (Frequency detection value 2), an active signal is outputted. Frequency detection range = (P0-41 to P0-42) x A2-04 (Per-unit frequency base value) to (P0-41 + P0-42) x A2-04 (Per-unit frequency base value)	P0-41/P0-42
28	Current 1 arrival	When the output current of the drive is within the detection range of P0-43 (Current detection value 1), an active signal is outputted. Current detection range = (P0-43 - P0-44) x C4-04 (Rated motor current) to (P0-43 + P0-44) x C4-04	P0-43/P0-44
29	Current 2 arrival	When the output current of the drive is within the detection range of P0-45 (Current detection value 2), an active signal is outputted. Current detection range = (P0-45- P0-46) x C4-04 (Rated motor current) to (P0-45+ P0-46) x C4-04	P0-45/P0-46
30	Timed operation arrival	When the timing function set by P0-13 is enabled and the operating time reaches the set timing period, an active signal is outputted. The timed operation is defined by P0-14 and P0-15.	P0-13 to P0-15
31	AI1 input limit violation	If the value of AI1 input is larger than the value of E2-14 (AI1 input protection upper limit) or lower than the value of E2-15 (AI1 input protection lower limit), an active signal is outputted.	E2-14, E2-15
32	Three-phase loss	When the drive encounters phase loss, an active signal is outputted.	-
33	Reverse run	When the drive is in reverse run, an active signal is outputted.	-
34	Zero current state	When the output current of the drive is within the zero-current range for a time exceeding P0-48 (Delay time for zero current detection), an active signal is outputted. Zero current detection range = 0 to (P0-47 x C4-04)	P0-47/P0-48
35	Module temperature arrival	When U0-82 [Heatsink temperature of the inverter module] reaches the value of P0-33 [Module temperature threshold], an active signal is outputted.	P0-33/U0-82
36	Output current limit violation	When the output current of the drive keeps exceeding P0-49 [Output current limit violation threshold] for a period longer than P0-50 [Delay time of output current limit violation detection], an active signal is outputted.	P0-49/P0-50

Value	Function	Description	Related parameters
37	Frequency lower limit arrival (output generated even at stop)	In forward run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or lower than the minimum positive frequency (L3070) multiplied by the per-unit frequency, an active signal is outputted. In reverse run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or lower than the minimum negative frequency (L3074) multiplied by the per-unit frequency, an active signal is outputted. When the set frequency is lower than the absolute value of the minimum effective frequency, an active signal is outputted in the stop state.	U0-00 to U0-01 F1-10 F2-26/F2-27 L3070/L3074
38	Error (fault/minor fault/alarm)	When a fault occurs and the drive continues operating upon fault, an active signal is outputted. For protective action selection upon fault, see parameters H1-00 to H1-13.	-
40	Current operating time arrival	When the current operating time of the drive exceeds the time defined by P0-20 (Current operating time arrival), an active signal is outputted.	P0-20/U0-26
41	Fault (excluding undervoltage)	When a fault (other than the undervoltage fault) occurs on the drive, an active signal is outputted.	-
42	STO	When STO is triggered, the RO terminal outputs an active signal.	-
43	Minor fault or alarm	When a minor fault that restricts the operation of the drive occurs, the operating panel of the drive displays "LXXX.XX" and an active signal is outputted.	-
44	AI2 input limit violation	If the value of AI2 input is higher than the value of E2-23 (AI2 input protection upper limit) or lower than the value of E2-24 (AI2 input protection lower limit), an active signal is outputted.	E2-23, E2-24

Table 5–24 List of DO/RO-related parameters

Param.	Name	Default	Value range	Description
E1-00	RO1 function selection	2	0 to 44	See *"Table 5-23 DO terminal functions" on page 336*.
E1-04	DO1 function selection	0		
E1-08	FMR (HDO) function selection (MD630S)	0		
E1-16	RO switch-on delay time	0.0s	0.0s to 3600.0s	Defines the RO output delay. The RO outputs an active signal only after the set delay elapses. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E1-17	RO switch-on delay time	0.0s	0.0s to 3600.0s	
E1-24	DO output switch-on delay time	0.0s	0.0s to 3600.0s	Defines the DO output delay. The DO terminal outputs an active signal only after the set delay time elapses. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E1-25	DO output switch-off delay	0.0s	0.0s to 3600.0s	

Param.	Name	Default	Value range	Description
E1-32	FMR output switch-on delay (MD630S)	0.0s	0.0s to 3600.0s	Defines the FMR output delay. FMR outputs an active signal only after the set delay elapses. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E1-33	FMR output switch-off delay	0.0s	0.0s to 3600.0s	
E1-36	DO/RO/VDO output source	0	bit0: RO output source 0: Output function 1: Forced value bit4: DO output source 0: Output function 1: Forced value bit8: FMR output source (MD630S) 0: Output function 1: Forced value bit10 to bit15: Output sources of VDO1 to VDO6 0: Output function 1: Forced value	Defines the output source of RO, DO, FMR, and VDO1 to VDO6 (in bit sequence). **Value description:** 0: Output function setting - The DO/RO/VDO output depends on E1-00 to E1-08 and E1-10 to E1-15. 1: Forced value - The DO/RO/VDO output depends on E1-37. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

Param.	Name	Default	Value range	Description
E1-37	Force value of DO/RO/VDO	0	bit0: RO setting 0: Low level 1: High level bit4: DO setting 0: Low level 1: High level bit8: FMR output source (MD630S) 0: Low level 1: High level	Defines the level state of forced values of RO, DO, FMR, and VDO1 to VDO6 (in bit sequence). **Value description:** 0: Low level - RO, DO, FMR, and VDO terminals output low level forcibly. 1: High level - RO, DO, FMR, and VDO terminals output high level forcibly. Note: This parameter is active when the corresponding bit of E1-36 is set to 1. In this case, the output is not related to the hardware. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E1-38	DO/RO/VDO terminal polarity selection	0	bit0: RO 0: Positive logic 1: Negative logic bit4: DO 0: Positive logic 1: Negative logic bit8: FMR output source (active only for MD630S) 0: Positive logic 1: Negative logic	Defines the polarity of the RO, DO, FMR, and VDO1 to VDO6 terminals (in bit sequence). **Value description:** 0: Positive logic - The output levels of RO, DO, FMR, and VDO are kept in positive logic. That is, when the output function of the selected terminal is active, RO, DO, FMR, and VDO generate output. Otherwise, RO, DO, FMR, or VDO does not generate output. 1: Negative logic - The output levels of RO, DO, FMR, and VDO are inverted. That is, when the output function of the selected terminal is inactive, RO, DO, FMR, and VDO generate output. Otherwise, RO, DO, FMR, or VDO does not generate output.

Table 5–25 DO terminal status connector

Param.	Name	Default	Value range	Description
L0034	RO	0	0 to 1	Bit connector: Displays the final level state of RO terminal. **Value description**: 0: No output 1: With output **Note:** It can be used as an option for parameters with "Other: B connector".
L0038	DO	0	0 to 1	Bit connector: Displays the final level state of DO terminal. **Value description:** 0: No output 1: With output **Note:** It can be used as an option for parameters with "Other: B connector".
L0042 (MD630S)	FMR	0	0 to 1	Bit connector: Displays the final level state of FMR terminal. **Value description:** 0: No output 1: With output **Note:** It can be used as an option for parameters with "Other: B connector".

Application example

When the DO output source (E1-36) is set to "Output function" (0x0000), to perform the following function: "DO terminal outputs an active signal during operation of the drive" , do as follows:

1. Assign the DO with function "In operation" (E1-04 = 1).
2. Set the polarity (E1-38 = 0000) of the RO, DO, and VDO terminals (according to the bit sequence).
   Value description:

   0: Positive logic

   The output levels of RO, FMR, DO, and VDO are kept in positive logic. That is, when the output function of the selected terminal is active, RO, FMR, DO, and VDO generate output. Otherwise, they do not generate output.

   1: Negative logic

   The output levels of RO, FMR, DO, and VDO are kept in negative logic. That is, when the output function of the selected terminal is inactive, RO, FMR, DO, and VDO generate output. Otherwise, they do not generate output.

If negative logic is selected, DO does not generate output during operation.

3. Set the output source of the DO to "Output function" (E1-36 = 0000), that is, whether the DO generates output depends on the function selected by E1-04.

After the preceding steps are done, the DO outputs active level during operation of the drive. When the drive stops, the DO outputs inactive level.

The FMR is a multi-functional output terminal unique to the MD630S-INT. It can be used as either a normal DO or an HDO. By default, it is used as an HDO. If you need to use it as a regular DO, set F4-88 (E5-00) [FM multi-functional terminal output selection] to 1 [Digital output].

5.2.10.4 Virtual Digital Input (VDI) Terminals

Function List

The following table describes the standard functions of VDI1 to VDI6.

Function	VDI terminal					
	VDI1	VDI2	VDI3	VDI4	VDI5	VDI6
VDI function selection	Yes	Yes	Yes	Yes	Yes	Yes
Whether the VDI source can be set	Yes	Yes	Yes	Yes	Yes	Yes
Forced data	Yes	Yes	Yes	Yes	Yes	Yes
Terminal active mode (active level)	Yes	Yes	Yes	Yes	Yes	Yes

Description

The VDI terminal, which is similar to the DI function, can be used as a multi-function digital input terminal.

The drive is equipped with six multi-functional DI terminals (VDI1 to VDI6) as standard. Each VDI terminal can be assigned with a specific function of the DI.

The VDI source can be set through E0-50 to E0-55, and function selection can be set through E0-10 to E0-15. When the VDI source set through E0-50 to E0-55 is active, the functions selected through E0-10 to E0-15 are active. The VDI source set through E0-50 to E0-55 can be used as DI terminals for expansion when the existing DIs cannot meet requirements.

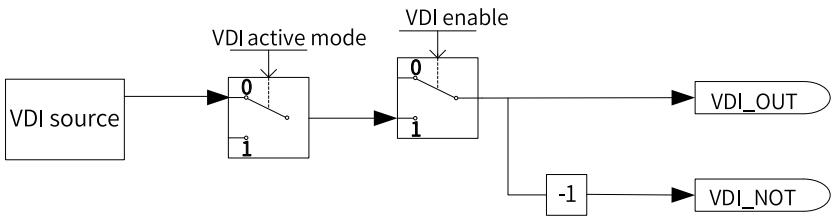


Figure 5-75 VDI data flow diagram

Layout of VDI terminals

VDI is the virtual DI terminal. The VDI source can be the actual physical terminal signals such as AI, DI, and DO/RO that set through E0-50 to E0-55.

After selecting the actual physical terminal signal, see the corresponding physical terminal for the hardware wiring diagram. For example, if the VDI source is AI1, see *"5.2.10.8 Analog Input (AI) Terminals" on page 361* to perform wiring. (Note: When AI2 is used in temperature mode, the AI fails to be used as DI. Therefore, AI2 is invalid as the VDI source.)

VDI function

Name	Description	Related parameters
1. VDI function selection	The VDI terminals can be set through E0-10 to E0-15. The optional functions are the same as those of the DI.	*"Table 5-26 VDI function selection" on page 344*
2. VDI source selection	The VDI source can be set through E0-50 to E0-55.	*"Table 5-27 VDI source" on page 345*
3. Other function setting	-	*"Table 5-28 Other function setting" on page 346*
4. Terminal status connector	1 .The status of the VDI terminal is displayed. The value 0 indicates that the VDI terminal has no input and the value 1 indicates that the VDI terminal has input. 2 .You can configure the parameter with option "Other: B connector" in the drop-down menu as the VDI terminal status connector.	The VDI terminal supports only 0 (closed) and 1 (opened). Therefore, the VDI terminal can be configured through a parameter with a drop-down menu containing "Other: B connector", as shown in *"5.7.1.1.1 Connector Introduction" on page 814*. *"Table 5-29 VDI terminal status connector" on page 347*

Table 5–26 VDI function selection

Param.	Name	Default	Value range	Description
E0-10	VDI1 function selection	0	0 to 80	See *"Table 5-18 DI terminal function description (E0-00 to E0-06)" on page 327*. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E0-11	VDI2 function selection	0		
E0-12	VDI3 function selection	0		
E0-13	VDI4 function selection	0		
E0-14	VDI5 function selection	0		
E0-15	VDI6 function selection	0		

Table 5–27 VDI source

Param.	Name	Default	Value range	Description
E0-50	VDI1 source	1	1: Forced value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 (active only for MD630S) 14: DI4 (active only for MD630S) 15: DI5 (active only for MD630S) 16: DI6 (active only for MD630S) 17: DI7/HDI (active only for MD630S) 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 27: DI1 on I/O card 1 28: DI2 on I/O card 1 29: DI3 on I/O card 1 30: DI1 on IO card 2 31: DI2 on IO card 2 32: DI3 on I/O card 2 51: RO1 55: DO1 59: FMR (Active only for MD630S) 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO6	Defines the VDI1 source. 1: Forced value. The forced value is set through E0-57. 4: AI1 - The DI setting source is based on the comparison between AI1 input and E2-35 and E2-36 settings. 5: AI2 - The DI setting source is based on the comparison between AI2 input and E2-35 and E2-36 settings. 11: DI1. Set source based on DI1 status. 12: DI2. Set source based on DI2 status. 13: DI3. Set source based on DI3 status. 14: DI4. Set source based on DI4 status. 15: DI5. Set source based on DI5 status. 16: DI6. Set source based on DI6 status. 17: DI7/HDI - Set source based on DI7 status. 22: VDI2. Set source based on VDI2 status. 23: VDI3. Set source based on VDI3 status. 24: VDI4. Set source based on VDI4 status. 25: VDI5. Set source based on VDI5 status. 26: VDI6. Set source based on VDI6 status. 27: DI1 on I/O card 1. Set source based on the status of DI1 on I/O card 1. 28: DI2 on I/O card 1. Set source based on the status of DI2 on I/O card 1. 29: DI3 on I/O card 1. Set source based on the status of DI3 on I/O card 1. 30: DI1 on I/O card 2. Set source based on the status of DI1 on I/O card 2. 31: DI2 on I/O card 2. Set source based on the status of DI2 on I/O card 2. 32: DI3 on I/O card 2. Set source based on the status of DI3 on I/O card 2. 51: RO1. Set source based on RO1 output status. 55: DO1. Set source based on DO1 output status. 59: FMR. Set source based on FMR output status. 61: VDO1. Set source based on VDO1 output status. 62: VDO2. Set source based on VDO2 output status. 63: VDO3. Set source based on VDO3 output status. 64: VDO4. Set source based on VDO4 output status. 65: VDO5. Set source based on VDO5 output status. 66: VDO6. Set source based on VDO6 output status.
E0-51	VDI2 source	1	Except for the absence of "22: VDI2" and addition of "21: VDI1", all the other values are the same as E0-50.	Defines the VDI2 source. **Same as E0-50.**
E0-52	VDI3 source	1	Except for the absence of "23: VDI3" and addition of "21: VDI1", all the other values are the same as E0-50.	Defines the VDI3 source. **Same as E0-50.**

Param.	Name	Default	Value range	Description
E0-53	VDI4 source	1	Except for the absence of "24: VDI4" and addition of "21: VDI1", all the other values are the same as E0-50.	Defines the VDI4 source. **Same as E0-50.**
E0-54	VDI5 source	1	Except for the absence of "25: VDI5" and addition of "21: VDI1", all the other values are the same as E0-50.	Defines the VDI5 source. **Same as E0-50.**
E0-55	VDI6 source	1	Except for the absence of "26: VDI6" and addition of "21: VDI1", all the other values are the same as E0-50.	Defines the VDI6 source. **Same as E0-50.**

Table 5–28 Other function setting

Param.	Name	Default	Value range	Description
E0-57	Force DI data	0	bit10 to bit15: Setting of VDI1 to VDI6 0: Low level 1: High level	Used to set the level state of forced data for VDI1 and VDI6 according to the bit sequence. **Value description:** Used to set the level state of forced data for VDI1 and VDI6 according to the bit sequence. Note: 1. For VDI, this parameter is valid when E0-50 to E0-55 are set to 1 (Forced value). 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than “Extended”.
E0-58	DI active mode selection	0	bit10 to bit15: Active mode of VDI1 to VDI6 0: Active high 1: Active low	Defines the active mode of VDI1 to VDI6 (in bit sequence). **Value description:** bit10: VDI1 active mode 0: Active high - When the VDI1 source set by E0-50 is high level, the function selected by E0-10 is active. 1: Active low - When the VDI1 source set by E0-50 is low level, the function selected by E0-10 is active. bit11 to bit15: Active mode of VDI2 to VDI6 0: Active high 1: Active low

Table 5–29 VDI terminal status connector

Param.	Name	Default	Value range	Description
L0012	VDI1	0	0 to 1	Bit connector: Displays the final level state of VDI1. **Value description:** 0: Opened 1: Closed Note: The options can be used for "Other: B connector".
L0013	VDI2	0	0 to 1	Bit connector: Displays the final level state of VDI2. **Description:** Same as L0012.
L0014	VDI3	0	0 to 1	Bit connector: Displays the final level state of VDI3. **Description:** Same as L0012.
L0015	VDI4	0	0 to 1	Bit connector: Displays the final level state of VDI4. **Description:** Same as L0012.
L0016	VDI5	0	0 to 1	Bit connector: Displays the final level state of VDI5. **Description:** Same as L0012.
L0017	VDI6	0	0 to 1	Bit connector: Displays the final level state of VDI6. **Description:** Same as L0012.

Application example

When E0-58 (Active mode of VDI1 and VDI2) is set to 00000, to implement the function "VDI1 for forward start and VDI2 for reverse start", do as follows:

1. Set the VDI1 function to "Terminal control IN1" (E0-10 = 1).
2. Set the VDI2 function to "Terminal control IN2" (E0-11 = 2).
3. Set the VDI1 source to "VDO1" (E0-50 = 61).
4. Set the VDI2 source to "VDO2" (E0-51 = 62).
5. Set the command source to "Terminal" (b1-00 = 1).
6. Set the start/stop module mode (b9-01 = 3).
7. Set VDO1 and VDO2 output source to "Forced value" (E1-36 = 0x0C00).

After preceding steps are done, when the forced VDO1 output is at active level, E1-37 is set to 0x0400 (VDI1 input is at active level), and VDO2 does not have output (VDI2 input is at inactive level), the drive is in forward run state. When the forced VDO2 output is at active level, E1-37 is set to 0x0800 (VDI2 input is at active level), and VDO1 does not have output (VDI1 input is at inactive level), the drive is in reverse run state.

5.2.10.5 Virtual Digital Output (VDO) Terminals

Function List

The following table describes the standard functions of VDO1 to VDO6.

Table 5–30 List of VDO terminal functions

Function	VDO terminal					
	VDO1	VDO2	VDO3	VDO4	VDO5	VDO6
VDO function selection	Yes	Yes	Yes	Yes	Yes	Yes
Output source	Yes	Yes	Yes	Yes	Yes	Yes
Forced data	Yes	Yes	Yes	Yes	Yes	Yes
Output terminal polarity selection	Yes	Yes	Yes	Yes	Yes	Yes

Description

The drive is equipped with six multi-function relay output terminals (VDO1 to VDO6) as standard. Each VDO terminal can be assigned with a specific function. The VDI and VDO can be used together to implement flexible control and simple logic control.

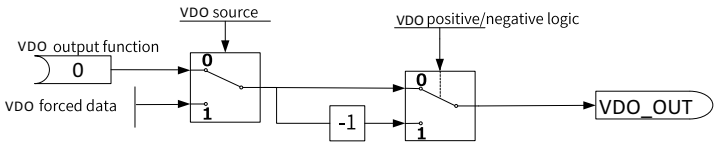


Figure 5-76 VDO data flow diagram

VDO terminal layout

VDO is the virtual DO terminal.

VDO function

Name	Description	Related parameters
1. VDO function selection	VDO terminals can be set through E1-10 to E1-15. See E1-00 to E1-38 for details.	*"10.8.2 E1: DO or RO" on page 1569*E1-00 to E1-38 Terminal function selection: *"Table 5-31 VDO function selection" on page 349*
2. Other function setting	-	*"Table 5-32 VDO-related parameter list" on page 349*
3. Terminal status connector	1 .Displays current VDO state. The value 0 indicates no output from the VDO terminal. The value 1 indicates that output is generated from the VDO terminal. 2 .You can configure the parameter labeled "Other: B connector" in the drop-down menu as the VDO terminal status connector.	The VDO terminal only supports two states, namely 0 (No output) and 1 (With output), which can be configured through the drop-down menu in parameters with option "Other: B connector", as shown in *"5.7.1.1.1 Connector Introduction" on page 814* *"Table 5-33 VDO terminal status connector" on page 350*

Table 5–31 VDO function selection

Param.	Name	Default	Value range	Description
E1-10	VDO1 function selection	0	0 to 44	For details, see "Table 5-23 DO terminal functions" on page 336.
E1-11	VDO2 function selection	0	Same as E1-10	Same as E1-10
E1-12	VDO3 function selection	0	Same as E1-10	Same as E1-10
E1-13	VDO4 function selection	0	Same as E1-10	Same as E1-10
E1-14	VDO5 function selection	0	Same as E1-10	Same as E1-10
E1-15	VDO6 function selection	0	Same as E1-10	Same as E1-10

Table 5–32 VDO-related parameter list

Param.	Name	Default	Value range	Description
E1-37	Forced DO/RO data	0	bit10 to bit15: Settings of VDO1 to VDO6 0: Low level 1: High level	Defines the level state of the forced values of the RO, DO, and VDO (in bit order). **Value description:** 0: Low level - The output of the RO, DO, and VDO is forced to be low level. 1: High level - The output of the RO, DO, and VDO is forced to be high level. Note: This parameter is valid when the corresponding bit of E1-36 is set to 1. In this case, the output is not related to the hardware. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E1-38	DO/RO polarity selection	0	bit10 to bit15: VDO1 to VDO6 0: Positive logic 1: Negative logic	bit0 to bit15 of this parameter specify the polarities of the VDO terminal. **Value description:** 0: Positive logic - DO and VDO output levels are set to positive logic, which means the VDO terminal outputs a signal when the functions selected in E1-00 to E1-04 and E1-10 to E1-15 are active or when E1-37 outputs a high level. 1: Negative Logic - DO and VDO output levels are set to negative logic, which means the VDO terminal outputs a signal when the functions selected in E1-00 to E1-04 and E1-10 to E1-15 are inactive or when E1-37 outputs a low level.

Table 5–33 VDO terminal status connector

Param.	Name	Default	Value range	Description
L0044	VDO1	0	0 to 1	Bit connector: Displays the final level state of VDO1. **Value description:** 0: No output 1: With output **Note:** The options can be used for "Other: B connector".
L0045	VDO2	0	0 to 1	Bit connector: Displays the final level state of VDO2. **Description:** Same as L0044.
L0046	VDO3	0	0 to 1	Bit connector: Displays the final level state of VDO3. **Description:** Same as L0044.
L0047	VDO4	0	0 to 1	Bit connector: Displays the final level state of VDO4. **Description:** Same as L0044.
L0048	VDO5	0	0 to 1	Bit connector: Displays the final level state of VDO5. **Description:** Same as L0044.
L0049	VDO6	0	0 to 1	Bit connector: Displays the final level state of VDO6. **Description:** Same as L0044.

Application example

When the VDO output source (E1-36) is set to 0000 (Output function), do as follows if you need VDO to output an active signal upon fault.

1. Assign VDO with function "Fault output" (E1-10 = 02).
2. Set the output source of VDO to "Output function" (E1-36 = 0000).

After preceding steps are done, VDO outputs active level upon fault or inactive level when the fault is cleared.

5.2.10.6 High-Speed Digital Input (HDI)

Function List

The HDI function is provided by the high-speed digital input terminal DI7.

Function	HDI (DI7)
Terminal type selection (normal DI/high-speed HDI)	Yes
Hardware source selection	Yes
Forced value	Yes
Two-point curve	Yes
Four-point curve	Yes
Curve selection	Yes
Curve absolute value/inversion calculation	Yes
Upper/Lower limit selection of the curve	Yes
Filter time	Yes

Function	HDI (DI7)
De-noising threshold	Yes
Salt-and-pepper noise	Yes

Description

The MD630S-INT is equipped with a high-speed digital input terminal as standard. The MD630N-INT is not equipped with a DI7 terminal. Therefore, it does not support the high-speed digital input terminal function (HDI).

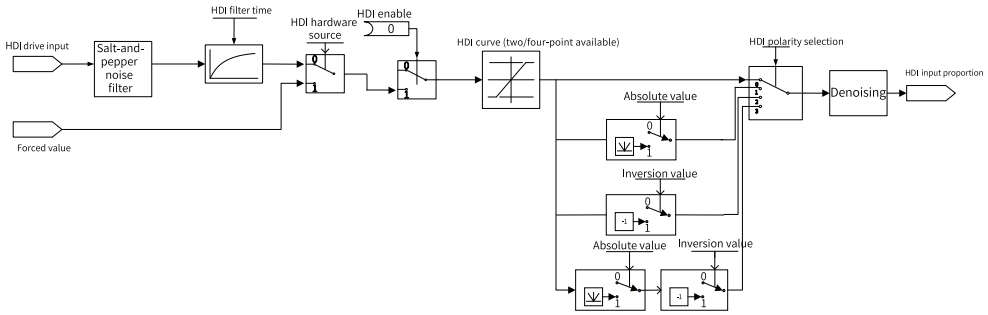


Figure 5-77 HDI data flow diagram

HDI terminal layout

For the DI terminal layout of the MD630S-INT, see CN4 in *"Table 3-6 Description of control circuit terminal layout of bus model" on page 105*. The MD630N-INT has no high-speed digital input terminal.

For details about the DI terminal wiring, see *" Wiring of the DI terminal" on page 111*.

HDI function

Name	Description	Related parameters
1. DI7 terminal type selection	DI7 is used as a regular DI by default. If it is used as a high-speed digital input terminal (HDI), change E4-00 (HDI terminal type selection) to 0 (Used as HDI). After the setting takes effect, E4-01 (HDI input enable state) is set to 1 (Enable). In this case, the function of DI7 is defined by E4-00 to E4-36.	*"Table 5-34 DI7 terminal type selection" on page 352*
2. Other function setting	-	*"Table 5-35 List of HDI functions" on page 352*

Table 5–34 DI7 terminal type selection

Param.	Name	Default	Value range	Description
E4-00	DI7/HDI terminal type selection	1	0 to 1	Defines the function assigned to DI7. **Value description:** 0: Use as HDI - DI7 is used as the HDI. 1: Used as DI - DI7 is used as a regular DI.
E4-01	HDI input enable state	0	0 to 1	Displays the HDI state. **Value description:** 0: Disable - HDI is disabled. 1: Enable - HDI is enabled. **Note:** Whether HDI is enabled is determined by E4-00.

Table 5–35 List of HDI functions

Param.	Name	Default	Value range	Description
E4-02	HDI hardware source	0	0 to 1	Used to select the HDI input source. 0: Hardware sampling - The HDI input source is the hardware sampling, namely DI7 input. 1: Forced value - The HDI input source is the forced value set by E4-03. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E4-03	HDI forced value	0.00 kHz	0.00 kHz to 20.00 kHz	Defines the forced HDI value. **Note:** 1. This parameter is valid when HDI input is enabled and the value of E4-02 is set to 1 (Forced value). 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than “Extended” .
E4-07	HDI curve setting	0	0 to 1	This parameter is used to select the HDI curve type, which is available in two-point curve or four-point curve. **Value description:** 0: Two-point curve - The two-point curve is selected. 1: Four-point curve - The four-point curve is selected.

Param.	Name	Default	Value range	Description
E4-08	Minimum input of HDI two-point curve	0.00 kHz	0.00 kHz to E4-10	Defines the minimum input point of x-axis on HDI two-point curve, that is, the minimum pulse input frequency. **Note:** When the high-speed pulse of DI7 terminal is used as the source of the main frequency reference, you must define a curve that relates pulse frequencies with frequency references. The frequency references are percentages to the rated motor frequency (C4-06). The x-axis of this curve represents the pulse frequencies of DI7 terminal, and the y-axis represents the percentages to the rated motor frequency (C4-06). The curve is a two-point linear graph with the minimum input point and the maximum input point. E4-08 corresponds to the minimum input point on the x-axis, that is, the minimum pulse input frequency.
E4-09	Percentage corresponding to the minimum input of HDI two-point curve	0.0%	-800.0% to +800.0%	Sets the y-axis corresponding to the minimum input point on HDI two-point curve, that is, the percentage corresponding to the minimum pulse input. **Note:** Same as E4-08 E4-09 corresponds to the y-axis of minimum pulse input, that is, the setpoint corresponding to the minimum pulse input frequency.
E4-10	Maximum input of HDI two-point curve	20.00 kHz	E4-08 to 20.00 kHz	This parameter sets the maximum input point on the x-axis of the HDI two-point curve, that is, the maximum pulse input frequency. **Note:** Same as E4-08 E4-10 corresponds to the x-axis of the maximum pulse input, that is, the maximum pulse input frequency.
E4-11	Percentage corresponding to the maximum input of HDI two-point curve	100.0%	-800.0% to +800.0%	This parameter sets the y-axis of the HDI two-point curve maximum input, that is, the per unit percentage corresponding to the maximum pulse input. **Note:** Same as E4-08 E4-11 corresponds to the y-axis of the maximum pulse input, that is, the set value corresponding to the maximum pulse input frequency.
E4-12	Minimum input of HDI four-point curve	0.00 kHz	0.00 kHz to E4-14	This parameter sets the minimum input on the x-axis of the HDI four-point curve, that is, the minimum pulse input frequency. **Note:** When the high-speed pulse of DI7 terminal is used as the main frequency reference, you must define a curve that relates pulse frequencies with frequency references. The frequency references are percentages to the rated motor frequency (C4-06). The x-axis of this curve represents the pulse frequencies of DI7 terminal, and the y-axis represents the percentages to the rated motor frequency (C4-06). The curve is a four-point linear graph with the minimum input point, two inflection points, and the maximum input point. E4-12 corresponds to the x-axis of the minimum pulse input, that is, the minimum pulse input frequency.

Param.	Name	Default	Value range	Description
E4-13	Percentage corresponding to the minimum input of HDI four-point curve	-100.0%	-800.0% to +800.0%	This parameter sets the y-axis of the HDI four-point curve minimum input, that is, the per unit percentage corresponding to the minimum pulse input. **Note:** Same as E4-12. E4-13 corresponds to the y-axis of the minimum pulse input, that is, the setpoint corresponding to the minimum pulse input frequency.
E4-14	Inflection point 1 input of HDI four-point curve	5.00 kHz	E4-12 to E4-16	Defines the inflection point 1 of x-axis on HDI four-point curve, that is, the pulse input frequency of inflection point 1. **Note:** Same as E4-12. E4-14 corresponds to the x-axis of the inflection point 1, that is, the pulse input frequency of inflection point 1.
E4-15	Percentage corresponding to inflection point 1 input of HDI four-point curve	-30.0%	-800.0% to +800.0%	This parameter sets the y-axis of HDI four-point curve inflection point 1, that is, the per unit percentage corresponding to inflection point 1. **Note:** Same as E4-12. E4-15 corresponds to the y-axis of the inflection point 1, that is, the setpoint corresponding to the pulse input frequency of inflection point 1.
E4-16	Inflection point 2 input of HDI four-point curve	10.00 kHz	E4-14 to E4-18	Defines the inflection point 2 of x-axis on HDI four-point curve, that is, the pulse input frequency of inflection point 2. **Note:** Same as E4-12. E4-16 corresponds to the x-axis of the inflection point 2, that is, the pulse input frequency of inflection point 2.
E4-17	Percentage corresponding to inflection point 2 input of HDI four-point curve	30.0%	-800.0% to +800.0%	Defines the y-axis corresponding to inflection point 2 on the HDI 4-point pulse curve, that is, the per unit percentage corresponding to inflection point 2. **Note:** Same as E4-12. E4-17 corresponds to the y-axis of the inflection point 2, that is, the setpoint corresponding to the pulse input frequency of inflection point 2.
E4-18	Maximum input of HDI four-point curve	20.00 kHz	E4-16 to 20.00 kHz	This parameter sets the maximum input on the x-axis of the HDI four-point curve, that is, the maximum pulse input frequency. **Note:** Same as E4-12. E4-18 corresponds to the x-axis of the maximum pulse input, that is, the maximum pulse input frequency.
E4-19	Percentage corresponding to the maximum input of HDI four-point curve	100.0%	-800.0% to +800.0%	This parameter sets the y-axis of HDI four-point curve maximum input, that is, the per unit percentage corresponding to the maximum pulse input. **Note:** Same as E4-12. E4-19 corresponds to the y-axis of the maximum pulse input, that is, the setpoint corresponding to the maximum pulse input frequency.

Param.	Name	Default	Value range	Description
E4-32	HDI filter time	0.10s	0.00s to 10.00s	The parameter is used to set the HDI software filter time. **Note:** 1. Perform software filtering on HDI pulse input (after the salt-and-pepper noise is processed). 2. When on-site signals are prone to interference, you can increase the HDI filter time to enhance the stability of per unit percentage input to the drive.
E4-33	Inversion calculation of HDI curve absolute value	0	0 to 3	This parameter sets the processing mode of HDI sampling values. **Value description:** Ones: HDI 0: Normal - The percentage of the HDI input on which per unit is performed based on the curve is used. 1: Absolute value - The absolute value of the percentage of the HDI input on which per unit is performed based on the curve is used. 2: Opposite to the normal value - The percentage of the HDI input on which per unit is performed based on the curve is inverted. 3: Opposite to the absolute value - The absolute value of the percentage of the HDI input on which per unit is performed based on the curve is inverted.
E4-34	HDI de-noising threshold	0.0%	0.0 % to 10.0%	This parameter sets the HDI denoising time. **Note:** 1. For the percentage of the HDI input on which per unit is performed based on the HDI curve, if the absolute value of the difference between current value and the last value is within the threshold, de-noising is performed. That is, the percentage remains unchanged. 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

Param.	Name	Default	Value range	Description
E4-35	HDI curve upper/lower limit selection	0	0 to 1	This parameter sets the output when the HDI input pulse is lower than the minimum input of the curve. **Description:** Ones: 0: Limited - When the HDI input is lower than the minimum input of the curve, the curve per unit percentage is the value corresponding to the minimum input. 1: Not limited - When the AI input voltage is lower than the minimum input of the curve, the interpolation calculation continues based on the curve slope.
E4-36	Salt-and-pepper noise of the HDI	0	0 ms to 1000 ms	Defines the duration for filtering salt-and-pepper noise of the HDI. The threshold of the salt-and-pepper noise of the HDI is 250 Hz. **Note:** 1. For HDI hardware sampling, if the absolute value of the difference between the current cycle input and the last cycle input is greater than the threshold (250 Hz), the signal of the last cycle is inputted. After the time defined by E4-36 elapses, the HDI signal of the current cycle is inputted. 2. If the absolute value of the difference between the current cycle input and the last cycle input is lower than the threshold of 250 Hz, the HDI signal of the last cycle is inputted directly.

Application example

To set the main frequency source to HDI, do as follows:

1. Set DI7 to "Used as HDI" (E4-00 = 0).
2. Set the function of HDI curve to "0 kHz to 20 kHz correspond to 0% to 100%" (E4-08 = 0 kHz, E4-09 = 0%, E4-10 = 20 kHz, and E4-11 = 100%).
3. Set the frequency source to HDI input (b5-00 = 5).

After the preceding settings, when HDI input is 0 Hz, the main frequency is set to 0 Hz. When HDI input is 10 kHz, the main frequency is set to 50% of C4-06 (Rated motor frequency).

5.2.10.7 High-Speed Digital Output (HDO)

Function List

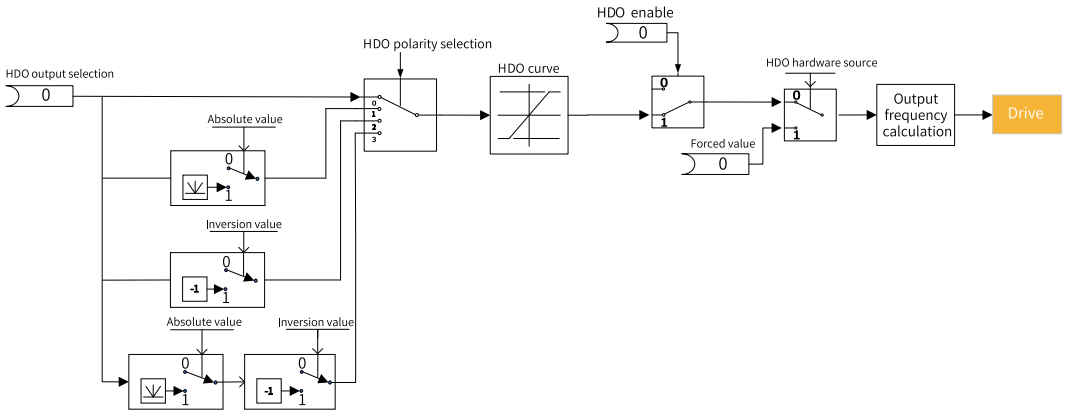
The HDO function is provided by the high-speed digital output terminal FM.

Function	HDO (FM)
Terminal output selection (normal DO/high-speed HDO)	Yes
Output function selection	Yes
Two-point curve	Yes
Output polarity selection	Yes
Hardware source selection	Yes

Function	HDO (FM)
Forced value	Yes
Maximum output frequency setting	Yes

Description

The MD630S-INT is equipped with a high-speed digital output terminal as standard, namely FM. The MD630N is not equipped with an FM terminal. Therefore, it does not support the high-speed digital output terminal function (HDO).



HDO terminal layout

For the HDO terminal layout of the MD630S-INT, refer to CN5 in *"Table 3-6 Description of control circuit terminal layout of bus model" on page 105*. MD630N-INT has no high-speed digital output terminal.

For hardware wiring of high-speed output terminals of MD630S-INT, refer to *" Wiring of the high-speed digital output terminal FM" on page 113*.

HDO function

Name	Description	Related parameters
1.FM terminal type selection	FM is used as a common DO terminal by default. You can select the FM terminal function through E5-00 (FM multi-functional terminal output selection). When E5-00 is set to 0 (HDO pulse output (FMP)), its function is determined by E5-00 to E5-15 (HDO-related functions).	*"Table 5-36 FM terminal type selection" on page 358*
2.HDO function selection	-	*"Table 5-37 HDO function selection parameter" on page 358*
3. Other function selection	-	*"Table 5-39 Other function selection" on page 359*

Table 5–36 FM terminal type selection

Param.	Description	Default	Value range	Description
E5-00	FM multi-functional terminal output selection	0	0 to 1	Used to set the FM multi-functional terminal output to FMP (HDO high-speed pulse output terminal) or FMR (Digital output terminal for open collector). **Value description:** 0: HDO pulse output (FMP) - The FM terminal is used as the HDO pulse output terminal. 1: Digital output (FMR) - The FM terminal is used as the common DO (FMR) output terminal.

Table 5–37 HDO function selection parameter

Param.	Description	Default	Value range	Description
E5-01	HDO function selection	0	0 to 16	See *"Table 5-38 List of HDO functions" on page 358*.

Table 5–38 List of HDO functions

Value	Function	Description
0	Operating frequency	The HDO outputs the pulse that corresponds to the ratio of the drive operating frequency to the rated motor frequency (100.0% corresponds to the rated motor frequency).
1	Frequency reference	The HDO outputs the pulse that corresponds to the ratio of the drive frequency reference to the rated motor frequency (100.0% corresponds to the rated motor frequency).
2	Output current	The HDO outputs the pulse that corresponds to the ratio of the drive output current to the rated motor current (100.0% corresponds to two times the rated motor current).
3	Motor output torque (absolute value)	The HDO outputs the pulse that corresponds to the ratio of the drive output torque (absolute value) to the rated motor torque (100.0% corresponds to two times the rated motor torque).
4	Output power	The HDO outputs the pulse that corresponds to the ratio of the drive output power to the rated motor power (100.0% corresponds to two times the rated motor power).
5	Output voltage	The HDO outputs the pulse that corresponds to the ratio of the drive output voltage to the rated motor voltage (100.0% corresponds to 1.2 times the rated motor voltage).
6	Pulse input	HDO output pulses follow HDI input frequency (50.0% corresponds to 20.0 kHz).
7	AI1	HDO output pulses follow AI1 input voltage (100.0% corresponds to 10 V).
8	AI2	HDO output pulses follow AI2 input voltage (100.0% corresponds to 10 V).
12	Communication reference	The HDO outputs the pulse that corresponds to the ratio of data that is written to 2004H/7315H address to 32767 (100.0% corresponds to HDO communication setting).
13	Motor speed	The HDO outputs the pulse that corresponds to the ratio of the motor speed to the motor speed at the rated motor frequency (100.0% corresponds to the speed at the rated frequency).
14	Output current	The HDO outputs the pulse that corresponds to the ratio of the AC drive output current to 1000 A (100.0% corresponds to 1000.0 A).
15	Bus voltage	The HDO outputs the pulse that corresponds to the ratio of the AC drive bus voltage to 1000 V (100.0% corresponds to 1000.0 V).
16	Motor output torque (actual value, proportion to the rated motor torque)	The HDO outputs the pulse that corresponds to the ratio of the AC drive output torque to the rated motor torque (100% corresponds to the rated motor torque, 50% corresponds to 0, 0% corresponds to the negative rated motor torque).

Table 5–39 Other function selection

Param.	Description	Default	Value range	Description
E5-03	Minimum input of HDO curve	0.0%	-100.0% to E5-05	This parameter sets the minimum input on the x-axis of the HDO curve, that is, the per-unit percentage of the selected HDO function. **Note:** The HDO curve input is the percentage of the function variable selected by E5-01. The curve output is the percentage of the maximum frequency of the HDO output (E5-15).
E5-04	Percentage corresponding to the minimum input of HDO curve	0.00 %	0.00 % to 100.00%	Defines the y-axis corresponding to the minimum input point of the HDO curve, that is, the percentage of the maximum frequency of HDO output (E5-15). **Note:** See E5-03.
E5-05	Maximum input of HDO curve	100.0%	E5-03 to 100.0%	This parameter sets the maximum input on the x-axis of the HDO curve, that is, the per-unit percentage of the selected HDO function. **Note:** See E5-03.
E5-06	Percentage corresponding to the maximum input of HDO curve	100.00 %	0.00 % to 100.00%	Defines the y-axis corresponding to the maximum input point of the HDO curve, that is, the percentage of the maximum frequency of the HDO output (E5-15). **Note:** See E5-03.
E5-11	HDO output polarity selection	0	Ones: HDO selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	Defines the HDO output polarity. **Value description:** 0: Normal value - The per-unit percentage of the selected function remains unchanged. 1: Absolute value - The absolute value of the per-unit percentage of the selected function is used. 2: Inversion - The inverted per-unit percentage of the selected function is used. 3: Absolute value inversion - The inverted absolute value of the per-unit percentage of the selected function is used.

Param.	Description	Default	Value range	Description
E5-12	HDO hardware source	0	Ones: HDO selection 0: Output function 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	Defines the hardware source of HDO. **Value description:** 0: Output function - E5-01 is used as the source. 1: Forced value - E5-13 is used as the source.
E5-13	HDO forced value	0.00 %	0.00 % to 100.00%	Defines the HDO forced output value, which is a percentage to the maximum frequency of HDO output (E5-15). **Note:** This parameter is active when E5-12 is set to 1.
E5-15	Maximum frequency of HDO output	50.00 kHz	0.01 kHz to 100.00 kHz	Defines the maximum frequency of HDO output. **Note:** The final HDO output frequency is calculated based on the HDO curve or E5-15 x percentage set by forced value.

Application example

To set the HDO to output the operating frequency of the drive, do as follows:

1. Set E5-00 (FM multi-function terminal output selection) to 0 (HDO pulse output (FMP)).
2. Allocate the HDO with function "Operating frequency" (E5-01 = 0).
3. Set the HDO curve relationship to "0% to 100% (per-unit percentage of the function variable selected by E5-01) correspond to 0% to 100% (per-unit percentage that the HDO output pulse corresponds to the HDO output maximum frequency set by E5-15).
4. Set E5-03 (Minimum input of HDO curve) to 0.0% (per-unit percentage of the function variable selected by E5-01), and set E5-04 (Percentage corresponding to HDO minimum input) to 0.0% (percentage of HDO output maximum frequency set by E5-15).
5. Set E5-05 (Maximum input of HDO curve to 100.0% (per-unit percentage of the function variable selected by E5-01), and set E5-06 (Percentage corresponding to HDO maximum input to 100.0% (percentage of HDO output maximum frequency set by E5-15).
6. Set the HDO output maximum frequency to 50 kHz (E5-15 = 50.00 kHz).

After the above steps, when the drive is running, it calculates the per-unit percentage of the HDO output frequency based on the per-unit percentage of the current running frequency and the curve set by E5-03 to E5-06. The actual pulse frequency of the HDO output is obtained by the formula: per-unit percentage of the HDO output frequency x E5-15 (HDO output maximum frequency). The product is used to drive the FM terminal output.

For example: The rated frequency is 50 Hz, and the running frequency (25 Hz) is 50% x rated frequency. In this case, 50% is obtained from the HDO curve. Based on E5-03 to E5-06, the HDO curve

output value is 50%. The current HDO output maximum frequency is 50 kHz. Therefore, the final HDO output frequency is 50 kHz × 50% = 25 kHz.

5.2.10.8 Analog Input (AI) Terminals

Function List

The following table describes the standard functions of AI1 and AI2 terminals. Only AI2 supports the temperature mode. If AI2 is set to the temperature mode, the calibration, gain+offset, denoising, and filtering functions are deactivated for AI2.

Table 5–40 List of AI terminal functions

Function	Terminal	
	AI1	AI2
Voltage/Current input switchover	Yes	Yes
Calibration	Yes	Yes
Gain+Offset	Yes	Yes
Denoising	Yes	Yes
Filter time setting	Yes	Yes
Dead zone width	Yes	Yes
Jump point+Jump amplitude setting	Yes	Yes
Input protection upper limit/lower limit/protection time	Yes	Yes
High/Low level threshold when AI is used as DI	Yes	Yes
Curve absolute value/inversion calculation	Yes	Yes
Curve selection	Yes	Yes
Curve lower limit selection	Yes	Yes
Two-point curves 1 to 3	Yes	Yes
Four-point curves 1 and 2	Yes	Yes
Hardware source selection	Yes	Yes
Forced value setting	Yes	Yes
AI temperature mode	-	Yes

Description

The MD630S-INT and MD630N-INT are equipped with two analog input terminals (input range: -10 V to +10 V) as standard. Input curve processing gain and deviation processing can be selected for the AI to achieve corresponding functions.

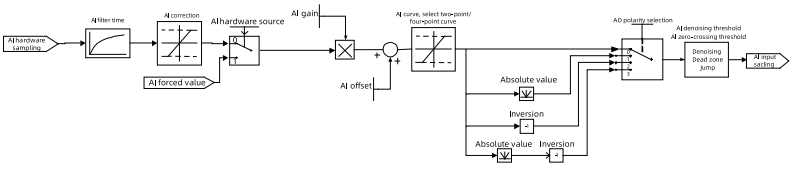


Figure 5-78 AI data flow diagram

AI terminal layout

For AI terminal layout of MD630S-INT, see CN4 in *"Table 3-6 Description of control circuit terminal layout of bus model" on page 105*. For AI terminal layout of MD630N-INT, see CN4 in *"Figure 3-44 Control circuit terminal layout of bus model" on page 105*.

Take MD630S-INT as an example. For the AI1 wiring, see *" Wiring of AI1 terminal" on page 109*. For the AI2 wiring, see *" Wiring of AI2 terminal" on page 109*.

Note

- The AI1 voltage/current mode of the MD630S-INT is switched by DIP switch S4 on the control board, the AI2 voltage/current mode is switched by DIP switch S2 on the control board, and the AI2 temperature mode is switched by DIP switch S3 on the control board.
- The AI1 voltage/current mode of the MD630N-INT is switched by DIP switch S3 on the control board, the AI2 voltage/current mode is switched by DIP switch S1 on the control board, and the AI2 temperature mode is switched by DIP switch S2 on the control board.

Table 5–41 DIP switch of the AI

Assignment			Description
Pin	Set the switch to the up position	Set the switch to the down position	
S4 (MD630S-INT) S3 (MD630N-INT)	Current	Voltage	Up position: The current input mode with the range from 0 mA to 20 mA applies to AI1.
			Down position (default): The voltage input mode with the range from -10 V to +10 V applies to AI1.
S2 (MD630S-INT) S1 (MD630N-INT)	Current	Voltage	Up position: The current input mode with the range from 0 mA to 20 mA applies to AI2.
			Down position (default): The voltage input mode with the range from -10 V to 10 V applies to AI2.
S3 (MD630S-INT) S2 (MD630N-INT)	Temperature mode	AI	Up position: The temperature mode applies to AI2.
			Down position (default): The voltage/current input mode applies to AI2.

Note: For the current-type analog input, 1 mA current corresponds to 0.5 V voltage. That is, 20 mA corresponds to 10 V.

AI function

Name	Description	Application scenario	Related parameters
1. AI correction	This group of parameters are used to calibrate the AI to eliminate the impact of AI zero offset and gain. This group of parameters have been calibrated by default. If restored to default, these setpoints are restored to the values calibrated by default. Generally, no calibration is needed on site. **Warning:** The calibration is inactive for AI temperature mode. The following takes AI1 as an example to show how to make calibration on site. 1 .Switchover of hardware switch: Set the S4 DIP switch on the control board to OFF (voltage input). 2 .Setting the AI source:Set E2-81 [AI hardware source selection] to 0 [Hardware sampling]. 3 .Calibration coefficient initialization recovery:Set EE-00 [AI1 measured voltage 1] to 2.000 V.Set EE-01 [AI1 displayed voltage 1] to 2.000 V.Set EE-02 [AI1 measured voltage 2] to 8.000 V.Set EE-03 [AI1 displayed voltage 2] to 8.000 V. 4 .Verification process:The external AI1 input voltage is 2.00 V.Record the value of U0-21 [Uncalibrated AI1 voltage] V_1 .The external AI1 input voltage is 8.00 V. Record the value of U0-21 [Uncalibrated AI1 voltage] V_2 . 5 .Set storage parameters:Set EE-00 [AI1 measured voltage 1] to the external AI1 input voltage of 2.00 V. Set EE-01 [AI1 displayed voltage 1] to the value of V_1 .Set EE-02 [AI1 measured voltage 2] to the external AI1 input voltage of 8.00 V.Set EE-03 [AI1 displayed voltage 2] to the value of V_2 . 6 .Check whether calibration parameters are set correctly. When the external AI1 input voltage is 3.00 V, check whether U0-09 [AI1 voltage] is 3.000 V. If an error or excessive error occurs, repeat steps 3, 4, and 5. 7 .Restore the selected AI hardware source.	The measured voltage indicates the actual output voltage measured by instruments such as the multimeter. The displayed voltage indicates the voltage sampled and displayed by the drive. For details, see U0-21 and U0-22. During calibration, input two voltage values to each AI terminal, and save the measured values and values read through parameters in group U0 to the following parameters. Then the drive automatically performs AI zero offset and gain calibration. In cases where the reference voltage does not match the sampled voltage, make calibration on site to match the sampled value with the reference value.	**Related parameters:** *"Table 5-42 AI correction parameter" on page 364*

Name	Description	Application scenario	Related parameters
2. AI used as DI	AI1 and AI2 can be used as DI. • When the AI input voltage is greater than 7 V, the AI terminal status is at high level. • When the AI input voltage is lower than 3 V, the AI terminal status is at low level. • When the AI input voltage is between 3 V and 7 V, the hysteresis state applies.	1 .When used as DI, AI acts as the source of VDI1 to VDI6, which can be set by E0-50 to E0-55. 2 .The result of the AI used as DI can be checked through the connector. The result of the AI used as DI is either 0 (Low level for the AI used as DI) or 1 (High level for the AI used as DI), which can be configured in the parameter drop-down box with "Other: B connector". For details, see *" Parameter Interconnection" on page 814*.	**Operating principle:** *"Figure 5-79 Schematic diagram for the AI used as DI" on page 366* **Related parameters:** *"Table 5-43 Parameters for AI used as DI" on page 365* E0-50 to E0-55: *"5.2.10.4 Virtual Digital Input (VDI) Terminals" on page 343* *"Table 5-44 Result of the AI used as DI" on page 366*
3. Other function setting	-	-	*"Table 5-45 AI-related parameter list" on page 367*

Table 5–42 AI correction parameter

Param.	Name	Default	Value range	Description
EE-00	AI1 measured voltage 1	Factory-calibrated	-10.000 V to +10.000 V	Defines the AI1 measured voltage 1, that is, the voltage measured by the meter. **Note:** When analog voltage calibration is conducted on AI1, a calibration curve is obtained based on two points, which correspond to a measured voltage and a displayed voltage, respectively.
EE-01	AI1 displayed voltage 1	Factory-calibrated	-10.000 V to +10.000 V	Defines the AI1 displayed voltage 1, which is the uncalibrated voltage of AI1 (U0-21). **Note:** See EE-00.

Param.	Name	Default	Value range	Description
EE-02	AI1 measured voltage 2	Factory-calibrated	-10.000 V to +10.000 V	Defines the measured voltage 2 of AI1, which is the voltage measured by the meter. **Note:** See EE-00.
EE-03	AI1 displayed voltage 2	Factory-calibrated	-10.000 V to +10.000 V	Indicates the AI1 displayed voltage 2, which is the uncalibrated voltage of AI1 (U0-21). **Note:** See EE-00.
EE-04	AI2 measured voltage 1	Factory-calibrated	-10.000 V to +10.000 V	Indicates the AI2 measured voltage 1, which is the voltage measured by the meter. **Note:** When analog voltage calibration is performed on AI2, a calibration curve is formed through two points, corresponding to the measured voltage and displayed voltage, respectively.
EE-05	AI2 displayed voltage 1	Factory-calibrated	-10.000 V to +10.000 V	Indicates the AI2 displayed voltage 1, which is the uncalibrated voltage of AI2 (U0-22). **Note:** See EE-04.
EE-06	AI2 measured voltage 2	Factory-calibrated	-10.000 V to +10.000 V	Indicates the AI2 measured voltage 2, which is the voltage measured by the meter. **Note:** See EE-04.
EE-07	AI2 displayed voltage 2	Factory-calibrated	-10.000 V to +10.000 V	Indicates the AI2 displayed voltage 2, which is the uncalibrated voltage of AI2 (U0-22). **Note:** See EE-04.

Table 5–43 Parameters for AI used as DI

Param.	Name	Default	Value range	Description
E2-35	High level threshold when AI is used as DI	7.0 V	5.5 V to 9.0 V	Defines the high level threshold when the AI is used as DI. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-36	Low level threshold when AI is used as DI	3.0 V	1.0 V to 4.5 V	Defines the low level threshold when the AI is used as DI. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

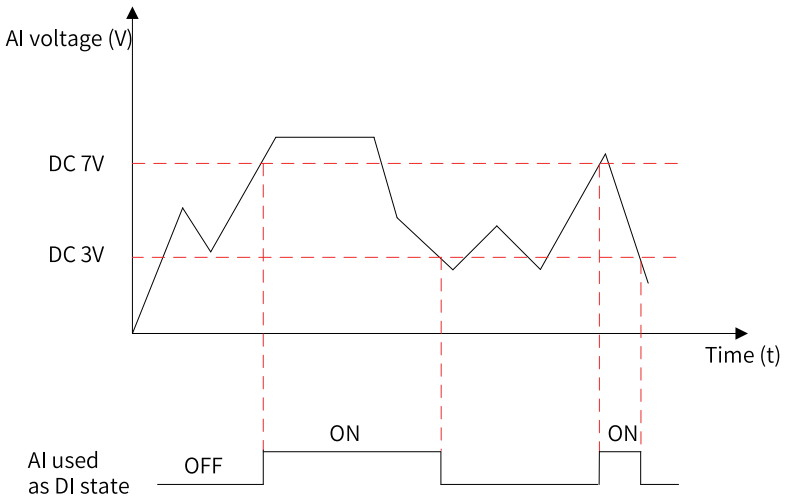


Figure 5-79 Schematic diagram for the AI used as DI

Table 5–44 Result of the AI used as DI

Param.	Name	Default	Value range	Description
L0054	Level state of the AI1 used as DI	0 (Low level)	0 to 1	Bit connector: Displays the level status when AI1 is used as the DI. 0: Low level 1: High level The options can be used for "Other: B connector".
L0055	Level state of the AI2 used as DI	0 (Low level)	0 to 1	Bit connector: Displays the level status when AI2 is used as the DI. 0: Low level 1: High level The options can be used for "Other: B connector".

Table 5–45 AI-related parameter list

Param.	Name	Default	Value range	Description
E2-07	AI1 gain	1.00	-10.00 to +10.00	Defines the gain multiplier of the AI1 analog sampling voltage. **Note:** 1. When used with E2-08, the AI1 input voltage can be amplified and offset. If k is the gain, b is the offset, X is AI1 input voltage (AI1 voltage defined by U0-09), and Y is the processed voltage, the voltage after processing is as follows: Y = kX + b 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-08	AI1 offset	0.00 V	-10.00 V to +10.00 V	Defines the offset coefficient of AI1 analog sampling voltage. **Note:** 1. When used with E2-07, the AI1 input voltage can be amplified and offset. If k is the gain, b is the offset, X is AI1 input voltage (AI1 voltage defined by U0-09), and Y is the processed voltage, the voltage after processing is as follows: Y = kX + b 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-09	AI1 denoising threshold	0.0%	0.0% to 100.0%	Defines the AI1 denoising threshold. **Note:** 1. For the per-unit percentage of the AI1 input after processed with the AI curve, if the absolute value of the difference between the current value and the last value is within the threshold, denoising is performed. That is, the percentage remains unchanged. 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-10	AI1 filter time	0.10s	0.00s to 10.00s	Indicates the software filter time of AI1. **Note:** 1. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 2. When on-site analog signals are prone to interference, you can increase the AI filter time to enhance the stability of the analog signals.

Param.	Name	Default	Value range	Description
E2-11	AI1 zero-crossing threshold	0.0%	100.0%	Defines the zero-crossing threshold of AI1. The output in this range is 0.0%, which is used to eliminate fluctuation around zero. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-12	AI1 jump point	0.0%	-800.0% to +800.0%	Defines the AI1 jump point. If the per-unit percentage of AI1 input that compared with AI1 jump point is within the jump range defined by E2-13, the jump point value will be outputted. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-13	AI1 jump amplitude	0.1%	0.0% to 100.0%	Defines the AI1 jump amplitude. If the input is within the range from E2-12 - E2-13 to A6-24 + A6-25, the value of the AI1 jump point (A6-24) will be output. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-14	Upper limit of AI1 input protection	8.00 V	E2-15 to 10.00 V	Defines the AI1 input voltage protection upper limit, which is used to indicate whether AI1 input voltage is within the set range. **Note:** When the AI1 value is higher than E2-14 or lower than E2-15, the DO terminal outputs an active signal to indicate that AI1 input limit has been exceeded. You can also set H1-14 to determine whether to report "E154.3" (AI open circuit).
E2-15	Lower limit of AI1 input protection	2.00 V	0.00 V to E2-14	Defines the AI1 input voltage protection lower limit, which is used to indicate whether AI1 input voltage is within the set range. **Note:** When the AI1 value is higher than E2-15 or lower than E2-14, the DO terminal outputs an active signal to indicate that AI1 input limit has been exceeded. You can also set H1-14 to determine whether to report "E154.3" (AI open circuit).

Param.	Name	Default	Value range	Description
E2-16	AI2 gain	1.00	-10.00 to +10.00	Defines the gain multiplier of the AI2 analog sampling voltage. **Note:** 1. When used with E2-17, the AI2 input voltage can be amplified and offset. If k is the gain, b is the offset, X is AI2 input voltage (AI2 voltage defined by U0-10), and Y is the processed voltage, the voltage after processing is as follows: Y = kX + b 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-17	AI2 offset	0.00 V	-10.00 V to +10.00 V	Defines the offset coefficient of AI2 analog sampling voltage. **Note:** 1. When used with E2-16, the AI2 input voltage can be amplified and offset. If k is the gain, b is the offset, X is AI2 input voltage (AI2 voltage defined by U0-10), and Y is the processed voltage, the voltage after processing is as follows: Y = kX + b 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-18	AI2 denoising threshold	0.0%	0.0% to 100.0%	Defines the AI2 denoising threshold. **Note:** 1. For the per-unit percentage of the AI2 input after the AI curve, if the absolute value of the difference between the current value and the last value is within the threshold, denoising is performed. That is, the percentage remains unchanged. 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-19	AI2 filter time	0.10s	0.00s to 10.00s	Defines the software filter time of AI2. **Note:** 1. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 2. When on-site analog signals are prone to interference, you can increase the AI filter time to enhance the stability of the analog signals.

Param.	Name	Default	Value range	Description
E2-20	AI2 zero-crossing threshold	0.0%	0.0% to 100.0%	Defines the AI2 zero-crossing threshold. If the percentage calculated according to the AI curve per-unit value does not exceed the threshold, the percentage is set to 0.0% forcibly. This parameter aims to eliminate fluctuations around zero point. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-21	AI2 jump point	0.0%	-800.0% to +800.0%	Defines the jump point for AI2. If the difference between the value (per-unit value in percentage obtained after AI2 is processed by the AI curve) and the jump point is within the jump amplitude (E2-22), the value of the jump point will be output. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-22	AI2 jump amplitude	0.1%	0.0% to 100.0%	Defines the jump amplitude for AI2. If the difference between the value (per-unit value in percentage obtained after AI2 is processed by the AI curve) and the jump point (E2-21) is within the jump amplitude (E2-22), the value of the jump point will be output. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-23	Upper limit of AI2 input protection	8.00 V	E2-24 to 10.00 V	Defines the upper limit of the AI2 voltage protection to define whether AI2 voltage is within the set range. **Note:** When the AI2 value is higher than E2-24 or lower than E2-23, the DO terminal outputs an active signal to indicate that AI2 input limit has been exceeded. You can also set H1-14 to determine whether to report "E154.4" (AI open circuit).
E2-24	Lower limit of AI2 input protection	2.00 V	0.00 V to E2-23	Defines the lower limit of AI2 voltage protection to define whether AI2 voltage is within the set range. **Note:** When the AI2 value is higher than E2-24 or lower than E2-23, the DO terminal outputs an active signal to indicate that AI2 input limit has been exceeded. You can also set H1-14 to determine whether to report "E154.4" (AI open circuit).

Param.	Name	Default	Value range	Description
E2-34	AI input protection time	0.01s	0.00s to 1.00s	Defines the duration during which the AI input limit exceeds the limit. When the AI input limit violation time is greater than or equal to this setpoint, the AI limit violation flag (L0050 to L0051) is outputted or the AI open circuit fault is reported.
E2-35	High level threshold when AI is used as DI	7.0 V	5.5 V to 9.0 V	Defines the high level threshold when the AI is used as DI. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-36	Low level threshold when AI is used as DI	3.0 V	1.0 V to 4.5 V	Defines the low level threshold when the AI is used as DI. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-37	Inversion calculation of AI curve absolute value	0	Ones: AI1 selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: AI2 selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	Defines the input polarity of AI1 and AI2 (assigned by ones and tens). **Value description:** 0: Normal - The per-unit value of the normal AI curve is used. 1: Absolute value - The absolute value of the per-unit value of the AI curve is used. 2: Inverted - The per-unit value of the AI curve is inverted. 3: Absolute value inverted - The absolute per-unit value of the AI curve is inverted. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

Param.	Name	Default	Value range	Description
E2-38	AI curve selection	0x21	Ones: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 1: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens: AI2 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 1: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Hundreds: Reserved Thousands: Reserved	Defines the input/output curve of AI1 and AI2. **Value description:** Ones: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 1: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens: AI2 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 1: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67)
E2-39	AI lower limit selection	0x000	Ones: Setting for AI1 lower than minimum input 0: Minimum value 1: 0.0% Tens: Setting for AI2 lower than minimum input 0: Minimum value 1: 0.0% Hundreds: Reserved Thousands: Reserved	Defines the output when AI1 and AI2 inputs are lower than the minimum input of the curve (assigned by ones and tens in sequence). **Value description:** 0000H: Percentage corresponding to the minimum input - When the AI input voltage is lower than the minimum input of the curve, the curve per-unit percentage is the value corresponding to the minimum input. 0001H: 0.0% - When the AI input voltage is lower than the minimum input of the curve, the curve per-unit percentage is 0.0%.

Param.	Name	Default	Value range	Description
E2-40	Minimum input of AI curve 1	0.00 V	-10.00 to E2-42	Defines the minimum input point of x-axis on AI curve 1, that is, the minimum analog input voltage (or minimum analog input current). **Note:** 1. The x-axis of the AI curve indicates the analog input voltage (or analog input current), and the y-axis indicates the per-unit percentage of the analog input voltage. The meaning is determined by the AI function. For example, if the AI terminal is selected as the frequency reference, the y-axis represents the per-unit percentage to the rated motor frequency. 2. Five AI curves are provided. Curves 1 to 3 are two-point curves. The two points are the minimum input point and maximum input point, and the relevant parameters are E2-40 to E2-51. Curves 4 and 5 are four-point curves. The four points are the minimum input point, maximum input point, and two inflection points, and the relevant parameters are E2-52 to E2-67.
E2-41	Percentage corresponding to the minimum input of AI curve 1	0.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 1 minimum input, which is the per-unit percentage corresponding to the minimum analog input. **Note:** See E2-40 for details.
E2-42	Maximum input of AI curve 1	10.00 V	E2-40 to 10.00	Defines the maximum input point of x-axis on AI curve 1, that is, the maximum analog input voltage (or maximum analog input current). **Note:** See E2-40 for details.
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 1 maximum input, which is the per-unit percentage corresponding to the maximum analog input. **Note:** See E2-40 for details.
E2-44	Minimum input of AI curve 2	0.00 V	-10.00 to E2-46	Defines the minimum input point of x-axis on AI curve 2, that is, the minimum analog input voltage (or minimum analog input current). **Note:** See E2-40 for details.
E2-45	Percentage corresponding to the minimum input of AI curve 2	0.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 2 minimum input, which is the per-unit percentage corresponding to the minimum analog input. **Note:** See E2-40 for details.
E2-46	Maximum input of AI curve 2	10.00 V	E2-44 to 10.00	Defines the maximum input point of x-axis on AI curve 2, that is, the maximum analog input voltage (or maximum analog input current). **Note:** See E2-40 for details.
E2-47	Percentage corresponding to the maximum input of AI curve 2	100.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to the AI curve 2 maximum input, which is the per-unit percentage corresponding to the maximum analog input. **Note:** See E2-40 for details.

Param.	Name	Default	Value range	Description
E2-48	Minimum input of AI curve 3	0.00 V	-10.00 to E2-50	Defines the minimum input point of x-axis on AI curve 3, that is, the minimum analog input voltage (or minimum analog input current). **Note:** See E2-40 for details.
E2-49	Percentage corresponding to the minimum input of AI curve 3	0.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 3 minimum input, which is the per-unit percentage corresponding to the minimum analog input. **Note:** See E2-40 for details.
E2-50	Maximum input of AI curve 3	10.00 V	E2-48 to 10.00V	Defines the maximum input point of x-axis on AI curve 3, that is, the maximum analog input voltage (or maximum analog input current). **Note:** See E2-40 for details.
E2-51	Percentage corresponding to the maximum input of AI curve 3	100.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 3 maximum input, which is the per-unit percentage corresponding to the maximum analog input. **Note:** See E2-40 for details.
E2-52	Minimum input of AI curve 4	0.00 V	-10.00 to E2-54	Defines the minimum input point of x-axis on AI curve 4, that is, the minimum analog input voltage (or minimum analog input current). **Note:** 1. The x-axis of the AI curve represents the analog input voltage (or current), and the y-axis represents the per-unit percentage to the analog input voltage. If the AI input is selected as the frequency reference, y-axis represents the percentage to the maximum frequency (C4-10). 2. Five AI curves are provided. Curves 1 to 3 are two-point curves. The two points are the minimum input point and maximum input point, and the relevant parameters are E2-40 to E2-51. Curves 4 and 5 are four-point curves. The four points are the minimum input point, maximum input point, and two inflection points, and the relevant parameters are E2-52 to E2-67.
E2-53	Percentage corresponding to the minimum input of AI curve 4	0.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 4 minimum input, which is the per-unit percentage corresponding to the minimum analog input. **Note:** See E2-40 for details.
E2-54	Inflection point 1 input of AI curve 4	3.00 V	E2-52 to E2-56	Defines the inflection point 1 of x-axis on AI curve 4, that is, the analog input voltage (or analog input current) at inflection point 2. **Note:** See E2-40 for details.
E2-55	Percentage corresponding to inflection point 1 input of AI curve 4	30.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 4 inflection point 1, which is the per-unit percentage corresponding to inflection point 1 analog input. **Note:** See E2-40 for details.

Param.	Name	Default	Value range	Description
E2-56	Inflection point 2 input of AI curve 4	6.00 V	E2-54 to E2-58	Defines the inflection point 2 of x-axis on AI curve 4, that is, the analog input voltage (or analog input current) at inflection point 2. **Note:** See E2-40 for details.
E2-57	Percentage corresponding to inflection point 2 input of AI curve 4	60.0 %	-800.0% to +800.0%	Defines the y-axis of AI curve 4 inflection point 2, that is, the per-unit percentage corresponding to inflection point 2 analog input. **Note:** See E2-40 for details.
E2-58	Maximum input of AI curve 4	10.00 V	E2-56 to 10.00	Defines the maximum input point of x-axis on AI curve 4, that is, the maximum analog input voltage (or maximum analog input current). **Note:** See E2-40 for details.
E2-59	Percentage corresponding to the maximum input of AI curve 4	100.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 4 maximum input, which is the per-unit percentage corresponding to the maximum analog input. **Note:** See E2-40 for details.
E2-60	Minimum input of AI curve 5	-10.00 V	-10.00 to E2-62	Defines the minimum input point of x-axis on AI curve 5, which is the minimum analog input voltage (or minimum analog input current). **Note:** See E2-40 for details.
E2-61	Percentage corresponding to the minimum input of AI curve 5	-100.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 5 minimum input, which is the per-unit percentage corresponding to the minimum analog input. **Note:** See E2-40 for details.
E2-62	Inflection point 1 input of AI curve 5	-3.00 V	E2-60 to E2-64	Defines the inflection point 1 of x-axis on AI curve 5, which is the analog input voltage (or analog input current). **Note:** See E2-40 for details.
E2-63	Percentage corresponding to inflection point 1 input of AI curve 5	-30.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 5 inflection point 1, which is the per-unit percentage corresponding to inflection point 1 analog input. **Note:** See E2-40 for details.
E2-64	Inflection point 2 input of AI curve 5	3.00 V	E2-62 to E2-66	Defines the inflection point 2 of x-axis on AI curve 5, which is the analog input voltage (or analog input current) at inflection point 2. **Note:** See E2-40 for details.
E2-65	Percentage corresponding to inflection point 2 input of AI curve 5	30.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 5 inflection point 2, which is the per-unit percentage corresponding to inflection point 2 analog input. **Note:** See E2-40 for details.
E2-66	Maximum input of AI curve 5	10.00 V	E2-64 to 10.00V	Defines the maximum input point of x-axis on AI curve 5, which is the maximum analog input voltage (or maximum analog input current). **Note:** See E2-40 for details.

Param.	Name	Default	Value range	Description
E2-67	Percentage corresponding to the maximum input of AI curve 5	100.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 5 maximum input, which is the per-unit percentage corresponding to the maximum analog input. **Note:** See E2-40 for details.
E2-81	AI hardware source selection	0	0 to 11	Defines the hardware source of AI (AI1 and AI2 assigned by ones and tens in sequence). **Value description:** 0: Hardware sampling - The AI value is sourced from hardware sampling. 1: Forced setpoint - AI1 and AI2 voltage can be set forcibly through E2-82 and E2-83. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-82	AI1 forced value	0	-10.0 V to +10.0 V	Defines the forced value of AI1. **Note:** 1. This parameter is valid when the ones of E2-81 is set to 1. 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E2-83	AI2 forced value	0	-10.0 V to +10.0 V	Defined the forced value of AI2. **Note:** 1. This parameter is valid when the tens of E2-81 is set to 1. 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

Application example

- **Application instance 1: AI1 used as analog input**
  To perform the following function: "AI used as operating frequency source", do as follows.

  1. Set the curve selection for AI voltage and frequency: Select one of the five curves (E2-38 = 0x0021) from E2-40 to E2-67 (AI1: Curve 1, AI2: Curve 2).
  2. Set the mapping relationship of AI1 curve to "0 V...10 V correspond to 0%...100%" (E2-40 = 0 V, E2-41 = 0%, E2-42 = 10 V, E2-43 = 100%).
  3. Set whether to continue curve interpolation or keep the minimum curve input point of the curve (default, E2-39 = 0x000) when the curve lower limit is violated.
  4. Set whether to perform secondary processing on AI1 curve calculation (E2-37 = 0, absolute value or inversion is not required by default).
  5. Determine whether to adjust E2-09...E2-13, that is, the denoising threshold, filter time, zero-crossing threshold, jump point+jump amplitude based on the actual conditions.
  6. Set the frequency source to "AI1" (b5-00 = 02).

After setting the preceding steps, when 5 V level is inputted to AI1, the drive gets the source for AI1 curve conversion of 50%, and the drive runs at 50% of C4-06 (Rated motor frequency). When AI1 input voltage changes, the running frequency changes according to the AI1 curve.

- **Application example 2: AI2 temperature sensor mode**
  AI2 provides the temperature sensor input function. When AI2 is used as the temperature sensor input, only E2-73 to E2-76 determine the function of AI2. AI2 temperature sensor mode is a completely independent channel. Analog input functions of AI2 do not work in the temperature sensor mode.

  To enable AI2 to function as PT100 temperature sensor, do as follows:

  1. Set AI2 to PT100 temperature sensor mode (E2-73 = 1). In this case, analog input functions of AI2 are deactivated (functions defined by E2-16 to E2-67).
  2. Set E2-74 (AI2 motor temperature reach), E2-75 (Motor overtemperature pre-alarm threshold), and E2-76 (Motor overtemperature protection threshold).
  3. The temperature information collected in AI2 temperature mode is displayed in U0-90. In addition, L0057, L0058, and L0059 display the motor temperature reach signal, motor overtemperature fault, and motor overtemperature pre-alarm information.

  The AI2 temperature mode is done setting after preceding steps and hardware wiring are done.

Param.	Name	Default	Value range	Description
E2-73	AI2 temperature mode - Motor temperature sensor type	0	0 to 4	Defines the AI2 temperature sensor type. Value description: 0: Analog input - AI2 is used as normal analog input. 1: PT100 - AI2 is used as PT100 sensor input. 2: PT1000 - AI2 is used as PT1000 sensor input. 3: KTY84-130 - AI2 is used as KTY84-130 sensor input. 4: PTC130 - AI2 is used as PTC130 sensor input. Note: AI2 indicates the corresponding temperature value of PT100, PT1000, KTY84-130, and PTC130 sensors, which is displayed in U0-90.
E2-74	AI2 temperature mode - Motor temperature arrival	75°C	0 to 100	Defines the alarm threshold for motor temperature arrival. Note: If the AI2 temperature exceeds the alarm threshold, L0057 of B connector [AI2 temperature mode - Motor temperature arrival] is set to 1.
E2-75	AI2 temperature mode - Motor overtemperature pre-alarm threshold	90 °C	0 to E2-76	Defines the motor overtemperature pre-alarm threshold. Note: If the AI2 temperature exceeds the pre-alarm threshold, L0059 of B connector [AI2 temperature mode - Motor overtemperature pre-alarm] is set to 1.
E2-76	AI2 temperature mode - Motor overtemperature protection threshold	110°C	E2-75 to 200	Defines the motor overtemperature protection threshold. Note: If the AI2 temperature exceeds the threshold, L0058 of B connector [AI2 temperature mode - Motor overtemperature fault arrival] is set to 1.

5.2.10.9 Analog Output (AO) Terminals

Function List

The AO function is provided by the analog output terminal.

Function	AO
Output function selection	Yes
Polarity selection	Yes
Curve type selection	Yes
Two-point curve	Yes
Zero offset coefficient	Yes
Gain+Offset	Yes
Hardware source selection	Yes
Forced value	Yes
Calibration	Yes

Description

The product is equipped with one analog output terminal (AO1) as standard. The MD630N-INT has no AO terminal. The AO terminal can be assigned with any AO terminal function, and can be set with the corresponding curve or gain and deviation parameters.

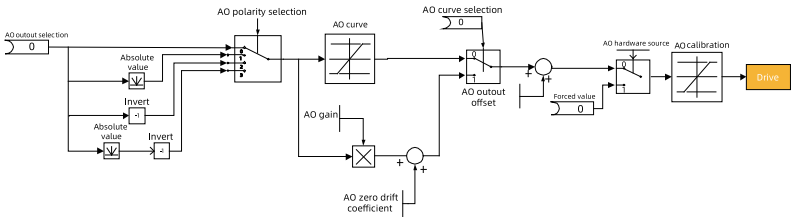


Figure 5-80 AO data flow diagram

AO terminal layout

For the AO terminal layout of the MD630S-INT, refer to CN5 in *"Table 3-6 Description of control circuit terminal layout of bus model" on page 105*. MD630N-INT has no AO terminal.

For hardware wiring of AO terminals of MD630S-INT, refer to *" Wiring of the AO terminal" on page 109*.

Table 5–46 DIP switch of the AO

Assignment			Description
Pin	Set the switch to the up position	Set the switch to the down position	
S5	Current	Voltage	Up position: The current output mode with the range from 0 mA to 20 mA applies to the AO.
			Down position (default): The voltage output mode with the range from 0 V to 10 V applies to the AO.

Note: For the current-type analog output, 1 mA current corresponds to 0.5 V voltage. That is, 20 mA corresponds to 10 V.

AO function

Name	Description	Application scenario	Related parameters
1. AO function selection	The AO terminal is set through E3-00 to E3-27. The AO terminal function is selected through E3-00.	-	*"Table 5-47 AO1 function selection (E3-00)" on page 381*
2. Calibration	This group of parameters are used to correct the AO to eliminate the impact of AO zero offset and gain. This group of parameters have been corrected by default. If restored to default, the parameters are restored to the values calibrated by default. Generally, no calibration is needed on site.	The target voltage indicates the theoretical output voltage of the drive. During calibration, enable the AO terminal to output voltage for a certain time. Then accurately input the measured value from the multimeter and the theoretical output voltage into the above parameters. In this case, the drive will automatically perform zero offset and gain calibration for AO. In cases where the required output voltage does not match the actual output voltage of the drive, make correction on site to match the sampled value with the required value.	To calibrate the voltage on site, do as follows: 1 .Hardware switch setting: Set the S5 DIP switch on the control board to OFF (voltage output). 2 .Set E3-26 (AO hardware source selection) to "1: Forced value". 3 .Calibration coefficient initialization recovery:Set EE-12 (AO1 target voltage 1) to 2.000 V.Set EE-13 (AO1 measured voltage 1) to 2.000 V.Set EE-14 (AO1 target voltage 2) to 8.000 V.Set EE-15 (AO1 measured voltage 2) to 8.000 V. 4 .Verification process:Set E3-27 (AO1 forced value) to 2.00 V.Measure the actual AO output value V_1 .Set E3-27 (AO1 forced value) to 8.00 V.Measure the actual AO output value V_2 . 5 .Set storage parameters:Set EE-13 (AO1 measured voltage 1) to V_1 .Set EE-15 (AO1 measured voltage 2) to V_2 . 6 .Verify if calibration parameters are set correctly. Set E3-27 (AO1 forced value) to 3.00 V, and check whether the value of U1-08 (AO output) is 3.000 V. If an error or excessive error occurs, repeat steps 3, 4, and 5. 7 .Restore the AO signal source. **Related parameters:** *"Table 5-49 AO calibration parameters" on page 382*

Name	Description	Application scenario	Related parameters
3. Other function setting	-	-	"Table 5-50 Related parameters" on page 383 The analog output 0 V to 10 V corresponds to 0% to 100%. When the AO function is set to 1 (frequency setting), and the drive frequency is set to 50% of the rated frequency, the output voltage of the AO is 5 V (50% x 10 V). The calculation method for AO zero offset coefficient (E3-17) and AO gain (E3-18) is as follows: Assume that the AO outputs the operating frequency. The rectified output needs to be 8 V (Y1) when the frequency is 0 Hz (X1) and 4 V (Y2) when the frequency is 40 Hz (X2). Formula for calculating the gain: $K = \frac{(Y1-Y2)\cdot X_{MAX}}{(X1-X2)\cdot Y_{MAX}}$ Formula for calculating zero offset coefficient: $b = \frac{(X1\cdot Y2-X2\cdot Y1)}{(X1-X2)\cdot Y_{MAX}} \cdot 100\%$ Xmax is the rated output frequency 50 Hz (assume that the maximum frequency C4-06 is 50 Hz). Ymax is the voltage and the value is 10 V. The value of E3-18 (AO gain) is -0.5 and the value of E3-17 (AO zero offset coefficient) is 80%.

Table 5–47 AO1 function selection (E3-00)

Param.	Description	Default	Value range	Description
E3-00	AO1 function selection	0	0 to 16	"Table 5-48 List of AO functions" on page 381

Table 5–48 List of AO functions

Value	Function	Description
0	Operating frequency	The AO outputs the voltage that corresponds to the ratio of the drive operating frequency to the rated motor frequency (100.0% corresponds to rated motor frequency).
1	Frequency reference	The AO outputs the voltage that corresponds to the ratio of the drive frequency reference to the rated motor frequency (100.0% corresponds to rated motor frequency).
2	Output current	The AO outputs the voltage that corresponds to the ratio of the drive output current to the rated motor current (100.0% corresponds to two times the rated motor current).
3	Motor output torque	The AO outputs the voltage that corresponds to the ratio of the drive output torque (absolute value) to the rated motor torque (100.0% corresponds to two times the rated motor torque).
4	Output power	The AO outputs the voltage that corresponds to the ratio of the drive output power to the rated motor power (100.0% corresponds to two times the rated motor power).
5	Output voltage	The AO outputs the voltage that corresponds to the ratio of the drive output voltage to the rated motor voltage (100.0% corresponds to 1.2 times the rated motor voltage).
6	HDI input	AO output voltage follows HDI input frequency (50.0% corresponds to 20.00 kHz).

Value	Function	Description
7	AI1	AO output voltage follows AI1 input voltage (100.0% corresponds to 10 V).
8	AI2	AO output voltage follows AI2 input voltage (100.0% corresponds to 10 V).
12	Communication reference	The AO outputs the voltage that corresponds to the ratio of data that is written to 2002h/7313h address to 32767 (100.0% corresponds to AO communication setting).
13	Motor speed	The AO outputs the voltage that corresponds to the ratio of the motor speed to the motor speed at rated motor frequency (100.0% corresponds to the speed at the rated frequency).
14	Output current	The AO outputs the voltage that corresponds to the ratio of the AC drive output current to 1000 A (100% corresponds to 1000.0 A).
15	Bus voltage	The AO outputs the voltage that corresponds to the ratio of the AC drive bus voltage to 1000 V (100.0% corresponds to 1000.0 V).
16	Motor output torque (actual value, proportion to the rated motor torque)	The AO outputs the voltage that corresponds to the ratio of the AC drive output torque to the rated motor torque (100% corresponds to the rated motor torque, 50% corresponds to 0, 0% corresponds to the negative rated motor torque).

Table 5–49 AO calibration parameters

Param.	Name	Default	Value range	Description
EE-12	AO1 target voltage 1	Factory-calibrated	-10.000 V to +10.000 V	Defines the AO1 target voltage 1, that is, the expected output voltage. **Note:** When analog voltage correction is carried out on AO, a correction curve is formed through two points, which correspond to a target voltage and a measured voltage.
EE-13	AO1 measured voltage 1	Factory-calibrated	-10.000 V to +10.000 V	Defines the AO1 measured voltage 1, that is, the output voltage measured by the meter. **Note:** See EE-12.
EE-14	AO1 target voltage 2	Factory-calibrated	-10.000 V to +10.000 V	Defines the AO1 target voltage 2, that is, the expected output voltage. **Note:** See EE-12.
EE-15	AO1 measured voltage 2	Factory-calibrated	-10.000 V to +10.000 V	Defines the AO1 measured voltage 2, that is, the output voltage measured by the meter. **Note:** See EE-12.

Table 5–50 Related parameters

Param.	Description	Default	Value range	Description
E3-03	AO polarity selection	0	0 to 33	Defines the AO1 curve output polarity through the ones place. 0: Normal value. The AO curve output value remains unchanged. 1: Absolute value. The absolute value of the AO curve output value is used. 2: Opposite to normal value. The opposite value of the AO curve output value is used. 3: Opposite to absolute value. The opposite value of the absolute value of the AO curve output value is used.
E3-04	AO curve selection	0	0 to 11	Sets the curve type corresponding to AO1 curve through the ones place. 0: Two-point curve. Set the two-point curve for AO1 through E3-05 to E3-08. 1: Gain+Offset. Set the AO1 gain and offset through E3-17 to E3-18.
E3-05	Percentage corresponding to minimum input of AO1 curve	0.0%	-800.0% to E3-07	This parameter sets the minimum input on the x-axis of the AO curve, that is, the per-unit percentage of the selected AO function.
E3-06	Minimum input of AO1 curve	0.00 V	0.00 V to 10.00 V	This parameter sets the y-axis of AO curve minimum input, that is, the AO voltage.
E3-07	Percentage corresponding to maximum input of AO1 curve	100.0%	E3-05 to 800.0%	This parameter sets the maximum input on the x-axis of the AO curve, that is, the per-unit percentage of the selected AO function.
E3-08	Maximum input of AO1 curve	10.00 V	0.00 V to 10.00 V	This parameter sets the y-axis of AO curve maximum input, that is, the AO voltage.

Param.	Description	Default	Value range	Description
E3-17	AO1 zero offset coefficient	0.0%	-100.0% to +100.0%	On the AO curve, if b indicates zero offset, k indicates gain, and X indicates standard output, the actual output Y is kX plus b (Y = kX + b). The zero offset coefficient 100% of AO1 corresponds to 10 V (or 20 mA). The standard output refers to the value of the analog output at 0 V to 10 V (or 0 mA to 20 mA) output without zero offset or gain adjustment. Zero offset = Zero offset coefficient x 10 V (or 20 mA) The drive supports one AO, that is, AO1. The AO can be used to indicate the internal operating parameters in the analog mode. The parameter property indicated is defined by E3-00. Formula for calculating zero offset coefficient: $b = \frac{(X1 \times Y2 - X2 \times Y1)}{(X1 - X2) \times Y_{MAX}} \times 100\%$ Assume that the AO outputs the operating frequency. The rectified output needs to be 8 V (Y1) when the frequency is 0 Hz (X1) and 4 V (Y2) when the frequency is 40 Hz (X2). Xmax is the rated output frequency 50 Hz (assume that the maximum frequency C4-06 is 50 Hz). Ymax is the voltage and the value is 10 V. The AO zero offset coefficient (E3-17) should be set to 80%.
E3-18	AO1 gain	1.00	-10.00 to +10.00	On the AO curve, if b indicates zero offset, k indicates gain, and X indicates standard output, the actual output Y is kX plus b (Y = kX + b). The zero offset coefficient 100% of AO1 corresponds to 10 V (or 20 mA). The standard output refers to the value of the analog output at 0 V to 10 V (or 0 mA to 20 mA) output without zero offset or gain adjustment. Zero offset = Zero offset coefficient x 10 V (or 20 mA) The drive supports one AO, that is, AO1. The AO can be used to indicate the internal operating parameters in the analog mode. The parameter property indicated is defined by E3-00. Formula for calculating the gain: $K = \frac{(Y1 - Y2) \times X_{MAX}}{(X1 - X2) \times Y_{MAX}}$ For details on X_{MAX}, see *"Table 5-51 Relationship between analog output content and corresponding maximum values (Xmax)" on page 385*. Assume that the AO outputs the operating frequency. The rectified output needs to be 8 V (Y1) when the frequency is 0 Hz (X1) and 4 V (Y2) when the frequency is 40 Hz (X2). Xmax is the rated output frequency 50 Hz (assume that the maximum frequency C4-06 is 50 Hz). Ymax is the voltage and the value is 10 V. Therefore, the AO gain (E3-18) should be set to -0.5.
E3-23	AO1 output offset	0.00 V	-10.00 V to +10.00 V	This parameter sets the output offset voltage of the AO, that is, the voltage calculated through the AO curve plus the offset.

Param.	Description	Default	Value range	Description
E3-26	AO hardware source	0	0 to 11	Defines the AO curve input source through the ones place. 0: Output function. The source is defined by E3-00. 1: Forced value. The forced value set by E3-27 is selected.
E3-27	AO1 forced value	0.00 V	0.00 V to 10.00 V	Defines the forced AO value. **Note:** When E3-26 is 1, E2-27 is valid.

Table 5–51 Relationship between analog output content and corresponding maximum values (Xmax)

Analog output content	Corresponding maximum value (Xmax)
Operating frequency	Rated output frequency
Frequency reference	Rated output frequency
Output current	2 x Rated motor current
Output torque (absolute value)	2 x Rated motor torque
Output power	2 x Rated power
Output voltage	1.2 x Rated drive voltage
Pulse input	20.00 kHz
AI1	10 V
Length	Maximum set length
Counting value	Maximum counting value
Communication reference	100.0%
Motor speed	Speed at the rated output frequency
Output current	1000.0 A
Output voltage	1000.0 V
Output torque (actual value)	Rated motor torque

Application example

To set the AO to output the operating frequency of the drive, do as follows:

1. Allocate the AO with function "Operating frequency" (E3-00 = 0).
2. Set the mapping relation of the AO curve to "0 V to 10 V correspond to 0% to 100%".
3. Set E3-05 to 0.0%, and E3-06 to 0.00 V.
4. Set E3-07 to 100.0%, and E3-08 to 10.00 V.

After the above steps, when the drive is running, the AO outputs the voltage value corresponding to the percentage of the running frequency of the drive to the rated frequency.

For example, the rated frequency is 50 Hz, the operating frequency is 25 Hz, and 50% is obtained for the AO. In this case, the AO outputs 5 V.

5.2.10.10 DI Function Settings

5.2.10.10.1 Operation Pause (Terminal Control)

Application scenario

This function is used to pause the drive without changing the operation command.

Working principles

Set F0-03 [Main command source of control channel 1] to 1 [Terminal control] to enable the operation pause function in terminal control mode.

As shown in the following figure, the drive responds to the operation command of the DI terminal and starts only when the operation pause function is OFF. If the operation pause function is enabled during operation of the drive, the drive stops as defined by d0-07 [Stop mode during operation]. If the operation command of the DI terminal is still valid after stop, the drive starts automatically as long as the operation pause function is set to OFF.

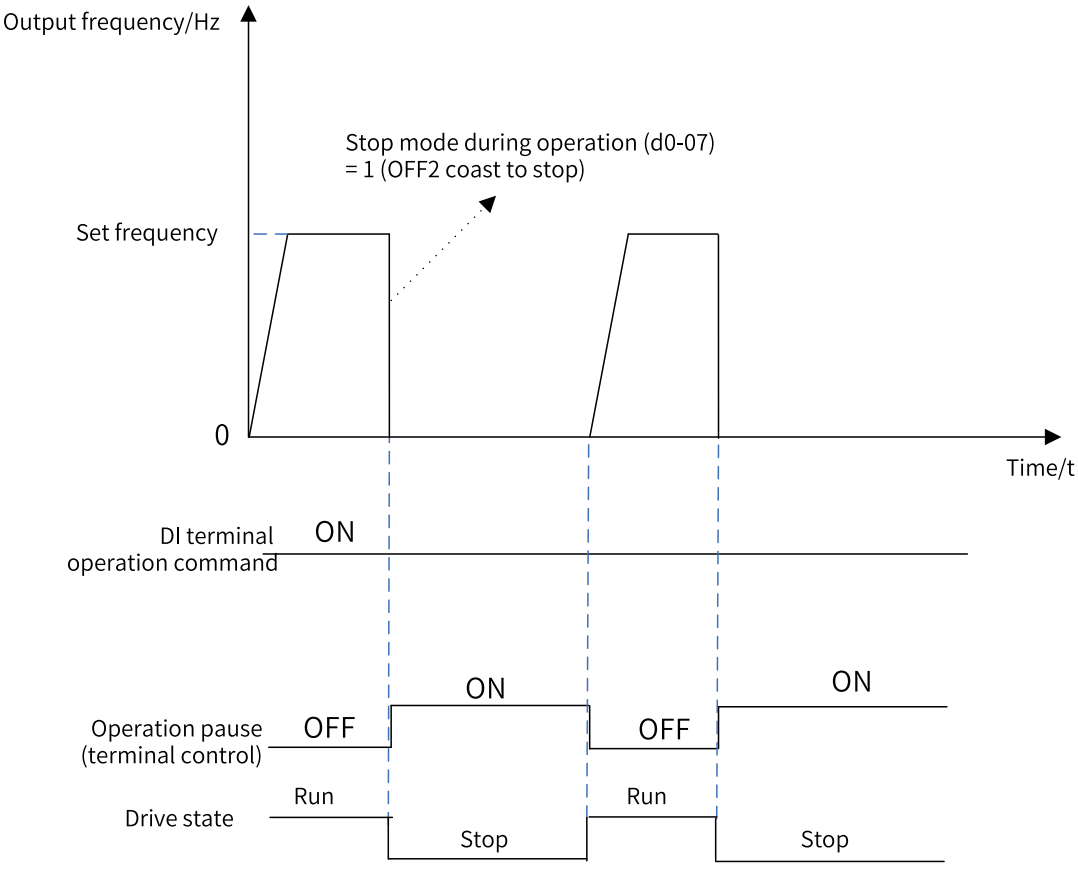


Figure 5-81 Schematic of operation pause (terminal control)

Application example

The following examples use terminals as the source of operation commands.

1. Set F0-03 [Main command source of control channel 1] to 1 [Terminal control].
2. Set F4-03 [DI1 function selection] to 1 [Terminal start/stop module A_IN1].

3. Set F4-04 [DI2 function selection] to 10 [Operation pause (terminal control)].
4. Set E0-58 [DI activation mode selection] to 0x0000 (active high).

After preceding settings are done, the operation commands of the drive can be controlled through DI1, and operation pause can be controlled through DI2. The drive can only start when DI2 opens and DI1 closes.

5.2.10.10.2 Operation Enable

Application scenario

This function is used to protect the drive from inadvertent startup through the operation enable terminal.

Working principles

The operation enable function (terminal control) is the pre-condition for startup of the drive. This function does not limit F0-03 (Main command source of control channel 1), that is, the function can be used with any operation command source (operating panel, terminal, communication, or custom).

As shown in the following figure, the drive responds to the operation command of the DI terminal and starts only when the operation enable function is active and the corresponding DI terminal is valid. If this function is enabled during operation of the drive, the drive stops as defined by d0-07. If the operation command of the DI terminal is still active after stop, the drive starts automatically as long as the operation enable function is active (the corresponding DI terminal is active).

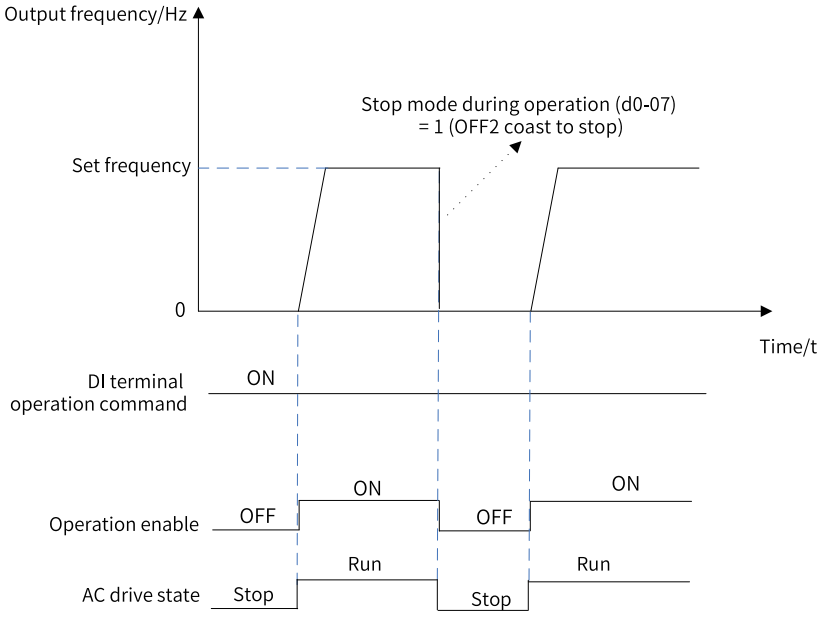


Figure 5-82 Schematic of operation enable (terminal control)

Application example

The following shows how to use terminals as the source of operation commands.

1. Set F0-03 [Main command source of control channel 1] to 1 [Terminal control].

2. Set F4-03 [DI1 function selection] to 1 [Terminal A IN1].
3. Set F4-04 [DI2 function selection] to 77 [Operation enable (all modes)].
4. Set E0-58 [DI activation mode selection] to 0x0000 (active high).

With the above configuration, the operation commands of the drive can be controlled through DI1, and operation enable can be controlled through DI2. The drive can only start when both DI1 and DI2 are closed.

5.2.10.10.3 Speed Control/Torque Control Switchover

Application scenario

This function is used to switch the motor control mode of the drive between speed control and torque control.

Working principles

There are two DI functions for speed control/torque control switchover, namely "29: torque control inhibition" and "46: speed control/torque control selection".

These two DI functions and F0-02 (Motor control mode) jointly determine the control mode of the drive, as shown in the following figure.

If the DI terminal function "29: Torque control inhibition" is active, the system control mode is forcibly set to speed control and input to the system.

- When this function is active, the speed control mode stays unchanged while the torque control mode is forcibly switched to speed control mode.
- When this function is inactive, the motor control mode is not affected.

If the DI terminal function "29: Torque control inhibition" is inactive, the DI terminal function "46: Speed control/Torque control selection" determines whether to switch the motor control mode defined by F0-02 and input the control mode to the system finally.

- When this function is active, the control mode defined by F0-02 is inverted. That is, if F0-02 is set to speed control, the system is automatically switched to torque control. If F0-02 is set to torque control, the system is automatically switched to speed control.
- When this function is inactive, F0-02 defines the current motor control mode of the system.

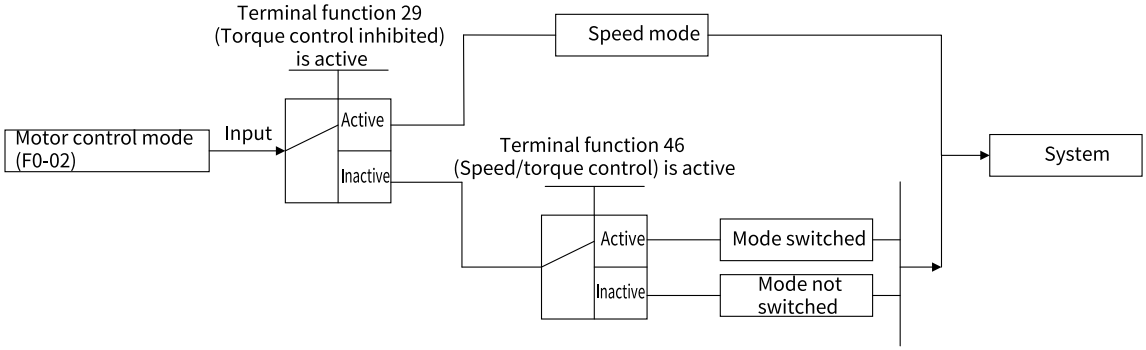


Figure 5-83 Schematic of speed control/torque control switchover

Application example

1. Set F0-02 (Motor control mode) to 1 (Torque control).
2. Set F4-03 (DI1 function selection) to 29 (Torque control inhibition).
3. Set F4-04 (DI2 terminal selection) to 46 (Speed control/Torque control selection).
4. Set E0-58 [DI activation mode selection] to 0x0000 (active high).

After preceding configurations are done, speed control applies if DI1 is closed or if DI1 is open and DI2 is closed; torque control applies when both DI1 and DI2 are open.

5.2.10.10.4 Immediate DC braking

Application scenario

This function is used to immediately brake the motor in emergencies to ensure that the rotor stops securely.

Description

When the DI assigned with "Immediate DC braking" is active, the drive outputs the current defined by d0-30 [DC braking current at stop] and immediately brakes the motor. In this case, the motor is in a dynamic braking state. When the DI is inactive, the DC braking state is canceled and the motor can operate normally.

Working principles

When the motor operates normally, activating DI assigned with "Immediate DC braking" makes the drive output the current defined by d0-30, which immediately brakes the motor to a stop. If this DI remains active, the drive continuously outputs the current defined by d0-30 to the motor, keeping the motor braked. If the DI is deactivated during operation, the motor exits the braking state and starts normally.

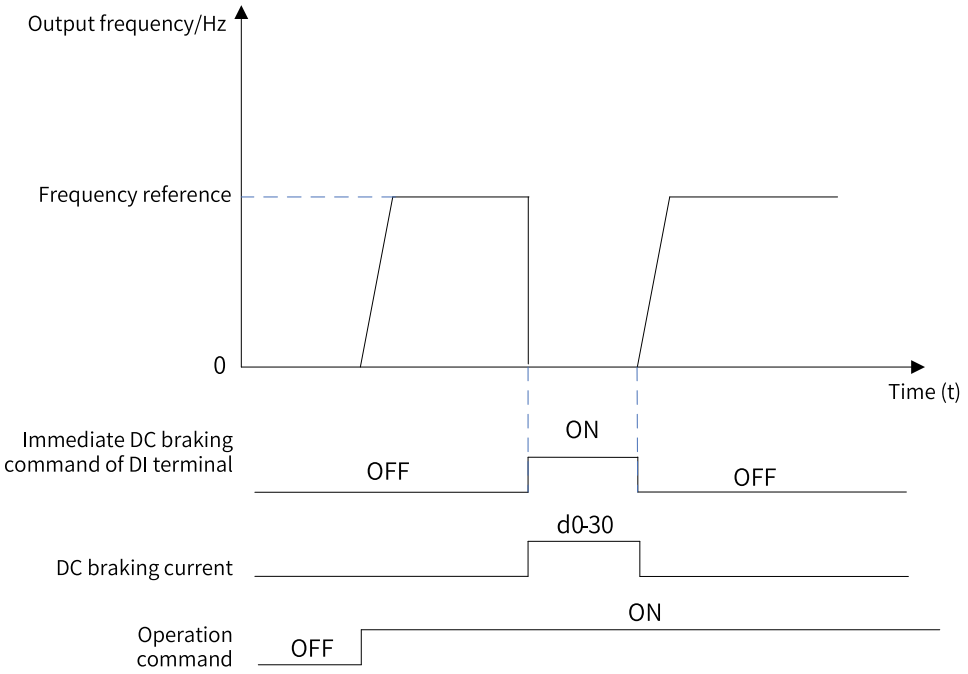


Figure 5-84 Schematic of immediate DC braking

Application instance

1. Set F4-03 [DI1 function selection] to "32: Immediate DC braking".
2. Set d0-30 [DC braking current at stop] to 50%.
3. Set E0-58 [DI activation mode selection] to 0x0000 (active high).

After preceding settings are done, if DI1 closes, the drive outputs the current defined by d0-30 and immediately brakes the motor to ensure that the rotor stops securely.

5.2.10.10.5 Decelerate To DC Braking

Application scenario

This function is used to decelerate the motor to a certain frequency before applying DC braking to ensure that the rotor stops securely.

Description

When the DI assigned with "Decelerate to DC braking" is active, the drive decelerates to the frequency set by d0-27 [Starting frequency of DC braking at stop], outputs the current defined by d0-30 [DC braking current at stop], and finally brakes the motor. In this case, the motor is in dynamic braking state. When the DI is inactive, the DC braking state is canceled and the motor can operate normally.

Working principles

When the motor operates normally, activating the DI assigned with "Decelerate to DC braking" makes the drive decelerate to the frequency set by d0-27, output the current set by d0-30, and

immediately brake the motor to a stop. If this DI remains active, the drive continuously outputs the current defined by d0-30 to the motor, keeping the motor braked. If the DI is deactivated during operation, the motor exits the braking state and starts normally.

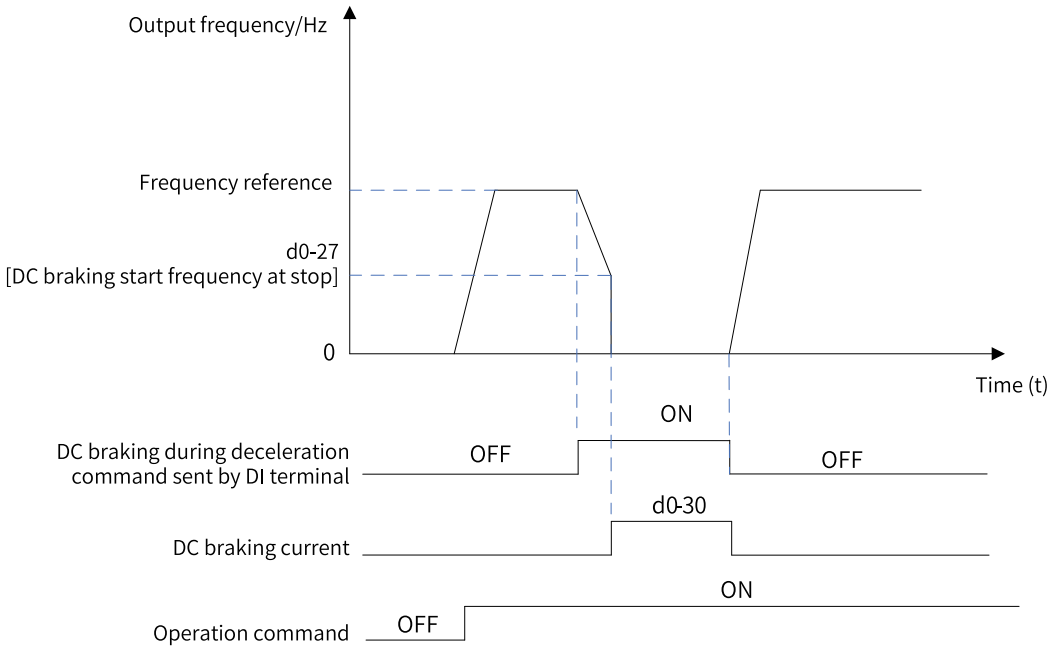


Figure 5-85 Schematic diagram of decelerating to DC braking

Application instance

1. Set F4-03 [DI1 function selection] to 49 [Decelerate to DC braking].
2. Set d0-30 [DC braking current at stop] to 50%.
3. Set d0-27 [Starting frequency of DC braking at stop] to 10 Hz.
4. Set E0-58 [DI activation mode selection] to 0x0000 (active high).

After preceding settings are done, if DI1 closes, the drive decelerates to 10 Hz, outputs the current set by d0-30, and finally brakes the motor to ensure that the rotor stops securely.

5.2.10.11 DO Function Settings

5.2.10.11.1 Motor overload pre-alarm

Application scenario

This function is used to monitor the motor overload state during operation and output the state through the DO terminal.

Description

Before motor overload protection, the drive determines whether the motor load exceeds the overload pre-alarm threshold set by d1-47. If the threshold is exceeded, the DO terminal outputs an active signal.

Working principles

The motor overload pre-alarm function is active when d1-47 is set to less than 100%. When the output current of the AC drive exceeds the rated motor current, the motor overload cumulative value (L3210) starts to accumulate. When L3210 reaches the threshold set by d1-47, the motor pre-overload alarm (A111.1) is reported and the DO terminal outputs an active signal. The motor overload fault (E11-1) is reported when L3210 accumulates to 100%.

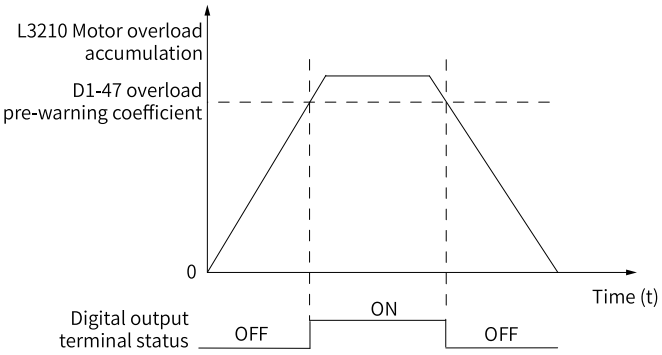


Figure 5-86 Motor overload pre-alarm

The relationship between overload current and fault reporting time is shown in the following figure.

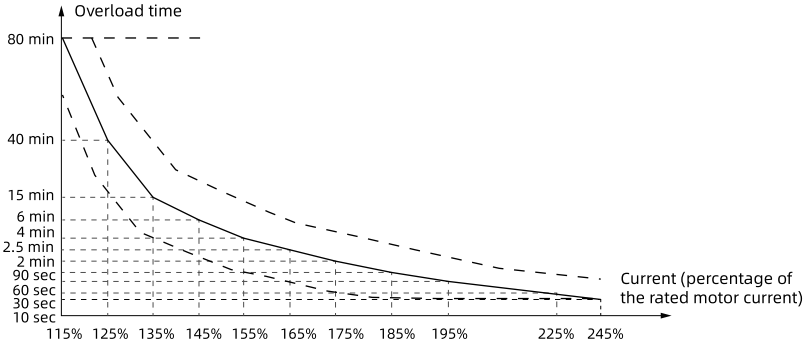


Figure 5-87 Motor overload curve

Application instance

1. Set d1-45 to 1 to enable motor overload protection and set the motor overload pre-alarm coefficient (d1-47) to less than 100%.
2. Set E1-00 (RO output function selection) to 6 (motor overload pre-alarm).

With the above configuration, the RO terminal outputs an active signal when the system detects that the motor is in the pre-overload state.

5.2.10.11.2 Drive overload pre-alarm

Application scenario

This function is used to monitor the overload state of the drive during operation and output the state through the DO terminal.

Description

Before drive overload protection, the system determines whether the drive load exceeds the pre-overload threshold defined by A3-53. If the threshold is exceeded, the DO terminal outputs an active signal.

Working principles

The drive overload pre-alarm function is active when A3-53 is set to a value lower than 100%. When the output current of the AC drive exceeds its rated current, the drive overload cumulative value starts to accumulate. When the cumulative value reaches the threshold set by A3-53, the drive pre-overload alarm (A110.1) is reported and the DO terminal outputs an active signal. The drive overload fault (E10-1) is reported when the cumulative drive overload value reaches 100%.

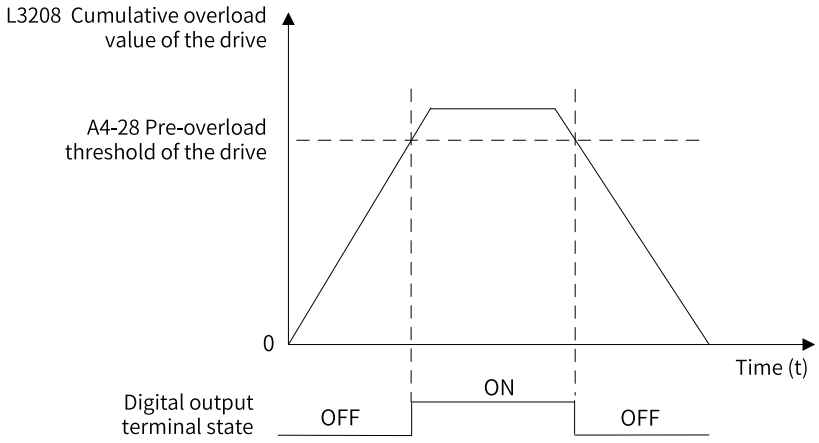


Figure 5-88 Drive overload pre-alarm

Application instance

1. Set the drive pre-overload threshold (A3-53) to a value lower than 100%.
2. Set E1-00 (RO output function selection) to "7: Drive overload pre-alarm".

After preceding settings are done, the RO terminal outputs an active signal when the system detects that the drive is in the pre-overload state.

5.2.10.11.3 Torque Limited

Application scenario

This function is used to limit the output torque in the speed control mode and output the state through the DO terminal.

Description

The torque limit function is active in vector control (FVC or SVC) mode. To switch to SVC mode, set F0-01 [Motor control method] to 0 [SVC]. When F0-02 [Motor control mode] is set to 0 [Speed control] and the DO terminal is set to "14: Torque limited", the system is in the torque limit state and the corresponding DO terminal outputs an active signal.

Working principles

This section takes motor forward operation as an example to demonstrate DO function 14 (torque limited).

As shown in the following figure, the DO terminal assigned with function "14: Torque limited" is active only when the following conditions are met.

1. The torque limit flag is valid.
2. The flag indicating deviation of the motor operation speed is valid.

For the first condition to be met, the motor object output torque (L3260) must exceed the limit threshold of the maximum positive torque (L3112) for a certain duration to enable system detection and assessment. If L3260 is lower than the limit threshold defined by L3112, the torque limit flag is invalid.

For the second condition to be met, a deviation must exist between the current motor speed and the target operating frequency of the system. If both conditions are met, the system determines that drive is in the torque limited state.

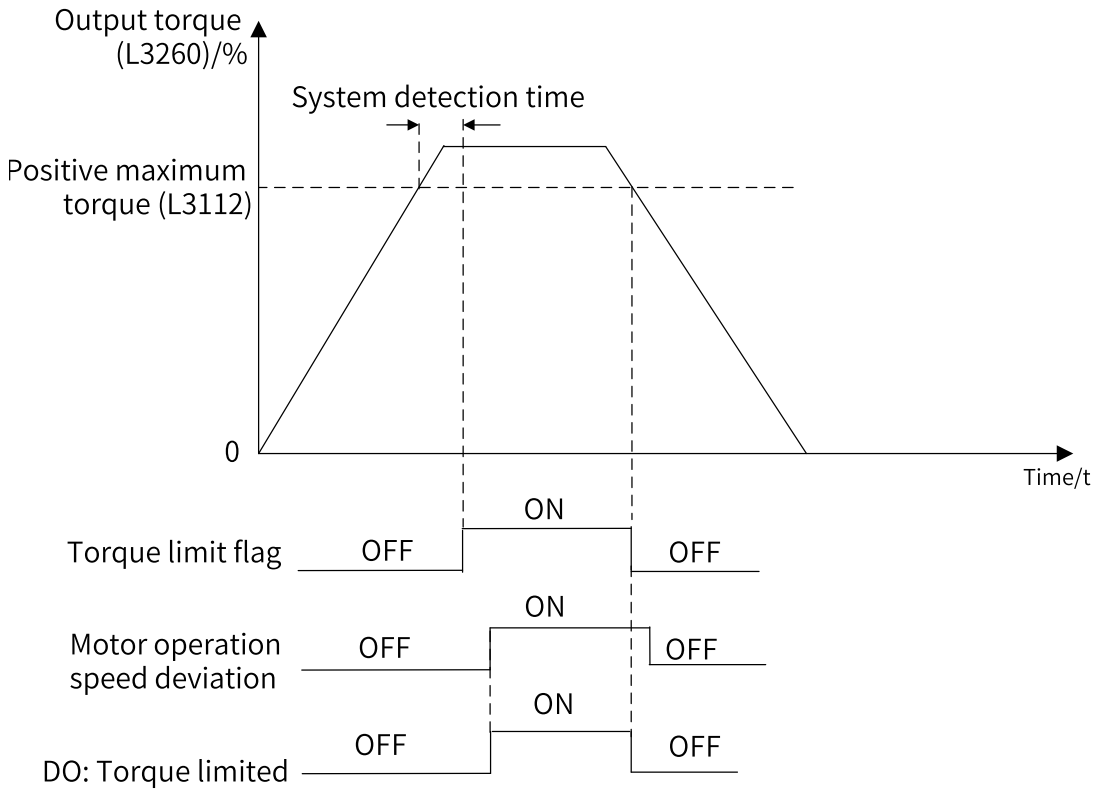


Figure 5-89 Operation principles

Application example

1. Set d1-09 [Digital reference of torque upper limit 1], d1-11 [Torque upper limit 2], d1-10 [Digital reference of torque lower limit 1], and d1-12 [Torque lower limit 2].
2. Set E1-00 [RO output function selection] to 14 "Torque limited".

After above settings are done, the RO terminal outputs an active signal when the system detects that the drive is in the torque limited state.

5.2.10.11.4 Undervoltage state

Application scenario

Undervoltage is prone to occur under conditions such as voltage dip and low grid voltage caused by grid voltage fluctuation. This function is used to monitor the motor bus voltage under such conditions and output the state through the DO terminal.

Description

The drive determines whether the system is in an undervoltage state by monitoring the bus voltage. If undervoltage occurs, the DO terminal outputs an active signal.

Working principles

When the bus voltage is lower than the undervoltage threshold (A3-56) due to voltage dip or low grid voltage, the undervoltage fault (E9-1) is reported and the DO terminal outputs an active signal.

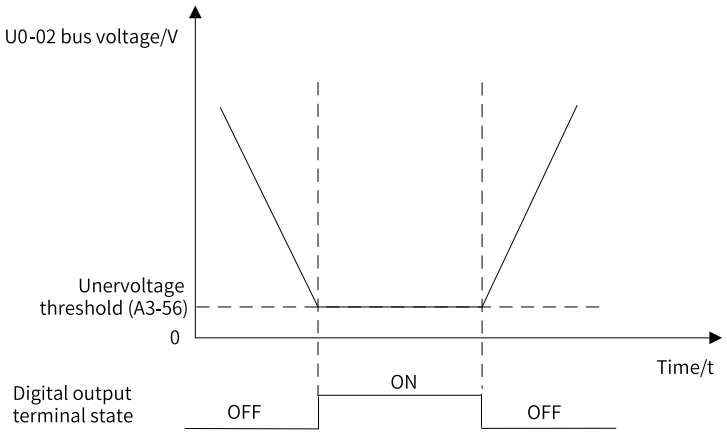


Figure 5-90 Undervoltage state

Application instance

1. Set E1-00 (RO output function selection) to "19: Undervoltage state".

With the above configuration, the RO terminal outputs an active signal when the system detects that the drive is in the undervoltage state.

5.2.10.11.5 Communication reference

Application scenario

This function is used to control the DO terminal output through remote communication.

Description

When the DO terminal function is set to 20 (communication setting), the system sends a specific value to address 0x2001 or 0x7312, and the corresponding DO terminal outputs an active signal.

Working principles

For the digital output terminals RO, DO, and FMR (for MD630S-INT), and the virtual digital output terminals VDO1 to VDO6 of the drive, if the function 20 (communication setting) is selected, the address 0x2001 or 0x7312 is used.

The address contains 16-bit data, with each terminal assigned according to the bit position. The terminal outputs an active signal when the value 1 is written to the corresponding bit of 0x2001 or 0x7312. The terminal does not output an active signal when the value 0 is written.

The data written can be viewed in U3-18.

Table 5–52 Bit positions of digital output terminals (communication setting)

Name	Bit position at address 0x2001 or 0x7312
RO	bit0
DO	bit4
FMR	bit8
VDO1	bit10
VDO2	bit11
VDO3	bit12
VDO4	bit13
VDO5	bit14
VDO6	bit15

Application example

The following shows the setting of DO output through communication.

1. Set E1-04 (DO output function selection) to 20 (communication setting) and use the address 0x7312.
2. According to *"Table 5-52 Bit positions of digital output terminals (communication setting)" on page 396*, the DO corresponds to bit4 at address 0x7312.
3. Confirm that the data to be sent is 0x0010 (bit4 is 1 and the remaining bits are 0).
4. Send 0x0010 to address 0x7312 to trigger the DO to output an active signal.

5.2.10.11.6 Three-Phase Loss

Application scenario

This function is used to monitor the phase loss state of the drive during operation and output the state through the DO terminal.

Description

When the three-phase output current is excessively low, the drive is in the phase loss state and the DO terminal outputs an active signal.

Working principles

Three-phase loss protection is enabled (d1-78 = 1). If the three-phase output current keeps lower than the three-phase output loss detection threshold (d1-82) for a period defined by d1-81, E30-1 (Three-phase output loss fault) is reported and the DO terminal outputs an active signal.

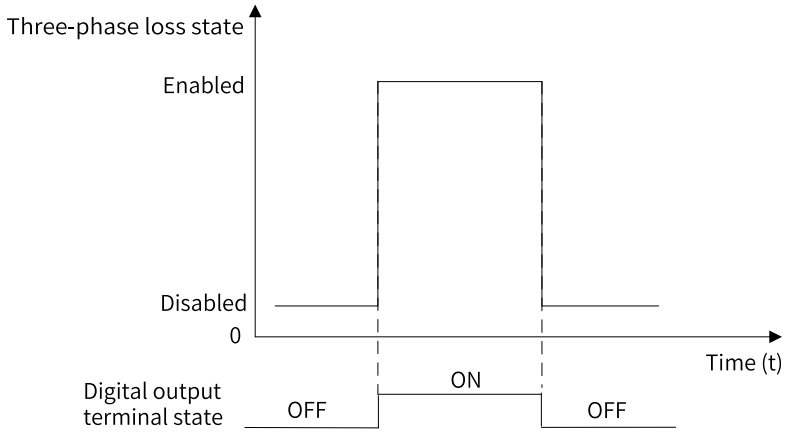


Figure 5-91 Three-phase loss

Application instance

1. Set E1-00 (RO output function selection) to "32: Three-phase loss".
2. Set d1-78 to 1 to enable three-phase loss protection.

With the preceding configuration, the RO terminal outputs an active signal when the system detects that the drive is in the three-phase loss state.

5.2.10.11.7 AI Input Overlimit

Application scenario

This function is used to detect whether AI1 and AI2 inputs exceed the limit.

Description

AI1 and AI2 feature overlimit detection function. For details, see *"5.2.10.8 Analog Input (AI) Terminals" on page 361*. When AI1/AI2 input exceeds the limit, the DO terminal outputs an active signal if it is assigned with function 31 (AI1 input overlimit) or 44 (AI2 input overlimit).

Note that overlimit detection function is not supported for AI2 in temperature sensor mode.

Working principles

The following figure takes AI1 as an example. If the AI1 input voltage remains higher than E2-14 (AI1 input protection upper limit) or lower than E2-15 (AI1 input protection lower limit) for a duration exceeding E2-34 (AI input protection time), the DO terminal outputs an active signal when it is assigned with function 31 (AI1 input overlimit). If the AI1 input voltage is lower than E2-14 or higher than E2-15, the DO terminal does not output a signal.

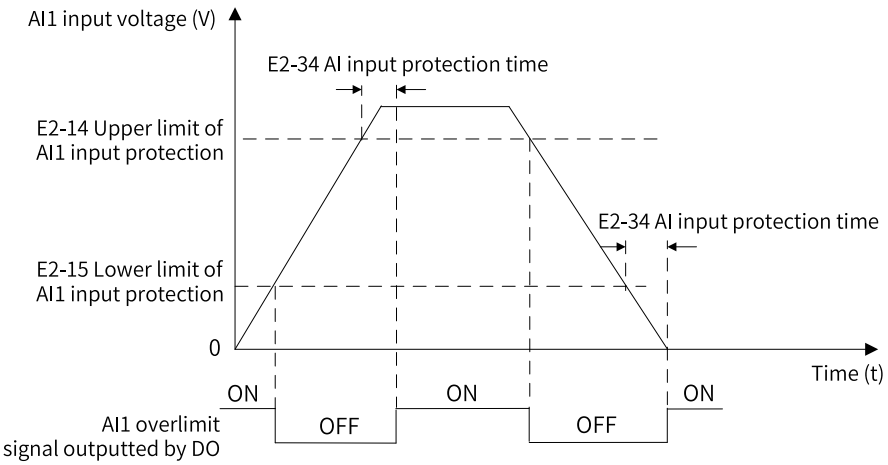


Figure 5-92 AI input overlimit

Application example

Take the RO terminal assigned with function 31 (AI1 input overlimit) as an example.

1. Set E2-14 (AI1 input protection upper limit) to 9 V, E2-15 (AI1 input protection lower limit) to 1 V, and E2-34 (AI input protection time) to 1s.
2. Set E1-00 (RO output function selection) to 31 (AI1 input overlimit).

With the above configuration, the RO terminal outputs an active signal when the AI1 input voltage remains higher than 9 V or lower than 1 V for over 1s. If the AI1 input voltage ranges from 1 V to 9 V, the RO terminal does not output an active signal.

5.2.10.11.8 Module temperature Reached

Application scenario

This function is used to monitor whether the module temperature reaches the threshold through the control terminal.

Description

When the system detects that the module temperature reaches the threshold, the DO assigned with function "35: Module temperature reached" outputs an active signal.

Working principles

As shown in the following figure, when the DO terminal function is set to 35 (Module temperature arrival) and U0-82 (Module temperature) exceeds P0-33 (Module temperature threshold), the DO terminal outputs an active signal. Otherwise, the DO terminal does not output an active signal.

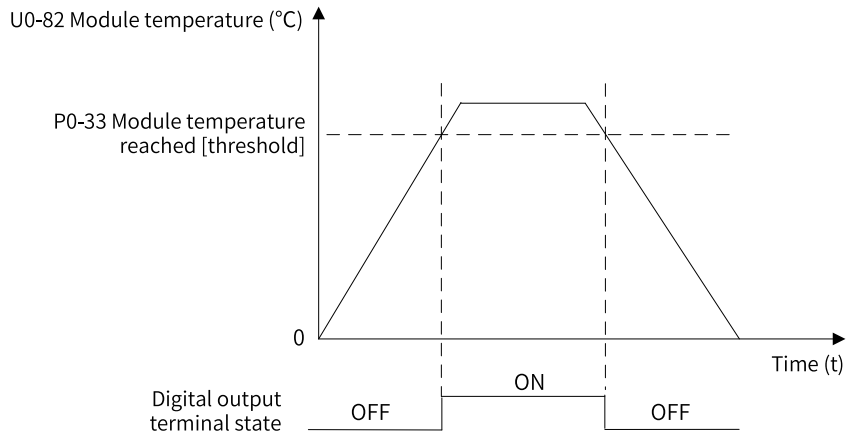


Figure 5-93 Module Temperature Reach

Application example

The following takes the RO assigned with function "35: Module temperature reached" as an example.

1. Set P0-33 (Module temperature arrival) to 60°C.
2. Set E1-00 (RO output function selection) to "35: Module temperature reached".
3. With above configuration, the RO outputs an active signal when U0-82 (Heatsink temperature) exceeds 60°C.

5.2.10.12 I/O Expansion Card

The MD6X0-multi-function I/O expansion card (MD-IO-M1) supports seven types of control interfaces, including two DIs, one DO, one AI, one AO, one RO, and one RTD temperature input terminal. AI supports voltage/current input, AO supports voltage/current output, and RO meets the requirement of long mechanical life with 1 million cycle for the lifting industry. The I/O expansion card is applicable to T1 to T5 models of the MD630-INT. Up to two I/O expansion cards can be installed to one drive. This manual uses expansion card 1 as an example. For detailed operations of two cards, refer to *I/O Expansion Card User Guide*.

5.2.10.12.1 Digital Input (DI) Terminals of I/O Expansion Card

The I/O expansion card is equipped with DI1 and DI2 as standard. The specific standard functions of the DI terminals are detailed in the table below. For specific functions, refer to the DI functions of the MD630-INT in *"5.2.10.2 Digital Input (DI) Terminals" on page 325*.

The DI terminals of the I/O expansion card support force functions. EA-00 (Set DI value to forced value) is used to set whether the DI input source is hardware input or forced value. EA-01 (DI forced data) is used to set the high or low level of the DI terminals forcibly. EA-02 to EA-10 are used to set DI-related delay parameters.

As shown in the table below, parameters in group EA are used to set DI functions and implement control of the DI terminals.

Param.	Name	Default	Value range	Description
EA-00	Set DI value to forced value	0x0000	0x0000 to 0xFFFF	Defines the source of DI1 and DI2 (in bit sequence) values. **Value description:** 0: Hardware. Hardware input is used as the input source. 1: Forced value. EA-01 is used as the input source.
EA-01	Force DI data	0x0000	0x0000 to 0xFFFF	Sets the level state of DI1 and DI2 forcibly according to the bit sequence. **Value description:** 0: Low level. DI input is forced to low level. 1: High level. DI input is forced to high level. **Note:** This parameter is active when the corresponding bit of EA-00 is set to 1. In this case, the DI input is hardware-independent.
EA-02	DI1 switch-on delay	0.0	0.0s to 3600.0s	Defines the delay change time when DI1 is switched on. **Note:** The parameter can be used together with the filter time.
EA-03	DI1 switch-off delay	0.0	0.0s to 3600.0s	Defines the delay change time when DI1 is switched off. **Note:** The parameter can be used together with the filter time.
EA-04	DI2 switch-on delay	0.0	0.0s to 3600.0s	Defines the delay change time when DI2 is switched on. **Note:** The parameter can be used together with the filter time.
EA-05	DI2 switch-off delay	0.0	0.0s to 3600.0s	Defines the delay change time when DI2 is switched off. **Note:** The parameter can be used together with the filter time.
EA-08	DI input filter time selection	0x0000	0x0000 to 0xFFFF	This parameter sets which DI filter time takes effect. **Value description:** bit0: DI1 filter time. Select DI1 filter time. 0: Filter time 1. DI1 filter time is set through EA-09. 1: Filter time 2. DI1 filter time is set through EA-10. bit1: DI2 filter time. Select DI2 filter time. 0: Filter time 1. DI2 filter time is set through EA-09. 1: Filter time 2. DI2 filter time is set through EA-10.
EA-09	DI input filter time 1	0.010	0.000s to 1.000s	Defines the filter time 1 for the drive to respond to changes in DI terminal status.
EA-10	DI input filter time 2	0.010	0.000s to 1.000s	Defines the filter time 2 for the drive to respond to changes in DI terminal status.

5.2.10.12.2 Digital Output Terminal of I/O Expansion Card

The I/O expansion card supports one DO and one RO, both of which can be individually set with switch-on delay and switch-off delay. Refer to the table below for details.

EA-16 (DO1 output function selection) can be set to any output function. EA-17 (RO1 output function selection) is used to select the output function for RO1. EA-18 is used to set the output source for DO and RO (according to the bit sequence). For DO functions, see the DO function of MD630-INT in *"5.2.10.3 Digital Output (DO) Terminal" on page 335*.

As shown in the table below, parameters in group EA are used to set functions for DO and RO.

Param.	Name	Default	Value range	Description
EA-16	DO1 function selection	0 (No output)	0 to 44	Defines the DO output function.
EA-17	RO1 function selection	0 (No output)	0 to 44	Defines the RO output function.
EA-18	DO/RO output source	0x0000	0x0000 to 0xFFFF	Defines the output source of DO and RO (according to the bit sequence). **Value description:** 0: Output function. DO and RO outputs are set by functions defined by EA-16 and EA-17. 1: Forced value. The DO and RO outputs are set by EA-19.
EA-19	Forced DO/RO data	0x0000	0x0000 to 0xFFFF	Defines the level state of forced values of DO and RO (in bit sequence). **Value description:** 0: Low level. DO and RO outputs are forced to low level. 1: High level. DO and RO outputs are forced to high level. Note: This parameter is valid when the corresponding bit of EA-18 is 1. In this case, the output is hardware-independent.
EA-20	DO/RO polarity selection	0x0000	0x0000 to 0xFFFF	Defines the polarity of the RO and DO terminals (in bit sequence). **Value description:** 0: Positive logic. Maintain positive logic for DO and RO output levels. 1: Negative logic. Maintain negative logic for DO and RO output levels.
EA-21	DO1 switch-on delay	0.0	0.0s to 3600.0s	Defines DO switch-on delay time. The DO terminal outputs an active signal only after the set delay time elapses.
EA-22	DO1 switch-off delay	0.0	0.0s to 3600.0s	Defines the DO switch-off delay time. The DO outputs an inactive signal only after the set delay time elapses.
EA-23	RO1 switch-on delay	0.0	0.0s to 3600.0s	Defines the RO switch-on delay time. The RO outputs an active signal only after the set delay time elapses.
EA-24	RO1 switch-off delay	0.0	0.0s to 3600.0s	Defines the RO switch-off delay time. The RO outputs an inactive signal only after the set delay time elapses.
EA-25	Forced output state of DO/RO upon communication disconnection	0x0000	0x0000 to 0xFFFF	Defines the forced output value when communication of DO and RO (in bit sequence) terminals is disconnected. **Value description:** 0: Low level. Output is forced to low level. 1: High level. Output is forced to high level.

5.2.10.12.3 Analog Input (AI) Terminals of I/O Expansion Card

The I/O expansion card supports one analog input terminal AI (input range: -10 V to +10 V). The AI supports both current and voltage signal types, which can be defined by EA-31 to EA-58. (*"5.2.10.8 Analog Input (AI) Terminals" on page 361*)

The hardware wiring of the AI terminal is shown below.

The AI voltage/current mode of the I/O expansion card is switched by DIP switch S2 on the expansion card. When the DIP switch is set to "ON", the current input mode applies. When it is set to "OFF", the voltage input mode applies.

Switch function	Switch state	Function
S1 (AO mode)	ON	Current output
	OFF	Voltage output
S2 (AI mode)	ON	Current input mode
	OFF	Voltage input mode
S3 (temperature sensor selection)	ON	PTC130 (single-core/three-core)
	OFF	PT100/PT1000/KTY84-130

AI used as DI

The AI terminal of the I/O expansion card can be used as a DI. For details, see the related section in MD630-INT user guide. Logic judgement on the AI input voltage is based on the values of EA-46 [High level threshold when AI used as DI] and EA-47 [Low level threshold when AI used as DI].

- When the AI input voltage is greater than 7 V, the AI terminal status is at high level.
- When the AI input voltage is lower than 3 V, the AI terminal status is at low level.
- When the AI input voltage is between 3 V and 7 V, the hysteresis state applies.

Table 5–53 Parameters for AI used as DI

Param.	Name	Default	Value range	Description
EA-46	High level threshold when AI is used as DI	7.0 V	5.5 V to 9.0 V	Defines the high level threshold when the AI is used as DI. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
EA-47	Low level threshold when AI is used as DI	3.0 V	1.0 V to 4.5 V	Defines the low level threshold when the AI is used as DI. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

AI curve gain

As a frequency source, the AI terminal supports two types of AI curves. The AI curve defines the relationship between the analog input voltage (or current) and the corresponding setpoint.

Table 5–54 Related parameters

Param.	Name	Default	Value range	Description
EA-36	AI1 gain	1.00	-10.00 to +10.00	Defines the gain multiplier of the AI1 analog sampling voltage. **Note:** 1. When used together with E2-08, the AI1 input voltage can be amplified and offset. If k is gain, b is offset, X is AI1 input voltage (U0-09 AI1 voltage), and Y is the processed voltage, then the voltage after processing is as follows: y = kx + b 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
EA-37	AI1 offset	0.00 V	-10.00 V to +10.00 V	Defines the offset coefficient of AI1 analog sampling voltage. **Note:** 1. When used together with E2-07, the AI1 input voltage can be amplified and offset. If k is gain, b is offset, X is AI1 input voltage (U0-09 AI1 voltage), and Y is the processed voltage, then the voltage after processing is as follows: y = kx + b 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
EA-38	AI1 denoising threshold	0.0%	0.0% to 100.0%	Defines the AI1 denoising threshold. **Note:** 1. For the per-unit percentage of the AI1 input after being processed with the AI curve, if the absolute value of the difference between the current value and the last value is within the threshold, denoising is performed. That is, the per-unit percentage remains unchanged. 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
EA-39	AI1 filter time	0.10s	0.00s to 10.00s	Indicates the software filter time of AI1. **Note:** 1. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 2. When on-site analog signals are prone to interference, you can increase the AI filter time to enhance the stability of the analog signals.
EA-40	AI1 zero-crossing threshold	0.0%	100.0%	Defines the zero-crossing threshold of AI1. The output in this range is 0.0%, which is used to eliminate fluctuation around zero. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
EA-41	Jump point of AI1 setting	0.0%	-800.0% to +800.0%	Defines the AI1 jump point. If the per-unitized percentage of AI1 input that compared with AI1 jump point is within the jump range defined by E2-13, the jump point value is outputted. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

Param.	Name	Default	Value range	Description
EA-42	Jump amplitude of AI1 setting	0.1%	0.0% to 100.0%	Defines the jump amplitude of AI1 setting. If the input that relative to the value of E2-12 is within the range defined by E2-13, the value of the jump point is outputted. **Note:** This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
EA-43	Upper limit of AI1 input protection	8.00 V	E2-15 to 10.00 V	Defines the AI1 input voltage protection upper limit, which is used to indicate whether AI1 input voltage is within the set range. **Note:** When the AI1 value is higher than E2-14 or lower than E2-15, the DO terminal outputs an active signal to indicate that AI1 input limit has been exceeded. You can also set H1-14 to determine whether to report E154.3 [AI open circuit].
EA-44	Lower limit of AI1 input protection	2.00 V	0.00 V to E2-14	Defines the AI1 input voltage protection lower limit, which is used to indicate whether AI1 input voltage is within the set range. **Note:** When the AI1 value is higher than E2-15 or lower than E2-14, the DO terminal outputs an active signal to indicate that AI1 input limit has been exceeded. You can also set H1-14 to determine whether to report E154.3 [AI open circuit].
EA-45	AI input protection time	0.01s	0.00s to 1.00s	Defines the duration during which the AI input limit exceeds the limit. When the AI input limit violation time is greater than or equal to this setpoint, the AI limit violation flag (L0050 to L0051) is outputted or the AI open circuit fault is reported.
EA-48	AI polarity selection	0 [Normal]	0 to 3	Defines AI1 input polarity. **Value description:** 0: Normal - The input value of AI is used. 1: Absolute value - The absolute value of AI is used. 2: Inversion - The AI input is inverted. 3: Absolute value inversion - The absolute value of AI is inverted.
EA-49	AI curve selection	0x0001	0x0001 to 0x0002	Defines the output when the AI1 input voltage is lower than the minimum input of the curve. **Value description:** 0000H: Percentage corresponding to the minimum input - When the AI input voltage is lower than the minimum input of the curve, the curve per-unit percentage is the value corresponding to the minimum input. 0001H: 0.0% - When the AI input voltage is lower than the minimum input of the curve, the curve per-unit percentage is 0.0%.
EA-50	AI lower limit selection	0x0000	0x0000 to 0x0001	Defines the output when the AI1 input voltage is lower than the minimum input of the curve. **Value description:** 0000H: Percentage corresponding to the minimum input - When the AI input voltage is lower than the minimum input of the curve, the curve per-unit percentage is the value corresponding to the minimum input. 0001H: 0.0% - When the AI input voltage is lower than the minimum input of the curve, the curve per-unit percentage is 0.0%.

Param.	Name	Default	Value range	Description
EA-51	Minimum input of AI curve 1	0.00 V	-10.00 to +10.00	Defines the minimum input on the x-axis of the AI curve 1, that is, the minimum analog input voltage (or current). **Note:** The x-axis of the AI curve represents the analog input voltage (or current), and the y-axis represents the per-unit percentage corresponding to the analog input voltage. If the AI input is selected as the frequency source, y-axis represents the percentage to the rated frequency of the motor.
EA-52	Percentage corresponding to the minimum input of AI curve 1	0.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 1 minimum input, which is the per-unit percentage corresponding to the minimum analog input. **Note:**Same as EA-51.
EA-53	Maximum input of AI curve 1	10.00 V	EA-51 to 10.00	Defines the maximum input point on the x-axis of the AI curve 1, that is, the maximum analog input voltage (or current). **Note:**Same as EA-51.
EA-54	Percentage corresponding to the maximum input of AI curve 1	100.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 1 maximum input, which is the per-unit percentage corresponding to the maximum analog input. **Note:**Same as EA-51.
EA-55	Minimum input of AI curve 2	0.00 V	-10.00 to +10.00	Defines the minimum input on the x-axis of the AI curve 2, that is, the minimum analog input voltage (or current). **Note:**Same as EA-51.
EA-56	Percentage corresponding to the minimum input of AI curve 2	0.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 2 minimum input, which is the per-unit percentage corresponding to the minimum analog input. **Note:**Same as EA-51.
EA-57	AI curve 2 maximum input	10.00 V	0.00 [EA-55] to 10.00	Defines the maximum input point on the x-axis of the AI curve 2, that is, the maximum analog input voltage (or current). **Note:**Same as EA-51.
EA-58	Percentage corresponding to the maximum input of AI curve 2	100.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to the AI curve 2 maximum input, which is the per-unit percentage corresponding to the maximum analog input. **Note:**Same as EA-51.
EA-55	Minimum input of AI curve 2	0.00 V	-10.00 to +10.00	Defines the minimum input on the x-axis of the AI curve 2, that is, the minimum analog input voltage (or current). **Note:**Same as EA-51.
EA-56	Percentage corresponding to the minimum input of AI curve 2	0.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to AI curve 2 minimum input, which is the per-unit percentage corresponding to the minimum analog input. **Note:**Same as EA-51.
EA-57	AI curve 2 maximum input	10.00 V	0.00 [EA-55] to 10.00	Defines the maximum input point on the x-axis of the AI curve 2, that is, the maximum analog input voltage (or current). **Note:**Same as EA-51.
EA-58	Percentage corresponding to the maximum input of AI curve 2	100.0%	-800.0% to +800.0%	Defines the y-axis that corresponds to the AI curve 2 maximum input, which is the per-unit percentage corresponding to the maximum analog input. **Note:**Same as EA-51.

Application instance of AI input

Instance 1: To use AI1 as the source of the operating frequency, set as follows.

1. Set the mapping relationship between the AI voltage and frequency: Select a curve from EA-51 to EA-58 (curve 1 for AI1 and curve 2 for AI2 when EA-49 = 0x0001).
2. Set the mapping relationship of AI1 curve to make 0 V...10 V correspond to 0%...100% (EA-51 = 0 V, EA-52 = 0%, EA-53 = 10 V, EA-54 = 100%).
3. Set whether to continue curve interpolation or keep the minimum curve input point of the curve (default, EA-50 = 0x000) when the curve lower limit is violated.
4. Determine whether to adjust EA-38...EA-42, that is, the denoising threshold, filter time, zero-crossing threshold, jump point+jump amplitude based on the actual conditions.
5. Set the frequency source to "Other" (b5-00 = Other). Select the input value of L2266 (I/O standard card 1-AI1) for the connector.

After the preceding steps are done, when 5 V level is inputted to AI1, the drive gets the AI1 input value of I/O standard card 1, then after being converted by the curve (50%), the operating frequency of the drive is 50% of C4-06 (Rated motor frequency). When AI1 input voltage changes, the operating frequency changes according to the AI1 curve.

5.2.10.12.4 Analog Output (AO) Terminals of I/O Expansion Card

The I/O expansion card supports one analog output terminal (AO). The AO terminal supports output of voltage and current signal types. Select the function of the AO based on the application scenario. Refer to the table below for details. For usage of the AO function, refer to the AO function description of the MD630-INT (*"5.2.10.9 Analog Output (AO) Terminals" on page 378*).

The hardware wiring of the AO terminal is shown below.

When AO1 is used for voltage output (supporting 0-10 V), set switch S1 to the OFF position. When AO1 is used for current output (supporting 0-20 mA), set switch S1 to the ON position. For the position of the DIP switch for AO1 voltage and current modes, see *"5.2.10.12.3 Analog Input (AI) Terminals of I/O Expansion Card" on page 402*.

The following table lists the AO function parameters.

Param.	Name	Default	Value range	Description
EA-71	AO1 function selection	0 (Operation frequency)	0 to 19	Defines the AO output function. After the corresponding function is selected, the AC drive calculates the per-unit percentage of the function variable and the corresponding output voltage is obtained after the AO curve.
EA-72	AO polarity selection	0	0 to 33	Defines the AO curve output polarity. **Value description:** 0: Normal value. The AO curve output value keeps unchanged. 1: Absolute value. The absolute value of the AO curve output value is used. 2: Opposite to normal value. The opposite value of the AO curve output value is used. 3: Opposite to absolute value. The opposite value of the absolute value of the AO curve output value is used.

Param.	Name	Default	Value range	Description
EA-73	AO curve selection	0	0 to 11	Defines the AO curve type. **Value description:** 0:Two-point curve. EA-74 to EA-77 are used to set the AO two-point curve parameters. 1:Gain+Offset. EA-78 and EA-79 are used to set the gain and offset parameters.
EA-74	Percentage corresponding to the minimum input of AO curve	0.0	-800.0 to 100.0 %	This parameter sets the minimum input on the x-axis of the AO curve, that is, the per-unit percentage of the selected AO function.
EA-75	Minimum input of AO curve	0.00	0.00 to 10.0 V	This parameter sets the y-axis of AO curve minimum input, that is, the AO voltage.
EA-76	Percentage corresponding to the maximum input of AO curve	100.0	0.0 (EA-74) to 800.0	This parameter sets the maximum input on the x-axis of the AO curve, that is, the per-unit percentage of the selected AO function.
EA-77	Maximum input of AO curve	10.00 V	0.00 V to 10.00 V	This parameter sets the y-axis of AO curve maximum input, that is, the AO voltage.
EA-78	AO1 zero offset coefficient	0.0%	-100.0 to +100.0	This parameter sets the AO zero offset coefficient (b in the linear formula Y= kX+b), which is a percentage of 10 V or 20 mA.
EA-79	AO1 gain	1.00	-10.00 to +10.00	Defines the AO gain, that is, k in the linear formula Y = kX+b.
EA-80	AO1 output offset	0.00 V	-10.00 to +10.00	AO curve linearization parameter
EA-81	AO hardware source	0	0 to 11	Defines the AO curve input source through the ones place. **Value description:** 0: Output function. The source is defined by EA-71. 1:Forced value. The forced value is defined by EA-82.
EA-82	AO1 forced value	0.00	0.00 to 10.00	Defines the forced AO value. **Note:** This parameter is valid when EA-81 is set to 1.

5.2.10.12.5 RTD Motor Temperature Parameters of I/O Expansion Card

The I/O expansion card supports independent AI sampling and independent processing for RTD motor temperature sampling. Set the motor temperature sensor type and motor temperature threshold through EA-59 to EA-62, and view the collected real-time temperature through U1-45 (I/O expansion card 1 - RTD temperature).

Note: The RTD temperature sampling resistor has been calibrated at the factory and generally does not require calibration on the site.

The hardware wiring for RTD motor temperature sampling can refer to the following methods:

The expansion card is compatible with multiple types of temperature sensors (*"5.2.10.12.3 Analog Input (AI) Terminals of I/O Expansion Card" on page 402*). When the switch S3 is in the OFF position, the PT100, PT1000, and KTY84-130 sensors are supported. When the switch S3 is in the ON position,

the single-conductor PTC130 and three-conductor PTC130 sensors are supported. The I/O expansion card provides two wiring methods, among which the four-wire method achieves higher measurement accuracy. If the two-wire method is used, short RTD+ and RYD_I+, and short RTD- and RYD_I- at the RTD terminal.

See the following table for setting of motor temperature-related parameters.

Param.	Name	Default	Value range	Description
EA-59	AI temperature mode - motor temperature sensor type	0	0: Invalid 1: PT100 2: PT1000 3: KTY84-130 4: PTC130 (single-conductor) 5: PTC130 (three-conductor)	Defines the AI temperature sensor type. Value description: 0: Invalid. No temperature acquisition is performed. 1: PT100. The AI is used for PT100 sensor input. 2: PT1000. The AI is used for PT1000 sensor input. 3: KTY84-130. The AI is used for KTY84-130 sensor input. 4: PTC130 (single-conductor). The AI is used for PTC130 sensor input. 5: PTC130 (three-conductor). The AI is used for PTC130 sensor input. Note: The AI is used as the PT100, PT1000, KTY84-130, PTC130 (three-conductor), or PTC130 (single-conductor) sensor to input temperature, which is displayed in U1-45.
EA-60	AI temperature mode - motor overtemperature protection threshold	130 °C	EA-61 to 200	Defines the alarm threshold for motor temperature arrival.
EA-61	AI temperature mode - motor overtemperature pre-alarm threshold	110℃	0 to EA-60	Defines the motor overtemperature pre-alarm threshold.
EA-62	AI temperature mode - motor temperature reach	75°C	0 to 100	Defines the motor overtemperature protection threshold.

U1-45 and U1-55 are used to display the temperature of the I/O expansion card.

Param.	Name	Default	Value range	Description
U1-45	I/O expansion card 1-RTD temperature value	0.0	PT100 (-25℃ to 200℃, ±0.5℃) PT1000 (-25℃ to 200℃, ±0.5℃) KTY84-130 (-40℃ to 260℃, ±0.5℃) PTC130 (100℃ to 180℃, ±5℃)	Displays the motor temperature (in unit of degree) sampled by the AI of I/O expansion card 1 used as the temperature sensor.
U1-55	I/O expansion card 2-RTD temperature value	0.0	PT100 (-25℃ to 200℃, ±0.5℃) PT1000 (-25℃ to 200℃, ±0.5℃) KTY84-130 (-40℃ to 260℃, ±0.5℃) PTC130 (100℃ to 180℃, ±5℃)	Displays the motor temperature (in unit of degree) sampled by the AI of I/O expansion card 2 used as the temperature sensor.

Application example

The temperature sensor mode of the I/O expansion card is determined by EA-59 (AI temperature mode - motor temperature sensor type). A value of 0 indicates "Disable", and values 1 to 4 correspond to PT100, PT1000, KTY84-130, PTC130 (single-conductor), and PTC130 (three-conductor) sensor input, with the temperature value displayed in U1-45.

To enable AI2 to function as PT100 temperature sensor, do as follows:

1. Set AI to PT100 temperature sensor mode (EA-59=1).
2. Set EA-62 (AI temperature mode - motor temperature reach), EA-61 (AI temperature mode - motor overheat pre-alarm threshold), and EA-60 (AI temperature mode - motor overheat protection threshold).
3. The temperature collected by the AI is displayed in U1-45.

The AI temperature mode is set after preceding steps are completed and the I/O expansion card is inserted.

5.2.11 Prediction on Critical Component Lifetime

The MD630-INT supports the lifetime prediction function for the main circuit capacitor, IGBT, and cooling fan. During use, the aging state of the wear parts is monitored in real time. When the lifetime of the components reaches the pre-alarm threshold, advance notification is sent to avoid unavoidable loss due to aging of components. The predicted lifetime is calculated based on mathematical models and is used for reference only.

Application scenario

This function applies to applications where the drive needs to output an alarm when the lifetime deadline of critical components is approaching, so as to prevent major faults.

Function description

The life prediction function for the main circuit capacitor, IGBT, and cooling fan of the drive is enabled by default. The component lifetime is affected by environmental factors, especially the internal temperature of the drive. Therefore, the lifetime varies dynamically. When the environment changes, the lifetime changes. The MD630-INT drive detects the surrounding environment in real time and calculates the theoretical lifetime of the components through mathematical models for your reference. The lifetime decreases from 100%. When the lifetime percentage decreases to the pre-alarm threshold, the drive notifies the user that an unknown fault may be caused by aging of the components. It is best to dispose of aging parts in advance.

Note: All parameters related to lifetime prediction are displayed only the A0-11 [Parameter access level] is set to 1 [Extended] or higher.

Function enable

This function is enabled by default, which can be disabled manually as needed. You can disable the lifetime prediction function through Ad-41 [Component lifetime prediction enable]. The prerequisite for enabling component lifetime prediction is that bit9 of A3-59 [Drive protection command word] is set to 1 (default). Otherwise, this function is invalid even if Ad-41 [Component lifetime prediction] is

enabled. Note that if the lifetime prediction function is manually turned off during use of the drive, a large error may occur.

Param.	Name	Default	Setting range	Description
A3-59	AC drive protection command word	0x0392	Bit 0: Reserved 0: Disable 1: Enable Bit 1: Input phase loss detection (software) 0: Disable 1: Enable Bit 2: Derating at low frequencies disabled 0: Enable 1: Disable Bit 3: Whether overvoltage reported at stop 0: Overvoltage alarm during stop 1: No overvoltage alarm during stop Bit 4: Zero drift fault enable 0: Disable 1: Enable Bit 5: Bus voltage acquisition analysis 0: Disable 1: Enable Bit 6: Software overcurrent enable 0: Disable 1: Enable Bit 7: CBC enable 0: Disable 1: Enable (Continued)	Defines whether the protection command word of the drive is valid. The corresponding bit corresponds to the protection command word. Value description: Bit 0: Reserved Set whether the input phase loss detection (software) is enabled through Bit 1. 0: Disable 1: Enable Set whether to turn off derating at low frequencies through Bit 2. 0: Enable 1: OFF - Derating at low frequencies is disabled. Set whether to report overvoltage at stop through Bit 3. 0: Overvoltage alarm during stop 1: No overvoltage alarm during stop Set whether to enable zero drift through Bit 4. 0: Disable 1: Enable - E18.01 current acquisition error is reported when zero drift error is detected. Set whether to enable bus voltage acquisition analysis through Bit 5. 0: Disable 1: Enable Set whether to enable software overcurrent through Bit 6. 0: Disable 1: Enable - When the phase current exceeds the threshold, the custom software overcurrent fault E02.02 is reported. Set whether to enable CBC through Bit 7. 0: Disable 1: Enable - Enable the pulse-by pulse current limit function. (Continued)

Param.	Name	Default	Setting range	Description
A3-59	AC drive protection command word	0x0392	(Continued) Bit 8: Reserved Bit 9: Junction temperature protection enable 0: Disable 1: Enable Bit 10: Capacitor leakage enable 0: Disable 1: Enable Bit 11 to Bit 15: Reserved	(Continued) Bit 8: Overload curve enable 0: Disable 1: Enable Bit 9: Junction temperature protection enable 0: Disable 1: Enable Bit 10: Capacitor leakage enable 0: Disable 1: Enable
Ad-41	Component lifetime prediction function	0x000D	Bit 0: Capacitor life prediction of the main circuit 0: Disable 1: Enable Bit 1: Reserved 0: Disable 1: Enable Bit 2: IGBT life prediction 0: Disable 1: Enable Bit 3: Cooling fan life prediction 0: Disable 1: Enable Bit 4 to Bit 15: Reserved	Set whether to enable the lifetime prediction of the main circuit capacitor, IGBT, and fan (arranged in sequence according to the bit). Value description: Bit 0: Capacitor life prediction of the main circuit 0: Disable - Disable the capacitor lifetime prediction of the main circuit. 1: Enable - Enable the capacitor lifetime prediction of the main circuit. Bit 1: Reserved 0: Disable 1: Enable Bit 2: IGBT life prediction 0: Disable - Disable the IGBT lifetime prediction. 1: Enable - Enable the IGBT lifetime prediction. Bit 3: Cooling fan life prediction 0: Disable - Disable the cooling fan lifetime prediction. 1: Enable - Enable the cooling fan lifetime prediction. Note: If component lifetime prediction is turned off during use of the drive, it will result in inaccurate prediction.

Note: Currently, only T1 to T5 models support the lifetime prediction function. The other models do not support this function.

Display of component lifetime

The product provides theoretical component lifetime for your reference. The drive displays the lifetime of the main circuit capacitor, IGBT, and cooling fan in %. The displayed value decreases from 100%. The cooling fan also provides the remaining lifetime, in units of 10h. As shown in the following table, the data among the main circuit capacitor Ad-45, Ub-12, and L2272 is the same. The same applies to the IGBT and cooling fan.

Param.	Name	Monitoring range
Ad-45	Predicted lifetime margin of main circuit capacitor	0% to 100%
Ad-59	Predicted lifetime margin of IGBT	0% to 100%
Ad-64	Remaining operating time of the cooling fan predicted in real time (x 10 h)	0 to 65535 (x 10 h)
Ad-65	Predicted lifetime margin of fan	0% to 100%
Ub-12	Predicted lifetime margin of main circuit capacitor	0% to 100%
Ub-17	Predicted lifetime margin of IGBT	0% to 100%
Ub-19	Predicted lifetime margin of fan	0% to 100%
L2272	Predicted lifetime margin of main circuit capacitor	0% to 100%
L2276	Predicted lifetime margin of IGBT	0% to 100%
L2278	Predicted lifetime margin of fan	0% to 100%

Component lifetime alarm output

When the drive detects that the lifetime margin (unit %) of the components in the preceding Table 2 is lower than the lifetime pre-alarm threshold, the drive generates a lifetime pre-alarm, indicating that the drive may encounter a fault. If E1-00 (RO1 output function selection), E1-04 (DO1 output function selection), and E1-08 (FMR (HDO) output function selection) select function 46: Component lifetime pre-alarm output, the main circuit capacitance The lifetime pre-alarm is generated by any of the components of the IGBT and cooling fan, corresponding to RO1, DO1, and DO1. FMR generates signal output.

If you want to generate the signal output of RO1, DO1, and FMR when a lifetime pre-alarm occurs on a single component, set "B connector" to L0281 (Main circuit capacitor life pre-alarm output) or L0283 (IGBT lifetime pre-alarm output) or L0284 (Cooling fan lifetime pre-alarm output) in E1-00 (RO1 output function selection), E1-04 (DO1 output function selection) or E1-08 (FMR (HDO) output function selection). For details, see the connector section.

The following tables list the parameters related to component lifetime pre-alarm output. If the main circuit capacitor and IGBT have a lifetime pre-alarm, contact the manufacturer to replace the component. If the cooling fan has a lifetime pre-alarm, contact the manufacturer and replace the cooling fan under the manufacturer's guidance.

Param.	Name	Default	Setting range	Description
Ad-50	Main circuit capacitor lifetime alarm threshold	10.00%	0.00% to 30.00%	Defines the lead value of the main circuit capacitor lifetime. When the predicted lifetime or capacitance measurement value is lower than this threshold, an alarm is generated (the default level is Alarm, which can be adjusted by H1-18). Note: If the value of Ad-45 is lower than Ad-50, a capacitor lifetime pre-alarm output is generated.
Ad-62	IGBT lifetime alarm threshold	10.00%	0.00% to 30.00%	Defines the lead value of IGBT lifetime alarm. When the predicted lifetime is lower than this threshold, an alarm is generated (the default level is Alarm, which can be adjusted by H1-18). Note: If the value of Ad-59 is lower than Ad-62, an IGBT lifetime pre-alarm output is generated.
Ad-68	Cooling fan lifetime alarm threshold	10.00%	0.00% to 30.00%	Used to set the advance value for reporting fan lifetime alarm. When the predicted lifetime is lower than this threshold, an alarm is generated (the default level is Alarm, which can be adjusted by H1-18). Note: If the value of Ad-65 is lower than Ad-68, an IGBT lifetime pre-alarm output is generated.

Param.	Name	Monitoring range
L0280	Lifetime alarm	0 to 1
L0281	Main circuit capacitor lifetime alarm output	0 to 1
L0283	IGBT lifetime alarm output	0 to 1
L0284	Cooling fan lifetime alarm output	0 to 1

5.2.12 Application Macro

5.2.12.1 Introduction to Applications

The application macro is a set of preset parameters. You can select one of the macros as the basis, modify some parameters based on functional requirements, and save the parameters as your own parameter set. This simplifies the commissioning process.

Application Scenario

This product application macro is divided into interface macro and industry macro.

The parameter set in the interface macro is mainly oriented to control interfaces such as digital input (DI), digital output (DO), and analog input (AI), facilitating user commissioning of control interface parameters.

The industry macro is mainly oriented to specific application scenarios, such as fans and pumps, to facilitate commissioning during application.

Description

The interface macro selection is set in A0-48 (Interface macro selection), which provides 18 interface macros, including terminal two-wire control for start/stop, terminal three-wire control for start/stop, analog input as frequency source, control channel 1/2 switching, terminal module A/B, and setting channel 1/2 switching.

The industry macro selection is set in A0-50 (Industry macro selection), which provides four industry macros, including fans, pumps, ceramics, logistics, and more. Each set of parameters corresponds to a macro number. The user selects a set of macros based on the application scenario, adjusts and modifies the parameters based on actual requirements, and backs up the parameters after the final commissioning through the iFA commissioning software. You can download parameters with one click in the same scenario, greatly simplifying the commissioning process.

A0-48 (Interface macro selection) and A0-50 (Industry macro selection) are triggered macro selection parameters. The parameter set is automatically cleared after it is written correctly to the AC drive. You can view the interface macro and industry macro that were written successfully the last time in A0-49 (Effective value of interface macro) and A0-51 (Effective value of industry macro).

Related parameters:

The following table shows the related parameters.

Table 5–55 Parameters

Item	Name	Default	Value Range	Descriptions
A0-48	Interface macro selection	0	0 to 200	Used to set interface macro parameters. 0: No operation 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode (valid only for MD630S) 103: Analog speed regulation in single-wire mode (valid only for MD630S) 104: Four fixed speeds in two-wire mode 2 (valid only for MD630S) 105: Analog speed regulation in two-wire mode 1 (valid only for MD630S) 106: Analog speed regulation in two-wire mode 2 (valid only for MD630S) 107: Analog speed regulation in two-wire mode 3 (valid only for MD630S) 108: Four fixed speeds in three-wire mode 2 (valid only for MD630S) 109: Analog speed regulation in three-wire mode 1 (valid only for MD630S) 110: Analog speed regulation in three-wire mode 2 (valid only for MD630S) 111: Analog PID controller (valid only for MD630S) 112: PID controller with fixed reference value (valid only for MD630S) 113: Modbus communication control macro (valid only for MD630S) 114: Modbus communication control macro with DI terminal start/stop control (valid only for MD630S) 115: Multi-channel switchover 1 (valid only for MD630S) 116: Multi-channel switchover 2 (valid only for MD630S) 117: DI terminal jog control (valid only for MD630S) Additional information: After the parameter operation is completed, this parameter is automatically restored to 0.
A0-49	Effective value of interface macro	0	0 to 65535	Same as A0-48.

Item	Name	Default	Value Range	Descriptions
A0-50	Industry macro selection	0	0 to 300	0: No operation 201: Regular fan (MD630S 202: Normal water pump (MD630S Packaging Ceramic
A0-51	Effective value of industry macro	0	0 to 65535	Same as A0-50.

Operation Flowchart

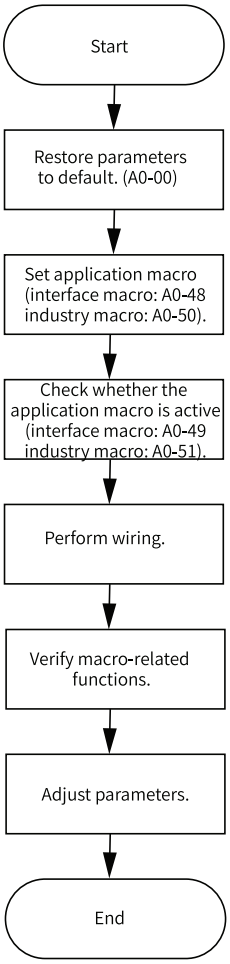


Figure 5-94 Operation Flowchart

Operation steps

It is recommended that users write a macro number from an interface macro or industry macro. Writing multiple macro numbers may result in abnormal functions.

Restore the default settings before writing each group of macros. Failure to comply may result in abnormal functions.

To select the interface macro or industry macro writing procedure:

1. Restore default settings of parameters
2. Select a macro write, A0-48 (Interface macro selection) or A0-50 (Industry macro selection).
3. Check whether the value of A0-49 is the macro number written in step 2.
4. For both interface macro and industry macro, wiring is required when interface functions such as DI, DO, AI, AO are involved. For details, see the description of each type of macro in "Interface Macro" and "Industry Macro".
5. Verify the macro function.
   For example, if 106 (Analog speed regulation in two-wire mode 2) is selected, when DI1 is closed and DI2 is open, the motor runs in the forward direction at the speed provided by AI1. When DI1 is open and DI2 is closed, the motor runs in the reverse direction at the speed provided by AI1. Adjust the AI1 input to control the set frequency. The RO function is the fault output, DO is the running output, and AO is the motor speed output.
6. Adjust and modify the parameters according to actual requirements.

Notes

1. To write an interface macro or industry macro, restore the default parameters.
2. It takes time to write parameters. Ensure that the power supply of the AC drive is normal.

5.2.12.2 Interface Macros

5.2.12.2.1 Interface Macro Overview

Scenarios

The MD630 AC drive provides 18 types of interface macros, which can be selected by setting the parameter A0-48 (interface macro selection).

1. Interface macros 102 to 110: Scenarios using terminals as operation commands
2. Interface macros 111 and 112: Scenarios using PID as the frequency source
3. Interface macro 115: Scenarios for switching between different frequency sources and terminal control modes by switching between set channels 1/2 and terminal modules A/B
4. Interface macro 116: Scenarios for switching between different frequency sources and operation command sources by switching between control channels 1/2 and set channels 1/2
5. Interface macro 117: Scenarios using the jogging function
6. Interface macros 113 and 114: Scenarios using Modbus for communication control

Interface macros can be used for the above application scenarios. For other scenarios not covered by these interface macros, you can configure the AC drive according to the actual needs.

Function description

The interface macro functions and parameters of the MD630-INT AC drive are all related to the control interface. To use the interface macros, select a macro number in A0-48 (interface macro selection) and a set of parameters is automatically written to implement the corresponding function, thus simplifying commissioning. For details, see *"Table 5-56 Interface Macros" on page 419*. The written parameters can be queried with the application macro function, as shown in the "Related Application Macro" column of the table below.

Table 5–56 Interface Macros

Param.	Name	Optional Macro	Function	Related Application Macro	Applicable AC Drive Series
A0-48	Interface macro selection	0	No operation	-	-
		101: Quick commissioning macro	Scenario: Start/stop the AC drive and set the frequency through the local operating panel. After pressing the RUN key on the operating panel, the AC drive operates.	"5.2.12.2.2 Quick Commissioning Macro (101)" on page 422	MD630S-INT and MD630N-INT
		102: Two fixed speeds in single-wire mode	Scenario: Start/stop the AC drive through the terminal in single-wire mode, and set frequency through multi-reference. • When DI1 is closed, the AC drive runs at the first fixed frequency. • When DI1 and DI4 are closed, the AC drive operates at the second fixed frequency. • When DI1 is open, the AC drive stops.	"5.2.12.2.3 Two Fixed Speeds in Single-wire Mode (102)" on page 423	MD630S-INT
		103: Analog speed regulation in single-wire mode	Scenario: Start/stop the AC drive through the terminal in single-wire mode, and set frequency through analog inputs. • When DI1 is closed, the AC drive runs. • Set the frequency through AI1.	"5.2.12.2.4 Analog Speed Regulation in Single-wire Mode (103)" on page 425	MD630S-INT
		104: Four fixed speeds in two-wire mode 2	Scenario: Start/stop the AC drive through the terminals in two-wire mode 2, and set frequency through multi-reference. • When DI1 is closed and DI2 is open, the AC drive runs at the forward direction. When DI1 is open and DI2 is closed, the AC drive runs at the reverse direction. • Four fixed frequencies (Multi-speed) can be set through the combination use of DI4 and DI5.	"5.2.12.2.5 Four Fixed Speeds in Two-wire Mode 2 (104)" on page 426	MD630S-INT
		105: Analog speed regulation in two-wire mode 1	Scenario: Start/stop the AC drive through the terminals in two-wire mode 1, and set frequency through analog inputs. • When DI1 is closed, the AC drive runs at the forward direction. Remain DI1 is closed and close DI2, then the AC drive runs at the reverse direction. • Set the frequency through AI1.	"5.2.12.2.6 Analog Speed Regulation in Two-wire Mode 1 (105)" on page 428	MD630S-INT
		106: Analog speed regulation in two-wire mode 2	Scenario: Start/stop the AC drive through the terminals in two-wire mode 2, and set frequency through analog inputs. • When DI1 is closed and DI2 is open, the AC drive runs at the forward direction. When DI1 is open and DI2 is closed, the AC drive runs at the reverse direction. • Set the frequency through AI1.	"5.2.12.2.7 Analog Speed Regulation in Two-wire Mode 2 (106)" on page 430	MD630S-INT

Param.	Name	Optional Macro	Function	Related Application Macro	Applicable AC Drive Series
A0-48	Interface macro selection	107: Analog speed regulation in two-wire mode 3	Scenario: Start/stop the AC drive through the terminals in two-wire mode 3, and set frequency through analog inputs. • When DI1 signal is in the rising edge and DI2 is closed, the AC drive runs. • When DI2 is open, the AC drive stops. • Set the frequency through AI1.	*"5.2.12.2.8 Analog Speed Regulation in Two-wire Mode 3 (107)" on page 431*	MD630S-INT
		108: Four fixed speeds in three-wire mode 2	Scenario: Start/stop the AC drive through the terminals in three-wire mode 2, and set frequency through multi-reference. • When DI1 signal is in the rising edge and DI4 is closed, the AC drive runs at the forward direction. When DI2 signal is in the rising edge and DI4 is closed, the AC drive runs at the diverse direction. When DI4 is open, the AC drive stops. • Four fixed frequencies (Multi-speed) can be set through the combination use of DI5 and DI6.	*"5.2.12.2.9 Four Fixed Speeds in Three-wire Mode 2 (108)" on page 433*	MD630S-INT
		109: Analog speed regulation in three-wire mode 1	Scenario: Start/stop the AC drive through the terminals in three-wire mode 1, and set frequency through analog inputs. • When DI2 is closed and DI1 transitions from open to closed (triggered from 0 to 1), the AC drive starts in the forward direction. When DI4 is closed, the AC drive rotates in the reverse direction. When DI2 is open, the AC drive stops. • Set the frequency through AI1.	*"5.2.12.2.10 Analog Speed Regulation in Three-wire Mode 1 (109)" on page 435*	MD630S-INT
		110: Analog speed regulation in three-wire mode 2	Scenario: Start/stop the AC drive through the terminals in three-wire mode 2, and set frequency through analog inputs. • When DI1 signal is in the rising edge and DI4 is closed, the AC drive runs at the forward direction. When DI2 signal is in the rising edge and DI4 is closed, the AC drive runs at the diverse direction. When DI4 is open, the AC drive stops. • Set the frequency through AI1.	*"5.2.12.2.11 Analog Speed Regulation in Three-wire Mode 2 (110)" on page 436*	MD630S-INT
		111: Analog PID controller	Scenario: Start/stop the AC drive through the terminal in single-wire mode and set frequency through PID regulation. • When DI1 is closed, the AC drive runs. • AI1 is used as the PID reference. • AI2 is used as the PID feedback.	*"5.2.12.2.12 Analog PID Controller (111)" on page 438*	MD630S-INT
		112: PID controller with fixed reference value	Scenario: Start/stop the AC drive through the terminal in single-wire mode and set frequency through PID regulation. • When DI1 is closed, the AC drive runs. • Local PID is used as PID reference. • AI1 is used as the PID feedback.	*"5.2.12.2.13 PID Controller with Fixed Reference Value (112)" on page 440*	MD630S-INT

Param.	Name	Optional Macro	Function	Related Application Macro	Applicable AC Drive Series
A0-48	Interface macro selection	113: Modbus communication control macro	Scenario: Start/stop the AC drive and set the frequency through Modbus communication.	"5.2.12.2.14 Modbus Communication Control Macro (113)" on page 441	MD630S-INT
		114: Modbus communication control macro with DI terminal start/stop control	Scenario: Start/stop the AC drive through the terminal in single-wire mode and set frequency through Modbus communication. • When DI1 is closed, the AC drive runs. • Set the frequency through Modbus.	"5.2.12.2.15 Modbus Communication Control Macro with DI Terminal Start/stop Control (114)" on page 442	MD630S-INT
		115: Multi-channel switchover 1	Scenario: Switch between the set channel (frequency reference) and terminal start/stop module (terminal control mode). • Terminal start/stop module A, set channel 1: Start the AC drive through DI1; make the AC drive run at reverse direction through DI2; set the frequency reference through AI1. • Terminal start/stop module B, set channel 2: Make AC drive start in the forward direction through DI6 and AC drive start in the reverse direction through DI7; set the frequency reference through AI2. • When DI4 is closed, the user can switch between set channel 1 and set channel 2. • When DI5 is closed, the user can switch between terminal start/stop module A and B.	"5.2.12.2.16 Multi-channel Switchover 1 (115)" on page 444	MD630S-INT
		116: Multi-channel switchover 2	Scenario: Switch between the two control channels and between the two set channels. • Control channel 1, set channel 1: Terminal control start/stop, frequency set by AI1 • Control channel 2, set channel 2: Communication controls start/stop and frequency reference. • When DI4 is closed, the user can switch between control channel 1 and control channel 2. • When DI5 is closed, the user can switch between set channel 1 and set channel 2.	"5.2.12.2.17 Multi-channel Switchover 2 (116)" on page 446	MD630S-INT
		117: Jog control through DI terminal	Scenario: Jog control through terminals. • When DI1 is closed, the AC drive starts by jogging 1 mode. • When DI2 is closed, the AC drive starts by jogging 2 mode.	"5.2.12.2.18 DI Terminal Jog Control (117)" on page 448	MD630S-INT

Operation steps:

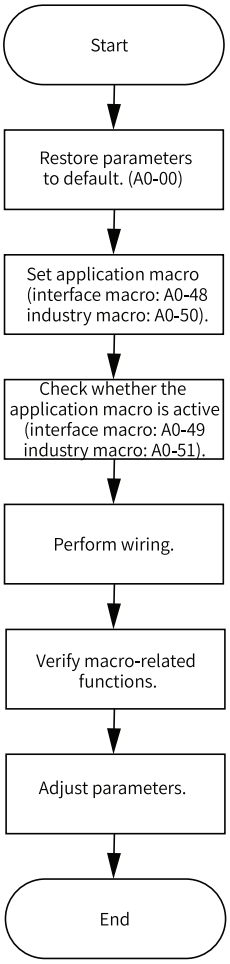


Figure 5-95 Procedure of using application macros

Precautions

1. Restore the default settings before writing a macro number to A0-48 (interface macro selection).
2. The successfully written macro parameter set is displayed in A0-49 (effective value of interface macro).

5.2.12.2.2 Quick Commissioning Macro (101)

Scenarios

This macro is mainly used for initial product commissioning to quickly configure the motor to start at a low speed in V/f control mode, the operating panel as the command source, and local digital setting as the frequency reference source.

Wiring diagram

The quick commissioning macro does not involve the control interface function and does not require wiring.

Parameters to be written

After A0-48 (interface macro selection) is set to 101 (quick commissioning macro), the AC drive automatically writes the parameters in the following table.

Table 5–57 Parameter set of quick commissioning macro

Parameter	Description	Default Value	Written Value
F0-01	Control method of motor 1	2: V/f mode	2: V/f mode
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	0: Operating panel
b5-00	Main frequency source	0: Set by the parameter (b5-01)	0: Set by the parameter (b5-01)
b5-01	Digital setting of main frequency	50.00 Hz	5.00 Hz
b7-04	Acceleration time	20.0 s	20.0s
b7-05	Deceleration time	20.0 s	20.0s
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.3 Two Fixed Speeds in Single-wire Mode (102)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in single-wire mode and set frequency through multi-reference.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, DI4, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 75*.

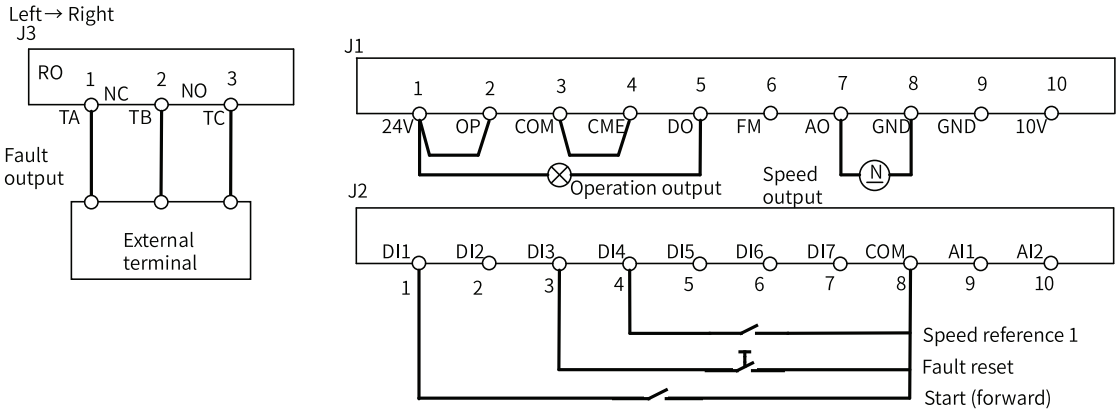


Figure 5-96 Wiring diagram of two fixed speeds in single-wire mode

Function description

- When DI1 is closed, the speed is set to 0.
- When DI1 is open, the AC drive stops.
- When both DI1 and DI4 are closed, the speed is set to 1.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 102 (two fixed speeds in single-wire mode), the AC drive automatically writes the parameters in the following table.

Table 5–58 Parameter set of two fixed speeds in single-wire mode

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	6: Multi-reference
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	12: Multi-reference terminal 1
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
b8-08	Source of multi-reference 0	0: Set by the parameter (b8-09)	0: Set by the parameter (b8-09)
b8-09	Multi-reference 0	0.0%	25.0%
b8-10	Multi-reference 1	0.0%	50.0%
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.4 Analog Speed Regulation in Single-wire Mode (103)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in single-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *“Electrical Wiring” on page 75*.

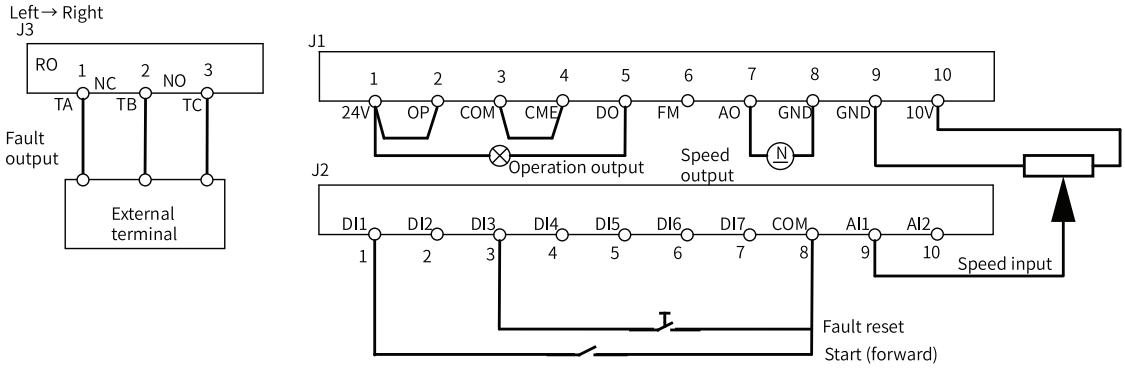


Figure 5-97 Wiring diagram of analog speed regulation in single-wire mode

Function description

- When DI1 is closed, the AC drive starts. When DI1 is open, the AC drive stops.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 103 (analog speed regulation in single-wire mode), the AC drive automatically writes the parameters in the following table.

Table 5–59 Parameter set of analog speed regulation in single-wire mode

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1

Parameter	Description	Default Value	Written Value
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault ouotput	2: Fault ouotput
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.5 Four Fixed Speeds in Two-wire Mode 2 (104)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in two-wire mode and set frequency through multi-reference.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, DI4, DI5, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 75*.

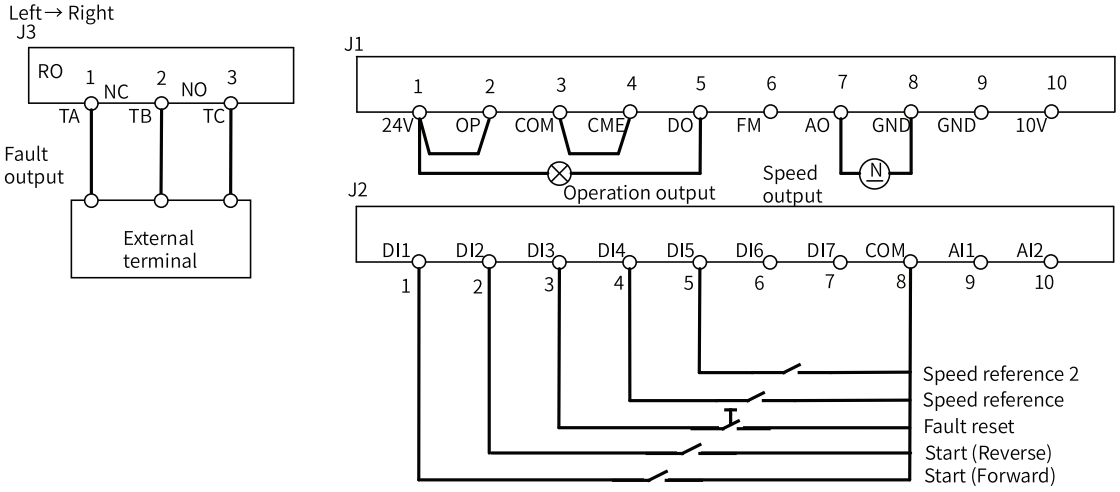


Figure 5-98 Wiring diagram of four fixed speeds in two-wire mode 2

Function description

- When DI1 is closed and DI2 is open, the AC drive starts in the forward direction.
- When DI1 is open and DI2 is closed, the AC drive starts in the reverse direction.
- The frequency is set by the multi-reference 0 to 3, which corresponds to the states of both DI4 and DI5.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 104 (four fixed speeds in two-wire mode 2), the AC drive automatically writes the parameters in the following table.

Table 5–60 Parameter set of four fixed speeds in two-wire mode 2

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	6: Multi-reference
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	3: IN1 for forward start, IN2 for reverse start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset

Parameter	Description	Default Value	Written Value
E0-03	DI4 function selection	12: Multi-reference terminal 1	12: Multi-reference terminal 1
E0-04	DI5 function selection	13: Multi-reference terminal 2	13: Multi-reference terminal 2
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
b8-08	Source of multi-reference 0	0: Set by the parameter (b8-09)	0: Set by the parameter (b8-09)
b8-09	Multi-reference 0	0.0%	25.0%
b8-10	Multi-reference 1	0.0%	50.0%
b8-11	Multi-reference 2	0.0%	75.0%
b8-12	Multi-reference 3	0.0%	100.0%
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.6 Analog Speed Regulation in Two-wire Mode 1 (105)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in two-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *“ Electrical Wiring” on page 75*.

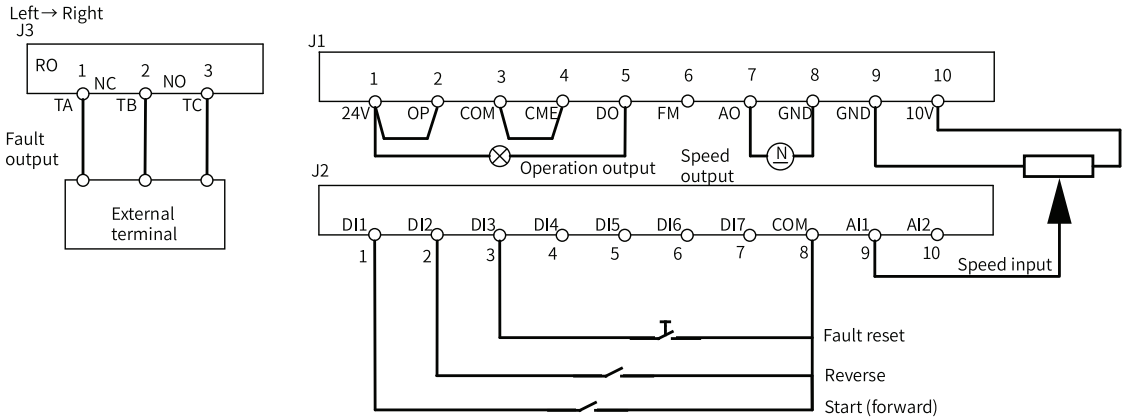


Figure 5-99 Wiring diagram of analog speed regulation in two-wire mode 1

Function description

- When DI1 is closed and DI2 is open, the AC drive starts in the forward direction.

- When both DI1 and DI2 are closed, the AC drive starts in the reverse direction.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 105 (analog speed regulation in two-wire mode 1), the AC drive automatically writes the parameters in the following table.

Table 5–61 Parameter set of analog speed regulation in two-wire mode 1

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	2: IN1 for start, IN2 for direction control
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to the minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.7 Analog Speed Regulation in Two-wire Mode 2 (106)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in two-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *" Electrical Wiring" on page 75*.

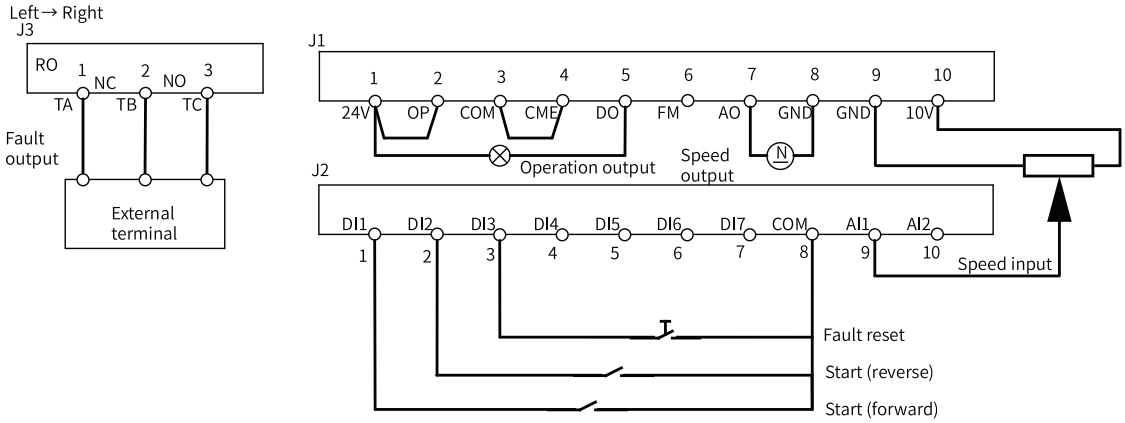


Figure 5-100 Wiring diagram of analog speed regulation in two-wire mode 2

Function description

- When DI1 is closed and DI2 is open, the AC drive starts in the forward direction.
- When DI1 is open and DI2 is closed, the AC drive starts in the reverse direction.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 106 (analog speed regulation in two-wire mode 2), the AC drive automatically writes the parameters in the following table.

Table 5–62 Parameter set of analog speed regulation in two-wire mode 2

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal

Parameter	Description	Default Value	Written Value
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	3: IN1 for forward start, IN2 for reverse start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.8 Analog Speed Regulation in Two-wire Mode 3 (107)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in two-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *“ Electrical Wiring” on page 75*.

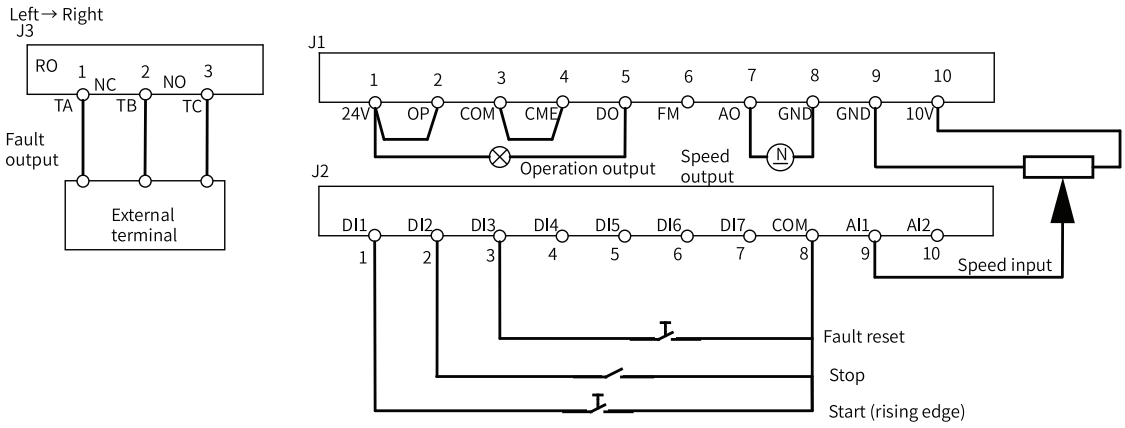


Figure 5-101 Wiring diagram of analog speed regulation in two-wire mode 3

Function description

- When DI2 is closed and DI1 transitions from open to closed (triggered from 0 to 1), the AC drive starts in the forward direction. When DI2 is open, the AC drive stops.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 107 (analog speed regulation in two-wire mode 3), the AC drive automatically writes the parameters in the following table.

Table 5–63 Parameter set of analog speed regulation in two-wire mode 3

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1:	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	4: IN1P for (rising edge) start, IN2 for stop
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function

Parameter	Description	Default Value	Written Value
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to the minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.9 Four Fixed Speeds in Three-wire Mode 2 (108)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in three-wire mode and set frequency through multi-reference.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, DI4, DI5, DI6, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 75*.

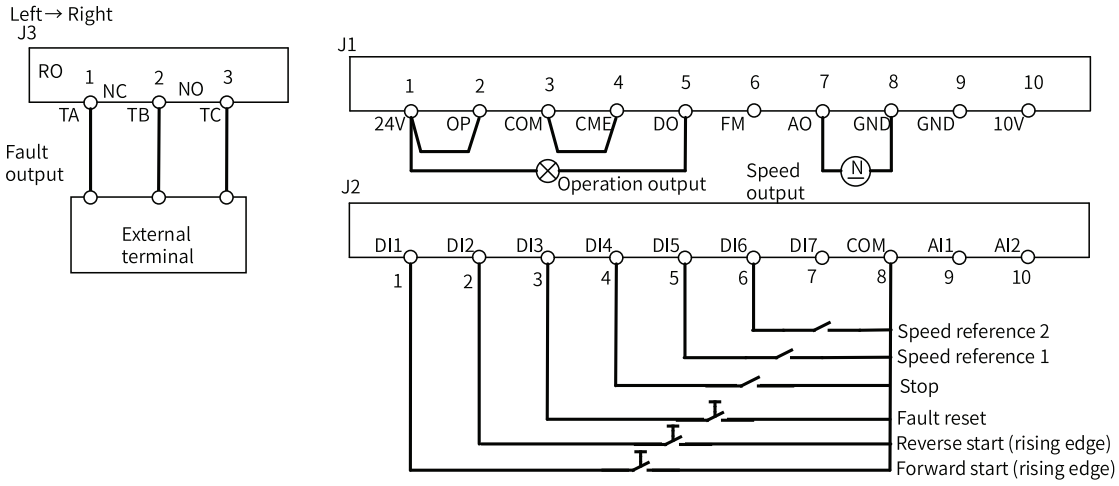


Figure 5-102 Wiring diagram of four fixed speeds in three-wire mode 2

Function description

- When DI4 is closed and DI1 transitions from open to closed (triggered from 0 to 1), the AC drive starts in the forward direction. When DI4 is closed and DI2 transitions from open to closed

(triggered from 0 to 1), the AC drive starts in the reverse direction. When DI4 is open, the AC drive stops.

- The frequency is set by the multi-reference 0 to 3, which corresponds to the states of both DI5 and DI6.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 108 (four fixed speeds in three-wire mode 2), the AC drive automatically writes the parameters in the following table.

Table 5–64 Parameter set of four fixed speeds in three-wire mode 2

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	6: Multi-reference
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	6: IN1P for forward start (rising edge), IN2P for reverse start (rising edge), IN3 for stop
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	3: Terminal start/stop module A_IN3
E0-04	DI5 function selection	13: Multi-reference terminal 2	12: Multi-reference terminal 1
E0-05	DI6 function selection	0: No function	13: Multi-reference terminal 2
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
b8-08	Source of multi-reference 0	0: Set by the parameter (b8-09)	0: Set by the parameter (b8-09)
b8-09	Multi-reference 0	0.0%	25.0%
b8-10	Multi-reference 1	0.0%	50.0%
b8-11	Multi-reference 2	0.0%	75.0%
b8-12	Multi-reference 3	0.0%	100.0%
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.10 Analog Speed Regulation in Three-wire Mode 1 (109)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in three-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, DI4, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *" Electrical Wiring" on page 75*.

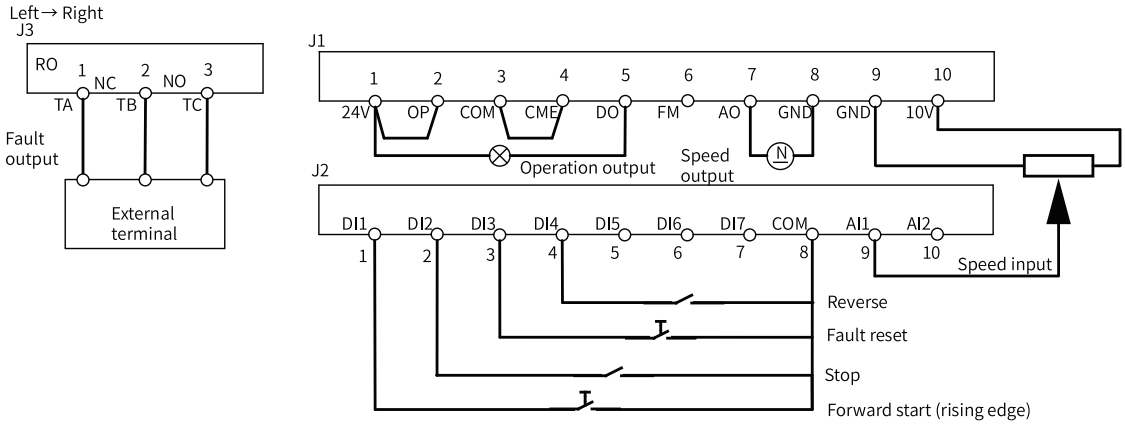


Figure 5-103 Wiring diagram of analog speed regulation in three-wire mode 1

Function description

- When DI2 is closed and DI1 transitions from open to closed (triggered from 0 to 1), the AC drive starts in the forward direction. When DI4 is closed, the AC drive rotates in the reverse direction. When DI2 is open, the AC drive stops.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 109 (analog speed regulation in three-wire mode 1), the AC drive automatically writes the parameters in the following table.

Table 5–65 Parameter set of analog speed regulation in three-wire mode 1

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1

Parameter	Description	Default Value	Written Value
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	5: IN1P for start (rising edge), IN2 for stop, IN3 for direction control
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	3: Terminal start/stop module A_IN3
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.11 Analog Speed Regulation in Three-wire Mode 2 (110)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in three-wire mode and set frequency through analog control.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, DI4, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. In the following wiring diagram, AI1 is connected to a local slide rheostat. If AI1 is connected to a controller analog interface, connect the analog interface to AI1 and GND. See the wiring details in *“Electrical Wiring” on page 75*.

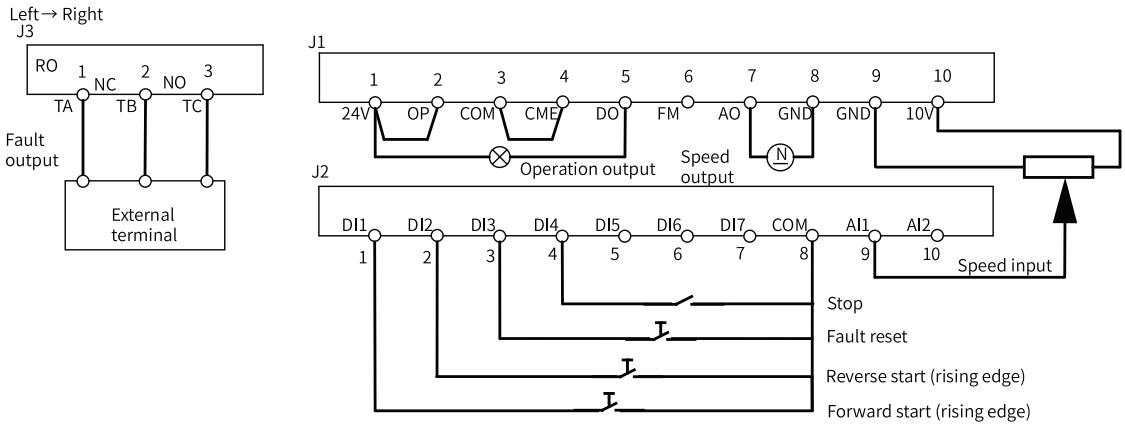


Figure 5-104 Wiring diagram of analog speed regulation in three-wire mode 2

Function description

- When DI4 is closed and DI1 transitions from open to closed (triggered from 0 to 1), the AC drive starts in the forward direction. When DI4 is closed and DI2 transitions from open to closed (triggered from 0 to 1), the AC drive rotates in the reverse direction. When DI4 is open, the AC drive stops.
- The frequency is set by the value of AI1 analog input.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 110 (analog speed regulation in three-wire mode 2), the AC drive automatically writes the parameters in the following table.

Table 5–66 Parameter set of analog speed regulation in three-wire mode 2

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	6: IN1P for forward start (rising edge), IN2P for reverse start (rising edge), IN3 for stop
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset

Parameter	Description	Default Value	Written Value
E0-03	DI4 function selection	12: Multi-reference terminal 1	3: Terminal start/stop module A_IN3
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.12 Analog PID Controller (111)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in single-wire mode and set frequency through PID controller.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, AI1, AI2, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 75*.

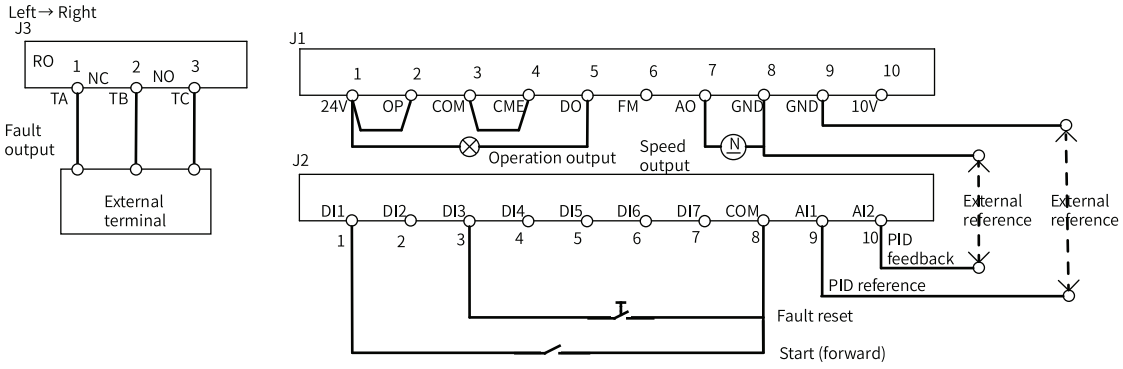


Figure 5-105 Wiring diagram of analog PID controller

Function description

- When DI1 is closed, the AC drive starts. When DI1 is open, the AC drive stops.
- AI1 is used as the PID reference source and AI2 as the feedback source.

- The frequency is set by the operation result of the PID controller.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 111 (analog PID controller), the AC drive automatically writes the parameters in the following table.

Table 5–67 Parameter set of analog PID controller

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	8: PID
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
P2-00	Process PID enablement	0: Disable	1: Enable
P2-01	PID action direction	0: Forward	0: Forward
P2-02	PID reference source	0: PID digital setting	1: AI1
P2-04	PID feedback source	0: AI1	1: AI2
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-44	Minimum input of AI curve 2	0.00 V	0.00 V
E2-45	Percentage corresponding to the minimum input of AI curve 2	0.0%	0.0%

Parameter	Description	Default Value	Written Value
E2-46	Maximum input of AI curve 2	10.00 V	10.00 V
E2-47	Percentage corresponding to the maximum input of AI curve 2	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.13 PID Controller with Fixed Reference Value (112)

Scenarios

This macro is mainly used to start/stop the AC drive through the terminal in single-wire mode and set frequency through PID controller.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 75*.

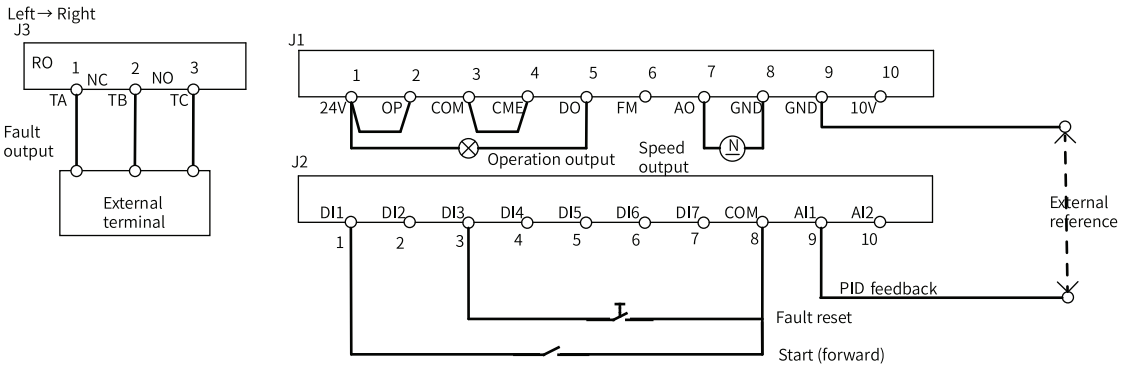


Figure 5-106 Wiring diagram of PID controller with fixed reference value

Function description

- When DI1 is closed, the AC drive starts. When DI1 is open, the AC drive stops.
- P2-03 (PID digital setting) is used as the PID reference source and AI1 as the feedback source.
- The frequency is set by the operation result of the PID controller.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 112 (PID controller with fixed reference value), the AC drive automatically writes the parameters in the following table.

Table 5–68 Parameter set of PID controller with fixed reference value

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	8: PID
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
P2-00	Process PID enablement	0: Disable	1: Enable
P2-01	PID action direction	0: Forward	0: Forward
P2-02	PID reference source	0: PID digital setting	0: PID digital setting
P2-03	PID digital setting	50.0%	50.0%
P2-04	PID feedback source	0: AI1	0: AI1
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.14 Modbus Communication Control Macro (113)

Scenarios

This macro is mainly used to start/stop the AC drive and set the frequency through Modbus communication.

Wiring diagram

This macro involves the wiring of terminals 485+ and 485-, as shown below. J1, J2, J3, and J5 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 75*.

With this macro, all commands and information of the AC drive (including start, stop, and frequency) are supported by the communication link. Therefore, no wiring is required for other control interfaces.

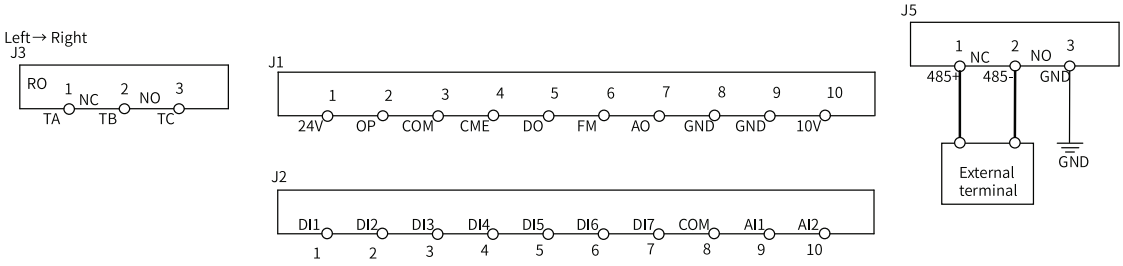


Figure 5-107 Wiring diagram of Modbus communication control macro

Function description

- Modbus communication is used to start/stop the AC drive and set the frequency.
- Modbus communication is used to read the state information of the AC drive.

Parameters to be written

After A0-48 (interface macro selection) is set to 113 (Modbus communication control macro), the AC drive automatically writes the parameters in the following table.

Table 5–69 Parameter set of Modbus communication control macro

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	2: Communication
b5-00	Main frequency source	0: Set by the parameter (b5-01)	9: Communication
n2-00	Modbus baud rate	5: 9600	5: 9600
n2-01	Modbus data format	0: 8-N-2 (no parity check)	3: 8-N-1 (no parity check)
n2-02	Modbus local address	1	1

5.2.12.2.15 Modbus Communication Control Macro with DI Terminal Start/stop Control (114)

Scenarios

This macro is mainly used to start/stop the AC drive through the DI terminal, set the frequency through Modbus communication, and read other information of the drive.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, RO, DO, AO, 485+, and 485-, as shown below. J1, J2, J3, and J5 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 75*.

With this macro, only the frequency information is supported by the communication link. Therefore, other control interfaces need to be wired.

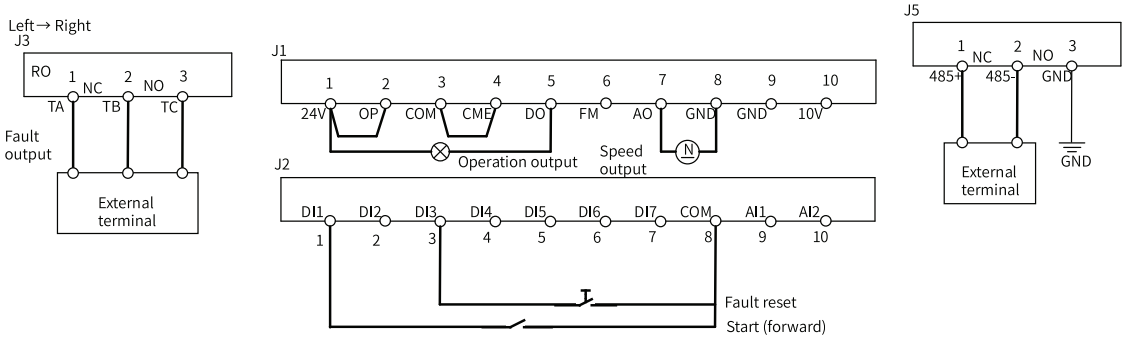


Figure 5-108 Wiring diagram of Modbus communication control macro with DI terminal start/stop control

Function description

- When DI1 is closed, the AC drive starts.
- When DI1 is open, the AC drive stops.
- When DI3 is closed, the AC drive resets the fault.
- Modbus communication is used to control the frequency and read the state information of the AC drive.

Parameters to be written

After A0-48 (interface macro selection) is set to 114 (Modbus communication control macro with DI terminal start/stop control), the AC drive automatically writes the parameters in the following table.

Table 5–70 Parameter set of Modbus communication control macro with DI terminal start/stop control

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	9 Communication
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	0: No function

Parameter	Description	Default Value	Written Value
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
n2-00	Modbus baud rate	5: 9600	5: 9600
n2-01	Modbus data format	0: 8-N-2 (no parity check)	3: 8-N-1 (no parity check)
n2-02	Modbus local address	1	1

5.2.12.2.16 Multi-channel Switchover 1 (115)

Scenarios

This macro is mainly used to switch between two terminal start/stop modules and two set channels.

Wiring diagram

This macro involves the wiring of terminals DI1 to DI7, AI1, AI2, RO, DO, and AO, as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 75*.

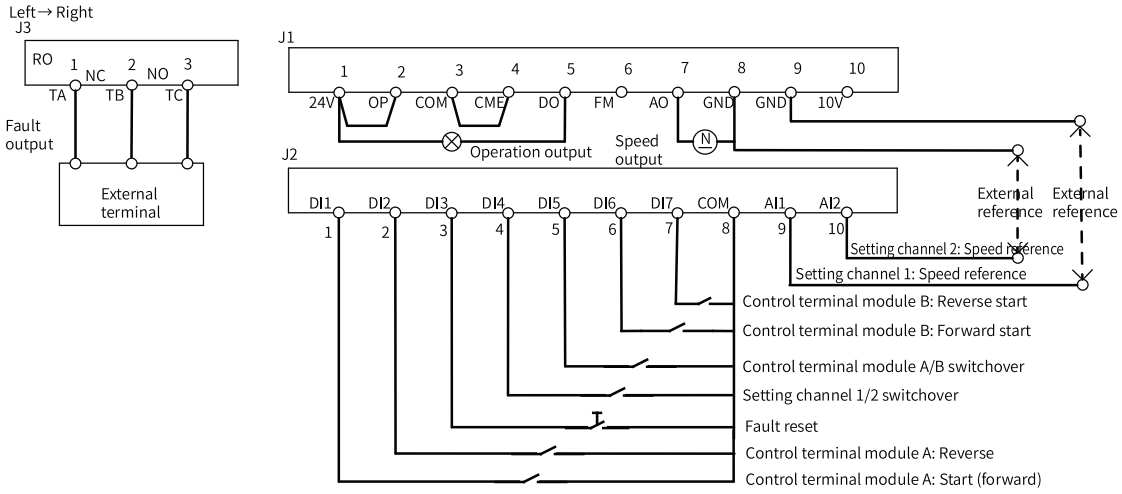


Figure 5-109 Wiring diagram of multi-channel switchover 1

Function description

In both mode 1 and 2, the DI terminal is used as the main command source of the control channel 1. In mode 1, the terminal start/stop module A is two-wire mode 1, and AI1 controls the frequency of set channel 1. In mode 2, the terminal start/stop module B is two-wire mode 2, and AI2 controls the frequency of set channel 2.

- When DI4 is open, the set channel 1 is active and AI1 controls the frequency.
- When DI4 is closed, the set channel 2 is active and AI2 controls the frequency.

- When DI5 is open, the terminal start/stop module A is active, indicating that the AC drive starts in forward direction with DI1 closed and DI2 opened, and it starts in reverse direction with DI1 opened and DI2 closed.
- When DI5 is closed, the terminal start/stop module B is active, indicating that the AC drive starts in forward direction with DI6 closed and DI7 opened, and it starts in reverse direction with DI6 opened and DI7 closed.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 115 (multi-channel switchover 1), the AC drive automatically writes the parameters in the following table.

Table 5–71 Parameter set of multi-channel switchover 1

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b6-00	Main frequency source	0: Set by the parameter (b5-01)	3: AI2
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	2: IN1 for start, IN2 for direction control
b9-09	Terminal start/stop module B	3: IN1 for forward start, IN2 for reverse start	3: IN1 for forward start, IN2 for reverse start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	71: Set channel selection
E0-04	DI5 function selection	13: Multi-reference terminal 2	72: Terminal start/stop module A/B selection
E0-05	DI6 function selection	0: No function	61: Terminal start/stop module B_IN1
E0-06	DI7 function selection	0: No function	62: Terminal start/stop module B_IN2
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V

Parameter	Description	Default Value	Written Value
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-44	Minimum input of AI curve 2	0.00 V	0.00 V
E2-45	Percentage corresponding to the minimum input of AI curve 2	0.0%	0.0%
E2-46	Maximum input of AI curve 2	10.00 V	10.00 V
E2-47	Percentage corresponding to the maximum input of AI curve 2	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.2.17 Multi-channel Switchover 2 (116)

Scenarios

This macro is mainly used to switch between two control channels and two set channels.

Wiring diagram

This macro involves the wiring of terminals DI1 to DI5, AI1, RO, DO, AO, 485+, and 485-, as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 75*.

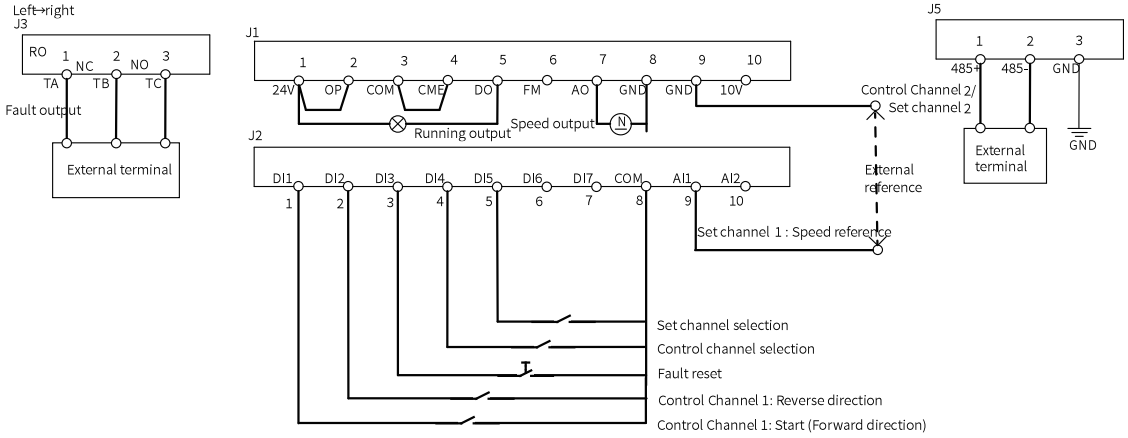


Figure 5-110 Wiring diagram of multi-channel switchover 2

Function description

In mode 1, the main command source of the control channel 1 is the DI terminal and AI1 controls the frequency of set channel 1. In mode 2, the main command source of the control channel 2 is communication and communication controls the frequency of set channel 2.

- When DI4 is open, the control channel 1 is active, indicating that the AC drive starts in forward direction with DI1 closed and DI2 opened, and it starts in reverse direction with DI1 opened and DI2 closed.
- When DI4 is closed, the control channel 2 is active and the Modbus communication controls the start/stop pf the AC drive.
- When DI5 is open, the set channel 1 is active and AI1 analog input controls the frequency.
- When DI5 is closed, the set channel 2 is active and the Modbus communication controls the frequency.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 116 (multi-channel switchover 2), the AC drive automatically writes the parameters in the following table.

Table 5–72 Parameter set of multi-channel switchover 2

Parameter	Description	Default Value	Written Value
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b3-00	Main command source of control channel 2	0: Operating panel	2: Communication
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b6-00	Main frequency source	0: Set by the parameter (b5-01)	9: Communication
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	2: IN1 for start, IN2 for direction control
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	70: Control channel selection
E0-04	DI5 function selection	13: Multi-reference terminal 2	71: Set channel selection
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve selection	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V

Parameter	Description	Default Value	Written Value
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed
n2-00	Modbus baud rate	5: 9600	5: 9600
n2-01	Modbus data format	0: 8-N-2 (no parity check)	3: 8-N-1 (no parity check)
n2-02	Modbus local address	1	1

5.2.12.2.18 DI Terminal Jog Control (117)

Scenarios

This macro is mainly used to perform jog control through the DI terminal.

Wiring diagram

This macro involves the wiring of terminals DI1 to DI3, AI1, RO, DO, AO, 485+, and 485-, as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in *" Electrical Wiring" on page 75*.

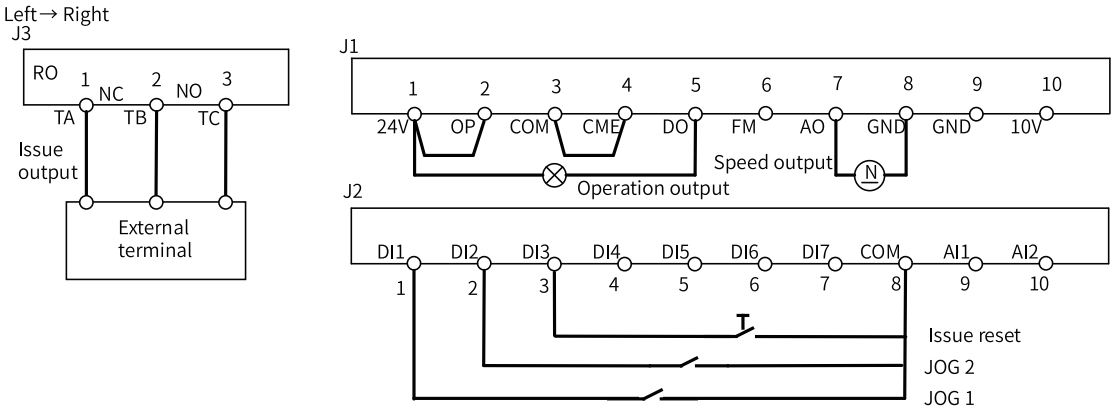


Figure 5-111 Wiring diagram of DI terminal jog control

Function description

- When DI1 is closed, the AC drive operates at the frequency set by jog 1. When DI1 is open, the drive stops.
- When DI2 is closed, the AC drive operates at the frequency set by jog 2. When DI2 is open, the drive stops.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-48 (interface macro selection) is set to 117 (DI terminal jog control), the AC drive automatically writes the parameters in the following table.

Table 5–73 Parameter set of DI terminal jog control

Parameter	Description	Default Value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Main command source of control channel 1	0: Operating panel	1: Terminal
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b5-07	Jog 1 frequency source	0: Set by the parameter (b5-08)	0: Set by the parameter (b5-08)
b5-08	Jog 1 frequency	2.00 Hz	2.00 Hz
b5-09	Jog 2 frequency source	0: Set by the parameter (b5-10)	0: Set by the parameter (b5-10)
b5-10	Jog 2 frequency	-2.00 Hz	-2.00 Hz
b7-31	Jog ramp source	0: Ramp time in normal operation mode	1: Ramp time in jog mode
b7-32	Jog ramp acceleration time	20.00 s	20.00 s
b7-33	Jog ramp deceleration time	20.00 s	20.00 s
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	4: Terminal start/stop module A (JOG1)
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	5: Terminal start/stop module A (JOG2)
E0-02	DI3 function selection	9: Fault reset	9: Fault reset
E0-03	DI4 function selection	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function selection	13: Multi-reference terminal 2	0: No function
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E1-00	RO output function selection	2: Fault output	2: Fault output
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Operation frequency	13: Motor speed

5.2.12.3 Industry Macro

5.2.12.3.1 Industry Macro Introduction

Application scenario

Industry macro selection in parameter A0-50 (Industry macro selection), provides four industry macros for selection according to your needs.

1. For the AC drive as a fan drive, see industry macro 201.
2. For the drive as a water pump drive, see industry macro 202.
3. For the drive as a driver for the packaging industry, see industry macro 203.

4. For the drive as a driver for the ceramic industry, see industry macro 204.

For the above usage scenarios, you can select the appropriate industry macro to simplify the commissioning process according to the requirements. If the current industry macro does not meet the requirements, you can perform other commissioning steps according to the actual situation.

Function description

The industry macro functions and parameters of the MD630-INT AC drive are all related to the control interface. To use the industry macros, select a macro number in A0-50 (industry macro selection) and a set of parameters is automatically written to implement the corresponding function, thus simplifying the commissioning. For industry macros function, see *"Table 5-74 Industry macro" on page 450*. The written parameters can be queried with the application macro function, as shown in the "Related application macro" column of the table below.

Table 5–74 Industry macro

Param.	Name	**Optional parameter**	Description	Related application macro
A0-50	Industry macro selection	0	No operation	-
		201 [Fan application]	Provides a set of common parameters for fan industry.	*"5.2.12.3.2 Fan Macro (201)" on page 451*
		202 [Water pump application]	Provides a set of common parameters for water pump industry.	*"5.2.12.3.3 Water Pump Macro (202)" on page 453*
		203 [Packaging application]	Provides a set of common parameters for packaging industry.	*"5.2.12.3.4 Macro for Packaging Industry (203)" on page 454*
		204 [Logistics application]	Provides a set of common parameters for logistics industry.	*"5.2.12.3.5 Macro for Ceramic Industry (204)" on page 456*

Operation steps

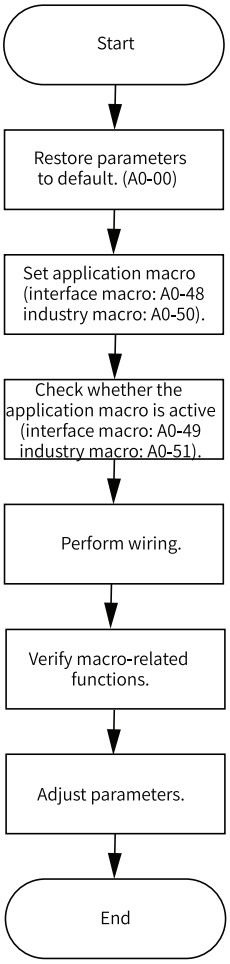


Figure 5-112 Procedure of using application macros

Precautions

1. Restore the default settings before writing a macro number to A0-50 (industry macro selection).
2. The successfully written macro parameter set is displayed in A0-51 (effective industry macro value).

5.2.12.3.2 Fan Macro (201)

Application scenario

The AC drive is used as a fan drive.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device.

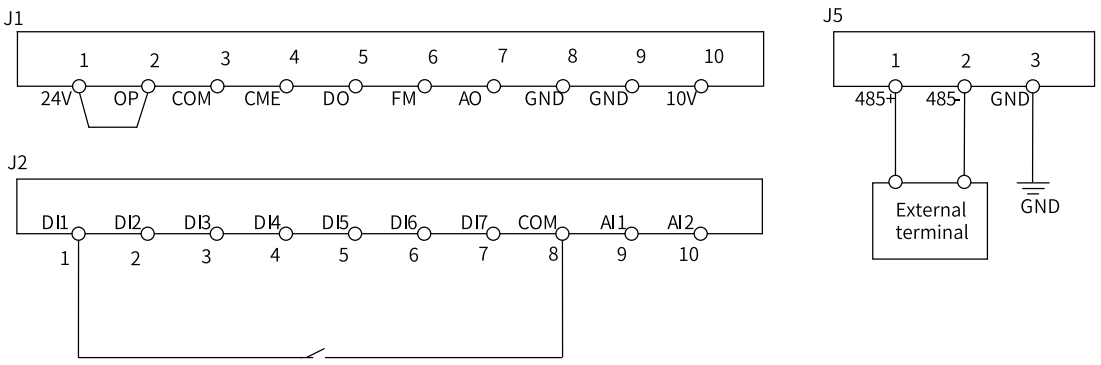


Figure 5-113 Wiring

Function description

- The control channel 1 main command source is terminal, and the setting channel 1 frequency (speed) source is set to function code.
- Set parameters related to Modbus communication
- Enable automatic fault reset.

Parameters to be written

After A0-50 (interface macro selection) is set to 201 (quick commissioning macro), the AC drive automatically writes the parameters in the following table.

Table 5–75 Parameter set of fan macro

Parameter	Description	Default Value	Written Value
F0-01	Motor control mode	2: V/f	2: V/f
F2-15	Start mode	0: Direct startup	1: Flying start
F2-16	Mode of speed tracking	4: Magnetic field oriented flying start	4: Magnetic field oriented flying start
F2-17	OFF1 stop mode	0: Decelerate to stop	1: Coast to stop
F2-43	Action upon undervoltage	0: Not act	1: Undervoltage suppression
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	0: Set by the parameter (b5-01)
b7-04	Ramp 1 acceleration time	20.0s	20.0s
b7-05	Ramp 1 deceleration time	20.0s	20.0s
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Mode of terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	1: IN1 for start
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
H3-00	Automatic fault reset	1: Enable	1: Enable
H3-01	Number of automatic fault resets	0	3

Parameter	Description	Default Value	Written Value
H3-02	Time interval between automatic fault reset	1.0s	10.0s
H3-04	Time for restoring the number of automatic fault resets	10 min	10 min
n2-00	Modbus baud rate	5: 9600 bps	5: 9600 bps
n2-04	Modbus data format	0: 8-N-2 (no parity check)	3: No check (8-N-1)
n2-02	Modbus local address	1	1

5.2.12.3.3 Water Pump Macro(202)

Application scenario

The AC drive is used as a water pump drive.

Wiring diagram

This macro involves the wiring of terminals DI1, DI2, DI3, DI4, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device.

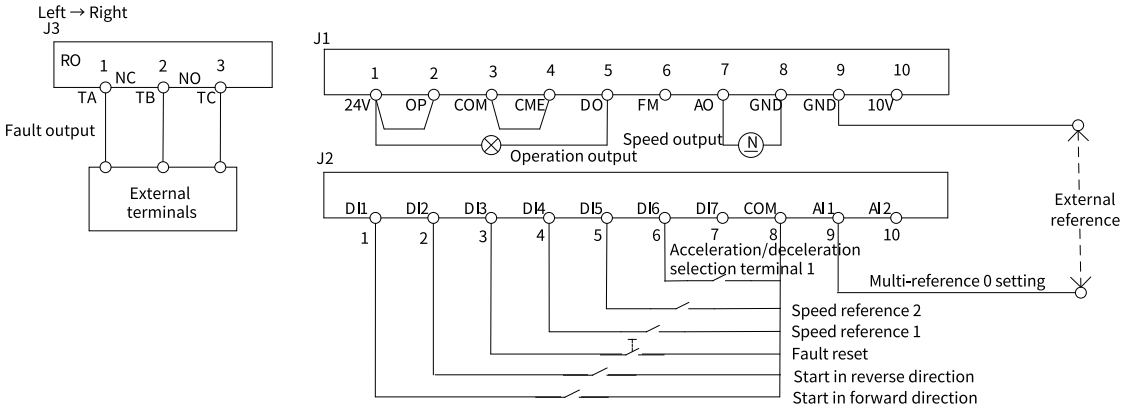


Figure 5-114 Wiring

Function description

- When DI1 is closed and DI2 is open, the AC drive starts in the forward direction.
- When both DI1 and DI2 are closed, the AC drive starts in the reverse direction.
- The frequency is set by the multi-reference 0 to 3, which corresponds to the states of both DI4 and DI5.
- AI1 provides speed information of multi-reference value 0.
- When DI3 is closed, the AC drive resets the fault.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.

Parameters to be written

After A0-50 (Industry macro selection) is set to 202 (water pump macro), the AC drive automatically writes the parameters in the following table.

Table 5–76 Parameter set of water pump macro

Parameter	Description	Default Value	Written Value
F0-01	Motor control mode	2: V/f	2: V/f
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	6: Multi-reference
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Mode of terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	2: IN1 for start, IN2 for direction control
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset (RESET)	9: Fault reset (RESET)
E0-03	DI4 function selection	12: Multi-reference terminal 1	12: Multi-reference terminal 1
E0-04	DI5 function selection	13: Multi-reference terminal 2	13: Multi-reference terminal 2
E0-05	DI6 function selection	0: No function	16: Terminal 1 for acceleration/deceleration selection
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
b7-04	Ramp 1 acceleration time	20.0s	20.0s
b7-05	Ramp 1 deceleration time	20.0s	20.0s
b7-10	Ramp 2 acceleration time	20.0s	15.0s
b7-11	Ramp 2 deceleration time	20.0s	15.0s
b8-08	Source of multi-reference 0	0: Set by the parameter (b8-09)	1: AI1
b8-10	Multi-reference 1	0.0%	100.0%
b8-11	Multi-reference 2	0.0%	80.0%
b8-12	Multi-reference 3	0.0%	50.0%
E1-00	RO output function selection	2: Fault	2: Fault
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Running frequency	13: Motor speed

5.2.12.3.4 Macro for Packaging Industry (203)

Application scenario

The AC drive is mainly used as a drive in the packaging industry.

Wiring diagram

This macro involves the wiring of terminals DI1, DI3, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device.

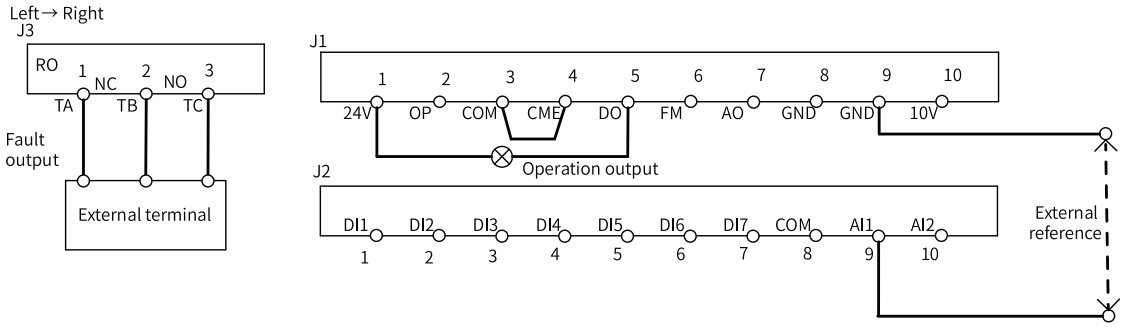


Figure 5-115 Packaging

Function description

- The main command source of control channel 1 is communication, and the frequency (speed) source of control channel 1 is communication.
- AI
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.

Parameters to be written

After A0-50 (interface macro selection) is set to 203 (quick commissioning macro), the AC drive automatically writes the parameters in the following table.

Table 5–77 Parameter set of packaging macro

Parameter	Description	Default Value	Written Value
F0-01	Motor control method	2: V/f	0: SVC
F0-02	Motor control mode	0: Speed control	0: Speed control
b1-00	Command source of control channel 1	0: Operating panel	2: Communication
b5-00	Main frequency source	0: Set by the parameter (b5-01)	9: Communication
b7-04	Ramp 1 acceleration time	20.0s	20.0s
b7-05	Ramp 1 deceleration time	20.0s	20.0s
E2-40	Minimum input of AI curve 1	0.00V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E1-00	RO output selection	2: Fault	2: Fault
E1-04	DO output function selection	0: No output	1: In operation

5.2.12.3.5 Macro for Ceramic Industry (204)

Application scenario

The AC drive is mainly used as a drive in the ceramic industry.

Wiring diagram

This macro involves the wiring of terminals DI1, DI5, AI1, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual device. See the wiring details in Electrical design section.

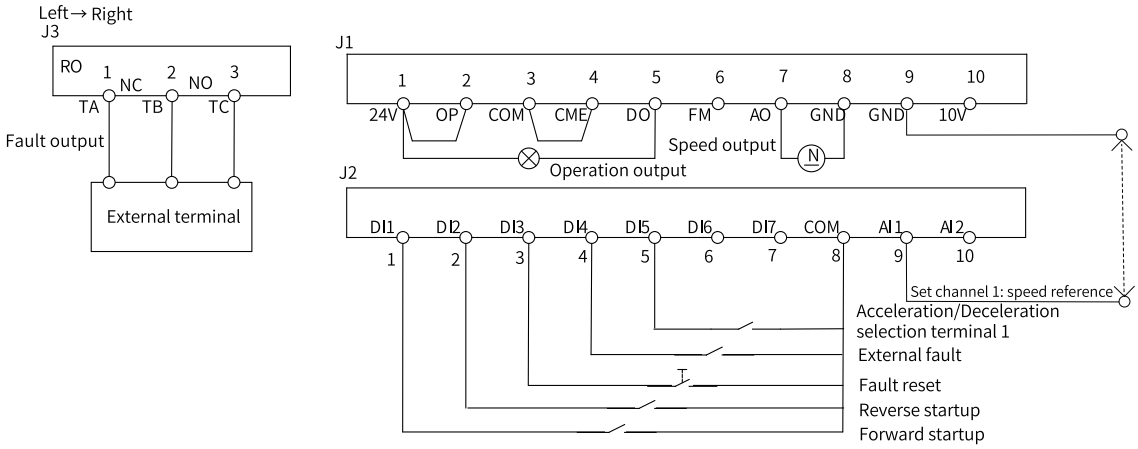


Figure 5-116 Ceramic

Function description

- When DI1 is closed and DI2 is open, the AC drive starts in the forward direction.
- When both DI1 and DI2 are closed, the AC drive starts in the reverse direction.
- When DI3 is closed, the AC drive resets the fault.
- If DI4 is disconnected, the AC drive is normal. If DI4 is closed, the AC drive reports an external fault.
- If DI5 is disconnected, b7-04 and b7-05 are used as ramp acceleration/deceleration time.
- When DI5 is closed, b7-10 and b7-11 are used as ramp acceleration/deceleration time.
- RO is used as the fault output terminal.
- DO outputs the AC drive operating flag.
- AO outputs the motor speed information.
- The main frequency source of channel 1 is set by AI1

Parameters to be written

After A0-50 (industry macro selection) is set to 204 (ceramic macro), the AC drive automatically writes the parameters in the following table.

Table 5–78 Parameter set of ceramic macro

Parameter	Description	Default Value	Written Value
F0-01	Motor control method	2: V/f	2: V/f
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Set channel selection	0: Set channel 1	0: Set channel 1
b1-00	Command source of control channel 1	0: Operating panel	1: Terminal
b5-00	Main frequency source	0: Set by the parameter (b5-01)	2: AI1
b9-00	Terminal start/stop module A/B selection	0: Module A	0: Module A
b9-01	Mode of terminal start/stop module A	3: IN1 for forward start, IN2 for reverse start	2: IN1 for start, IN2 for direction control
E0-00	DI1 function selection	1: Terminal start/stop module A_IN1	1: Terminal start/stop module A_IN1
E0-01	DI2 function selection	4: Terminal start/stop module A (JOG1)	2: Terminal start/stop module A_IN2
E0-02	DI3 function selection	9: Fault reset (RESET)	9: Fault reset (RESET)
E0-03	DI4 function selection	12: Multi-reference terminal 1	11: NO input of external fault
E0-04	DI5 function selection	13: Multi-reference terminal 2	16: Terminal 1 for acceleration/deceleration selection
E0-05	DI6 function selection	0: No function	0: No function
E0-06	DI7 function selection	0: No function	0: No function
E0-56	DI forcible enablement	0x0000: Hardware	0x0000: Hardware
E2-38	AI curve	0X0021: Curve 1 for AI1, curve 2 for AI2	0X0021: Curve 1 for AI1, curve 2 for AI2
E2-40	Minimum input of AI curve 1	0.00 V	0.00 V
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	0.0%
E2-42	Maximum input of AI curve 1	10.00 V	10.00 V
E2-43	Percentage corresponding to the maximum input of AI curve 1	100.0%	100.0%
E2-81	AI hardware source selection	0: Hardware	0: Hardware
b7-04	Ramp 1 acceleration time	20.0s	1.0s
b7-05	Ramp 1 deceleration time	20.0s	1.2s
b7-10	Ramp 2 acceleration time	20.0s	3.5s
b7-11	Ramp 2 deceleration time	20.0s	3.5s
E1-00	RO output function selection	2: Fault	2: Fault
E1-04	DO output function selection	0: No output	1: In operation
E3-00	AO output function selection	0: Running frequency	13: Motor speed

5.3 Motor Control

5.3.1 Function List

Function type	Name	Description	Link
Motor control mode	Vector control	Vector control (SVC and FVC included) refers to speed and torque closed-loop control, which features excellent dynamic performance and steady-state accuracy. To enable the motor to work in SVC or FVC mode, perform parameter auto-tuning operation.	*"5.3.2.1 Function List" on page 461*
	Asynchronous motor V/f control	Indicates an open-loop control with constant voltage-to-frequency ratio. The dynamic performance and speed accuracy of this mode are inferior to those of the vector control mode. It is simple, reliable, and easy to use without the need of exactly accurate parameters.	*" V/f Control Mode for Asynchronous Motor" on page 528*
Motor control function	Basic control	Includes random PWM, overmodulation, braking resistor control. Basic control is applicable to both vector control and V/f control.	*"5.3.4.1 Function List" on page 549*
	Encoder	FVC control requires an encoder for feedback speed detection. The drive supports multiple types of encoders. Different types of encoders require different types of encoder cards for signal processing.	*" Wiring and Basic Setting of the Encoder" on page 562*

Control mode		Advantage	Disadvantage	Common application scenarios	Link
Vector control	SVC	The SVC mode features excellent dynamic response and requires less use of encoders, encoder cables, and encoder cards compared with the FVC mode. The fault rate of SVC mode is lower than that of FVC mode during long-term operation.	The back EMF is low at low speed, so long-term operation at low speed is not allowed. For synchronous motors, you can enable speed open loop mode in SVC through d0-85 [Low speed processing mode] to switch the operation mode at low speed, ensuring long-term operation at low speed. In this case, only the speed is controlled. Fluctuation can occur at speeds close to zero in the torque control mode.	SVC control applies to most applications except for applications where FVC is mandatory. Such applications include fans, pumps, air compressors, air conditioners, steam turbines, turbines, rough rolling mills, furnace rollers, tensioners, gantry/ trolley of cranes, flywheel energy storage, and leg lifting systems for offshore platforms.	*"5.3.2.3 SVC Control" on page 465*
	FVC	The FVC mode allows long-term stable operation at zero speed. It supports position control and has higher control accuracy in speed control compared with the SVC mode. When used together with a high-resolution encoder, high dynamic performance can be achieved in the FVC mode.	However, the FVC mode requires use of more encoder cards and encoder cables compared with SVC mode. In FVC mode, encoder feedback signals may be easily disturbed.	The FVC mode applies to hoists, tension initialization at zero speed (winding/ unwinding, loopers), position control (estimated position error may exist in low-speed operation in SVC mode), and applications requiring ultra-high accuracy and dynamic response (such as new energy vehicle test benches, high-speed finishing mills, and flying shears).	*"5.3.2.2 FVC mode" on page 462*

Control mode		Advantage	Disadvantage	Common application scenarios	Link
V/f control for asyn-chro-nous motor	V/f	The V/f mode features easy control and commissioning.	However, the dynamic response and control accuracy in V/f mode are low. Only the speed can be controlled in the V/f mode. For high-power motors, it is recommended to switch to the SVC mode for parameter adjustment. Only asynchronous motors support V/f control.	The V/f mode applies to applications with low accuracy requirements, such as fans and water pumps.	*" V/f Control Mode for Asynchronous Motor" on page 528*

Related parameters

Motor control methods include vector control and V/f control (for asynchronous motors). Vector control features high dynamic response and control precision, allowing adjustment of output torque. Vector control includes sensorless vector control (SVC) and feedback vector control (FVC). The control method can be selected through [d0-00].

Param.	Name	Description	Default	Range
d0-00	Motor control method	Value description: 0: SVC - This mode features excellent dynamic performance and steady-state accuracy, but it is highly dependent on parameters and needs prior auto-tuning of motor parameters. 1: FVC - The speed is fed back by the encoder to achieve the optimal control performance. 2: V/f - This mode is less dependent on parameters and easy to use, but the dynamic performance of this mode is not as good as that of the SVC mode.	0	0 to 2

5.3.2 Vector Control

5.3.2.1 Function List

Function type	Name	Description	Link
Vector control method	FVC mode	Indicates feedback vector control, where the speed feedback is measured by the encoder. The low-speed control accuracy and dynamic performance of FVC control are superior to those of SVC control.	"5.3.2.2 FVC mode" on page 462
	SVC control	Indicates sensorless vector control, where the speed feedback is calculated by a model. The low-speed control accuracy and dynamic performance of SVC control are inferior to those of FVC control.	"5.3.2.3 SVC Control" on page 465
Vector control function (controlled through FVC or SVC)	Speed control	Used to control the motor speed accurately.	" Speed control" on page 471
	Torque control	In most applications, the motor speed needs to be controlled. In vector control, the speed can be controlled accurately.	"5.3.2.5.1 Torque Control" on page 494
	Current limit	Used to control the current automatically to ensure that the total current does not exceed the limit value.	"5.3.2.6 Current Limit" on page 503
	Torque limit	Used to limit the output of the speed loop. The actual torque limit of the motor is also affected by the current limit, torque limit, and power limit.	"5.3.2.7 Torque Limit" on page 504
	Power limit	Used to restrict the total output power of the motor, ensuring the total power output does not exceed the current limit.	"5.3.2.8 Power Limit" on page 508
	Overvoltage suppression	Applies to applications with high inertia or rapid deceleration. Enabling overvoltage suppression can suppress the rise in DC bus voltage and prevent overvoltage.	"5.3.2.9 Overvoltage Suppression (Vector)" on page 510
	Undervoltage suppression	Applies in cases where a brief power outage or DC bus power interruption occurs. Enabling undervoltage suppression can compensate for energy loss on the bus and prevent undervoltage.	"5.3.2.10 Undervoltage Suppression (Vector)" on page 513
	Flux control	Used to adjust the motor flux automatically, ensuring the motor does not lose control at high speeds.	"5.3.2.11.1 Flux control" on page 518
	Energy-saving control	Used to reduce energy consumption of the asynchronous motor during no-load and low-load operation.	"5.3.2.12 Energy-Saving Control (Vector)" on page 521
	Overexcitation	Used to accelerate the motor deceleration process.	"5.3.2.13 Overexcitation" on page 522
	Current loop	In vector control, the current loop acts as the regulator of the inner loop, making the output current follow the current reference closely. The current reference is the output value of the outer loop regulator. Ensure that the maximum allowable current is obtained during dynamic speed change to accelerate dynamic response.	"5.3.2.14 Current Loop" on page 523
	Droop control	Applies to applications where the load is driven by multiple motors, allowing automatic balanced load distribution between motors without motor-to-motor communication.	"5.3.2.15 Droop control" on page 525

5.3.2.2 FVC mode

Application scenario

The difference between FVC (d0-00 = 1) and SVC is that the feedback speed in FVC is measured by the encoder, while the feedback speed in SVC is calculated by the back EMF and output current. The back EMF is low at low speed, making it difficult to estimate the speed and flux angle. Therefore, the dynamic performance of the control accuracy during low-speed operation in SVC mode is not as good as that in the FVC mode.

FVC must be used in the following scenarios.

1. It is recommended to use FVC for loads such as cranes and hoists because the risks of getting stuck or faults may be present in the SVC mode under heavy load.

2. It is recommended to use FVC for the position control type of loads. The position estimated by SVC at low speed may be deviated, and large position deviation can be cumulated during long-term operation.

3. For applications requiring torque limiting at zero speed for extended periods, FVC is recommended. Stable operation can be maintained in SVC at low speeds only for short durations. If speed open loop is enabled (d0-85) in SVC, torque control cannot be achieved. Otherwise, periodic speed fluctuations may be caused.

4. It is recommended to use FVC for applications requiring ultra-high dynamic response and ultra-high precision. For example, the power system test bench for an electric vehicle requires ultra-high dynamic responses.

Working principles

The following figure shows the FVC control block diagram.

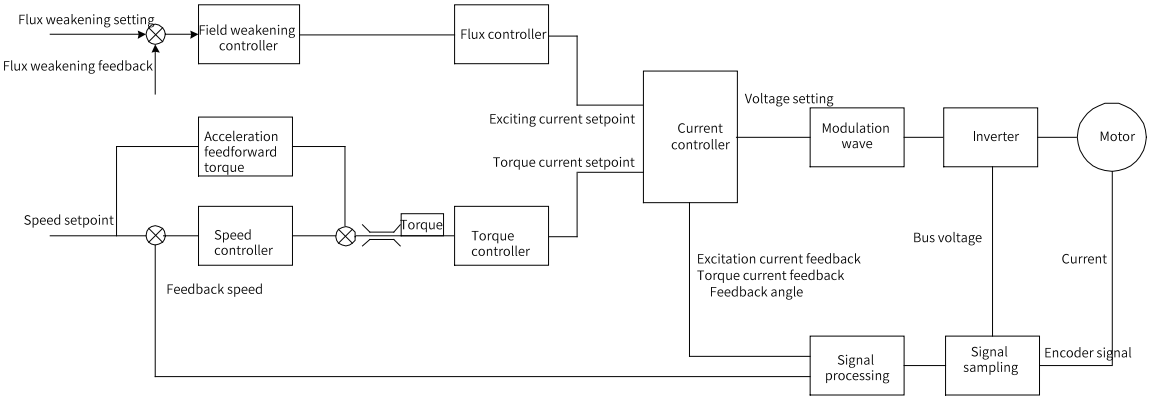


Figure 5-117 Block diagram for FVC

High-speed and low-speed model switchover of asynchronous motor in FVC mode

The high speed and low speed models have different features.

Model	Advantage	Disadvantage
Low-speed model	Simple and stable; Operation allowed in the whole speed range.	Serious encoder interference compared with the high-speed model; Torque accuracy affected by rotor resistance due to high motor temperature rise
High-speed model	High torque precision and low impact of motor temperature rise;	More motor parameters involved compared with the low-speed model, affecting precision in low-speed operation; Operation stability affected by model fluctuation due to excessive motor harmonics

Typical troubleshooting scenarios:

1. The motor harmonics affect the speed and torque fluctuation of the high-speed model. You can set d6-12 (Switching frequency for FVC model of asynchronous motor) to a value higher than the maximum operating speed to make the motor run in the low-speed model, thus improving the steady state performance.

2. If motor temperature rise is significant and high torque accuracy is required, reduce d6-12 (Switching frequency for FVC model of asynchronous motor) and d6-13 (Switching hysteresis for FVC model of asynchronous motor), so that the high-speed model covers the commonly used range. It is recommended to set the model speed in high-speed range to a value not lower than 5% of the rated speed. You can also refer to the motor temperature model parameter setting to reduce the impact of temperature rise on motor control.

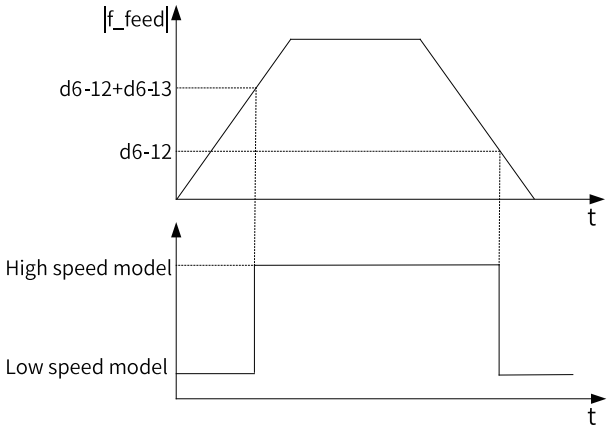


Figure 5-118 High-speed and low-speed model switchover of the asynchronous motor in FVC mode

Switching from FVC to SVC upon encoder error

If open circuit occurs on the encoder frequently during operation in FVC mode, set FVC-to-SVC switch mode to "2: Passive switchover" in *"Table 5-79 d7-02" on page 465* to ensure continuous operation of the motor after the encoder fault occurs.

If the encoder feedback speed fluctuation is low in low-speed operation but high in high-speed operation, set FVC-to-SVC switch mode to "1: Active switchover" in *"Table 5-79 d7-02" on page 465*.

Use FVC mode during low-speed operation and switch to SVC mode during high-speed operation, ensuring normal operation of the motor upon unusual fluctuation of the encoder feedback during high-speed operation. There is a hysteresis band during switchover between FVC mode and SVC mode, as shown below.

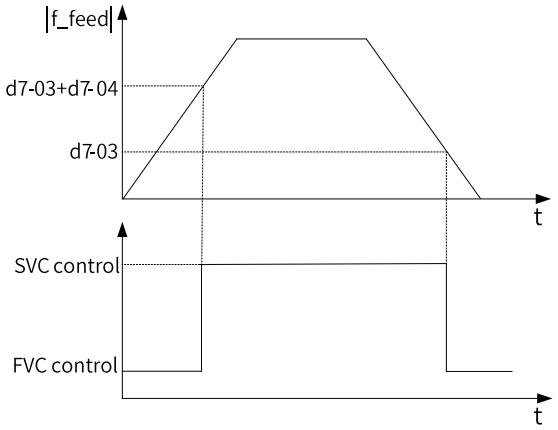


Figure 5-119 Switching between FVC and SVC

Note

Active or passive switchover from FVC to SVC is not supported in I/F phase.

Application example

Switching to SVC mode upon encoder fault

The continuous production line of a metallurgical rolling mill requires running of multiple AC drives. If the encoder of a motor is disconnected or being disturbed, one of the drives may report a fault and stop. This can cause the entire production line to stop, resulting in severe property loss. To avoid this situation, set d7-02 to 2 to enable passive switching from FVC to SVC, ensuring continues operation of the motor upon an encoder fault. In this case, a fault is reported after the motor decelerates to a very low speed.

Switching to SVC at high-speed operation upon encoder fluctuation

If the encoder is installed with improper alignment, the motor can operate normally at low speed. During high-speed operation, large speed fluctuation can occur. In cases where the radial runout of the encoder cannot be calibrated, set d7-02 to 1 (Switching from FVC to SVC actively) to ensure that the motor operation is not affected by encoder speed fluctuation.

Related parameters

Table 5–79 d7-02

Param.	Name	Description	Default	Range
d7-02	Switch FVC to SVC	Set to 1: The drive keeps operating in FVC mode at the low speed set by d7-03 and d7-04, and switches to SVC mode at the high speed. This mode is applicable to operating applications with encoder signals disturbed. Set to 2: The drive switches to SVC mode if encoder open circuit is detected. If the encoder is recovered during operation, the FVC mode will be switched back after stop.	0	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC upon encoder open circuit. If the encoder is recovered during operation, the FVC mode will be switched back after stop.)

Param.	Name	Description	Default	Range
d7-03	Frequency for switching from FVC to SVC	Defines the frequency for switching from FVC to SVC when d7-02 is set to 1.	50%	10% to 500%
d7-04	Hysteresis for switching from FVC to SVC	Defines the hysteresis for switching from FVC to SVC when d7-02 is set to 1.	10 %	10% to 100%

5.3.2.3 SVC Control

Application scenarios

In applications of fans, water pumps, air compressors, air conditioners, and crushers, SVC control can be used except for applications where FVC is mandatory.

Function description

In SVC mode, the speed and position are estimated based on the motor voltage, current, and motor parameters. Therefore, complete motor parameters are required for SVC mode. It is recommended to perform dynamic auto-tuning before operation. Failure to perform dynamic no-load auto-tuning may result in oscillation or overcurrent due to inaccurate motor parameters.

Vector control typically requires an encoder to acquire motor speed and position, while sensorless vector control (SVC) can achieve the excellent performance of vector control without encoder feedback. To do so, set the control mode [d0-00] to 0 [SVC control].

Both SVC and V/f control require no encoder signal feedback. The main differences are as follows.

Motor control mode	SVC	V/f
Parameter setting	Set [d0-00] to 0 [SVC control].	Set [d0-00] to 2 [V/f control].
Property	Speed and torque closed-loop control	V/f open-loop control
Advantages	Excellent dynamic performance and steady-state accuracy	Insensitive to parameters, simple, reliable, and easy to use
Disadvantages	Sensitive to parameters, motor parameter auto-tuning needed before operation	Inferior dynamic performance and speed accuracy compared to SVC
Remarks	-	The torque cannot be controlled in V/f control of the asynchronous motor, so settings related to the torque limit are inactive.

Operating principles

The control block diagram for SVC mode is shown below, which includes sampling/pulsing, loop control, and model observation.

- Sampling/Pulsing: Signal sampling and modulation signal generation
- Loop control: Field weakening controller, flux controller, speed controller, torque controller, and current controller
- Model observation: Observer

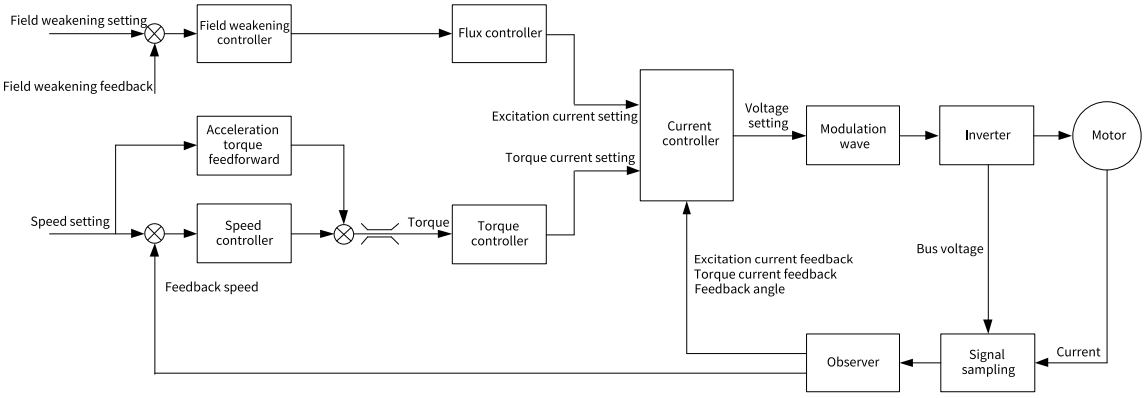


Figure 5-120 Control block diagram of SVC mode

In SVC mode, the feedback speed and angle needed in vector control are estimated through the motor model and output current by the observer module.

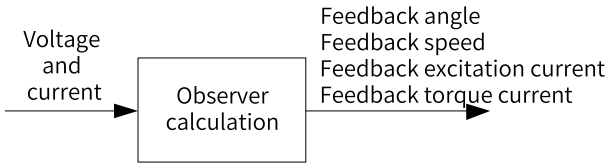


Figure 5-121 Diagram of the observer module

Precautions

- Stator resistance, rotor resistance, leakage inductance, mutual inductance, and dead zone auto-tuning curve of the drive need to be auto-tuned for asynchronous motors.
- Stator resistance, d-axis inductance, q-axis inductance, rated back EMF, and dead zone auto-tuning curve of the drive need to be auto-tuned for synchronous motors.

Application instance

Example 1:

A film winding/unwinding machine runs without an encoder. During tension set-up, the drive that controls unwinding must keep the unwinding device running at zero speed. When SVC mode is used, long-term stable operation at zero speed is not available. In this case, you need to set the speed open-loop I/F function as follows.

1. Set bit1 of [d0-85] to 1 to enable SVC speed open-loop function.
2. The torque corresponding to the tension is about 50% during normal operation. Therefore, set d0-86 to 70%.
3. During normal acceleration/deceleration, for precise control and rapid response, you can set the switchover frequency to a low value ([d0-87] = 2%, [d0-88] = 2%).

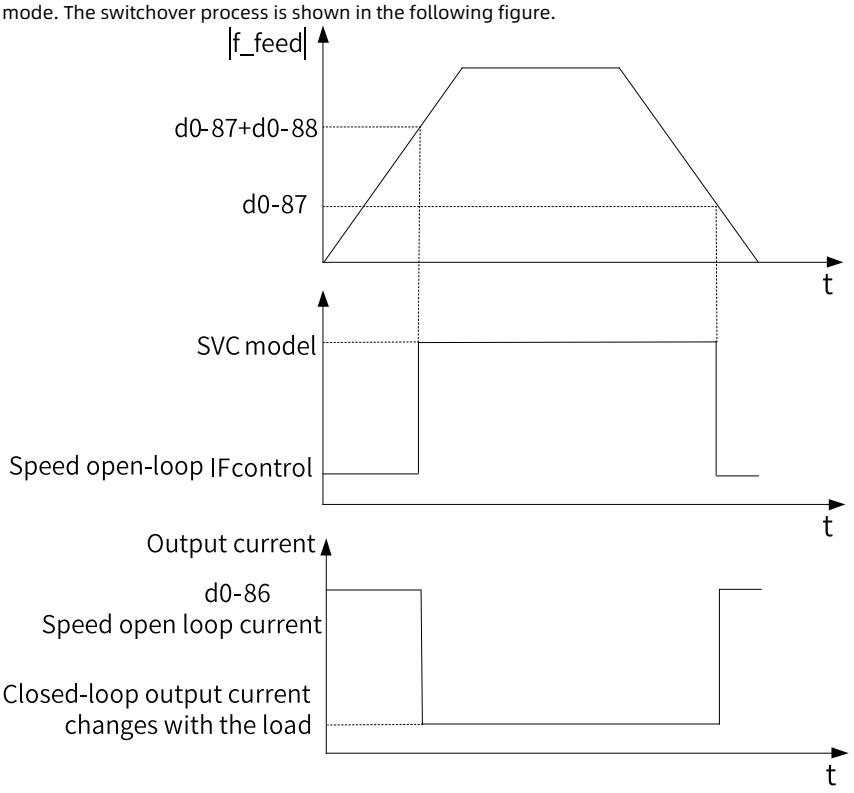
Example 2:

The device controls the tension through torque limit in speed control in SVC mode, which results in cyclic fluctuation during low-speed operation. In this case, the material tension is higher than the set tension. This is because speed open-loop control (SVC) is enabled through bit1 of [d0-85]. In the SVC mode, the torque limit is no longer active, and the motor only runs at the set speed. The torque output in speed open-loop control will be higher than the set torque. The material can be broken in severe cases.

1. Try changing bit1 of [d0-85] to 0 to disable the speed open-loop function. Observe whether the fault can be rectified.
2. If the fault persists, try changing bit1 of [d0-85] to 1 and reducing the open-loop switchover frequency [d0-87] to a value within the acceptable range.
3. If none of the above measures work, install an encoder and use FVC control.

Application in special circumstances

During low-speed operation, the motor speed and angle cannot be accurately calculated, affecting the control accuracy and even result in observation failure and unstable operation. The following describes the situations and solutions for asynchronous and synchronous motors respectively.

Motor type	Application	Description
Asynchronous motor	Non-stop at zero speed	In some applications, the asynchronous motor is kept at zero speed without stop, so that it can start immediately whenever a speed reference is received. As shown in the following figure, a motor kept at zero speed for a long time may not start properly because of failure of the observer. In this case, you can set the SVC observer model of the asynchronous motor [d6-27] to 2. This is to make the asynchronous motor run at 0 speed. However, in this case, sufficient torque cannot be provided to ensure that the rotor stays at its original position when an external force is present. Note: It is recommended to install an encoder in FVC mode for long-term operation at low speed or zero speed.
Synchronous motor/ Reluctance motor with permanent magnet	Low-speed open-loop I/F control	You can enable low-speed open-loop I/F control for long-term operation at zero speed or low speed of synchronous motors. Low-speed I/F control, also known as current/frequency control, is a speed open-loop control with limited control accuracy and dynamic performance compared to speed closed-loop mode. When the speed open-loop I/F function is enabled, speed open-loop control applies when the motor operates at low speed. In this case, the drive outputs the current defined by d0-86 and switches to SVC control at high speed. A hysteresis range exists during switchover between the speed open-loop I/F control and SVC mode. The switchover process is shown in the following figure.  Figure 5-122 Switching between IF control and SVC mode

Motor type	Application	Description
Synchronous motor/ Reluctance motor with permanent magnet	Low-speed HFI (high-frequency injection) operation	In applications requiring load-carrying at low speed or zero speed, you can enable low-speed HFI function to enhance load capacity. In SVC control, you can enable low-speed HFI function through d0-85 [Low-speed processing method]. When the control target is a permanent magnet synchronous motor, this function is only applicable to salient-pole permanent magnet synchronous motors. It is recommended to use motors with a saliency ratio of 2 or higher. By injecting high-frequency voltage into the motor to induce high-frequency current, the angle and speed of the synchronous motor can be observed. **Note:** High-frequency noise will be generated during the high-frequency injection phase. This function cannot be used in applications with high requirements on noise reduction. **Example:** In application of the wire drawing machine, the customer uses a permanent magnet synchronous motor with a saliency ratio of 2. In the past, an encoder is required to ensure high-torque startup at zero speed, which can increase the cost and installation difficulty, and easily incur exceptions such as open circuit and interference, leading to unexpected shut-down and property loss. Now, you can enable high-frequency injection by setting the tens of d0-85 [Low-speed processing method] to 3, allowing startup with high load at zero speed in SVC mode for synchronous motors, therefore ensuring proper operation of the wire drawing machine.

Related parameter

Param.	Name	Default	Value range	Description
d6-27	Observer model of asynchronous motor in SVC mode	0	0 to 3	Defines the observer mode of asynchronous motor in SVC mode.
d0-85	Low-speed processing method	101	Ones: Synchro-nous motor in V/f mode Tens: Synchro-nous motor in SVC mode Hundreds: Reluctance motor in SVC mode Thousands: Reserved Ten thousands: Reserved	Used to enable low-speed open-loop or low-speed high-frequency injection. Value description Ones: Low-speed processing of synchronous motor in V/f mode 0: No action 1: Speed open-loop Tens: Low-speed processing of permanent magnet motor in SVC mode Hundreds: Low-speed processing of reluctance motor in SVC mode Tens and hundreds: 0: No action 1: Speed open-loop 2: Speed open-loop advanced mode 3: High-frequency injection Note: After this function is enabled, if the operating frequency is lower than the switchover frequency [d0-87], the drive outputs the current specified by d0-86. If the operating frequency is higher than the sum of d0-87 and d0-88, the regular SVC mode or synchronous motor V/f mode applies. The speed open-loop function improves the load carrying capacity at low speed.
d0-86	Speed open-loop current	100%	0% to 800%	Defines the magnitude of speed open-loop current. Set this parameter to a value higher than 20% of the load.
d0-87	Speed open-loop switchover frequency	10.0%	0.0% to 100.0%	Defines the speed open-loop switchover frequency as a percentage to the rated frequency. If the percentage of the operating frequency to the rated frequency is lower than d0-87, speed open-loop control applies. The default value is 10% of the rated frequency based on the low-speed operation range in speed open-loop mode.
d0-88	Speed open-loop switchover hysteresis frequency	2.5%	0.0% to 100.0%	Defines the speed open-loop switchover hysteresis, which is a percentage to the rated frequency. If the percentage of the operating frequency to the rated frequency is higher than "d0-87 + d0-88", switch to SVC control. The default value is 2.5% of the rated frequency according to the actual required hysteresis band.

5.3.2.4 Speed Control

5.3.2.4.1 Function List

Function type	Name	Description	Link
Speed control	Speed control	In the vector control mode, the motor speed can be precisely controlled through speed reference and current controller.	*"5.3.2.4.2 Speed Control" on page 471*
	Speed controller (speed loop)	The speed controller calculates the torque based on the difference between the speed reference and the feedback speed, and adjusts its strength through parameters related to the speed loop.	*"5.3.2.4.3 Speed Controller (Speed Loop)" on page 473*
	Speed controller adapter	The speed controller adapter can automatically adjust the speed loop parameters using a correction coefficient based on the current speed, thereby optimizing the speed controller.	*"5.3.2.4.4 Speed controller adapter" on page 477*
	Acceleration torque feedforward	The acceleration torque can be automatically calculated and added to the output of the speed regulator, improving speed following characteristics and reducing speed overshoot during acceleration.	*"5.3.2.4.5 Acceleration Torque Feedforward" on page 482*
	Frequency ramp transition	When the speed reference is given by the PLC through communication, this function can be used to avoid unsmooth output speed caused by discontinuous speed references from the PLC.	*"5.3.2.4.6 Frequency Ramp Transition" on page 484*
	Speed control optimization in vector control	This function introduces optimization methods for speed control under scenarios involving speed reference tracking and load disturbance rejection.	*"5.3.2.4.7 Speed Control Optimization in Vector Control" on page 486*

5.3.2.4.2 Speed Control

Application scenarios

Most of the applications require the motor speed to be controlled. In vector control, the speed can be controlled accurately.

Operating principles

The following figure shows the typical speed control diagram. The speed reference is outputted to the motor only after being processed with the speed limit, ramp function generator (RFG), speed controller, additional torque, torque limit, and current controller (ACR).

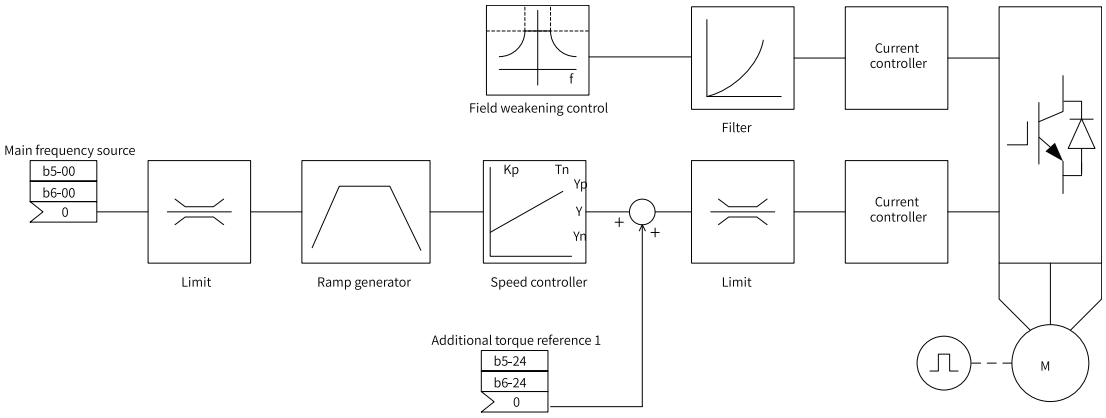


Figure 5-123 Typical block diagram of speed control

In speed control mode, the speed setpoint is generated as shown in the figure below. After the main frequency source is superimposed with the auxiliary frequency source, it is processed by the ramp function generator (RFG), then superimposed with an additional frequency, and finally used as the final motor speed reference (L3002).

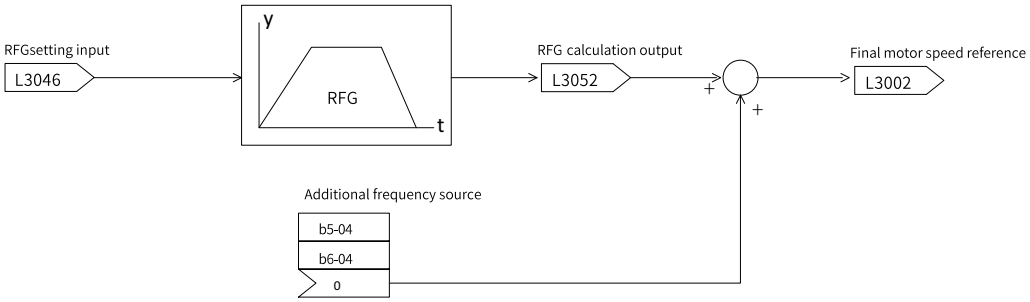


Figure 5-124 Speed reference block diagram

Related parameter

Param.	Name	Description	Default value	Range
F0-01/d0-01	Motor control mode	0: SVC - SVC is an open-loop vector control mode that applies to high-performance control applications. In this mode, one drive can drive only one motor. This mode applies to loads such as machine tools, centrifuges, wire drawing machines, and injection molding machines. Parameter auto-tuning is required in this mode. Vector control requires accurate motor parameters. 1: FVC - FVC is a closed-loop vector control which requires the motor to be configured with an encoder and the AC drive to be installed with a PG card matching the encoder type. This mode is applicable to high-accuracy speed control or torque control applications. One AC drive can drive only one motor. This mode is applicable to loads such as high-speed papermaking machinery, hoisting machinery, and elevators. Parameter auto-tuning is required in this mode. Vector control requires accurate motor parameters. 2: V/f- V/f is an open-loop control mode based on constant voltage and frequency ratios. This mode is applicable to scenarios without high requirements on load control performance such as fans and water pumps and scenarios without high requirements on accuracy of parameters. This mode is simple and easy to use. The dynamic performance of the V/f control mode is not as good as that of the SVC mode.	2	0: SVC 1: FVC 2: V/f

5.3.2.4.3 Speed Controller (Speed Loop)

Application scenarios

In vector control, speed control can be implemented through the speed controller.

Operating principles

The speed controller obtains the speed reference (L3002) from the reference channel, receives the feedback speed value (L3000) in the feedback channel, and then generates the torque reference (L3100) from the deviation of the reference and feedback through the PI controller. Then the speed controller sends the obtained values to the current controller. The function diagram of the speed controller is as follows.

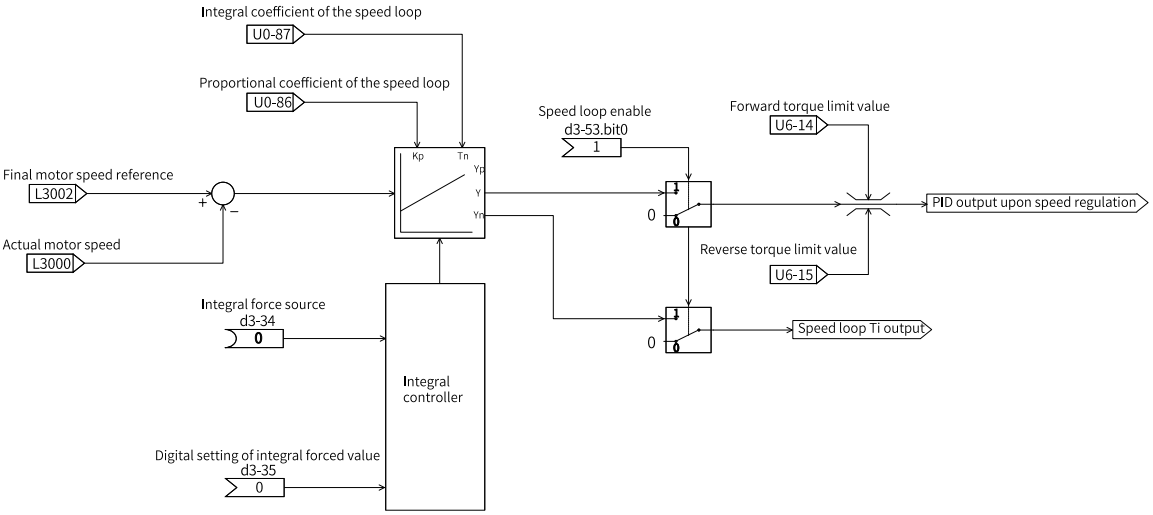


Figure 5-125 Function diagram of the speed controller

You can adjust the gain parameters of the speed controller through d3-00 [Speed loop Kp in FVC] and d3-01 [Speed loop Ti in FVC].

In SVC control, the speed controller can be adjusted by d3-02 [Speed loop Kp in SVC mode] and d3-03 [Speed loop Ti in SVC mode]. The relationship between the speed controller output and Kp and Ti is shown in the following table.

$$Out = k_P \Delta f + \int \frac{k_P}{T_i} \Delta f dt$$

The torque reference is shown in the following figure. For speed deviation of Δf, the torque reference output of the proportional term is KpΔf. After Ti elapses, the torque reference output of the integral term is KpΔf.

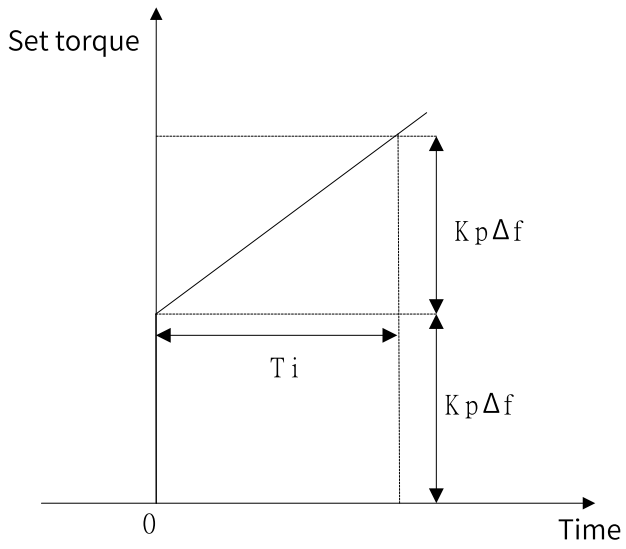


Figure 5-126 Torque reference diagram

The parameters Kp and Ti of the speed loop PI regulator can be optimized through the following auto-tuning methods.

- c2-00 = 2 [No-load dynamic auto-tuning of asynchronous motor]
- c2-00 = 12 [No-load dynamic auto-tuning of synchronous motor]

If the auto-tuned values cannot deliver expected performance, you can manually optimize the controller parameters. The effect of Kp and Ti on the controller is as follows.

- When Kp is low, the feedback speed overshoot is high. Increasing Kp can quicken the adjustment process and reduce overshoot. Note that an excessively high Kp can result in oscillation of the output torque and feedback speed.
- Decreasing Ti can quicken the adjustment process. Note that an excessively low Ti can result in oscillation of the output torque and feedback speed.

The speed loop regulator may need special processing when it is used with the PLC to set the integral parameters.

Forced integral of speed loop: It is enabled/disabled by d3-33. d3-34 defines the forced integral value, and the integral output value will be set to the value defined by d3-34 forcibly after forced integral is enabled.

Related parameter

Param.	Name	Default	Value range	Description
F2-00/d3-00	Speed loop in FVC mode Kp	8.0	0.0 to 600 0.0	Defines the speed loop proportional gain in FVC mode. Note: The higher the Kp value, the higher the speed loop stiffness, and the better the speed following performance can be. Note that an excessively high Kp value can easily result in oscillation.
F2-01/d3-01	Speed loop Ti in FVC mode	0.080s	0.000s to 20.000s	Defines the speed loop integral time in FVC mode. Note: The lower the Ti value, the higher the speed loop stiffness, and the better the speed following performance. Note that an excessively low Ti value can easily result in oscillation.
F2-02/d3-02	Speed loop Kp in SVC	5.0	0.0 to 6000.0	Defines the speed loop proportional gain in SVC mode. Note: The higher the Kp value, the higher the speed loop stiffness, and the better the speed following performance. Note that an excessively high Kp value can easily result in oscillation.
F2-03/d3-03	Speed loop Ti in SVC mode	0.127s	0.000s to 20.000s	Defines the speed loop integral time in the SVC mode. Note: The lower the Ti value, the higher the speed loop stiffness, and the better the speed following performance. Note that an excessively low Ti value can easily result in oscillation.

Param.	Name	Default	Value range	Description
d3-33	Forced integral enable	0	0 to 1	Defines whether to set the integral value forcibly. Value description: 0: Inactive 1: Enable - When this function is enabled, the integral term output of the speed loop is determined by d3-34 [Source of forced integral] and d3-35 [Digital reference of forced integral]. Other: B connector - Whether to enable forced integral of speed loop depends on the value of the B connector.
d3-34	Forced integral source	0	0 to 9	Defines the source of forced integral value. Value description: 0: d3-35 2: AI1 - The integral force value is input by using current or voltage signals at the AI1 and calculated according to the set AI curve. 3: AI2 - The integral force value of speed loop is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse reference - The forced integral value is set through the pulse frequency of DI and calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the forward torque limit source, combinations of different DI states correspond to different forward torque limits. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operation time and acceleration/deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The forced integral value is set through PID. PID control is a common process control method, which calculates the proportion, integral, and differential of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the AC drive accordingly. This method finally creates a closed-loop system to stabilize the controlled variable at the target value. 9: Communication - The forced integral value is set through communication. The positive frequency upper limit can be input through remote communication. The drive must be equipped with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple devices. Other: F connector - Set a parameter number for the floating-point connector, and the value of the connector is used as the source. It is used for extension of common sources.
d3-35	Digital reference of forced integral	0.0%	-800.0 % to +800.0 %	Defines the integral force value of the speed loop. Note: When d3-33 [Forced integral enable] is enabled and d3-34 [Forced integral source] is set to 0 [Digital reference], the output of the speed loop integral term is the setpoint of this parameter.

5.3.2.4.4 Speed controller adapter

Application scenarios

The speed controller adapter automatically adjusts the speed loop parameters to suppress overshoot or oscillation of the speed controller.

Operating principles

The adapter includes speed adaptation and adaptive adaptation.

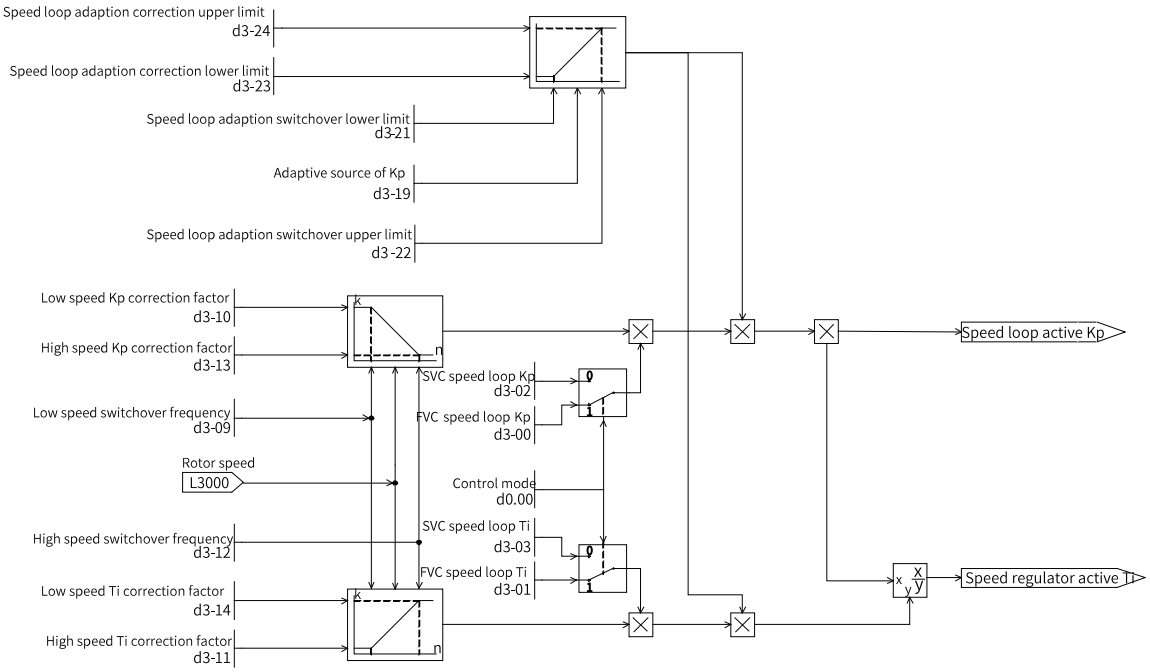
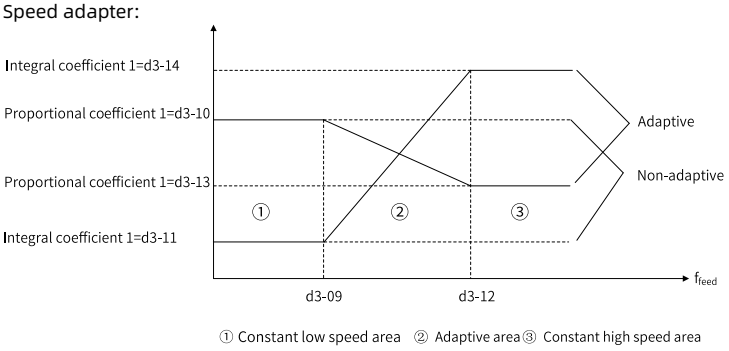
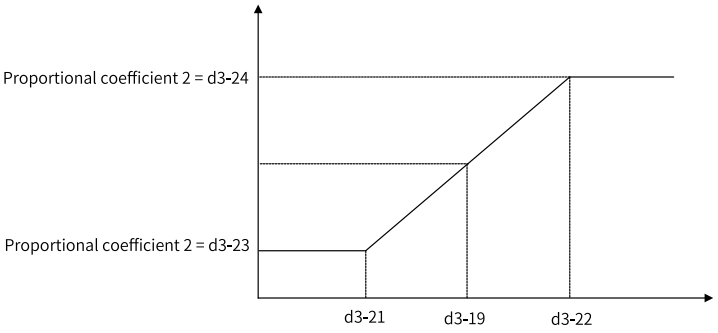


Figure 5-127 Speed controller adapter

Speed loop adjustment type	Condition/Principle	Adjustment rules
Zero speed adaptation	When U0-01 [Frequency reference] is lower than d3-06 [Zero speed switchover frequency]	During operation at zero speed, the speed loop is adjusted based on the frequency reference based on the following rules. The effective speed loop parameters U0-86 [Effective proportional coefficient of speed loop] and U0-87 [Effective integral coefficient of speed loop] are adjusted based on the original speed loop parameters d3-00 [Speed loop Kp in FVC], d3-01 [Speed loop Ti in FVC], d3-02 [Speed loop Kp in SVC], and d3-03 [Speed loop Ti in SVC] using the corresponding calibration coefficients "d3-07 [Zero speed Kp calibration coefficient] and d3-08 [Zero speed Ti calibration coefficient]."
Low/High-speed adaption	When U0-01 [Frequency reference] is lower than d3-06 [Zero speed switchover frequency]	Adjust the speed loop based on the feedback speed. During operation at high speed, current control capacity is weakened, resulting in decrease of the speed loop bandwidth. In this case, adjust the effective Kp and Ti parameters in real time based on the feedback speed. The adjustment rules are as follows. • When L3000 [Actual motor speed] is lower than d3-09 [Low-speed switchover frequency], the effective speed loop parameters U0-86 [Effective proportional coefficient of speed loop] and U0-87 [Effective integral coefficient of speed loop] are adjusted based on the original speed loop parameters d3-00 [Speed loop Kp in FVC], d3-01 [Speed loop Ti in FVC], d3-02 [Speed loop Kp in FVC], and d3-03 [Speed loop Ti in SVC] using the corresponding calibration coefficients d3-10 [Low speed Kp calibration coefficient] and d3-11 [Low speed Ti calibration coefficient]. • When L3000 [Actual motor speed] is higher than d3-12 [High-speed switchover frequency], the effective speed loop parameters "U0-86 [Active proportional coefficient of speed loop] and U0-87 [Active integral coefficient of speed loop]" are adjusted based on the original speed loop parameters d3-02 [Speed loop Kp in SVC] and d3-03 [Speed loop Ti in SVC] using the corresponding calibration coefficients "d3-13 [High speed Kp calibration coefficient] and d3-14 [High speed Ti calibration coefficient]". • The speed loop calibration coefficient changes linearly when L3000 [Actual motor speed] is between low speed and high speed. Speed adapter:  Figure 5-128 Speed adapter

Speed loop adjustment type	Condition/Principle	Adjustment rules
Adaptive adaptation	The operating principle of speed adapter is the same as that of speed adaptation, but the adjustment reference value range for adaptive adaptation is wider. For example, if the speed loop controller needs to be modified when the roll diameter changes during winding and unwinding, the roll diameter can be used as the adjustment reference. The adaptive adapter outputs an adjustment coefficient, which acts on Kp of the speed adaptation output.	• When d3-19 [Speed loop Kp adaptive source] is lower than d3-21 [Lower limit of speed loop adaptive switchover], the speed loop Kp term is calibrated using d3-23 [Lower limit of speed loop adaptive calibration]. • When it is higher than d3-22 [Upper limit of speed loop adaptive switchover], the speed loop Kp term is calibrated using d3-24 [Upper limit of speed loop adaptive calibration]. • When source value is between d3-21 and d3-22, the Kp calibration coefficient varies linearly between d3-23 and d3-24. The adaptive calibration coefficient is calculated as follows.  Figure 5-129 Adaptive adapter The final effective Kp and Ti are calculated as follows: Final effective K_p value = d3-02 x Proportional coefficient 1 (speed adapter) x Proportional coefficient 2 (adaptive adapter) Final effective T_i value = d3-03 x Integral coefficient 1 (speed adapter)

Application case

In the application of a wire drawing machine, the improper mechanical installation results in mechanical vibration of the stand. The higher the speed, The more obvious the vibration is. On-site commissioning reveals that the speed loop needed to be intensified at low speed to suppress speed fluctuation, and the speed loop needed to be reduced at high speed to reduce vibration.

Based on the actual commissioning, the speed loop parameters can be adjusted automatically by using the low-/high-speed speed loop adaptive function.

The following shows the detailed procedure.

1. Set F2-07/d3-09 (Low speed switchover frequency) to 5 Hz.
2. Set low-speed speed loop calibration coefficient to 100%. Set F2-08/d3-10 to 100% and F2-09/d3-11 to 100%.
3. Reduce the value of high-speed speed loop parameters, and set the high-speed speed loop switchover threshold (F2-10/d3-12) to 15 Hz.
4. Reduce the proportional term of the high-speed speed loop based on the commissioning results (set F2-11/d3-13 to 30%), and keep the integral term unchanged (F2-12/d3-14 = 100%).

Related parameter

Param.	Name	Default	Value range	Description
F2-04/d3-06	Zero speed switchover frequency	1.0%	0.0% to d3-09	Defines the zero speed switchover frequency of the speed loop.
F2-05/d3-07	Zero speed Kp calibration coefficient	100.0%	0.0% to 1000.0%	Defines the proportional calibration coefficient of the speed loop at zero speed.
F2-06/d3-08	Zero speed Ti calibration factor	100.0%	0.0% to 1000.0%	Defines the integral calibration factor of the speed loop at zero speed.
F2-07/d3-09	Low speed switchover frequency	10.0%	0.0% to d3-12	Defines the low speed switchover frequency of the speed loop.
F2-08/d3-10	Low speed Kp calibration factor	100.0%	0.0% to 1000.0%	Defines the proportional calibration factor of the speed loop at low speed.
F2-09/d3-11	Low speed Ti calibration factor	100.0%	0.0% to 1000.0%	Defines the integral calibration factor of the speed loop at low speed.
F2-10/d3-12	High speed switchover frequency	100.0%	d3-09 to 400.0%	Defines the high speed switchover frequency of the speed loop.
F2-11/d3-13	High speed Kp calibration factor	100.0%	0.0% to 1000.0%	Defines the proportional calibration coefficient of the speed loop at high speed.
F2-12/d3-14	High speed Ti calibration factor	100.0%	0.0% to 1000.0%	Defines the integral calibration factor of the speed loop at high speed.

Param.	Name	Default	Value range	Description
d3-19	Adaptive source of speed loop Kp	0	0 to 9	Defines the adaptive source of speed loop Kp. Value description: 0: Inactive 2: AI1 - The positive frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The positive frequency upper limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The positive frequency upper limit is set through the pulse frequency of the DI. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the positive frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - The multi-speed reference is used to control the operating time and acceleration/deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The positive frequency upper limit is set through PID. PID control is a common process control method, which calculates the proportion, integral, and differential of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the AC drive accordingly. This method finally creates a closed-loop system to stabilize the controlled variable at the target value. 9: Communication - The adaptive source is set through communication. The adaptive source is set through remote communication. The drive must be equipped with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple devices. Other: F connector - Set a parameter number for the floating-point connector, and the value of the connector is used as the source. It is used for extension of common sources.
d3-21	Lower limit of speed loop adaptive switchover	40.0 %	0.0% to 1000.0%	Defines the adaptive switchover lower limit of the speed loop.
d3-22	Upper limit of speed loop adaptive switchover	100.0%	0.0% to 1000.0%	Defines the adaptive switchover upper limit of the speed loop.

Param.	Name	Default	Value range	Description
d3-23	Lower limit of speed loop adaptive calibration	100.0%	0.0% to 1000.0%	Defines the lower limit of speed loop adaptive calibration.
d3-24	Upper limit of speed loop adaptive calibration	100.0%	0.0% to 1000.0%	Defines the adaptive calibration upper limit of the speed loop.

5.3.2.4.5 Acceleration Torque Feedforward

Application scenarios

To allow the motor to accelerate/decelerate based on the set RFG curve, set a proper acceleration torque for the motor ($T_a = T_e - T_L$) instead of using the speed regulator only, preventing overshoot at the end of acceleration and speed lag at the start of acceleration.

In this case, acceleration torque feedforward function can be used to calculate the acceleration torque needed based on the auto-tuned moment of inertia and expected acceleration, which is then superimposed to the speed regulator to reduce the output of the speed regulator and improve speed following characteristics.

Operating principles

Acceleration torque feedforward is implemented based on the motion equation of the motor, as shown below.

$$T_e - T_L = J\frac{d\omega}{dt}$$

In the preceding formula,

T_e represents the electromagnetic torque of the motor.

T_L represents the load torque and friction torque.

J represents the moment of inertia, which is displayed in C4-64 after auto-tuning. The per-unit value is equal to the electromechanical time constant (C4-63).

dω/dt represents the speed change rate of the motor, which is associated with the acceleration/deceleration time and calculated automatically by the system.

The acceleration output by RFG is used for acceleration torque feedforward to get the motor speed change rate. In this case, an accurate acceleration torque can be obtained when the speed curve is set to be generated only by RFG. The following shows the block diagram for generating feedforward torque.

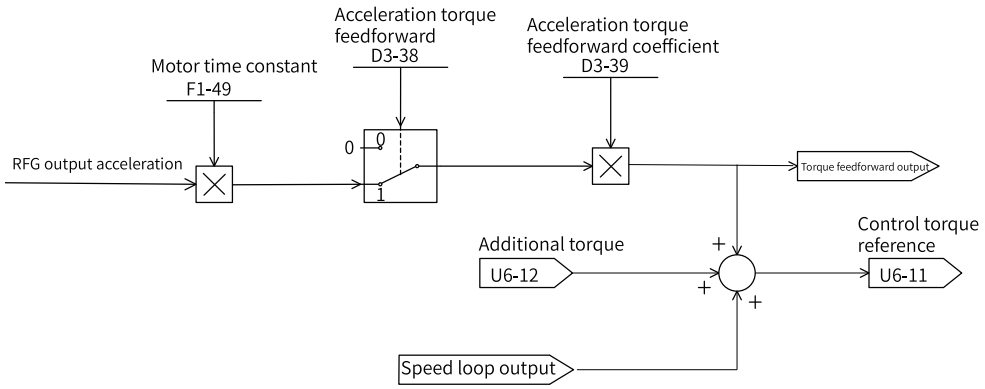


Figure 5-130 Feedforward torque

Related parameters

Param.	Name	Default value	Value range	Description
d3-38	Acceleration torque feedforward enable	0	0 to 1	Defines whether to enable feedforward torque. In the speed mode, enabling feedforward torque significantly improves the acceleration following performance. Value description: 0: Disable 1: Enable Note:To ensure the feedforward effect, complete auto-tuning or inertia auto-tuning is required.
d3-39	Acceleration torque feedforward coefficient	100.0%	0.0% to 1000.0%	Defines the magnitude of feedforward torque. Feedforward torque = Acceleration x Moment of inertia x Feedforward torque coefficient
d3-40	Acceleration source of acceleration torque feedforward	0	0 to 1	Defines the source for calculating feedforward torque. Value description: 0: Set by RFG - Setting the speed through the RFG module yields optimal performance. 1: Calculated automatically - If the speed is not set through the RFG module, select this option. Note: When the speed reference is generated by RFG, it is recommended to set this parameter to 0.

Application instance

In textile production lines, SVC speed control mode is used, where the host controller sends the speed reference through the PLC, with a communication cycle of 50 ms. After the motor accelerates to the set speed in SVC mode, excessive speed overshoot occurs.

In this case, you can enable acceleration torque feedforward to reduce overshoot. Given that the speed reference is sent through PLC, the frequency ramp transition function needs to be enabled.

Operation procedure:

1. Ensure no-load complete auto-tuning or inertia auto-tuning has been performed on the motor. If not, perform inertia auto-tuning by setting C2-00 to 4.
2. After inertia auto-tuning is done, enable frequency ramp transition function by setting b5-11 to 1.
3. As the communication cycle with PLC is 50 ms, set the frequency ramp transition interval to 50 ms (b5-12 = 50).
4. Enable the acceleration feedforward function by setting d3-38 to 1.
5. Select the source of acceleration feedforward. As the drive operates in speed control mode, and the speed reference is generated by RFG, set d3-40 to 0.

After preceding steps are done, both frequency ramp transition and acceleration torque feedforward functions are enabled simultaneously.

If in actual field applications, the speed reference is not sent through PLC, or if the speed reference is sent through PLC, but the speed reference is used as the final target speed without ramp integration by the host controller, you only need to enable RFG feedforward, with steps 2 and 3 skipped and frequency ramp transition not set.

5.3.2.4.6 Frequency Ramp Transition

Application scenarios

When the speed is set through PLC communication, the RFG output speed may be not smooth due to the long communication cycle between the PLC and the drive and non-continuous speeds sent by the PLC, resulting in non-continuous acceleration. When the acceleration torque feedforward function is used, the sudden change in calculated feedforward torque may cause torque oscillation in the motor output, potentially damaging rigid structures connected by gears. This issue can be resolved through frequency ramp transition.

Operating principles

After b5-11 [Frequency ramp transition] is set to “Enable”, the speed ramp slope is controlled during changes in the speed references, generating a continuous ramp transition rate. When the signal update interval of the external control system (PLC transmission interval) is consistent with ramp transition rate (b5-12), the output speed reference of RFG is linear.

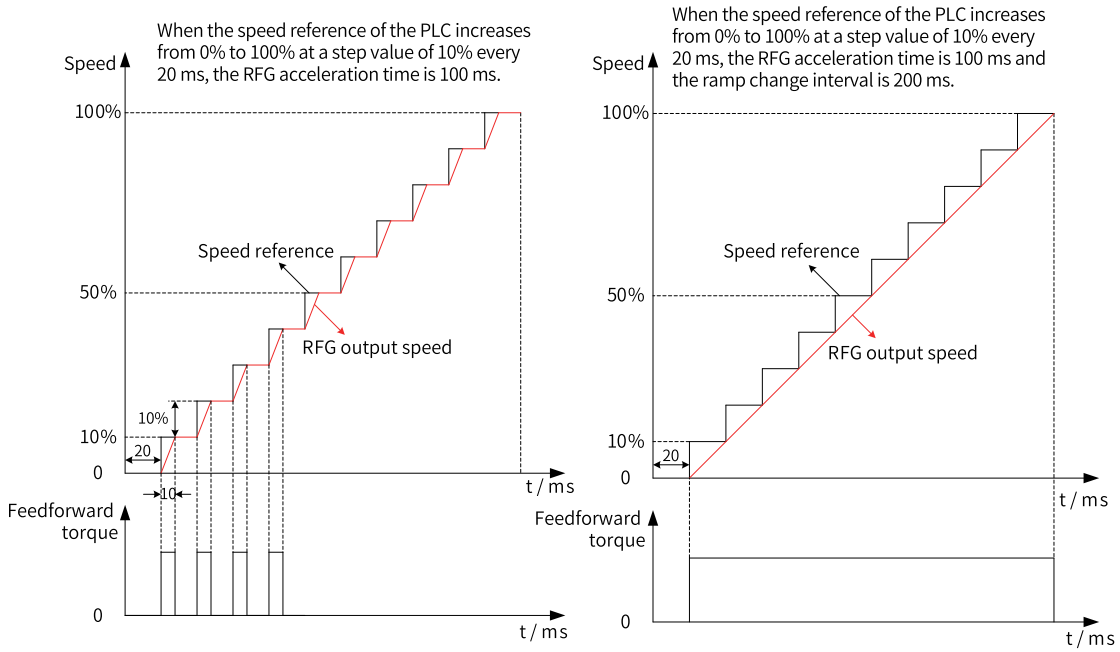


Figure 5-131 Ramp transition diagram

Related parameter

Param.	Name	Default	Value range	Description
b5-11	Frequency ramp transition enable	0	0 to 9	Defines whether to enable frequency ramp transition. When the bit signal is set to 0, this function is not enabled. When the bit signal is set to 1, this function is enabled. Value description: 0: Disable - This function is disabled. 1: Enable - This function is enabled; 3: Depends on the final state of DI1 - 0: Inhibited; 1: Enabled 4: Depends on the final state of DI2 - 0: Inhibited; 1: Enabled 5: Depends on the final state of DI3 - 0: Inhibited; 1: Enabled (active only for MD630S) 6: Depends on the final state of DI4 - 0: Inhibited; 1: Enabled (active only for MD630S) 7: Depends on the final state of DI5 - 0: Inhibited; 1: Enabled (active only for MD630S) 8: Depends on the final state of DI6 - 0: Inhibited; 1: Enabled (active only for MD630S) 9: Depends on the final state of DI7 - 0: Inhibited; 1: Enabled (active only for MD630S) Other: B connector - Depends on the B connector. You can select "Other: B connector" through the pop-up window. When the connector value is 0, this function is inhibited. When it is 1, this function is enabled. Note: When the speed reference is sent to the drive through communication, the frequency ramp transition function must be enabled simultaneously if the acceleration torque feedforward function needs to be enabled.
b5-12	Frequency ramp transition interval	50 ms	2 ms to 10000 ms	Defines the frequency ramp transition interval. Note: The frequency ramp transition interval must be the same as the communication cycle of the speed reference.

Application instance

Frequency ramp transition is generally used together with the acceleration torque feedforward function. See the application instance in *"5.3.2.4.5 Acceleration Torque Feedforward" on page 482*.

5.3.2.4.7 Speed Control Optimization in Vector Control

During commissioning of the drive, speed fluctuation often occur, which can be improved by increasing or decreasing the speed loop PI parameters. In high-inertia systems and applications requiring quick acceleration and deceleration, it is difficult to improve speed following performance by adjusting PI parameters, and incorrect adjustment methods may worsen system operation.

In vector control, the speed control performance is represented by the ability to follow the speed reference and the resistance to load disturbance. During commissioning, improve the speed following performance first, and then improve the resistance to load disturbance.

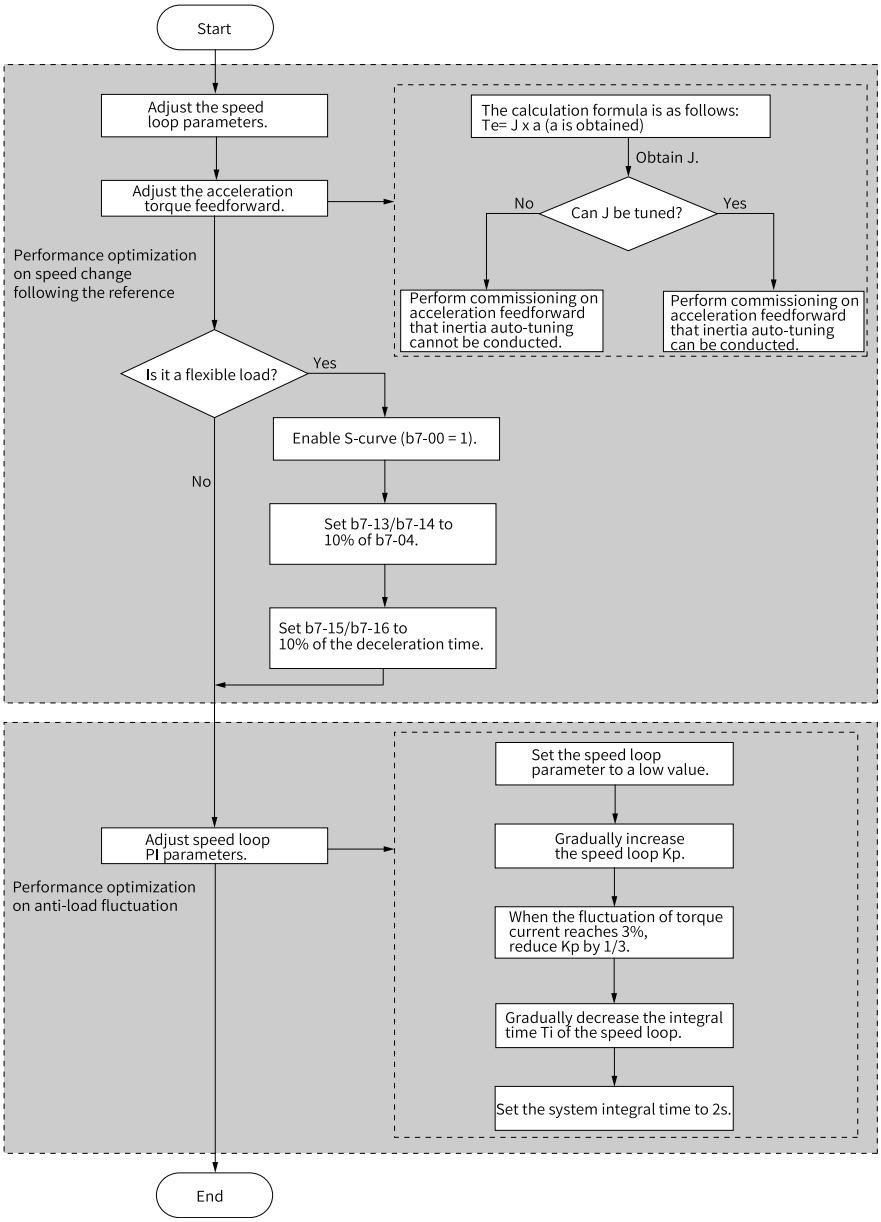


Figure 5-132 Speed control optimization in vector control

Speed following performance

Application scenarios

During acceleration/deceleration, the actual speed may fail to follow the speed reference closely, resulting in excessive overshoot or repeated oscillation after the speed is reached.

Function description

Speed following performance indicates the ability to follow the speed reference, which is usually a challenge during acceleration/deceleration, as shown in the following figure.

Acceleration feedforward is mainly used to improve the speed following capability. When the speed following performance is affected by acceleration/deceleration, commission the acceleration feedforward first.

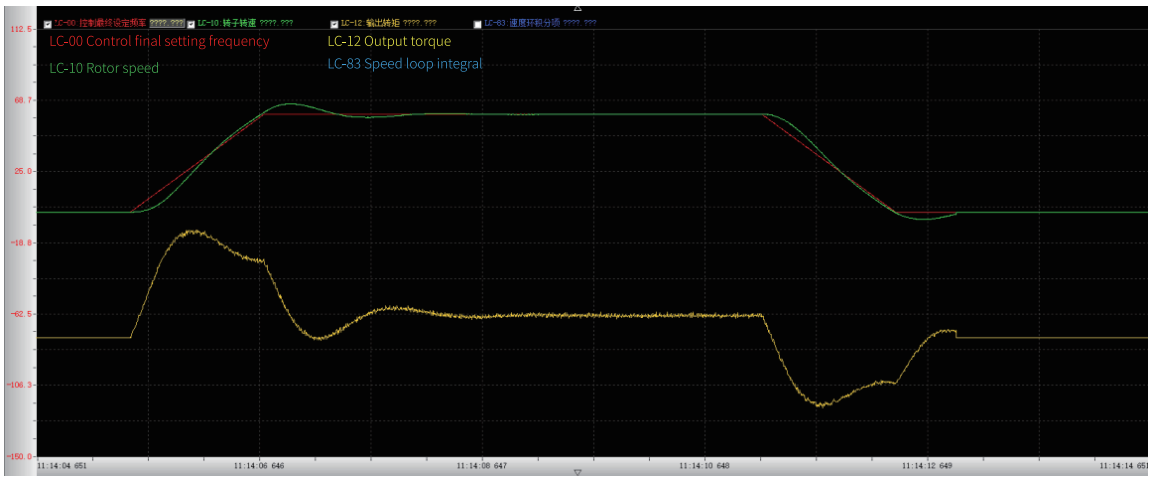


Figure 5-133 Poor speed following performance

Procedure

To optimize speed control, first set the speed loop to a low value. For example, set F2-00 [Speed loop Kp in FVC mode] to 5 and F2-01 [Speed loop Ti in FVC mode] to 2.0s, or set F2-02 [Speed loop Kp in SVC mode] to 5 and F2-03 [Speed loop Ti in SVC mode] to 2.0s. Then set the acceleration torque feedforward properly to improve the speed following performance.

Acceleration torque feedforward calculation

Acceleration torque feedforward calculation formula: $T_e = J \times a$.

T_e : Motor output acceleration torque

J: Moment of inertia. This is a system parameter that needs to be auto-tuned or adjusted manually.

A: Acceleration rate, indicating the acceleration/deceleration time

In the above formula, the acceleration/deceleration time "a" is known, the feedforward torque can be calculated once the system inertia "J" is known. The system inertia "J" can be auto-tuned through inertia auto-tuning. If failed, you can adjust d3-39 [Acceleration torque feedforward coefficient] manually to get the accurate inertia compensation.

Commissioning for acceleration feedforward based on inertia auto-tuning

If dynamic inertia auto-tuning is available, see the commissioning process for acceleration feedforward in the following diagram.

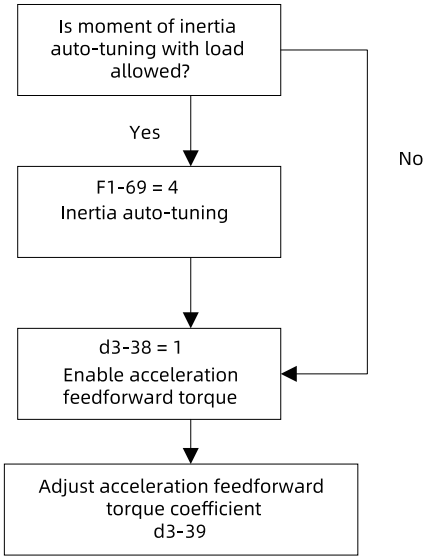


Figure 5-134 Commissioning procedure for acceleration feedforward based on inertia auto-tuning

The moment of inertia is an important parameter for acceleration feedforward. Precautions for inertia auto-tuning are shown below.

1. Inertia auto-tuning is available for systems with fixed inertia such as inertia disks and rollers.
2. Inertia auto-tuning is not available for systems with travel limits. Partial inertia compensation (acceleration feedforward compensation) can be made for variable inertia system, with PI parameters adjusted.
3. Do not perform inertia auto-tuning on systems with variable inertia, such as winding/unwinding and reciprocating cam slider mechanisms.
4. For systems with large load variation, such as fans and pumps, you can reduce the auto-tuning speed, for example, setting C2-10 to 10% and C2-11 to 15% can reduce the adverse impact caused by load variation (the difference between C2-10 and C2-11 cannot be lower than 3%; otherwise, the auto-tuning accuracy can be affected).

Commissioning for acceleration feedforward without inertia auto-tuning

If dynamic inertia auto-tuning is not available, see the commissioning process for acceleration feedforward in the following diagram.

If inertia auto-tuning is not performed, the system assigns a moment of inertia by default and adjusts d3-39 [Acceleration torque feedforward coefficient] directly during operation for commissioning on acceleration feedforward torque. First set a relatively low speed loop Kp (F2-02 = 5) and Ti (F2-03 = 2.0s), and then adjust the feedforward torque.

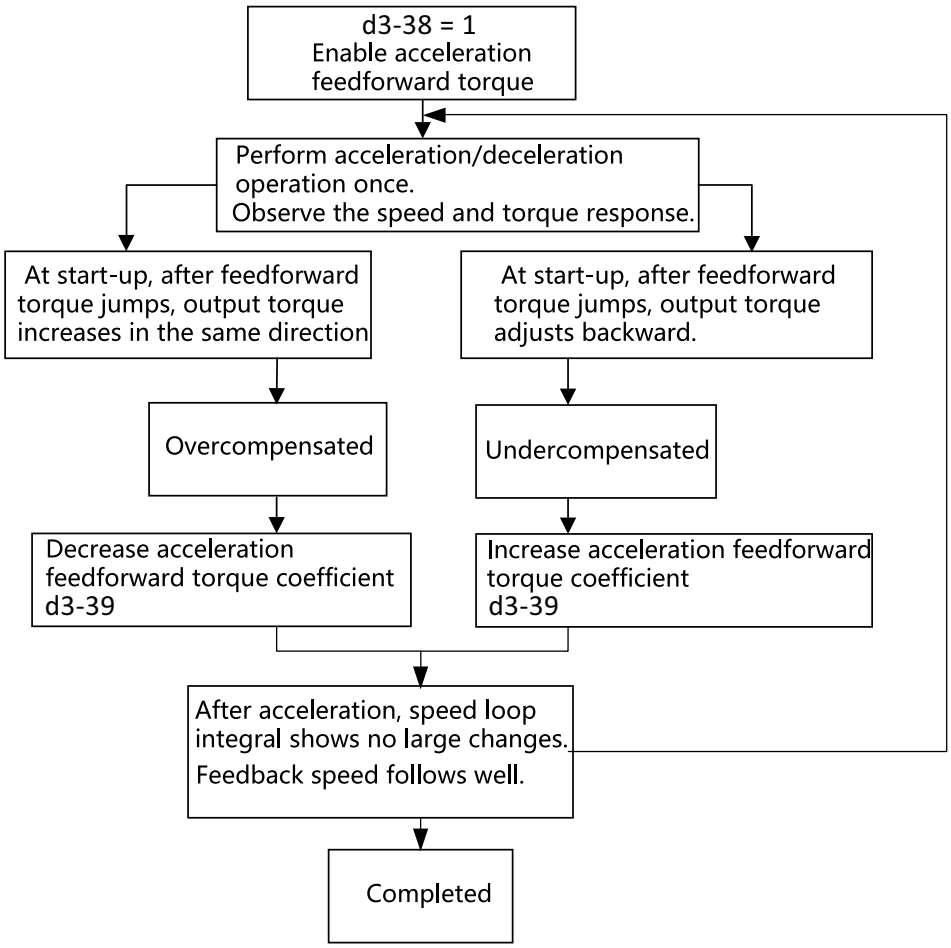


Figure 5-135 Commissioning process for acceleration feedforward without inertia auto-tuning

Feedforward undercompensation: The feedforward torque step change does not reach the required level at the start of acceleration/deceleration and speed arrival. The speed loop integral value changes significantly after the speed is reached. In undercompensation, the compensation coefficient (d3-39) needs to be increased.

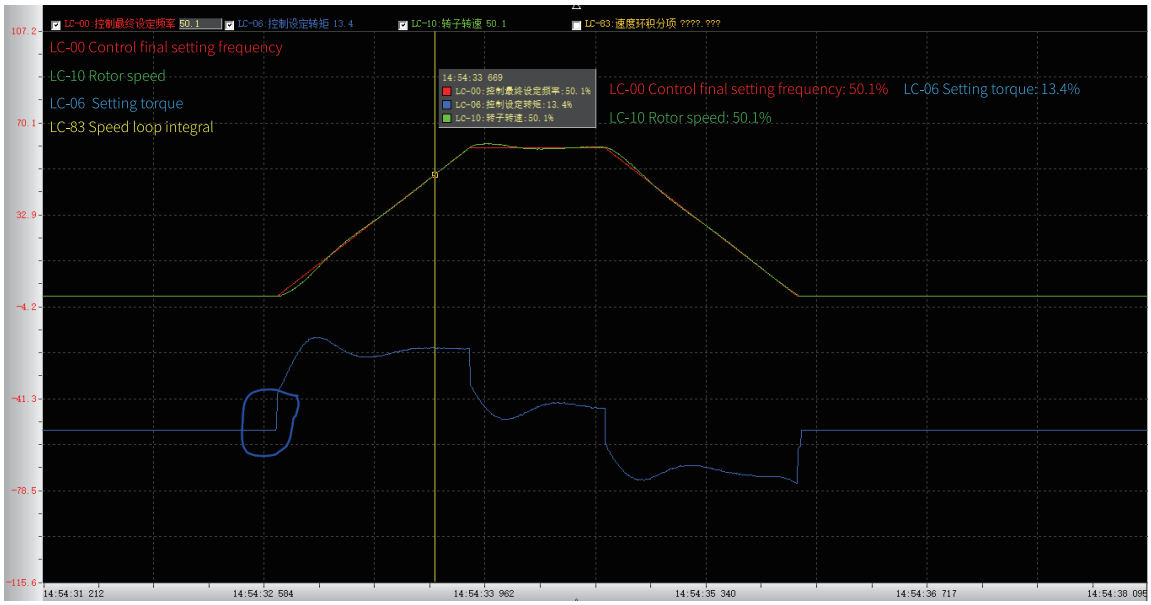


Figure 5-136 Acceleration torque feedforward undercompensation

Feedforward overcompensation: When the feedforward torque step change exceeds the required level at the start of acceleration/deceleration start and speed arrival, the speed loop integral value changes significantly after the speed is reached. In overcompensation, the compensation coefficient (d3-39) needs to be reduced.



Figure 5-137 Acceleration torque feedforward overcompensation

As shown in the following figure, the feedforward is close to the required torque. The actual speed follows the speed reference closely

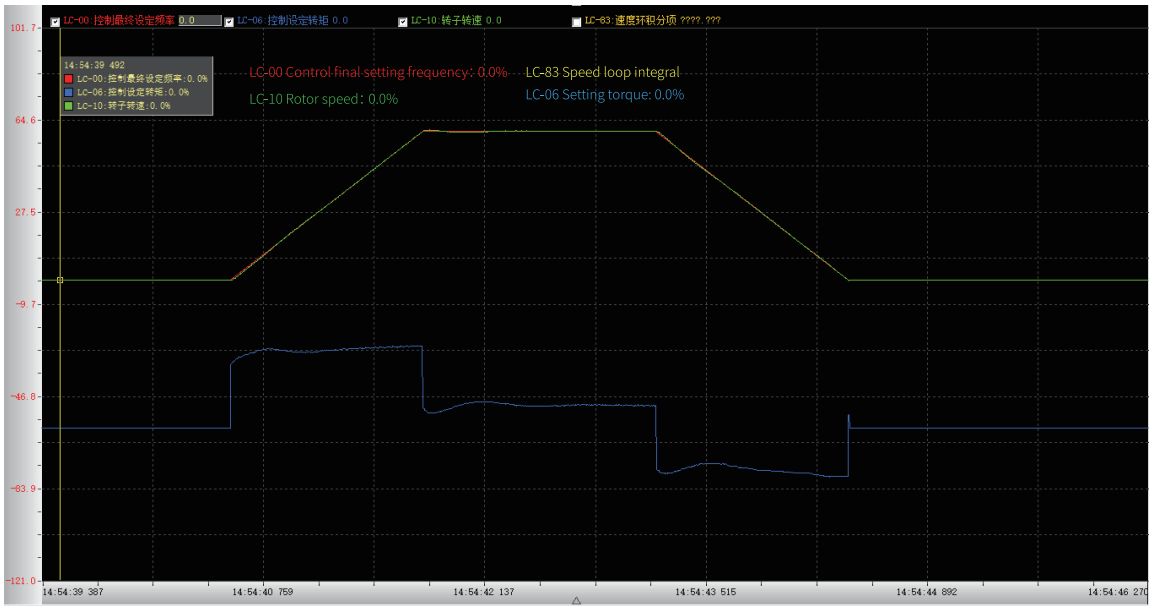


Figure 5-138 Normal effect of acceleration torque feedforward

Flexible load conditions

For flexible loads, sudden changes in feedforward torque can cause acceleration shock, resulting in mechanical vibration or unusual noise. In this case, enable the S-curve by setting b7-00 to 1, and set b7-13/b7-14 to 10% of the acceleration time b7-04. For example, if b7-04 is 20s, set b7-13/b7-14 to 2s. b7-15/b7-16 can be set to 10% of the deceleration time, making the torque change linearly, which can significantly reduce torque shock and minimize mechanical vibration.

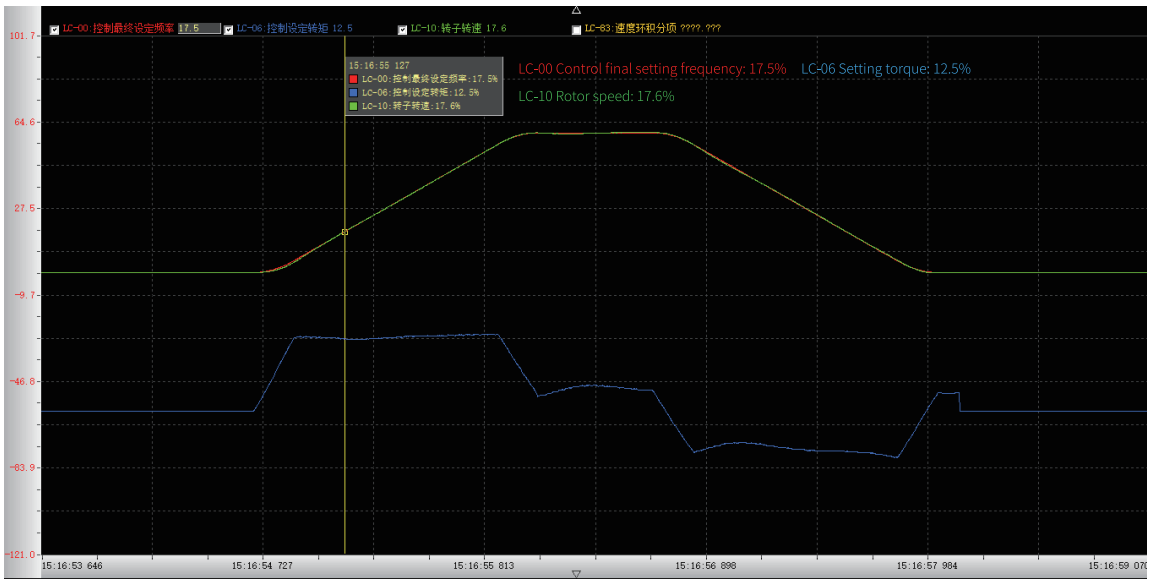


Figure 5-139 Normal effect of acceleration torque feedforward after S-curve enabled

Applications in special operating conditions

When the PLC writes the speed reference at a slow cycle, such as once every 100 ms, step changes can occur on the feedback speed, with the output torque fluctuating significantly (see *"5.3.2.4.6 Frequency Ramp Transition" on page 484*). This symptom is widely present in industries such as metallurgy, papermaking, test benches, chemicals, and textiles where the PLC provides the speed

references. In this case, you can enable the ramp transition function (b5-11) and define the PLC speed reference cycle through b5-12 (measure the time interval through the oscilloscope in the software tool). The ramp transition function can effectively reduce the torque ripple during acceleration/deceleration.

Load disturbance resistance

Application scenarios

Obvious speed drop occurs due to load changes, such as excessive load in the crushers and bite and throw of steel in bar/wire rod and heavy plate mills. Adjust speed loop PI parameters when the speed following performance is affected by excessive friction of the port RTG, and gantry travel and trolley, or when speed drop occurs due to sudden torque change in the assembly test bench of electric vehicles, or when torque oscillation and unusual mechanical noise occurs upon start due to excessively high speed loop parameters of low-inertia systems.

Function description

Load disturbance resistance indicates the ability to keep the speed stable when the load changes, which is usually a challenge when the load changes, as shown in the following figure.

The speed loop PID is mainly used to improve the load disturbance resistance. When the speed following performance is disturbed by the load, optimize speed loop PID parameters first.

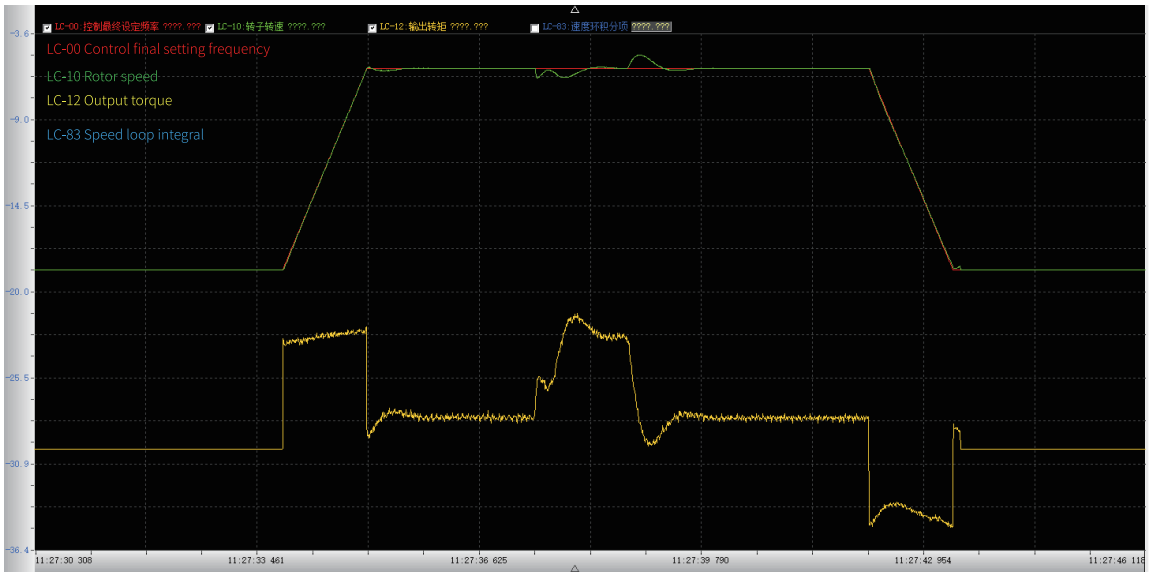


Figure 5-140 Poor load disturbance resistance

Procedure

See the following procedure for PI parameter adjustment.

1. Set speed loop parameters to low values. In FVC mode, the speed loop parameters are Kp (F2-00 = 3) and Ti (F2-01 = 2.0s). In SVC mode, the speed loop parameters are Kp (F2-02 = 3) and Ti (F2-03 = 2.0s). Set speed loop parameters to low values initially to prevent oscillation during operation caused by excessively high PI parameters. For motors with high torque output, such as direct-drive motors, set the speed loop Kp to a value lower than 3.

2. Gradually increase the speed loop Kp, and observe U6-00 [Motor actual speed] and U6-23 [Set torque current]. The normal waveform should show speed fluctuation within 0.3% and torque current within 3%.
3. When increasing the value of Kp, note that fluctuation of U6-23 [Torque current reference] cannot exceed 3%. After changing the value of Kp, run at different speeds to check whether torque current fluctuation increases.
4. When the torque current reference fluctuates by 3%, decrease Kp by 1/3 and perform Kp value commissioning.
5. Reduce the speed loop integral time Ti gradually as needed by the load. Keep the integral time higher than 0.5s in general applications. In applications with high dynamic responses, keep the integral value higher than 0.1s.
6. The bandwidth of large equipment or mechanical systems with high inertia ratio is low, which may easily incur repeated speed fluctuation upon sudden unloading after loading, resulting in bus voltage pumping and overtemperature/overload of the braking transistor IGBT and braking resistor. It is recommended to set the system integral time to 2s, with the integral time set to a high value.

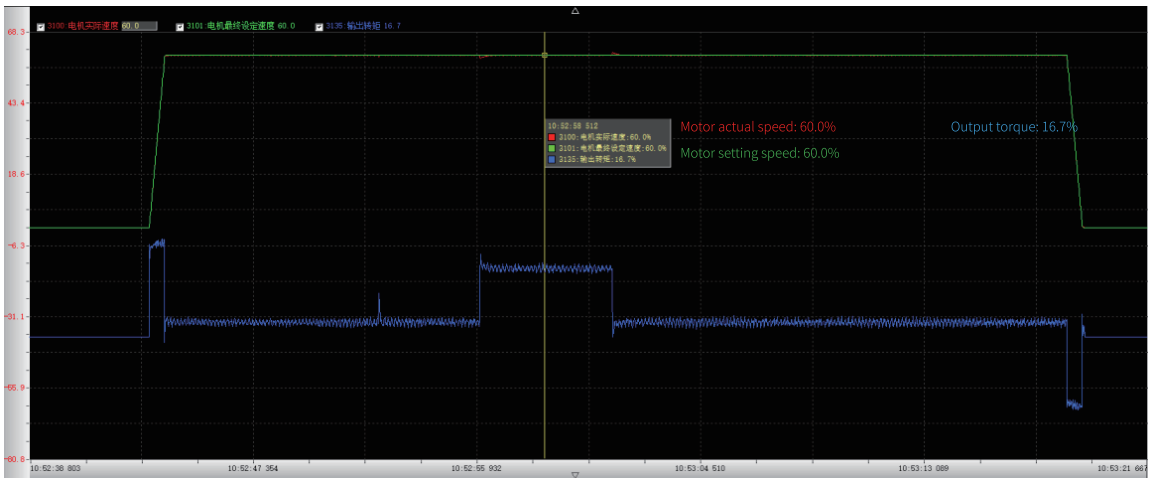


Figure 5-141 Waveform upon sudden loading/unloading after commissioning is done

5.3.2.5 Torque Control

5.3.2.5.1 Torque Control

Torque control is the control mode that ensures that the motor output torque directly follows the torque reference. Torque control includes torque reference and overspeed control. The torque reference includes torque reference setting, gain calculation, filtering, and acceleration/deceleration. Overspeed control includes setting speed limit, filtering, acceleration/deceleration, speed offset mode, and speed offset value.

Torque control must be used together with overspeed control. When the motor output torque is lower than or equal to the motor load, the motor speed is determined by the load. When the motor output torque is greater than the load torque, the motor accelerates to run. To prevent the motor from overspeed, the motor speed must be limited in torque control. When the motor speed exceeds the limit, the speed control mode applies. When the speed is restored to a value below the limit, the torque control mode applies.

5.3.2.5.2 Torque Reference

Application scenarios

Switch the torque control mode through d0-01. In the torque control mode, set the torque reference filter and torque ramp-up/down time through b5-16, b5-17, and b5-18. In torque control, the difference between the motor output torque and the load torque determines the speed change rate of the motor and load. Therefore, the motor speed may change quickly, which can result in noise or excessive mechanical stress.

Proper torque ramp-up/down time helps smooth changes in the motor speed. The torque ramp-up/down time represents the time needed for the torque to increase from 0 to the rated motor torque.

Application

In torque control, the difference between the output torque of the motor and the load torque determines the speed change rate of the motor and load. Therefore, the motor speed may change rapidly, resulting in noise or excessive mechanical stress. Proper torque ramp-up/down time and filter time (b5-17 and b5-18) helps smooth changes in the motor speed. The torque ramp-up/down time represents the time needed for the torque to increase from 0 to b5-14.

In the torque control mode, the torque ramp-up/down time is not needed for start with low torque. For applications requiring quick torque response, set the torque ramp-up/down time to 0.00s.

Operating principles

In the torque control mode, the torque is set through torque control references. Torque control references can be set through digital reference of other setting methods in the parameter list.

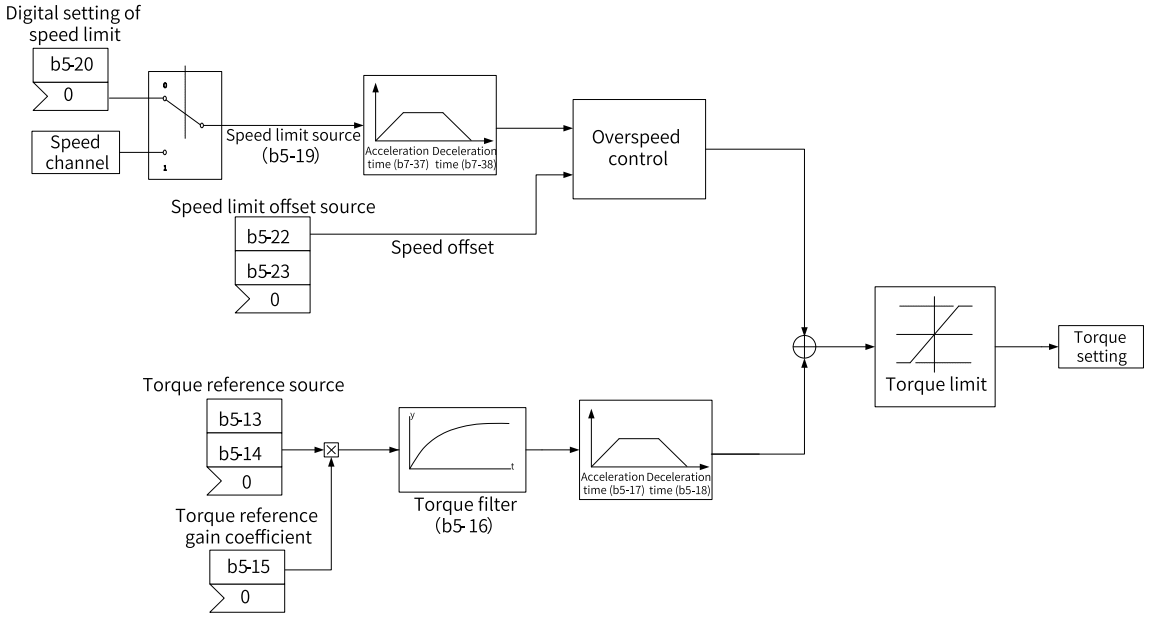


Figure 5-142 Torque control diagram

Application instance

Two drives are connected rigidly to drive the same load. To ensure even load distribution, set one drive as the master with speed control and the other as the slave with torque control. The slave receives the output torque of the master as the torque reference and must follow the master rapidly. In this case, the torque ramp-up/down time of the slave is 0.00s.

Related parameter

Param.	Name	Default	Value range	Description
F0-02/d0-01	Motor control mode	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5 to 9: DI3 (active only for MD630S) to DI7 (active only for MD630S) Other: B connector	Defines the motor control target. Value description: 0: Speed control - The speed is controlled. 1: Torque control - The torque is controlled. 3 to 9: DI1 to DI7 - Depends on the final terminal state of the DI (0: Speed control; 1: Torque control). Other: B connector - Depends on the status of B connector (0: Speed control; 1: Torque control).
b5-13	Torque reference source	0	b5-14 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the torque reference source. The default value is 0 [b5-14].
b5-14	Digital torque reference	0.0%	-800.0 % to +800.0%	Defines the digital torque reference in the torque control mode. The torque reference is a percentage to the rated motor torque. The value 100.0% corresponds to the rated torque of the motor. Setting range: The setting range is -800.0% to +800.0%, indicating that the maximum torque of the drive is 8 x rated torque of the motor. When the torque reference value is positive, the drive operates in the forward direction. When the torque reference value is negative, the drive operates in the reverse direction.

Param.	Name	Default	Value range	Description
b5-15	Torque reference gain factor	0	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of the torque reference gain factor. The default gain coefficient is 0 [100%].
b5-16	Torque filter time	0	0 ms to 10000 ms	Defines the torque filter time, which can be used to filter out torque command input interference. Set this parameter according to the actual reference signal quality. The higher the setpoint, the better the filtering effect, but the longer the torque reference delay.
b5-17	Torque ramp-up time	0.000s	0.000s to 60.000s	Defines the torque ramp-up time.
b5-18	Torque ramp-down time	0.000s	0.000s to 60.000s	Defines the torque ramp-down time.

5.3.2.5.3 Overspeed Controller

Application scenarios

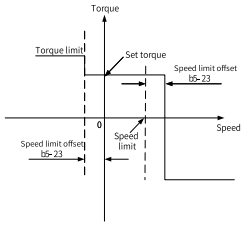
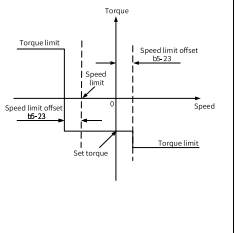
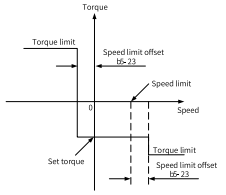
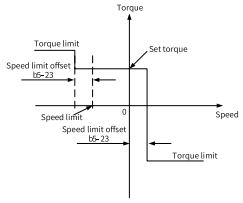
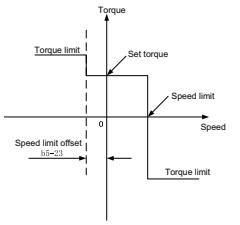
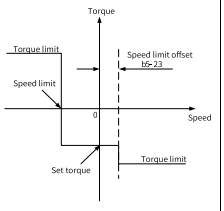
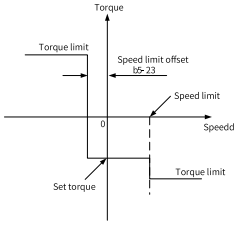
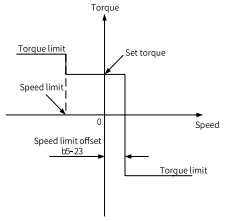
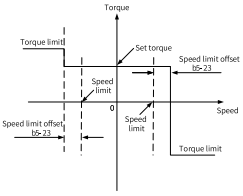
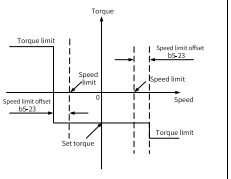
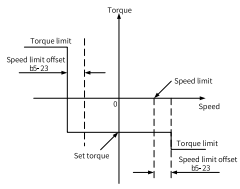
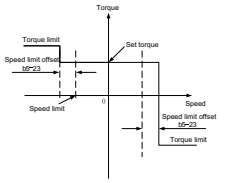
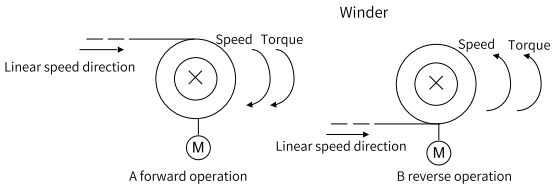
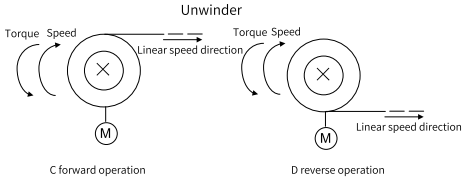
In the torque control mode, if the load torque is lower than the output torque of the motor, the motor speed keeps increasing. Therefore, the motor speed (frequency upper limit) must be limited to prevent accidents such as runaway.

Overspeed control is used in torque control mode to prevent overspeed. When the motor speed exceeds the speed limit, overspeed control is triggered. In this case, speed control applies and the motor torque cannot be outputted based on the torque reference. When the speed is restored to a value within the speed limit range, torque control resumes.

Operating principles

The speed limit parameter for overspeed control consists of two parts: speed limit and speed bias. The active status of overspeed control in the torque control mode varies with the speed limit bias setting method and the motor operating state, as shown below.

Item	Operating condition			
Operation command	Forward	Forward	Forward	Forward
Torque reference direction	+	-	-	+

Item	Operating condition			
Speed limit direction	+	-	+	-
Normal operating direction	Forward	Reverse	Forward	Reverse
Bidirectional speed limit bias (b5-21 = 0)				
Unidirectional speed limit bias (b5-21 = 1)				
Overspeed control mode (b5-21 = 2)				
Application instance				

Related parameter

Param.	Name	Description	Default value	Range
b5-19	Speed limit source	Defines the speed limit source. Value description: 0: Digital reference - In torque control mode, the speed limit source is digital reference, and the speed limit set by b5-20 [Digital reference of speed limit] is active. 1: Speed channel - The speed limit is set through the speed channel in torque control mode.	0	0: Digital reference 1: Speed channel
b5-20	Digital reference of speed limit	Defines the digital reference of the speed limit. This parameter is active when b5-19 [Speed limit source] is set to "0: Digital reference".	0.0%	-800.0 % to +800.0%

Param.	Name	Description	Default value	Range
b5-21	Speed limit bias mode in torque mode	Defines the speed limit bias mode in the torque control mode. Value description: 0: Bidirectional bias - The bias is active in both directions (forward and reverse). 1: Unidirectional bias - The bias is active only in one direction (opposite to the limit direction). 2: Overspeed control mode - The bias is active in both directions (forward and reverse), and the absolute values of positive and negative speed limits are equal to the speed limit plus the bias.	0	0: Bidirectional bias 1: Unidirectional bias 2: Overspeed control mode
b5-22	Speed limit bias source	Defines the speed limit bias source.	0	0: Digital reference 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
b5-23	Digital reference of speed limit bias	Defines the speed limit bias as a percentage to the rated speed. This parameter is active when b5-22 [Speed limit bias source] is set to 0 [Digital reference].	5.0%	0.0% to 800.0%

Application instance

Instance 1: Tension control in torque mode for winding and unwinding is a typical application scenario of torque control.

As shown in the application example "A forward" below, this is forward winding. Overspeed control is used to prevent the motor from continuously accelerating and limit reverse rotation of the motor.

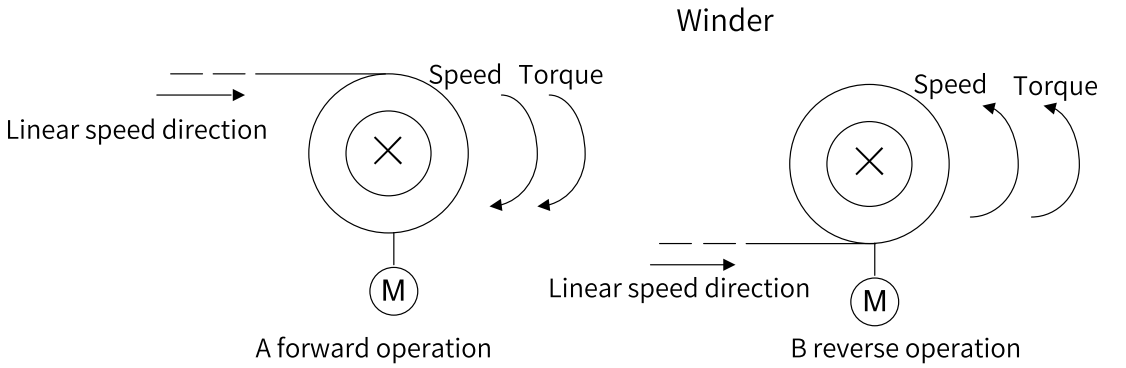


Figure 5-143 Torque control diagram 1 for winder/unwinder

If the drive controls the winder to run forwardly at a speed of 0% to 100%, and a torque of 20% is needed for winding without reverse rotation, configure parameters as shown below

Param.	Function	Value
b5-14	Digital torque reference	20.0%
b5-20	Digital reference of speed limit	100.0%
b5-21	Speed limit bias mode in torque mode	1
b5-23	Digital reference of speed limit bias	0.0%

Instance 2: As shown in the application example "C forward" below, the drive drives the unwinder to run forwardly.

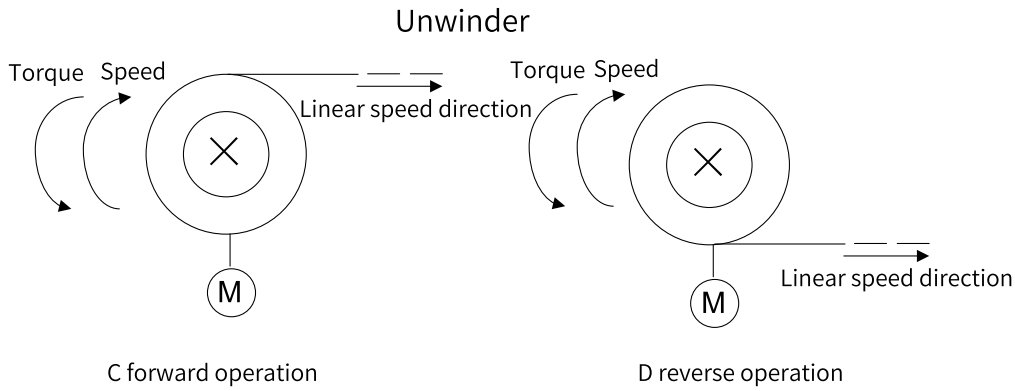


Figure 5-144 Torque control diagram 2 for winder/unwinder

If a torque of 20% is needed for unwinding and a reverse run at 5% speed is allowed, configure parameters as shown below.

Param.	Function	Value
b5-14	Digital torque reference	-20.0 %
b5-20	Digital reference of speed limit	100.0%
b5-21	Speed limit bias mode in torque mode	1
b5-23	Digital reference of speed limit bias	5.0%

Instance 3: As shown below, the motor runs forwardly, the torque reference in torque control is set by b5-14, and the speed limit for overspeed control is set by b5-20, with single-phase bias mode adopted.

Assume:

Before t1, the motor output torque equals the value of b5-14, and the motor operating speed is lower than b5-20.

At t1, the load suddenly decreases, causing the load torque to be lower than the motor output torque, resulting in motor acceleration. At t2, the speed reaches b5-20, the set speed limit is reached, and overspeed control is activated.

After t2, the speed stabilizes at b5-20. The motor torque cannot output according to the value of b5-14. The actual output torque is determined by the actual load torque, friction, and other factors at this moment.

At t3, the load continues to decrease or an external force drives the motor in the forward direction. To prevent the speed from exceeding the speed limit, the speed regulator PI decreases the positive torque rapidly. When the final torque output reaches the negative torque limit, the overspeed control fails. After this, the speed can exceed the set speed limit. In this case, check the system configuration.

In Figure (a), the control before t3 corresponds to region I in Figure (a). Within the speed limit, the output torque equals the torque reference. At the speed limit threshold, the output torque is lower than the torque reference.

After t3, the output torque reaches the torque limit, and the actual speed exceeds the speed limit.

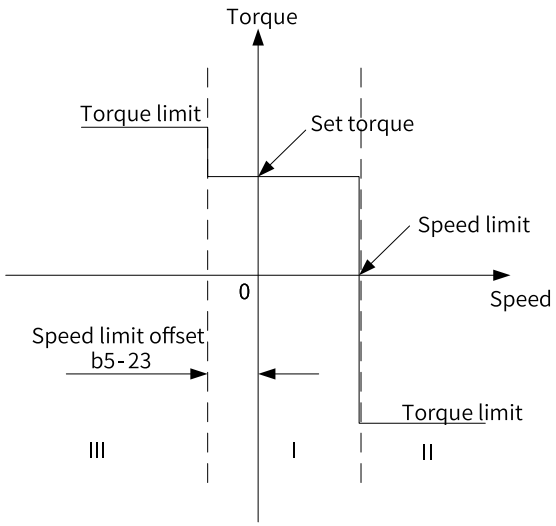


Figure 5-145 (a) Example of unidirectional limit bias in forward motoring overspeed control

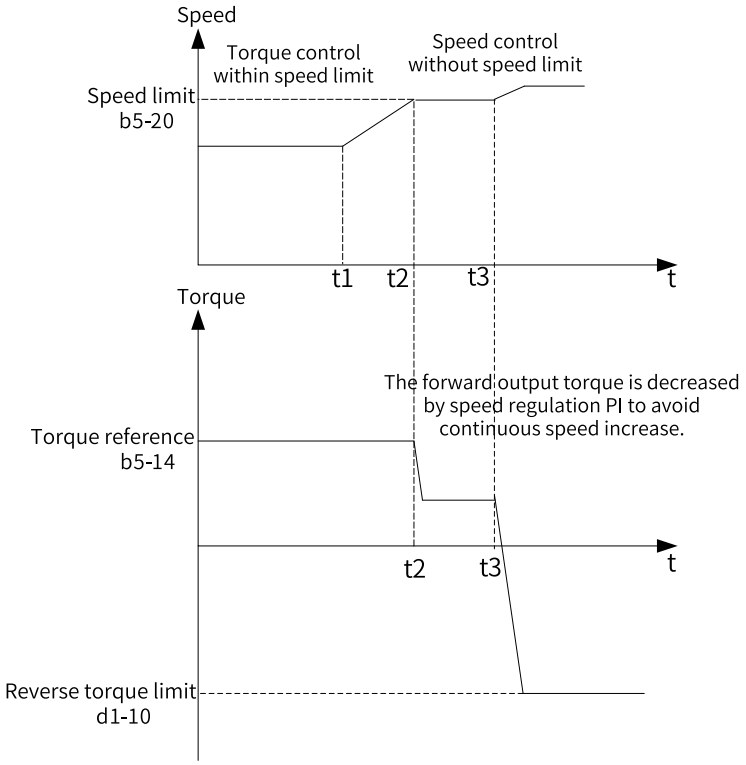


Figure 5-146 (b) Example of unidirectional limit bias in forward motoring dynamic behavior

Example 4: As shown in the figure below, the settings and operating status before t1 are the same as those in the previous example.

At t2, the load suddenly increases. Since the system does not allow significant speed reversal, a unidirectional speed bias is set. In this case, the speed regulator PI increases the motor positive torque output, and the speed reaches the speed reference of speed bias.

At t3, the load further increases or an external force drives the motor. To prevent the speed from exceeding the speed bias, the speed regulator PI increases the positive torque output. When the final torque output reaches the positive torque limit, overspeed control fails. After this, the speed can exceed the speed bias. In this case, check the system configuration.

In Figure (c), the control before t3 corresponds to region I in Figure (c). Within the speed limit and speed bias, the output torque equals the torque reference. At the speed bias threshold, the output torque is greater than the torque reference.

After t3, the output torque reaches the torque limit, and the actual speed exceeds the speed bias.

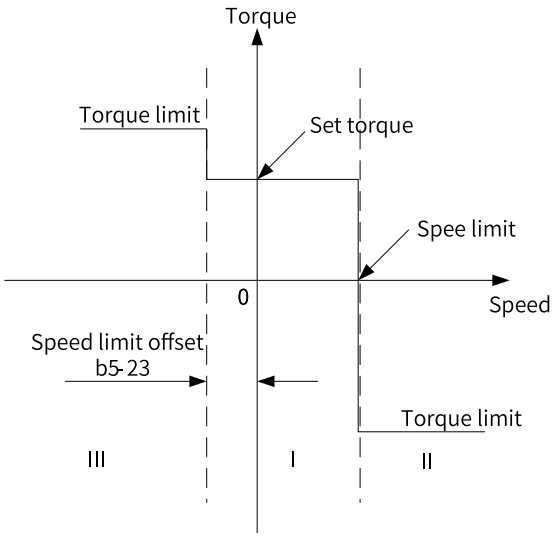


Figure 5-147 (c) Example of unidirectional limit bias in forward motoring overspeed control

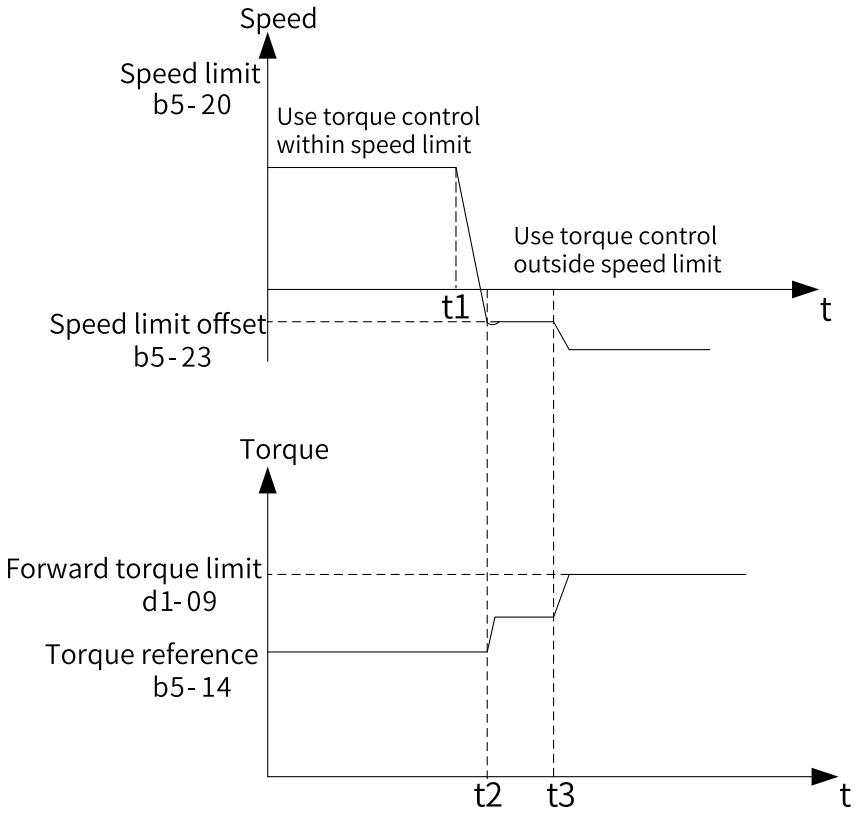


Figure 5-148 (d) Example of unidirectional limit bias in forward motoring dynamic control

5.3.2.6 Current Limit

Application

If the operating current of the motor needs to be limited in FVC or SVC mode, set the maximum motor current [F1-13] and maximum current of the drive [A3-05] to keep the current during normal operation of the motor lower than or equal to the smaller of [F1-13] and [A3-05].

Precautions

- Limiting the maximum current of the motor may affect the overload capacity of the motor and reduce the motor torque output.
- The current limit of the motor is active only in vector control. In V/f mode, the overcurrent suppression function needs to be enabled to ensure that the current is lower than the maximum current.
- When the current limit is valid, it is recommended to set [b7-46] to 1 [Ramp tracking enable] to prevent excessive deviation between the set speed and the actual speed.

Operating principles

The current regulator automatically controls the current, ensuring that the total current output does not exceed the limit value.

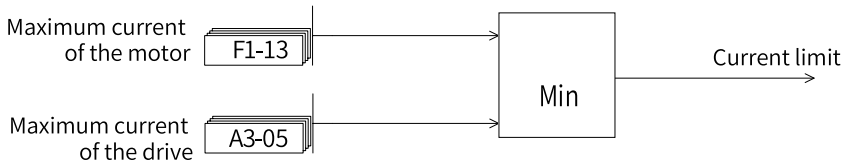


Figure 5-149 Effective current limit diagram

Related parameter

Param.	Name	Default	Value range	Description
F1-13	Maximum motor current	1000.0 %	0.0% to 1000.0%	Defines the maximum current of the motor. The value 100% corresponds to the rated motor current. Note: The current limit is the smaller of F1-13 and A3-05.
A3-05	Maximum current of the drive	150 %	0% to 600 %	Defines the maximum current of the drive. The value 100% corresponds to the rated motor current. Note: The current limit is the smaller of F1-13 and A3-05.

5.3.2.7 Torque Limit

Application scenarios

In some process applications, the motor output torque needs to be limited in the FVC or SVC mode. In some cases, the motor torque limit needs to be adjusted to achieve torque control while the motor runs in the speed mode.

Operating principles

The torque limit can be achieved by limiting the output of the speed loop. The following figure shows how to set the torque limit.

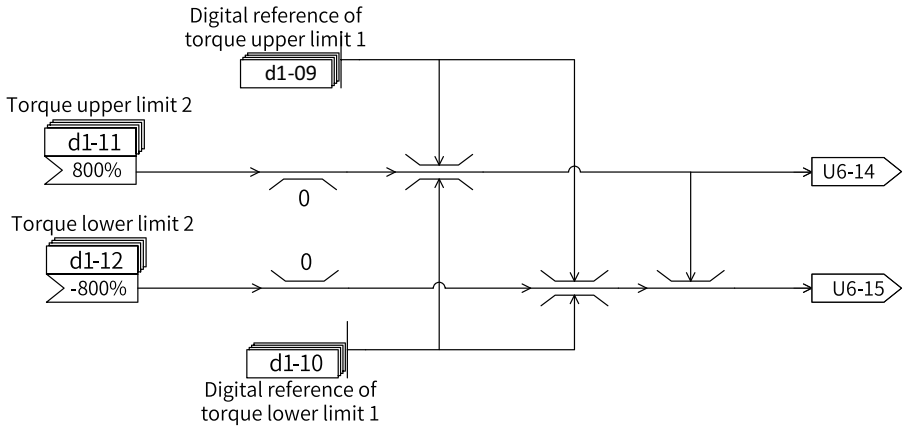


Figure 5-150 Torque limit setting

The following figure shows how the torque limit takes effect.

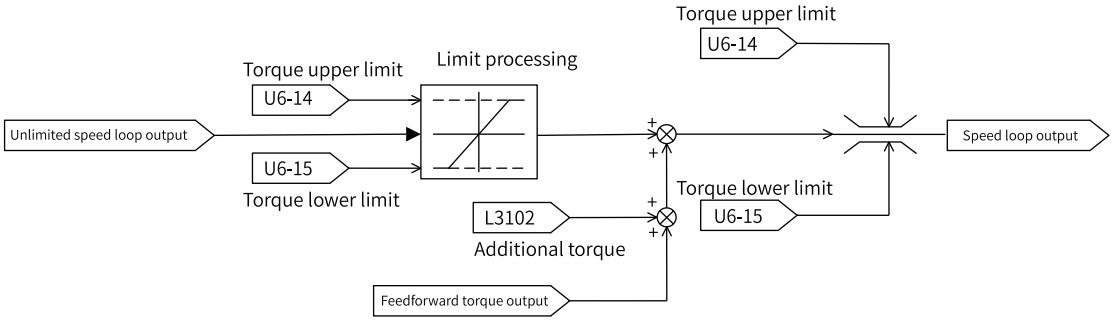


Figure 5-151 Speed loop with output torque limit

Precautions

- The motor torque limit is active only in vector control modes. It is inactive in V/f mode.
- The actual torque limit of the motor is affected by the current limit, torque limit, and power limit. The preceding figure takes the motoring condition as an example to describe the impact of the three limits on the actual torque limit. Among all the limits, the one with the most severe restriction is active. In the figure, the effective torque limit is slightly lowered down for easy comparison. In actual applications, the torque reference limit is the same as the minimum torque limit.

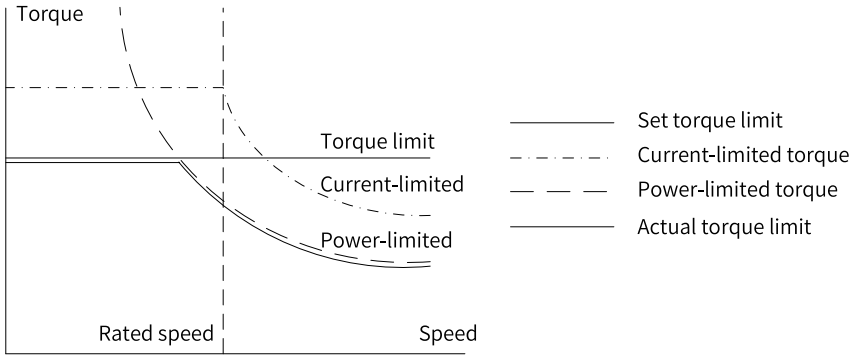


Figure 5-152 Torque limit diagram

Related parameter

Param.	Name	Default	Value range	Description
d1-09	Digital reference of torque upper limit 1	150.0%	0.0% to 800.0%	Defines the maximum positive torque output. The value 100% corresponds to the rated torque of the motor. Note: The effective positive torque limit is the smaller of d1-09 and d1-11.
d1-10	Digital reference of torque lower limit 1	-150.0%	-800.0% to 0.0%	Used to limit the maximum negative torque output. The value 100% corresponds to the rated torque of the motor. Note: The effective negative torque limit is the smaller of d1-10 and d1-12.

Param.	Name	Default	Value range	Description
d1-11	Source of torque upper limit 2	0: 800%	0: 800% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of torque upper limit 2, which is the per-unit value based on the rated torque of the motor. d1-11 [Source of torque upper limit 2] is mapped to F2-32 in group F. These two parameters have the same function. Value description: 0: 800% - The positive torque limit is set to 800%. 2: AI1 - The positive torque limit is input by current or voltage signal through AI1 and the corresponding per-unit value is calculated according to the preset AI curve. 3: AI2 - The positive torque limit is input by current or voltage through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The positive torque limit is set through the pulse frequency of the DI7. The corresponding per-unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the positive torque limit source, combinations of different DI states correspond to different negative torque limits. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. The limit is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each frequency reference. Up to 16 speeds can be set. 8: PID - The positive torque limit is set through PID. 9: Communication - The positive torque limit is set through communication. The positive frequency upper limit can be set through remote communication. Other: F connector - The positive torque limit depends on the value of the selected F connector. Note: The effective positive torque limit is the smaller of d1-09 and d1-11.

Param.	Name	Default	Value range	Description
d1-12	Source of torque lower limit 2	1: [Inverted value of the positive frequency upper limit]	0: -800% 1: Inverted value of the positive frequency upper limit 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the torque lower limit 2, which is the per-unit value based on the rated torque of the motor. d1-12 [Source of torque lower limit 2] is mapped to F2-33 in group F. These two parameters have the same function. Value description: 0: -800% - The negative torque limit is set to -800%. 1: Inverted value of positive torque upper limit - The negative torque limit is the inverted value of d1-11. 2: AI1 - The negative torque limit is input by current or voltage signal through AI1 and the corresponding per-unit value is calculated according to the preset AI curve. 3: AI2 - The negative torque limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The negative torque limit is set through the pulse frequency of DI7. The corresponding per-unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference - When multi-reference is used as the torque limit source, combinations of different DI states correspond to different negative torque limits. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operation time and acceleration/deceleration time. The negative torque limit is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each frequency reference and supports up to 16 references. 8: PID - The negative torque limit is set through PID. 9: Communication - The negative torque limit is set through communication. Other: F connector - The negative torque limit depends on the value of the selected F connector. Note: The effective negative torque limit is the smaller of d1-10 and d1-12.

5.3.2.8 Power Limit

Application scenarios

In FVC or SVC control, the power limit can limit the total power output of the motor, which is applicable to applications where the output power of the motor needs to be limited separately.

Operating principles

The power limit is converted to the torque limit internally. As the motor speed increases, the output torque limit decreases due to the power limit.

The following figure describes the difference between the generating power and the motoring power. When the motor speed direction and torque direction are both positive or negative, that is,

when the speed direction and torque direction are consistent, the motor is in the motoring state and is limited by the motoring power limit. When the motor speed direction is positive and the torque direction is negative, or the speed direction is negative and the torque direction is positive, that is, the speed direction is opposite to the torque direction, the motor is in the generating state and is subject to the generating torque limit.

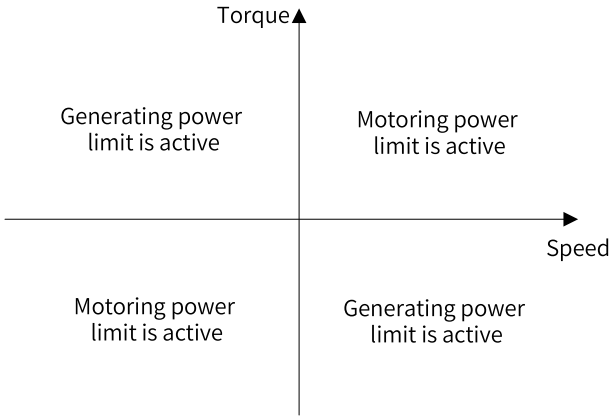


Figure 5-153 Effective range of different power limits

The generating power limit is the smaller of d1-14 [Generating power limit 1] and d1-17 [Generating power limit 2].

d1-15 [Selection of generating power limit 2] defines whether d1-17 [Generating power limit 2] is active, as well as the actual effective range.

When d1-15 [Selection of generating power limit 2] is set to 0 [Inactive], d1-17 [Generating power limit 2] is inactive.

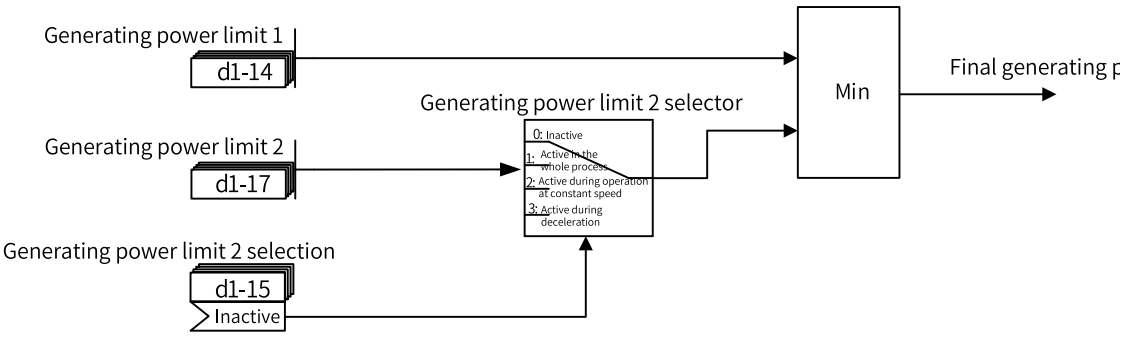


Figure 5-154 Diagram of generating power limit

Related parameters

Param.	Name	Default value	Value range	Description
d1-13	Motoring power limit	400.0%	0.0% to 1000.0%	Used to limit the output power of the motor in the motoring state. The value 100% corresponds to the rated power of the motor.
d1-14	Generating power limit 1	400.0%	0.0% to 1000.0%	Limits the output power of the motor in the generating state. The value 100% corresponds to the rated power of the motor.

Param.	Name	Default value	Value range	Description
d1-15	Selection of generating power limit 2	0 [Inactive]	0: Inactive 1: Active in the whole process 2: Active during operation at constant speed 3: Active during deceleration	Defines whether the motoring power limit 2 is active. Value description: Inactive: Inactive during operation of the motor Active in the whole process: Active during operation of the motor Active during operation at constant speed: Active when the motor operates at constant speed Active during deceleration: Active during deceleration of the motor Note: The smaller of d1-14 [Generating power limit 1] and d1-17 [Generating power limit 2] is applied.
d1-17	Generating power limit 2	20.0%	0.0% to 800.0%	Limits the output power of the motor in the generating state. The value 100% corresponds to the rated power of the motor.

Precautions

The motor power limit is active only in vector control. It is inactive in V/f mode.

5.3.2.9 Overvoltage Suppression (Vector)

Application scenarios

In applications with high inertia or quick deceleration, overvoltage may occur during deceleration. In this case, the motor is in the generating state, which causes the DC bus voltage to rise. In FVC or SVC control, you can enable overvoltage suppression to suppress the rise of the DC bus voltage.

Applications

In the case of short deceleration time and large motor inertia, an overvoltage fault may occur during deceleration or during speed overshoot.

Overvoltage suppression (vector), which is disabled by default, is used to reduce the power generation by suppressing the generating torque to prevent the bus voltage from rising. During suppression, the bus voltage is kept at d1-56 [Actual effective voltage threshold of overvoltage suppression]. You can reduce this threshold through d1-55 [Voltage threshold of overvoltage suppression].

When in the overvoltage suppression phase, a prompt N202.2 Overvoltage suppression activated is displayed, indicating that the system is currently in the overvoltage suppression phase, and the motor speed may not behave as expected compared to normal operation.

If the bus voltage cannot be suppressed, increase d1-57 (Overvoltage suppression Kp adjustment) and d1-58 (Overvoltage suppression Ki adjustment) to limit the generating power and improve the bus voltage control effect.

When other factors, such as an increase in grid voltage, cause an abnormal rise in bus voltage, and the overvoltage suppression function fails to suppress the bus voltage, a continuous speed increase may occur. The overvoltage suppression overspeed detection function is enabled by default. If the

feedback speed exceeds the feedback speed at the moment of entering overvoltage suppression plus the value of d1/d9/y1/y9-53 [Overvoltage suppression overspeed detection threshold], and this condition persists for d1/d9/y1/y9-52 [Overvoltage suppression overspeed detection time], then fault E193.3 Vector overvoltage suppression overspeed fault is reported.

Note

- Set d1-55 to a relatively large value to prevent incorrect trigger in the case of large grid voltage fluctuations. It is better to verify this trigger voltage during application.
- Use the overvoltage suppression function only when the power supply lacks the regenerative capability.
- When using a braking resistor, set the braking voltage to a value lower than the overvoltage suppression voltage threshold or disable overvoltage suppression.
- When a common bus is used, enable overvoltage suppression control of an inverter with the highest inertia, keeping the overvoltage suppression function of others disabled.
- In the torque control mode, take cautions when enabling overvoltage suppression. If the torque cannot adjust the system bus voltage, the torque may be adjusted to the limit value.
- In case of proactive load such as the lifting load, disable the overvoltage suppression function. Because overvoltage suppression will restrict the power generation torque, which may cause motor driven by the load, resulting in serious consequences such as heavy object falling.

Operating principles

When overvoltage suppression is enabled, the actual deceleration speed of the motor is limited by PID control of the bus voltage after the bus voltage exceeds d1-56 [Effective voltage threshold for overvoltage suppression], preventing overvoltage caused by DC bus voltage rise. In this case, the deceleration time can be longer than the set value.

The following figure shows the overvoltage suppression process.

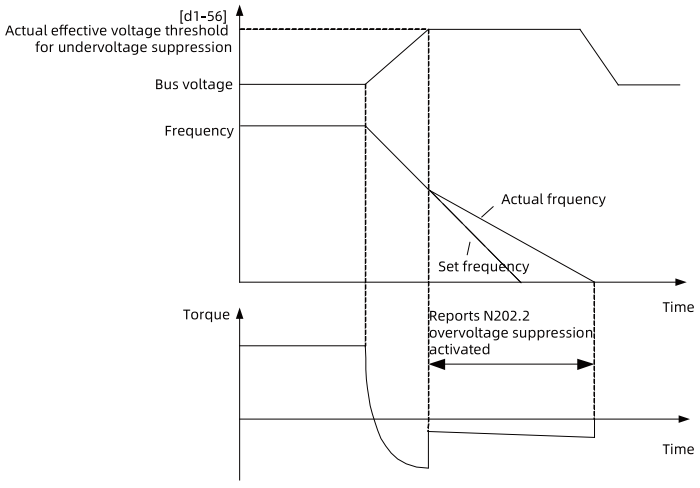


Figure 5-155 Overvoltage suppression control process

Application instance

In applications such as logistics conveyors with rapid start-stop cycles or fans, where the deceleration time is short and the inertia is high, to prevent overvoltage faults during deceleration,

set d1-54 [Overvoltage suppression enable] to 3 to enable overvoltage suppression, keeping the bus voltage near the value set in d1-56 [Effective voltage threshold for overvoltage suppression].

Related parameters

Param.	Name	Default	Value range	Description
d1-52	Overvoltage suppression overspeed detection time	50 ms	0 ms to 10000 ms	If the feedback speed exceeds the feedback speed at the moment of entering overvoltage suppression plus the value of d1/d9/y1/y9-53 [Overvoltage suppression overspeed detection threshold], and this condition persists for d1/d9/y1/y9-52 [Overvoltage suppression overspeed detection time], then fault E193.3 Vector overvoltage suppression overspeed fault is reported.
d1-53	Overvoltage suppression overspeed detection threshold	20%	0% to 100%	If the feedback speed exceeds the feedback speed at the moment of entering overvoltage suppression plus the value of d1/d9/y1/y9-53 [Overvoltage suppression overspeed detection threshold], and this condition persists for d1/d9/y1/y9-52 [Overvoltage suppression overspeed detection time], then fault E193.3 Vector overvoltage suppression overspeed fault is reported.
d1-54 (F2-39)	Overvoltage suppression enable	1 [Enable]	bit0: Overvoltage suppression enable in V/f mode • 0: Disable • 1: Enable bit1: Overvoltage suppression enable in vector control mode • 0: Disable • 1: Enable	Sets whether overvoltage suppression is enabled. F2-39 is the same parameter as d1-54. After F2-39 is modified, d1-54 is updated synchronously.
d1-55 (F2-40)	Voltage threshold for overvoltage suppression	770.0 V	600.0 V to A3-57	Sets the DC bus voltage at which overvoltage suppression becomes active. The actual effective value is displayed in d1-56. F2-40 is the same parameter as d1-55. After F2-39 is modified, d1-54 is updated synchronously.
d1-56	Actually effective action voltage of overvoltage suppression	770.0 V	600.0 V to A3-57	Displays the actual effective voltage for triggering overvoltage suppression. This parameter is automatically obtained by the system and cannot be modified. When the bus voltage is greater than d1-56, overvoltage suppression function is activated.

Param.	Name	Default	Value range	Description
d1-57	Overvoltage suppression Kp adjustment	100%	0% to 1000%	Defines the proportional coefficient of the overvoltage suppression control loop. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.
d1-58	Overvoltage suppression Ki adjustment	100%	0% to 1000%	Defines the integral coefficient of the overvoltage suppression control loop. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.

5.3.2.10 Undervoltage Suppression (Vector)

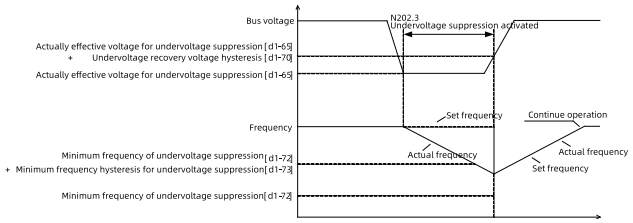
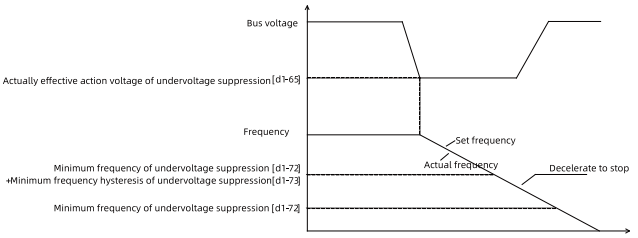
Application scenarios

When the power supply or DC bus encounters instantaneous power failure in FVC or SVC mode, undervoltage can occur if the fault is not handled timely, which can cause the motor to coast to stop. After undervoltage suppression function is enabled, undervoltage can be suppressed in a short period of time, preventing stop upon instantaneous power failure. When the power supply or DC bus encounters long-term power failure, you need to enable undervoltage suppression to compensate for the bus energy loss until all motors stop reliably.

Operating principles

After the bus voltage falls below the undervoltage suppression threshold, the motor decelerates and enters the generating state to compensate for energy loss, stabilizing the voltage in the DC bus.

Undervoltage suppression	Decelerate to stop
When d1-63 [Action upon undervoltage] = 1 [Undervoltage suppression] / 3 [Undervoltage suppression with time limit setting]	When d1-63 [Action upon undervoltage] = 2 [Decelerate to stop]
When the bus voltage falls below d1-65 [Actually effective action voltage of undervoltage suppression], and the running frequency is higher than d1-72 [Minimum frequency of undervoltage suppression (vector)] plus d1-73 [Minimum frequency hysteresis for undervoltage suppression (SVC)], undervoltage suppression begins.	When the bus voltage falls below d1-65 [Actually effective action voltage of undervoltage suppression], the drive decelerates to stopaccording to d1-69 [Decelerate-to-stop time at undervoltage].
When the bus voltage is higher than d1-72 upon recovery of the bus voltage, the drive accelerates to the speed set originally based on the set acceleration time after the bus voltage is recovered.	The drive remains in the stop state upon bus voltage recovery until the stop process is done.
When the undervoltage action is set to 3 [Undervoltage suppression with time limit setting], the maximum duration of undervoltage suppression is limited to d1-68. After the undervoltage suppression time exceeds the duration, the system stops immediately and reports fault E193.2: Undervoltage suppression timeout.	

Undervoltage suppression	Decelerate to stop
	
Figure 5-156 Undervoltage suppression applied, normal operation resumes after voltage recovery	Figure 5-157 Undervoltage action is set to deceleration stop, normal stop occurs after voltage recovery.

- When the action upon undervoltage is enabled, if the operating frequency is higher than the sum of d1-72 [Minimum frequency of undervoltage suppression (vector)] and d1-73 [Minimum frequency hysteresis of undervoltage suppression (vector)] at the moment when undervoltage occurred, the undervoltage suppression limit violation fault can be reported if the bus is not recovered when the operating frequency reaches d1-72 [Minimum frequency of undervoltage suppression (vector)].
- When the action upon undervoltage is enabled, if the operating frequency is lower than the sum of d1-72 [Minimum frequency of undervoltage suppression (vector)] and d1-73 [Minimum frequency hysteresis of undervoltage suppression (vector)] at the moment when undervoltage occurred, undervoltage suppression does not apply and the operation continues until the bus voltage falls below A3-56 [Undervoltage threshold] where an undervoltage fault is reported and the drive stops accordingly.

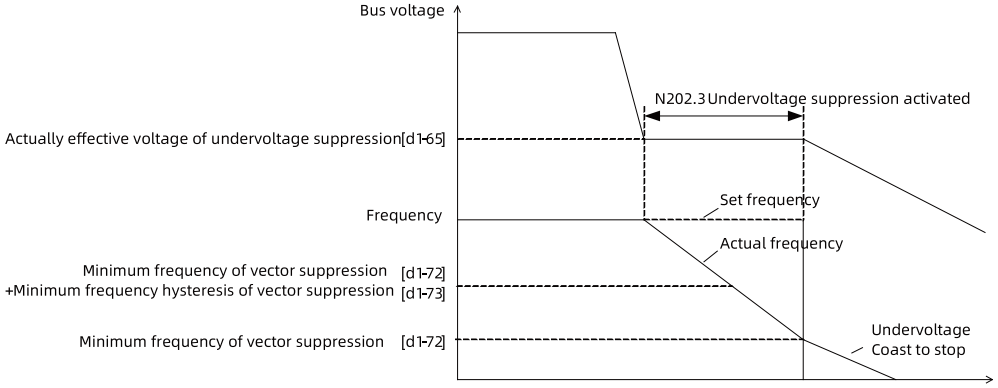


Figure 5-158 When undervoltage is suppressed, running frequency lower than minimum frequency of undervoltage suppression

Note

Set d1-64 to a relatively small value to prevent incorrect trigger in the case of large grid voltage fluctuations. It is better to verify this trigger voltage during application.

Application instance

When the grid voltage is unstable, undervoltage that causes stop may easily occur, leading to process issues. In this case, enable undervoltage suppression through d1-63 to decelerate the motor, stabilizing the bus voltage.

To maintain operation after the DC bus voltage drops and resume normal operation once the voltage recovers, set d1-63 to 1. Normal operation can resume when the bus voltage recovers before the speed drops to the minimum frequency.

To maintain operation after the DC bus voltage drops and resume normal operation once the voltage recovers, while limiting the duration of abnormal operation, set D1-63 to 3: Set d1-63 to 3, If the speed does not drop below the minimum frequency and the undervoltage suppression operation time does not exceed d1-68, normal operation resumes after the bus voltage recovers.

Note that after exceeding the time limit, the system stops immediately and reports fault E193.2: Undervoltage suppression timeout.

To stop normally after bus voltage abnormality and wait for manual restart, set d1-63 to 2. The drive immediately decelerates to stop upon bus voltage abnormality. d1-69 should be adjusted appropriately to ensure that the generated torque maintains the bus voltage above the undervoltage level during deceleration.

When undervoltage suppression is active, the motor enters the deceleration and power generation state and to keep the bus volatge at d1-65. If you want the bus voltage to maintain at a higher level, increase the value of d1-64.

When in undervoltage suppression stage, a prompt N202.3 Undervoltage suppression activated is displayed, reminding that the system is currently in the undervoltage suppression stage, and motor speed behavior may differ from normal operation expectations.

If the bus voltage cannot be maintained when the load inertia is appropriate and the power generation is normal, increase d1-66 and d1-67.

In some special application scenarios, when the bus voltage drops into the undervoltage suppression state, abnormal load actions may cause continuous speed increase. The undervoltage suppression overspeed detection is enabled by default. If the feedback speed exceeds the feedback speed at the moment of entering undervoltage suppression plus the value of d1/d9/y1/y9-75 [Undervoltage suppression overspeed detection threshold], and this condition persists for d1/d9/y1/y9-74 [Undervoltage suppression overspeed detection time], then fault E193.3 Vector undervoltage suppression overspeed fault is reported.

Related parameters

Param.	Name	Default	Value range	Description
d1-63 (F2-43)	Action upon undervoltage	Three	0: Not respond 1: Undervoltage suppression applied, normal operation resumes after voltage recovery 2: Decelerate to stop after voltage recovery 3: Undervoltage suppression with time limit setting	Defines the response when the bus voltage reaches the undervoltage suppression threshold due to power failure. d1-63 [Response upon undervoltage] is mapped to F2-43 in group F. These two parameters have the same function. 0: Not respond 1: Maintains the bus at the undervoltage suppression point through motor deceleration and energy feedback, keeping the motor running for a short period without stopping. If the bus voltage is restored during this period, the motor restores to the target speed according to the acceleration time. 2: Decelerate to stop - When the bus voltage fall below the undervoltage suppression threshold, the motor decelerates to stop based on the deceleration time defined by d1-69. If the bus voltage is recovered during this period, the motor still stops. 3: Undervoltage suppression with time limit setting - Maintains the bus at the undervoltage suppression point through motor deceleration and energy feedback, keeping the motor running for a short period without stopping. After continuously running for the set time of d1/d9/y1/y9-68, an immediate shutdown will trigger the E193.2 undervoltage suppression timeout fault.
d1-64 (F2-44)	Undervoltage suppression action voltage reference	430.0 V	A3-55 to 500.0 V	Defines the voltage threshold for triggering undervoltage suppression. d1-64 [Voltage threshold of undervoltage suppression] is mapped to F2-44 in group F. These two parameters have the same function. Note: Defines the response when the bus voltage is lower than the undervoltage suppression threshold due to power failure.
d1-65	Actually effective action voltage of undervoltage suppression	430.0 V	A3-55 to 500.0 V	Displays the actual effective voltage that triggers undervoltage suppression. This is a read-only variable that cannot be modified.
d1-66	Undervoltage suppression Kp adjustment	100%	0% to 1000%	Defines the proportional coefficient of the undervoltage suppression control loop, which is a percentage to Kp. Kp is calculated through loop calculation. Increasing this setpoint improves the dynamic characteristics of the bus voltage. Note that an excessively high setpoint can result in fluctuation, oscillation, or even unusual noise. A low Kp value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Kp gain is calculated through loop calculation, which is the product of Kp and d1-66 [Undervoltage suppression Kp adjustment].

Param.	Name	Default	Value range	Description
d1-67	Undervoltage suppression Ki adjustment	100%	0% to 1000%	Defines the proportion coefficient of the undervoltage suppression control loop, which is a percentage to Ki. Ki is calculated through the loop calculation. Increasing this setpoint improves the dynamic characteristics of bus voltage. A high Ki value can result in output frequency fluctuation. When the output frequency fluctuates greatly during undervoltage suppression, reduce this setpoint properly. A low Ki value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Ki gain is calculated through the loop calculation, which is the product of Ki and d1-67 [Undervoltage suppression Ki adjustment].
d1-68	Maximum undervoltage suppression time	1.0s	0.1s to 600.0s	Defines the maximum operating time during undervoltage suppression. Note: When the value of d1-63 is set to 3 or 1, and the bit1 of d1-76 is set to enabled; After the undervoltage suppression time exceeds the duration, the system reports fault E193.2: Undervoltage suppression timeout.
d1-69	Decelerate-to-stop time at undervoltage	20.0s	0.0s to 300.0s	Defines the time for decelerating to stop during undervoltage suppression. This function is activated when the action upon undervoltage suppression is set to “2-Decelerate to stop” .
d1-70	Undervoltage recovery voltage hysteresis	30 V	1 V to 100 V	Defines the voltage hysteresis when the bus voltage recovers from undervoltage suppression state. Note: In the undervoltage suppression state, when the bus voltage exceeds the sum of d1-65 [Voltage threshold for undervoltage suppression] and d1-70 [Voltage hysteresis for recovering from undervoltage], the bus voltage is recovered. The undervoltage suppression state will be canceled in vector control mode. In the V/f control mode, when the time defined by d1-71 [Waiting time for recovering from undervoltage (V/f)] elapses, the undervoltage suppression state will be canceled.
d1-72	Minimum frequency of undervoltage suppression (vector)	3.00 Hz	0.00 Hz to 10.00 Hz	Defines the minimum frequency of undervoltage suppression in SVC mode. Note: The undervoltage suppression state can be applied only when the actual speed is higher than the sum of d1-72 [Minimum frequency for undervoltage suppression] and d1-73 [Minimum frequency hysteresis for undervoltage suppression]. When the speed during undervoltage suppression is lower than d1-72 [Minimum frequency for undervoltage suppression], E193.1 [Undervoltage suppression limit arrival] will be reported.

Param.	Name	Default	Value range	Description
d1-73	Minimum frequency hysteresis for undervoltage suppression (SVC)	3.00 Hz	0.00 Hz to 10.00 Hz	Defines the minimum frequency hysteresis of undervoltage suppression in vector mode. Note: The undervoltage suppression state can be applied only when the actual speed is higher than the sum of d1-72 [Minimum frequency for undervoltage suppression] and d1-73 [Minimum frequency hysteresis for undervoltage suppression]. When the speed during undervoltage suppression is lower than d1-72 [Minimum frequency for undervoltage suppression], E193.1 [Undervoltage suppression limit arrival] will be reported.
d1-74	Undervoltage suppression overspeed detection time	50 ms	0 ms to 10000 ms	If the feedback speed during undervoltage suppression exceeds the feedback speed at the moment of entering undervoltage suppression plus the value of d1/d9/y1/y9-75 undervoltage suppression overspeed detection threshold, and this condition persists for the duration of d1/d9/y1/y9-74 undervoltage suppression overspeed detection time, fault 193.3 vector undervoltage suppression overspeed will be reported.
d1-75	Undervoltage suppression overspeed detection threshold	20%	0% to 100%	If the feedback speed during undervoltage suppression exceeds the feedback speed at the moment of entering undervoltage suppression plus the value of d1/d9/y1/y9-75 undervoltage suppression overspeed detection threshold, and this condition persists for the duration of d1/d9/y1/y9-74 undervoltage suppression overspeed detection time, fault 193.3 vector undervoltage suppression overspeed will be reported.

5.3.2.11 Flux control

5.3.2.11.1 Flux control

5.3.2.11.2 Field Weakening Control of Asynchronous Motor

Application scenarios

In FVC or SVC control, field weakening control of the asynchronous motor is triggered when the acceleration process of the motor requires a voltage output capacity higher than the maximum value or the bus voltage is insufficient to support current operating speed.

Operating principles

When the motor operating speed increases, the back EMF increases accordingly. When the back EMF exceeds the maximum output voltage, the drive cannot adjust the current, which means the motor is out of control. In this case, you can reduce the magnetic flux to reduce the back EMF and prevent motor runaway, so that the motor speed can be increased.

1. First, the maximum available voltage is calculated based on the bus voltage, and a voltage margin (d5-00) is reserved to ensure the current regulation capability. The maximum output voltage is calculated as follows.

$$V_{max} = \frac{\textit{Bus voltage}}{\sqrt{2}}(100\% - [\mathrm{d5-00}])$$

The voltage margin for field weakening (d5-00) can be adjusted manually when the output voltage capability is insufficient.

2. Second, when the maximum output voltage is reached and the output frequency continues to increase, the field weakening range is entered. In this case, the back EMF is reduced based on the set magnetic flux according to the built-in curve, preventing motor runway during high-speed operation.
   When the output frequency enters the field weakening range, set the flux according to the following curve to reduce the back EMF, preventing motor runway during high-speed operation.

$$\Psi_{set} = \begin{cases} \Psi_N & \cdots\cdots f_{syn} < f_N \\ \Psi_N \dfrac{f_N}{f_{syn}} & \cdots\cdots f_{syn} \geqslant f_N \end{cases}$$

Ψ_N , Ψ_{set}: Rated magnetic flux and magnetic flux setpoint;

f_N , f_{syn}: Rated frequency and output frequency

As shown in the following figure, the output voltage (Vout) has reached the maximum output voltage (Vmax). The frequency continues to increase and enters the field weakening range. After entering this range, the flux decreases and the output voltage (Vout) no longer increases.

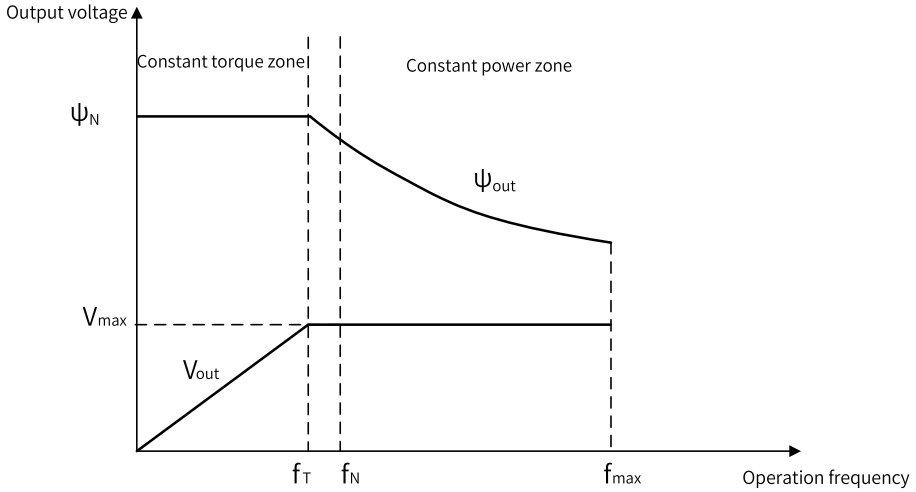


Figure 5-159 Flux frequency characteristics of the motor under voltage constraints

3. Finally, after the maximum output voltage is known, you can get the final flux reference in the field weakening phase shown in the following figure.
   Rated flux of the motor x Rated flux tuning factor = Actual applied flux of motor

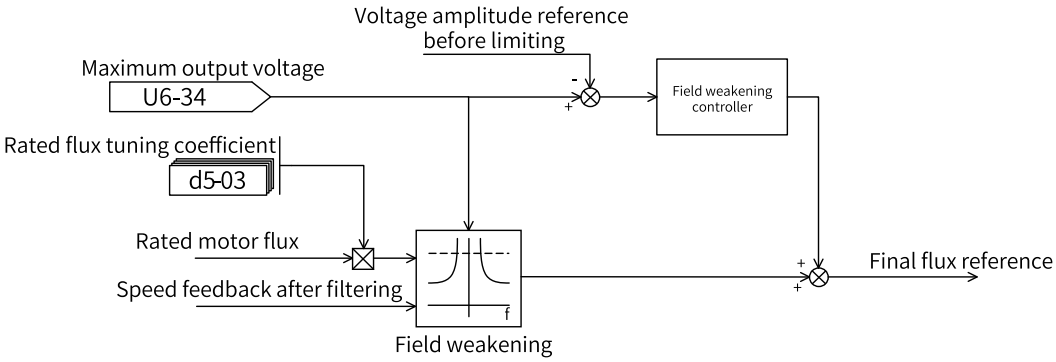


Figure 5-160 Calculation process for final flux reference

Related parameter

Param.	Name	Default	Value range	Description
d5-00	Voltage margin for field weakening through adjustment	3.0%	0.1% to 50.0%	Defines the voltage margin for field weakening. Note: Decreasing this value improves voltage utilization, allowing lower current at the same load in the field weakening range. Note that an excessively low setpoint can affect dynamic performance.
d5-03	Rated flux tuning factor	100.0%	50.0% to 200.0%	Defines the flux tuning factor of the asynchronous motor. Note: This parameter is used to adjust the operation flux of the asynchronous motor. Decreasing the setpoint can cause the motor to enter the under-excitation state. Increasing the setpoint can cause the motor to enter the over-excitation state.

Precautions

Do not set the reserved voltage margin (d5-00) to an excessively high value. Otherwise, the load capacity of the motor at high speed can be affected.

5.3.2.11.3 Field Weakening Control of Synchronous Motor

Application scenarios

In FVC or SVC control, field weakening control of the synchronous motor is triggered when the acceleration process of the motor requires a voltage output capacity higher than the maximum value or when the bus voltage is insufficient to support current operating speed.

Operating principles

The motor back EMF increases with the operating speed of the motor. When the back EMF exceeds the maximum voltage that can be output by the drive, the synchronous motor enters field weakening control. In the field weakening control mode, the synchronous motor reduces the flux linkage of the motor stator through increasing the demagnetization current, which also reduces the motor back EMF voltage. Increasing the demagnetization current of the synchronous motor can

result in an increase in the motor output current. The higher the motor speed, the higher the demagnetization current can be.

Related parameter

Param.	Name	Default	Value range	Description
d5-00	Voltage margin for field weakening	3.0%	0.1% to 50.0%	Defines the voltage margin for field weakening. Note: Decreasing this value improves voltage utilization, allowing lower current at the same load in the field weakening range. Note that an excessively low setpoint can affect dynamic performance.
d5-17	Demagnetization current limit	300%	0% to 500%	Used to limit the demagnetization current range of synchronous motors to prevent faults such as overload. The value 100% corresponds to the rated current of the motor.

5.3.2.12 Energy-Saving Control (Vector)

Application scenarios

In applications requiring high energy conservation, you can enable energy-saving control in FVC or SVC mode to reduce the energy consumption during no-load or low-load operation of the asynchronous motor.

Operating principles

Energy consumption during no-load and low-load operation of the asynchronous motor can be reduced through reducing the excitation current of the motor.

The following figure shows the energy-saving control function.

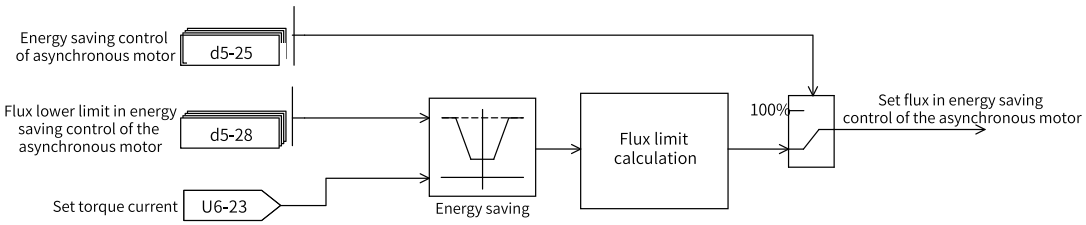


Figure 5-161 Energy-saving control

Related parameter

Param.	Name	Default	Value range	Description
d5-25	Asynchronous motor energy-saving control	0 [Disable]	0: Disable 1: Enable	Defines whether to enable energy-saving control for the asynchronous motor in the vector control mode. Value description: 0: Disable - Energy-saving control is disabled. 1: Enable - Energy-saving control is enabled. Note: After energy-saving control is enabled, the current in no-load or low-load mode can be reduced.
d5-28	Flux lower limit in energy-saving control of asynchronous motor	50.0%	10.0 % to 100.0%	Defines the flux lower limit in energy-saving control of the asynchronous motor. Note: Defines the minimum flux linkage allowed in energy-saving control. The lower the value, the more energy will be saved at no load. However, this can affect the dynamic response after loaded.

Precautions

The function is applicable to application with stable loads. In applications where the sudden loading/unloading occurs frequently, enable this function with caution.

5.3.2.13 Overexcitation

Application scenarios

For high-inertia loads, over-excitation gain in the vector control mode can speed up motor deceleration.

Operating principles

Increasing the over-excitation current helps consume the excess energy on the motor, which can accelerate deceleration. After over-excitation is enabled, over-excitation control is activated in the motor power generation state.

Related parameters

Param.	Name	Default value	Value range	Description
d0-39	Over-excitation selection (vector)	0 [Inactive]	0: Inactive 1: Active	Defines whether over-excitation is enabled in vector control.
d0-40	Over-excitation current (vector)	100%	0% to 800%	Defines the target current after over-excitation is activated in vector mode, where the value 100% corresponds to the rated current of the motor.

Precautions

The higher the over-excitation current, the quicker the motor deceleration can be. However, over-excitation in the vector control mode can increase the output current of the drive and motor loss.

5.3.2.14 Current Loop

Application scenarios

In the FVC or SVC control mode, the current loop acts as the regulator of the inner loop, which makes the output current follow the reference current closely. The reference current is the output value of the outer loop regulator. Ensure that the maximum allowable current is obtained during dynamic speed change to accelerate dynamic response.

Operating principles

General principles:

The PID output of the speed loop is the input of the current loop. The output current of the drive is inputted as negative feedback. The difference between the input and feedback is inputted to the PI controller of the current loop to adjust the final voltage output, achieving current control to improve current stability and system performance.

Current loop parameters are auto-tuned without the need of modification.

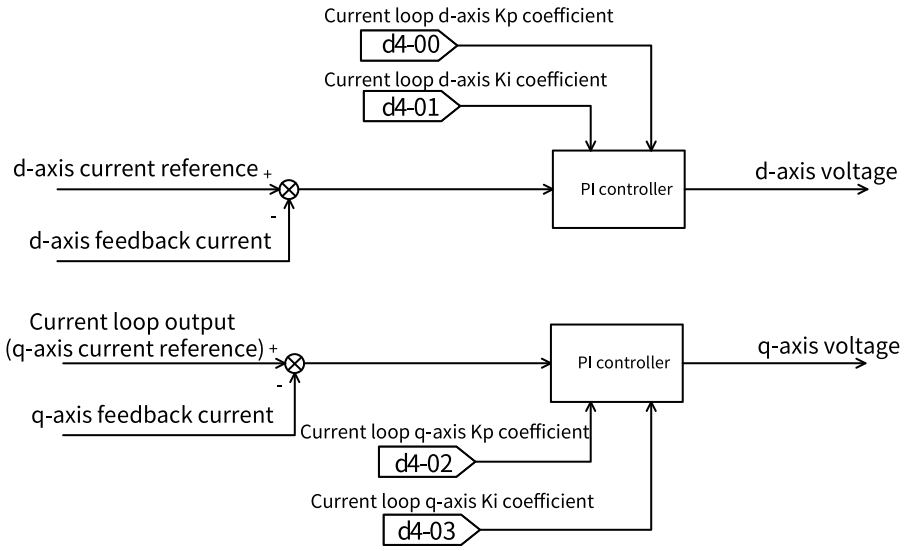


Figure 5-162 Current loop diagram

Adaptive PI parameter of current loop:

Adaptive PI parameters for current loop are suitable for adaptive adjustment of current loop parameters under heavy-duty conditions.

When the current exceeds d4-06 [Adaptive lower limit of current loop Kp] but lower than or equal to d4-05 [Adaptive upper limit of current loop Kp], the effective d-axis Kp coefficient and q-axis Kp coefficient in the current loop are obtained through calculation. Calculation method: The adaptive coefficient is calculated linearly based on the actual current. The effective d-axis Kp coefficient and

q-axis Kp coefficient is the product of the adaptive coefficient and Kp coefficient setpoint (d4-00 and d4-02).

When the current exceeds d4-05 [Adaptive upper limit of current loop Kp], the effective d-axis Kp coefficient of the current loop is the product of d4-00 [Current loop d-axis Kp coefficient] and d4-04 [Adaptive upper limit coefficient of current loop Kp], and the q-axis Kp coefficient is the product of d4-02 [Current loop q-axis Kp coefficient] and d4-04 [Adaptive upper limit coefficient of current loop Kp].

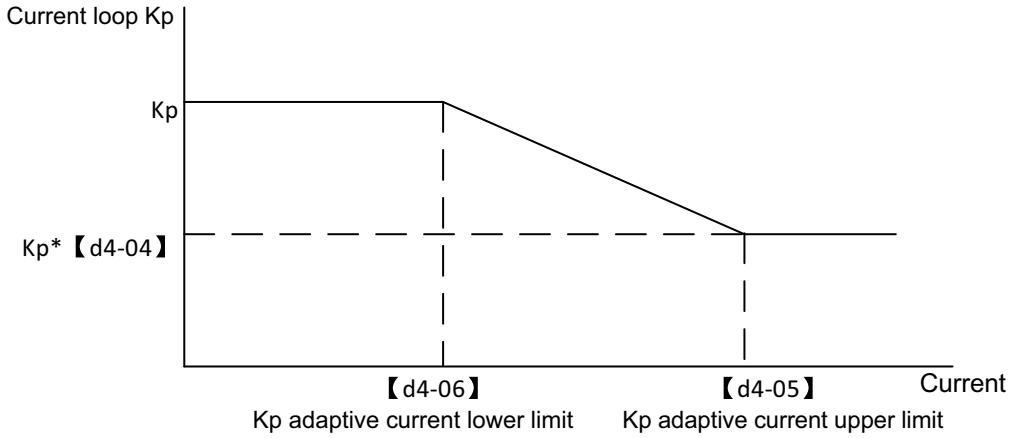


Figure 5-163 Adaptive Kp of current loop

Application instance

In heavy-duty applications, current oscillation may occur due to excessively high current loop parameters. In this case, you can limit the current loop parameters through d4-05 and d4-06 after the current exceeds d4-05, and adjust the intensity of the current loop through d4-04, helping restore the current loop to the normal operation state.

Related parameters

Param.	Name	Default value	Value range	Description
d4-00	Current loop d-axis Kp coefficient	100%	1 to 1000 %	Defines the d-axis Kp coefficient of the current loop. Note: The higher the value, the faster the torque response. However, an excessively high setpoint may cause current oscillation.
d4-01	Current loop d-axis Ki coefficient	100%	1 to 1000 %	Defines the d-axis Ki coefficient of current loop. Note: The higher the value, the faster the torque response. However, an excessively high setpoint may cause current oscillation.
d4-02	Current loop q-axis Kp adjustment	100%	1 to 1000 %	Defines the q-axis Kp coefficient of the current loop. Note: The higher the value, the faster the torque response. However, an excessively high setpoint may cause current oscillation.

Param.	Name	Default value	Value range	Description
d4-03	Current loop q-axis Ki adjustment	100%	1 to 1000 %	Defines q-axis Ki coefficient of the current loop. Note: The higher the value, the faster the torque response. However, an excessively high setpoint may cause current oscillation.
d4-04	Kp adaptive upper limit coefficient of current loop	50%	1 to 100 %	Defines the Kp adaptive upper limit coefficient of current loop.
d4-05	Kp adaptive current upper limit of current loop	200%	d4-06 to 300%	Defines the adaptive current upper limit of current loop.
d4-06	Kp adaptive current lower limit of current loop	100%	10% to d4-05	Defines the adaptive current lower limit of current loop.

5.3.2.15 Droop control

Application scenario

In working conditions such as belt conveyor transmission, roller bed transmission, and continuous casting machines, when multiple motors drive the same load together, a slight deviation occurs between the motors even at the same speed reference due to different mechanical behaviors. In addition, the output torque is much different, and even motors may drive each other.

Description

Droop control can be applied to all motors to enable automatic balanced load distribution between motors, requiring no communication between motors. The motor with a high speed carries more torque. The speed reference of the motor is reduced automatically through negative feedback, achieving torque distribution to other motors.

Droop control characteristics:

- Simple application, without need for communication between motor controllers.
- Multiple motors can be connected rigidly or flexibly to drive the same load.
- When redundant operation is needed in the case of multiple motors, the faulty device can be stopped easily without affecting operation of other devices.
- The adjustment range of the speed is generally not greater than the rated motor slip.
- The speed cannot be followed accurately. The steady-state error is present between the actual speed and speed reference. The difference value is in proportion to the load.
- Accurate load distribution is not available during dynamic process.

Working principles

Droop control is a control method that uses the output torque of the motor to generate negative feedback, reducing the motor speed reference. See the block diagram below.

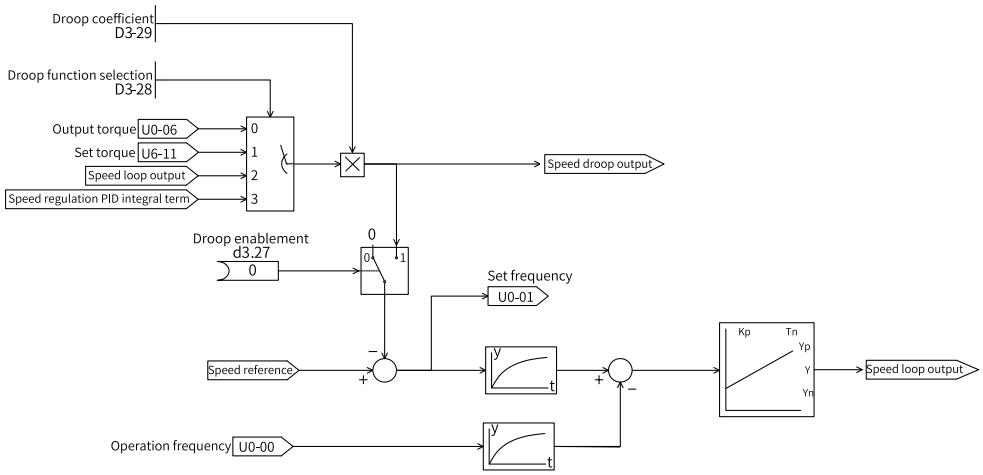


Figure 5-164 Block diagram of droop control

Four droop sources are available in droop control, which are output torque, torque reference, speed loop output, and speed loop Ti term output. The droop source can be set through d3-28. The relationship among the four droop sources is shown in the following diagram.

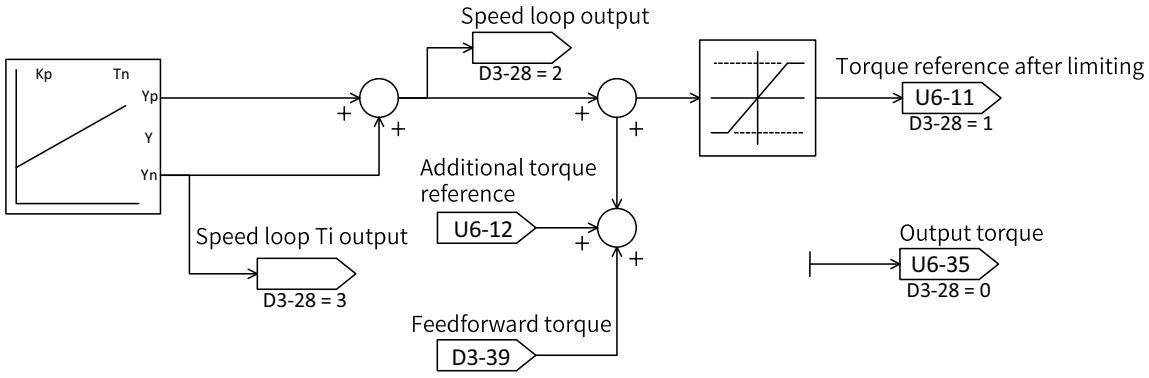


Figure 5-165 Four different droop sources

Application case

In a marine elevating platform, 12 motors are connected to the same rack through the gearbox (reduction ratio 80:1), and the rack is welded to the jack-up leg. The host controller uses the PLC to set different speeds to raise the jack-up leg. Difference in the manufacturing of the gearbox and rack can result in the situation where some motors are connected tightly but some motors need to run for a certain period of time to come into contact with the rack.

In general speed control mode, the motor output with good contact is in overload state, and the motor with poor contact is in no output state, or its load is pulled in reverse direction. The motor reducer that runs under heavy duty for a long time may be easily damaged, leading to a fault.

In this case, the output speed accuracy and dynamic response requirements are not high. However, the system must be reliable if the motor or AC drive is damaged. This can be achieved by using the droop function.

Operation procedure:

1. Enable droop function for all AC drives by setting d3-27 to 1.
2. Set d3-29 to a value equal to the rated slip of the motor.

Related parameters

Param.	Name	Default	Value range	Description
d3-27	Droop function	0	0 to 1	Set whether the droop function of speed control is enabled. Value description: 0:Disable 1:Enable Note: In applications where multiple motors drive the same load, enabling this function can affect the speed control accuracy during load distribution of multiple motors.
d3-28	Droop source	1	0 to 3	Defines the droop source. Droop speed change = Motor rated power × Droop source × Droop coefficient. The unit of droop speed change is Hz. Value description: 0: Output torque - The actual output torque of the motor is used as the droop source. 1: Torque reference - The final torque reference of the motor is used as the droop source. 2: Speed regulator output - The output of the speed loop is used as the droop source. 3: Integral component of speed regulator - The integral item of the speed loop is used as the droop source. Note: This parameter can be set to 0 only in V/f control mode.
d3-29	Droop coefficient	0.0%	0.0% to 50.0%	Sets the droop coefficient. The higher the droop coefficient, the better the droop performance is, but an excessively high setpoint can affect the speed accuracy and lead to speed oscillation. Note: Droop speed change = Motor rated power × 3-28 (Droop speed change source) × d3-29 (Droop coefficient). The unit of droop speed change is Hz.

5.3.3 Asynchronous Motor V/f Control

5.3.3.1 Function List

Function type	Name	Description	Link
Asynchronous motor V/f control	V/f curve selection	V/f curves come in three types: linear V/f, multi-point V/f, and decoupled V/f, which can be selected as needed.	"5.3.3.3 V/f Curve Selection" on page 529
	Overvoltage suppression in V/f mode	Applies to applications with high inertia or rapid deceleration. Enabling overvoltage suppression can suppress the rise in DC bus voltage and prevent overvoltage.	"5.3.3.4 Overvoltage Suppression in V/f" on page 533
	Undervoltage suppression in V/f mode	Applies in cases where a brief power outage or DC bus power interruption occurs. Enabling undervoltage suppression can compensate for energy loss on the bus and prevent undervoltage.	"5.3.3.5 Undervoltage Suppression in V/f Mode" on page 535
	Overcurrent suppression in V/f mode	Used to reduce output frequency to lower output current, thereby preventing the output current from exceeding the overcurrent suppression threshold.	"5.3.3.6 Overcurrent Suppression in V/f Mode" on page 538
	Oscillation suppression in V/f mode	During motor operation, mechanical resonance causes system oscillation. Enable oscillation suppression for a better control effect.	"5.3.3.7 Oscillation Suppression in V/f Mode" on page 540
	Torque boost in V/f mode	Used to compensate the voltage loss on the stator resistance to improve the load capacity of the motor during low-speed operation.	"5.3.3.8 V/f Torque Boost" on page 541
	Slip compensation in V/f mode	Used to compensate speed drop of an asynchronous motor when the load increases, so that the motor speed can remain stable when the load changes. It can improve the speed control accuracy in V/f mode.	"5.3.3.9 Slip Compensation in V/f Mode" on page 543
	Energy-saving control in V/f mode	Used to reduce the output current in low-load applications to achieve energy-saving purpose. It can be used in applications such as fans, pumps, and air compressors where load changes are slow.	"5.3.3.10 Energy-saving Control in V/f Mode" on page 544
	Droop control in V/f mode	Applies to applications where the load is driven by multiple motors, allowing automatic balanced load distribution between motors without motor-to-motor communication.	"5.3.3.11 Droop Control in V/f Mode" on page 544
	No pulse generation at zero speed in V/f mode	Used to reduce interference generated from the drive. This function stops PWM pulse output when the speed is below the set threshold, thereby improving the system's EMC performance in low-speed scenarios with severe interference.	"5.3.3.12 Pulse Generation Inhibition at Zero Speed in V/f Mode" on page 546
	Overexcitation	Used to accelerate the motor deceleration process.	"5.3.3.13 Over-excitation" on page 547

5.3.3.2 Control Mode

Application scenario

The V/f control mode is applicable to asynchronous motor control applications.

Working principles

The frequency reference curve is regulated through droop control algorithm based on the user-defined speed reference curve. This curve, after being regulated through overcurrent suppression, overcurrent suppression, undervoltage suppression, and slip compensation, generates the final output frequency. This output frequency, after being regulated through the V/f curve, generates the output voltage reference. The final voltage magnitude is outputted after being regulated through energy-saving control and over-excitation control. The output frequency, after being regulated through oscillation suppression, is converted to the final frequency reference. The final frequency reference is then regulated through the integral action to generate the voltage phase angle to be outputted to the drive.

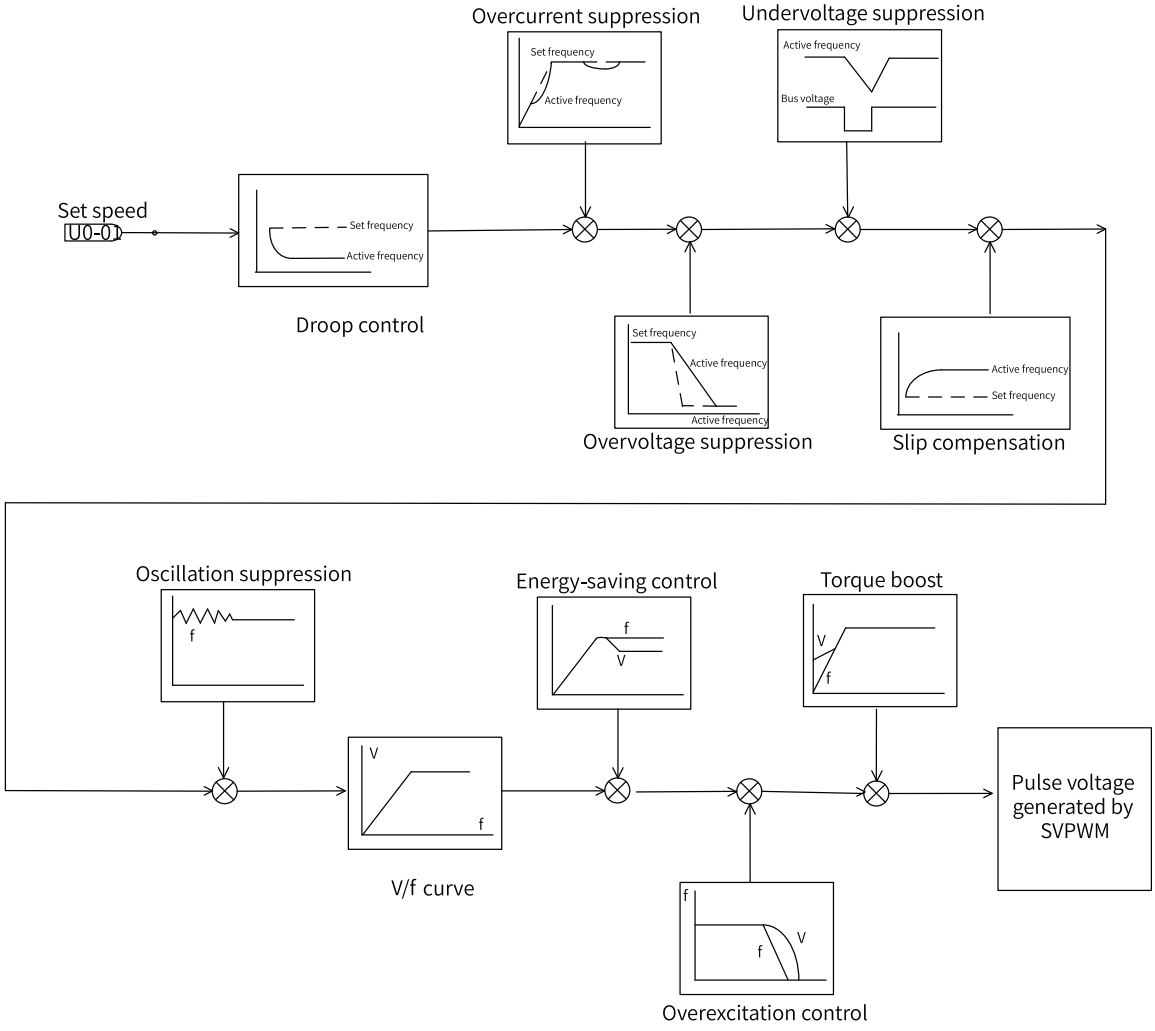


Figure 5-166 Schematic diagram of V/f control mode

5.3.3.3 V/f Curve Selection

Application scenarios

There are three types of V/f curves:

1. Linear V/f: When the motor runs at frequencies lower than the rated frequency, a linear relationship is kept between the output voltage and the frequency. It is applicable to common constant-torque load.
2. Multi-point V/f curve: It is applicable to special loads such as dehydrators and centrifuges. The relationship between the voltage and frequency points can be set based on the motor characteristics.
3. Decoupled V/f: It is applicable to induction heating, inverter power supply, and torque motor control. In this mode, the output voltage of the drive is independent of the frequency. You can set the output frequency and output voltage as needed.

Working Principle

1. Linear V/f. When the motor runs at frequencies lower than the rated frequency, a linear relationship is kept between the output voltage and the frequency.
2. Multi-point V/f curve. You can set d2-02...d2-10 to define the V/f curve frequency point and voltage point. The multi-point V/f curve needs to be set according to the motor load characteristics. The three voltage points and frequency points should meet the following conditions: V1 ≤ V2 ≤ V3 and f1 < f2 < f3. Different voltage and frequency points are connected by a polyline.
3. Decoupled V/f. The output frequency is determined by the frequency source. The output voltage is set by d2-48. If the set decoupled voltage changes, you can set the V/f decoupled voltage ramp-up/down time through d2-50/d2-51 to prevent sudden voltage change. You can set the frequency source through d2-52 [RFG time selection for V/f decoupled frequency] to determine whether the frequency source reaches the setpoint per a carrier frequency cycle or per the ramp-up/down curve.
4. V/f partially separated. In this mode, the voltage and frequency are proportional, which can be set through the voltage source. The relationship between the voltage and frequency is also related to the rated motor voltage and rated motor frequency. Assume that the voltage source input is X (0 to 100%), the relationship between V and f is: V/f = 2 x X x (Rated motor voltage)/(Rated motor frequency)

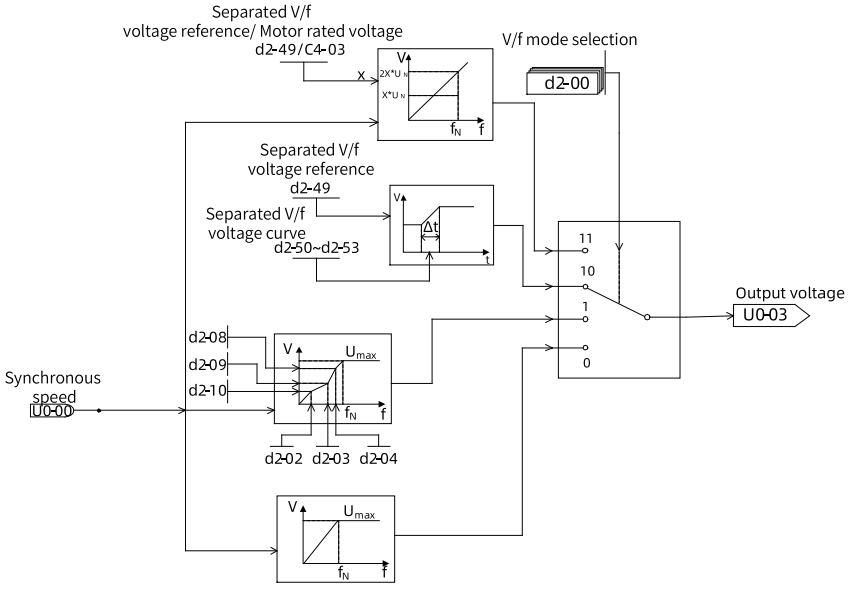


Figure 5-167 Operating principle of V/f curve

Note: F_N indicates the set frequency, and U_{max} indicates the maximum output voltage.

Note

In decoupled V/f and multi-point V/f control, note that the ratio of V/f cannot be excessively high. Otherwise, overcurrent may occur. For example, if voltage is set without a frequency reference, overcurrent may easily occur.

Related parameters

Param.	Name	Default	Value range	Description
d2-00	V/f curve type	0	0 to 10	0: Linear V/f curve 1: Multi-point V/f curve 10: Decoupled V/f 11: V/f partially separated
d2-01	Multi-point curve source	0	0	Used to select the multi-point curve source. 0: Three-point V/f curve - The V/f curve is set through d2-02...d2-04 and d2-08...d2-10.
d2-02	Frequency point 1 of multi-point V/f curve	0.0 Hz	0.0 Hz to d2-03	Defines frequency point 1 of a multi-point V/f curve.
d2-03	Frequency point 2 of multi-point V/f curve	0.0 Hz	d2-02 to d2-04	Defines frequency point 2 of a multi-point V/f curve.
d2-04	Frequency point 3 of multi-point V/f curve	0.0 Hz	d2-03 to 600.0 Hz	Defines frequency point 3 of a multi-point V/f curve.
d2-08	Multi-point V/f curve voltage 1	0.0	0.0 V to 1000.0 V	Defines voltage point 1 of a multi-point V/f curve.
d2-09	Voltage point 2 of multi-point V/f curve	0.0	0.0 V to 1000.0 V	Defines voltage point 2 of a multi-point V/f curve.
d2-10	Voltage point 3 of multi-point V/f curve	0.0	0.0 V to 1000.0 V	Defines voltage point 3 of a multi-point V/f curve.
d2-47	Voltage upper limit for V/f separation	100.0%	50.0% to 200.0%	Defines the voltage upper limit of decoupled V/f. This parameter uses the rated motor voltage as the base value in percentage.

Param.	Name	Default	Value range	Description
d2-48	Voltage source in V/f decoupled mode	0	0 to 9	Defines the target voltage reference source in case of separated V/f. 0: Digital setting - The V/f separation voltage is set by d2-49 (voltage digital setting for V/f separation). 2: AI1 - The V/f separation voltage is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The voltage source is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse reference (DI7) - The V/f decoupled voltage is set through DI7. The frequency is calculated based on the curve of the relationship between the pulse frequency and operating frequency. 6: Multi-reference - Combinations of different DI terminal states correspond to different setpoints. 7: Simple PLC - The V/f separation voltage is set by simple PLC. For details, see the function description of simple PLC. 8: PID - The V/f separation voltage is set by PID. For details, see the PID function description. 9: Communication - The V/f separation voltage is set through communication. This mode is applicable to applications requiring remote control or centralized control of multiple devices. In this mode, you can input the frequency through remote communication. In this case, the AC drive must be installed with a communication card for communicating with the host controller. Other: F connector - Read the connector value through setting the parameter No. of a float connector. The value being read is used as the V/f separation voltage in speed control. It is used for extension of common sources. Connector selection will be jumped to if you set the parameter to "Other". In this case, click on a connector and the value of this connector will be used as the source for V/f decoupled voltage.
d2-49	Digital setting of voltage in V/f decoupled mode	0 V	0 to C4-03	Digital setting of V/f separation voltage. This parameter is valid when d2-48 [V/f decoupled voltage source] is set to 0.
d2-50	Voltage acceleration time for V/f separation	0.0s	0.0s to 1000.0s	Defines the time required for the output voltage to rise from 0 to the rated motor voltage.
d2-51	Voltage deceleration time for V/f separation	0.0s	0.0s to 1000.0s	Defines the time required for the output voltage to fall from the rated motor voltage to 0.

Param.	Name	Default	Value range	Description
d2-52	RFG time of the frequency in V/f decoupled mode	0	0 to 1	Sets the frequency RFG time of V/f separation. 0: RFG time set to 0 forcibly - The frequency reference ramp-up/down time is forcibly set to zero. 1: Preset RFG time - The ramp-up/down is set based on normal operation.
d2-53	Stop mode in decoupled V/f	0	0 to 2	Sets the stop mode selection of V/f separation. 0: Frequency and voltage reduced to 0 independently - The frequency/voltage is reduced to 0 independently based on the respective ramp-down time. 1: Frequency reduced after voltage reduced to 0 - The voltage is reduced to 0 based on the ramp-down time. Then the frequency is reduced to 0 based on the ramp-down-time. 2: Coast to stop - Coast-to-stop applies directly without observing the frequency/voltage ramp-down curve.

5.3.3.4 Overvoltage Suppression in V/f

Application scenario

When the motor is in the deceleration (generating) state, if the power supply does not have the regenerative capacity, energy will be fed to the bus, causing the DC bus voltage to rise. This is especially true for motors with high inertia and short deceleration time.

If overvoltage exists in the DC bus, enable overvoltage suppression in V/f mode.

Working principles

After enabling the overvoltage suppression through F2-39, when the bus voltage rises to F2-40 [Voltage threshold for overvoltage suppression], the drive stabilizes the bus voltage and suppresses voltage rise by adjusting the output frequency.

After this function is enabled, the actual deceleration time is prolonged automatically. If the actual deceleration time cannot meet the requirements, increase the value of d0-41 [Over-excitation gain in V/f] properly.

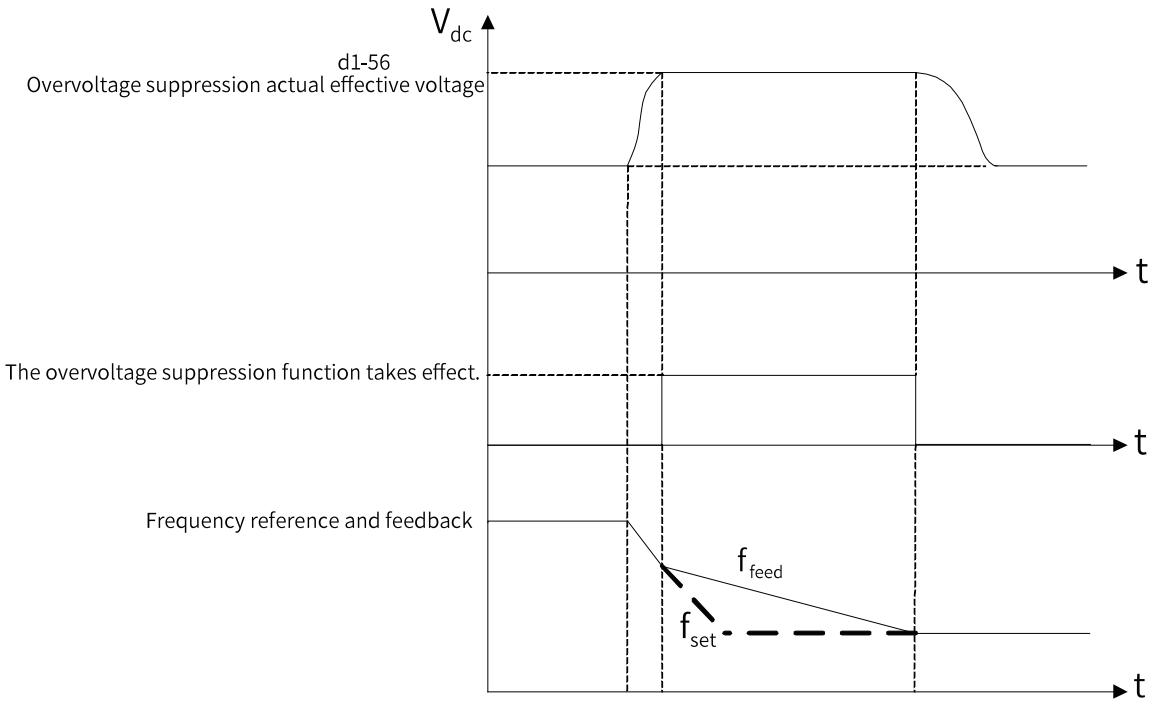


Figure 5-168 Operating principle of overvoltage suppression in V/f mode

Note: f_{feed} represents feedback frequency, f_{set} represents set frequency.

Related parameters

Param.	Name	Default	Value range	Description
F2-39/d1-54	Overvoltage suppression enable	1	0 to 1	Sets whether overvoltage suppression is enabled. 0: Disable 1: After the overvoltage suppression function is enabled, the bus voltage rise is suppressed by limiting the generating torque or actual deceleration speed of the motor to prevent overvoltage. In this case, the deceleration time is longer than the setting. F2-39 is the same parameter as d1-54. After F2-39 is modified, d1-54 is updated synchronously.
F2-40/d1-55	Voltage threshold for overvoltage suppression	770.0 V	600.0 V to A3-57	Defines the bus voltage threshold for overvoltage suppression. The actual effective value is displayed in d1-56. If the grid voltage is excessively high and the overvoltage suppression voltage threshold is set to a value lower than the rectified bus voltage, the motor may accelerate or overcurrent may occur at startup. F2-40 has the same function as d1-55. When F2-40 is modified, d1-55 is updated synchronously.
d1-56	Effective voltage threshold for overvoltage suppression	770.0 V	600.0 V to A3-57	Displays the actual effective voltage for triggering overvoltage suppression. When the bus voltage is greater than this value, overvoltage suppression is activated.

Param.	Name	Default	Value range	Description
d1-57	Overvoltage suppression Kp adjustment	100%	0% to 1000%	Defines the proportional coefficient of the overvoltage suppression control loop, which is a percentage to Kp. Kp is calculated through loop calculation. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately. The actual Kp gain is calculated through loop calculation, which is the product of Kp and d1-57 [Overvoltage suppression Kp adjustment].
d1-58	Overvoltage suppression Ki adjustment	100%	0% to 1000%	Defines the proportion coefficient of the overvoltage suppression control loop, which is a percentage to Ki. Ki is calculated through loop calculation. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately. The actual Ki gain is calculated through loop calculation, which is the product of Ki and d1-58 [Overvoltage suppression Ki adjustment coefficient].

Precautions

- Use the overvoltage control function only when the power supply is lack of the regenerative capability.
- When using a braking resistor, set the braking voltage to a value lower than the voltage threshold of overvoltage suppression or disable overvoltage suppression.
- When a common bus is used, enable overvoltage suppression control of an inverter with the highest inertia, keeping the overvoltage suppression function of others disabled.
- Overvoltage suppression cannot be enabled for lifting-type active loads. When the load drops, the motor is in the generating state. Overvoltage suppression limits the power generation, which can prevent the motor from carrying the load effectively, leading to continuous acceleration and the risk of motor stall.
- If massive parallel motors are connected, increase the overvoltage suppression Kp. If the motor inertia is large, decrease the overvoltage suppression Kp.

Application case

When the braking resistor is not installed, set F2-39/d1-54 to "Enable", and set F2-40 (d1-55) according to the actual bus voltage. The remaining parameters can be set with the default values. When decelerate-to-stop is needed, you can enable overvoltage suppression to prevent the bus voltage from rising to an excessively high value.

5.3.3.5 Undervoltage Suppression in V/f Mode

Application scenarios

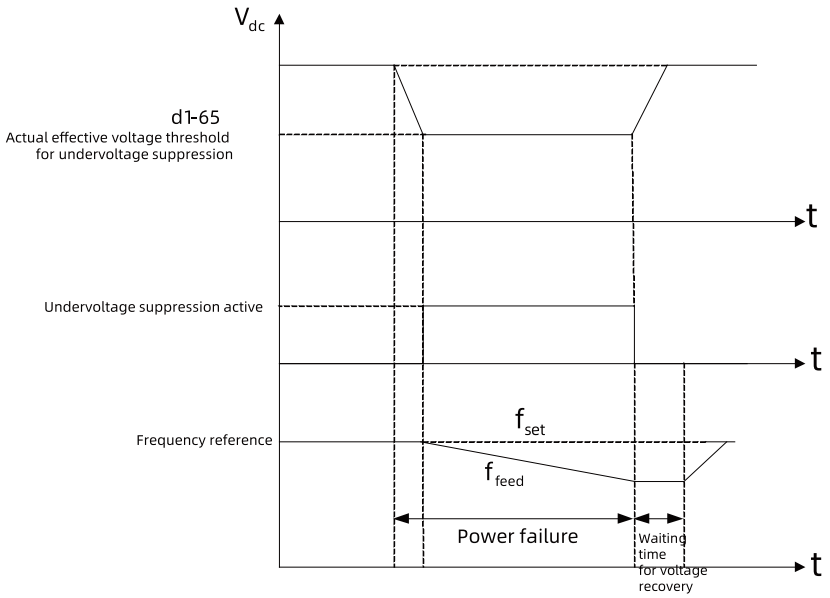
This function is mainly applicable to unstable power grid, preventing system stop due to undervoltage caused by transient voltage dip. It can also be used to prevent coast-to-stop of the

mechanism due to power failure, avoiding machining materials from be damaged, such as yarn breakage in the textile industry.

During undervoltage suppression, when the bus voltage detected is lower than the value of d1-65 [Actual effective voltage threshold for undervoltage suppression], the motor will be set to the generating state to compensate for the energy loss, stabilizing the DC bus voltage. When instantaneous power failure occurs on the power supply or DC bus, undervoltage can occur if the fault is not handled in time, resulting in coast-to-stop.

Working Principle

When undervoltage suppression is enabled (d1-63 ≠ 0), the undervoltage fault can be suppressed for a short period of time to allow power dip ride-through. When the power supply or DC bus is powered off for a long time, the drive keeps the bus voltage stable and suppresses voltage drop by adjusting the output frequency. Enabling the undervoltage suppression function can compensate for the energy loss of the bus until each motor stops reliably.



Note

F_{feed} : feedback frequency, f_{set} : set frequency

Application case

The textile industry requires high yarn continuity. If the power grid is disconnected, the entire machine coasts to stop. In this case, all yarns are broken, making it difficult to restart production. Undervoltage suppression can effectively prevent the machine from rotating freely and breaking the yarn after power failure. When power failure occurs for a short period of time, the machine enters undervoltage suppression state and resumes normal production.

Configuration for this application case is as follows.

1. Connect the buses of the drives together and use a drive of a high power rating to power up other drives.
2. Select a motor with larger inertia and enable undervoltage suppression by setting d1-63 to 1.

3. During power failure, the motor with undervoltage suppression enabled is used as the master. The PLC calculates the matching speed of other motors, and the master motor decelerates to stop.
4. Bit4 of L1021 is the undervoltage suppression activation flag. This flag is set to 1 after undervoltage suppression is activated.

Related parameters

Param.	Name	Default	Value range	Description
d1-63	Response upon undervoltage	3	0: Not act 1: Suppress undervoltage 2: Decelerate to stop 3: Undervoltage suppression with time limit setting	Defines the response when the bus voltage reaches the undervoltage suppression threshold due to power failure. 0: Not respond 1: Undervoltage suppression applied, normal operation resumes after voltage covery - The bus is kept at the undervoltage suppression threshold through the regenerative energy generated during deceleration of the motor, keeping the drive continue operating without stop for a short period of time. If the bus voltage is recovered during this period, the motor accelerates to the target speed based on the acceleration time. 2: Decelerate to stop - When the bus voltage fall below the undervoltage suppression threshold, the motor decelerates to stop based on the deceleration time defined by d1-69. If the bus voltage is recovered during this period, the motor still stops. 3: Undervoltage suppression with time limit setting – By decelerating the motor to feed energy back and maintain the bus voltage at the undervoltage suppression point, enabling short-term operation without shutdown. After reaching the set time defined by d1/d9/y1/y9-68, the system immediately stops and reports fault E193.2: Undervoltage suppression timeout.
d1-64	Undervoltage suppression action voltage reference	430.0 V	A3-55 to 500.0 V	Defines the voltage threshold for triggering undervoltage suppression. When the bus voltage falls below the undervoltage suppression threshold due to power failure of the system, the drive responds accordingly based on the setting of d1-63.
d1-65	Actually effective action voltage of undervoltage suppression	430.0 V	A3-55 to 500.0 V	Displays the actual effective voltage that triggers undervoltage suppression. The actual voltage threshold is internally limited when the set undervoltage suppression threshold does not match the model.

Param.	Name	Default	Value range	Description
d1-66	Undervoltage suppression Kp adjustment	100%	0% to 1000%	Defines the proportional coefficient of the undervoltage suppression control loop, which is a percentage to Kp. Kp is calculated through loop calculation. Increasing this setpoint improves the dynamic characteristics of the bus voltage. Note that an excessively high setpoint can result in fluctuation, oscillation, or even unusual noise. A low Kp value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Kp gain is calculated through loop calculation, which is the product of Kp and d1-66 [Undervoltage suppression Kp adjustment].
d1-67	Undervoltage suppression Ki adjustment	100%	0% to 1000%	Defines the integral coefficient of the undervoltage suppression control loop, which is a percentage to Ki. Ki is calculated through the loop calculation. Increasing this setpoint improves the dynamic characteristics of bus voltage. A high Ki value can result in output frequency fluctuation. When the output frequency fluctuates greatly during undervoltage suppression, reduce this setpoint properly. A low Ki value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Ki gain is calculated through the loop calculation, which is the product of Ki and d1-67 [Undervoltage suppression Ki adjustment].

5.3.3.6 Overcurrent Suppression in V/f Mode

Application scenario

In the case of rapid acceleration, deceleration, or overload, the current can easily exceed the limit, resulting in overcurrent. The overcurrent suppression function can prevent the current from exceeding the overcurrent threshold.

Working principles

After overcurrent suppression is enabled, if the output current of the drive reaches the motor overcurrent suppression threshold during motor current rise, the output frequency of the drive changes to reduce the motor output current by reducing the motor slip. When the current falls below the overcurrent threshold, the frequency changes to the target frequency again. During common rapid acceleration, the actual acceleration time may automatically extend. During rapid deceleration, the deceleration time may also extend. The motor output frequency drops when a sudden heavy load is connected during steady-state operation.

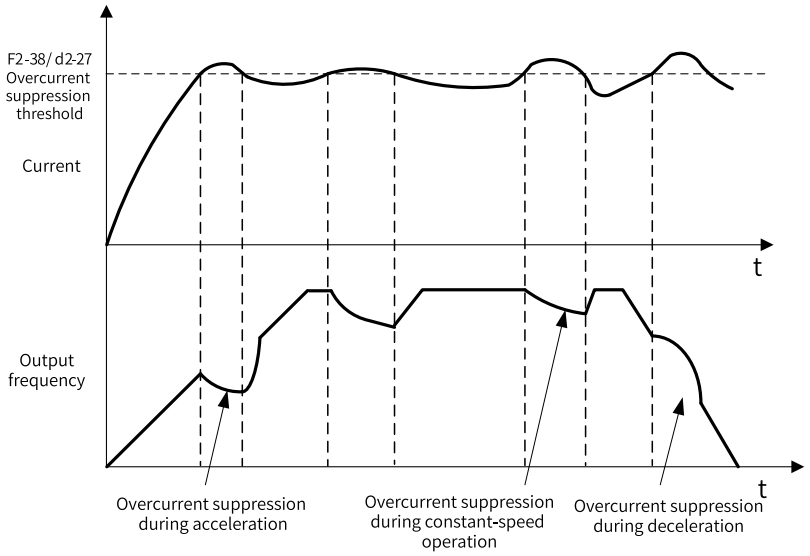


Figure 5-169 Schematic diagram of the overcurrent suppression control function

Related parameters

Param.	Name	Default	Value range	Description
F2-37/d2-26	Overcurrent suppression enable	1	0 to 1	Sets whether overcurrent suppression is enabled. 0: Disable 1. When the drive output current reaches the threshold set by d2-27, the drive slows down the acceleration or reduces the operation frequency to prevent continuous current rising, suppressing the overcurrent faults. F2-37 has the same function as d2-26. After modifying F2-37, d2-26 is updated synchronously.
F2-38/d2-27	Overcurrent suppression threshold	200%	80% to 300%	Defines the current threshold for triggering overcurrent suppression. The setpoint is a percentage to the rated current of the motor. The actual effective overcurrent suppression threshold is also limited by A3-05 [Maximum current of the drive], whichever the smaller. F2-38 has the same function as d2-27. After F2-38 is modified, d2-27 is updated synchronously.

Param.	Name	Default	Value range	Description
d2-28	Overcurrent suppression Kp adjustment	100%	1% to 500%	Defines the proportional coefficient of the overcurrent suppression control loop, which is a percentage to Kp. Kp is calculated through loop calculation. The higher the setpoint, the faster the frequency adjustment, and the better the acceleration following performance. However, an excessively high setpoint can increase the risk of oscillation. The actual Kp gain is calculated based on the loop. Actual Kp gain = Kp x d2-28 [Overcurrent suppression Kp adjustment].
d2-29	Overcurrent suppression Ki adjustment	100%	10% to 1000%	Defines the integral coefficient of the overcurrent suppression control loop, which is a percentage to Ki. Ki is calculated through loop calculation. The higher the setpoint, the faster the frequency adjustment, and the better the acceleration following performance. However, an excessively high setpoint can increase the risk of oscillation. The actual Ki gain is calculated based on the loop. Actual Ki gain = Ki x d2-29 [Overcurrent suppression Ki adjustment].

Precautions

The current in V/f overcurrent suppression is high, so the motor decelerates upon high loads. When the output frequency is lower than 5 Hz, the drive may derate at low frequencies, triggering the overload fault easily. If overload may easily occur at low speed during overcurrent suppression, check whether the load is proper. Otherwise, select a drive with a higher rated power.

Application case

Set F2-37/d2-26 [Overcurrent suppression] to 1 [Enable] and set F2-38/d2-27 [Overcurrent suppression threshold] according to the current magnitude in the application site. Ensure that the current suppression threshold is higher than the current under normal operating conditions. The remaining parameters can be set with default values.

5.3.3.7 Oscillation Suppression in V/f Mode

Application scenarios

During motor operation, mechanical resonance causes system oscillation. Enable oscillation suppression for a better control effect.

Function Applications

You can enable oscillation suppression by setting d2-22 to 1 to improve the control effect. d2-23 represents the V/f oscillation suppression gain, which must be as low as possible to minimize the impact on operation, provided that the oscillation can be effectively suppressed. Increase this gain only upon obvious oscillation. The higher the gain, the better the suppression effect can be.

Note

When the oscillation suppression function is enabled, the rated current and no-load current of the motor must be as accurate as possible to ensure the V/f oscillation suppression effect.

Application case

Motor oscillation caused by mechanical structure on site can be reduced through d2-22 [V/f oscillation suppression]. Observe the actual motor oscillation during normal operation.

Related parameters

Param.	Name	Default	Value range	Description
d2-22	V/f oscillation suppression	1	0 to 1	Sets whether V/f oscillation suppression is enabled. 0: Disable 1: During motor operation, mechanical resonance causes system oscillation. Enable oscillation suppression for a better control effect.
d2-23	V/f oscillation suppression gain	100%	0% to 400%	Sets the V/f oscillation suppression gain. This parameter is used to adjust the intensity of V/f oscillation suppression. The higher the setpoint, the stronger the compensation performance is, but an excessively high setpoint can result in over-compensation and oscillation.

5.3.3.8 V/f Torque Boost

Application scenario

When the motor operates in V/f control mode, the voltage drop on the stator resistor can lead to low motor output torque, and even low load-carrying capacity of the motor during low-speed operation. In this case, you can compensate the voltage loss on the stator resistor through the torque boost function to improve the load-carrying capacity of the motor during low-speed operation. If the torque boost is not enabled upon heavy-duty startup in V/f mode, overload faults may occur.

Working principles

Enable this function through d2-16 and select the torque boost mode.

During manual torque boost, the voltage can be compensated by the torque boost defined by d2-14. When the load is excessive and the starting torque of the motor is insufficient, the value of d2-14 can be increased. Note that an excessively high setpoint can easily result in motor overtemperature and drive overcurrent. d2-15 defines the cutoff frequency of torque boost. If the frequency is lower than this value, the boost is enabled; otherwise, it is disabled.

When automatic torque boost is applied, the drive automatically calculates the voltage compensation value according to the motor parameters, so there is no need to set d2-14 and d2-15. Before using this function, ensure that the motor parameter auto-tuning function is enabled to guarantee the motor parameter accuracy.

When the automatic and manual torque boost is selected, you can adjust the manual boost value through d2-14 and d2-15. If the manual boost value is excessively low, the automatic torque boost calculates the voltage needed and makes voltage compensation accordingly.

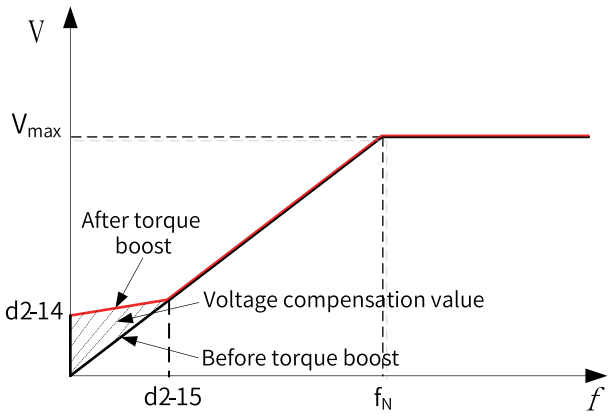


Figure 5-170 Schematic diagram of torque boost in V/f mode

Note: f_N indicates set frequency, V_{max} Displays the maximum output voltage.

Related parameters

Param.	Name	Default	Value range	Description
d2-14	Manual torque boost	3.0%	0.0% to 100.0%	Defines the manual torque boost value. This parameter defines the voltage boost value at zero speed in V/f mode. Increasing this voltage can improve the load-carrying capacity at low speed, but an excessively high setpoint may easily result in overcurrent and overload. After the output frequency is increased to the value of d2-15 [Cutoff frequency of torque boost], the boost voltage is linearly reduced to 0.
d2-15	Cutoff frequency of torque boost	100.0%	0.0% to 400.0%	Defines the cutoff frequency of torque boost. When the operating frequency exceeds this cutoff frequency, manual torque boost is disabled.
d2-16	Torque boost mode	2	0 to 2	Defines the torque boost mode. 0: Manual boost - The boost value at zero speed is defined by d2-14. After the speed increases, the manual boost amount is reduced linearly until the cutoff frequency decreases to 0. 1: The boost voltage is calculated automatically based on motor parameters. In this mode, it is recommended to perform auto-tuning for better effects. 2: Manual boost + Automatic boost - The final effective boost value is the sum of the manual boost and the automatic boost. This boost mode is recommended.

Application case

After startup, operation errors occur to high load. The value of d2-14 [Manual torque boost] needs to be increased in the stop state. Increase this value continuously until the motor can be started properly.

5.3.3.9 Slip Compensation in V/f Mode

Application scenario

Slip compensation is used to compensate speed drop of an asynchronous motor when the load increases, so that the motor speed can remain unchanged when the load changes. Slip compensation can improve the speed accuracy in V/f mode.

Working principles

Enable d2-41 [Slip compensation mode] to activate slip compensation, and adjust the compensation frequency through d2-42. When the coefficient is set to 100%, the compensation slip is the rated slip of the motor when the rated load is applied to the motor. When the compensation coefficient is set to 0, the slip compensation function is disabled. When adjusting the V/f slip compensation gain, check that the motor speed under the rated load is the same as the target motor speed. If they are different, adjust this parameter.

d2-43 defines the slip compensation filter time in V/f mode. The lower the setpoint, the faster the response speed of slip compensation, but an excessively low setpoint can also result in oscillation or instability in the dynamic process of the motor.

Related parameters

Param.	Name	Default	Value range	Description
d2-41	Slip compensation mode	0	0 to 1	Sets the slip compensation mode. 0: No slip compensation 1: Enable compensation mode.
d2-42	Slip compensation gain	100.0%	0.0% to 200.0%	Adjust the slip compensation frequency based on the rated slip setting.
d2-43	Slip compensation filter time	0.5s	0.1s to 10.0s	Defines the slip compensation filter time. A longer filter time means a slower and smoother dynamic process of slip compensation.

Precautions

Slip compensation in V/f mode can improve dynamic accuracy, but slows down the dynamic response. For applications requiring high dynamic response, use vector control.

Application case

In textile applications, the asynchronous motor operates stably in V/f mode. The heavier the load, the lower the output speed on the motor shaft end compared with the speed reference. In the actual process, the speed must be as accurate as possible to match motors of different mechanisms.

If d2-41 (Slip compensation mode) is set to 1, the slip compensation mode is enabled to improve the speed accuracy. The speed accuracy during operation can meet the process requirements. If compensation is too fast during slip compensation, increase d2-43 [Slip compensation filter time].

5.3.3.10 Energy-saving Control in V/f Mode

Application scenario

Energy-saving control is applicable to applications where the motor load does not change. It can be also used in low-load applications to reduce output current automatically for energy conservation. It can be used in applications where the load changes slowly, such as fans, water pumps, and air compressors.

Working principles

After this function is enabled through d2-35, when the motor runs with low load, the drive reduces the output voltage continuously to lower the excitation current for less energy consumption.

Related parameters

Param.	Name	Default	Value range	Description
d2-35	Energy-saving control in V/f mode	0	0 to 1	Used to enable/disable energy-saving control in V/f mode. 0: Disable 1: Enable - Energy-saving control can reduce the output current and energy consumption of an asynchronous motor when it runs without load or with low load.
d2-36	Cutoff frequency of energy-saving control in V/f mode	30 %	20% to 100%	Defines the cutoff frequency of energy-saving control in V/f mode. Energy-saving control can be enabled only when the frequency is greater than this cutoff frequency.

Application Cases

In low-load applications, to reduce the output power, you can enable d2-35 [Energy-saving control in V/f mode] and set the cutoff frequency (d2-36) to the value lower than the normal operating frequency.

5.3.3.11 Droop Control in V/f Mode

Application scenario

The droop control function applies to applications where the load is driven by multiple motors. Slight deviation exists among motors at the same speed reference due to different mechanical characteristics, which may result in significant difference in the output torque or even mutual dragging between motors.

The droop control function is widely used in applications with belt conveyors, roller conveyors, or continuous casting machines. The function is easy to use, without the need for communication between motor controllers. Multiple motors can be used to drive the same load through rigid or flexible connection. When multiple motors run in redundant mode, you can stop the faulty devices while keeping others running normally.

Working principles

The droop (softening) control is a control method that uses the output torque of the motor to generate negative feedback, reducing the motor speed. Droop control features good stability and simple application though low control accuracy. It can be applied to all motors to enable even load distribution between motors without communication. The motor with a high speed carries more torque. The speed reference of the motor is reduced automatically through negative feedback, achieving torque distribution to other motors.

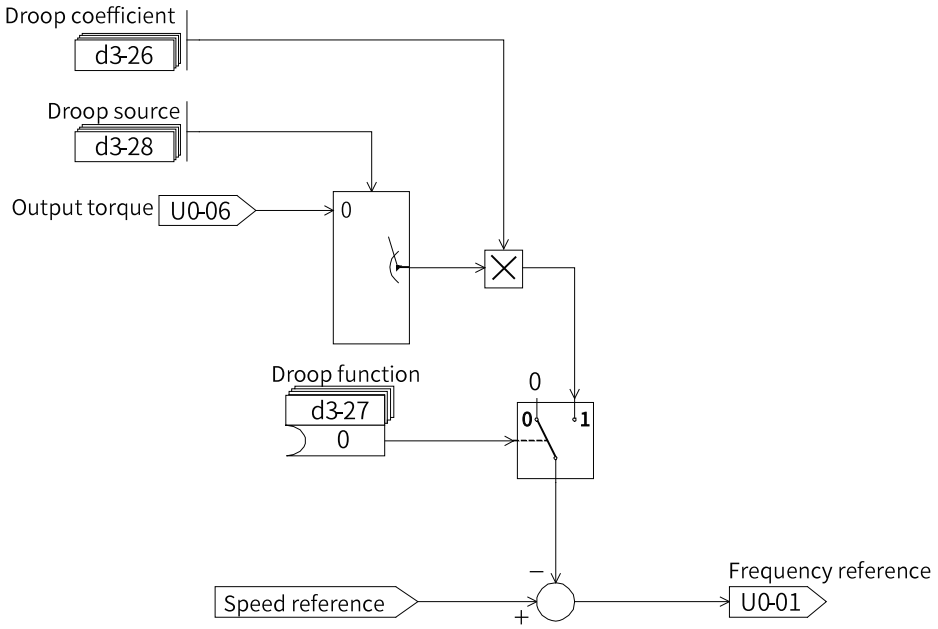


Figure 5-171 Schematic diagram of droop control in V/f mode

Precautions

- The adjustment range of the speed is generally not greater than the rated motor slip.
- The actual speed may not follow the speed reference accurately, where a steady difference exists between the actual speed and reference speed. The difference is proportional to the load.
- Accurate load distribution is not available during dynamic process.

Application case

When multiple motors are connected with a belt, a droop coefficient needs to be set to prevent any of the motor from generating due to uneven load distribution. The droop coefficient must allow the speed change value in droop control to be adjusted to the rated slip.

In this case, the system must be able to operate properly when the motor or drive is damaged, without high requirements on the speed output accuracy or output dynamic response. It is recommended to enable the droop (softening) function (d3-27 = 1), and set d3-29 = to [Rated frequency x 60/Number of pole pairs - Rated speed]/Rated speed.

Related parameters

Param.	Name	Default	Value range	Description
d3-27	Droop function	0	0 to 1	Enables/disables the droop function in speed control. Value description: 0: Disable 1: Enable When multiple motors are used to drive the same load, the load distribution between multiple motors can be achieved after this function is enabled. Note that the speed accuracy can be affected.
d3-28	Droop source	1	0 to 3	Defines the droop source. Droop speed change = Motor rated power × Droop source × Droop coefficient. The unit of droop speed change is Hz. 0: Output torque - The actual output torque of the motor is used as the droop source. 1: Torque reference - The final torque reference of the motor is used as the droop source. 2: Speed loop output - The output of the speed loop is used as the droop source. 3: Integral component of speed regulator - The integral item of the speed loop is used as the droop source. For droop control in V/f mode, the droop source can only be set to 0.
d3-29	Droop coefficient	0.0%	0.0% to 50.0%	Sets the droop coefficient. The higher the droop coefficient, the better the droop performance is, but an excessively high setpoint can affect the speed accuracy and lead to speed oscillation. Droop speed change = Motor rated power × 3-28 (Droop speed change source) × d3-29 (Droop coefficient). The unit of droop speed change is Hz.

5.3.3.12 Pulse Generation Inhibition at Zero Speed in V/f Mode

Application scenario

When the motor runs at zero speed, the three-phase (U/V/W) switching transistors of the drive simultaneously turn on and off, resulting in maximum common voltage, common leakage current, and EMC interference. At zero speed, the normal operation of AI/AO terminals, DI/DO terminals, encoders, and PLCs may be affected.

The function of pulse generation inhibition at zero speed can significantly reduce the interference generated by the drive. This function stops PWM pulse output when the speed is below the set threshold, thereby improving the system's EMC performance in low-speed scenarios with severe interference.

Description

When this function is enabled for the asynchronous motor in V/f control mode, no pulse is generated at low speed. In this case, the drive remains in operation, but the output current is zero, and the motor stops rotating.

d2-46 (pulse generation inhibition at zero speed) is set to 1 (enable). During acceleration, when the frequency is lower than d2-44 (frequency for pulse generation inhibition at zero speed) + d2-45

(hysteresis frequency for pulse generation inhibition at zero speed), the output voltage is forcibly set to zero. During deceleration, when the frequency is lower than d2-44 (frequency for pulse generation inhibition at zero speed), the output voltage is forcibly set to zero.

Note

This function is applicable only to normal startup of asynchronous motors in V/f control mode, which is inactive in DC braking control mode.

Application example

In scenarios where multiple devices work together, the drive is required to remain in standby at zero speed by the process when the devices are temporarily inactive. At this time, continuous pulse output from the drive generates significant common mode interference, affecting the normal operation of nearby sensitive equipment (such as PLCs and sensors).

After pulse generation inhibition at zero speed is enabled (d2-46 = 1), the drive stops PWM pulse output at zero speed, which eliminates the interference source and effectively ensures the stable operation of other devices.

Related parameters

Param.	Name	Default	Value range	Description
d2-44	Frequency for pulse generation inhibition at zero speed	1.0%	0.0% to 100.0%	d2-46 is set to 1. During acceleration, if the set frequency and actual frequency are below d2-44 + d2-45, no pulse is generated at zero speed. During deceleration, if the set frequency and actual frequency are below d2-44, no pulse is generated at zero speed. The baseline value is the motor rated frequency = 100%.
d2-45	Hysteresis frequency for pulse generation inhibition at zero speed	0.5 %	0.0% to 100.0%	d2-46 is set to 1. During acceleration, if the set frequency and actual frequency are below d2-44 + d2-45, no pulse is generated at zero speed. During deceleration, if the set frequency and actual frequency are below d2-44, no pulse is generated at zero speed. The baseline value is the motor rated frequency = 100%.
d2-46	Pulse generation inhibition at zero speed	0 (disable)	0 to 1	This parameter sets whether to enable pulse generation inhibition at zero speed for the asynchronous motor in V/f control mode. Value description: 0: Disable 1: Enable

5.3.3.13 Over-excitation

Application scenario

During quick deceleration, the bus voltage increases. When the bus voltage is close to the overvoltage threshold, increase the motor excitation current to increase the loss and reduce the deceleration time.

Working principles

Set over-excitation gain through d0-41 when the asynchronous motor is decelerating and the bus voltage is approaching the overvoltage threshold in V/f mode. When entering the over-excitation state, the drive increases the output voltage to increase the motor exciting current and the loss and shorten the motor deceleration time. The higher the over-excitation gain, the better the suppression effect.

Related parameters

Param.	Name	Default	Value range	Description
F2-36 (d0-41)	Overexcitation gain (V/f)	90%	0 to 200 %	Set the over-excitation gain. Increasing the over-excitation will increase the output voltage and reduce the motor deceleration time, but too much may cause current oscillation. F2-36 has the same function as d0-41. After modifying F2-36, d0-41 is updated synchronously.

Application case

In the ceramic industry, massive mechanisms on the ceramic tile production line need to be started and stopped quickly. The bus voltage rises during deceleration, triggering overvoltage suppression and prolonging the deceleration time. For devices that require quick start and stop, increase d0-41 [Over-excitation gain in V/f] properly to allow faster consumption of the bus voltage, reducing the deceleration time significantly.

5.3.4 Basic Control

5.3.4.1 Function List

Function type	Name	Description	Link
Basic control	Random PWM	After random PWM is enabled, the actual effective carrier frequency will randomly vary around the set frequency, improving sound quality and reducing electromagnetic noise.	"5.3.4.2 Random PWM" on page 549
	Overmodulation	After enabling overmodulation, you can increase the voltage overmodulation coefficient to enhance the voltage output capability and improve load capacity of the motor in the field-weakening range.	"5.3.4.3 Overmodulation" on page 550
	Braking resistor control	In applications with quick deceleration of high-inertia loads or potential energy loads like hoists, a braking unit must be connected to dissipate the energy that is fed back to the bus, preventing overvoltage faults.	"5.3.4.4 Braking Resistor Control" on page 551
	Parameter calculation	Applies to applications where auto-tuning is not available or high parameter accuracy is not required (such as V/f control). In parameter calculation, some auto-tuning parameters are calculated and updated based on the motor nameplate parameters and built-in algorithms.	"5.3.4.5 Parameter Calculation" on page 553
	Self-test	Used to check the potential errors of the drive automatically. The self-test covers IGBT shoot-through, ground short circuit, and output phase loss.	"5.3.4.6 Self-test" on page 554
	Active short circuit control	Applies to synchronous motors. In active short circuit control, a certain braking torque is generated. In fan and pump applications, active short circuit control can also prevent the motor from rotating due to inertia.	"5.3.4.7 Active Short Circuit Control" on page 557
	Carrier frequency and pulse generation	You can set different carrier frequencies according to actual operating conditions and further define various carrier frequency limits.	"5.3.4.8 Carrier Frequency and Pulse Generation" on page 559

5.3.4.2 Random PWM

Application scenarios

When a motor is being driven, a sharp noise may be caused by the switching frequency. In noise-sensitive applications, you can enable the random PWM function to improve the user experience.

Operating principles

After random PWM is enabled, the active carrier frequency changes randomly near the set carrier frequency, changing the sharp noise to a soft rustling sound.

Related parameters

Param.	Name	Default value	Value range	Description
A5-11	Random PWM depth	0	0 to 10	Used to turn the sharp electromagnetic noise of the motor caused by the carrier frequency into a soft rustling sound. Setting this parameter to 0 disables this function. The higher the setpoint, the better the noise reduction performance can be.

Precautions

- The higher the random PWM depth, the better the noise reduction performance can be. Note that an excessively high setpoint may increase current harmonics. Therefore, it is recommended to increase the default value gradually during actual commissioning.
- When the carrier ratio (ratio of carrier frequency to output frequency) is lower than 10, it is recommended that random PWM cannot be turned on. When the carrier ratio is low, enabling the random PWM can result in insufficient control frequency and excessive motor speed fluctuation.
- This parameter is active only for asynchronous motors in the V/f mode.

5.3.4.3 Overmodulation

Application scenario

In applications with high requirements on the output current and energy efficiency, increasing the voltage overmodulation coefficient can enhance the output capacity of the voltage and effectively improve the load capacity of the motor in the field weakening range.

Working principles

Under the same loads, increasing the output voltage can reduce the output current and the heat generated by the motor, cable, and inverter. The output voltage is related to the grid voltage/grid capacity, rectifier, and inverter. Generally, the grid and rectifier determine the base of the output voltage, and the small capacity of the grid will lead to a large voltage drop after heavy load. After the grid gets the bus voltage after rectification, the maximum reference voltage is determined. In the SVPWM linear modulation range, the relationship between the bus voltage and the maximum output voltage of the drive is as follows.

$$V_{\text{maximum output voltage}} = \frac{1}{\sqrt{2}} U_{dc}$$

For control stability, reserve a voltage margin of 3% (D5-00) to stabilize the output voltage at a value calculated through the following formula.

$$V_{\text{max output voltage}} = \frac{1-(D5-00)}{\sqrt{2}} U_{dc} = \frac{0.97}{\sqrt{2}} U_{dc}$$

Some sites have low bus voltage due to low input voltage. Increase the output voltage by overmodulation and set the overmodulation coefficient (A5-06). Take A5-06 = 106% as an example. If the output voltage is not enabled, the overmodulation coefficient can be increased by 6% (in the case of low harmonics during stable operation). After overmodulation is enabled, the conversion relationship between the effective value of the maximum output line voltage and the bus voltage of the drive is as follows.

$$\text{Umax} = \frac{U_{DC}}{1.414} \times (A5-06) \times \{1-(D5-00)\}$$

Related parameters

Param.	Name	Default	Value range	Description
A5-06	Overmodulation coefficient	103.0 %	0.0% to 110.0%	Sets the overmodulation coefficient. Increasing the voltage overmodulation coefficient can enhance the voltage output capacity and effectively improve the load capacity of the motor in the field weakening range. However, this can also increase the output current distortion.

Precautions

- The higher the overmodulation coefficient, the greater the output voltage distortion and current fluctuation. Excessive fluctuation can easily result in pulse-by-pulse current limit or overcurrent. Therefore, the negative effect of increased fluctuation must be considered when the overmodulation coefficient is increased.
- The output voltage reserves a voltage margin of 3% to meet the dynamic current response. Therefore, a overmodulation coefficient of 103% is equal to 100% of the maximum output voltage, which means there is no overmodulation effect. It is recommended that the overmodulation coefficient not exceed 108%. A value within 105% is recommended. Otherwise, large harmonic current can be generated, resulting in a decrease in system efficiency.

5.3.4.4 Braking Resistor Control

Application scenarios

In applications with energy regeneration, such as quick deceleration of high-inertia loads or potential energy loads like hoists, a braking unit must be connected to dissipate the energy that is fed back to the bus, preventing overvoltage faults.

In quick deceleration applications, if high speed tracking accuracy is required, it is recommended to install a braking resistor. If speed tracking accuracy upon deceleration is not required, you can enable over-excitation and overvoltage suppression to prevent excessive bus voltage rise during deceleration.

Operating principles

During operation of the drive, if the bus voltage is higher than the actual effective voltage threshold for activating the braking unit, the braking unit acts to discharge the energy through braking resistor. When the bus voltage falls below the braking unit activation voltage, the braking unit stops.

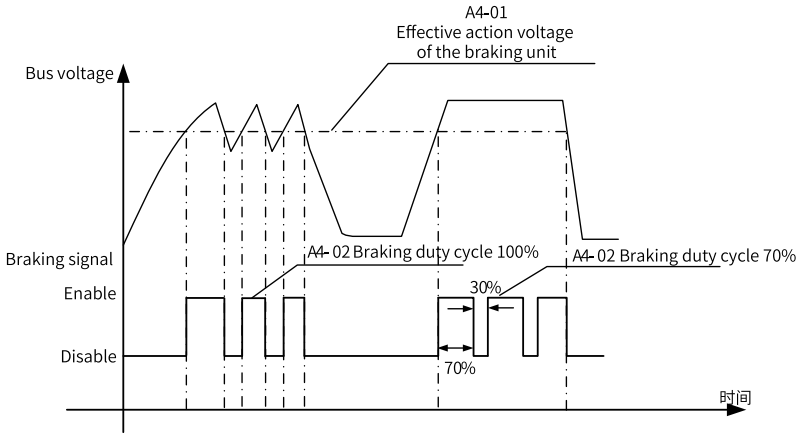


Figure 5-172 Braking resistor control schematic

Related parameter

The activation voltage of the braking unit is set through A4-00 [Braking unit activation voltage], and the actual effective value is displayed in A4-01. A4-02 [Braking duty cycle] can be used to adjust the power of the braking unit.

Param.	Name	Default	Value range	Description
A4-00	Braking unit activation voltage	760.0 V	600.0 V to 820.0 V	Defines the bus voltage threshold for activating the braking transistor. The actual effective value is displayed in A4-01. When the bus voltage exceeds this threshold, the braking transistor turns on to prevent overvoltage through discharging bus energy through the external braking resistor. The braking transistor will not act when the drive is in the stop state.
A4-01	Effective activation voltage of the braking unit	760.0 V	600.0 V to 820.0 V	Displays the actual effective activation voltage of the braking unit, which is set through A4-00.
A4-02	Braking duty cycle	100%	0.0% to 100.0%	Defines the braking duty cycle. The setpoint 0 indicates that the brake is not applied. The setpoint 100% indicates that the brake is normally open. This parameter is used to control the braking power. Formula for calculating braking power: Braking power = Square of bus voltage/Braking resistance x Braking duty cycle

Precautions

- Connect one end of the braking resistor to BR terminal and the other end to the bus (+) terminal. Then measure whether the resistance between the bus (+) and BR terminals is normal with a multimeter.

- Select a braking resistor of proper power and connect the braking resistor terminals properly. Improper contact can result in temperature rise of wiring terminals, which can lead to a fire in extreme conditions.
- If a braking resistor is connected but overvoltage still occurs on the bus during regeneration, the power of the braking unit may be insufficient. In this case, replace with a braking unit of higher power. You can also reduce the activation voltage of the braking unit to apply brake in advance in abrupt deceleration. For details on the braking resistor, see *"9.8.6 Braking Resistor" on page 1364*.
- When setting the braking voltage, pay attention to the power supply voltage range. When the grid voltage is high, the corresponding bus voltage will also be high. If the braking voltage is set below the normal bus voltage, the braking unit may continuously operate during operation of the drive, which may damage the braking unit. Therefore, the braking voltage must be kept at least 20 V higher than the normal bus voltage to prevent preceding risks.
- When the braking unit is connected and overvoltage suppression is enabled, set the braking voltage A4-00 to a value below d1-56 [Actual effective voltage threshold for overvoltage suppression].
- For loads with high inertia, if the speed loop integral time is excessively low in vector control, bus voltage fluctuation may repeatedly occur during load fluctuation, causing overtemperature of the braking resistor. In this case, increase F2-03 [Speed loop integral time] (2s for example) to effectively reduce bus voltage fluctuation.

5.3.4.5 Parameter Calculation

Application scenarios

The parameter calculation function can be used when auto-tuning is not available or high parameter accuracy is not required (such as V/f control). This function calculates and updates some auto-tuning parameters based on the motor nameplate parameters and built-in algorithms.

Operating procedure

When using parameter calculation, first set the motor nameplate parameters including C4-00 to C4-09 properly, then set C2-19 [Parameter calculation enable] to 1 and C2-20 [Parameter calculation acknowledgement] to 1 to complete parameter calculation.

Related parameters

Param.	Name	Default value	Value range	Description
C2-19	Parameter calculation enable	0	0 to 1	Used to enable the parameter calculation function. Value description: 0: Inactive 1: Motor nameplate parameter calculation
C2-20	Parameter calculation confirmation	0	0 to 1	Used to confirm whether the parameter calculation function is active. Parameter calculation can be executed only when C2-19 and C2-20 are both set to 1. Value description: 0: Inactive 1: Active

Precautions

Parameter calculation is based on algorithms, which can provide a reference value only.

In parameter calculation, only active motor parameter sets are updated. You can set and view active motor parameter sets through b0-00 and b0-01.

The parameters updated through parameter calculation are as follows.

Param.	Name	Parameters updated through parameter calculation
C4-12	Back EMF of synchronous motor	Yes
C4-20	Stator resistance	Yes
C4-22	Rotor resistance of asynchronous motor	Yes
C4-24	Leakage inductance of asynchronous motor stator	Yes
C4-26	Leakage inductance of asynchronous motor rotor	Yes
C4-28	Mutual inductance of asynchronous motor	Yes
C4-30	No-load current of asynchronous motor	Yes
C4-32	d-axis inductance of synchronous motor	Yes
C4-34	q-axis inductance of synchronous motor	Yes

5.3.4.6 Self-test

Description

Self-check is used to check the potential errors of the drive automatically.

The self-test covers IGBT shoot-through, ground short circuit, and output phase loss. It is recommended to perform manual static self-test during initial use of the drive and motor to check whether the drive/motor and external wiring are normal. Self-test can be used to detect ground

short circuit, phase-to-phase short circuit, phase loss or other hardware faults of the system, with instructions generated to guide users in terms of maintenance.

Self-test can be started in three ways: manual self-test, self-test before operation, and self-test upon power-on.

- Manual self-test: Self-test is triggered through C2-04 manually.
- Self-test before operation: Self-test is performed before operation every time when a startup command is set.
- Self-test upon power-on: Self-test is performed every time the drive is powered on.

Precautions

- During self-test, the inverter can generate pulses. Therefore, perform self-test, especially self-test upon power-on without the risk of electric shock.
- Self-test takes about 100 ms. In applications with strict startup time requirements, enable self-self with caution, otherwise startup may be delayed.
- Do not start self-test when the motor is rotating. If the motor has back EMF, false triggering of self-test faults may occur, such as ground short circuit fault (E023.1).
- When using the self-test function, ensure that the rated current of the motor is greater than 0.2 x rated current of the drive. If the power of the motor is much lower than the power of the drive, self-test may fail. In this case, self-test is not recommended.
- For drives with power lower than 30 kW, when motor cables reach hundreds of meters, the ground capacitance is significant. During self-test, the ground leakage current may be much higher than the rated current of the drive, which may incur false triggering of self-test faults. In this case, self-test is not recommended.
- When the grid is an IT system, ground short circuit cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system. The following figure shows connection for different power grid types.

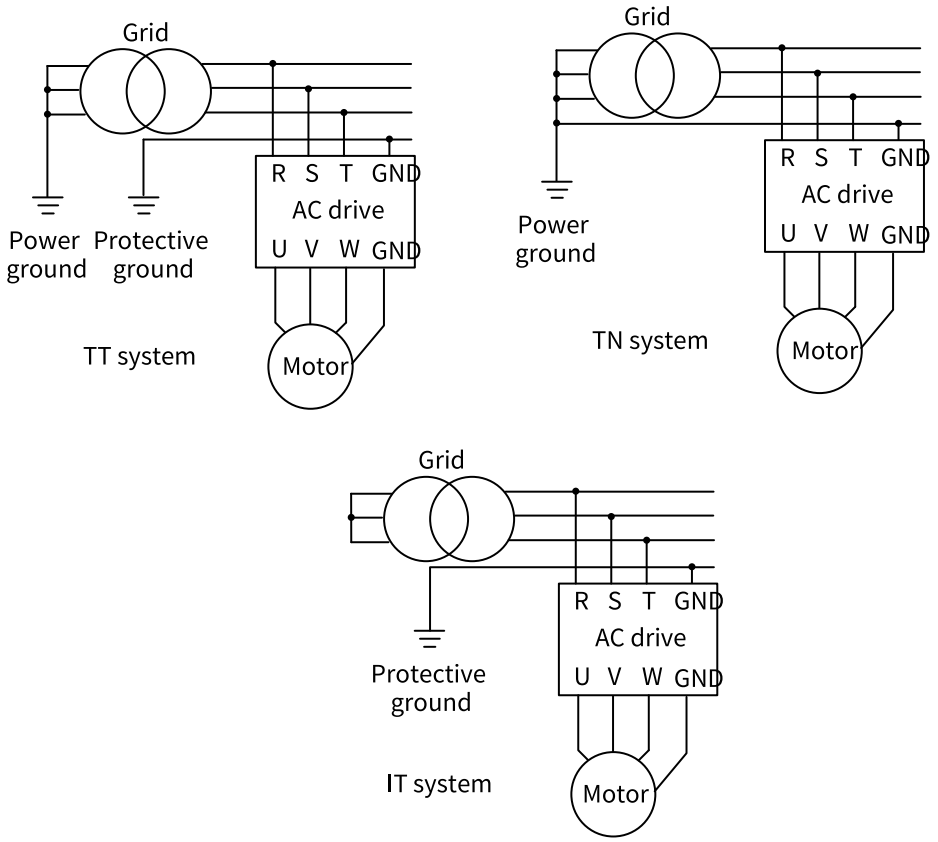


Figure 5-173 Connection for self-test under different power grid types

Related parameters

Table 5–80 Parameter configuration for self-test before startup

Param.	Name	Default	Value range	Description
C2-03	Self-test configuration before startup	0x0000	0x0000 to 0xFFFF	Defines the self-test configuration before startup. Value description: bit0: Whether IGBT shoot-through self-test is enabled before start of the drive bit1: Whether ground short circuit self-test is enabled before start of the drive bit2: Whether output phase loss self-test is enabled before start of the drive

Table 5–81 Power-on self-check configuration

Param.	Name	Default	Value range	Description
C2-06	Self-test configuration upon power-on	0x0002	0x0000 to 0xFFFF	Defines the self-test configuration upon power-on. Value description: bit0: Whether IGBT shoot-through self-test is enabled upon power-on of the drive bit1: Whether ground short circuit self-test is enabled upon power-on of the drive bit2: Whether output phase loss self-test is enabled upon power-on of the drive

Table 5–82 Manual self-check configuration

Param.	Name	Default	Value range	Description
C2-04	Manual self-test	0	0 to 1	Defines manual self-test command. Value description: 0: No command 1: Static self-test

Similar to parameter auto-tuning, when self-test is selected, the operating panel flashes CHEC. Self-test will be done 100 ms after startup and the drive then enters the startup lockout state. If no fault is reported, the self-test is normal.

5.3.4.7 Active Short Circuit Control

Application scenarios

Active short circuit control is applicable for braking control of synchronous motors. For instance, in potential energy load applications such as hoists, when the load moves unexpectedly, a defined braking torque is generated through active short circuit control to prevent load overspeed. In applications with fans and water pumps, active short circuit control can also be used to prevent the motor from rotating due to inertia.

Operating principles

When the motor is rotating, the drive short-circuits the three winding phases in the synchronous motor in the active short circuit control state, inducing current within the windings to generate a braking torque. Therefore, the higher the motor speed is, the greater the braking torque can be generated in active short circuit control.

The diagram for active short circuit control is shown in the following figure.

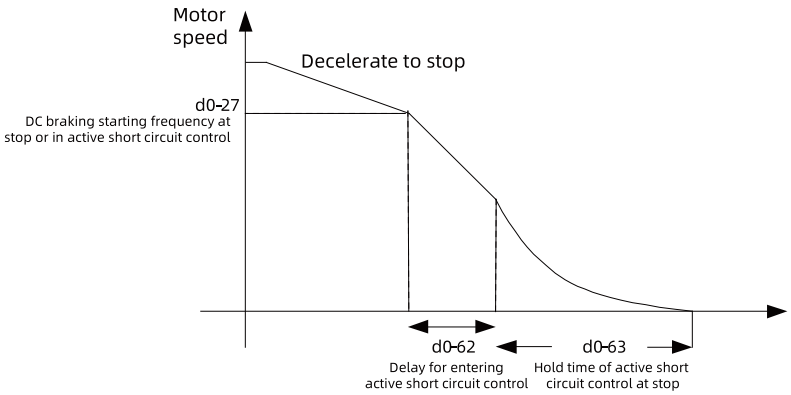


Figure 5-174 Schematic of active short circuit control

Precautions

When the motor speed is high, the kinetic energy generated during rotation of the motor is fed back to the bus in the active short circuit control state, causing the bus voltage to rise. When the bus voltage reaches a high level, to prevent overvoltage, the drive stops active short circuit control, causing the motor to lose the braking torque generated in active short circuit control. Therefore, it is recommended to use this function together with a braking resistor.

Related parameters

Param.	Name	Default value	Value range	Description
d0-27	Starting frequency of DC braking at stop or active short circuit control	0.0 Hz	0.0 Hz to 600.0 Hz	Defines the starting frequency of DC braking at stop. Note: When both the active short circuit control and DC braking are enabled, the drive responds to active short circuit control first without DC braking. When active short circuit control is enabled: During decelerating to stop, when the operating frequency drops to d0-27, the drive blocks output. After the time defined by d0-62 elapses, the drive enters the active short circuit control state. After the hold time defined by d0-63 elapses, the drive enters the stop state. When only DC braking is enabled: 1. During decelerating to stop, when the operating frequency drops to d0-27, the drive blocksoutput. After the time defined by d0-28 elapses, the drive outputs the DC braking current defined by d0-30. After the time defined by d0-29 elapses, the drive enters the stop state. 2. Do not set this parameter to an excessively high value. Failure to comply can result in overcurrent of the drive.
d0-61	Active short circuit control	0	0 to 1	0: Disable 1: Enable Other: B connector This function is active in the decelerate-to-stop, stop-with-maximum-capacity, and quick stop modes, but not in the coast-to-stop mode.
d0-62	Delay for entering active short circuit control	0.0 ms	0.0 ms to 5000.0 ms	Defines the delay for entering active short circuit control.
d0-63	Hold time of active short circuit control at stop	10.0s	0.1s to 3600.0s	The active short circuit state is exited after the hold time elapses. When this parameter is set to the maximum value (3600.0s), active short circuit control persists.

5.3.4.8 Carrier Frequency and Pulse Generation

Application scenario

The carrier frequency of the drive is set by A5-01. The effective carrier frequency is limited by A5-01 [Frequency reference], A5-00 [Maximum carrier frequency of the drive], and the functions of "Carrier

frequency adjusted with synchronous frequency" and "Random PWM". For details, see descriptions of A5-09 to A5-13.

Working principles

After the carrier frequency is set to be adjusted with the synchronous frequency (bit1 of A5-08), if the output frequency is lower than the value of A5-10, the carrier frequency is limited by A5-12 or A5-13. If the output frequency is higher than "A5-10 + A5-09", the effective carrier frequency will reach the set carrier frequency. The operating principles for carrier frequency to be adjusted with the synchronous frequency is shown in the following figure.

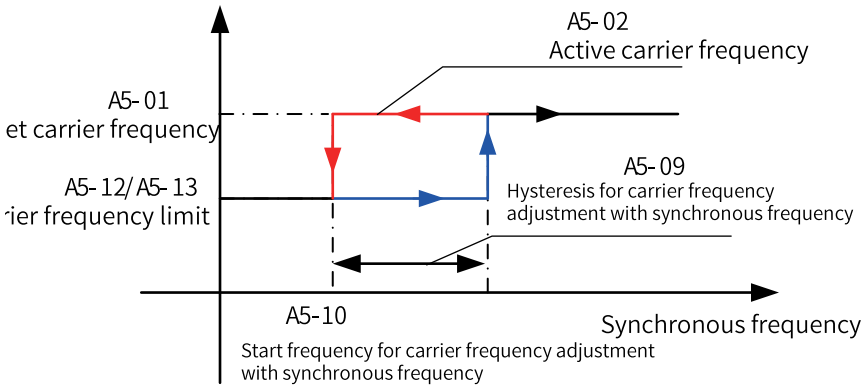


Figure 5-175 Schematic for carrier frequency to be adjusted with the synchronous frequency

Related parameters

Param.	Name	Default	Value range	Description
A5-00	Maximum AC drive carrier frequency	16.0 kHz	0.0 kHz to 24.0 kHz	Defines the maximum carrier frequency that can be set. This parameter is unchangeable and related to the motor type, control mode (d0-00), and the model hardware.
A5-01	Set carrier frequency	4.0 kHz	0.8 kHz to 20.0 kHz	Sets the carrier frequency of the AC drive. This function is used to adjust the carrier frequency of the drive. You can reduce the motor noise, avoid the resonance point of the mechanical system, and reduce the ground leakage current and interference generated by the drive through adjusting the carrier frequency. Note: The higher the setting, the lower the motor noise and the lower the current ripple. However, a higher carrier frequency will derate the AC drive, making it more prone to overload. An excessively low carrier frequency can lead to increase of high-order harmonics in the output current, motor loss and temperature rise.
A5-02	Effective carrier frequency	4.0 kHz	0.8 kHz to 20.0 kHz	Displays the carrier frequency currently in effect. Note: The actual effective carrier frequency of the drive is also affected by the synchronous frequency and random PWM.

Param.	Name	Default	Value range	Description
A5-09	Hysteresis for adjusting carrier frequency with synchronous frequency	3.0 Hz	0.0 Hz to 100.0 Hz	Sets the hysteresis for adjusting carrier frequency with synchronous frequency.
A5-10	Start frequency for adjusting carrier frequency with synchronous frequency	5.0 Hz	0.0 Hz to 600.0 Hz	Sets the start frequency for adjusting carrier frequency with synchronous frequency.
A5-12	Low-speed carrier frequency limit (V/f)	20.0 kHz	0.8 kHz to 20.0 kHz	Sets the low-speed carrier frequency limit in V/f mode. Note: Valid for V/f mode.
A5-13	Low speed carrier frequency limit (SVC)	2.0 kHz	0.8 kHz to 20.0 kHz	Defines the low-speed carrier frequency limit in the SVC mode. Note: This parameter is effective only in the SVC mode.

Precautions

In SVC mode, an excessively high setpoint may easily cause low motor torque and result in failure to drive the load or start. It is recommended to set A5-13 to a value not exceeding 6.0 kHz.

Increasing the carrier frequency generally improves the control performance and reduces the current harmonics and noise of the motor, but may also incur temperature rise of the drive, as described below.

Item	Response
Carrier	Low → High
Motor noise	High → Low
Current harmonics	Bad → Good
Motor temperature rise	High → Low
AC drive temperature rise	Low → High
Leakage current	Low → High
External radiation interference	Low → High

The default carrier frequency varies with the power rating of the drive. You can change the carrier frequency as needed.

If the set carrier frequency is higher than the default value, it will lead to an increase in temperature rise of the AC drive heatsink. In this case, you need to de-rate the AC drive. Otherwise, the AC drive may overheat.

Due to leakage current to the ground and voltage reflection, long-line output may cause louder motor noise, increased current harmonics, and higher temperature rise in the motor and reactor. High carrier frequency on long lines may lead to reduced motor service life and increased

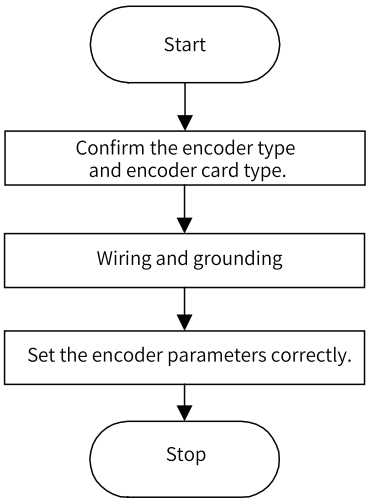
interference. In long-line applications, keep the carrier frequency as low as possible, provided the control frequency is sufficient.

5.3.5 Encoder

5.3.5.1 Encoder Wiring and Basic Settings

5.3.5.1.1 Encoder Commissioning Guide

The drive supports ABZ encoders, 23-bit encoders, resolvers, SSI encoders, sine-cosine encoders, EnDat encoders, and BiSS encoders. The commissioning procedure for the encoder is as follows.



5.3.5.1.2 Encoder Type and Specifications

The drive supports multiple types of encoders. Different types of encoders require different types of encoder cards (hereafter referred to as PG cards) for signal processing. Only one PG card can be inserted at a time.

The following table shows the encoder signal types supported by the PG card.

Encoder card model	Encoder types supported	Encoder card specifications	Links
MD-PG-AU1	ABZ incremental encoder	TTL/HTL level supported; differential (500 kHz)/push-pull (100 kHz)/OC (50 kHz) signal input supported; hardware open circuit detection (differential/push-pull) supported	"5.3.5.1.3 ABZ Encoder" on page 564
	Inovance communication-type 23-bit encoder	Resolution: 26-bit (max.); Data update rate: 16 kHz; Communication rate: 8 Mbps (max.)	"5.3.5.1.4 23-bit Encoder" on page 569
	SSI encoder	Resolution: 32-bit (Max) per revolution, 32-bit (Max) multi-revolution; Communication speed: 2 Mbps (Max)	"5.3.5.1.5 SSI encoder" on page 570
	EnDat encoder	Resolution: 32-bit (max.); Communication rate: 10 Mbps (max.)	"5.3.5.1.6 EnDat encoder" on page 572
	BiSS encoder	Resolution: 32-bit (Max) per revolution, 32-bit (Max) multi-revolution; Communication speed: 10 Mbps (Max)	"5.3.5.1.8 BiSS Encoder" on page 575
	Magnetic encoder	Resolution: 26-bit (max.); Data update rate: 16 kHz; Communication rate: 2 Mbps (max.)	"5.3.5.1.7 Magnetic Encoder" on page 574
MD-PG-R1	Resolver	Resolution: 12-bit Excitation frequency: 10 kHz/12 kHz/15 kHz/20 kHz (adjustable) Excitation voltage: 7 Vrms Resolver transformation ratio: 0.5 or 0.286	"5.3.5.1.9 Resolver" on page 577
MD-PG-S1	Sine-cosine encoder	Differential-mode voltage: Vpp = 0.6 V to 1.0 V to 1.2 V Common-mode voltage: Vcm = 3.0 V (max.) Input frequency: f = 100 kHz (max.)	"5.3.5.1.10 Sine-Cosine Encoder" on page 579

Parameters in group F3 can be used for quick commissioning of encoder detection signals.

Parameters in group C2 are used to set encoder detection signals. Parameters in group F3 are mapped from those in group C2, which are synchronized automatically.

The encoder card and the control board are stacked in the drive, as shown below.



5.3.5.1.3 ABZ Encoder

Encoder wiring

The incremental encoder adopts PG card [MD-PG-AU1].

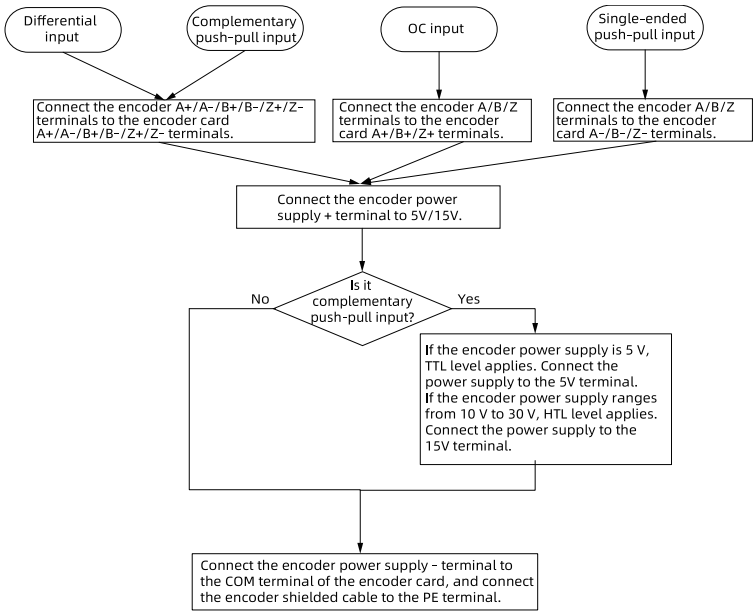
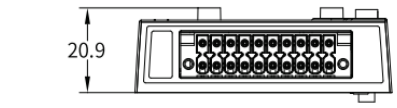


Figure 5-176 Encoder input wiring procedure

Assignment of encoder input terminal pins are shown in the following table *"5.3.5.1.11 Frequency Division Output" on page 581*.

Terminal	Pin No.	Name	Function
	1	A+	ABZ encoder A signal (+)
	2	A-	ABZ encoder A signal (-)
	3	B+	ABZ encoder B signal (+)
	4	B-	ABZ encoder B signal (-)
	5	Z+	ABZ encoder Z signal (+)
	6	Z-	ABZ encoder Z signal (-)
	7	5V	5 V power supply for the encoder
	8	15 V	15 V power supply for the encoder
	10	COM	C5V/C15V power supply reference ground
	18	COM	External input power supply ground for frequency division output
	19	PE	Shield grounding
	20	PE	

Basic setting procedure

For ABZ encoders, set as follows:

1. Setting the encoder type: Set C0-00 [Encoder type] to 1 [ABZ encoder] based on the PG card connected.

2. Setting the resolution (PPR) of the ABZ encoder: The nameplate of the encoder is marked with the number of pulses per revolution. If a 1024-PPR encoder is used, set C0-02 to 1024.

3. Set the level type of ABZ encoder. If the setting does not match the actual hardware type, pulse detection and fault trigger errors can occur.

4. Set the pulse processing method (C0-19) and the pulse speed measurement mode (C0-20) as needed. If there are no special requirements, use the default values.

5. Set C0-21...C0-30 based on the actual application and encoder characteristics. If no special requirements are imposed, use the default values.

Param.	Name	Description	Default	Range	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BiSS encoder	Yes
C0-02	Encoder pulses per revolution	When using ABZ encoders and sin-cos encoders, set the incremental encoder nameplate parameters, indicating the number of pulses generated per rotation.	1024	1 to 65535	Yes
C0-18	ABZ encoder level type	ABZ encoders support differential output, TTL complementary push-pull output, HTL complementary push-pull output, TTL single-ended push-pull output, HTL single-ended push-pull output, and OC output. See the user guide to check whether the encoder level type is differential, complementary push-pull, single-ended push-pull, or open-collector output. Complementary push-pull and single-ended push-pull: For encoders with a power supply range of 5 V, TTL level applies. In this case, connect the power to 5V terminal. For encoders with a power range of 10 V to 30 V, HTL level applies. In this case, connect the power to 15V terminal. If the level is set improperly, the encoder may be damaged.	1: Differential output	1: Differential output 2: TTL complementary push-pull output 3: HTL complementary push-pull output 4: TTL single-ended push-pull output 5: HTL single-ended push-pull output 6: OC output	Yes

Param.	Name	Description	Default	Range	Mandatory
C0-19	ABZ encoder command word	Set ABZ encoder signal input processing and frequency division output signal processing. Value description: Set the A/B pulse selection in M/T speed measurement through bit0. If this parameter is set to 0, pulse counting is based on the edge of A pulse to achieve accurate speed calculation. Otherwise, B pulse is used as the reference. 0: A pulse 1: B pulse Set interchange of A and B signals through bit2, which is equivalent to interchange of the encoder phase sequence. 0: Disable 1: Enable Set interchange of A and B signals during frequency division output through bit3, which is equivalent to interchange of frequency division output phase sequence. 0: Disable 1: Enable Set Z signal inversion during frequency division output through bit4. Enable this function based on the level state of the frequency division Z signal. 0: Disable 1: Enable Set the low-order bit selection for the filter function through bit5. 0: Disable 1: Enable Set the high-order bit selection of the filter function through bit6. 0: Disable 1: Enable Filter function selection (which defines the filter mode for encoder A/B signal input, with high-order bits followed by low-order bits): 00: Non-adaptive filter, fixed to 0.2-us filtering 01: Adaptive filter, which is divided into 11 speed levels based on clock count between two rising edges of signal A. The sampling frequency varies with the motor speed. (Continued)	0x0E60	bit0: A/B pulse selection in M/T speed measurement 0: A pulse 1: B pulse bit1: Reserved bit2: Interchange of input signals A and B 0: Disable 1: Enable bit3: Interchange of signals A and B during frequency division output 0: Disable 1: Enable bit4: Z signal inversion during frequency division output 0: Disable 1: Enable bit5: Low-order bit of filter function selection 0: Disable bit6: High-order bit of filter function selection 0: Disable 1: Enable bit7: Reserved bit8: Reserved bit9: A pulse disconnection detection 0: Disable 1: Enable bit10: B pulse disconnection detection 0: Disable 1: Enable bit11: Z pulse disconnection detection 0: Disable 1: Enable bit12 to bit15: Reserved	-

Param.	Name	Description	Default	Range	Mandatory
Same as above	Same as above	(Continued) 10: Fixed interlock. A/B pulses are in the quadrature interlock filter mode. 11: Automatic interlock. A/B pulses are in the quadrature interlock filter mode when the speed is equal to or higher than 7.2 k. The mode is disabled when speed is below 7.2 k. Set whether to enable hardware disconnection signal detection for A pulse through bit9. 0: Disable 1: Enable Set whether to enable hardware disconnection signal detection for B pulse through bit10. 0: Disable 1: Enable Set whether to enable hardware disconnection signal detection for Z pulse through bit11. 0: Disable 1: Enable	Same as above	Same as above	-
C0-20	ABZ speed measurement mode selection in quadrature counting	Speed measurement mode in ABZ speed measurement 0: Quadruple frequency - Features fast response at low speed. The measured speed fluctuation increases when the duty cycle of the encoder signal is not 50% or the quadrature speed measurement of A/B signals is not good. 1: Quadruple frequency at low speed, single frequency at high speed -Switched automatically 2: Single frequency - The speed measurement response at low speed is slightly poor but relatively stable.	0: Quadruple frequency	0: Quadruple frequency 1: Quadruple frequency at low speed, single frequency at high speed 2: Single frequency	-
C0-58	Z signal interference detection	Defines whether Z signal interference is detected. Value description: 0: Disable 1: Enable - For details, see C0-59 [Z signal interference detection threshold].	1: Enable	0: Disable 1: Enable	-

Param.	Name	Description	Default	Range	Mandatory
C0-59	Z signal interference detection threshold	Defines Z signal interference detection threshold. Note: During operation of a synchronous motor with the ABZ or sine-cosine encoder in FVC mode, when C0-58 [Z signal interference detection] is set to 1 [Enable], E20-7 [Z signal interference fault] can be reported when one of the following conditions is met: 1. The position of the Z signal deviates from the encoder installation position. 2. The number of AB pulses per motor rotation is decreased or increased compared to the encoder PPR. 3. C0-59 [Z signal interference detection threshold] is exceeded for multiple times, with the value defined by C0-60 [Allowable number of Z signal interferences] exceeded.	0.5%	0.5% to 10.0%	-
C0-60	Allowable number of Z signal interferences	Defines the allowable number of Z signal interferences. For details, see C0-59 [Z signal interference detection threshold].	10	5 to 1000	-
C0-61	Z signal loss detection	Defines whether Z signal loss is detected. Value description: 0: Disable 1: Enable - For details, see C0-62 [Allowable number of Z signal loss events].	1: Enable	0: Disable 1: Enable	-
C0-62	Allowable number of Z signal loss events	Defines the Z signal loss detection threshold. Note: During operation of a synchronous motor with the ABZ or sine-cosine encoder in FVC mode, when C0-61 [Z signal loss detection] is set to 1 [Enable], E22-6 [Z signal loss alarm] can be reported when Z signal is not received after the number of motor revolutions exceeds C0-62 [Z signal loss detection threshold]. In this case, E20-8 [Z signal loss fault] can be reported after stop.	10	5 to 100	-
C0-63	Orientation deviation detection	Defines whether to enable orientation deviation detection. Value description: 0: Disable 1: Enable - When a synchronous motor with the ABZ encoder or sine-cosine encoder operates in FVC mode, if the Z signal calibration angle exceeds 45°, E22-5 [Orientation deviation fault] can be reported.	1: Enable	0: Disable 1: Enable	-

Note

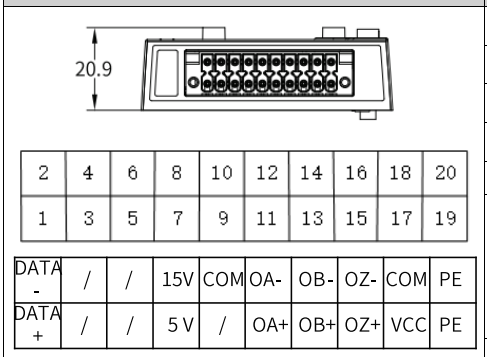
- For synchronous motors, the encoder Z signal must be connected. See details in *"5.3.5.3.4 Synchronous motor angle calibration" on page 591*.
- For asynchronous motors, the motor can be used without Z signal.

5.3.5.1.4 23-bit Encoder

Encoder wiring

The 23-bit encoder uses the PG card [MD-PG-AU1].

Assignment of encoder input terminal pins are shown in the following table *"5.3.5.1.11 Frequency Division Output" on page 581*.

Terminal	Pin No.	Name	Function
	1	DATA+	23-bit encoder data signal (+)
	2	DATA-	23-bit encoder data signal (-)
	7	5V	5 V power supply for the encoder
	8	15 V	15 V power supply for the encoder
	10	COM	C5V/C15V power supply reference ground External input power supply ground for frequency division output
	18	COM	
	19	PE	Shield grounding
	20	PE	

Basic setting procedure

To set the 23-bit encoder, do as follows.

1. Setting the encoder type: Set C0-00 [Encoder type] to 2 [23-bit encoder].

2. Setting the encoder communication frequency: Set the communication frequency according to the nameplate or user guide of the encoder. For example, set C0-23 to 1 (2 M).

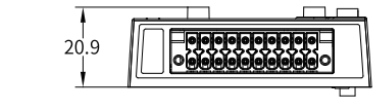
Param.	Name	Description	Default value	Range	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BiSS encoder	Yes
C0-23	23-bit encoder communi-cation frequency selection	Set the corresponding communication frequency according to the nameplate or user guide of the encoder.	1: 2 M	0: 2 M 2 M to 4 M 3 M to 8 M	Yes

5.3.5.1.5 SSI encoder

Encoder wiring

The SSI encoder adopts PG card [MD-PG-AU1].

Assignment of encoder input terminal pins are shown in the following table *"5.3.5.1.11 Frequency Division Output" on page 581*.

Terminal	Pin No.	Name	Function
 2 4 6 8 10 12 14 16 18 20 1 3 5 7 9 11 13 15 17 19 CLK- DATA- / 15V COM OA- OB- OZ- COM PE CLK+ DATA+ / 5V / OA+ OB+ OZ+ VCC PE	1	CLK+	SSI encoder clock signal (+)
	2	CLK-	SSI encoder clock signal (-)
	3	DATA+	SSI encoder data signal (+)
	4	DATA -	SSI encoder data signal (-)
	7	C5V	5 V power supply for the encoder
	8	C15V	15 V power supply for the encoder
	10	COM	C5V/C15V power supply reference ground External input power supply ground for frequency division output
	18	COM	
	19	PE	Shield grounding
	20	PE	

Basic setting procedure

To set the SSI encoder, do as follows.

1. Setting the encoder type: Set C0-00 [Encoder type] to 4 [SSI encoder] based on the PG card connected.

2. Setting SSI encoder communication frequency: Set the proper communication baud rate according to the actual baud rate supported by the encoder and the length of the encoder cable.

3. Set SSI encoder data format: Set the encoder parameters according to the actual data format of the encoder, including C0-32 [SSI encoder parity selection], C0-33 [SSI encoder data format], C0-34 [SSI encoder status bit count], C0-51 [Communication-type encoder single-turn bit count], C0-52 [Encoder multi-turn bit count].

For example, with odd parity, Gray code, 2 status bits, 13-bit single-turn resolution, and 12-bit multi-turn resolution:

Set C0-32 [SSI encoder parity selection] to 1, C0-33 [SSI encoder data format] to 1, C0-34 [SSI encoder status bit count] to 2, C0-51 [Communication-type encoder single-turn bit count] to 13, and C0-52 [Encoder multi-turn bit count] to 12.

[Baud rate limit]

The maximum baud rate supported for SSI encoders decreases as the encoder length on site increases. The longer the cable, the lower the baud rate supported. If the cable length does not match the baud rate, a disconnection fault may be reported. If the encoder does not support the specified baud rate, a disconnection fault can be reported.

Param.	Name	Description	Default value	Range
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	0: None	Yes
C0-31	SSI encoder communication baud rate	Set the corresponding communication frequency according to the encoder nameplate or user guide. Incorrect settings may cause the encoder to report a hardware disconnection fault.	3: 0.5 M	Yes
C0-32	SSI encoder parity selection	Set the parity mode of the SSI encoder based on the nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	0: Zero parity	Yes
C0-33	SSI encoder data encoding format	Set the decoding mode of the SSI encoder based on the nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	0: Binary	Yes
C0-34	SSI encoder status bit count	Set the number of status bits of the SSI encoder based on the nameplate or user guide. Incorrect settings may result in an encoder hardware disconnection fault.	0	Yes
C0-51	Single-turn bit count of communication-type encoder	Set the single-turn bits of EnDat, SSI, and BiSS encoders according to the nameplate or user guide. Incorrect setting may result in an encoder hardware disconnection fault.	23	Yes
C0-52	Multi-turn bit count of communication-type encoder	Set the multi-turn bits of EnDat, SSI, and BiSS encoders according to the nameplate or user guide. Incorrect setting may result in an encoder hardware disconnection fault.	0	Yes

Note

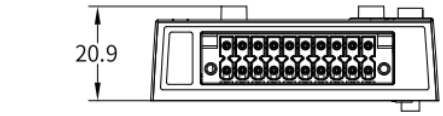
In the SSI data, the sum of the multi-turn bits, the single-turn bits, and the status bits must be lower than 36 bits, and the upper limit resolution of the multi-turn bits and single-turn bits must be lower than 24 bits.

5.3.5.1.6 EnDat encoder

Encoder wiring

The EnDat encoder adopts PG card [MD-PG-AU1].

Assignment of encoder input terminal pins are shown in the following table *"5.3.5.1.11 Frequency Division Output" on page 581*.

Terminal	Pin No.	Name	Function
 2 4 6 8 10 12 14 16 18 20 1 3 5 7 9 11 13 15 17 19 CLK- DATA- / 15 V COM OA- OB- OZ- COM PE CLK+ DATA+ / 5V / OA+ OB+ OZ+ VCC PE	1	CLK+	EnDat encoder clock signal (+)
	2	CLK-	EnDat encoder clock signal (-)
	3	DATA+	EnDat encoder data signal (+)
	4	DATA -	EnDat encoder data signal (-)
	7	C5V	5 V power supply for the encoder
	8	C15V	15 V power supply for the encoder
	10	COM	C5V/C15V power supply reference ground External input power supply ground for frequency division output
	18	COM	
	19	PE	Shield grounding
	20	PE	

Basic setting procedure

To set the EnDat encoder, do as follows.

1. Setting the encoder type: Set C0-00 [Encoder type] to 6 [EnDat encoder] based on the PG card connected.

2. Setting EnDat encoder communication frequency: Set the proper communication baud rate according to the actual baud rate supported by the encoder and the length of the encoder cable.

3. Setting EnDat encoder data format: Set the encoder parameters according to the actual data format of the encoder, including C0-51 [Communication encoder single-turn bit count] and C0-52 [Encoder multi-turn bit count].

For example, with 13-bit single-turn resolution and 12-bit multi-turn resolution: Set C0-51 [Communication encoder single-turn bit count] to 13 and C0-52 [Encoder multi-turn bit count] to 12.

[Baud rate limit]

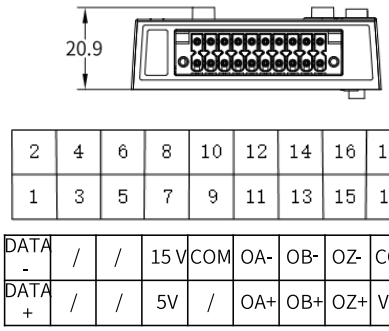
The maximum baud rate supported for EnDat encoders decreases as the encoder length on site increases. The longer the cable, the lower the baud rate supported. If the cable length does not match the baud rate, a disconnection fault may be reported. If the encoder does not support the specified baud rate, a disconnection fault can be reported.

Param.	Name	Description	Default value	Range	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BiSS encoder	Yes
C0-41	EnDat encoder communi-cation baud rate	The resolver is an electromagnetic transducer, also known as synchronous resolver. It is a small AC motor used to measure angles, and measure shaft angular displacement and angular velocity of a rotating object. It consists of stators and rotors. The higher the number of resolver pole pairs, the higher the precision. If a resolver is used, set the number of pole pairs of the resolver properly.	1: 1 M	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	Yes
C0-51	Single-turn bit count of communi-cation-type encoder	Used to select a resolver excitation signal frequency, which can be 10 K, 12 K, 15 K, and 20 K. The excitation current is fixed to 7 Vrms.	23	1 to 32	Yes
C0-52	Multi-turn bit count of communi-cation-type encoder	Used to set the command word for the resolver. Value description: bit0: Whether to enable excitation amplifier output 0: No 1: Yes bit1: Whether to invert the input signal 0: Forward 1: Reverse	0	0 to 32	Yes

5.3.5.1.7 Magnetic Encoder

Encoder wiring

Assignment of [MD-PG-AU1] encoder input terminal pins are shown in the following table *"5.3.5.1.11 Frequency Division Output" on page 581*.

Terminal	Pin No.	Name	Function
	1	DATA+	23-bit encoder data signal (+)
	2	DATA-	23-bit encoder data signal (-)
	7	5V	5 V power supply for the encoder
	8	15 V	15 V power supply for the encoder
	10	COM	C5V/C15V power supply reference ground
	18	COM	External input power supply ground for frequency division output
	19	PE	Shield grounding
	20	PE	

Basic setting procedure

To set the magnetic encoder, do as follows.

1. Setting the encoder type: Set C0-00 [Encoder type] to 2 [23-bit encoder].

2. Setting the magnetic encoder communication frequency: The magnetic encoder only supports 2 M communication frequency, so set C0-23 to 1.

Param.	Name	Description	Default value	Range	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BiSS encoder	Yes
C0-23	23-bit encoder communica-tion frequency selection	Set the corresponding communication frequency according to the nameplate or user guide of the encoder.	1: 2 M	1: 2 M 2: 2.5 M 3: 4 M 4: 8 M	Yes

Note

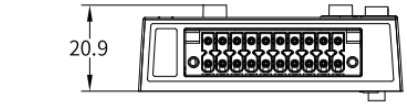
- The magnetic encoder baud rate only supports 2 M, and C0-23 can only be 1.
- The magnetic encoder data refresh rate is 16 kHz.

5.3.5.1.8 BiSS Encoder

Encoder wiring

The BiSS encoder adopts PG card [MD-PG-AU1].

Assignment of encoder input terminal pins are shown in the following table *"5.3.5.1.11 Frequency Division Output" on page 581*.

Terminal	Pin No.	Name	Function
	1	CLK+	BiSS encoder clock signal (+)
	2	CLK-	BiSS encoder clock signal (-)
	3	DATA+	BiSS encoder data signal (+)
	4	DATA -	BiSS encoder data signal (-)
	7	C5V	5 V power supply for the encoder
	8	C15V	15 V power supply for the encoder
	10	COM	C5V/C15V power supply reference ground External input power supply ground for frequency division output
	18	COM	
	19	PE	Shield grounding
	20	PE	

2	4	6	8	10	12	14	16	18	20
1	3	5	7	9	11	13	15	17	19

CLK-	DATA-	/	15V	COM	OA-	OB-	OZ-	COM	PE
CLK+	DATA+	/	5 V	/	OA+	OB+	OZ+	VCC	PE

Basic setting procedure

To set the BiSS encoder, do as follows.

1. Setting the encoder type: Set C0-00 [Encoder type] to 7 [BiSS encoder] based on the PG card connected.

2. Setting BiSS encoder communication frequency: Set the proper communication baud rate according to the actual baud rate supported by the encoder and the length of the encoder cable.

[Baud rate limit]

The maximum baud rate supported for BiSS encoders decreases as the cable length on site increases. The longer the cable, the lower the baud rate supported. If the cable length does not match the baud rate, a disconnection fault may be reported. If the encoder does not support the specified baud rate, a disconnection fault can be reported.

3. Setting BiSS encoder data format: Set the encoder parameters according to the actual data format of the encoder, including C0-46 [BiSS encoder parity selection], C0-47 [BiSS encoder status bit count], C0-51 [Communication encoder single-turn bit count], and C0-52 [Encoder multi-turn bit count].

For example, with CRC calculation matching received CRC, 2 status bits, 13-bit single-turn resolution, and 12-bit multi-turn resolution:

Set C0-46 [BiSS encoder parity selection] to 1, C0-47 [BiSS encoder status bit count] to 2, C0-51 [Communication encoder single-turn bit count] to 13, and C0-52 [Encoder multi-turn bit count] to 12.

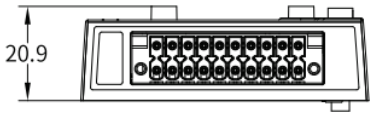
Param.	Name	Description	Default value	Range	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BiSS encoder	Yes
C0-45	Communica-tion frequency of BiSS encoder	Defines the corresponding communication frequency according to the encoder nameplate or user guide. Incorrect settings may cause an encoder hardware disconnection fault.	1: 1 M	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	Yes
C0-46	BiSS encoder parity selection	Defines the parity mode of the encoder. Incorrect settings may cause an encoder hardware disconnection fault.	1: Calculated CRC same as received CRC	0: Calculated CRC inconsistent with the received CRC 1: Calculated CRC same as received CRC	-
C0-47	BiSS encoder status bit count	Defines the number of status bits of the encoder. Incorrect settings may cause an encoder hardware disconnection fault.	0	0 to 8	-
C0-51	Single-turn bit count of communica-tion-type encoder	Set the single-turn bits of EnDat, SSI, and BiSS encoders according to the nameplate or user guide. Incorrect settings may cause an encoder hardware disconnection fault.	23	1 to 32	-
C0-52	Multi-turn bit count of communica-tion-type encoder	Set the multi-turn bits of EnDat, SSI, and BiSS encoders according to the nameplate or user guide. Incorrect settings may cause an encoder hardware disconnection fault.	0	0 to 32	-

5.3.5.1.9 Resolver

Encoder wiring

The PG card [MD-PG-R1] can be used in the resolver (hereinafter referred to as resolver).

Assignment of encoder input terminal pins are shown in the following table *"5.3.5.1.11 Frequency Division Output" on page 581*.

Terminal	Pin No.	Name	Function
	1	SIN+	Resolver feedback SIN (+)
	2	SIN-	Resolver feedback SIN (-)
	3	COS+	Resolver feedback COS (+)
	4	COS-	Resolver feedback COS (-)
	5	EXC+	Resolver excitation (+)
	6	EXC-	Resolver excitation (-)
	19	PE	Shield grounding
	20	PE	

2	4	6	8	10	12	14	16	18	20
1	3	5	7	9	11	13	15	17	19

SIN-	COS-	EXC-	/	/	OA-	OB-	OZ-	COM	PE
SIN+	COS+	EXC+	/	/	OA+	OB+	OZ+	VCC	PE

Basic setting procedure

To set resolver, do as follows.

1. Setting the encoder type: Set C0-00 [Encoder type] to 3 [Resolver] based on the PG card connected.

2. Setting the number of pole pairs: Set the number of pole pairs according to the nameplate or user guide of the resolver. For one pair of poles, set C0-13 to 1.

Param.	Name	Description	Default value	Range	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BiSS encoder	Yes
C0-13	Number of pole pairs of resolver	The resolver is an electromagnetic transducer, also known as synchronous resolver. It is a small AC motor used to measure angles, and measure shaft angular displacement and angular velocity of a rotating object. It consists of stators and rotors. The higher the number of resolver pole pairs, the higher the precision can be. If a resolver is used, set the number of pole pairs of the resolver properly.	1	1 to 65535	Yes
C0-27	Resolver excitation signal selection	Used to select a resolver excitation signal frequency, which can be 10 K, 12 K, 15 K, and 20 K. The excitation voltage is fixed to 7 Vrms.	0: 10 kHz	0: 10 kHz 1: 15 kHz 2: 12 kHz 3: 20 kHz	-
C0-28	Command word of the resolver	Used to set the command word for the resolver. Value description: bit0: Whether to enable excitation amplifier output 0: No 1: Yes bit1: Whether to invert the input signal 0: No 1: Yes	0x0000	bit0: Whether to enable excitation amplifier output 0: Disable 1: Enable bit1: Whether to invert the input signal 0: Forward 1: Reverse bit2 to bit15: Reserved	-
C0-29	Resolver transforma-tion ratio	Defines the resolver transformation ratio, which can be 0.5 and 0.286.	0: 0.5	0: 0.5 1: 0.286	-

Note

For synchronous motors running with a resolver, ensure that the following two conditions are met:

1. Number of motor pole pairs ≥ number of rotor pole pairs.
2. The motor pole pairs/resolver pairs can be divided.

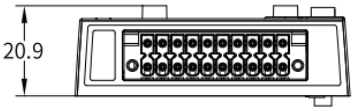
The asynchronous motor does not have this limit.

5.3.5.1.10 Sine-Cosine Encoder

Encoder wiring

The sine-cosine encoder can use the PG card MD-PG-S1.

Assignment of encoder input terminal pins and input terminals are described as follows. For details, see *"5.3.5.1.11 Frequency Division Output" on page 581*.

Terminal	Pin No.	Terminal name	Function
 2 4 6 8 10 12 14 16 18 20 1 3 5 7 9 11 13 15 17 19 SIN- COS- Z- COM / OA- OB- OZ- COM PE SIN+ COS+ Z+ 5V / OA+ OB+ OZ+ VCC PE	1	SIN+	Sine-cosine encoder feedback SIN+
	2	SIN-	Sine-cosine encoder feedback SIN-
	3	COS+	Sine-cosine encoder feedback COS+
	4	COS-	Sine-cosine encoder feedback COS-
	5	Z+	Sine-cosine encoder signal Z+
	6	Z-	Sine-cosine encoder signal Z-
	7	C5V	5 V power supply for the encoder
	8	COM	5 V power supply reference ground External power supply ground for frequency division output
	18	COM	
	19	PE	Shield grounding
	20	PE	

Basic setup procedure

To set the sine-cosine encoder, do as follows:

1. According to the PG card connected, set C0-00 (encoder type) to 5 (sine-cosine encoder).

2. Set the resolution (PPR) of the sine-cosine encoder. The resolution printed on the nameplate indicates the number of pulses per revolution. If a 1024-PPR encoder is used, set C0-02 to 1024.

3. According to the site usage conditions, application requirements, and characteristics of the encoder, set whether the Z signal fault is enabled and the fault detection threshold in C0-21 to C0-30. If there is no special need, the default configuration can be used.

Param.	Name	Description	Default	Range	Mandatory
C0-00	Encoder type	After installing the PG card, set this parameter properly to ensure normal operation of the drive.	0: None	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BiSS encoder	Yes
C0-02	Encoder pulses per revolution	When using ABZ encoders and sine-cosine encoders, set this nameplate parameter, which indicates the number of pulses per revolution.	1	1 to 65535	Yes
C0-58	Z signal interference detection	Sets whether Z signal interference is detected. Value description: 0: Disable 1: Enable. For details, see C0-59 (Z signal interference detection threshold).	1: Enable	0: Disable 1: Enable	-
C0-59	Z signal interference detection threshold	Defines Z signal interference detection threshold. Note: The synchronous motor with the ABZ or sine-cosine encoder installed is running in the FVC mode. C0-58 (Z signal interference detection) is set to 1 (enable). E20-7 (Z signal interference fault) will be reported when one of the following conditions is met: 1. The position of the Z signal deviates from the encoder installation position. 2. The deviation caused by decreased or increased number of AB pulses per motor rotation compared to the encoder PPR exceeds C0-59 (Z signal interference detection threshold) for the number of times greater than C0-60 (allowable number of Z signal interference times).	0.5 %	0.5% to 10.0%	-
C0-60	Allowable number of Z signal interference times	Sets the allowable number of Z signal interference times. For details, see C0-59 (Z signal interference detection threshold).	10	5 to 1000	-

Param.	Name	Description	Default	Range	Mandatory
C0-61	Z signal loss detection	Sets whether Z signal loss is detected. Value description: 0: Disable 1: Enable. For details, see C0-62 (allowable number of Z signal loss times).	1: Enable	0: Disable 1: Enable	-
C0-62	Allowable number of Z signal loss times	Defines the Z signal loss detection threshold. Note: The synchronous motor with the ABZ or sine-cosine encoder installed is running in the FVC mode. C0-61 (Z signal loss detection) is set to 1 (enable). If no Z signal is received after the motor rotates for over the circle set by C0-62, E22-6 (Z signal loss warning) is reported during operation and E20-8 (Z signal loss fault) is reported after shutdown.	10		-

Note

For synchronous motors, the encoder Z signal (R signal) must be connected. The MD630 does not support correction of the sine/cosine encoder through the C/D signal.

For asynchronous motors, the motor can be used without Z signal.

5.3.5.1.11 Frequency Division Output

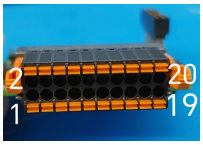
Wiring

Steps for frequency division output wiring are as follows:

1. Connect the complementary push-pull frequency division output cables to the OA+/OA-, OB+/OB-, and OZ+/OZ- of the PG card J3 terminal, and connect the reference ground of the frequency division output to COM.

2. Connect the single-ended push-pull frequency division output cables to the OA+, OB+, and OZ+ of the PG card J3 terminal, and connect the reference ground of the frequency division output to COM.

Assignment of encoder input terminal pins and input terminals are described as follows.

Terminal	Pin No.	Complementary push-pull terminal name	Complementary push-pull function	Single-ended push-pull terminal name	Single-ended push-pull function
 / / / / / OA- OB- OZ- COM PE / / / / / OA+ OB+ OZ+ VCC PE	11	OA+	A+	OA+	A+
	12	OA-	A-	-	-
	13	OB+	B+	OB+	B+
	14	OB-	B-	-	-
	15	OZ+	Z+	OZ+	Z+
	16	OZ-	Z-	-	-
	17	VCC	External power supply input for frequency division output (5 V power supply output from the board by default, or external 5-30 V power supply input)	VCC	External power supply input for frequency division output (5 V power supply output from the board by default, or external 5-30 V power supply input)
	18	COM	External power supply ground for frequency division output	COM	External power supply input for frequency division output If single-ended push-pull cables use twisted pair cables, the negative ends of the twisted pair cables are all grounded.
	19	PE	Shield grounding	PE	Shield grounding
	20	PE		PE	

Basic setup procedure

To set frequency division output, do as follows:

1. Set the frequency division pulse number as required.

2. If the input source is an ABZ encoder, you can set the ABZ encoder frequency division factor. The frequency of the ABZ encoder after frequency division output equals the input frequency of the ABZ encoder divided by C0-16 (frequency division factor of ABZ encoder).

Param.	Name	Default	Value range	Description
C0-15	Number of frequency division output pulses	4096	4 to 65532	Sets the number of A/B pulses (quadrupled frequency) output by the PG card to an integer multiple of 4. Otherwise, the output pulses are inaccurate. For example, if 4097 is set, the number of output pluses is 4096, which equals to 1024 PPRs.
C0-16	Frequency division factor of ABZ encoder	1	1 to 64	It is used only for frequency division output of the ABZ encoder. ABZ encoder frequency/C0-16 = Frequency for frequency division output of the ABZ encoder.
C0-17	Configuration command word for frequency division output	0x0004	bit0: frequency division signal source selection (reserved) 0: Channel 1 1: Channel 2 bit1: A/B signal phase for frequency division output 0: Phase A leads phase B. 1: Phase B leads phase A. bit2: Z signal level for frequency division output 0: The Z signal is at a low level. 1: The Z signal is at a high level. bit3 to bit15: Reserved	Configures frequency division output. Value description: Sets the frequency division signal input source through bit0. 0: Channel 1 1: Channel 2 Sets the A/B signal phase for frequency division output through bit1. 0: Phase A leads phase B. 1: Phase B leads phase A. Sets the Z signal level for frequency division output through bit2. 0: The Z signal is at a high level. 1: The Z signal is at a low level.

Param.	Name	Default	Value range	Description
C0-19	ABZ encoder command word	0x0E60	bit0: A/B pulse selection in M/T speed measurement 0: A pulse 1: B pulse bit1: Reserved bit2: Interchange of input signals A and B 0: Disable 1: Enable bit3: Interchange of A and B signals during frequency division output 0: Disable 1: Enable bit4: Z signal inversion during frequency division output 0: Disable 1: Enable bit5: Low-order bit selection for filter function 0: Disable 1: Enable bit6: High-order bit selection of filter function 0: Disable 1: Enable bit7: Reserved bit8: Reserved (Continued)	Sets ABZ encoder signal input processing and frequency division output signal processing. Value description: Sets the A/B pulse selection in M/T speed measurement through bit0. If this parameter is set to 0, pulse counting is based on the edge of A pulse to achieve accurate speed calculation. Otherwise, B pulse is used as the reference. 0: A pulse 1: B pulse Sets interchange of A and B signals through bit2. After the interchange, it is equivalent to interchange of the encoder phase sequences. 0: Disable 1: Enable Sets interchange of A and B signals during frequency division output through bit3. After the interchange, it is equivalent to interchange of frequency division output sequences. 0: Disable 1: Enable Sets Z signal inversion during frequency division output through bit4. Enable this function based on the level. 0: Disable 1: Enable Sets the low-order bit selection for the filter function through bit5. 0: Disable 1: Enable Sets the high-order bit selection of the filter function through bit6. 0: Disable 1: Enable Filter function selection (namely the filter mode for the A/B signal input by the encoder, with high-order bits followed by low-order bits): 00: Non-adaptive filter, fixed to 0.2-us filter 01: Adaptive filter, which is divided into 11 speed levels based on clock counts between two rising edges of signal A. The sampling frequency varies with the motor speed. (Continued)

Param.	Name	Default	Value range	Description
C0-19	ABZ encoder command word	0x0E60	(Continued) bit9: A pulse disconnection detection 0: Disable 1: Enable bit10: B pulse disconnection detection 0: Disable 1: Enable bit11: Z pulse disconnection detection 0: Disable 1: Enable bit12 to bit15: Reserved	(Continued) 10: Fixed interlock. A/B pulses are in the quadrature interlock filter mode. 11: Automatic interlock. A/B pulses are in the quadrature interlock filter mode when the speed is equal to or higher than 7.2 k. The mode is disabled when speed is below 7.2 k. Sets whether to enable hardware disconnection signal detection for A pulse through bit9. 0: Disable 1: Enable Sets whether to enable hardware disconnection signal detection for B pulse through bit10. 0: Disable 1: Enable Sets whether to enable hardware disconnection signal detection for Z pulse through bit11. 0: Disable 1: Enable

5.3.5.1.12 Precautions for Wiring of the Encoder

Wiring precautions:

● As the output voltage of the drive is pulse voltage and there is common mode voltage to ground, connect the PE terminal of the motor to the PE terminal of the drive in addition to the U/V/W power cables. Ensure that the grounding busbar of the electrical cabinet is grounded. Otherwise, common-mode voltage and leakage current interference may result in encoder signal interference caused by backflow from the encoder cable.

● The encoder cable has high anti-interference capability. Select a cable with a dense metal mesh shield and connect the shield to the PE terminal. Use twisted pair cables and connect them in pairs. For example, use twisted pairs for A+ and A-, which can reduce common-mode interference.

● Minimize use of encoder cable connectors because connectors can generate radiation interference.

● Avoid parallel routing of the encoder cable and motor power cables to prevent the power cables from disturbing the encoder signal.

● For short encoder cables (within 10 m), it is recommended to ground both ends of the cable. For long encoder cables (above 10 m), it is recommended to ground one end of the cable.

5.3.5.2 Common Faults Triggered by Abnormalities

Description

The drive supports three PG cards, namely MD-PG-AU1, MD-PG-R1, and MD-PG-S1. Whether the PG card is online cannot be determined because there is no handshake message or hardware circuit connection.

Therefore, different faults or alarms will be reported in different parameter settings and control modes.

Control mode	Description	Setting	Fault code	Fault description
SVC, V/f	Any encoder is abnormal.	-	N/A	N/A
FVC	The PG card is not connected.	-	E22.7 (encoder card communication abnormality)	Communication between the encoder card and the main controller is abnormal.
	The PG card is connected, but the handshake between the encoder card and the main controller fails.	Start the motor.		The handshake between the encoder card and the main controller fails.
	The PG card is connected, but the encoder type set is inconsistent with the actual type.	Enable hardware disconnection detection through bit3 of C0-01 (encoder control word), or switch FVC mode to SVC mode in a passive way (d7-02/dF-02/y7-02/yF-02=2).	E20.01 (encoder disconnection) E22.8 (encoder communication abnormality)	Communication between the encoder and the encoder card is abnormal. A verification error occurs.
	The PG card is connected, but the encoder hardware is disconnected.		E20.01 (encoder disconnection)	Encoder disconnection (hardware detection)
	The PG card is connected, but communication between the encoder and the PG card is abnormal.		E22.08 (encoder communication abnormality)	Communication between the encoder and the encoder card is abnormal, and position is not obtained.

For detailed causes and solutions of the above faults, refer to *"7.7 Troubleshooting of Common Faults" on page 1146*.

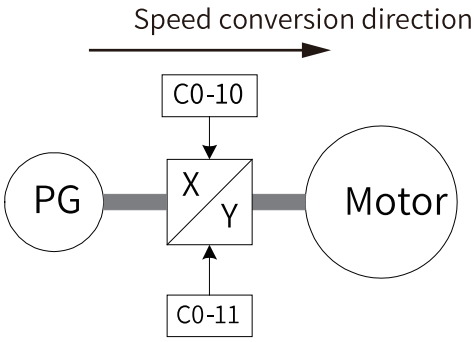
5.3.5.3 Encoder Function

5.3.5.3.1 Function List

Function type	Name	Description	Link
Encoder function	Transmission ratio	When there is a transmission mechanism between the motor and encoder, which means the motor and encoder are not coaxially installed, set the speed relationship between the motor and encoder through the transmission ratio parameter.	"5.3.5.3.2 Transmission ratio" on page 587
	Input phase sequence of encoder	Indicates whether the direction of encoder speed is consistent with the direction of motor speed. If the parameter is set improperly, the encoder speed feedback may be negative when the motor rotates forwardly. The encoder input phase sequence can be auto-tuned or set manually.	"5.3.5.3.3 Input Phase Sequence of the Encoder" on page 590
	Synchronous motor angle calibration	Defines the deviation between the encoder angle and the permanent magnet angle of the synchronous motor, which can be auto-tuned through dynamic auto-tuning or with-load auto-tuning (back EMF excluded) of permanent magnet motor after setting the encoder phase sequence.	"5.3.5.3.4 Synchronous motor angle calibration" on page 591
	Encoder open circuit detection and SVC switchover	The drive detects hardware open circuit by checking whether the encoder card is disconnected, and detects software disconnection by checking whether the ABZ encoder feedback is normal. You can set the response of the drive to encoder open circuit through parameters. For example, you can make the drive report the open circuit fault or switch to SVC mode to continue operating upon open circuit.	"5.3.5.3.5 Encoder Open Circuit Detection and SVC Switchover" on page 593
	Encoder switching from FVC to SVC	If encoder signals are subject to unavoidable interference during high-speed operation, you can switch from FVC to SVC mode during high-speed operation and switch back to FVC mode at low-speed operation to prevent divergence during low-speed operation.	"5.3.5.3.6 Encoder Switching from FVC to SVC" on page 596
	Encoder statistics	The host controller requires the drive to provide data such as cumulative encoder pulses, motor rotation count, and motor shaft angle for further control.	"5.3.5.3.7 Encoder Statistics" on page 597

5.3.5.3.2 Transmission ratio

This product supports a transmission mechanism between the motor and encoder. It indicates that when the encoder and motor are not coaxially installed, the speed conversion relationship is shown in the figure below.



C0-10 and C0-11 set the transmission ratio between the motor and the corresponding encoder. The speed relationship is shown below.

$$\frac{\text{Motor speed}}{\text{Encoder speed}} = \frac{\text{C0-10}}{\text{C0-11}}$$

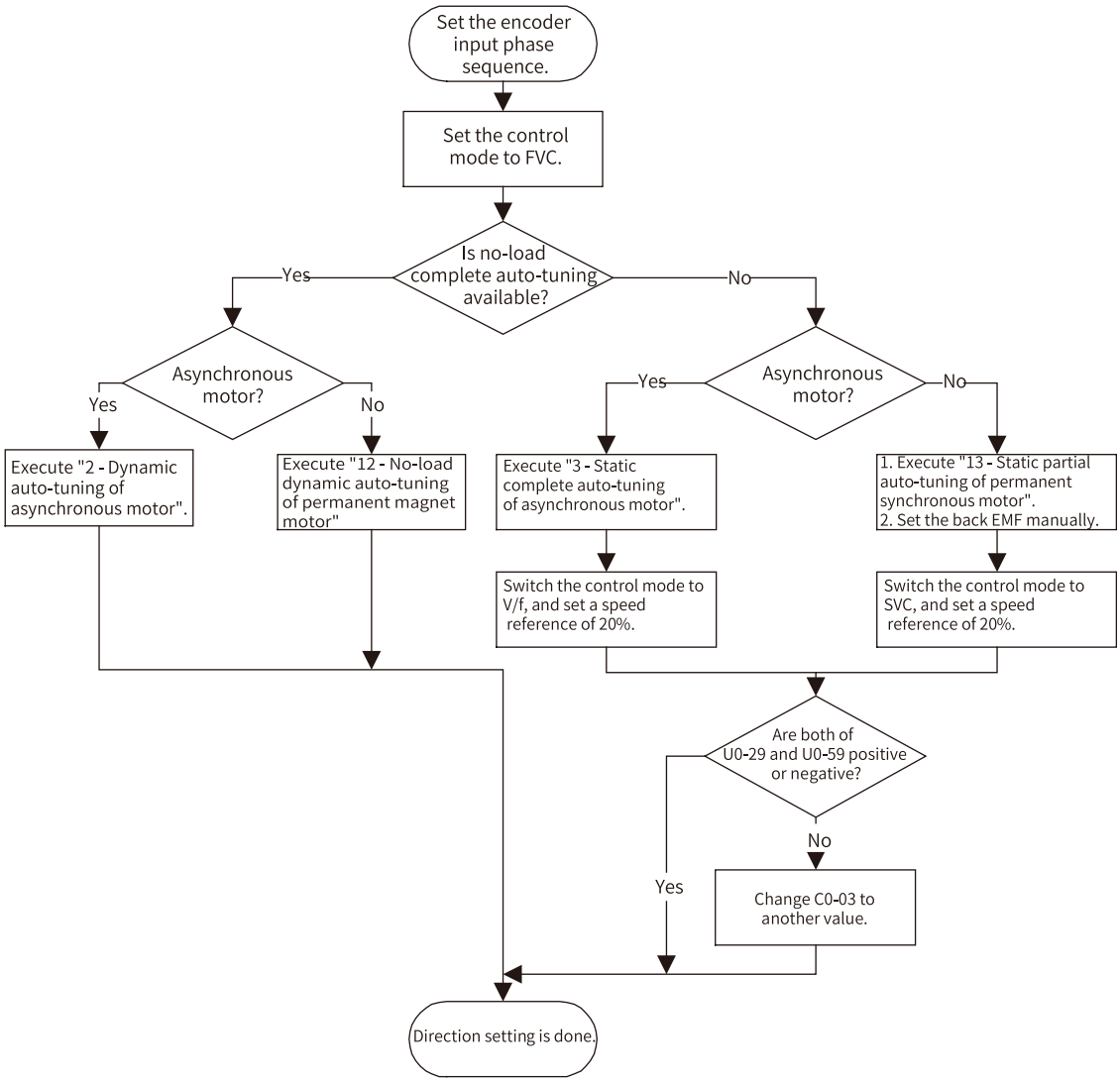
Param.	Name	Default	Value range	Description
C0-10	Encoder gear ratio numerator	1	1 to 65535	When the encoder and motor are not coaxially installed, set this parameter, which forms the transmission ratio together with C0-11. If the motor-to-load deceleration ratio is 2.5 (2.5 revolutions of motor = 1 revolution of load), and the encoder is installed on the load, the numerator should be set to 5 and the denominator should be set to 2. Note: The product of the transmission ratio numerator and the number of motor pole pairs cannot exceed 65535.
C0-11	Encoder gear ratio denominator	1	1 to 65535	When the encoder and motor are not coaxially installed, set this parameter, which forms the transmission ratio together with C0-11. If the motor-to-load deceleration ratio is 2.5 (2.5 revolutions of motor = 1 revolution of load), and the encoder is installed on the load, the numerator should be set to 5 and the denominator should be set to 2. Note: The product of the transmission ratio numerator and the number of motor pole pairs cannot exceed 65535.

5.3.5.3.3 Input Phase Sequence of the Encoder

The parameter C0-03 [Encoder phase sequence] indicates whether the encoder speed and motor speed are in the same direction. If the parameter is set improperly, the encoder speed feedback may be negative when the motor rotates forwardly.

[Input phase sequence setting process]

Set the encoder direction based on the following figure.



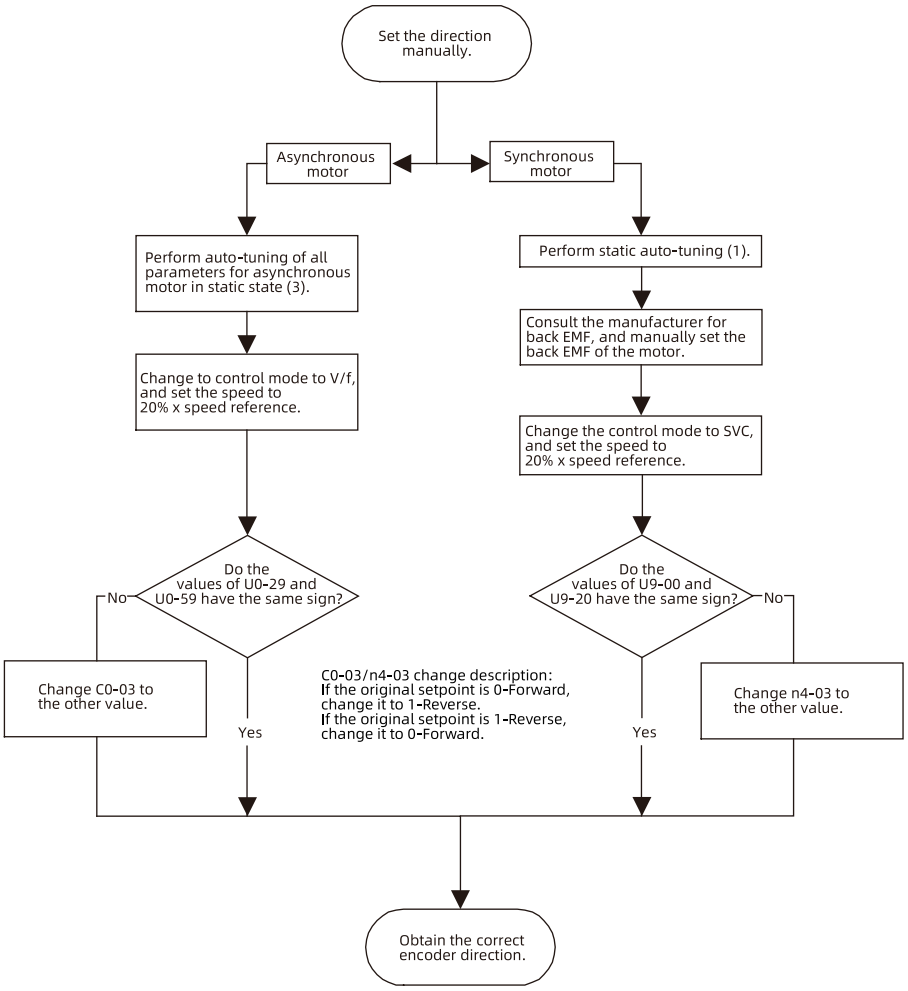
[Auto-tuning direction]

If the motor can be disconnected from the load and rotate freely, it is recommended to perform "2 - Dynamic auto-tuning of asynchronous motor" for an asynchronous motor or "12 - No-load dynamic auto-tuning of permanent magnet motor" for a synchronous motor to auto-tune the encoder direction.

Note: Before auto-tuning, set the control mode to FVC, and ensure the encoder type is correctly set.

[Manual direction setting]

See the following figure for how to set the direction manually.



Note:

For a synchronous motor, the encoder rotation direction and accurate encoder mounting position angle must be known for operation in FVC mode. Otherwise, runaway accidents may occur. See detailed procedure in *"5.3.5.3.4 Synchronous motor angle calibration" on page 591*.

For an asynchronous motor, only the encoder phase sequence needs to be known for operation in the FVC mode.

The auto-tuning in the above flowchart must be performed after C0-00 [Encoder type] is correctly set.

Param.	Name	Default	Value range	Description
C0-03	Phase sequence of encoder	0: Forward	0: Forward 1: Reverse	Used to change the phase sequence in encoder speed measurement.

5.3.5.3.4 Synchronous motor angle calibration

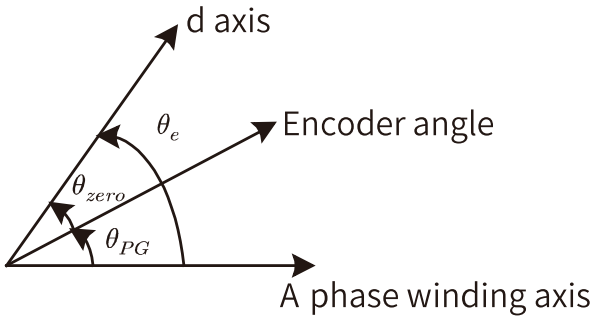
Encoder installation angle description

When the synchronous motor adopts FVC mode, the drive controls the motor based on the accurate permanent magnet angle (D-axis). Therefore, the deviation between the encoder angle and permanent magnet angle must be obtained through C0-04 (encoder mounting position angle).

For incremental encoders, the encoder mounting position angle represents the angle between the Z signal and the phase A winding axis.

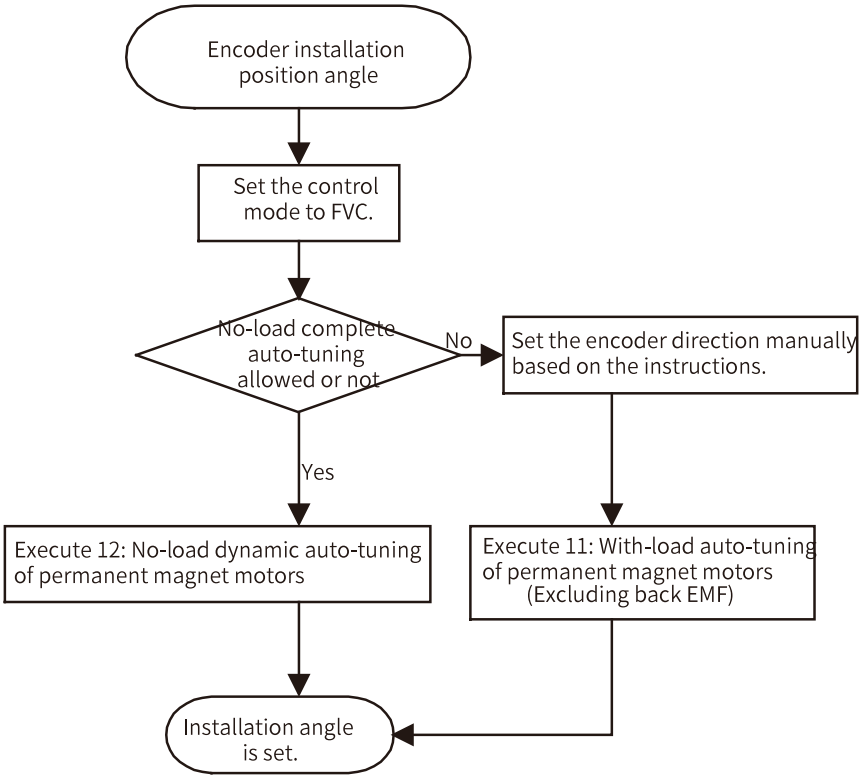
For absolute encoders, the encoder mounting position angle represents the angle between the encoder zero degree and phase A winding axis of the motor.

The following figure shows the relationship among the encoder angle (θ_{PG}), D-axis angle (θ_e), encoder mounting position angle (θ_{zero}), and motor phase A winding axis.



Method for getting the encoder mounting position angle

The C0-04 (encoder mounting position angle) can be automatically obtained through parameter auto-tuning.



For motors that can rotate freely, it is recommended to perform no-load dynamic auto-tuning for permanent magnetic motor. The input signal phase sequence and mounting position angle of the encoder can be auto-tuned through this auto-tuning mode.

If this auto-tuning mode is not available, you can manually set the encoder direction and perform with-load auto-tuning for the permanent magnetic (excluding back EMF) to get the encoder mounting position angle, as shown below.

1. Based on *"5.3.5.3.3 Input Phase Sequence of the Encoder" on page 590*, obtain the accurate encoder phase sequence (C0-03).

2. After obtaining the encoder phase sequence, perform with-load auto-tuning for the permanent magnetic (excluding back EMF) to obtain the encoder mounting position angle.

Note:

1. During with-load auto-tuning for the permanent magnetic (excluding back EMF), the encoder input phase sequence cannot be tuned. If the encoder phase sequence is incorrect, performing this auto-tuning mode will obtain an incorrect encoder mounting position angle.

2. If the synchronous motor is in the FVC mode, you must obtain an accurate encoder mounting position angle. Otherwise, runaway may occur.

3. When a synchronous motor equipped with an incremental encoder, ABZ encoder, or sine-cosine encoder operates in FVC mode, Z signal must be provided to prevent operation failure. Runaway may occur without a Z signal.

Param.	Name	Default	Value range	Description
C0-04	Encoder mounting position angle	0.0	0.0 to 359.9	-

5.3.5.3.5 Encoder Open Circuit Detection and SVC Switchover

Encoder open circuit detection by hardware

Hardware open circuit detection refers to the open circuit detection through the encoder card. All types of encoders support hardware open circuit detection.

With hardware open circuit detection enabled through bit03 of C0-01, when the hardware open circuit signal is detected for longer than the time defined by C0-07, E20.01 (encoder disconnection) is reported.

Param.	Name	Default	Value range	Description
C0-01	Encoder control word	0x0008	bit0: Reserved bit1: Software open circuit detection 0: Disable 1: Enable bit2: Deburring 0: Disable 1: Enable bit3: Hardware open circuit detection 0: Disable 1: Enable bit4: Average filter 0: Disable 1: Enable bit5 to bit15: Reserved	bit0: Speed measurement enable When the FVC control mode is selected, speed measurement is enabled automatically. When other control mode is selected, you can enable or disable the encoder speed measurement function as needed. bit1: Software open circuit detection The software open circuit detection serves to detect open circuit of the encoder during operation based on the encoder speed measurement result. The encoder open circuit cannot be detected at stop. After software open circuit detection is enabled, the deburring function is enabled automatically. When the number of speed measurement errors exceeds C0-09, the encoder software open circuit fault will be reported. bit2: Deburring The deburring function serves to remove occasional speed measurement burrs. The size of the burrs removed is controlled by A9-08. bit3: Hardware open circuit detection The hardware open circuit detection determines whether open circuit occurs based on the hardware open circuit signal. When the hardware open circuit signal is active for a period longer than the time set by C0-07, the hardware open circuit fault is reported. bit4: Average filter The value 0 indicates that average filter is disabled, and the value 1 indicates that average filter is enabled. bit5 to bit15: Reserved
C0-07	Open circuit detection time of PG card for speed feedback	0.5s	0.1s to 10.0s	This parameter sets the encoder open circuit detection time. With encoder hardware open circuit detection enabled (bit3 of C0-01 set to 1), when the drive detects an open circuit fault and the fault lasts for a period longer than C0-07, the drive reports ERR20.

Encoder error detection by software

Only the ABZ encoder can determine whether the encoder feedback is normal through the software. This function is not supported by other types of encoders. By default, software open circuit detection is disabled. You can enable it through bit1 (software open circuit detection) of C0-01 (encoder control word).

If software open circuit detection is enabled, a detection threshold in the software can be adjusted through C0-08 (software detection coefficient for encoder open circuit). When the number of errors detected by the software exceeds C0-09 (threshold of speed error events), E20.05 (encoder software open circuit) will be reported.

Param.	Name	Default	Value range	Description
C0-08	Software detection coefficient for encoder open circuit	100.0%	0.0% to 800.0%	This parameter sets the size of the speed burrs when the speed is abnormal. The default is 100%. Generally, no change is required.
C0-09	Threshold of speed error events	10	1 to 100	Encoder software open circuit detection is enabled. When the number of speed measurement errors detected exceeds C0-09, the encoder software open circuit fault is reported.

Open circuit troubleshooting

You can set how the drive acts when different groups of motors are running upon encoder open circuit through d7-02 to d7-04, dF-02 to dF-04, y7-02 to y7-04, and yF-02 to yF-04.

Open circuit judgment

The encoder open circuit fault is processed based on the setting of d7-02/dF-02/y7-02/yF-02 (Switchover between FVC and SVC modes).

Select "0: Not switched": If hardware/software open circuit detection (C0-01) is enabled, the open circuit fault is reported and the drive coasts to stop. If the detection function is disabled, overcurrent, overload, bus overvoltage may occur due to angle update error.

Selection "2: Switched passively": The encoder hardware and software open circuit detection is performed automatically.

Switch to SVC upon encoder open circuit

d7-02/dF-02/y7-02/yF-02 set to 2 (Switched passively): When the encoder hardware/software open circuit fault occurs, the control mode switches from FVC to SVC automatically and the drive continues operation until a stop command is received or the operating speed is lower than the threshold defined by d0-09/d8-09/y0-09/y8-09. In this case, a fault is reported.

The default value of d0-09/d8-09/y0-09/y8-09 is 2%. This means the minimum operating speed after switchover to SVC mode upon encoder open circuit is 2% of the default value. When the synchronous frequency is lower than 2% of the default value, a fault is reported. When the preceding parameters are set to 0%, the operation continues until a stop command is received. In this case, a fault is reported.

Note: Setting d0-09/d8-09/y0-09/y8-09 of active load to 0% may result in operational divergence.

Param.	Name	Default	Value range	Description
d7-02/dF-02/y7-02/yF-02	Switch FVC to SVC	0	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC upon encoder open circuit. If the encoder is recovered during operation, the FVC mode will be switched back after stop.)	Set to 1: The drive keeps operating in FVC mode at the low speed set by d7-03 and d7-04, and switches to SVC mode at the high speed. This mode is applicable to operating applications with encoder signals disturbed. Set to 2: The drive switches to SVC mode if encoder open circuit is detected. If the encoder is recovered during operation, the FVC mode will be switched back after stop.
d7-03/dF-03/y7-03/yF-03	Frequency for switching from FVC to SVC	50%	10% to 500%	Defines the frequency for switching from FVC to SVC when d7-02 is set to 1.
d7-04/dF-04/y7-04/yF-04	Hysteresis for switching from FVC to SVC	10 %	10% to 100%	Defines the hysteresis for switching from FVC to SVC when d7-02 is set to 1.

5.3.5.3.6 Encoder Switching from FVC to SVC

If encoder signals are subject to unavoidable interference during high-speed operation, you can switch from FVC to SVC mode during high-speed operation and switch back to FVC mode at low-speed operation to prevent divergence during low-speed operation.

By default, this function is disabled. You can enable this function through d7-02/dF-02/y7-02/yF-02. Adjust the speed for switching FVC to SVC through d7-03/dF-03/y7-03/yF-03 and d7-04/dF-04/y7-04/yF-04.

Param.	Name	Default	Value range	Description
d7-02/dF-02/y7-02/yF-02	Switch FVC to SVC	0	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC upon encoder open circuit. If the encoder is recovered during operation, the FVC mode will be switched back after stop.)	Set to 1: The drive keeps operating in FVC mode at the low speed set by d7-03 and d7-04, and switches to SVC mode at the high speed. This mode is applicable to operating applications with encoder signals disturbed. Set to 2: The drive switches to SVC mode if encoder open circuit is detected. If the encoder is recovered during operation, the FVC mode will be switched back after stop.
d7-03/dF-03/y7-03/yF-03	Frequency for switching from FVC to SVC	50%	10% to 500%	Defines the frequency for switching from FVC to SVC when d7-02 is set to 1.
d7-04/dF-04/y7-04/yF-04	Hysteresis for switching from FVC to SVC	10 %	10% to 100%	Defines the hysteresis for switching from FVC to SVC when d7-02 is set to 1.

5.3.5.3.7 Encoder Statistics

Application scenario

The host controller requires the drive to provide data such as cumulative encoder pulses, motor rotation count, and motor shaft angle for further control.

Description

This product provides statistics on pulses of any type of supported encoders. The statistics data includes cumulative encoder pulses, motor rotation count, and motor shaft angle. Additionally, the cumulative encoder pulses can be converted into user-defined units.

The product also allows you to set the encoder pulse data, such as clearing the cumulative encoder pulse data or setting the initial pulse count for the encoder.

Function module	Description
Encoder cumulative pulse statistics	This function directly accumulates the acquired pulse count to form a 64-bit value. The final cumulative pulse count can be displayed through U0-55 to U0-58 as a 64-bit value. For example, if U0-55 (High-order 16 bits of encoder cumulative pulses) is 0x0021, U0-56 (High/Middle-order 16 bits of encoder cumulative pulses) is 0x0121, U0-57 (Low/Middle-order 16 bits of encoder cumulative pulses) is 0x00EF, and U0-58 (Low-order 16 bits of encoder cumulative pulses) is 0x0035, the cumulative pulse count is 0x0021012100EF0035. If the motor rotates in reverse, the encoder cumulative pulse count may be negative. You must manually convert the combined data from U0-55 to U0-58 into a signed value. Additionally, you can set the conversion relationship between encoder pulses and the actual unit through C0-90 (Encoder pulse unit conversion numerator) and C0-91 (Encoder pulse unit conversion denominator). For example, if the motor rotates one turn and generates 10000 pulses and one turn corresponds to a load movement distance of 2.5 mm, set C0-90 to 5 and C0-91 to 20000.
Motor rotation count statistics	This function is used to calculate the number of pulses for the motor shaft to rotate one turn based on C0-10 (Encoder gear ratio numerator), C0-11 (Encoder gear ratio denominator), C0-13 (Number of resolver pole pairs), and the number of pulses per encoder revolution. Then the total motor rotation count is calculated using the cumulative encoder pulse count and the number of pulses per motor shaft revolution.
Motor rotation angle statistics	The motor rotation angle ranges from 0.00 to 359.99. If the motor rotates forward, the motor rotation angle decreases from 359.99. When the angle value reaches 0, the motor rotation count decreases by 1. If the motor rotates reversely, the motor rotation angle increases from 0.00. When the angle value reaches 359.99, the motor rotation count increases by 1.

Application example

1. Complete encoder wiring, type selection, and basic function settings according to 9.5.1 to 9.5.2.
2. Set the initial cumulative pulse count of the encoder through C0-93 (High-order bit of encoder cumulative pulses) and C0-94 (low-order bit of encoder cumulative pulses). Then set C0-92 (Encoder cumulative pulse setting switch) to write the data to C0-93 (High-order bit of encoder cumulative pulses) and C0-94 (low-order bit of encoder cumulative pulses).
3. Set C0-90 (Encoder pulse unit conversion numerator) and C0-91 (Encoder pulse unit conversion denominator) as required.
4. Obtain the required data from U0-55 to U0-58 and U0-92 to U0-95.

Related parameters

Param.	Name	Default	Value range	Description
C0-90	Encoder pulse unit conversion numerator	1	0 to 65535	Sets the pulse unit conversion numerator. Note: 1. Set C0-90 and C0-91 to convert the cumulated pulses (U0-55 to U0-58) into the actual units required for motor movement. 2. The conversion results are displayed in U0-92 and U0-93.
C0-91	Encoder pulse unit conversion denominator	1	0 to 65535	Sets the pulse unit conversion denominator. Note: 1. Set C0-90 and C0-91 to convert the cumulated pulses (U0-55 to U0-58) into the actual units required for motor movement. 2. The conversion results are displayed in U0-92 and U0-93.

Param.	Name	Default	Value range	Description
C0-92	Setting of encoder pulse accumulation	0	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Sets whether to reset the encoder cumulated pulses. If this parameter is set to 1, the values of C0-93 and C0-94 will be updated to the encoder cumulative pulse counter (U0-55 to U0-58). Note: This function is active on the rising edge (0 -> 1).
C0-93	High-order bits of encoder pulse accumulation	0x0000	0x0000 to 0xFFFF	Sets the high-order bits of the encoder cumulated pulses, which form 32-bit signed data with U0-94. Note: 1. C0-93 and C0-94 represent the memory values of data. For example, to set the cumulated reverse pulse count to 1000 (-1000), set C0-93 to 0xFFFF and C0-94 to 0xFC18, and then set C0-92 to 1 to write the data. 2: If C0-93 and C0-94 are both 0, the cumulated pulse count is cleared. 3. C0-93 and C0-94 correspond to U0-57 and U0-58, supporting the setting of the lower-order 32 bits of the 64-bit cumulative pulse data. The higher-order 32 bits are default to 0.
C0-94	Low-order bits of encoder pulse accumulation	0x0000	0x0000 to 0xFFFF	Sets the low-order bits of the encoder cumulated pulses, which form 32-bit signed data with U0-93. Note: 1. C0-93 and C0-94 represent the memory values of data. For example, to set the cumulated reverse pulse count to 1000 (-1000), set C0-93 to 0xFFFF and C0-94 to 0xFC18, and then set C0-92 to 1 to write the data. 2: If C0-93 and C0-94 are both 0, the cumulated pulse count is cleared. 3. C0-93 and C0-94 correspond to U0-57 and U0-58, supporting the setting of the lower-order 32 bits of the 64-bit cumulative pulse data. The higher-order 32 bits are default to 0.
U0-55	High-order 16 bits of encoder cumulative pulses	-	-	Displays the high-order 16 bits of the cumulative encoder pulses (64-bit signed number in total). Note: U0-55 to U0-58 are used to form a signed 64-bit number in descending order.

Param.	Name	Default	Value range	Description
U0-56	Middle/High-order 16 bits of cumulative encoder pulses	-	-	Displays the middle/high-order 16 bits of the cumulative encoder pulses (64-bit signed number in total). Note: U0-55 to U0-58 are used to form a signed 64-bit number in descending order.
U0-57	Low/Middle-order 16 bits of cumulative encoder pulses	-	-	Displays the low/middle-order 16 bits of cumulative encoder pulses (64-bit signed number in total). Note: U0-55 to U0-58 are used to form a signed 64-bit number in descending order.
U0-58	Low-order 16 bits of cumulative encoder pulses	-	-	Displays the low-order 16 bits of cumulative encoder pulses (64-bit signed number in total). Note: U0-55 to U0-58 are used to form a signed 64-bit number in descending order.
U0-92	Conversion result of encoder pulse unit (high-order 16 bits)	-	-	Displays the conversion result of the encoder pulse unit (high-order 16 bits).
U0-93	Conversion result of encoder pulse unit (low-order 16 bits)	-	-	Displays the conversion result of the encoder pulse unit (low-order 16 bits).
U0-94	Motor rotation count (high-order 16 bits)	-	-	Motor rotation count (high-order 16 bits)
U0-95	Motor rotation count (low-order 16 bits)	-	-	Motor rotation count (low-order 16 bits)

5.3.5.4 Encoder Error and Solutions

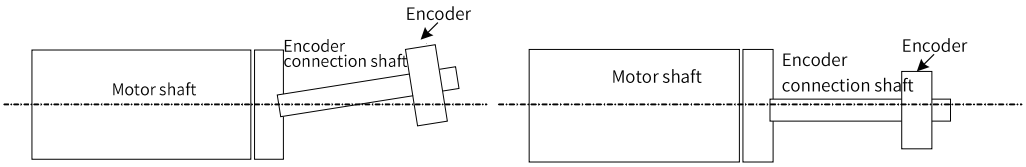
5.3.5.4.1 Speed Measurement Fluctuation Caused by Improper Encoder Installation

In high-performance applications (such as test benches), a low fluctuation in the motor speed is required. In this case, proper installation of the encoder is critical. Improper installation can affect system performance or even result in faults. Radial runout frequently occurs during encoder installation, which are further divided into the following three situations.

Connection shaft not vertical to the end face: The connection shaft is not vertical to the encoder end face, leading to encoder shaft misalignment.

Encoder connection shaft not aligned with motor shaft: The encoder shaft is not aligned with the motor shaft, leading to radial runout during operation.

Manufacturing problems: For example, the motor bearing is damaged or the motor is severely unbalanced (rarely occurred).



(a) The connection shaft and transverse plane are not perpendicular.

(b) The encoder shaft is connected to a different axis from the motor shaft.

Figure 5-177 Improper installation

Problems caused by radial runout

The encoder radial runout can affect the system in the following aspects.

Feedback speed fluctuation: Torque fluctuation and shock may occur, leading to unusual noise of the machine, which is especially true during high-speed operation. This can affect the service life of the machine.

Control error: In high-speed operation with a high-gain speed loop, overcurrent and overvoltage may occur.

Mechanical fatigue: The radial runout of the encoder increases the fatigue stress at the connection parts, leading to spring breakage on the encoder base or encoder coupling breakage.

Troubleshooting methods

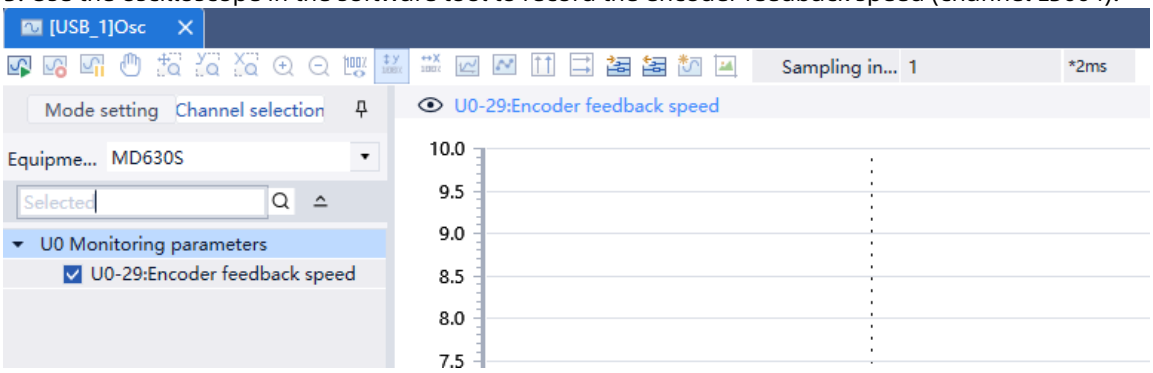
Radial runout in the encoder shaft can result in encoder feedback speed jitter along with the mechanical frequency. You can use the following two methods to determine whether a fault occurs:

Method 1: Coast to stop

1. Select any control mode (such as V/f, SVC, or FVC) and set the stop mode to "Coast to stop".

2. Start the motor and run it to a certain speed (for example, 50% of the rated speed).

3. Use the oscilloscope in the software tool to record the encoder feedback speed (channel L3004).



4. Observe the waveform. After coast-to-stop, the feedback speed of the encoder can jitter along with the mechanical frequency. For example, if the operating frequency of the motor with two pairs of poles is 62.99 Hz, the mechanical frequency is 31.75 Hz. If the waveform shows that fluctuation that close to the mechanical frequency (such as 31.25 Hz) is present in the encoder speed feedback, the radial runout of the encoder is abnormal.

Method 2: Comparison between SVC speed and encoder speed

1. Set the control mode to SVC.

2. Observe the actual motor speed (L3000) and encoder feedback speed (L3004) through the oscilloscope in the software tool.

3. If the encoder feedback speed (L3004) is stable without fluctuation, but the actual motor speed (L3000) shows mechanical frequency fluctuation, the encoder is installed improperly.

Encoder concentricity assessment criteria

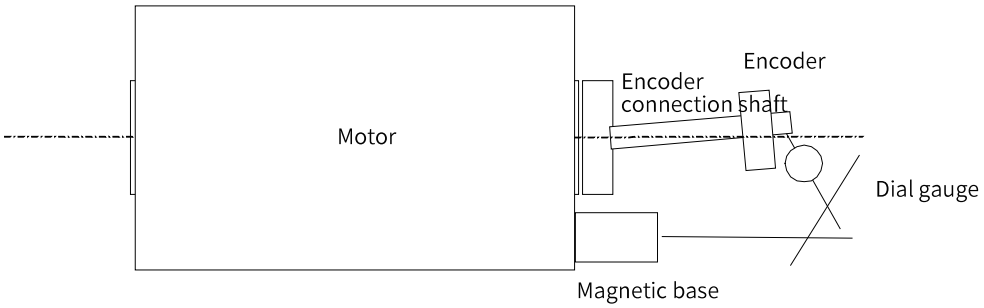
If the encoder is installed improperly, you can calibrate the stand with a dial indicator to measure the radial runout of the encoder. The following shows the detailed procedure.

1. Fix the dial indicator to the magnetic base and align the dial indicator head to the encoder shaft.

2. After zero calibration, rotate the motor shaft slowly to read the radial runout value of the encoder.

3. Acceptance criteria: The radial runout range of the encoder is lower than 0.03 mm. During operation in SVC mode, encoder feedback speed fluctuation must be kept within 0.2%.

In applications requiring low speed fluctuation, install the encoder as required. For commissioning in retrofit applications, measure and evaluate the radial runout value of the encoder to ensure installation quality.



Recommended method for installing the stand

The following measures are recommended to ensure system stability and reliability during encoder installation.

1. Coupling selection: Do not use rigid coupling. The rigid coupling may expose the encoder bearing to additional stress during operation, which increases the risk of damage. It is recommended to select a flexible coupling to reduce vibration and shock.

2. Reinforcement of the fixing screws: Install spring washers to the encoder fixing screws. The spring washers prevent loosening of screws due to vibration during operation, preventing the encoder from jittering and ensuring stable installation.

3. Do not use long shaft: Do not use long shafts for the shaft system of the stand. In long shafts, the torsional stiffness decreases and the system deflection and vibration increases. When connected to the load, the shaft system may oscillate, affecting the overall control performance.

The above measures can effectively improve the installation quality of the encoder, reduce system faults caused by improper installation, and ensure stable operation of the equipment for a long time.

5.3.5.4.2 Encoder Slip

If the coupling between the motor and the encoder is not connected tightly, relative slip may occur between the encoder and the motor.

For asynchronous motors, the motor can operate normally with slight slip.

For synchronous motors, the mounting position angle of the encoder changes due to encoder slip. In this case, the load-carrying capacity of the motor is affected, which may result in runaway in severe cases.

You can verify whether the encoder slips by using the following two methods.

Method 1: Software method

You can check whether the encoder slips through auto-tuning of encoder mounting position angle again. This method is applicable to any operating condition.

Follow the steps below:

a. Record the current value of C0-04.

b. For no-load motors that can rotate freely, perform no-load dynamic auto-tuning for the permanent magnetic motor. For motors connected to a load, perform with-load auto-tuning for the permanent magnetic motor (excluding back EMF) to tune the encoder mounting position angle again.

c. Compare the recorded encoder mounting position angle with the auto-tuned encoder mounting position angle. The deviation between them should not exceed 20°. If the deviation exceeds 20°, the encoder slips.

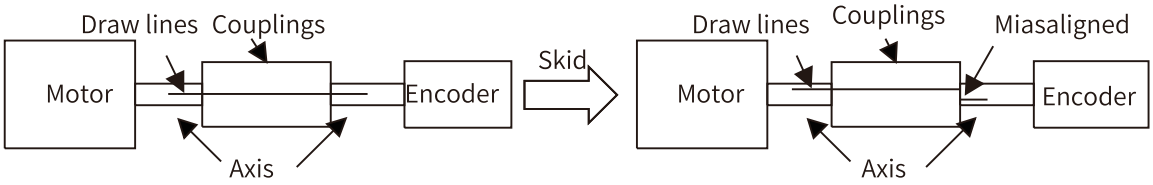
Method 2: Physical method

The physical method applies when the encoder and motor are connected through a coupling and the encoder is exposed. This method is not applicable when the encoder is integrated into the motor.

a. Draw a straight line along the encoder-coupling-motor shaft.

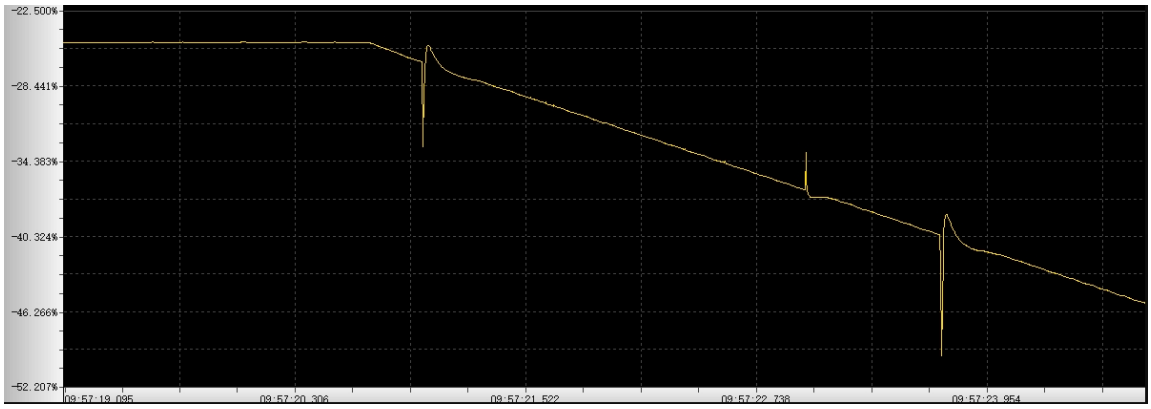
b. Switch the control mode to SVC, start the motor, set a low speed such as 30%, and run for a period of time.

c. Stop the motor and observe whether the line drawn is misaligned. If yes, the encoder has slipped. Tighten the encoder again. The following figure shows the details.



5.3.5.4.3 Encoder Interference

The motor generates electromagnetic interference during operation, which can disturb encoder signals, incurring burrs in the angle or speed. The figure below shows the waveform of the feedback speed from an interfered L3004 encoder.



Interference source analysis

Common interference types and sources are as follows.

Electrostatic interference: Indicates electrostatic discharge or high impedance circuit from the surface of the device.

Magnetic field interference: Indicates electromagnetic field from the motor, AC drive, or power cable.

High-frequency interference: Indicates radiation from external electromagnetic waves or reflection of signal cables.

Low-frequency interference: Indicates inductive coupling or power supply noise from the signal cable.

Anti-interference measures

1. Selection and routing of signal cables

Twisted pair cables: Twisted pair cables are recommended. The signals are transmitted in pairs (including A+/A-, B+/B-, power supply+/power suppl-, and Data+/Data-) to reduce interference.

Shield: Use a metal meshy shield with high shielding performance instead of single-layer aluminum foil to enhance the shielding effect.

Cable thickness: Due to the skin effect, high-frequency signals tend to flow along the surface of the conductor. Therefore, signal cables should not be excessively thick. However, the 0 V power supply cable must be as thick as possible to form a high inter-conductor capacitance with the shield, dissipating high-frequency disturbing signals away from 0 V cable. Spare conductors in the cable can be combined into the 0 V cable. The recommended thickness ratio between the signal cable and power supply cable is 1:3.5. The cross-sectional area of the signal cable and 0 V cable is 0.14 square meters and 0.5 square meters respectively.

Avoid winding: Keep the signal cable as straight as possible to prevent signal distortion caused by inductance characteristics.

Avoid re-connection of the separate cables: It is recommended to use only one cable from encoder signal generation to signal reception. The more the cable joints, the more the radiation sources, the more signal burrs and the more severe the distortion.

Avoid parallel power cables: Long encoder cables must be routed through special metal duct to avoid sharing the same duct with power cables. This is to prevent encoder signals from being disturbed by power cables.

2. Grounding and shielding

Proper grounding and shielding is the key to reduce interference. A closed loop must be formed from the source to grounding of the encoder signal cable feedback.

Grounding of the drive: The PE terminal of the drive must be connected to the grounding cable of the power supply to ensure that the drive is grounded properly.

Grounding of the motor: The motor enclosure is connected to the PE terminal of the drive through the grounding cable to ensure that the motor is grounded properly.

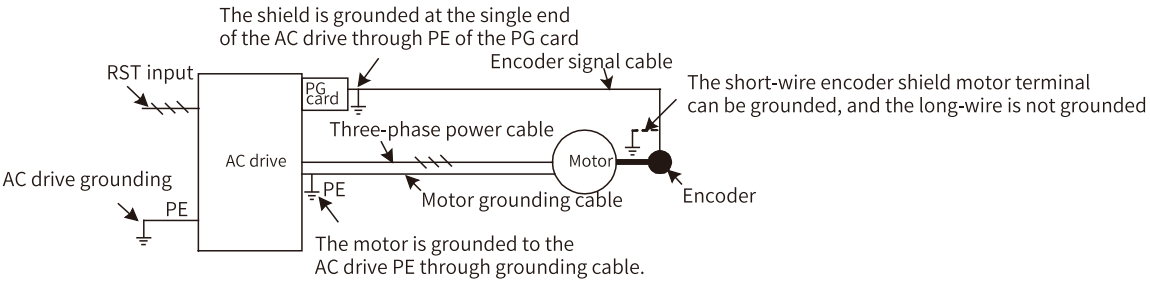
Grounding of the encoder signal cable shield: Single-ended grounding and double-ended grounding are available for the shield.

Single-ended grounding: Only the PG card of the drive is grounded. When the encoder cable is long (50 m), single-ended grounding is recommended. Connect the shield of the encoder signal cable to the PE terminal on the PG card.

Double-ended grounding: Both the drive and the encoder are grounded. When the encoder cable is short, double-ended grounding is recommended.

Connection between 0 V of power supply and PE: Normally, the PE is not connected to 0 V of the power supply unless the PE signal is free from disturbance. After the PE is connected to 0 V of the power supply, the high-frequency signals of the filter can be absorbed by PE quickly, reducing interference to encoder signals. On-site test can be used to confirm whether PE is connected to 0 V.

Insulated shaft sleeve: The encoder with insulated shaft sleeve or rubber shaft sleeve can prevent shaft voltage interference.



Parameter filter

If interference on the encoder speed feedback cannot be eliminated, and requirements on motor control performance is not high, try increasing the filter time of the encoder feedback speed.

Param.	Name	Default	Value range	Description
C0-05	Filter time of encoder speed measurement	0.0040s	0.0000s to 6.0000s	By adjusting the filter time constant for encoder speed measurement, the filtering effect on the encoder signal can be changed. The higher the filter time, the smoother the encoder feedback speed, but the longer the feedback speed delay. The lower the filter time, the greater the encoder feedback speed fluctuation, but the shorter the feedback speed delay. Under the FVC mode, the filter time constant cannot be too low when the resolver and other encoder signal quality is not good.

Note

Increasing the filter will seriously reduce the control performance of the AC drive. If the filter time is set too large, oscillation may occur.

5.4 Advanced Functions

5.4.1 Frequency Detection

5.4.1.1 Function List

Function type	Name	Description	Link
Frequency detection	Frequency detection (FDT)	Frequency detection is used to detect the output frequency of the drive. When the frequency detected exceeds the set detection value, the drive outputs an active signal. When the output frequency is lower than the set detection value and the hysteresis value, the drive stops outputting an active signal.	"5.4.1.2 Frequency Detection (FDT)" on page 608
	Frequency arrival detection window	The detection window of the target frequency is set by the user. When the operating frequency of the drive is within this window, the drive outputs an active signal.	"5.4.1.3 Frequency Arrival Detection Window" on page 610
	Frequency arrival detection value	This function is used to detect the operating frequency of the drive, within a certain range of any frequency.	"5.4.1.4 Detection Value for Frequency Arrival" on page 611
	Frequency upper limit arrival	This function is used to detect whether the operating frequency of the drive reaches the frequency upper limit and output the corresponding signal. You can limit the maximum output frequency of the drive by setting the upper limit.	"5.4.1.5 Frequency Upper Limit Arrival" on page 612
	Frequency lower limit arrival	This function is used to detect whether the frequency reference of the drive reaches the frequency lower limit. If yes, a corresponding signal is output. You can limit the minimum frequency reference of the drive by setting the frequency lower limit.	"5.4.1.6 Frequency Lower Limit Arrival" on page 617
	Target speed arrival	When the actual motor speed reaches the target speed and remains in this state for a specified period of time, the RO terminal outputs an active signal.	"5.4.1.7 Target Speed Arrival" on page 618
	Speed comparison arrival	When the actual motor speed reaches the speed comparison threshold and such status lasts for a specified period of time, the DO outputs an active signal.	"5.4.1.8 Speed Comparison Arrival" on page 620
	Jump frequency	The drive can avoid the mechanical resonance point of the load through the jump frequency.	"5.4.1.9 Jump Frequency" on page 622

5.4.1.2 Frequency Detection (FDT)

Function description

This function is used to set the detection value for the output frequency and the hysteresis value for output action deactivation. The hysteresis value is active only during deceleration. Hysteresis does not occur in detection during acceleration.

Operating principles

When the operating frequency is higher than the frequency detection value, the DO, which is assigned by E1-04 [DO function selection] with the function of "3: Frequency level detection FDT1" or "25: Frequency level detection FDT2" outputs an active signal. When the frequency is lower than the frequency detection hysteresis, the active signal outputted by DO is deactivated. The frequency detection function is shown in the following figure, in which the frequency detection level (FDT1) is used as an example.

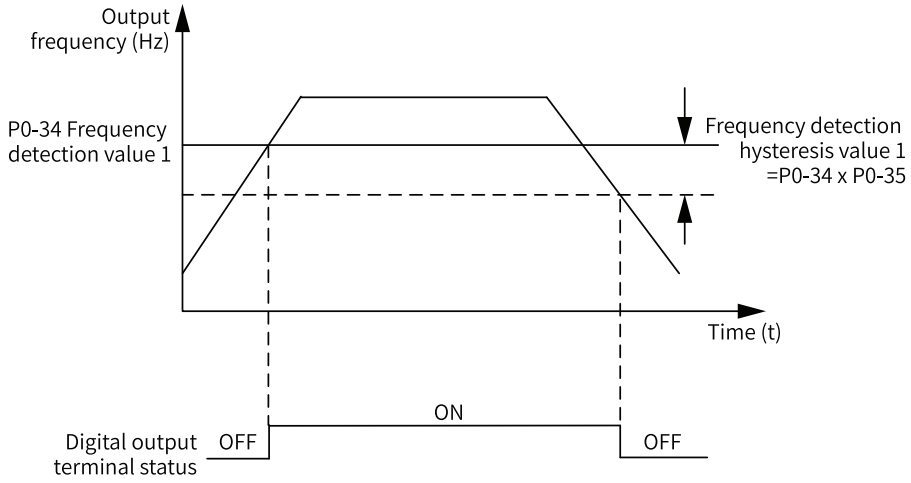


Figure 5-178 Parameters related to frequency detection

Related parameters

Table 5–83 Parameters to frequency detection

Param.	Name	Default value	Value range	Description
P0-34	Frequency detection value (FDT1)	50.00 Hz	0.00 Hz to A2-17	Defines the operating frequency detection value 1 of the drive. Note: 1 .Set DO output function to "3: Frequency level detection FDT1 output". 2 .When the operating frequency of the drive is higher than or equal to the frequency detection value (FDT1), the DO outputs an active signal. 3 .When the operating frequency is lower than the result of "P0-34 - P0-34 x P0-35", the DO terminal outputs an inactive signal.
P0-35	Frequency detection hysteresis value (FDT1)	5.0%	0.0% to 100.0%	Defines the operating frequency detection hysteresis coefficient of the drive, which is a percentage to the frequency detection value (FDT1). Note: Same as P0-34.
P0-36	Frequency detection value (FDT2)	50.00 Hz	0.00 Hz to A2-17	Defines the operating frequency detection value 2 of the drive. Note: 1 .Set DO function to "25: Frequency level detection FDT2 output". 2 .When the operating frequency of the drive is higher than or equal to the frequency detection value (FDT2), the DO can be configured to output an active signal 3 .When the operating frequency is lower than the result of "P0-36 - P0-36 x P0-37", the DO terminal outputs an inactive signal.
P0-37	Frequency detection hysteresis value (FDT2)	5.0%	0.0% to 100.0%	Defines the operating frequency detection hysteresis coefficient of the drive, which is a percentage to the frequency detection value (FDT2). Note: Same as P0-36.

Application instance

The following takes frequency detection (FDT) as an example.

1. Set E1-00 [RO output function selection] to "3: Frequency level detection FDT1 output".
2. Set P0-34 [Frequency detection value (FDT1)] and P0-35 [Frequency detection hysteresis value (FDT1)].
3. Set the target frequency of the drive to a value higher than frequency detection value (FDT1).
4. During operation of the drive, if the operating frequency during acceleration reaches P0-34 [Frequency detection value (FDT1)], the RO outputs an active signal.

5. If the operating frequency during deceleration is lower than the result of "P0-34 [Frequency detection value (FDT1)] - P0-34 [Frequency detection value (FDT1)] x P0-35 [Frequency detection hysteresis (FDT1)]", the RO stops outputting the active signal.

5.4.1.3 Frequency Arrival Detection Window

Function description

This function is used to detect the operating frequency of the drive, which is within the target frequency range.

Operating principles

Set the frequency arrival detection range through P0-38 [Frequency arrival detection window]. When the operating frequency of the drive is within "Frequency reference±A2-04 x P0-38", and E1-04 [DO output function selection] is set to "4: Frequency arrival", the detection amplitude sequence diagram is shown below.

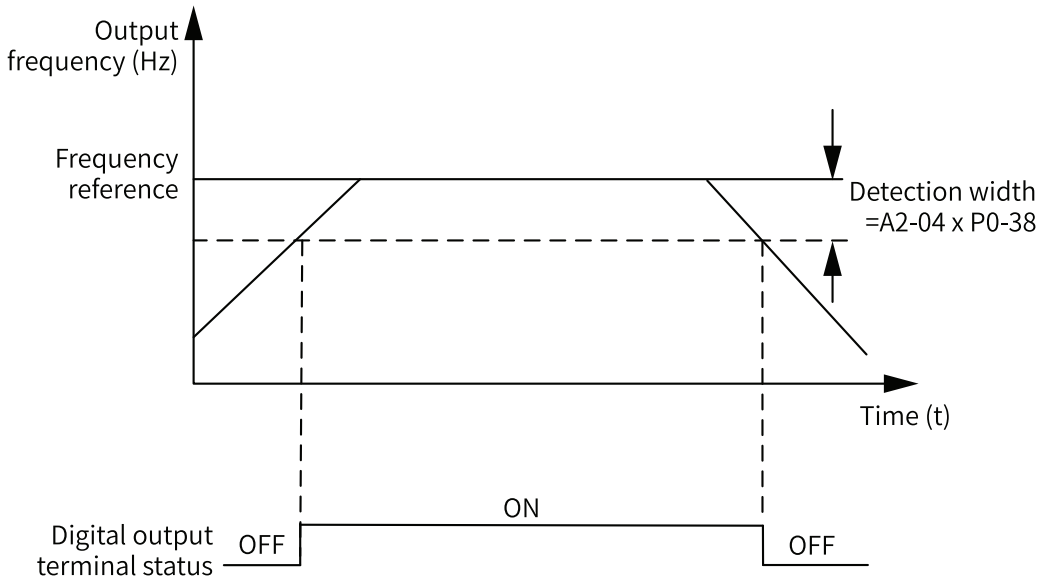


Figure 5-179 Detection amplitude sequence

Related parameters

Table 5–84 Parameters related to frequency arrival detection amplitude

Param.	Function	Default value	Value range	Description
P0-38	Frequency arrival detection window	0.0%	0.0% to 100.0%	Defines the detection window for the operating frequency of the drive, which is a percentage to A2-04. Note: 1 .Set the DO function to "4: Frequency arrival". 2 .When the operating frequency of the drive is within the range of "Target frequency±A2-04 x P0-38", the DO terminal outputs an active signal.

Application instance

The following takes RO output function as an example.

1. Set E1-00 [RO output function selection] to "4: Frequency arrival".
2. Set the frequency of the drive.
3. During operation of the drive, when the operating frequency during acceleration reaches the result of "Frequency reference - A2-04 x P0-38 [Frequency arrival detection window]", the RO terminal outputs an active signal.
4. When the operating frequency during deceleration is lower than the result of "Frequency reference - A2-04 x P0-38 [Frequency arrival detection window]", the RO terminal stops outputting the active signal.

5.4.1.4 Detection Value for Frequency Arrival

Function description

This function is used to detect the operating frequency of the drive, within a certain range of any frequency.

Operating principles

The drive provides two sets of frequency detection parameters, allowing separate settings for the frequency arrival value and the frequency detection range. When the operating frequency of the drive is within the range of "Frequency arrival detection value±Frequency arrival detection amplitude", the DO terminal outputs an active signal when E1-04 [DO output function selection] is set to "26: Frequency 1 arrival" or "27: Frequency 2 arrival".

The following figure for frequency arrival function takes frequency 1 as an example.

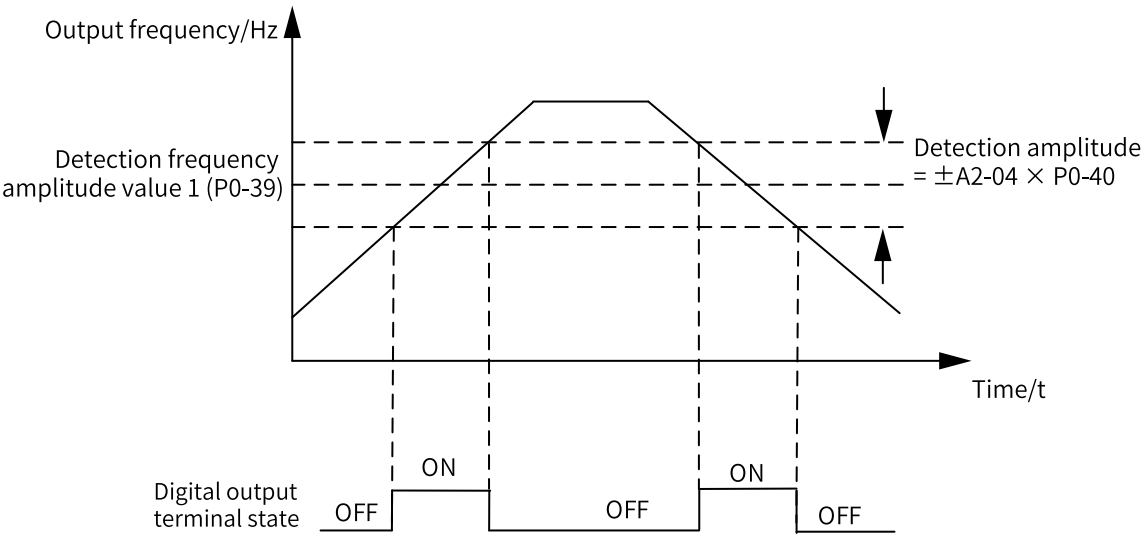


Figure 5-180 Frequency arrival

Related parameters

Table 5–85 Parameters related to detection value for frequency arrival

Param.	Name	Default value	Value range	Description
P0-39	Frequency arrival detection value 1	50.00 Hz	0.00% to A2-17	Defines the detection value 1 for the operating frequency of the drive. Note: 1 .Set the DO function to "26: Frequency 1 arrival". 2 .When the operating frequency of the drive is within the range of P0-39±A2-04 x P0-40, the DO terminal can be configured to output an active signal.
P0-40	Frequency arrival detection amplitude 1	0.1%	0.1 % to 100.0%	Defines detection amplitude 1 for the operating frequency of the drive, which is a percentage to A2-04. Note: Same as P0-39
P0-41	Frequency arrival detection value 2	50.00 Hz	0.00% to A2-17	Defines frequency detection value 2 for the operating frequency of the drive. Note: 1 .Set the DO function to "27: Frequency 2 arrival". 2 .When the operating frequency of the drive is within the range of P0-41±A2-04 x P0-42, the DO terminal can be configured to output an active signal.
P0-42	Detection frequency amplitude 2	0.1%	0.1 % to 100.0%	Defines detection window 2 for the operating frequency of the drive, which is a percentage to A2-04. Note: Same as P0-41.

Application instance

The following takes the detection value 1 for RO output frequency as an example.

1. Set E1-00 [RO output function selection] to "26: Frequency 1 arrival".
2. Set P0-39 [Frequency arrival detection value 1] and P0-40 [Frequency arrival detection amplitude 1].
3. The target frequency of the drive to a value higher than P0-39 [Frequency arrival detection value 1].
4. During operation of the drive, if the operating frequency during acceleration/deceleration reaches the result of "P0-39 [Frequency arrival detection value 1]±A2-04 x P0-40 [Frequency arrival detection amplitude 1]", the RO terminal outputs an active signal.

5.4.1.5 Frequency Upper Limit Arrival

Function description

This function is used to detect whether the operating frequency of the drive reaches the frequency upper limit and output the corresponding signal. You can limit the maximum output frequency of the drive by setting the upper limit.

Operating principles

The frequency upper limit is divided into positive frequency upper limit and negative frequency upper limit according to the operating direction.

The effective positive frequency upper limit is limited by combination of three parameters: C4-10 [Maximum motor frequency], d1-03 [Digital reference of the positive frequency upper limit 1], and d1-05 [Source of positive frequency upper limit 2]. The minimum value among these three parameters is used as the positive frequency upper limit.

The effective negative frequency upper limit is limited by combination of three parameters: C4-10 [Maximum frequency of the motor], d1-04 [Digital reference of the negative frequency upper limit 1], and d1-06 [Source of negative frequency upper limit 2]. The minimum value among these three parameters is used as the negative frequency upper limit.

When the upper limit frequency is reached, set E1-04 [DO output function selection] to "17: Frequency upper limit arrival". When the operating frequency of the drive reaches the effective frequency upper limit, the DO terminal outputs an active signal. The upper limit frequency arrival function is shown in the figure below.

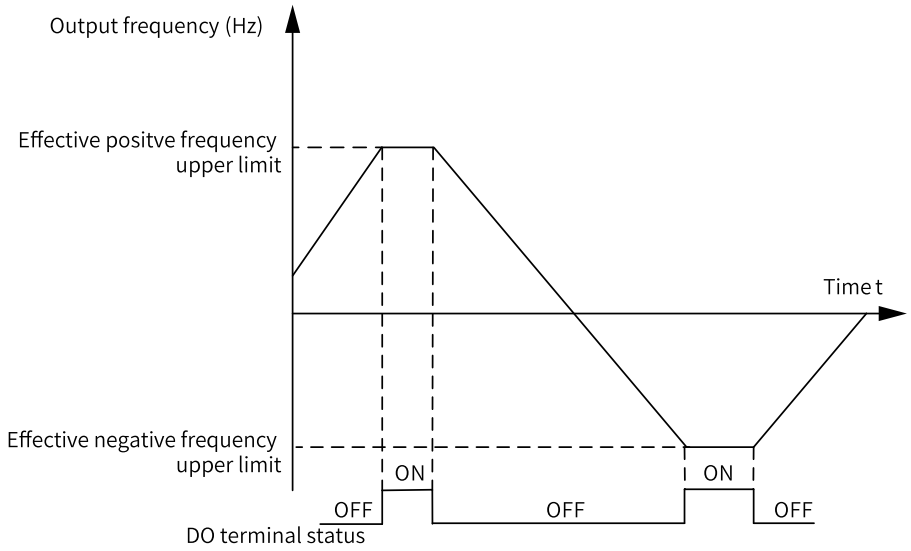


Figure 5-181 Diagram of frequency upper limit arrival

Application instance

The following takes RO output frequency upper limit arrival as an example.

1. Set E1-00 [RO output function selection] to "17: Frequency upper limit reached".
2. Set C4-10 [Maximum frequency of the motor], d1-03 [Digital reference of positive frequency upper limit], d1-04 [Digital reference of negative frequency upper limit 1], d1-05 [Source of positive frequency upper limit 2], and d1-06 [Source of negative frequency upper limit 2].
3. When the operating frequency reaches the effective frequency upper limit during operation of the drive, the RO terminal outputs an active signal.

Related parameter

Table 5–86 Parameters related to frequency upper limit arrival

Param.	Name	Default	Value range	Description
d1-03	Digital reference of positive frequency upper limit 1	800.0%	d1-07 to 800.0%	Limits the maximum positive operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. Note: The positive frequency upper limit is the smaller of d1-03 and d1-05.
d1-04	Digital reference of negative frequency upper limit 1	800.0%	-800.0% to d1-08	Limits the maximum negative operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. Note: The negative frequency upper limit is the smaller of d1-04 and d1-06.

Param.	Name	Default	Value range	Description
d1-05	Source of positive frequency upper limit 2	0	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the highest operating frequency in the forward direction, which is expressed as a percentage to the motor rated frequency. Value description: 0: 800% - The positive frequency upper limit to 800%. 2: AI1 - The positive frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2 - The positive frequency upper limit is input by current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse - The positive frequency upper limit is set through the pulse frequency of the DI. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. (active only for MD630S) 6: Multi-reference - When multi-reference is used as the positive frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operation time and acceleration/deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The positive frequency upper limit is set through PID. 9: Communication - The positive frequency upper limit is set through communication. The positive frequency upper limit can be set through remote communication. Other: F connector - The positive frequency upper limit depends on the value of the selected F connector. Note: The effective positive frequency upper limit is the minimum value among C4-10, d1-03, and d1-05.

Param.	Name	Default	Value range	Description
d1-06	Source of negative frequency upper limit 2	1	0: -800% 1: Inverted value of positive frequency upper limit 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Limits the maximum negative operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. Value description: 0: -800% - The negative frequency upper limit is set to -800%. 1: Inverted value of positive frequency upper limit 2 - The inverted value of d1-05 is used as the negative frequency upper limit. 2: AI1 - The negative frequency upper limit is input through current or voltage signals from AI1 and calculated according to the preset AI curve. 3: AI2 - The negative frequency upper limit is input through current or voltage signal from AI2 and calculated according to the preset AI curve. 5: HDI pulse - The negative frequency upper limit is set through the pulse frequency of the DI and calculated based on the curve of the relationship between the pulse frequency and the set frequency. (active only for MD630S) 6: Multi-reference - When multi-reference is used as the negative frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 limit values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operation time and acceleration/deceleration time. Multi-reference parameters are used to set the negative frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The negative frequency upper limit is set through PID. 9: Communication - The negative frequency upper limit is set through communication. The negative frequency upper limit can be input through remote communication. Other: F connector - The negative frequency upper limit depends on the value of the selected F connector. Note: The negative frequency upper limit is the smaller of d1-04 and d1-06.
C4-10	Maximum frequency of the motor	50.00 Hz	C4-06 to 599.00 Hz	Defines the allowable maximum frequency of the motor in Hz. Note: When the maximum frequency is set to a value lower than the motor rated frequency, the effective maximum frequency is the rated frequency of the motor. You can set the speed limit through d1-03 to d1-08.

5.4.1.6 Frequency Lower Limit Arrival

Function description

This function is used to detect whether the frequency reference of the drive reaches the lower limit frequency. If yes, a corresponding signal is output. You can limit the minimum frequency reference of the drive by setting the frequency lower limit.

Operating principles

The lower limit frequency is divided into positive lower limit and negative lower limit according to the running direction.

The effective positive frequency lower limit is limited by two parameters, C4-11 [Minimum frequency of the motor] and d1-07 [Positive frequency lower limit]. The higher of C4-11 and d1-07 is used as the final effective positive frequency lower limit.

The effective negative frequency upper limit is restricted by two parameters, C4-11 [Minimum frequency of the motor] and d1-08 [Negative frequency lower limit]. The inverted absolute value of the higher of C4-11 and d1-08 is used as the final effective negative frequency lower limit. See details in *"5.2.2.5 Setting Frequency Reference Limits" on page 245*.

When the frequency lower limit is reached, if E1-04 [DO output function selection] is set to "18: Frequency lower limit arrival (no output at stop)" and E1-04 [DO output function selection] is set to "37: Frequency lower limit arrival (no output at stop)", the DO outputs an active signal as long as the frequency reference reaches the effective frequency lower limit, regardless of the drive state.

The following takes the positive frequency lower limit arrival function as an example.

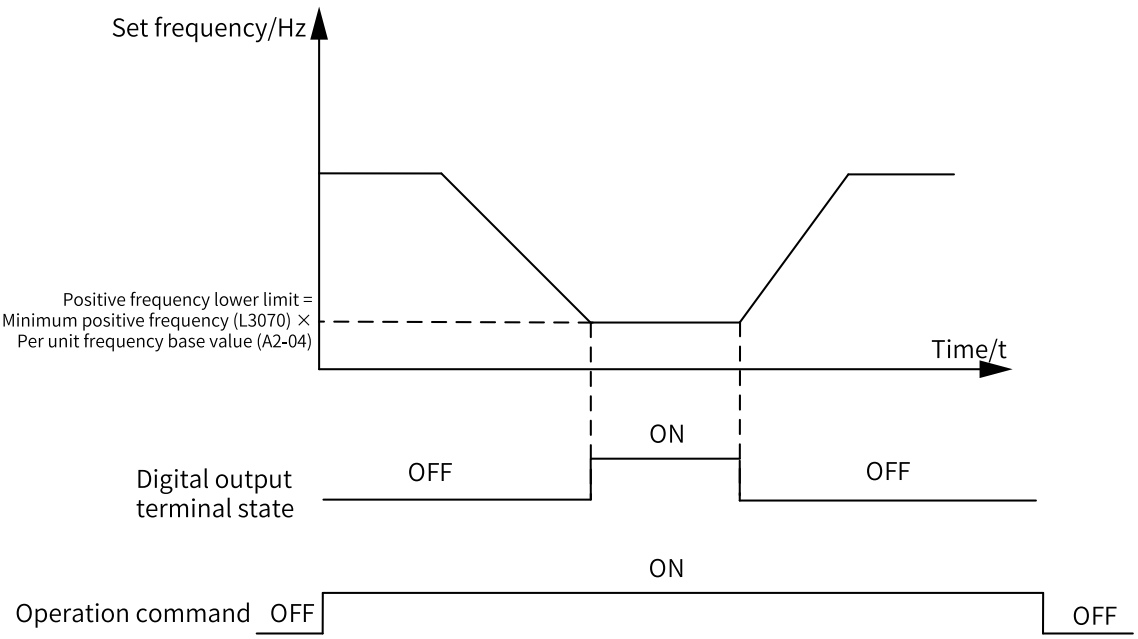


Figure 5-182 18: Frequency lower limit arrival (no output at stop)

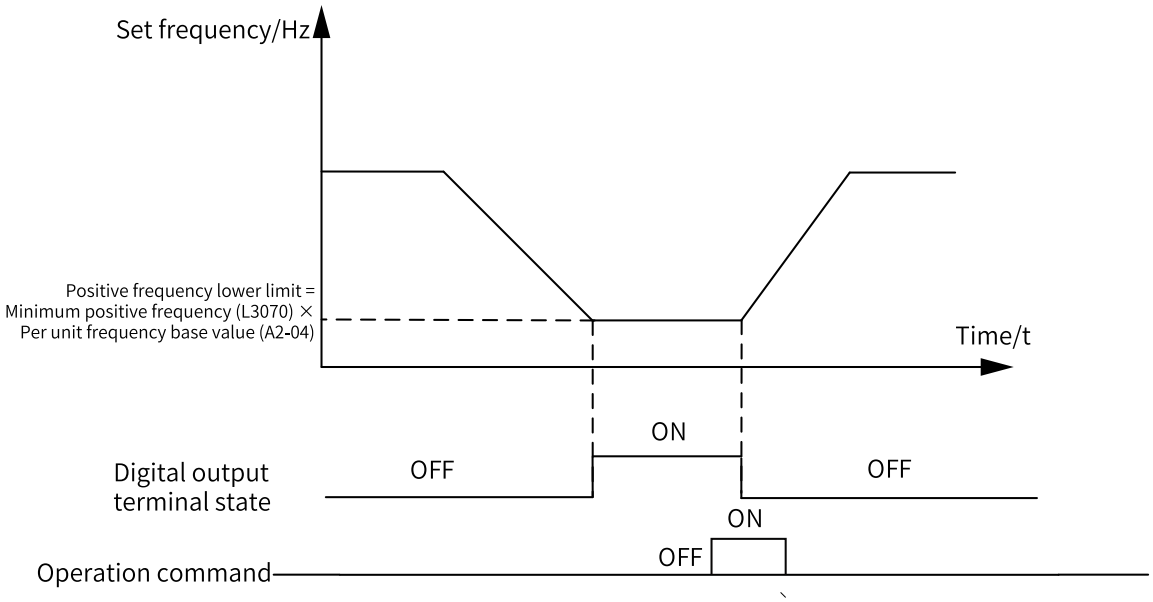


Figure 5-183 37: Frequency lower limit arrival (output generated even at stop)

Related parameter

Table 5–87 Parameters related to frequency lower limit arrival

Param.	Name	Default	Value range	Description
d1-07	Positive frequency lower limit	0.0%	0.0% to d1-03	Defines the positive frequency lower limit, which is a percentage to the rated frequency of the motor.
d1-08	Negative frequency lower limit	0.0%	d1-04 to 0.0%	Defines the negative frequency lower limit, which is a percentage to the rated frequency of the motor.
C4-11	Minimum frequency of the motor	0.00	0.00 to C4-10	Defines the allowable minimum frequency of the motor in Hz. Note: For motors that do not support low-speed operation, this parameter does not need to be set.

Application instance

The following takes RO frequency lower limit arrival as an example.

1. Set E1-00 [RO output function selection] to "18: Frequency lower limit arrival (no output at stop)".
2. Set C4-11 [Minimum frequency of the motor], d1-07 [Digital reference of positive frequency lower limit 1], and d1-08 [Digital reference of negative frequency lower limit 1].
3. During operation of the drive, if the frequency reference reaches the effective frequency lower limit, the RO terminal outputs an active signal.

5.4.1.7 Target Speed Arrival

Function description

When the actual motor speed reaches the target speed and remains in this state for a specified period of time, the RO terminal outputs an active signal.

Operating principles

You can set the target speed arrival detection window through P0-51. When the actual motor speed detected by the drive is within the target speed±window range (P0-51) for a specified period of time, the DO outputs an active signal when you set E1-04 [DO output function selection] to "Other: B connector" and select "L0110 Target speed arrival", as shown below.

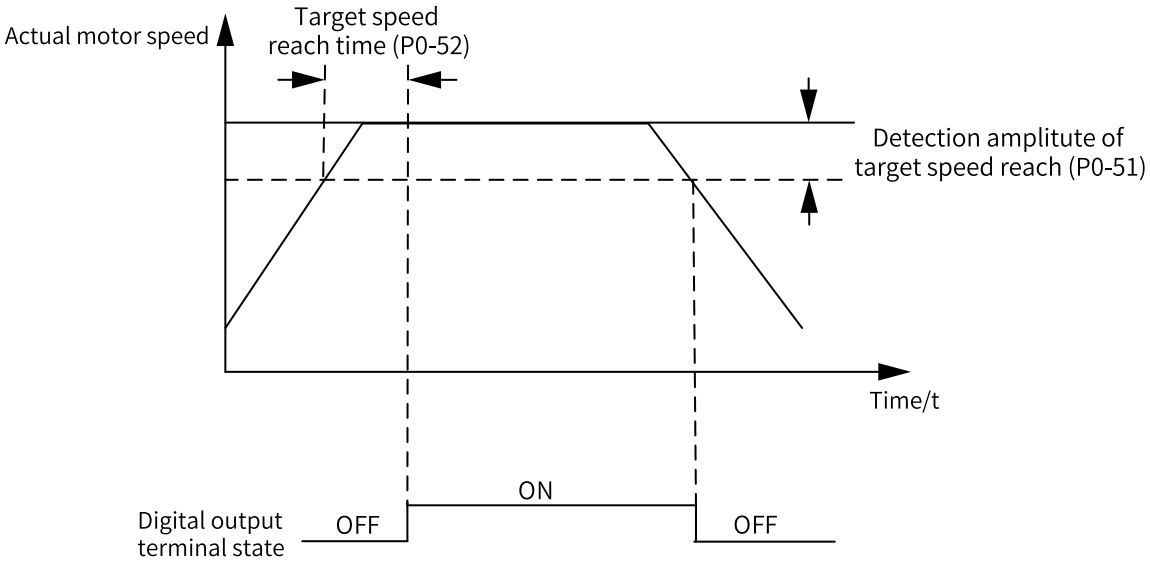


Figure 5-184 Target speed arrival

Related parameters

Table 5–88 Parameters related to target speed arrival

Param.	Name	Default value	Value range	Description
P0-51	Target speed arrival detection window	3.0%	0.0% to 600.0%	Defines the operating frequency of the drive and the window for detecting whether the actual motor speed reaches the target speed (frequency). Note: 1 .When both the operating frequency of the drive and the detected actual motor speed are within the target speed±window range (P0-51), and such state persists for a specified period of time, the DO terminal outputs an active signal. 2 .If the detection window is set to 0, the target speed arrival function is inactive.
P0-52	Target speed arrival time	3.00s	0.00s to 100.00s	Defines the duration for the operating frequency and the actual motor speed to reach the target speed (frequency). Note: Same as P0-51.

Application instance

The following takes the target speed of RO as an example.

1. Set E1-00 [RO output function selection] to "L0110 Target speed arrival" under "Other: B connector".
2. Set P0-51 [Target speed arrival detection window] and P0-52 [Target speed arrival time].
3. When the drive is running, and the detected actual motor speed remains within the target speed ±window range (P0-51) for a specified period of time, the RO outputs an active signal.

5.4.1.8 Speed Comparison Arrival

Function description

When the actual motor speed reaches the speed comparison threshold and such status lasts for a specified period of time, the DO outputs an active signal.

Operating principles

Name	Parameter setting	Other related parameters	Condition	Action upon arrival
Speed comparison arrival 1	Set P0-53 [Speed comparison arrival threshold 1]	Observe P0-55 [Speed comparison arrival time 1]	When the motor operating speed (absolute value) exceeds the speed comparison threshold and such status lasts for the speed comparison arrival time	The DO assigned with "L0270 speed comparison arrival 1" or "L0271 speed comparison arrival 2" in "Other: B connector" outputs an active signal.
Speed comparison arrival 2	Set P0-56 [Speed comparison threshold 2].	Observe P0-58 [Speed comparison threshold time 2].		

The speed comparison arrival function is shown in the figure below, which takes speed comparison arrival 1 as an example.

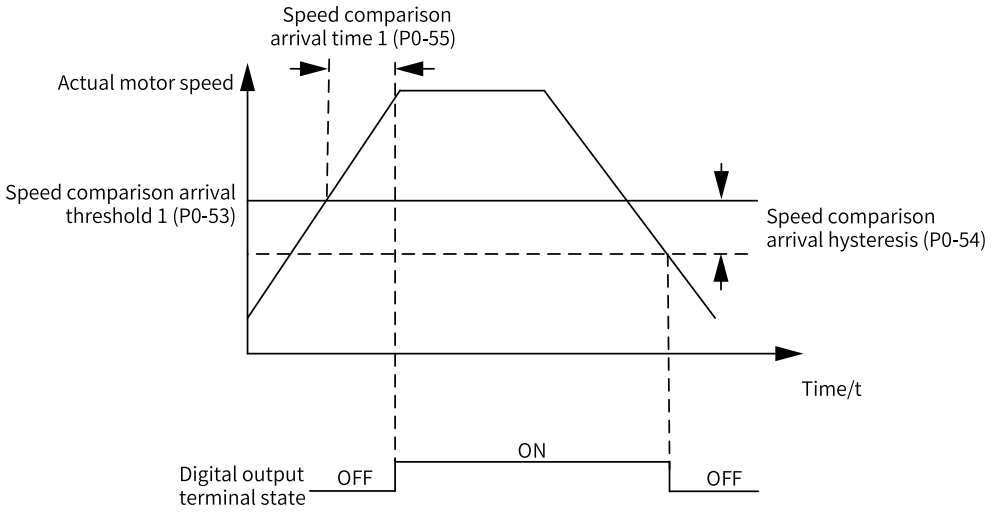


Figure 5-185 Speed arrival

Related parameters

Table 5–89 Parameters related to frequency upper limit arrival

Param.	Name	Default value	Value range	Description
P0-53	Speed comparison arrival threshold 1	100.0%	0.0% to 600.0%	Defines speed comparison arrival threshold 1 of the motor operating speed (absolute value). Note: 1. During normal operation, when the motor operating speed (absolute value) exceeds P0-53 and such status persists for the time defined by P0-55, the multi-function DO terminal assigned with "Speed comparison arrival 1" outputs an active signal. 2. When any one of the following conditions is met, the multi-function DO assigned with "Speed comparison arrival" outputs an inactive signal. (1) P0-53 [Speed comparison arrival threshold 1] is set to 0. (2) The motor operating speed is 0. (3) The operating direction is opposite to the previous one. (4) P0-53 > P0-54, and the motor operating speed (absolute value) < |P0-53- P0-54|
P0-54	Speed comparison arrival hysteresis 1	3.0%	0.0% to 600.0%	Defines speed comparison threshold hysteresis 1 of the motor operating speed (absolute value). Note: See P0-53.
P0-55	Speed comparison arrival time 1	3.00s	3.00s to 100.00s	Defines the speed comparison arrival time of the motor operating speed (absolute value). Note: See P0-53.
P0-56	Speed comparison arrival threshold 2	100.0%	0.0% to 600.0%	Defines speed comparison reach threshold 2 of the motor operating speed (absolute value). Note: During normal operation, when the motor speed (absolute value) exceeds the speed set by P0-56 while P0-56 is not 0, and this status lasts for the time defined by P0-58, the multi-function DO assigned with "Speed comparison arrival 1" outputs an active signal. When any one of the following conditions is met, the multi-function DO assigned with "Speed comparison arrival" outputs an inactive signal. (1) P0-56 [Speed comparison arrival threshold 2] is set to 0. (2) The motor operating speed is 0. (3) The operating direction is opposite to the previous one. (4) P0-56 > P0-57, and the motor operating speed (absolute value) < |P0-56-P0-57|.

Param.	Name	Default value	Value range	Description
P0-57	Speed comparison arrival hysteresis 2	3.0%	0.0% to 600.0%	Defines the speed comparison threshold hysteresis 2 of the motor operating speed (absolute value). Note: See P0-56.
P0-58	Speed comparison arrival time 2	3.00s	3.00s to 100.00s	Defines speed comparison arrival time 2 of the motor operating speed (absolute value). Note: See P0-56.

Application instance

The following takes RO output speed comparison arrival 1 as an example.

1. Set E1-00 [RO output function selection] to "L0270 Speed comparison arrival 1" in "Other: B connector".
2. Set P0-53 [Speed comparison arrival threshold 1], P0-54 [Speed comparison hysteresis 1], and P0-55 [Speed comparison arrival time 1].
3. During operation of the drive, if the actual motor speed detected during acceleration exceeds the value of P0-53 [Speed comparison arrival threshold 1], and such status lasts for the time defined by P0-55 [Speed comparison arrival time 1], the RO outputs an active signal.
4. During operation of the drive, if the actual motor speed detected during deceleration is lower than the result of P0-53 [Speed comparison arrival threshold 1] minus P0-54 [Speed comparison arrival hysteresis 1], the RO outputs an active signal.

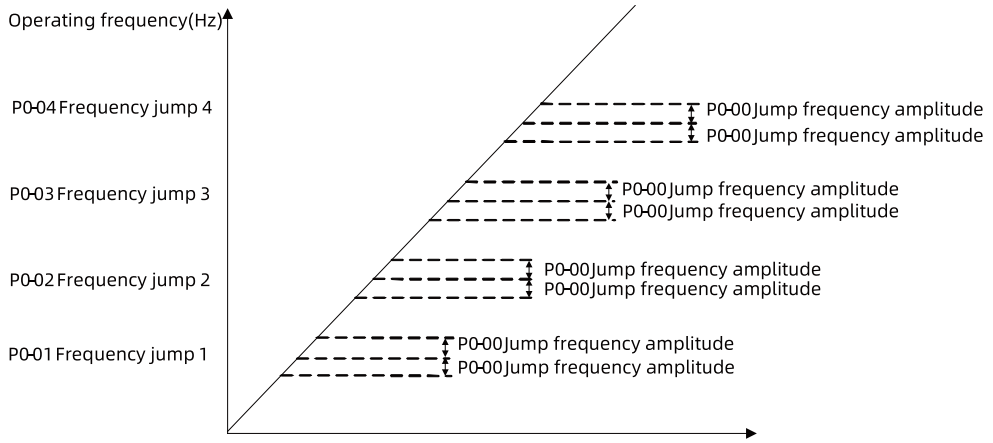
5.4.1.9 Jump Frequency

Description

The jump frequency function enables the AC drive to avoid mechanical resonance point of load.

Working principles

The AC drive supports four jump frequencies. If the four jump frequencies are set to 0, the jump frequency function is disabled. Set whether the jump frequency is active during acceleration/deceleration by P0-05 (Jump frequency during acceleration/deceleration). If “0: disabled” is selected, the AC drive will normally reach the jump frequency during acceleration and deceleration.

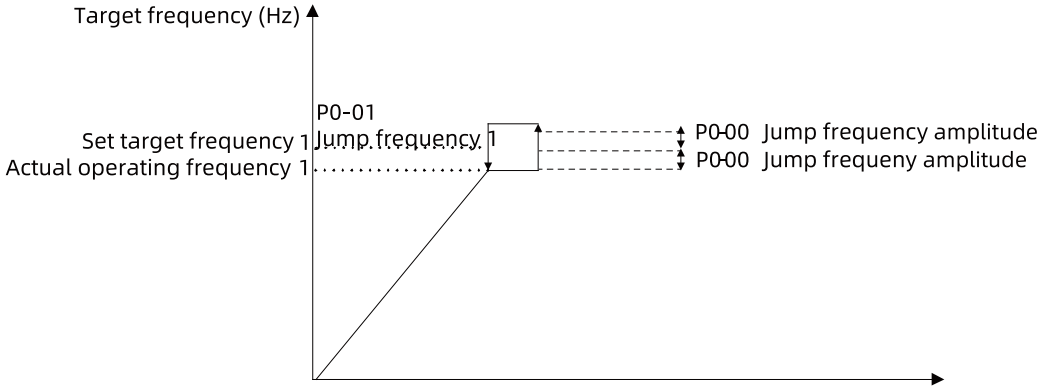


When the target frequency is within the range of the jump frequency, the AC drive will jump the target frequency to the set jump frequency boundary "jump frequency ± P0-00 [Jump frequency amplitude]."

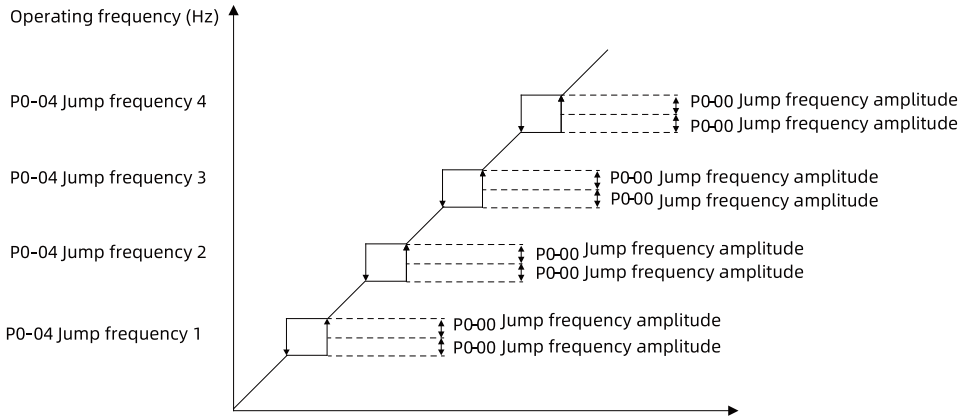
When the target frequency is within the range of "jump frequency - P0-00 [Jump frequency amplitude]," the target frequency will jump to the lower boundary of the jump frequency;

When the target frequency is within the range of "jump frequency + P0-00 [Jump frequency amplitude]," the target frequency will jump to the upper boundary of the jump frequency.

When P0-05 [Jump frequency during acceleration/deceleration] is set to 0: disabled, the jump frequency function is as shown in Figure 2. Taking jump frequency 1 as an example, if the target frequency is set within the jump frequency range, the jump frequency processing will be executed, and the actual operation can only reach the jump frequency boundary point.



When P0-05 [Jump frequency during acceleration/deceleration] is set to 1: enabled, the jump frequency function is as shown in Figure 3. During acceleration and deceleration, passing through the jump frequency point can normally execute the jump frequency processing.



Application example

Taking jump frequency 1 as an example.

1. Set P0-05 [Jump frequency during acceleration/deceleration] to 0, meaning no jump frequency processing during acceleration and deceleration.
2. Set P0-10 [Jump frequency amplitude] and P0-01 [Jump frequency 1].

Related parameters

Table 5–90 Frequency Jump Parameters

Param.	Name	Default	Value range	Description
P0-05	Jump frequency during acceleration/ deceleration	0	0 to 1	This parameter is used to enable or disable the jump frequency function during acceleration/deceleration. Settings 0: Disable - During acceleration/deceleration, when the running frequency reaches the jump frequency, the AC drive continues to run at the running frequency. 1: Enable - The AC drive skips over the jump frequency when the running frequency reaches the jump frequency during acceleration and deceleration. The jump range is twice the value of P0-10 (Jump frequency amplitude).
P0-06	Jump frequency 1	0.0 Hz	0.0 Hz to 800.0Hz	Set the first jump frequency to be used with P0-10. Note: 1 .When the set frequency is within the jump frequency range, the actual running frequency is at the edge of the jump frequency range (lower limit or upper limit of the range) to avoid the mechanical resonance point of the load. 2 .If this parameter is set to 0, the first jump frequency is disabled.
P0-07	Jump frequency 2	0.0 Hz	0.0 Hz to 800.0Hz	Set the second jump frequency to be used with P0-10. Note: Same as P0-06
P0-08	Jump frequency 3	0.0 Hz	0.0 Hz to 800.0Hz	Set the third jump frequency to be used with P0-10. Note: Same as P0-06

Param.	Name	Default	Value range	Description
P0-09	Jump frequency 4	0.0 Hz	0.0 Hz to 800.0Hz	Set the fourth jump frequency to be used with P0-10. Note: Same as P0-06
P0-10	Jump frequency amplitude	0.0 Hz	0.0 Hz to 800.0Hz	The jump frequency amplitude is set to determine the effective range of the jump frequency. Note: 1 .1. If the running frequency jumps over the jump frequency and the frequency reaches the jump frequency again, the frequency jumps over the value of the jump frequency plus the jump frequency amplitude (upper limit of the range). 2 .If the running frequency does not jump over the jump frequency, when the frequency is set to the jump frequency again, the frequency jumps over the value that is jump frequency minus the jump frequency amplitude (lower limit of the range).

5.4.2 Current Detection

5.4.2.1 Zero Current Detection

Function description

When the output current of the drive keeps lower than or equal to the zero current detection level for a period longer than the zero current detection delay, the DO outputs an active signal.

Operating principles

When the output current of the drive keeps lower than or equal to P0-47 [Zero current detection level] for a period of time longer than P0-48 [Zero current detection delay time], the DO terminal assigned with "34: Zero current status function" outputs an active signal. You can also check whether the drive enters the zero current state through L0260 [Zero current state] or bit10 of L1005 [System status word 4].

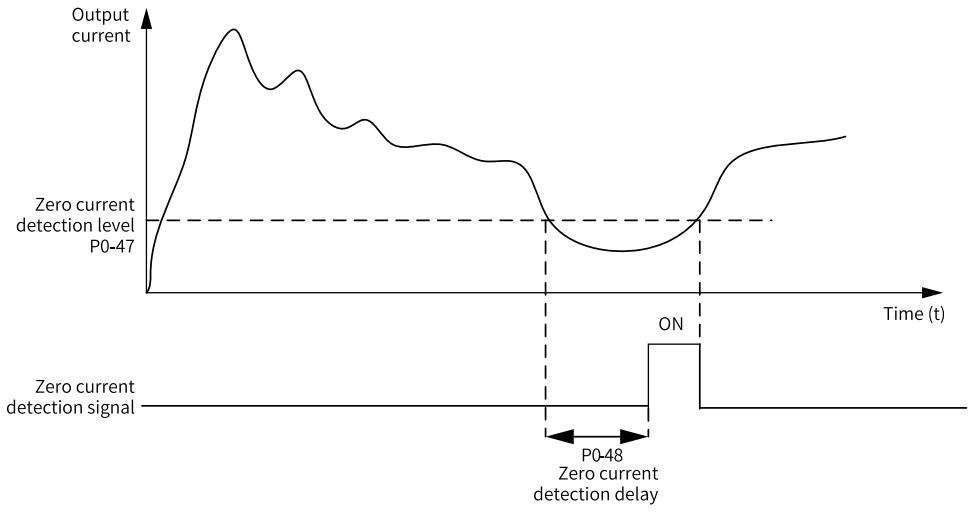


Figure 5-186 Zero current detection

Related parameters

Table 5–91 Parameters related to zero current detection

Param.	Name	Default value	Value range	Description
P0-47	Zero current detection level	5.0%	0.0% to 300.0% (Base current)	Defines the zero current detection value of the output current of the drive, which is a percentage corresponds to the rated motor current.
P0-48	Zero current detection delay	0.10s	0.01s to 600.00s	Defines the zero current detection delay of the output current of the drive.

5.4.2.2 Output Current Limit Violation

Function description

When the output current of the drive keeps exceeding the setpoint for a specified period of time, the DO terminal outputs an active signal.

Operating principles

When the output current of the drive keeps exceeding P0-49 [Output current threshold limit] for a period longer than P0-50 [Output current limit violation detection delay], the DO terminal assigned with "36: Output current limit violation" outputs an active signal. You can also check whether the output current limit of the drive is exceeded through L0261 [Output current limit violated] or bit11 of L1005 [System status word 4].

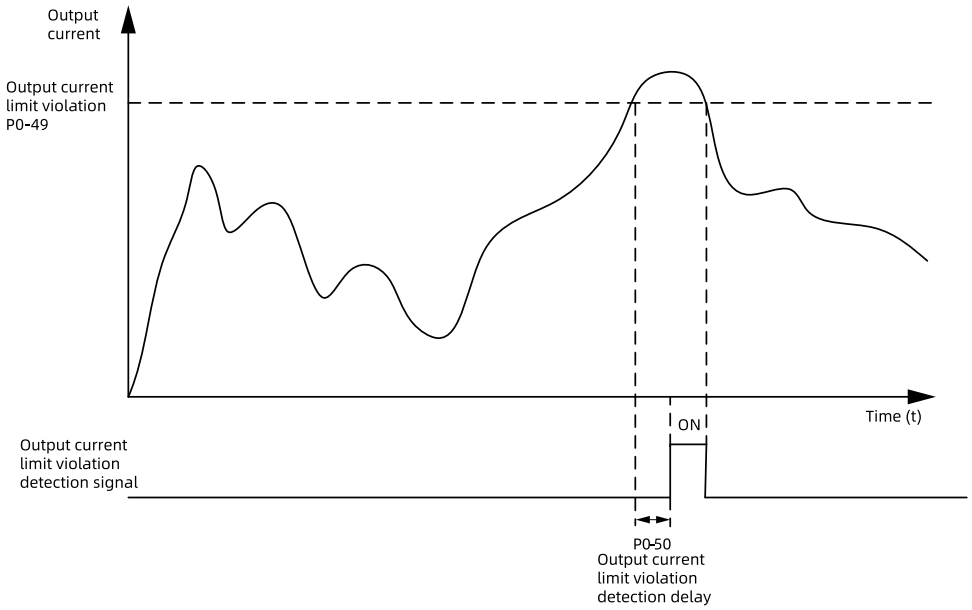


Figure 5-187 Output current limit violation detection

Related parameters

Table 5–92 Parameters related to output current limit violation

Param.	Name	Default value	Value range	Description
P0-49	Output current threshold limit	200.0%	0.0% to 300.0% (Base current)	Defines the output current threshold limit of the drive, which is a percentage to the rated current of the drive.
P0-50	Delay time for output current limit violation detection	0.00s	0.00s to 600.00s	Defines the output current limit violation detection delay.

5.4.2.3 Current Arrival

Function description

This function is used to detect whether the output current of the drive reaches the setting range (any). If yes, the DO terminal outputs an active signal.

Operating principles

When the output current of the drive is within "(Current arrival 1±Window of current arrival 1) x Base current", the DO terminal assigned with "28/29: Current 1/2 arrival" outputs an active signal. The drive provides two sets of current arrival and detection window parameters, as shown below.

You can also check whether the corresponding state is reached through L0258 [Current 1 arrival], L0259 [Current 2 arrival], or bit8 and bit9 of L1005 [System status word 4].

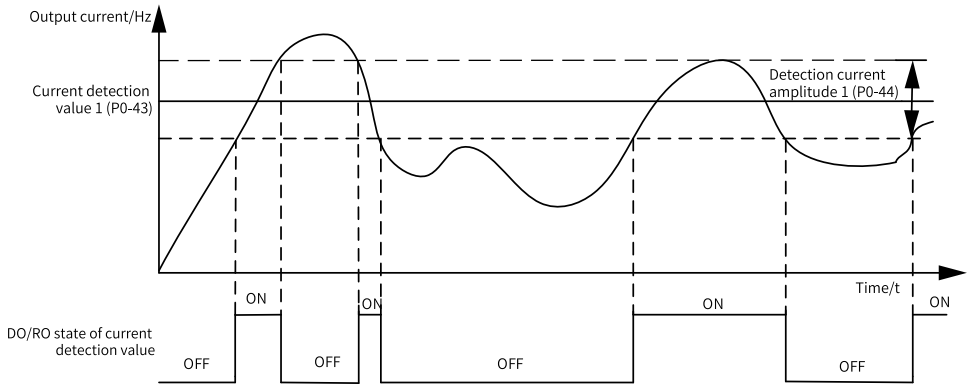


Figure 5-188 Sequence for current arrival

Related parameters

Table 5–93 Parameters related to current arrival

Param.	Name	Default value	Value range	Description
P0-43	Current arrival 1	100.0%	0.0% to 300.0% (Base current)	Defines current arrival 1 of the output current of the drive, which is a percentage to the rated current of the motor. Note: When the output current of the drive is within "(Current arrival 1±Window of current arrival 1) x Rated current of the motor", the DO terminal can be configured to output an active signal.
P0-44	Window of current arrival 1	0.0%	0.0% to 300.0% (Base current)	Defines the current arrival 1 window of the output current of the drive, which is a percentage to the rated current of the motor.
P0-45	Current arrival 2	100.0%	0.0% to 300.0% (Base current)	Defines current arrival 2 of the output current of the drive, which is a percentage to the rated current of the motor. Note: When the output current of the drive is within "(Current arrival 2±Window of current arrival 2) x Rated current of the motor", you can configure the active signal through the DO terminal.
P0-46	Window of current arrival 2	0.00 %	0.0% to 300.0% (Base current)	Defines the current arrival 2 window of the output current of the drive, which is a percentage to the rated current of the motor.

5.4.3 Fan Control

Application scenario

The fan control is used to control the running mode of the cooling fan, or to switch the forward and reverse running of the fan.

Users can set different control modes for the fan according to actual requirements. Especially in the textile industry, the forward and reverse running mode of the fan is important to the blow-off of the lint.

Working principles

Six fan control modes are available. Select the appropriate control mode according to the needs. Switch the control modes through A4-11 (Fan control mode).

Note

If the heatsink temperature is higher than a certain value after the fan is turned, The fan automatically switches the speed to high speed. When the heatsink temperature drops to a certain value, the fan switches back to low speed. See the following figure. The heat sink temperature can be viewed by U0-82 (Module temperature).

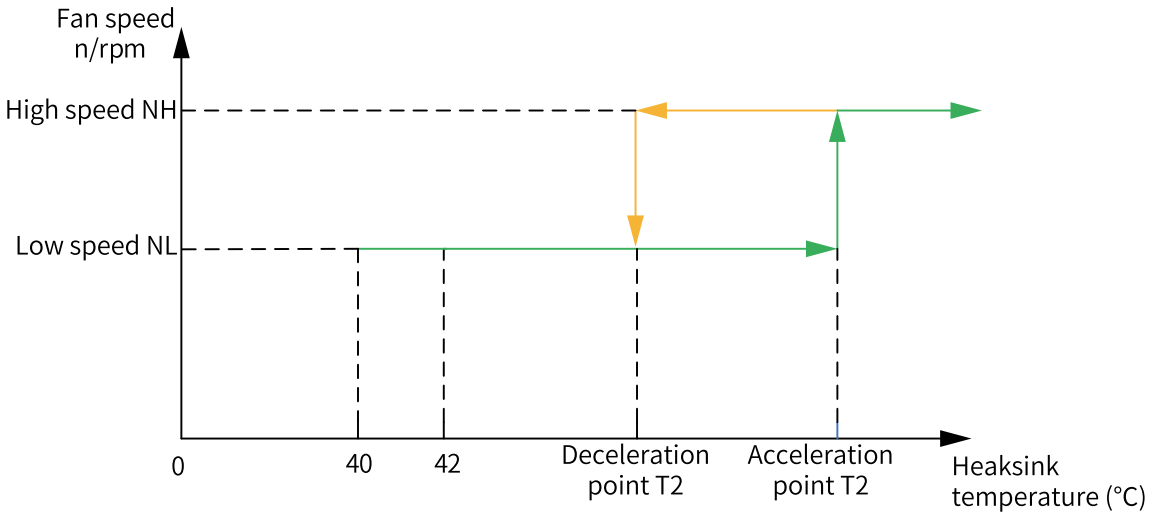


Figure 5-189 Fan speed curve

Related parameters

Table 5–94 Parameters related to fan control

Param.	Name	Default	Value range	Description
A4-11	Fan control mode	0	0 to 5	Defines the general operation mode of the fan. Value description: 0: Working (forward running when the heatsink temperature is higher than 42℃ at stop state) when AC drive is running When A4-11 is set to 0, except for undervoltage state, the fan works when the AC drive is running. When the AC drive stops, the fan works when the heatsink temperature is higher than 42℃ and stops when the heatsink temperature is lower than 40℃. 1: Working continuously (forward running) When this parameter is set to 1, the fan keeps operating in the non-undervoltage state. 2: Working (forward/reverse running when the heatsink temperature is higher than 42℃ at stop state) when AC drive is running When A4-11 is set to 2, except for undervoltage state, the fan works when the AC drive is running. When the AC drive stops, the fan works when the heatsink temperature is higher than 42℃ and stops when the heatsink temperature is lower than 40℃. While the fan is running, it first runs in the forward direction according to A4-14 (forward running time during forward and reverse running), and then runs in the reverse direction according to A4-15 (reverse running time during forward and reverse running). This cycle repeats continuously. 3: Working continuously (forward and reverse) 3: Except for undervoltage state, the fan runs continuously. While the fan is running, it first runs in the forward direction according to A4-14 (forward running time during forward and reverse running), and then runs in the reverse direction according to A4-15 (reverse running time during forward and reverse running). This cycle repeats continuously. 4: Manufacturer-defined mode 1 4: Manufacturer-defined mode 1. It is not recommended to set this mode. 5: Manufacturer-defined mode 2 4: Manufacturer-defined mode 1. It is not recommended to set this mode.
A4-12	Digital setting of fan speed	1500 RPM	1500 RPM to 14000 RPM	Defines the operating speed of the fan. This value is active when A4-11 is set to 4.
A4-13	Effective value of digital setting of fan speed	1500 RPM	1500 RPM to 14000 RPM	Displays the set speed of the active fan.
A4-14	Forward operating time of the fan during forward/reverse operation	60s	60s~65535s	Sets the forward running time during forward and reverse running. This value is active when A4-11 is set to 2 or 3.

Param.	Name	Default	Value range	Description
A4-15	Reverse operating time of the fan during forward/reverse operation	60s	60s~65535s	Sets the reverse running time during forward and reverse running. This value is active when A4-11 is set to 2 or 3.
U0-49	Set fan speed	0 rpm	0 RPM to 65535 RPM	Displays the set speed of the fan when it is running. The unit is rpm.
U0-50	Real-time speed of the fan	0 rpm	-32768rpm to 32767rpm	Displays the real-time speed of the fan. The unit is rpm.

5.4.4 Setting Time Reached

5.4.4.1 Cumulative Power-on Time Arrival

Application scenario

When the DO (RO) terminal function is set to 24 [Cumulative power-on time arrival], the DO (RO) terminal outputs an active signal after the cumulative power-on time exceeds the user-defined cumulative power-on time threshold, indicating that the set power-on time has been arrival.

Description

The following shows how to set the cumulative power-on time threshold.

1. Set the DO (RO) terminal function to 24 [Cumulative power-on time arrival].
2. Set the cumulative power-on time threshold through P0-16 [Power-on time threshold in hours] and P0-17 [Power-on time threshold in seconds]. The cumulative power-on time threshold is the sum of P0-16 and P0-17. Note that if both P0-16 [Power-on time threshold in hours] and P0-17 [Power-on time threshold in seconds] are set to 0, the cumulative operating time threshold is inactive, and the DO (RO) terminal always outputs an inactive signal.

When the cumulative power-on time threshold of the drive is set to an active value, the DO (RO) outputs an active signal as long as "Ad-02 [Cumulative power-on time in hours] x 3600 + Ad-03 [Cumulative power-on time in seconds]" exceeds "P0-16 [Power-on time threshold in hours] x 3600 + P0-17 [Power-on time threshold in seconds]".

Related parameters

Param.	Name	Default	Value range	Description
Ad-02	Cumulative power-on time - hours	-	-	Displays the cumulative power-on time in hours.
Ad-03	Cumulative power-on time - seconds	-	-	Displays the cumulative power-on time in seconds.

Param.	Name	Default	Value range	Description
P0-16	Power-on time threshold in hours	0	0 to 65535h	Defines the power-on time threshold in hours. Note: 1 .The power-on time is determined by the combination of P0-16 and P0-17. After the cumulative power-on time reaches the set value, the multi-function DO terminal assigned with the related function outputs the ON signal. 2 .When both P0-16 and P0-17 are set to 0, this function is disabled.
P0-17	Power-on time threshold in seconds	0	0 to 3599s	Defines the power-on threshold in seconds. Note: 1 .The power-on time is determined by the combination of P0-16 and P0-17. After the cumulative power-on time reaches the set value, the multi-function DO terminal assigned with the related function outputs the ON signal. 2 .When both P0-16 and P0-17 are set to 0, this function is disabled.

Precautions

The cumulative operating time is not automatically cleared. When A0-00 [Parameter initialization] is set to 2 [Clear log information], the values of Ad-02 [Cumulative power-on time in hours] and Ad-03 [Cumulative power-on time in seconds] can be cleared. In this case the cumulative power-on time is counted from zero again.

5.4.4.2 Cumulative Operating Time Arrival

Application scenario

When the DO (RO) terminal function is set to 12 [Cumulative operating time arrival], the DO (RO) terminal outputs an active signal after the cumulative operating time of the drive exceeds the user-defined cumulative operating time threshold, indicating that the set target has been reached.

Description

The following shows how to set the cumulative operating time threshold.

1. Set the DO (RO) terminal function to 12 [Cumulative operating time arrival].
2. Set the cumulative operating time threshold through P0-18 [Operating time threshold in hours] and P0-19 [Operating time threshold in seconds]. The cumulative operating time threshold is the sum of P0-18 and P0-19. Note that if both P0-18 [Operating time threshold in hours] and P0-19 [Operating time threshold in seconds] are set to 0, the cumulative operating time threshold is inactive, and the DO (RO) terminal always outputs an inactive signal.

When the cumulative operating time threshold of the drive is set to an active value, the DO (RO) outputs an active signal as long as "Ad-00 [Cumulative operating time in hours] x 3600 + Ad-01 [Cumulative operating time in seconds]" exceeds "P0-18 [Operating time threshold in hours] x 3600 + P0-19 [Operating time threshold in seconds]".

Related parameters

Param.	Name	Default	Value range	Description
Ad-00	Cumulative operating time - hours	-	-	Displays the cumulative operating time in hours.
Ad-01	Cumulative operating time - seconds	-	-	Displays the cumulative operating time in seconds.
P0-18	Set operating time threshold in hours	0	0 to 65535h	Defines the operating time of the drive in hours. Note: 1 .The operating time is determined by the combination of P0-18 and P0-19. After the cumulative operating time reaches the set value, the multi-function DO terminal assigned with the related function outputs the ON signal. 2 .Set P0-18 and P0-19 to 0 to disable the function.
P0-19	Set operating time threshold in seconds	0	0 to 3599s	Defines the operating time of the drive in seconds. Note: 1 .The operating time is determined by the combination of P0-18 and P0-19. After the cumulative operating time reaches the set value, the multi-function DO terminal assigned with the related function outputs the ON signal. 2 .Set P0-18 and P0-19 to 0 to disable the function.

Precautions

The cumulative operating time is not automatically cleared. When A0-00 [Parameter initialization] is set to 2 [Clear log information], the values of Ad-00 [Cumulative operating time in hours] and Ad-01 [Cumulative operating time in seconds] can be cleared. In this case the cumulative operating time is counted from zero again.

5.4.4.3 Current Operating Time Arrival

Application scenarios

When the DO (RO) terminal function is set to 40 [Current operating time arrival], the DO (RO) terminal outputs an active signal after the current operating time of the drive exceeds the threshold, indicating that the set target time has been reached.

Function description

Observe the following steps to set this function.

1. Set the DO (RO) terminal function to 40 [Current operating time arrival].
2. Set the arrival time through P0-20 [Current operating time threshold]. Note that if P0-20 [Current operating time threshold] is set to 0, this function is inactive, and the DO (RO) terminal always outputs an inactive signal.

When the arrival time is set to a valid value, the DO (RO) terminal outputs an active signal as long as U0-26 [Current operating time] exceeds P0-20 [Current operating time threshold].

Related parameters

Param.	Name	Default value	Value range	Description
P0-20	Current operating time threshold	0.0 min	0.0 min to 6500.0 min	Defines the current operating time threshold of the drive. Note: 1 .If the current operating time reaches the value set in this parameter, the DO terminal assigned with "Current operating time arrival" outputs an active signal, indicating that the current operating time is reached. 2 .The setpoint 0 indicates this function is disabled.
U0-26	Current operating time	-	-	Displays the current operating time in minute. The maximum value is 6553.5. If the maximum value is reached, timing stops.

5.4.5 Load Monitoring

Application scenarios

The load monitoring function is used to monitor input signals (such as output current, output torque, and output power) related to the output speed of the drive.

This function includes overload monitoring and load loss monitoring.

- Load loss monitoring is used to detect whether the load is lost, such as belt breakage or mechanical shaft breakage.
- Overload monitoring is used to detect whether the load is blocked, such as motor stall.

Function description

After the motor actual speed enters the user-defined monitoring range, the drive samples the current motor speed and monitoring signal, and finds the corresponding upper and lower boundary points of the monitoring signal on the multi-point curve based on the current motor speed.

- If the current monitoring signal exceeds the upper boundary point, overload occurs.
- If the current monitoring signal exceeds the lower boundary point, load loss occurs.
- If the current monitoring signal is between the upper and lower boundary points, the load normal.

Application

The monitoring signal is generally a signal related to motor speed, which can be set through P0-66 [Load monitoring signal selection]. The monitoring signal can be selected as output current, output torque, or output power, or you can select other signal from "Other: F connector," following the method described in *" Parameter Interconnection" on page 814*.

The current status of the selected monitoring signal can be checked through P0-67 [Load monitoring signal status].

You can set the allowable overload/load loss time as needed through P0-85 [Overload permission time] and P0-86 [Load loss permission time]. If the system detects that the duration of overload/load loss exceeds the set time, an overload/load loss action can be triggered. The corresponding action can be selected through P0-68 [Load monitoring overload action] or P0-69 [Load monitoring load loss action].

Operating principles

The schematic of the load monitoring function is shown below. The lower boundary curve is formed by the x-coordinate (P0-70 to P0-74) and the y-coordinate (P0-80 to P0-84). The upper boundary curve is formed by the x-coordinate (P0-70 to P0-74) and the y-coordinate (P0-75 to P0-79).

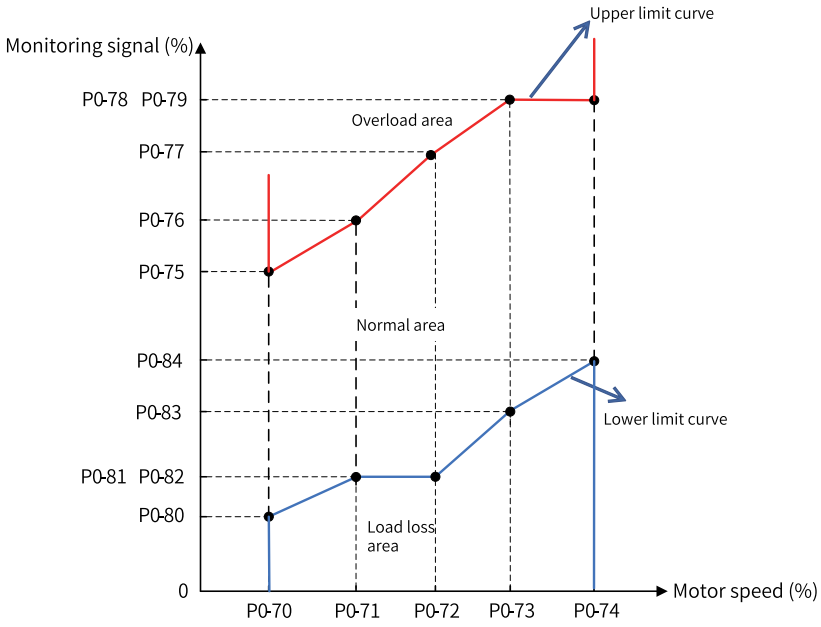


Figure 5-190 Schematic of load monitoring signal

When the motor actual speed falls within the user-defined x-coordinate range (P0-70 to P0-74), load monitoring starts. The system calculates the points of the monitoring signals (output current, output torque, output power) on the upper and lower boundary curves based on the current motor speed signal, and compares them with the monitoring signals sampled by the current system.

Precautions

The conditions for activating the load monitoring module include the following.

- P0-66 [Load monitoring signal] is not set to 0.
- Speeds on the load monitoring curve are incremental (that is, P0-70 < P0-71 < P0-72 < P0-73 < P0-74).
- The actual motor speed is within the range of P0-70 to P0-74.
- The set overload threshold is higher than the set load loss threshold under the same speed point on the load monitoring curve.

Application instance

The following example takes the output current as the monitored signal.

1. Set P0-66 [Load monitoring signal selection] to 1 [Monitor output current].
2. Set P0-68 [Load monitoring overload action] to 1 [Alarm], and set P0-69 [Load loss response in load monitoring state] to 1 [Alarm].
3. Set P0-85 [Allowable overload time] and P0-86 [Allowable load loss time].
4. Set the x-coordinate P0-70 to P0-74.
5. Set P0-80...P0-84 and P0-75...P0-79.
6. After the drive starts and runs, analyze based on the following curve. After the motor speed signal enters the monitoring range (> P0-70), the monitored current signal is below the lower boundary curve, so P0-67 outputs 1 to indicate load loss. If this duration exceeds P0-86 [Allowable load loss time], an alarm message is output. When the motor speed signal is between P0-72 and P0-73, the monitored current signal is above the upper boundary curve, so P0-67 outputs 4 to indicate overload. If this duration exceeds P0-85 [Allowable overload time], an alarm message is output.

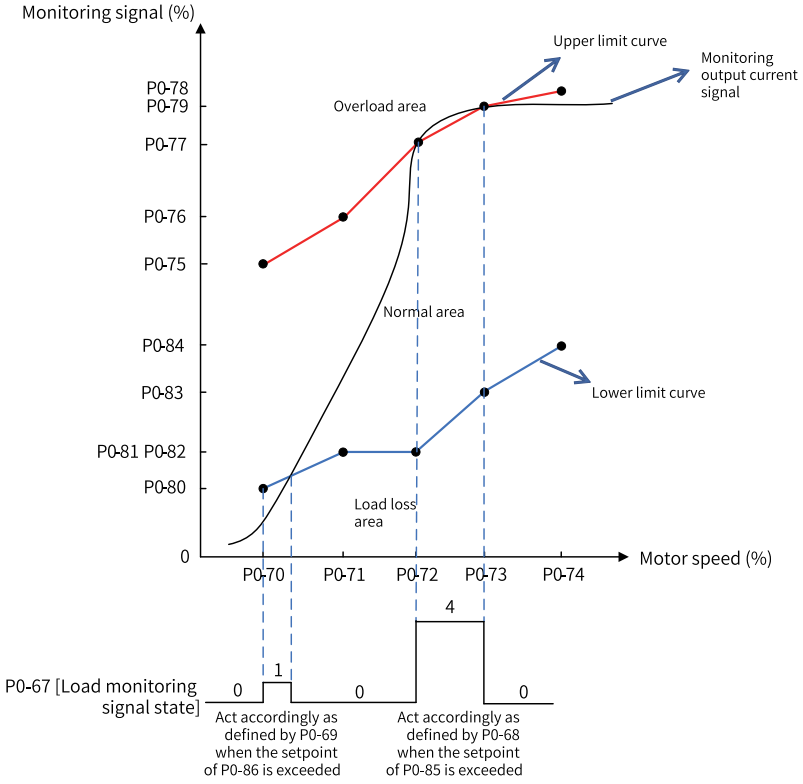


Figure 5-191 Monitoring example

Related parameter

Param.	Name	Default	Value range	Description
P0-66	Load monitoring signal selection	0	0: Monitoring not enabled 1: Monitor output current 2: Monitor output torque 3: Monitor output power Other: F connector	Used to select the monitoring signal, which can be the output current, output torque, or output power. The monitoring signal can also be selected from the connector. Value description: 0: Monitoring not enabled 1: Monitor output current (L3234) 2: Monitor output torque (L3260) 3: Monitor output power (L3266) Other: F connector
P0-67	Load monitoring signal state	0	0 to 65535	Displays the monitoring signal state. Value description: 0 - The monitoring signal is within the normal range. 1 - The monitoring signal is below the normal range (load loss). 4 - The monitoring signal is above the normal range (overload).
P0-85	Allowable overload time	20.0 s	0.0s to 6553.5s	Defines the response delay from overload detection to triggering P0-68.
P0-86	Allowable load loss time	20.0 s	0.0s to 6553.5s	Defines the response delay from load loss detection to triggering P0-69.
P0-68	Response upon overload in load monitoring state	0	0: No alarm/fault 1: Alarm 2: Fault 3: Alarm/fault	Defines the response of the drive when overload is detected. [No alarm/fault]: No alarm or fault is reported. [Alarm]: Overload alarm A046.2 is reported when the monitoring signal keeps higher than the set overload curve for a period longer than the value of P0-85 [Allowable overload time]. [Fault] Overload fault E046.1 is reported when the monitoring signal keeps higher than the set overload curve for a period longer than the value of P0-85[Allowable overload time]. [Alarm/Fault]: If the monitoring signal keeps higher than the set overload curve for a period longer than half of P0-85 [Allowable overload time], overload alarm A046.2 is reported. If the period is longer than or equal to P0-85, overload fault E046.1 is reported.

Param.	Name	Default	Value range	Description
P0-69	Response upon load loss in load monitoring state	0	0: No alarm/fault 1: Alarm 2: Fault 3: Alarm/fault	Defines the response of the drive when load loss is detected. [No alarm/fault]: No alarm or fault is reported. [Alarm]: Overload alarm A046.4 is reported when the monitoring signal keeps lower than the set overload curve for a period longer than the value of P0-86 [Allowable load loss time]. [Fault] Overload fault E046.3 is reported when the monitoring signal keeps lower than the set overload curve for a period longer than the value of P0-86 [Allowable load loss time]. [Alarm/Fault]: If the monitoring signal keeps lower than the set overload curve for a period longer than half of P0-86, overload alarm A046.4 is reported. If the period is longer than or equal to P0-86, overload fault E046.3 is reported.
P0-70	X-coordinate point 1 in load monitoring state	0.0%	0.0% to 600.0%	Defines the first speed point on the x-axis in load monitoring state. Note: When the motor speed is negative, the absolute speed value is used as the x-coordinate point to determine the range of the monitoring signal.
P0-71	X-coordinate point 2 in load monitoring state	0.0%	0.0% to 600.0%	Defines the second speed point on the x-axis in load monitoring state. Note: When the motor speed is negative, the absolute speed value is used as the x-coordinate point to determine the range of the monitoring signal.
P0-72	X-coordinate point 3 in load monitoring state	0.0%	0.0% to 600.0%	Defines the third speed point on the x-axis in load monitoring state. Note: When the motor speed is negative, the absolute speed value is used as the x-coordinate point to determine the range of the monitoring signal.
P0-73	X-coordinate point 4 in load monitoring state	0.0%	0.0% to 600.0%	Defines the fourth speed point on the x-axis in load monitoring state. Note: When the motor speed is negative, the absolute speed value is used as the x-coordinate point to determine the range of the monitoring signal.
P0-74	X-coordinate 5 in load monitoring state	0.0%	0.0% to 600.0%	Defines the fifth speed point on the x-axis in load monitoring state. Note: When the motor speed is negative, the absolute speed value is used as the x-coordinate point to determine the range of the monitoring signal.

Param.	Name	Default	Value range	Description
P0-75	Upper limit 1 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the first overload point on the load curve.
P0-76	Upper limit 2 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the second overload point on the load curve.
P0-77	Upper limit 3 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the third overload point on the load curve.
P0-78	Upper limit 4 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the fourth overload point on the load curve.
P0-79	Upper limit 5 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the fifth overload point on the load curve.
P0-80	Lower limit 1 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the first load loss point on the load curve.
P0-81	Lower limit 2 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the second load loss point on the load curve.
P0-82	Lower limit 3 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the third load loss point on the load curve.
P0-83	Lower limit 4 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the fourth load loss point on the load curve.
P0-84	Lower limit 5 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the fifth load loss point on the load curve.

5.4.6 Process Functions

5.4.6.1 Wobble Control Function

Scenarios

The wobble control function is applicable to textile and chemical fiber industries, which involve traverse motion and winding during production. In these cases, cyclic changing frequency is preferred rather than constant frequency. To meet requirements of production in the preceding industries, adopt the wobble control function s through P0-95 and P0-97.

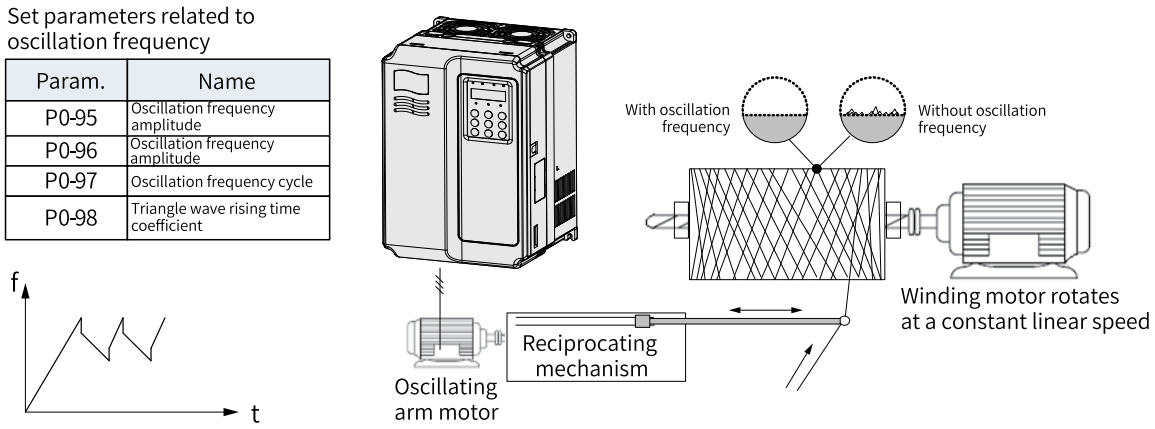


Figure 5-192 Application scenario of the wobble function

Description

Wobble control means that the output frequency of the AC drive wobbles up and down around the center frequency Fset in the wobble amplitude setting mode [P0-94], as shown in the following figure.

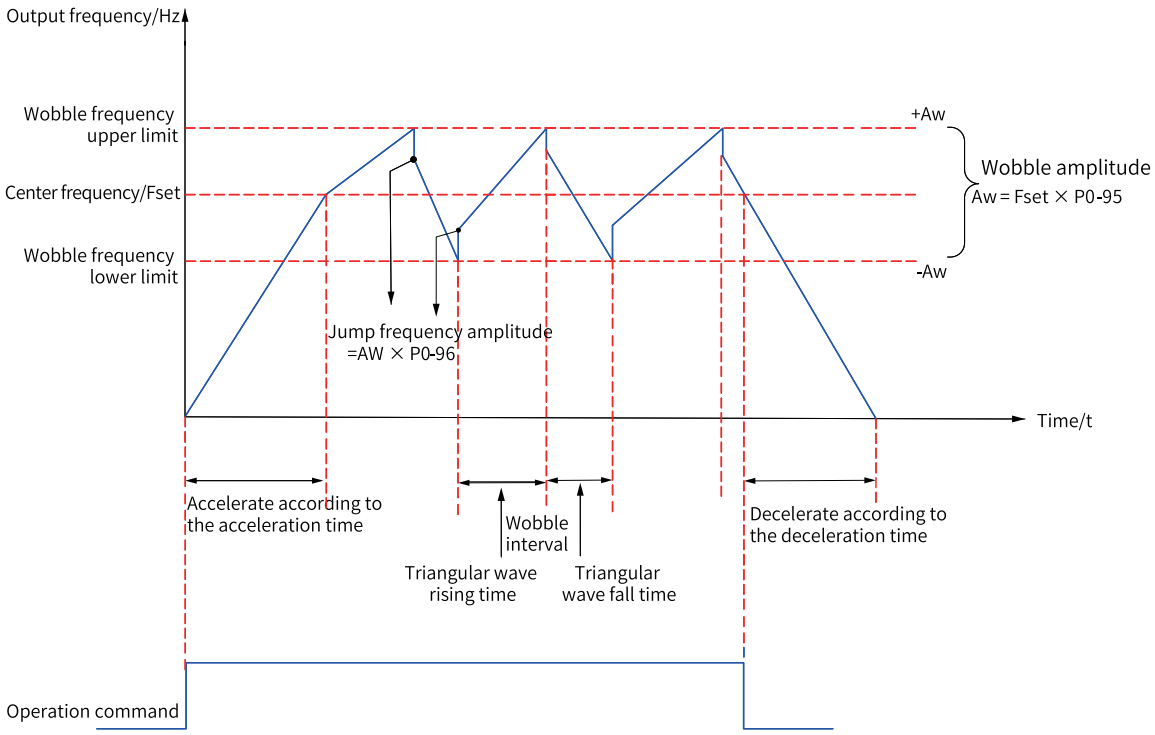


Figure 5-193 Working principle of the wobble function

- **Wobble calculation**

  When P0-94 is set to 0 (relative to the center frequency), wobble frequency (AW) = Main frequency source (b5-00/b6-00) x wobble amplitude (P0-95).

  When P0-94 is set to 1 (relative to the maximum frequency), wobble frequency (AW) = A2-17 (maximum frequency) x P0-95 (wobble amplitude).

- **Jump frequency calculation**

During wobble, jump frequency = wobble frequency (AW) x P0-96 (jump frequency amplitude).

When P0-94 is set to 0 (relative to the center frequency), the jump frequency is a variable.

When P0-94 is set to 1 (relative to the maximum frequency), the jump frequency is a fixed value.

- **Calculation of the triangular wave rise/fall time**
  Triangular wave rise time (unit: s) = P0-97 (wobble cycle) x P0-98 (triangular wave rise time coefficient)

  Triangular wave drop time = Wobble frequency cycle (wobble cycle) - Triangular wave rise time

  (Wobble cycle = Triangular wave rise time + Triangular wave fall time)

Related parameters

Param.	Name	Default	Value range	Descriptions
P0-94	Wobble amplitude setting mode	0	0: Relative to the center frequency	0: Relative to the center frequency (b5-00 or b6-00 main frequency source superposition selection). This mode is a variable wobble system, in which the wobble changes with the center frequency.
			1: Relative to the maximum frequency	1: Relative to the maximum frequency (A2-17). This mode is a fixed wobble system, in which the wobble amplitude is fixed.
P0-95	Wobble amplitude	0.0%	0.0% to 100.0%	Defines the wobble frequency amplitude, which is the percentage to the base frequency of the wobble frequency. Additional information: 1. When P0-95 is set to 0.0%, the wobble frequency function is disabled. 2. When P0-95 is not 0.0%, if P0-94 is set to 0, the wobble frequency amplitude is the target frequency×P0-95; if P0-94 is set to 1, the wobble amplitude is set to the maximum frequency×P0-95.
P0-96	Jump frequency amplitude	0.0%	0.0% to 50.0%	Defines the frequency percentage of the jump frequency to the wobble frequency amplitude during wobble operation. Additional information: The jump frequency is the wobble frequency amplitude× P0-96.
P0-97	Wobble cycle	10.0s	0.1s to 3000.0s	This parameter defines the time of a complete wobble cycle.
P0-98	Wobble triangular wave rise time coefficient	50.0%	0.1% to 100.0%	Defines the triangular wave rise time, which is the percentage to the wobble frequency cycle. Additional information: Triangular wave drop time = Wobble frequency cycle - Triangular wave rise time Triangular wave rise time = Wobble frequency cycle x P0-98

Instances

1. Set P0-94 to 0 0 to make the wobble changes with the center frequency.

2. Set b5-00 (Main frequency source) to 0 (Set by b5-01) and the target operating frequency through b5-01 (Main frequency digital setting).
3. For example, to perform winding operations at 30 Hz, set b5-01 (Main frequency digital setting) to 30 Hz.
4. Set P0-95 (Wobble amplitude) to 10%. This means the wobble amplitude frequency will be 3 Hz (calculated as 30 Hz × 10%). The AC drive will then wobbles between the lower limit (30 Hz - 3 Hz = 27 Hz) and the upper limit (30 Hz + 3 Hz = 33 Hz), with 30 Hz as the center frequency.
5. Set P0-97 (wobble cycle) to 10s, which means that the time required to perform a cycle (from the center frequency and return to the center frequency) is 10s.
6. Set P0-98 (Wobble triangular wave rise time coefficient) to 50%, that is, the triangular wave rising time is 10s x 50% = 5s. This means the wobble cycle from the lower limit to the upper limit takes 5 seconds. The triangular wave fall time equals 5s (10s - 5s). This meas the wobble cycle from the upper limit to the lower limit takes 5 seconds.

5.4.6.2 Process PID Control

Scenarios

The output of process PID (Proportional Integral Derivative) control is used as the running frequency. The process PID control is generally used for field process closed-loop control, such as constant pressure closed-loop control and constant tension closed-loop control.

Function description

As a general process control method, the process PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency.

- Proportional gain Kp: When there is a deviation between the PID input and output, the PID regulator adjusts the output to reduce the deviation of the controlled variable. The deviation reduction speed depends on the proportionality coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction. (A proportional gain of 100.0 indicates that when the deviation between PID feedback and PID reference is 100.0%, the PID regulator regulates the output reference at the amplitude of the maximum range. For example, the maximum frequency applies during frequency adjustment.)
- Integral time Ti: Ti determines the integral regulation intensity of the PID regulator. Shorter differential time indicates greater adjustment intensity. (When the deviation between PID feedback and PID reference is 100.0%, the integral regulator performs continuous regulation within the time. The regulation amount reaches the maximum range. For example, the maximum frequency applies during frequency adjustment.)
- Differential time Td: Td determines the regulation intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity. (Differential time indicates the time within which the feedback change reaches 100.0%. The regulation amount reaches the maximum range. For example, the maximum frequency applies during frequency adjustment.)

Related parameters

Param.	Name	Default	Value range	Description
P2-00	Process PID enable	0	0: Disable	The PID function does not perform calculations, and the PID output is reset to zero.
			1: Enable	The PID function runs and calculates the PID output based on the set parameter.
			Others: B connector	Select the parameter in the bit connector to control whether the PID function runs.
P2-01	PID action direction	0	0: Forward action	If the feedback siganl is smaller than the PID reference, the drive output frequency increases.
			1: Reverse action	If the feedback signal is smaller than the PID reference, the drive output frequency decreases.
			Others: B connector	Select the parameter in the bit connector to control PID direction. (The value 0 represents forward action and 1 represents reverse action.)
P2-02	PID reference source	0	0: PID digital setting	Indicates the reference channel of the PID target value. The PID reference is a relative value. The value 100% corresponds to 100% of the feedback signal of the controlled system. The PID reference is set by P2-03 (PID reference value).
			1: AI1	The PID reference is set by AI1 input.
			2: AI2	The PID feedback reference is set by AI2 input.
			4: HDI reference (valid only for MD630S)	The PID reference is set by the pulse frequency input through the DI terminal. The frequency is calculated according to the corresponding relationship curve between the pulse frequency and operating frequency.
			5: Multi-reference	In the multi-reference mode, combinations of different DI terminal states correspond to different frequency references. The four multi-reference terminals have 16 state combinations, corresponding to 16 target frequency values. Note: When P2-00 is set to 5 (Multi-reference), b8-08 (Source of multi-reference 0) cannot be set to 5 (PID reference).
			6: Simple PLC	The PID reference is set through simple PLC.
			8: Communication reference	The PID reference is set through remote communication.
			Others: F connector	The parameter in float connector is used as the PID target reference value.
P2-03	PID digital reference	50.0%	0.0% to 800.0%	When P2-02 (PID reference source) is set to 0, this parameter must be set. When the parameter value is set to 100%, it corresponds to the maximum feedback value.

Param.	Name	Default	Value range	Description
P2-04	PID feedback source	0	0: AI1	The PID feedback reference is set by AI1 input.
			1: AI2	The PID feedback reference is set by AI2 input.
			4: HDI reference (valid only for MD630S)	The PID feedback reference is set by the pulse frequency input through the DI terminal. The frequency is calculated according to the corresponding relationship curve between the pulse frequency and operating frequency.
			5: Communication reference	The PID feedback reference is set through remote communication.
			Others: F connector	The parameter in the float connector is used as the PID feedback value.
P2-05	PID reference feedback range	1000	0 to 65535	This parameter is used for display of the PID reference and feedback, which are dimensionless. For example, if this parameter is set to 1000, the PID reference (0% to 100%) corresponds to the feedback (0 to 1000) linearly, that is, 1000 (PID reference feedback dimension)/100 (PID output %) = 10 (dimension coefficient). PID output 0% is dimension 0. PID output 100% is dimension 1000.
P2-06	PID reference change time	0.00s	0.00s to 650.00s	This parameter defines the time required for the PID reference to change from 0.0% to 100.0%.
P2-07	PID feedback filter time	0.00s	0.00s to 60.00s	This parameter defines the filter time of PID feedback. The filter helps to reduce interference on the feedback but degrades the responsiveness of the process closed-loop system. Note: An excessively high setpoint may result in slow PID feedback speed and large deviation from the actual speed. An excessively low setpoint may result in fast PID feedback speed and large system vibration.
P2-08	PID output filter time	0.00s	0.00s to 60.00s	This parameter defines the filter time of PID output. The filter enhances smooth output but lowers the responsiveness of the process closed-loop. Note: An excessively high setpoint may result in slow PID output speed and large deviation from the actual speed. An excessively low setpoint may result in fast PID output speed and large system vibration.
P2-09	PID reverse cut-off frequency	2.00 Hz	0.00 Hz to A2-07	When the frequency source is only the PID, the PID reverse cutoff frequency is the minimum value of the current PID output. When the frequency source is "main frequency + PID", P2-09 acts on the "main frequency + PID" and outputs the minimum frequency value after "main frequency + PID" operation. This parameter takes effect only when P2-09 is set to 0. Note: When using this function, you need to select connector L2480 (General PID reverse cut-off output) for the minimum PID output source.

Param.	Name	Default	Value range	Description
P2-11	PID parameter switchover condition	0	0: No switchover, PID parameter group 1 by default	This parameter defines the switchover between two groups of PID parameters. When no switching occurs; the first group of PID parameters (P2-14 to P2-16) is used.
			1: Switchover by DI	To enable switchover through the DI, assign the DI with function 43 (PID parameter switchover). If the DI is invalid, group 1 (P2-14 to P2-16) is selected. If the DI is valid, group 2 (P2-17 to P2-19) is selected.
			2: Automatic switchover based on deviation	When the absolute value of the deviation between PID feedback and PID reference is smaller than PID parameter switchover deviation 1 (P2-12), group 1 is selected. When the absolute value of the deviation between PID feedback and PID reference is larger than PID parameter switchover deviation 2 (P2-13), group 2 is selected. When the deviation is between P2-12 and P2-13, the PID parameters are the linearly interpolated value of the two groups of PID parameter values, as shown in *"Figure 5-196 PID parameter switchover" on page 652*.
			3: Automatic switchover based on running frequency	In this mode, when the running frequency of the AC drive is between 0 and the maximum frequency, the PID parameters are the linearly interpolated value of the two groups of parameter values, as shown in *"Figure 5-196 PID parameter switchover" on page 652*.
P2-12	PID parameter switchover deviation 1	20.0%	0.0% to P2-13	The value 100% corresponds to the maximum deviation between the reference and feedback.
P2-13	PID parameter switchover deviation 2	80.0%	P2-12 to 800.0%	The value 100% corresponds to the maximum deviation between the reference and feedback.
P2-14	PID parameter 1 proportional gain Kp1	20.0	0.0 to 1000.0	This parameter defines the proportional gain Kp in PID control. The deviation reduction speed depends on the proportional coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-15	PID parameter 1 integral time Ti1	2.00s	0.01s to 10.00s	Defines the integral time Ti in PID control. This parameter determines the integral adjustment intensity of the PID regulator. Shorter differential time indicates greater adjustment intensity.
P2-16	PID parameter 1 differential time Td1	0.000s	0.000s to 10.000s	This parameter defines the derivative time Td in PID control. It decides the regulating intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity.

Param.	Name	Default	Value range	Description
P2-17	PID parameter 2 proportional gain Kp2	20.0	0.0 to 1000.0	This parameter defines the proportional gain Kp in PID control. The deviation reduction speed depends on the proportional coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-18	PID parameter 2 integral time Ti2	2.00s	0.01s to 10.00s	Defines the integral time Ti in PID control. This parameter determines the integral adjustment intensity of the PID regulator. Shorter differential time indicates greater adjustment intensity.
P2-19	PID parameter 2 differential time Td2	0.000s	0.000s to 10.000s	This parameter defines the derivative time Td in PID control. It decides the regulating intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity.
P2-20	PID initial value	0.0%	0.0% to 800.0%	When the AC drive starts, the PID starts closed-loop algorithm only after the PID output is fixed to the PID initial value and lasts for the time longer than the PID initial value active time.
P2-21	Active time of PID initial value	0.00s	0.00s to 650.00s	When the AC drive starts, the PID starts closed-loop algorithm only after the PID output is fixed to the PID initial value and lasts for the time longer than the PID initial value active time.
P2-22	PID deviation dead zone	0.0%	0.0% to 800.0%	When the deviation is within the PID deviation dead zone, no adjustment is required. This parameter is used to ensure the accuracy and stability of the system output.
P2-23	PID derivative limit	0.10%	0.00% to 600.0%	This parameter is used to set the PID derivative output range. In PID control, the derivative operation may easily cause system oscillation. Therefore, the PID derivative output is restricted to a specific range.

Param.	Name	Default	Value range	Description
P2-26	Source of maximum PID output	0	0: 100.0%	This parameter defines the source of the maximum PID output. When the PID is used for frequency setting, the PID output is limited by frequency limit. When the PID is used for non-frequency setting, the maximum PID output value is limited by this parameter. When 0 is selected, the default maximum PID output value is 100.0%.
			2: AI1	The maximum PID output value is defined by AI1 input.
			3: AI2	The PID feedback reference is set by AI2 input.
			5: Pulse reference	The maximum PID output value is set through DI. The frequency is calculated based on the relationship curve between the pulse frequency and running frequency.
			6: Multi-reference	When multi-reference is used as the source of the maximum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 multi-reference values.
			7: Simple PLC	The maximum PID output value is defined by simple PLC output setting.
			8: PID	The maximum PID output value is set by the current PID output.
			9: Communication reference	The maximum PID output value is set through communication, and can be input through remote communication.
			Others: F connector	The parameter in the float connector is used as the maximum PID output value.

Param.	Name	Default	Value range	Description
P2-27	Source of minimum PID output	0	0: -100.0%	This parameter defines the source of the minimum PID output. When the PID is used for frequency setting, the PID output is limited by frequency limit. When the PID is used for non-frequency setting, the minimum PID output value is limited by this parameter. When 0 is selected, the default minimum PID output value is -100.0%.
			2: AI1	The minimum PID output source is the AI1 input.
			3: AI2	The minimum PID output source is the AI2 input.
			5: Pulse reference	The minimum PID output value is set through DI. The frequency is calculated based on the relationship curve between the pulse frequency and running frequency.
			6: Multi-reference	When multi-reference is used as the source of the minimum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 multi-reference values.
			7: Simple PLC	The minimum PID output value is defined by simple PLC output setting.
			8: PID	The minimum PID output value is set by the current PID output.
			9: Communication reference	The minimum PID output value is set through communication, and can be input through remote communication.
			Others: F connector	The parameter in the float connector is used as the minimum PID output value.
P2-28	Forced value of PID output	0	0: 0.0%	This parameter defines the source of forced assignment of PID output. When P2-29 [Forced value assignment of PID output] is set to 1, the PID output is the forced value, that is, the value set by P2-28. When P2-29 [Forced value assignment of PID output] is set to 1 and P2-28 is set to 0, the PID output remains 0.0%, that is, the PID does not generate output.
			2: AI1	The forced value of PID output is defined by AI1.
			3: AI2	The forced value of PID output is defined by AI2.
			5: Pulse reference	The forced value of PID output is the pulse frequency reference of the DI terminal.
			6: Multi-reference	The forced value of PID output is the multi-reference output value.
			7: Simple PLC	The forced value of PID output is defined by simple PLC output.
			8: PID	The forced value of PID output is set by the current PID output.
			9: Communication reference	The forced value of PID output is set through communication.
			Others: F connector	The parameter in the float connector is used as the forced value of PID output.

Param.	Name	Default	Value range	Description
P2-29	Forced assignment of PID output enable	0	0: Invalid	The forced output value is invalid, and the PID calculation is performed normally.
			1: Enable	The PID stops calculation and performs forced value assignment of the output. The PID output is the forced value, that is, the value set by P2-28.
			Others: B connector	Select the parameter in the bit connector to set whether to enable forced output value. 0: Invalid 1: Enable
P2-30	Upper limit for PID feedback loss detection	100.0%	P2-31 to 800.0%	This parameter is used to determine whether the PID feedback is lost. When the PID feedback has been greater than the value of this parameter for a period longer than the PID feedback loss detection time (P2-32), the AC drive reports E31.1. When this parameter is set to 800.0%, PID feedback loss detection is disabled.
P2-31	Lower limit for PID feedback loss detection	0.0%	0.0% to P2-30	This parameter is used to determine whether the PID feedback is lost. When the PID feedback has been lower than the value of this parameter for a period longer than the PID feedback loss detection time (P2-32), the AC drive reports E31.1. When this parameter is set to 0, PID feedback loss detection is disabled.
P2-32	Duration of PID feedback loss detection	0.0s	0.0s to 20.0s	Defines the duration of the PID feedback loss detection.
P2-33	Selection of PID operation at stop	0	0: Disabled	This parameter is used to determine whether to continue the PID operation when the AC drive stops. Generally, the PID operation needs to be stopped when the AC drive stops. When the drive stops, the PID function does not perform calculations, and the PID output is reset to zero.
			1: Enabled	When the drive stops, the PID function still perform calculation, and the PID output changes based on PID feedback and PID reference.
			Others: B connector	Select the parameter in the bit connector to set whether to enable calculation at stop. 0: Disabled 1: Enabled

Param.	Name	Default	Value range	Description
P2-34	PID integral property	10	Ones position: Integral pause/ separation 0: Invalid 1: Valid	When integral pause/separation is invalid, the integral remains invalid regardless of whether the multi-functional DI is valid. When the integral pause/separation is valid and the DI assigned with the PID integral pause function is valid (set to 22), the PID integral operation stops. In this case, only proportional and derivative operations take effect.
			Tens position: Whether to stop integral operation when the output reaches the limit 0: Continue integral operation 1: Stop integral operation	Determines whether to stop the integral operation when the PID operation output reaches the maximum or minimum value. If you select "Stop the integral operation", the PID integral operation stops, which may help reduce the PID overshoot. If you select "Continue integral operation", the PID integral operation continues, which may result in PID overshoot.
P2-36	PID calculation during jog	0	0: Disabled 1: Enabled	Defines whether PID calculation is allowed during jogging. Value description: 0: Disabled - PID calculation is disabled during jogging. 1: Enabled - PID calculation is allowed during jogging.
P2-37	PID execution interval	1	0 to 20	Defines the PID execution interval. The larger the setting, the longer the calculation cycle; the smaller the setting, the shorter the calculation cycle.
P2-38	Valid mode selection for PID ramp setting	-	0: Valid when PID is enabled 1: Valid when PID calculation is started Others: B connector	0: Valid when PID is enabled When the PID function is enabled, the PID ramp setting is valid and the PID reference value is calculated based on the PID reference time. 1: Valid when PID calculation is started When PID operation starts, the PID ramp reference is valid and the PID reference value is calculated based on the PID reference time. Others: B connector Select the parameter in the bit connector to select the active mode of PID ramp reference.

Application example

1. Set P2-00 to 1 to enable process PID function.
2. Set P2-02 to select the target PID reference source. If P2-02 is set to 0, set P2-03. The value 100% of this parameter corresponds to the maximum value of PID feedback.

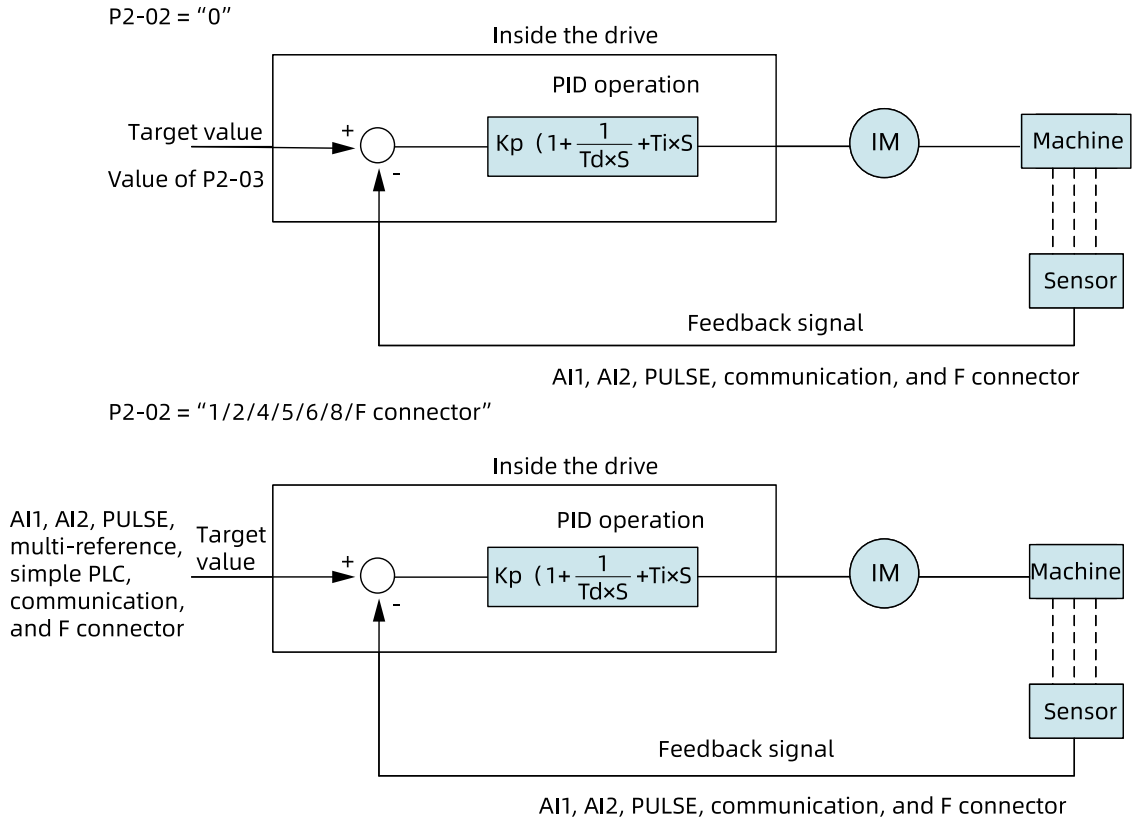


Figure 5-194 Principle of process PID control

3. Set P2-04 to select a PID feedback source.
4. Set P2-01 to select a PID action direction.

   The following figure shows the logic of process PID control parameter settings.

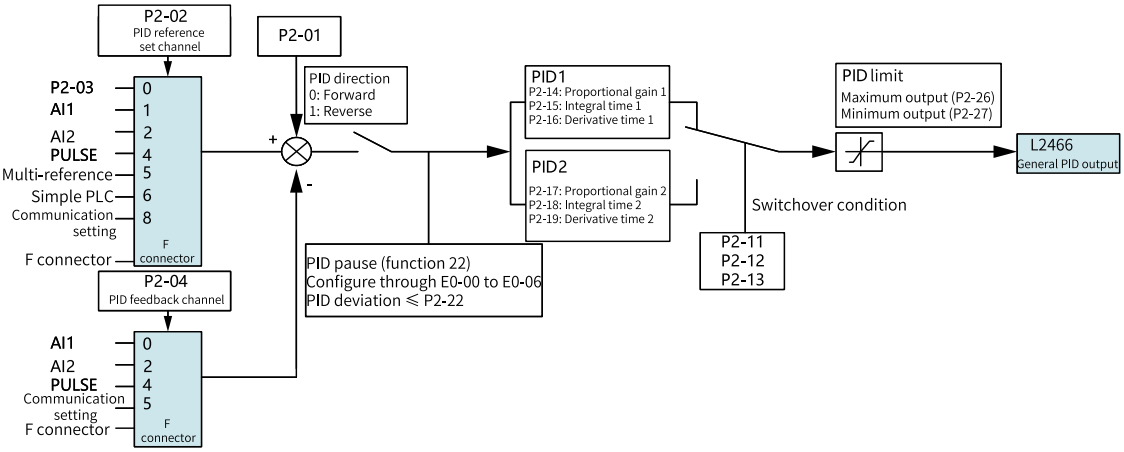


Figure 5-195 Parameter settings for process PID control

5. Select PID reference or connector L2466 as the control source.

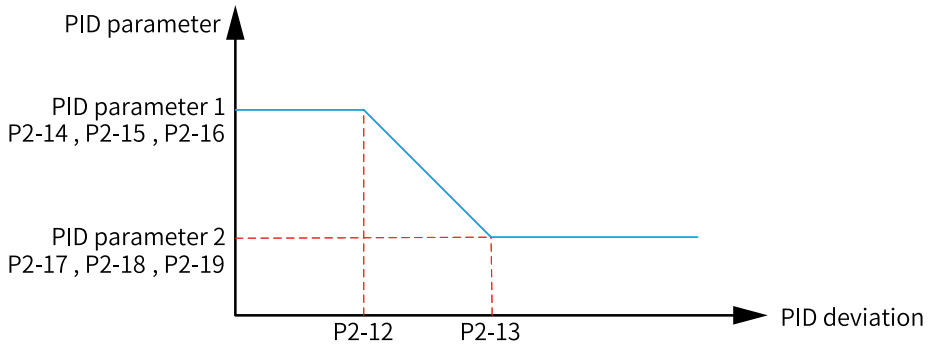


Figure 5-196 PID parameter switchover

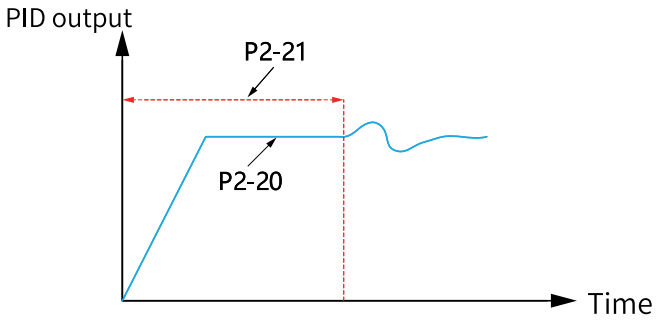


Figure 5-197 PID output function

5.4.6.3 Simple PLC Function

Scenarios

Simple PLCs are generally used in scenarios where multiple speeds are required. The execution time and frequency cannot be accurately controlled by the operating panel or other frequency sources. In this case, the drive can control different running frequencies at different times by using a simple PLC. The running time of different frequencies can also be controlled.

You need to set the frequency and running time through the P1-00 to P1-56.

Description

The simple PLC module performs a simple combination of 16 multi-references based on the setting of each operating time. In applications requiring multiple speeds, for example, when the conveyor belt is used to handle goods, the simple PLC can be used together with the main frequency source [F0-29] or auxiliary frequency source [F0-31]. You can control the acceleration/deceleration time and operating time of each speed by configuring simple PLC acceleration/deceleration time for segments 0 to 15.

When using the simple PLC module, you need to manually enable the simple PLC module. In addition, you need to configure the simple PLC references 0 to 15, operating time, acceleration/deceleration time, and operation mode. Then configure the source for enabling simple PLC calculation. When simple PLC calculation is enabled, the simple PLC module starts operating according to the set operating time and mode.

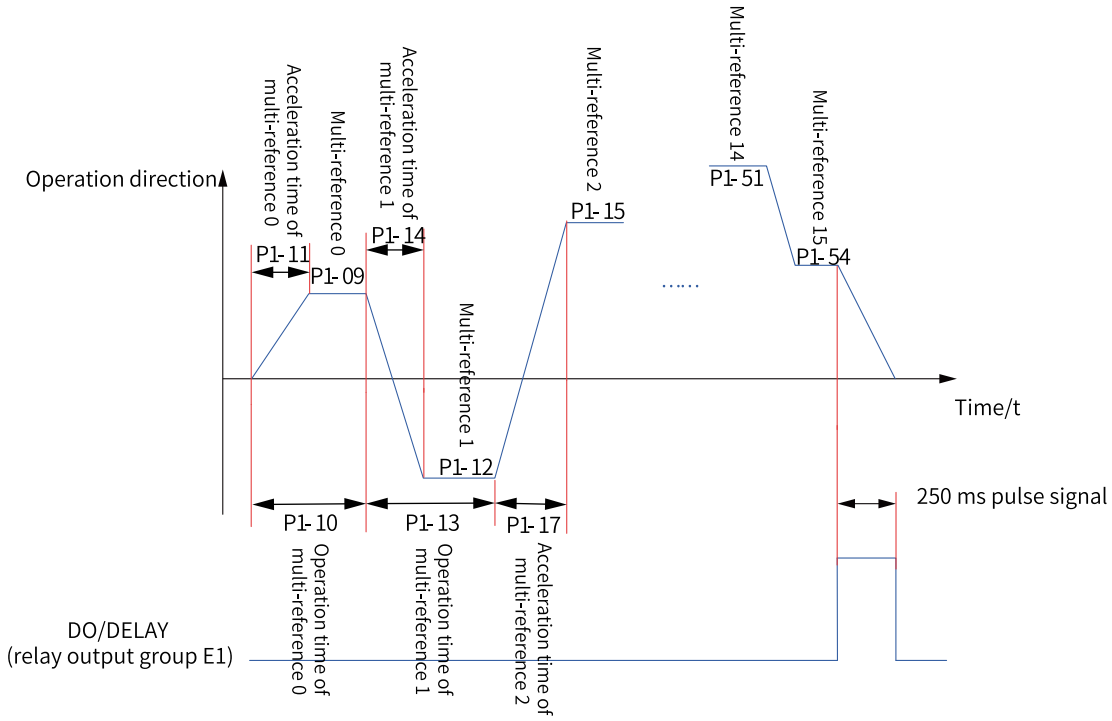


Figure 5-198 Operation diagram of the simple PLC

Technical data

Param.	Name	Default value	Value range	Description
P1-00	Simple PLC module enable	0: Disable	0: Disable 1: Enable	Used to enable/disable the simple PLC module. 0: Disable - The simple PLC module is disabled. In this case, the current STEP and current STEP running time (in hours and seconds) of the simple PLC, as well as the per unit value obtained in the simple PLC step, are all cleared. 1: Enable - The simple PLC module is enabled, but whether the PLC module is calculated and outputted normally depends on P1-01.
P1-01	Simple PLC calculation source	L0114 Motor running flag	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines the source for enabling simple PLC calculation. 1. If the simple PLC calculation function is enabled, the simple PLC module runs according to the operation mode of the simple PLC. The simple PLC module also calculates the current STEP based on the running time and outputs the current STEP, current STEP running time (hours and seconds), and current STEP per unit value. 2. If the simple PLC calculation enable source is disabled, the current STEP, current STEP running time (in hours and seconds) of the simple PLC is the value when the calculation is stopped. The per unit value obtained in the simple PLC step is the value of multi-reference i when the calculation is stopped.

Param.	Name	Default value	Value range	Description
P1-02	Simple PLC operation mode	0: Keep multi-reference 0 output after running for one cycle	0: Keep multi-reference 0 output after running for one cycle 1: Keep final values after running for one cycle 2: Repeat after running for one cycle 3: Output 0 after running for one cycle	Sets the running mode of the simple PLC. 0: Keep multi-reference 0 output after running for one cycle After an individual cycle of operation of done by the simple PLC, the multi-reference 0 output is kept and the individual cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms. 1: Keep final values after running for one cycle After an individual cycle of operation of done by the simple PLC, the final value is kept and the individual cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms. 2: Repeat after running for one cycle The simple PLC starts running again after completing a cycle. The simple PLC cycle completion flag outputs a high level for 250 ms after each cycle is completed. 3: Output 0 after running for one cycle After an individual cycle of operation of done by the simple PLC, the value obtained in the PLC step is outputted as 0. In this case, the individual cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms.
P1-03	Simple PLC function selection	0	Ones: Retention upon power failure 0: Non-retentive 1: Retentive Tens: Calculation configuration 0: Keep the current segment when calculation is invalid and re-calculate when it is valid 1: Keep the current segment when calculation is invalid and continue to run when it is valid	Defines the simple PLC function. Ones: 0: Current operating segment and operating time are not recorded. 1: The current operating segment and operating time are recorded upon power failure, and both the ones and tens need to be set to 1. Tens: 0: Current segment retained when disabled, which is recalculated after enabled 1: Current segment retained when disabled, and operation continued after enabled

Param.	Name	Default value	Value range	Description
P1-04	Simple PLC status reset	0: Invalid	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Used to reset the simple PLC status. Invalid: When the simple PLC state reset is invalid, the simple PLC operates according to the setting. Valid: When the simple PLC status reset is valid, the simple PLC module is restored to the initial state. The operation segment of the simple PLC is 0, and the output of the simple PLC is the setpoint of the multi-reference 0 defined by P1-09.
P1-05	Current STEP of the simple PLC	0	Displays the current STEP of the simple PLC.	Displays the STEP speed to which the simple PLC is running.
P1-06	Current STEP operating time (in hours) of the simple PLC	0	Displays the current STEP operating time (in hours) of the simple PLC.	Displays the current STEP operating time (in hours) of the simple PLC.
P1-07	Current STEP operating time (in seconds) of the simple PLC	0	Displays the current STEP operating time (in seconds) of the simple PLC.	Displays the current STEP operating time in seconds of the simple PLC.
P1-08	Operating time unit of simple PLC	0: s (second)	0: s (second) 1: h (hour)	Defines the operating time unit of simple PLC.
P1-09	Multi-reference 0 set by simple PLC	0.0%	-800.0% to +800.0%	Defines the target frequency of multi-reference 0 of the simple PLC, which is a percentage to the rated motor frequency.
P1-10	Operating time of multi-reference 0 set by simple PLC	0.0s	0.0s to 6553.5s	Defines the operating time of multi-reference 0 set by simple PLC, which is the sum of acceleration or deceleration time and operating time at constant speed and target frequency.

Param.	Name	Default value	Value range	Description
P1-11	Acceleration/ Deceleration time of multi-reference 0 set by simple PLC	0: Acceleration/ Deceleration time of ramp 1 (B7-04/B7-05).	0: Acceleration/ Deceleration time of ramp 1 (B7-04/B7-05). 1: Acceleration/ Deceleration time of ramp 2 (B7-10/B7-11). 2: Acceleration/ Deceleration time of ramp 3 (B7-16/B7-17). 3: Acceleration/ Deceleration time of ramp 4 (B7-22/B7-23).	Defines the acceleration/deceleration time of multi-reference 0 set by simple PLC.
…	…	…	…	…
P1-54	Multi-reference 15 set by simple PLC	0.0%	-800.0%-800.0%	Defines the target frequency of multi-reference 15 of the simple PLC, which is a percentage to the rated motor frequency.
P1-55	Operating time of multi-reference 15 set by simple PLC	0.0s	0.0s to 6553.5s	Defines the operating time of multi-reference 15 set by simple PLC, which is the sum of acceleration or deceleration time and operating time at constant speed and target frequency.
P1-56	Acceleration/ Deceleration time of multi-reference 15 set by simple PLC	0: Acceleration/ Deceleration time of ramp 1 (acceleration time B7-04/ deceleration time B7-05)	0: Acceleration/ Deceleration time of ramp 1 (acceleration time B7-04/ deceleration time B7-05) 1: Acceleration/ Deceleration time of ramp 2 (acceleration time B7-10/ deceleration time B7-11) 2: Acceleration/ Deceleration time of ramp 3 (acceleration time B7-16/ deceleration time B7-17) 3: Acceleration/ Deceleration time of ramp 4 (acceleration time B7-22/ deceleration time B7-23)	Defines the acceleration/deceleration time of multi-reference 15 set by simple PLC.

Application instance

1. Set P1-00 [Simple PLC module enable] to 1 to enable the simple PLC module function.
2. Set P1-01 [Simple PLC calculation enable source] to 1 to enable the 16 multi-references values of simple PLC.
3. Set P1-02 [Simple PLC operation mode] to 0, that is, the drive remains at P1-09 (Multi-reference 0 set by simple PLC) after all 16 setpoints of the simple PLC are done executing.
4. Set P1-03 [Simple PLC function selection] to 0, that is, the 16 multi-references set by the simple PLC is non-retentive at power failure and calculation starts from multi-reference 0 again at next power-on.
5. Set P1-04 [Simple PLC state reset] to 0 to disable the reset function of the simple PLC.
6. Set P1-08 [PLC operating time unit] to 0 to set the operating time in seconds (s).
7. Set P1-09 [Multi-reference 0 set by simple PLC] to 10%, that is, the frequency of multi-reference 0 during operation = 10% [P1-09] x rated frequency [F1-06].
8. Set P1-10 [Simple PLC operating time 0] to 5s, which is the sum of the acceleration/deceleration time at start and operating time.
9. Set P1-11 [Simple PLC acceleration/deceleration time selection 0] to 0, which means that the target frequency acceleration/deceleration time is converted based on ramp 1 acceleration/ deceleration time (B7-04/B7-05).
10. Set P1-12 to P1-14, P1-15 to P1-17, P1-18 to P1-20, P1-21 to P1-23, P1-24 to P1-26, P1-27 to P1-29, P1-30 to P1-32, P1-33 to P1-35, P1-36 to P1-38, P1-39 to P1-41, P1-42 to P1-44, P1-45 to P1-47, P1-48 to P1-50, P1-51 to P1-53, and P1-54 to P1-56, together with P1-09 to P1-11, a total of 16 groups of simple PLC parameters;
11. Run the AC drive, that is, the drive runs at variable speed according to the target frequency set in 16 groups of parameters. P1-05 [Current STEP of simple PLC) can be used to observe the simple PLC stage. P1-07 [Current STEP operating time (in seconds) of simple PLC] can be used to observe the number of operating hours in the current stage.

5.4.6.4 Motorized Potentiometer

Scenarios

The motorized potentiometer function is applicable to industries such as logistics and ceramics that require flexible speed control.

In these applications, the motorized potentiometer replaces the physical potentiometer as the frequency source and provides parameters P3-05 [Motor potentiometer increase command source] and P3-06 [Motor potentiometer decrease command source]. Speed control is performed through the acceleration/deceleration button of these two custom sources instead of the rotary knob.

Operation principles

The motorized potentiometer function can be used to simulate the potential difference of analog potentiometer input. The per unit value calculated based on P3-07 (Maximum value of potentiometer), P3-08 (Minimum value of potentiometer), P3-03 (Increase time), and P3-04 (Decrease time) is used as the output value of the potentiometer. The motorized potentiometer function can be used as the source for functions such as the main frequency or jog frequency.

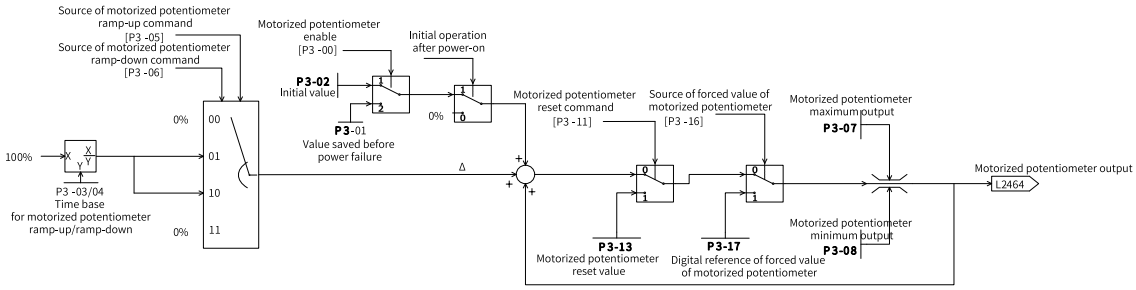


Figure 5-199 Motorized potentiometer functions

Technical data

Param.	Name	Default	Value range	Description
P3-00	Motorized potentiometer enable	0	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether the motorized potentiometer function is enabled. Value description: 0: Inhibited - The motorized potentiometer is not enabled. 0: Enabled - The motorized potentiometer is enabled. 3 to 9: DI1 to DI7 - Whether the motorized potentiometer is enabled depends on the terminal state of the DI. Others: B connector - Whether the motorized potentiometer is enabled depends on the B connector state (0: Inhibited; 1: Enabled)
P3-01	Retention at power failure of motorized potentiometer	0	0: Disable 1: Enable	Defines whether the motorized potentiometer is retentive at power failure. Value description: 0: Disable - Non-retentive upon power failure 1: Enable - Retentive Value: If memory retention at power failure is enabled and the motorized potentiometer is enabled before power failure, the output value of the motorized potentiometer after power-on is the last output value before the power failure. When memory retention is disabled, the output value of the motorized potentiometer after power-on is P3-02 (Initial value of the motorized potentiometer).
P3-02	Initial value of motorized potentiometer	0.0%	-600.0% to +600.0%	Indicates the initial value of the motorized potentiometer.

Param.	Name	Default	Value range	Description
P3-03	Time increase base of motorized potentiometer	20.00s	0.00 to 655.35s	Defines the time required for the motorized potentiometer to increase from 0% to 100%.
P3-04	Time decrease base of motorized potentiometer	20.00s	0.00 to 655.35s	Defines the time required for the motorized potentiometer to decrease from 100% to 0%.
P3-05	Source of motorized potentiometer increase command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether the motorized potentiometer increase command is valid. Value description: 0: Invalid - The increase command is invalid. 1: Active - The increase command is valid. 3 to 9: DI1 to DI7 - Whether the increase command is valid depends on the terminal state of the DI1 to DI7. 0: Invalid; 1: Valid Others: B connector - Whether the increase command is valid depends on the state of B connector. 0: Invalid; 1: Valid Value description: 1. After the increase command is active, the value is increased according to the rate defined by P3-03. 2. If the increase command and the decrease command are set simultaneously, both commands are invalid and the current output remains unchanged.
P3-06	Source of motorized potentiometer decrease command	0	0: Disabled 1: Enabled 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether the motorized potentiometer decrease command is valid. Value description: 0: Invalid - The decrease command is invalid. 1: Valid - The decrease command is valid. 3 to 9: Whether the decrease command is valid depends on the terminal state of the DI1 to DI7. 0: Invalid; 1: Valid Others: B connector - Whether the decrease command is valid depends on the state of B connector. 0: Invalid; 1: Valid Value description: 1. After the decrease command is activated, the value is decreased according to the rate defined by P3-04. 2. If the increase command and the decrease command are set simultaneously, both commands are invalid and the current output remains unchanged.
P3-07	Maximum value of motorized potentiometer output	600.0%	P3-08 to 600.0%	Defines the maximum range that can be outputted by the motorized potentiometer.

Param.	Name	Default	Value range	Description
P3-08	Minimum value of motorized potentiometer output	-600.0%	-600.0% to P3-07	Defines the minimum range that can be outputted by the motorized potentiometer.
P3-09	Source 1 of motorized potentiometer pause command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether the motorized potentiometer pause command 1 is valid. Value description: 0: Invalid - The pause command is invalid. 1: Valid - The pause command is valid. 3 to 9: Whether the pause command is valid depends on the terminal state of the DI1 to DI7. 0: Invalid; 1: Valid Others: B connector - Whether the pause command is valid depends on the state of B connector. 0: Invalid; 1: Valid Value description: When the pause command is 1, the motorized potentiometer change pauses. When the pause command is 0, the pause is inactive.
P3-10	Source 2 of motorized potentiometer pause command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether the motorized potentiometer pause command 2 is valid. The function description is the same as P3-09.

Param.	Name	Default	Value range	Description
P3-11	Source 1 of motorized potentiometer reset command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether motorized potentiometer reset command 1 is valid. Value description: 0: Invalid - The fault reset command is invalid. 1: Valid - The fault reset command is valid. 3 to 9: Whether the reset command is valid depends on the terminal state of the DI1 to DI7. 0: Invalid; 1: Valid Others: B connector - Whether the reset command is valid depends on the state of B connector. 0: Invalid; 1: Valid Value description: When the reset command changes from 0 to 1, the output value of the motorized potentiometer is reset to the values of P3-13 and P3-14.
P3-12	Source 2 of motorized potentiometer reset command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines whether motorized potentiometer reset command 2 is valid. The function description is the same as P3-11.
P3-13	Source of reset value of motorized potentiometer	0	0: Digital setting 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Defines the source of motorized potentiometer reset value. Value description: 0: P3-14 2 to 3: AI output value 5: HDI output value 6: Multi-reference output value 7: Simple PLC output value 8: General PID output value 9: Reference value set through communication (address 7310H). Others: F connector. - Value of the selected connector

Param.	Name	Default	Value range	Description
P3-14	Digital setting of the reset value of motorized potentiometer	0.0%	-600.0% to +600.0%	Defines the digital setting of the reset value of motorized potentiometer. Value description: When P3-13 is set to 0, the reset value of the motorized potentiometer is the setpoint of P3-14.
P3-15	Source of motorized potentiometer forced command	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	Defines the whether the forced command of the motorized potentiometer is valid. Value description: 0: Invalid - The forced command is invalid. 1: Valid - The forced command is valid. 3 to 9: DI1 to DI7 - Whether the forced command is valid depends on the terminal state of the DI. 0: Invalid; 1: Valid Others: B connector - Whether forced command is valid depends on the state of B connector. 0: Invalid; 1: Valid Value description: When the forced command (P3-15) is 1, the output value of the motorized potentiometer is set to the forced values of P3-16 and P3-17.
P3-16	Forced value source of motorized potentiometer	0	0: Digital setting 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	Defines the source of the forced value after the forced command of the motorized potentiometer is activated. Value description: 0: P3-17 2 to 3: AI output value 5: HDI output value 6: Multi-reference output value 7: Simple PLC output value 8: General PID output value 9: Reference value set through communication (address 7310H). Others: F connector. - Value of the selected connector
P3-17	Digital setting of the force value of motorized potentiometer	0.0%	-600.0% to +600.0%	Defines the digital setting of forced value of motorized potentiometer. Value description: When P3-16 is set to 0, the reset value of the motorized potentiometer is the setpoint of P3-17.
P3-38	High bits of the value saved by motorized potentiometer	0	0 to 65535	Defines the high bits (those higher than 65535) saved by the motorized potentiometer at next power-on after the memory retention function (P3-01) is enabled.
P3-39	High bits of the value saved by motorized potentiometer	0	0 to 65535	Defines the high bits (those lower than 65535) saved by the motorized potentiometer at next power-on after the memory retention function (P3-39) is enabled.

Application instance

The following describes how to use the output of the motorized potentiometer as the frequency source.

1. Set P3-00 [Motorized potentiometer enable] to 1, which means that the jog potentiometer function is activated.
2. Set b5-00 [Main frequency source] to L2464 (Final output value of jog potentiometer) in "Others [F connector]".
3. Set P3-03 [Time increase base of motorized potentiometer] to 10s and [Time decrease base of motorized potentiometer] P3-04 to 10s.
4. Set P3-05 [Increase command source of motorized potentiometer] to 3 [DI1] and P3-06 [Decrease command source of motorized potentiometer] to 4 [DI2]. Set P3-07 [Maximum output value of motorized potentiometer] to 100% and P3-08 [Minimum output value of motorized potentiometer] to 0%.
5. After setting is done, when DI1 is valid and DI2 is invalid, the potentiometer output increases from 0% at a rate of 10% per second. This continues until the time set in P3-03 [Time increase base of motorized potentiometer] is 10s, at which point 100% x rated frequency is output. On the contrary, when DI1 is invalid and DI2 is valid, the potentiometer output decreases from 100% at a rate of 10% per second. This continues until the time set in P3-04 [Time decrease base of motorized potentiometer] is 10s, at which point 0% x rated frequency is output.

5.4.6.5 Brake Control

5.4.6.5.1 Description

Scenarios

The brake control function can keep the motor and drive at zero speed when the drive module is not running. The brake control function allows effective control of the brake logic, ensuring operational safety.

Time sequence in vector control

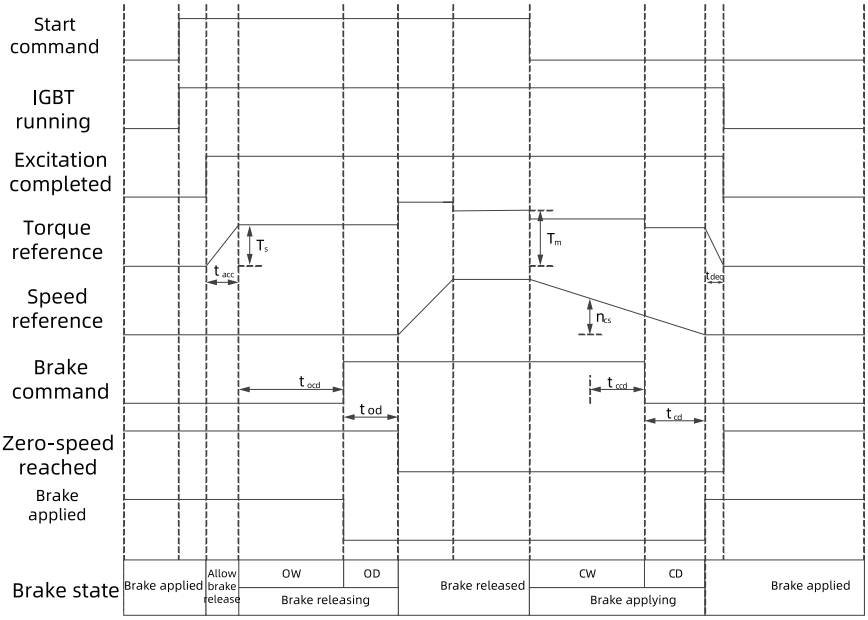


Figure 5-200 Brake time sequence in vector control

Abbreviation	Description
t_{acc}	Brake release torque increment time (P4-11 [Starting torque increment time])
T_s	Starting torque upon brake release (P4-08 [Starting torque source in the vector control mode])
t_{ocd}	Brake release comparison delay (P4-27 [Brake release delay time])
t_{od}	Actuating time of brake release (P4-02 [Brake release action time])
T_m	Recorded torque upon brake apply
n_{cs}	Brake apply speed threshold (P4-18 Actual speed monitoring threshold for brake apply])
t_{ccd}	Brake apply actual speed monitoring time (P4-19 [Actual speed monitoring time for brake apply])
t_{cd}	Actuating time of brake apply (P4-03 [Brake apply action time])
t_{dec}	Brake torque decrement time (P4-34)
OW	Brake release waiting
OD	Brake release delay
CW	Brake apply waiting
CD	Brake apply delay

Time sequence in V/f control

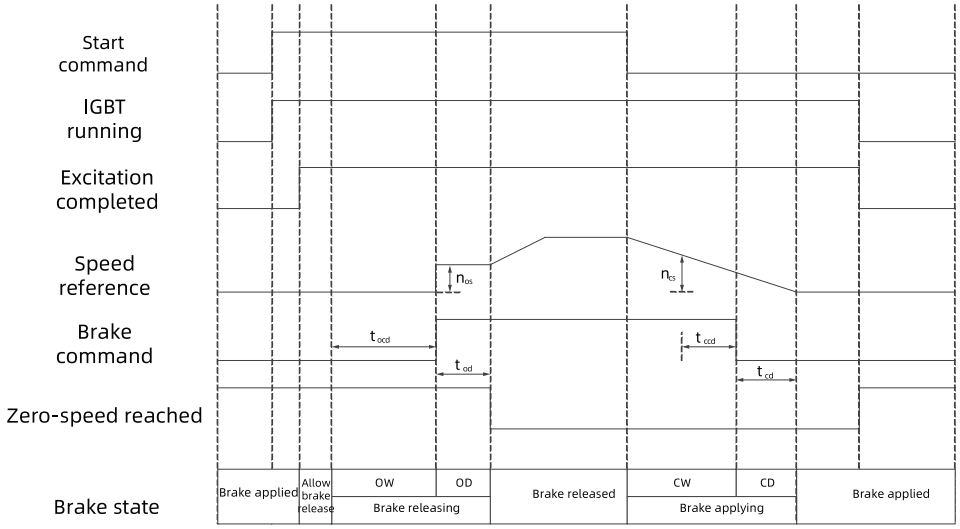


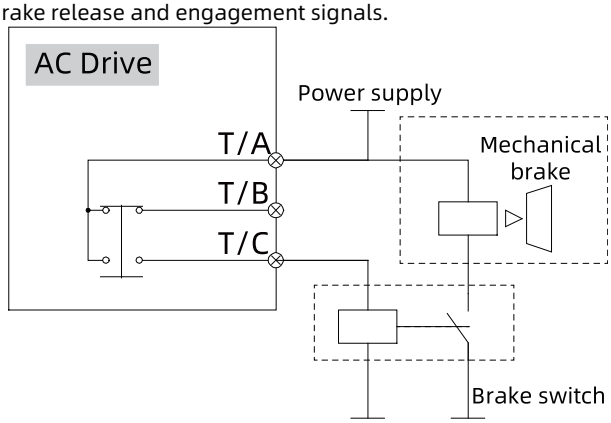
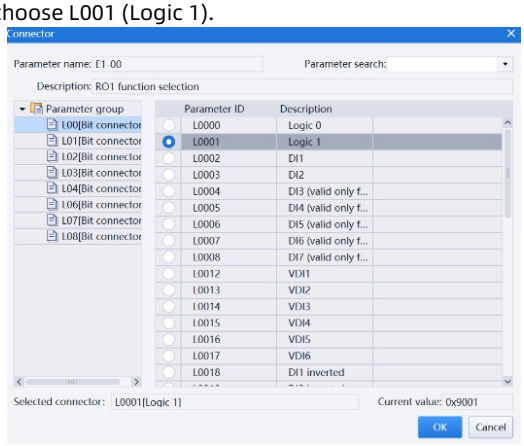
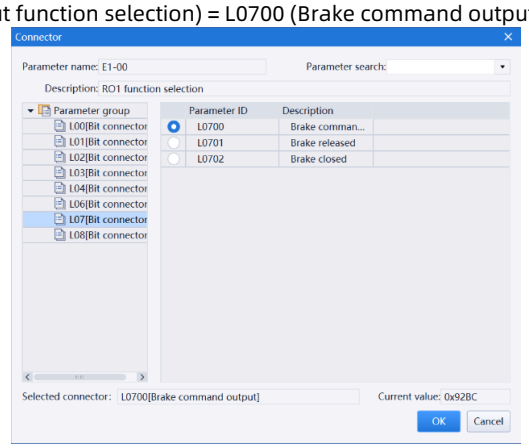
Figure 5-201 Brake time sequence in V/f control

Abbreviation	Description
t_{ocd}	Brake release comparison delay (P4-13 [Starting speed source])
n_{os}	Brake release start speed (P4-13 [Starting speed source], P4-14 [Digital setting of starting speed])
t_{od}	Actuating time of brake release (P4-02 [Brake release action time])
n_{cs}	Brake apply actual speed monitoring threshold (P4-18 [Actual speed monitoring threshold for brake apply])
t_{ccd}	Brake apply actual speed monitoring time (P4-19 [Actual speed monitoring time for brake apply])
t_{cd}	Actuating time of brake apply (P4-03 [Brake apply action time])
OW	Brake release waiting
OD	Brake release delay
CW	Brake apply waiting
CD	Brake apply delay

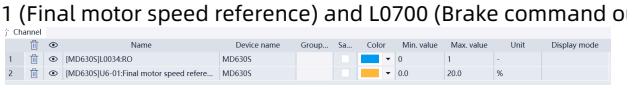
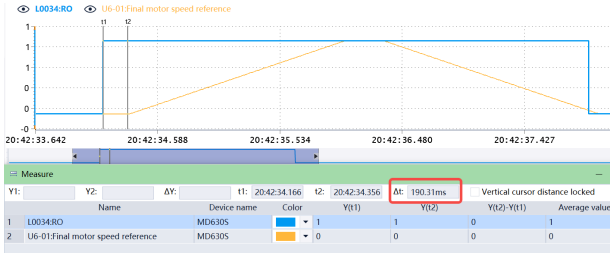
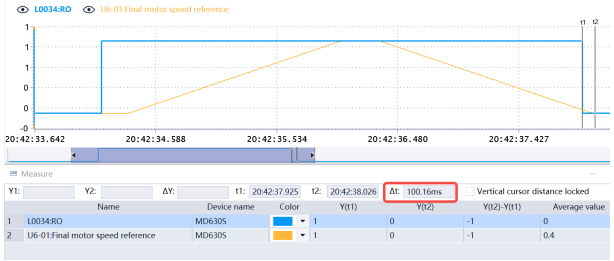
5.4.6.5.2 Brake Control Implementation Steps

Note

Visit the Inovance Technology official website *https://www.inovance.com/global/support/download-documentation* to obtain the iFA Drive software. For detailed instructions on how to download and install the software, see *"4.2.2.1 Downloading and Installing Software" on page 130*.

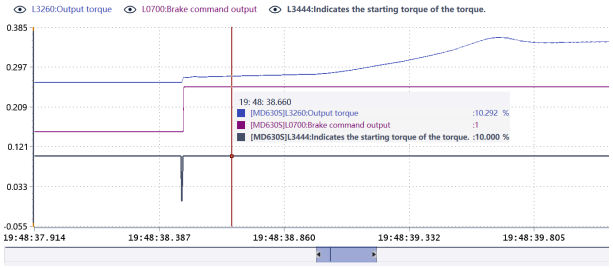
Task steps	Description
Step 1: Check brake wiring and enable brake control	**Note:**Under safe conditions, the brake wiring can be verified by forcibly opening the relay output. 1 .Ensure the relay output and motor brake are correctly connected and the drive RO relay output is the sole source of brake release and engagement signals.  2 .Set E1-00 (RO1 function selection) = L0001 (Logic 1): select others (B connector), and in the pop-up connector window, choose L001 (Logic 1).  3 .Set F1-55 (Motor brake control) = 1 (Enable). 4 .Set E1-00 (RO1 output function selection) = L0700 (Brake command output). 
Step 2: Confirm whether the motor brake has an integrated feedback signal	• If it has a feedback signal, connect the corresponding signal to any DI terminal of the AC drive, and change P4-04 (Brake feedback source) to the corresponding DI. • If it does not have an integrated feedback signal, proceed directly to Step 3 for settings. • If the brake does not have feedback information, set P4-00 (Brake function selection) = 1 (Enable brake without detection information); if the brake has feedback information, set P4-00 (Brake function selection) = 2 (Enable brake with detection information), and set P4-04 (Brake feedback source) to the corresponding DI. The remaining parameters of P4 group should be set according to the default values.

<table>
<tr><th>Task steps</th><th>Description</th></tr>
<tr><td>Step 3: Complete motor parameter auto-tuning</td><td>According to the motor nameplate or motor design values, set the rated motor parameters in F1-00 to F1-11.
For detailed information on motor parameter auto-tuning, refer to "4.7.1 Auto-Tuning Procedure" on page 158.
<table>
<tr><th>Motor state</th><th>Auto-tuning mode</th><th>Description</th></tr>
<tr><td>Motor without load (Recommended)</td><td>Dynamic parameter auto-tuning</td><td>It is recommended to perform dynamic auto-tuning before connecting the load to the motor to achieve better brake control performance.
Note: When performing dynamic parameter auto-tuning, make sure the brake is open; otherwise it will trigger fault E084.6 (The brake is not allowed to be released during auto-tuning.). If you cannot manually open the brake, you can choose one of the following methods under safe conditions:
• Set P4-07 [Brake auxiliary function selection] = 8, which enables the brake to open during parameter auto-tuning;
• Reconnect the brake wiring and enable brake control, then forcibly open RO. Note: After completing parameter auto-tuning, change the RO output source to L0700 (Brake command output).</td></tr>
<tr><td>Motor with load</td><td>Static parameter auto-tuning</td><td>I the motor is already connected to a load, only static motor parameter auto-tuning can be performed.</td></tr>
</table></td></tr>
</table>

Task steps	Description
Step 4: Set the brake release action time and brake apply action time	You can set the brake release and apply time to the default value of 200 s under normal conditions. If the brake has been in use for a long time or the brake control cable is long, accurately set the brake release action time and brake apply action time by following the procedure below: 1 .Open the iFA software, connect to the AC drive, then use the [Oscilloscope] function to monitor two channels: U6-01 (Final motor speed reference) and L0700 (Brake command output).  2 .Perform jog operation via the control panel of iFA, and measure the time interval Δt between the rising edge of L0700 (Brake command output) and the point when motor actual speed becomes non-zero.As shown in the figure, measure the brake release time Δt. Otherwise, set it to the Δt value. If the actual brake release time Δt ≤ P4-02 (Brake release action time) (default 200 ms), keep the default setting. Otherwise, set P4-02 to the measured Δt.  3 .Capture the time interval between the falling edge of L0700 (Brake command output) and the moment the actual motor speed is not zero. Check whether this time interval is less than 200 s. If so, no modification is needed. Otherwise, set P4-03 (Brake apply action time) to the measured time from the falling edge of L0700 (Brake command output) to when the speed becomes zero.As shown in the figure, measure the time Δt from the falling edge of the relay output brake signal to when the actual motor speed reaches zero. When Δt ≤ P4-03 (Brake apply action time) (default 200ms), keep the default setting. Otherwise, set P4-03 to the Δt value.  **Note:** In the SVC control mode, do not set excessively long brake apply action time in order to meet requirements; otherwise it may cause prolonged zero-speed holding time and lead to instability.

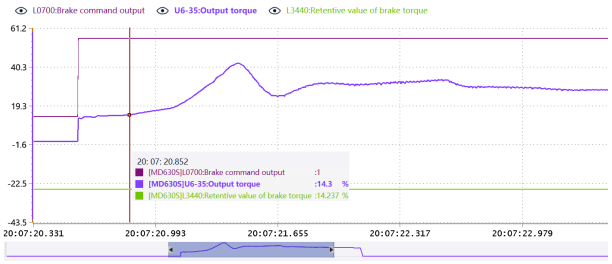
<table>
<tr><th>Task steps</th><th>Description</th></tr>
<tr><td>Step 5: Set starting torque and starting speed</td><td>
For vertical application loads, a starting torque or starting speed is needed when the brake is released to prevent the motor from unexpected movement. The following are several common application scenarios requiring starting speed or torque.

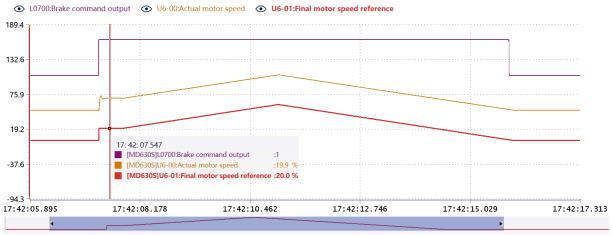
• Require starting torque to prevent the motor from unexpected movement: applicable for SVC or FVC control in scenarios with stable load.

Set the parameters as follows:
<table>
<tr><th>Param.</th><th>Name</th><th>Setpoint</th></tr>
<tr><td>P4-08</td><td>Starting torque source in the vector control mode</td><td>2: Digital setting of starting torque</td></tr>
<tr><td>P4-09</td><td>Digital setting of starting torque</td><td>Set according to the estimated load weight.</td></tr>
<tr><td>E1-00</td><td>RO1 function selection</td><td>L0700 [Brake command output]</td></tr>
</table>
P4-09 (Digital setting of starting torque) should be set according to the torque required by the load. After setting P4-09 (Digital setting of starting torque) = 10%, the start waveform is as follows. Before the motor starts, the output torque has already reached the value of P4-09.


If unexpected movement or lifting occurs during startup, the value of P4-09 (Digital setting of starting torque) can be adjusted appropriately.

If the torque direction and magnitude during startup need to automatically change according to the startup frequency, set P4-08 (Starting torque source in the vector control mode) =3 (Determined by digital setting of starting torque and motor operating direction). For details, see “Starting torque direction and gain coefficient” on page 673.
</td></tr>
</table>

<table>
<tr><th>Task steps</th><th>Description</th></tr>
<tr><td>Step 5: Set starting torque and starting speed</td><td>• Require to use recorded torque as starting torque: applicable for scenarios where the load changes during motion, but the load is stable each time startup occurs.
<table>
<tr><th>Param.</th><th>Name</th><th>Setpoint</th></tr>
<tr><td>P4-08</td><td>Starting torque source in the vector control mode</td><td>1: Retentive torque</td></tr>
<tr><td>P4-09</td><td>Digital setting of starting torque</td><td>Use the torque set by L1-07 as the retentive torque when the motor is started for the first time. You can also set the parameter according to the estimated load weight.</td></tr>
<tr><td>P4-10</td><td>Retentive starting torque gain factor</td><td>Set it to 100% in normal scenarios. To adjust the proportion of the retentive torque, set this parameter.</td></tr>
<tr><td>E1-00</td><td>RO1 function selectionR</td><td>L0700[Brake command output]</td></tr>
</table>
After setting P4-08 (Starting torque source of vector control) =1 (Recorded torque value), the startup waveform is as follows. After the brake command is issued, the output torque quickly reaches the recorded output during last shutdown. For details, refer to “ Automatic memory of start torque” on page 674.

</td></tr>
</table>

<table>
<tr><th>Task steps</th><th>Description</th></tr>
<tr><td>Step 5: Set starting torque and starting speed</td><td>• Require starting speed to prevent the motor from unexpected movement: applicable for V/f control in scenarios with stable load.
<table>
<tr><th>Param.</th><th>Name</th><th>Setpoint</th></tr>
<tr><td>P4-13</td><td>Starting speed source</td><td>1: Digital setting of starting speed</td></tr>
<tr><td>P4-14</td><td>Digital setting of torque reference</td><td>Set according to the estimated load weight.</td></tr>
<tr><td>E1-00</td><td>RO1 function selectionR</td><td>L0700[Brake command output]</td></tr>
</table>
Set P4-13 (Starting speed source) and P4-14 (Digital setting of starting speed). Then the motor final speed reference will be forced set to the value of P4-14 during brake release, instead of accelerating from zero speed. This allows the motor to quickly build torque and prevent the load from unexpected movement. After the brake is fully released, the motor accelerates from the starting speed to the set speed.
After setting P4-14 (Digital setting of starting speed) =20%, the startup waveform is as follows. Before the motor starts, the set speed has already reached the value of P4-14.


If unexpected movement or lifting occurs during startup, the value of P4-14 (Digital setting of starting speed) can be adjusted appropriately.
If the direction of the starting speed needs to automatically change according to the direction of the starting frequency, refer to " Start speed direction" on page 673.</td></tr>
</table>

<table>
<tr><th>Task steps</th><th>Description</th></tr>
<tr><td>Step 6: Set monitoring threshold and time for brake applying</td><td>
After receiving the brake apply command, the system judges the brake apply conditions. The brake apply signal is output only when the conditions are met.

Condition for brake apply: Actual speed or set speed, whichever is met

Condition 1: Actual speed is below P4-18 (Actual speed monitoring threshold for brake apply) for longer than P4-19 (Actual speed monitoring time for brake apply);OR Condition 2: Set speed is below P4-20 (Set speed monitoring threshold for brake apply) for longer than P4-21 (Set speed monitoring time for brake apply). When either condition is satisfied, the brake apply condition is marked as satisfied, and the system enters the brake apply output phase.

When P4-20 (Set speed monitoring threshold for brake apply) =0%, the set speed condition is not checked.

When the motor control mode is SVC, it is recommended to set P4-20 to a non-zero value, allowing the brake closing judgment to be based on the set speed. Otherwise, the actual motor speed may diverge around zero speed, causing the brake to fail to close.

<table>
<tr><th>Param.</th><th>Name</th><th>Setpoint</th></tr>
<tr><td>P4-18</td><td>Actual speed monitoring threshold for brake apply</td><td>Reference default value 1%</td></tr>
<tr><td>P4-19</td><td>Actual speed monitoring time for brake apply</td><td>Reference default value 0.1s</td></tr>
<tr><td>P4-20</td><td>Set speed monitoring threshold for brake apply</td><td>SVC is recommended to be set to 3.0%</td></tr>
<tr><td>P4-21</td><td>Set speed monitoring time for brake apply</td><td>SVC is recommended to set to 0.1s.</td></tr>
</table>

The values of P4-18 (Actual speed monitoring threshold for brake apply) and P4-20 (Set speed monitoring threshold for brake apply) should not be set too large; otherwise it may cause the brake to apply prematurely, leading to wear and affecting the performance and lifespan of the brake.
</td></tr>
</table>

<table>
<tr><th>Task steps</th><th>Description</th></tr>
<tr><td>Step 7: Brake force test (Optional)</td><td>This function is only valid when the motor control mode is FVC (i.e., d0-00=1).

The braking force may decrease after the brake is used for a long time. To check whether the braking force meets requirements through the internal logic function before the motor starts each time, set P4-40 to 1 to enable the braking force test.

During the test, the AC drive will continuously output torque according to P4-42 (Max. verification torque for brake test), and detect whether the feedback torque is normal.

If the feedback torque is too low or the motor rotates, it is considered that the brake torque is insufficient, triggering fault E084.3 (Brake torque verification failure) or E084.4 (Brake speed verification failure) for indication.

<table>
<tr><th>Param.</th><th>Name</th><th>Description</th></tr>
<tr><td>P4-40</td><td>Braking self-test enable</td><td>You can use the connector to enable or disable self-test. When this parameter is set to 1, the test is performed when pre-excitation is completed but the brake is not opened.</td></tr>
<tr><td>P4-41</td><td>Brake test duration</td><td>Defines the test duration.</td></tr>
<tr><td>P4-42</td><td>Max. verification torque for brake test</td><td>During the test, the output torque increases gradually but the maximum torque cannot exceed the torque specified by this parameter.</td></tr>
<tr><td>P4-43</td><td>Torque direction of braking test</td><td>Defines the torque direction, which can be modified in the connector. The torque is output and tested in the forward direction by default.</td></tr>
<tr><td>P4-44</td><td>Slip speed threshold of braking test</td><td rowspan="2">During brake test, if the motor speed keeps exceeding the value of P4-44 for a period longer than that specified by P4-45, the motor starts rotating actually.</td></tr>
<tr><td>P4-45</td><td>Slip speed duration in braking test</td></tr>
</table>
</td></tr>
</table>

5.4.6.5.3 Application of Brake Function

Starting torque direction and gain coefficient

In actual operation, different operation directions may require different starting torque in both direction and magnitude. In such cases, set P4-08 (Starting torque source in the vector control mode) to 3.

RFG setting input [L3042]	Starting torque digital setting [P4-09]	Positive speed - starting torque gain coefficient [P4-28]	Negative speed - starting torque gain coefficient [P4-29]	Actual effective starting torque
50%	50%	50%	100%	25%
-50%	50%	50%	100%	-50%
50%	-50%	50%	100%	-25%
-50%	-50%	50%	100%	50%

Start speed direction

In actual operation, different operation directions may require different starting torque direction. In such cases, set P4-13 (Starting speed source) to 2.

RFG setting input (L3046)	Starting speed digital setting (P4-14)	Actual effective starting speed
50%	50%	50%
-50%	50%	-50%
50%	-50%	-50%
-50%	-50%	50%

Automatic memory of start torque

When P4-08 is set to 1, the internal torque memory function of the AC drive is activated. Upon each stop, the torque before brake closing is recorded and will be used as the start torque output upon the next startup. This reduces load drop during brake release. The automatic torque memory function can well adapt to load changes during operation.

When the automatic torque memory function is activated for the first time, the initial value of the torque memory is sourced from P4-09.

The P4-10 parameter can be set to adjust the coefficient for automatic torque memory. If P4-10 is set to 80% and the retentive torque during the stop process is 50%, the start torque will be 40%.

Excitation delay disabling

To improve the working efficiency of asynchronous motors, users may want to keep continuous output of motor exciting current for a period even if the brake is closed during the stop process. In this way, when users start motors again within a short period, the brake can directly run without motor excitation (excitation time for some motors may take 3s to 5s).

PWM output will be blocked after the brake is closed, and the motor feedback speed reaches zero speed. Increasing the shutdown delay time (d0-16) can maintain excitation for a longer period after the brake is closed, thus eliminating the need for excitation during the next brake release. The shutdown delay time (d0-16) needs to be longer than the brake apply action time. If d0-16 is set to be shorter than the brake apply action time, excitation cannot be maintained after the brake is applied.

Param.	Name	Description
d0-16	Shutdown time delay	PWM output blocking is permitted only after the actual speed stays below the value of d0-16 for a period exceeding the time specified by d0-09.
P4-03	Brake apply action time (Actuating time of brake-apply)	PWM output blocking is permitted only after the time specified by P4-03 elapses after the brake close signal is output (L0700 = 0).

Start torque restriction

In some lifting load scenarios, the brake can be released only when the load torque is greater than the threshold for security reasons. The speed loop does not act before the brake release. Therefore, the torque cannot be output even if the speed is specified. In this case, set the start torque and the torque detection method is as follows.

It can be realized using the comparison function of P4-25. First, set a starting torque higher than the comparison threshold, and then set P4-25 to L3260, P4-26 to the required comparison threshold,

and P4-27 to the delay time. When the absolute value of P4-25 is greater than P4-26 and the duration exceeds the value indicated by P4-27, the AC drive enters the brake release state.

5.4.6.5.4 Troubleshooting for Common Problems

FAQ	Solution
Unexpected movement after brake releasing	Suitable starting torque or speed is not set. Follow the brake commissioning guide to correctly set the brake parameters. For details, see *"5.4.6.5.2 Brake Control Implementation Steps" on page 665*.
	Enhance speed loop response in SVC and FVC control modes. Before brake release, the speed loop is not active. During startup, the speed loop response is slow, leading to unexpected movement. You can appropriately enhance the speed loop response. For SVC control, you can appropriately increase the value of D3-02 [Speed loop Kp in SVC mode]. For FVC control, you can appropriately increase the value of D3-00 [Speed loop Kp in FVC mode].
	If the starting torque has been set, appropriately increase the starting torque or, on the basis of the starting torque, appropriately increase a part of the starting speed to enhance the speed loop response.
Unexpected movement upon brake apply	The brake apply time is too short. Severe brake wear or an excessively short brake apply time can cause torque removal and unexpected movement of heavy load before the mechanism brake is fully engaged. To address this, gradually increase P4-03 [Brake closing time] to extend the duration of the drive output current.
Brake release jerk	The brake release time is too short. An excessively short brake release time can lead to severe brake wear. If torque is applied before the brake is fully released, a brake release jerk may be caused.
Long startup time causes poor device following performance	Long startup time may be caused by the set value of the brake release time being larger than the actual value. Refer to step four of the brake commissioning guide to gradually shorten the brake release time.
	Shorten P4-27 [Brake apply delay time].
	When the motor type is asynchronous, in a continuous operation condition, you can disable the excitation delay function to shorten the motor excitation time, thus improving the startup time. For details, see *"5.2.4.1.2 Direct Start of Asynchronous Motor (Pre-excitation Start)" on page 274*.
Long or no brake applying time at motor zero speed	It usually occurs when the control mode is SVC. Set P4-20 [Speed monitoring threshold setpoint when brake applied] to a non-zero value. For details, refer to the brake commissioning guide in *"5.4.6.5.2 Brake Control Implementation Steps" on page 665*.

5.4.7 Tension Control

5.4.7.1 Tension Control

Function description

Tension control is a typical process. It is mainly used in the winding equipment to control the extension tension of material.

Related parameters

Function	Description	Details
Control mode selection	Select a proper tension control mode and winding mode based on actual situations.	"5.4.7.2.1 Control Mode Selection" on page 678
Roll diameter calculation	The roll diameter is a necessary parameter for any tension control mode. An unreasonable roll diameter value can cause the tension control function to be abnormal.	"5.4.7.2.2 Roll Diameter Calculation" on page 680
Linear speed	Linear speed plays a key role in tension control: It is used to adjust the winding synchronous running frequency, calculate the material roll diameter, and support auxiliary functions such as pre-charge, inertia compensation, and friction compensation.	"5.4.7.2.3 Linear Speed" on page 684
Tension setting	In both open-loop and closed-loop torque control modes, tension control is achieved by adjusting the output torque. The target tension must be set based on material characteristics and production requirements.	"5.4.7.2.4 Tension reference" on page 686
PID closed-loop adjustment	In the closed-loop speed/torque control mode, use PID adjustment to improve accuracy. You need to set the FA group parameters (such as PID channel, direction, ratio, and integral value).	"5.4.7.2.5 PID Closed-Loop Adjustment" on page 686
Winding speed limits and unwinding reverse tightening	The winding speed limit prevents Material breakage caused by overload by setting a maximum speed. Reverse tensioning is applied during unwinding to counteract inertia, which prevents slackness and thereby ensures overall tension stability.	"5.4.7.2.6 Winding Speed Limiting and Unwinding Reverse Tightening" on page 687
PID adjustment limit	The PID adjustment limit controls the range of output adjustments to prevent overshoot or oscillation, ensuring smooth control and stable system.	"5.4.7.2.7 PID Adjustment Limit" on page 688

Function		Description	Details
Tension torque compensation[1] (Only applicable to torque control mode)	Running friction compensation parameters	When the motor runs stably, the output torque is used for material tension establishment and rotation friction. If the rotation friction cannot be ignored, compensation for friction torque is required.	"5.4.7.2.8 Running Friction Compensation Parameters" on page 688
	Startup friction compensation parameters	In some scenarios, the reel is subject to large startup friction, which makes system startup difficult. In this case, torque compensation can be provided during startup and canceled once the system runs properly to ensure constant tension.	"5.4.7.2.9 Startup Friction Compensation Parameters" on page 691
	Inertia compensation parameters	In the open-loop torque control mode, the output torque is used for material tension and rotation inertia of the system during acceleration or deceleration.	"5.4.7.2.10 Inertia Compensation Parameters" on page 692
	Terminal tension rise	When the DI terminal is assigned with the corresponding function and is activated, the tension torque is boosted by certain ratio. After the DI terminal is deactivated, the boost part is canceled gradually.	"5.4.7.2.11 Terminal Tension Boost" on page 693
	Torque direction control parameters	This parameter takes effect only when PD-00 is set to 1 or 3. After the friction and inertia compensation are added, the calculated torque is likely to be negative. The processing method can be set by this parameter when the torque is reversed.	"5.4.7.2.12 Torque Direction Control Parameters" on page 694
Taper		In some scenarios, the tension should be reduced with the increase of the roll diameter to ensure smooth winding. For this purpose, set taper parameters properly.	"5.4.7.2.13 Taper" on page 694
Pre-charge		The pre-charge function is applied to automatic reel replacement scenarios. To achieve shockless reel replacement, ensure that the linear speed of the new roll matches that of the material when replacing a full roll with a new roll.	"5.4.7.2.14 Pre-drive" on page 696
Constant Linear Speed Mode		In this mode, the running frequency for winding and unwinding is automatically calculated based on the set target linear speed.	"5.4.7.2.15 Constant Linear Speed Mode" on page 697
Optimization for control mode	Tension Setup at Zero Speed in Closed-Loop Control Mode	In scenarios demanding accurate tension setup at zero speed or roll diameter auto-tuning during tension setup at zero speed, the accurate tension setup process can be configured.	"5.4.7.2.16 Tension Setup at Zero Speed in Closed-Loop Control Mode" on page 698
	Initial roll diameter auto-tuning	When the tension setup at pre-speed function is enabled, you can also enable the initial roll diameter auto-tuning function. During tension setup, the AC drive auto-tunes the initial roll diameter to remove the need for roll diameter reset or initial roll diameter input (for tension setup at zero speed in FVC mode only).	"5.4.7.2.17 Initial Roll Diameter Auto-tuning" on page 699
	Closed-loop Tension Torque Mode	You can set the tension in closed-loop torque control mode by using PID alone or main torque + PID.	"5.4.7.2.18 Closed-loop Tension Torque Mode" on page 699

Function		Description	Details
Related I/O Functions	DI Function	Tension control is achieved through the DI terminal.	"5.4.7.2.19 DI Function" on page 699
	AO/Pulse Output Functions	This function supports output of variables related to tension control.	"5.4.7.2.20 AO/Pulse Output Functions" on page 701
Monitoring		You can monitor the parameters in real time through the operating panel or the software.	"5.4.7.2.21 Monitoring" on page 701

Typical applications

Function	Description	Details
Tension Open-Loop Torque Control	Select a proper tension control mode and winding mode based on actual situations.	"5.4.7.3.1 Tension Open-Loop Torque Control" on page 703
Tension Closed-Loop Speed Control	The roll diameter is a necessary parameter for any tension control mode. An unreasonable roll diameter value can cause the tension control function to be abnormal.	"5.4.7.3.2 Tension Closed-Loop Speed Control" on page 704
Tension Closed-Loop Torque Control	In this mode, a tension sensor is used to feed back the material tension and the target frequency is regulated in closed-loop mode to ensure constant tension.	"5.4.7.3.3 Tension Closed-Loop Torque Control" on page 705
Constant linear speed control	This mode is applicable to scenarios where no specific traction is used to directly control the material tension; instead, the winding or unwinding machine runs at a constant linear speed and serves as the traction motor, and the material tension is controlled by the winding/unwinding operation.	"5.4.7.3.4 Constant linear speed control" on page 705
Application Restrictions	Description of the limitations of the four tension controls modes.	"5.4.7.3.5 Application Restrictions" on page 706

Note

[1]: These parameters can be set for the open-loop torque control mode (PD-00 = 1) and generally do not need to be set for the closed-loop torque control mode (PD-00 = 3).

5.4.7.2 Functions

5.4.7.2.1 Control Mode Selection

Select a proper tension control mode and winding mode based on actual situations. Correct running direction setting is necessary for proper tension control.

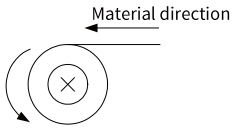
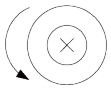
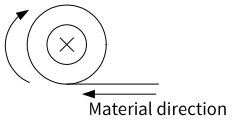
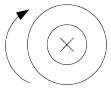
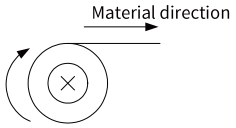
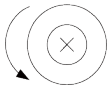
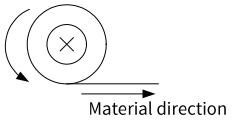
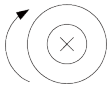
Parameter	Name	Default	Value Range	Descriptions
PD-00	Tension control mode	0	0: Disabled 1: Open-loop torque control 2: Closed-loop speed control 3: Closed-loop torque control 4: Constant linear speed control	B0-00 is used to select the tension control mode. 0: Disabled Used for direction judgment and parameter auto-tuning. 1: Open-loop torque control Tension/Position detection and feedback are not required. The drive controls torque output to control the tension on the material in the torque control mode. Use FVC to achieve optimal control effect. 2: Closed-loop speed control Tension/Position detection and feedback are required. Based on the set main frequency calculated through linear speed and roll diameter, the AC drive adjusts the output frequency by superposing the PID closed-loop operation to achieve stable tension or position in the speed control mode. The SVC, V/f control, or FVC mode can be used. 3: Closed-loop torque control Tension detection and feedback are required. Based on the set torque in the open-loop torque control mode, the AC drive controls the output torque to obtain the required tension by superposing the PID closed-loop operation. Use FVC to achieve optimal control effect. 4: Constant linear speed control In the speed mode, the AC drive adjusts its own operating frequency according to the change of roll diameter to ensure that the system runs at a constant linear speed. The SVC, V/f control, or FVC mode can be used.

When DI function 60 (exit tension control) is activated, settings in the preceding modes become invalid and the AC drive exits the tension control mode.

Parameter	Name	Default	Value Range	Descriptions
PD-01	Winding mode	0	0: Winding 1: Unwinding	Used with the DI function 58 (winding/unwinding switchover terminal) to determine the winding mode. When the terminal assigned with function 58 is inactive, the winding mode is consistent with that set by this parameter. When the terminal assigned with function 58 is active, the winding mode is reverse to that set by this parameter.
F0-09	Running direction selection	0	0: Default direction 1: Direction opposite to the default direction	You can change the rotation direction of the motor by modifying this parameter without changing the motor wiring. Modifying this parameter is equivalent to exchanging any two of the motor's U, V, W wires.

Judging the running direction:

When PD-00 is set to 1 (tension control mode disabled), the AC drive runs in speed control mode and its running direction should be the same as the target winding direction (opposite to the target unwinding direction). Otherwise, edit the parameter to correct the direction. Check the running direction according to the following figure:

Winding/ Unwinding	With-load Running Direction	No-load Running Direction (Speed Control Mode)
Winding		
		
Un-winding		
		

For the first run, determine the running direction and set the parameter properly. When the switchover between winding and unwinding is required, modify B0-01 directly, or change the state of the winding/unwinding switching terminal without modifying B0-01 (otherwise, misfunction may occur).

5.4.7.2.2 Roll Diameter Calculation

The roll diameter is a required parameter in any tension control mode. Select a proper calculation method and set the related parameters correctly to ensure accuracy of the roll diameter. Otherwise, the tension control function may fail.

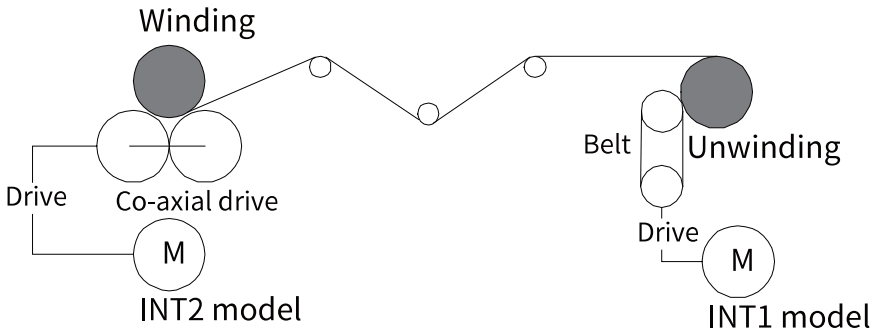


Figure 5-202 Surface winding/unwinding

Roll diameter calculation method

Table 5–95 Roll diameter calculation method

Param.	Name	Default	Value Range	Descriptions
PD-09	Roll diameter calculation method	0	0: Calculated based on linear speed 1: Calculated based on cumulative thickness 2: AI1 3: AI2 4: AI3 5: Pulse input (DI7) 6: Communication (1000H) 7: Digital setting (PD-16)	0: Calculated based on linear speed This calculation method is independent of material thickness. The roll diameter is calculated based on the linear speed and running frequency in real time, so the error is not accumulated. 1: Calculated based on accumulative thickness This calculation method does not require linear speed. The roll diameter is calculated based on the cumulative material thickness and revolution counting signals. The calculation result is stable, but the error is accumulated. 2 to 6: The reel diameter can be obtained through channels 2 to 6 to meet the situation that the reel diameter is directly measured by sensors or the reel diameter operation is performed outside the AC drive. When using the preceding channels, the maximum reel diameter (PD-10) should be set correctly according to the per-unit relationship. If AI1 is used as the reel diameter channel, the reel diameter corresponding to 100.0% of AI1 input will be the maximum reel diameter (PD-10). 7: Set by PD-16 (Digital setting of torque limit in speed control) When calculation method 7 is used, the roll diameter is directly set through D1-16 and used for additional communication address or manual roll diameter setting.

Initial roll diameter

Table 5–96 Relationship between the initial roll diameter sources and settings

DI2	DI1	Initial Roll Diameter Source
0	0	PD-11 (winding) or PD-10 (unwinding)
0	1	PD-13
1	0	PD-14
1	1	PD-15

Note

When the system is shut down due to reel replacement, running faults, or other reasons, the roll diameter often changes. To ensure accurate roll diameter during startup of the system, roll diameter reset must be performed by enabling the function 54 of the DI terminal (roll diameter reset).

Table 5–97 Parameters related to the initial roll diameter

Param.	Name	Default	Value Range	Descriptions
PD-10	Maximum roll diameter	500.0 mm	PD-11 to 6000.0 mm	Actual full roll diameter
PD-11	Empty roll diameter	100.0 mm	0.1 to PD-10 mm	Actual empty roll diameter

Param.	Name	Default	Value Range	Descriptions
PD-12	Initial Roll Diameter Source	0	0: PD-13 (Initial winding diameter 1) to PD-15 (Initial winding diameter 3) 1: AI1 2: AI2 3: AI3 4: Communication setting (1000H)	By default, the source of the initial roll diameter is set to PD-10 or PD-11, depending on the winding mode. 1 to 4: The initial winding diameter can be obtained through channels 1 to 4. When using the preceding channels, the maximum winding diameter (PD-10) should be set correctly according to the per unit relationship.
PD-13	Initial roll diameter 1	100.0 m/min	PD-11 to PD-10 mm	For details about initial roll diameters 1 to 3, see PD-12.
PD-14	Initial roll diameter 2	100.0 m/min	PD-11 to PD-10 mm	For details about initial roll diameters 1 to 3, see PD-12.
PD-15	Initial roll diameter 3	100.0 m/min	PD-11 to PD-10 mm	For details about initial roll diameters 1 to 3, see PD-12.
PD-16	Current roll diameter	100.0 m/min	PD-11 to PD-10 mm	This parameter shows the current roll diameter in real time. Modifying this parameter can modify the current roll diameter, and the result of roll diameter calculation will override this parameter (except PD-09 = 7). It can also be used as a way to reset the roll diameter.
PD-21	Roll diameter reset during running	0	0: Disabled 1: Enabled	This parameter can be used to enable roll diameter reset during operation.

Linear speed calculation roll diameter

Table 5–98 Parameters for roll diameter calculation based on linear speed (roll diameter calculation is affected only when PD-09 is set to 0)

Param.	Name	Default	Value Range	Descriptions
PD-03	Mechanical transmission ratio	1.00	0.01 to 300.00	This parameter specifies the ratio of motor speed to reel speed. Set it based on the mechanical transmission structure. When the linear speed is used to calculate the winding diameter (PD-09 = 0), the larger the parameter is, the larger the calculated winding diameter is, and vice versa. Referring to this rule, the parameter can be corrected according to the deviation between the calculated value and the actual value of the winding diameter.
PD-07	Minimum linear speed for winding diameter calculation	20.0 m/min	0.0 m/min to 6500.0 m/min	This parameter takes effect only when PD-09 is set to 0. When the linear speed is lower than the value of this parameter, the current reel diameter is maintained. When the linear speed is higher than the value of this parameter, the reel diameter is calculated. This parameter can be used to solve the problems that the running frequency is low or the winding diameter calculation is incorrect during acceleration.

Param.	Name	Default	Value Range	Descriptions
PD-18	Roll diameter filter time	5.00s	0.00 to 10.00s	This parameter takes effect only when PD-09 is set to 0. The user can set this parameter to filter the result of winding diameter operation and suppress the jitter of winding diameter. The larger the parameter value, the smoother the winding diameter operation, and the longer the winding diameter change delay. Rule: When the winding diameter changes linearly, the time that the calculated winding diameter lags behind the actual winding diameter is basically equal to the parameter value.
PD-19	Roll diameter change rate	0	0: Unlimited 0.1 to 1000.0 mm/s.	This parameter takes effect only when PD-09 is set to 0. You can set this parameter to a non-zero value to limit the change of roll diameter per unit of time and prevent abnormal fast change. An excessively low setpoint can limit the reel diameter change, affecting the real-time reel diameter operation. Set this parameter based on actual conditions (you can set this parameter based on the maximum change rate at a linear speed of 100.0 m/min).
PD-20	Roll diameter change direction limit	0	0: Disable 1: Decrease inhibited during winding, and increase inhibited during unwinding	This parameter takes effect only when PD-09 is set to 0. Set this parameter to limit the direction change of the roll diameter. Use it under the condition of setting PD-19 reasonably. Otherwise, if there is abnormal fluctuation of roll diameter, excessive deviation of winding diameter calculation result will be caused.

Roll diameter calculated by accumulative thickness

Table 5–99 Parameters for roll diameter calculation based on cumulative thickness (roll diameter calculation is affected only when PD-09 is set to 1)

Param.	Name	Default	Value Range	Descriptions
PD-35	Pulses per revolution	1	1 to 60000	This parameter specifies the number of pulses per revolution of the reel.
PD-36	Revolutions per layer	1	1 to 10000	This parameter specifies the number of revolutions for each layer of winded materials, generally used for wire rods. Set this parameter to 1 in cable/strip applications.

Param.	Name	Default	Value Range	Descriptions
PD-37	Material thickness reference source	0	0: Digital setting 1: AI1 2: AI2 3: AI3	You can set this parameter to select an input channel of material thickness. 0: Digital setting The material thickness is affected by the DI functions 62 and 63 (material thickness selection terminal). Example: PD-37 is set to 0, DI1is set to function 62, and DI2 is set to function 63. The material thickness is as follows. 1 to 3: The initial winding diameter can be obtained through channels 1 to 3. When the preceding channels are used, the maximum material thickness (PD-42) must be set correctly based on the per-unit relationship.
PD-38	Material thickness 0	0.01 mm	0.00 mm to 100.00 mm	For details about the material thickness 0 to 3, see PD-37.
PD-39	Material thickness 1	0.01 mm	0.00 mm to 100.00 mm	
PD-40	Material thickness 2	0.01 mm	0.00 mm to 100.00 mm	
PD-41	Material thickness 3	0.01 mm	0.00 mm to 100.00 mm	
PD-42	Maximum material thickness	1.00 mm	0.00 mm to 100.00 mm	For details about the maximum material thickness, see PD-37.

Table 5–100 Material Thickness

DI2	DI1	Initial Roll Diameter Source
0	0	It is determined by PD-38.
0	1	It is determined by PD-39.
1	0	It is determined by PD-40.
1	1	It is determined by PD-41.

5.4.7.2.3 Linear Speed

In the closed-loop speed control mode, the winding synchronous frequency reference is calculated based on the linear speed. Linear speed is required in roll diameter calculation. Linear speed can also be used for pre-drive, inertia compensation, friction compensation, and other functions. Therefore, the linear speed is an important part in tension control.

Table 5–101 Related parameters

Param.	Name	Default Value	Value Range	Descriptions
PD-04	Linear speed input source	0	0: PD-05 1: AI1 2: AI2 3: AI3 4: Pulse input (DI7) 5: Communication (1000H)	0: Defined by PD-05. The setpoint is non-retentive upon power failure. 1 to 5: If the linear speed is input through the preceding channels, the maximum linear speed (PD-06) must be set properly based on per-unit relationship.
PD-05	Digital setting of linear speed input	0.0 m/min	0.0 m/min to PD-06 m/min	When the linear speed input source is digital setting, the linear speed value is determined by this parameter. This parameter is non-retentive upon power failure. It can be used as an additional communication address used for line speed reference set through communication.
PD-06	Maximum linear speed	1000.0 m/min	0.0 m/min to 6500.0 m/min	Used to set the maximum linear speed. It corresponds to the actual linear speed when 100.0% is input for channel 1 to 5 of PD-04. (It differs from the maximum linear speed required by production. Verify them during settings.) When the linear speed is used to calculate the winding diameter (PD-09 = 0), the larger the parameter is, the larger the calculated winding diameter is, and vice versa. Referring to this rule, the parameter can be corrected according to the deviation between the calculated value and the actual value of the roll diameter.
PD-44	Constant linear speed source selection	0	0: PD-45 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI7) 5: Communication (1000H)	It is used to select the target linear speed source in the constant linear speed control mode. 0: Defined by PD-45. The setpoint is non-retentive upon power failure. 1 to 5: If the linear speed is input through the preceding channels, the maximum linear speed (PD-06) must be set properly based on per-unit relationship.
PD-45	Digital setting of constant linear speed input	0.0 m/min	0.0 m/min to PD-06 m/min	When digital setting is used as the source for constant linear speed, the constant linear speed is defined by this parameter, which is non-retentive upon power failure. It can be used as an additional communication address used for line speed reference set through communication.

5.4.7.2.4 Tension reference

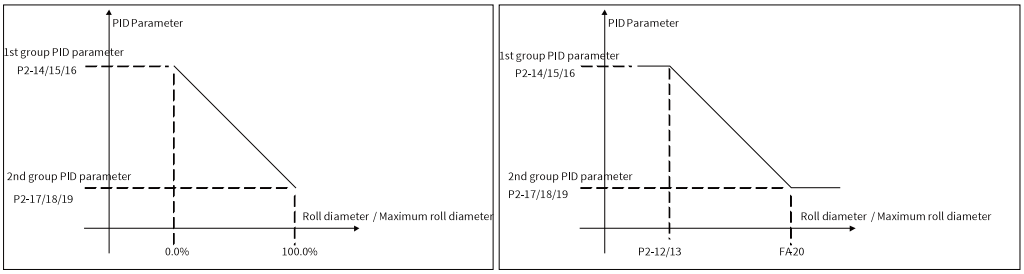
In either open-loop torque control mode (PD-00 is set to 1) or closed-loop torque control mode (PD-00 is set to 3), tension control is implemented by controlling the output torque. Therefore, a target tension must be set based on material characteristics and production requirements.

Param.	Name	Default	Value Range	Descriptions
PE-00	Tension reference source	0	0: PE-01 1: AI1 2: AI2 3: AI3 4: Pulse reference (DI7) 5: Communication (1000H)	0: PE-01 1 to 5: Indicates the ratio (in percentage) of the target tension to the maximum tension. The maximum tension (PE-02) must be set properly based on the per-unit relationship.
PE-01	Tension digital setting	50 N	0~PE-02 N	See channel 0 of PE-00.
PE-02	Maximum tension	500 N	0~65000 N	Used to set the maximum tension, corresponding to the tension value when 100.0% is input for channels 1 to 5 of PE-00. When the actual tension does not meet requirements, corrections can be performed by editing this parameter without changing AI, pulse input signals, or curves.

5.4.7.2.5 PID Closed-Loop Adjustment

In closed-loop speed control mode (PD-00 is set to 2) and closed-loop torque control mode (PD-00 is set to 3), PID closed-loop control based on the open-loop reference is important to ensure control accuracy. Therefore, the parameters for PID closed-loop control must be set properly. When PD-00 is set to 2 or 3, parameters for closed-loop control, such as PID reference source, PID feedback source, PID direction, and PID proportional and integral parameters, need to be set properly based on actual conditions. Only some particular PID parameters are introduced here. For details of standard parameters, see descriptions of Group FA parameters.

The roll diameter based PID parameter switchover function is added for the tension control mode.



4: Automatic adjustment based on roll diameter 1

5: Automatic adjustment based on roll diameter 2

Figure 5-203 Automatic adjustment based on roll diameter

Param.	Name	Default	Value Range	Descriptions
P2-11	PID parameter switchover condition	0	4: Automatic adjustment mode 1 based on roll diameter 5: Automatic adjustment mode 2 based on roll diameter	4: The first group of PID parameters is used at empty roll. The second group of PID parameters is used at full roll. For other situations, the PID parameters change linearly. 5: The first group of PID parameters is used at empty roll. The second group of PID parameters is used at full roll. If the roll changes between a specific range determined by P2-12 and FA-20, the PID parameters change linearly.

5.4.7.2.6 Winding Speed Limiting and Unwinding Reverse Tightening

This function is valid only in torque mode (PD-00 is set to 1 or 3).

No.	Scenario	Description
1	Winding scenarios where the winding speed is not limited (subject to the frequency upper limit).	PD-32 = 0. The winding speed is subject to the frequency upper limit.
2	Winding scenarios where the winding speed is limited	PD-32= 1. The winding speed limit is calculated according to the following formula, where the synchronous frequency is the running frequency of the winding machine that matches the current linear speed: Frequency upper limit of winding = Linear speed synchronous frequency x (1+PD-30)+PD-31.
3	Unwinding scenarios where reverse tightening is disabled	PD-02 = 0
4	Unwinding scenarios where reverse tightening is enabled	Reverse tightening at fixed linear speed can be enabled through P0-02.

Param.	Name	Default	Value Range	Descriptions
PD-30	Tension frequency limit	50.0%	0.0 to 100.0%	Winding lower limit percentage (a percentage of the linear speed synchronous frequency)
PD-31	Tension frequency limit offset	5.00 Hz	0.00-100.00 Hz	Winding lower limit offset (fixed frequency)
PD-02	Unwinding reverse tightening selection	0	0: Disabled 0.1–500.0 m/min	When this parameter is set to 0, at zero material speed, the unwinding reel has no output and the material is not tightened. If this parameter is set to 0.1 m/min to 500.0 m/min, the reel runs in the direction reverse to the set linear speed when running without material or with loose material. Under the condition of zero speed of material, the output is maintained and the material is tightened.

5.4.7.2.7 PID Adjustment Limit

This function is valid only in closed-loop mode (PD-00 is set to 2 or 3).

No.	Scenario	Description
1	The closed-loop speed control mode is used and the closed-loop limit is associated with the synchronous frequency.	PD-32 = 0 Closed-loop adjustment limit = Linear speed synchronous frequency x PD-30 + PD-31
2	The closed-loop speed control mode is used and the closed-loop limit is set to a fixed frequency.	PD-32 = 1 Closed-loop adjustment limit = PD-31
3	The closed-loop torque control mode is used and the closed-loop limit is set to a fixed torque.	The limit is set through PD-34 and the value is a percentage of the motor rated torque.

Parameter	Name	Default	Value Range	Descriptions
PD-30	Tension frequency limit	50.0%	0.0 to 100.0%	Winding lower limit percentage (a percentage of the linear speed synchronous frequency)
PD-31	Tension frequency limit offset	5.00 Hz	0.00-100.00 Hz	Winding lower limit offset (fixed frequency)
PD-34	Tension closed-loop torque limit	100.0%	0.0 to 200.0%	Used to limit the ratio (in percentage) of the closed-loop torque control value to the open-loop control torque reference in the closed-loop torque control mode (PD-00 is set to 3).

5.4.7.2.8 Running Friction Compensation Parameters

When the motor runs stably, the output torque is used for material tension establishment and rotation friction. If the rotation friction cannot be ignored, the output torque needs compensation for friction.

Param.	Name	Default	Value Range	Descriptions
PE-07	Friction force compensation	0.0%	0.0 to 50.0%	In tension control mode, the AC drive automatically sets the target torque according to the tension reference and reel diameter. The target torque is increased (winding)/decreased (unwinding) according to the setting of this parameter to offset the effect of friction on material tension. This parameter value is a percentage to the rated torque of the drive.
PE-16	Friction force compensation correction coefficient	0.0%	50.0 to 50.0%	In most scenarios, friction may vary with running frequency. Using PE-07 may not achieve ideal friction compensation effect, so it can be used with this parameter. See PE-17 for details. This parameter value is a percentage to the rated torque of the drive.

Param.	Name	Default	Value Range	Descriptions
PE-17	Friction force compensation curve	0	0: Running frequency 1: Linear speed 2: Multi-segment friction force compensation curve 1 3: Multi-friction force compensation curve 2	Five friction compensation modes are available to meet the complex friction change rule. 0: Compensation is performed according to the running frequency. In some cases, the friction force will change with the running frequency of the system. When this mode is set, the friction force compensation value is determined by the following formula: Friction compensation torque = PE-07 x (1 + Linear speed conversion frequency/Maximum frequency x PE-16). 1: Compensation is performed according to the linear speed, which is similar to Mode 0. The compensation correction is based on the linear speed, and the value of friction compensation is determined by the following formula: Friction compensation torque = PE-07 x (1 + Linear speed/Maximum linear speed x PE-16). 2. Multi-friction force compensation curve 1. In some cases, the friction force does not change linearly with frequency. At this time, the frequency can be converted based on the linear speed in the multi-section curve to obtain dynamic friction force compensation. For details, see PE-18 to PE-23. 3. Multi-friction compensation curve 2. Compared with the compensation curve 1, the compensation curve 2 is more flexible, but more parameters need to be set.
PE-18	Multi-segment friction compensation torque 1	0.0%	0.0 to 50.0%	-
PE-19	Multi-segment friction compensation torque 2	0.0%	0.0 to 50.0%	-
PE-20	Multi-segment friction compensation torque 3	0.0%	0.0 to 50.0%	-
PE-21	Multi-segment friction compensation torque 4	0.0%	0.0 to 50.0%	-
PE-22	Multi-segment friction compensation torque 5	0.0%	0.0 to 50.0%	-

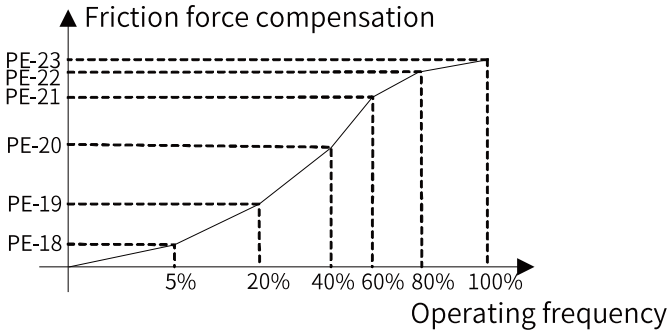
Param.	Name	Default	Value Range	Descriptions
PE-23	Multi-segment friction compensation torque 6	0.0%	0.0 to 50.0%	-
PE-24	Multi-segment friction compensation inflection point 1	0.00 Hz	0.00 Hz to maximum frequency	-
PE-25	Multi-segment friction compensation inflection point 2	0.00 Hz	0.00 Hz to maximum frequency	-
PE-26	Multi-segment friction compensation inflection point 3	0.00 Hz	0.00 Hz to maximum frequency	-
PE-27	Multi-segment friction compensation inflection point 4	0.00 Hz	0.00 Hz to maximum frequency	-
PE-28	Multi-segment friction compensation inflection point 5	0.00 Hz	0.00 Hz to maximum frequency	-
PE-29	Multi-segment friction compensation inflection point 6	0.00 Hz	0.00 Hz to maximum frequency	-

The preceding parameters are used for multi-friction compensation curves 1 and 2.

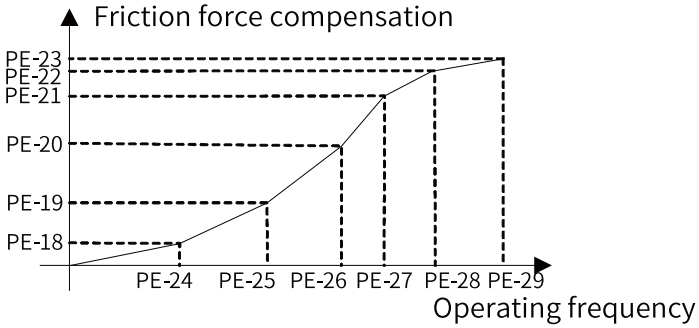
When PE-17 is set to 2, parameters PE-18 to PE-23 take effect. When PE-17 is set to 3, PE-18 to PE-29 take effect.

The change curves of friction compensation values are as shown in the following figures. You can set the parameters based on actual conditions.

When PE-17 is set to 2, friction compensation curve 1 is as follows.



When PE-17 is set to 3, friction compensation curve 2 is as follows.



5.4.7.2.9 Startup Friction Compensation Parameters

In some scenarios, the reel is subject to large startup friction, which makes system startup difficult. In this case, torque compensation can be provided during startup and canceled once the system runs properly to ensure constant tension.

Parameter	Name	Default	Value Range	Descriptions
PE-03	Zero-speed threshold	0.0%	0.0 to 20.0%	If the running frequency is lower than the value of this parameter, startup friction tension compensation will be carried out according to PE-04. If the running frequency is higher than the value of this parameter, startup friction tension compensation will not be carried out.
PE-04	Zero-speed tension rise	0.0%	0.0 to 100.0%	This parameter corresponds to the percentage of tension reference and must be set properly according to the range of allowable material tension. On the premise of ensuring startup, the parameter value must be as small as possible.
PE-14	Zero-speed compensation over-frequency	2.00 Hz	0.00 Hz to 20.00 Hz	This parameter supports smooth switchover of zero-speed tension rise at the threshold.

The preceding three parameters can be used together for static compensation, as shown below.

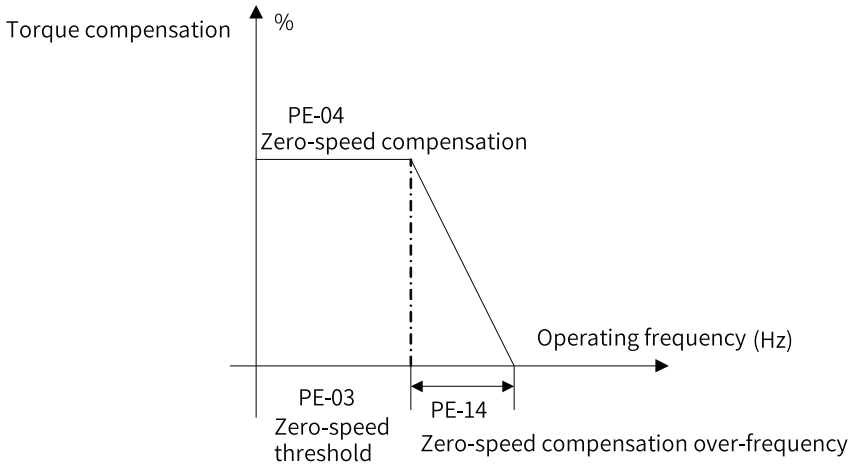


Figure 5-204 Static friction compensation function

5.4.7.2.10 Inertia Compensation Parameters

In the open-loop torque control mode, the output torque is used for material tension and rotation inertia of the system during acceleration or deceleration.

Inertia compensation is required in the following cases:

- Small material tension during acceleration of winding
- Large material tension during deceleration of winding
- Large material tension during acceleration of unwinding
- Small material tension during deceleration of unwinding

The inertia of a winding/unwinding system consists of mechanical inertia and material inertia. The parameter can be set according to the value mapping between mechanical inertia and material inertia. If the material is heavy and the reel is light, only the parameters related to material inertia need to be set, and vice versa.

Accurate linear speed is required for inertia compensation.

Parameter	Name	Default	Value Range	Descriptions
PE-08	Mechanical inertia compensation coefficient	0 Nm^2	0 to 65535 Nm^2	Set this parameter based on the actual mechanical flywheel inertia. For general cylindrical mechanical reels, the theoretical value of mechanical flywheel inertia can be obtained using the following formula: $GD_M^2=\frac{\pi g}{8i^2}\gamma b\,(D^4-D_0^4)$ Where, g is the gravitational acceleration (9.8 m/s^2), γ is the density of machine materials, b is the length of the mechanical reel, D and D0 are respectively the outer diameter and inner diameter (0 for a solid reel) of the mechanical reel, and i is the transmission ratio. The international system of units (SI) is applied. The setting value can be adjusted according to the actual change of material tension during acceleration or deceleration.
PE-11	Material density	0 Kg/m^3	0 x 65535 Kg/m^3	Set this set of parameters with reference to the actual material properties, and set the exact mechanical transmission ratio (D1-03) at the same time. The AC drive automatically calculates the flywheel inertia according to the material density, material width, reel diameter, and material roll diameter.
PE-12	Material width	0 mm	0-65535 mm	
PE-09	Correction of acceleration inertia compensation	100.0%	0.0 to 200.0%	An inevitable deviation exists between the theoretical inertia and the actual inertia, so the inertia compensation effect may not be ideal even after the inertia parameters are set. This set of parameters can be fine-tuned to optimize the control effect. Taking the winding acceleration as an example, if the material tension is small, increase the value of PE-09 to strengthen the compensation effect; Otherwise, reduce the value of this parameter. It works the same for deceleration. This group of parameters can facilitate commissioning.
PE-10	Correction of deceleration inertia compensation	100.0%	0.0 to 200.0%	

5.4.7.2.11 Terminal Tension Boost

In some scenarios, customized torque boost is required.

When the DI terminal (assigned with the tension boost function) is activated, the tension torque is boosted by certain ratio. After the DI terminal is deactivated, the boost part is canceled gradually.

Param.	Name	Default	Value Range	Descriptions
PE-33	Terminal tension boost proportion	50.0%	0.0 to 500.0%	/
PE-34	Terminal torque boost cancellation time	0.0s	0.0 to 50.0s	/

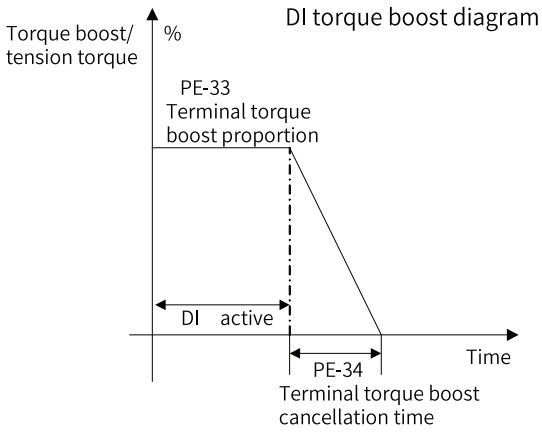


Figure 5-205 DI torque boost function

5.4.7.2.12 Torque Direction Control Parameters

Parameter	Name	Default	Value Range	Descriptions
PE-15	Open-loop torque reversal	0	0: Reverse torque inhibited 1: Enabled	This parameter takes effect only when PD-00 is set to 1 or 3. After the friction and inertia compensation are added, the calculated torque is likely to be negative. The processing method can be set by this parameter when the torque is reversed. The torque direction is limited by default. You can set this parameter to allow reverse direction.

5.4.7.2.13 Taper

In some scenarios, the tension should be reduced with the increase of the roll diameter to ensure smooth winding. For this purpose, set taper parameters properly. This group of parameters is valid only in the winding mode (PD-01 is set to 0).

Param.	Name	Default	Value Range	Descriptions
PE-00	Taper curve selection	0	0: Curve taper 1: Multi-taper	Used to set the generation mode of the taper curve. 0: The specific taper curve is generated according to the tapper setting and taper compensation correction value (PE-03). See the description of PE-03. 1: For details of the linear multi-taper, see description of PE-08 to PE-19.
PE-01	Tension taper source	0	0: PE-02 1: AI1 2: AI2 4: Communication (1000H)	0: PE-02 1–2: Set by analog channels 1 to 2 4: Communication setting (1000H)
PE-02	Taper digital setting	0.0%	0.0 to 100.0%	See channel 0 of PE-01.

Param.	Name	Default	Value Range	Descriptions
PE-03	Correction of tension taper compensa-tion	0 mm	0-10000 mm	Used to set the correction value of tension taper compensation. The curve taper is implemented together with the taper setting, and the taper value can be determined according to the following formula (the taper is implemented in a variety of ways, and the current software uses one of the following typical implementation methods): F=F_0*{1-K*[1-(D_0+D_1)/(D+D_1) Where, F is the tension after taper is set; F_0 is the tension before taper is set, determined by PE-00; K is the taper value, determined by PE-01; D_0 is the reel diameter set through D1-09; D is the current roll diameter set through D1-16; D1 is the correction coefficient of taper compensation.
PE-05	Maximum external taper source	0	0: PE-06 1: AI1 2: AI2 4: Communication (1000H)	In some cases, the material tension is determined by the external actuator. In this case, the external taper output function can be used to control the external executive parts to obtain the tension taper. The maximum external taper value determines the maximum taper output value when the external taper output (DO function 19) is selected for FMP or AO (F5-06 to F5-08) , that is, the corresponding output value when the roll is empty. Its value setting channel is determined by this parameter. 0: PE-06 1-2: Set by analog channels 1 to 2 4: Communication setting (1000H)
PE-06	External taper setting	100.0%	0.0 to 100.0%	It defines the digital setting of the maximum external taper value. See channel 0 of PE-05.
PE-08	Minimum roll diameter taper	100.0%	0.0 to 100.0%	Taper corresponding to minimum winding diameter
PE-09	Linear taper switchover point 1	150.0 mm	PD-11 to PE-11	-
PE-10	Taper of switchover point 1	100.0%	0.0 to 100.0%	-
PE-11	Linear taper switchover point 2	200.0 mm	PE-09 to PE-15.	-
PE-12	Taper of switchover point 2	90.0%	0.0 to 100.0%	-
PE-13	Linear taper switchover point 3	250.0 mm	PE-11 to PE-15	-
PE-14	Taper of switchover point 3	80.0%	0.0 to 100.0%	-

Param.	Name	Default	Value Range	Descriptions
PE-15	Linear taper switchover point 4	300.0 mm	PE-13 to PE-17	-
PE-16	Taper of switchover point 4	70.0%	0.0 to 100.0%	-
PE-17	Linear taper switchover point 5	400.0 mm	PE-15 to PD-10	-
PE-18	Taper of switchover point 5	50.0%	0.0 to 100.0%	-
PE-19	Max. roll diameter taper	30.0%	0.0 to 100.0%	-

The following figure shows a multi-point linear taper curve, where the ordinate represents the ratio of tension after taper is set to original tension, and the abscissa represents the roll diameter. You can set the preceding parameters to obtain a multi-liner taper curve.

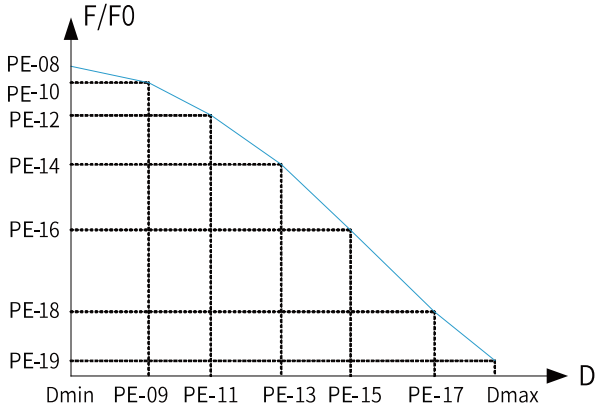


Figure 5-206 Multi-point linear taper curve

5.4.7.2.14 Pre-drive

The Pre-drive function is applied to automatic reel replacement scenarios. To achieve shockless roll change, ensure that the linear speed of the new roll matches that of the material when replacing a full roll with a new roll. For this purpose, enable DI function(Pre-drive terminal) of the DI terminal and set the pre-drive parameters properly.

Accurate linear speed and roll diameter are required for this function.

Param.	Name	Default	Value Range	Descriptions
PD-22	Pre-drive speed gain	0.0%	-100.0 to 200.0%	For pre-drive, the running frequency is automatically calculated based on the linear speed and roll diameter to ensure matching with the linear speed of the material. For small deviation of linear speed, you can increase or decrease the operating frequency through this parameter during pre-drive , ensuring accurate linear speed matching.
PD-23	Pre-drive torque limit source	0	0: F2-09 1: Torque in tension control mode	In the torque control tension mode, the target torque is automatically generated to meet the material tension demand. In the normal operation mode, the target torque can also be set according to F2-30 to F2-32. This parameter provides the preceding options for the source of the target torque in the pre-drive mode. You can set it as required. 0: The target torque is set by F2-30 to F2-32. 1: The target torque is set according to the open-loop torque in the tension control mode (for mode 1 and mode 3 only).
PD-24	Pre-drive torque correction	0.0%	100.0 to 100.0%	The parameter takes effect when PD-23 is set to 1 and is used to correct the tension control torque in pre-drive mode. To avoid excessively slow pre-drive acceleration due to low torque limit when PD-23 is set to 1, the minimum torque limit in pre-drive mode can be limited.
PD-26	Pre-drive acceleration time	20.0s	0.0s to 6000.0s	PD-26, PD-27, and D1-28 are used to set the time as a group, which correspond to the acceleration and deceleration time when the roll diameter is the minimum roll diameter. With the increase of roll diameter, the acceleration and deceleration time increase in proportion to avoid the impact caused by excessive acceleration and deceleration in large winding.
PD-27	Pre-drive deceleration time	20.0s	0.0s to 6000.0s	
PD-28	Minimum torque limit in pre-drive mode	0.0%	0.0 to 100.0%	
PD-29	Pre-drive roll diameter calculation function	0	0: Disabled 1: Enabled	This parameter takes effect only when PD-09 is set to 1. When the winding diameter is calculated by thickness accumulation, the winding diameter increases/decreases with the number of revolutions of the reel. At this time, this parameter can be set to 1 to avoid the cumulative error caused by the failure of winding diameter calculation during pre-driving. You can set this parameter as required.

5.4.7.2.15 Constant Linear Speed Mode

In this mode, the running frequency for winding and unwinding is automatically calculated based on the set target linear speed.

Parameter	Name	Default	Value Range	Descriptions
PD-44	Constant linear speed source selection	0	0: PD-45 1: AI1 2: AI2 4: Pulse reference (DI7) 5: Communication (1000H)	0: Digital setting of D1-45 and non-retentive upon power failure 1 to 2: AI channel 4: Pulse 5: Communication address (1000H); set by percentage
PD-45	Digital setting of constant linear speed input	0 m/min	0.0 m/min to 6500.0 m/min	When digital setting is used as the source for constant linear speed, the constant linear speed is defined by this parameter, which is non-retentive upon power failure.

5.4.7.2.16 Tension Setup at Zero Speed in Closed-Loop Control Mode

Generally, the AC drive can run without the need for additional configuration of closed-loop control.

Configure the following parameters in scenarios demanding accurate tension setup at zero speed or roll diameter auto-tuning during tension setup at zero speed.

Parameter	Name	Default	Value Range	Descriptions
PE-30	Tension establishment	0	0: Disable 1: Enable	In closed-loop control mode, when PE-30 is set to 0, the pre-speed tensioning function is disabled. When PE-30 is set to 1, the pre-speed tensioning function is enabled.
PE-31	Tension establishment dead zone	2.0%	0.0 to 100.0%	The PID operation stops when the pre-speed tensioning function is enabled and the PID feedback is lower than the value of PE-31.
PE-32	Tension establishment frequency	0.10 Hz	0.00 Hz to F0-10	Used to set the running frequency in scenarios where the tension setup at pre-speed function is enabled but the system is not in the tension setup dead zone.

For details about tension setup at zero speed, see the following figure. You can set PE-30 to 1 to enable the tension setup at pre-speed function and set PE-31 to define the tension setup dead zone.

When PID feedback is below the tension setup dead zone, PID calculation stops and the reel runs at a fixed frequency to slowly wind the material.

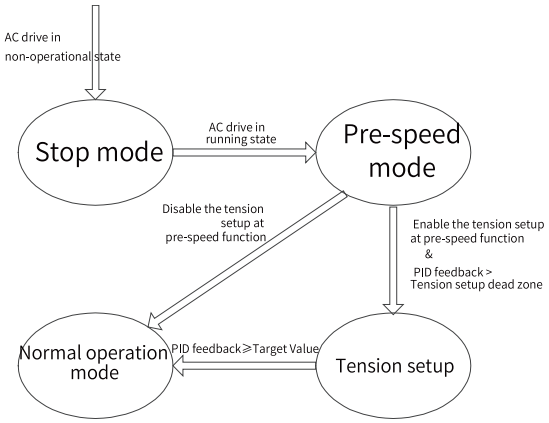


Figure 5-207 Diagram of tension setup at zero speed

5.4.7.2.17 Initial Roll Diameter Auto-tuning

When the pre-speed tension function is enabled, the initial roll diameter auto-tuning function can be configured. During tension setup, the AC drive auto-tunes the initial roll diameter to remove the need for roll diameter reset or initial roll diameter input (for tension setup at zero speed in FVC mode only).

Parameter	Name	Default Value	Value Range	Descriptions
PE-36	Initial roll diameter auto-tuning	0	0: Disabled 1: Enabled	When the pre-speed tension function is enabled, the initial winding diameter auto-tuning function can be configured to realize the auto-tuning of the initial winding diameter, which is only suitable for swing rod control. This function is enabled when PE-36 is set to 1 and disabled when PE-36 is set to 0.
PE-37	Rod length	300 mm	1-65535 mm	Indicates the rod length after initial winding diameter auto-tuning.
PE-38	Rod angle	40°	0.1 degree to 360.0 degrees	Indicates the rod angle after initial winding diameter auto-tuning.

5.4.7.2.18 Closed-loop Tension Torque Mode

You can set the tension in closed-loop torque control mode by using PID alone or main torque + PID.

Param.	Name	Default	Value Range	Descriptions
PD-33	Closed-loop tension torque mode selection	0	0: Torque calculated through pure PID 1: Torque calculated through main + PID	-

The main torque is the torque calculated when PD-00 is set to 1.

In pure PID mode, the set friction and inertia compensation are still valid, but the tension torque is invalid.

When the main + PID mode is used, accurately configure the tension corresponding to 100.0% of PID feedback value, and set parameter PE-02.

5.4.7.2.19 DI Function

The DI function facilitates the implementation and operation of tension control. The DI provides a wide range of functions in conjunction with the setting of related parameters.

The DI function is set through PF-30 to PF-42. Flexible communication functions can be implemented through virtual DIs. The general terminal functions of the drive are not described here.

Thickness accumulation

When roll diameter is calculated based on accumulative thickness, assign the DI with this function and ensure that revolution count signals are input through the DI.

Roll diameter reset

Roll diameter reset during reel replacement is necessary for tension control. It ensures accurate roll diameter at the moment when the system is started after reel replacement, and also ensures normal system startup and proper material tension.

Initial roll diameter selection terminals 1 and 2

These functions provide initial roll diameter switchover modes to meet different requirements for different reels or materials. For details of use, see PD-12.

Pre-drive

When the terminal is activated, the AC drive is switched to the pre-charge speed control mode. After the roll is changed, deactivate this terminal to activate the tension function.

Switchover between winding and unwinding

Winding/unwinding switchover is performed without modifying the parameter, greatly facilitating the operation. For details of use, see PD-01.

Disable roll diameter calculation

When the terminal is activated, the roll diameter calculation is disabled.

Exit tension mode

When the terminal is activated, the system exits the tension control mode and the AC drive restores general AC drive functions (the frequency source and torque source are enabled based on the general AC drive functions).

Terminal tension increase

When the terminal is activated, the tension torque is increased by a certain ratio. After the DI terminal is deactivated, the boost part will be canceled gradually based on time.

Thickness selection terminals 1 and 2

These functions provide material thickness switchover modes to meet different requirements for materials with different thickness. In the tension mode, PD-38/39/40/41 is selected as the material thickness through terminal combinations. When these two terminals are inactive, PD-38 is selected as the material thickness. When only the terminal for thickness selection 1 is active, PD-39 is selected as the material thickness. When only the terminal for thickness selection 2 is active, PD-40 is selected as the initial reel diameter. When these two terminals are active, PD-41 is selected as the material thickness.

Passive unwinding (cable drum application)

In the winding mode, when the encoder feedback speed is negative or the terminal is set to “Passive unwinding” , the dynamic friction compensation is the current torque reference x PD-50.

Emergency stop - Tension torque compensation enable

In tension mode, when PE-54 is enabled, emergency stop PI parameters (PE-51 to PE-53) are switched.

5.4.7.2.20 AO/Pulse Output Functions

In addition to the AC drive, PLC or actuators also affect the tension control function. The AC drive supports output of variables related to tension control, enriching means to realize the tension control function.

The AO/pulse output is set through E3-00. The general terminal functions of the AC drive are not described here.

Output function 17: External taper output

When the tension taper control is required and the material tension is determined by the external actuator, you can enable this function to output taper.

Output function 18: Roll diameter output

When the roll diameter is calculated in the AC drive and the calculation result needs to be output, you can enable this function to output the result.

Output function 19: Tension output

You can enable this function to output the tension reference of the AC drive. The actual valid tension after taper calculation is calibrated based on the maximum tension (PE-02).

5.4.7.2.21 Monitoring

The following table lists monitoring parameters, which can be monitored through an operating panel or in the background in real time.

Parameters	Parameter Name	Unit	Description
U7-00	Linear speed	0.1 m/min	Indicates the target linear speed of the tension process.
U7-01	Current winding diameter	0.1 mm	This parameter represents the current roll diameter.
U7-02	Linear speed synchronization frequency	0.01 Hz	This parameter represents the motor target frequency that is synchronized with the linear speed.
U7-03	Closed loop speed output	0.01 Hz	Indicates the motor target frequency calculated by the PID output in closed loop tension speed mode.
U7-04	Tension reference (before taper)	1 N	This parameter represents the tension setpoint calculated based on the tension setting source.
U7-05	Tension reference (after taper)	1 N	This parameter represents the tension setpoint calculated by the taper, which is the actual tension setpoint in effect.
U7-06	Torque reference	0.1%	This parameter represents the target torque of the tension process.
U7-07	Closed loop torque output	0.1%	This parameter represents the target torque calculated by the PID output in closed loop tension torque mode.

Parameters	Parameter Name	Unit	Description
U7-08	Tension control state machine	1	This parameter represents the state of the tension process, where: 0 indicates a non-tension control state, and the tension process is invalid; 10 represents an open loop torque control state; 20 to 23 represent the closed loop tension speed control state, and 20 represents the shutdown branch state, 21 represents the pre-speed branch state, 22 represents the tension setup branch state, and 23 represents the normal operation branch state; 30 to 33 represent the closed loop tension torque control state, and 30 represents the shutdown branch state, 31 represents the pre-speed branch state, 32 represents the tension setup branch state, and 33 represents the normal operation branch state; 40 represents constant linear speed control state; 50 represents pre-drive control state.
U7-09	Closed loop tension (speed/torque) PID setting display	0.1%	Indicates the PID reference in closed loop tension (speed/torque) control mode.
U7-10	Closed loop tension (speed/torque) PID feedback display	0.1%	Indicates the PID feedback value in closed loop tension (speed/torque) control mode.
U7-11	Closed loop tension (speed/torque) PID proportional output	1	Indicates the PID calculation proportional output value in closed loop tension (speed/torque) control mode.
U7-12	Closed loop tension (speed/torque) PID integral output	1	This parameter represents the PID calculation integral output value in closed loop tension (speed/torque) control mode.
U7-13	Closed loop tension (speed/torque) PID derivative output	1	This parameter represents the PID calculation derivative output value in closed loop tension (speed/torque) control mode.
U7-14	Tension process execution time	1	Records the actual execution time of tension process in each cycle.
U7-15	Winding mode	1	This parameter indicates the winding/unwinding state when the tension process is valid. 0 indicates winding, and 1 indicates unwinding.
U7-16	Tension torque setpoint	0.1%	This parameter represents the set torque calculated based on parameters such as tension setpoint, roll diameter, etc.
U7-17	Static friction torque	0.1%	This parameter represents the frictional torque caused by the static friction of the system.
U7-18	Dynamic friction torque	0.1%	This parameter represents the frictional torque caused by the dynamic frictional force during operation.

Parameters	Parameter Name	Unit	Description
U7-19	Inertia torque	0.1%	This parameter indicates the torque caused by the system inertia.
U7-20	Terminal lift torque	0.1%	This parameter represents the torque at which the terminal tension is increased and the base value is the tension torque setpoint.
U7-21	Torque upper limit in vertical cable drum application (calculated value)	0.1%	Defines the maximum torque output calculated for vertical cable drum applications based on maximum set tension and empty roll diameter.
U7-22	Torque lower limit in vertical cable drum application (calculated value)	0.1%	Defines the minimum torque output calculated for vertical cable drum applications based on minimum set tension and max. roll diameter.
U7-23	Torque upper limit in vertical cable drum application (actual value)	0.1%	Defines the max. torque calculated for vertical cable drum applications.
U7-24	Torque lower limit in vertical cable drum application (actual value)	0.1%	Defines the min. torque calculated for vertical cable drum applications.
U7-25	Closed loop tension (speed/torque) PID output	0.1%	This parameter represents the PID calculation output (i.e., sum of proportional, integral, derivative) in closed loop tension (speed/ torque) control mode.
U7-26	Linear acceleration	0.1%	This parameter represents the linear acceleration of the material during operation.

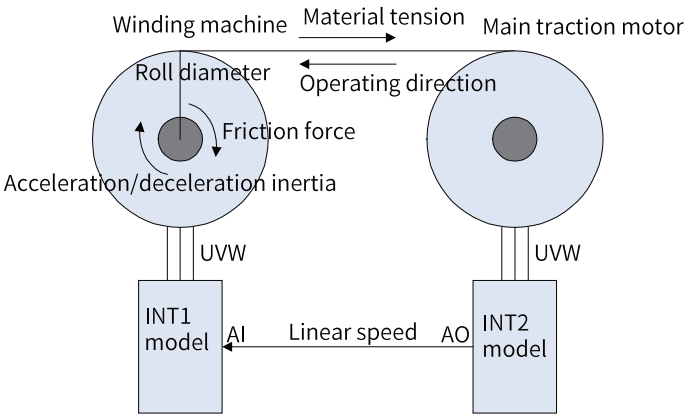
For better control effect, conduct commissioning based on the measurements obtained using a speed measuring device or tape and comparison between such measurements with related monitoring parameters.

5.4.7.3 Typical Applications

This section describes the typical application of each tension control mode (corresponding to the PD-00 selection).

5.4.7.3.1 Tension Open-Loop Torque Control

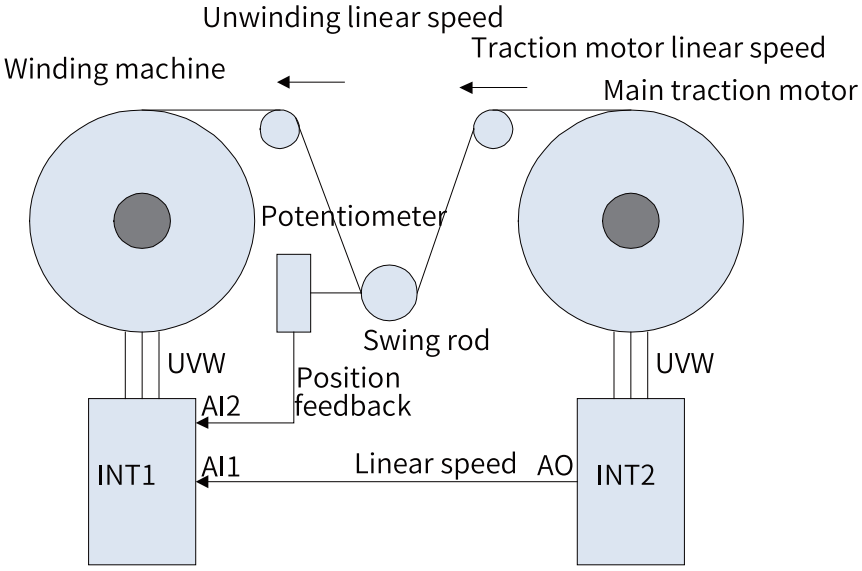
In this mode, no swing rod (floating roller) or tension sensor is required. Tension accuracy is slightly low. This control mode is applicable to scenarios where tension accuracy is not critical.



In the preceding figure, the winding machine runs in tension open-loop torque control mode. The roll diameter is calculated based on the linear speed and the target torque is updated based on the set material tension and current roll diameter. You can set the friction compensation torque and dynamic inertia compensation torque as needed to improve the tension control effect.

5.4.7.3.2 Tension Closed-Loop Speed Control

In this mode, a swing rod (floating roller) or tension sensor is used to feed back material tension. The output frequency of the AC drive is regulated in the closed-loop mode to ensure stable swing rod position or constant tension. The tension is controlled by linear speed synchronous frequency and PID closed-loop frequency. This mode is applicable to scenarios where the speed can be adjusted (the system has an swing rod for pre-charge) or the material can be pulled and stretched.

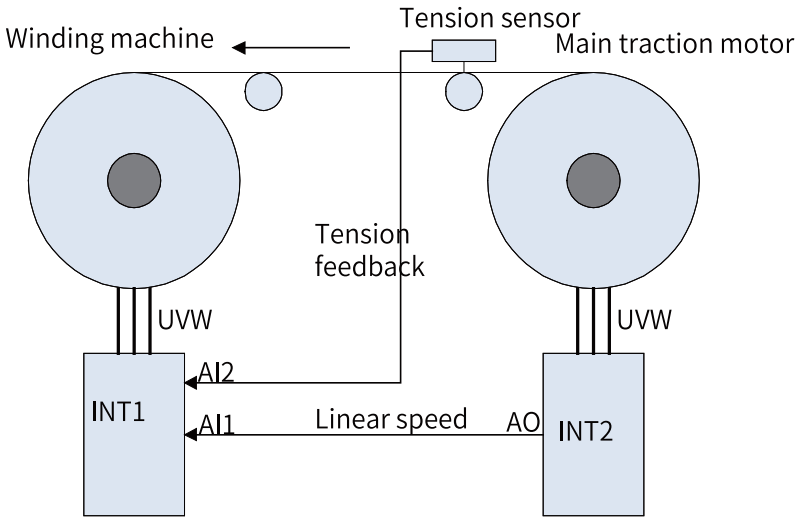


As shown in the preceding figure, when the winding machine works in closed-loop speed control mode, two AI signal channels receive swing rod position potentiometer signals and main traction motor running frequency signals, respectively. The roll diameter is calculated based on linear speed control. The target frequency depends on the main frequency calculated based on linear speed synchronous frequency and the closed-loop regulation based on swing rod position feedback.

The general-purpose AC drive supports main frequency + PID as the frequency source. In tension control mode, the roll diameter is calculated in real time to facilitate matching between the main frequency and linear speed. Therefore, the tension control stability and speed are improved.

5.4.7.3.3 Tension Closed-Loop Torque Control

In this mode, a tension sensor is used to feed back the material tension and the target frequency is regulated in closed-loop mode to ensure constant tension. The main + PID mode or pure PID mode can be configured as needed. The main + PID mode incorporates the operation torque in tension open-loop torque mode, whereas the pure PID mode achieves constant tension control through torque adjustment by pure PID. To optimize dynamic response, enable friction and inertia compensation. This mode is applicable to materials with regular elasticity or applications with small speed adjustment margin.

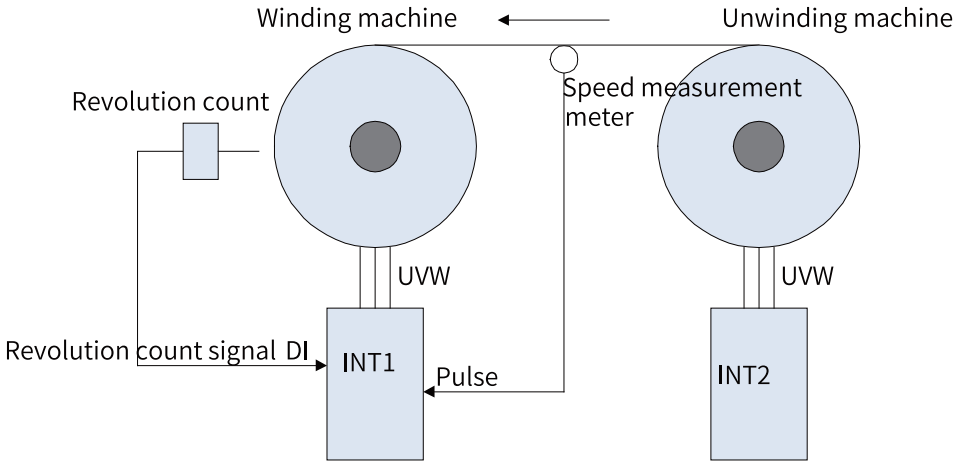


In the preceding figure, when the winding machine works in closed-loop torque control mode, two AI signal channels receive tension sensor signals and main traction motor linear speed signals, respectively. When tension is controlled in the "open-loop tension reference plus tension sensor regulation" mode, the torque of friction and inertia compensation can be set as needed.

For scenarios where elastic materials (speed adjustment margin and tension sensor) and tension sensors are used, the tension closed-loop speed control mode can also be applied.

5.4.7.3.4 Constant linear speed control

Different from preceding modes, this mode is applicable to scenarios where no specific traction is used to directly control the material tension; instead, the winding or unwinding machine runs at a constant linear speed and serves as the traction motor, and the material tension is controlled by the winding/unwinding operation.



In the preceding figure, the winding machine serves as the traction motor. To make the system run at a constant linear speed, the roll diameter must be calculated in either of the following two modes:

- Assign the DI terminal with the revolution count signal function to calculate the roll diameter in thickness overlying mode based on revolution count signals.
- Install a speed measuring device to measure the material linear speed and calculate the roll diameter based on the measured linear speed. Update the target frequency based on the target linear speed and current roll diameter to make the system run at a constant linear speed.

The preceding typical applications only describes the four tension control modes. You can also use other applicable modes. If the basic conditions are met, you can handle them flexibly according to actual conditions.

5.4.7.3.5 Application Restrictions

The preceding section describes four typical tension control applications, which are determined by roll diameter, linear speed, and control feedback.

Table 5–102 Required conditions for tension control modes

Control Mode	Roll Diameter[Note 1]	Linear speed	Control Feedback
Open-Loop Torque Control	Required	Not required	Not required
Closed-loop Speed Control	Required	Required	Required
Closed-Loop Torque Control	Required	Not required	Required
Constant linear speed control	Required	Not required	Not required

Notes:

Note 1: If the roll diameter is calculated based on linear speed control (PD-09 is set to 0), the linear speed is required.

Note 2: Inertia and friction compensation is associated with linear speed, so the linear speed is required in such applications.

5.4.8 Free Function Module

5.4.8.1 Free Function Module

In more complex engineering applications, the MD630-INT can use the free function module to associate multiple status signals and control signals together to achieve project control requirements. The application functions of MD630-INT include logic operation, arithmetic function, word-to-bit conversion, data conversion, switch function, control function, multi-point curve, constant setting module. You can set related parameters to achieve simple logic operation.

5.4.8.2 Word-bit Coversion Module

5.4.8.2.1 Word-to-Bit Module Introduction

Description

This module enables conversion between 16-bit data and 16 bits.

Applicable scenario

Generally, user-defined status words can be generated for viewing through the word-to-bit module, or the user-defined control words can be parsed through the word-to-bit module to meet control requirements.

5.4.8.2.2 Word-to-Bit Module (A to D)

Function description

The word-to-bit module is used to convert 16-bit data to bit0-bit15, which is a total of 16 bits.

Working principle

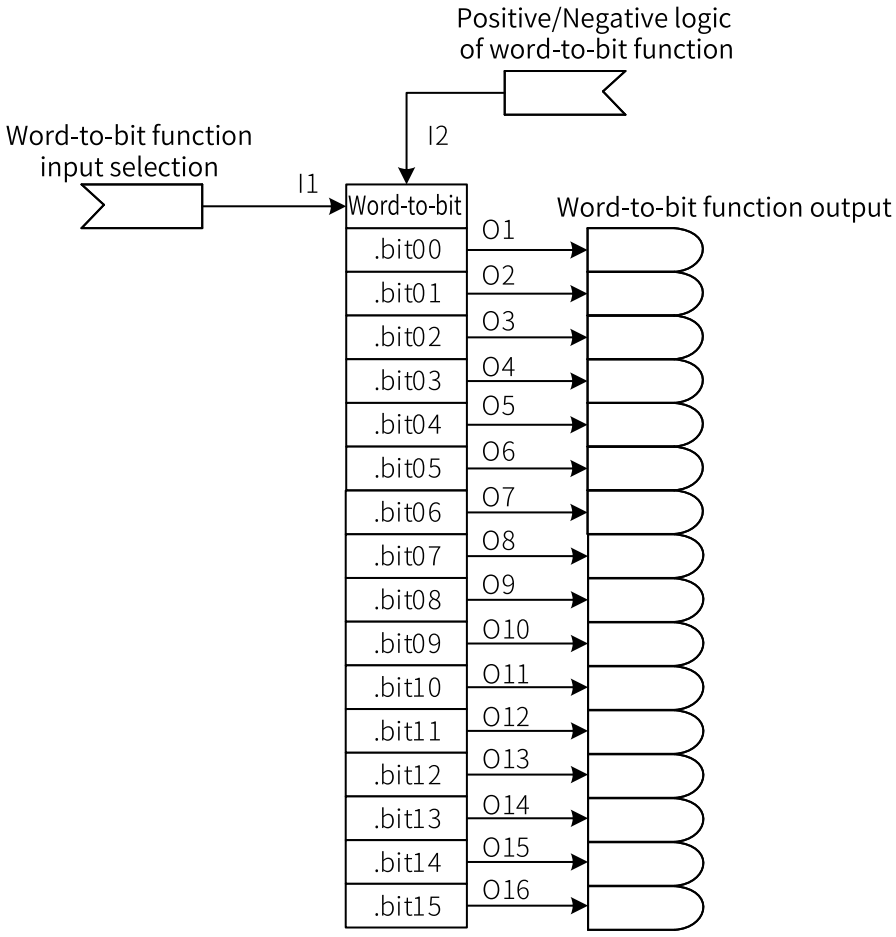


Figure 5-208 Word-to-bit module

When the input I1 is a 16-bit single word, the output O1 to O16 correspond to bit 00 to bit 15 of the input I.

When the input I1 is a 32-bit double word, the output O1 to O16 correspond to high-order 16 bits (bit 00 to bit 15) of the input I1.

Input I2 is used to set the positive and negative logic during conversion. When bit 00–bit 15 of input I2 is 1, the corresponding output of input I1, namely O1–O16, is inverted.

Connection parameters

MD630-INT has four word-to-bit module modules (A to D). The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I1: Single -word connector, double-word connector.

Parameter value source of input I2 : Unsigned number.

Storage position of output O1 to O16: Bit connector.

The parameters corresponding to the input and output of word-to-bit module are shown in the following table.

Word-to-bit Module		A	B	C	D
Input	I1	o3-00	o3-01	o3-02	o3-03
	I2	o3-04	o3-05	o3-06	o3-07
Output	O1 (bit 00)	L0304	L0320	L0336	L0352
	O2 (bit01)	L0305	L0321	L0337	L0353
	O3 (bit02)	L0306	L0322	L0338	L0354
	O4 (bit03)	L0307	L0323	L0339	L0355
	O5 (bit04)	L0308	L0324	L0340	L0356
	O6 (bit05)	L0309	L0325	L0341	L0357
	O7 (bit06)	L0310	L0326	L0342	L0358
	O8 (bit07)	L0311	L0327	L0343	L0359
	O9 (bit08)	L0312	L0328	L0344	L0360
	O10 (bit09)	L0313	L0329	L0345	L0361
	O11 (bit 10)	L0314	L0330	L0346	L0362
	O12 (bit11)	L0315	L0331	L0347	L0363
	O13 (bit12)	L0316	L0332	L0348	L0364
	O14 (bit13)	L0317	L0333	L0349	L0365
	O15 (bit14)	L0318	L0334	L0350	L0366
	O16 (bit15)	L0319	L0335	L0351	L0367

Instances

You can convert the received custom control word to bit data through the word-to-bit module , and read the control commands issued by the user. For example, you can convert a custom command word of control channel 1 to bit data through word-to-bit module A.

Control word bit	Meaning	Description
bit0	ON_OFF1 (start/stop)	The AC drive starts when the bit value changes from 0 to 1 and stops when the bit value is 0.
bit1	OFF2 (coast to stop)	Coast to stop command is active when the bit value is 1.
bit2	OFF3 (quick stop)	Quick stop command is active when the bit value is 1.
bit3	Operation permission	Bit value 1 indicates that operation is allowed.
bit4	Reset command	Reset command is active when the bit value changes from 0 to 1.
bit5	JOG1	Bit value 1 indicates that the jog 1 command is valid.
bit6	JOG2	Bit value 1 indicates that the jog 2 command is valid.
bit7	Speed inversion	Bit value 1 indicates that the speed is reversed.
Bit 8 to bit 15	Reserved	-

The parameters to be set are described in the following table.

Parameters	Description	Setting value	Description
o3-00	Input of word-to-bit function A	L1044 (Custom command word of control channel 1)	The input of word-to-bit module A is custom control word.
o3-04	Positive and negative logic of word-to-bit function A	0x0000	The bit output of word-to-bit module A remains unchanged.

At this time, you can check whether the coast to stop instruction is valid by L0305 [word-to-bit module A output Bit01], and whether the fault reset instruction is valid by L0308 [word-to-bit module A output Bit04].

5.4.8.2.3 Bit-to-Word Module (A to D)

Function description

The bit-to word module is used to combine 16 bits from bit 0 to bit 15 into a single 16-bit data.

Working principle

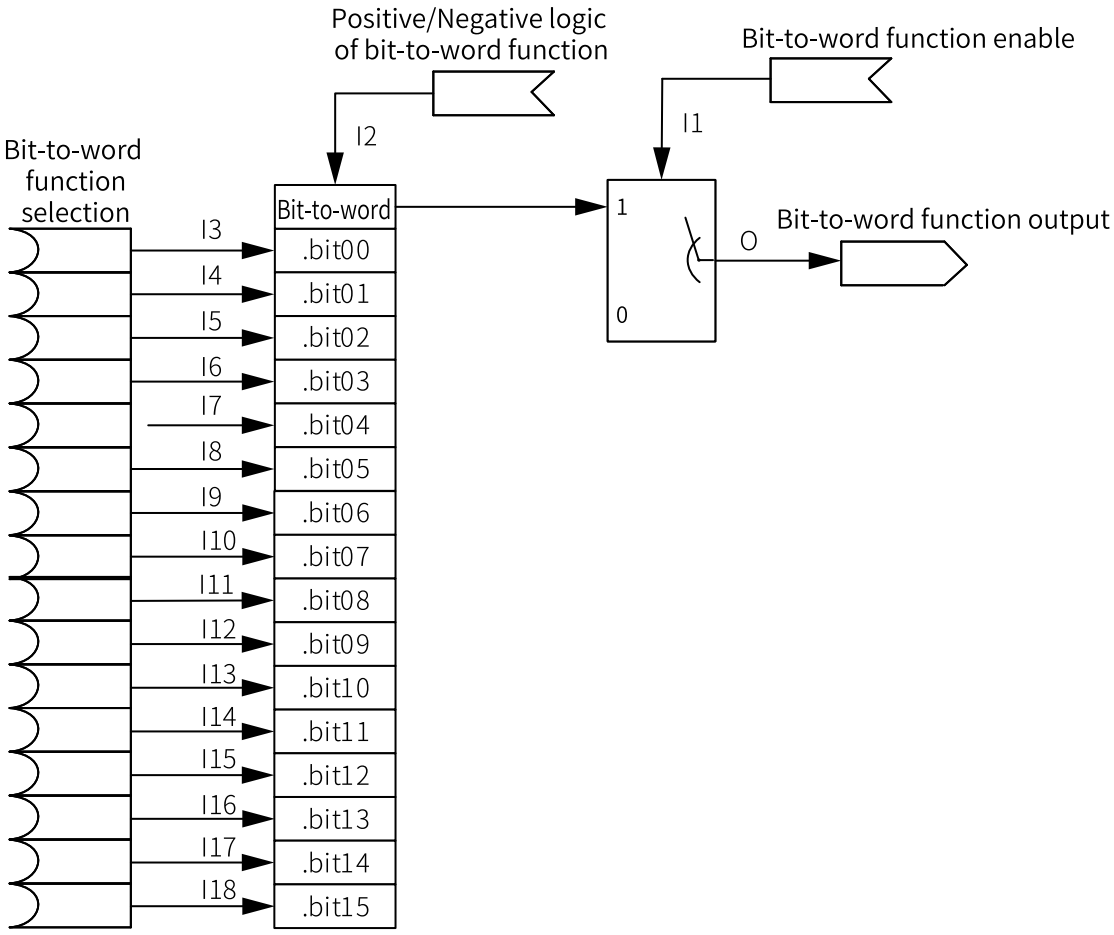


Figure 5-209 Bit-to-word module

Bit-to-word modules input I3–I18 as bit 00–bit 15 of hexadecimal numbers, and output 16-bit single-word data to O.

Input I1 of the bit-to-word module is the enable control bit. When input I1 is 1, the function of the module is valid. When input I1 is 0, output O is 0.

Input I2 is used to set the positive and negative logic during conversion. When bit 00–bit 15 of input I2 is 1, the corresponding bit 00–bit 15 of output O are inverted.

Connection parametres

MD630-INT has 4 bit-to-word modules (A to D). The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I1 : Binary number.

Parameter value source of input I2 : Unsigned number.

Parameter value source of inputs I3 to I18: 0, 1, DI input, and bit connector.

The storage position of the output O: Word connector.

The parameters corresponding to the input and output of bit-to-word module are shown in the following table.

Bit-to-word module		A	B	C	D
Input	I1	o3-08	o3-26	o3-44	o3-62
	I2	o3-09	o3-27	o3-45	o3-63
	I3 (bit00)	o3-10	o3-28	o3-46	o3-64
	I4 (bit01)	o3-11	o3-29	o3-47	o3-65
	I5 (bit02)	o3-12	o3-30	o3-48	o3-66
	I6 (bit03)	o3-13	o3-31	o3-49	o3-67
	I7 (bit04)	o3-14	o3-32	o3-50	o3-68
	I8 (bit05)	o3-15	o3-33	o3-51	o3-69
	I9 (bit06)	o3-16	o3-34	o3-52	o3-70
	I10 (bit07)	o3-17	o3-35	o3-53	o3-71
	I11 (bit08)	o3-18	o3-36	o3-54	o3-72
	I12 (bit09)	o3-19	o3-37	o3-55	o3-73
	I13 (bit 10)	o3-20	o3-38	o3-56	o3-74
	I14 (bit 11)	o3-21	o3-39	o3-57	o3-75
	I15 (bit 12)	o3-22	o3-40	o3-58	o3-76
	I16 (bit 13)	o3-23	o3-41	o3-59	o3-77
	I17 (bit 14)	o3-24	o3-42	o3-60	o3-78
	I18 (bit15)	o3-25	o3-43	o3-61	o3-79
Output	O	L1208	L1209	L1210	L1211

Instances

You can customize the control word to be sent to the user through the bit-to-word module to meet the control requirements. For example, the status word can be defined through bit-to word Module module A as follows.

Param.	Name	Value Range	Description
o3-08	Bit-to-word module A enable	1: Enable	Sets whether to enable bit-to-word module A.
o3-09	Positive and negative logic selection for bit-to-word module A	0x0000	Each bit of the bit-to-word module A is positive logic
o3-10	Bit-to-word module A - Bit00 selection	L0100: Ready to switch on	The value 1 indicates that the AC drive is ready to switch on.
o3-11	Bit-to-word module A - Bit01 selection	L0102: During operation	The value 1 indicates that the AC drive is running.

Param.	Name	Value Range	Description
o3-12	Bit-to-word module A - Bit02 selection	L0103: Fault active	The value 1 indicates a fault occurs.
o3-13	Bit-to-word module A - Bit03 selection	L0106: Switch-on blocking	The value 1 indicates that the AC drive is blocked from running.
o3-14	Bit-to-word module A - Bit04 selection	L0118: Current control channel	0 indicates that channel 1 is active, and 1 indicates that channel 2 is active.
o3-15	Bit-to-word module A - Bit05 selection	L0119: Current set channel	0 indicates that channel 1 is active, and 1 indicates that channel 2 is active.
L1208:	Output of bit-to-word module A	-	Bit-to-word module A output value

In this case, you can send the output value of the bit-to-word module A (L1208) to the user to enable custom status word transmission.

5.4.8.3 Data Conversion Module

5.4.8.3.1 Introduction to Data Conversion Module

Function description

This module enables conversion between different types of data, such as 16-bit single word data and 32-bit double word data.

Applicable scenario

You can convert data to the type of data required by the user to facilitate data query and processing.

5.4.8.3.2 Word-to-Double Word Module(A to D)

Function description

The word to double-word module (W-DW module) combines two 16-bit single-word data into a single 32-bit data, and then divides the 32-bit data by a user-defined 32-bit base value, to obtain the converted 32-bit double-word data.

Working principle

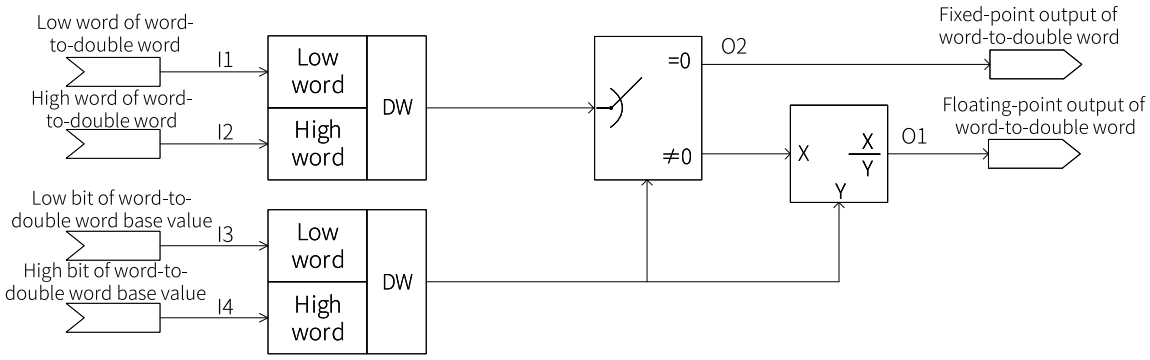


Figure 5-210 W-DW module

The conversion formula for the input and output of W-DW module is as follows:

$$O=\begin{cases} O1:\ \dfrac{I1+I2\times 65536}{I3+I4\times 65536}, & I3+I4\times 65536\neq 0 \\ O2:\ I1+I2\times 65536, & I3+I4\times 65536=0 \end{cases}$$

(1) When the base value with I3 as the low-order 16 bits and I4 as the high-order 16 bits of the W-DW module is not zero, the output (O1) equals the double word divided by the base value with I1 as the low-order 16 bits and I2 as the high-order 16 bits.

(2) When the base value with l3 as the low-order 16 bits and l4 used as the high-order 16 bit is zero, the output equals the double word with l1 as the low-order 16 bits and I2 as the high-order 16 bits. The double word is output directly to O2 without base value conversion.

Connection parameters

MD630-INT has four sets of word to double-word modules (A to D). The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I2: Word connector, double-word connector.

Parameter value source of input I3 and I4: 16-bit unsigned number.

Storage location of output O1: Floating-point connector.

Storage position of output O2: Double-word connector.

The parameters corresponding to the input and output of the W-DW module are shown in the following table.

Word-to-double word module	Input				Output	
	I1	I2	I3	I4	O1	O2
A	o5-00	o5-01	o5-02	o5-03	L2500	L2000
B	o5-04	o5-05	o5-06	o5-07	L2502	L2002
C	o5-08	o5-09	o5-10	o5-11	L2504	L2004
D	o5-12	o5-13	o5-14	o5-15	L2506	L2006

Note: When the input I2 of the word-to-double word conversion module is set to 0 [Disable], this module is disabled and the output is 0. The module functions normally when the input I2 selects others [K connector].

5.4.8.3.3 Double-Word to Word Conversion Module (A to D)

Function description

The double-word to word module (DW-W module) divides the input 32-bit double-word data by the user-defined 32-bit base value to obtain the converted 16-bit single-word data.

Working principle

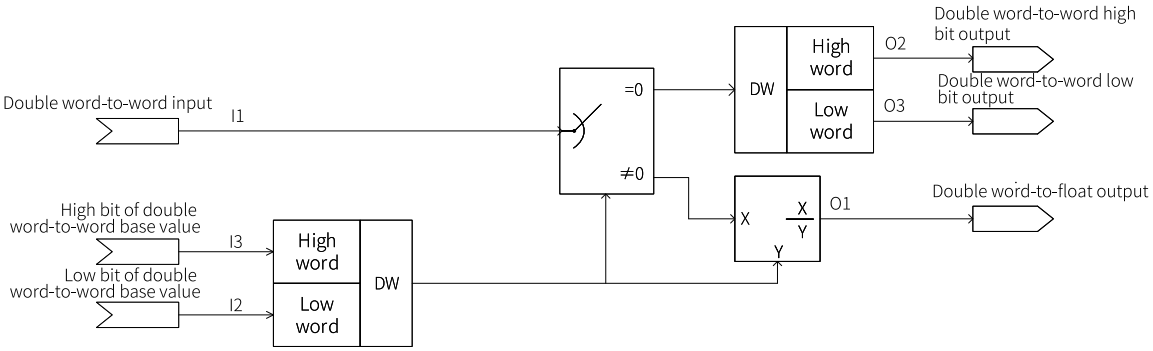


Figure 5-211 DW-W module

The conversion formula for the input and output of the DW-W module is as follows:

$$O=\begin{cases} O1:\ \dfrac{I1}{I2+I3\times 65536}, & I2+I3\times 65536\neq 0 \\ \begin{cases} O2:\ (I1\gg 16)\ \&\ 0xFFFF \\ O3:\ I1\ \&\ 0xFFFF \end{cases}, & I2+I3\times 65536=0 \end{cases}$$

(1) When the base value with I2 as the low-order 16 bits and I3 as the high-order 16 bits of the DW-W module is not zero, the output equals the value of I1 divided by the base value. The result is output is to O1.

(2) When the base value with I2 as the low-order 16 bits and I3 as the high-order 16 bits of the DW-W module is zero, the output O2 is the high-order 16 bits of I1 and the output O3 is the low-order 16 bits of I1.

Connection Parameter

MD630-INT has four sets of DW-W modules (A to D). The corresponding inputs and outputs of each module are as follows:

Parameter value source of input I1: Word connector, double-word connector.

Parameter value source of input I2 and I3: 16-bit unsigned number.

Storage location of output O1: Floating-point connector.

Storage position of output O2 and O3: Word connector.

The parameters corresponding to the input and output of the DW-W conversion module are shown in the following table.

DW-W module	Input			Output		
	I1	I2	I3	O1	O2	O3
A	o5-32	o5-33	o5-34	L2508	L1212	L1213
B	o5-35	o5-36	o5-37	L2510	L1214	L1215
C	o5-38	o5-39	o5-40	L2512	L1216	L1217
D	o5-41	o5-42	o5-43	L2514	L1218	L1219

5.4.8.3.4 Floating-point connector-to-monitoring parameter module (A to H)

Function description

The floating-point connector-to-monitoring parameter module converts the input floating-point connector data into monitoring parameters displayed in the U group.

Working principle

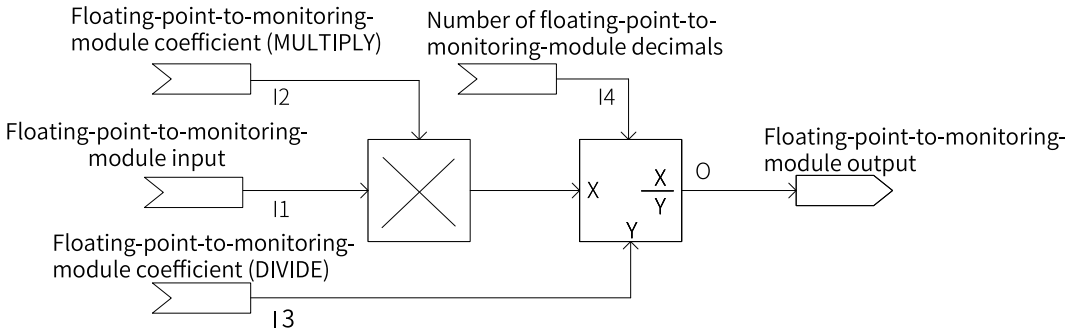


Figure 5-212 Diagram of floating-point connector-to-monitoring parameters

The input I1 of floating-point connector-to-monitoring parameter module is the raw value. Input I2 is the multiplier coefficient, and input I3 is the division coefficient. Final output O = input value (I1) * coefficient (I2) / coefficient (I3).

Input I4 is used to set the number of decimal places of the output value O. You can set the number of decimal places to 0-3. The meaning of the different decimal places is as follows:

(1) When there is no decimal place, the converted monitoring parameter displays the value of the floating-point connector value × 100.

(2) When there is one decimal place, the converted monitoring parameter displays the value of floating-point connector value × 100 × 10.

(3) When there are two decimal places, the converted monitoring parameter displays the value of floating-point value × 100 × 100.

(4) When there are three decimal places, the converted monitoring parameter displays the value of floating-point value × 100 × 1000.

For example, when the floating-point connector value is 40.0%, I2 and I3 are set to 1, and I4 is set to 1 decimal place, the converted monitoring parameter is 40.0% x 100 x 10 = 400.

Connection Parameter

MD630-INT has eight floating-point connector-to-monitoring parameter modules (A to H). The corresponding inputs and outputs of each module are as follows:

Parameter value source of input I1: Floating-point connector.

Parameter value source of input I2 and I3: 16-bit unsigned number (I3 cannot be 0).

Parameter value source of input I4: 0, 1, 2, and 3

The storage position of the output O: Group U3 monitoring parameters

The parameters corresponding to the input and output of the DW-W conversion module are shown in the following table.

Float-to-monitor	Input				Output
	I1	I2	I3	I4	O
A	o5-60	o5-62	o5-63	o5-61	U3-90
B	o5-64	o5-66	o5-67	o5-65	U3-91
C	o5-68	o5-70	o5-71	o5-69	U3-92
D	o5-72	o5-74	o5-75	o5-73	U3-93
E	o5-76	o5-78	o5-79	o5-77	U3-94
F	o5-80	o5-82	o5-83	o5-81	U3-95
G	o5-84	o5-86	o5-87	o5-85	U3-96
H	o5-88	o5-90	o5-91	o5-89	U3-97

Instances

When using HDI input, you can view the input value of the HDI curve in the monitoring parameter group through the floating-point connector-to-monitoring parameters module. The parameters to be set are described in the following table.

Param.	Name	Value Range	Description
o5-60	Floating-point connector-to-monitoring parameter module A input	L2250 (HDI input)	Sets the input value of the module to HDI input.
o5-61	Number of decimal places of floating-point concatenator-to-monitoring parameter module A	0 (No decimal digits)	Set to no decimal place
o5-62	Floating-point connector-to-monitoring parameter module A coefficient (multiply)	1	Sets the multiplier coefficient to 1.
o5-63	Floating-point concatenator-to-monitoring parameter module A coefficient (divide)	1	Sets the division coefficient to 1 during conversion
U3-90	Floating-point concatenator-to-monitoring parameter module A output	-	The monitoring parameter displayed in the U group after conversion

In this case, the value displayed by the monitoring parameter U3-90 is the result of the HDI input value of the floating-point connector × 100. For example, when the HDI value is 20.000%, U3-90 displays 20.

5.4.8.4 Logic Operation

5.4.8.4.1 Logic Operation

Description

This module enables simple logic operations, such as AND, OR, XOR, etc.

Applicable scenario

This module allows simple logic processing of data such as DI signals to enable multiple signal source combined-control of the same module.

5.4.8.4.2 Logic AND/Logic OR Module (A to H)

Function

You can select the logic AND/OR modules to implement logic AND, logic OR function. Up to four inputs can be processed logically. If the logic AND function is selected, the output is 1 when the input is all 1; otherwise the output is 0. If the logic OR function is selected, the output is 0 when the input is all 0; otherwise the output is 1.

Working principle

Logic AND/OR modules A to D support four input values, and Logic AND/OR modules E to H support three input values. This section describes logic AND/OR functions, using modules A to D as the example.

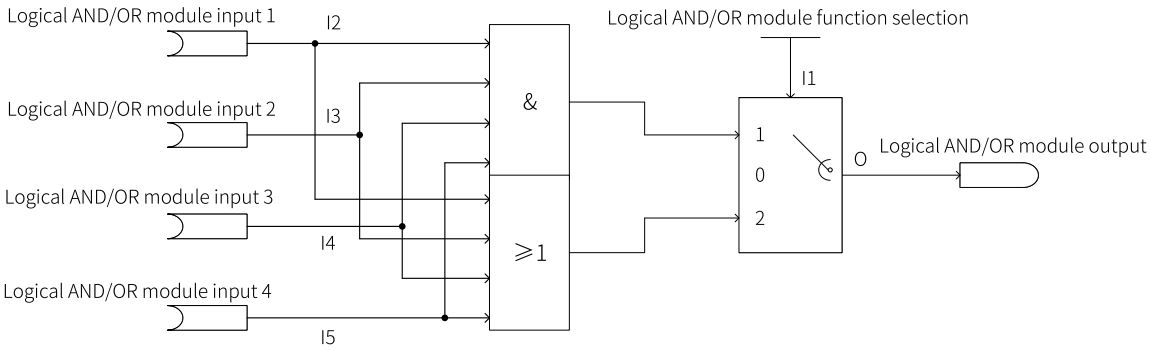


Figure 5-213 Logic AND/OR module

When I1 for enabling logic AND/OR module is set to 0, the module is inactive, and the output (O) is 0.

When I1 for enabling logic AND/OR module is set to 1, the logic AND module is valid and the output (O) is I2 & I3 & I4 & I5. Only when I2, I3, I4 and I5 values are 1, the output (O) is 1; otherwise, the output (O) is 0. The truth table is as follows.

Input				Output
I2	I3	I4	I5	O
0	X	X	X	0
X	0	X	X	0
X	X	0	X	0
X	X	X	0	0
1	1	1	1	1

When I1 for logic AND/OR module is set to 2, logic OR is valid and the output (O) is I2 | I3 | I4 | I5. Only when I2, I3, I4 and I5 values are 0, the output (O) is 0; otherwise, the output (O) is 1. The truth table is as follows.

Input				Output
I2	I3	I4	I5	O
1	X	X	X	1
X	1	X	X	1
X	X	1	X	1
X	X	X	1	1
0	0	0	0	0

Connection Parameter

MD630-INT has eight logic AND/OR modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I1: 0 (Disable); 1 (logic AND module); 2 (logic OR module)

Parameter value source of inputs I2, I3, I4, and I5: 0, 1, DI input, or bit connector input

The storage position of the output O: Bit connector.

The parameters corresponding to the input and output of the logic AND/OR module are shown in the following table.

Logic	Input					Output
AND/OR	I1	I2	I3	I4	I5	O
A	o6-00	o6-01	o6-02	o6-03	o6-04	L0376
B	o6-05	o6-06	o6-07	o6-08	o6-09	L0377
C	o6-10	o6-11	o6-12	o6-13	o6-14	L0378
D	o6-15	o6-16	o6-17	o6-18	o6-19	L0379
E	o6-20	o6-21	o6-22	o6-23	-	L0380
F	o6-24	o6-25	o6-26	o6-27	-	L0381
G	o6-28	o6-29	o6-30	o6-31	-	L0382
H	o6-32	o6-33	o6-34	o6-35	-	L0383

5.4.8.4.3 Logic NOT Module (A to H)

Function description

Logical NOT function can be implemented through this module. The output value is the inverted value of the input value.

Working principle

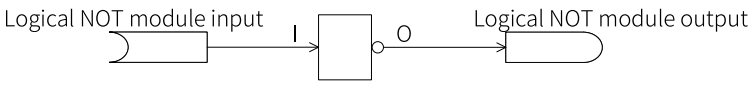


Figure 5-214 Logic NOT module

When the logic NOT module input I is 0 [Disable], the module is disabled and the output is 0.

When the logic NOT module input I is not 0, the output O is the inverted value of the input.

Input	Output
I	O
0	1
1	0

Connection parameters

MD630-INT has eight logic NOT modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter source of input I: 0 [Disable], DI input, bit connector.

The storage position of the output O: Bit connector.

The parameters corresponding to the input and output of the logic NOT module are shown in the following table.

Logic NOT module	Input	Output
	I	O
A	o6-80	L0384
B	o6-81	L0385
C	o6-82	L0386
D	o6-83	L0387
E	o6-84	L0388
F	o6-85	L0389
G	o6-86	L0390
H	o6-87	L0391

5.4.8.4.4 Logic XOR/XNOR Module (A to H)

Function description

You can select the logic XOR/XNO modules to implement logic XOR/XNO function. Up to two inputs can be processed logically. If the logic XOR function is selected, the output is 1 when the input1 is different with input 2, otherwise the output is 0. If the logic XNOR function is selected, the output is 1 when the input 1 is the same with input 2, otherwise the output is 0.

Working principle

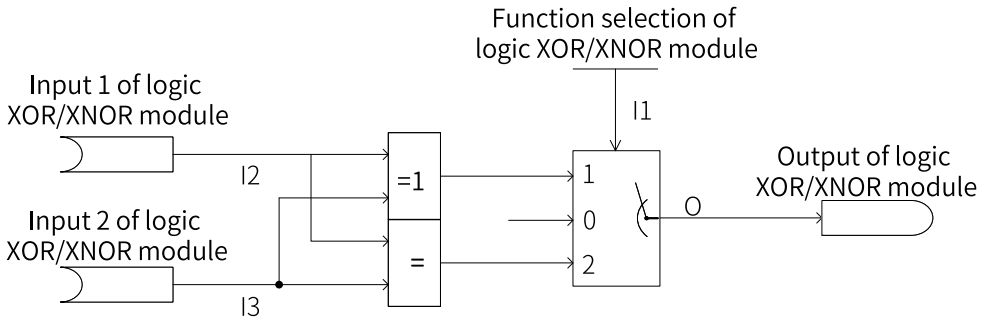


Figure 5-215 Logic XOR/XNOR module

When I1 for enabling logic XOR/XNOR module is set to 0, the module is inactive, and the output (O) is 0.

When I1 for enabling the logic XOR/XNOR module is set to 1, the logic XOR module is active. When I2 and I3 are the same, the output (O) is 0. When I2 and I3 are different, the output (O) is 1. The truth table is as follows.

Input		Output
I2	I3	O
0	0	0
1	0	1
0	1	1
1	1	0

When I1 for enabling the logic XOR/XNOR module is set to 2, the XNOR module is active. When I2 and I3 are the same, the output (O) is 1. When I2 and I3 are different, the output (O) is 0. The truth table is as follows.

Input		Output
I2	I3	O
0	0	1
1	0	0
0	1	0
1	1	1

Connection Parameter

MD630-INT has eight logic XOR/XNOR modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I1: 0 (Disable); 1 (logic XOR module); 2 (logic XNOR module)

Parameter value source of inputs I2 and I3: 0, 1, DI input, or bit connector.

The storage position of the output O: Bit connector.

The parameters corresponding to the input and output of the logic XOR/XNOR module are shown in the following table.

Logic XOR/ XNOR Module	Input			Output
	I1	I2	I3	O
A	o7-00	o7-01	o7-02	L0392
B	o7-03	o7-04	o7-05	L0393
C	o7-06	o7-07	o7-08	L0394
D	o7-09	o7-10	o7-11	L0395
E	o7-12	o7-13	o7-14	L0396
F	o7-15	o7-16	o7-17	L0397
G	o7-18	o7-19	o7-20	L0398
H	o7-21	o7-22	o7-23	L0399

5.4.8.5 Arithmetic Operation

5.4.8.5.1 Introduction to Arithmetic Operations

Function description

This module can perform simple operations on values, such as addition, subtraction, multiplication, division, comparison, absolute values, etc.

Applicable scenario

You can use this module to perform operation on the input value to obtain a value that meets the user's requirements.

5.4.8.5.2 Absolute Value Module (A to H)

Function description

The absolute value module is used to output the absolute value of an input value. The output is equal to the absolute value of the input.

Working principle

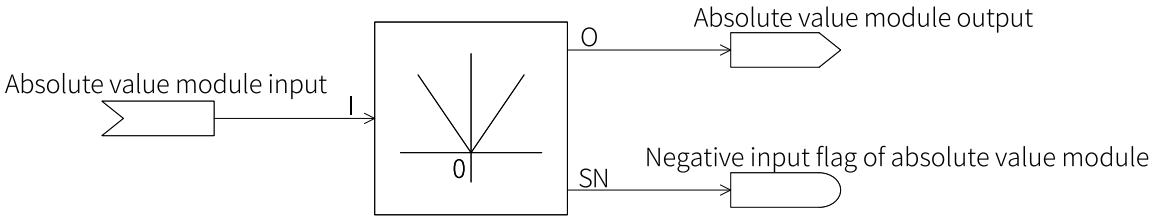


Figure 5-216 Absolute value module Diagram

The calculation formula for absolue value module as follows.

$$O = |I|$$

$$SN = \begin{cases} 1, & I < 0 \\ 0, & I \geqslant 0 \end{cases}$$

(1) When the absolute value module input I is selected as 0 [Disable], the module does not take effect, and the output is 0.

(2) When the absolute value module input I is not 0, the output O is equal to the absolute value of input I. When the input I is negative, the negative input flag SN is 1, otherwise it is 0.

Connection Parameter

MD630-INT has eight absolute value modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter source of input I: 0 [Disable], AI1, AI2, HDI, Multi-reference, simple PLC, PID, communication, and floating-point connector.

The storage position of output O: Floating-point connector.

The storage position of the output SN: Bit connector.

The parameters corresponding to the input and output of the absolute value module are shown in the following table.

Absolute value module	Input	Output	
	I	O	SN
A	o9-00	L2400	L0420
B	o9-01	L2402	L0421
C	o9-02	L2404	L0422
D	o9-03	L2406	L0423
E	o9-04	L2408	L0424
F	o9-05	L2410	L0425
G	o9-06	L2412	L0426
H	o9-07	L2414	L0427

5.4.8.5.3 Addition and Subtraction Module (A to H)

Function description

The addition and subtraction module is used to add and subtract input values. The addition and subtraction module has four sets of inputs. The first three inputs are summed, and the result is then subtracted from the fourth input to obtain the output value.

Working principle

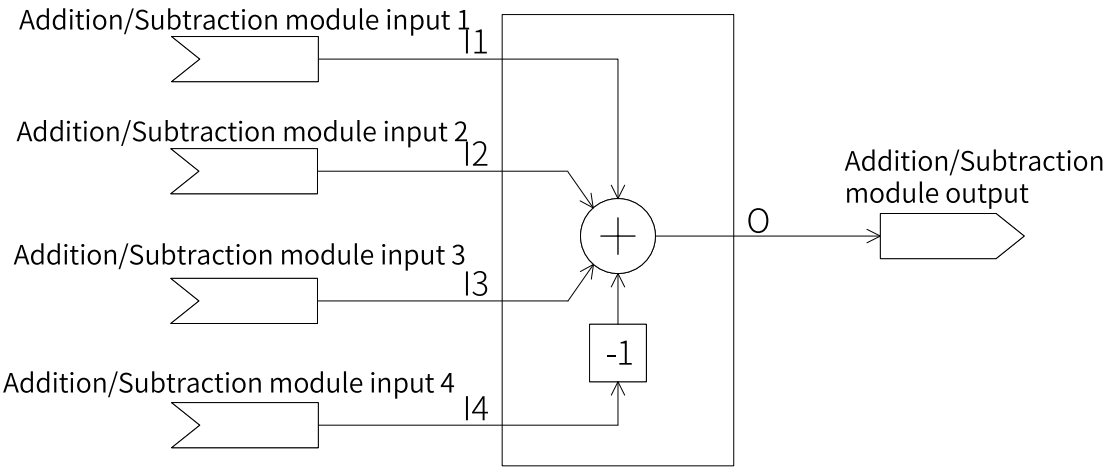


Figure 5-217 Diagram of the addition and subtraction module

The calculation formula for addition and subtraction module is as follows:

O=I1+I2+I3-I4

(1) When the addition and subtraction module input I is selected as 0 [Disable], the module does not take effect, and the output is 0.

(2) When the module input I1 is set to other values, the value of output O is input I1+I2+I3-I4.

Connection Parameter

MD630-INT has eight addition and subtraction modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter source of input I1: 0 [Disable], AI1, AI2, HDI, multi-reference, simple PLC, PID, communication, and floating-point connector.

Parameter source of input I2, I3, and I4: 0, AI1, AI2, HDI, multi-reference, simple PLC, PID, communication, and floating-point connector.

The storage position of output O: Floating-point connector.

The parameters corresponding to the input and output of the addition and subtraction module is shown in the following table.

Addition and subtraction module	Input				Output
	I1	I2	I3	I4	O
A	o8-00	o8-01	o8-02	o8-03	L2368
B	o8-04	o8-05	o8-06	o8-07	L2370
C	o8-08	o8-09	o8-10	o8-11	L2372
D	o8-12	o8-13	o8-14	o8-15	L2374
E	o8-16	o8-17	o8-18	o8-19	L2376
F	o8-20	o8-21	o8-22	o8-23	L2378
G	o8-24	o8-25	o8-26	o8-27	L2380
H	o8-28	o8-29	o8-30	o8-31	L2382

5.4.8.5.4 Multiplication and Division Module (A to H)

Function description

The multiplication and division module is used to multiply and divide the input value and output it. The multiplication/division module has three sets of inputs. Input 1 and input 2 are multiplied by each other, and the result is divided by input 3 to obtain the output value.

Working principle

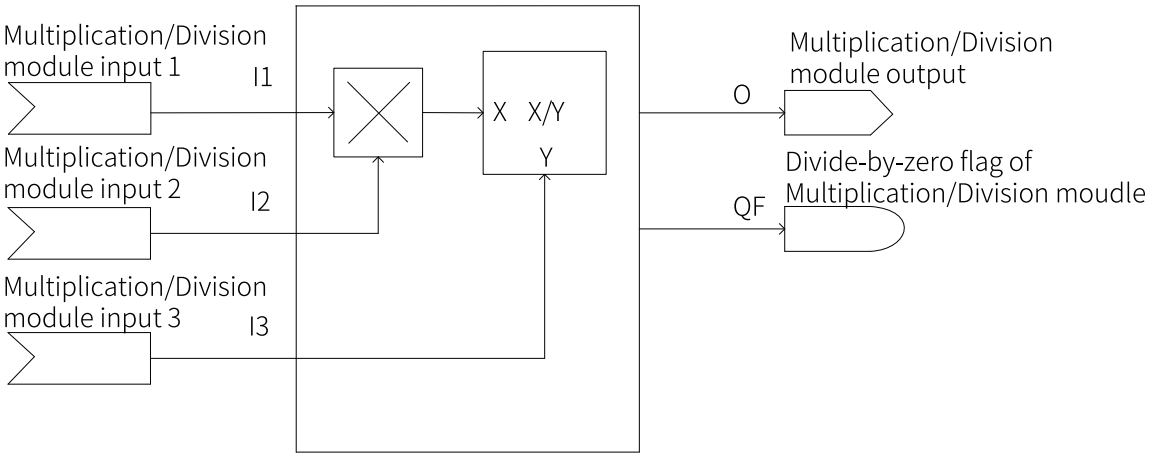


Figure 5-218 Diagram of the multiplication and division module

The multiplication and division module is calculated as follows:

$$\begin{cases} I1 \times I2, & I3 \text{ selection } 0 \text{ [value 1]} \\ \dfrac{I1 \times I2}{I3}, & I3 \neq 0 \\ 0, & I3 = 0 \end{cases}$$

$$QF = \begin{cases} 1, & I3 = 0 \\ 0, & I3 \neq 0 \end{cases}$$

(1) When the multiplication and division module input I is set to 0 [Disable], the module does not take effect, and the output is 0.

(2) When input I3 of the multiplication and division module selects 0 [value 1], output O is the product of input I1 and I2.

(3) When I3 is set to other options, if the input value I3 is 0, the output is 0 and the divisor is the zero flag bit QF which is 1; if the input value I3 is not 0, the output is the product of (I1 x I2)/I3, and the divisor is the zero flag bit QF which is 0.

Connection Parameter

MD630-INT has eight multiplication and division modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter source of input I1: 0 [Disable], AI1, AI2, HDI, Multi-reference, simple PLC, PID, communication, and floating-point connector.

Parameter source of input I2 and I3: 0 [Value 1], AI1, AI2, HDI, Multi-reference, simple PLC, PID, communication, and floating-point connector.

The storage position of output O: Floating-point connector.

The parameters corresponding to the input and output of the multiplication and division module is shown in the following table.

Multiplication and division module	Input			Output	
	I1	I2	I3	O	QF
A	o8-48	o8-49	o8-50	L2384	L0412
B	o8-51	o8-52	o8-53	L2386	L0413
C	o8-54	o8-55	o8-56	L2388	L0414
D	o8-57	o8-58	o8-59	L2390	L0415
E	o8-60	o8-61	o8-62	L2392	L0416
F	o8-63	o8-64	o8-65	L2394	L0417
G	o8-66	o8-67	o8-68	L2396	L0418
H	o8-69	o8-70	o8-71	L2398	L0419

5.4.8.5.5 Comparison Module (A to H)

Function description

You can select parameters through the comparison module and set the comparison mode of the input. Three modes are available, including input 1> input 2, input 1 = input 2, and input 1 < input 2. The comparison module compares input 1 and input 2 according to the set mode. When the comparison conditions are met, the output is 1; otherwise the output is 0.

Working principle

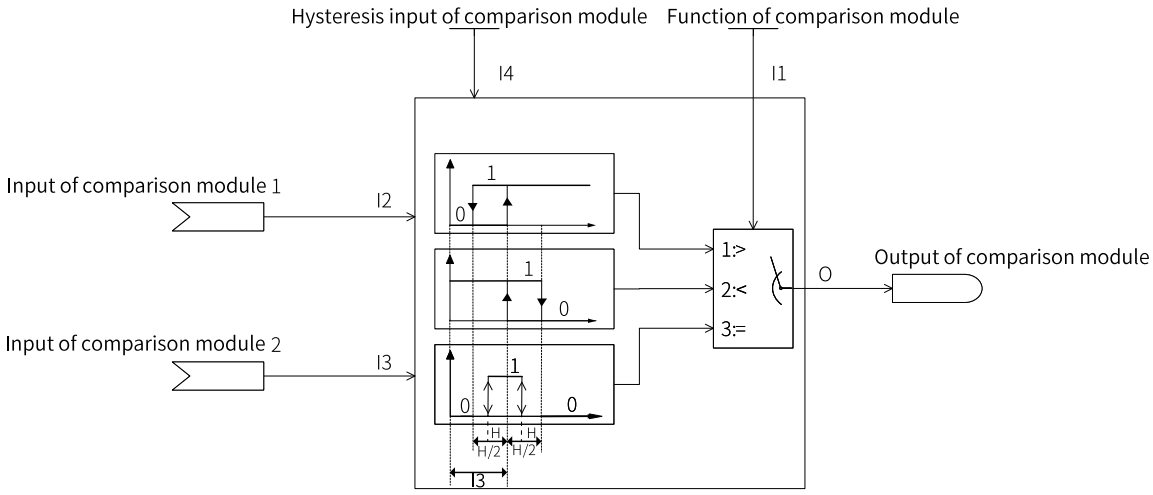


Figure 5-219 Diagram of the comparison module

(1) When the comparison module function selection I1 is set to 0 [Disable], the module is inactive and the output is 0.

(2) When l1 (comparison module function) is set to 1 (input 1> input 2), before I2 increases from 0 to I3 in the forward direction, the output O keeps low level. When I2 increases to a value higher than I3, the output O changes from low level to high level. When I2 keeps increasing, the output O keeps high level. If I2 decreases but remains ≥ I3 - l4, the output O keeps high level. Only when I2 is lower than I3 - l4, the output O changes from high level to low level.

(3) When l1 (comparison module function) is set to 2 (input 1 < input 2.), before I2 increases from 0 to I3+I4 in the forward direction, the output O keeps high level. When I2 increases to a value higher than I3+I4, the output O changes from high level to low level. When I2 keeps increasing, the output O keeps low level. If I2 decreases but remains ≥ I3, the output O keeps low level. Only when I2 is lower than I3, the output O changes from low level to high level.

(4) When l1 (comparison module function) is set to 3 (input 1 = input 2), the output keeps high level if I2 is within the range of I3-I4/2 to I3+I4/2; otherwise, the output is low level.

Connection Parameter

MD630-INT has eight comparison modules (A to H). The corresponding inputs and outputs of each module are as follows.

Parameter source of input I1: 0 (Disable);1: Input 1 > Input 2; 2: Input 1 < Input 2; 3: Input 1 = Input 2

Parameter source of input I2 and I3: 0, AI1, AI2, HDI, multi-reference, simple PLC, PID, communication, and floating-point connector.

Parameter source of I4: Floating point number with two decimal places

The storage position of output O: Floating-point connector.

The parameters corresponding to the input and output of the comparison module is shown in the following table.

Comparison module	Input				Output
	I1	I2	I3	I4	O
A	o9-16	o9-17	o9-18	o9-19	L0400
B	o9-20	o9-21	o9-22	o9-23	L0401
C	o9-24	o9-25	o9-26	o9-27	L0402
D	o9-28	o9-29	o9-30	o9-31	L0403
E	o9-32	o9-33	o9-34	o9-35	L0404
F	o9-36	o9-37	o9-38	o9-39	L0405
G	o9-40	o9-41	o9-42	o9-43	L0406
H	o9-44	o9-45	o9-46	o9-47	L0407

5.4.8.6 Switch Selection

5.4.8.6.1 Switch Selection

Description

Select the signal through the module input to decide control output is equal to input 1 or input 2. When the input selection signal is 0, the output is equal to input 1. When the input selection signal is 1, the output is equal to input 2.

Applicable scenario

This module allows parameter setting value to be changed accordingly when the control conditions are changed.

5.4.8.6.2 Binary Selector Module (A to H)

Description

The binary selector module has two binary inputs. The input is used to determine whether the output is equal to input 1 or input 2. When the input selection signal is 0, the output is equal to input 1. When the input selection signal is 1, the output is equal to input 2.

Operation principles

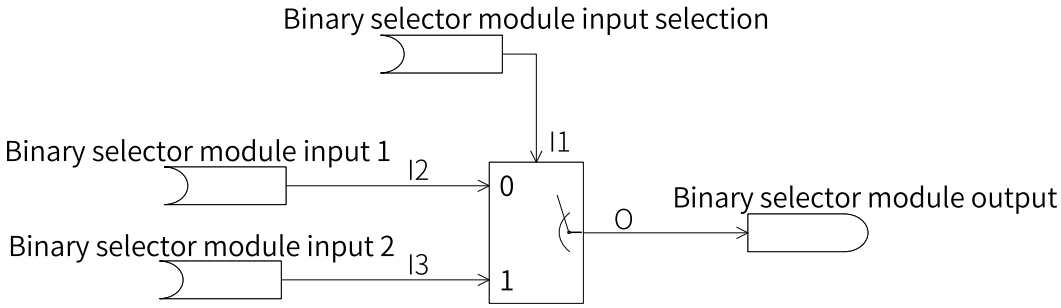


Figure 5-220 Diagram of the binary selector

When input I1 of the binary selector module is set to 0 (invalid), the module is inactive and the output is 0.

When input I1 of the binary selector module is set to a non-zero value and I1 input is 0, the output O equals input I2 of the module; when I1 input is 1, the output O equals input I3 of the module.

Connection parameters

The input and output of binary selector modules (A to H) are as follows:

Input I1 parameter value source: 0 (invalid), DI input, bit connector.

Source of parameter value of input I2, I3: Logic 0, logic 1, DI input, Bit connector.

Output (O): Bit connector

The following table lists the parameters corresponding to input and output of the binary selector module.

Binary Selector Module	Input			Output
	I1	I2	I3	O
A	OA-00	OA-01	OA-02	L0368
B	OA-03	OA-04	OA-05	L0369
C	OA-06	OA-07	OA-08	L0370
D	OA-09	OA-10	OA-11	L0371
E	OA-12	OA-13	OA-14	L0372
F	OA-15	OA-16	OA-17	L0373
G	OA-18	OA-19	OA-20	L0374
H	OA-21	OA-22	OA-23	L0375

Note: Connector L1234 is used to display the selection results of each binary selector module.

Param.	Name	Default	Value Range	Descriptions
L1234	Input selection state of binary selector module	-	/	Displays the input selection state for binary selector module. Bit0 to bit7 indicate the selection result of binary selector module A to H. Bit value 0 indicates input 1 and bit value 1 indicates input 2.

5.4.8.6.3 Digital Selector Module (A to H)

Description

The digital selector module has two floating-point inputs. The input determines whether the output is equal to input 1 or input 2. When the input selection signal is 0, the output is equal to input 1. When the input selection signal is 1, the output is equal to input 2.

Operation principles

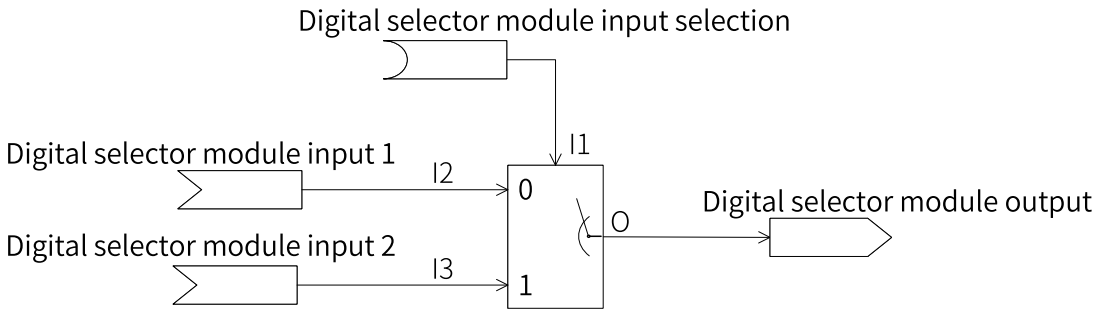


Figure 5-221 Digital selector module

When input I1 of the digital selector module is set to 0 (invalid), the module is inactive and the output is 0.

Input I1 of the digital selector module Select other options. When I1 is entered as 0, the output O is equal to the input I2 of the module. When I1 is entered as 1, the output O is equal to the input I3 of the module.

Connection Parameter

The input and output of the digital selector module (A to H) are as follows:

Input I1 parameter value source: 0 (invalid), DI input, bit connector.

Input I2 and I3 parameter value source: 0, AI1, AI2, HDI, multi-segment value, simple PLC, PID, Communication reference, floating-point connector

Output O: Floating point connector

The following table lists the function codes corresponding to the input and output of the digital selector module.

Digital selector module	Input			Output
	I1	I2	I3	O
A	OA-24	OA-25	OA-26	L2416
B	OA-27	OA-28	OA-29	L2418
C	OA-30	OA-31	OA-32	L2420
D	OA-33	OA-34	OA-35	L2422
E	OA-36	OA-37	OA-38	L2424
F	OA-39	OA-40	OA-41	L2426
G	OA-42	OA-43	OA-44	L2428
H	OA-45	OA-46	OA-47	L2430

Note: Connector L1235 is used to display the selection results of each digital selector module.

Item	Name	Default	Value Range	Descriptions
L1235	Input selection state for digital selector module	-	/	Displays the input selection state for digital selector module. Bit0 to bit7 indicate the selection result of digital selector module A to H. Bit 0 indicates input 1. Bit 1 indicates input 2.

5.4.8.7 Control Function

5.4.8.7.1 Introduction to Control Function

Function description

The input signal can be processed through this module to eliminate signal error.

Applicable scenario

This module is generally used to filter and limit signals such as level and frequency to eliminate signal errors.

5.4.8.7.2 Filter Module (A to D)

Description

The filter module filters the input signal to obtain the output value, which can effectively eliminate the signal error. You can also set the filter time. The longer the filter time, the better the effect, but the output signal lags behind the input signal.

Operation principles

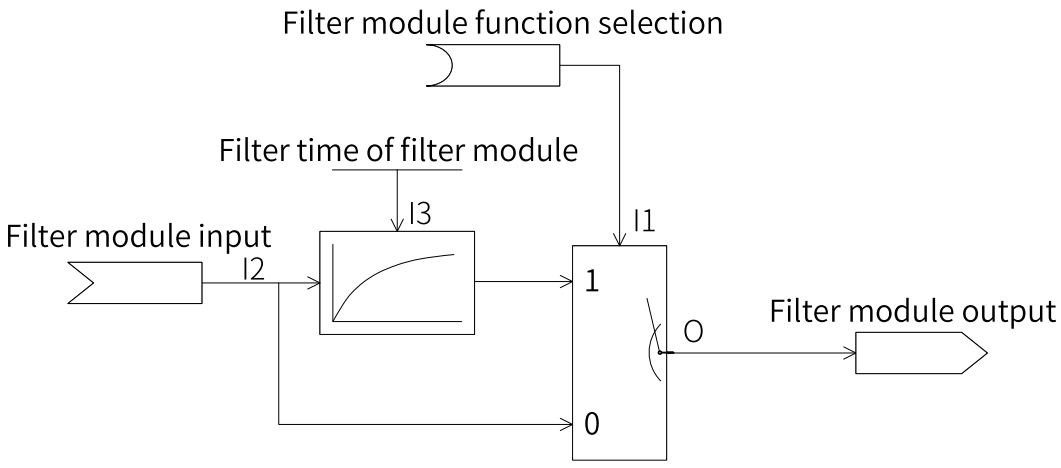


Figure 5-222 Figure 3 Installing the filter module

Connection Parameter

The input and output of the filter module (A to D) are as follows:

Input I1 parameter value source: 0 [invalid], 1 [active], DI input, bit connector.

Input I2 parameter value source: 0, AI1, AI2, HDI, Multi-segment value, simple PLC, PID, communication setting, Floating point connector

Input I3: Floating point number with two decimal places

Output O: Floating point connector

The following table lists the function codes corresponding to input and output of the filter module.

Filter module	Input			Output
	I1	I2	I3	O
A	B-00	OB-01	OB-02	L2440
B	OB-03	OB-04	OB-05	L2442
C	OB-06	Ob-07	OB-08	L2444
D	OB-09	OB-10	B-11	L2446

5.4.8.7.3 Level-Pulse Conversion Module (A to D)

Description

The level-pulse conversion module enables the mutual conversion of the level signal and pulse signal. When the function of the level-pulse conversion module is set to 1, the module is used to convert level signals to pulse signals. When the function of the level-pulse conversion module is set to 2, the module is used to convert the pulse signals to level signals.

Operation principles

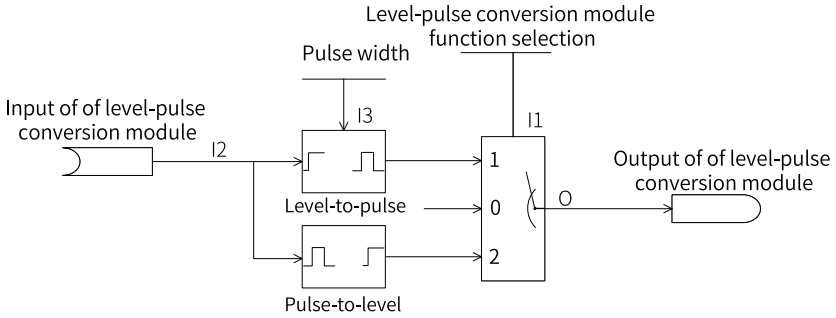
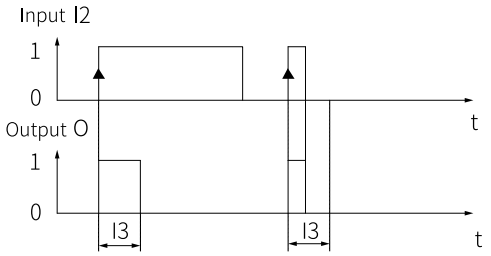


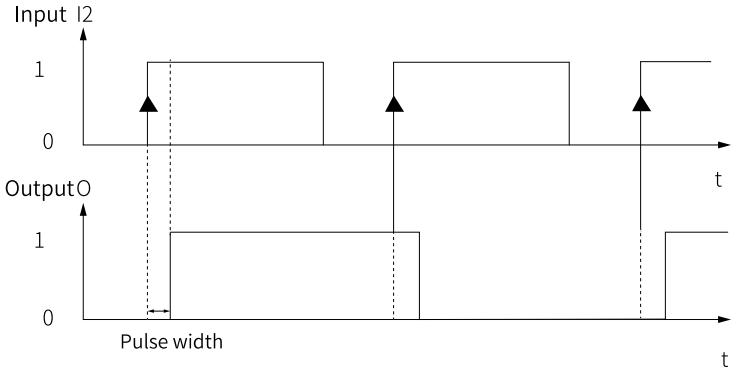
Figure 5-223 Level-pulse conversion module

(1) When I1 is set to 0 (Module disabled), the module is inactive and the output is 0.

(2) When I1 is set to 1, level-to-pulse conversion is valid, and the output is set to 1 within the pulse time l3 on the rising edge of input l2. If input I2 is 0, the output is 0 immediately regardless of whether the pulse duration is reached.



(3) When I1 is set to 2, pulse-to-level conversion is valid. The output is set to 1 after input I2 keeps the pulse width for I3 time at the first rising edge and set to 0 after input I2 keeps the pulse width for I3 time at the second rising edge. After that, the output is set to 1 at each odd rising edge and set to 0 at each even rising edge.



Connection Parameter

The corresponding inputs and outputs of the level pulse conversion modules (A to D) are as follows:

Input I1: 0: Module disabled; 1: Level-to-pulse conversion; 2: Pulse-to-level conversion

Input I2: 0, 1, DI input, and bit connector input

Input I3: Floating point number with two decimal places

Output (O): Bit connector

The following table lists the parameters corresponding to the input and output of the level-pulse conversion module.

Level-pulse conversion module	Input			Output
	I1	I2	I3	O
A	ob-24	ob-25	ob-26	L0408
B	ob-27	ob-28	ob-29	L0409
C	ob-30	ob-31	ob-32	L0410
D	ob-33	ob-34	ob-35	L0411

5.4.8.7.4 Limiting Module (A to D)

Function description

The limiting module is used to set the upper and lower limit of the input signal. When the input is within the limit range, the output equals the input. When the input exceeds the upper limit, the

output equals the upper limit. When the input is below the lower limit, the output equals the lower limit.

Operation principles

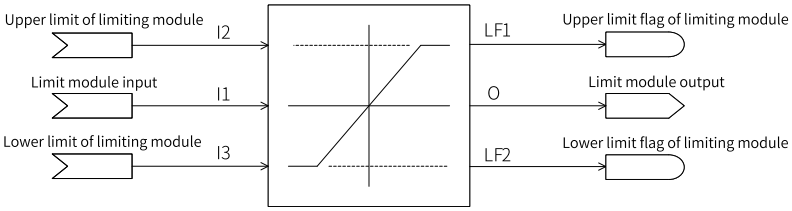


Figure 5-224 Diagram of the limiting module

(1) When input I1 of the limiting module is set to 0 (Disable), the module is inactive and the output is 0.

(2) When the input I1 of the limiting module is larger than the upper limit I2, the output O is equal to the input I2 and the upper limit flag LF1 is set to 1.

(3) When input I1 is smaller than the lower limit I3, the output O is equal to the input I3 and the lower limit flag LF2 is set to 1.

(4) When input I1 is within the upper and lower limits, the output O equals the input value I1.

Connection parameter

The corresponding inputs and outputs of the limit modules (A to D) are as follows:

Input I1 parameter value source: 0 (disabled), AI1, AI2, HDI, multi-reference, simple PLC, PID, communication setting, Floating point connector

Input I2 parameter value source: 0 (upper limit invalid), AI1, AI2, HDI, multi-reference, simple PLC, PID, communication setting, Floating point connector

Input I3 parameter value source: 0 (lower limit invalid), AI1, AI2, HDI, multi-reference, simple PLC, PID, communication setting, Floating point connector

The storage position of output O is the floating-point connector.

The storage position of the output LF1 and LF2 is bit connector.

The following table lists the parameters corresponding to input and output of the limiting module.

Limiting Module	Input			Output		
	I1	I2	I3	O	LF1	LF2
A	oC-00	oC-01	oC-02	L2432	L0429	L0428
B	oC-03	oC-04	oC-05	L2434	L0431	L0430
C	oC-06	oC-07	oC-08	L2436	L0433	L0432
D	oC-09	oC-10	oC-11	L2438	L0435	L0434

5.4.8.7.5 Logic Delay Module (A to H)

Function description

The logic delay module is used to delay input signals. After the switch-on delay function is enabled, the output signal changes from 0 to 1. After the switch-off delay function is enabled, the input signal changes from 1 to 0. The output signal changes at a delay.

Operation principles

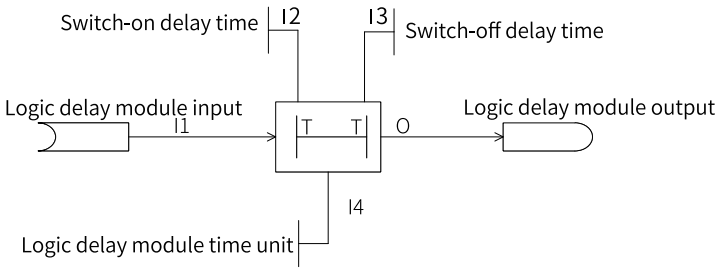
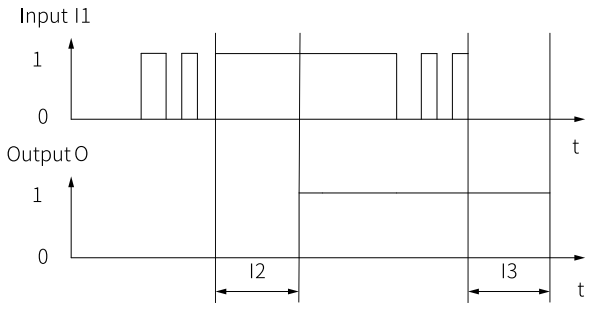


Figure 5-225 Logic delay module diagram

When input I1 of the logic delay module is set to 0 (Disable), the module is inactive and the output is 0.

When input I1 of the logic delay module is set to other values, the output O performs switch-on delay when input I1 changes from low level to high level. The delay time depends on the switch-on delay time set by I2 and the time unit is selected by I4. The output O also performs switch-off delay when input I1 changes from high level to low level. The delay time depends on the switch-off delay time set by I3 and the time unit is selected by I4.

Pulse signals shorter than the set delay time are also filtered when the delay is active, as shown in the following figure.



Connection parameter

The corresponding input and output of logic delay modules (A to H) are as follows:

Input I1 parameter value source: 0 (disabled), DI input, bit connector.

Input I2 and I3 parameter value source: Unsigned number.

Input I4 parameter value source: 0 (no delay), 1 (10 ms), 2 (100 ms), 3 (1s), 4 (10s), 5 (1 min), 6 (2 min).

Storage position of output O: Bit connector

The following table lists the parameters corresponding to the input and output of the logic delay module.

Logic delay module	Input				Output
	I1	I2	I3	I4	O
A	oC-28	oC-29	oC-30	oC-31	L0456
B	oC-32	oC-33	oC-34	oC-35	L0457
C	oC-36	oC-37	oC-38	oC-39	L0458
D	oC-40	oC-41	oC-42	oC-43	L0459
E	oC-44	oC-45	oC-46	oC-47	L0460
F	oC-48	oC-49	oC-50	oC-51	L0461
G	oC-52	oC-53	oC-54	oC-55	L0462
H	oC-56	oC-57	oC-58	oC-59	L0463

5.4.8.8 Multi-point Curve (A and B)

Description

The multi-point curve module can define up to ten curve points, which describes the relationship between input and output by segment. After setting the multi-point curve, set the input value of the module. The output value corresponding to the input value will be calculated based on the curve relation.

Applicable scenario

When the change relationship between input and output is complex, the corresponding change between input and output can be achieved through multi-point curves.

Operation principles

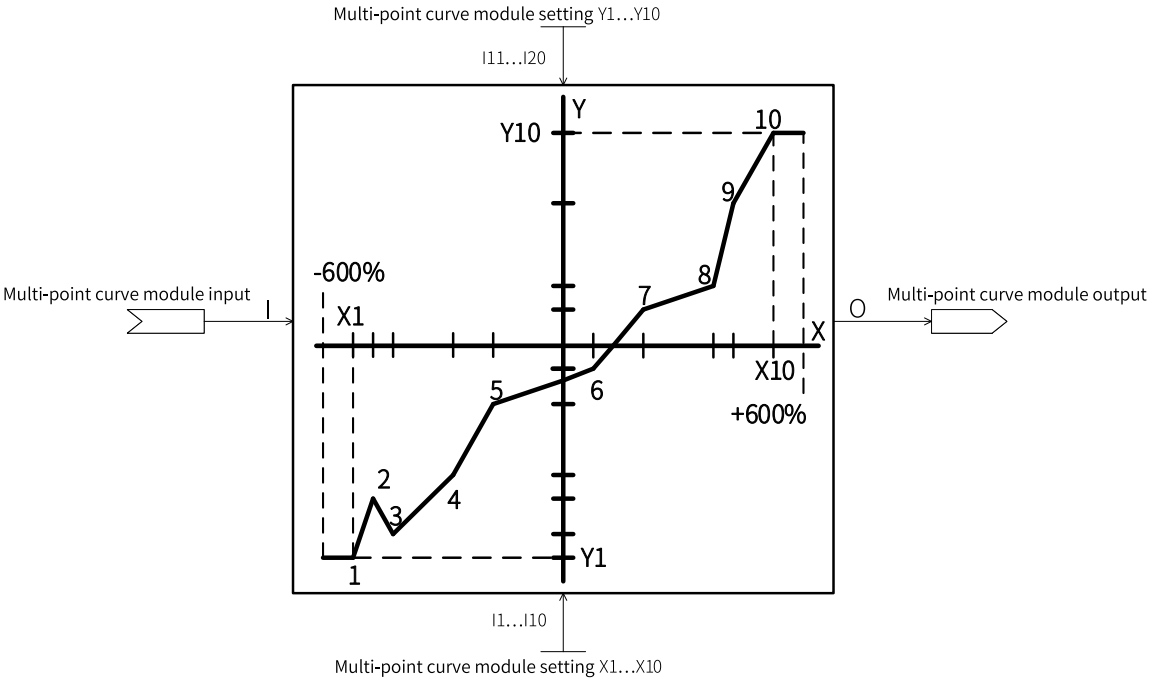


Figure 5-226 HDI four-point curve

The coordinate is valid only when X1 ≤ X2 ≤⋯≤ X10 is satisfied. When the input is outside the active coordinate point, the output is equal to the ordinate value of adjacent valid coordinate point. When the input is within the valid coordinate point, the corresponding ordinate value is calculated based on the curve.

Assume that the coordinate is valid and number of coordinates inputted is lower than 10. If the last abscissa inputted is negative, the abscissa and the following abscissa whose value is 0 are kept, and the subsequent coordinate values are discarded. If the last abscissa inputted is positive, the abscissa is kept, and the subsequent coordinate values are discarded.

When the multi-point curve horizontal coordinate does not meet the setting of X1 ≤ X2 ≤ · · · ≤ X10, U6-74 (Multi-point curve setting error flag) is set to 1, indicating that the curve is set incorrectly.

Connection Parameter

The input and output of multi-point curves (A to B) are as follows:

Input I parameter value source: 0 [Module not enabled], floating-point connector.

The parameter values of the coordinate settings X1 to X10 and Y1 to Y10 are derived from one decimal floating-point number.

Output O: Floating point connector

The following table lists the parameters corresponding to the input and output of the multi-point curve module.

Multi-point block		A	B
Input	I	o2-00	o2-21
	I1 (X1)	o2-01	o2-22
	I2 (X2)	o2-02	o2-23
	I3 (X3)	o2-03	o2-24
	I4 (X5)	o2-04	o2-25
	I5 (X5)	o2-05	o2-26
	I6 (X6)	o2-06	o2-27
	I7 (X7)	o2-07	o2-28
	I8 (X8)	o2-08	o2-29
	I9 (X9)	o2-09	o2-30
	I10 (X10)	o2-10	o2-31
	I11 (Y1)	o2-11	o2-32
	I12 (Y2)	o2-12	o2-33
	I13 (Y3)	o2-13	o2-34
	I14 (Y5)	o2-14	o2-35
	I15 (Y5)	o2-15	o2-36
	I16 (Y6)	o2-16	o2-37
	I17 (Y7)	o2-17	o2-38
	I18 (Y8)	o2-18	o2-39
	I19 (Y9)	o2-19	o2-40
	I20 (Y10)	o2-20	o2-41
Output	O	L2448	L2450
	U6-74	U6-74_bit0	U6-74_bit1

Instances

You need to adjust the frequency based on AI input, but the relationship is complicated and the AI curve cannot meet the requirement. In this case, you can set the frequency through the multi-point curve module. For example, the AI input and frequency setting meet the following correspondence:

(1) When the AI input is 0, the frequency is set to 10%.

(2) When the AI input is 30%, the frequency is set to 25%.

(3) When the AI input is 50%, the frequency is set to 60%.

(4) When the AI input is 70%, the frequency is set to 85%.

(5) When the AI input is 100%, the frequency is set to 100%.

In this case, you can set the multi-point curve parameters as follows to set the relationship between AI and frequency. Set F0-29 (Main frequency source) to L2448 (Multi-point curve A output) to modify the frequency setting through the multi-point curve.

Item	Name	Value range:	Description
o2-00	Input of multi-point curve module A	L2244 [AI1 input value]	Multi-point curve input is set to AI1
o2-01	Setpoint X1 of multi-point curve module A	0.0%	Defines the horizontal coordinate of the first point of the multi-point curve
o2-02	Setpoint X2 of multi-point curve module A	30.0%	Defines the horizontal coordinate of the second point of the multi-point curve
o2-03	Setpoint X3 of multi-point curve module A	50.0%	Defines the horizontal coordinate of the third point of the multi-point curve
o2-04	Setpoint X4 of multi-point curve module A	70.0%	Defines the horizontal coordinate of the fourth point of the multi-point curve
o2-05	Setpoint X5 of multi-point curve module A	100.0%	Defines the horizontal coordinate of the fifth point of the multi-point curve
o2-11	Setpoint Y1 of multi-point curve module A	10.0%	Defines the vertical coordinate of the first point of the multi-point curve
o2-12	Setpoint Y2 of multi-point curve module A	25.0%	Defines the vertical coordinate of the second point of the multi-point curve
o2-13	Setpoint Y3 of multi-point curve module A	60.0%	Defines the vertical coordinate of the third point of the multi-point curve

Item	Name	Value range:	Description
o2-14	Setpoint Y4 of multi-point curve module A	85.0%	Defines the vertical coordinate of the fourth point of the multi-point curve
o2-15	Setpoint Y5 of multi-point curve module A	100.0%	Defines the vertical coordinate of the fifth point of the multi-point curve
F0-29	Main frequency source	L2448 [Multi-point curve A output]	The main frequency source is set to multi-point curve A output

When AI1 input is 30.0%, the output of the multi-point curve module is 25.000% and the frequency setting is 25%.

When AI1 input is 40.0%, this value lies between the X2 and X3 of the x-coordinates on the multi-point curve, and the multi-point curve output is calculated based on the linear relationship between the second and third points. The output is (Y3-Y2) ÷ (X3-X2) x (40.0%-X2) + Y2 = 42.5%, that is, the frequency setpoint is 42.5%.

5.4.8.9 Constant Value

Function description

The output value of the constant value module always equals the input value.

Applicable scenario

To select a fixed value as the input source, you can set the value through the constant value module, and set the input source to output from the constant value module.

Working principle

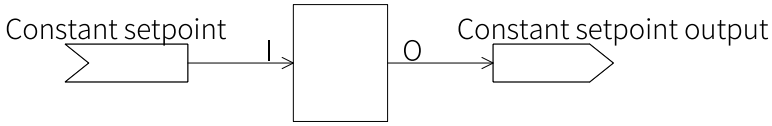


Figure 5-227 Diagram of constant value module

The output O of the constant value module equals the set value I. There are two constant value settings:

(1) Floating-point with one decimal place number, ranging from -3000.0 to 3000.0%.

(2) Signed number, ranging from -32768 to 32767.

Connection Parameter

MD630-INT has sixteen constant value modules. The corresponding inputs and outputs of each module are as follows.

Parameter value source of input I: Floating-point number or signed number.

The storage position of output O: Word connector and floating-point connector

The parameters corresponding to the input and output of the constant value module are shown in the following table.

Constant value setting module	Input	Output
	I	O
Floating point 1	o1-00	L2352
Floating point 2	o1-01	L2354
Floating point 3	o1-02	L2356
Floating point 4	o1-03	L2358
Floating point 5	o1-04	L2360
Floating point 6	o1-05	L2362
Floating point 7	o1-06	L2364
Floating point 8	o1-07	L2366
Single-word 1	o1-08	L1200
Single-word 2	o1-09	L1201
Single-word 3	o1-10	L1202
Single-word 4	o1-11	L1203
Single-word 5	o1-12	L1204
Single-word 6	o1-13	L1205
Single-word 7	o1-14	L1206
Single-word 8	o1-15	L1207

5.4.9 Fire Mode

5.4.9.1 Fire Mode

Scenarios

In case of emergency situations such as a fire, the MD630-INT AC drive can enter fire mode. In this mode, the AC drive will ignore some non-critical faults and continue to operate to ensure the safe evacuation of personnel and timely response to fire fighting efforts in buildings, elevators, tunnels, etc. Additionally, fire mode supports bypass operation, allowing the motor to run directly from the power grid. The logical conditions for fire mode can be set through group J6 parameters.

Note

When operating in the fire mode, the AC drive is in an extremely abnormal operating environment, and may be damaged. Damage in this case may not be included in the warranty.

Function description

You can set the function status of the fire mode through parameter J6-02 [Fire mode enable].

- J6-02 = 1 [Enable]: The fire mode is activated according to the input signal of J6-03 [Fire mode operation source]. Once the fire mode is activated, the AC drive will operate in abnormal extreme conditions, which may affect the product warranty.

- J6-02=2 [Fire mode test]: Meet the testing requirements. When set to 2 [Fire mode test], the AC drive will still enter the fire mode activation state based on the input signal of J6-03, but it differs from option 1 [Enable] in that: Test mode is only used for a one-time test, and during the test, the input signal of J6-03 will no longer take effect. Furthermore, if the AC drive is powered on with J6-02 set to 2 [Fire mode test], the system will automatically force J6-02 to 0 [Disable].
  Test mode is only used for fire mode function verification after factory shipment. The use of this mode is recorded and recognized by the system, but it does not affect the AC drive's warranty.



If the test mode is selected during use, the fire mode may not be activated in critical situations.

Related parameters

Param.	Name	Default	Value Range	Description
J6-02	Fire mode enable	0	0: Disable fire mode 1: Enable fire mode 2: Fire mode test	Set whether to enable the fire mode. **Value description:** 0: Disable 1: Enable 2: Fire mode test: Use this mode for the fire mode testing after factory release. Otherwise, the AC drive will consider a real fire has occurred, affecting warranty. Note: Do not select this mode for actual use, as the fire mode may not be activated.
J6-03	Fire mode operation source	0	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 Others: B connector	When the fire mode enable is enabled, the active source can activate the fire mode. When the AC drive is running in the fire mode, this source can deactivate the fire mode if it becomes invalid.

5.4.9.2 Operating Frequency and Direction

Description

The frequency source in fire mode is set through the following independent channels.

1. Main frequency source (set by J6-11 [Frequency source in fire mode]): digital reference (set through J6-13), pre-operational frequency, AI input, PID, or communication

2. Backup frequency source (set by J6-12 [Backup frequency source in fire mode]): digital reference, pre-operational frequency, or maximum operating frequency (converted based on per-unit value defined by C4-10).

You can select the main/backup frequency source according to actual scenarios.

Working principles

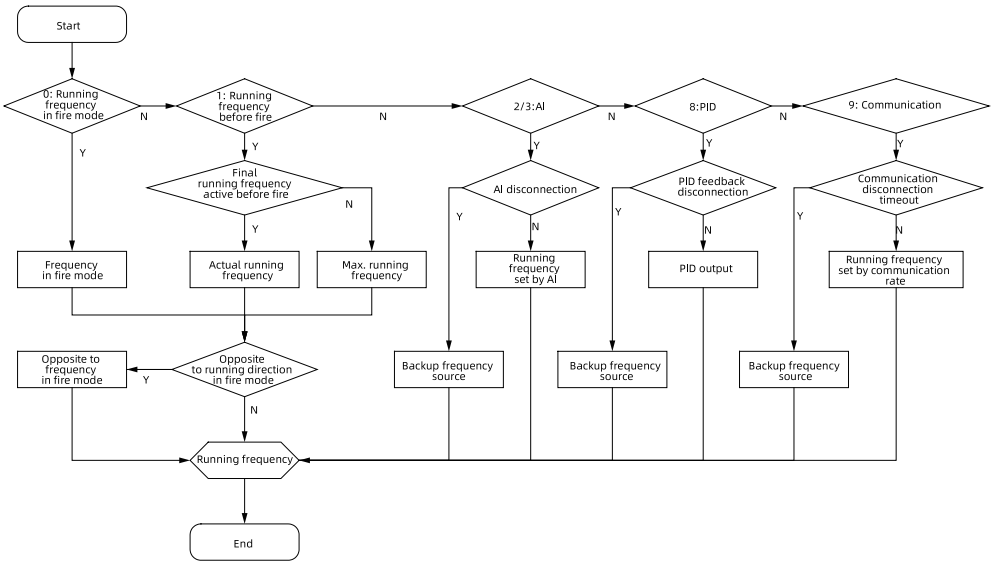


Figure 5-228 Main frequency source flowchart

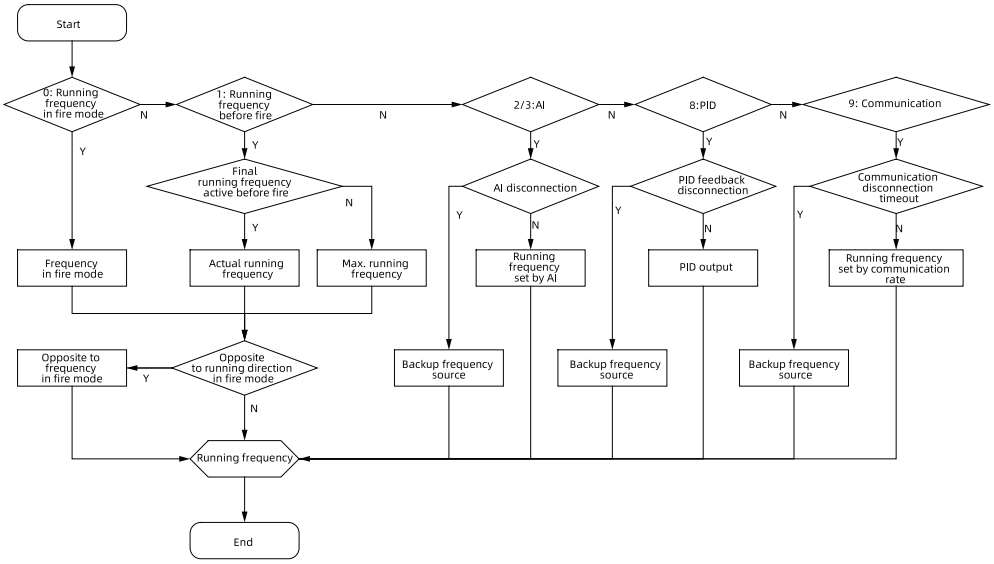


Figure 5-229 Backup frequency source flowchart

J6-12 [Backup frequency source in fire mode] serves as a supplement to J6-11 [Frequency source in fire mode]. Observe the following rules when setting the frequency source.

1. **Normal condition**: The frequency source set by J6-11 [Frequency source in fire mode] is preferred.
2. **Switchover upon fault**: The drive automatically switches to the frequency source defined by J6-12 [Backup frequency source in fire mode] when any of the following conditions is met:

- J6-11 [Frequency source in fire mode] is set to AI1 or AI2, AI1 or AI2 open-circuit detection is enabled, and an open circuit occurs in AI1 or AI2.
- J6-11 [Frequency source in fire mode] is set to PID, PID feedback loss detection is enabled, and PID feedback is lost.
- J6-11 [Frequency source in fire mode] is set to communication, and the communication cable is disconnected.

3. **Special scenario**: When J6-11 is set to 1 [Filtered frequency value before fire], the drive operates at the maximum frequency in fire mode under the following conditions:

- The drive is in the stopped state when the fire occurs.
- The operating time of the drive has not exceeded J6-17 [Active time threshold], which means the operating frequency has not stabilized.
- The drive is in the decelerate-to-stop state when the fire occurs.

Note

1. The frequency setting in the fire mode is determined by the motor maximum frequency, digital setting of forward upper frequency 1, digital setting of reverse upper frequency 1, forward upper frequency 2 selection, and reverse upper frequency 2 selection in the motor parameter group.
2. The operating frequency in the fire mode is not affected by H1-60 (restricted speed mode), H1-61 (safe operating frequency), H1-62 (maximum forward frequency limit), and H1-63 (maximum negative frequency limit).

Related parameters

Param.	Name	Default	Range	Description
J6-06	Operating direction in fire mode	0	0: Default direction 1: Direction opposite to the default direction	Defines the operating direction in fire mode. 0: Default direction 1: Direction opposite to the default direction **Note:** This parameter is active only when J6-11 is set to 0 or 1.
J6-07	Acceleration time in fire mode	20.0	0 to 6500.0	Defines the acceleration time in fire mode. **Note:** This parameter is active only when fire mode is activated, and the acceleration and deceleration time set through other channels are inactive.
J6-08	Deceleration time in fire mode	20.0	0 to 6500.0	Defines the deceleration time in fire mode. **Note:** This parameter is active only when fire mode is activated, and the acceleration and deceleration time set through other channels are inactive.

Param.	Name	Default	Range	Description
J6-11	Frequency source in fire mode	0	0: Digital frequency reference in fire mode 1: Filtered frequency value before fire mode applied 2: AI1 3: AI2 8: PID 9: Communication	Defines the frequency source in fire mode. **Value description:** 0: Digital frequency reference in fire mode - The frequency of the fire mode is defined by J6-13. 1: Filtered frequency value before fire mode applied - The target frequency in the fire mode depends on operating frequency of the drive before the fire mode is activated. (1) If the drive is not running before the fire mode is activated, or if the operating time is lower than the value defined by J6-17, the drive will run at the maximum frequency. (2) If the drive is already running before the fire mode is activated and has been continuously running for a duration exceeding the time defined by J6-17, the drive will continue running at the frequency prior to activation after fire mode is activated. 2: AI1 - The target frequency in fire mode is input by the current or voltage signal through AI1. The corresponding frequency value is calculated according to the preset AI curve. 3: AI2 - The target frequency in fire mode is input by the current or voltage signal through AI2. The corresponding frequency value is calculated according to the preset AI curve. 8: PID - The target frequency in fire mode is determined by the PID controller output. 9: Communication - The target frequency in fire mode is set through communication. You can set the frequency through remote communication. **Note:** This parameter is active when fire mode is activated. When the fire mode is activated, frequency sources set through other channels are inactive.

Param.	Name	Default	Range	Description
J6-12	Backup frequency source in fire mode	0	0: Digital frequency reference in fire mode 1: Filtered frequency value before fire mode applied 2: Maximum operating frequency	Defines the backup frequency source in the fire mode. When the J6-11 (Fire mode frequency source) is set to AI1, AI2, PID, or communication, the backup frequency source is activated upon AI disconnection, PID feedback disconnection, and communication errors. **Value description:** 0: Digital frequency reference in fire mode - When the backup frequency source is enabled, the frequency set by J6-13 is used as the target frequency. 1: Filtered frequency value before fire mode applied - When the backup frequency source is enabled, the target frequency depends on the operating frequency of the drive before the fire mode is activated. (1) If the drive is not running before the fire mode is activated, or if the operating time is lower than the value defined by J6-17, the drive will run at the maximum frequency. (2) If the drive is already running before the fire mode is activated and has been continuously running for a duration exceeding the time defined by J6-17, the drive will continue running at the frequency prior to activation after fire mode is activated. 2: Maximum operating frequency - When the backup frequency source is enabled, the maximum frequency is used as the target frequency. **Note:** • If the frequency source (J6-11) is set to AI1 or AI2, the backup frequency applies upon the AI disconnection. • If the frequency source (J6-11) is set to PID, the backup frequency applies upon the PID feedback disconnection. • If the frequency source (J6-11) is set to communication, the backup frequency applies upon the communication disconnection. The drive switches to the backup source mode when any one of the preceding three conditions occurs.
J6-13	Digital frequency reference in fire mode	50.00	0.00 to A2-17	Defines the digital frequency reference in fire mode.

Param.	Name	Default	Range	Description
J6-16	Final operating frequency filter time before fire mode applied	1.0	0.0 to 300.0	Defines the filter time of the frequency reference before the fire mode applies. If the drive runs before the fire mode is activated, you can filter the operating frequency of the drive through this parameter. **Note:** This parameter is usually used together with J6-17 to define the frequency before fire mode applies.
J6-17	Effective time of final operating frequency before fire mode applied	30.0	0.0 to 6000.0	Defines the effective time of final operating frequency before fire mode applied. The drive must have been continuously running for a period longer than the time defined by this parameter before the fire mode is activated. Otherwise, the frequency before activation of the fire mode is invalid. **Note:** This parameter is usually used together with J6-16 to define the frequency before fire mode applied.

5.4.9.3 Troubleshooting

Description

When the fire mode is active, the system classifies all detected faults into the following five categories: negligible faults, resettable faults, non-operational faults, pending reset faults (type 1), and pending reset faults (type 2).

Fault level		Response	Reset logic
Negligible faults		The drive continues operating.	No need for fault reset
Resettable faults		The drive stops immediately.	Automatic reset applies after the delay defined by J6-21 [Automatic fault reset delay in fire mode] elapses. • Reset successfully: The drive restarts automatically. • Reset failed: Fault reset is applied again after the delay defined by J6-21 [Automatic fault reset delay in fire mode] elapses.
Non-operational faults		The drive stops forcibly.	-
Pending reset faults	Type 1	The drive stops immediately.	Automatic reset applies only after the time defined by J6-22 [Fault reset waiting time 1 in fire mode]/J6-23 [Fault reset waiting time 2 in fire mode] and J6-21 [Automatic fault reset delay in fire mode] elapse. • Reset successfully: The drive restarts automatically. • Reset failed: Fault reset is applied again after the delay defined by J6-21 [Automatic fault reset delay in fire mode] elapses.
	Type 2		

Automatic fault reset in fire mode: Three types of faults (resettable faults, pending reset faults (type 1), and pending reset faults (type 2)) can be reset automatically. After the fault is reset, the drive restarts automatically.

The priority for response to multiple faults is as follows.

Fault coexistence scenarios		Response	Response priority
Non-operational faults occurred		Immediate stop	High
No non-operational fault, but:	Resettable faults occurred	Stop → Automatic reset → Restart Note: The reset duration depends on the longest waiting time.	Medium
	Pending reset faults occurred		
Only negligible faults/No fault occurred		Operation continued	Low

Related parameters

Param.	Name	Default	Range	Description
J6-20	Automatic fault reset count in fire mode	80	0 to 100	Defines the number of automatic fault resets in fire mode. When fire mode is activated, most faults can be ignored and the system can run directly. For certain faults, reset is required before operation. This parameter defines the number of automatic fault resets. After the fault is reset, the drive can be started directly. **Note:** This parameter is active when the fire mode is activated, and after activation, the automatic fault reset and restart function in group H3 group is deactivated.
J6-21	Automatic fault reset delay in fire mode	1.0	0 to 300.0	Defines the automatic fault reset delay in fire mode. When a fault requiring automatic reset occurs in fire mode, a reset command is generated after the set delay elapses. **Note:** This parameter is active when the fire mode is activated, and after activation, the automatic fault reset and restart function in group H3 group is deactivated.
J6-22	Fault reset waiting time 1 in fire mode	10	0 to J6-23	Defines the fault reset waiting time 1 in fire mode. When fire mode is activated, most faults can be ignored and the system can run directly. For certain faults, a delay is required before automatic fault reset. **Note:** When the fire mode is activated and this type of faults occurs, the drive stops and waits for the time set by J6-22, then performs automatic fault reset. The automatic fault reset command is sent after the delay defined by J6-21 elapses.
J6-23	Fault reset waiting time 2 in fire mode	30	J6-22 to 3600	Defines the fault reset waiting time 2 in fire mode. When fire mode is activated, most faults can be ignored and the system can run directly. For certain faults, a delay is required before automatic fault reset. **Note:** When the fire mode is activated and this type of faults occurs, the drive stops and waits for the time set by J6-23, then performs automatic fault reset. The automatic fault reset command is sent after the delay defined by J6-21 elapses.

5.4.9.4 Bypass

Scenarios

The bypass function allows the motor to switch to the mains frequency for operation through a bypass switch (such as a contactor or circuit breaker) when the AC drive fails or needs to be switched urgently, bypassing the AC drive control to ensure motor continuous operation.

Function description

The bypass function of MD630-INT fire mode is controlled by parameter J6-27 [Enable bypass function in fire mode]. After the function is enabled, the AC drive stops running when it fails to operate or the number of automatic fault resets is exhausted. After the time set by J6-28 elapses, a bypass signal is output to L0802 [fire mode bypass flag] connector (the user can bind the connector to the DO output to control the bypass switch). The purpose of the bypass delay is to wait for the motor to decelerate.

Related parameters

Param.	Name	Default	Value Range	Descriptions
J6-27	Enable bypass function in fire mode	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S) Others: B connector	Sets whether to enable the fire bypass function. When the AC drive is abnormal in fire mode and cannot operate normally, the motor can switch to mains frequency for operation through the bypass function. **Description:** 0: Disable - When the AC drive is abnormal in fire mode, the motor stops running without the bypass signal. 1: Enable - When the AC drive is abnormal in the fire mode, DO/RO outputs a bypass signal and makes the motor switch to mains frequency for operation through external electrical lines. 3 to 9: DI1 to DI7 - Whether the bypass function is enabled depends on the terminal state of the DI. Others: B connector **Note:** You can control the bypass switch by selecting "L0802" in "Others: B Connector" on the DO/RO terminal
J6-28	Fire bypass delay	5.0	0.0 to 300.0	Sets the delay time of bypass function in fire mode. After an AC drive failure, the bypass signal is output after this delay time.

5.5 Fault and Protection

5.5.1 Startup Protection

Application scenarios

By setting P0-21 (Start protection) to 1 (enable), you can enable startup protection for the AC drive, which prevents the motor from responding to abnormal operation command.

Startup protection applies to the following scenarios:

If the running command is valid when the AC drive is powered on (for example, an input terminal is ON before power-on), the AC drive does not respond to the command. The AC drive responds only after the running command is canceled and becomes valid again.

Related parameters

Table 5–103 Parameters related to startup protection

Specification	Name	Default value	Value Range	Descriptions
P0-21	Startup protection	1	0: Disable 1: Enable	It is used to set whether the startup protection function is enabled. Value description 0: Disable. The startup protection is disabled. 1: Enable. The startup protection is enabled. Additional information: If it is set to 1, the AC drive does not respond to valid running command upon AC drive power-on (for example, an input terminal is ON before power-on). The AC drive responds only after the running command is cancelled and becomes valid again. In addition, the AC drive does not respond to the valid running command upon fault reset of the AC drive. The startup protection can be disabled only after the running command has been cancelled.

5.5.2 Fault Reset and Restart

5.5.2.1 Fault Reset Mode

MD630-INT supports two fault reset modes, automatic reset and manual reset.

After troubleshooting, you can perform a manual reset through  on the operating panel, by configuring the DI terminal function, or through communication. For details, see *"5.5.2.2 Manual Fault Reset" on page 748*.

The automatic reset mode takes effect only when parameters in group H3 are configured. For details, see *"5.5.2.3 Automatic Fault Reset " on page 749*.

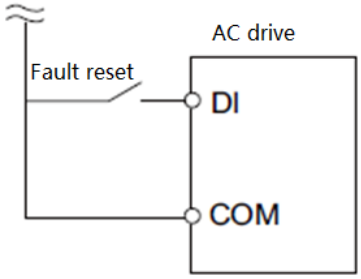
5.5.2.2 Manual Fault Reset

When the AC drive is faulty, users need to perform a manual reset for troubleshooting, preventing negative effects on the equipment.

There are four methods to manually reset a fault:

Method 1: Reset the fault through the DI terminal.

Set the function of any DI terminal to 9 (fault reset). In this way, the faults can be reset when an active signal is sent to the DI terminal.



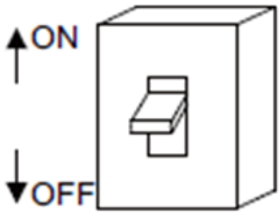
Method 2: Reset the fault through the operating panel.

Press the  key on the operating panel to reset the fault.



Method 3: Automatic fault reset after the AC drive is powered on again.

Disconnect the main circuit power supply. Wait until the fault code disappears, and then connect the power supply again.



Method 4: Reset the fault through communication.

When b1 (command source) is set to 2 (communication control), write "16" (Bit 4 fault reset) to communication address 7321H using the host controller to reset the AC drive after the fault is cleared.



5.5.2.3 Automatic Fault Reset

Scenario

After a fault occurs, the fault is automatically reset if the fault triggering condition does not exist. In this case, you do not need to take any action.

Working principle

The function of automatic fault reset of the MD630-INT drive is invalid by default. The default value of parameter H3-01 (number of automatic fault resets) is 0. To enable the function, you need to configure the relevant parameters. The following figure shows the function of automatic fault reset.

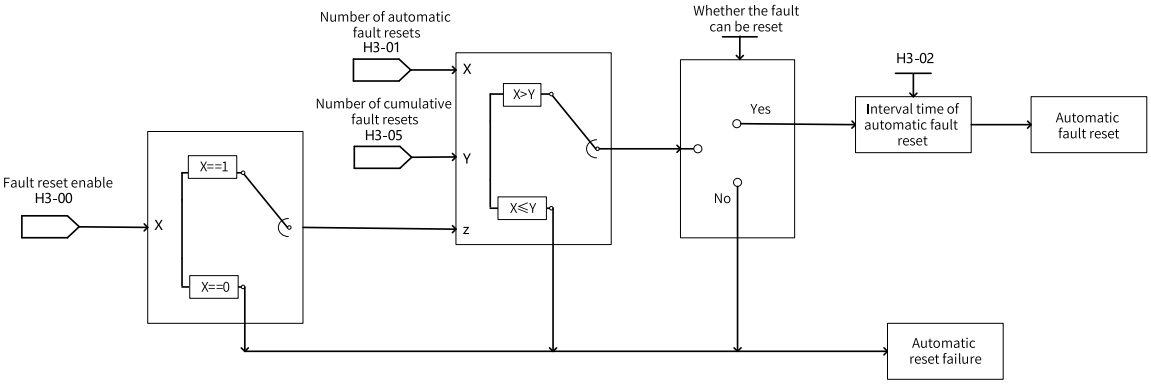


Figure 5-230 Function of automatic fault reset

As shown in the figure above, the parameters to be set are as follows:

(1) Set H3-00 (automatic fault reset) to 1 (enable).

(2) Set H3-01 (number of automatic fault resets).

(3) Set H3-02 (time interval for automatic fault reset), which is the duration from the time when the drive reports a fault to the time when automatic fault reset is performed.

When a fault occurs, you need to ensure that H3-00 (automatic fault reset) is set to 1 (enable), and H3-01 (number of automatic fault resets) is greater than H3-05 (cumulative number of automatic fault resets). The drive will reset the fault every time set by H3-02 (time interval for automatic fault reset) until the problem has been resolved.

Unless the fault can be quickly located and resolved, the value of H3-02 (time interval for automatic fault reset) is not recommended to set to a small value. This is because the drive will reset the fault

once every set interval after the fault occurs. If the fault does not meet the reset condition, the number of reset times of the current fault (H3-05) is increased by 1. If the interval is too short and the fault does not reach the reset condition for a long time, the number of automatic fault resets may be exhausted. That is, the value of H3-05 (Cumulative number of automatic fault resets) is greater than the value of H3-01 (number of automatic fault resets).

In addition, when the number of automatic fault resets is exhausted, the number can be resumed through H3-04 (time for restoring the number of automatic fault resets) and H3-06 (action when the number of automatic fault resets reaches).

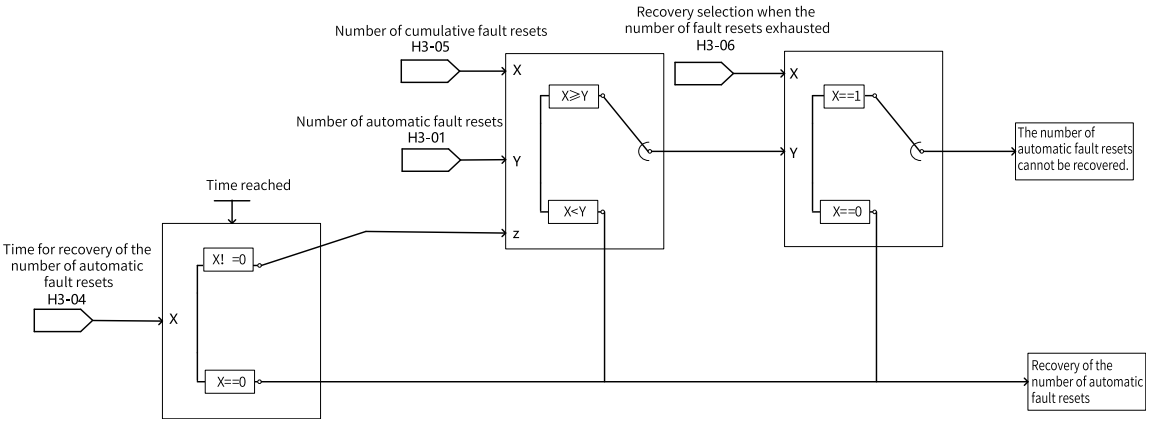


Figure 5-231 Recovery of the automatic fault reset number

As shown in the above figure, if H3-04 (time for restoring the number of automatic fault resets) is not set, H3-01 (number of automatic fault resets) can be restored continuously. If H3-04 is set and the value of H3-05 (cumulative number of automatic fault resets) is smaller than the value of H3-01 (number of automatic fault resets), the number of automatic fault resets can be restored.

When the value of H3-05 (cumulative number of automatic fault resets) is larger than or equal to the value of H3-01 (number of automatic fault resets), whether the number of automatic fault resets can be restored depends on the value of H3-06 (action when the number of automatic fault resets reaches). When H3-06 is set to 1 (number of automatic fault resets not restored), the number of automatic fault resets cannot be restored, that is, the number of automatic fault resets is exhausted. When H3-06 is set to 0 (number of automatic fault resets restored), the number of automatic fault resets is restored.

At the same time, the MD630-INT drive supports ten faults that are inhibited from automatic fault reset, which are set through H3-13 (fault code 1 inhibited from automatic fault reset) to H3-22 (fault code 10 inhibited from automatic fault reset).

Related parameters

Table 5–104 Parameters related to automatic fault reset

Parameter code	Parameter name	Default value	Range	Description
H3-00	Automatic fault reset	1	0: Disable 1: Enable	This parameter sets whether to enable automatic fault reset. Value description 0: Disable. Automatic fault reset is disabled. 1: Enable. Automatic fault reset is enabled.
H3-01	Number of automatic fault resets	0	0 to 100	This parameter sets the number of automatic fault resets. Remarks: If the number of reset times exceeds the value of this parameter, the AC drive remains in the faulty state.
H3-02	Time interval for automatic fault reset	1.0s	0.1s to 600.0s	This parameter sets the time interval for automatic fault reset. Remarks: This parameter sets the duration from the time when the drive reports a fault to the time when automatic fault reset is performed.
H3-03	Automatic reset disabled when manual reset applies	1	0: Automatic reset terminated 1: Automatic reset continues	This parameter sets whether automatic reset can be terminated by manual reset during the automatic reset process. If the fault is terminated, the AC drive no longer resets the fault automatically. Value description 0: Automatic reset is terminated upon manual reset. 1: Automatic reset continues after manual reset.
H3-04	Time for restoring the number of automatic fault reset times	10 min	0 min to 6000 min	This parameter sets the time for restoring the number of automatic reset times. Remarks: When it is not set to 0, the number of automatic fault reset times is restored after the time set by H3-04 elapses; when it is set to 0, the number of automatic fault reset times is restored all the time.
H3-05	Cumulative number of automatic fault resets	0	-	This parameter displays the cumulative number of automatic fault resets, which cannot be modified. When the number of manual resets and automatic resets are reached, the number will be cleared.

Parameter code	Parameter name	Default value	Range	Description
H3-06	Action when the number of automatic fault resets reaches	0	0: Number of automatic fault resets restored. 1: Number of automatic fault resets not restored.	This parameter sets whether to restore the number of automatic fault resets after the number is exhausted. Value description: 0: When the number of automatic fault resets is exhausted and time for restoring the number of automatic fault resets reach, the number of automatic fault resets can be restored automatically. 1: When the number of automatic fault resets is exhausted, the number cannot be restored automatically.
H3-07	Fault output selection	0	0: No output during automatic fault reset 1: Output during automatic fault reset	This parameter sets whether there is output during automatic fault reset, which determines whether connector L0134 (fault output) is 1 during fault reset. Value description: 0: No output during automatic fault reset 1: Output during automatic fault reset
H3-13	Fault code 1 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the fault code 1 that is inhibited from automatic fault reset. You need to enter the main code and subcode of the fault, such as 187.1. Remarks: For example, after the main code and subcode of the fault, such as 187.1, is set, the power unit EEPROM junction temperature parameter storage error (E187.1) cannot be reset automatically.
H3-14	Fault code 2 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-15	Fault code 3 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-16	Fault code 4 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-17	Fault code 5 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-18	Fault code 6 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13

Parameter code	Parameter name	Default value	Range	Description
H3-19	Fault code 7 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-20	Fault code 8 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-21	Fault code 9 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13
H3-22	Fault code 10 inhibited from automatic fault reset	0.0	0.0 to 255.9	Same as H3-13

5.5.2.4 Restart After Automatic Fault Reset

Scenarios

During operation, if a fault occurs on the drive and both the automatic fault reset and automatic restart functions are enabled, the drive will automatically restart after a successful automatic fault reset and the subsequent elapse of the auto-reset restart delay time.

Operation principles

During restart, if the AC drive receives a stop/manual reset command, it will stop and not restart. You can set a white list containing up to six faults, upon which the AC drive will reset and then restart. Or you can also set a black list containing up to six faults, upon which the AC drive is not allowed to reset or restart.

When H3-31 (Restart after automatic fault reset) is 0 (white list), H3-34 (designated fault code 1) to H3-39 (specified fault code 6) can set six groups of fault numbers for automatic restart. When H3-31 is set to 1 (black list), all fault numbers except H3-34 to H3-39 are allowed to restart automatically. The following figure shows details.

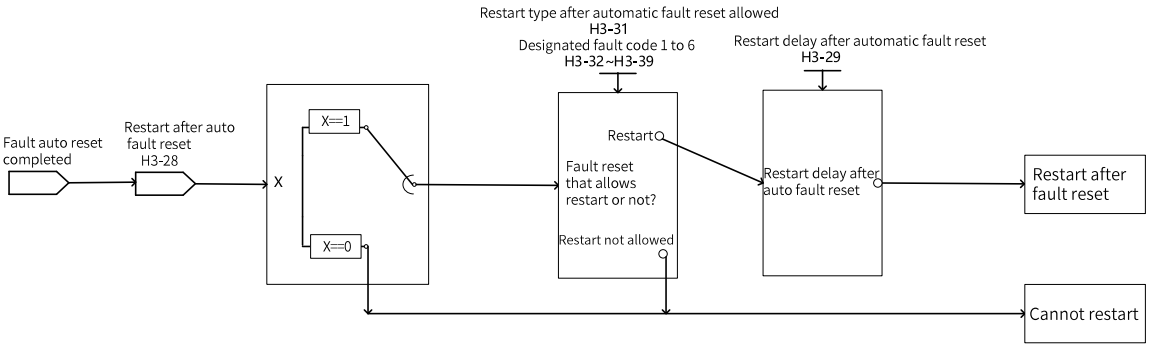


Figure 5-232 Automatic fault reset/restart

For example, set H3-00 to 1, H3-01 to 10, and H3-02 to 5s. H3-28 (Restart after automatic fault reset) is 1 (Enable) and H3-29 (Restart delay after automatic fault reset) is 5s.

When the AC drive is running, a fault is created and H2-00 (External fault 1 (NO) source) is set to 1 (Active). In this case, the AC drive reports the fault E015.1. Then set H2-00 to 0 to turn off the fault occurrence condition. After the fault is reset automatically, after the 5s restart delay, the AC drive starts automatically.

Related parameters:

Table 5–105 Automatic fault reset/restart

Param.	Name	De fault	Value Range	Descriptions
H3-28	Restart after automatic fault reset	0	0: Disable 1: Enable	This parameter is used to define whether the AC drive restarts. Value description 0: Disable - Restart is not performed after automatic fault reset. 1: Enable - Restart is performed after automatic fault reset.
H3-29	Restart interval upon automatic fault reset	0.5s	0.0–600.0s	This parameter sets the waiting time from automatic fault reset to automatic restart.
H3-30	Adopt flying start after automatic fault reset	0	0: Disable Flying start is not adopted after automatic fault reset. 1: Enable Flying start is adopted after automatic fault reset.	This parameter determines whether to enable flying start for automatic restart upon a fault. Flying start prevents the motor from being restarted when motor speed is not reduced to 0 upon fault, thus avoiding overcurrent fault caused by inrush current upon start. Description 0: Disable. Flying start is not adopted after automatic fault reset. 1: Enable. Flying start is adopted after automatic fault reset.
H3-31	List that allows restart after automatic fault reset	1	0: White list 1: Black list	Sets the method of allowing restart after automatic fault reset. Value description 0: Whitelist. Automatic restart is allowed for the faults set by H3-34 to H3-39 after the faults are reset. 1: Blacklist. Automatic restart is allowed for the faults set by parameters other than H3-34 to H3-39 after the faults are reset.

Param.	Name	De fault	Value Range	Descriptions
H3-34	Designated fault code 1	0.0	0.0 to 255.9	This parameter specifies fault code 1 for which automatic restart after a fault reset is permitted. The value contains the fault code and subcode, such as 187.1. Additional information: For example, enter the master code and subcode of the fault, such as 187.1. When E187.1 occurs, the drive determines whether to restart after automatic fault reset according to the setting of H3-31
H3-35	Designated fault code 2	0.0	0.0 to 255.9	This parameter specifies fault code 2 for which automatic restart after a fault reset is permitted.
H3-36	Designated fault code 3	0.0	0.0 to 255.9	This parameter specifies fault code 3 for which automatic restart after a fault reset is permitted.
H3-37	Designated fault code 4	0.0	0.0 to 255.9	This parameter specifies fault code 4 for which automatic restart after a fault reset is permitted.
H3-38	Designated fault code 5	0.0	0.0 to 255.9	This parameter specifies fault code 5 for which automatic restart after a fault reset is permitted.
H3-39	Designated fault code 6	0.0	0.0 to 255.9	This parameter specifies fault code 6for which automatic restart after a fault reset is permitted.

5.5.3 Fault Protection Action Selection

5.5.3.1 Setting Actions to Faults

Scenarios

The fault action indicates the corresponding measures taken by the drive in response to a fault. You can set the fault action according to actual requirements to keep the drive in the corresponding state after the fault occurs.

Function description

The MD630-INT AC drive can be set with 11 types of fault actions. Ranked from most severe to least severe, the fault levels can be divided into: coast-to-stop > stop at maximum capacity> quick stop > decelerate-to-stop > limited operation (with limited speed, power, current, and torque) > alarm > notification > No detection.

When "No detection" is selected as the protective action against fault, no prompt will be displayed when a fault occurs. Select this option only when necessary.

Different fault actions can be set for faults so that the drive takes corresponding measures when a fault occurs. See the table below.

Table 5–106 Fault action description

Action	**Description**	Related parameters
Coast to stop	After a fault occurs, the AC drive stops output and the load coasts to stop due to its inertia.	-
Maximum-capacity stop	After a fault occurs, the AC drive outputs at maximum capacity to stop the load in the shortest time.	The fixed deceleration time for maximum-capacity stop is 50 ms.
Quick stop	After a fault occurs, the AC drive stops according to the specified quick stop time.	b7-34 (Deceleration time for quick stop)
Decelerate to stop	After a fault occurs, the AC drive stops according to the specified deceleration time.	Take the first group of acceleration/ deceleration time as an example: b7-04 (Ramp 1 acceleration time) b7-05 (Ramp 1 deceleration time)
Run with speed restriction	After a fault occurs, the AC drive keeps running in the mode set by H1-60.	H1-60 (Run with speed restriction) H1-61 (Designated safe running frequency) H1-62 (Maximum forward frequency limit) H1-63 (Maximum reverse frequency limit)
Run with power restriction	After a fault occurs, the AC drive keeps running with a power not exceeding the power limited by H1-64 and H1-65.	H1-64 (Maximum motoring power limit) H1-65 (Maximum regenerative power limit)
Run with current restriction	After a fault occurs, the AC drive keeps running with a current not exceeding the current limited by H1-68.	H1-68 (Maximum current limit)
Run with torque restriction	After a fault occurs, the AC drive keeps running with a torque not exceeding the torque limited by H1-66 and H1-67.	H1-66 (Maximum forward torque limit) H1-67 (Maximum reverse torque limit)
Alarm	After a fault occurs, the AC drive displays the alarm code, which has no effect on running.	-
Notification	After a fault occurs, the AC drive displays the notification code, which has no effect on running.	-
Ignorable fault	A fault that is ignored by the AC drive	-

There are multiple modes and parameters for the "Run with speed restriction" action. When a fault occurs and the fault action is set to "Run with speed restriction", the drive continues to run in the mode defined by H1-60 (Run with speed restriction). The following six options are available for H1-60:

0: Run at limit frequency. In this mode, the drive continues to run after a fault occurs, but the speed is limited by H1-62 and H1-63. The drive cannot run at a speed higher than the speed limit. H1-62 and H1-63 indicate the frequency reference in percentages. The base value (100%) is determined by A2-04 (Per unit frequency base value).

1: Run at the running frequency upon fault. In this mode, after a fault occurs, the drive continues to run according to the running frequency upon fault.

2: Designated safe running frequency. In this mode, after a fault occurs, the drive continues to run according to H1-61. H1-61 indicates the frequency reference in percentages. The base value (100%) is determined by A2-04 (Per unit frequency base value).

3: Run at set frequency. In this mode, the drive continues to run at the set frequency after a fault occurs.

4: Run at the upper frequency limit in the current direction. In this mode, the drive runs at the upper frequency in the current direction after a fault occurs.

5: Run at the lower frequency limit in the current direction. In this mode, the drive runs at the lower limit frequency in the current direction after a fault occurs

The MD630-INT can be configured with output terminals that provide a valid signal when a fault occurs.

For example, parameter E1-04 [DO output function selection] is configured as option 2 [Fault output], option 38 [Abnormal output (Fault/Minor fault/Warning)], option 41 [Fault (excluding undervoltage) output], and option 43 [Output on minor fault or warning]:

2: Fault - When the AC drive stops due to a fault (coast to stop, stop at maximum capability, quick stop, or decelerate to stop), the terminal outputs an active signal.

38: Exception (fault/minor fault/alarm) - When the AC drive encounters a fault, a minor fault, or an alarm, the terminal outputs an active signal.

41: Fault (excluding undervoltage) - When the AC drive encounters a fault (excluding undervoltage), the terminal outputs an active signal.

43: Minor fault or alarm - When the AC drive encounters a minor fault or an alarm, the terminal outputs an active signal.

For the fault protection action selection, see the fault action range set in H1-00 to H1-18. For details, see "Setting Protection Actions upon Faults".

When the fault level is a notification, the output terminals cannot be configured to output signals upon faults.

Related parameters

Table 5–107 Fault operation mode related parameters

Param.	Name	Default	Setting range	Description
H1-60	Run with speed restriction	1	0: Run at limit frequency 1: Run at the running frequency upon fault 2: Run at designated safe running frequency 3: Run at set frequency 4: Run at the upper frequency limit in the current direction 5: Run at the lower frequency limit in the current direction	This parameter is used to select the mode in which the AC drive runs with speed restrictions upon a minor fault. Value description: 0: When the limit occurs, the maximum running frequency is limited by H1-62 and H1-63. 1: When the limit occurs, the drive continues to run at the running frequency upon fault. 2: When the limit occurs, the drive runs at the safe running frequency specified by H1-61. 3: When the limit occurs, the drive runs at the set frequency. 4: When the limit occurs, the drive runs at the upper frequency limit in the current direction. 5: When the limit occurs, the drive runs at the lower frequency limit in the current direction.
H1-61	Designated safe running frequency	0.0%	0.0% to 800.0%	This parameter sets the designated safe running frequency under restricted running conditions. Note: If H1-60 (Running with speed restriction) is set to 2, the AC drive runs at the designated safe operation frequency upon a minor fault.
H1-62	Maximum forward frequency limit	100.0%	0.0% to 800.0%	This parameter sets the maximum frequency in the forward direction under restricted running conditions. Note: If H1-60 (Running with speed restriction) is set to 0, the AC drive runs at the maximum frequency in the forward direction upon a minor fault.
H1-63	Maximum reverse frequency limit	100.0%	0.0% to 800.0%	This parameter sets the maximum frequency in the reverse direction under restricted running conditions. Note: If H1-60 (Running with speed restriction) is set to 0, the AC drive runs at the maximum frequency in the reverse direction upon a minor fault.
H1-64	Maximum motoring power limit	50.0%	0.0% to 400.0%	This parameter sets the maximum frequency in the reverse direction under restricted operation conditions. Note: This parameter is used to set the maximum motoring power for occurrence of minor faults.

Param.	Name	Default	Setting range	Description
H1-65	Maximum regenerative power limit	50.0%	0.0% to 400.0%	This parameter sets the maximum regenerative power under restricted running conditions. Note: This parameter is used to set the maximum regenerative power for occurrence of minor faults.
H1-66	Maximum forward torque limit	50.0%	0.0% to 400.0%	This parameter sets the maximum torque in the forward direction under restricted running conditions. Note: This parameter is used to set the maximum positive torque for occurrence of minor faults.
H1-67	Maximum reverse torque limit	50.0%	0.0% to 400.0%	This parameter sets the maximum torque in the reverse direction under restricted running conditions. Note: This parameter is used to set the maximum reverse torque for occurrence of minor faults.
H1-68	Maximum current limit	50.0%	0.0% to 400.0%	This parameter sets the maximum current under restricted running conditions. Note: This parameter is used to set the maximum current for occurrence of minor faults.

5.5.3.2 Setting Protection Actions upon Faults

Scenarios

The fault protection action setting is used to set the action of all fault subcodes of the fault code, ensuring that the fault protection action of the subcodes is consistent.

Function description

MD630-INT supports setting fault actions for 76 fault codes. The corresponding fault actions are set through the parameters H1-00 to H1-18. The fault action is set by the ones, tens, hundreds, and thousands places of each parameter. As shown in the following table, the ones, tens, hundreds, and thousands places of H1-00 stand for the fault actions of overcurrent, overvoltage, pre-charge fault, and undervoltage, respectively.

Table 5–108 Parameter setting for fault protection action

Parameter	Fault Name	Subcode		
H1-00	Protection action 0 upon fault	Ones place	Overcurrent (E002)	0: Coast to stop
		Tens place	Overvoltage (E005)	0: Coast to stop
		Hundreds place	Pre-charge fault (E008)	0: Coast to stop
		Thousands place	Undervoltage (E009)	0: Coast to stop

It should be noted that not every fault code can set be with 11 fault actions; only the fault actions provided in the parameter description can be set. For example, for the ones place of H1-00, only one option (coast to stop) is available for an overcurrent fault (E002). This indicates that fault code E002 only supports one fault action and other fault actions are not supported.

When the fault action of the fault code is set, all the subcodes under the fault code will be configured with the same action set for the fault code. You can modify the fault actions as needed. For details, see *"5.5.3.3 Action Modification of a Single Fault" on page 796*.

For example, if you set the value of H1-03 to 3, that is, the fault protection action of the fault code E186 (Power EEPROM fault) is set to decelerate to stop, then the fault action for all the subcodes under this fault code is set to decelerate to stop, including E186.1, E186.2 , and E186.3.

Related parameters

Table 5–109 Parameter setting for protection action of fault codes

Param.	Name	Default	Value Range	Descriptions
H1-00	Protection action 0 upon fault	0	Ones position: Overcurrent (E002) 0: Coast to stop Tens position: Overvoltage (E005) 0: Coast to stop Hundreds position: Pre-charge fault (E008) 0: Coast to stop Thousands position: Undervoltage (E009) 0: Coast to stop	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: Overcurrent (E002) 0: Coast to stop - When the AC drive encounters overcurrent due to certain reasons, the operating panel displays E002 and the motor coasts to stop. Tens position: Overvoltage (E005) 0: Coast to stop - When the AC drive encounters overvoltage due to certain reasons, the operating panel displays E005 and the motor coasts to stop. Hundreds position: Pre-charge fault (E008) 0: Coast to stop When the AC drive encounters a pre-charge fault due to certain reasons, the operating panel displays E008 and the motor coasts to stop. Thousands position: Undervoltage (E009) 0: Coast to stop When the AC drive encounters undervoltage for some reason, the operating panel displays E009 and the motor coasts to stop. Remarks: Fault protection actions for overcurrent, overvoltage, pre-charge fault, and undervoltage set by this parameter cannot be changed. If preceding faults occur, the AC drive stops output and the motor coasts to stop.

Param.	Name	Default	Value Range	Descriptions
H1-01	Protection action 1 upon fault	0	Ones position: Inverter overload (E010) 0: Coast to stop Tens position: Motor overload (E011) 0: Coast to stop Hundreds position: Input phase loss (E012) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque (Continued)	Sets the protection action for different faults. Value description: Ones position: Inverter overload (E010) 0: Coast to stop - When the AC drive encounters overload due to certain reasons, the operating panel displays E010 and the motor coasts to stop. Tens position: Motor overload (E011) 0: Coast to stop - When the AC drive encounters motor overload due to certain reasons, the operating panel displays E011 and the motor coasts to stop. Hundreds position: Input phase loss (E012) 0: Coast to stop - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays E012 and the motor coasts to stop. 1: Stop at maximum capability - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays E012 and the motor stops at the maximum capability. 2: Quick stop - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays E012 and the motor performs quick stop. 3: Decelerate to stop - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays E012 and the motor decelerates to stop. 9: Run at limited speed - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays L012 and the AC drive runs with the speed limited to a certain range. 00AH: Run at restricted power - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays L012 and the AC drive runs with the power limited to a certain range. 000BH: Run with limited current - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays L012 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays L012 and the AC drive runs with the torque limited to a certain range. (Continued)

Param.	Name	Default	Value Range	Descriptions
H1-01	Protection action 1 upon fault	0	(Continued) D: Alarm E: Prompt F: No detection Thousands position: Output phase loss (E013) 0: Coast to stop	(Continued) 00DH: Alarm - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays A012 and the AC drive operates normally. 00EH: Prompt - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel displays N012 and the AC drive operates normally. 00FH: Ignore - When the AC drive encounters phase loss on the input side due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Thousands position: Output phase loss (E013) 0: Coast to stop - When the AC drive encounters phase loss on the output side due to certain reasons, the operating panel displays E013 and the motor coasts to stop. Remarks: Fault protection actions for inverter overload, motor overload, and phase loss on the output side set by this parameter cannot be changed. If preceding faults occur, the AC drive stops output and the motor coasts to stop. If a phase loss fault occurs on the input side, you can modify the fault protection action to make the AC drive act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-02	Protection action 2 upon fault	0	Ones position: Module overtemperature (E014) 0: Coast to stop Tens position: External fault (E015) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt (Continued)	The ones, tens, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: Module overtemperature (E014) 0: Coast to stop - When the AC drive encounters the drive overtemperature threshold reach fault due to certain reasons, the operating panel displays E014 and the motor coasts to stop. Tens position: External fault (E015) 0: Coast to stop - When the AC drive encounters an external fault due to certain reasons, the operating panel displays E015 and the motor coasts to stop. 1: Stop at maximum capability - When the AC drive encounters an external fault due to certain reasons, the operating panel displays E015 and the motor stops at the maximum capability. 2: Quick stop - When the AC drive encounters an external fault due to certain reasons, the operating panel displays E015 and the motor performs quick stop. 3: Decelerate to stop - When the AC drive encounters an external fault due to certain reasons, the operating panel displays E015 and the motor decelerates to stop. 9: Run with speed restriction - When the AC drive encounters an external fault due to certain reasons, the operating panel displays L015 and the AC drive runs with the speed limited to a certain range. 10: Run with power restriction - When the AC drive encounters an external fault due to certain reasons, the operating panel displays L015 and the AC drive runs with the power limited to a certain range. 11: Run with current restriction - When the AC drive encounters an external fault due to certain reasons, the operating panel displays L015 and the AC drive runs with the current limited to a certain range. 12: Run with torque restriction - When the AC drive encounters an external fault due to certain reasons, the operating panel displays L015 and the AC drive runs with the torque limited to a certain range. 13: Alarm - When the AC drive encounters an external fault due to certain reasons, the operating panel displays A015 and the AC drive operates normally. 14: Prompt - When the AC drive encounters an external fault due to certain reasons, the operating panel displays N015 and the AC drive operates normally. (Continued)

Param.	Name	Default	Value Range	Descriptions
H1-02	Protection action 2 upon fault	0	(Continued) F: No detection Hundreds position: Reserved 0: Coast to stop Thousands position: Current sampling error (E018) 0: Coast to stop	(Continued) 15: Ignore - When the AC drive encounters an external fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Thousands position: Current sampling error (E018) 0: Coast to stop - When the AC drive encounters a current sampling fault due to certain reasons, the operating panel displays E018 and the motor coasts to stop. Remarks: Fault protection actions for drive overtemperature threshold reach and current sampling faults set by this parameter cannot be changed. If the above fault occurs, the AC drive stops output and the motor coasts to stop. If an external fault occurs, you can modify the fault protection action to make the AC drive act accordingly.
H1-03	Protection action 3 upon fault	0	Ones position: Parameter auto-tuning error (E019) 0: Coast to stop Tens position: Reserved 0: Coast to stop Hundreds position: EEPROM fault (E021) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop Thousands: Power unit EEPROM fault (E186) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop F: No detection	Same as H1-00

Param.	Name	Default	Value Range	Descriptions
H1-04	Protection action 4 upon fault	0	Ones position: Output short-circuited to ground (E023) 0: Coast to stop Tens position: Reserved 0: Coast to stop Hundreds position: Cumulative running time reached (E026) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Thousands position: User-defined fault (E027) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	The ones, tens, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: Output short-circuited to ground (E023) 0000H: Coast to stop - When the AC drive encounters an output short-circuited to ground fault due to certain reasons, the operating panel displays E023 and the motor coasts to stop. Hundreds position: Cumulative running time reached (E026) 0000H: Coast to stop - When the AC drive encounters a cumulative running time reach fault due to certain reasons, the operating panel displays E026 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays E026 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays E026 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays E026 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays L026 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L026 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays L026 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays L026 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays A026 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays N026 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-04	Protection action 4 upon fault	0	Continued	(Continued) Thousands position: User-defined fault (E027) 0000H: Coast to stop - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays E027 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays E027 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays E027 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays E027 and the motor decelerates to stop. 000FH: Ignore - When the AC drive encounters a custom fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for output short-circuited to ground faults set by this parameter cannot be changed. If the above fault occurs, the AC drive stops output and the motor coasts to stop. If the cumulative running time reach fault and user-defined fault occur, you can modify the fault protection action to make the AC drive act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-05	Protection action 5 upon fault	0x00DD	Ones position: User-defined alarm (E028) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Tens position: Accumulative power-on time reached (E029) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection (To be continued)	The ones, tens, and thousands of this parameter are used to set protection actions upon different faults. Value description: Ones position: User-defined alarm (E028) 0000H: Coast to stop - When the AC drive encounters a user-defined alarm due to certain reasons, the operating panel displays E028 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters a custom alarm due to certain reasons, the operating panel displays E028 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a custom alarm due to certain reasons, the operating panel displays E028 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a custom alarm due to certain reasons, the operating panel displays E028 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays L028 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays L028 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays L028 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays L028 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays A028 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a custom fault due to certain reasons, the operating panel displays N028 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a custom alarm due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-05	Protection action 5 upon fault	0x00DD	(Continued) Hundreds position: Three phase loss (E030) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Thousands position: PID fault feedback loss (E031) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	(Continued) Tens position: Accumulative power-on time reached (E029) 0000H: Decelerate to stop - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays E029 and the motor decelerates to stop. 0001H: Stop at maximum capability - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays E029 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays E029 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays E029 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L029 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L029 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L029 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L029 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays A029 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays N029 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-05	Protection action 5 upon fault	0x00DD	Continued	(Continued) Hundreds position: Three phase loss (E030) 0000H: Coast to stop - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays E030 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays E030 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays E030 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays E030 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays L030 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays L030 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays L030 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays L030 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays A030 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters three-phase loss due to certain reasons, the operating panel displays N030 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters hree-phase loss due to certain reasons, the operating panel does not display any fault and the AC drive operates normally.

Param.	Name	Default	Value Range	Descriptions
H1-05	Protection action 5 upon fault	0x00DD	Continued	(Continued) Thousands position: PID fault feedback loss (E031) 0000H: Coast to stop - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays E031 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays E031 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays E031 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays E031 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays L031 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays L031 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays L031 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays L031 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays A031 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the PID fault due to certain reasons, the operating panel displays N031 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the PID fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions, including actions for custom fault, cumulative power-on time reached, three-phase loss fault, and PID feedback loss fault can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-06	Protection action 6 upon fault	0x0D0D	Ones position: Parameter reset error (E032) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Tens position: Reserved 0: Coast to stop (Continued)	The ones, tens, and thousands of this parameter are used to set protection actions upon different faults. Value description: Ones position: Parameter reset error (E032) 0000H: Coast to stop - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays E032 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays E032 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays E032 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays E032 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays L032 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays L032 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays L032 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays L032 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays A032 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays N032 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a parameter exception due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Tens position: Reserved (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-06	Protection action 6 upon fault	0x0D0D	(Continued) Hundreds position: Excessive speed deviation (E042) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection (Continued)	(Continued) Hundreds position: Excessive speed deviation (E042) 0000H: Coast to stop - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays E042 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays E042 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays E042 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays E042 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays L042 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays L042 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays L042 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays L042 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays A042 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a parameter exception due to certain reasons, the operating panel displays N032 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a parameter exception due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-06	Protection action 6 upon fault	0x0D0D	(Continued) Thousands position: Motor speed overlimit (E043) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	(Continued) Thousands position: Motor speed error (E043) 0000H: Coast to stop - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays E043 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays E043 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays E043 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays E043 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays L043 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays L043 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays L043 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays L043 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays A043 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters motor overspeed due to certain reasons, the operating panel displays N043 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters motor overspeed due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for parameter reset error, excessive speed deviation fault, and motor overspeed error can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-07	Protection action 7 upon fault	0x0	Ones: Reserved 0: Coast to stop Tens position: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Auto-tuned pole position error (E051) 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Description: Ones: Reserved 0000H: Coast to stop Tens: Reserved 0000H: Coast to stop Hundreds: Reserved 0000H: Coast to stop Thousands: Auto-tuned pole position error (E051) 0000H: Coast to stop - When the AC drive encounters a magnetic pole position auto-tuning error due to certain reasons, the operating panel displays E051 and the motor coasts to stop. Note: Fault protection actions for the magnetic pole position auto-tuning error set by this parameter cannot be changed. If the above fault occurs, the AC drive stops output and the motor coasts to stop.
H1-08	Protection action 8 upon fault	0x0	Ones: Reserved 0: Coast to stop Tens: Self-test fault 1 (E056) 0: Coast to stop Hundreds: Self-test fault 2 (E057) 0: Coast to stop Thousands：Self-test fault 3 (E058) 0: Coast to stop	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Description: Tens: Self-test fault 1 (E056) 0000H: Coast to stop - When the AC drive encounters self-test fault 1 due to certain reasons, the operating panel displays E056 and the motor coasts to stop. Hundreds: Self-test fault 2 (E057) 0000H: Coast to stop - When the AC drive encounters self-test fault 2 due to certain reasons, the operating panel displays E057 and the motor coasts to stop. Thousands: Self-test fault 3 (E058) 0000H: Coast to stop - When the AC drive encounters self-test fault 3 due to certain reasons, the operating panel displays E058 and the motor coasts to stop. Note: Fault protection actions for self-test fault 1 to self-test fault 3 set by this parameter cannot be changed. If the above fault occurs, the AC drive stops output and the motor coasts to stop.

Param.	Name	Default	Value Range	Descriptions
H1-09	Protection action 9 upon fault	0x0	Ones position: Self-test fault 4 (E059) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Description: Tens: Self-test fault 4 (E059) 0000H: Coast to stop - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays E059 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays E059 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays E059 and the motor performs quick stop. 0003H: Quick stop - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays E059 and the motor performs quick stop. 0009H: Run with speed limited - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays L059 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays L059 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays L059 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays L059 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays A059 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel displays N059 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters self-test fault 4 due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Note: Fault protection action for self-test fault 4 cannot be changed. If this fault occurs, the AC drive stops output and the motor coasts to stop.

Param.	Name	Default	Value Range	Descriptions
H1-10	Protection action 10 upon fault	0	Ones position: Fan fault (E080) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Tens position: Reserved 0: Coast to stop Hundreds position: Reserved 0: Coast to stop Thousands position: Reserved 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Value description: Ones position: Fan fault (E080) 0000H: Coast to stop When the AC drive encounters a fan fault due to certain reasons, the operating panel displays E080 and the motor coasts to stop. 0001H: Stop at maximum capability When the AC drive encounters a fan fault due to certain reasons, the operating panel displays E080 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays E080 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays E080 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays L080 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays L080 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays L080 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays L080 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays A080 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters a fan fault due to certain reasons, the operating panel displays N080 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters a fan fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for fan fault can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-11	Protection action 11 upon fault	0x0F00	Ones: Reserved 0: Coast to stop Tens position: Reserved 0: Coast to stop Hundreds position: Sequence fault (E085) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Thousands position: Motor control error 1 (E093) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Value description: Hundreds position: Sequence fault (E085) 0000H: Coast to stop - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays E085 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays E085 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays E085 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays E085 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays L085 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays L085 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays L085 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays L085 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays A085 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel displays N085 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the time sequence fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-11	Protection action 11 upon fault	0x0F00	Continued	(Continued) Thousands position: Motor control error 1 (E093) 0000H: Coast to stop - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays E093 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays E093 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays E093 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays E093 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays L093 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays L093 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays L093 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays L093 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays A093 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel displays N093 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters motor control exception 1 due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for time sequence fault and motor control exception 1 can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-12	Protection action 12 upon fault	0xDDDD	Ones: Motor control error 2 (E094) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Tens position: AC drive pre-overload (E110) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection (To be continued)	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: Motor control error 2 (E094) 0000H: Coast to stop - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays E094 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays E094 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays E094 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays E094 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays L094 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays L094 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays L094 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays L094 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays A094 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel displays N094 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters motor control exception 2 due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-12	Protection action 12 upon fault	0xDDDD	(Continued) Hundreds position: Motor pre-overload (E111) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Thousands position: Module pre-overheat (E114) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	(Continued) Tens position: AC drive pre-overload (E110) 0000H: Coast to stop - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays E110 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays E110 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays E110 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays E110 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays L110 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays L110 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays L110 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays L110 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays A110 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel displays N110 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the AC drive pre-overload fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-12	Protection action 12 upon fault	0xDDDD	Continued	(Continued) Hundreds position: Motor pre-overload (E111) 0000H: Coast to stop - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays E111 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays E111 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays E111 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays E111 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays L111 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays L111 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays L111 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays L111 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays A111 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays N111 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the motor pre-overload fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-12	Protection action 12 upon fault	0xDDDD	Continued	(Continued) Thousands position: Module pre-overheat (E114) 0000H: Coast to stop - When the AC drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel displays E114 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays E114 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays E114 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays E114 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays L114 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays L114 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the drive pre-overtemperature fault due to certain reasons, the operating panel displays L114 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel displays L114 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel displays A114 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel displays N114 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for motor control exception 2, AC drive pre-overload, motor pre-overload, and module pre-overtemperature can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-14	Protection action 14 upon fault	0x00DF	Ones: AI/HDI disconnected (E154) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Tens: IO expansion card communication timeout 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Hundreds: Reserved 0: Coast to stop Thousands: Automatic fault rest failure (E159) 0: Coast to stop 0: Coast to stop	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: AI/HDI disconnected (E154) 0000H: Coast to stop - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays E154 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays E154 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays E154 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays E154 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays A154 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays N154 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-14	Protection action 14 upon fault	0x00DF	Continued	(Continued) Thousands position: Automatic fault reset failure (E159) 0000H: Coast to stop - When the AC drive encounters an automatic fault reset failure due to certain reasons, the operating panel displays E159 and the motor coasts to stop. Remarks: Fault protection actions for AI/HDI disconnection fault and automatic fault reset failure can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-15	Protection action 15 upon fault	0x0333	Ones position: Modbus communication timeout (E160) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore (To be continued)	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Description: Ones: Modbus communication timeout (E160) 0000H: Coast to stop - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays E160 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays E160 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays E160 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays E160 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays L160 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays L160 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays L160 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays L160 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays A160 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays N160 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-15	Protection action 15 upon fault	0x0333	(Continued) Tens: CANopen fault (E161) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore (To be continued)	(Continued) Tens: CANopen fault (E161) 0000H: Coast to stop - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays E161 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays E161 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays E161 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays E161 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays L161 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays L161 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays L161 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays L161 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays A161 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel displays N161 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the CANopen fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-15	Protection action 15 upon fault	0x0333	(Continued) Hundreds: CANlink fault (E162) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore Continued	(Continued) Hundreds: CANlink fault (E162) 0000H: Coast to stop - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays E162 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays E162 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays E162 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays E162 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays L162 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays L162 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays L162 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays L162 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the CAN-link fault due to certain reasons, the operating panel displays A162 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel displays N162 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the CANlink fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-15	Protection action 15 upon fault	0x0333	Continued Thousands: Modbus TCP communication timeout (E169) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Warning E: Prompt F: Ignore	(Continued) Thousands: Modbus TCP communication timeout (E169) 0000H: Coast to stop - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays E169 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays E169 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays E169 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays E169 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays L169 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays L169 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays L169 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays L169 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays A169 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel displays N169 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the Modbus TCP communication timeout fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Note: Protection action 15 for Modbus communication timeout fault, CANopen fault, and CANlink faults be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-16	Protection action 16 upon fault	0	Ones: EtherNet/IP failure (active only for MD630N) (E165) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Ten position: PROFINET fault (active only for MD630N) (E166) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection (To be continued)	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones: EtherNet/IP fault (E165) 0000H: Coast to stop - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays E165 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays E165 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays E165 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays E165 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays L165 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays L165 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays L165 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays L165 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays A165 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays N165 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the EtherNet/IP fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-16	Protection action 16 upon fault	0	(Continued) Hundreds: EtherCAT fault 1 (active only for MD630N) (E167) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Thousands: EtherCAT fault 2 (active only for MD630N)(E168) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	(Continued) Tens position: PROFINET fault (E166) 0000H: Coast to stop - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays E166 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays E166 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays E166 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays E166 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays L166 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays L166 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays L166 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays L166 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays A166 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel displays N166 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the PROFINET fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-16	Protection action 16 upon fault	0	Continued	(Continued) Hundreds: EtherCAT fault 1 (E167) 0000H: Coast to stop - When the AC drive encounters EtherCAT fault 1 due to certain reasons, the operating panel displays E167 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays E167 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays E167 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays E167 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays A167 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays N167 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-16	Protection action 16 upon fault	0	Continued	(Continued) Thousands: EtherCAT fault 2 (E168) 0000H: Coast to stop - When the AC drive encounters EtherCAT fault 2 due to certain reasons, the operating panel displays E168 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays E168 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays E168 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays E168 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays A168 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays N168 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for Ethernet/IP, PROFINET, EtherCAT fault 1, and EtherCAT fault 2 can be changed to enable the AC drive to act accordingly.

Param.	Name	Default	Value Range	Descriptions
H1-17	Protection action 17 upon fault	0	Ones: Inobus extension protocol (E170) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection Tens: Junction temperature fault (E191) 0: Coast to stop Hundreds: flying start fault (E192) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection (To be continued)	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Value description: Ones position: Inobus protocol fault (E170) 0000H: Coast to stop - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays E170 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays E170 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays E170 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays E170 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays A170 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays N170 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the Inobus protocol fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-17	Protection action 17 upon fault	0	(Continued) Thousands: Undervoltage suppression limit reached (E193) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Run with power restriction B: Run with current restriction C: Run with torque restriction D: Display warning E: Prompt F: No detection	(Continued) Hundreds: Flying start fault (E192) 0000H: Coast to stop - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays E192 and the motor coasts to stop. 0001H: Stop at maximum capability - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays E192 and the motor stops at the maximum capability. 0002H: Quick stop - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays E192 and the motor performs quick stop. 0003H: Decelerate to stop - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays E192 and the motor decelerates to stop. 0009H: Run with speed limited - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays L192 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays L192 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays L192 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays L192 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays A192 and the AC drive operates normally. 000EH: Prompt - When the AC drive encounters the flying start fault due to certain reasons, the operating panel displays N192 and the AC drive operates normally. 000FH: Ignore - When the AC drive encounters the flying start fault due to certain reasons, the operating panel does not display any fault and the AC drive operates normally. (To be continued)

Param.	Name	Default	Value Range	Descriptions
H1-17	Protection action 17 upon fault	0	Continued	(Continued) Thousands: Undervoltage suppression limit reached (E193) 0000H: Coast to stop - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor coasts to stop. 0001H: Stop at maximum capability - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor stops at the maximum capability. 0002H: Quick stop - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor performs quick stop. 0003H: Decelerate to stop - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor decelerates to stop. 0009H: Run with speed limited - When the undervoltage suppression limit is reached, the operating panel displays L193 and the AC drive runs with the speed limited to a certain range. 000AH: Run with power limited - When the undervoltage suppression limit is reached, the operating panel displays L193 and the AC drive runs with the power limited to a certain range. 000BH: Run with current limited - When the undervoltage suppression limit is reached, the operating panel displays L193 and the AC drive runs with the current limited to a certain range. 000CH: Run with torque limited - When the undervoltage suppression limit is reached, the operating panel displays L193 and the AC drive runs with the torque limited to a certain range. 000DH: Alarm displayed - When the undervoltage suppression limit is reached, the operating panel displays A193 and the AC drive operates normally. 000EH: Prompt - When the undervoltage suppression limit is reached, the operating panel displays N193 and the AC drive operates normally. 000FH: Ignore - When the undervoltage suppression limit is reached, the operating panel does not display any fault and the AC drive operates normally. Remarks: Fault protection actions for Inobus protocol fault, speed trakcing fault, undervoltage suppression limit reached fault can be changed to enable the AC drive to act accordingly.

5.5.3.3 Action Modification of a Single Fault

Scenario

This function enables you to set the action of a sub-fault under a master fault. It applies to the scenario that actions for the sub-fault and master fault are different.

Function description

The MD630-INT supports setting the fault action of a single fault, which is implemented by H1-30 (setting of the first group fault code) to H1-49 (setting of fault level for fault codes of group 10).

H1-30 and H1-31 are used together to set the fault action of the first fault. H1-30 is used to set the fault code, and H1-31 is used to select the type of fault action. In this case, there are 20 parameters, that is, actions of 10 faults can be set separately.

For example, set H1-30 to 186.1 and H1-31 to 0x0002 (quick stop). The action of E186.1 (model parameter read/write failure) is "quick stop".

Table 5–110 Modifying the fault action

Parameter code	Fault name	Value
H1-30	Settings of fault codes of group 1	186.1
H1-31	Settings of fault level for fault codes of group 1	0x0002 (Quick stop)

Actions that can be set for a fault must be supported by the master fault.

For example, the thousands place of H1-03 (Fault protection action selection 3) indicates power unit EEPROM fault (E186). Options of E186 include only 0 (coast to stop), 1 (stop at maximum capability), 2 (quick stop), 3 (decelerate to stop), and F (No detection). For sub-faults under E186, you can only set one of the five fault actions.

Related parameters

Table 5–111 Parameters for modifying fault actions

Parameter code	Parameter name	Default value	Range	Description
H1-30	Settings of fault codes of group 1	0.0	0.0 to 255.9	This parameter specifies the fault code of group 1 whose fault level is to be edited. Remarks Enter the main code and subcode of the fault. For example, fill in 187.1 and set H1-31 to 000FH. In this case, E187.1 (Power unit EEPROM junction temperature fault) is not displayed, but the AC drive can operate normally.
H1-31	Settings of fault level for fault codes of group 1	0x000F	0000H: Coast to stop 0001H: Stop at maximum capability 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Display warning 000EH: Prompt 000FH: Not detected	This parameter specifies the fault level of fault codes of group 1. Value description 0000H: Coast to stop. When a fault occurs, the AC drive displays E and the motor coasts to stop. 0001H: Stop at maximum capability. When a fault occurs, the AC drive displays E and the motor stops at its maximum capacity. 0002H: Quick stop. When a fault occurs, the AC drive displays E and the motor performs quick stop. 0003H: Decelerate to stop. When a fault occurs, the AC drive displays E and the motor decelerates to stop. 0009H: Run at limited speed. The AC drive displays L and continues running with speed restriction. 000AH: Run at limited power. The AC drive displays L and continues running with power restriction. 000BH: Run at limited current. The AC drive displays L and continues running with current restriction. 000CH: Run at limited torque. The AC drive displays L and continues running with torque restriction. 000DH: Display warning The AC drive displays alarm A, which has no effect on operation. 000EH: Prompt The AC drive displays prompt N, which has no effect on operation. 000FH: Not detected This fault is shielded by the AC drive. Remarks After fault codes are set, this parameter represents the action against current fault. The fault level setting adopts a white list, and only allowable levels can be set.
H1-32	Settings of fault codes of group 2	0.0	0.0 to 255.9	This parameter specifies the fault code of group 2 whose fault level is to be edited, which is the same as H1-30.
H1-33	Settings of fault level for fault codes of group 2	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 2, which is the same as H1-31.
H1-34	Settings of fault codes of group 3	0.0	0.0 to 255.9	This parameter specifies the fault code of group 3 whose fault level is to be edited, which is the same as H1-30.

Parameter code	Parameter name	Default value	Range	Description
H1-35	Settings of fault level for fault codes of group 3	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 3, which is the same as H1-31.
H1-36	Settings of fault codes of group 4	0.0	0.0 to 255.9	This parameter specifies the fault code of group 4 whose fault level is to be edited, which is the same as H1-30.
H1-37	Settings of fault level for fault codes of group 4	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 4, which is the same as H1-31.
H1-38	Settings of fault codes of group 5	0.0	0.0 to 255.9	This parameter specifies the fault code of group 5 whose fault level is to be edited, which is the same as H1-30.
H1-39	Settings of fault level for fault codes of group 5	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 5, which is the same as H1-31.
H1-40	Settings of fault codes of group 6	0.0	0.0 to 255.9	This parameter specifies the fault code of group 6 whose fault level is to be edited, which is the same as H1-30.
H1-41	Settings of fault level for fault codes of group 6	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 6, which is the same as H1-31.
H1-42	Settings of fault codes of group 7	0.0	0.0 to 255.9	This parameter specifies the fault code of group 7 whose fault level is to be edited, which is the same as H1-30.
H1-43	Settings of fault level for fault codes of group 7	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 7, which is the same as H1-31.
H1-44	Settings of fault codes of group 8	0.0	0.0 to 255.9	This parameter specifies the fault code of group 8 whose fault level is to be edited, which is the same as H1-30.
H1-45	Settings of fault level for fault codes of group 8	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 8, which is the same as H1-31.
H1-46	Settings of fault codes of group 9	0.0	0.0 to 255.9	This parameter specifies the fault code of group 9 whose fault level is to be edited, which is the same as H1-30.
H1-47	Settings of fault level for fault codes of group 9	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 9, which is the same as H1-31.
H1-48	Settings of fault codes of group 10	0.0	0.0 to 255.9	This parameter specifies the fault code of group 10 whose fault level is to be edited, which is the same as H1-30.
H1-49	Settings of fault level for fault codes of group 10	0x000F	Same as H1-31	This parameter specifies the fault level of fault codes of group 10, which is the same as H1-31.

5.5.4 Custom Faults and Alarms

Application scenario

The drive supports custom faults and alarms. You can select the B connector as the condition for triggering faults and alarms, and define custom faults and alarms through parameter interconnection. For details, see *" Parameter Interconnection" on page 814*.

Working principles

Custom faults and alarms include two external fault sources, external fault 1 (NO) source and external fault 2 (NC) source.

The source of external fault 1 (NO) is set by H2-00 (0: Inactive; 1: Active). The drive reports E015.1 when H2-00 is set to 1. Alternatively, you can define the conditions for triggering custom faults through B connector.

The source of external fault 2 (NC) is set by H2-01 (0: Active; 1: Inactive). The drive reports E015.2 when H2-01 is set to 1. Alternatively, you can define the conditions for triggering custom faults through B connector.

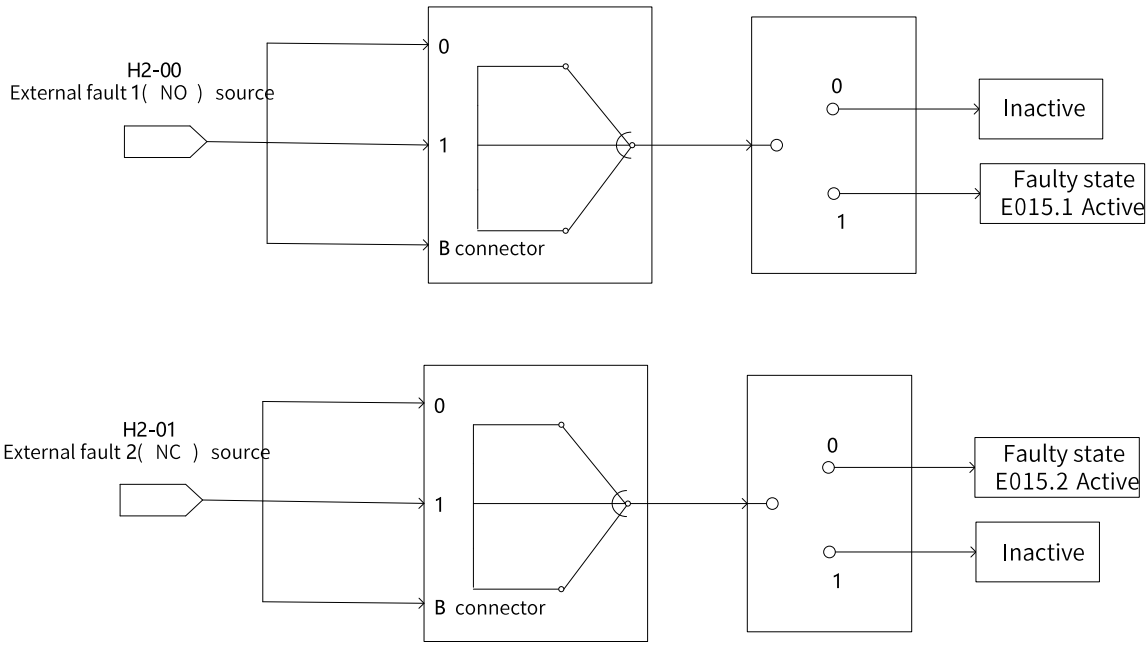


Figure 5-233 External fault diagram

Note that the DI terminal assigned with function 11 (External fault NO input) and function 33 (External fault NC input) can also be used as the source for triggering these faults. When the DI is assigned with these functions, the corresponding parameter is read-only. For example, if DI1 is assigned with function 11 (External fault NO input), H2-00 is read-only.

In addition, the MD630-INT drive provides eight groups of custom faults and alarms. You can set the source for triggering the eight sets of custom faults through H2-02 (Custom fault 1 source) to H2-09 (Custom fault 8 source). The fault codes are E027.1 to E027.8. You can set the source for triggering the eight sets of custom alarms through H2-10 (Custom alarm 1 source) to H2-17 (Custom alarm 8 source). The alarm codes are A28.1 to A28.8.

For example, if you set H2-02 (Custom fault 1 source) to connector B and select "L00 [Bit connector 1]" > "L0002 [DI1]" in the dialog box, when DI1 is active, the drive reports E027.1.

Note that if the DI function is set to 44 (User-defined fault 1) or 45 (User-defined fault 2), the source for triggering E027.1 and E027.2 is defined by the DI status.

Related parameters

Table 5–112 Parameters related to custom faults and alarms

Param.	Name	Default	Value range	Description
H2-00	External fault 1 (NO) source	0	0: Invalid 1: Valid Others: B connector	Defines the source of external fault 1 (NO). Value description: 0: Inactive - External fault 1 (NO) is inactive, and the drive does not report the fault. 1: Valid - External fault 1 (NO) is valid, and the drive reports E015.1. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: 1: This parameter defines the source of external fault 1 (NO). When this parameter is set to 1, the drive reports E015.1 upon receiving external fault 1 signal. If external fault 1 does not need to be reported, set this parameter to 0 and reset the fault. 2: After the DI function is set to 11 (External fault NO input), the value of H2-00 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
H2-01	External fault 2 (NC) source	1	0: Invalid 1: Valid Others: B connector	Defines the source of external fault 2 (NC). Value description: 0: Inactive - External fault 2 (NC) is inactive, and the drive reports E015.2. 1: Valid - External fault 2 (NC) is valid, and the drive does not report the fault. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: 1. This parameter defines the source of external fault 2 (NC). When this parameter is set to 0, the drive reports E015.2 upon receiving external fault 2 signal. If external fault 2 does not need to be reported, set this parameter to 1 and reset the fault. 2. After the DI function is set to 33 (External fault NC input), the value of H2-01 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).

Param.	Name	Default	Value range	Description
H2-02	Source of user-defined fault 1	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 1. Value description: 0: Inactive - The custom fault 1 is inactive, and the drive does not report the fault. 1: Active - The custom fault 1 is active, and the drive reports E027.1. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of user-defined fault 1. When this parameter is set to 1, E027.1 is reported. After the DI function is set to 44 (Custom fault 1), the value of H2-02 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
H2-03	Source of user-defined fault 2	1	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 2. Value description: 0: Inactive - The custom fault 2 is inactive, and the drive does not report the fault. 1: Active - The custom fault 2 is active, and the drive reports E27.2. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom fault 2. E27.2 is reported when it is active. After the DI function is set to 45 (User-defined fault 2), the value of H2-03 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
H2-04	Source of user-defined fault 3	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 3. Value description: 0: Inactive - The custom fault 3 is inactive, and the drive does not report the fault. 1: Valid - The custom fault 3 is valid, and the drive reports E27.3. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom fault 3. E27.3 is reported when it is active.

Param.	Name	Default	Value range	Description
H2-05	Source of user-defined fault 4	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 4. Value description: 0: Inactive - The custom fault 4 is inactive, and the drive does not report the fault. 1: Valid - The custom fault 4 is valid, and the drive reports E27.4. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom fault 4. E27.4 is reported when it is active.
H2-06	Source of user-defined fault 5	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 5. Value description: 0: Inactive - The custom fault 5 is inactive, and the drive does not report the fault. 1: Valid - The custom fault 5 is valid, and the drive reports E27.5. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom fault 5. E27.5 is reported when it is active.
H2-07	Source of user-defined fault 6	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 6. Value description: 0: Inactive - The custom fault 6 is inactive, and the drive does not report the fault. 1: Valid - The custom fault 6 is valid, and the drive reports E27.6. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom fault 6. E27.6 is reported when it is active.
H2-08	Source of user-defined fault 7	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 7. Value description: 0: Inactive - The custom fault 7 is inactive, and the drive does not report the fault. 1: Valid - The custom fault 7 is valid, and the drive reports E27.7. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom fault 7. E27.7 is reported when it is active.

Param.	Name	Default	Value range	Description
H2-09	Source of user-defined fault 8	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom fault 8. Value description: 0: Inactive - The custom fault 8 is inactive, and the drive does not report the fault. 1: Valid - The custom fault 8 is valid, and the drive reports E27.8. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom fault 8. E27.8 is reported when it is active.
H2-10	Source of user-defined alarm 1	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom alarm 1. Value description: 0: Inactive - The custom alarm 1 is inactive, and the drive does not report the alarm. 1: Valid - The custom alarm 1 is valid, and the drive reports A28.1. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom alarm 1. A28.1 is reported when it is active.
H2-11	Source of user-defined alarm 2	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom alarm 2. Value description: 0: Inactive - The custom alarm 2 is inactive, and the drive does not report the alarm. 1: Valid - The custom alarm 2 is valid, and the drive reports A28.2. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom alarm 2. A28.2 is reported when it is active.
H2-12	Source of user-defined alarm 3	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom alarm 3. Value description: 0: Inactive - The custom alarm 3 is inactive, and the drive does not report the alarm. 1: Valid - The custom alarm 3 is valid, and the drive reports A28.3. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom alarm 3. A28.3 is reported when it is active.

Param.	Name	Default	Value range	Description
H2-13	Source of user-defined alarm 4	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom alarm 4. Value description: 0: Inactive - The custom alarm 4 is inactive, and the drive does not report the alarm. 1: Active - The custom alarm 4 is active, and the drive reports A28.4. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom alarm 4. A28.4 is reported when it is active.
H2-14	Source of user-defined alarm 5	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom alarm 5. Value description: 0: Inactive - The custom alarm 5 is inactive, and the drive does not report the fault. 1: Valid - The custom alarm 5 is valid, and the drive reports A28.5. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom alarm 5. A28.5 is reported when it is active.
H2-15	Source of user-defined alarm 6	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom alarm 6. Value description: 0: Inactive - The custom alarm 6 is inactive, and the drive does not report the alarm. 1: Valid - The custom alarm 6 is valid, and the drive reports A28.6. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom alarm 6. A28.6 is reported when it is active.

Param.	Name	Default	Value range	Description
H2-16	Source of user-defined alarm 7	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom alarm 7. Value description: 0: Inactive - The custom alarm 7 is inactive, and the drive does not report the alarm. 1: Valid - The custom alarm 7 is valid, and the drive reports A28.7. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom alarm 7. A28.7 is reported when it is active.
H2-17	Source of user-defined alarm 8	0	0: Invalid 1: Valid Others: B connector	Defines the source of custom alarm 8. Value description: 0: Inactive - The custom alarm 8 is inactive, and the drive does not report the alarm. 1: Valid - The custom alarm 8 is valid, and the drive reports A28.8. Other: B connector - Select the B connector as the trigger condition for faults and alarms. Note: This parameter defines the source of custom alarm 8. A28.8 is reported when it is active.

5.6 Monitoring

5.6.1 Setting Monitoring Parameters Displayed on Operating Panel

Scenarios

You can set commonly used parameters to be displayed on the operating panel in the stop or running state. Use the shift keys  and  on the operating panel and for quick viewing.

Function description

The parameter monitoring function enables you to view the status of the AC drive via the operating panel. Parameters A6-03, A6-04, and A6-05 determine what the operating panel displays and whether to display free mappings. Parameters A6-07, A6-08, A6-09, and A6-10 determine what the free mapping displays.

In the stop or running state, use the shift key  and  on the operating panel to switch the display of different monitoring parameters.

In the running state, 32 operating state parameters are supported. The corresponding parameters can be displayed by setting parameter A6-03 and A6-04. The two parameters can be selected by 32 bits. If the corresponding bit value is set to 1, the parameters are displayed under the run page.

In the stop state, 16 stop status parameters are available. A6-05 determines whether the corresponding parameter is displayed. The corresponding parameter bit is shown in the following table.

Table 5–113 Content displayed in the running and stop states

Param.	Bit	Operating panel display	Bit	Operating panel display
A6-03 Parameter 1 displayed on LED operating panel during operation	bit0	Operating frequency	bit8	DO output state
	bit1	Frequency reference	bit9	AI1 voltage
	bit2	Bus voltage	bit10	AI2 voltage
	bit3	Output voltage	bit11	Reserved
	bit4	Output current	bit12	Reserved
	bit5	Output power	bit13	Reserved
	bit6	Output torque	bit14	Load speed display
	bit7	DI input state	bit15	PID reference
A6-04 Parameter 2 displayed on LED operating panel during operation	bit0	PID feedback	bit8	Motor velocity
	bit1	PLC stage	bit9	Current power-on time
	bit2	HDI input pulse frequency	bit10	Current operating time
	bit3	Running frequency 2 (Hz)	bit11	Reserved
	bit4	Remaining running time	bit12	Communication setpoint
	bit5	AI1 voltage before correction	bit13	Encoder feedback speed
	bit6	Free mapping 0	bit14	Display of main frequency X
	bit7	Free mapping 1	bit15	Display of auxiliary frequency Y
A6-05 Parameter displayed on LED operating panel at stop	bit0	Frequency reference	bit8	Reserved
	bit1	Bus voltage	bit9	PLC stage
	bit2	DI input state	bit10	Reserved
	bit3	DO output state	bit11	PID reference
	bit4	AI1 voltage	bit12	HDI input pulse frequency
	bit5	AI2 voltage	bit13	Reserved
	bit6	Reserved	bit14	Free mapping 0
	bit7	Reserved	bit15	Free mapping 1

For example, when setting parameter A6-05 to 0x003F (the value at bit 0/1/2/3/4/5 is 1), the corresponding display is shown on the operating panel in the shutdown state. The display parameters are switched through the  and  keys on the panel. For example, in the stop state,

the panel displays the frequency reference. Press the key, the panel displays the bus voltage. Press the key again, and the panel displays the DI input status, as shown in the following figure.

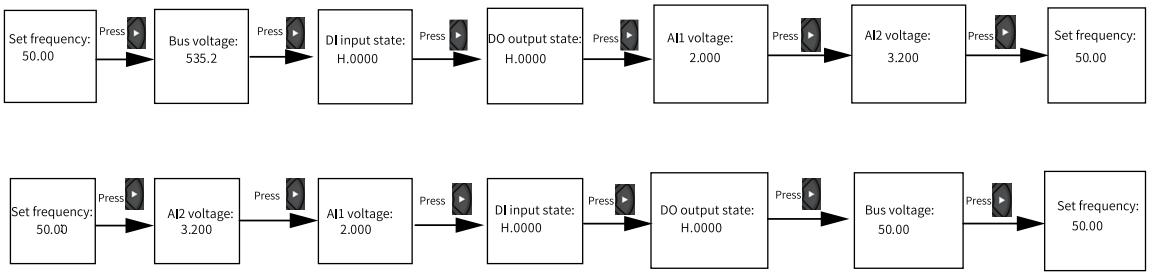


Figure 5-234 Parameter switching in the shutdown state

At the same time, the product supports two free mapping channels. You can select mappings by parameters A6-07 and A6-09. Select the unit and decimal point of the mappings through parameters A6-08 and A6-10.

Free mapping can be set in both the running state and the stop state through bit 6 and bit 7 of A6-04 and bit 14 and bit 15 of A6-05, respectively.

For example, if you want L1002 [system status word 1] to be displayed in the stop stop, follow the steps below.

(1) Set A6-07 by locating L10 [Word connector 1] in the drop-down option, and selecting L1002 [System status word 1].

(2) Set A6-05 to 0x4033, that is, bit value of 0/1/4/5/14 to 1, and the last parameter of the stop parameter display is the content of the free mapping 0 [L1002 (System status word 1)].

(3) Switch the stop parameters through the and keys on the operating panel, as shown in the following figure.

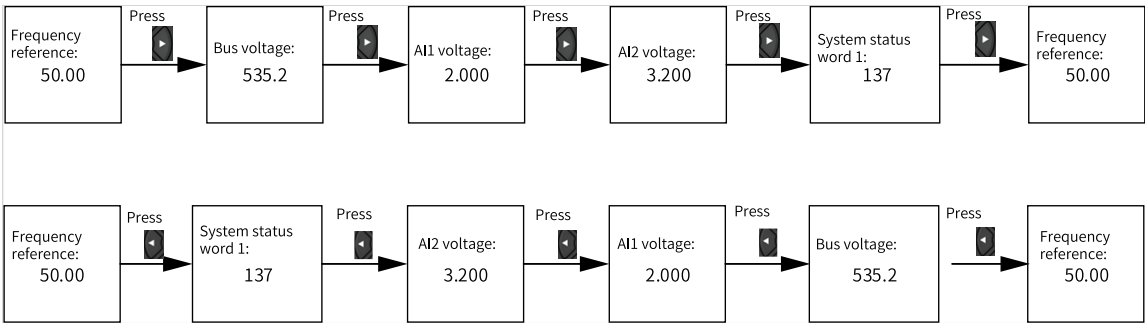


Figure 5-235 Free mapping 0 switching diagram 1

Set the hundreds position of A6-08 and A6-10 to configure whether the unit and decimal place setting (the ones and tens position) is active. When the value at the hundreds position is set to 0, the unit and decimal place setting is not inactive even if the ones and tens positions are set. When the value at the hundreds position is set,, the unit and decimal place setting is active.

For example, if you want L1101 [base value of frequency per unit value] to be 50.0 Hz, follow the steps below.

(1) Set A6-07 by locating L11 [Word connector 2] in the drop-down option, and select L1101 [Base value of frequency per unit value].

(2) Set A6-08 [Format displayed by free mapping 0] to 0x111, that is, the unit is Hz, the decimal place is 1 and the settings are active.

(3) Set A6-05 to 0x4033, that is, bit value of 0/1/4/5/14 to 1, and the last parameter of the stop parameter display is the content of the free mapping 0 [L1101 (Base value of frequency per unit value)].

(4) Switch the stop parameters through the  and  keys on the operating panel.

The detailed procedure is as follows.

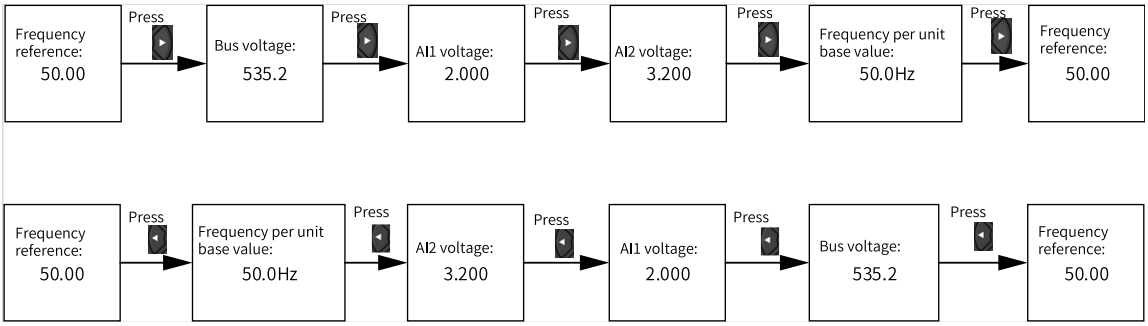


Figure 5-236 Free mapping 0 switching diagram 2

Related parameters

Table 5–114 Display parameter setting

Param.	Name	Default	Value Range	Descriptions
A6-03	Parameter 1 displayed on LED operating panel during operation	0x001F	Bit 0: Running frequency (Hz) Bit 1: Frequency reference (Hz) Bit 2: Bus voltage (V) Bit 3: Output voltage (V) Bit 4: Output current (A) Bit 5: Output power (kW) Bit 6: Output torque (%) Bit 7: DI input status Bit 8: DO output status Bit 9: AI1 voltage (V) Bit 10: AI2 voltage (V) bit11 to bit13: Reserved Bit 14: Load speed Bit 15: PID reference The bit value description is as follows. 0: Hidden 1: Displayed	Sets the contents of parameter 1 displayed on LED operating panel during operation. Note: Defines the parameters displayed on the LED operating panel when the AC drive is running with the left  and right shift  keys pressed down. The value 1 of a bit indicates that the parameter group is displayed. The value 0 of a bit indicates that the parameter group is not displayed. (Reserved bits are skipped during LED display.)

Param.	Name	Default	Value Range	Descriptions
A6-04	Parameter 2 displayed on LED operating panel during operation	0x0000	Bit 0: PID feedback Bit 1: PLC stage Bit 2: HDI pulse input frequency (kHz) (Only valid for MD630S) Bit 3: Running frequency 2 (Hz) Bit 4: Remaining running time Bit 5: AI1 voltage before correction (V) Bit 6: Free mapping 0 Bit 7: Free mapping 1 Bit 8: Motor speed Bit 9: Current power-on time (min) Bit 10: Current running time (min) bit11: Reserved Bit 12: Communication setting value Bit 13: Encoder feedback speed Bit 14: Main frequency X Bit 15: Auxiliary frequency Y The bit value description is as follows. 0: Hidden 1: Displayed	Sets the contents of parameter 2 displayed on LED operating panel during operation. Note: Defines the parameters displayed on the LED operating panel when the AC drive is running with the left and right shift keys pressed down. The value 1 of a bit indicates that the parameter group is displayed. The value 0 of a bit indicates that the parameter group is not displayed. (Reserved bits are skipped during LED display.)

Param.	Name	Default	Value Range	Descriptions
A6-05	Parameter displayed on LED operating panel at stop	0x0033	Bit 0: Frequency reference (Hz) Bit 1: Bus voltage (V) Bit 2: DI input status Bit 3: DO output status Bit 4: AI1 voltage (V) Bit 5: AI2 voltage (V) Bit 6 to bit 8: Reserved Bit 9: PLC stage Bit 10: Reserved Bit 11: PID reference Bit 12: HDI pulse input frequency (kHz) (Only valid for MD630S) bit13: Reserved Bit 14: Free mapping 0 Bit 15: Free mapping 1 The bit value description is as follows. 0: Hidden 1: Displayed	Sets the parameter displayed on LED operating panel at stop. Note: Defines the parameters displayed on the LED operating panel when the AC drive is in the stop state with the left and right shift keys pressed down. The value 1 of a bit indicates that the parameter group is displayed. The value 0 of a bit indicates that the parameter group is not displayed. (Reserved bits are skipped during LED display.)
A6-07	Address displayed by free mapping 0	0	0: Invalid address Other: K connector	Sets the address displayed by free mapping 0. Note: The parameter is associated with the free mapping 0 of bit 6 of A6-04 and bit 14 of A6-05. When the value at bit 6 of A6-04 is set to 1, the operating panel displays the free mapping 0 in the running state; when the value at bit 14 of A6-05 is set to 1, the operating panel displays the free mapping 0 in the stop state. The display shows the connector value set by A6-07. It is inactive when A6-07 is set to 0.

Param.	Name	Default	Value Range	Descriptions
A6-08	Format displayed by free mapping 0	0x148	Ones position: Unit 0: Disable 1: Hz 2: A 3: RPM 4: V 5: Link 6: % 7: s 8: h 9: kW A: KW/h B: ℃ Tens position: Decimal point 0: 0 decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places 4: 4 decimal places Hundreds: Enable 0: Disable 1: Enable Thousands position: Reserved	Used to set the format displayed by free mapping 0. Value description Ones position: Defines the display format (unit) of free mapping 0. When free mapping 0 is active, that is, the connector value set by A6-07 is valid, if free mapping 0 is selected for parameter 2 displayed during operation or parameter displayed at stop (A6-04 or A6-05), the unit defined by the ones will be used for display. The tens position is used to set the number of decimal place of the free mapping 0. Similar to the ones position, it indicates how many decimal places the content of the free mapping 0 is displayed. The hundred position is used to set whether the unit and decimal place setting of the free mapping 0 is valid. When the value at the hundreds position is set to 0, the unit and decimal place setting is not inactive even if the ones and tens positions are set. When setting the value at the hundreds position, the unit and decimal place setting is active.
A6-09	Address displayed by free mapping 1	0	0: Invalid address Other: K connector	Sets the address displayed by free mapping 1. Note: The parameter is associated with the free mapping 1 of bit 7 of A6-04 and bit 15 of A6-05. When the value at bit 7 of A6-04 is set to 1, the operating panel displays the free mapping 0 in the running state; when the value at bit 15 of A6-05 is set to 1, the operating panel displays the free mapping 0 in the stop state. The display shows the connector value set by A6-09. It is inactive when A6-09 is set to 0.

Param.	Name	Default	Value Range	Descriptions
A6-10	Format displayed by free mapping 1	0x148	Ones position: Unit 0: Disable 1: Hz 2: A 3: RPM 4: V 5: Link 6: % 7: s 8: h 9: kW A: KW/h B: ℃ Tens position: Decimal point 0: 0 decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places 4: 4 decimal places Hundreds: Enable 0: Disable 1: Enable Thousands position: Reserved	Used to set the format displayed by free mapping 1. Value description: Ones position: Defines the display format (unit) of free mapping 1. When free mapping 0 is active, that is, the connector value set by A6-09 is valid, if free mapping 0 is selected for parameter 2 displayed during operation or parameter displayed at stop (A6-04 or A6-05), the unit defined by the ones will be used for display. The tens position is used to set the number of decimal place of the free mapping 1. Similar to the ones position, it indicates how many decimal places the content of the free mapping 1 is displayed. The hundred position is used to set whether the unit and decimal place setting of the free mapping 1 is valid. When the value at the hundreds position is set to 0, the unit and decimal place setting is not inactive even if the ones and tens positions are set. When setting the value at the hundreds position, the unit and decimal place setting is active.

5.7 Additional Functions

5.7.1 Parameter interconnection

5.7.1.1 Connector Resource

5.7.1.1.1 Connector Introduction

Function description

Connectors refer to parameters in group L, which are divided into bit connectors (B connector), word connector system (K connector), and floating-point connectors (F connector).

The word connector system contains word connectors (16 bits, corresponding to groups L10 to L12) and double-word connectors (32 bits, corresponding to group L20).

The double-word connector can represent more valid digits to improve the value precision.

This drive also supports mutual conversion between bit connectors, word connectors, and double-word connectors through free function blocks. See "Free Function Blocks" for details.

Application scenarios

1. You can monitor internal status information of the system through the connector.
2. When used for parameter interconnection, this function serves as signal sources for certain functions, enabling internal resource sharing.
3. When this function is used as inputs for free function blocks, you can perform various mathematical operations to achieve diversified control logic.

5.7.1.1.2 Bit Connector (B Connector)

Application scenarios

This connector is used to monitor the digital signal status in the system or as a binary signal source for certain functions.

1. Used for monitoring the system state, where only the system digital signal state can be monitored. For example, it can be used to display DI input status, DO output status, a specific bit of the communication word, a specific bit of the control word and status word, and fault activation status information.

2. Used for parameter interconnection. As the system resource pool, for a parameter with the drop-down menu "Other: B connector", the bit connector (B connector) is used as the binary signal source. You can select any bit connector from L00 to L09 as the input of the parameter to implement specific functions (for example, to convert bit connectors to word connectors, see section "Free Function Block" for details).

Function description

The bit connector (B connector) saves information such as the digital signal status in the system, and can be used as the connector signal source for parameters of reference source type. The value of bit connector can only be 0 or 1. Groups L00 to L09 are bit connectors.

Related parameter

Group L00			
Param.	Name	Display range	Description
L0000	Logic 0	0	Constant 0
L0001	Logic 1	1	Constant 1
L0002	DI1	0: DI1 open 1: DI1 closed	Displays the final level state of DI1.
L0003	DI2	0: DI2 open 1: DI2 closed	Displays the final level state of DI2.
L0004	DI3 (active only for MD630S)	0: DI3 open 1: DI3 closed	Displays the final level state of DI3.
L0005	DI4 (active only for MD630S)	0: DI4 open 1: DI4 closed	Displays the final level state of DI4.
L0006	DI5 (active only for MD630S)	0: DI5 open 1: DI5 closed	Displays the final level state of DI5.
L0007	DI6 (active only for MD630S)	0: DI6 open 1: DI6 closed	Displays the final level state of DI6.

Group L00			
Param.	Name	Display range	Description
L0008	DI7 (active only for MD630S)	0: DI7 open 1: DI7 closed	Displays the final level state of DI7.
L0012	VDI1	0: VDI1 open 1: VDI1 closed	Displays the final level state of VDI1.
L0013	VDI2	0: VDI2 open 1: VDI2 closed	Displays the final level state of VDI2.
L0014	VDI3	0: VDI3 open 1: VDI3 closed	Displays the final level state of VDI3.
L0015	VDI4	0: VDI4 open 1: VDI4 closed	Displays the final level state of VDI4.
L0016	VDI5	0: VDI5 open 1: VDI5 closed	Displays the final level state of VDI5.
L0017	VDI6	0: VDI6 open 1: VDI6 closed	Displays the final level state of VDI6.
L0018	DI1 inversion	0: The inverted value of DI1 is 0. 1: The inverted value of DI1 is 1.	Displays the state after the final output of DI1 is inverted.
L0019	DI2 inversion	0: The inverted value of DI2 is 0. 1: The inverted value of DI2 is 1.	Displays the state after the final output of DI2 is inverted.
L0020	DI3 inversion (active only for MD630S)	0: The inverted value of DI3 is 0. 1: The inverted value of DI3 is 1.	Displays the state after the final output of DI3 is inverted (active only for MD630S).
L0021	DI4 inversion (active only for MD630S)	0: The inverted value of DI4 is 0. 1: The inverted value of DI4 is 1.	Displays the state after the final output of DI4 is inverted (active only for MD630S).
L0022	DI5 inversion (active only for MD630S)	0: The inverted value of DI5 is 0. 1: The inverted value of DI5 is 1.	Displays the state after the final output of DI5 is inverted (active only for MD630S).
L0023	DI6 inversion (active only for MD630S)	0: The inverted value of DI6 is 0. 1: The inverted value of DI6 is 1.	Displays the state after the final output of DI6 is inverted (active only for MD630S).
L0024	DI7 inversion (active only for MD630S)	0: The inverted value of DI7 is 0. 1: The inverted value of DI7 is 1.	Displays the state after the final output of DI7 is inverted (active for MD630S).
L0028	VDI1 inversion	0: The inverted value of VDI1 is 0. 1: The inverted value of VDI1 is 1.	Displays the state after the final output of VDI1 is inverted.

Group L00			
Param.	Name	Display range	Description
L0029	VDI2 inversion	0: The inverted value of VDI2 is 0. 1: The inverted value of VDI2 is 1.	Displays the state after the final output of VDI2 is inverted.
L0030	VDI3 inversion	0: The inverted value of VDI3 is 0. 1: The inverted value of VDI3 is 1.	Displays the state after the final output of VDI3 is inverted.
L0031	VDI4 inversion	0: The inverted value of VDI4 is 0. 1: The inverted value of VDI4 is 1.	Displays the state after the final output of VDI4 is inverted.
L0032	VDI5 inversion	0: The inverted value of VDI5 is 0. 1: The inverted value of VDI5 is 1.	Displays the state after the final output of VDI5 is inverted.
L0033	VDI6 inversion	0: The inverted value of VDI6 is 0. 1: The inverted value of VDI6 is 1.	Displays the state after the final output of VDI6 is inverted.
L0034	RO	0: RO does not generate output. 1: RO generates output.	Displays the final output state of relay RO1.
L0038	DO	0: The DO terminal does not generate output. 1: The DO terminal generates output.	Displays the final output state of DO.
L0042	FMR (active only for MD630S)	0: FMR does not generate output. 1: FMR generates output.	Displays the final output state of FMR (active only for MD630S).
L0044	VDO1	0: VDO1 does not generate output. 1: VDO1 generates output.	Displays the final output state of VDO1.
L0045	VDO2	0: VDO2 does not generate output. 1: VDO2 generates output.	Displays the final output state of VDO2.
L0046	VDO3	0: VDO3 does not generate output. 1: VDO3 generates output.	Displays the final output state of VDO3.
L0047	VDO4	0: VDO4 does not generate output. 1: VDO4 generates output.	Displays the final output state of VDO4.
L0048	VDO5	0: VDO5 does not generate output. 1: VDO5 generates output.	Displays the final output state of VDO5.
L0049	VDO6	0: VDO6 does not generate output. 1: VDO6 generates output.	Displays the final output state of VDO6.

Group L00			
Param.	Name	Display range	Description
L0050	AI1 input limit violation	0: Inactive 1: Active	Displays whether the AI1 input voltage exceeds the AI limit range.
L0051	AI2 input limit violation	0: Inactive 1: Active	Displays whether the AI2 input voltage exceeds the AI limit range.
L0053	HDI input disconnection (active only for MD630S)	0: Inactive 1: Active	Displays whether the HDI input is disconnected. Disconnection occurs when the HDI input pulse frequency is less than half of the HDI input lower limit or the input is disconnected.
L0054	Level state of the AI1 that used as DI	0: Low level 1: High level	Indicates the level status when AI1 is used as the DI.
L0055	Level state of the AI2 that used as DI	0: Low level 1: High level	Indicates the level status when AI2 is used as the DI.
L0057	AI2 temperature mode - Motor temperature reached	0: Inactive 1: Active	Displays whether the motor temperature reaches E2-74 [AI2 temperature mode - motor temperature reached] in AI2 temperature mode.
L0058	AI2 temperature mode - Motor overtemperature fault	0: Inactive 1: Active	Displays whether the motor temperature exceeds E2-76 [AI2 temperature mode - Motor overtemperature protection threshold] in AI2 temperature mode.
L0059	AI2 temperature mode - Motor overtemperature pre-alarm	0: Inactive 1: Active	Displays whether the motor temperature exceeds E2-75 [AI2 temperature mode - Motor overtemperature pre-alarm threshold] in AI2 temperature mode.

Group L01			
Param.	Name	Display range	Description
L0100	Ready for switch-on	0: Inactive 1: Active	Displays whether the drive is ready for switch-on.
L0101	Ready to run	0: Inactive 1: Active	Displays whether the drive is ready to run.
L0102	Operation state	0: Inactive 1: Active	Displays whether the drive is operating.
L0103	Fault activation	0: Inactive 1: Active	Displays whether the drive is faulty.
L0104	OFF2 (coast to stop) flag	0: Active 1: Inactive	Displays the current state of the OFF2 (coast to stop) command.
L0105	OFF3 (quick stop) flag	0: Active 1: Inactive	Displays the current state of the OFF3 (quick stop) command.
L0107	Alarm/Minor fault activation	0: Inactive 1: Active	Displays whether the drive encounters an alarm or a minor fault.

Group L01			
Param.	Name	Display range	Description
L0110	Target speed arrival	0: Inactive 1: Active	Displays whether the target speed of the drive is reached. When both the operating speed and the actual motor speed are in the range of target speed±P0-51 for a period longer than the time set by P0-52, the output is activated.
L0111	Torque limit arrival	0: Inactive 1: Active	Displays whether the torque reaches the set upper and lower limits. The data is valid when the torque is limited.
L0112	Positive speed	0: Inactive 1: Active	Displays the direction of the operating speed. This parameter is valid when the operating direction is forward.
L0113	Negative speed	0: Inactive 1: Active	Displays the direction of the operating speed. This parameter is valid when the operating direction is reverse.
L0118	Current control channel	0: Control channel 1 1: Control channel 2	Displays the effective control channel.
L0119	Current setting channel	0: Setting channel 1 1: Setting channel 2	Displays the effective setting channel.
L0120	Active terminal start/stop module	0: Terminal start/stop module A 1: Terminal start/stop module B	Displays the effective terminal start/stop module.
L0121	Terminal control state	0: Inactive 1: Active	Displays whether the command source is terminal control. This parameter is valid when the command source is terminal control.
L0132	Error output	0: Inactive 1: Active	Displays whether the drive reports faults, minor faults, or alarms.
L0133	Error output (excluding undervoltage fault)	0: Inactive 1: Active	Defines whether the drive reports faults, minor faults, or alarms (excluding undervoltage faults).
L0134	Fault output	0: Relay inactive upon fault and automatic fault reset 1: Relay active upon fault and automatic fault reset	Displays whether the relay is active upon fault and automatic fault reset.
L0135	Stop at fault	0: Inactive 1: Active	Displays whether the stop-at-fault command is active.
L0136	Normal operation	0: Inactive 1: Active	Displays whether the drive is in the normal operation state.
L0137	Jog	0: Inactive 1: Active	Displays whether the drive is in the jog state.
L0138	Decelerate-to-stop state	0: Inactive 1: Active	Displays whether the drive is in the decelerate-to-stop state.

Group L01			
Param.	Name	Display range	Description
L0139	Quick stop	0: Inactive 1: Active	Displays whether the drive is in the quick-stop state.
L0140	Stop-at-maximum-capability state	0: Inactive 1: Active	Displays whether the drive is in the stop-at-maximum-capability state.
L0156	Reverse run	0: Inactive 1: Active	Displays whether the drive is operating in the reverse direction.
L0174	Bus voltage state	0: Abnormal 1: Normal	Displays the bus voltage state and the "ready for switch-on" state.

Group L02			
Param.	Name	Display range	Description
L0244	Power-on time arrival	0: Inactive 1: Active	Displays whether the cumulative power-on time (Ad-02 and Ad-03) reaches the set value (P0-16 and P0-17).
L0245	Operating time arrival	0: Inactive 1: Active	Displays whether the cumulative operating time (Ad-00 and Ad-01) reaches the set value (P0-18 and P0-19).
L0246	Timed operation arrival	0: Inactive 1: Active	Displays whether the current operating time reaches the timed operation time (P0-14 and P0-15).
L0247	Current operating time arrival	0: Inactive 1: Active	Displays whether the current operation time reaches the set time (P0-20).
L0258	Current 1 arrival	0: Inactive 1: Active	Displays whether the output current reaches the range of current detection level 1.
L0259	Current 2 arrival	0: Inactive 1: Active	Displays whether the output current reaches the range of current detection level 2.
L0260	Zero current state	0: Inactive 1: Active	Displays whether the drive is in the zero current output state.
L0261	Output current limit violation	0: Inactive 1: Active	Displays whether the output current exceeds the limit.
L0262	Frequency level detection 1	0: Inactive 1: Active	Displays whether the operating frequency reaches the frequency level detection 1 (FDT1) range.
L0263	Frequency level detection 2	0: Inactive 1: Active	Displays whether the operating frequency reaches the frequency level detection 2 (FDT2) range.
L0264	Frequency arrival	0: Inactive 1: Active	Displays whether the operating frequency reaches the target frequency.
L0265	Frequency arrival 1	0: Inactive 1: Active	Displays whether the running frequency reaches detection frequency 1.
L0266	Frequency arrival 2	0: Inactive 1: Active	Displays whether the running frequency reaches detection frequency 2.

Group L02			
Param.	Name	Display range	Description
L0267	Frequency upper limit arrival	0: Inactive 1: Active	Displays whether the operating frequency reaches the upper limit. Note: The effective positive frequency upper limit is determined by C4-10 (Maximum motor frequency), d1-03 (Digital reference of positive frequency upper limit), and d1-05 (Positive frequency upper limit selection), whichever is the minimum. The negative frequency upper limit is similar to the positive frequency upper limit.
L0268	Frequency lower limit arrival (no output at stop)	0: Inactive 1: Active	Displays whether the operating frequency reaches the lower limit. The connector outputs an active signal when the operating frequency reaches the lower limit. This flag is inactive in the stop state. Note: The effective frequency lower limit is determined by C4-11 [Minimum motor frequency] and d1-07 [Digital reference of positive frequency lower limit], whichever is higher. The negative frequency lower limit is similar to the positive frequency lower limit.
L0269	Frequency lower limit arrival (output generated even at stop)	0: Inactive 1: Active	Displays whether the operating frequency reaches the lower limit. The connector outputs an active signal when the operating frequency reaches the lower limit. This flag is active even in the stop state. Note: The effective frequency lower limit is determined by C4-11 [Minimum motor frequency] and d1-07 [Digital reference of positive frequency lower limit], whichever is higher. The negative frequency lower limit is similar to the positive frequency lower limit.
L0270	Speed comparison arrival 1	0: Inactive 1: Active	Displays whether the motor operating speed reaches the range of speed comparison 1.
L0271	Speed comparison arrival 2	0: Inactive 1: Active	Displays whether the motor operating speed reaches the range of speed comparison 2.

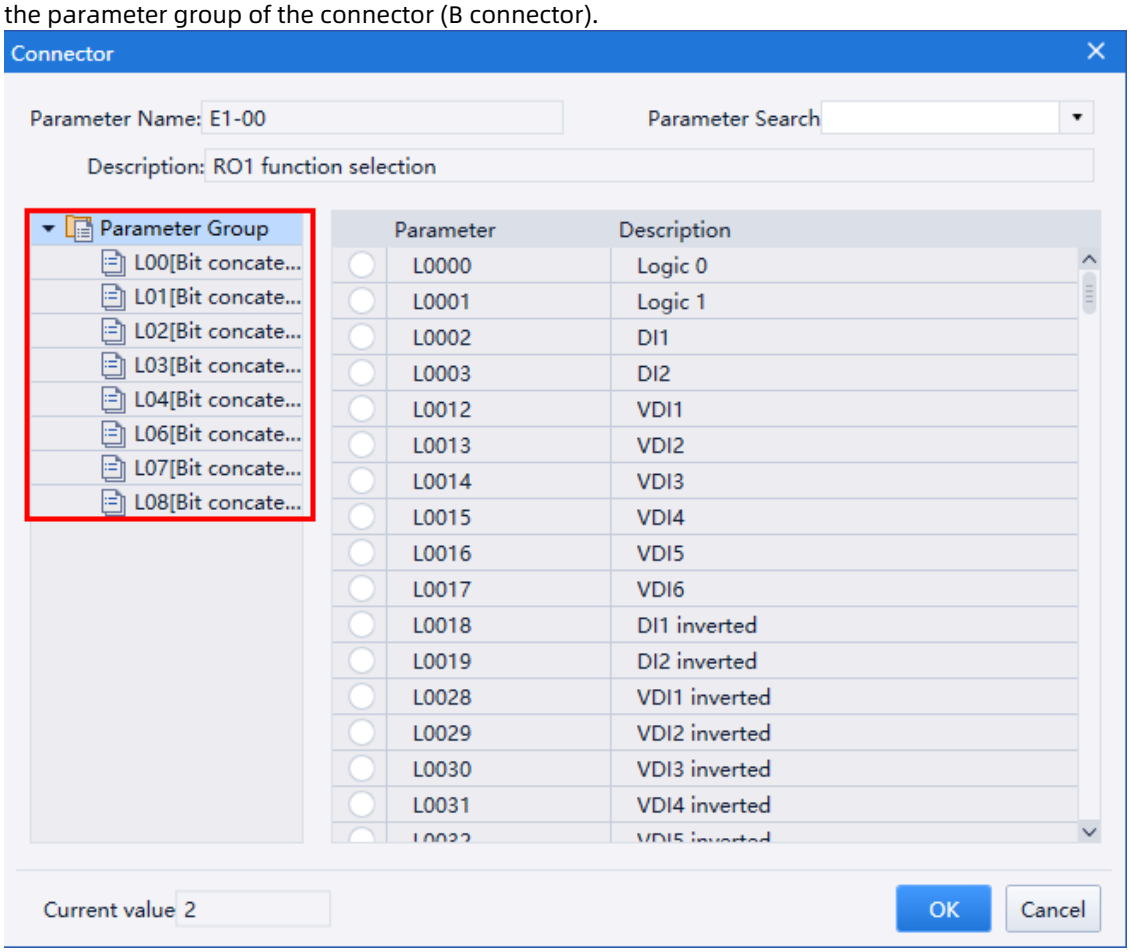
Application instance

The following takes E1-00 [RO output function selection] as an example to describe how to select the bit connector (B connector) as the parameter input.

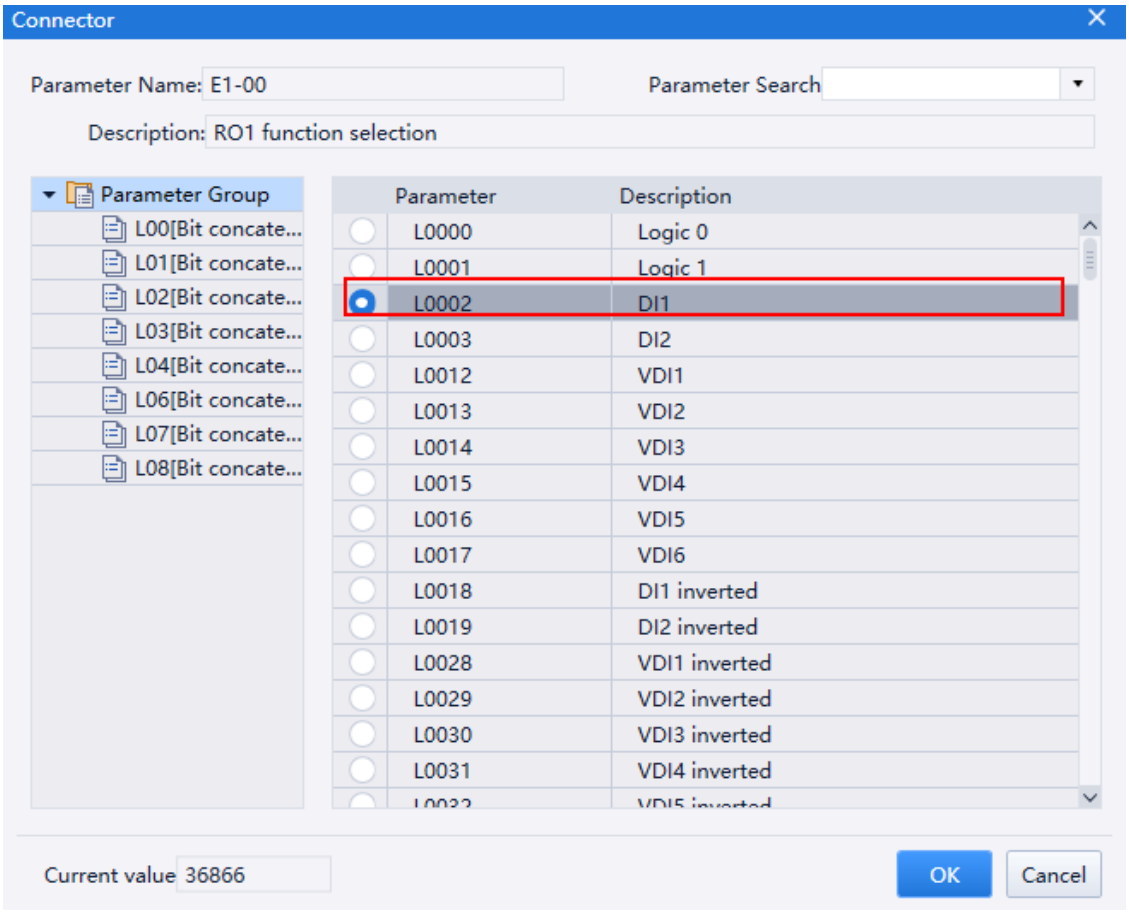
1. Select "Others [B connector]" in the drop-down menu of E1-00 [RO1 output function selection].

Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...	Modify...	Display mode	Postal...
E1-00	RO1 function selection	2 [Fault]	-	2	0	46	AnyM...	Decimalism	0xE100
E1-04	DO1 output function selection	33 [Reverse run in progress]	-	0	0	46	AnyM...	Decimalism	0xE104
E1-10	VDO1 function selection	34 [Zero current state]	-	0	0	46	AnyM...	Decimalism	0xE10A
E1-11	VDO2 function selection	35 [Drive overtemperature threshold	-	0	0	46	AnyM...	Decimalism	0xE10B
E1-12	VDO3 function selection	36 [Output current limit exceeded]	-	0	0	46	AnyM...	Decimalism	0xE10C
E1-13	VDO4 function selection	37 [Frequency lower limit reached (c	-	0	0	46	AnyM...	Decimalism	0xE10D
E1-14	VDO5 function selection	38 [Error (Fault/Minor fault/Alarm)]	-	0	0	46	AnyM...	Decimalism	0xE10E
E1-15	VDO6 function selection	40 [Current operating time reached]	-	0	0	46	AnyM...	Decimalism	0xE10F
E1-16	RO1 switch-on delay	41 [Fault (excluding undervoltage)]	s	0	0	3600	AnyM...	Decimalism	0xE110
E1-17	RO1 switch-off delay	42 [STO]	s	0	0	3600	AnyM...	Decimalism	0xE111
E1-24	DO1 output switch-on delay	43 [Minor fault or alarm]	s	0	0	3600	AnyM...	Decimalism	0xE118
E1-25	DO1 output switch-off delay	44 [AI2 input limit violated]	s	0	0	3600	AnyM...	Decimalism	0xE119
E1-36	DO/RO/VDO output source	46 [Component lifetime alarm]	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0xE124
E1-37	DO/RO/VDO forced data	others [B Connector]	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0xE125
E1-38	DO/RO/VDO polarity selection		-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0xE126

2. After clicking "Others [B connector]", the following dialog box pops up. Click on the left to select the parameter group of the connector (B connector).



3. Click L0002 DI1 and then click "OK".



4. When the current value of E1-00 [RO output function selection] is "L0002 [DI1]", the setting is successful.

Parameter	Description	Current value	Unit	Factory...	Minim...
E1-00	RO1 function selection	L0002[DI1]	-	2	0
E1-04	DO1 output function selection	0 [No output]	-	0	0
E1-10	VDO1 function selection	0 [No output]	-	0	0

After the above settings are done, if DI1 is closed, L0002 [DI1] is 1 and the RO1 terminal generates output.

5.7.1.1.3 Word Connector (K Connector)

Application scenarios

This connector is used to monitor the status word in the system or used as a signal source of certain functions.

1. Monitor the system status, during which the status word of a certain function is monitored generally, such as the control word, communication word, status word, and internal monitoring parameter of the drive. For example, you can monitor DI1 to DI7 and VDI1 to VDI6 through L1065 DI state.

2. Monitor per-unit values of internal monitoring system. For example, L1101 is the per-unit base value of the frequency.

3. The connector can also be used for parameter interconnection. The status word of a function module of the drive is used as the signal source input. As the resource pool of the system, you can

select a word connector from L10 to L19 as the parameter input in the drop-down menu "Other: K connector" to implement a specific function (including using the word connector as the input source, converting it to bit connector or double-word connector, see *"5.4.8.1 Free Function Module" on page 707* for details).

Function description

The word connector (K connector) saves information such as analog values, status words, or command words in the system, which is divided into word connector and double-word connector to be used as the connector signal source for source-type parameters. For the word connector, the data type is 16-bit data. Parameter groups L10 to L19 are word connectors.

Related parameter

Group L10			
Param.	Name	Display range	Description
L1000	Current state of the system state machine	0: Initialization 1: Switch-on inhibited 2: Switch-on permitted 3: Operation permission 4: Start 5: Run 6: Stop 7: Active 8: Auto-tuning	Displays the current state of the system state machine.
L1001	Switchover command of system state machine	bit0: Start command state 0: Inactive 1: Active bit1: Stop command state 0: Inactive 1: Active bit2: OFF2 (coast to stop) state 0: Inactive 1: Active bit3: OFF3 (quick stop) state 0: Inactive 1: Active bit4: Operation permission (non-sleep state) 0: Inactive 1: Active bit5: Operation inhibition 0: Inactive 1: Active bit6: Stop at fault state 0: Inactive 1: Active bit7 to bit15: Reserved	Indicates the effective system state machine switchover command. You can click the current value of the parameter to view the command and status indicated by each bit. Value description: bit0: Start command valid - The current start command is valid. bit1: Stop command valid - The current stop command is valid. bit2: OFF2 (coast to stop) state - The OFF2 (coast to stop) command is valid, and coast-to-stop is under execution. bit3: OFF3 (quick stop) - The OFF3 (quick stop) command is valid, and quick-stop is under execution. bit4: Operation permission (non-sleep state) - The drive is allowed to run currently. bit5: Operation inhibition active - The drive is inhibited from running currently. bit6: Stop-at-fault active - The drive stops due to a fault.

Group L10			
Param.	Name	Display range	Description
L1002	System status word 1	bit0: Ready to switch on 0: Inactive 1: Active bit1: Ready to run 0: Inactive 1: Active bit2: Operation in progress 0: Inactive 1: Active bit3: Fault 0: Inactive 1: Active bit4: OFF2 (coast to stop) stop 0: Inactive 1: Active bit5: OFF3 (quick stop) stop 0: Inactive 1: Active bit6: Switch-on block 0: Inactive 1: Active bit7: Alarm/Limited operation 0: Inactive 1: Active bit8: No speed deviation 0: Inactive 1: Active bit9: Local/Remote 0: Local 1: Remote bit10: Target speed reach 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active (Continued)	Displays the value of system status word 1. You may click the current value of the parameter to view the system status indicated by each bit. Value description: bit0: Ready for switch-on - The drive passes self-test upon power-on and no fault occurs. bit1: Ready to run - The drive is ready to run. bit2: Operating - The drive is operating. bit3: Faulty - The drive stops due to a fault. bit4: OFF2 (coast to stop) - OFF2 (coast to stop) command is active, and the motor coasts to stop. bit5: OFF3 (quick stop) - OFF3 (quick stop) command is active, and the motor performs quick stop. bit6: Startup lockout - The drive is in the startup lockout state. bit7: Alarm/Limited operation - The drive reports Axxx.x (fault) or Lxxx.x (limited operation). bit8: No speed deviation - The deviation between the operating speed and target speed is within the allowable range. bit9:Local/Remote - Displays whether the drive is in the local control mode or remote control mode. bit10: Target speed arrival - Displays whether the set target speed is reached. bit11: Torque limited - Displays whether the torque limit is triggered. bit12: Positive speed - The drive is running in the forward direction. bit13: Negative speed - The drive is operating in the reverse direction. bit14: Running (pulsing) - The drive is operating and generates output. bit15: User-defined state 0 - The drive is in user-defined state 0. Whether this bit is valid depends on the main status setting word 1 of P0-59. When P0-59 is 1, bit15 is set to 1. When P0-59 is 0, bit15 is set to 0.

Group L10			
Param.	Name	Display range	Description
Same as above	Same as above	(Continued) bit12: Positive speed 0: Inactive 1: Active bit13: Negative speed 0: Inactive 1: Active bit14: Running (pulsing) 0: Inactive 1: Active bit15: User-defined state 0 0: Inactive 1: Active	Same as above

Group L10			
Param.	Name	Display range	Description
L1003	System status word 2	bit0: Self-test in progress 0: Inactive 1: Active bit1: Parameter auto-tuning 0: Inactive 1: Active bit2: Minor fault state 0: Inactive 1: Active bit3: Alarm state 0: Inactive 1: Active bit4: Speed mode 0: Inactive 1: Active bit5: Torque mode 0: Inactive 1: Active bit6: Position control mode (reserved) 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active (Continued)	Displays the value of system status word 2. You may click the current value of the parameter to view the system status indicated by each bit. Value description: bit0: Self-testing - The drive is in self-test state. bit1: Parameter auto-tuning - The drive is in the process of parameter auto-tuning. bit2: Minor fault state - The drive is in the minor fault state. bit3: Alarm state - The drive reports alarm code Axxx.x. bit4: Speed mode - The motor control mode is speed control. bit5: Torque mode - The motor control mode is torque control. bit6: Position mode (reserved) - The motor control mode is position control. bit7: RFG enable - The RFG module is enabled. bit8: RFG operating - The RFG module is operating. bit9: Stop at fault - The drive stops due to a fault, with Exxx. reported. bit10: Normal operation - The drive is operating at the set frequency. bit11: Jogging - The drive is jogging. bit12: Decelerate to stop - The drive is in the decelerate-to-stop state. bit13: Reserved bit14: Terminal control - The current control mode of the drive is terminal control. bit15: User-defined state 1 - The drive is in user-defined state 1. Whether this bit is valid depends on the main status setting word 2 of P0-60. When P0-60 is 1, bit15 is set to 1. When P0-60 is 0, bit15 is set to 0.

Group L10			
Param.	Name	Display range	Description
Same as above	Same as above	(Continued) bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Normal operation 0: Inactive 1: Active bit11: Jogging 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Brake (reserved) 0: Inactive 1: Active bit14: Terminal control 0: Inactive 1: Active bit15: User-defined state 1 0: Inactive 1: Active	Same as above

Group L10			
Param.	Name	Display range	Description
L1004	System status word 3	bit0: Control channel selection 0: Control channel 1 1: Control channel 2 bit1: Setting channel selection 0: Setting channel 1 1: Setting channel 2 bit2: Motor selection bit0 0: Logic 0 1: Logic 1 bit3: Motor selection bit1 0: Logic 0 1: Logic 1 bit4: Error (fault/alarm) 0: No error 1: Error (fault) occurred bit5: EEPROM idle 0: EEPROM idled 1: EEPROM in use bit6: Communication control 0: Inactive 1: Active bit7: Relay action during automatic fault reset 0: Relay inactive 1: Relay active (Continued)	Displays the value of system status word 3. You may click the current value of the parameter to view the system status indicated by each bit. Value description: bit0: Control channel selection - Displays the effective control channel of the drive. bit1: Setting channel selection - Displays the effective setting channel of the drive. bit2: Motor selection bit0 - Displays the state of motor group selection parameter bit0. bit3: Motor selection bit1 - Displays the state of motor group selection parameter bit1. bit4: Error (fault/alarm) - When bit4 is set to 1, the drive is in the error sate, with fault code Exxx.x or alarm code Axxx.x displayed. bit5: EEPROM idled - When bit5 is set to 0, EEPROM is in the idle state without read/write tasks. bit6: Communication control - Displays the system communication control status. bit7: Relay action during automatic fault reset Displays whether the relay acts during automatic fault reset. bit8: IGBT pulsing state - Displays the current pulsing state. bit9: System command direction - Displays the system command direction. bit10: IGBT pulsing state with delay - Displays the IGBT pulsing state with delay. bit11: Internal parameter processing flag - Displays the internal parameter processing flag. bit12: Internal voltage state - Displays the internal voltage state. bit14 to bit15: Power board initialization state - Displays whether power board initialization is done.

Group L10			
Param.	Name	Display range	Description
Same as above	Same as above	(Continued) bit8: IGBT pulsing state 0: Stop 1: Active bit9: System command direction 0: Forward 1: Reverse bit10: IGBT pulsing state with delay 0: Stop 1: Active bit11: Internal parameter processing flag 0: Not processed 1: Processing bit12: Internal voltage state 0: Undervoltage or not initialized 1: Normal bit13: Reserved 0: Inactive 1: Active bit14 to bit15: Power board initialization state 0: Not initialized 1: Initializing 2: Initialized 3: Reserved	Same as above

Group L10			
Param.	Name	Display range	Description
L1005	System status word 4	bit0: Operating at zero speed (inactive at stop) 0: Inactive 1: Active bit1: Operating at zero speed (active at stop) 0: Inactive 1: Active bit2: Frequency level detection 1 0: Inactive 1: Active bit3: Frequency level detection 2 0: Inactive 1: Active bit4: AI1 > AI2 0: Inactive 1: Active bit5: Simple PLC cycle state 0: Not completed 1: Completed bit6: Communication reference value 0: Inactive 1: Active bit7: Reserved (Continued)	Displays the value of system status word 4. You may click the current value of the parameter to view the system status indicated by each bit. Value description: bit0: Operating at zero speed (inactive at stop) - The drive is operating at zero speed, which is invalid at stop. bit1: Zero speed (active at stop) - The drive is operating at zero speed, which is valid even at stop. bit2: Frequency level detection 1 - This bit is valid when the operating frequency is higher than the frequency detection value 1 (FDT1). This bit invalid when the operating frequency is lower than the result of frequency detection value 1 minus frequency detection value 1 multiplied by frequency detection hysteresis coefficient 1. Set FTD1-related parameters through P0-34 to P0-35. bit3: Frequency level detection 2 - The bit is valid when the running frequency is higher than the frequency detection value 2 (FDT2). The bit is invalid when the running frequency is lower than the result of frequency detection value 2 minus frequency detection value 2 multiplied by frequency detection hysteresis coefficient 2. Set FTD2-related parameters through P0-36 to P0-37. bit5: Simple PLC cycle state - Active when the simple PLC module is done executing one cycle of operation. bit6: Communication reference value - The parameter is set through communication. bit7: Reserved bit8: Current 1 arrival - When the output current of the drive is within the range of (detection current 1±detection current amplitude 1) x rated motor current, this bit is valid. Set related parameters through P0-43 to P0-44. bit9: Current 2 arrival - When the output current of the drive is within the range of (detection current 2 ± detection current amplitude 2) x rated motor current, the bit is valid. Set related parameters through P0-45 to P0-46. bit10: Zero current state - When the output current of the drive is lower than or equal to the zero current detection level for a period longer than the zero current detection delay, the bit outputs an active signal. Set current-related parameters through P0-47 to P0-48. (Continued)

Group L10			
Param.	Name	Display range	Description
Same as above	Same as above	(Continued) bit8: Current 1 arrival 0: Inactive 1: Active bit9: Current 2 arrival 0: Inactive 1: Active bit10: Zero current state 0: Inactive 1: Active bit11: Output current limit violation 0: Inactive 1: Active bit12: Motor overload pre-alarm 0: Inactive 1: Active bit13: Drive overload pre-alarm 0: Inactive 1: Active bit14: Undervoltage 0: Inactive 1: Active bit15: Three-phase loss 0: Inactive 1: Active	(Continued) bit11: Output current limit violation - Active when the output current of the drive is higher than the output current limit violation threshold for a period longer than the output current limit violation detection delay. Parameters related to output current limit violation detection are set through P0-49 to P0-50. bit12: Motor overload pre-alarm - The drive reports A111.1 when this bit is active. bit13: Drive overload pre-alarm - The drive reports A110.1 when this bit is active. bit14: Undervoltage - The drive reports E009.1 when this bit is active. bit15: Three-phase loss - The drive reports E030.1 when this bit is active.

Group L10			
Param.	Name	Display range	Description
L1006	Main status word of the drive	bit0 and bit1: Operation status 0: Initialization 1: Sampling preparation 2: Undervoltage 3: Ready bit2: Hardware information status 0: Not ready 1: Ready bit3: Operation state 0: Stop 1: Active bit4: Output locked out forcibly at fault 0: Inactive 1: Active bit5: Bus undervoltage state 0: Inactive 1: Active bit6 to bit15: Reserved	Displays the real-time operating status of the drive. You can view the drive status information corresponding to each bit by clicking the current value of the parameter. Value description: bit0 to bit1: Operation state - Displays the power-on initialization state of the drive. bit2: Hardware information status - Displays whether the hardware self-test upon power-on is passed without exception. bit3: Operation state - Displays the current state of the drive. bit4: Output locked out forcibly at fault - The drive output is locked out forcibly at fault. bit5: Bus undervoltage state - The DC bus of the drive is in the undervoltage state.

Group L10			
Param.	Name	Display range	Description
L1044	User-defined command word of control channel 1	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Active bit1: OFF2 (coast to stop) state 0: Stop 1: Active bit2: OFF3 (quick stop) stop 0: Stop 1: Active bit3: Operation permission 0: Disable 1: Enable bit4: Reset command 0: Not reset 1: Reset bit5: Jog 1 0: Inactive 1: Active bit6: Jog 2 0: Inactive 1: Active bit7: Speed inversion 0: Not inverted 1: Inverted	Displays the real-time operating status of user-defined command word of control channel 1. You can view the status information corresponding to each bit by clicking the current value of the parameter. bit0: ON_OFF1 (start/stop) state - Displays the ON_OFF1 (start/stop) state of the user-defined command word of control channel 1. bit1: OFF2 (coast to stop) state - Displays the OFF2 (coast to stop) state of the user-defined command word of control channel 1. bit2: OFF3 (quick stop) state - Displays the OFF3 (quick stop) state of the user-defined command word of control channel 1. bit3: Operation permission - Displays the operation permission state of the user-defined command word of control channel 1. bit4: Reset command - Displays the reset command status of the user-defined command word of control channel 1. bit5: Jog 1 - Displays the jog 1 state of the user-defined command word of control channel 1. bit6: Jog 2 - Displays the jog 2 state of the user-defined command word of control channel 1. bit7: Speed inversion - Displays the speed inversion state of the user-defined command word of control channel 1.

Group L10			
Param.	Name	Display range	Description
L1045	User-defined command word of control channel 2	Same as L1044	Displays the real-time operating status of user-defined command word of control channel 2. You can view the status information corresponding to each bit by clicking the current value of the parameter. bit0: ON_OFF1 (start/stop) state - Displays the ON_OFF1 (start/stop) state of the user-defined command word of control channel 2. bit1: OFF2 (coast to stop) state - Displays the OFF2 (coast to stop) state of the user-defined command word of control channel 2. bit2: OFF3 (quick stop) state - Displays the OFF3 (quick stop) state of the user-defined command word of control channel 2. bit3: Operation permission - Displays the operation permission state of the user-defined command word of control channel 2. bit4: Reset command - Displays the reset command status of the user-defined command word of control channel 2. bit5: Jog 1 - Displays the jog 1 state of the user-defined command word of control channel 2. bit6: Jog 2 - Displays the jog 2 state of the user-defined command word of control channel 2. bit7: Speed inversion - Displays the speed inversion state of the user-defined command word of control channel 2.

Group L10			
Param.	Name	Display range	Description
L1046	Auxiliary command word of control channel 1	bit0: OFF2 (coast to stop) state 2 0: Stop 1: Active bit1: OFF2 (coast to stop) state 3 0: Stop 1: Active bit2: OFF3 (quick stop) stop 2 0: Stop 1: Active bit3: OFF3 (quick stop) state 3 0: Disable 1: Enable bit4: Reset command 2 0: Not reset 1: Reset bit5: Reset command 3 0: Not reset 1: Reset bit6: RFG inhibition 0: Active 1: Inactive bit7: RFG pause 0: Active 1: Inactive bit8: Forced RFG 0: Active 1: Inactive	Displays the real-time operating status of the auxiliary command word of control channel 1. You can view the status information corresponding to each bit by clicking the current value of the parameter. bit0: OFF2 (coast to stop) state 2 - Displays the OFF2 (coast to stop) state 2 of the auxiliary command word of control channel 1. bit1: OFF2 (coast to stop) state 3 - Displays the OFF2 (coast to stop) state 3 of the auxiliary command word of control channel 1. bit2: OFF3 (quick stop) state 2 - Displays the OFF3 (quick stop) state 2 of the auxiliary command word of control channel 1. bit3: OFF3 (quick stop) state 3 - Displays the OFF3 (quick stop) state 3 of the auxiliary command word of control channel 1. bit4: Reset command 2 - Displays the reset command 2 status of the auxiliary command word of control channel 1. bit5: Reset command 3 - Displays the reset command 3 status of the auxiliary command word of control channel 1. bit6: RFG inhibition - Displays the RFG inhibition state of the auxiliary command word of control channel 1. bit7: RFG pause - Displays the RFG pause state of the auxiliary command word of control channel 1. bit8: Forced RFG - Displays the forced RFG state of the auxiliary command word of control channel 1.

Group L10			
Param.	Name	Display range	Description
L1047	Auxiliary command word of control channel 2	Same as L1046	Displays the real-time operating status of the auxiliary command word of control channel 2. You can view the status information corresponding to each bit by clicking the current value of the parameter. bit0: OFF2 (coast to stop) state 2 - Displays the OFF2 (coast to stop) state 2 of the auxiliary command word of control channel 2. bit1: OFF2 (coast to stop) state 3 – Displays the OFF2 (coast to stop) state 3 of the auxiliary command word of control channel 2. bit2: OFF3 (quick stop) state 2 - Displays the OFF3 (quick stop) state 2 of the auxiliary command word of control channel 2. bit3: OFF3 (quick stop) state 3 - Displays the OFF3 (quick stop) state 3 of the auxiliary command word of control channel 2. bit4: Reset command 2 – Displays the reset command 2 status of the auxiliary command word of control channel 2. bit5: Reset command 3 - Displays the reset command 3 state of the auxiliary command word of control channel 2. bit6: RFG inhibition - Displays the RFG inhibition state of the auxiliary command word of control channel 2. bit7: RFG pause - Displays the RFG pause state of the auxiliary command word of control channel 2. bit8: Forced RFG - Displays the forced RFG state of the auxiliary command word of control channel 2.
L1050	STO output status word	-	Displays the STO state, the input state of dual STOs, and the DO output state. Note: bit0 indicates the STO1 disconnection flag. When the 24 V input of STO1 is disconnected, this bit is set to 1. bit1 indicates the STO2 disconnection flag. When the 24 V input of STO2 is disconnected, this bit is set to 1. bit2 indicates whether the DO of STO is outputted. When both 24 V inputs are disconnected, a DO output signal is generated. In this case, this flag is set to 1. bit3 indicates the STO status flag bit. When both 24 V inputs are disconnected, this flag is set to 1.

Group L10			
Param.	Name	Display range	Description
L1051	LED control word	bit0: Start command 0: Inactive 1: Active bit1: Stop 0: Inactive 1: Active bit2: Jog 1 0: Inactive 1: Active bit3: Local control 0: Inactive 1: Active bit4: Reset 0: Inactive 1: Active bit5: Jog 2 0: Inactive 1: Active bit6: Direction switchover 0: Inactive 1: Active	Displays the control command status of the LED operating panel. You can click current value of the parameter to view the control word status indicated by each bit.

Group L10			
Param.	Name	Display range	Description
L1054	Command channel control word	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Active bit1: OFF2 (coast to stop) stop 0: Active 1: Normal bit2: OFF3 (quick stop) stop 0: Active 1: Normal bit3: Operation permission 0: Operation inhibited 1: Operation allowed bit4: RFG output set to 0 forcibly 0: Normal 1: RFG output set to 0 forcibly bit5: RFG pause 0: Normal 1: RFG pause bit6: RFG input set to 0 forcibly 0: Normal 1: RFG input set to 0 forcibly (Continued)	Displays the input status of the command channel. You can click the current value of the parameter to view the control word status indicated by each bit.

Group L10			
Param.	Name	Display range	Description
Same as above	Same as above	(Continued) bit7: Fault reset 0: Inactive 1: Active bit8: Jog 1 0: Inactive 1: Active bit9: Jog 2 0: Inactive 1: Active bit10: Remote control (reserved) 0: Inactive 1: Active bit11: Speed inversion 0: Not inverted 1: Inverted bit12: Start signal 0: Inactive 1: Active bit13: Internal start command 0: Inactive 1: Active	Same as above

Group L10			
Param.	Name	Display range	Description
L1055	Control word set through communication	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Active bit1: OFF2 (coast to stop) state 0: Stop 1: Active bit2: OFF3 (quick stop) stop 0: Stop 1: Active bit3: Operation permission 0: Disable 1: Enable bit4: Reset command 0: Not reset 1: Reset bit5: Jog 1 0: Inactive 1: Active bit6: Jog 2 0: Inactive 1: Active bit7: Speed inversion 0: Not inverted 1: Inverted	Displays the input status of the communication control command. You can click the current value of the parameter to view the control word status indicated by each bit.
L1057	Terminal module control word	Same as L1055	Displays the final effective control command status of the terminal control mode. You can view the command status corresponding to the bit by clicking the current value of the parameter.

Group L10			
Param.	Name	Display range	Description
L1058	Terminal module A input state	bit0: ON_OFF1 (start/stop) stop 0: Inactive 1: Active bit1: Reverse run (REV) 0: Inactive 1: Active bit2: Operation permission (enable) 0: Inactive 1: Active bit3: Reset command (reset) 0: Inactive 1: Active bit4: Jog 1 0: Inactive 1: Active bit5: Jog 2 0: Inactive 1: Active bit6: Reserved (Rsvd1) 0: Inactive 1: Active bit7: Terminal function input (In1) 0: Inactive 1: Active bit8: Terminal function input (In2) 0: Inactive 1: Active bit9: Terminal function input (In3) 0: Inactive 1: Active	Displays the control command input state of terminal module A. You can click the current value of the parameter to view the control word status indicated by each bit.
L1059	Terminal module B input state	Same as L1058	Displays the control command input state of terminal module B. You can click the current value of the parameter to view the command status indicated by each bit.

Group L10			
Param.	Name	Display range	Description
L1060	Active external command source	0: Operating panel 1: Terminal 2: Communication 3: User-defined	Displays the effective external command source.
L1065	DI state	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2 to bit6: DI3 status (MD630S) to DI7 status (MD630S) 0: Low level 1: High level bit10 to bit15: States of VDI1 to VDI6 0: Low level 1: High level	Displays the final output status of DI and VDI. You can view the DI/VDI status of the bit by clicking the current value of the parameter.
L1068	DO state	bit0: RO state 0: Low level 1: High level bit4: DO state 0: Low level 1: High level bit8: FMR (MD630S) 0: Low level 1: High level bit10 to bit15: States of VDO1 to VDO6 0: Low level 1: High level	Displays the final output status of DO and VDO. You can view the DO/VDO status of the bit by clicking the current value of the parameter.

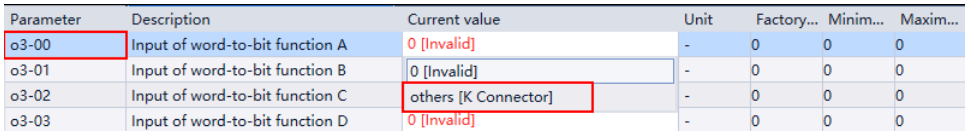
Group L11			
Param.	Name	Display range	Description
L1100	Base value of speed per-unit value	0 rpm to 65535 rpm	Displays the base value of speed per-unit value. Speed per-unit value = Actual speed/Base value
L1101	Base value of frequency per-unit value	0.0 Hz to 6553.5 Hz	Displays the base value of current frequency per-unit value. Frequency per-unit value = Actual frequency/Base value

Group L11			
Param.	Name	Display range	Description
L1102	Base value of voltage per-unit value	0.0 V to 6553.5 V	Displays the base value of current voltage per-unit value. Voltage per-unit value = Actual voltage/Base value
L1103	Base value of current per-unit value	0.0 A to 6553.5 A	Displays the base value of current per-unit value. Current per-unit value = Actual current/Base value
L1104	Base value of power per-unit value	0.0 kW to 655.35 kW	Displays the base value of power per-unit value. Power per-unit value = Actual power/Base value
L1105	Base value of torque per-unit value	0.00 N·m to 655.35 N·m	Displays the base value of torque per-unit value. Torque per-unit value = Actual torque/Base value
L1106	Base value of DC bus voltage per-unit value	0 V to 65535 V	Displays the base value of DC bus voltage per-unit value. Bus voltage per-unit value = Actual bus voltage/Base value

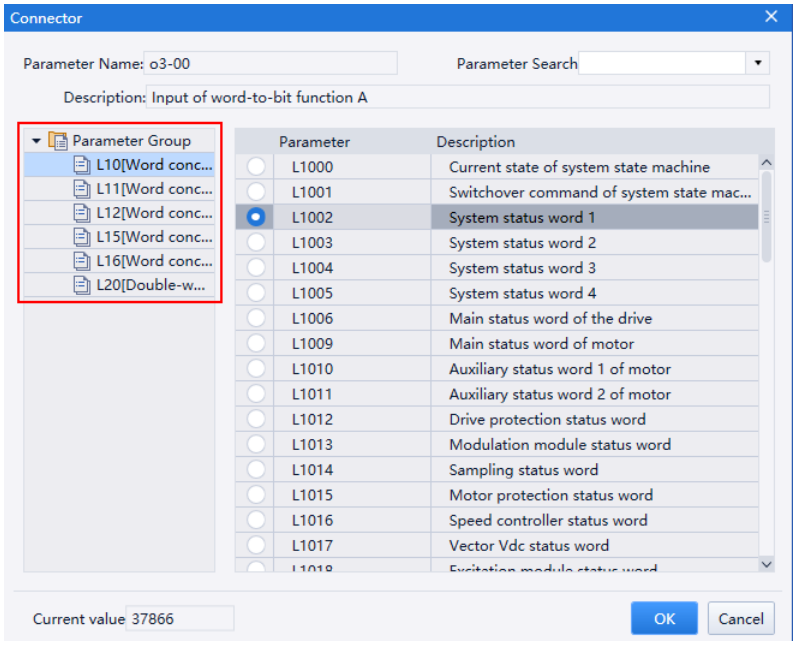
Application instance

The following takes o3-00 [Input of word-to-bit function A] as an example to describe how to select the word connector (K connector) as the parameter input.

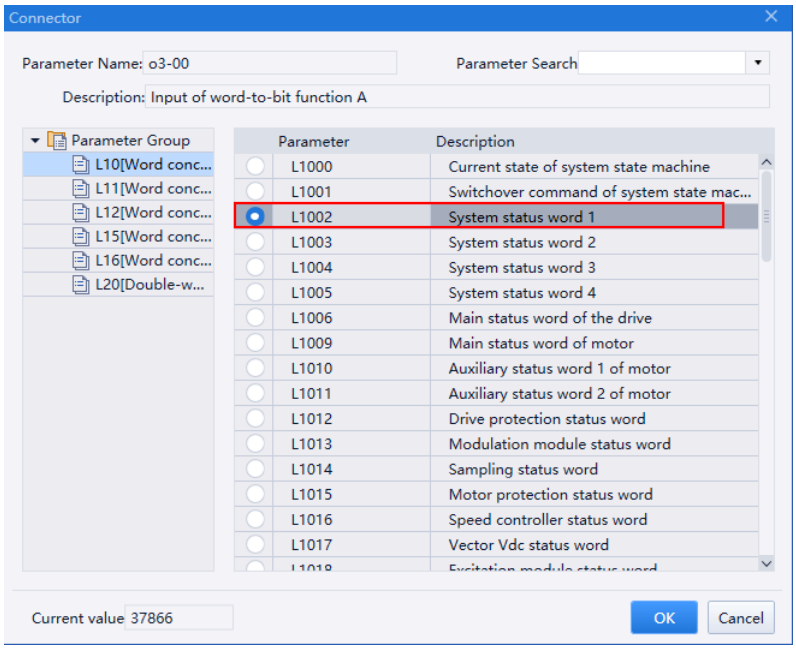
1. Select "Others [K connector]" in the drop-down menu of o3-00 [Input of word-to-bit function A].



2. After you click "Others [K connector]", the following dialog box displays. Then click on the left side to select the parameter group of the word connector (K connector).



3. Click L1002 system status word 1, and then click "OK".



4. When the current value of o3-00 [Input of word-to-bit function A] is "L1002 [system status word 1]", the setting is done.

Parameter	Description	Current value	Unit	Factory...	Minim...
o3-00	Input of word-to-bit function A	L1002[System status word 1]	-	0	0
o3-01	Input of word-to-bit function B	0 [Invalid]	-	0	0

After the preceding settings are done, you can convert L1002 [System status word 1] to a bit connector and display the bits in L0304 to L0319.

5.7.1.1.4 Double-Word Connector (K Connector)

Application scenarios

This connector is used to monitor the status word in the system or used as a signal source of certain functions.

1. Used for system status monitoring, such as the output of the word-to-double word module A. Compared to double-word connectors and bit connectors (which can read only 1 bit per address) and word connectors (which can read only 16 bits per address), a double-word connector can read more information per address. The double-word connector can represent more valid digits to improve the value precision.

2. Used for parameter interconnection. The status word of a function module of the drive is used as the signal source input. As the resource pool of the system, you can select a word connector from L20 to L21 as the parameter input in the drop-down menu "Other: K connector" to implement a specific function (such as converting double-word connector to bit connector, see section "Free function block" for details).

Function description

The word connector (K connector) saves information such as analog values, status words, or command words in the system, which is divided into word connector and double-word connector to be used as the connector signal source for source-type parameters. The data in double-word

connector is of 32-bit double-word type. Parameter groups L20 and L21 are double-word connectors.

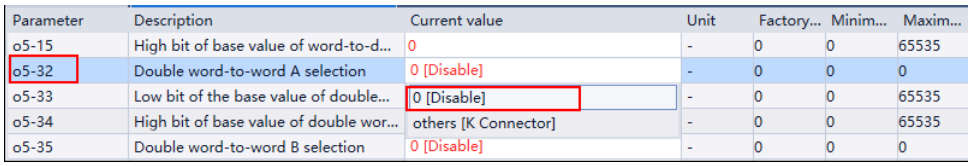
Related parameters

Group L20			
Param.	Name	Display range	Description
L2000	Output of word-to-double-word module A	0 to 0xFFFFFFFF	Indicates the output of word-to-double-word module A.
L2002	Output of word-to-double-word module B	0 to 0xFFFFFFFF	Indicates the output of word-to-double-word module B.
L2004	Output of word-to-double-word module C	0 to 0xFFFFFFFF	Indicates the output of word-to-double-word module C.
L2006	Output of word-to-double-word module D	0 to 0xFFFFFFFF	Indicates the output of word-to-double-word module D.

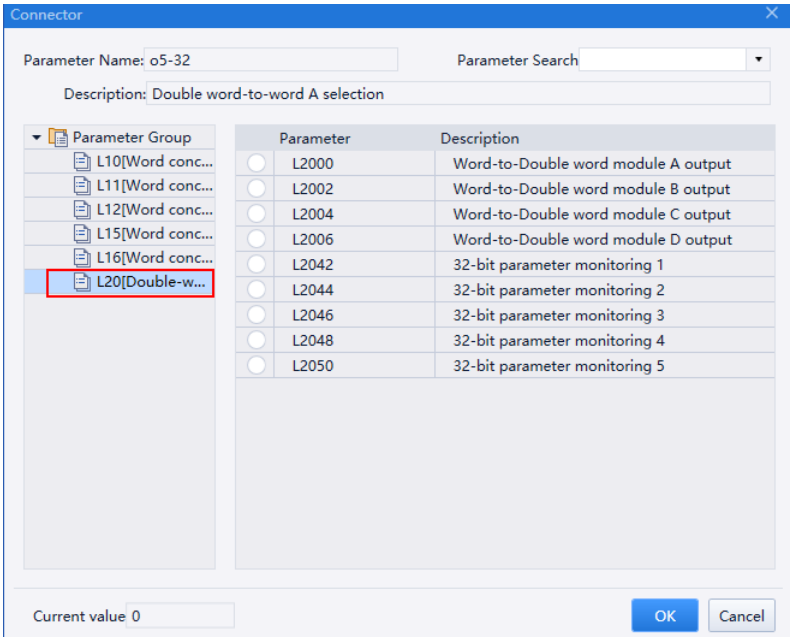
Application instance

The following takes o5-32 [Selection of double-word-to-word module A] as an example to describe how to select the double-word connector (K connector) as the parameter input.

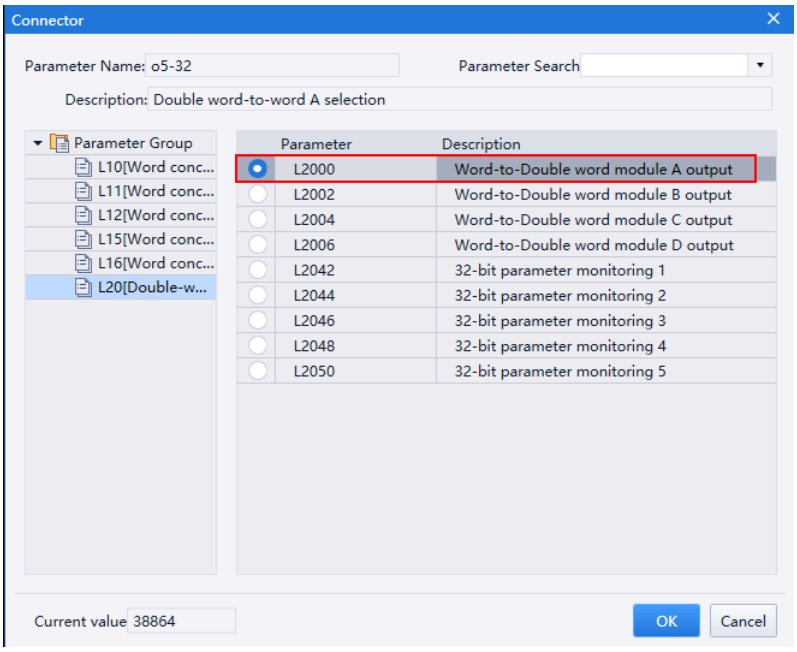
1. Select "Others [K connector]" in the drop-down menu of o5-32 [Double word-to-word A selection].



2. After you click"Others [K connector]", the following dialog box displays. Then click on the left to select the parameter group of the double-word connector (K connector).



3. Click "L2000 word-to-double-word module A output". Then click "OK".



4. When the value of o5-32 [Selection of double-word-to-word module A] changes to "L2000 word-to-double-word module A", the setting is done successfully.

Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...
o5-15	High bit of base value of word-to-d...	0	-	0	0	65535
o5-32	Double word-to-word A selection	L2000[Word-to-Double word module...	-	0	0	0
o5-33	Low bit of the base value of double...	0	-	0	0	65535

After the above settings are done, L2000 can be converted to a word connector and displayed in L1212 and L1213.

5.7.1.1.5 Floating-Point Connector (F Connector)

Application scenarios

This connector is used to monitor floating-point type data in the system or act as a signal source for certain functions.

1. It can be used to monitor the operation data of the system, including floating-point variables in the system, which are generally related to system operations such as output frequency and motor speed.

2. It can be used for parameter interconnection. The data related to a function module of the drive is used as the signal source input. As the resource pool of the system, you can select a floating-point connector from L24 to L39 as the input of the parameter with the drop-down menu "Other: F connector".

Function description

The floating-point connector (F connector) saves information such as analog values in the system and can be used as the connector signal source for parameters of the floating-point source type. The data type in the floating-point connector is 32-bit single-precision floating-point type. Parameter groups L22 to L39 are floating-point connectors.

Table 5–115 Related parameter

Group L22			
Param.	Name	Display range	Description
L2200	Output frequency	-800.0 % to +800.0%	Displays the output frequency.
L2202	Motor speed	-800.0 % to +800.0%	Displays the motor speed.
L2204	Output current	-800.0 % to +800.0%	Displays the output current.
L2206	Output voltage	-800.0 % to +800.0%	Displays the output voltage.
L2208	Output power	-800.0 % to +800.0%	Displays the output power.
L2210	Output torque	-800.0 % to +800.0%	Displays the output torque.
L2244	AI1 input value	-800.0 % to +800.0%	Displays the per-unit value of AI1 input.
L2246	AI2 input value	-800.0 % to +800.0%	Displays the per-unit value of AI2 input.
L2250	HDI input value	-800.0 % to +800.0%	Displays the per unit value of HDI input.
L2252	AO value percentage written through communication (MD630S)	-800.0 % to +800.0%	Displays the percentage of the AO value written through communication.
L2258	Per-unit current value based on 1000 A at maximum	-800.0 % to +800.0%	Displays the per-unit current value based on 1000 A at maximum.
L2260	Per-unit voltage value based on 1000 V at maximum	-800.0 % to +800.0%	Displays the per-unit voltage value based on 1000 V at maximum.
L2262	Absolute output of AO output torque (MD630S)	-800.0 % to +800.0%	Displays the absolute output of AO output torque.
L2264	Actual value of AO output torque (MD630S)	-200.0 % to +200.0%	Displays the AO output torque range.

Group L23			
Param.	Name	Display range	Description
L2318	Multi-reference selection output	-800.0 % to +800.0%	Displays the output corresponding to the selected multi-reference value.
L2320	Output corresponding to multi-reference 0	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 0.
L2322	Multi-reference 1 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 1.
L2324	Multi-reference 2 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 2.
L2326	Multi-reference 3 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 3.
L2328	Multi-reference 4 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 4.
L2330	Multi-reference 5 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 5.
L2332	Multi-reference 6 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 6.
L2334	Multi-reference 7 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 7.
L2336	Multi-reference 8 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 8.

Group L23			
Param.	Name	Display range	Description
L2338	Multi-reference 9 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 9.
L2340	Multi-reference 10 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 10.
L2342	Multi-reference 11 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 11.
L2344	Multi-reference 12 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 12.
L2346	Multi-reference 13 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 13.
L2348	Multi-reference 14 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 14.
L2350	Multi-reference 15 output	-800.0 % to +800.0%	Displays the output corresponding to multi-reference 15.

Group L24			
Param.	Name	Display range	Description
L2452	Digital reference of motorized potentiometer forced value	-800.0 % to +800.0%	Displays the forced value of motorized potentiometer.
L2454	Reset value of motorized potentiometer	-800.0 % to +800.0%	Displays the reset value of motorized potentiometer.
L2456	Maximum value of motorized potentiometer	-800.0 % to +800.0%	Displays the maximum value of motorized potentiometer.
L2458	Minimum value of motorized potentiometer	-800.0 % to +800.0%	Displays the minimum value of motorized potentiometer.
L2460	Initial value of motorized potentiometer	-800.0 % to +800.0%	Displays the initial value of motorized potentiometer.
L2462	Process operation value of motorized potentiometer	-800.0 % to +800.0%	Displays the process operation value of motorized potentiometer.
L2464	Final output value of motorized potentiometer	-800.0 % to +800.0%	Displays the final output value of the motorized potentiometer.
L2466	General PID output	-800.0 % to +800.0%	Displays the total output of the general PID.
L2468	General PID error	-800.0 % to +800.0%	Displays the error input of the general PID.
L2470	General PID reference	-800.0 % to +800.0%	Displays the reference input of the general PID.
L2472	General PID feedback	-800.0 % to +800.0%	Displays the feedback input of the general PID.
L2474	General PID proportional output	-800.0 % to +800.0%	Displays the proportional output of the general PID.
L2476	General PID integral output	-800.0 % to +800.0%	Displays the integral term output of the general PID.
L2478	General PID derivative output	-800.0 % to +800.0%	Displays the derivative term output of the general PID.

Group L24			
Param.	Name	Display range	Description
L2480	General PID inversion cutoff output	-800.0 % to +800.0%	Displays the maximum output upon PID inversion cutoff.
L2482	Per-unit value of simple PLC step	-800.0 % to +800.0%	Displays the per-unit value of simple PLC step.

Group L30			
Param.	Name	Display range	Description
L3000	Actual motor speed	-800.0 % to +800.0%	Display the actual motor speed. Note: The value of this parameter is the encoder speed in the FVC mode, motor observation speed in the SVC mode, and synchronous frequency before slip compensation in the V/f mode.
L3002	Final motor speed reference	-800.0 % to +800.0%	Displays the final motor speed reference. Note: This parameter indicates the speed after the final output of RFG.
L3006	Target frequency	-800.0 % to +800.0%	Displays the target frequency.
L3008	Operating frequency	-800.0 % to +800.0%	Defines the real-time frequency output of the drive, which is also the motor control target frequency.
L3016	Jog 1 frequency	-800.0 % to +800.0%	Defines jog 1 frequency of the effective setting channel, which is obtained based on settings of the jog 1 frequency source and jog 1 frequency reference.
L3018	Jog 2 frequency	-800.0 % to +800.0%	Defines jog 2 frequency of the effective setting channel, which is obtained based on settings of the jog 2 frequency source and jog 2 frequency reference.
L3046	RFG reference input	-800.0 % to +800.0%	Displays the frequency set by the input RFG.
L3052	RFG calculation output	-800.0 % to +800.0%	Displays the frequency after RFG calculation.
L3054	RFG acceleration	-800.0 % to +800.0%	Displays RFG acceleration value.
L3058	Offset of frequency adjusted by UP/DOWN key	-800.0 % to +800.0%	Displays the offset frequency adjusted by UP/DOWN keys on the operating panel or DIs functioning as UP/DOWN keys.
L3060	Upper limit of frequency adjusted by UP/DOWN key	-800.0 % to +800.0%	Displays the UP/DOWN upper limit.
L3062	Lower limit of frequency adjusted by UP/DOWN key	-800.0 % to +800.0%	Displays the UP/DOWN lower limit.
L3064	Speed reference set through communication	-800.0 % to +800.0%	Displays the per-unit value of the speed reference set through communication.
L3066	Communication (0x1000H)	-800.0 % to +800.0%	Displays the reference set through communication.
L3068	Maximum positive frequency	-800.0 % to +800.0%	Displays the effective maximum positive frequency.

Group L30			
Param.	Name	Display range	Description
L3070	Minimum positive frequency	-800.0 % to +800.0%	Displays the effective minimum positive frequency.
L3072	Maximum negative frequency	-800.0 % to +800.0%	Displays the effective maximum negative frequency.
L3074	Minimum negative frequency	-800.0 % to +800.0%	Displays the effective minimum negative frequency.

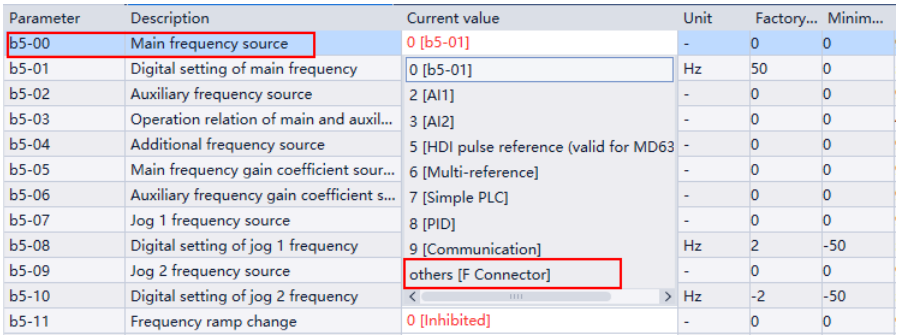
Group L31			
Param.	Name	Display range	Description
L3100	Torque reference	-800.0 % to +800.0%	Displays the torque reference. Note: The torque reference is obtained after the torque is multiplied by the torque gain factor and processed with the maximum and minimum torque limits.
L3112	Maximum positive torque	-800.0 % to +800.0%	During operation without torque limit, the maximum positive torque is the smaller value between digital reference of positive torque upper limit and the positive torque upper limit. During operation with torque limited, the maximum positive torque is the smaller value among the digital reference of positive torque upper limit, positive torque upper limit selection, and the maximum positive torque limit.
L3114	Maximum negative torque	-800.0 % to +800.0%	During operation without torque limit, the maximum negative torque is the higher value between inverted digital reference of negative torque upper limit and absolute value of negative torque upper limit. During operation with torque limited, the maximum negative torque is the higher value among the inverted digital reference of negative torque upper limit, negative torque upper limit selection, and the absolute value of maximum negative torque limit.
L3120	Target voltage in V/f decoupled mode	-800.0 % to +800.0%	In the non-operational state or when the V/f decoupled mode is not enabled, the target voltage in the V/f decoupled mode is 0. In the operational state and when the V/f decoupled mode is enabled, the target voltage in the V/f decoupled mode is the value outputted after digital reference of voltage in the V/f decoupled mode is processed with the voltage upper limit in the V/f decoupled mode.
L3122	Voltage output in V/f decoupled mode	-800.0 % to +800.0%	In the non-operational state, the voltage output in the V/f decoupled mode is 0. In the operational state, the voltage output in the V/f decoupled mode is the voltage processed with voltage ramp-up/down in the V/f decoupled mode.

Group L32			
Param.	Name	Display range	Description
L3208	Cumulative drive overload value	-800.0 % to +800.0%	Displays the cumulative value of drive overload. Note: Defines the cumulative value of drive overload. When the value 100% is reached, the drive reports overload fault.
L3210	Cumulative motor overload value	-800.0 % to +800.0%	Displays the cumulative value of motor overload. Note: Defines the cumulative value of motor overload. When the value 100% is reached, the motor reports overload fault.
L3212	Synchronous frequency	-800.0 % to +800.0%	Displays the synchronous frequency.
L3228	Phase U current	-800.0 % to +800.0%	Displays the phase U current.
L3230	Phase V current	-800.0 % to +800.0%	Displays the phase V current.
L3232	Phase W current	-800.0 % to +800.0%	Displays the phase W current.
L3234	Output current amplitude	-800.0 % to +800.0%	Displays the amplitude of the output current.
L3238	Output voltage amplitude	-800.0 % to +800.0%	Displays the amplitude of the output voltage.
L3248	Bus voltage of the drive	-800.0 % to +800.0%	Displays the bus voltage of the drive.

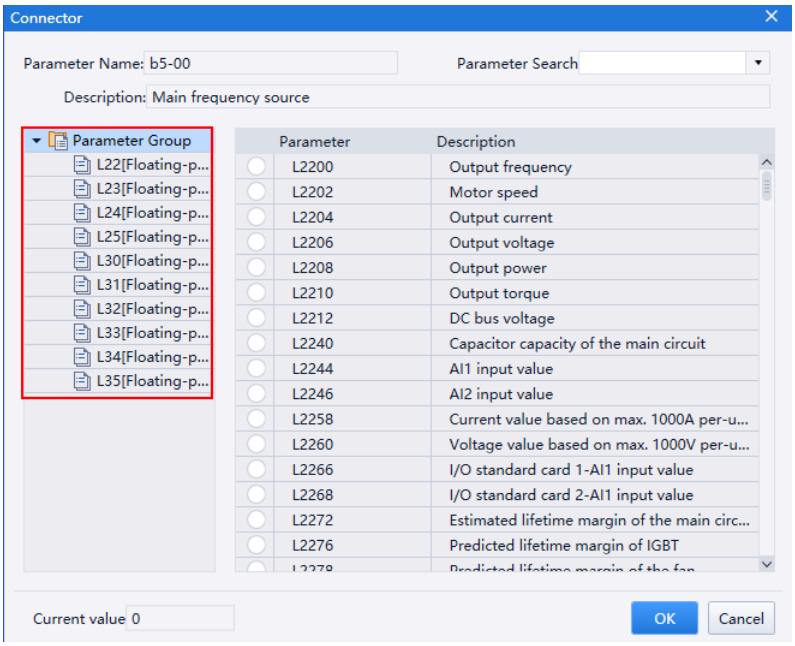
Application instance

Take b5-00 [Main frequency source] as an example to describe how to select the floating-point connector (F connector) as the parameter input.

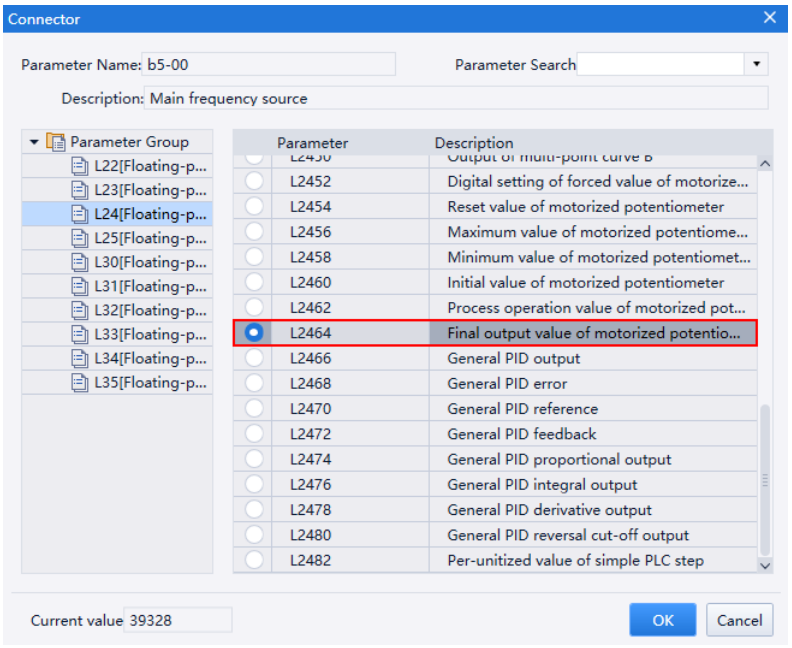
1. Select "Others [F connector]" from the drop-down menu of b5-00 [Main frequency source].



2. After clicking "Others [F connector]", the following dialog box pops up. You can click on the left to select the parameter group of the floating-point connector (F connector).



3. Click the final output value of L2464 motorized potentiometer and click "OK".



4. When the current value of b5-00 [Main frequency source] is "L2464 final output value of the motorized potentiometer", the setting is done.

Parameter	Description	Current value	Unit	Factory...	Minim...
b5-00	Main frequency source	L2464[Final output value of motorize...	-	0	0
b5-01	Digital setting of main frequency	50.00	Hz	50	0

After the above settings are done, the motorized potentiometer can be used as the main frequency source.

5.7.1.2 Parameter Interconnection

Application scenarios

Parameter interconnection is a flexible method for setting parameters and combining input and output functions, enabling connection between internal functional modules and parameters. It is generally used in control scenarios with complex functions that require multiple modules and different parameters to work together.

Function description

The parameter interconnection system allows certain parameters or modules to read and use other parameters to achieve corresponding control functions.

Connector parameters are read-only parameters that display various states and data of the drive, which can be viewed by users or be read or used by other parameters. When the parameter setting options include the "Other" option, it indicates that this parameter can select a connector as its input value. The "Other" option is divided into the following categories:

Option	Description
Other: B connector	The input value source can be selected as a bit connector (B connector), with values limited to 0 or 1. Connector values include DI inputs, DO outputs, a specific bit of the communication word, a specific bit of the control word and status word, and fault status information. It is located in parameter groups L00 to L09.
Other: K connector	The input value source can be selected as a word connector (K connector). Connector values include the control word, communication word, status word, and internal monitoring parameters of the drive. It is located in parameter groups L10 to L19, L20 to L21, where L20 to L21 are double-word connectors.
Other: F connector	The input value source can be selected as a floating-point connector (F connector). Connector values include per-unit values of drive control-related data such as voltage, current, and power, as well as values received through communication and analog per-unit values detected through AI/AO. It is located in parameter groups L22 to L25 and L30 to L33.

There are two ways to set the parameter value source as a connector through parameter interconnection: using the iFA commissioning software or using the operation panel.

When using iFA, first set the parameter value to "Other," then select the connector parameter in the pop-up window. This method allows a clear view of the selected connector parameter, but requires a PC to be connected for commissioning.

When using the operation panel, you can directly set the parameter value to the desired connector number. This method is easy to use, but does not display the meaning of the connector, so you need to understand the connector definitions to set them accurately.

Application instance 1: Achieving parameter interconnection through iFA commissioning software

The following shows how to set the connector parameter as the frequency through iFA commissioning software.

1. As shown in the figure below, open the drop-down list of F0-29 [Main frequency source], and the last option is "Other [F connector]".

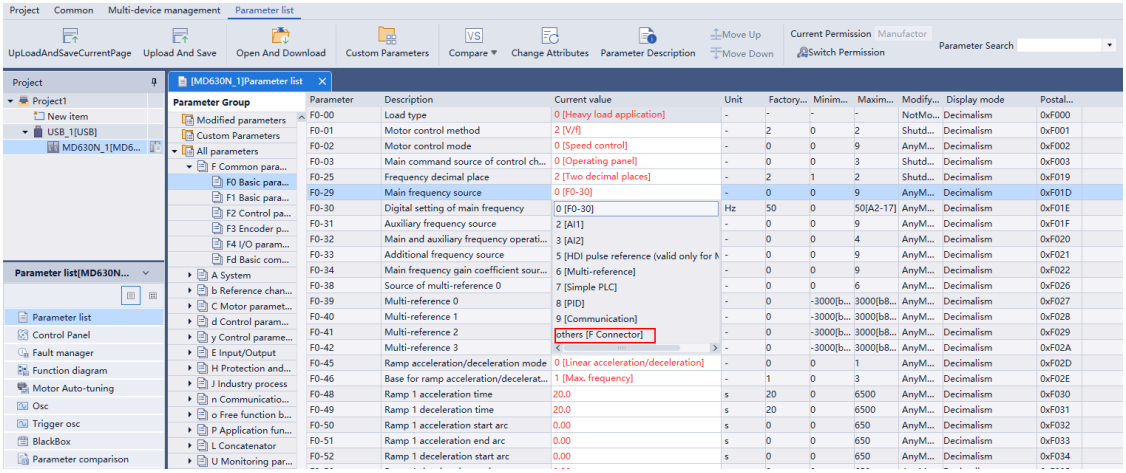


Figure 5-237 Setting the parameter value source

2. Click the "Other [F connector]" option in the drop-down list, and the following page displays. The top section displays parameter information, the left menu shows optional connector groups, and the right side displays the connector parameters available within the current connector group.

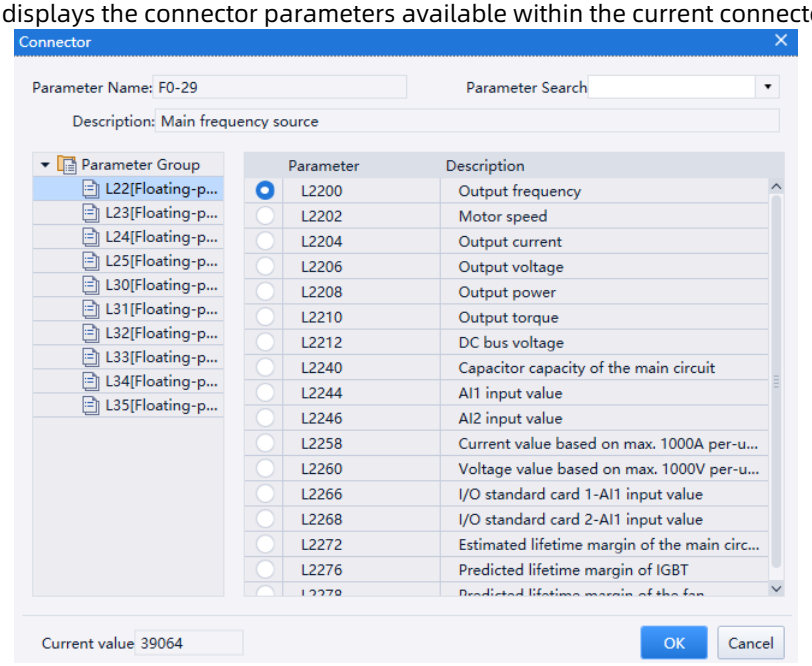


Figure 5-238 Connector selection window

3. Select the connector value to be set. As shown in the figure below, L2352 [Constant setpoint 1 (per-unit)] has been selected.

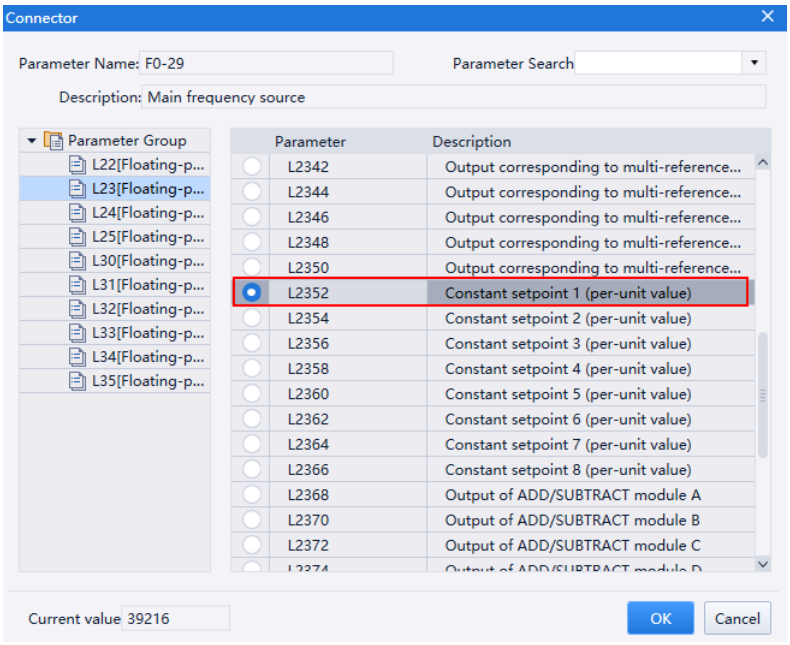


Figure 5-239 Selecting the floating-point connector

4. After selecting the connector, click "OK" to return to the parameter list. F0-29 [Main frequency source] is now set to L2352 [Constant setpoint 1 (per-unit)]. Connector L2352 is the output of the constant value module, meaning that the main frequency of the drive can be modified through o1-00 [Constant setpoint 1 (per-unit)].

Parameter	Description	Current value	Unit	Factory...	Minim...
F0-00	Load type	0 [Heavy load application]	-	-	-
F0-01	Motor control method	2 [V/f]	-	2	0
F0-02	Motor control mode	0 [Speed control]	-	0	0
F0-03	Main command source of control ch...	0 [Operating panel]	-	0	0
F0-25	Frequency decimal place	2 [Two decimal places]	-	2	1
F0-29	Main frequency source	L2352[Constant setpoint 1 (per-unit...	-	0	0
F0-30	Digital setting of main frequency	50.00	Hz	50	0

Figure 5-240 Setting result

Application instance 2: Achieving parameter interconnection through operating panel

The following show how to set the connector parameter as the frequency source.

1. On the operating panel, enter the parameter menu and locate F0-29 [Main frequency source].
2. Press OK to enter the parameter value setting interface, and use ▲ to change the parameter option.
3. Set the parameter value to connector L2352, then press OK to save the parameter value.

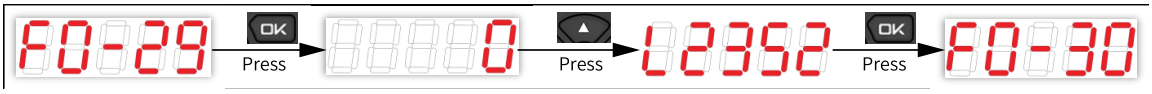


Figure 5-241 Setting the connector parameter through the operating panel

5.7.2 Parameter Access Level

5.7.2.1 Parameter Access Level Introduction

Application scenario

The MD630-INT series supports parameter access permission levels. Different levels allow access to different numbers of parameters. The higher the access level, the more parameters the AC drive can access. You can switch to the corresponding access level for operation and maintenance.

The AC drive is set to the standard access level by default at the factory. At this level, you can access parameters for basic functions, while parameters for extended functions are not accessible. If you need to access parameters for extended functions, the current system parameter access level can be changed to extended level.

The standard access level includes common AC drive parameters, meeting the basic commissioning requirements of the AC drive. For complex and extended function commissioning scenarios, the current system parameter access level can be set to extended level.

Function description

MD630-INT classifies parameters into standard, extended, expert, and manufacturer access levels. The number of parameters that can be viewed varies according to the parameter access level. These correspond to the numbers 0 to 3, with higher numbers indicating higher levels and more accessible parameters.

Higher access levels include all the parameters of lower access levels, meaning that the parameters of lower levels are subsets of those in higher levels. The relationship between parameter access levels from low to high is shown in the following figure.

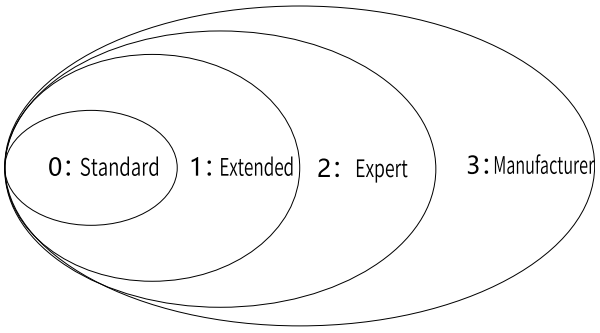


Figure 5-242 Inclusion relationship of parameter access levels from low to high

See the table below for explanations and applicable scopes of different parameter access levels:

Table 5–116 Parameter access level description

Parameter Access Level	Description	Remarks	Applicable scenario
0	Standard	It covers most common functions of the AC drive. If there is no requirement for advanced application functions or complex processes, it is recommended to use the standard level.	The default parameter access level mainly includes the parameters commonly used by the AC drive, meeting the basic function commissioning requirements of the AC drive.
1	Extended	Based on the common functions of the AC drive, extended application functions and complex processes, can be accessed in this level, such as user-defined parameters, VDI, VDO, wobble frequency, free function blocks, etc. If necessary, the extended level is recommended.	In addition to the access to standard parameters, get further access to the extended function parameters of the AC drive to meet the specific function requirements.
2	Expert	In addition to the access to extended function parameters, get further access to complex motor performance commissioning parameters, which must be accessed by password.	You need to use password to access more complex motor performance commissioning parameters, which are only applicable to professional commissioning personnel.
3	Manufacturer	The manufacturer access level is locked by password and includes parameters for Inovance only.	This level includes all parameters and only the manufacturer can access these parameters.

Note

1. The function codes corresponding to the standard and extension levels can meet the commissioning requirements of most scenarios.
2. If you have questions about expert parameters due to motor control effects, contact the manufacturer for technical support.
3. The manufacturer-level function code is not reflected in the manual. The modification needs to be confirmed by the manufacturer after-sales maintenance personnel. The modification is prohibited on site.

Related parameters

Param.	Name	Default	Setting range	Description
A0-10	System parameter access level	0	0: Standard 1: Extended 2: Expert 3: Manufacturer	Displays the parameter level of current system. Value description: 0: Standard - The default parameter access level. You can only access the standard-level parameters. Most common functions of the AC drive are at the standard level, meeting the requirements of most commissioning scenarios. 1: Extended - You can access the standard-level and extended-level parameters. Parameters at the extended level refer to those related to specific function requirements and process requirements. 2: Expert - You can access to the standard-level, extended-level and expert-level parameters. Expert-level parameters require a password for access and are intended for professional commissioning personnel. 3: Manufacturer - Manufacturer-level parameters can be accessed. The manufacturer-level parameters are password-locked and is used for Inovance only.
A0-11	Parameter access level setting	0	0: Standard 1: Extended 2: Expert	Sets the parameter access level. Value description: 0: Standard Standard-level parameters can be accessed. 1: Extended Extended-level parameters can be accessed. 2: Expert Expert-level parameters can be accessed. Note: If the expert password status (A0-14) is locked, you cannot switch directly to expert level.

Param.	Name	Default	Setting range	Description
A0-14	Expert password status	0	0: Invalid (no expert password assigned) 1: Locked (expert password set) 2: Unlocked (expert password set)	This parameter displays the current expert password status. Value description: 0: Invalid (expert password not set) - The expert password is set to 0. That is, no expert password is set. In this case, you can switch to the expert level directly through A0-11. 1: Locked (expert password has been set, locked state) - The expert password is set, and the expert-level parameters are locked. You need to enter the expert password to switch to the expert level through A0-11. 2: Unlocked (expert password has been set, unlocked state) - The expert password has been set and the correct expert password is entered. You can switch to the expert level directly through A0-11. Note: This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
A0-15	Expert password input	-	-	This parameter is used to input the expert password. Note: If the data entered through A0-15 is consistent with the expert password set in A0-16, you can unlock the expert-level parameters. This parameter is an extended parameter, requiring access level A0-10 or higher in the extended category to display.
A0-16	Expert password setting	-	0 to 65535	This parameter sets the expert password. If this parameter is set to 0, the expert password is invalid. If this parameter is set to a non-zero value, the expert password is valid. Note: If the expert password is set, you need to enter the correct expert password through A0-15 before switching to the expert-level parameter through A0-11. If you enter the password incorrectly, you cannot enter the expert level. This parameter is an expert-level parameter, requiring access level A0-10 or higher in the expert category to display.

5.7.2.2 Parameter Access Level Switchover

The parameter access level of the AC drive is standard by default. You can switch to other parameter access levels when using the AC drive. The parameter access permission of the AC drive is displayed in A0-10 (Current system parameter access level).

The following figure shows how to switch the parameter access level.

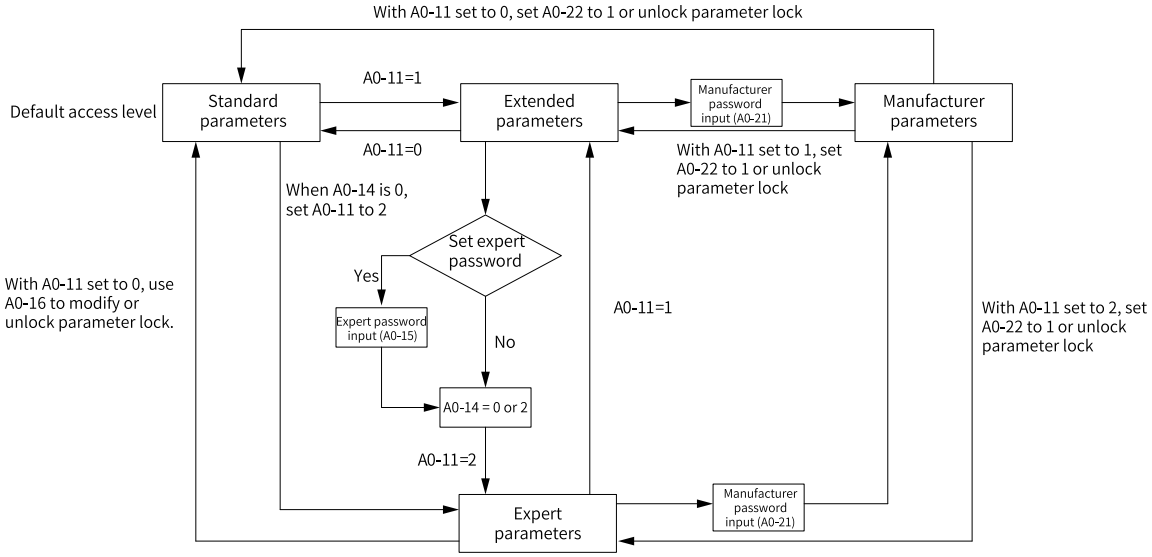


Figure 5-243 Parameter access level

The following rules apply to the switchover of parameter access levels:

1. For standard parameters and extended parameters, change the value of A0-11 directly.
   When A0-11 (Parameter access level setting) = 0 (Standard), the parameter access level is the standard parameter.

   When A0-11 (Parameter access level setting) = 1 (Extended), the parameter access level is the extended parameter.

2. For expert parameters.
   When A0-14 (Expert password status) is set to 0 (Invalid) or 2 (Unlocked), set A0-11 (Parameter access level setting) to 2 to switch directly to expert parameters. In this case, standard parameters, extended parameters, and expert parameters can be switched freely.

   When A0-14 (Expert password status) = 1: Locked (expert password set), set A0-11 (Parameter access level setting) to 1 (Extended). Switch to the extended parameter first and enter the expert password set in A0-15 (Expert password input). After unlocking, A0-14 (Expert password status) = 2 (Unlocked). In this case, set A0-11 (Parameter access level setting) to 2 (Expert) to switch to expert parameters.

3. There are three ways to exit from expert parameters:
   Method 1: Change the expert password in A0-16 (Expert password setting).

   Method 2: Set A0-11 (Parameter access level setting) to 0 (Standard) or 1 (Extended) to switch to standard or extended parameters.

   Method 3: The expert password is set to 0 by default. After the expert password is set to take effect, enter the expert parameter and wait for the unlock time of the expert password to reach 1 hour. Then automatic exit of expert parameters.

Switch from standard to extended parameters

1. By default, check that A0-10 (System parameter access level) is 0 (standard).
2. Modify A0-11 (Parameter access level setting) = 1 (Extended).

3. Check that A0-10 (System parameter access level) is 1 (Extended), indicating that the parameter has been switched from standard to extended.

Switch from standard parameters to expert parameters

- If A0-14 (Expert password status) = 0: Invalid (no expert password assigned) or 2: Unlocked (expert password set)
  Set A0-11 (Parameter access level setting) to 2 (Expert) to switch directly to expert parameters.
- If A0-14 (Expert password status) = 1: Locked (expert password set)
  1. Set A0-11 (Parameter access level setting) to 1 (Extended). Switch to the extended parameter first.
  2. Enter the set expert password in A0-15 (Expert password input). After unlocking, A0-14 (Expert password status) = 2: Unlocked (expert password set).
  3. Set A0-11 (Parameter access level setting) to 2 (Expert) to switch from standard to expert parameters.

5.7.3 Parameter Protection

5.7.3.1 Parameter Lock

5.7.3.1.1 Parameter Lock Introduction

Application Scenario

This product provides parameter lock function. All parameters of the AC drive can be locked after commissioning is completed. In the locked state, all parameters are not allowed to be viewed or copied/downloaded. You can only view the monitoring parameters on the Monitoring page in the operating panel and user-defined parameter groups in the user menu.

If you do not want other unauthorized personnel to view the parameters of the AC drive after on-site commissioning, you can use this function to lock the parameters.

Description

The parameter lock function is turned off by default. If you need to enable the parameter lock function, it is recommended to turn on the parameter lock after all commissioning of the AC drive is completed to prevent frequent unlocking of the parameter lock during commissioning.

The parameter lock function can be used together with the user-defined parameter group. That is, the user-defined parameter group can be used as a group of interface parameters. The interface parameters include some monitoring parameters or non-critical commissioning parameters, allowing you to perform monitoring and commissioning.

After setting the parameter lock password, only users who know the password can modify the parameters.

The parameter lock is set as follows:

- By default, the parameter lock is invalid. All users can modify the parameters. Set the parameter lock password through A0-31 to enable the parameter lock and the AC drive parameter menu is locked immediately.
- After the parameter menu is locked, it can be unlocked only by entering the correct password. After unlocking, the value of A0-30 (Parameter lock status) is 2 (Parameter lock unlocked). Parameters can be modified normally. The parameter menu is automatically locked after the time set by A0-32 (Unlock effective time of parameter lock) is reached.
- After setting the parameter lock password, you can set A0-33 (Lock parameter lock) to 1 (Lock) to activate the parameter lock function, in addition to waiting for the time set by A0-32.
- When A0-30 (Parameter lock status) is set to 0 (Parameter lock inactive), setting A0-33 (Lock parameter lock) or A0-32 (Unlock effective time of parameter lock) is invalid, and the parameter lock will not be activated.

Related parameters

Param.	Name	Default	Value Range	Descriptions
A0-30	Parameter lock status	0	0: Parameter lock inactive (parameter lock not set) 1: Parameter lock locked (parameter lock set) 2: Parameter lock unlocked (parameter lock set)	This parameter displays the parameter lock status. Value description 0: Parameter lock inactive (parameter lock not set) Parameter lock is set to 0, that is, parameter lock is not set. The parameter lock is inactive. 1: Parameter lock locked (parameter lock set) Parameter lock is set, and the parameter lock is in the locked state. You need to enter the correct parameter lock to unlock it. 2: Parameter lock unlocked (parameter lock set) The parameter lock is set, and the correct parameter lock is entered. The parameter lock is unlocked. Additional information: 1 .If the value of A0-31 is non-zero, the parameter lock takes effect. 2 .When the parameter lock is in the locked state, you need to enter the correct parameter lock to access the parameter list.
A0-31	Parameter lock setting	-	0 to 65535	This parameter sets the parameter lock. If the parameter lock is set to 0, the parameter lock is inactive. If the parameter lock is set to a value other than 0, the parameter lock is active. Additional information: 1 .If the value of A0-31 is non-zero, the parameter lock takes effect. 2 .When the parameter lock is in the locked state, you need to enter the correct parameter lock to access the parameter list.

Param.	Name	Default	Value Range	Descriptions
A0-32	Unlock effective time of parameter lock	3600	60 to 65535s	Set the duration for parameter lock unlock, that is, after the parameter lock is activated and the correct password is entered, the timer starts. After the set time is reached, The parameter lock is automatically locked. Additional information: 1 .The parameter lock is valid when A0-31 is not 0. 2 .The parameter lock is automatically locked after the unlock time exceeds the effective time. You need to enter the correct parameter lock again to unlock the parameter.
A0-33	Lock parameter lock	0	0: No operation 1: Lock	This parameter sets whether to lock the parameter lock manually. Value description 0: No operation. Disable this function. 1: The parameter lock is locked. Additional information: 1 .The parameter lock is valid when A0-31 is not 0. 2 .After A0-33 is set to 1, you do not need to wait for the time set by A0-32, and the parameter lock is locked immediately. You need to enter the correct parameter lock again to unlock the parameter. 3 .Automatic clearing is performed after parameter lock is locked.

Notes

If the parameter lock function needs to be enabled, remember the parameter lock password. Otherwise, the AC drive will be locked and the parameter cannot be viewed again.

5.7.3.1.2 Setting the Password for Locking Parameters

It is recommended to set a parameter lock password after all parameters of the AC drive are commissioned and all parameters are basically fixed to prevent the parameter lock from being unlocked frequently during commissioning.

The steps for setting the parameter lock are as follows:

1. Check that the basic commissioning of the AC drive is complete.
2. Check that A0-30 (Parameter lock state) is set to 0 (Parameter lock invalid (parameter lock not set)).
3. Record the password to be set and enter A0-31 (Parameter lock setting).

The parameter lock becomes effective after the preceding steps are set. After the function is enabled, you are prompted to enter a password when you access the function code. That is:

When accessing function codes via the operation panel, enter the base mode or -C- (user modification) mode in the QUICK menu, and then enter the password. When accessing function codes via the iFA background, enter the parameter list and enter the password.

5.7.3.1.3 Accessing User-defined Parameter Groups

The user-defined parameter groups (AE-00 to AE-31) and AC drive fault information are not affected by the parameter lock and can be accessed even if a parameter lock is set.

The parameter lock is generally used in combination with the user-defined parameter group.

Prerequisites

The AC drive has been commissioned and is ready to enter the stable running phase.

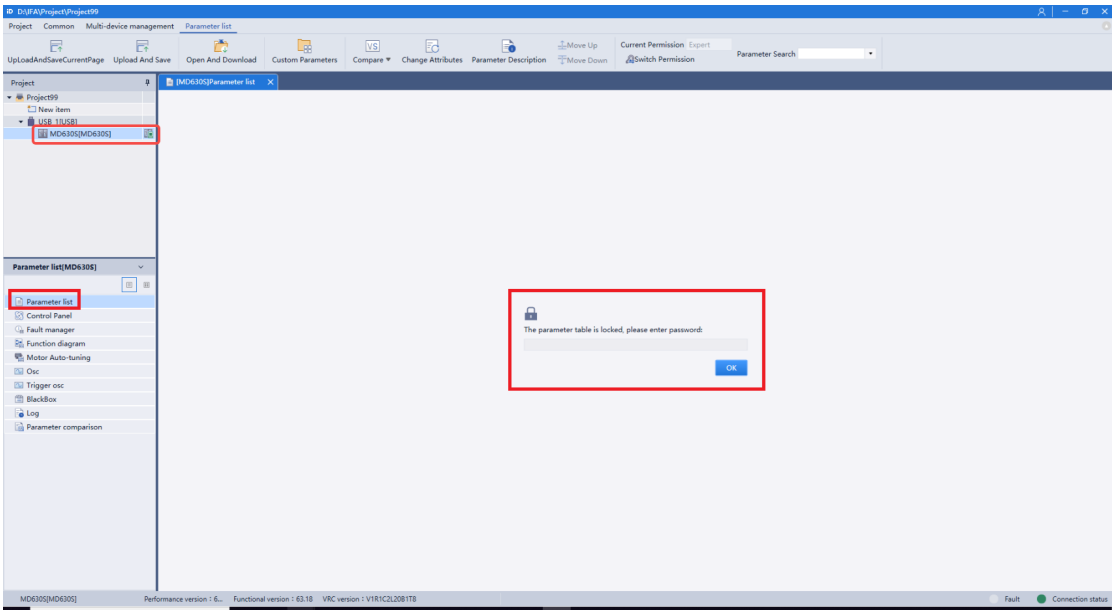
Operating procedure

1. Map common user parameters and user-defined parameter groups (AE-00 to AE-31).
   Use the operating panel to access group AE. AE-00 (User function code 0) is filled in uF0.30, AE-01 (User function code 1) is filled in uF0.48, and AE-02 (User function code 2) is filled in uF0.49. Enter uF0.49 for AE-03 (User function code 3), uU0.26 for AE-04 (User function code 4), and uU0.61 for AE-05 (User function code 5) to set F0-30 (Main frequency digital setting). F0-48 (ramp 1 acceleration time), F0-49 (ramp 1 deceleration time), U0-26 (current running time), and U0-61 (drive state 1) are mapped to group AE. For details, see "User-defined Parameter Groups".
2. Check that A0-30 (Parameter lock state) is set to 0 (Parameter lock invalid (parameter lock not set)).
3. Adjust A0-32 (Parameter lock unlock holding time).
4. Write the password in A0-31 (Parameter lock setting) and remember the password. Parameters (other than user-defined parameter groups) cannot be accessed normally after the password is entered.
5. Switch the operating panel to the user mode in the QUICK menu. You can access F0-30 (main frequency digital setting), F0-48 (ramp 1 acceleration time), F0-49 (ramp 1 deceleration time), U0-26 (current running time), and U0-61 (drive state 1) through user-defined parameter groups when the parameter lock is locked.

5.7.3.1.4 Unlock Parameters

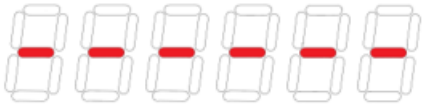
The parameters cannot be accessed in the locked state. You need to unlock the parameters first. The steps for unlocking the parameters are as follows:

- For the iFA commissioning software, click the Parameter List button. Enter the parameter lock password in the pop-up dialog box and click OK to unlock it.



- For the operating panel, switch to the base mode or the -C-(user-modified) mode in the QUICK menu of the operating panel. In the displayed "----", enter the parameter lock password and click 

to unlock.



5.7.3.1.5 Modifying the Parameter Lock Password

When the parameter lock is unlocked, enter a different password in A0-31 (Parameter lock setting) to modify the password.

> ***Note***
> The parameter lock is automatically locked after the password is modified.

5.7.3.1.6 Disable Parameter Lock

1. In the parameter lock unlock state, enter 0 in A0-31 (Parameter lock setting).
2. Check that A0-30 (Parameter lock status) is 0 (Parameter lock inactive (parameter lock not set)), and the parameter lock function is canceled.
   After cancellation, access to parameters is not restricted by the parameter lock.

5.7.3.1.7 Re-lock

Scenarios

- The AC drive needs to be commissioned again (the user-defined parameter group cannot meet the commissioning requirements).
- Batch copy of AC drive parameters is required.

Operation steps:

1. Check that commissioning/copying is completed.
2. Set A0-33 to 1 to lock the parameter immediately.

The parameter lock becomes effective after the preceding steps are set. After the function is enabled, you are prompted to enter a password when accessing parameters. Which is to say:

For the operating panel, you need to enter the password to access the parameters in the base mode or -C (user-changed) mode in the QUICK menu. For the iFA software, when entering the parameter list, you need to enter the password.

5.7.3.1.8 Designated Unlocked Functions

After the parameter lock is enabled, the following functions are not affected.

For operating panel:

1. Monitor display
2. All keys on the operating panel
3. User mode display in QUICK menu
4. Err fault menu display

For iFA commissioning software:

1. Oscilloscope
2. Control panel
3. Fault management
4. Function diagram

5.7.3.2 Parameter-write Protection

Scenarios

When this function is enabled, the AC drive parameters cannot be modified except for a few parameters that can be modified internally. This is to prevent the commissioning parameters to be modified incorrectly.

Description

Set the parameter write protection function through A0-44. When A0-44 (Parameter write protection) = 1 (Enable), the parameter write protection function takes effect, and the AC drive parameters cannot be modified except for a few parameters that can be modified internally.

Parameters that can be modified after write protection is enabled are as follows:

Param.	Parameter Name	Description
A0-44	Parameter write protection	Sets whether to enable parameter write protection.
A0-11	Parameter access level setting	Sets the parameter access level. Value description 0: Standard Standard-level parameters can be accessed. 1: Expansion Expansion-level parameters can be accessed. 2: Expert Expert-level parameters can be accessed. Additional information: If the expert password status (A0-14) is locked, you cannot switch directly to expert level.
A0-15	Expert password input	This parameter is used to input the expert password. Additional information: If the data entered through A0-15 is consistent with the expert password set in A0-16, you can unlock the expert-level parameter.
A0-21	Factory password input	This parameter indicates the manufacturer password input window which is used to enter the manufacturer password. Note: After the correct manufacturer password is entered through A0-21, the manufacturer password is unlocked and the system automatically switches to the manufacturer level. A0-10 displays the manufacturer.

Param.	Parameter Name	Description
A0-22	Exit manufacturer level	Used to exit manufacturer level. Value description 0: No operation No operation is performed. 1: Exit - Exit the manufacturer level and switch to the level set by A0-11. Additional information: Automatic clearing is performed after the manufacturer level is exited.
A0-33	Lock parameter lock	This parameter sets whether to lock the parameter lock manually. Value description 0: No operation No operation is performed. 1: Lock The the parameter lock is locked. Additional information: 1. The parameter lock is valid when A0-31 is not 0. 2. After A0-33 is set to 1, you do not need to wait for the time set by A0-32, and the parameter lock is locked immediately. You need to enter the correct parameter lock again to unlock the parameter. 3. Automatic clearing is performed after parameter lock is locked.

Different from the parameter lock function, the parameter protection function allows users to view parameter menu and modify the parameter access level to check AC drive parameters if the function is enabled.

Related parameters

Param.	Parameter Name	De fault	Value Range	Descriptions
A0-44	Parameter write protection	0	0: Disable 1: Enable	Used to set whether the write protection of the drive parameters is enabled. After the parameter-write protection is enabled, the drive parameters are not allowed to be changed. 0: Disable - Parameter-write protection is disabled. 1: Enable - Parameter-write protection is enabled. The drive parameters are not allowed to be changed. Note: A0-11, A0-15, A0-33, and A3-00 drive models are not controlled by A0-44.

5.7.4 Restore Parameters to Default Settings

In A0-00 (Parameter initialization), you can restore the specified parameter values to the default settings by selecting the required action. After the operation is completed, A0-00 (parameter initialization) is automatically reset to 0 (no operation).

5.7.4.1 Restoring Parameters to Factory Settings (Excluding Motor Parameters)

Application

This function applies to the scenario where the parameter initialization is required while the motor parameters have been set and do not need to be reset.

Description

Set A0-00 (Parameter initialization) to 1 to restore parameters (excluding motor parameters) to default settings.

Note

- The parameters related to the power module model are restored to the default values of the model instead of the factory values.
- Do not clear log parameters.

5.7.4.2 Restoring Parameters to Factory Settings (Including Motor Parameters)

Application scenarios

It is applicable when the motor parameters are not set or if you want the motor parameters to be reset and the parameters to be initialized.

Function description

Set A0-00 (Parameter initialization) to 3 (Restore factory parameters (including motor parameters)) to restore the AC drive parameters to factory values, including motor parameters.

Note

- The parameters related to the power module model are restored to the default values of the model instead of the factory values.
- Do not clear log parameters.

5.7.4.3 Back up current user parameters

Application Scenario

It is applicable to situations where you want to back up the parameters set to local storage.

Description

Set A0-00 to 4 (Back up the current user parameters) to back up the user-defined parameter settings that are different from the default parameter settings.

> ***Note***
> Same as A0-39 (User backup) when it is set to 400.

5.7.4.4 Restore user backup parameters

Application Scenario

It is applicable to situations where you want to restore the backed-up parameters from the local device.

Description

Set A0-00 to 501 (Restore user backup parameters) to restore the parameters backed up by setting A0-00 to 4.

> ***Note***
> Same as A0-38 (Backup parameter restore) when it is set to 500.

5.7.4.5 Clear Records

Function description

Set A0-00 (parameter initialization) to 2 (clear record information) to clear the recorded parameters.

> ***Note***
> - The parameters Ad-00 to Ad-17 are record parameters.
> - The parameters in groups H6 to Hb of historical fault records are record parameters.
> - P1-05 to P1-07 are record parameters in the simple PLC function.

5.7.4.6 Clear Fault Information

Function description

Parameter A0-00 (parameter initialization) can be set to 5 (clear fault information) to clear the historical fault information in groups H6 to Hb.

5.7.4.7 Resotring Parameters to Factory Settings (Including Motor Parameters) and Clearing the Records

Application scenarios

It is applicable when motor parameters are not set, or if you want the motor parameters to be reset, and the recorded parameters are cleared and parameters are initialized.

Function description

Set A0-00 (Parameter initialization) to 503 (Restore factory parameters (including motor parameters) and clear the recorded information) to restore the AC drive parameters to factory values, including motor parameters, and clear the recorded parameters.

Note

The parameters related to the model are restored to the default values of the model instead of the factory values.

5.7.5 User-defined Parameters

5.7.5.1 User-defined parameters

Application Scenario

Users classify common parameters dispersed in different function code groups into a user-defined parameter group for easy access and debugging.

Description

Group AE consists of user-defined parameters (AE-00 to AE-31). Users can define up to 32 commonly used parameters for easier check and modification. Only fill in the addresses of commonly used parameters in the user-defined parameter group. Accessing and modifying user-defined parameter groups is the same as accessing and modifying commonly used parameters distributed among different function code groups. The two form a mapping relationship.

As shown in the following figure, common parameters that are more dispersed can be grouped into user-defined parameter groups for unified management.

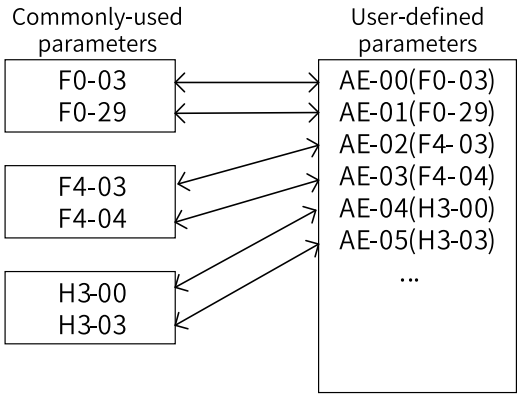


Figure 5-244 **Application example 3: Configure the mapping relationship between common parameters and user-defined parameter groups through communication**

Related parameters:

Param.	Name	Default	Value Range	Descriptions
A0-72	Parameter display setting	111	Ones position: 0: Hide user mode 1: Show user mode Tens: 0: Hide calibration mode 1: Show calibration mode Hundreds: 0: Hide error menu 1: Display error menu	This parameter is used to determine whether the user-defined parameter group, user-modified parameter group, and error menu are displayed on the operating panel through the ones, tens, and hundreds places.
AE-00	User-defined parameter 0	F0-00	0x0000 to 0xFFFF	User-defined parameters A total of 32 user-defined parameters can be set through AE-00 and AE-31. Additional information: This group of parameters is user-defined. You can select required parameters from all parameters and summarize them into the AE group for ease of viewing and modification. To view user-defined parameters, long-press the Back key to switch to the -USER menu.
AE-01	User-defined parameter 1	Same as AE-00	Same as AE-00	Same as AE-00
AE-02	User-defined parameter 2	Same as AE-00	Same as AE-00	Same as AE-00
AE-03	User-defined parameter 3	Same as AE-00	Same as AE-00	Same as AE-00

Param.	Name	Default	Value Range	Descriptions
AE-04	User-defined parameter 4	Same as AE-00	Same as AE-00	Same as AE-00
AE-05	User-defined parameter 5	Same as AE-00	Same as AE-00	Same as AE-00
AE-06	User-defined parameter 6	Same as AE-00	Same as AE-00	Same as AE-00
AE-07	User-defined parameter 7	Same as AE-00	Same as AE-00	Same as AE-00
AE-08	User-defined parameter 8	Same as AE-00	Same as AE-00	Same as AE-00
AE-09	User-defined parameter 9	Same as AE-00	Same as AE-00	Same as AE-00
AE-10	User-defined parameter 10	Same as AE-00	Same as AE-00	Same as AE-00
AE-11	User-defined parameter 11	Same as AE-00	Same as AE-00	Same as AE-00
AE-12	User-defined parameter 12	Same as AE-00	Same as AE-00	Same as AE-00
AE-13	User-defined parameter 13	Same as AE-00	Same as AE-00	Same as AE-00
AE-14	User-defined parameter 14	Same as AE-00	Same as AE-00	Same as AE-00
AE-15	User-defined parameter 15	Same as AE-00	Same as AE-00	Same as AE-00
AE-16	User-defined parameter 16	Same as AE-00	Same as AE-00	Same as AE-00
AE-17	User-defined parameter 17	Same as AE-00	Same as AE-00	Same as AE-00
AE-18	User-defined parameter 18	Same as AE-00	Same as AE-00	Same as AE-00
AE-19	User-defined parameter 19	Same as AE-00	Same as AE-00	Same as AE-00
AE-20	User-defined parameter 20	Same as AE-00	Same as AE-00	Same as AE-00
AE-21	User-defined parameter 21	Same as AE-00	Same as AE-00	Same as AE-00
AE-22	User-defined parameter 22	Same as AE-00	Same as AE-00	Same as AE-00
AE-23	User-defined parameter 23	Same as AE-00	Same as AE-00	Same as AE-00
AE-24	User-defined parameter 24	Same as AE-00	Same as AE-00	Same as AE-00
AE-25	User-defined parameter 25	Same as AE-00	Same as AE-00	Same as AE-00
AE-26	User-defined parameter 26	Same as AE-00	Same as AE-00	Same as AE-00
AE-27	User-defined parameter 27	Same as AE-00	Same as AE-00	Same as AE-00
AE-28	User-defined parameter 28	Same as AE-00	Same as AE-00	Same as AE-00

Param.	Name	Default	Value Range	Descriptions
AE-29	User-defined parameter 29	Same as AE-00	Same as AE-00	Same as AE-00
AE-30	User-defined parameter 30	Same as AE-00	Same as AE-00	Same as AE-00
AE-31	User-defined parameter 31	Same as AE-00	Same as AE-00	Same as AE-00

5.7.5.2 Address Mapping

The parameter addresses of group AE are 0x2F00 to 0X2F1F, which are used to establish the mapping relationship. Write the address that needs to be mapped to 0x2F00 to 0X2F1F,and then the mapping is completed. 0xAE00 to 0xAE1F are addresses for users to access. They are used for users to access the commonly-used parameters after the mapping relationship is established. Reading and writing to these addresses is equivalent to reading and writing the mapped user-commonly-used parameters.

Table 5–117 Parameter group AE

Param.	Name	Parameter Address (Used for establish mapping)	Parameter Address (For Users to access)
AE-00	User-defined parameter 0	0x2F00	0xAE00
AE-01	User-defined parameter 1	0x2F01	0xAE01
AE-02	User-defined parameter 2	0x2F02	0xAE02
AE-03	User-defined parameter 3	0x2F03	0xAE03
AE-04	User-defined parameter 4	0x2F04	0xAE04
AE-05	User-defined parameter 5	0x2F05	0xAE05
AE-06	User-defined parameter 6	0x2F06	0xAE06
AE-07	User-defined parameter 7	0x2F07	0xAE07
AE-08	User-defined parameter 8	0x2F08	0xAE08
AE-09	User-defined parameter 9	0x2F09	0xAE09
AE-10	User-defined parameter 10	0x2F0A	0xAE0A
AE-11	User-defined parameter 11	0x2F0B	0xAE0B
AE-12	User-defined parameter 12	0x2F0C	0xAE0C
AE-13	User-defined parameter 13	0x2F0D	0xAE0D
AE-14	User-defined parameter 14	0x2F0E	0xAE0E
AE-15	User-defined parameter 15	0x2F0F	0xAE0F
AE-16	User-defined parameter 16	0x2F10	0xAE10
AE-17	User-defined parameter 17	0x2F11	0xAE11
AE-18	User-defined parameter 18	0x2F12	0xAE12
AE-19	User-defined parameter 19	0x2F13	0xAE13

Param.	Name	Parameter Address (Used for establish mapping)	Parameter Address (For Users to access)
AE-20	User-defined parameter 20	0x2F14	0xAE14
AE-21	User-defined parameter 21	0x2F15	0xAE15
AE-22	User-defined parameter 22	0x2F16	0xAE16
AE-23	User-defined parameter 23	0x2F17	0xAE17
AE-24	User-defined parameter 24	0x2F18	0xAE18
AE-25	User-defined parameter 25	0x2F19	0xAE19
AE-26	User-defined parameter 26	0x2F1A	0xAE1A
AE-27	User-defined parameter 27	0x2F1B	0xAE1B
AE-28	User-defined parameter 28	0x2F1C	0xAE1C
AE-29	User-defined parameter 29	0x2F1D	0xAE1D
AE-30	User-defined parameter 30	0x2F1E	0xAE1E
AE-31	User-defined parameter 31	0x2F1F	0xAE1F

5.7.5.3 Create Mapping Relationship

Enter the addresses of commonly used parameters into the parameter group AE (AE-00 to AE-31) to complete the mapping relationship. The default values of AE-00 to AE-31 are 0xF000, indicating that no parameters are mapped.

The mapping relationship can be established through the operating panel, iFA commissioning software, and communication.

You can directly modify the parameters AE-00 to AE-31 using the operating panel or the iFA commissioning software. To set up the mapping relationship, simply enter the corresponding parameter address in the range AE-00 to AE-31.To establish the mapping through communication, write the parameter address to be mapped in group AE.

After the mapping relationship is established, reading and writing to the addresses 0xAE00 to 0xAE1F through communication is equivalent to reading and writing to the addresses of the commonly used parameters in different parameter groups.

Application example 1: Configure the mapping relationship between common parameters and user-defined parameter groups through the operating panel

Set the mapping relationship between AE-00 (User-defined parameter 0) and F0-03 (Command source of control channel 1) through the operating panel:

1. Locate the AE group parameters of the secondary menu on the operating panel. For details, see section *6.1 Operating Panel*.

2. After finding AE-00, press OK to enter the AE-00 mapping configuration. uF0.00 is displayed by default.
3. Continue to press ▲ to adjust the mapping parameters. Press ▲ three consecutive times to adjust to uF0.03.
4. Press OK to complete the mapping. The operating panel displays AE-01

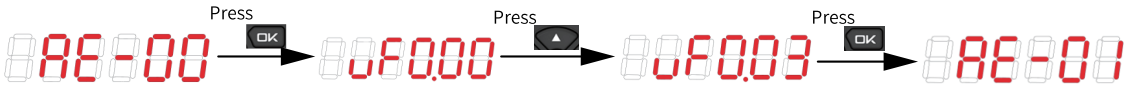
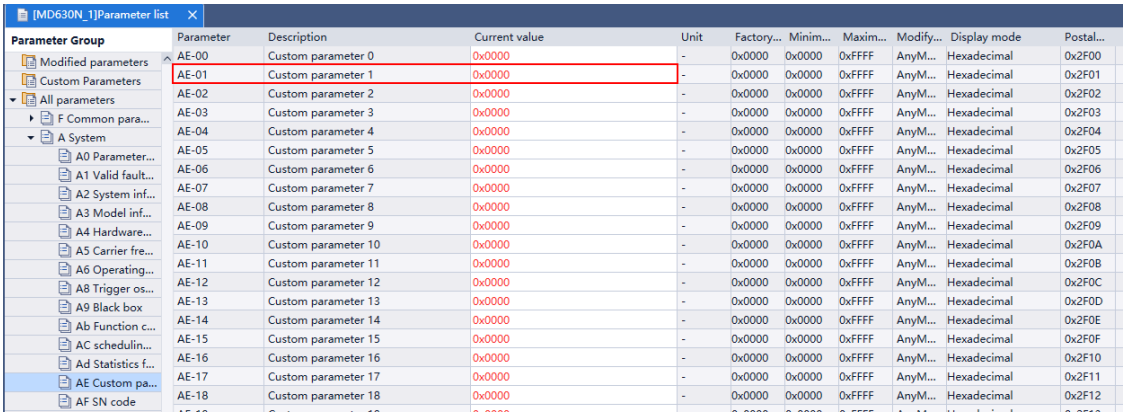


Figure 5-245 Set the mapping relationship through the operating panel

Application example 2: Configure the mapping relationship between common parameters and user-defined parameter groups through the iFA software

Set the mapping relationship between AE-01 (User-defined parameter 1) and F0-29 (Main frequency source) through the iFA:

1. Locate the AE parameter group and find the AE-01.



2. Input 0xf01D in AE-01 and press Enter. Then the mapping is established.

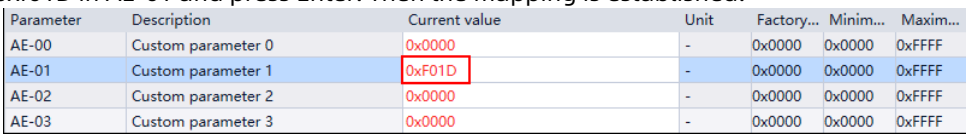


Figure 5-246 Set the mapping relationship through iFA

Application example 3: Configure the mapping relationship between common parameters and user-defined parameter groups through communication

Set the mapping relationship between AE-02 (User-defined parameter 2) and F4-03 (DI1 function selection) through communication:

1. Write 0xF403 (Address of F4-03) to 0x2F02 (Address of AE-02) to establish the mapping relationship.
2. Read the address 0xAE-02 (user parameter access address of AE-02), that is, read the value of F4-03.
3. Write 2 to 0xAE02 (user parameter access address of AE-02), which is to write 2 to F4-03.

Notes

These user-defined parameters are displayed differently on the operating panel and the commissioning software. The operating panel displays the selected parameter name and the commissioning software displays the corresponding communication address.

For example, when the operating panel displays AE-00 (user-defined parameter 0) = uF0.03, the user-defined parameter 0 is F0-03 (Command source of control channel 1). The value of AE-00 in the commissioning software is 0xF003, which is the communication address of F0-03 (Command source of control channel 1).

5.7.5.4 QUICK Menu

The QUICK menu on the operating panel contains four modes: Base mode, user-defined mode (User mode), user-modified mode (-C– mode), and fault mode (-Err– mode).

- Base mode: Displays all parameters of F0, F1....A0...
- User-defined (user) mode: Displays parameters mapped by group AE (that is, parameters commonly used by users), such as F0-03, F0-29, F0-29, F4-03 parameters. In this mode, you can view and modify the values of commonly-used parameters through mapping parameters.
- User-modified mode (-C– mode): Displays the modified parameters, that is, the parameters that are different from the default value.
- Fault mode (-Err– mode): Displays current AC drive fault information.

The following figure shows the switchover of the four modes.

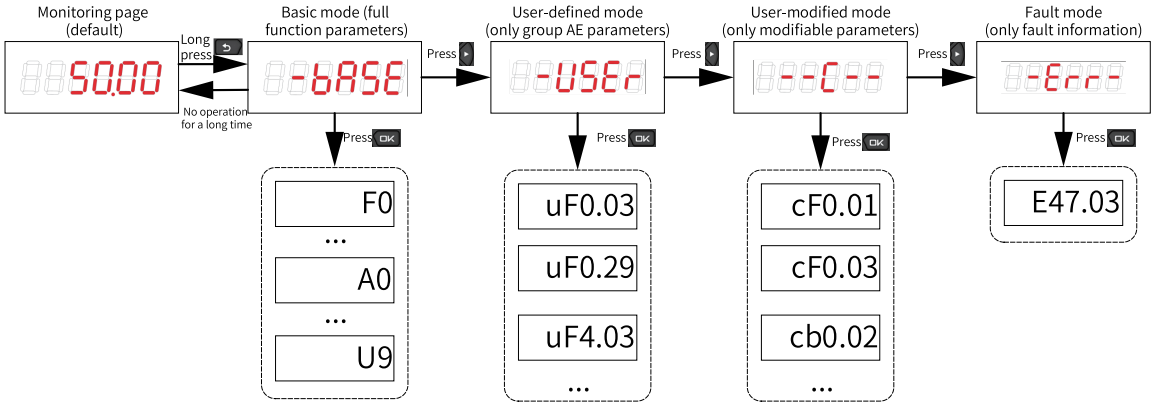


Figure 5-247 Diagram of the mode switchover on QUICK menu

Application example: Modifying user commonly-used parameters after mapping in user mode

You can view and set the values of commonly-used parameters after mapping through the user mode in the QUICK menu on the operating panel. As shown in the following figure, enter the user mode from the default monitoring page. In the user mode, you can access and set the commonly-used parameters after mapping.

Conditions

The mapping between AE-00 and F0-03 as well as AE-01 and F0-29 are established.

Operation steps:

1. On the default monitoring page, long press  to enter the QUICK menu.
2. After entering the QUCIK menu, the base mode is the default. Press  to select the user mode.
3. When the operating panel displays "-user", press  to enter the user mode, and you can see the parameter of the first group AE mapping, uF0.03 (F0-03).
4. Continue to press  to select the second AE group mapped parameter uF0.29 (F0-29).
5. When uF0.29 is displayed, press  to access the current value of F0-29.
6. Continue to press  to modify the value of F0-29.
7. Press  to save the value of F0-29.

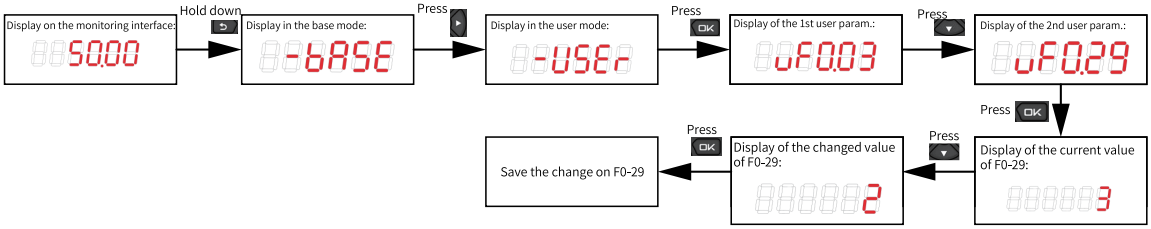


Figure 5-248 Example of entering the user mode

The default values of AE-00 to AE-31 are 0xF000 (uF0.00 is displayed on the operating panel). In this case, only F0-00 is displayed in the user mode.

5.7.6 Black Box

The MD630-INT series products are equipped with the built-in black box function. The black box is mainly used for recording important internal data when special events are triggered. This function is enabled by default, and starts automatically upon power-on.

Application

You can maintain the AC drive through the data recorded in the black box, but the data analysis of the black box requires professional commissioning personnel.

Function Description

The black box supports automatic triggering of fault and user-defined triggering, either of which will trigger the black box recording. The logged data is stored on MD630-INT's own flash, which stores up to 20 data sets that have occurred recently. Each set can contain up to 6 configurable-period data, 16 fixed-period data, and corresponding event information. After more than 20 sets of data, the oldest triggered data is automatically overwritten. The configurable-period can be a carrier cycle or 0.5 ms cycle, and configured through the parameter A9-15 [Data sampling cycle of configurable-period 1 to 6 channel], while the fixed-period data acquisition period is a 2 ms cycle.

By default, the black box is triggered by any fault, and the trigger condition can be selected through A9-66.

Automatic fault trigger condition: When the AC drive enters to the fault state, black box record will be triggered once automatically.

User-defined triggering: You can define a black box triggering condition through a custom logical combination. When the set condition is met, the black box record is triggered once.

The parameters related to black box trigger is shown in the following table. The user-defined trigger condition A and B have the same function. Take the user-defined trigger condition A as an example.

5.7.7 Clear Records

5.7.7.1 Fault Log Clear

Scenarios

The parameter groups H6 to Hb of the AC drive are used to store fault record information. After the fault is reset, the fault record can be cleared through the fault record clearing function.

Description

Set A0-00 (Parameter initialization) to 5 (Clear fault information) and perform parameter initialization to clear the fault information recorded by groups H6 to Hb of the AC drive.

You can also set A0-00 (Parameter initialization) to 2 (Clear log information) to clear the fault records. However, this method also clears all the records of the AC drive, such as the cumulative running time, cumulative power-on time, and cumulative power consumption. It is not recommended to clear fault records.

Related parameters:

Param.	Name	Default	Value Range	Descriptions
A0-00	Parameters Initialization	0	0: No operation 1: Restore parameters (excluding motor parameters) to default settings 2: Clear records 3: Restore parameters (including motor parameters) to default settings 4: Back up current user parameters 5: Clear fault information 501: Restore user backed-up parameters 503: Restore parameters including motor parameters to default settings and clear records	0: No operation 1: AC drive parameters except factory parameters, motor parameters, and records are restored to default settings. 2: Fault records, cumulative running time, cumulative power-on time, and cumulative power consumption are cleared. 3: AC drive parameters except factory parameters and records are restored to default settings. 4: The current parameter values are backed up, which is the same as the function when A0-39 is set to 400. 5: Clear the fault information recorded in groups H6 to Hb. 501: Parameters backed up by setting A0-00 to 4 are restored, which is the same as the function when A0-38 is set to 500. 503: AC drive parameters except factory parameters are restored to default settings and records are cleared. Factory parameters include the model parameters, AI/AO correction parameters. Record information parameters include the fault record, cumulative running time, and cumulative power-on time. Note: After the parameter operation is done, this parameter is automatically restored to 0.

5.7.7.2 Record Clearance

Scenarios

Records such as accumulative running time and accumulative power consumption cannot be reset automatically after the AC drive is powered on again. You can clear the records by clearing the records and start the statistics again.

Description

When A0-00 is set to 2, fault records, cumulative running time, cumulative power-on time, and cumulative power consumption are cleared.

Related parameters:

Param.	Name	Default	Value Range	Descriptions
A0-00	Parameters Initialization	0	0: No operation 1: Restore parameters (excluding motor parameters) to default settings 2: Clear records 3: Restore parameters (including motor parameters) to default settings 4: Back up current user parameters 5: Clear fault information 501: Restore user backed-up parameters 503: Restore parameters including motor parameters to default settings and clear records	0: No operation 1: AC drive parameters except factory parameters, motor parameters, and records are restored to default settings. 2: Fault records, cumulative running time, cumulative power-on time, and cumulative power consumption are cleared. 3: AC drive parameters except factory parameters and records are restored to default settings. 4: The current parameter values are backed up, which is the same as the function when A0-39 is set to 400. 5: Clear the fault information recorded in groups H6 to Hb. 501: Parameters backed up by setting A0-00 to 4 are restored, which is the same as the function when A0-38 is set to 500. 503: AC drive parameters except factory parameters are restored to default settings and records are cleared. Factory parameters include the model parameters, AI/AO correction parameters. Record information parameters include the fault record, cumulative running time, and cumulative power-on time. Note: After the parameter operation is done, this parameter is automatically restored to 0.

5.7.8 Log Function

Description

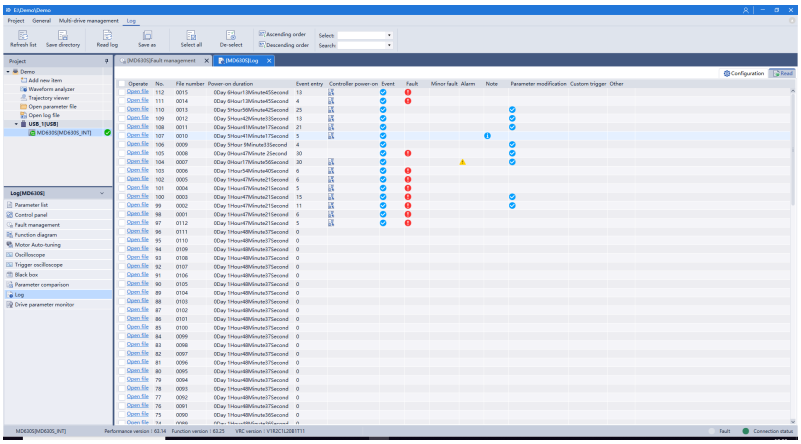
The operation log records information about software, hardware, and system problems in the system, including specific data and time of occurrence. You can monitor related events such as operating events, state changes, faults, minor faults, and alarms in the system. Users and manufacturers can locate the fault causes through the log for easy fault tracking and equipment maintenance. It includes the changing of important system state (including power-on/power-off, state machine change, command setting, automatic fault reset, etc.), factory restoration of parameters, and so on.

The log function is enabled by default. You can disable this function through AA-00.

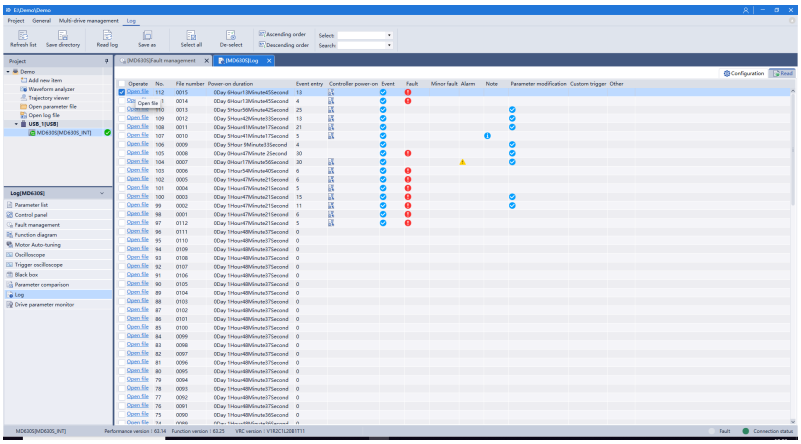
Reading the log

After connecting the drive to the iFA debugging software, open the log interface through "Log". After clicking "Refresh List," you can see the generated log files and the power-up time. You can open the log to see the time when each event record occurred.

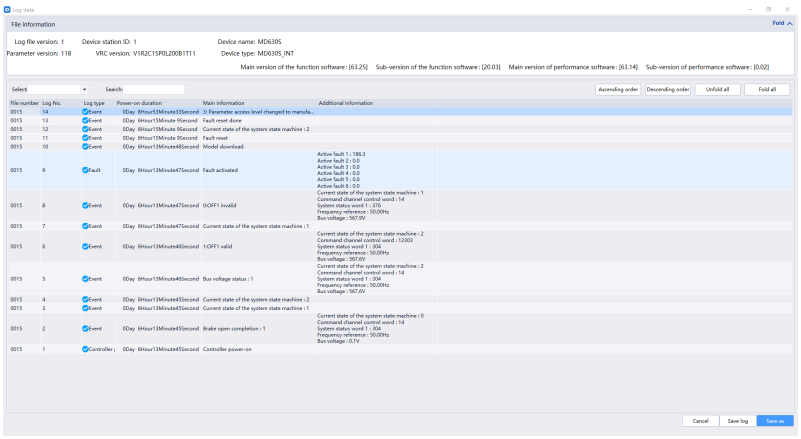
After the drive is powered on again, a log file will be created to record events. All records are stored in the newly created log file during power-on. A log file will be created only after the existing file is fully occupied. The system can save up to 112 log files, with 30 records saved in each log file.



After the log is refreshed, check the log as needed and click "Open log" to view the log file.

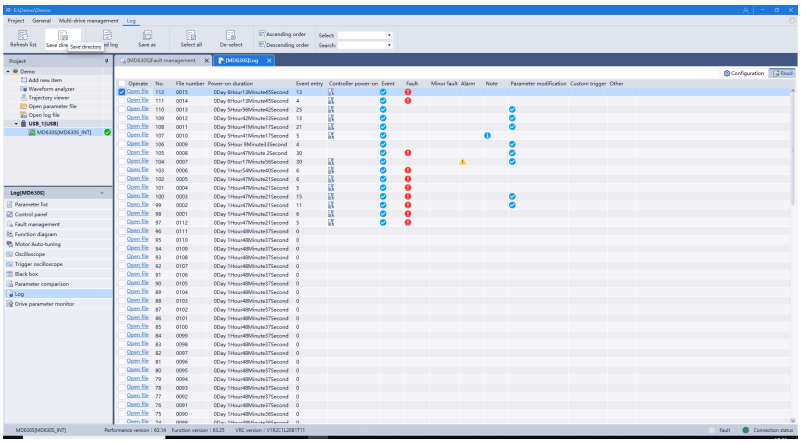


Log data includes the log type, the time that the log is recorded, and the log information.

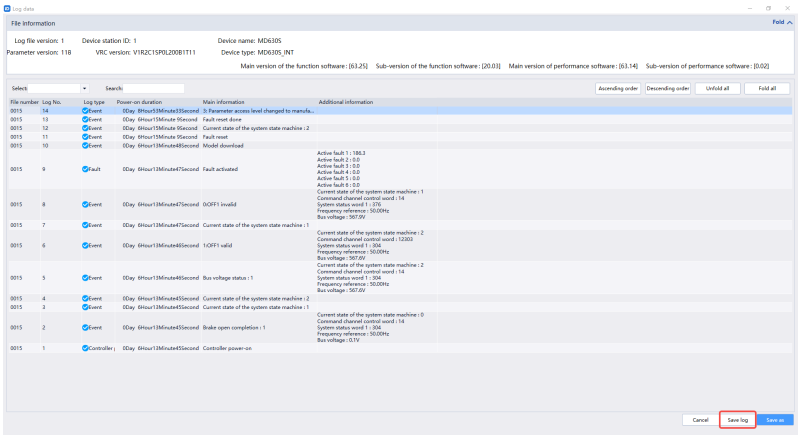


Saving logs

Select the logs to be saved and select a local path to save the log to the computer.

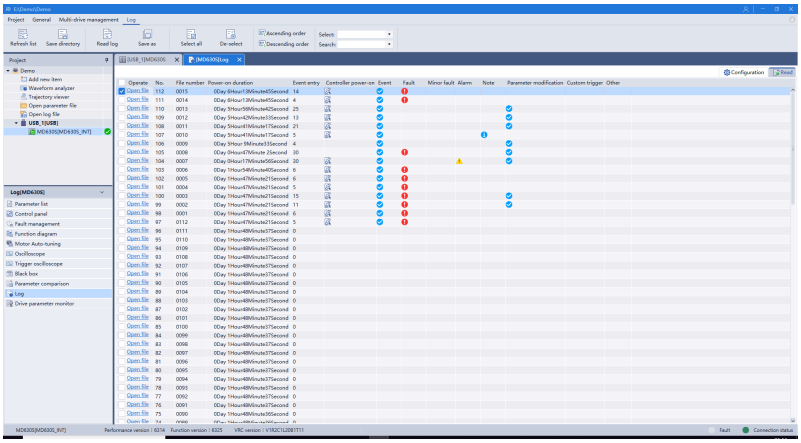


Select the log data to be saved, and then click the save log button to save the logs to the computer.

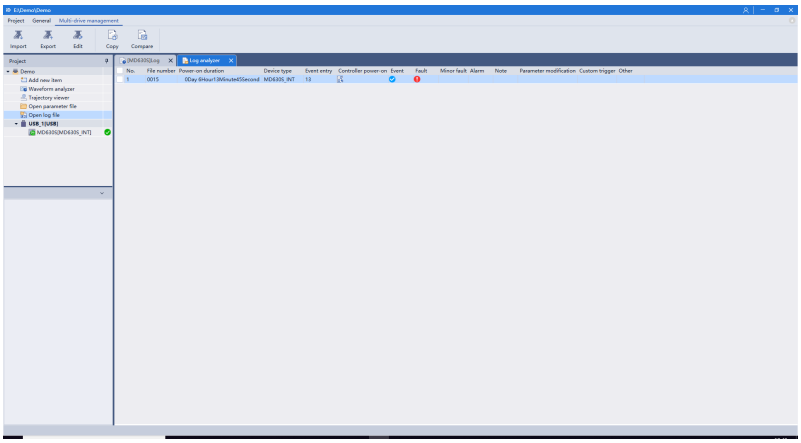


Opening saved log files

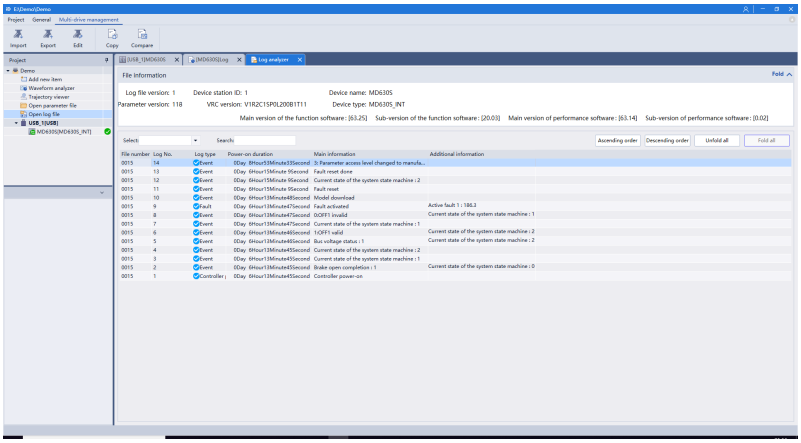
Click the open log file button to view the previously saved log and data.



View the log path.



View the log file.



Clearing logs

Do as follows:

1. Set AA-94 to 1 (Clear).
2. Set AA-95 to 1 to confirm the log clear operation.

All the log records will be cleared.

Caution

Cleared log information cannot be recovered. Be cautious when clearing the log information.

Customized log triggering

The log supports analog triggering and digital triggering. When digital triggering is used, the log record can be triggered once at the edge of the digital signal. The edge signal type can be configured by parameters. When analog triggering is used, a log record can be triggered by comparing with the source value setpoint. Four groups of customized log triggering are supported. For related parameters, see *"Table 5-118 AA-79 to AA-82" on page 888*. The following table describes the parameters of customized log 1 only. The configurations of customized log 2 to customized log 4 are the same.

Enable the log function

The log function can be configured. You can disable or enable specific log functions to mask or record related events.

Table 5–118 AA-79 to AA-82

Param.	Name	Value	Description
AA-79	Log event switch 1	bit0: Current state machine bit1: OFF1 state bit2: OFF2 activated bit3: OFF3 activated bit4: Operation allowed bit5: Fault activated bit6: Minor fault activated bit7: Alarm activated bit8: Prompt activated bit9: Bus voltage power-up bit10: Bus voltage undervoltage bit11: Fault reset bit12: Fault reset completed bit13: Brake released bit14: Brake closed Bit 15: Reserved bit0 to bit15: 0: Disable; 1: Enable	Sets the log function switch 1. Select whether to enable the log function for common operations, and select the events that trigger log record. 0: Disable. Log events are not recorded. 1: Enable. Log events are recorded.
AA-80	Log event switch 2	bit0: AI1 disconnected bit1: AI2 disconnected bit2: Jog operation effective bit3: STO output bit4: Undervoltage suppression bit5: Overvoltage suppression bit6: Motor overload bit7: Motor pre-overload bit8: Drive overload bit9: Auto-tuning bit10: Manual self-test bit11: Self-test and auto-tuning upon power-up/ startup bit12: Encoder cable disconnected bit13: Communication disconnected bit14 to bit15: Reserved bit0 to bit15: 0: Disable; 1: Enable	Sets the log function switch 2. Additional note: Same as AA-79.

Param.	Name	Value	Description
AA-81	Log event enable switch 3	bit0: Control channel selection bit1: Channel reference selection bit2: Motor parameter group selection bit3: Clear black box data bit4: Parameter lock bit5: Parameter-level modification bit6: Software control permission switch bit7: Model download bit8: Control method switching bit9: Control mode switching bit10: Parameter modification bit11 to bit15: Reserved bit0 to bit15: 0: Disable; 1: Enable	Sets the log function enable switch 3. Additional note: Same as AA-79.
AA-82	Log event switch 4	bit0: Fire mode activated bit1: Fire mode operation bit2: Fire mode bypass bit3: Fire mode overlimit bit4 to bit15: Reserved bit0 to bit15: 0: Disable; 1: Enable	Sets the log function enable switch 4. Additional note: Same as AA-79.

5.7.9 Modified Parameter List

Application scenarios

When parameters modified during function commissioning need to be modified again, you can locate the modified parameters through this list to improve the commissioning efficiency.

When parameters are modified inadvertently, you can locate the modified parameters through this list to restore these parameters.

Function description

The modified parameter list consolidates modified parameters from different groups into the same menu level. You can access this list through the operating panel or iFA commissioning software.

Application instance 1: Accessing the list through operating panel

You can view the list through the QUICK menu of the operating panel. For detailed information on the operation panel, see *" List of Commissioning Tools" on page 121*. For details on the QUICK menu, see *"5.7.5.1 User-defined parameters" on page 873*.

The basic steps to access the list through the operating panel are shown in the figure below.

1. Hold down the  on the default monitoring page to enter the QUICK menu.
2. After entering the QUICK menu, the default mode is basic mode (-bASE). Press  to switch to user-change mode.
3. When the operation panel displays "–C–", press  to enter the user-change mode, where the first modified parameter cF1.01 (F1-01) will be displayed.
4. Keep pressing  to view the second modified parameter cF1.04 (F1-04).
5. When "cF1.04" is displayed, press  to access F1-04, where the parameter value shown in the figure is 6.70.
6. Press  or  to modify the value of F1-04 to 6.85.
7. Press  to save the modified value of F0-29.

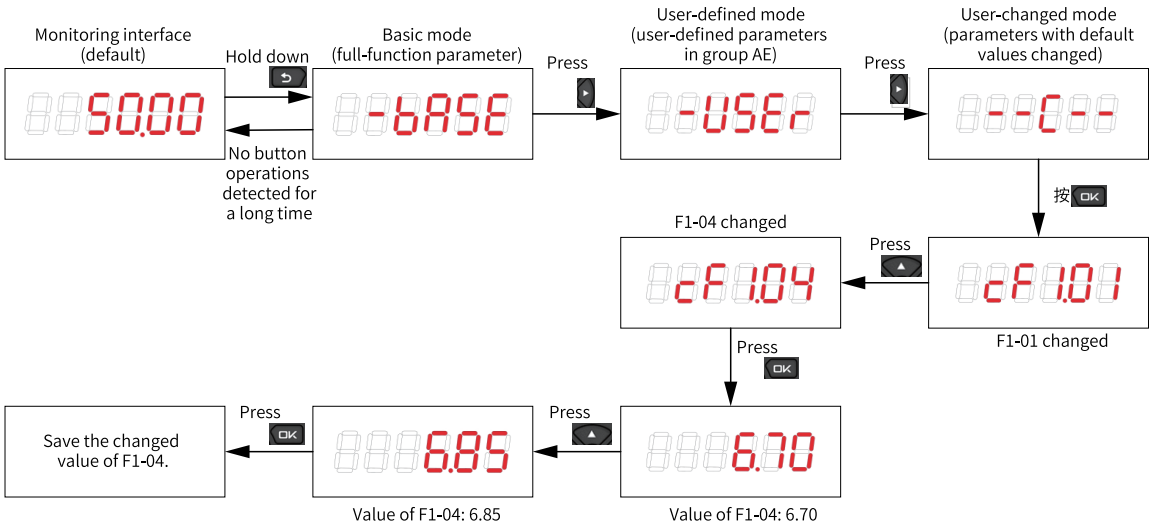


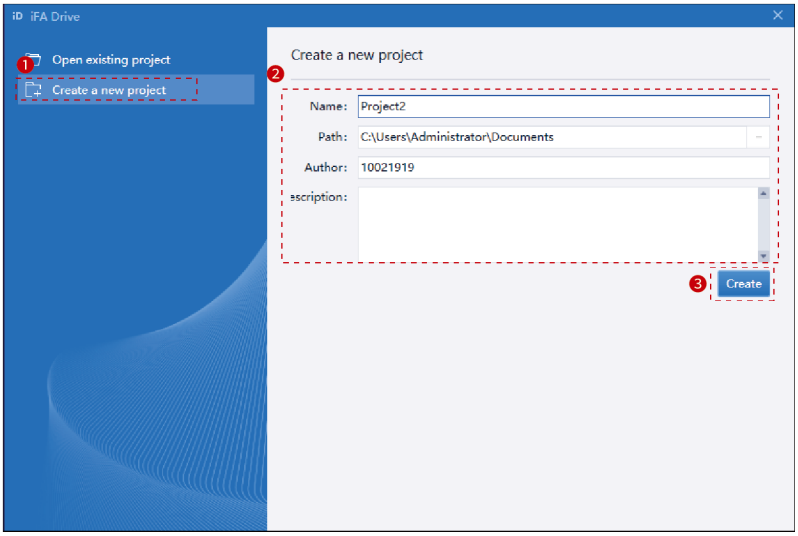
Figure 5-249 Accessing the list through operating panel

Application instance 2: Accessing the list of modified parameters through iFA commissioning software

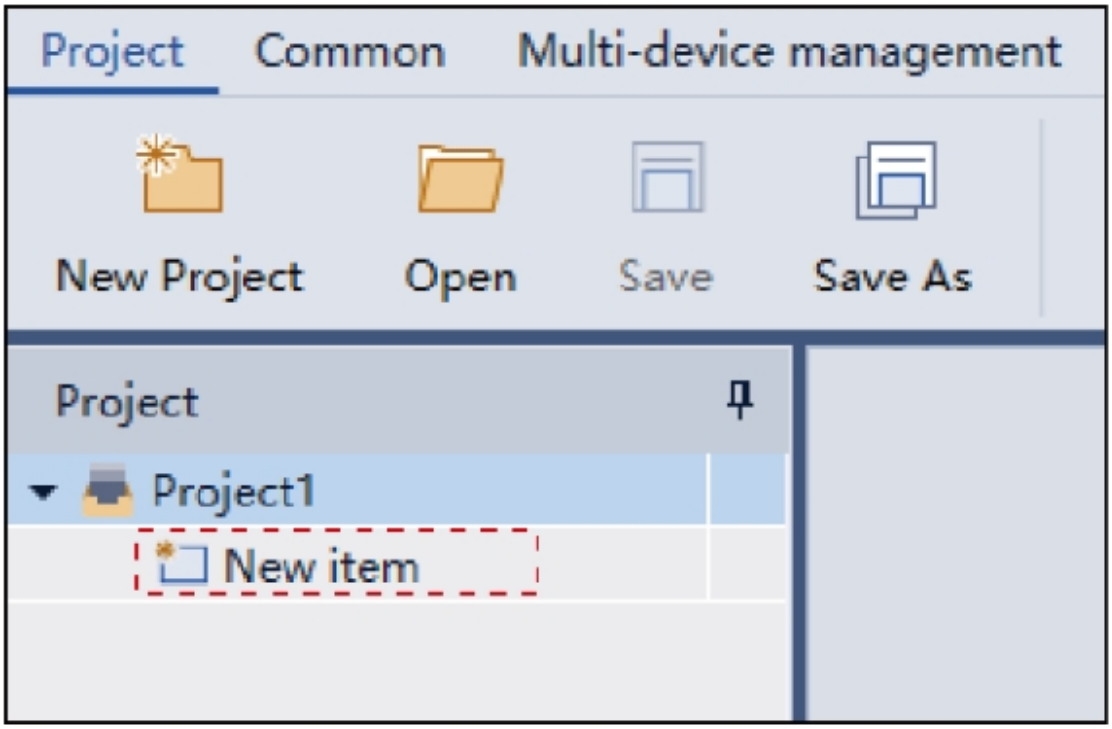
The iFA commissioning software can also synchronize and display the modified parameters of the drive. For detailed information on the iFA commissioning software functions, see *"4.2.2.1 Downloading and Installing Software" on page 130*.

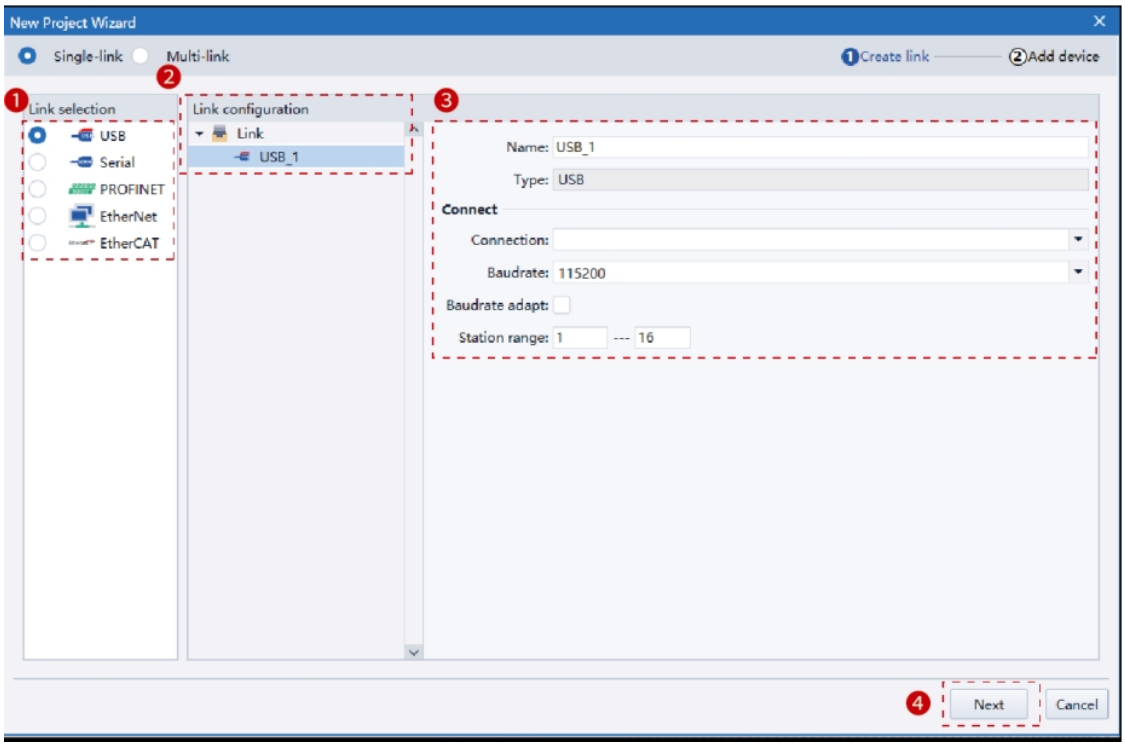
The basic steps to access the list of modified parameters through iFA commissioning software are as follows:

1. Open the iFA commissioning software, enter the project information, and click "Create" to create a new project.

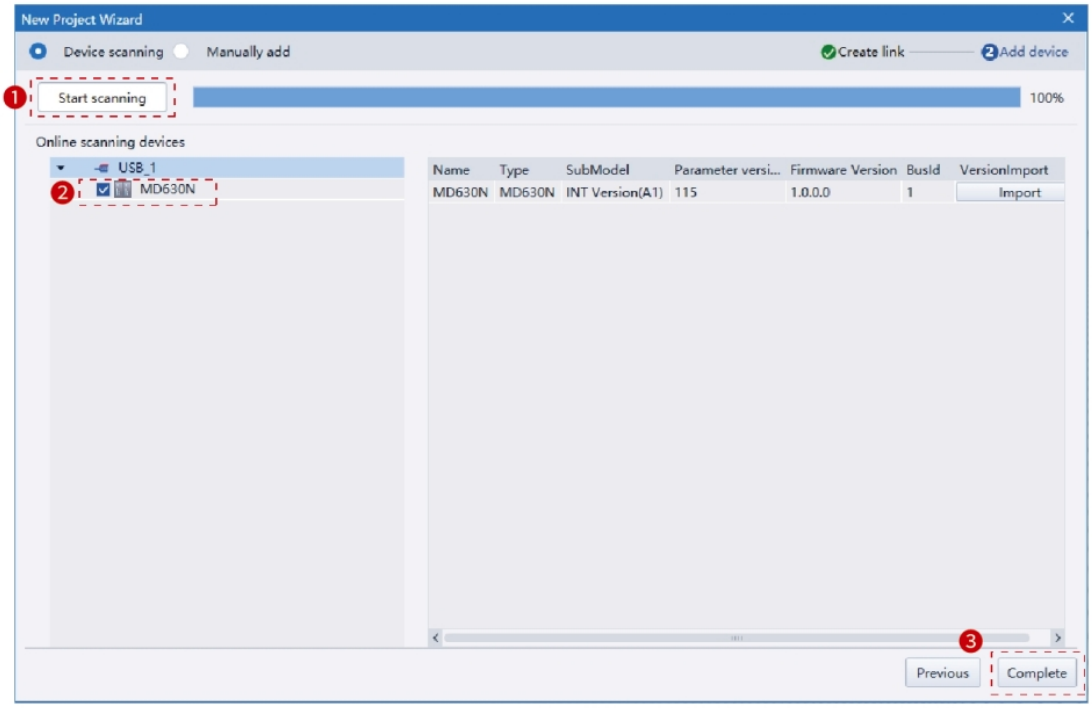


2. After entering the main page, click on the left side to add new items. In the wizard page displayed, enter information such as baud rate and station number, then click "Next".

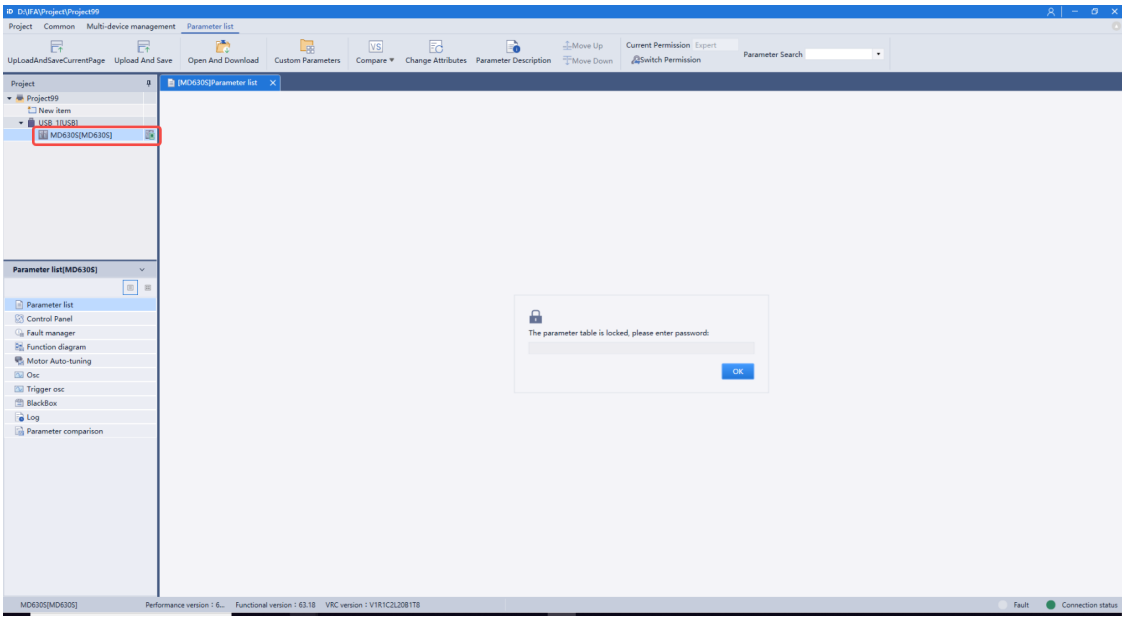


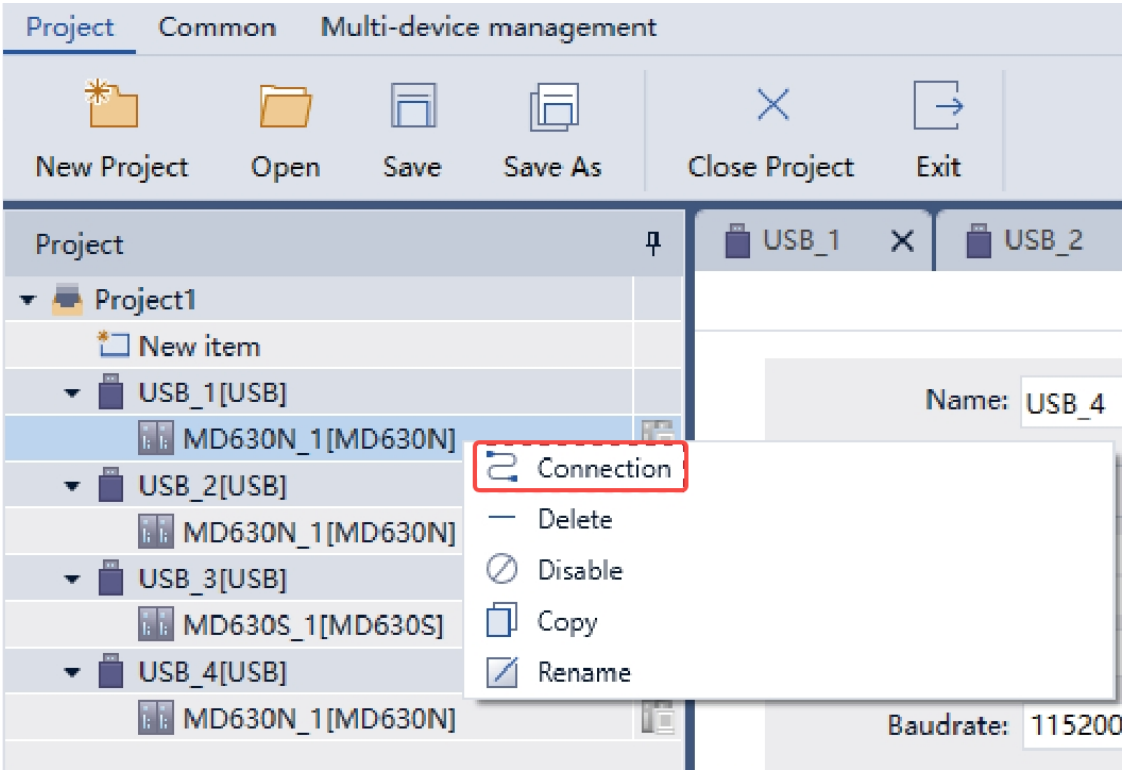


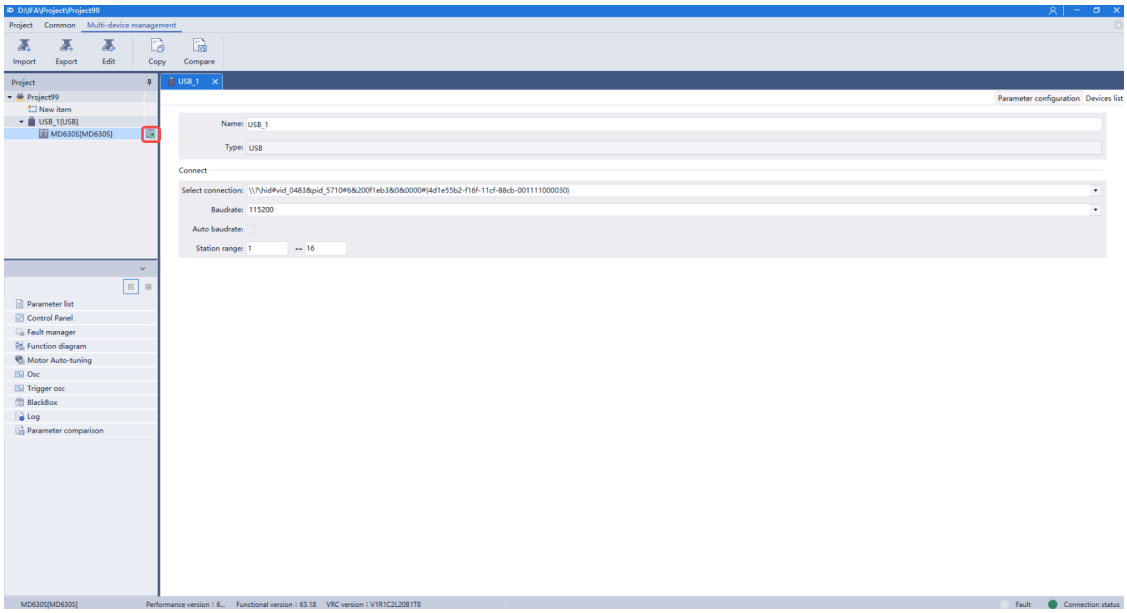
3. First, click "Start scanning" on the new page to scan for devices. After the connected device information is displayed, click "Done" to return to the main page.



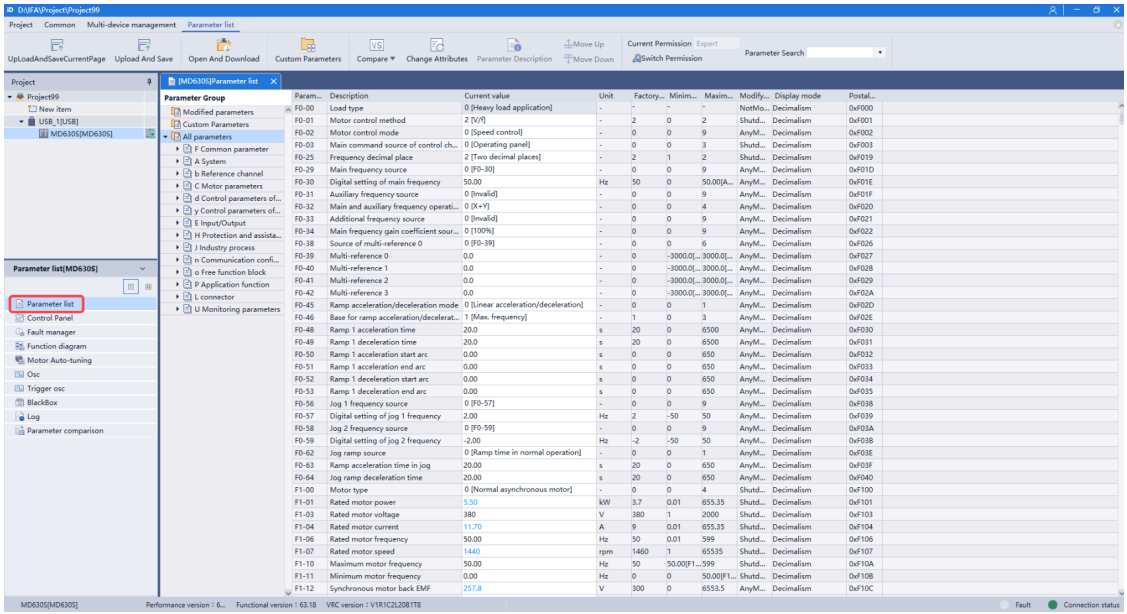
4. Right-click on the device name on the left side of the main page, which is MD630S here, and select "Connect device" in the pop-up menu. A green mark displayed besides the device name indicates this device has been connected successfully.



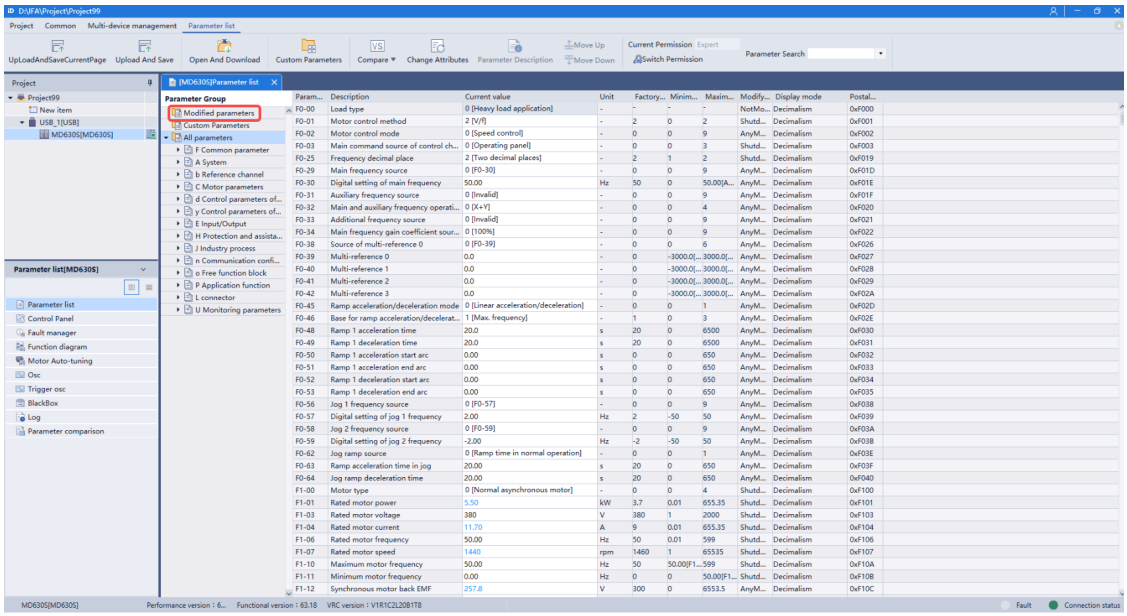

Project
Common
Multi-device management
New Project
Open
Save
Save As
Close Project
Exit
Project
Project1
New item
USB_1[USB]
MD630N_1[MD630N]
USB_2[USB]
MD630N_1[MD630N]
USB_3[USB]
MD630S_1[MD630S]
USB_4[USB]
MD630N_1[MD630N]
USB_1
USB_2
Name: USB_4
Connection
Delete
Disable
Copy
Rename
Baudrate: 115200

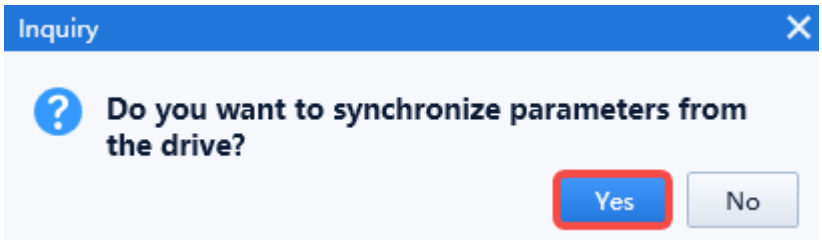


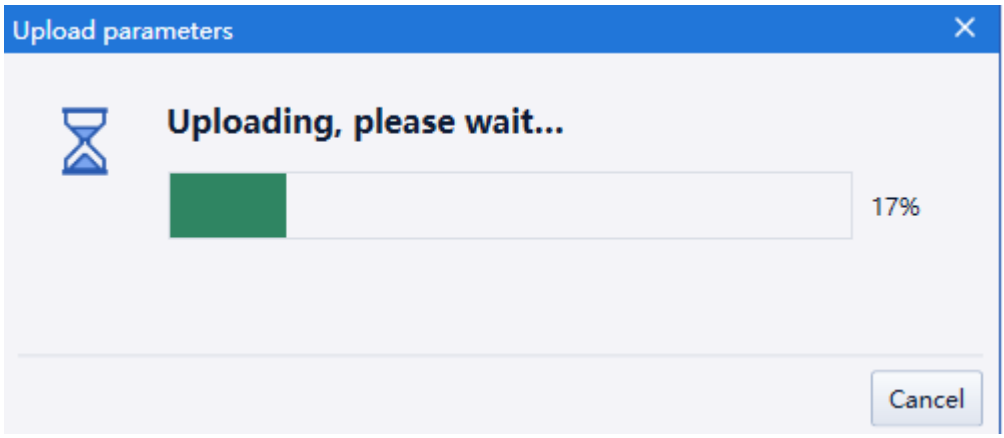
5. Next, click the parameter list on the left side to display parameters of the drive. Parameter groups are displayed on the right side.



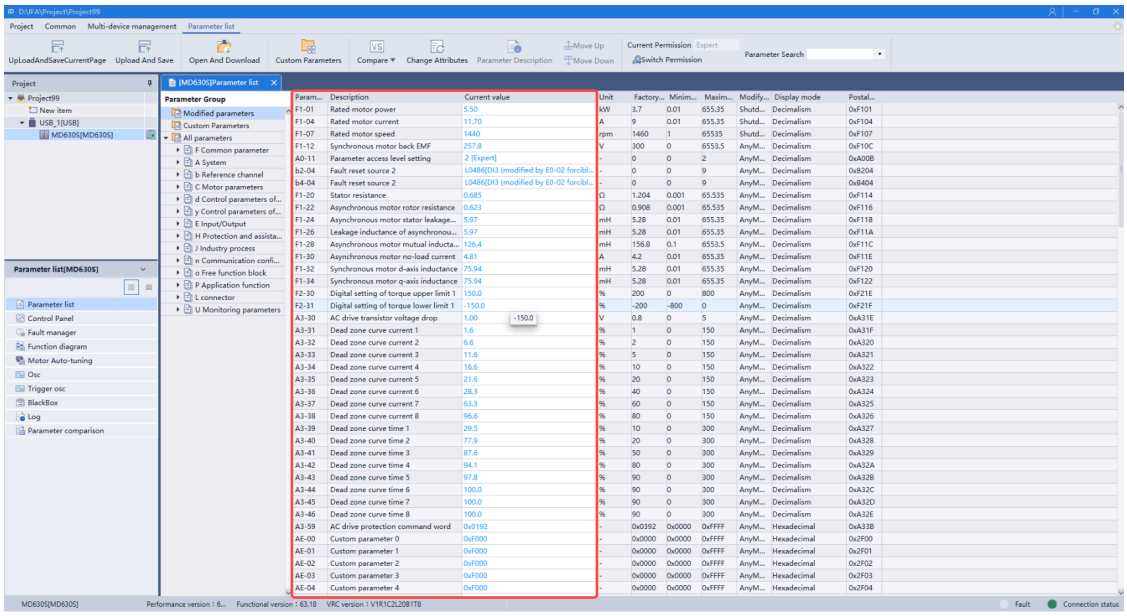
6. Click the modified parameters at the top of the parameter groups on the right side of the page. In the pop-up menu, click "Yes". Then the message "Uploading, please wait" is displayed, indicating that the modified parameters are being synchronized.







7. After synchronization is done, the modified parameters are displayed as follows. You can scroll up and down to view all the parameters, or click the current value input box of a parameter to modify it.


Project
Common
Multi-device management
Parameter list
UpLoadAndSaveCurrentPage
Upload And Save
Open And Download
Custom Parameters
Compare
Change Attributes
Parameter Description
Move Up
Move Down
Current Permission
Switch Permission
Parameter Search
Project99
New item
USB_1[USB]
MD630S[MD630S]
Parameter list[MD630S]
Parameter list
Control Panel
Fault manager
Function diagram
Motor Auto-tuning
Osc
Trigger osc
BlackBox
Log
Parameter comparison
[MD630S]Parameter list
Parameter Group
Modified parameters
Custom Parameters
All parameters
F Common parameter
A System
b Reference channel
C Motor parameters
d Control parameters of...
y Control parameters of...
E Input/Output
H Protection and assista...
J Industry process
n Communication confi...
o Free function block
P Application function
L connector
U Monitoring parameters
Param...
Description
Current value
Unit
Factory...
Minim...
Maxim...
Modify...
Display mode
Postal...
F1-01 Rated motor power 5.50 kW 3.7 0.01 655.35 Shutd... Decimalism 0xF101
F1-04 Rated motor current 11.70 A 9 0.01 655.35 Shutd... Decimalism 0xF104
F1-07 Rated motor speed 1440 rpm 1460 1 65535 Shutd... Decimalism 0xF107
F1-12 Synchronous motor back EMF 257.8 V 300 0 6553.5 AnyM... Decimalism 0xF10C
A0-11 Parameter access level setting 2 [Expert] - 0 0 2 AnyM... Decimalism 0xA00B
b2-04 Fault reset source 2 L0486[DI3 (modified by E0-02 forcibl... - 0 0 9 AnyM... Decimalism 0xB204
b4-04 Fault reset source 2 L0486[DI3 (modified by E0-02 forcibl... - 0 0 9 AnyM... Decimalism 0xB404
F1-20 Stator resistance 0.685 Ω 1.204 0.001 65.535 AnyM... Decimalism 0xF114
F1-22 Asynchronous motor rotor resistance 0.623 Ω 0.908 0.001 65.535 AnyM... Decimalism 0xF116
F1-24 Asynchronous motor stator leakage... 5.97 mH 5.28 0.01 655.35 AnyM... Decimalism 0xF118
F1-26 Leakage inductance of asynchronou... 5.97 mH 5.28 0.01 655.35 AnyM... Decimalism 0xF11A
F1-28 Asynchronous motor mutual inducta... 126.4 mH 156.8 0.1 6553.5 AnyM... Decimalism 0xF11C
F1-30 Asynchronous motor no-load current 4.81 A 4.2 0.01 655.35 AnyM... Decimalism 0xF11E
F1-32 Synchronous motor d-axis inductance 75.94 mH 5.28 0.01 655.35 AnyM... Decimalism 0xF120
F1-34 Synchronous motor q-axis inductance 75.94 mH 5.28 0.01 655.35 AnyM... Decimalism 0xF122
F2-30 Digital setting of torque upper limit 1 150.0 % 200 0 800 AnyM... Decimalism 0xF21E
F2-31 Digital setting of torque lower limit 1 -150.0 % -200 -800 0 AnyM... Decimalism 0xF21F
A3-30 AC drive transistor voltage drop 1.00 V 0.8 0 5 AnyM... Decimalism 0xA31E
A3-31 Dead zone curve current 1 1.6 % 1 0 150 AnyM... Decimalism 0xA31F
A3-32 Dead zone curve current 2 6.6 % 2 0 150 AnyM... Decimalism 0xA320
A3-33 Dead zone curve current 3 11.6 % 5 0 150 AnyM... Decimalism 0xA321
A3-34 Dead zone curve current 4 16.6 % 10 0 150 AnyM... Decimalism 0xA322
A3-35 Dead zone curve current 5 21.6 % 20 0 150 AnyM... Decimalism 0xA323
A3-36 Dead zone curve current 6 28.3 % 40 0 150 AnyM... Decimalism 0xA324
A3-37 Dead zone curve current 7 63.3 % 60 0 150 AnyM... Decimalism 0xA325
A3-38 Dead zone curve current 8 96.6 % 80 0 150 AnyM... Decimalism 0xA326
A3-39 Dead zone curve time 1 29.5 % 10 0 300 AnyM... Decimalism 0xA327
A3-40 Dead zone curve time 2 77.9 % 20 0 300 AnyM... Decimalism 0xA328
A3-41 Dead zone curve time 3 87.6 % 50 0 300 AnyM... Decimalism 0xA329
A3-42 Dead zone curve time 4 94.1 % 80 0 300 AnyM... Decimalism 0xA32A
A3-43 Dead zone curve time 5 97.8 % 90 0 300 AnyM... Decimalism 0xA32B
A3-44 Dead zone curve time 6 100.0 % 90 0 300 AnyM... Decimalism 0xA32C
A3-45 Dead zone curve time 7 100.0 % 90 0 300 AnyM... Decimalism 0xA32D
A3-46 Dead zone curve time 8 100.0 % 90 0 300 AnyM... Decimalism 0xA32E
A3-59 AC drive protection command word 0x0192 - 0x0392 0x0000 0xFFFF AnyM... Hexadecimal 0xA33B
AE-00 Custom parameter 0 0xF000 - 0x0000 0x0000 0xFFFF AnyM... Hexadecimal 0x2F00
AE-01 Custom parameter 1 0xF000 - 0x0000 0x0000 0xFFFF AnyM... Hexadecimal 0x2F01
AE-02 Custom parameter 2 0xF000 - 0x0000 0x0000 0xFFFF AnyM... Hexadecimal 0x2F02
AE-03 Custom parameter 3 0xF000 - 0x0000 0x0000 0xFFFF AnyM... Hexadecimal 0x2F03
AE-04 Custom parameter 4 0xF000 - 0x0000 0x0000 0xFFFF AnyM... Hexadecimal 0x2F04
-150.0
MD630S[MD630S]
Performance version : 6...
Functional version : 63.18
VRC version : V1R1C2L20B1T8
Fault
Connection status

6 Communication

6.1 List of Terms

Table 6–1 List of Terms

Function type	Terms	Explanation
Communication	CW	Control word
	SW	Status word
EtherCAT	EtherCAT	Ethernet for Control Automation Technology
	CoE	CANopen over EtherCAT
	PDO	Process data object
	SDO	Service data object
	WKC	Working counter
	FCS	Frame check sequence
	EoE	Ethernet over EtherCAT
	CoE	CANopen over EtherCAT
	FoE	File access over EtherCAT
	SoE	Servo drive over EtherCAT
	VoE	Vendor specific profile over EtherCAT
EtherNet/IP	EtherNet/IP	EtherNet industrial protocol
	TCP	Transmission control protocol
	UCMM	Unconnected message manager
	UDP	User datagram protocol
	DHCP	Dynamic host configuration protocol
Modbus-RTU	Modbus-RTU	Modbus-Remote terminal unit
PROFINET	PROFINET	Process field network
	MRP	Media redundancy protocol
	DCP	Discovery and basic configuration protocol
	LLDP	Link layer discovery protocol
	FSU	Prioritized startup
	SFD	Start frame delimiter
	APDU	Application protocol data unit
	IOPS	Input output object provider status
	IOCS	Input output object consumer status
	RPC	Remote procedure call
Modbus TCP	Modbus TCP	Modbus transmission control protocol, a Modbus protocol based on Ethernet TCP/IP

6.2 Communication System Connections

In the communication system, data is divided into cyclic data and service data.

- Cyclic data belongs to cyclic interaction data, also known as process data that typically used to transmit control words, setpoints, status words, and actual values.
- Service data is acyclic interaction data. Data transmission occurs only after the corresponding request is executed. It also becomes SDO data, which is usually used to read and write parameters.

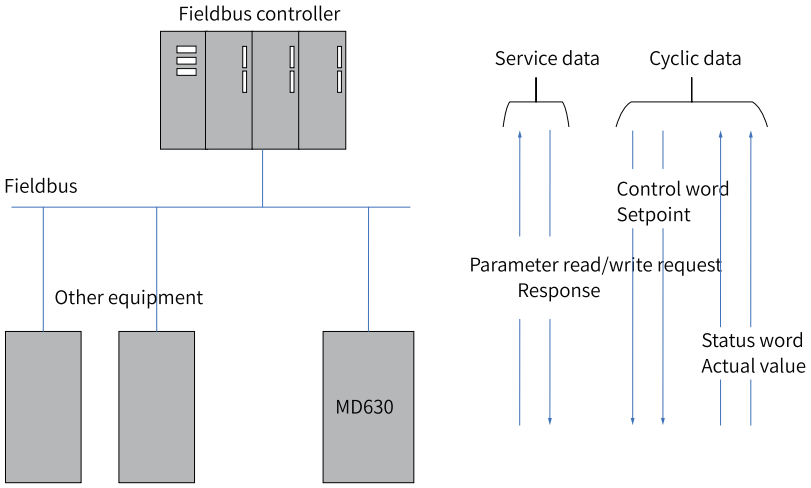


Figure 6-1 Communication system connection diagram

6.3 List of Communication Protocols

The MD630-INT drive is divided into two versions, MD630S-INT and MD630N-INT.

See the following table for the supported communication protocols.

Model	Supported Protocol	Communication Hardware
MD630S-INT	Modbus	RS485 terminal of MD630 AC drive
MD630N-INT	EtherCAT, EtherNet/IP, PROFINET, and Modbus TCP	RJ45 network port of MD630 AC drive

6.4 Communication Configuration Process

The communication configuration of this product is generally performed according to the following procedure:

1. Connect the communication circuit correctly according to the selected communication type, and connect the drive to the bus system.
2. Configure the communication between the drive and the bus controller according to the selected communication type, including:

   a. Set communication parameters in the drive to ensure that the drive communication parameters match those of the bus controller.

   b. Configure the bus controller to ensure that communication connection is established between the drive and the bus controller [Note 1].

3. Set functions that need to be set through communication. Make the communication data received by the drive as the source for the corresponding function [Note 2] [Note 3].

Note 1: For the MD630N model, first set n0-10 [Communication type selection] to 1 [EtherCAT], 2 [EtherNet/IP], 3 [PROFINET], or 4 [Modbus TCP] as needed, and then set the corresponding communication parameter.

Note 2: For example, if the bus controller sends a command word to control start/stop of the drive, set the main command source for the effective control channel (two control channels available: F0-03/b1-00 as channel 1 and b3-00 as channel 2) to 2 [Communication].

Note 3: For example, if the bus controller sends a frequency reference to control the output frequency of the drive, set the effective main frequency source (two setting channels available: F0-29/b5-00 as channel 1 and b6-00 as channel 2) to 9 [Communication].

6.5 Parameter Communication Address

The communication address of the parameter is in unsigned 16-bit format, represented in hexadecimal. For example, the communication address of F1-10 is 0xF10A.

The communication address of the parameter can be obtained from the corresponding user guide or from the communication address column in the parameter list of the commissioning software.

Additionally, the drive provides a non-persistent communication address. If the parameter modified through communication does not need to be preserved after power-off, simply changing the value in the non-persistent communication address. The non-persistent communication address of the parameter is the persistent communication address plus 100.



Generally, the parameter is written to the communication address of the read-write parameter, and the parameter value is saved at power failure. It is forbidden to write values to the storage communication address frequently, which may affect the service life of the storage device of the AC drive.

6.5.1 Special Communication Address

This drive provides special communication address that can be read and written. This allows the host controller to write certain values, configuring communication setting of certain functions of the AC drive. The special communication addresses described in this section are non-retentive at power failure.

6.5.1.1 Communication Control Word

In the effective control channel, set the main command source of control channel (F0-03/b1-00 or b3-00) to 2 [Communication] and configure the communication parameters correctly. After sending a command to any control command address below according to the communication protocol, you can control the start, stop, forward run, reverse run, jog, and fault reset of the drive.

Comm. address		Description
Control word 2 set through communication	7311H	The setpoint of 7311H is in decimal. References corresponding to different values are shown below. 0: Stop (stop according to F2-17 [OFF1 stop mode]) 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop (stop according to F2-17 [OFF1 stop mode]) 7: Reset fault 8: Emergency stop For example, write 1 to 7311H to control forward run of the drive.
Communication setting control word 1	7321H	The value format of 7321H is hexadecimal. The command mapped to each bit is shown below. bit0: ON_OFF1; 0: Stop, 0->1: Run bit1: OFF2 (coast to stop) - 0: Active; 1: Inactive bit2: OFF3 (quick stop) - 0: Active, 1: Inactive bit3: Operation permission - 0: Disable, 1: Enable bit4: Reset command - 0: Inactive; 1: Active bit5: Jog 1 - 0: Inactive; 1: Active bit6: Jog 2 - 0: Inactive; 1: Active bit7: Speed inversion - 1: Inverted For example, you can control the start of the drive by writing 0x000F to 7321H.
DO/RO communication address of MD630	7312	When E1-00 [RO1 output function selection] is set to 20 [Communication], the state of RO1 is determined by the setpoint of the communication address 0x7312, in which the 8 low-order bits represent the output control status word of RO1. When E1-04 [DO1 output function selection] is set to 20 [Communication], the state of DO1 is determined by the setpoint of the communication address 0x7312, in which the 8 high-order bits represent the output control status word of DO1.
DO/RO communication address of I/O expansion card	7322	When the DO1/RO1 output function of the I/O expansion card is set to 20 [Communication], the state of DO1/RO1 is controlled by the setpoint of communication address 0x7322. The 8 low-order bits represent I/O expansion card 1, in which the first four bits represent RO and the last four bits represent DO. The 8 high-order bits represent I/O expansion card 2, in which the first four bits represent RO, and the last four bits represent DO.

Comm. address		Description
Communication address of AO communication reference of I/O expansion card 1	7323	EA-71 [AO1 output function selection] = 12 [Communication]: When an integer between 0 and 32767 is written to address 7323H, the AO terminal outputs the analog voltage (the value 100.0% corresponds to the AO communication reference) based on the ratio of this integer to 32767.
Communication address of AO communication reference of I/O expansion card 2	7324	Eb-71 [AO1 output function selection] = 12 [Communication]: When an integer between 0 and 32767 is written to address 2002h/7324H, the AO terminal outputs the analog voltage (the value 100.0% corresponds to the AO communication reference) based on the ratio of this integer to 32767.

Note

Select the command source as communication. When control commands are sent through 7311H and 7321H respectively, the AC drive executes the commands according to the receiving order.

The following takes 7311H as an example to show how to set commands through communication.

1. Check the communication protocols supported and connect communication cables properly.
2. Set related communication parameters for the corresponding communication type so that communication parameters between the host controller and the drive match each other, thereby establishing communication between the host controller and the drive.
3. Set the command source to "Communication". Set b0-02 [Control channel selection] to 0 [Control channel 1] and F0-03 (b1-00) [Main command source of control channel 1] to 2 [Communication].
4. Send a start/stop command to the drive through the host controller, and write 1 to 7311H to start the drive, or write 0 to stop the drive.

6.5.1.2 Communication Reference Value

The special address values for communication reference values supported by the drive are as shown in the following table.

Comm. address	Description	
Communication reference value 2	7310H	Communication reference value

The host controller can set the target frequency by writing the communication reference value. In the effective setting channel, set the main frequency source parameters such as F0-29/b5-00 or b6-00 to 9 [Communication], and configure the communication parameters correctly. After sending a command to a specific communication address according to the communication protocol, you can set the main frequency of the drive.

The data format of address 7310H is determined by the data format of the frequency reference, as specified by n0-14 [7310H Reference selection]. See the following table for details.

Options of n0-14	Unit	Data format	Number of decimal places	Example of communication reference value	Actual value
0 [Frequency (unsigned 16-bit)]	Hz	Unsigned 16-bit	A0-70 [Number of frequency decimal places], 2 by default	1000	10.00 Hz
				2000	20.00 Hz
1 [Frequency (signed 16-bit)] (Default)	Hz	Signed 16-bit	A0-70 [Number of frequency decimal places], 2 by default	1000	10.00 Hz
				-1000	-10.00 Hz
2 [Speed (signed 16-bit)]	rpm	Signed 16-bit	No decimal place	1500 (2 pairs of motor poles)	1500 rpm (50.00 Hz)
				-1500 (2 pairs of motor poles)	1500 rpm (-50.00 Hz)
3 [Percentage (corresponds to rated frequency/signed 16-bit/ 2 decimal places)]	%	Signed 16-bit	Two decimal places	1000 (Rated frequency: 50.00 Hz)	10.00 % (5.00 Hz)
				-1000 (Rated frequency:100.00 Hz)	-10.00 % (-10.00 Hz)
3 [Percentage (corresponds to maximum frequency/signed 16-bit/ 2 decimal places)]	%	Signed 16-bit	Two decimal places	1000 (maximum frequency: 50.00 Hz)	10.00 % (5.00 Hz)
				-5000 (maximum frequency: 100.00 Hz)	-50.00 % (-50.00 Hz)

The following takes 7310H as an example to show how to set frequency through communication.

1. Check the communication protocol supported and connect communication cables properly.
2. Set related communication parameters for the corresponding communication type so that communication parameters between the host controller and the drive match each other, thereby establishing communication between the host controller and the drive.
3. Set the frequency source to "Communication". Set b0-03 [Setting channel selection] to 0 [Setting channel 1] and F0-29 (b5-00) [Main frequency source] to 9 [Communication].
4. Write the target frequency to the drive through the host controller. For example, when n0-14 [7310H Reference selection] is set to 1 and A0-70 [Number of decimal places of frequency reference] is set to 2, writing 2500 to 7310H sets the main frequency to 25.00 Hz, and writing -2500 to 7310H sets the main frequency to -25.00 Hz.

6.5.1.3 Other Commonly-Used Special Addresses

Address for drive status query

When reading the operating state through communication, the communication addresses are 703DH and 7044H. The host controller gets the operating state of the drive through reading the address data. The addresses are defined as follows.

Comm. address		Address Attribute	Description
AC drive state 1	703DH	Read-only	The values read through 703DH are converted to values in decimal. The drive states corresponding to different values are as follows. 1: Forward run 2: Reverse run 3: Stop 4: Auto-tuning 5: Fault
Drive state 2	7044H	Read-only	The status value of 7044H is hexadecimal. The drive states corresponding to bit values are as follows. bit0: Operation status - 0: Stop; 1: Run bit1: Operating direction - 0: Forward; 1: Reverse bit2: Fault state - 0: No fault; 1: Faulty bit3: Frequency arrival - 0: Not reached; 1: Reached bit4 to bit7: Reserved bit8 to bit15: Fault code. For details, see specific fault descriptions.

DO terminal control

When the RO/DO1/VDO function (E1-00/E1-04 to E1-05/E1-10 to E1-15) is set to 20 (communication), the host controller can control the DO of the AC drive through the special address 7312H. The address is defined as follows:

Comm. address		Address Attribute	Description
DO terminal control	7312H	Read/Write	The output of the RO/DO/VDO terminal is set through the bit state. When the bit is 1, the corresponding terminal output is valid. When the bit is 0, the corresponding terminal output is invalid. The mapping relationship between bits and DOs is described in the following table. bit0: RO bit01 to bit03: Reserved Bit 04: DO bit5 to bit7: Reserved bit08: FMR (valid only for MD630S) VDO6 Bit 09: Reserved bit10 to bit15, VDO1 to VDO6

For example, set E1-00 [RO output function selection] to 20 [Communication], and then set the corresponding communication parameters. Write 0001H to 7312H in the instruction format and set bit0 to 1 to activate RO output.

AO terminal control

When E3-00 (AO1 function selection) is set to 12 (Communication), the host controller can control the AO terminals of the AC drive through the communication address 7313H, as defined below.

Comm. address		Address Attribute	Description
AO setting	7313H	Read/Write	Set the AO output ratio by writing a hexadecimal value: 0 to 7FFF indicates that the AO output value is 0% to 100%

Set E3-00 (AO function selection) to 12 (communication), and then set the corresponding communication parameters. Write 7FFFH to 7313H in the instruction format to set the AO1 output proportion to 100%.

Fault information query

When the status of the drive is read through communication, the communication addresses are 702DH to 7030H. The host controller can obtain the current faulty status of the drive by reading the address. The communication address is defined as follows.

Comm. address		Address Attribute	Description
Fault code	702DH	Read-only	Current fault code of the drive
Minor fault code	702EH	Read-only	Current minor fault code of the drive
Alarm code	702FH	Read-only	Current alarm code of the drive
Prompt code	7030H	Read-only	Current prompt code of the drive

6.5.1.4 Modbus Compatible Address

In addition to the above special communication addresses, 1000H to 1020H, 2000H to 2004H, 3000H, and 8000H to 8001H are compatible communication addresses dedicated to the Modbus communication, which can also be read and written to the Modbus communication of some preceding products.

Set whether the Modbus communication address is compatible by setting n0-12 (Compatibility with legacy communication address). When n0-12 = 1 [Compatible], the Modbus compatible communication address can be accessed. Otherwise, the Modbus compatible communication address cannot be accessed normally.

Param.	Name	Default	Value range
n0-12	Compatible with old communication address	1	0: Incompatible 1: Compatible

The Modbus compatible communication addresses are as follows.

Start/stop command

Set F0-03/b1-00 or b3-00 (Main command source of control channel 1) to 2 (Communication) and configure the Modbus communication parameters correctly. After sending a command to 2000H

according to the communication protocol, you can control the start, stop, forward running, reverse running, jog, and fault reset of the AC drive.

Comm. address		Address Attribute	Description
Control command input to AC drive 2	2000H	Read/Write	It can be used as the command source for communication. The value format is decimal. 0: Stop (stop according to F2-17 (OFF1 stop mode)) 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop (stop according to F2-17 [OFF1 stop mode]) 7: Fault reset 8: Emergency stop For example, write 2 to 2000H to control the reverse running of the AC drive.

Note

When this address is active, the AC drive executes the start/stop commands based on the order in which it receives 2000H, 7311H, and 7321H.

Communication setting

Set the main frequency source parameters such as b5-00/F0-29 or b6-00 to 9 (Communication), and configure the communication-related parameters correctly. After sending a command to the 1000H according to the communication protocol, you can set the main frequency of the AC drive.

Comm. address		Address Attribute	Description
Communication reference value	1000H	Read/Write	The value written to this address can be set as communication reference. The value attribute is switched by n0-13 (1000H set selection).

Note

When this address is valid, the communication value written later in 1000H and 7310H is the final valid communication value.

The data format of the special address 1000H is set by n0-13 [1000H setting], as shown in the following table.

Param.	Name	Default	Value range
n0-13	1000 H setting selection	2	0: Percentage (corresponds to rated frequency/1 decimal place) 1: Percentage (corresponds to rated frequency/2 decimal place) 2: Percentage (corresponds to maximum frequency/2 decimal places)

The following table shows the format of the n0-13 [1000H setting selection] setpoint.

n0-12 setpoint	Unit	Number of decimal places	Example of communication reference value	Actual value
0: Percentage (corresponds to rated frequency/1 decimal place)	%	Two decimal places	100 (Rated frequency (50.00 Hz))	10.0% (5.00 Hz)
			-100 (Rated frequency:100.00 Hz)	-10.0 % (-10.00 Hz)
1 [Percentage (corresponds to rated frequency/2 decimal places)]	%	Two decimal places	1000 (Rated frequency: 50.00 Hz)	10.00 % (5.00 Hz)
			-1000 (Rated frequency:100.00 Hz)	-10.00 % (-10.00 Hz)
2: Percentage (corresponds to maximum frequency/2 decimal places)	%	Two decimal places	1000: Maximum frequency (50.00 Hz)	10.00 % (5.00 Hz)
			-5000 (maximum frequency: 100.00 Hz)	-50.00 % (-50.00 Hz)

State query

When the AC drive running status is read through communication, the host controller enables you to obtain the current running status information of the drive by reading the following address. The addresses are defined as follows:

Param.	Name	Change mode	Value range
Operating frequency	1001H	Read-only	It indicates the AC drive running frequency (unit: 0.01 Hz).
Bus voltage	1002H	Read-only	Indicates the bus voltage of the drive (unit: 0.1 V).
Output voltage	1003H	Read-only	It is used to set the output voltage of the AC drive (unit: 1 V).
Output current	1004H	Read-only	It is used to set the output current of the AC drive (unit: 0.01 A).
Output power	1005H	Read-only	It is used to set the output power of the AC drive (unit 0.1 kW).
Output torque	1006H	Read-only	It is used to set the output torque of the AC drive (unit 0.1%).
Operating speed	1007H	Read-only	It indicates the AC drive running speed (unit: 0.01 Hz).
DI input indication	1008H	Read-only	This parameter shows the input state of the DI terminal of the AC drive.
DO output indication	1009H	Read-only	This parameter shows the output state of the DO terminal of the AC drive.
AI1 voltage	100AH	Read-only	Indicates the AI1 voltage of the drive (unit: 0.001 V).
Load speed	100FH	Read-only	It indicates the load running speed (unit: rpm).
PID reference	1010H	Read-only	PID reference
PID feedback	1011H	Read-only	PID feedback
PLC procedure	1012H	Read-only	PLC process
HDI input pulse frequency	1013H	Read-only	HDI input, unit 0.01 kHz

Param.	Name	Change mode	Value range
Feedback speed	1014H	Read-only	Load feedback speed (unit: 0.01 Hz)
Remaining running time	1015H	Read-only	Displays the remaining running time during timed running (unit: 0.1 min).
AI1 voltage before correction	1016H	Read-only	Displays AI1 raw voltage value (unit: 0.001 V).
Motor speed	1019H	Read-only	Motor speed (rpm)
Current power-on time	101AH	Read-only	Indicates current power-on time of the AC drive (unit: 1 min).
Current operating time	101BH	Read-only	Indicates current operating time of the drive (unit: 0.1 min).
Communication reference value	101DH	Read-only	The value given by communication.
Main frequency X	101FH	Read-only	Main frequency setpoint (unit: 0.01 Hz)
Auxiliary frequency Y	1020H	Read-only	Auxiliary frequency setpoint (unit: 0.01 Hz)
Read AC drive state 1	3000H	Read-only	The read results are converted to values in the decimal format. The AC drive states corresponding to different values are as follows: 1: Forward run 2: Reverse run 3: Stop 4: Auto-tuning 5: Fault

DO terminal control

When the RO/DO/VDO function (E1-00/E1-04 to E1-05/E1-10 to E1-15) is set to 20 (communication), the host controller can control the DO of the AC drive through the compatible address 2001H. The address is defined as follows:

Param.	Name	Change mode	Value range
DO control	2001H	Read/Write	The output of the RO/DO/VDO terminal is set through the bit state. When the bit is 1, the corresponding terminal output is valid. When the bit is 0, the corresponding terminal output is invalid. The mapping relationship between bits and DOs is described in the following table. bit0: RO bit01 to bit03: Reserved Bit 04: DO bit5 to bit7: Reserved bit08: FMR (valid only for MD630S) Bit 09: Reserved bit10 to bit15, VDO1 to VDO6

AO terminal control

When E3-00 (AO1 function selection) is set to 12 (Communication), the host controller can control the AO terminals of the AC drive through the communication address 2002H, as defined below.

Param.	Name	Change mode	Value range
AO1 control	2002H	Write-only	Set the AO1 output ratio by writing a hexadecimal value: 0 to 7FFF indicates that the AO1 output value is 0% to 100%

6.5.2 Control Word and Status Word

6.5.2.1 Control Word

The control word setting range for communication is 0 to 8, with the following options.

Comm. address	Description
0x7311H	0: Stop (the drive stops according to the OFF1 stop mode)
	1: Forward run
	2: Reverse run
	3: Jog 1
	4: Jog 2
	5: Coast to stop
	6: Stop (the drive stops according to the OFF1 stop mode)
	7: Reset fault
	8: Emergency stop (the drive performs emergency stop according to the OFF3 stop mode)

The control word setting is active only after the main command source (b1-00/F0-03, or b3-00) in the currently set control channel (b0-02) is set to 2 [Communication].

The meaning of the communication target frequency is as follows.

Param.	Description
Frequency reference	You can set the target frequency of the drive through this data during communication. The data format of this address is defined by n0-14 [7310H Setting selection].

The setting is active only after the main frequency source (F0-29/b5-00 or b6-00) in the active setting channel is set to 9 [Communication].

The data format of the frequency reference is determined by the setting of n0-14 [7310H Setting Selection], as shown below.

Options of n0-14	Unit	Data format	Number of decimal places	Example of communication reference value	Actual value
0 [Frequency (unsigned 16-bit)]	Hz	Unsigned 16-bit	A0-70 [Number of frequency decimal places], 2 by default	1000	10.00 Hz
				2000	20.00 Hz
1 [Frequency (signed 16-bit)] (Default)	Hz	Signed 16-bit	A0-70 [Number of frequency decimal places], 2 by default	1000	10.00 Hz
				-1000	-10.00 Hz
2 [Speed (signed 16-bit)]	rpm	Signed 16-bit	No fractional part	1500 (2 pairs of motor poles)	1500 rpm (50.00 Hz)
				-1500 (2 pairs of motor poles)	1500 rpm (-50.00 Hz)
3 [Percentage (corresponds to rated frequency/signed 16-bit/ 2 decimal places)]	%	Signed 16-bit	Two decimal places	1000 (Rated frequency: 50.00 Hz)	10.00 % (5.00 Hz)
				-1000 (Rated frequency:100.00 Hz)	-10.00 % (-10.00 Hz)
3 [Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)]	%	Signed 16-bit	Two decimal places	1000: Maximum frequency (50.00 Hz)	10.00 % (5.00 Hz)
				-5000 (maximum frequency: 100.00 Hz)	-50.00 % (-50.00 Hz)

6.5.2.2 Status Word

The meaning of each bit of the status word of communication is shown below.

Comm. address	bit	Definition	Description
0x7044H	0	0 = Stop	Stop state of the drive
		1 = Running	Operating state of the drive
	1	0 = Motor rotating forwardly	Actual motor speed > 0
		1 = Motor rotating reversely	Actual motor speed < 0
	2	0 = No fault	No fault occurred on the drive
		1 = Fault occurred	Fault occurred on the drive Reset the fault by writing 7 to the control word.
	3	0 = Frequency not reached	The operating frequency of the drive does not reach the target frequency detection range.
		1 = Frequency reached	The operating frequency of the drive has reached the target frequency detection range (target frequency ±per-unit frequency A2-04 x frequency arrival detection window P0-38).
	4 to 7	Reserved	-
	8 to 15	Fault	Current fault code of the drive

The meaning of the communication target frequency is as follows.

Param.	Description
Operating frequency	Indicates the operating frequency of the drive. Data format is signed 16-bit with 2 decimal places.

6.5.3 Mapping Table

Mapping table

See the following table for commonly used monitoring and setting parameters during communication.

Comm. address (Hexadecimal)	Comm. address (Decimal)	Name	Change mode	Value range	Unit	Data type	Param.
Basic state of the drive							
0x7000	28672	Operating frequency	Read-only	0.00 to 600.00	Hz	Unsigned 16-bit	U0-00
0x7001	28673	Frequency reference	Read-only	0.00 to 600.00	Hz	Unsigned 16-bit	U0-01
0x7002	28674	Bus voltage	Read-only	0.0 to 6553.5	V	Unsigned 16-bit	U0-02
0x7003	28675	Output voltage	Read-only	0 to 65535	V	Unsigned 16-bit	U0-03
0x7004	28676	Output current	Read-only	0.00 to 655.35	A	Unsigned 16-bit	U0-04
0x7005	28677	Output power	Read-only	-3276.8 to +3276.7	kW	Signed 16-bit	U0-05
0x7006	28678	Output torque	Read-only	-3276.8 to +3276.7	%	Signed 16-bit	U0-06
0x702D	28717	Fault code	Read-only	0.0 to 6553.5	-	Unsigned 16-bit	U0-45
0x702E	28718	Minor fault code	Read-only	0.0 to 6553.5	-	Unsigned 16-bit	U0-46
0x702F	28719	Alarm code	Read-only	0.0 to 6553.5	-	Unsigned 16-bit	U0-47
0x7030	28720	Prompt code	Read-only	0.0 to 6553.5	-	Unsigned 16-bit	U0-48
0x7052	28754	Heatsink temperature	Read-only	-20.0 to +120.0	℃	Signed 16-bit	U0-82
0x7053	28755	Ambient temperature	Read-only	-20.0 to +120.0	℃	Signed 16-bit	U0-83
Digital input state							

Comm. address (Hexadecimal)	Comm. address (Decimal)	Name	Change mode	Value range	Unit	Data type	Param.
0x7007	28679	DI state	Read-only	bit0 to bit1: States of DI1 and DI2 0: Low level 1: High level bit2 to bit6: States of DI3 to DI7 (active only for MD630S) 0: Low level 1: High level bit7 to bit9: Reserved bit10 to bit15: States of VDI1 to VDI6 0: Low level 1: High level	-	Unsigned 16-bit	U0-07
Digital output state							
0x7008	28680	DO state	Read-only	bit0: RO state 0: Low level 1: High level bit1 to bit3: Reserved bit4: DO state 0: Low level 1: High level bit5 to bit7: Reserved bit8: FMR state (active only for MD630S) 0: Low level 1: High level bit9: Reserved bit10 to bit15: States of VDO1 to VDO6 0: Low level 1: High level	-	Unsigned 16-bit	U0-08
High-speed digital input state							
0x7012	28690	HDI input pulse reference (active only for MD630S)	Read-only	0.00 to 20.00	kHz	Unsigned 16-bit	U0-18
Analog input state							
0x7009	28681	AI1 voltage	Read-only	-10.57 to +10.57	-	Signed 16-bit	U0-09
0x700 A	28682	AI2 voltage	Read-only	-10.57 to +10.57	-	Signed 16-bit	U0-10

Comm. address (Hexadecimal)	Comm. address (Decimal)	Name	Change mode	Value range	Unit	Data type	Param.
Analog output state							
0x7123	28963	Calibrated AO (active only for MD630S)	Read-only	-32.767 to +32.767	V	Signed 16-bit	U1-35
Common setting of the drive							
0xF030 (0xB704)	61488 (46852)	Ramp-up time of ramp 1	Read/Write	0.0 to 6500.0	s	Unsigned 16-bit	F0-48 (b7-04)
0xF031 (0xB705)	61489 (46853)	Ramp-down time of ramp 1	Read/Write	0.0 to 6500.0	s	Unsigned 16-bit	F0-49 (b7-05)

6.6 Modbus RTU Drive Control

6.6.1 Introduction

Modbus RTU supports various electrical interfaces, such as RS-485, RS-232, etc. The communication medium generally uses twisted pair cables, employing a master/slave communication architecture, where the master device initiates communication requests and the slave devices respond to the requests. Slave devices cannot communicate directly with each other; at any given moment, only one device can transmit data, while all other devices remain in receive mode. Each device participating in communication must have a unique communication address, with the address setting range being 1 to 247, and 0 being the broadcast communication address.



Before use, check whether communication parameters, including communication address, baud rate, and data bits, are configured correctly. Stop bit and check mode. Otherwise, communication will be abnormal.

6.6.2 Communication Specifications

Item	Specifications
Communication protocol	Modbus-RTU communication protocol
Transmission mode	Master-slave communication mode
Communication mode	Half-duplex communication
Topology	Bus type
Transmission rate (unit: bps)	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200
Transmission medium	Twisted pair
Transmission distance	< 1000 m
Communication port	RS485
Modbus frame length (bytes)	5 to 137
Maximum cable length (unit: m)	1000

Item	Specifications
Maximum number of connected slaves	247
Number of request messages that can be received at the same time	1

6.6.3 Communication System Connection

As shown in the figure, the AC drive, acting as a slave device, receives data requests from the controller and returns the processed results to the controller, completing one communication cycle. When multiple AC drives or Modbus communication devices need to be networked, it is recommended to connect the devices using a bus topology. The RS485 signal reference ground of all nodes must be connected together. Up to 247 nodes can be connected.

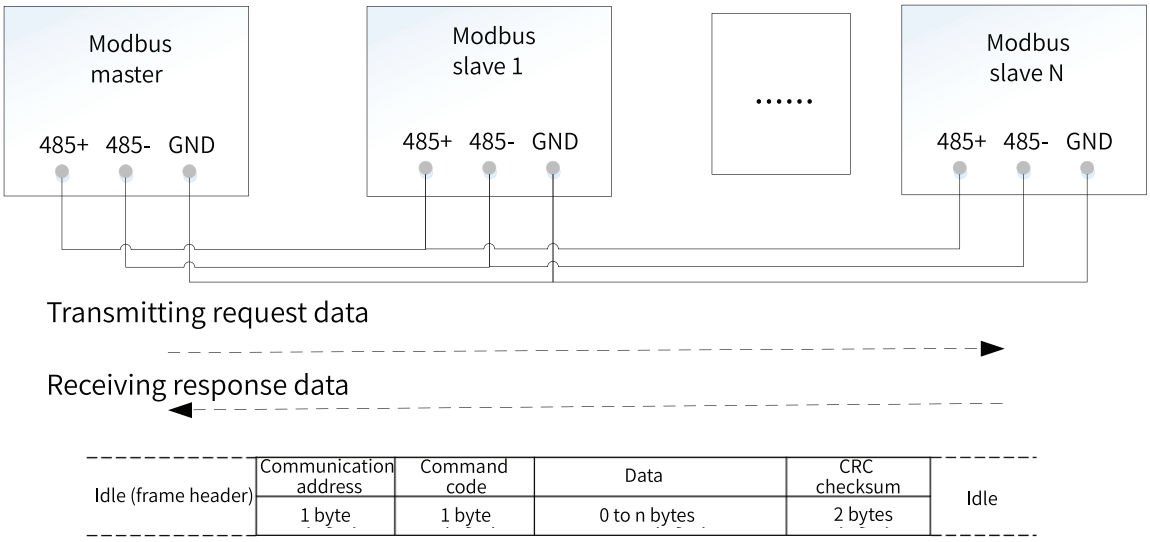
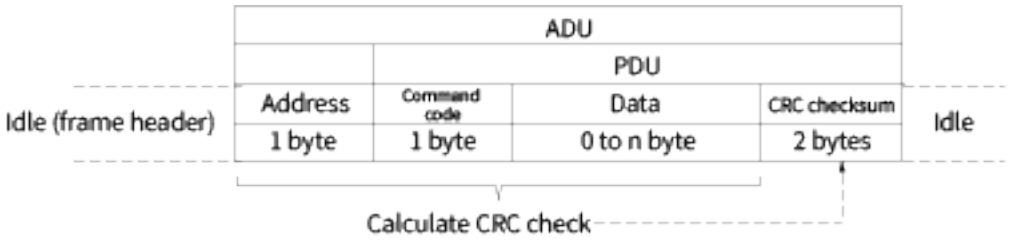


Figure 6-2 Bus-type topology

6.6.4 Message

6.6.4.1 Message Structure

The Modbus RTU protocol communication message consists of four parts: communication address, command code, data, and CRC. The frame structure is shown in the figure below:



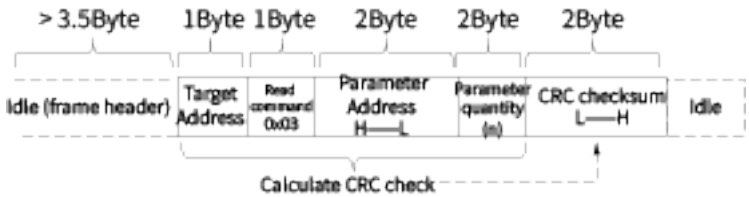
Field	Description
Comm. address	Used to uniquely identify its own identity on the network, occupies one byte, and can be set via n2-03.
Command code	Command codes defined by the Modbus standard, occupies one byte.
Data	The length of the data field depends on the command and specific usage. For example, the 0x06 write parameter command can only be used to write one parameter, with a fixed length of 4 bytes. In contrast, the 0x03 read parameter command and the 0x10 write multiple parameters command can read or write multiple parameters, and their length depends on the usage.
CRC checksum	The CRC value is calculated using the standard Modbus CRC16 checksum algorithm, occupies 2 bytes.

Application example

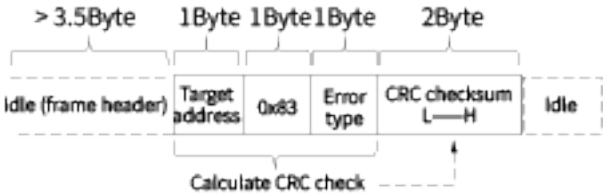
The drive supports reading or writing of word type parameters only. The read operation command is 0x03, the write operation command is 0x06, and the multi-write operation command is 0x10.

1. Process of communication read operation

The controller or host controller sends a read request data frame to the AC drive.

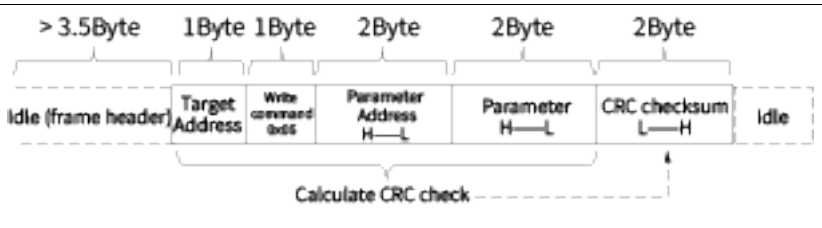
Read parameter request	

Based on the processing result of the read request data, the AC drive sends a normal response data frame if correct, or an abnormal response data frame if incorrect.

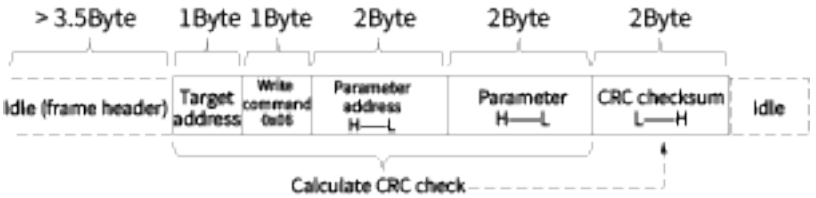
Read parameter normal response	
Read parameter abnormal response	

2. Process for writing through communication

The controller or host controller sends a write request data frame to the AC drive.

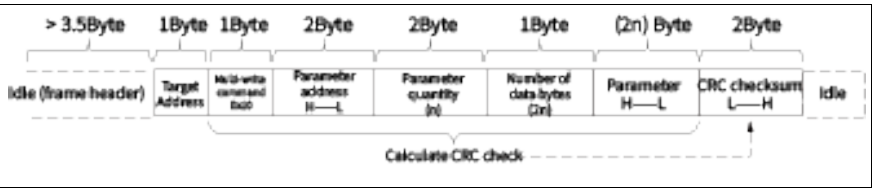
Write parameter request	

Based on the processing result of the write request data, the AC drive sends a normal response data frame if correct, or an abnormal response data frame if incorrect.

Write parameter normal response	
Write parameter abnormal response	

3. Process for multi-write operation

The controller or host controller sends a multi-write request data frame to the AC drive.

Write multiple parameters request	

Based on the processing result of the multi-write request data, the AC drive sends a normal response data frame if correct, or an abnormal response data frame if incorrect.

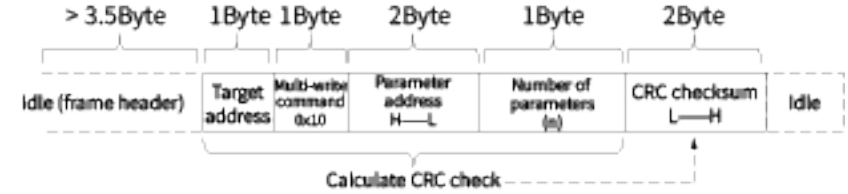
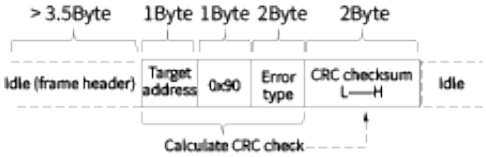
Write multiple parameters normal response	
Write multiple parameters abnormal response	

Table 6–2 Data frame structure field description

Field	Description
Frame header	Idle level Longer than or equal to the time for transmitting 3.5 bytes
Destination address	Communication address range: 1 to 247; 0: Broadcast address
Command code	03: Read parameter, 06: Write parameter, 10: Write multiple parameters.
Parameter address H	The internal parameter address of the AC drive, represented in hexadecimal. Low-order bytes follow high-order bytes during transmission.
Parameter address L	
Number of parameters	Indicates the number of parameters to be read/written in this frame. If set to 1, it means reading/writing one parameter. During transmission, low-order bytes follow the high-order bytes. Note: The communication write operation (0x06) does not have this field.
Number of bytes	Data length, which is twice the number of parameters
Parameter H	Response data of read request or data to be written (During transmission, low-order bytes follow high-order bytes.)
Parameter L	
CRC H	Detection value: CRC16 check value. High bytes follow low bytes during transmission.
CRC L	
Free	Idle level Longer than or equal to the time for transmitting 3.5 bytes

6.6.4.2 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 908*.

6.6.4.3 Baud rate

To avoid data conflicts during transmission, Modbus generally requires an interval of 3.5 character transmission times between each frame. Taking the default Modbus data format (n2-01 = 0) as an example, when the Modbus response delay (n2-03) is 0, the character transmission delay and minimum inter-frame interval time at different baud rates can be determined as follows:

Baud rate (bit/s)	Character transmission time (ms)	Minimum inter-frame interval time (ms)
300	36.666	128.333
600	18.333	64.166
1200	9.166	32.083
2400	4.583	16.041
4800	2.291	8.020
9600	1.145	4.010
19200	0.572	2.005
38400	0.286	1.002
57600	0.190	0.668
115200	0.095	0.334

6.6.4.4 Mapping Table (AC Drive Data)

For details, see *"6.5.3 Mapping Table" on page 910*.

6.6.5 Communication Ports

The standard model (MD630S) supports Modbus communication. The Modbus communication interface complies with the RS485 electrical standard, providing a single RS485 channel through the J5 interface and S1 DIP switch. The physical layout of the communication port and DIP switch positions is shown in the following figure.

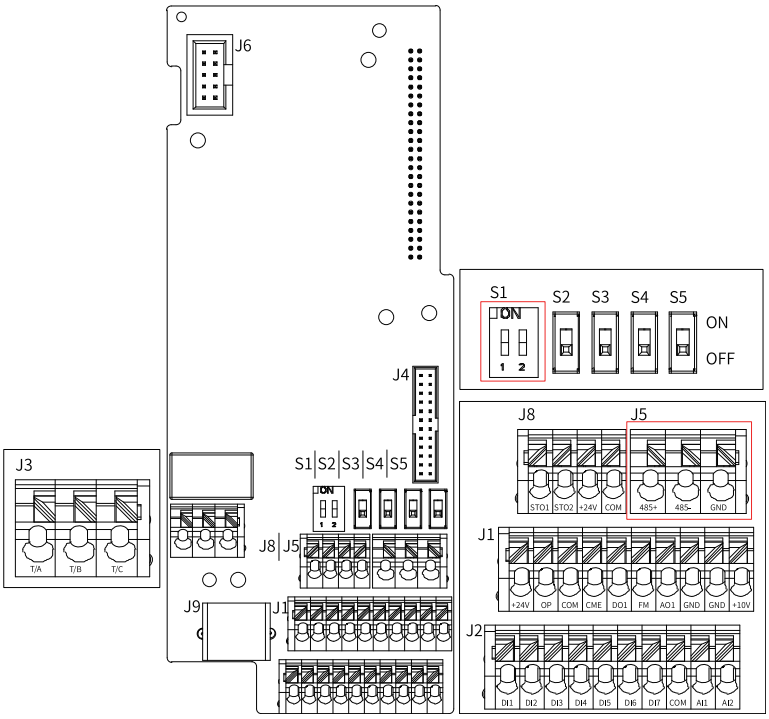


Figure 6-3 Diagram showing the positions of the Modbus communication port and DIP switch

Table 6–3 RS485 communication terminal

External terminal	Type	Type of information transmitted	Mark	Name	Function
J5	3P crimping terminal block - 5 mm	RS485 communi-cation	485+	RS485 differential pair signal (+)	Maximum baud rate: 115200 bps Maximum communication distance: 1 km Maximum number of nodes: 247
			485-	RS485 differential pair signal (-)	
			GND	RS485 differential pair reference ground	

Table 6–4 Descrpition of DIP switches

Name	DIP switch function
S1	DIP switch for RS485 communication termination and bias resistor selection • When both are set to ON, the 485± signals are terminated and biased. • When both are set to OFF (default), the 485± signals are neither terminated nor biased. Note: The S1 DIP switch is a 2-bit switch. Both bits must be ON or OFF simultaneously.

6.6.6 Connect AC Drive to Bus System Through RS485 Port

Connection procedure

1. Switch off the system power supply.
2. As shown in the figure, the 485+ and 485- of the Modbus master (PLC) and slave (AC drive) are connected using twisted pair cables (signal lines) in a bus topology.

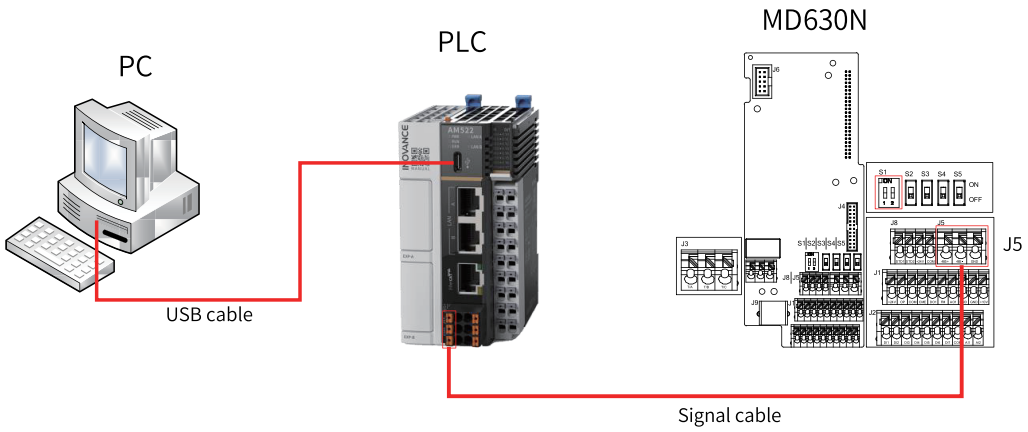


Figure 6-4 Modbus communication wiring

Use a three-conductor shielded cable as the RS485 bus to connect to 485+, 485-, and GND terminals of the AC drive. Use the twisted pair cable to connect to the 485+ and 485- terminals and use the other cable to connect to the RS485 reference ground terminal GND. Connect the shield to the equipment ground.

The cable length between adjacent devices should be less than 3 m, with a maximum connection count of 247. The connection of signal lines between the master and slave is shown in the figure below.

The master can externally install termination resistors (Method 1) or set termination resistors via DIP switches (Method 2), depending on actual requirements.

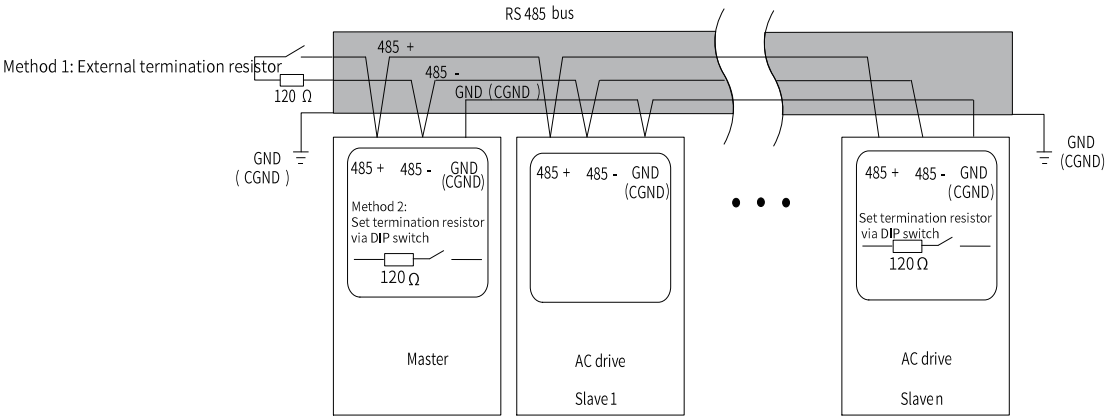


Figure 6-5 Diagram of signal cable connections between master and slave

3. To prevent signal reflection, a 120Ω termination resistor should be connected between the 485+ and 485- at the first station (usually the master) and the last station (usually the slave). The AC drive's termination resistor can be selected via a DIP switch.
4. After confirming that the cable connections are correct, power on the devices.

6.6.7 Configuring Communication between the Drive and Controller

The standard drive (MD630S) can communicate with the master that supporting standard Modbus RTU, such as Inovance PLCs.

1. Connect the master and drive, as shown in *"6.6.6 Connect AC Drive to Bus System Through RS485 Port" on page 917*.
2. Set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference input source for channel 1 (b0-03 = 0, b5-00 = 9). (This operation can be performed through the operating panel or software tool.)
3. Set different communication addresses for each drive (n2-02), and configure the baud rate (n2-00) and data format (n2-01) of all drives to consistent values.
4. Configure communication between the master (controller) and slave (drive) as shown in *"6.6.10.1 Configuration for RS485 Communication Between the Drive and H5U" on page 921*.



Ensure that the baud rate and data format of the master are consistent with the settings of the slave. Otherwise, communication errors may occur.

6.6.8 Communication Parameters

Param.	Name	Default	Value range	Change mode	Description
n2-00 (Fd-05)	Modbus baud rate	5	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	At stop	Defines the speed of data transmitted between the host controller and the drive. The higher the baud rate, the faster the communication speed. **Note:** The baud rate of the host controller must be the same as that of the drive. Otherwise, communication can fail.
n2-01 (Fd-06)	Modbus data format	0	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	Real-time	Note that the data format of the host controller must be the same as that of the AC drive. Otherwise, communication fails.
n2-02 (Fd-07)	Modbus local address	1	1 to 247	At stop	The Modbus communication address of the drive is unique, which is the basis for achieving point-to-point communication between the host control and the drive.

Param.	Name	Default	Value range	Change mode	Description
n2-03 (Fd-08)	Modbus response delay time	2	0 ms to 20 ms (active for Modbus)	Real-time	Defines the time interval from the time when the drive finishes data reception to the time when the drive starts to send data to the host controller. • If the response delay is shorter than the system processing time, the system processing time prevails. • If the response delay is longer than the system processing time, the drive will send data to the host controller only after the system finishes data processing and the response delay expires.
n2-04 (Fd-09)	Modbus communication timeout time	0	0.0 (inactive) 0.1s to 600.0s	Real-time	If this parameter is set to a valid value, when the drive does not receive the communication signal within the time set in this parameter, Err160.1 [Communication fault] can be reported. This parameter is generally set to an invalid value. This parameter is used to monitor communication status in a system with continuous communication.
n2-05	Limit on the number of data written/ read through Modbus	12	12 to 100	Real-time	Defines the maximum number of parameters that can be read or written at one time.

6.6.9 Communication Fault Diagnosis

Table 6–5 Modbus-RTU communication fault diagnosis

Fault code	Fault code name	Cause	Verification method	Solution
E160.1	Modbus-RTU communication timeout	Ambient interference exists.	Check whether the RS485 communication cable is correctly connected.	Connect the 485 communication cable.
		The baud rate and data format of the master and slave are inconsistent.	Check whether communication parameters such as Modbus local address (n2-02), Modbus baud rate (n2-00), and Modbus data format (n2-01) are set correctly. The baud rate and data format set by the host controller and the AC drive must be consistent. The station number must be unique. Otherwise, communication can fail.	Ensure that the baud rate, data format, and station number set by the host controller and the AC drive are consistent, and ensure that the station number is unique.
		The master does not send request data to the slave within the timeout period.	1. Check whether the master configures data request commands for the slave that reports errors. 2. Check whether the values of the Modbus communication timeout (n2-04) and the PLC communication cycle are proper. The Modbus communication timeout (n2-04) must be greater than the PLC communication cycle.	1. Ensure that the master configures data request command for the slave that reports errors. 2. Ensure that the value of the Modbus communication timeout (n2-04) is higher than the PLC communication cycle.

6.6.10 Communication Configuration Examples

6.6.10.1 Configuration for RS485 Communication Between the Drive and H5U

Prerequisite

1. Log in to the official website of Inovance (***https://www.inovance.com/global/support/download-documentation***) to download AutoShop PLC software.
2. Prepare a drive, an H5U PLC module, cables, and distributors.
3. Ensure the controller is connected to the drive properly (H5U as Modbus master, MD630S as Modbus slave). Connect the H5U PLC to the 485+, 485-, and GND terminals of the drive, respectively. See details in *"6.6.6 Connect AC Drive to Bus System Through RS485 Port" on page 917*.
4. Ensure the data format of the controller matches the Modbus data format of the drive.

Configuration procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.

Step 2: Set the frequency or torque through communication.

Set the frequency as follows:

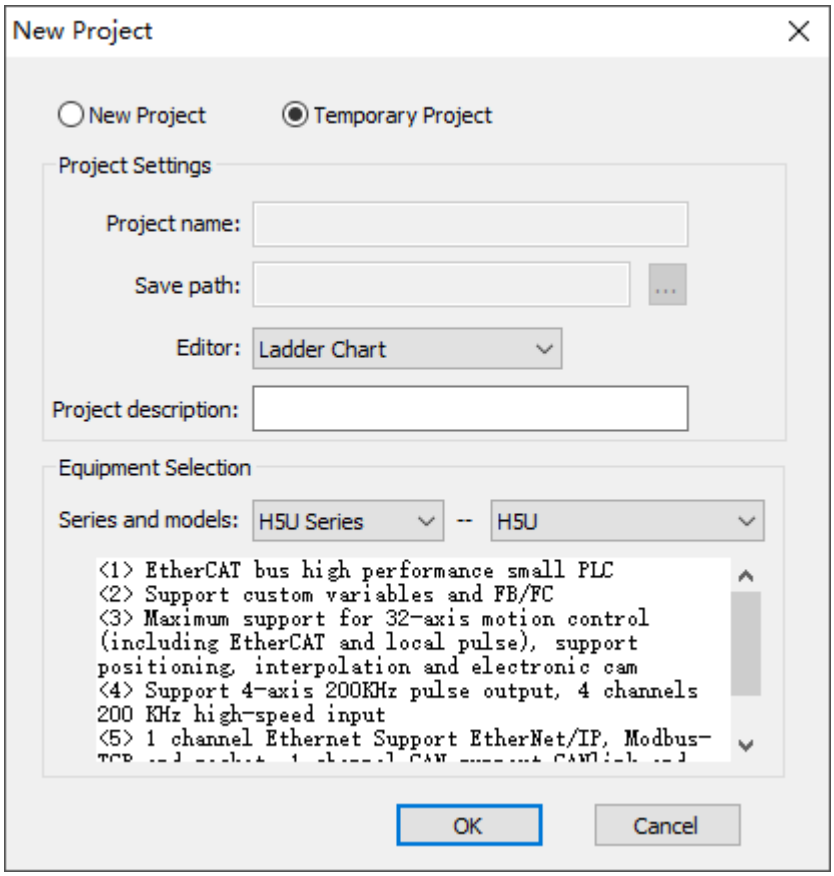
1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed. 0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set the torque as follows:

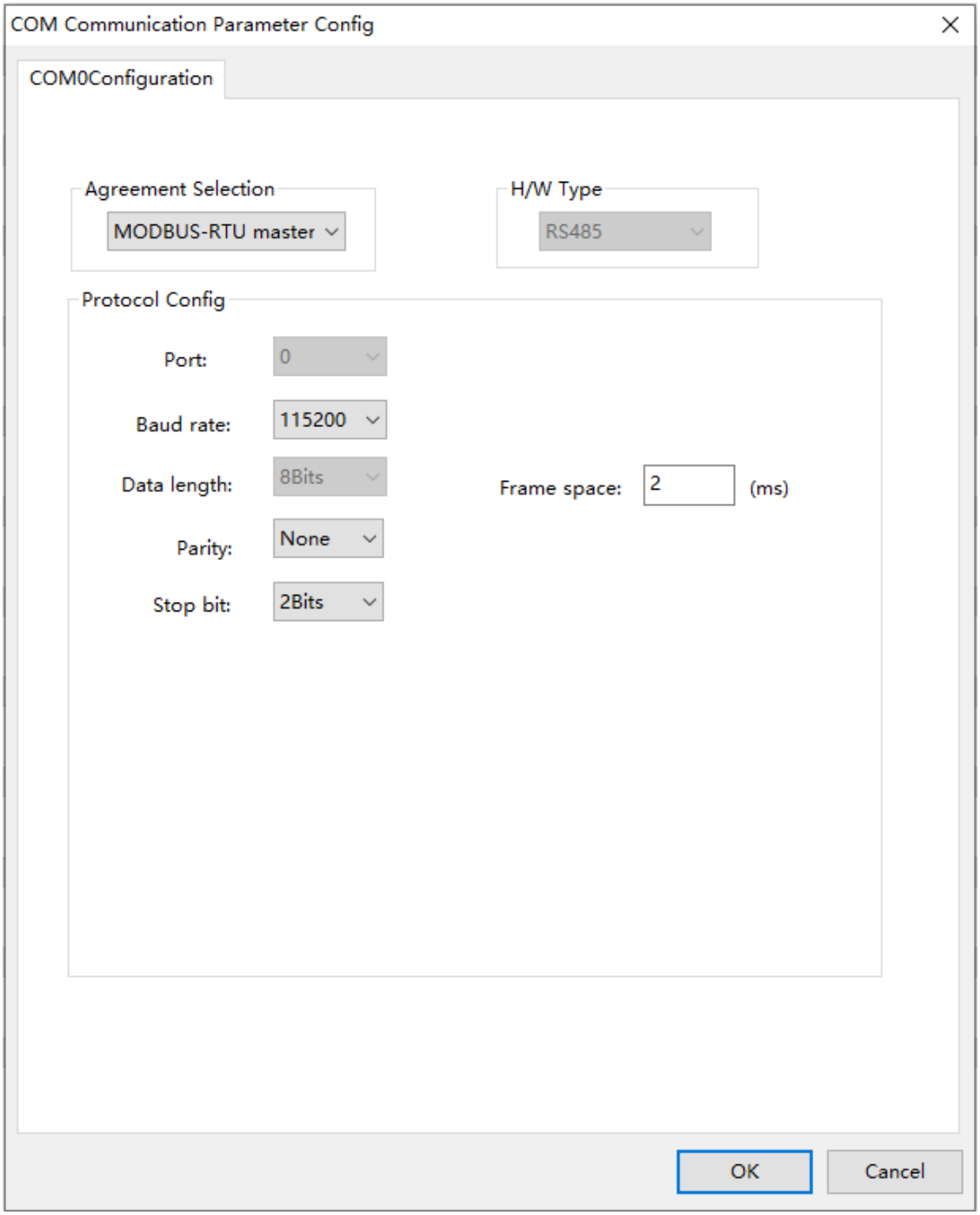
1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed. 0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish Modbus-RTU communication connection.

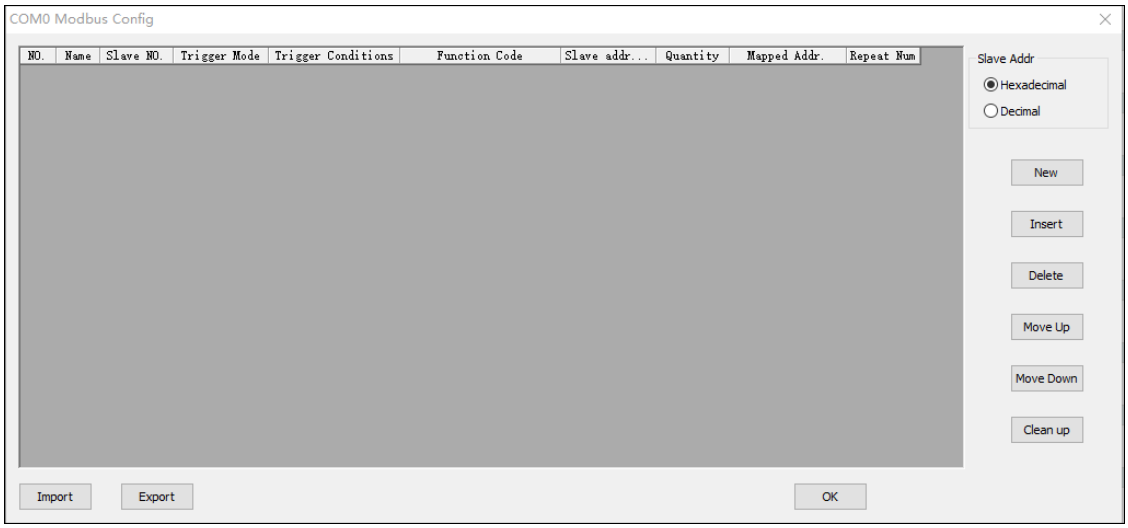
1. Open AutoShop. Click "Create a new project(Ctrl+N)", select "H5U Series" from the "Series and models" drop-down list, and click "OK".



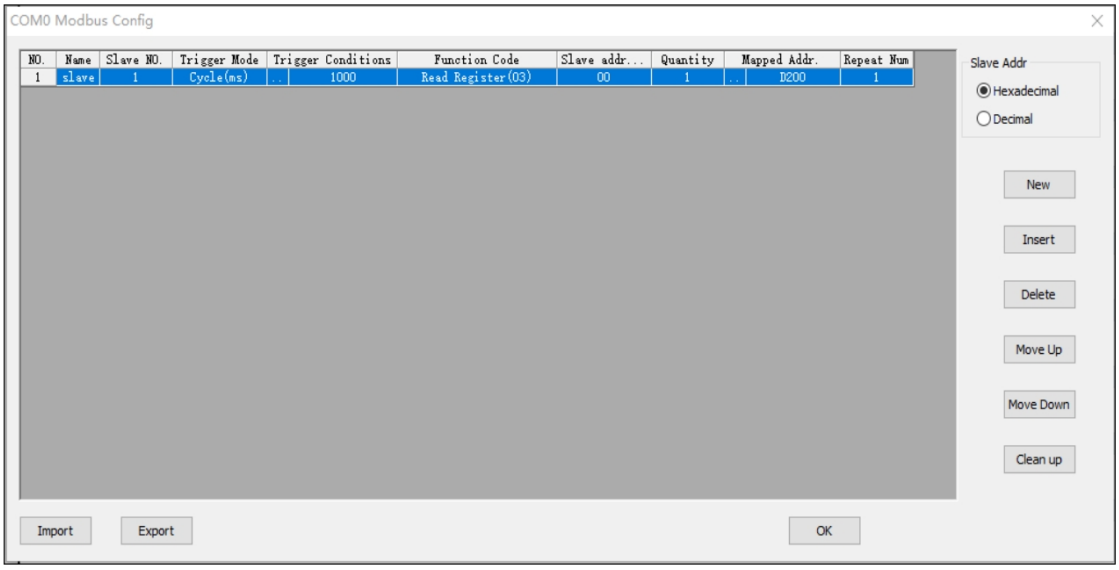
2. Click COM in the left pane to go to the PLC configuration interface, select the protocol and data format, and click "OK". Note: The data format must be consistent with the drive.



3. Click COM0, then click "Add Modbus Config" and "OK". Double-click COM0 Modbus Config and click "Add" on the displayed interface to access a variable of the drive.



4. Write operation: After clicking "Add", select the "Slave NO." and "Trigger Mode" (typically "Cycle").



The following takes writing multi-speed value 0 of station 1 as an example. Set the slave number to 1, indicating operation on slave 1. Set the trigger mode to "Cycle," and the parameter to "Write Single Register (06)". Set "Quantity" to 1; otherwise, writing can fail. The register address for multi-reference 0 for the drive is 0xF027.

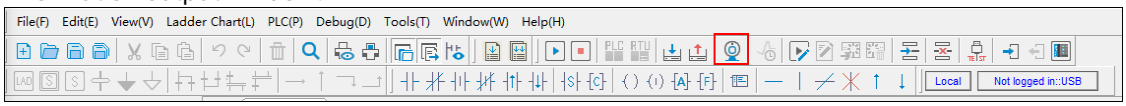
NO.	Name	Slave NO.	Trigger Mode	Trigger Conditions		Function Code	Slave addr...	Quantity		Mapped Addr.	Repeat Num
1	slave	1	Cycle(ms)	..	1000	Write Single Registe...	F027	1	..	D200	1

5. Read operation: After clicking "Add", select the "Slave NO." and "Trigger Mode" (typically "Cycle").

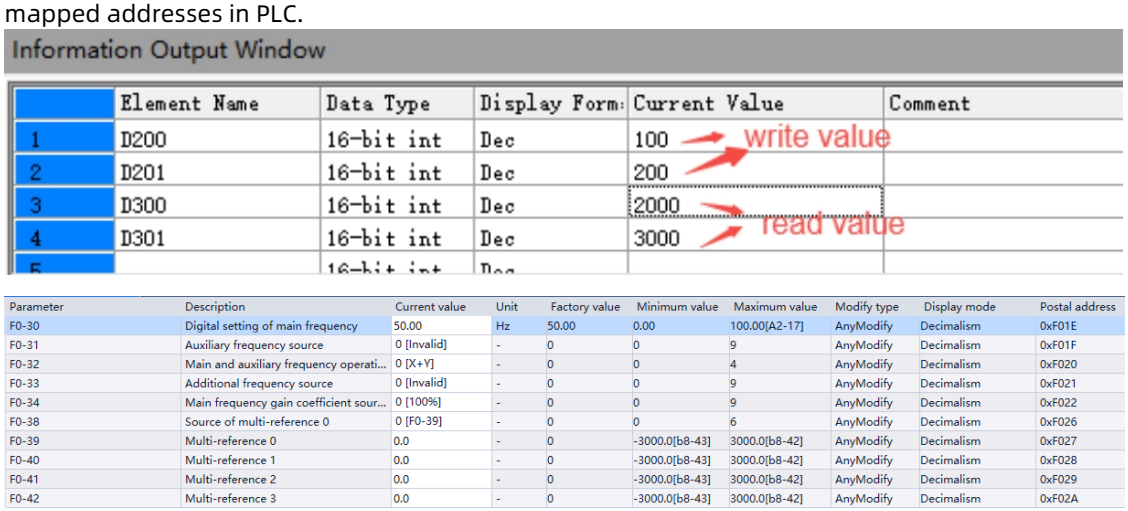
NO.	Name	Slave NO.	Trigger Mode	Trigger Conditions		Function Code	Slave addr...	Quantity		Mapped Addr.	Repeat Num
1	slave	1	Cycle(ms)	..	1000	Write Single Registe...	F027	1	..	D200	1
2	slave	1	Cycle(ms)	..	1000	Write Single Registe...	F028	1	..	D201	1
3	slave	1	Cycle(ms)	..	1000	Read Register(03)	F029	1	..	D300	1
4	slave	1	Cycle(ms)	..	1000	Read Register(03)	F02A	1	..	D301	1

The following takes writing multi-speed values 2 and 3 of station 1 as an example. Set the slave number to 1, indicating operation on slave 1. Set the trigger mode to "Cycle," and the parameter to "Read Register"; otherwise, reading can fail. Set the quantity to 1, indicating reading only one register. The register addresses for multi-reference values 2 and 3 are 0xF029 and 0xF02A, respectively.

6. After the read and write operation settings are done, click "OK" to return to the programming page.
7. After clicking "Monitor" in the PLC software tool, the element monitoring page appears in the information output window.



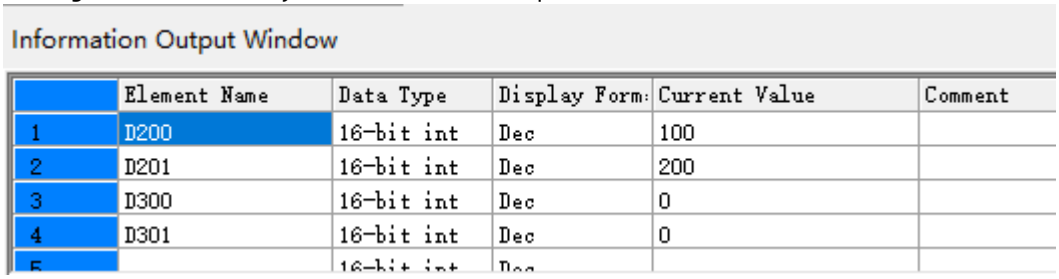
8. Enter the mapped addresses of each register from step 5 into the element monitoring page. As shown in the software tool, multi-speed values 0, 1, 2, and 3 are all 0, matching the values in the mapped addresses in PLC.



	Element Name	Data Type	Display Form:	Current Value	Comment
1	D200	16-bit int	Dec	100	
2	D201	16-bit int	Dec	200	
3	D300	16-bit int	Dec	2000	
4	D301	16-bit int	Dec	3000	

Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
F0-30	Digital setting of main frequency	50.00	Hz	50.00	0.00	100.00[A2-17]	AnyModify	Decimalism	0xF01E
F0-31	Auxiliary frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF01F
F0-32	Main and auxiliary frequency operati...	0 [X+Y]	-	0	0	4	AnyModify	Decimalism	0xF020
F0-33	Additional frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF021
F0-34	Main frequency gain coefficient sour...	0 [100%]	-	0	0	9	AnyModify	Decimalism	0xF022
F0-38	Source of multi-reference 0	0 [F0-39]	-	0	0	6	AnyModify	Decimalism	0xF026
F0-39	Multi-reference 0	0.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF027
F0-40	Multi-reference 1	0.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF028
F0-41	Multi-reference 2	0.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF029
F0-42	Multi-reference 3	0.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF02A

9. In the PLC software, change the current value of D200 to 100 and D201 to 200. In the drive software, 10.0 and 20.0 (with one decimal place) are written to multi-references 0 and 1, indicating the drive correctly receives the write request from the PLC.



	Element Name	Data Type	Display Form:	Current Value	Comment
1	D200	16-bit int	Dec	100	
2	D201	16-bit int	Dec	200	
3	D300	16-bit int	Dec	0	
4	D301	16-bit int	Dec	0	

Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
F0-30	Digital setting of main frequency	50.00	Hz	50.00	0.00	100.00[A2-17]	AnyModify	Decimalism	0xF01E
F0-31	Auxiliary frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF01F
F0-32	Main and auxiliary frequency operati...	0 [X+Y]	-	0	0	4	AnyModify	Decimalism	0xF020
F0-33	Additional frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF021
F0-34	Main frequency gain coefficient sour...	0 [100%]	-	0	0	9	AnyModify	Decimalism	0xF022
F0-38	Source of multi-reference 0	0 [F0-39]	-	0	0	6	AnyModify	Decimalism	0xF026
F0-39	Multi-reference 0	10.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF027
F0-40	Multi-reference 1	20.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF028
F0-41	Multi-reference 2	0.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF029
F0-42	Multi-reference 3	0.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF02A

10. In the drive software, change multi-references 2 and 3 to 200 and 300, respectively. In the PLC software, D300 and D301 change to 2000 and 3000 respectively, indicating the drive correctly responds to the read request from the PLC.

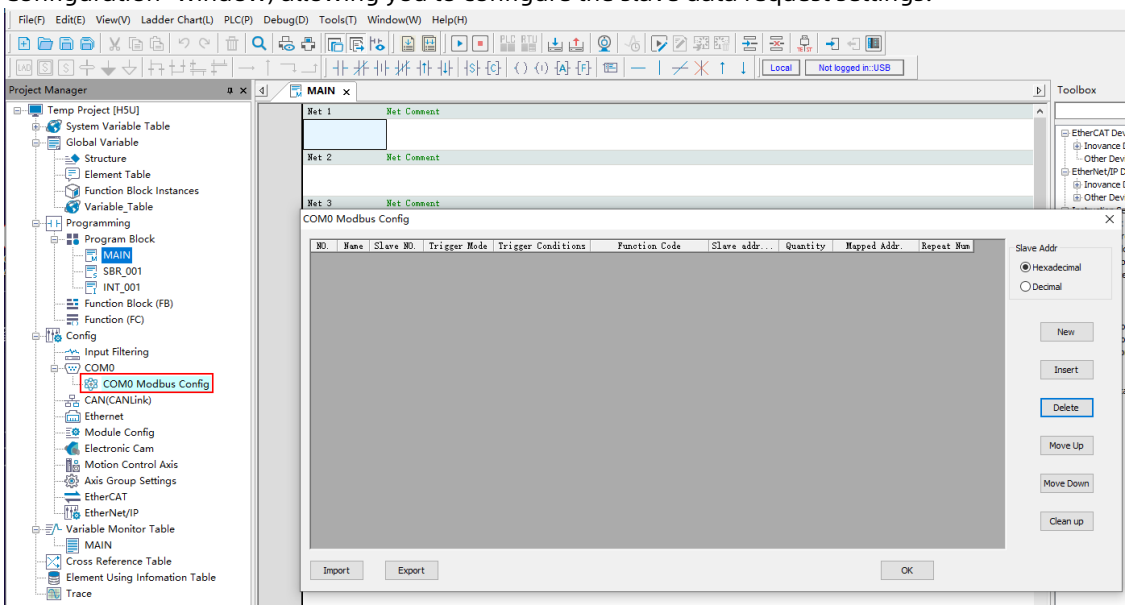
Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
F0-30	Digital setting of main frequency	50.00	Hz	50.00	0.00	100.00[A2-17]	AnyModify	Decimalism	0xF01E
F0-31	Auxiliary frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF01F
F0-32	Main and auxiliary frequency operati...	0 [X+Y]	-	0	0	4	AnyModify	Decimalism	0xF020
F0-33	Additional frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF021
F0-34	Main frequency gain coefficient sour...	0 [100%]	-	0	0	9	AnyModify	Decimalism	0xF022
F0-38	Source of multi-reference 0	0 [F0-39]	-	0	0	6	AnyModify	Decimalism	0xF026
F0-39	Multi-reference 0	10.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF027
F0-40	Multi-reference 1	20.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF028
F0-41	Multi-reference 2	200.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF029
F0-42	Multi-reference 3	300.0	-	0	-3000.0[b8-43]	3000.0[b8-42]	AnyModify	Decimalism	0xF02A

Information Output Window

	Element Name	Data Type	Display Form:	Current Value	Comment
1	D200	16-bit int	Dec	100	
2	D201	16-bit int	Dec	200	
3	D300	16-bit int	Dec	2000	
4	D301	16-bit int	Dec	3000	
5		16-bit int	Dec		

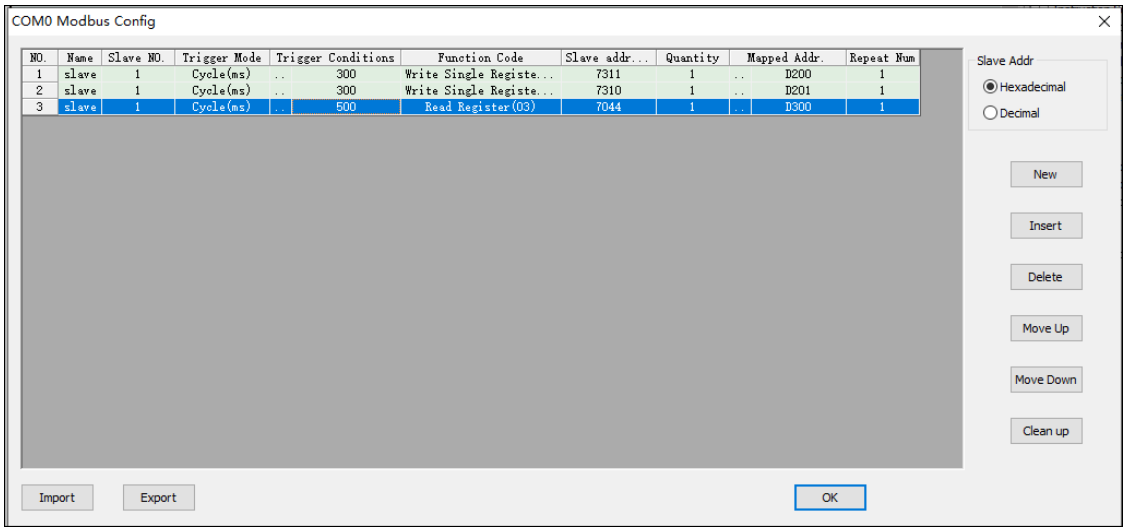
Step 4: Control the drive through communication.

1. Click "COM0 Modbus Config" in the project management, which opens the "COM0 Modbus Configuration" window, allowing you to configure the slave data request settings.

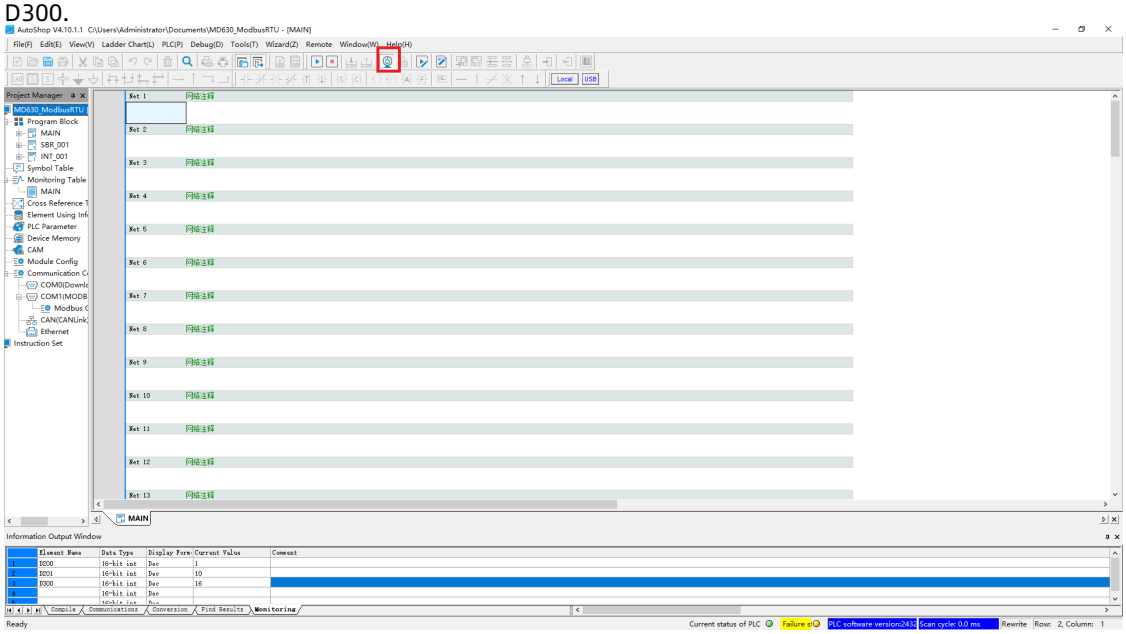


2. Configure the request data.

   To implement start/stop control and set reference frequency/torque through Modbus communication, perform write operations on specific Modbus register addresses of the drive. For simple start/stop control and frequency/torque setting, configure the write requests for addresses 7311H and 7310H. To promptly get the operating status of the drive, you also need to configure read request for 7044H.



3. Click the motor monitoring icon. In the information output tab, set the values of control instructions, which is to add D200, D201, and D300. These three registers correspond to 7311H, 7310H, and 7044H, respectively. Set the values as shown below and observe the feedback value of D300.



Description of the communication address:

7311H is one of the communication addresses supported by the drive. It is defined as follows.

Comm. address		Description
Control word 2 set through communication	7311H	The setpoint of 7311H is in decimal. References corresponding to different values are shown below. 0: Stop as defined by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop as defined by F2-17 7: Reset fault 8: Emergency stop

For example, writing 1 to 7311H activates forward run. Writing 0 to 7311H stops the drive as defined by F2-17 [OFF1 stop mode].

The 7310H is one of the communication addresses supported by the drive. It is defined as follows.

Comm. address		Description
Speed reference 2 set through communication	7310H	The target frequency can be set through this address. The property of values written by this address is switched by n0-14 [7310H Reference selection]. The setting range of n0-14 is as follows. 0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to rated frequency/signed 16-bit/2 decimal places) 4: Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)

In default settings, when n0-14 [7310H Reference selection] is set to 1 [Frequency (signed 16-bit)], writing 1000 to 7310H sets the main frequency to 10.00 Hz. Writing -1000 sets the main frequency to -10.00 Hz.

See the table below for the corresponding feedback status.

Comm. address		Description
Drive state 2	7044H	The status value of 7044H is hexadecimal. The drive states corresponding to bit values are as follows. bit0: Operation status. 0: Stopped; 1: Operating bit1: Operating direction. 0: Forward; 1: Reverse bit2: Fault state. 0: No fault; 1: Faulty bit3: Frequency arrival. 0: Inactive; 1: Active bit4 to bit7: Reserved bit8 to bit15: Fault code. For details, see specific fault descriptions.
AC drive operating frequency 2	7045H	Default: 2 decimal places, signed number, in units of Hz. The decimal places are switchable.

6.7 Modbus TCP Drive Control

6.7.1 Introduction

The drive achieves Modbus TCP communication via Ethernet, and achieves high-speed data exchange between devices using the TCP/IP network protocol. It conforms to the Modbus TCP industrial Ethernet standard. As a Modbus TCP server, the drive can connect to a PC/PLC control network with a single master and multiple slaves to receive control requests from the Modbus TCP client. You can implement centralized control by using a PC or PLC and set the running commands, modify or read parameters, and read the running status and fault information of the drive through the communication protocol. This protocol clearly defines the format and transmission method of information during communication. When a slave encounters an error during information reception or is unable to complete the operation requested by the master, it generates corresponding fault information and sends it back to the master. This communication method effectively improves system communication efficiency and enhances the networking capability of the drive.

6.7.2 Communication Specifications

Item	Specifications
Communication protocol	Modbus TCP slave communication protocol
Transmission mode	Master-slave communication mode
Communication mode	Full-duplex auto-negotiation
Topology	Bus, star
Transmission rate	100 Mbps adaptive
Transmission medium	Twisted pair
Transmission distance	< 100 m
Communication port	502 (TCP)
Modbus TCP frame length (bytes)	Ethernet frame length (64 to 1518) The maximum length of Modbus TCP is generally 260 bytes (7 bytes for MBAP header, 1 byte for parameter, and up to 252 bytes for data field)
Number of combined read/write parameters	12
Modbus TCP slave communication timeout period (unit: s)	0 to 6000 (0 by default. The setpoint 0 indicates the timeout period is invalid.)
Maximum cable length (unit: m)	< 100

6.7.3 Communication System Connection

Modbus TCP requires use of shielded twisted pair cables with standard RJ45 interface. The shielded cable must be of Cat5e (or higher) and comply with the TIA/EIA-568-B standard, with each cable shorter than 100 m.

The Modbus TCP supports multiple types of topologies, including the bus type and star type. Multiple types of networking can be achieved through the switch.

Bus connection

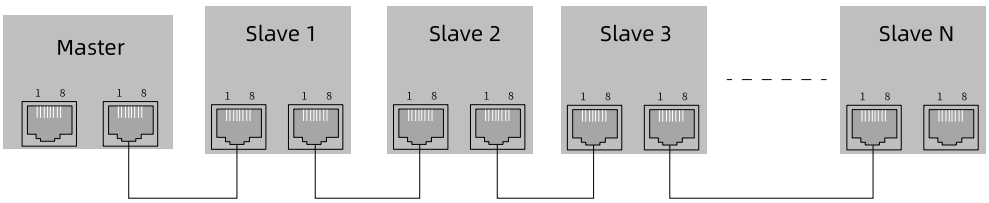


Figure 6-6 Bus-type topology

Star connection

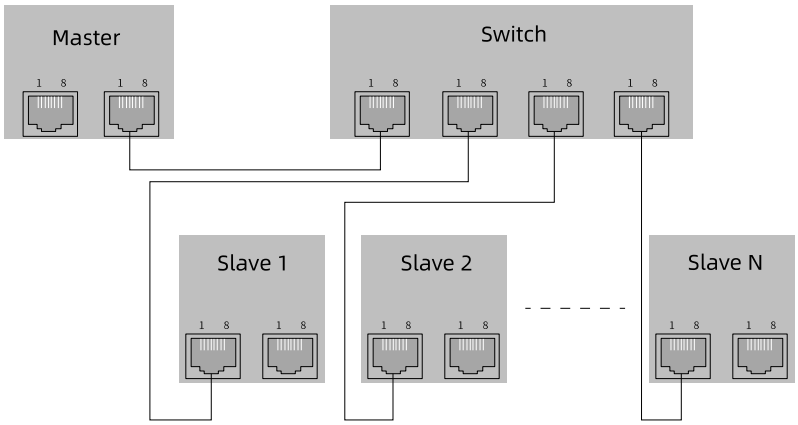


Figure 6-7 Star-type topology

6.7.4 Message

6.7.4.1 Message Structure

The communication data format of Modbus TCP protocol is as follows.

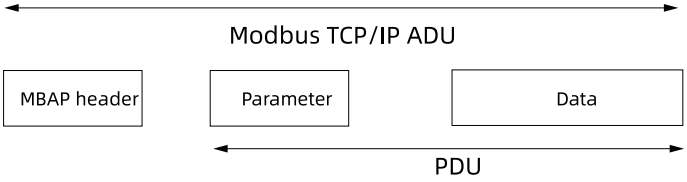


Figure 6-8 Request/Response of Modbus over TCP/IP

The MBAP header includes the following fields.

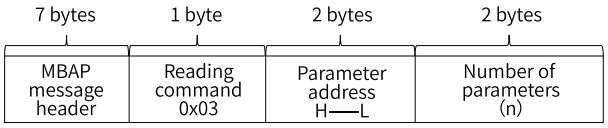
Field	Length	Description	Client	Server
Transaction meta identifier	2 bytes	Identifier of the Modbus request/response transaction	Initiated by the client	Recopied by the server from the received request
Protocol identifier	2 bytes	0: Modbus protocol	Initiated by the client	Recopied by the server from the received request

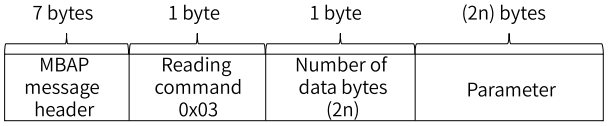
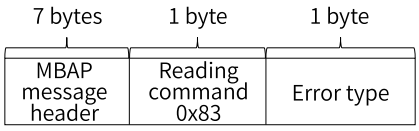
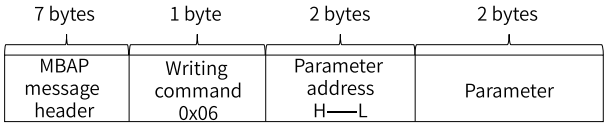
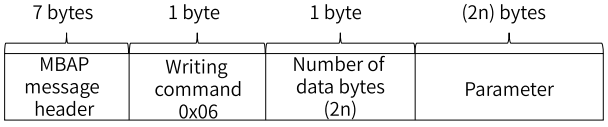
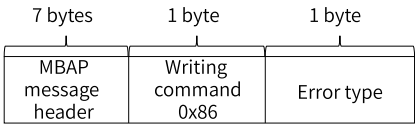
Field	Length	Description	Client	Server
Length	2 bytes	Number of bytes of the next field	Initialized by the client (Request)	Initialized by the server (Response)
Unit identifier	2 bytes	Identification code of the remote slaves connected to the serial link or other bus	Initiated by the client	Recopied by the server from the received request

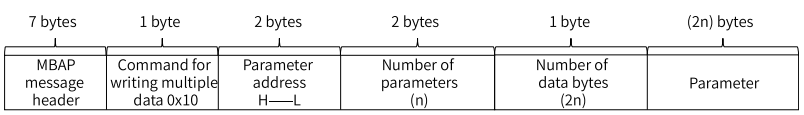
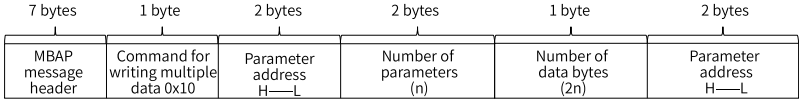
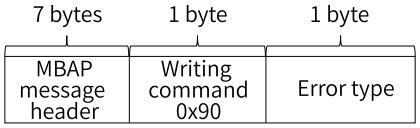
The drive supports reading or writing of word type parameters only. The read operation command is 0x03, the write operation command is 0x06, and the multi-write operation command is 0x10.

Application example

The controller or host controller sends a read/write/multi-write request data frame to the drive. The drive sends a normal response data frame if the processing of the read/write/multi-write request data is correct, or sends an exception response data frame if there is an error.

<table>
<tr><td colspan="2">Process of communication read operation</td></tr>
<tr><td>Master read command frame</td><td> 

In theory, the host controller can read or write a maximum of 12 consecutive parameters. However, these parameters must be in the same group. Otherwise, an error will be reported in the response.</td></tr>
<tr><td>Frame that the slave responds to the read command</td><td> 
</td></tr>
<tr><td>Slave reads response error frame</td><td> 
</td></tr>
<tr><td colspan="2">Process for writing through communication</td></tr>
<tr><td>Write command frame sent by master</td><td> 
</td></tr>
<tr><td>Frame that the slave responds to the write command</td><td> 
</td></tr>
<tr><td>Slave writes response error frame</td><td> 
</td></tr>
<tr><td colspan="2">Process for multi-write operation</td></tr>
</table>

Write command frame for multiple parameters sent by master	
Frame of slave response to multi-write command	
Frame of multi-write error returned from the slave	

Field	Description
Command code (CMD)	0x03: Read slave parameters 0x06: Write slave parameters 0x10: Write parameters to multiple slaves
Parameter address	It is the internal parameter address of the AC drive, expressed in hexadecimal format. The parameters include functional parameters and non-functional parameters (running status and running command). During transmission, low-order bytes follow the high-order bytes.
Number of parameters	It is the number of parameters read by this frame. If it is 1, one parameter is read. During transmission, low-order bytes follow the high-order bytes. For this protocol, only one parameter can be rewritten at a time without this field.
Number of bytes	Data length, which is twice the number of parameters
Parameter	Response data or data to be written (During transmission, low-order bytes follow high-order bytes.)

6.7.4.2 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 908*.

6.7.4.3 Mapping Table

For details, see *"6.5.3 Mapping Table" on page 910*.

6.7.5 Communication Ports

This product supports the Modbus TCP protocol and communicates via the J9 (terminal label IN) and J5 (terminal label OUT). When facing the two RJ45 ports of the drive, the two ports are equivalent and are direction-insensitive.

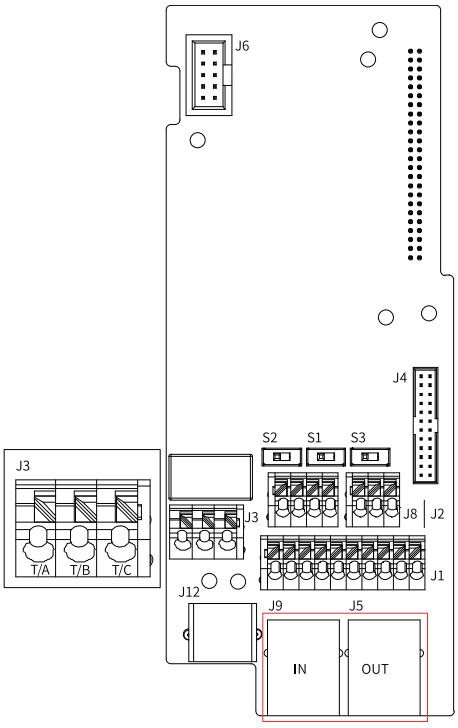


Table 6–6 Modbus TCP communication port description

External terminal	Type	Type of information transmitted	Mark	Name	Function
J9	RJ45 port	100 M bus	IN	100 M bus cascading port	Four communication protocols, including ECAT, EIP, PN, and Modbus TCP are supported. Select the protocol type using n0-10. When ECAT is selected, the IN port applies. The port is direction-insensitive for EIP, PN, and Modbus TCP.
J5	RJ45 port	100 M bus	OUT	100 M bus cascading port	Four communication protocols, including ECAT, EIP, PN, and Modbus TCP are supported. Select the protocol type using n0-10. When ECAT is selected, the IN port applies. The port is direction-insensitive for EIP, PN, and Modbus TCP.

6.7.6 Connecting the Drive to the Bus System Through the Ethernet Port

The Modbus TCP bus adopts standard RJ45 interface. The cable must be a shielded twisted pair cable of at least CaT 5e and compliant with the TIA/EIA-568-B standard, with the shield grounded properly. The maximum cable length between two devices is 100 m.

Connection procedure:

1. Switch on the system power supply.
2. See the communication networking topology in *"6.7.3 Communication System Connection" on page 929* and connect the network cable to the shielded network port terminal, as shown in

"Figure 6-9 Modbus TCP communication connection" on page 934. For communication interface specifications, see *"6.7.5 Communication Ports" on page 932*.

Note

For Modbus TCP communication, the IN and OUT communication port are direction-insensitive.

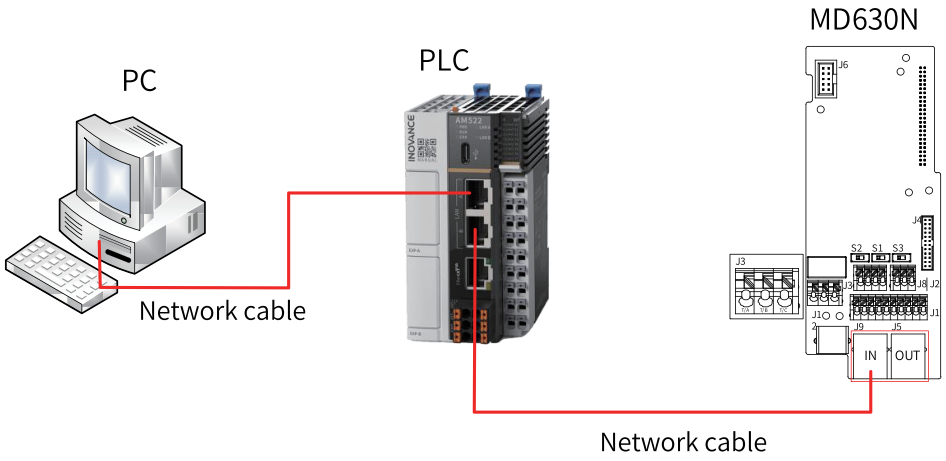


Figure 6-9 Modbus TCP communication connection

3. Set n0-10 to 4.
4. Configure the IP addresses through n2-51 to n2-54, the subnet masks through n2-55 to n2-58, and the gateway addresses through n2-59 to n2-62.

Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
n2-51	Most significant byte of Modbus TCP IP address	192	-	0	0	255	ShutdownModify	Decimalism	0x2233
n2-52	Second most significant byte of Modbus TCP IP a...	168	-	0	0	255	ShutdownModify	Decimalism	0x2234
n2-53	Third byte of Modbus TCP IP address	1	-	0	0	255	ShutdownModify	Decimalism	0x2235
n2-54	Least significant byte of Modbus TCP IP address	14	-	0	0	255	ShutdownModify	Decimalism	0x2236
n2-55	Most significant byte of Modbus TCP subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2237
n2-56	Second most significant byte of Modbus TCP IP s...	255	-	0	0	255	ShutdownModify	Decimalism	0x2238
n2-57	Third byte of Modbus TCP subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2239
n2-58	Least significant byte of Modbus TCP subnet mask	0	-	0	0	255	ShutdownModify	Decimalism	0x223A
n2-59	Most significant byte of Modbus TCP gateway	192	-	0	0	255	ShutdownModify	Decimalism	0x223B
n2-60	Second most significant byte of Modbus TCP gat...	168	-	0	0	255	ShutdownModify	Decimalism	0x223C
n2-61	Third byte of Modbus TCP gateway	1	-	0	0	255	ShutdownModify	Decimalism	0x223D
n2-62	Least significant byte of Modbus TCP gateway	1	-	0	0	255	ShutdownModify	Decimalism	0x223E
n2-69	Modbus TCP communication timeout	0.0	s	0	0	6000	AnyModify	Decimalism	0x2245

5. Restart the device power supply.

6.7.7 Configuring Communication between the Drive and Controller

When using Modbus TCP communication, the controller must support the Modbus TCP protocol.

The following basic operations are required for Modbus TCP communication with the drive.

1. Perform wiring according to *"6.7.6 Connecting the Drive to the Bus System Through the Ethernet Port" on page 933*.
2. Switch the device communication mode to Modbus TCP communication (n0-10 = 4), set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference source for setting channel 1 (b0-03 = 0, b5-00 = 9). (This operation can be performed through the operating panel or software tool.)
3. Wait a few seconds until the network port indicators LED0 (green) and LED1 (yellow) turn on, indicating that the Ethernet link has been successfully established.

4. Configure communication between the master (controller) and slave (drive) as shown in *"6.7.10.1 Configuration for Modbus TCP Communication Between AC Drive and H3U" on page 938*.

6.7.8 Communication Parameters

Param.	Name	Default	Range	Change mode	Description
n2-51	Most significant byte of Modbus TCP IP address	0	0 to 255	At stop	Defines the most significant byte of the IP address. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-52	Second most significant byte of Modbus TCP IP address	0	0 to 255	At stop	Defines the second most significant byte of the IP address. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-53	Third byte of Modbus TCP IP address	0	0 to 255	At stop	Defines the third byte of the IP address. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-54	Least significant byte of Modbus TCP IP address	0	0 to 255	At stop	Defines the least significant byte of the IP address. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-55	Most significant byte of Modbus TCP subnet mask	0	0 to 255	At stop	Defines the most significant byte of subnet mask. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-56	Second most significant byte of Modbus TCP subnet mask	0	0 to 255	At stop	Defines the second most significant byte of subnet mask. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-57	Third byte of Modbus TCP subnet mask	0	0 to 255	At stop	Defines the third byte of the subnet mask. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.

Param.	Name	Default	Range	Change mode	Description
n2-58	Least significant byte of Modbus TCP subnet mask	0	0 to 255	At stop	Defines the least significant byte of subnet mask. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-59	Most significant byte of Modbus TCP gateway	0	0 to 255	At stop	Defines the most significant byte of the gateway. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-60	Second most significant byte of Modbus TCP gateway	0	0 to 255	At stop	Defines the second most significant byte of gateway. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-61	Third byte of Modbus TCP gateway	0	0 to 255	At stop	Defines the third byte of the gateway. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-62	Least significant byte of Modbus TCP gateway	0	0 to 255	At stop	Defines the least significant byte of gateway. **Note:** The setting range is 0 to 255. The actual setting is based on the actual scenario. The modification on this parameter is activated at next power-on.
n2-69	Modbus TCP communication timeout period	0.0	0.0 to 6000.0	Real-time	Defines Modbus TCP communication timeout period. **Note:** 1 .When it is set to 0.0s, the Modbus communication timeout time is invalid. This parameter is generally set to an invalid value. It is used to monitor communication status in a system with continuous communication. 2 .If this parameter is set to a valid value and the communication interval between the current communication and next communication exceeds the value of n2-69 [Modbus TCP communication timeout], the system reports a communication error. 3 .The modification on this parameter is activated at next power-on.

6.7.9 Communication Fault Diagnosis

Fault code	Name	Cause	Verification method	Remedy
E169.1	Ethernet communication timeout	The power supply of the device is unstable or the network topology is disturbed.	1. Check whether the power supply of the equipment is stable. Measure whether the bus voltage is within the operating voltage range. If not, check whether a high-power device uses the same power supply. If yes, this may cause voltage instability. In this case, an independent power supply is required. 2. Check whether the communication cable and power cable are routed through different routes. If the communication cable is routed together with the power cable, interference may occur. It is recommended to route the cables through different routes according to the cable routing specifications.	1. Ensure that high-power devices share the same power supply. Use independent power supplies for high-power devices. 2. Route communication cables and power cables through different routes. If the voltage is still unstable after preceding causes are rectified, replace the power supply.
		A fault occurs on the network device.	1. Ping the device continuously, check whether the device responds and whether the response delay is greater than the set communication service cycle. If no response is received or the response delay is greater than the communication service cycle, the network equipment may be faulty. Use the step-by-step ping method to locate the faulty device and replace it. If the response delay is lower than the communication service cycle, check whether the delay fluctuation is stable or excessive. If it is unstable or excessive, the network equipment may be faulty or the network bandwidth may be insufficient. 2. Use the ifconfig command to check whether the network bandwidth is sufficient, or use Wireshark to capture packets and analyze whether the data is lost.	1. Replace the network device that is faulty in the network topology. 2. If the network bandwidth is insufficient, reduce the number of nodes in the network topology or upgrade the network bandwidth. 3. Contact Inovance for technical support.
		The controller is faulty.	Check whether the controller works properly and whether there is any data sent. If not, the controller is abnormal and needs to be replaced.	Replace the controller.
E169.2	Ethernet hardware error	The Ethernet integrated circuit is faulty.	Check whether the MCB network port, PHY integrated circuit, and network transformer are dirty.	Clean the dirty parts. If the fault persists, contact technical support.

Fault code	Name	Cause	Verification method	Remedy
E169.3	MAC address not programmed	The MAC address is lost.	Check whether the MAC address of the drive can be read by the host controller through the iFA commissioning software. If it cannot be read, the MAC address is lost.	Contact the technical support.
E169.4	IP addresses conflict	IP address conflict exists in the communication network.	Disconnect the device from the network and check whether the fault disappears. If the fault is reported only after the device is connected to the network, the IP address of the device conflicts with other devices in the network.	Modify the IP address of the device to ensure its uniqueness.

6.7.10 Communication Configuration Examples

6.7.10.1 Configuration for Modbus TCP Communication Between AC Drive and H3U

Prerequisite

1. Log in to the official website of Inovance (***https://www.inovance.com/portal/serviceSupport/download***) to obtain the programming software AutoShop of the H3U.
2. Prepare an AC drive, an H3U PLC, cables, and other components.
3. Ensure the PLC is correctly wired to the drive. The H3U is used as the Modbus TCP master, and the MD630N is used as the Modbus TCP slave. Use a standard network cable to connect the network port of the H3U and network port 1 or 2 of the drive. For details, see *"6.7.6 Connecting the Drive to the Bus System Through the Ethernet Port" on page 933*.

Configuration procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 (Main command source of control channel 1) to 2 (Communication) to set communication as the command source.

Step 2: Set the frequency or torque through communication.

Set the frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H reference selection) to one of the following values as needed:
   - 0: Frequency (unsigned 16-bit)
   - 1: Frequency (signed 16-bit)
   - 2: Speed (signed)
   - 3: Percentage (corresponds to rated frequency/Int16/2 decimal places)
   - 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

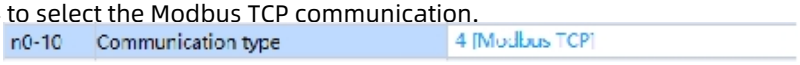
Set the torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of set channel 1.
2. Set n0-14 (7310H reference selection) to one of the following values as needed:

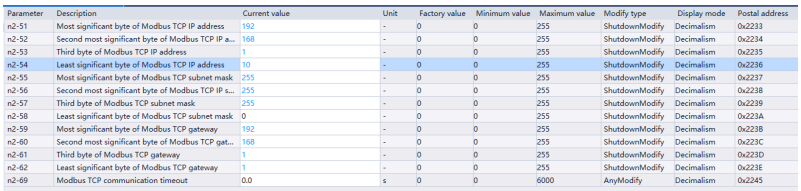
- 0: Frequency (unsigned 16-bit)
- 1: Frequency (signed 16-bit)
- 2: Speed (signed)
- 3: Percentage (corresponds to rated frequency/Int16/2 decimal places)
- 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

Step 3: Enable the Modbus TCP communication.

1. Set n0-10 to 4 to select the Modbus TCP communication.

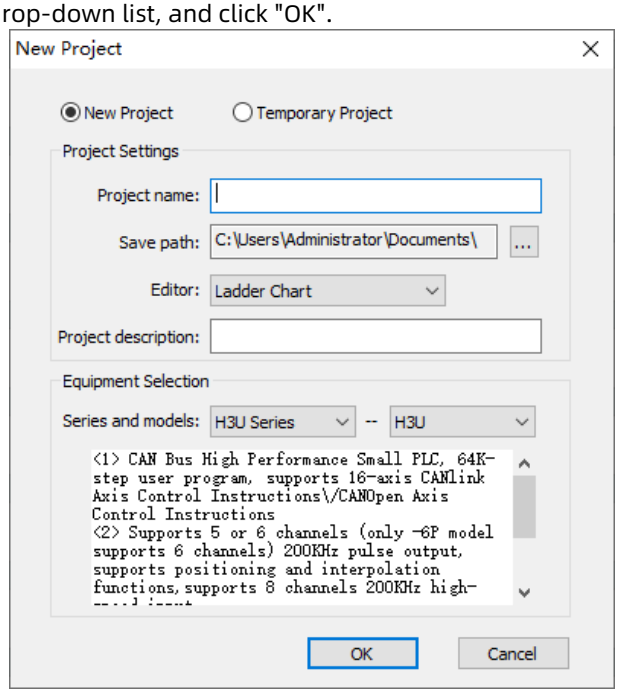


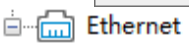
2. Set IP-related addresses through n2-51 to n2-62. After setting, power on the drive (MD630N) again.



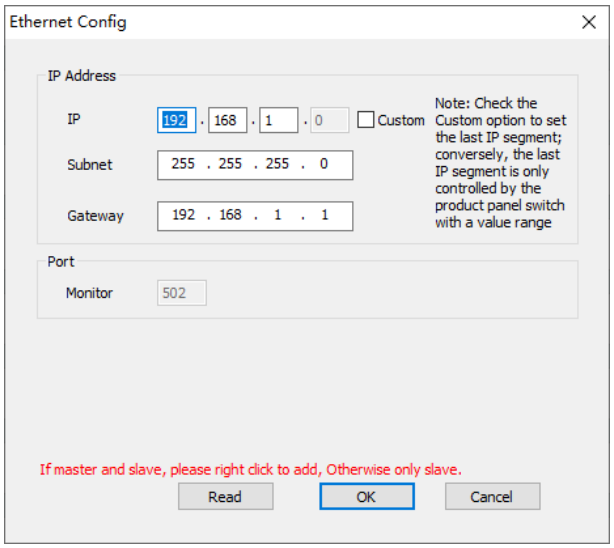
Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
n2-51	Most significant byte of Modbus TCP IP address	192	-	0	0	255	ShutdownModify	Decimalism	0x2233
n2-52	Second most significant byte of Modbus TCP IP a...	168	-	0	0	255	ShutdownModify	Decimalism	0x2234
n2-53	Third byte of Modbus TCP IP address	1	-	0	0	255	ShutdownModify	Decimalism	0x2235
n2-54	Least significant byte of Modbus TCP IP address	10	-	0	0	255	ShutdownModify	Decimalism	0x2236
n2-55	Most significant byte of Modbus TCP subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2237
n2-56	Second most significant byte of Modbus TCP IP s...	255	-	0	0	255	ShutdownModify	Decimalism	0x2238
n2-57	Third byte of Modbus TCP subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2239
n2-58	Least significant byte of Modbus TCP subnet mask	0	-	0	0	255	ShutdownModify	Decimalism	0x223A
n2-59	Most significant byte of Modbus TCP gateway	192	-	0	0	255	ShutdownModify	Decimalism	0x223B
n2-60	Second most significant byte of Modbus TCP gat...	168	-	0	0	255	ShutdownModify	Decimalism	0x223C
n2-61	Third byte of Modbus TCP gateway	1	-	0	0	255	ShutdownModify	Decimalism	0x223D
n2-62	Least significant byte of Modbus TCP gateway	1	-	0	0	255	ShutdownModify	Decimalism	0x223E
n2-69	Modbus TCP communication timeout	0.0	s	0	0	6000	AnyModify	Decimalism	0x2245

3. Open the PLC programming software AutoShop. Click "New Project", select "H3U Series" from the "Series and models" drop-down list, and click "OK".



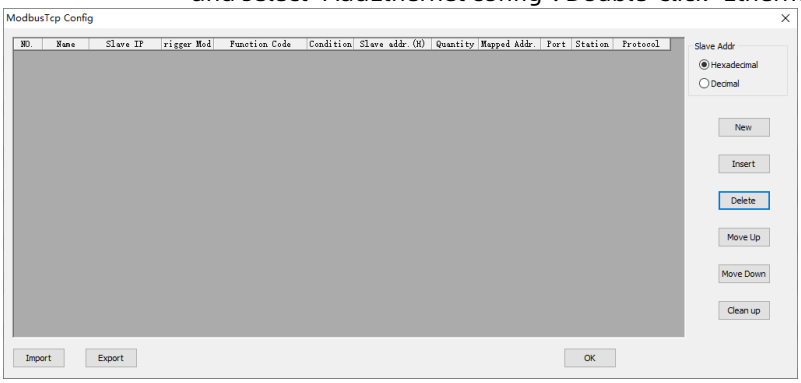
4. Double-click 

in the left pane to enter the PLC Ethernet configuration interface.
Note: The IP address of the PLC must be in the same network segment as that of the drive (MD630N).

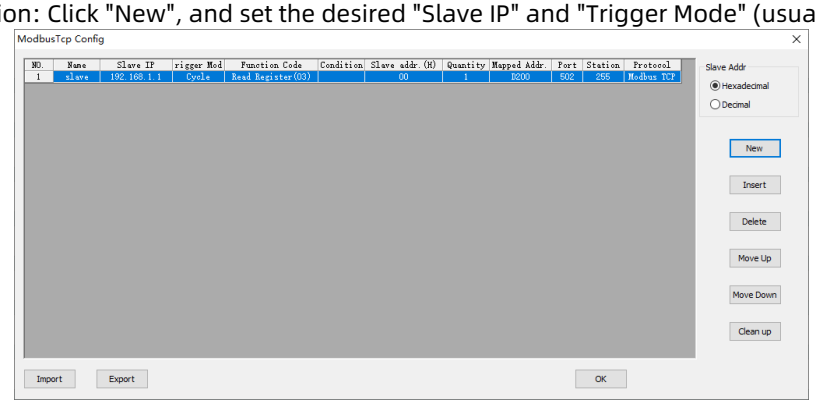


5. Right-click 

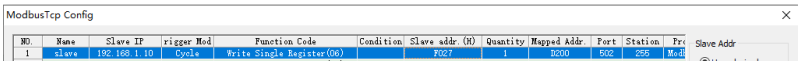
and select "AddEthernet config". Double-click "Ethernet Config".



6. Write operation: Click "New", and set the desired "Slave IP" and "Trigger Mode" (usually "Cycle").

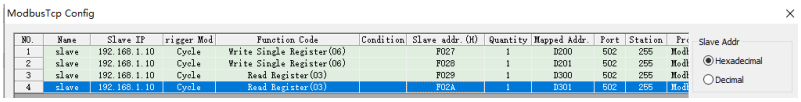


As shown in the figure, use writing multi-reference 0 as an example. Set the slave IP to 192.16.1.10, trigger mode to "Cycle", and function code to "Write Single Register (06)". Set "Quantity" to 1; otherwise, writing will fail. The register address for multi-reference 0 for the drive is 0xF027.

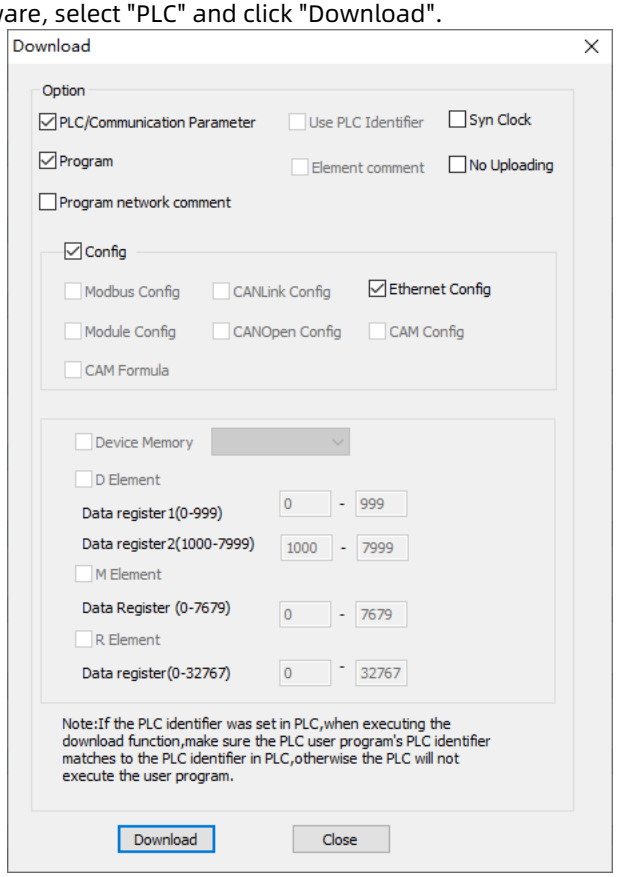


7. Read operation: Click "New", and set the desired "Slave IP" and "Trigger Mode" (usually "Cycle"). As shown in the figure, use reading multi-reference 2 and multi-reference 3 of station 1 as an example. Set the slave IP to 192.16.1.10 and trigger mode to "Cycle". Set the function code to "Read Register"; otherwise, reading will fail. The quantity 1 indicates that only one register is read.

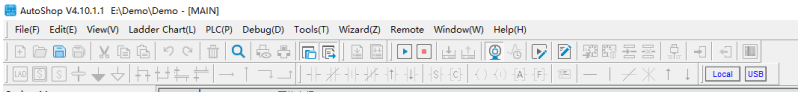
The register addresses for multi-reference 2 and multi-reference 3 are 0xF029 and 0xF02A, respectively.



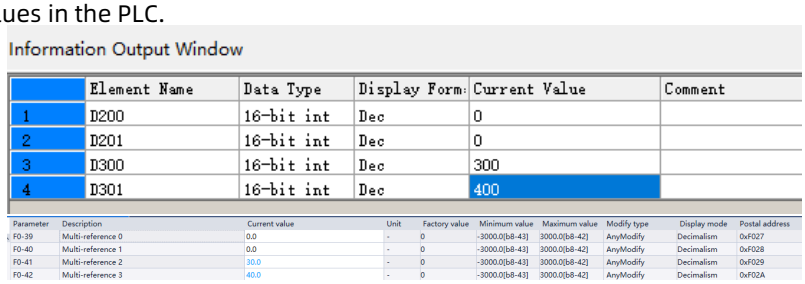
8. After the read and write operation settings, click "OK" to return to the programming interface.
9. In the AutoShop software, select "PLC" and click "Download".



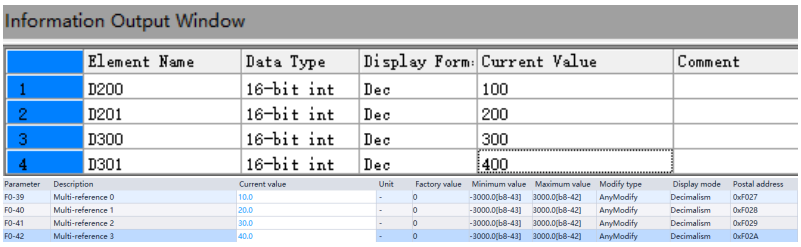
10. After clicking "Monitor" in the AutoShop software, the element monitoring interface appears.



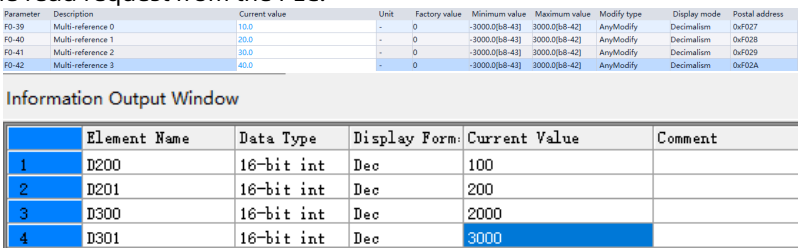
11. Enter the mapped addresses of each register in step 5 to the element monitoring interface. View the drive software to check that multi-references 0, 1, 2, and 3 are all 0, matching the mapped addresses values in the PLC.



12. In the PLC software, change the current value of D200 to 100 and D201 to 200. In the drive software, 10.0 and 20.0 (one decimal place) are written to multi-references 0 and 1, indicating the drive correctly receives the write request from the PLC.

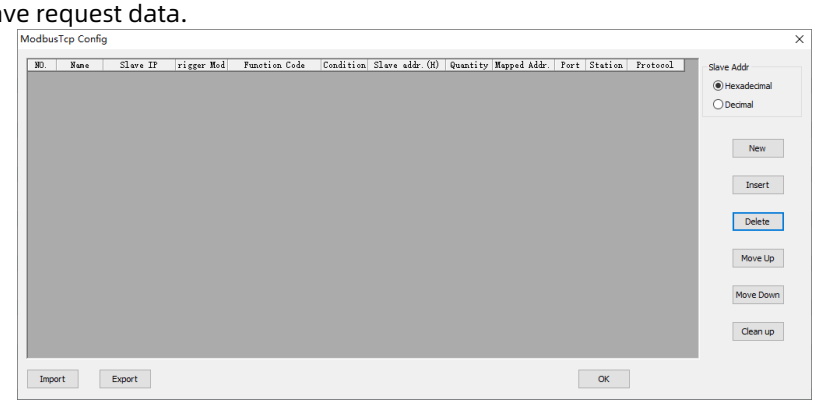


13. In the drive software, change multi-references 2 and 3 to 200 and 300, respectively. In the PLC software, D300 and D301 change to 2000 and 3000 respectively, indicating the drive correctly responds to the read request from the PLC.

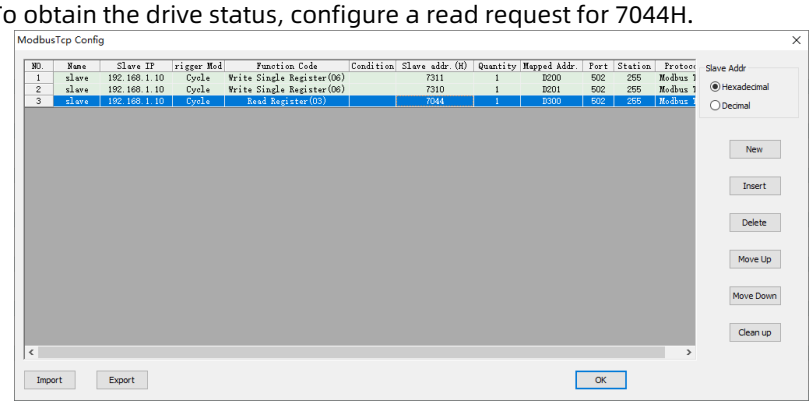


Step 4: Control the drive through communication.

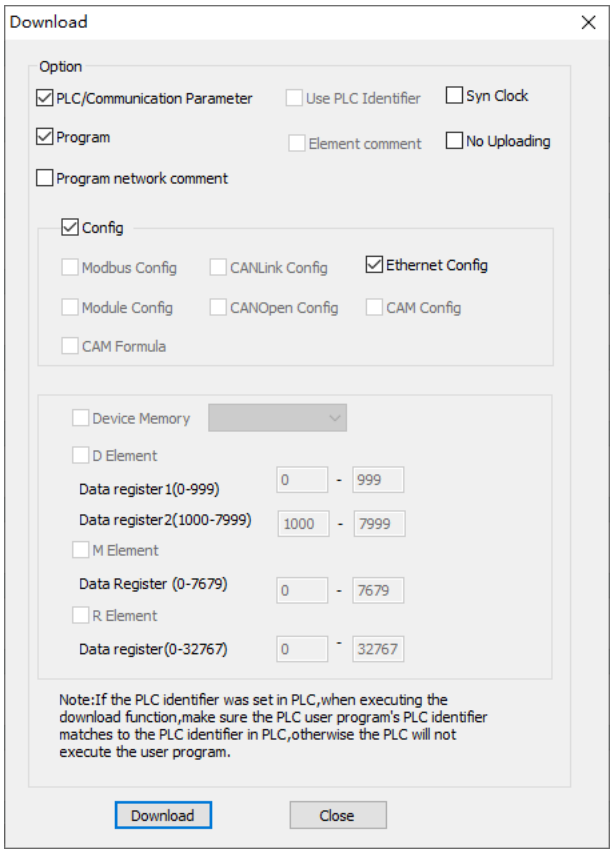
1. Right-click "Ethernet" and select "AddEthernet Config". In the "ModbusTcp Config" dialog box, configure slave request data.



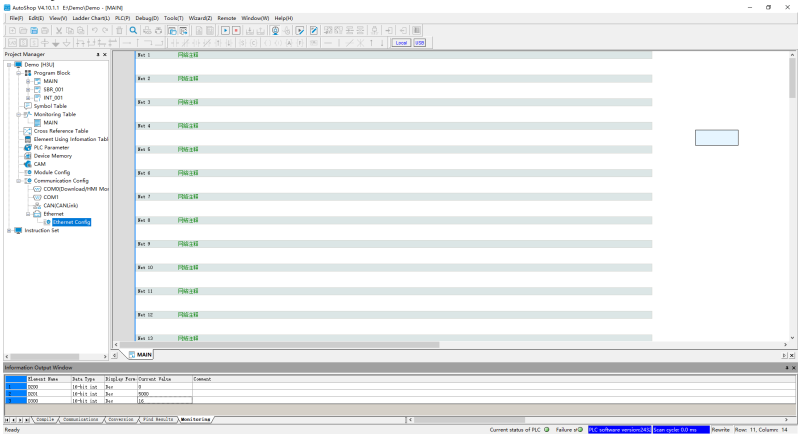
2. Configure request data. Set "Slave IP" to "192.16.1.10", and set "Trigger mode" to "Cycle". To perform start/stop control and set frequency/torque through Modbus TCP communication, write operations must be performed on specific communication addresses of the drive. For start/stop control and frequency or torque setting, write requests of 7311H and 7310H need to be configured. To obtain the drive status, configure a read request for 7044H.



3. In the AutoShop software, select "PLC" and click "Download".



4. Click the monitoring icon. In the information output tab, set the values of control instructions. That is, correspond registers D200, D201, and D300 to address of parameters 7311H, 7310H, and 7044H, respectively. Set the values as shown below and observe the feedback value of D300.



7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Communication address		Description
Control word 2 set through communication	7311H	The setpoint of 7311H is in decimal. References corresponding to different values are shown below. 0: Stop mode set by F2-17 (Stop mode) 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop mode set by F2-17 (Stop mode) 7: Fault reset 8: Emergency stop

For example, writing 1 to 7311H activates forward run. Writing 0 to 7311H stops the drive as defined by F2-17 (OFF1 stop mode).

The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows:

Communication address		Description
Speed reference 2 set through communication	7310H	The target frequency can be set through this address through communication. The write parameter attribute for this address is switched by n0-14 (7310H reference selection). The value range of n0-14 is as follows: 0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)

In default settings, when n0-14 is set to 1, writing 1000 to 7310H can set the main frequency to 10.00 Hz. Writing -1000 to 7310H can set the main frequency to -10.00 Hz.

Refer to the table below for corresponding feedback status.

Communication address		Description
Drive state 2	7044H	The status value of 7044H is hexadecimal. The drive states corresponding to bit values are as follows. bit0: Operation status 0: Stop 1: Run bit1: Running direction 0: Forward run 1: Reverse run bit2: Faulty state 0: No fault 1: Fault present bit3: Frequency reached 0: Not reached 1: Reached bit4: Reserved bit5 to bit7: Reserved bit8 to bit15: Fault code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	Default: 2 decimal places, signed number, in units of Hz. The decimal places are switchable.

6.8 EtherCAT Drive Control

6.8.1 Introduction

EtherCAT communication is a real-time industrial fieldbus communication protocol based on Ethernet, which features high performance, flexible topology, low cost, high precision, and simple application.

6.8.2 Communication Specifications

Table 6–7 EtherCAT protocol

Item	Content
Communication protocol	EtherCAT protocol
Services available	CoE (CANopenover EtherCAT)
Network establishment time (Link)	Within 2s
Synchronization mode	DC (minimum sync time 500 us) - default mode SM FreeRun
Physical layer	100BASE-TX
Duplex mode	Full duplex
Topology	Ring, linear, star, and tree types
Transmission rate	100 Mbps (100Base-TX)
Transmission medium	Shielded cables of Cat 5e or higher
Transmission distance	Shorter than 100 m between two nodes (with proper environment and cables)

Item	Content
Communication Ports	Not supported
Communication type	Based on Ethernet protocol
EtherCAT frame length	44 bytes to 1498 bytes
Cyclical process data	Maximum of 16 PDOs per direction, each not exceeding 32 bytes in length
Acyclical mailbox data	Supports: SDO request SDO response
Min. synchronization cycle	500 us
Maximum cable length	100 m
Maximum number of connected slaves	65535
Number of request messages that can be received at the same time	Not supported

6.8.3 Communication System Connection

Linear networking topology

In a linear network topology, data frames transmitted by the master propagate serially through all slaves connected in the system before returning to the master. The message undergoes on-the-fly processing at each node without requiring full Ethernet packet decoding, directly inserting or reading process data at corresponding positions, achieving end-to-end latency at nanosecond levels. Data transmission is shown in the following figure.

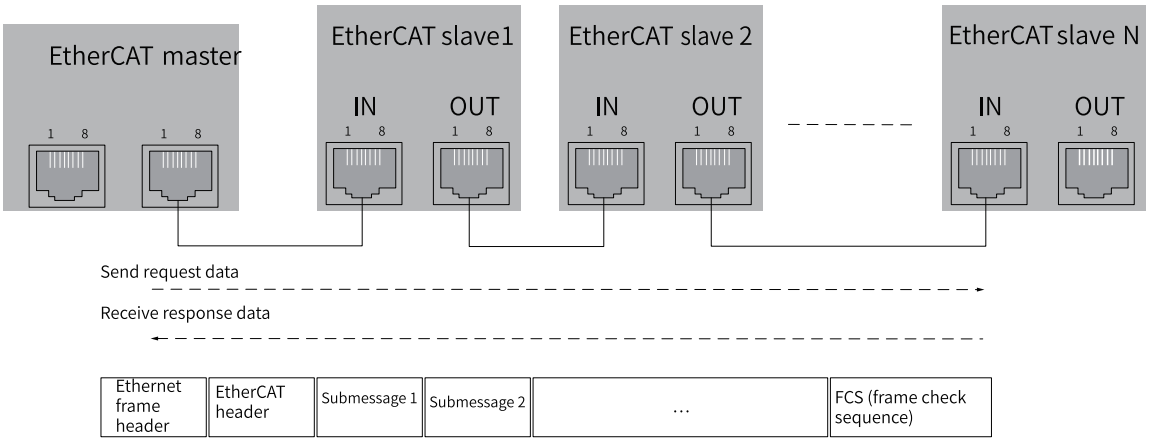


Figure 6-10 Data transmission diagram

Ring networking topology

The ring topology is a derivative of the linear topology, differing from the linear topology in that the cable from the last device is routed back to the redundant network port on the master. This topology inherits the advantages of the bus topology, and a single node fault within the topology does not affect the entire topology.

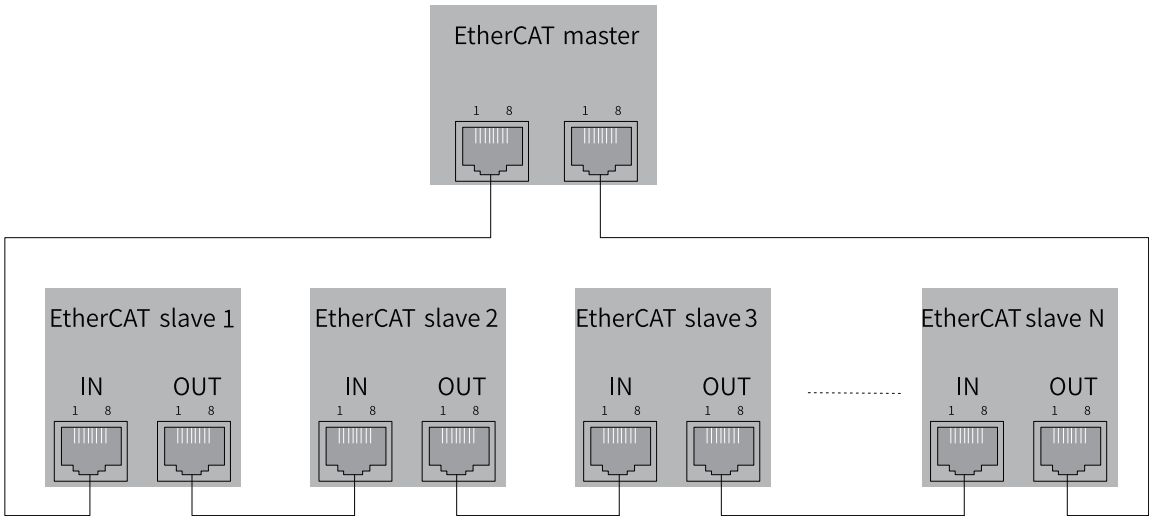


Figure 6-11 Ring networking topology

Star networking topology

In star topology, the cable is first routed out from the master to the junction, and then connected to each device through the junction.

Compared to bus topology, star topology requires an additional junction. A single device failure does not affect communication of other devices, but if the junction fails, communication for all devices is affected.

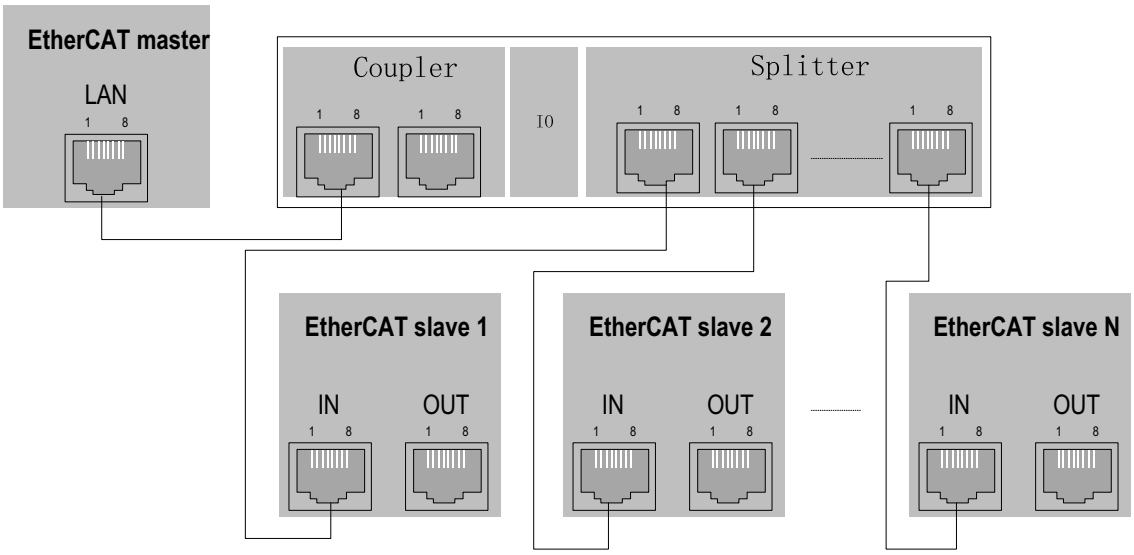


Figure 6-12 Star networking topology

Tree networking topology

The tree topology combines the star and bus topologies, allowing more flexible on-site layout, but also inherits the disadvantages of both topologies. When a junction in the tree topology fails, all devices connected to that junction cannot communicate normally.

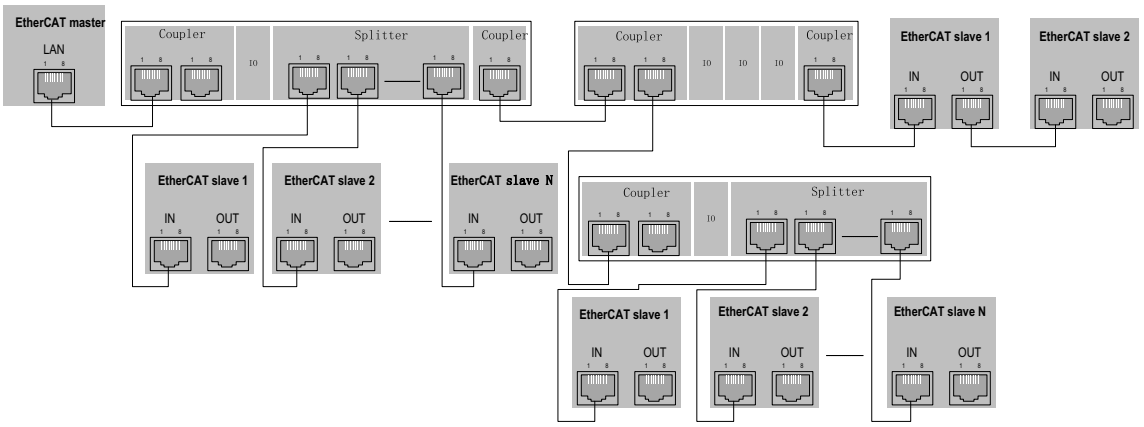


Figure 6-13 Tree networking topology

6.8.4 Message

6.8.4.1 Message Structure

EtherCAT data is transmitted in the form of Ethernet frames, using frame type 0x88A4. EtherCAT data includes a 2-byte data header and 44 to 1498 bytes of data. The data area consists of one or more EtherCAT sub-messages, as shown in the following figure. Each sub-message corresponds to an independent device or slave storage area.

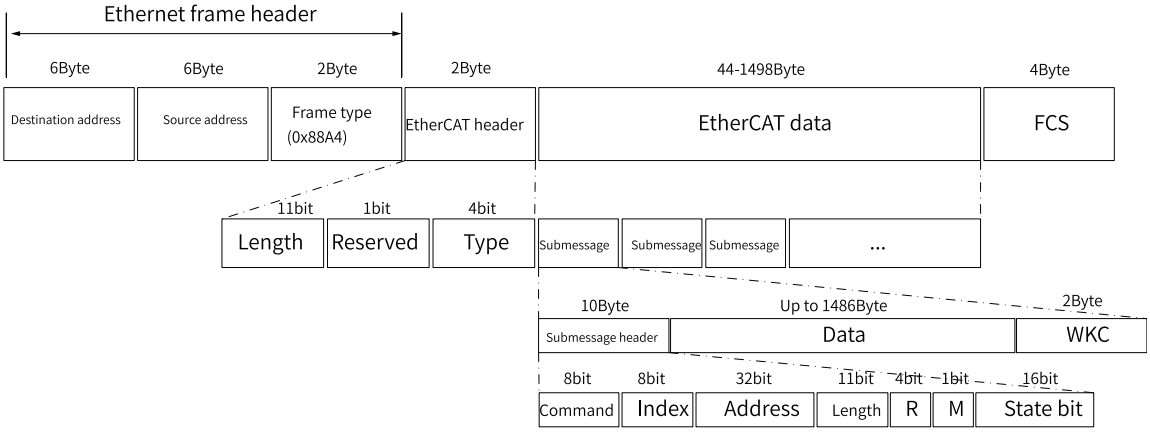


Figure 6-14 Structure of EtherCAT message

Table 6–8 Definition of EtherCAT data frame structure

Name		Definition
Destination address		Destination MAC address
Source address		Source MAC address
Frame type		0x88A4
EtherCAT header	Length	Length of the EtherCAT data area, namely the sum of all sub-message lengths.
	Type	The value 1 indicates communication with a slave. Other data is reserved.

Name		Definition
EtherCAT data	Sub-message	Composed of sub-messages, each EtherCAT sub-message includes a sub-message header, data field, and a corresponding working counter (WKC, Working Counter). The sub-message header contains key information such as command, index, address area, length, and status. Data: User-defined data information WKC: Counts the number of times sub-telegrams are processed by the slave.
FCS		FCS (Frame check sequence)

The structure definition of EtherCAT sub-messages is shown in the following table.

Table 6–9 Structure definition of EtherCAT sub-messages

Name	Definition
Command	Addressing mode and read/write mode
Index	Frame encoding
Address area	Slave address
Length	Message data area length
R	Reserved bits
M	Subsequent message flag
Status bit	Interrupt arrival flag [Note 1]
Data area	Sub-message data structure (user-defined)
WKC	Working counter

Note 1:

In EtherCAT, after a slave completes a cycle of process data exchange, it sends an interrupt character to notify the master. This interrupt character contains important information, such as error flags and the slave status.

In the implementation of an EtherCAT master, there is usually an ISR (Interrupt Service Routine) to handle this interrupt. When the hardware detects an interrupt signal (for example, through the MII or MAC interrupt pin of the EtherCAT slave), the interrupt service routine is triggered. In the ISR, relevant hardware status registers are read, the interrupt character is parsed, and corresponding logic is processed based on the content of the interrupt character.

6.8.4.2 Process Data Interconnection

The master achieves real-time read/write of the drive data and cyclic data exchange through the data in PDO area. The data communication addresses are directly configured by the drive. The following content is included:

- Communication reference control word and communication reference frequency of the drive
- Current operating status and operating frequency of the drive
- Real-time exchange of function parameters and monitoring parameters between the drive and EtherCAT master

The PDO is used for cyclic data exchange between the master and drive, as described in the following table.

Table 6–10 PDO exchange data

PDO (0x1600) sent by the master		
Fixed RPDO		Variable RPDO
Communication reference control word (0x2073:12)	Communication reference frequency (0x2073:11)	Real-time change of function parameters
RPDO1	RPDO2	RPDO3 to RPDO16
PDO (0x1A00) responded by the drive		
Fixed TPDO		Variable TPDO
Operation state (0x2070:45)	Operating frequency (0x2070:46)	Real-time reading of function parameters
TPDO1	TPDO2	TPDO3 to TPDO16

Caution

Fixed PDOs are not recommended to change. The fixed PDO meets the basic operating requirements of the AC drive. Otherwise, the device cannot operate normally.

6.8.4.3 Message Instances

6.8.4.3.1 Cyclic Process Data Communication

Cyclic process data communication typically uses FMMU for logical addressing, allowing the master to simultaneously operate on multiple slaves using logical read, write, or exchange commands. In process data communication, process data can include multiple PDO mapping objects. The CoE protocol uses data objects 0x1C10:0x1C2F to define the list of PDO mapping objects for the corresponding SM channels. Taking the cyclic output data as an example, the output data uses SM2 channel, with PDO assignment defined by object data 0x1C12, and the message structure is shown in the following figure.

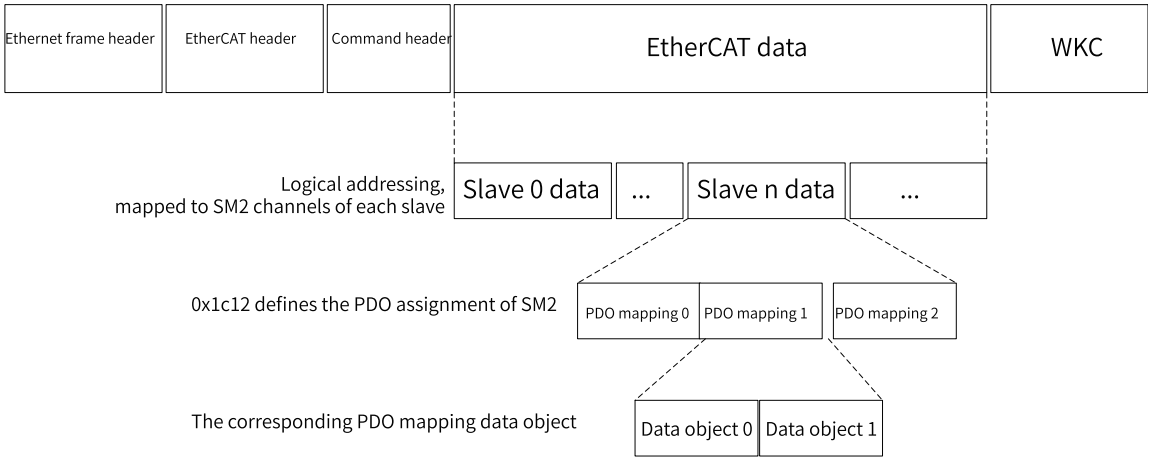


Figure 6-15 PDO data mapping assignment message structure

6.8.4.3.2 Acyclic Mailbox Data Communication

Acyclic mailbox data communication can be bidirectional, from master to slave or slave to master. Full-duplex operation, independent bidirectional communication, and multi-user protocol are supported. Communication between slaves is managed by the master as a router. The mailbox communication data header includes an address field, allowing the master to retransmit mailbox data. Mailbox data communication is the standard method for parameter exchange. Use mailbox data communication when configuring cyclic process data communication or when acyclic services are required.

The mailbox data message structure is shown in the following figure. Mailbox communication is assigned to a single slave, therefore the messages use device addressing mode. See the following table for definition of the mailbox data header structure.

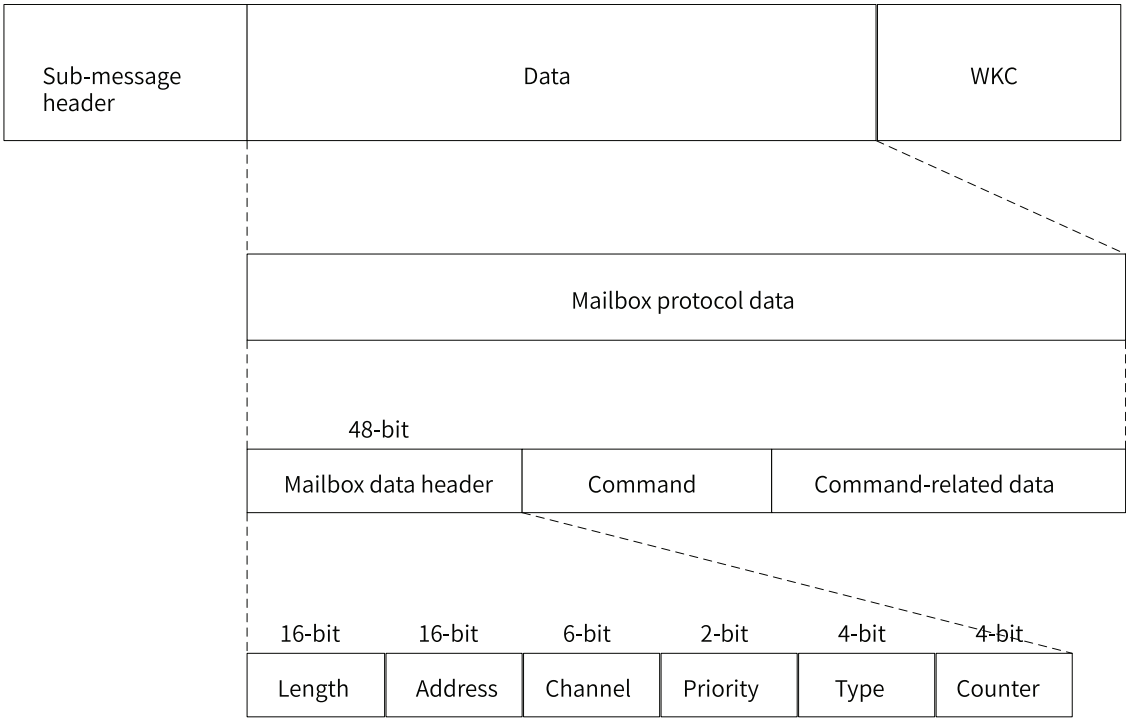


Figure 6-16 Mailbox data message structure

Table 6–11 Definition of mailbox data header structure

Name	Length (bit)	Definition
Length	16	Mailbox command data length
Address	16	When communicating from master to slave, this is the source slave address. When communicating from slave to slave, this is the destination slave address.
Channel	6	Reserved
Priority	2	Reserved

Name	Length (bit)	Definition
Type	4	Mailbox type, following the protocol identifier of the data: 0: Mailbox communication error; 2: EoE (Ethernet over EtherCAT) 3: CoE (CANopenover EtherCAT) 4: FoE (File Access over EtherCAT) 5: SoE (Servo Drive over EtherCAT) 15: VoE (Vendor specific profile over EtherCAT)
Counter	4	Sequence number used for duplicate detection; incremented by 1 for each new mailbox service

When a mailbox communication error occurs, the response data is defined as follows.

Data element	Length (bit)	Definition
Command	16	0x01 Mailbox command
Command-related data	16	0x01 Mailbox syntax error 0x02 Unsupported mailbox protocol 0x03 Invalid mailbox channel 0x04 Mailbox service not supported 0x05 Invalid mailbox header 0x06 Mailbox data too short 0x07 Insufficient mailbox service memory 0x08 Incorrect number of mailbox data entries

EtherCAT master uses the mailbox data SM channel for acyclic data communication. See the following table for mailbox data definition. The CoE protocol mailbox data structure is shown in the figure below.

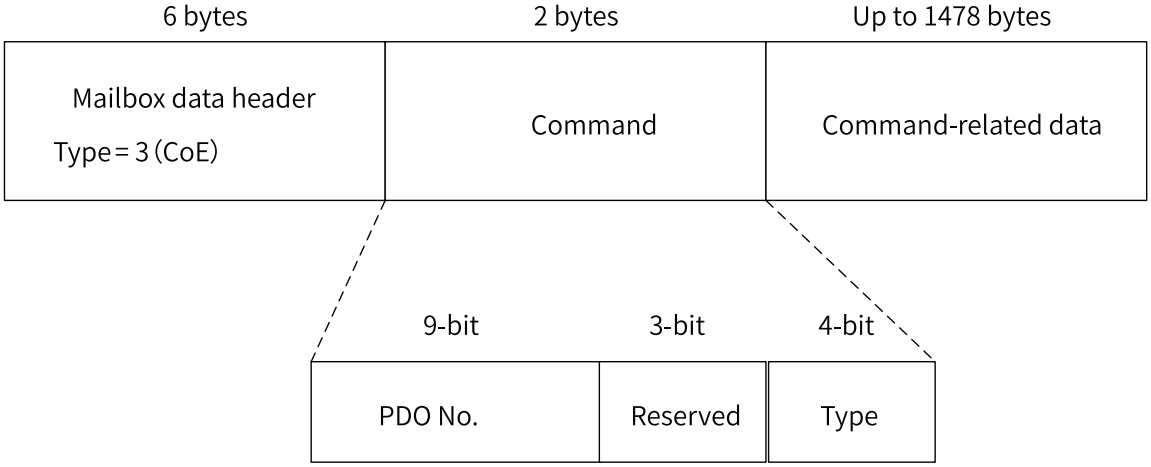


Figure 6-17 Acyclic data communication message structure through SM channel

Table 6–12 Mailbox data command definition

Field	Description
PDO number	Indicates the PDO sequence number used during PDO transmission.
Type	CoE service type 0: Reserved 1: Emergency event information 2: SDO request 3: SDO response 4: TxPDO 5: RxPDO 6: Remote TxPDO transmission request 7: Remote RxPDO transmission request 8: SDO information service 9 to 15: Reserved

CoE communication service types 2 and 3 are SDO (Service Data Object) communication services. The SDO data frame format is shown in the following figure. SDO communication service transmission types include three types: fast transmission, regular transmission, and segmented transmission.

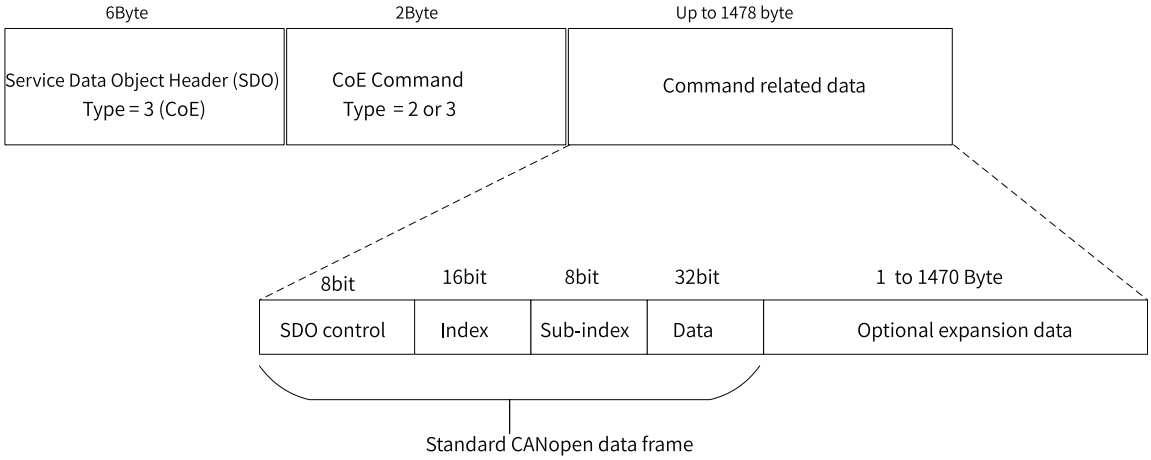


Figure 6-18 SDO data message structure

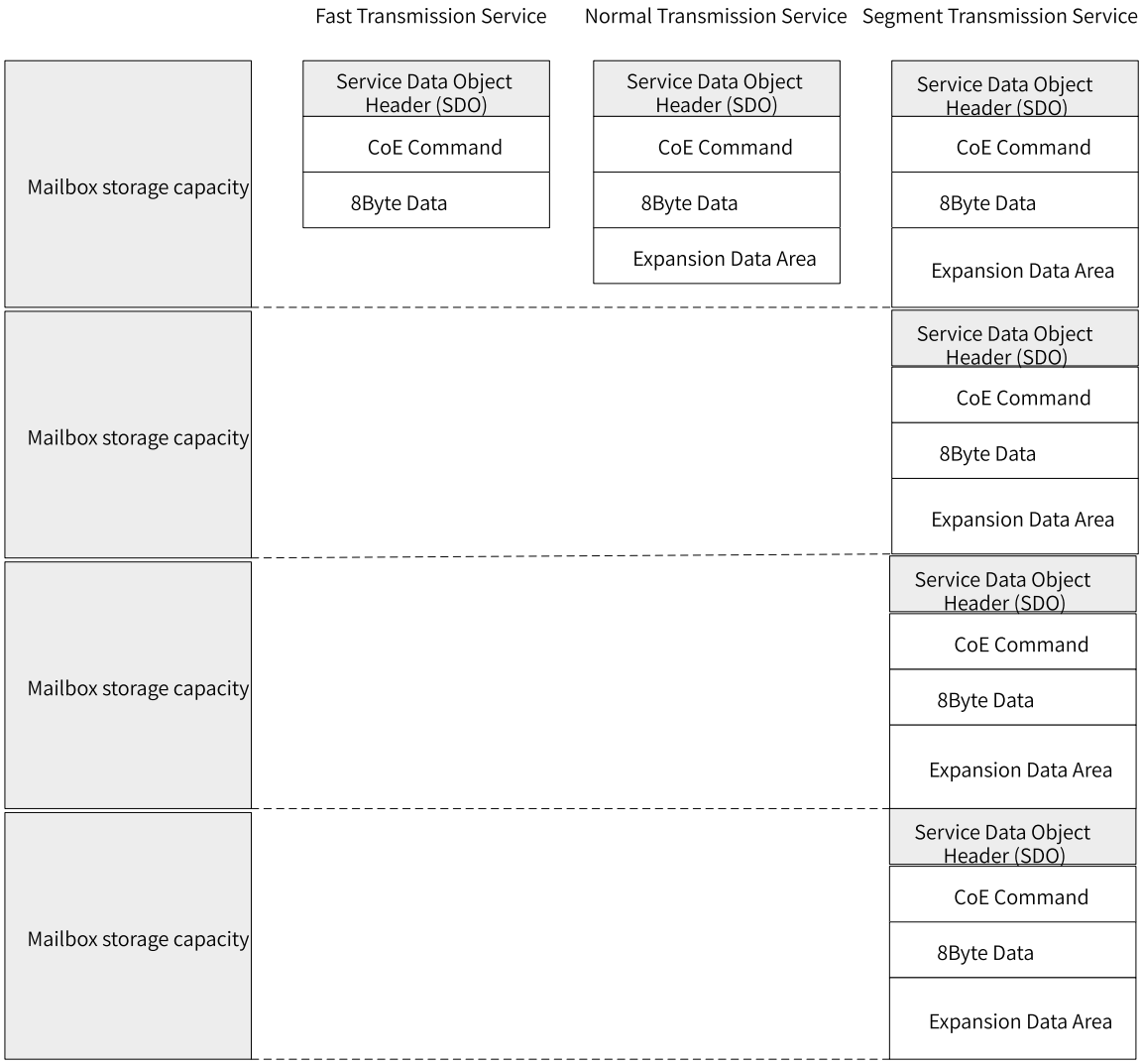


Figure 6-19 SDO communication service transmission type

6.8.4.4 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 908*.

6.8.4.5 Mapping Table (AC Drive Data)

For details, see *"6.5.3 Mapping Table" on page 910*.

Mapping relationship between the mapping table and the EtherCAT protocol object dictionary:

For the object dictionary in the EtherCAT protocol, address offset is performed based on this mapping table, with the EtherCAT object dictionary address being 0x2000.

The 8 high-order bits of each address in the mapping table are converted into the 8 low-order bits of the object dictionary index. The 8 low-order bits of each address in the mapping table are incremented by 1 and then converted into the object dictionary sub-index.

Example:

The address 0x7001 in the mapping table corresponds to 0x2070:02 in the EtherCAT object dictionary.

Calculation method: (0x2000 + 0x0070):(0x0001 + 0x0001)

6.8.4.6 Communication Ports

The EtherCAT bus adopts standard RJ45 network port and standard RJ45 connector. Use Cat 5e shielded twisted pairs and injection cables with iron housing. As verified by FastEthernet technology, when the EtherCAT bus is used, the cable between equipment shall not exceed 100 m. Failure to comply may result in signal attenuation, affecting normal communication.

The bus version of this product supports the EtherCAT protocol. Communication is performed through J9 (labeled IN) and J5 (labeled OUT). When facing the two RJ45 terminals of the drive, the left one is IN port and the right one is OUT port.

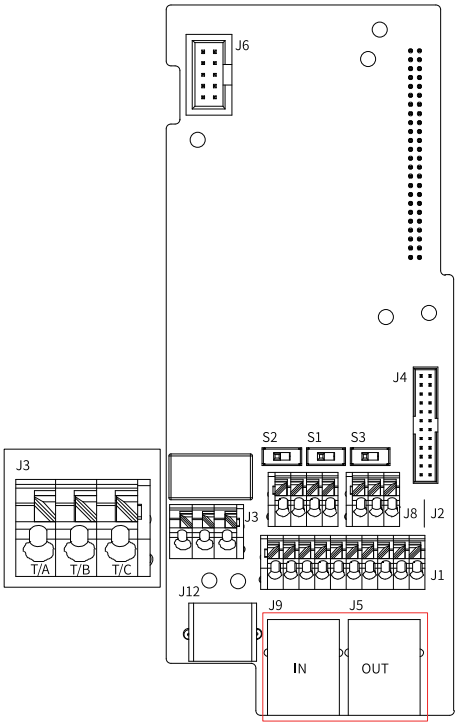


Figure 6-20 Description of EtherNet/IP communication ports

Description of EtherCAT communication ports:

External terminal	Type	Type of information transmitted	Mark	Name	Function
J9	RJ45 port	100 M bus	IN	100 M bus cascading port	Supports three communication protocols: ECAT/EIP/PN. Select the protocol type through n0-10. When ECAT is selected, it is the IN port. EIP/PN is direction-insensitive.
J5	RJ45 port	100 M bus	OUT	100 M bus cascading port	Supports three communication protocols: ECAT/EIP/PN. Select the protocol type through n0-10. When ECAT is selected, it is the OUT port. EIP/PN is direction-insensitive.

Indicator status for the network port:

Name	State	Description
LED0 (Green)	OFF	No connection established between devices
	Steady on	Connection established between devices
	Flashing	Data exchange between devices
LED1 (Yellow)	OFF	No connection established between devices
	Steady on	Connection established between devices

6.8.4.7 Connecting the Drive to Bus System

The EtherCAT bus uses standard RJ45 network ports with standard registered jacks, as well as 100BASETX Category 5 cables, allowing a maximum cable length of 100 meters between two devices and supporting up to 65535 stations.

Steps for connecting to PC:

1. Turn off the system power supply of the AC drive.
2. Connect the EtherCAT master and EtherCAT slave with shielded network cables.
   See communication network topology in *"6.8.3 Communication System Connection" on page 946* and connect the network cable to the metal shielded network port, with separate input (IN) and output (OUT) ports, as shown in the following figure. For communication port specifications, see *"6.8.4.6 Communication Ports" on page 955*.

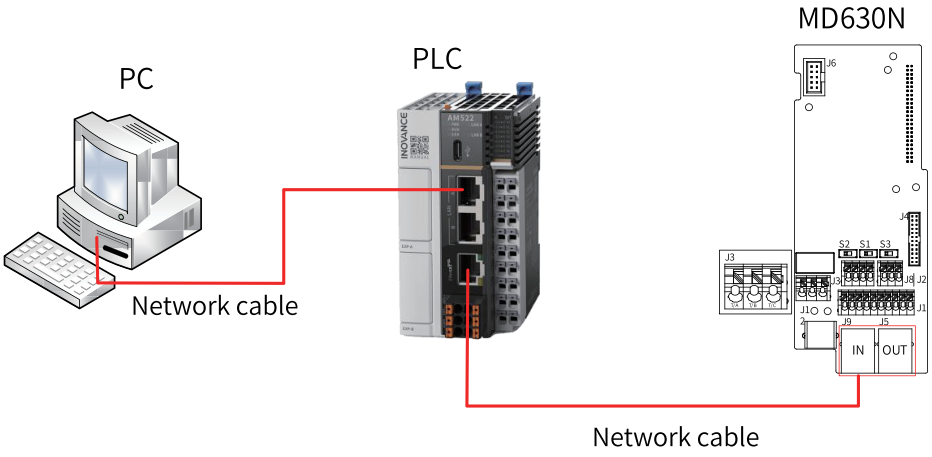


Figure 6-21 EtherCAT communication connection

It is recommended to use shielded cables for network data transmission. The following table lists the recommended specifications of network cables.

Item	Specification
Cable type	Flexible crossover cable, S-FTP, Cat 5e
Standards compliance	EIA/TIA568A, EN50173, ISO/IEC11801, EIA/TI Abulletin TSB, and EIA/TIA SB40-A&TSB36
Cross-sectional area	26AWG
Conductor type	Twisted pair
Number of pairs	4

3. Power on the AC drive after ensuring that connections are correct.

6.8.4.8 Configuring Communication between the Drive and Controller

The MD630N drive, as an EtherCAT slave, supports communication with standard EtherCAT master, such as Inovance, Beckhoff, and Omron controllers. If the controller used is not supported by the drive, contact Inovance technical support.

Procedure

1. Perform wiring according to *"6.8.6 Connecting the Drive To Bus System" on page 980*.
2. Switch the device communication mode to EtherCAT (n0-10 = 1), set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference source of setting channel 1 (b0-03 = 0 and b5-00 = 9). (This operation can be performed through the operating panel or software tool.)
3. Wait for a few seconds until LED0 flashes green and LED1 turns yellow (steady). This indicates that the connection between slave and master is established successfully, and data exchange is available.
4. Configure communication between the master (controller) and slave (drive) as shown in *" " on page* .

6.8.4.9 Communication Parameters

The parameter group n4 defines parameters related to EtherCAT communication.

Table 6–13 Parameter settings for EtherCAT communication

Param.	Name	Default	Value range	Change Method	Description
n0-09	Active communication mode	0	-	Not modifiable	Displays the active communication mode.
n0-10	Communication type	1 [EtherCAT]	1 to 3	Change at stop	Defines the communication type. Value description: 1: EtherCAT - Set to 1 for EtherCAT communication; 2: EtherNet/IP - Set to 2 for EtherNet/IP communication; 3: PROFINET - Set to 3 for PROFINET communication.
n4-16 (Fd-39)	Station name	0	0 to 65535	Unchangeable	Displays EtherCAT slave name.
n4-17 (Fd-40)	Station alias	0	0 to 65535	Real-time	Used to set EtherCAT slave alias. Additional information: 1. If n4-17 is set to 0, the slave alias is configured by the master. 2. If n4-17 is not set to 0, if the master does not set the slave alias, the slave alias is set by n4-17. If the master sets the slave alias, the slave alias is set by the master.
n4-18	Station alias backup	0	0 to 65535	Unchangeable	Displays EtherCAT slave alias backup.
n4-33	XML file version No.	0	0 to 65535	Unchangeable	Displays the XML file version.
n4-34	Device synchronization mode	0	0 to 65535	Unchangeable	Displays the synchronization mode of MD630.
n4-35	Synchronization cycle	0	0 to 65535	Unchangeable	Displays the synchronization cycle of MD630.

6.8.4.10 Communication Fault Diagnosis

When communication is faulty, the operating panel of the MD630N displays the corresponding fault code. The following table describes EtherCAT-related communication faults and solutions.

Table 6–14 Diagnosis on EtherCAT communication faults

Fault code	Fault name	Cause	Verification method	Solution
E167.1	EtherCAT Sync loss	The slave hardware (for example, the ESC register) causes the synchronization signal to be lost and the drive runs improperly.	Observe whether the indicator (difference between SYNC and IRQ phases) is larger than the synchronization cycle set by the master through the continuous oscilloscope function of Inovance software, If yes, it indicates an error.	Replace the drive or contact technical support.
E167.2	EtherCAT link loss	The physical connection of the data link is unstable or the process data is lost due to plug-in/plug-out of the network cable.	When the device is not powered on again, view the value of the link loss register through the software tool of the master. If it is not zero or the value increases continuously, the process data is lost.	Check whether the network cable of the drive is connected reliably. Check whether the network cable is loose due to strong vibration in the field. Ensure that the network cable is connected securely.
E167.3	EtherCAT read-only memory loading error	The information saved in EEPROM is incorrect.	The version number defined by n4-33 is not 0, but E167.3 is still reported.	Program the XML file again.
		The XML file is not programmed in the flash.	The version number (n4-33) is 655.35.	Program the XML file again.
E167.4	EtherCAT initialization error	Hardware fault (such as ESC chip fault)	EtherCAT cannot communicate properly. The master cannot scan and identify the slave device.	Replace the drive or contact technical support.
E167.5	ESC status switchover error	During the application layer state switchover, the register of ESC is forcibly modified due to errors of the master or manual operation.	A master status switchover error occurs.	The device stops due to fault, restart the device.
E167.6	Distributed clock not enabled in EtherCAT	The master is faulty or the operation on the master is improper.	Check whether the master is configured correctly or analyze whether the master is faulty by capturing the packet.	Configure the master properly or ask for technical support.
E167.7	Number or length of EtherCAT PDO mapping outside the limit	The master configuration information is incorrect.	Check whether the PDO is configured correctly.	Configure the number of mapped PDOs and bytes correctly. You can configure a maximum of 16 PDOs per group, and a maximum of 32 bytes per group of PDOs.

Fault code	Fault name	Cause	Verification method	Solution
E167.8	EtherCAT process data reception timeout	The data frame is lost at the upstream station and the upstream station is faulty.	If the master communication is not recovered, view the synchronous loss counter value (n4-30) of the drive. When a fault occurs, the value is not 0.	Check whether link loss occurs on the upstream station. Check that the wiring is correct.
		The performance of the master is poor, the jitter of the IRQ exceeds the set value x communication cycle.	Observe the SYNC and Irq phases through the online oscilloscope function in the software tool of the drive. When a fault occurs, the phase is greater than or equal to the synchronization loss threshold x communication cycle.	Check whether the CPU operation load of the master is too large. You can optimize load reduction of the master by reducing the communication time and setting a high synchronization loss threshold.
E167.9	EtherCAT ESC port 0 reception error	The data is lost due to EMC interference, poor quality of the network cable, or improper connection.	View the error counter values of port 0 and port 1 in the master software tool, or view the corresponding port parameter of the drive. The values of port 0 (n4-25) or port 1 (n4-26) is not 0.	Check whether proper grounding is performed and rectify EMC measures. Check whether the network cable used is provided by Inovance and whether the network cable is connected properly.
E168.1	EtherCAT ESC port transfer and EPU processing error	The data frame is corrupted due to an upstream station fault or a link fault.	Check whether values of the transfer error counter (n4-27) and the processing unit error counter (n4-28) changed through parameters.	If yes, the upstream station may be disturbed, the link layer may be faulty, and the hardware is faulty. Replace the upstream station or contact technical support if necessary.
E168.2	EtherCAT MailBox setting error protection	An incorrect XML file is imported to the master.	Check whether the master imports the correct XML file. The XML file must meet the following conditions: 1. The SM channel is enabled. 2. Check whether the read/write direction is configured correctly. 3. Check whether the mailbox mode applies (single buffer mode). 4. Check whether the length of the data received is within the set range. 5. Check whether the address of the data received is within the set range. 6. Check whether the memory of the read/write mailbox overlaps.	1. Re-import the XML file to the master software and restart the connection. 2. If the fault persists after the master is restarted, contact technical support to rectify the XML configuration.

Fault code	Fault name	Cause	Verification method	Solution
E168.3	EtherCAT SM2 setting error	An incorrect XML file is imported to the master.	Check whether the master imports the correct XML file. Check the following configuration. 1. Check whether the SM2 channel is configured incorrectly. The following conditions must be met. (1) The SM length and RxPDO length are not 0 when SM2 is not enabled. (2) SM2 channel is configured to the write mode. (3) The memory of SM2 overlaps with adjacent SM1 or SM3. 2. Check whether the index of the RxPDO mapping object dictionary is out of the limit (the maximum index is 0x0A). The following conditions must be met: (1) The length of the RxPDO is proper. (2) In the preop state, the address of RxPDO is in the set address field (maximum and minimum addresses), or not in a non-preop state. The address of SM2 is not equal to the starting address of RxPDO. (3) PDO mapping object dictionary index does not exceed the set maximum value (0x1600-0x170A).	1. Re-import the XML file to the master software and restart the connection. 2. If the fault persists after the master is restarted, contact technical support to rectify the XML configuration.
E168.4	EtherCAT SM3 setting error	An incorrect XML file is imported to the master.	Check whether the master imports the correct XML file. Check the following configuration. 1. Check whether the SM3 channel is configured incorrectly. The following conditions must be met. (1) The SM length and TxPDO length are 0 when SM3 is not enabled. (2) SM3 channel is configured to the read mode. (3) No overlap occurs among the memory of SM2, SM3, SM0, or SM1. 2. Check whether the index of the TxPDO mapping object dictionary is out of the limit (the maximum index is 0x1A). The following conditions must be met. (1) The length of the TxPDO is proper. (2) In the preop state, the address of TxPDO is in the set address field (maximum and minimum addresses), or not in a non-preop state. The address of SM3 is not equal to the starting address of TxPDO. (3) The index of the object dictionary mapped by PDO exceeds the maximum value (0x1A00-0x1B0A).	1. Re-import the XML file to the master software and restart the connection. 2. If the fault persists after the master is restarted, contact technical support to rectify the XML configuration.

Fault code	Fault name	Cause	Verification method	Solution
E168.5	PDO watchdog setting error	The master is configured incorrectly or the attempt to configure the master failed.	The value of ESC state register 0x0134 read through the master software tool is 0x001F.	Restart the master and check whether the fault disappears. Otherwise, contact technical support.
E168.6	No signc signal in EtherCAT	During the switchover process from SAFEOP to OP, DC is enabled but not operating due to the following reasons. 1. The DC startup time and DC activation time are set improperly. 2. There is no pulse signal input.	The value of ESC state register 0x0134 read through the master software tool is 0x002D.	Restart the master and check whether the fault disappears. Otherwise, contact technical support.
E168.7	EtherCAT Phy initialization configuration error	1. The ESC is not working properly before reading the phy ID. 2. The phy chip is damaged. 3. Data is subject to interference. 4. The configured model differs from the actual phy model.	Check the hardware to see whether the PHY integrated circuit is working properly.	Replace the AC drive and contact technical support,
E168.8	Abnormal pulse length of synchronous data signal configured in the EtherCAT read-only memory	1. EEPROM configuration data are written mistakenly by the master. 2. There is a difference between the XML file imported by the master and the information in the slave.	Check whether there is any difference between the XML file information saved in the slave (which can be read through the master software) and the XML file information imported to the master software.	Reset the ESI file by setting n4-41 to 1 or re-program the XML file. If the fault persists, contact technical support.

6.8.4.11 Communication Configuration Examples

6.8.4.11.1 Configuration for Communication Between MD630N and Inovance AC801

Prerequisite

Ensure that all equipment is correctly wired according to *"6.8.6 Connecting the Drive To Bus System" on page 980*.

Procedure

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish EtherCAT communication connection

1. Set the value of n0-10 to 1 (through operating panel or the software tool). Set the communication mode to EtherCAT.
2. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow . This indicates that the slave and master are connected successfully and there is data exchange.
3. Import the device description file (XML) of the MD630N to the host controller software (otherwise, the slave cannot be added later) and add the MD630N device.
4. Open the host controller software InoProShop and select “New Project” . Select the PLC model in the pop-up interface, and click "OK". Save the project to the specified path (path can be modified).

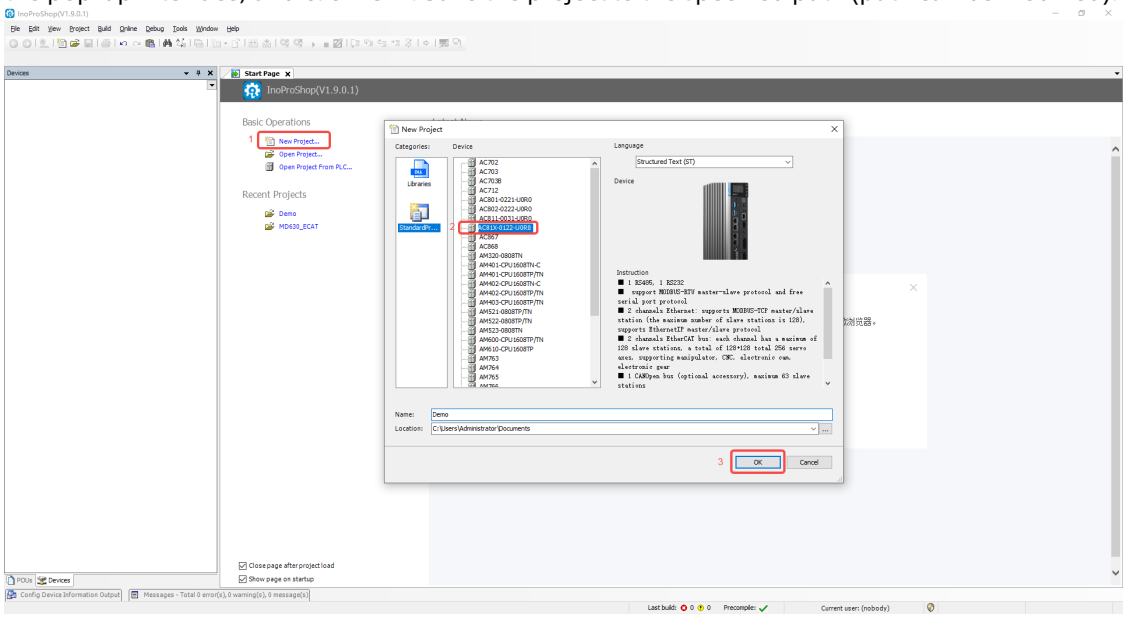


Figure 6-22 Create project

5. Import the device description file (XML) of the AC drive; otherwise, the AC drive cannot be identified.
   Click “Tools” -> “Device Repository” . Then after the pop-up interface appears, click Install.

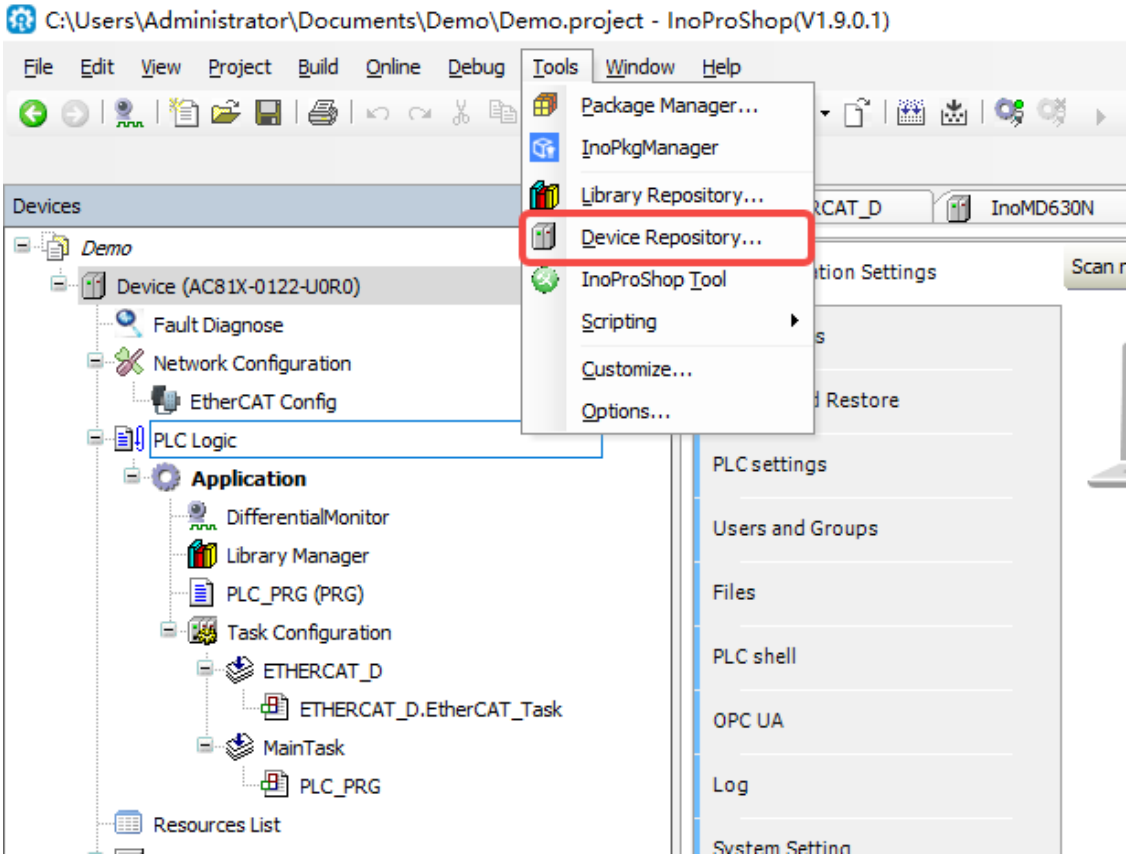


Figure 6-23 Add a device description file

6. After clicking Install, the “Install Device Description” interface appears. Select the file in "*.xml" format. Otherwise, the XML file of the device cannot be displayed. Click “Open” and wait for a few seconds. Then the installation is completed.

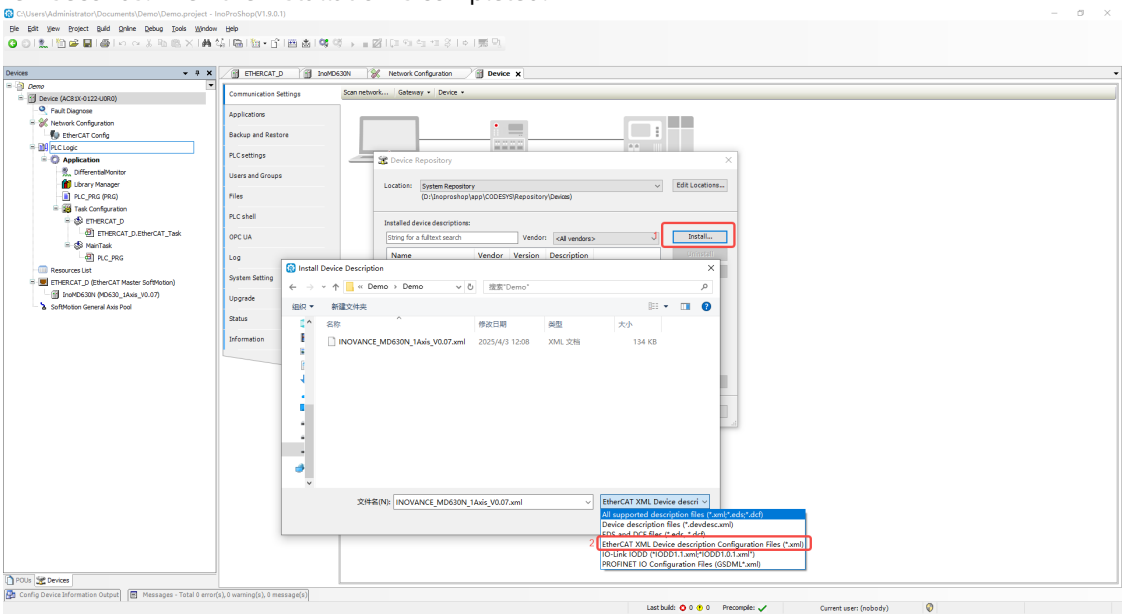


Figure 6-24 Install the device description file

7. After entering the interface, double-click “Device” and the blank area on the right displays detailed information. Then, click “Scan network” to pop up the “Select Device” window, and then scan the network to identify the PLC device.

Note

The IP address of the computer connected to the PLC should be set in the same segment as the PLC's IP which can be viewed through the panel.

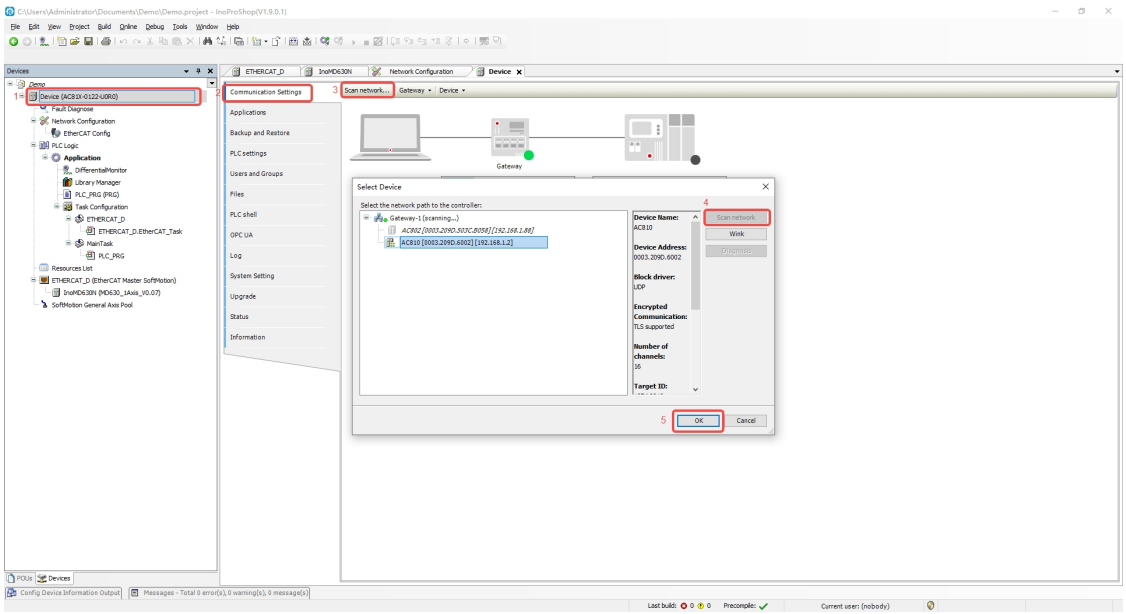


Figure 6-25 Scan and identify the master device

8. After identifying the correct PLC, click “Network Configuration” to select the supported communication interface. Check the “EtherCATMaster” box.

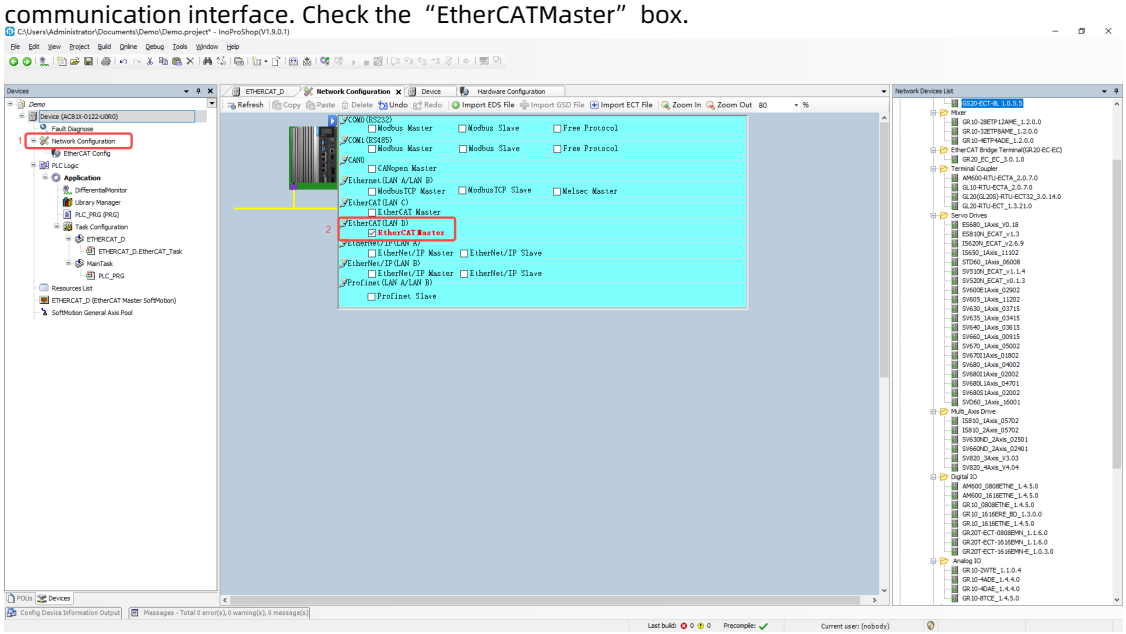


Figure 6-26 Configure master communication interface

9. Locate "ETHERCAT_D (EtherCAT Master SoftMotion)" in the device bar on the left. Right-click on the pop-up bar and select "Scan Device". The Scan Devices window will pop up. Click "Scan Device" below to scan the MD630N.
   Click “Copy Scan Device” to complete adding the AC drive.

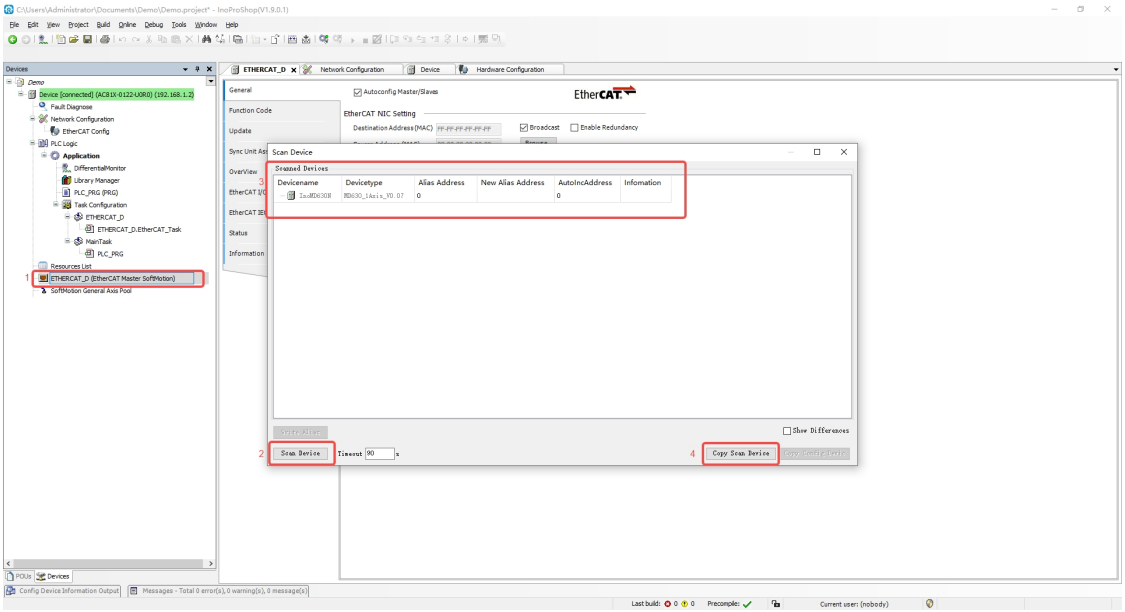
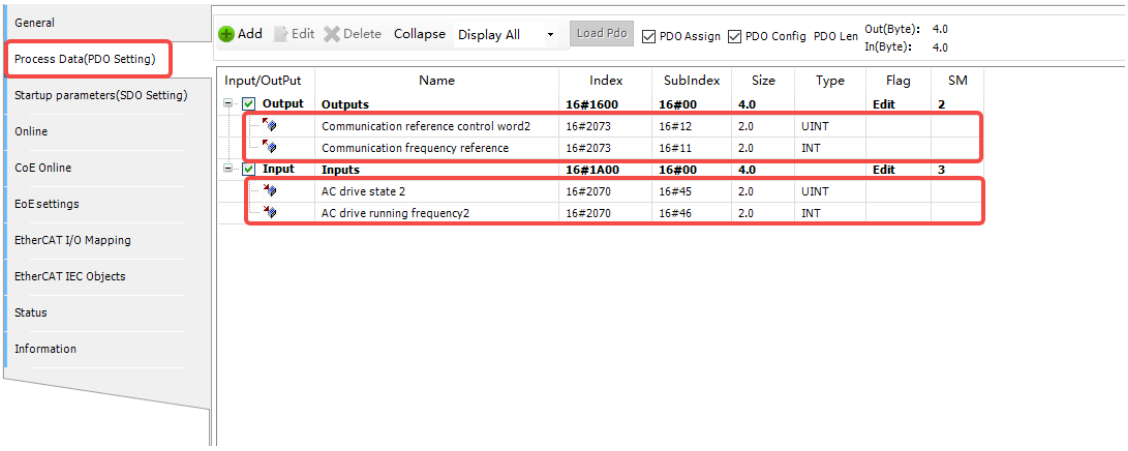


Figure 6-27 Scan the slave device

10. After adding the AC drive, the user can configure PDO on the slave device.
    The default fixed PDO mapping in the XML file meets basic motor control requirements. The following table lists the PDO interactive data description.

PDO (0x1600) Sent by the Master Station		
Fixed RPDO		Variable RPDO
Communication reference control word (0x2073:12)	Communication reference frequency (0x2073:11)	Real-Time Change of AC Drive Function Parameter
RPDO1	RPDO2	RPDO3~RPDO16
PDO Responded by AC Drive (0x1A00)		
Fixed TPDO		Variable TPDO
Operation state (0x2070:45)	Operating frequency (0x2070:46)	Real-Time Reading of AC Drive Function Parameter
TPDO1	TPDO2	TPDO3~TPDO16



11. Click “Compile”. Wait until the compilation is complete, and then click “Login” to wait for the program to be downloaded to the PLC.

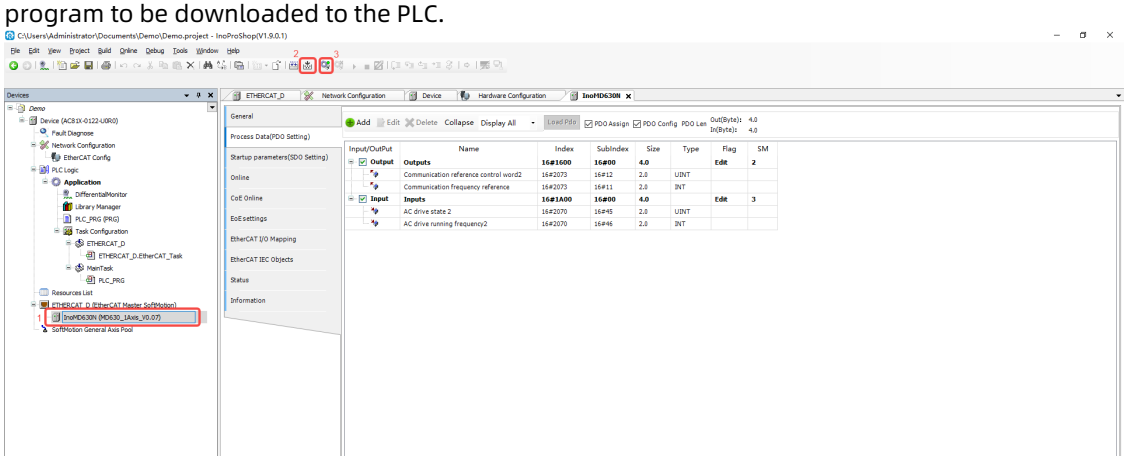


Figure 6-28 Login and download to PLC

12. After login and download are complete, click the start button. The green mark appears on the right side of the MD630N device in the left column to indicate that the device is started and communication is established properly. In this case, the user can monitor the I/O variables of the configuration mapping, as well as online COE and state machine operations.

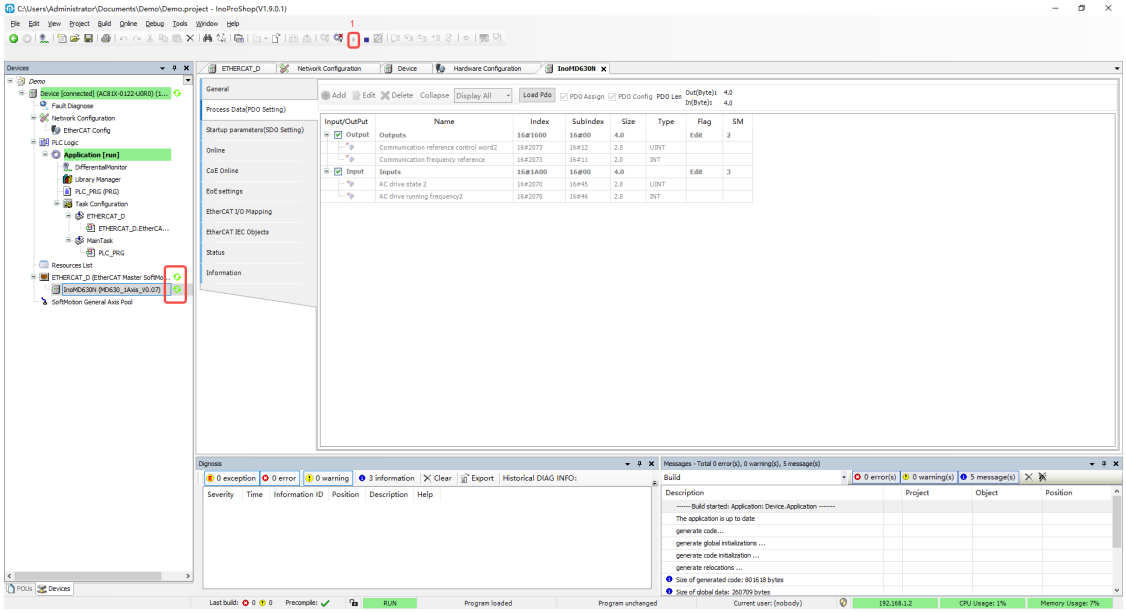
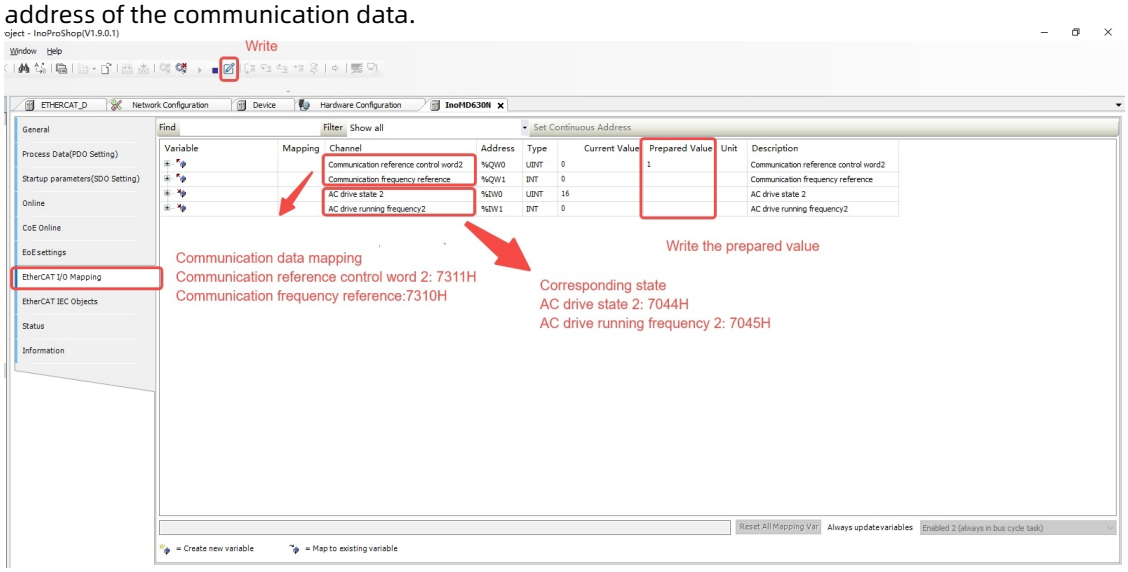


Figure 6-29 Establish communication successfully between the master and slave

Step 4: Control the AC drive through communication

1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.



2. For start/stop control and setting frequency or torque using EtherCAT communication, read and write specific communication addresses of the AC drive. In other words, the specific addresses are mapped to the PDO data of EtherCAT.
   For start/stop control and setting frequency or torque, 7311H and 7310H need to be need to be mapped to the PDO data.

   The 7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Comm. Address		Description
Communication reference control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run (IN1) 2: Reverse run (IN2) 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop mode set by F2-17 (Stop mode) 7: Reset upon fault 8: Emergency stop

   For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

   The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows.

Comm. Address		Description
Speed reference 2 set through communication	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0- 14 [7310H setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

In default settings, when n0-14 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write -1000 to set the main frequency to -10.00 Hz.

The corresponding state is as follows.

Comm. Address		Description
Drive state 2	7044H	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: bit00: Operation status. 0: Stopped; 1: Operating bit01: Operating direction. 0: Forward; 1: Reverse Bit 02: Faulty state. 0: No fault; 1: Faulty bit03: Frequency reached: 0: Not reached; 1: Reached bit04 to bit07: Reserved Bits 8-15: Fault master code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	2 decimal places, signed number, unit Hz by default. The decimal places is switchable.

6.8.4.11.2 Configuration for Communication Between MD630 and Beckhoff Controller

Prerequisite

Ensure that all equipment is correctly wired, see *"6.8.6 Connecting the Drive To Bus System" on page 980*.

Procedure

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.

0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish EtherCAT communication connection

1. Set the value of n0-10 to 1 (through operating panel or the software tool). Set the communication mode to EtherCAT.
2. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow . This indicates that the slave and master are connected successfully and there is data exchange.
3. Open the installation directory of TwinCAT and copy the XML file to the directory shown in the following figure.
   After installing the Beckhoff TwinCAT software on the PC, you need to import the device description XML file of the EtherCAT slave device. Otherwise, the slave device cannot be scanned.

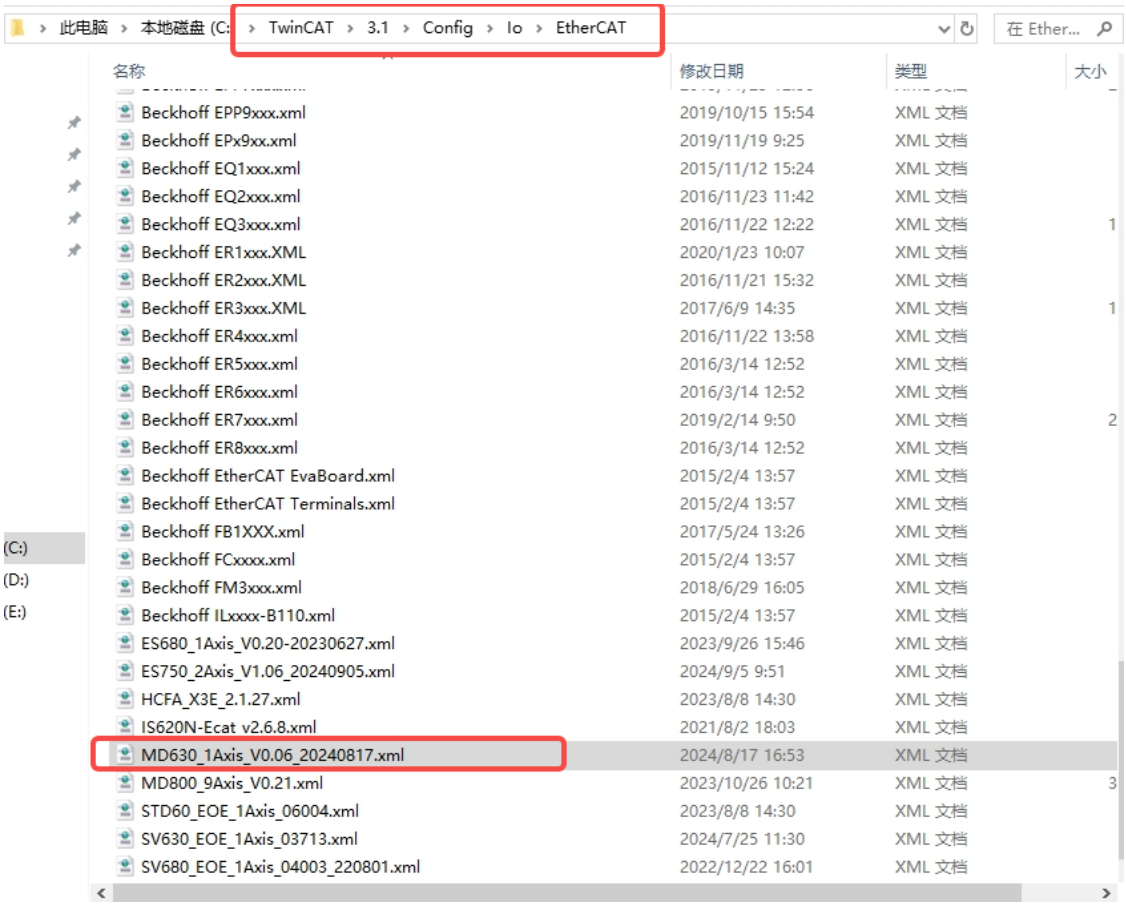


Figure 6-30 Add an XML file

4. Open TwinCAT XAE (TcXaeShell) to create a new project, as shown in the following figure.

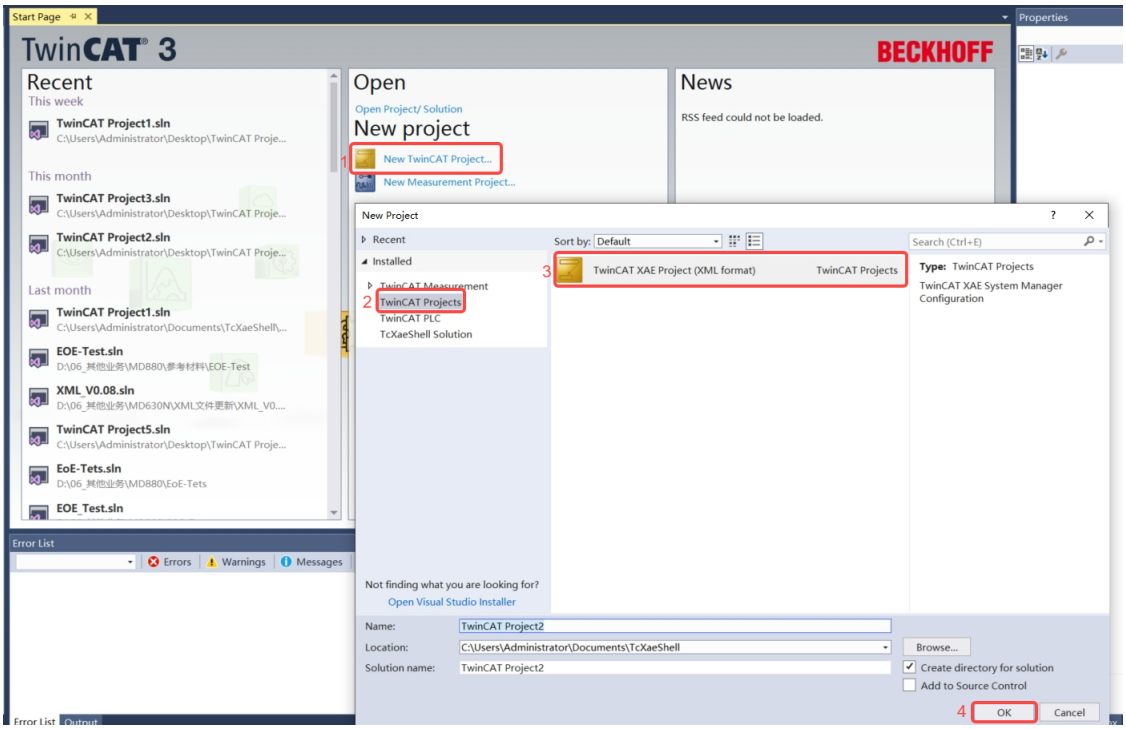


Figure 6-31 Create project

5. To scan and add a Beckhoff PLC controller, ensure that the IP address of the PC and PLC ports are in the same network segment. Open the Ethernet properties of the corresponding network port in the PC settings, and then set the IP address.

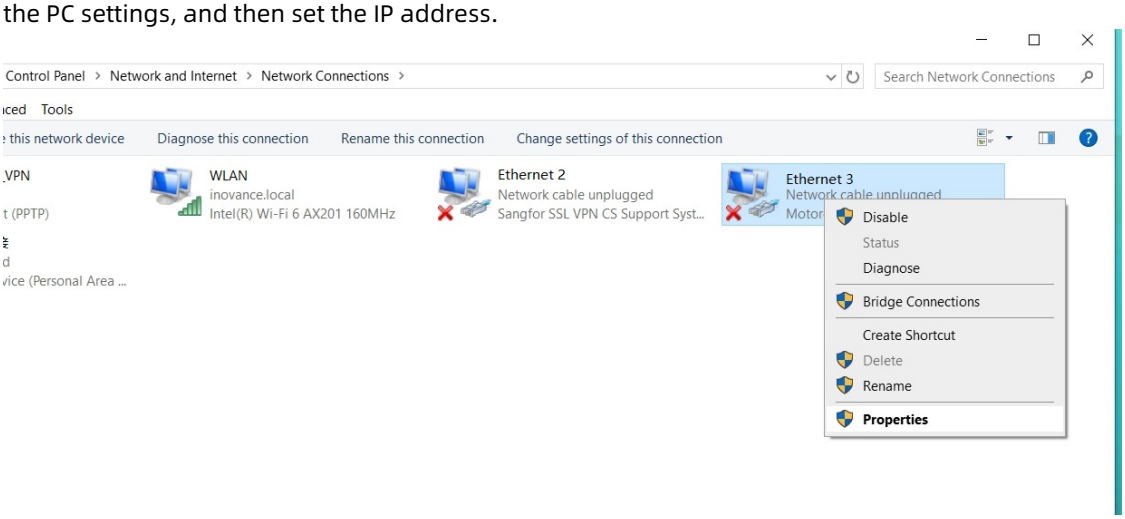


Figure 6-32 Open the Ethernet Properties setting

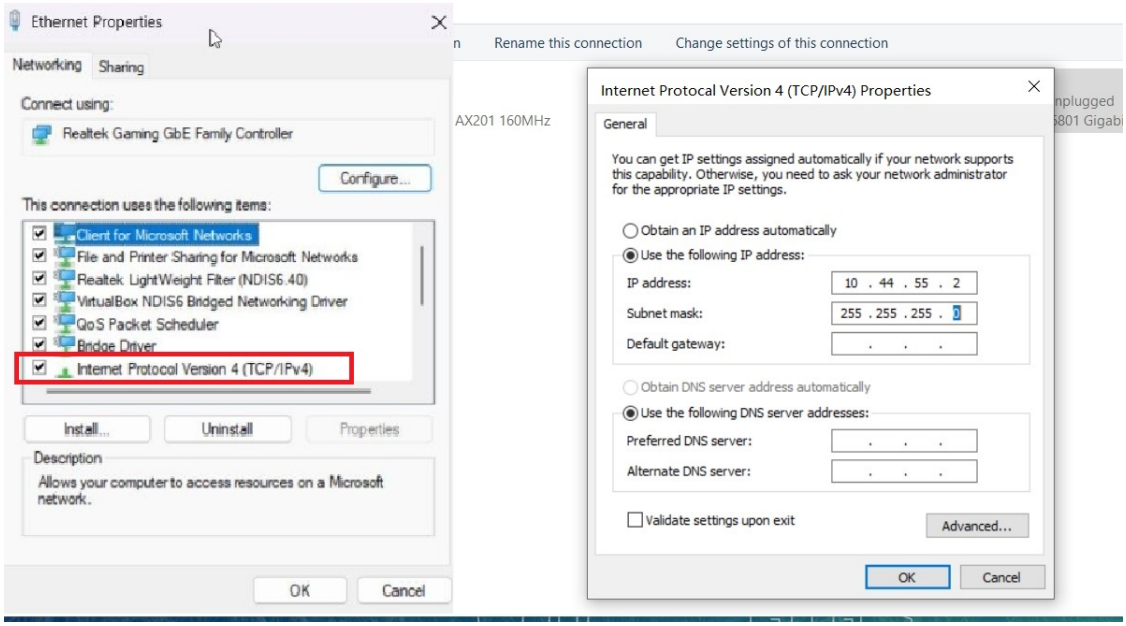


Figure 6-33 Setting IP

6. After the setting is done, scan the PLC controller in the form of network segment broadcast, and click the drop-down box in the field. If the PLC has been added before, it will be displayed in the drop-down bar and be used directly. If it is added the first time, you need to click “Choose Target System”.

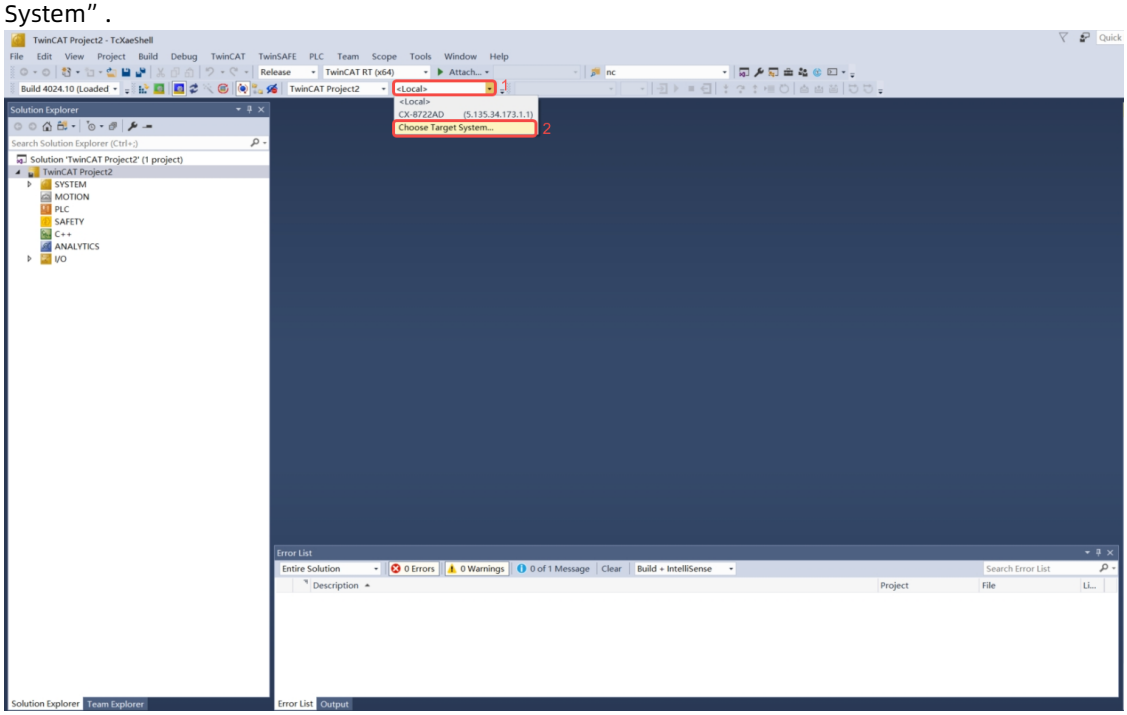


Figure 6-34 Select PLC device

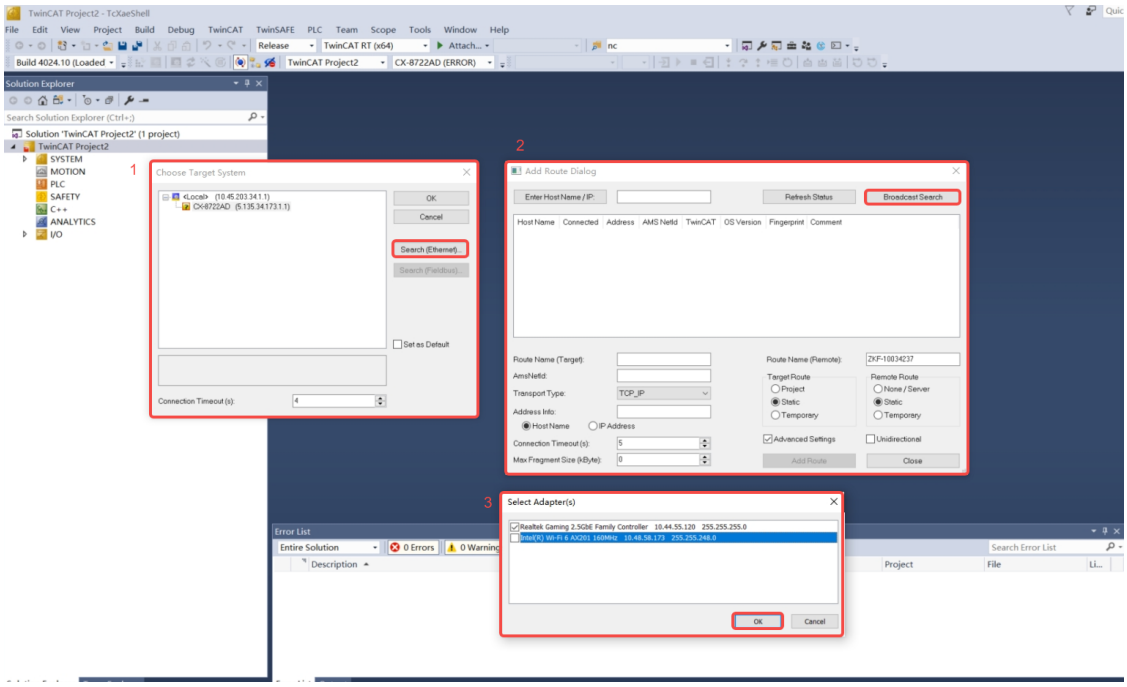


Figure 6-35 Scan PLC steps

After scanning the PLC, information about the PLC will be displayed. You need to enter a password for adding the PLC to the project. The default password is usually 1.

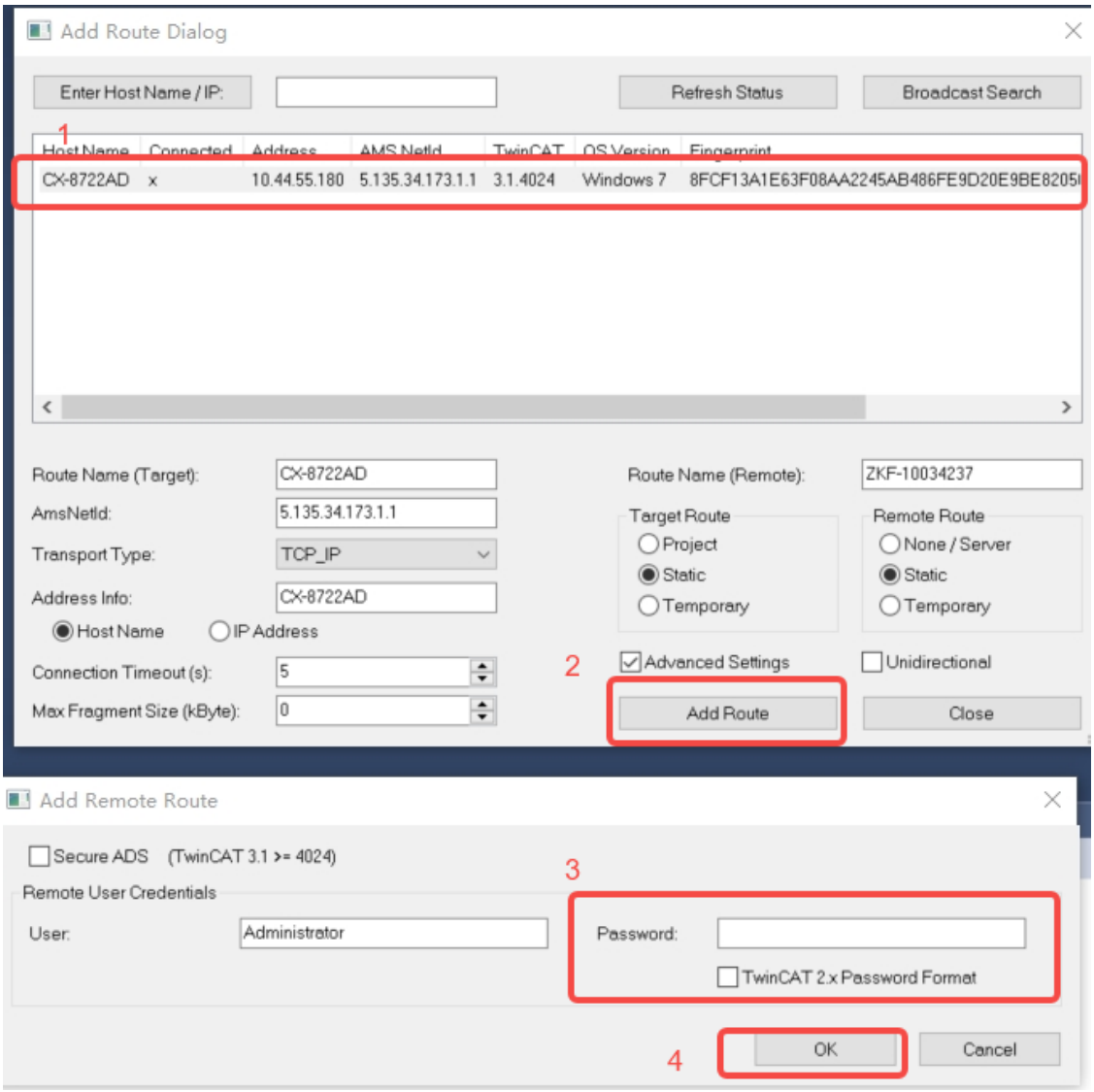


Figure 6-36 Add the scanned PLC device

7. After adding the PLC, scan to add the EtherCAT slave device. In the left column of the project, select “Devices” and right-click “Scan”. Select “Device 3” in the pop-up window and Click “OK”, and then click “Yes” in the pop-up window.

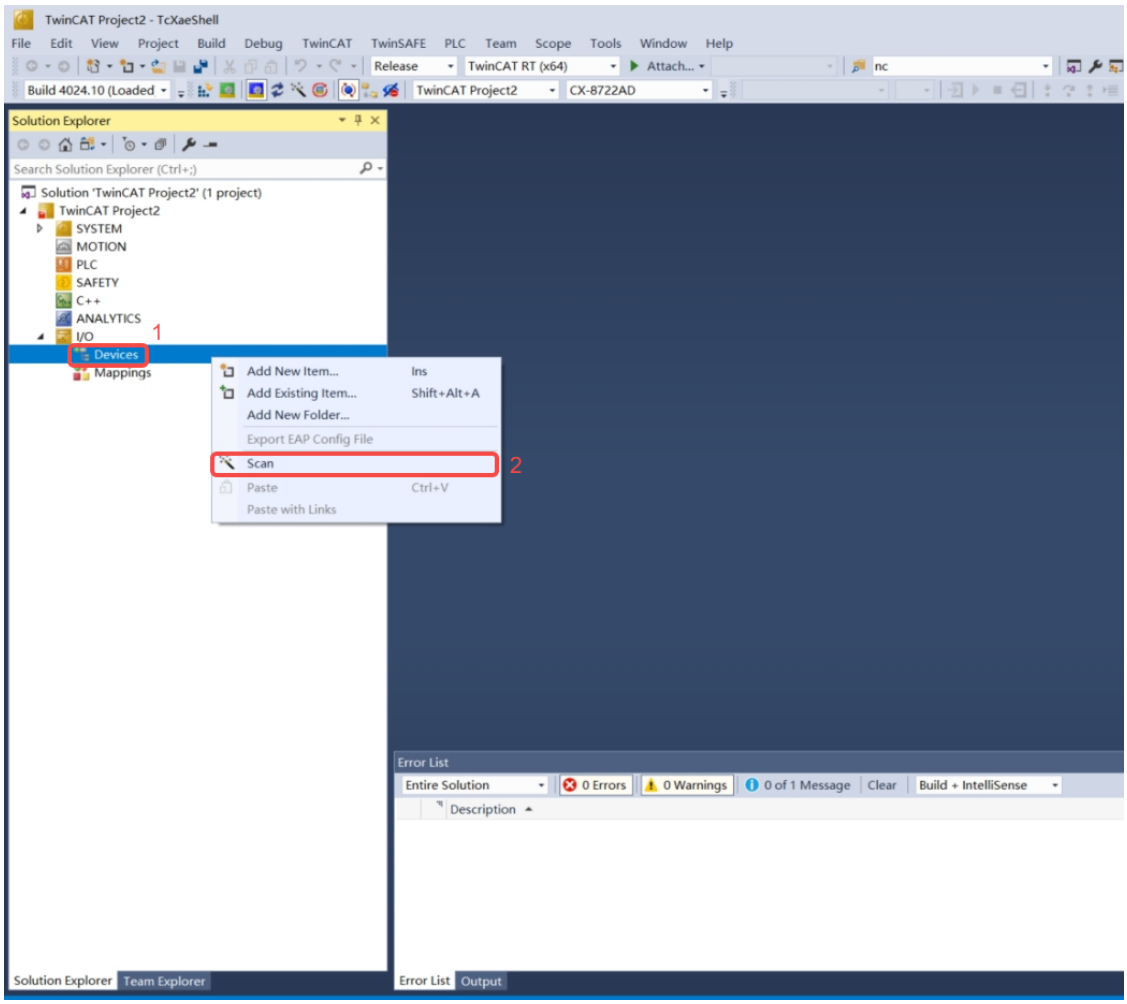


Figure 6-37 Scan the slave device

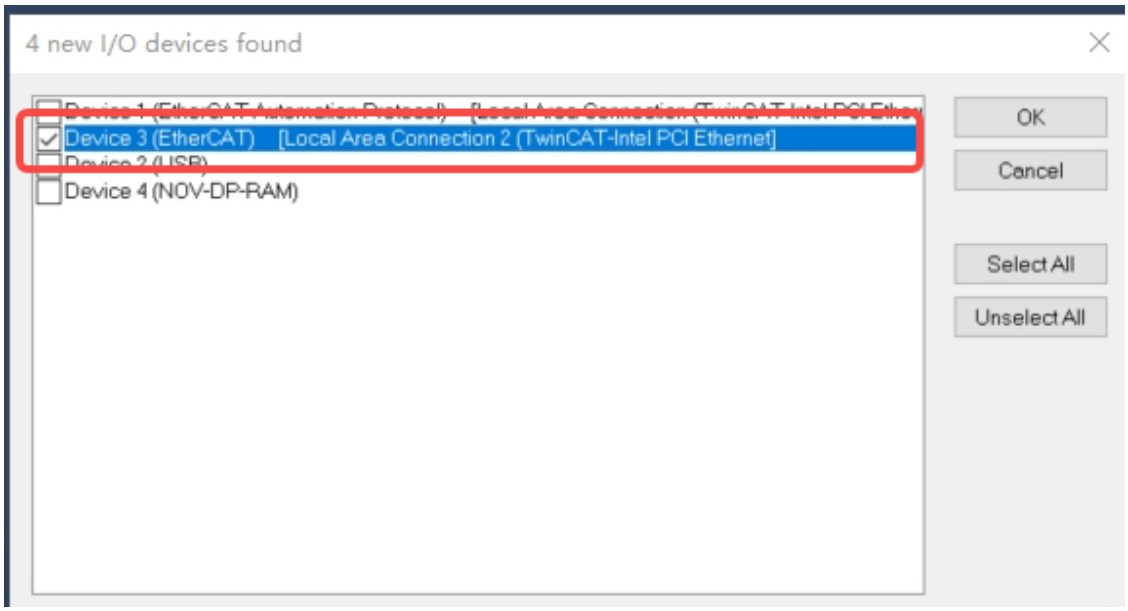


Figure 6-38 Select the corresponding port

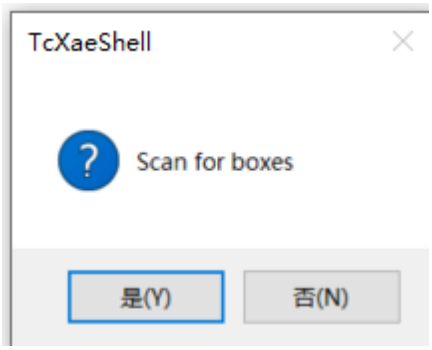


Figure 6-39 Confirm the scan

8. After you add the device, the corresponding EtherCAT slave device icon will be displayed in the left column of the project. Double-click the empty area to the right of the device to display the setup interface of the corresponding slave device , where you can configure PDO mapping, online CoE, status switching, synchronization modes, etc. Click the  icon in the preceding column to run the PLC master. Click the  icon to stop the PLC master.

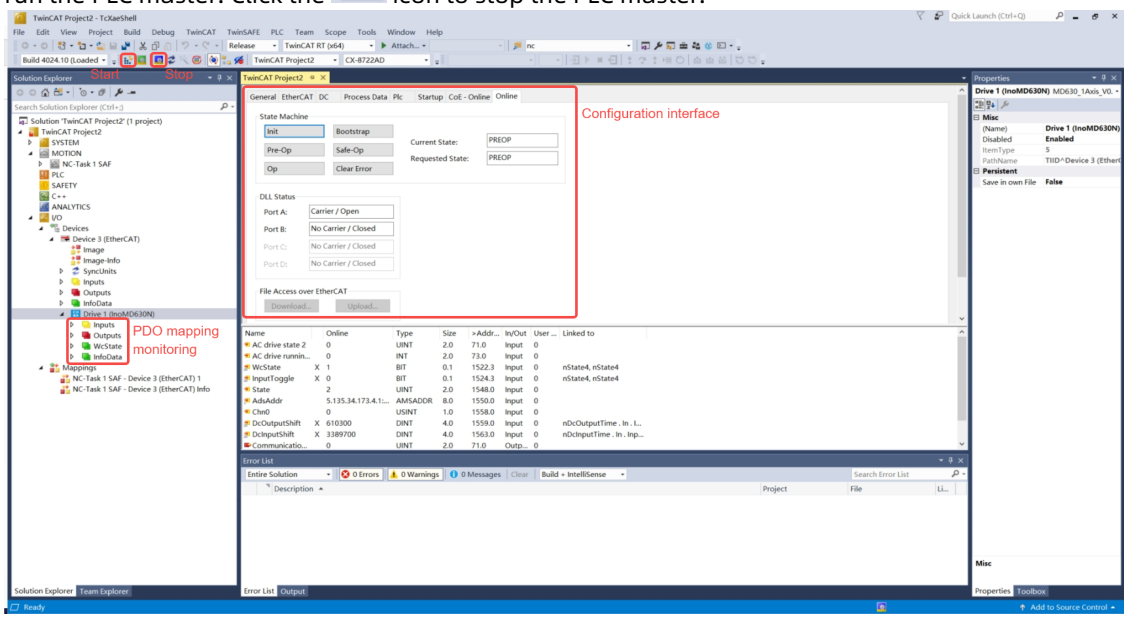
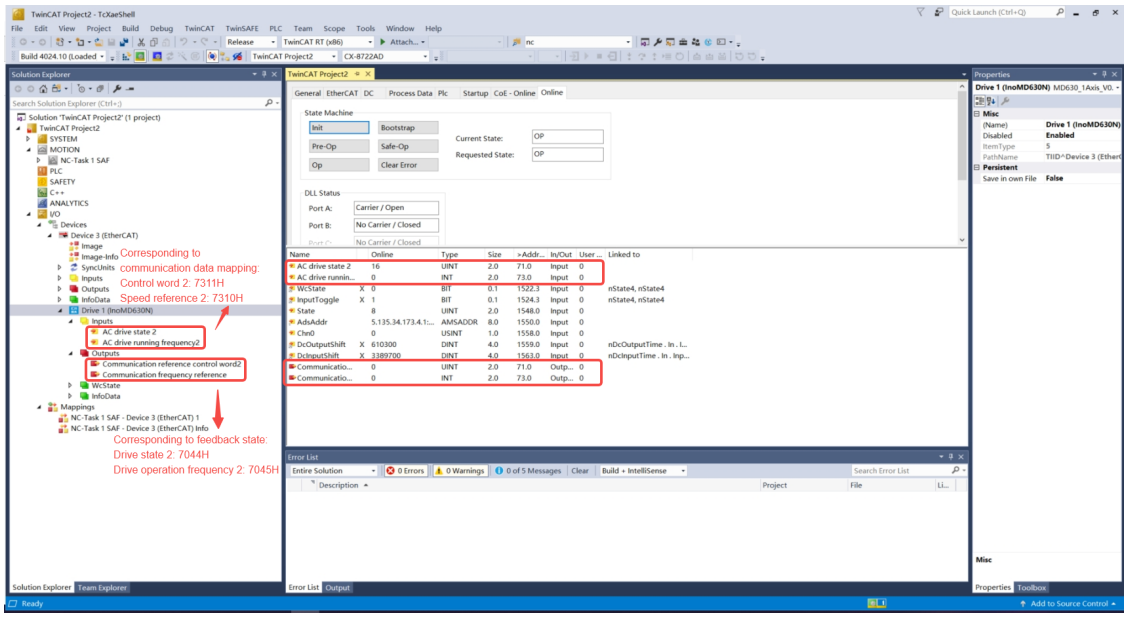


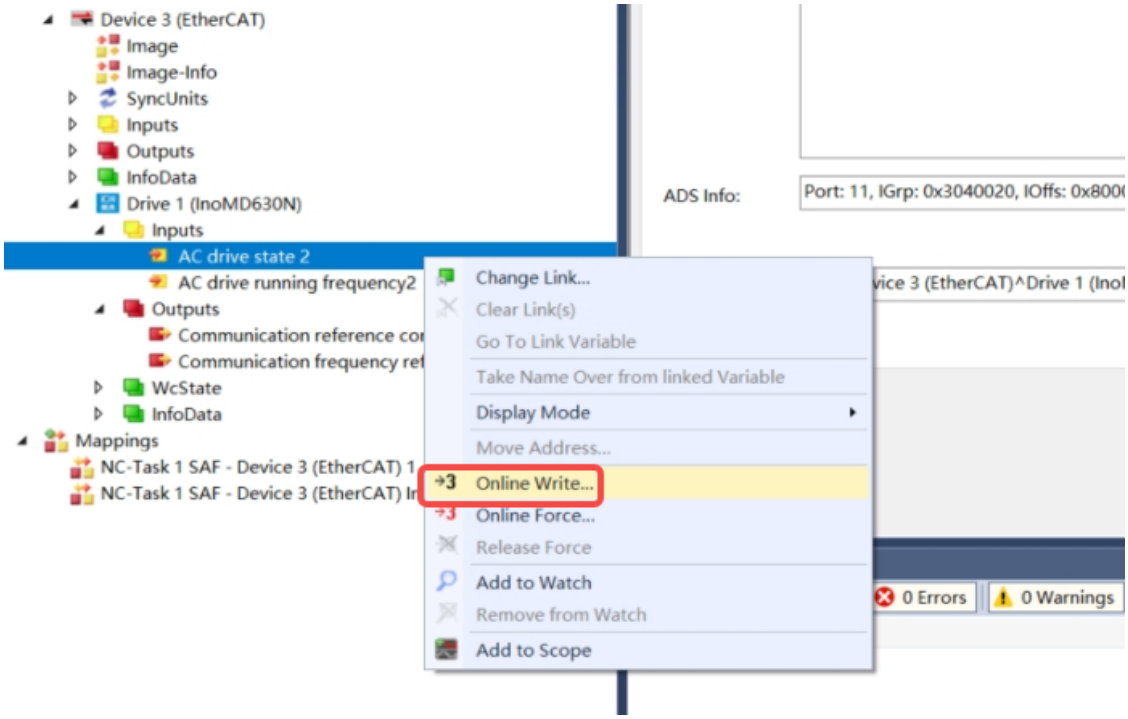
Figure 6-40 Overview interface

Step 4: Control the AC drive through communication

1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.



You can change the mapped value by right-clicking and selecting “Online Write”, as shown below.



2. For start/stop control and setting frequency or torque using EtherCAT communication, read and write specific communication addresses of the AC drive. In other words, the specific addresses are mapped to the PDO data of EtherCAT.
   For start/stop control and setting frequency or torque, 7311H and 7310H need to be mapped to the PDO data.

   The 7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Comm. Address		Description
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run (IN1) 2: Reverse run (IN2) 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop mode set by F2-17 (Stop mode) 7: Reset upon fault 8: Emergency stop

For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows.

Comm. Address		Description
Communication speed setting value 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0- 14 [7310H setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

In default settings, when n0-14 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write -1000 to set the main frequency to -10.00 Hz.

The corresponding state is as follows.

Comm. Address		Description
Drive state 2	7044H	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: bit00: Running status. 0: Stopped; 1: Running bit01: Running direction. 0: Forward; 1: Reverse bit02: Fault state. 0: No fault; 1: Fault bit03: Frequency reached: 0: Not reached; 1: Reached bit04 to bit07: Reserved Bits 8-15: Fault master code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	2 decimal places, signed number, unit Hz by default. The decimal places is switchable.

6.8.4.12 Replacing the Faulty Device

When using EtherCAT, the MD630N drive supports direct replacement of a faulty device without reconfiguration or reassignment of the device.

The following conditions must be met when replacing a faulty device.

1. The new drive must be of the same model of the drive to be replaced, which must be MD630N.
2. If the alias mode is used in master configuration, ensure the alias set on the new drive is consistent with that of the drive to be replaced, then restart the slave to activate the alias setting. If the alias mode is not used, you can replace the drive directly.
3. The topology has been correctly set during configuration (namely the actual ports to which each network cable is connected have been defined).
4. Ensure that all parameters of the new drive are set correctly, and then restart the PLC master.

6.8.5 Communication Ports

The EtherCAT bus adopts standard RJ45 network port and standard RJ45 connector. Use Cat 5e shielded twisted pairs and injection cables with iron housing. As verified by FastEthernet technology, when the EtherCAT bus is used, the cable between equipment shall not exceed 100 m. Failure to comply may result in signal attenuation, affecting normal communication.

The bus version of this product supports the EtherCAT protocol. Communication is performed through J9 (labeled IN) and J5 (labeled OUT). When facing the two RJ45 terminals of the drive, the left one is IN port and the right one is OUT port.

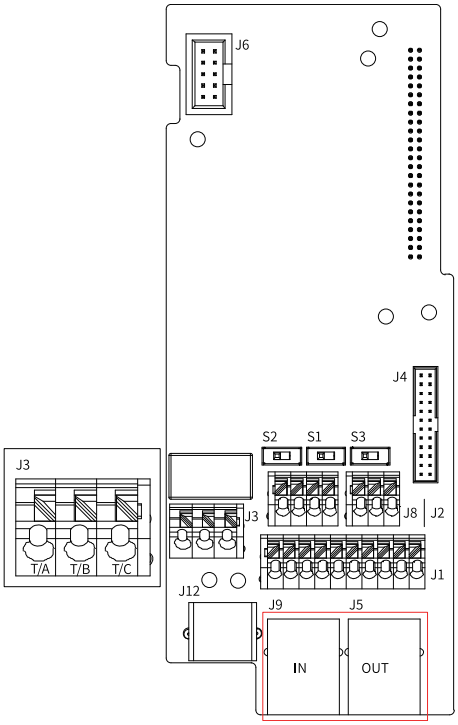


Figure 6-41 Description of EtherNet/IP communication ports

Description of EtherCAT communication ports:

External terminal	Type	Type of information transmitted	Mark	Name	Function
J9	RJ45 port	100 M bus	IN	100 M bus cascading port	Supports three communication protocols: ECAT/EIP/PN. Select the protocol type through n0-10. When ECAT is selected, it is the IN port. EIP/PN is direction-insensitive.
J5	RJ45 port	100 M bus	OUT	100 M bus cascading port	Supports three communication protocols: ECAT/EIP/PN. Select the protocol type through n0-10. When ECAT is selected, it is the OUT port. EIP/PN is direction-insensitive.

Indicator status for the network port:

Name	State	Description
LED0 (Green)	OFF	No connection established between devices
	Steady on	Connection established between devices
	Flashing	Data exchange between devices
LED1 (Yellow)	OFF	No connection established between devices
	Steady on	Connection established between devices

6.8.6 Connecting the Drive To Bus System

The EtherCAT bus adopts standard RJ45 terminal and standard registered jack, with Cat 5e cables that comply with the 100BASE_Tx specifications used. The maximum permissible cable length between two devices is 100 m. Up to 65535 stations are supported.

Connection procedure

1. Switch off the power supply of the drive system.
2. Connect the EtherCAT master to the EtherCAT slave using shielded network cables.
   See the communication network topology in *"6.8.3 Communication System Connection" on page 946* and connect the network cable to the metal shielded network port, with separate input (IN) and output (OUT) interfaces, as shown in the following figure. For communication interface specifications, see *"6.8.5 Communication Ports" on page 979*.

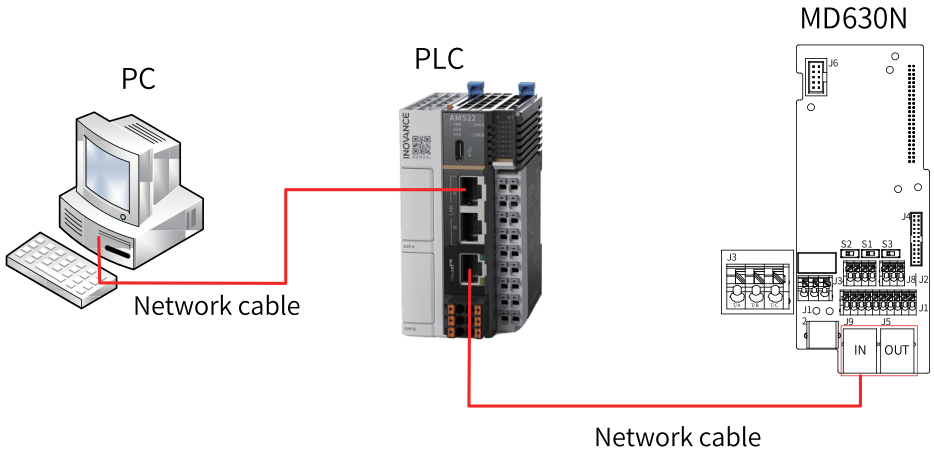


Figure 6-42 EtherCAT communication connection

Recommend to use shielded cables for network data transmission. The following table lists the recommended specifications of network cables.

Item	Specification
Cable type	Flexible crossover cable, S-FTP, Cat 5e
Standard compliance	EIA/TIA568A，EN50173，ISO/IEC11801，EIA/TI Abulletin TSB，EIA/TIA SB40-A&TSB36
Cross-sectional area	26 AWG
Conductor type	Twisted pair cable
Number of pairs	4

3. Power on the drive only after ensuring all connections other than communication are correct.

6.8.7 Configuring Communication between the Drive and Controller

The MD630N drive, as an EtherCAT slave, supports communication with standard EtherCAT master, such as Inovance, Beckhoff, and Omron controllers. If the controller used is not supported by the drive, contact Inovance technical support.

Procedure

1. Perform wiring according to *"6.8.6 Connecting the Drive To Bus System" on page 980*.
2. Switch the device communication mode to EtherCAT (n0-10 = 1), set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference source

of setting channel 1 (b0-03 = 0 and b5-00 = 9). (This operation can be performed through the operating panel or software tool.)

3. Wait for a few seconds until LED0 flashes green and LED1 turns yellow (steady). This indicates that the connection between slave and master is established successfully, and data exchange is available.
4. Configure communication between the master (controller) and slave (drive) as shown in *" " on page* .

6.8.8 Communication Parameters

The parameter group n4 defines parameters related to EtherCAT communication.

Table 6–15 Parameter settings for EtherCAT communication

Param.	Name	Default	Value range	Change mode	Description
n0-09	Active communication mode	0	-	Modification prohibited	Displays the effective communication mode.
n0-10	Communication type selection	1 [EtherCAT]	1 to 3	At stop	Defines the communication type. Value description: 1: EtherCAT - Set to 1 for EtherCAT communication; 2: EtherNet/IP - Set to 2 for EtherNet/IP communication; 3: PROFINET - Set to 3 for PROFINET communication.
n4-16 (Fd-39)	Station name	0	0 to 65535	Read only	Displays EtherCAT slave name.
n4-17 (Fd-40)	Station alias	0	0 to 65535	Real-time	Used to set EtherCAT slave alias. Note: 1. If n4-17 is set to 0, the slave alias is configured by the master. 2. If n4-17 is not set to 0, if the master does not set the slave alias, the slave alias is set by n4-17. If the master sets the slave alias, the slave alias is set by the master.

Param.	Name	Default	Value range	Change mode	Description
n4-18	Station alias backup	0	0 to 65535	Read only	Displays EtherCAT slave alias backup.
n4-33	XML file version	0	0 to 65535	Read only	Displays the XML file version.
n4-34	Device synchronization mode	0	0 to 65535	Read only	Displays the synchronization mode of the MD630.
n4-35	Synchronization cycle	0	0 to 65535	Read only	Displays the synchronization cycle of the MD630.

6.8.9 Communication Fault Diagnosis

When communication is faulty, the operating panel of the MD630N displays the corresponding fault code. The following table describes EtherCAT-related communication faults and solutions.

Table 6–16 Diagnosis on EtherCAT communication faults

Fault code	Fault name	Cause	Verification method	Solution
E167.1	EtherCAT Sync loss	The slave hardware (for example, the ESC register) causes the synchronization signal to be lost and the drive runs improperly.	Observe whether the indicator (difference between SYNC and IRQ phases) is larger than the synchronization cycle set by the master through the continuous oscilloscope function of Inovance software, If yes, it indicates an error.	Replace the drive or contact technical support.
E167.2	EtherCAT link loss	The physical connection of the data link is unstable or the process data is lost due to plug-in/plug-out of the network cable.	When the device is not powered on again, view the value of the link loss register through the software tool of the master. If it is not zero or the value increases continuously, the process data is lost.	Check whether the network cable of the drive is connected reliably. Check whether the network cable is loose due to strong vibration in the field. Ensure that the network cable is connected securely.
E167.3	EtherCAT read-only memory loading error	The information saved in EEPROM is incorrect.	The version number defined by n4-33 is not 0, but E167.3 is still reported.	Program the XML file again.
		The XML file is not programmed in the flash.	The version number (n4-33) is 655.35.	Program the XML file again.
E167.4	EtherCAT initialization error	Hardware fault (such as ESC chip fault)	EtherCAT cannot communicate properly. The master cannot scan and identify the slave device.	Replace the drive or contact technical support.
E167.5	ESC status switchover error	During the application layer state switchover, the register of ESC is forcibly modified due to errors of the master or manual operation.	A master status switchover error occurs.	The device stops due to fault, restart the device.

Fault code	Fault name	Cause	Verification method	Solution
E167.6	Distributed clock not enabled in EtherCAT	The master is faulty or the operation on the master is improper.	Check whether the master is configured correctly or analyze whether the master is faulty by capturing the packet.	Configure the master properly or ask for technical support.
E167.7	Number or length of EtherCAT PDO mapping outside the limit	The master configuration information is incorrect.	Check whether the PDO is configured correctly.	Configure the number of mapped PDOs and bytes correctly. You can configure a maximum of 16 PDOs per group, and a maximum of 32 bytes per group of PDOs.
E167.8	EtherCAT process data reception timeout	The data frame is lost at the upstream station and the upstream station is faulty.	If the master communication is not recovered, view the synchronous loss counter value (n4-30) of the drive. When a fault occurs, the value is not 0.	Check whether link loss occurs on the upstream station. Check that the wiring is correct.
		The performance of the master is poor, the jitter of the IRQ exceeds the set value x communication cycle.	Observe the SYNC and Irq phases through the online oscilloscope function in the software tool of the drive. When a fault occurs, the phase is greater than or equal to the synchronization loss threshold x communication cycle.	Check whether the CPU operation load of the master is too large. You can optimize load reduction of the master by reducing the communication time and setting a high synchronization loss threshold.
E167.9	EtherCAT ESC port 0 reception error	The data is lost due to EMC interference, poor quality of the network cable, or improper connection.	View the error counter values of port 0 and port 1 in the master software tool, or view the corresponding port parameter of the drive. The values of port 0 (n4-25) or port 1 (n4-26) is not 0.	Check whether proper grounding is performed and rectify EMC measures. Check whether the network cable used is provided by Inovance and whether the network cable is connected properly.
E168.1	EtherCAT ESC port transfer and EPU processing error	The data frame is corrupted due to an upstream station fault or a link fault.	Check whether values of the transfer error counter (n4-27) and the processing unit error counter (n4-28) changed through parameters.	If yes, the upstream station may be disturbed, the link layer may be faulty, and the hardware is faulty. Replace the upstream station or contact technical support if necessary.

Fault code	Fault name	Cause	Verification method	Solution
E168.2	EtherCAT MailBox setting error protection	An incorrect XML file is imported to the master.	Check whether the master imports the correct XML file. The XML file must meet the following conditions: 1. The SM channel is enabled. 2. Check whether the read/write direction is configured correctly. 3. Check whether the mailbox mode applies (single buffer mode). 4. Check whether the length of the data received is within the set range. 5. Check whether the address of the data received is within the set range. 6. Check whether the memory of the read/write mailbox overlaps.	1. Re-import the XML file to the master software and restart the connection. 2. If the fault persists after the master is restarted, contact technical support to rectify the XML configuration.
E168.3	EtherCAT SM2 setting error	An incorrect XML file is imported to the master.	Check whether the master imports the correct XML file. Check the following configuration. 1. Check whether the SM2 channel is configured incorrectly. The following conditions must be met. (1) The SM length and RxPDO length are not 0 when SM2 is not enabled. (2) SM2 channel is configured to the write mode. (3) The memory of SM2 overlaps with adjacent SM1 or SM3. 2. Check whether the index of the RxPDO mapping object dictionary is out of the limit (the maximum index is 0x0A). The following conditions must be met: (1) The length of the RxPDO is proper. (2) In the preop state, the address of RxPDO is in the set address field (maximum and minimum addresses), or not in a non-preop state. The address of SM2 is not equal to the starting address of RxPDO. (3) PDO mapping object dictionary index does not exceed the set maximum value (0x1600-0x170A).	1. Re-import the XML file to the master software and restart the connection. 2. If the fault persists after the master is restarted, contact technical support to rectify the XML configuration.

Fault code	Fault name	Cause	Verification method	Solution
E168.4	EtherCAT SM3 setting error	An incorrect XML file is imported to the master.	Check whether the master imports the correct XML file. Check the following configuration. 1. Check whether the SM3 channel is configured incorrectly. The following conditions must be met. (1) The SM length and TxPDO length are 0 when SM3 is not enabled. (2) SM3 channel is configured to the read mode. (3) No overlap occurs among the memory of SM2, SM3, SM0, or SM1. 2. Check whether the index of the TxPDO mapping object dictionary is out of the limit (the maximum index is 0x1A). The following conditions must be met. (1) The length of the TxPDO is proper. (2) In the preop state, the address of TxPDO is in the set address field (maximum and minimum addresses), or not in a non-preop state. The address of SM3 is not equal to the starting address of TxPDO. (3) The index of the object dictionary mapped by PDO exceeds the maximum value (0x1A00-0x1B0A).	1. Re-import the XML file to the master software and restart the connection. 2. If the fault persists after the master is restarted, contact technical support to rectify the XML configuration.
E168.5	PDO watchdog setting error	The master is configured incorrectly or the attempt to configure the master failed.	The value of ESC state register 0x0134 read through the master software tool is 0x001F.	Restart the master and check whether the fault disappears. Otherwise, contact technical support.
E168.6	No signc signal in EtherCAT	During the switchover process from SAFEOP to OP, DC is enabled but not operating due to the following reasons. 1. The DC startup time and DC activation time are set improperly. 2. There is no pulse signal input.	The value of ESC state register 0x0134 read through the master software tool is 0x002D.	Restart the master and check whether the fault disappears. Otherwise, contact technical support.

Fault code	Fault name	Cause	Verification method	Solution
E168.7	EtherCAT Phy initialization configuration error	1. The ESC is not working properly before reading the phy ID. 2. The phy chip is damaged. 3. Data is subject to interference. 4. The configured model differs from the actual phy model.	Check the hardware to see whether the PHY integrated circuit is working properly.	Replace the AC drive and contact technical support,
E168.8	Abnormal pulse length of synchronous data signal configured in the EtherCAT read-only memory	1. EEPROM configuration data are written mistakenly by the master. 2. There is a difference between the XML file imported by the master and the information in the slave.	Check whether there is any difference between the XML file information saved in the slave (which can be read through the master software) and the XML file information imported to the master software.	Reset the ESI file by setting n4-41 to 1 or re-program the XML file. If the fault persists, contact technical support.

6.8.10 Communication Configuration Examples

6.8.10.1 Configuration for Communication Between MD630N and Inovance AC801

Prerequisite

Ensure that all equipment is correctly wired according to *"6.8.6 Connecting the Drive To Bus System" on page 980*.

Procedure

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish EtherCAT communication connection

1. Set the value of n0-10 to 1 (through operating panel or the software tool). Set the communication mode to EtherCAT.
2. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow . This indicates that the slave and master are connected successfully and there is data exchange.
3. Import the device description file (XML) of the MD630N to the host controller software (otherwise, the slave cannot be added later) and add the MD630N device.
4. Open the host controller software InoProShop and select “New Project” . Select the PLC model in the pop-up interface, and click "OK". Save the project to the specified path (path can be modified).

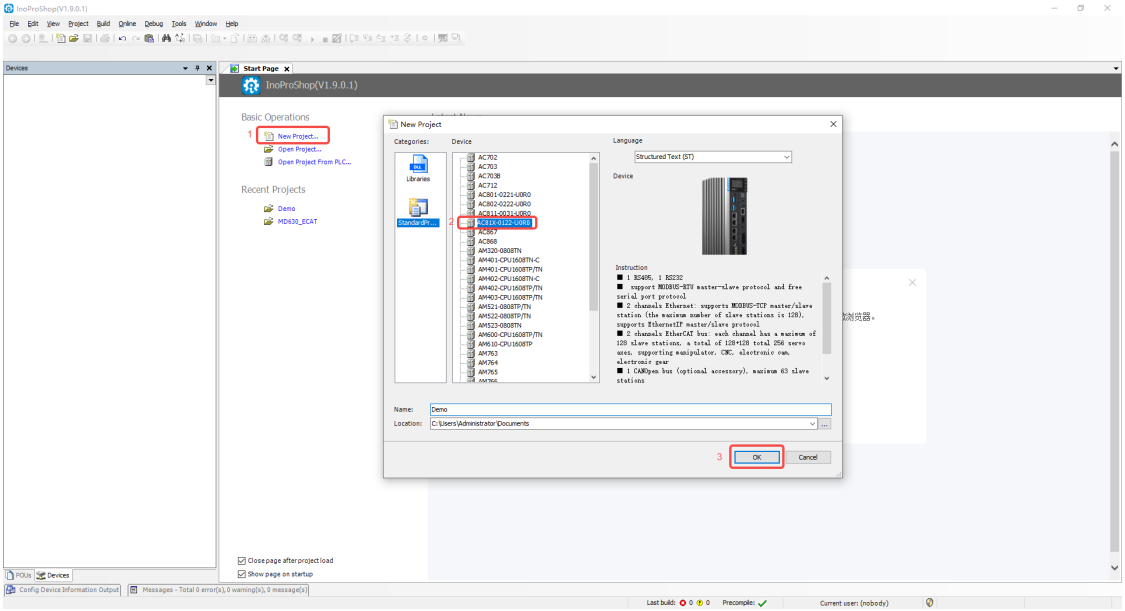


Figure 6-43 Create project

5. Import the device description file (XML) of the AC drive; otherwise, the AC drive cannot be identified.
   Click “Tools” -> “Device Repository” . Then after the pop-up interface appears, click Install.

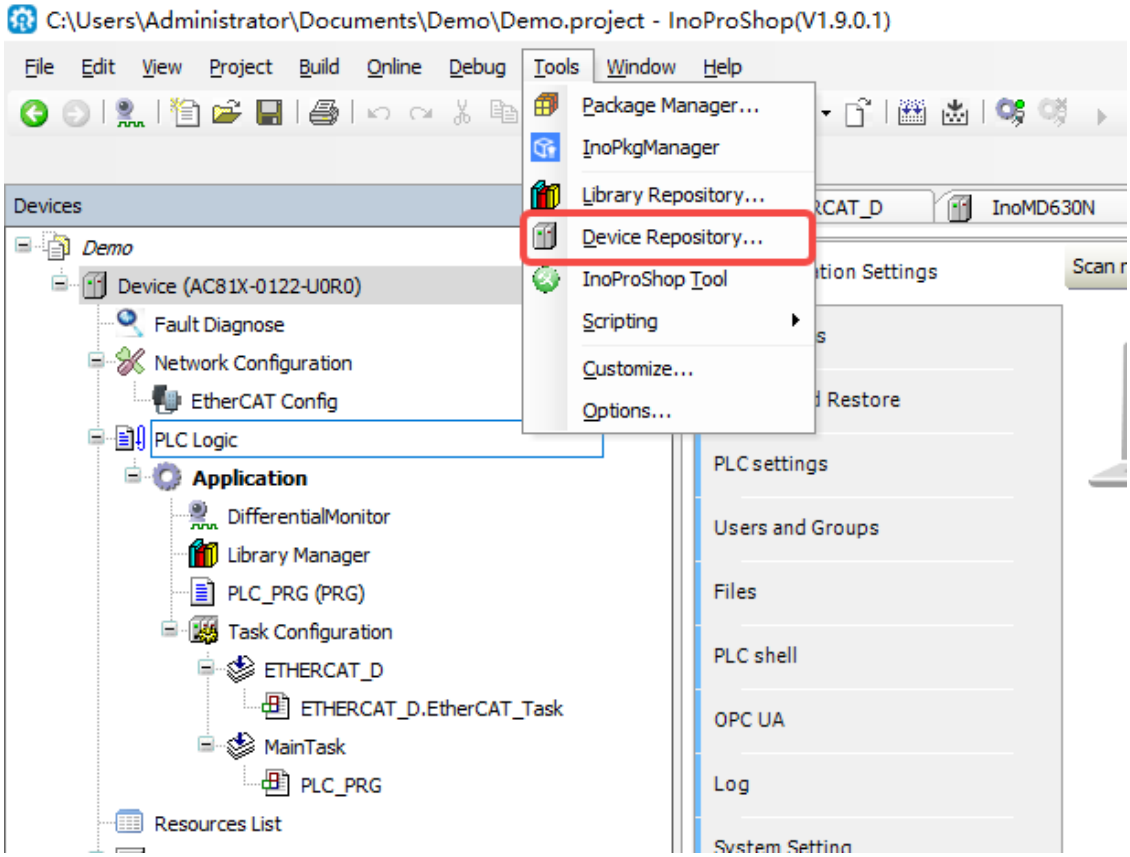


Figure 6-44 Add a device description file

6. After clicking Install, the “Install Device Description” interface appears. Select the file in "*.xml" format. Otherwise, the XML file of the device cannot be displayed. Click “Open” and wait for a few seconds. Then the installation is completed.

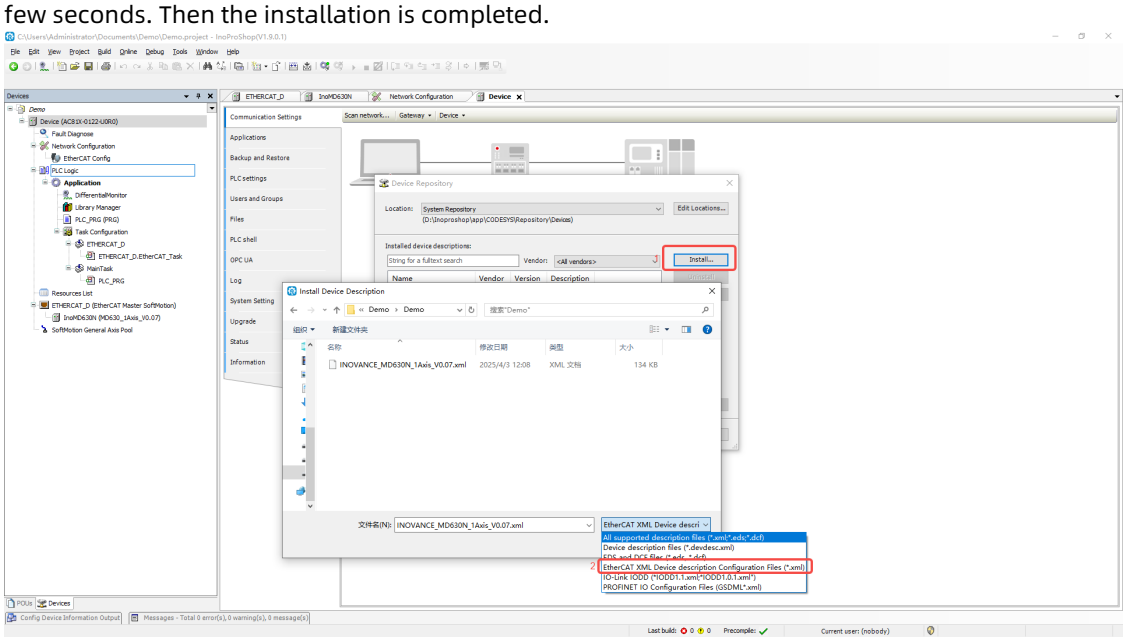


Figure 6-45 Install the device description file

7. After entering the interface, double-click “Device” and the blank area on the right displays detailed information. Then, click “Scan network” to pop up the “Select Device” window, and then scan the network to identify the PLC device.

Note

The IP address of the computer connected to the PLC should be set in the same segment as the PLC's IP which can be viewed through the panel.

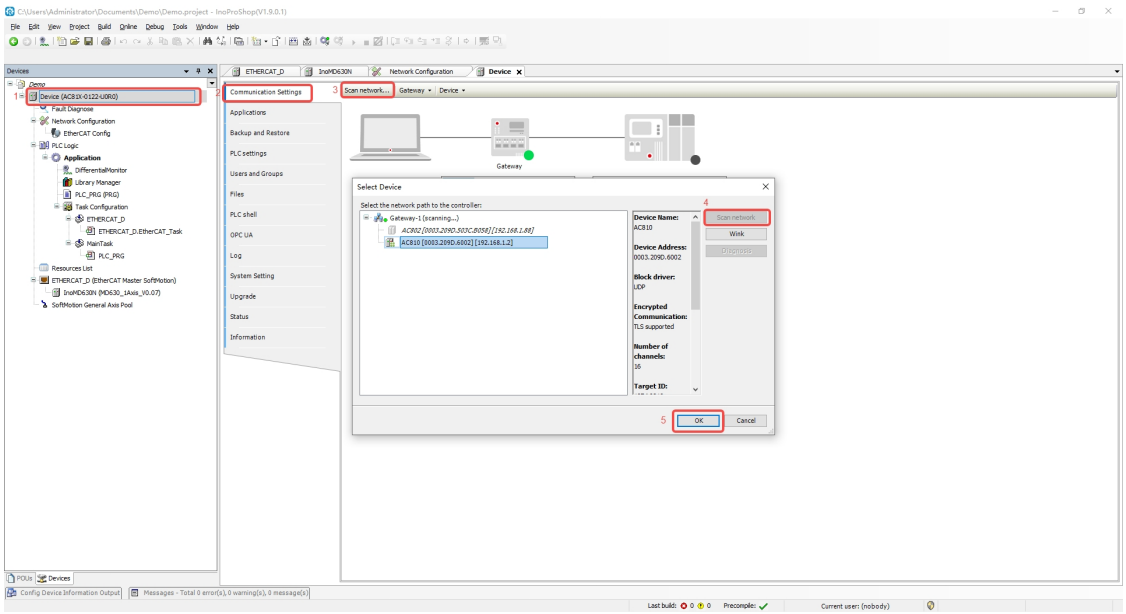


Figure 6-46 Scan and identify the master device

8. After identifying the correct PLC, click “Network Configuration” to select the supported communication interface. Check the “EtherCATMaster” box.

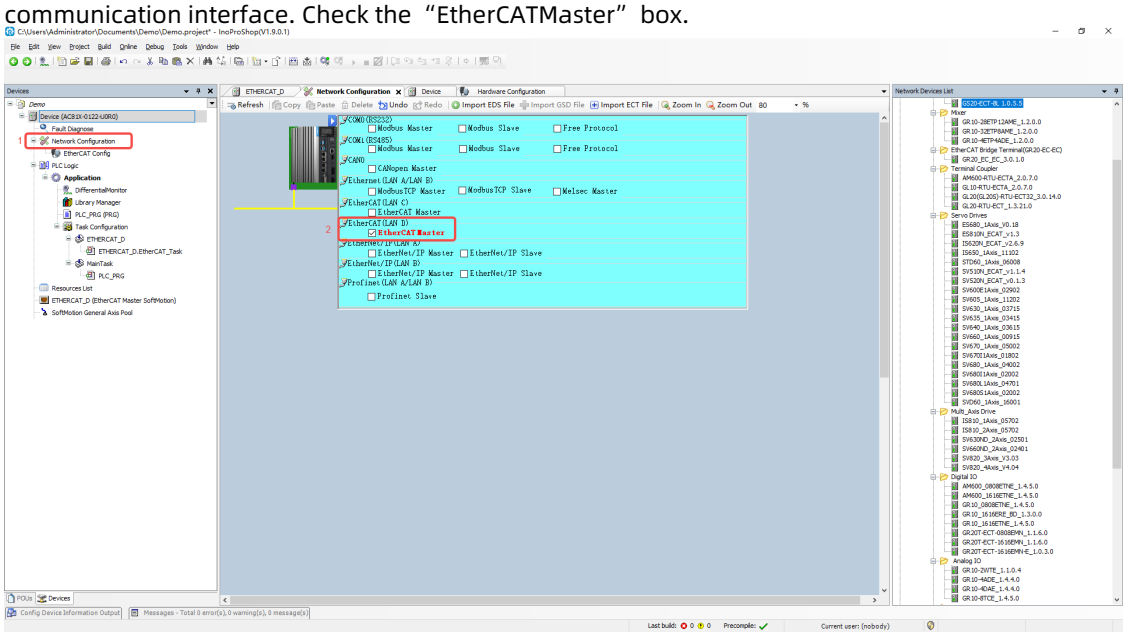


Figure 6-47 Configure master communication interface

9. Locate "ETHERCAT_D (EtherCAT Master SoftMotion)" in the device bar on the left. Right-click on the pop-up bar and select "Scan Device". The Scan Devices window will pop up. Click "Scan Device" below to scan the MD630N.
   Click “Copy Scan Device” to complete adding the AC drive.

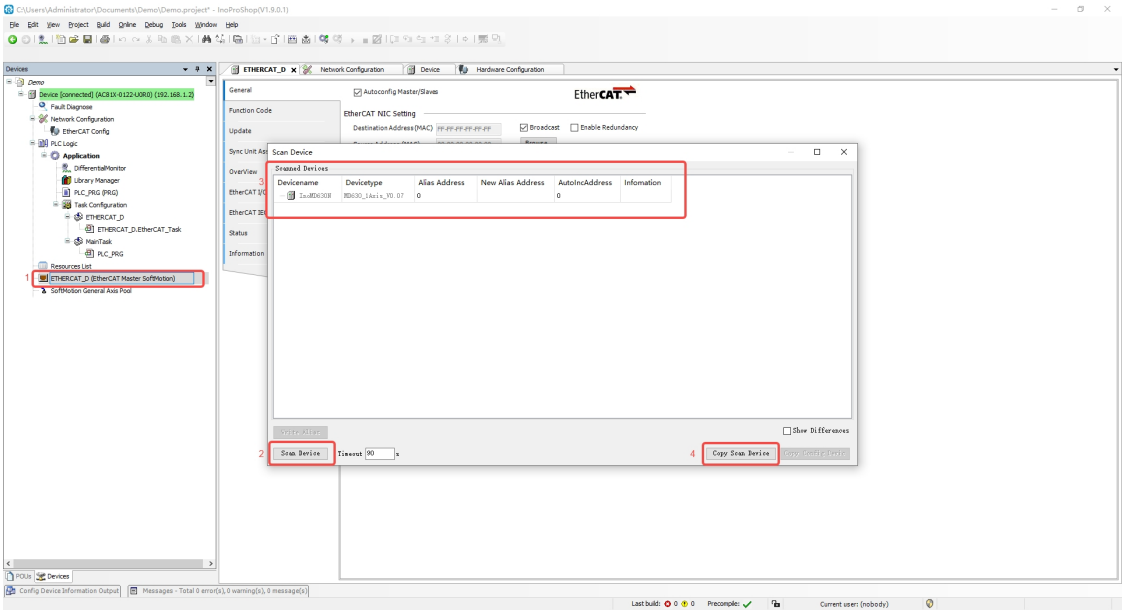
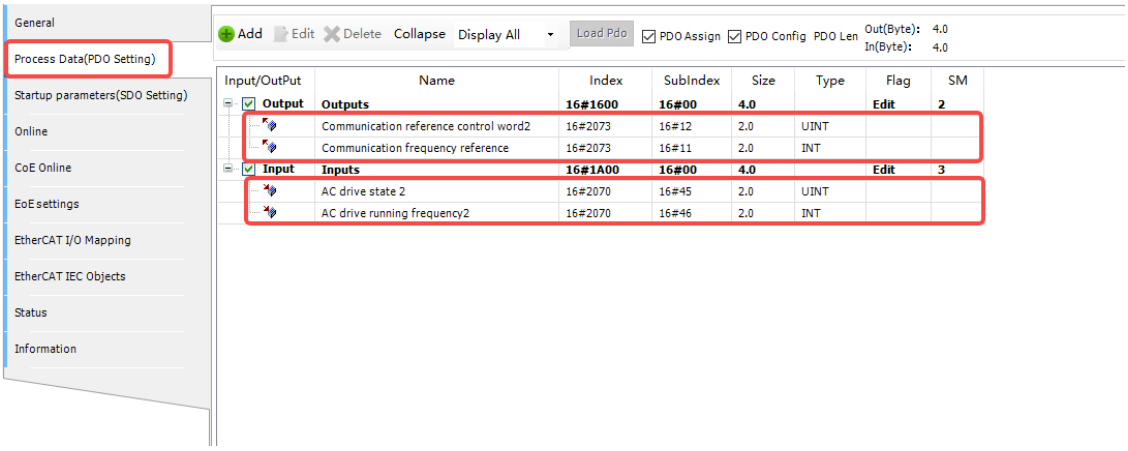


Figure 6-48 Scan the slave device

10. After adding the AC drive, the user can configure PDO on the slave device.
    The default fixed PDO mapping in the XML file meets basic motor control requirements. The following table lists the PDO interactive data description.

PDO (0x1600) Sent by the Master Station		
Fixed RPDO		Variable RPDO
Communication reference control word (0x2073:12)	Communication reference frequency (0x2073:11)	Real-Time Change of AC Drive Function Parameter
RPDO1	RPDO2	RPDO3~RPDO16
PDO Responded by AC Drive (0x1A00)		
Fixed TPDO		Variable TPDO
Operation state (0x2070:45)	Operating frequency (0x2070:46)	Real-Time Reading of AC Drive Function Parameter
TPDO1	TPDO2	TPDO3~TPDO16



11. Click “Compile”. Wait until the compilation is complete, and then click “Login” to wait for the program to be downloaded to the PLC.

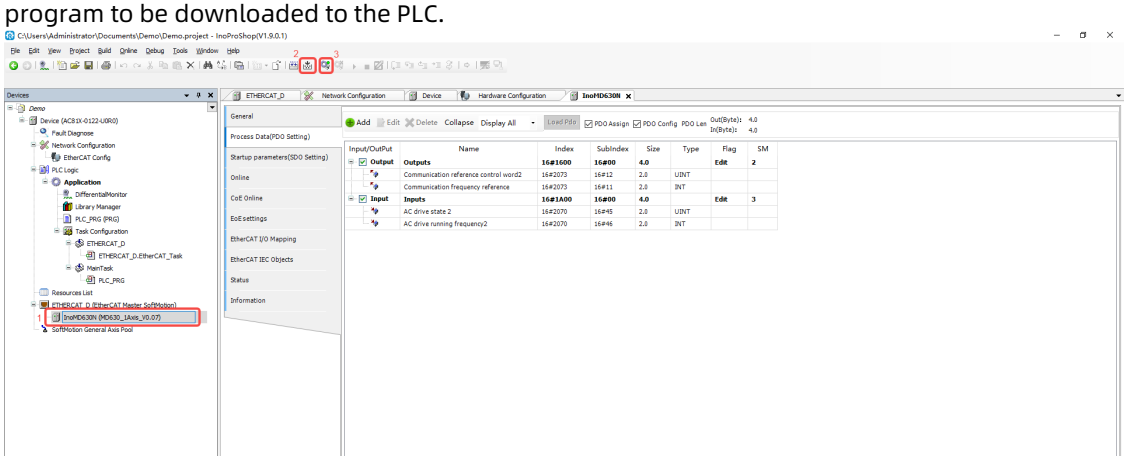


Figure 6-49 Login and download to PLC

12. After login and download are complete, click the start button. The green mark appears on the right side of the MD630N device in the left column to indicate that the device is started and communication is established properly. In this case, the user can monitor the I/O variables of the configuration mapping, as well as online COE and state machine operations.

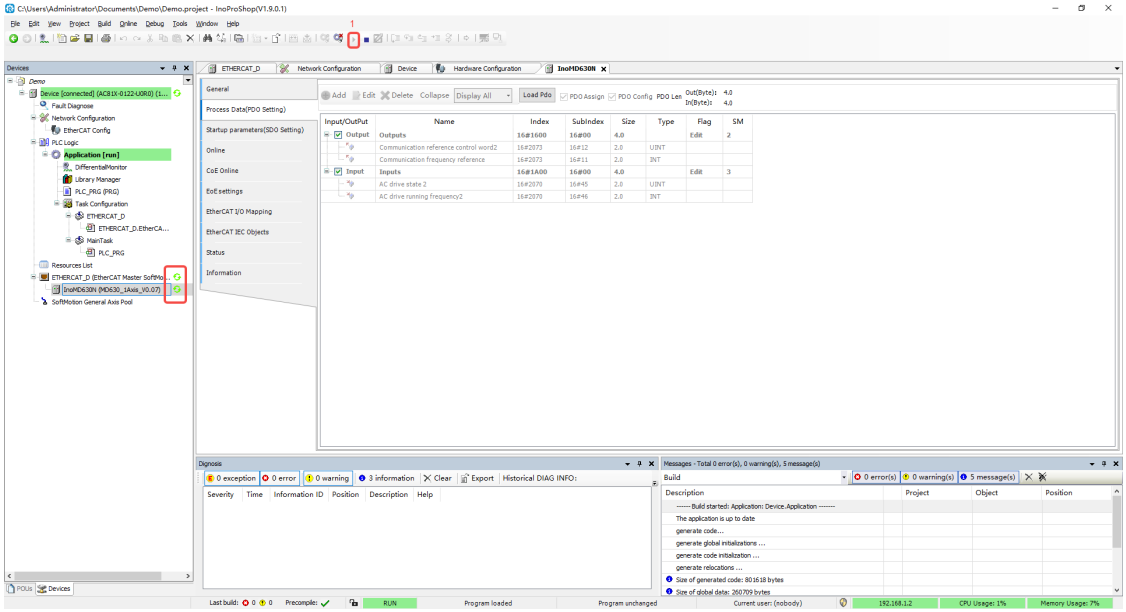
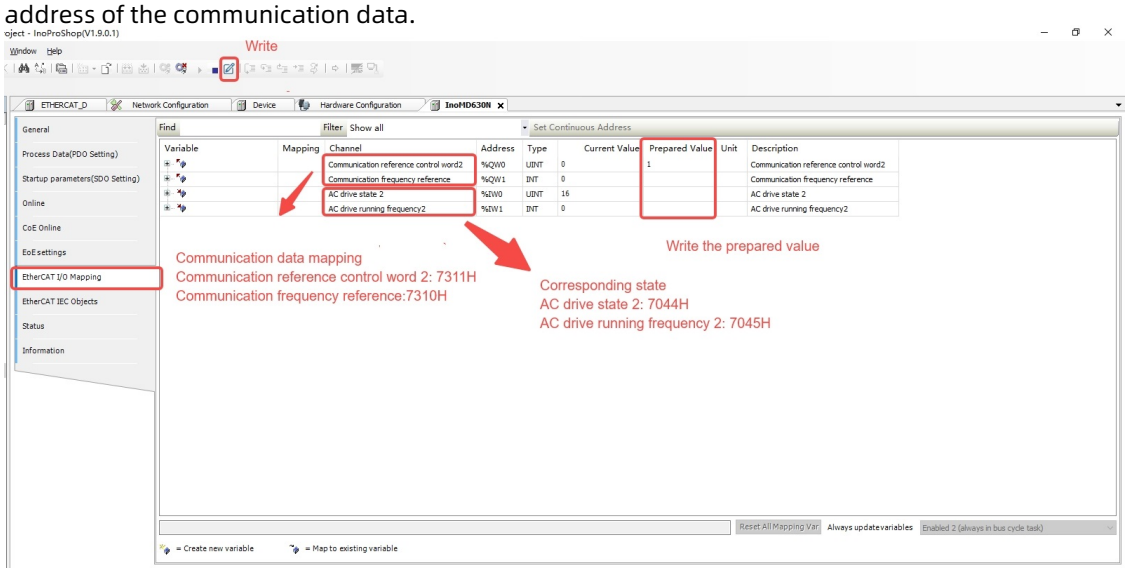


Figure 6-50 Establish communication successfully between the master and slave

Step 4: Control the AC drive through communication

1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.



2. For start/stop control and setting frequency or torque using EtherCAT communication, read and write specific communication addresses of the AC drive. In other words, the specific addresses are mapped to the PDO data of EtherCAT.
   For start/stop control and setting frequency or torque, 7311H and 7310H need to be need to be mapped to the PDO data.

   The 7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Comm. Address		Description
Communication reference control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run (IN1) 2: Reverse run (IN2) 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop mode set by F2-17 (Stop mode) 7: Reset upon fault 8: Emergency stop

   For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

   The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows.

Comm. Address		Description
Speed reference 2 set through communication	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0- 14 [7310H setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

In default settings, when n0-14 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write -1000 to set the main frequency to -10.00 Hz.

The corresponding state is as follows.

Comm. Address		Description
Drive state 2	7044H	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: bit00: Operation status. 0: Stopped; 1: Operating bit01: Operating direction. 0: Forward; 1: Reverse Bit 02: Faulty state. 0: No fault; 1: Faulty bit03: Frequency reached: 0: Not reached; 1: Reached bit04 to bit07: Reserved Bits 8-15: Fault master code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	2 decimal places, signed number, unit Hz by default. The decimal places is switchable.

6.8.10.2 Configuration for Communication Between MD630 and Beckhoff Controller

Prerequisite

Ensure that all equipment is correctly wired, see *"6.8.6 Connecting the Drive To Bus System" on page 980*.

Procedure

Step 1: Start or stop the AC drive through remote communication

1. Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

Step 2: Set the frequency or torque through communication

Set frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.

0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to select communication as the torque reference source of set channel 1.
2. Set n0-14 (7310H setting) to the following values according to on-site requirements.
   0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish EtherCAT communication connection

1. Set the value of n0-10 to 1 (through operating panel or the software tool). Set the communication mode to EtherCAT.
2. Wait for a few seconds until LED0 to become green and LED1 to become steady yellow . This indicates that the slave and master are connected successfully and there is data exchange.
3. Open the installation directory of TwinCAT and copy the XML file to the directory shown in the following figure.
   After installing the Beckhoff TwinCAT software on the PC, you need to import the device description XML file of the EtherCAT slave device. Otherwise, the slave device cannot be scanned.

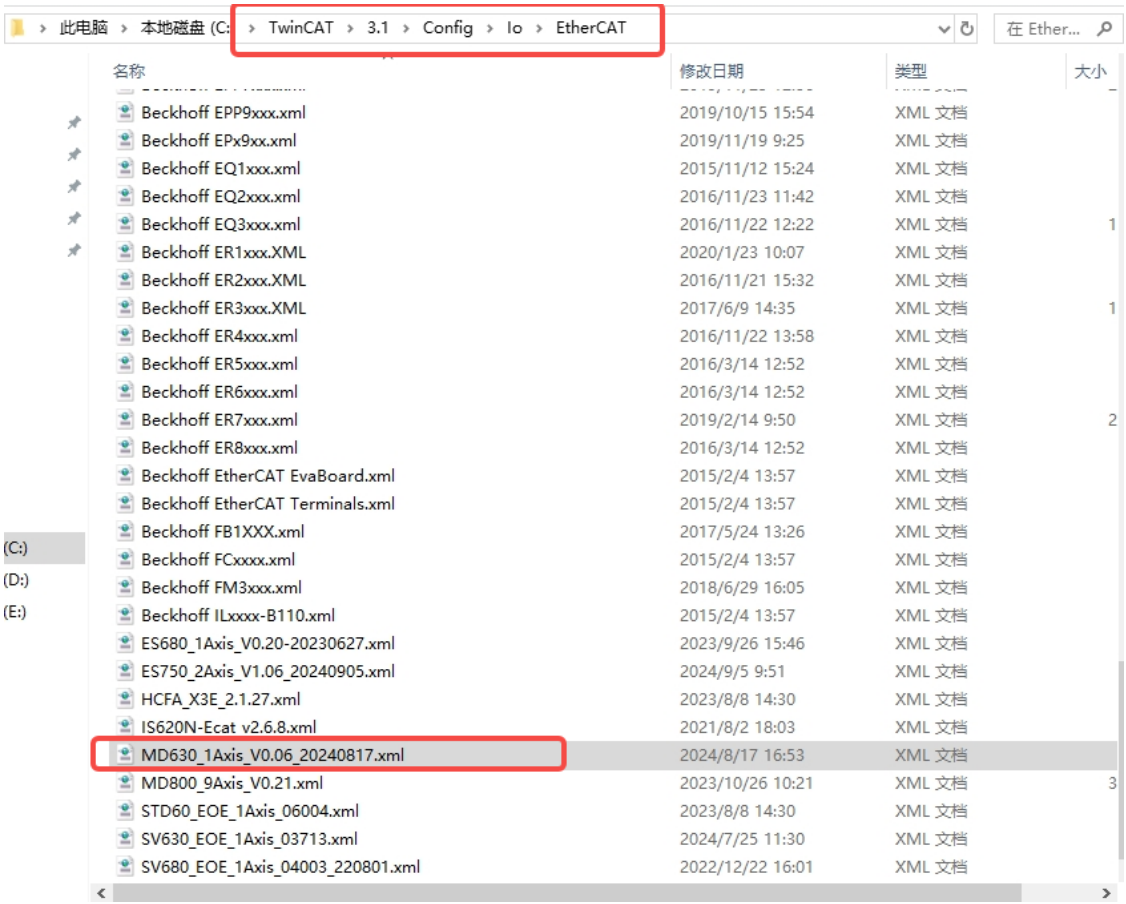


Figure 6-51 Add an XML file

4. Open TwinCAT XAE (TcXaeShell) to create a new project, as shown in the following figure.

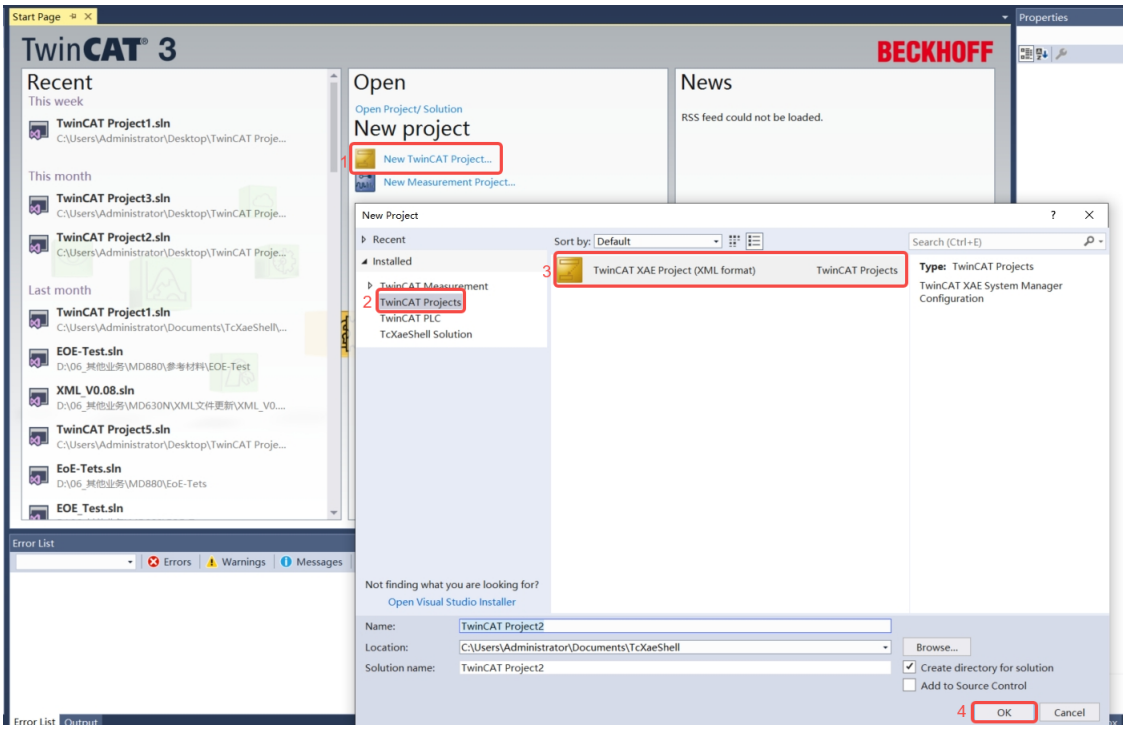


Figure 6-52 Create project

5. To scan and add a Beckhoff PLC controller, ensure that the IP address of the PC and PLC ports are in the same network segment. Open the Ethernet properties of the corresponding network port in the PC settings, and then set the IP address.

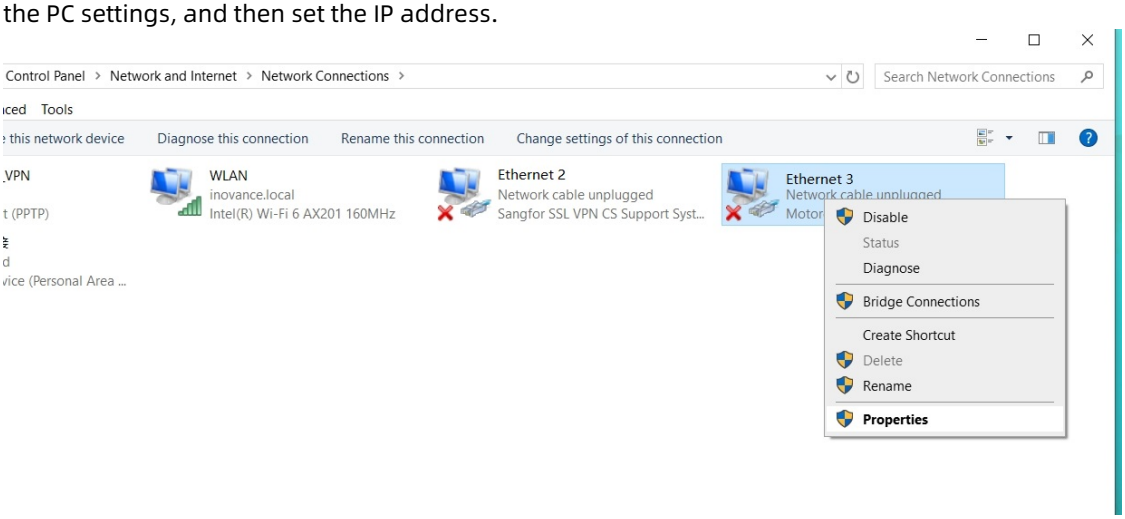


Figure 6-53 Open the Ethernet Properties setting

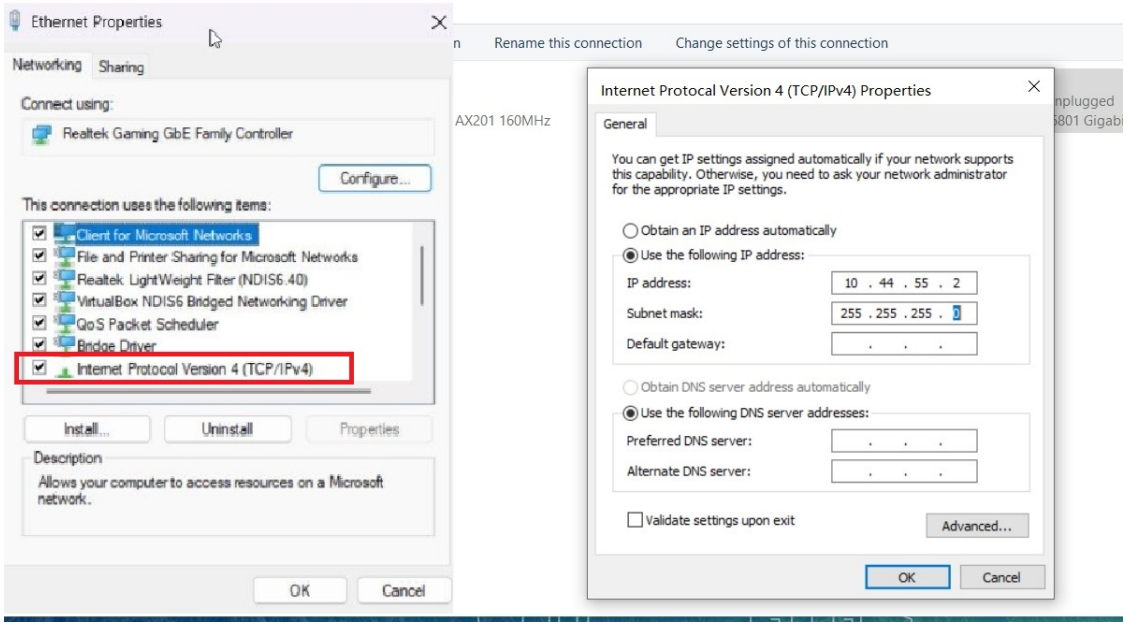


Figure 6-54 Setting IP

6. After the setting is done, scan the PLC controller in the form of network segment broadcast, and click the drop-down box in the field. If the PLC has been added before, it will be displayed in the drop-down bar and be used directly. If it is added the first time, you need to click “Choose Target System” .

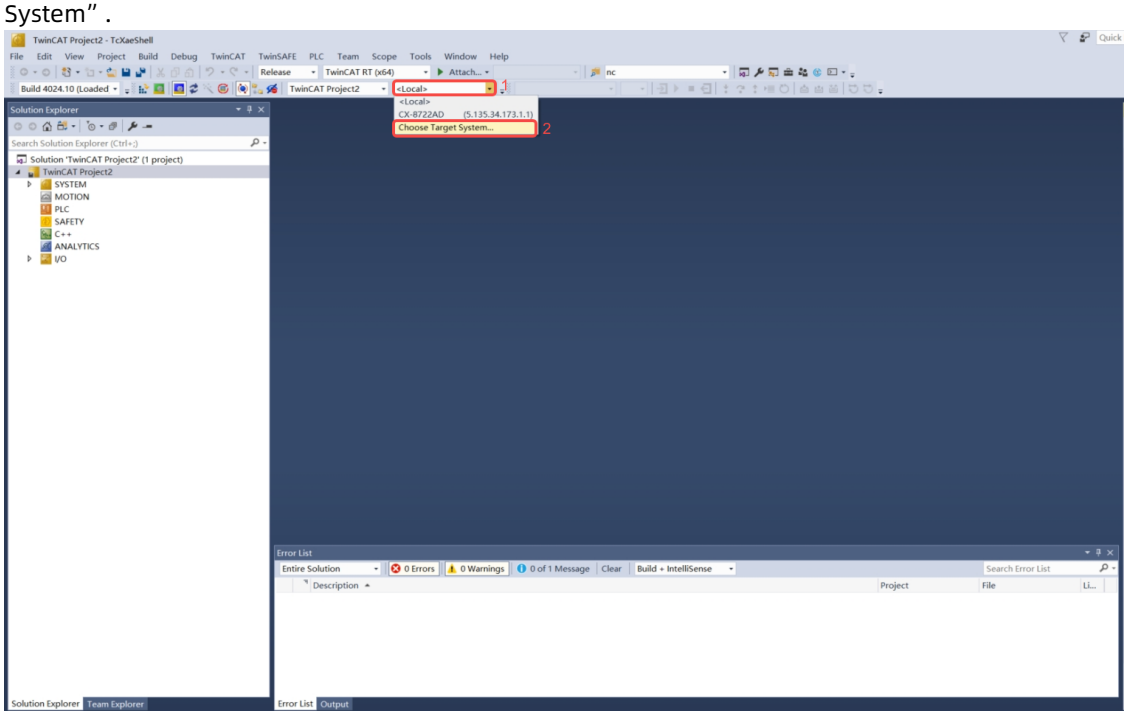


Figure 6-55 Select PLC device

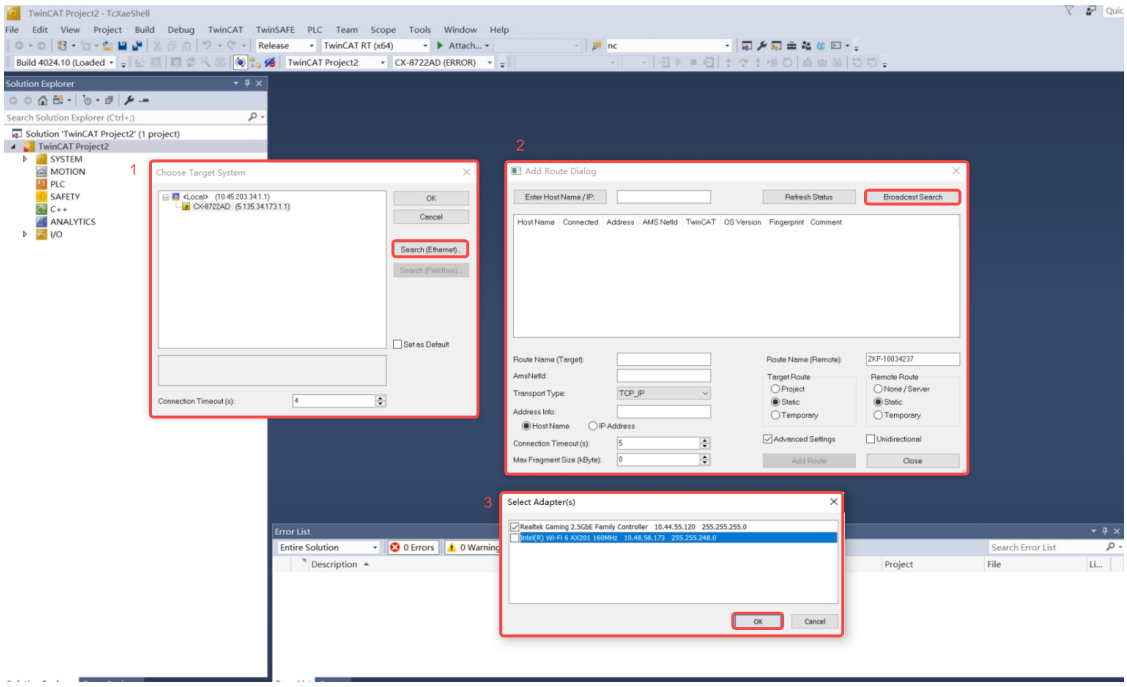


Figure 6-56 Scan PLC steps

After scanning the PLC, information about the PLC will be displayed. You need to enter a password for adding the PLC to the project. The default password is usually 1.

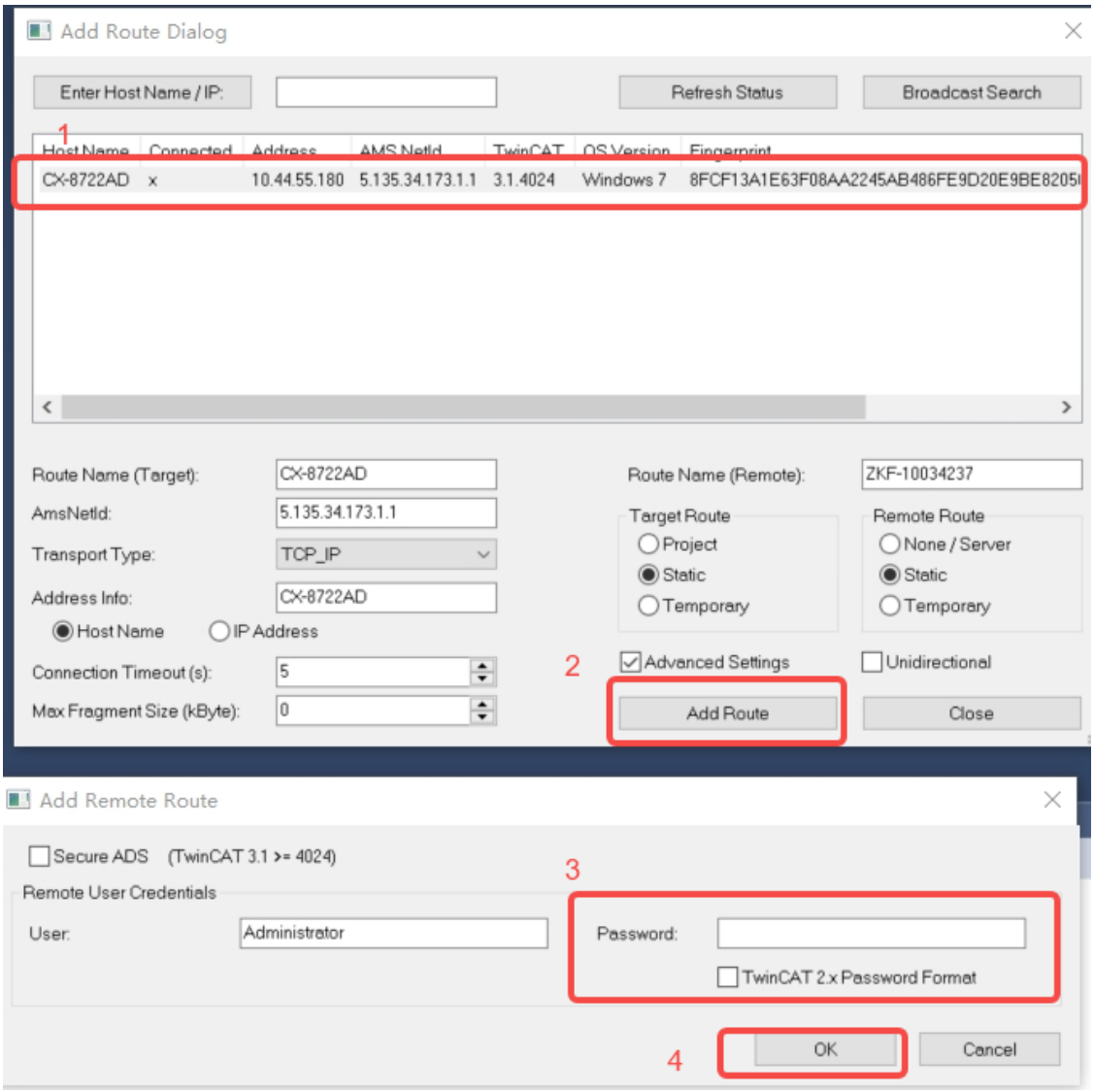


Figure 6-57 Add the scanned PLC device

7. After adding the PLC, scan to add the EtherCAT slave device. In the left column of the project, select “Devices” and right-click “Scan”. Select “Device 3” in the pop-up window and Click “OK”, and then click “Yes” in the pop-up window.

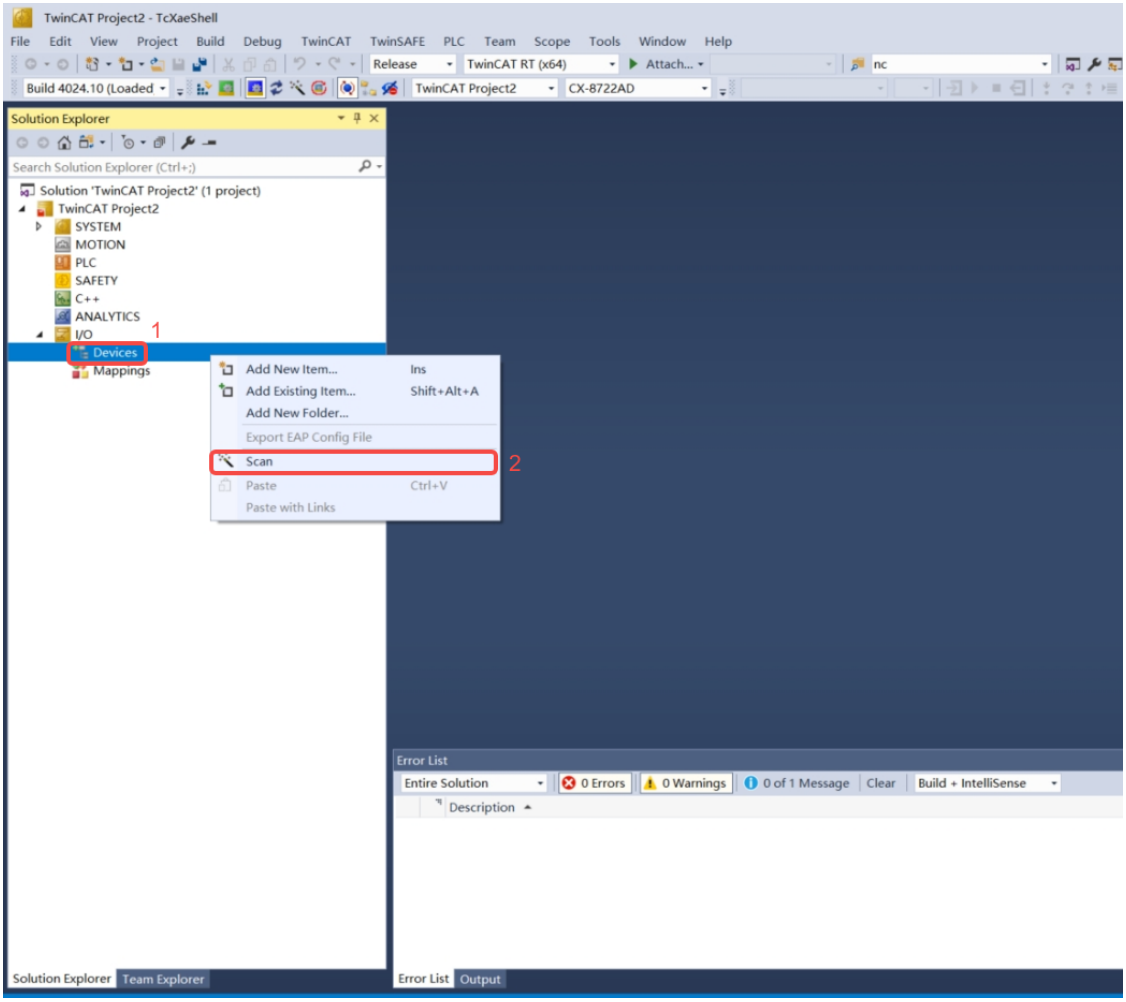


Figure 6-58 Scan the slave device

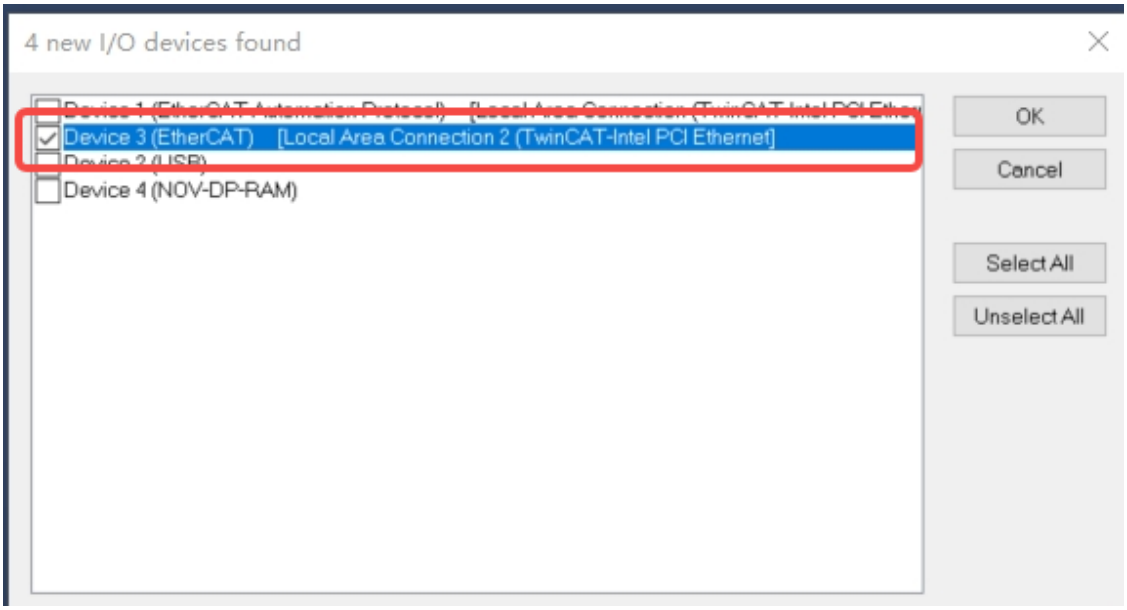


Figure 6-59 Select the corresponding port

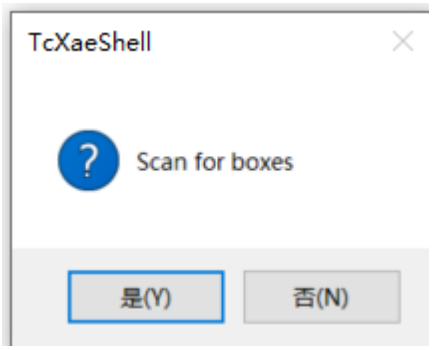


Figure 6-60 Confirm the scan

8. After you add the device, the corresponding EtherCAT slave device icon will be displayed in the left column of the project. Double-click the empty area to the right of the device to display the setup interface of the corresponding slave device , where you can configure PDO mapping, online CoE, status switching, synchronization modes, etc. Click the  icon in the preceding column to run the PLC master. Click the  icon to stop the PLC master.

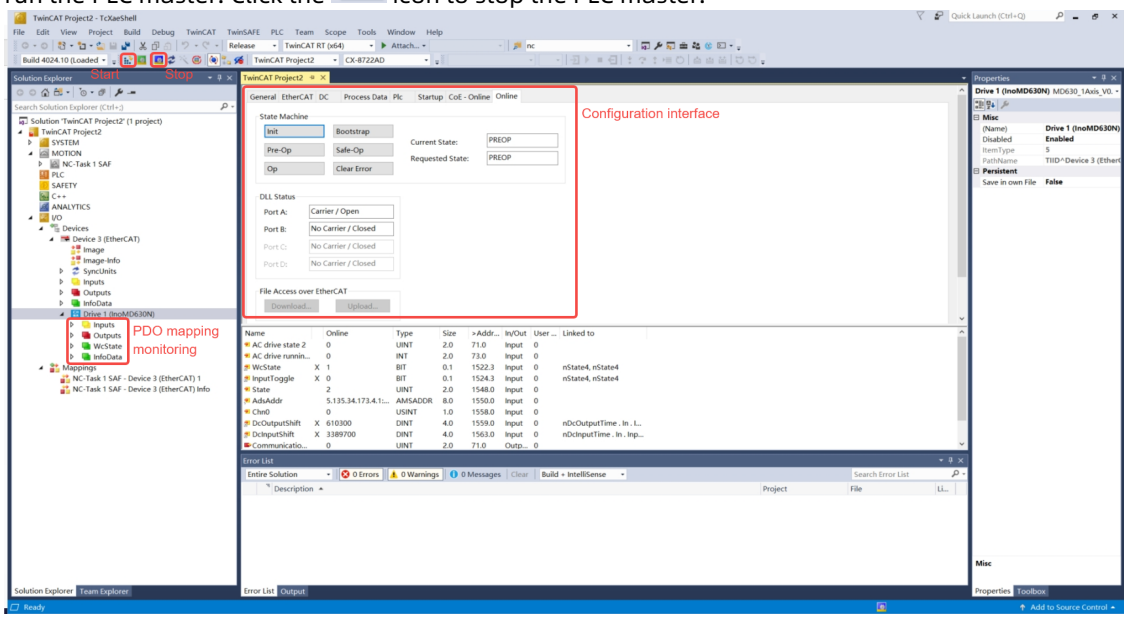
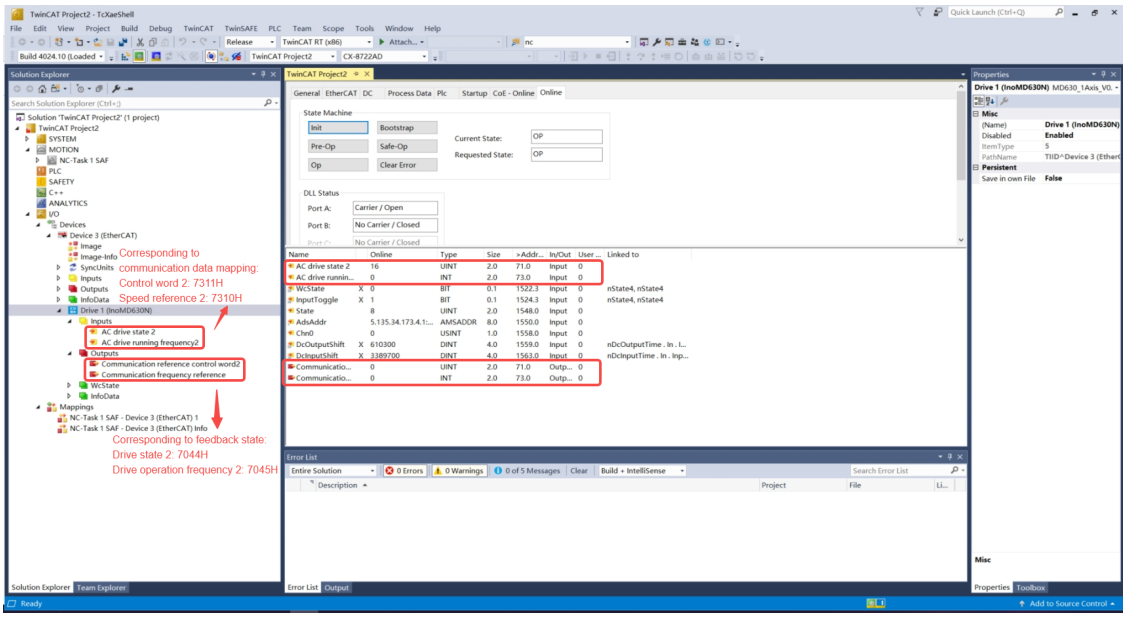


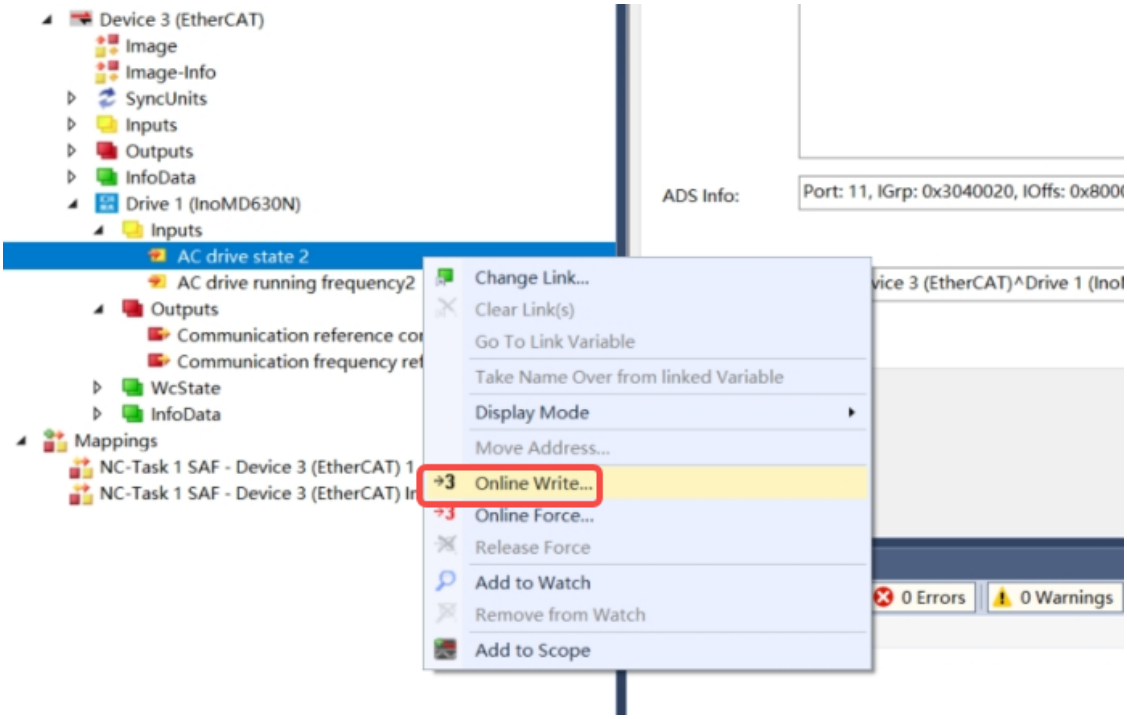
Figure 6-61 Overview interface

Step 4: Control the AC drive through communication

1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.



You can change the mapped value by right-clicking and selecting “Online Write”, as shown below.



2. For start/stop control and setting frequency or torque using EtherCAT communication, read and write specific communication addresses of the AC drive. In other words, the specific addresses are mapped to the PDO data of EtherCAT.
   For start/stop control and setting frequency or torque, 7311H and 7310H need to be mapped to the PDO data.

   The 7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Comm. Address		Description
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run (IN1) 2: Reverse run (IN2) 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop mode set by F2-17 (Stop mode) 7: Reset upon fault 8: Emergency stop

For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows.

Comm. Address		Description
Communication speed setting value 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0- 14 [7310H setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

In default settings, when n0-14 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write -1000 to set the main frequency to -10.00 Hz.

The corresponding state is as follows.

Comm. Address		Description
Drive state 2	7044H	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: bit00: Running status. 0: Stopped; 1: Running bit01: Running direction. 0: Forward; 1: Reverse bit02: Fault state. 0: No fault; 1: Fault bit03: Frequency reached: 0: Not reached; 1: Reached bit04 to bit07: Reserved Bits 8-15: Fault master code. For details, see specific fault descriptions.
AC drive running frequency 2	7045H	2 decimal places, signed number, unit Hz by default. The decimal places is switchable.

6.8.11 Replacing the Faulty Device

When using EtherCAT, the MD630N drive supports direct replacement of a faulty device without reconfiguration or reassignment of the device.

The following conditions must be met when replacing a faulty device.

1. The new drive must be of the same model of the drive to be replaced, which must be MD630N.
2. If the alias mode is used in master configuration, ensure the alias set on the new drive is consistent with that of the drive to be replaced, then restart the slave to activate the alias setting. If the alias mode is not used, you can replace the drive directly.
3. The topology has been correctly set during configuration (namely the actual ports to which each network cable is connected have been defined).
4. Ensure that all parameters of the new drive are set correctly, and then restart the PLC master.

6.9 EtherNet/IP Drive Control

6.9.1 Introduction

EtherNet/IP protocol is based on the TCP/IP protocol stack and uses both connection-oriented and connectionless communication methods. It defines two types of communication: explicit communication and implicit communication.

- Explicit communication: Data is transmitted through TCP (Transmission Control Protocol), which is suitable for transmitting high-accuracy data with relaxed real-time constraints. Explicit communication is further divided into UCMM (Unconnected Explicit Messages) and Class3 (Connected Explicit Messages) based on connection methods.
- Implicit communication: Data is transmitted through UDP (User Datagram Protocol), which is suitable for transmitting data with strict real-time constraints. Implicit messages consist of only one type: Class1 "Implicit Message (I/O Messages)".

EtherNet/IP is a high-speed, real-time, flexible, easy-to-integrate, expandable, and secure industrial automation network protocol that widely used in industrial automation control systems.

6.9.2 Communication Specifications

Table 6–17 Communication specifications

Item	Content
Communication protocol	EtherNet/IP
Services available	PDO (Process Data Object) SDO (Server Data Object)
Physical layer	10/100Base-TX
Communication mode	Half/Full duplex auto-negotiation
Topology	Linear, star, tree, ring
Transmission rate	10/100 Mbit/s adaptive
Transmission medium	Shielded twisted pair of CaT 5e or higher
Transmission distance (m)	< 100

Item	Content
Communication ports	44818 (tcp), 2222 (udp)
Communication type	UCMM, Class3, Class1
EtherNet/IP frame length (bytes)	64 to 1518
Cyclic data	Fixed to 32 bytes (16 status/control words)
Acyclic data (bytes)	6 to 512
Communication cycle (ms)	1 to 50000
Maximum number of connections	1 (Proprietary connection)
Maximum cable length (m)	100
Maximum number of connected slaves	N/A
Number of request messages that can be received at the same time	N/A

6.9.3 Communication System Connection

EtherNet/IP requires shielded twisted pair cables with standard RJ45 port. The shielded cable must be of Cat5e (or higher) can comply with the TIA/EIA-568-B standard, with each cable shorter than 100 m.

The EtherNet/IP protocol itself does not impose any restrictions on the number of slaves in the network. During on-site implementation, the actual number of devices in the network is determined by the master or network addresses.

EtherNet/IP supports bus, star, ring, and tree topologies.

Bus topology

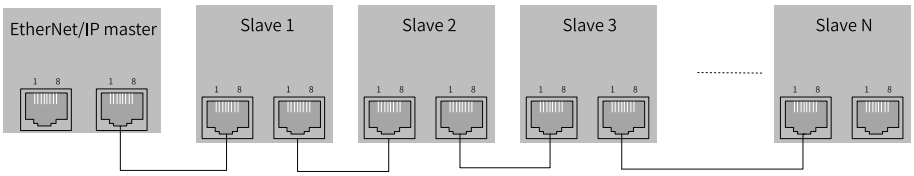


Figure 6-62 Bus topology

In bus topology, the cable is first routed out from the master to any RJ45 terminal of the first device, and then routed out from another RJ45 terminal to the next device, and so on sequentially.

Bus topology features easy wiring and low cost, but if an upstream device fails, all devices downstream of the fault point cannot communicate.

Star topology

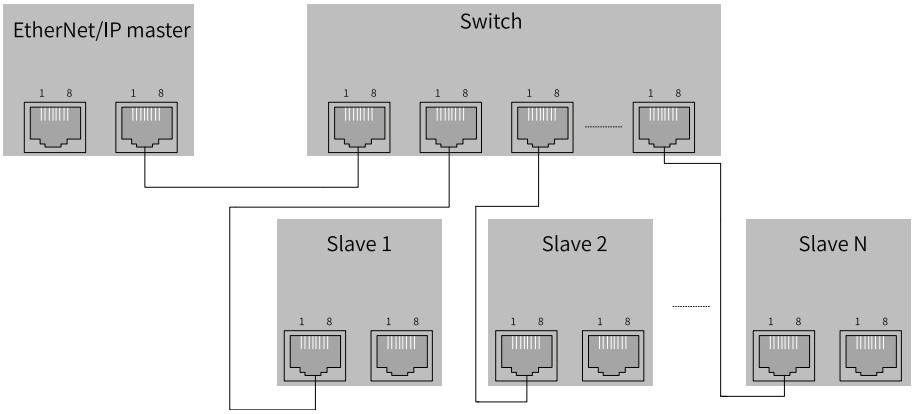


Figure 6-63 Star topology

For wiring with star topology, the cable is first routed out from the master to a network switch, then connected to each device through the switch.

Compared to bus topology, star topology requires an additional switch. A single device failure does not affect communication of other devices, but if the switch fails, communication for all devices is affected.

Tree topology

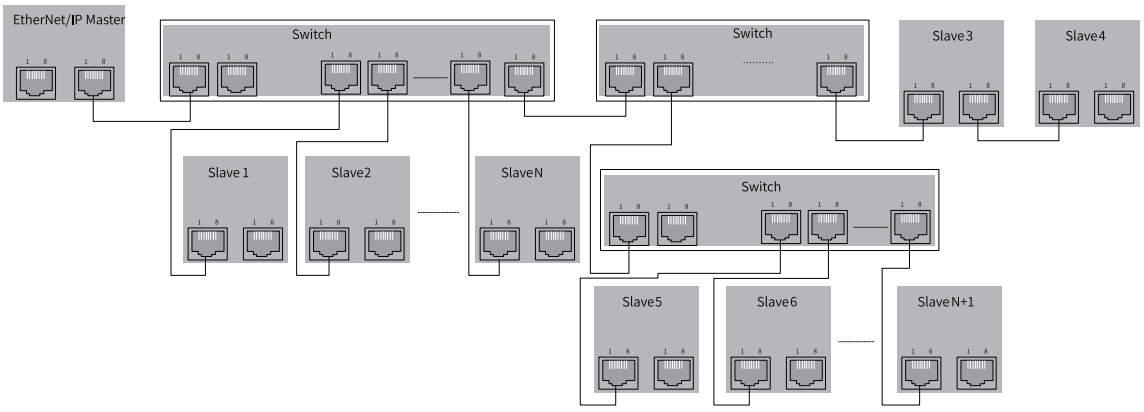


Figure 6-64 Tree topology

The tree topology combines the star and bus topologies, allowing more flexible on-site layout, but also inherits the disadvantages of both topologies. When a switch in the tree topology fails, all devices connected to that switch cannot communicate normally.

Ring topology

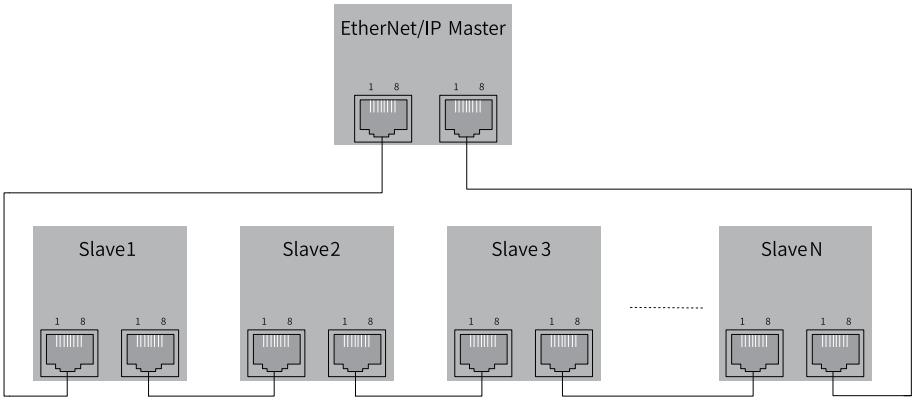


Figure 6-65 Ring topology

The ring topology is a derivative of the bus topology, differing from the bus topology in that the cable from the last device is routed to another port on the master.

This topology inherits the advantages of the bus topology, and a single node fault within the topology does not affect the entire topology. However, this topology requires the master to support and enable DLR management function, or the topology must include a DLR manager. Otherwise, network storms can occur, resulting in a complete collapse of the topology.

6.9.4 Message

6.9.4.1 Message Structure

EtherNet/IP is based on the traditional TCP/IP protocol suite, which uses three connection types: Class 1, Class 3, and UCMM. Among these, Class 3 and UCMM are explicit messages based on the TCP protocol, with the overall frame format as shown in "EtherNet/IP Explicit Message Frame." Class 1 is an implicit message based on the UDP protocol, with the overall frame format as shown in "EtherNet/IP Implicit Message Frame."

In actual applications, acyclic data is exchanged using explicit messages (UCMM and Class 3) and cyclic data is exchanged using implicit messages (Class 1 data).

Note that the EtherNet/IP protocol operates at the application layer of the TCP/IP four-layer network model, and the TCP/IP protocol suite is extensive, so only the EtherNet/IP protocol frame is described here. Others such as Ethernet header, IP datagram, and TCP/UDP messages are not detailed.

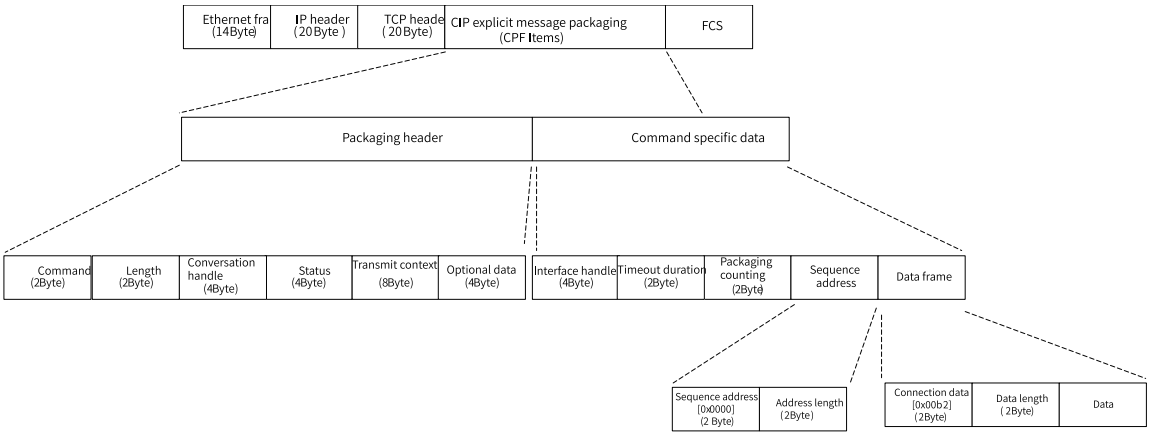


Figure 6-66 EtherNet/IP explicit message

The CIP encapsulation for transmitting acyclic explicit messages consists of a header and command-specific data, as shown below.

Table 6–18 Explicit data frame definition

Field			Description
Ethernet frame header			Ethernet frame information
IP header			IP data encapsulation information
TCP header			TCP encapsulation information
Header	Command		UCMM: SendRRData command (0x6F) Class 3: SendUnitData command (0x70)
	Length		Command-specific data length
	Session handle		Assigned by the device during session registration
	State		0
	Send context		Generated during session registration
	Optional data		0
Command-specific data	Interface handle		0
	Timeout		Any value
	Encapsulation packet	Encapsulation count	2 (one address encapsulation and one data encapsulation)
		Address ID	UCMM: 0 Class3: 0xa1
		Address length	UCMM: 0 Class: 4
		Address data	UCMM: Not applicable Class3: Generated when session is opened
		Data ID	UCMM: 0x00b2 Class3: 0x00b1
		Data length	Actual length of acyclic data transmitted
		Data	Acyclic data transmitted

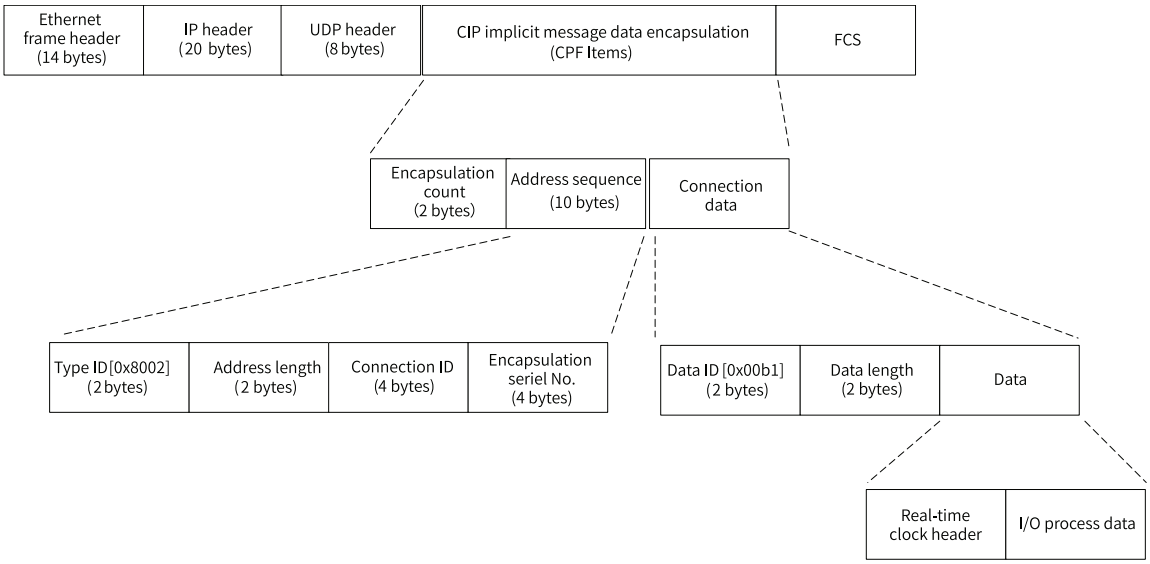


Figure 6-67 EtherNet/IP implicit message packet

Process data is transmitted using implicit message packets. See the table below for encapsulation description.

Field		Description
Ethernet frame header		Ethernet frame information
IP header		IP data encapsulation information
UDP header		UDP encapsulation information
Encapsulation count		2
Address sequence	Type ID	0x8002
	Length	8
	Connection ID	Generated during session registration
	Encapsulation sequence number	Initial value is 1, incremented by 1 per data packet
Connection data	Data ID	0x000B1
	Data length	Process data length
	Data	Process data

6.9.4.2 Process Data Interconnection

Process data supports transmission of up to 16 control words. Among these control words, the first two from master to device (O->T) are fixed as control command and operating frequency, and the rest are user-defined control words. The first two from device to master (T->O) represent the status and operating frequency of the drive, and the rest are user-defined. See the table below for detailed message format.

Note

This section only displays the I/O process data. For the complete frame format, see the EtherNet/IP Class 1 message structure.

Table 6–19 Master process data format

Output data [0]	Output data [1]	Output data [2 to 15]
Communication control command (0x7011)	Operating frequency (0x7010)	User-defined control word
1st control word (2 bytes)	2nd control word (2 bytes)	3rd to 16th control words (2 bytes for each, 28 bytes in total)

Table 6–20 Device process data format

Input data [0]	Input data [1]	Input data [2 to 15]
Device status (0x7044)	Current frequency (0x7045)	User-defined status word
1st status word (2 bytes)	2nd status word (2 bytes)	3rd to 16th status words (2 bytes for each, 28 bytes in total)

6.9.4.3 Message Application Example

Process data

Set the command source to communication (F0-29/b1-00 = 0, or b3-00 = 0), and control the drive to run forwardly at 50 Hz.

Table 6–21 Example for master process data

Output data [0]	Output data [1]	Output data [2]	Output data [3]	...	Output data [15]
0x0001	0x0032	0x0000	0x0000	-	0x0000
1st control word	2nd control word	3rd control word	4th control word	-	16th control word

Cyclic device status returned, forward rotation at 1500 r/min

Table 6–22 Example of slave process data

Input data [0]	Input data [1]	Input data [2]	...	Input data [15]
0x0011	0x05dc	0x0000	-	0x0000
1st status word	2nd status word	3rd status word	-	16th status word

Acyclic data

This example only demonstrates the data content in the message (namely, the data items in the CIP encapsulation), for example, retrieving the current device operating time (control word 0xad03).

Request message:

Data ID	Length	Access type	Path length	Path type	Path value	Path type	Path value	Path type	Path value
0x00b2 (UCMM access)	0x000a	0x0e (Request)	0x04	0x20 (Class)	0x93	0x24 (Instance)	0x01	0x31 (Attribute)	0x00ad03

Response message:

Data ID	Length	Access type	Path length	State	Data
0x00b2	0x0006	0x8e (Response)	0x04	0x0000 (Success)	0x07bd

6.9.4.4 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 908*.

6.9.4.5 Mapping Table (AC Drive Data)

For details, see *"6.5.3 Mapping Table" on page 910*.

6.9.5 Communication Ports

The MD630 bus model supports the EtherNet/IP protocol and communicates through J9 (terminal marked IN) and J5 (terminal marked OUT). When facing the two RJ45 ports of the drive, these two terminals are equivalent and direction-insensitive.

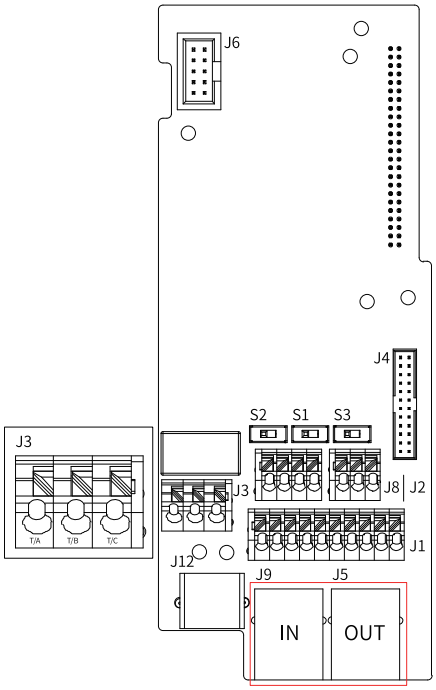


Table 6–23 Description of EtherNet/IP communication port

External terminal	Type	Type of information transmitted	Mark	Name	Function
J9	RJ45 port	100 M bus	IN	100 M bus cascading port	Supports three communication protocols: ECAT/EIP/PN. Select the protocol type through n0-10. When ECAT is selected, it is the IN port. EIP/PN is direction-insensitive.
J5	RJ45 port	100 M bus	OUT	100 M bus cascading port	Supports three communication protocols: ECAT/EIP/PN. Select the protocol type through n0-10. When ECAT is selected, it is the OUT port. EIP/PN is direction-insensitive.

6.9.6 Connecting the Drive To Bus System

The EtherNet/IP bus uses a standard RJ45 interface. The cable shall be a shielded twisted pair cable of at least CaT 5e and meeting the TIA/EIA-568-B standard. The shield must be properly grounded. The maximum cable length between two devices is 100 m.

Connection procedure

1. Switch on the system power supply.
2. See the communication networking topology in *"6.9.3 Communication System Connection" on page 1005* and connect the network cable to the shielded network port terminal, as shown in *"Figure 6-68 EtherNet/IP communication connection" on page 1012*. For communication interface specifications, see *"6.9.5 Communication Ports" on page 1011*.

Note

In EtherNet/IP communication, IN and OUT of the communication port are direction-insensitive.

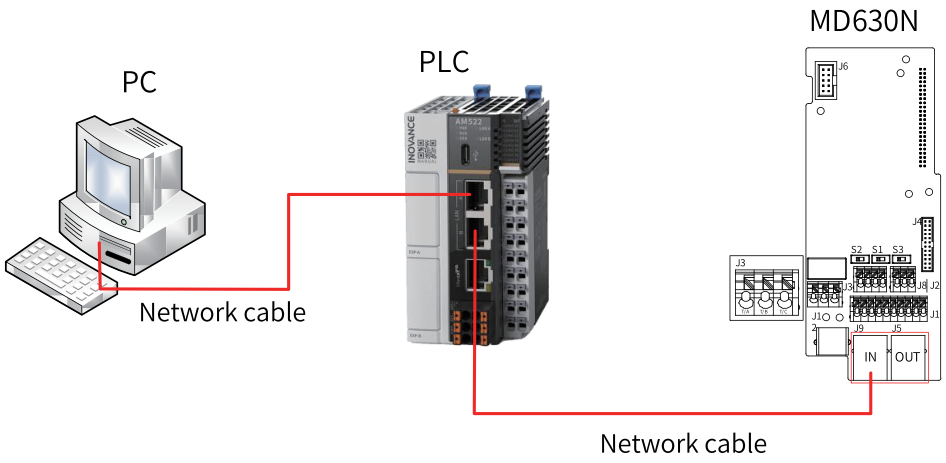


Figure 6-68 EtherNet/IP communication connection

3. Set n0-10 to 2.
4. Configure the IP addresses in n5-01 to n5-04, subnet masks in n5-05 to n5-08, and gateway addresses in n5-09 to n5-12.

Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
n5-00	DHCP function	0 [Disable]	-	0	0	1	ShutdownModify	Decimalism	0x2500
n5-01	Most significant byte of the IP address	192	-	0	0	255	ShutdownModify	Decimalism	0x2501
n5-02	Second most significant byte of the IP address	168	-	0	0	255	ShutdownModify	Decimalism	0x2502
n5-03	Third byte of the IP address	1	-	0	0	255	ShutdownModify	Decimalism	0x2503
n5-04	Least significant byte of the IP address	8	-	0	0	255	ShutdownModify	Decimalism	0x2504
n5-05	Most significant byte of the subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2505
n5-06	Second most significant byte of the subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2506
n5-07	Third byte of the subnet mask	255	-	0	0	255	ShutdownModify	Decimalism	0x2507
n5-08	Least significant byte of the subnet mask	0	-	0	0	255	ShutdownModify	Decimalism	0x2508
n5-09	Most significant byte of the gateway	192	-	0	0	255	ShutdownModify	Decimalism	0x2509
n5-10	Second most significant byte of the gateway	168	-	0	0	255	ShutdownModify	Decimalism	0x250A
n5-11	Third byte of the gateway	1	-	0	0	255	ShutdownModify	Decimalism	0x250B
n5-12	Least significant byte of the gateway	1	-	0	0	255	ShutdownModify	Decimalism	0x250C

5. Restart the device power supply.

6.9.7 Configuring Communication between the Drive and Controller

When using EtherNet/IP communication, the controller must support the EtherNet/IP protocol. It is recommended to use a EtherNet/IP branded controller to avoid compatibility issues.

The following basic operations are required for EtherNet/IP communication with the drive.

1. Perform wiring according to *"6.9.6 Connecting the Drive To Bus System" on page 1012*.
2. Switch the device communication mode to EtherNet/IP (n0-10 = 2), set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference source of setting channel 1 (b0-03 = 0 and b5-00 = 9). (This operation can be performed through the operating panel or software tool.)
3. Wait a few seconds until LED0 (green) and LED1 (yellow) are steady on, indicating successful establishment of the Ethernet link.
4. Configure communication between the master (controller) and slave (drive) as shown in *"6.9.10.1 EtherNet/IP Communication Configuration Example between the Drive and Inovance AC801 Controller" on page 1017*.

6.9.8 Communication Parameters

Table 6–24 EtherNet/IP parameters

Param.	Name	Default	Value range	Change mode	Description
n5-00 (Fd-58)	DHCP enable	0	0 to 1	At stop	Enable DHCP (Dynamic Host Configuration Protocol). Value description: 0: The DHCP function is disabled. 1: The DHCP function is enabled. Note: After enabling DHCP, the IP address-related parameters n5-01 to n5-12 are inactive, which are assigned by DHCP server.
n5-01 (Fd-59)	Most significant byte of the IP address	0	0 to 255	At stop	Indicates the most significant byte of the IP address. For example, if the IP address is 192.168.1.2, this parameter displays 192. Note: The modification on this parameter is activated at next power-on.
n5-02 (Fd-60)	Second most significant byte of the IP address	0	0 to 255	At stop	Defines the second most significant byte of IP address. For example, if the IP address is 192.168.1.2, this parameter displays 168. Note: The modification on this parameter is activated at next power-on.
n5-03 (Fd-61)	Third byte of the IP address	0	0 to 255	At stop	Defines the third byte of IP address. For example, if the IP address is 192.168.1.2, this parameter displays 1. Note: The modification on this parameter is activated at next power-on.

Param.	Name	Default	Value range	Change mode	Description
n5-04 (Fd-62)	Least significant byte of the IP address	0	0 to 255	At stop	Least significant byte of the IP address Defines the least significant byte of IP address. For example, if the IP address is 192.168.1.2, this parameter displays 2. Note: The modification on this parameter is activated at next power-on.
n5-05 (Fd-63)	Most significant byte of the subnet mask	0	0 to 255	At stop	Defines the most significant byte of subnet mask. For example, if the subnet mask is 255.255.255.255, this parameter displays 255. Note: The modification on this parameter is activated at next power-on.
n5-06 (Fd-64)	Second most significant byte of the subnet mask	0	0 to 255	At stop	Defines the second most significant byte of subnet mask. For example, if the subnet mask is 255.255.255.255, this parameter displays 255. Note: The modification on this parameter is activated at next power-on.
n5-07 (Fd-65)	Third byte of subnet mask	0	0 to 255	At stop	Defines the third byte of subnet mask. For example, if the subnet mask is 255.255.255.255, this parameter displays 255. Note: The modification on this parameter is activated at next power-on.
n5-08 (Fd-66)	Least significant byte of the subnet mask	0	0 to 255	At stop	Defines the least significant byte of subnet mask. For example, if the subnet mask is 255.255.255.255, this parameter displays 0. Note: The modification on this parameter is activated at next power-on.
n5-09 (Fd-67)	Most significant byte of the gateway	0	0 to 255	At stop	Defines the most significant byte of gateway address. For example, if the gateway address is 192.168.1.1, this parameter displays 192. Note: The modification on this parameter is activated at next power-on.
n5-10 (Fd-68)	Second most significant byte of the gateway	0	0 to 255	At stop	Defines second most significant byte of gateway address. For example, if the gateway address is 192.168.1.1, this parameter displays 168. Note: The modification on this parameter is activated at next power-on.

Param.	Name	Default	Value range	Change mode	Description
n5-11 (Fd-69)	Third byte of gateway	0	0 to 255	At stop	Defines the third byte of gateway address. For example, if the gateway address is 192.168.1.1, this parameter displays 1. Note: The modification on this parameter is activated at next power-on.
n5-12 (Fd-70)	Least significant byte of the gateway	0	0 to 255	At stop	Defines the least significant byte of the gateway address. For example, if the gateway address is 192.168.1.1, this parameter displays 1. Note: The modification on this parameter is activated at next power-on.

6.9.9 Communication Fault Diagnosis

Table 6–25 Diagnosis method for EtherNet/IP communication fault

Fault code	Fault name	Cause	Verification method	Remedy
E165.1	EtherNet/IP Ethernet communication timeout	The power supply of the device is unstable or the network topology is disturbed.	1. Check whether the power supply of the equipment is stable. Measure whether the bus voltage is within the operating voltage range. If not, check whether a high-power device is using the same power supply. The same power supply is used for high-power devices. This may cause voltage instability. In this case, an independent power supply is required. 2. Check whether the communication cable and power cable are routed through different routes. If the communication cable is routed together with the power cable, interference may occur. It is recommended to route the cables through different routes according to the cable routing specifications.	1. Ensure that each of the high-power device is equipped with an independent power supply. 2. Route the communication cables and power cables through different routes. If the voltage is still unstable after preceding causes are rectified, replace the power supply.
		A fault occurs on the network device.	1. Ping the device continuously, check whether the device responds and whether the response delay is greater than the set communication service cycle. If no response or response delay is greater than the communication service cycle, the network equipment may be faulty. Use the step-by-step ping method to locate the faulty device and replace it. If the response delay is lower than the communication service cycle, check whether the delay fluctuation is stable or too large. If yes, the network equipment may be faulty or the network bandwidth may be insufficient. 2. Check whether the network bandwidth is sufficient with the command ifconfig.	1. Replace the network device that is faulty in the network topology. 2. If the network bandwidth is insufficient, reduce the number of nodes in the network topology or upgrade the network bandwidth.
		The controller is faulty.	Check whether the controller works properly and whether there is any data sent. If not, the controller is abnormal and needs to be replaced.	Replace the controller.
E165.2	Ethernet/IP hardware error	The Ethernet integrated circuit is faulty.	Check whether the MCB network port, PHY integrated circuit, and network transformer are dirty.	Clean the dirty parts. If this is not possible, contact technical support.

Fault code	Fault name	Cause	Verification method	Remedy
E165.3	MAC address not programmed for EtherNet/IP	MAC address is lost.	Check whether the MAC address of the drive can be read by the host controller through the iFA commissioning software. If it cannot be read, the MAC address is lost.	Contact the technical support.
E165.4	EtherNet/IP IP conflict	IP address conflict exists in the communication network.	Disconnect the device from the network and check whether the fault disappears. If there is no fault when the device is not connected to the network, the fault is reported after connection. The IP address of this device conflicts with other devices in the network.	Modify the IP address of the conflict device.

6.9.10 Communication Configuration Examples

6.9.10.1 EtherNet/IP Communication Configuration Example between the Drive and Inovance AC801 Controller

Prerequisite

Software acquisition and hardware wiring:

1. Log in to Inovance website https://www.inovance.com/global to download the programming software InoProShop and the latest EDS file.
2. Use a standard Ethernet cable to connect LAN A or LAN B port of AC801 to port 1 or 2 of the drive, see details in *"6.9.6 Connecting the Drive To Bus System" on page 1012*.

Procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.

Step 2: Set the frequency or torque through communication.

Set the frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set the torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed.

0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish EtherNet/IP communication.

1. Set n0-10 to 2 (through the operating panel or the software tool). Set the communication mode to EtherNet/IP.
2. Wait for a few seconds until LED0 flashes green and LED1 turns yellow (steady). This indicates that the connection between slave and master is established successfully, and data exchange is available.
3. Create a project.
   Open InoProShop and create a project. Select "AC801-02-U0R0" in the "Device" pane.

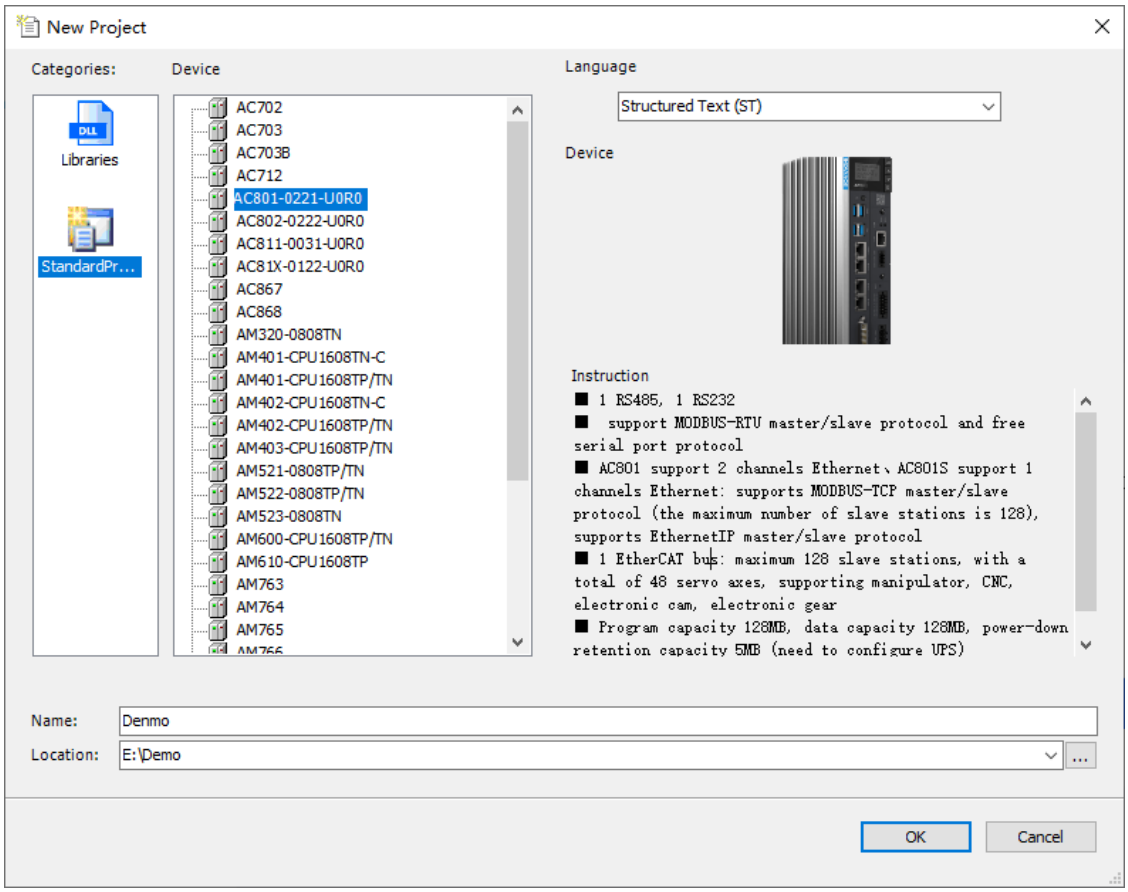


Figure 6-69 Select the master device.

4. Import the EDS file and add a slave.
   Open the "Network configuration" interface, click on the PLC, and set the current communication protocol to "EtherNet/IP master." Click "Import EDS file" at the top, import the EDS file, and then import the device into the device list on the right.

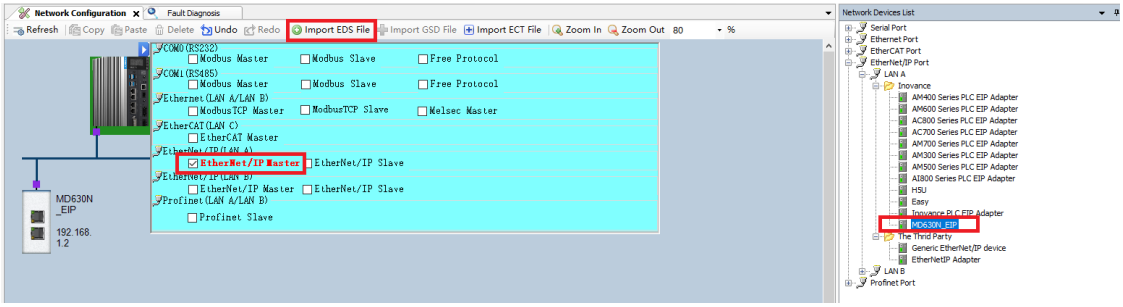


Figure 6-70 Selecting the slave device

5. Configure the slave parameters.

a. Select the drive and enter the corresponding "IP address" of the device.

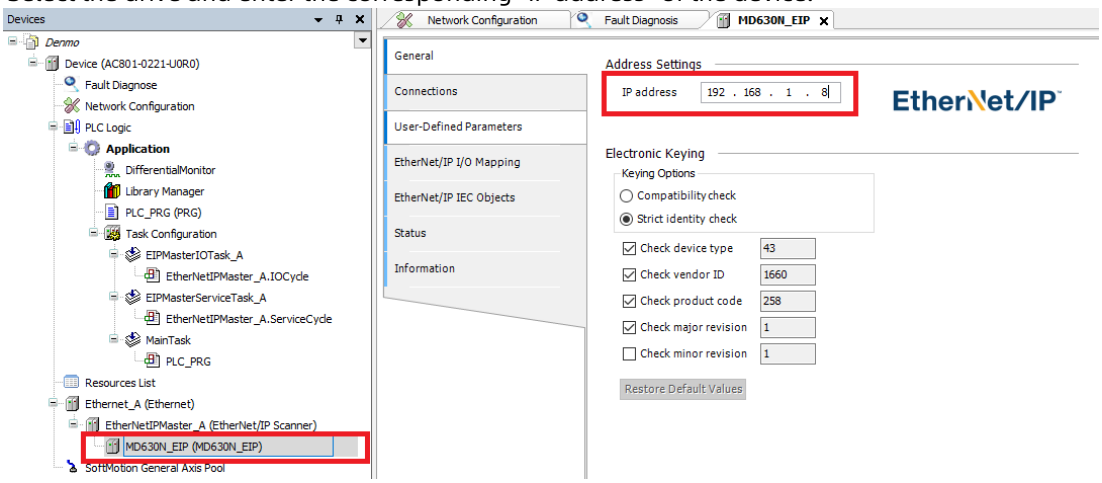


Figure 6-71 Configuring the IP address

b. Click "Connection" on the left side and configure the communication parameters and process data mapping addresses according to actual requirements.

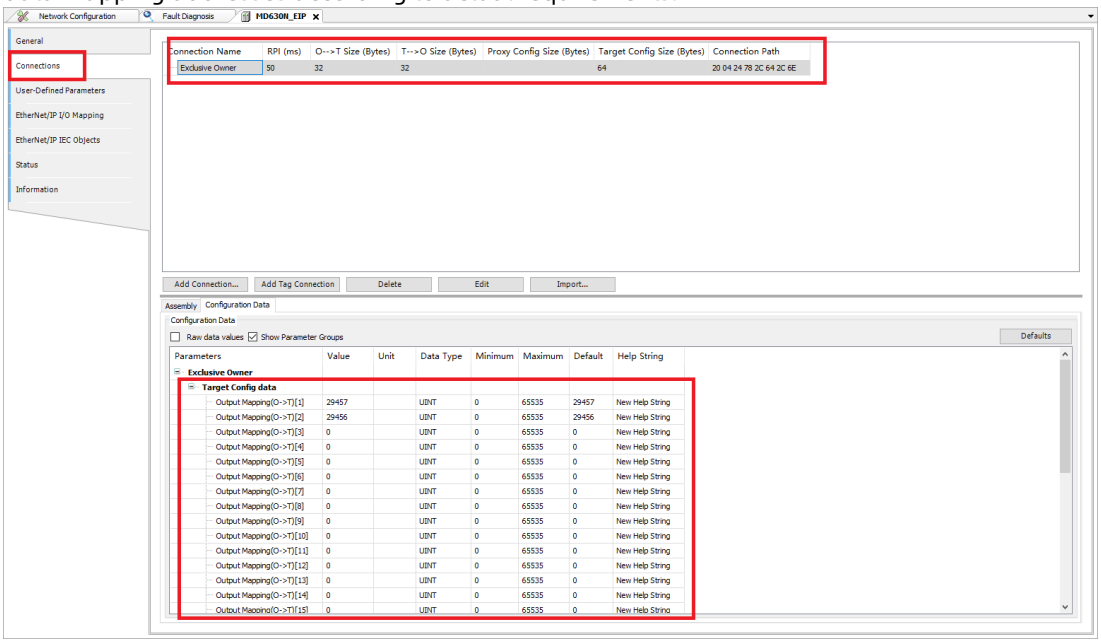


Figure 6-72 Configuring process data mapping

6. Compile the program, download it to the PLC, and run it to establish the connection between the PLC and the controller.

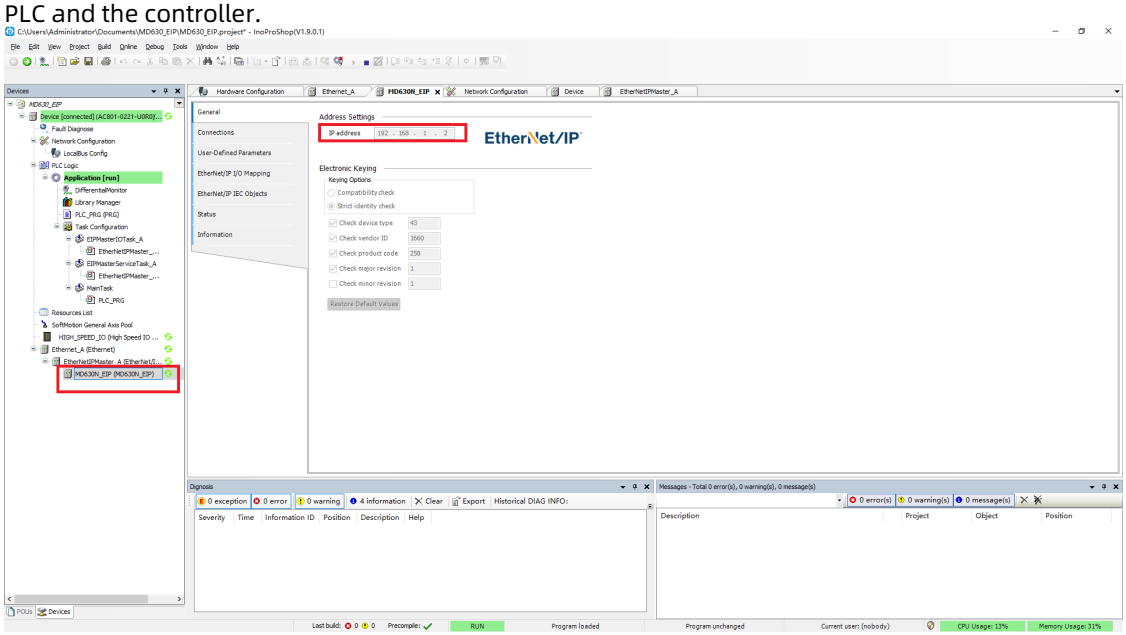


Figure 6-73 Starting EtherNet/IP communication

Step 4: Control the drive through communication.

1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.

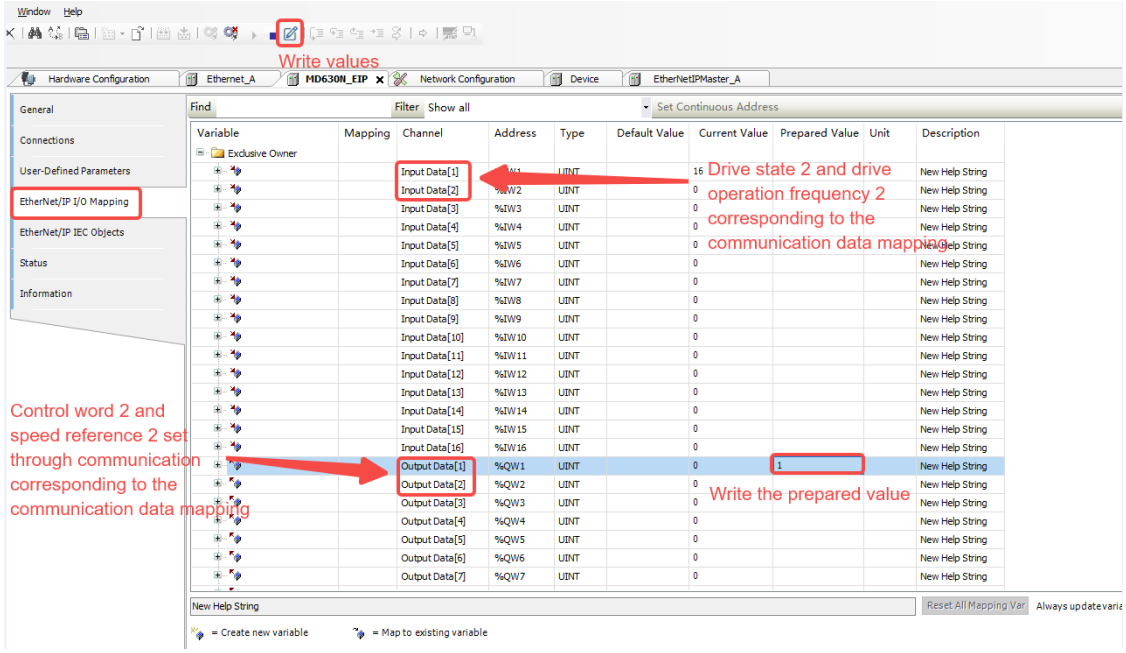


Figure 6-74 Configuring communication data mapping

2. For start/stop control and frequency/torque reference through EtherNet/IP communication, read and write specific communication addresses of the drive. In other words, the specific addresses need to be mapped to the PDO data of EtherNet/IP.
   For simple start/stop control and frequency/torque reference, 7311H and 7310H need to be mapped to the PDO data.

7311H is one of the communication addresses supported by the drive, which is defined as follows.

Comm. address		Description
Control word 2 set through communication	7311H	The setpoint of 7311H is in decimal. References corresponding to different values are shown below. 0: Stop as defined by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop as defined by F2-17 7: Reset fault 8: Emergency stop

For example, writing 1 to 7311H activates forward run. Writing 0 to 7311H stops the drive as defined by F2-17 [OFF1 stop mode].

7310H is one of the communication addresses supported by the drive, which is defined as follows.

Comm. address		Description
Speed reference 2 set through communication	7310H	The target frequency can be set through this address. The property of values written by this address is switched by n0-14 [7310H Reference selection]. The setting range of n0-14 is as follows. 0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to rated frequency/signed 16-bit/2 decimal places) 4: Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)

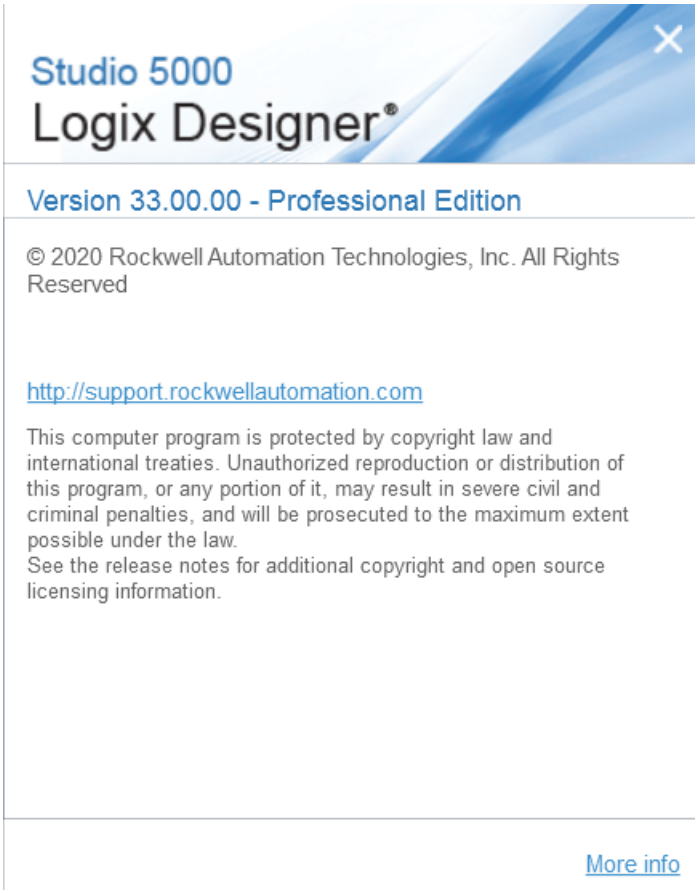
In default settings, when n0-14 [7310H Reference selection] is set to 1 [Frequency (signed 16-bit)], writing 1000 to 7310H sets the main frequency to 10.00 Hz. Writing -1000 sets the main frequency to -10.00 Hz.

The corresponding feedback states are defined in the following table.

Comm. address		Description
Drive state 2	7044H	The status value of 7044H is hexadecimal. The drive states corresponding to bit values are as follows. bit0: Operation status. 0: Stopped; 1: Operating bit1: Operating direction. 0: Forward; 1: Reverse bit2: Fault state. 0: No fault; 1: Faulty bit3: Frequency arrival. 0: Inactive; 1: Active bit4 to bit7: Reserved bit8 to bit15: Fault code. For details, see specific fault descriptions.
AC drive operating frequency 2	7045H	Default: 2 decimal places, signed number, in units of Hz. The decimal places are switchable.

6.9.10.2 Configuration for EtherNet/IP Communication Between the Drive and Rockwell Master L1756-L82

In this configuration example, Studio5000 and master 1756-L82 are used.



Rockwell official website: support.rockwellautomation.com

Prerequisite

1. See *"6.9.6 Connecting the Drive To Bus System" on page 1012* to complete the communication network connection.
2. Install the Rockwell PLC host controller Studio5000 to the PC.

Procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.

Step 2: Set the frequency or torque through communication.

Set the frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed.

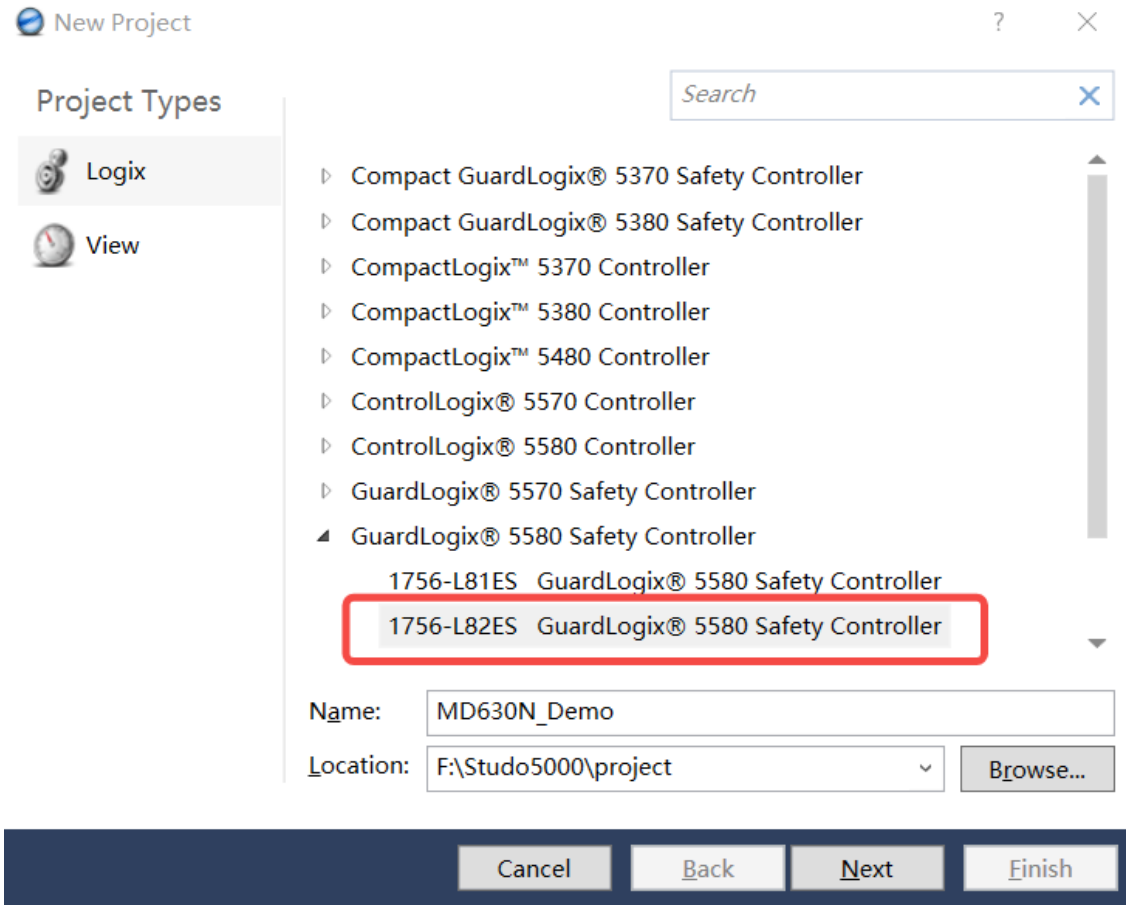
0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 3: Percentage (corresponding to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponding to the maximum frequency/signed 16-bit/two decimal places)

Set the torque as follows:

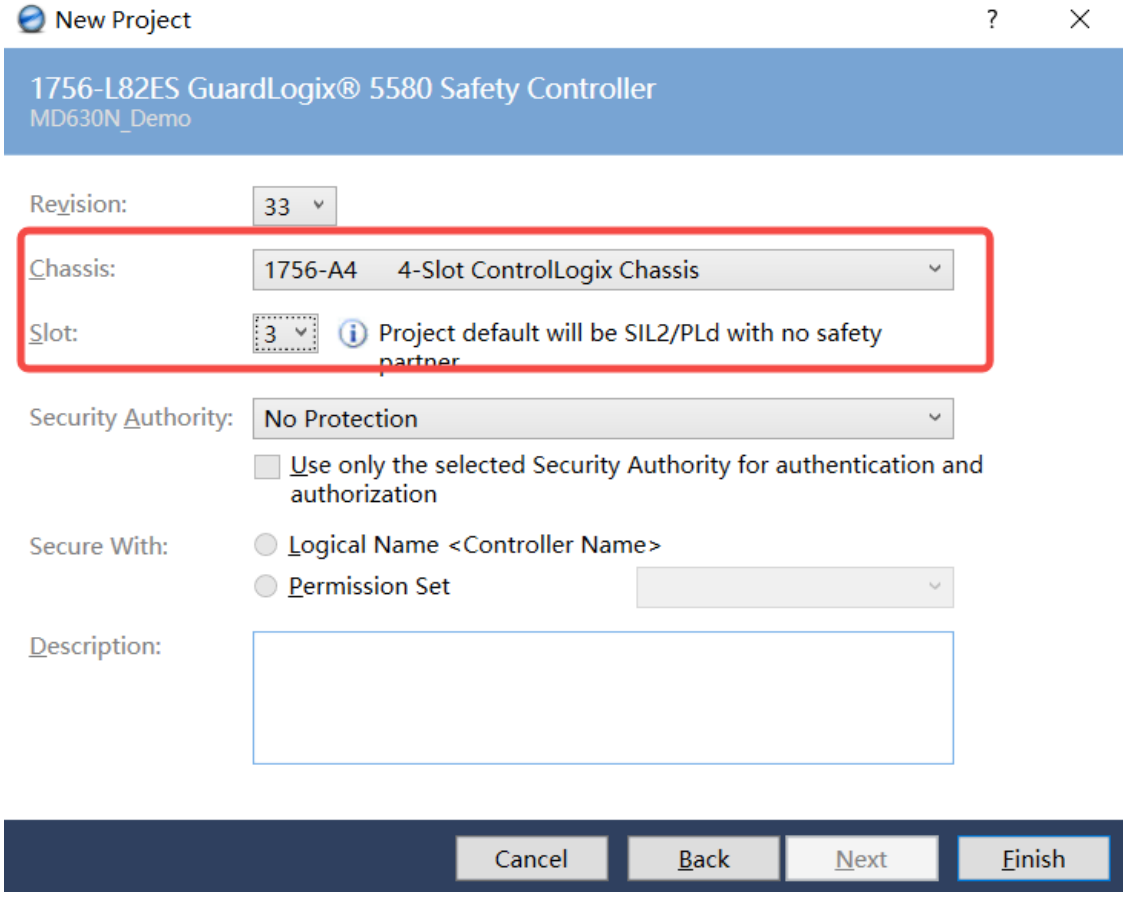
1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish EtherNet/IP communication.

1. Set n0-10 to 2 (through the operating panel or the software tool). Set the communication mode to EtherNet/IP.
2. Wait for a few seconds until LED0 flashes green and LED1 turns yellow (steady). This indicates that the connection between slave and master is established successfully, and data exchange is available.
3. Create a project.
   Select 1756-L82ES of the controller model "CompactLogix 5580 Controller". Click "Next" when the selection is done.

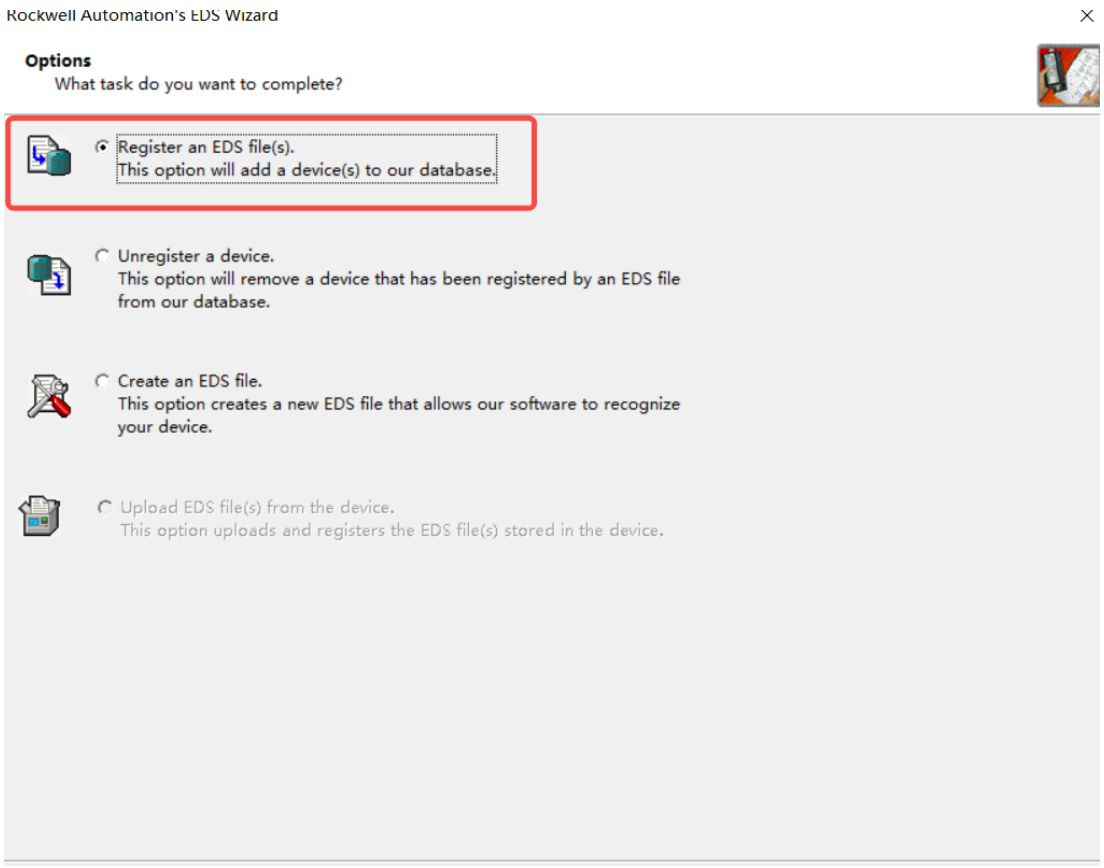


4. Select the chassis of the device and the slot number of the controller. In this example, the chassis model is 1756-A4 and the slot number of the controller is 3. Click "Finish" when the selection is done.

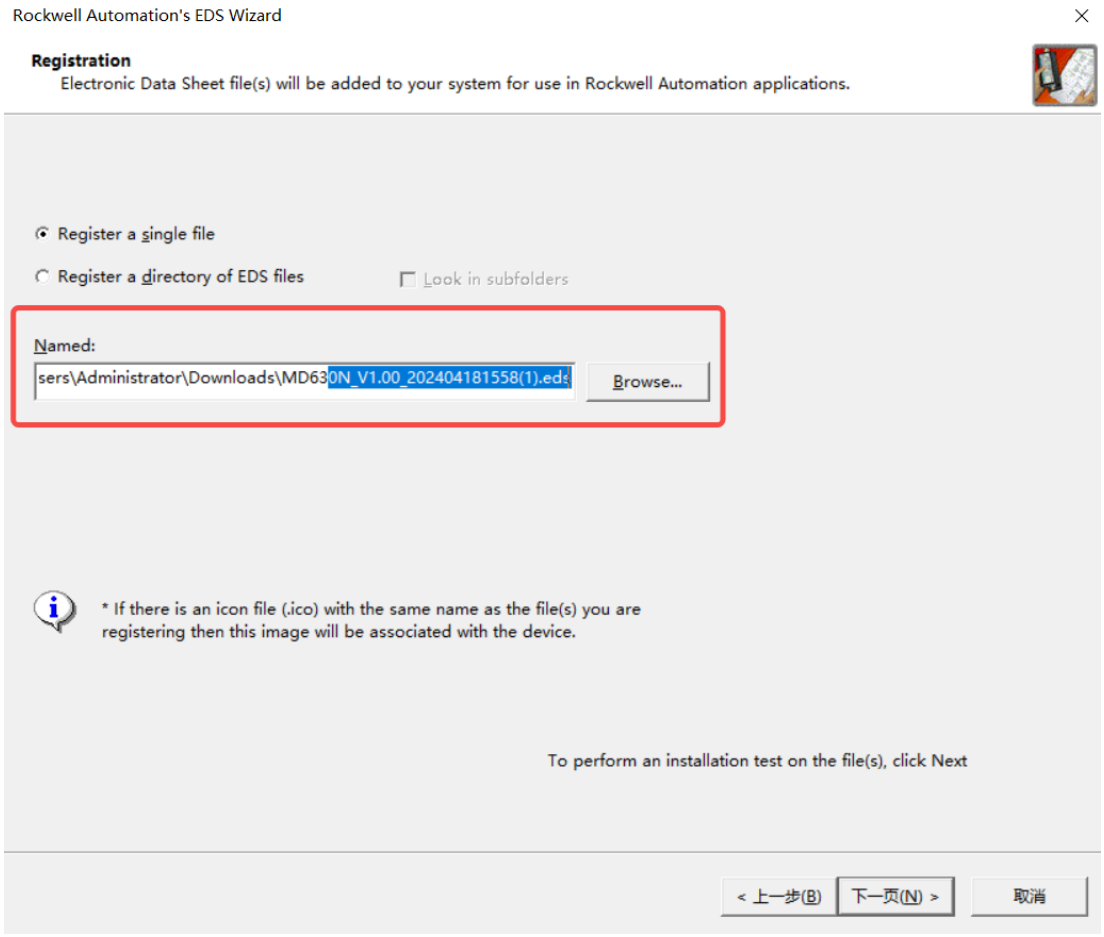


5. Import the EDS file.

a. Click "Tools > EDS Hardware Installation Tool", and then click "Next" and select "Register an EDS file(s)".



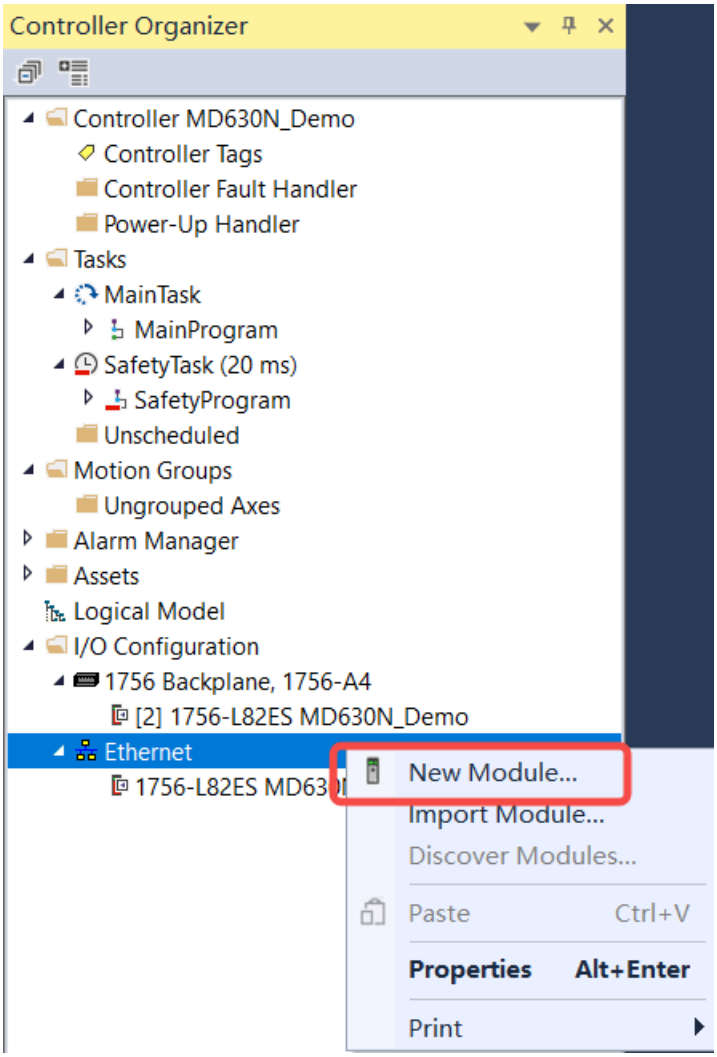
b. Select the corresponding EDS file and click "Next" until the end.


Rockwell Automation's EDS Wizard
Registration
Electronic Data Sheet file(s) will be added to your system for use in Rockwell Automation applications.
Register a single file
Register a directory of EDS files
Look in subfolders
Named:
sers\Administrator\Downloads\MD630N_V1.00_202404181558(1).eds
Browse...
* If there is an icon file (.ico) with the same name as the file(s) you are registering then this image will be associated with the device.
To perform an installation test on the file(s), click Next
< 上一步(B)
下一页(N) >
取消

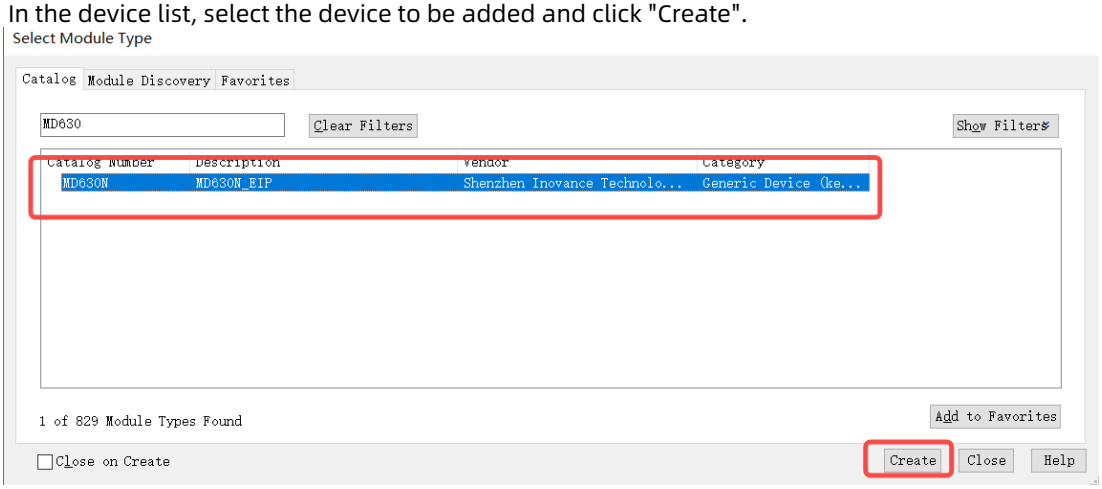

Rockwell Automation's EDS Wizard
You have successfully completed the EDS Wizard.

6. Add devices to the project.

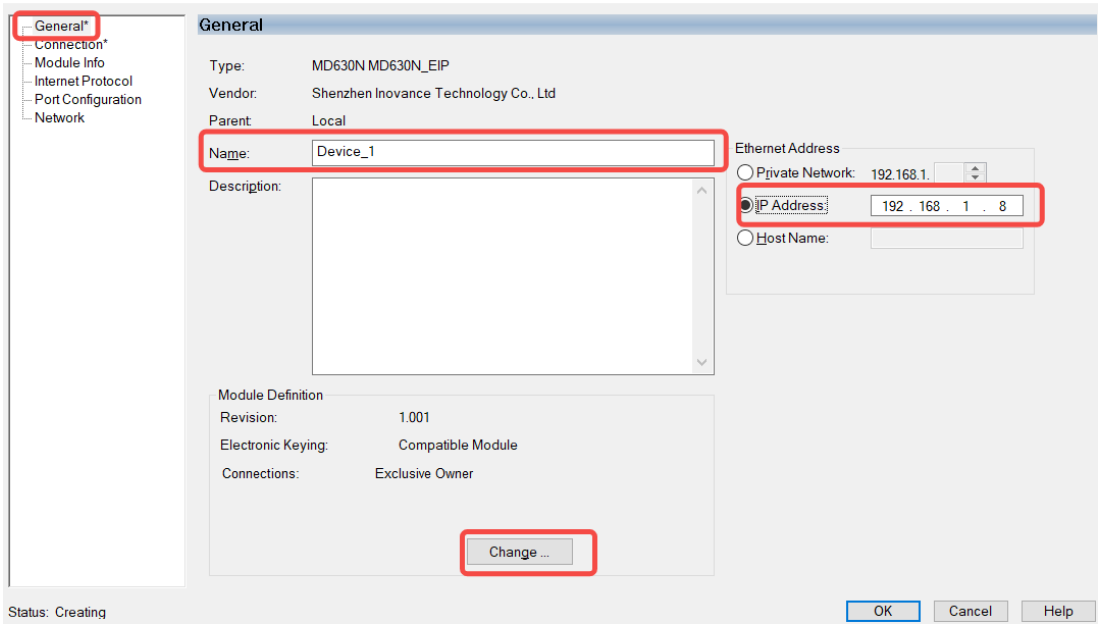
a. Right-click "Ethernet" and select "New Module".



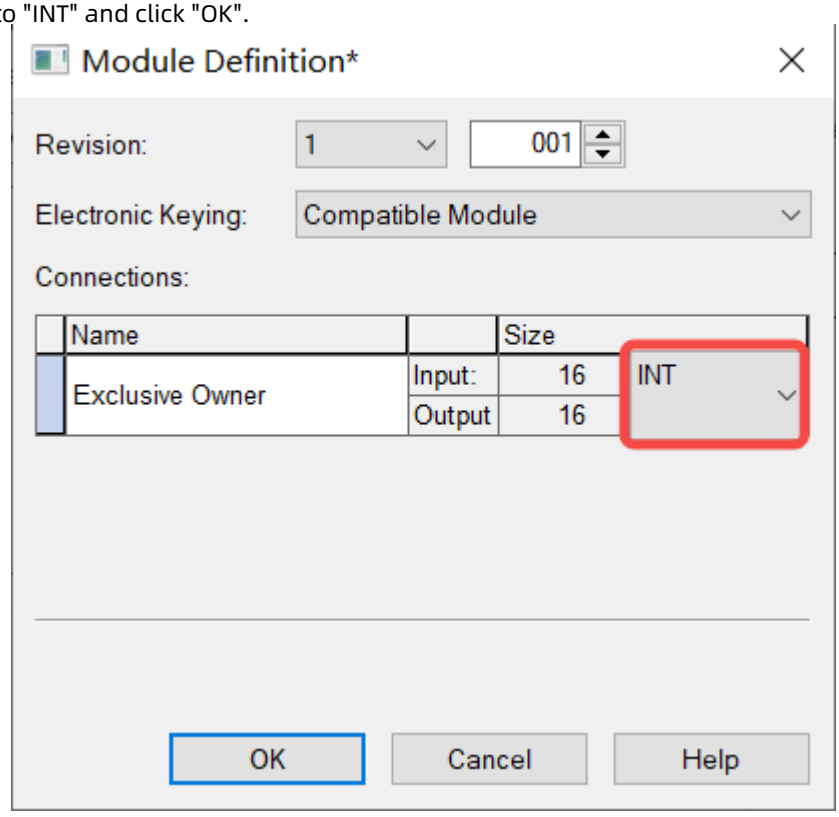
b. In the device list, select the device to be added and click "Create".



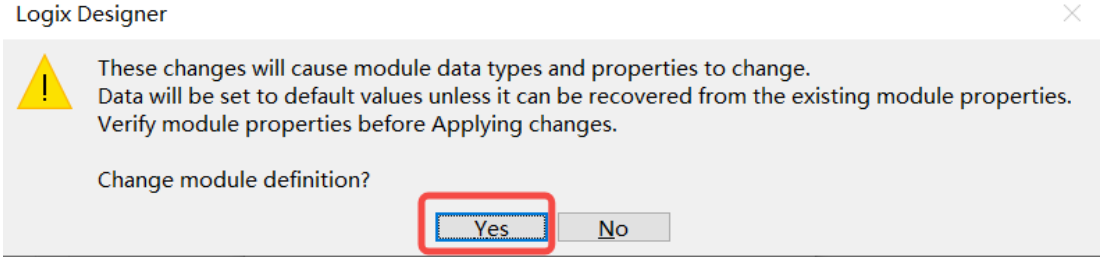
c. Select "General" on the left and set the "Name" and "IP Address" of the device. The IP address here needs to be the same as the IP address in the device communication parameters. After settings are done, click "Change".



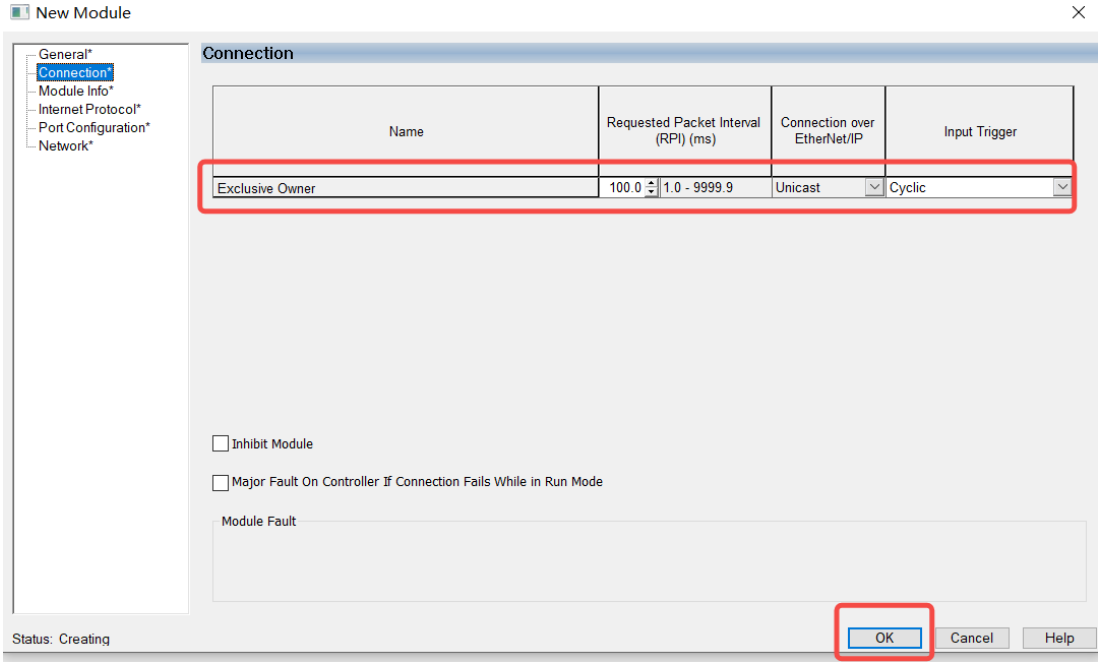
d. Set "Size" to "INT" and click "OK".



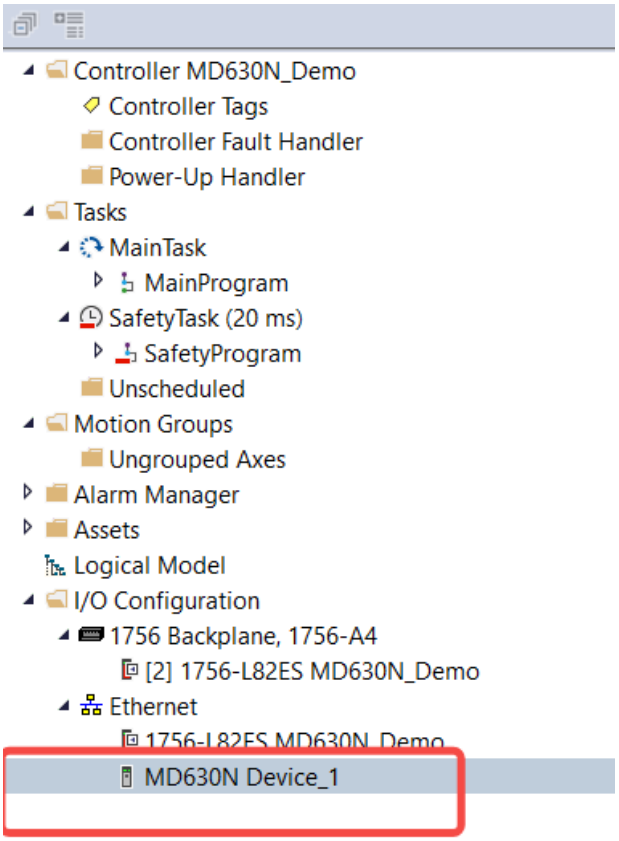
e. Click "Yes".



f. Click "Connection" on the left to set the connection parameters. Set the parameters according to the actual project requirements, and click "OK".

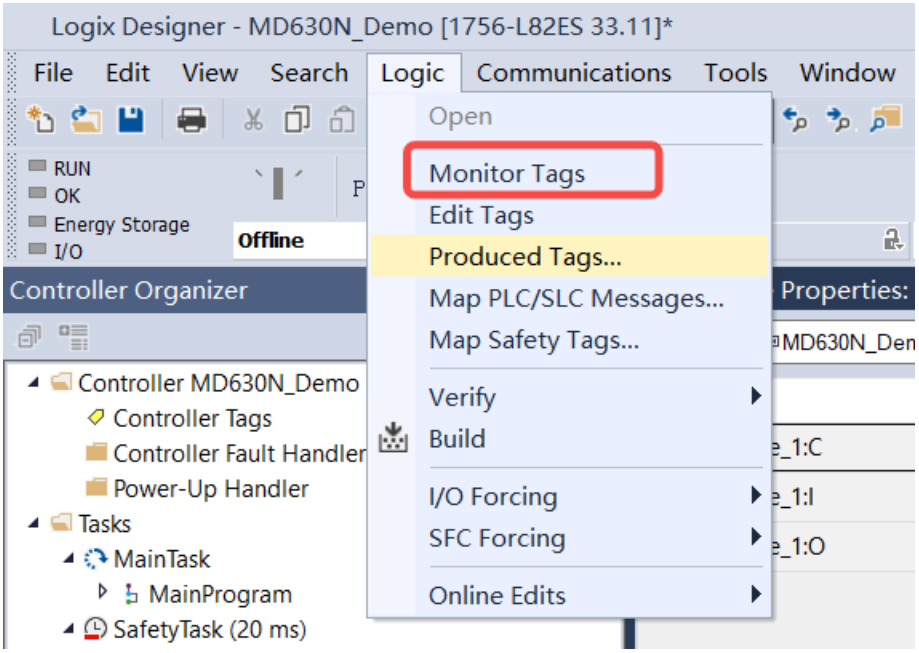


The device is added, and the device is visible in the project status bar.

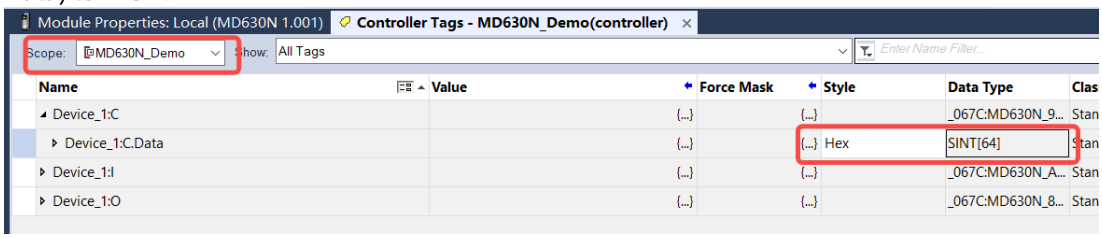


7. Configure the mapping data.

a. Click "Logic > Monitor Tags" in the menu.

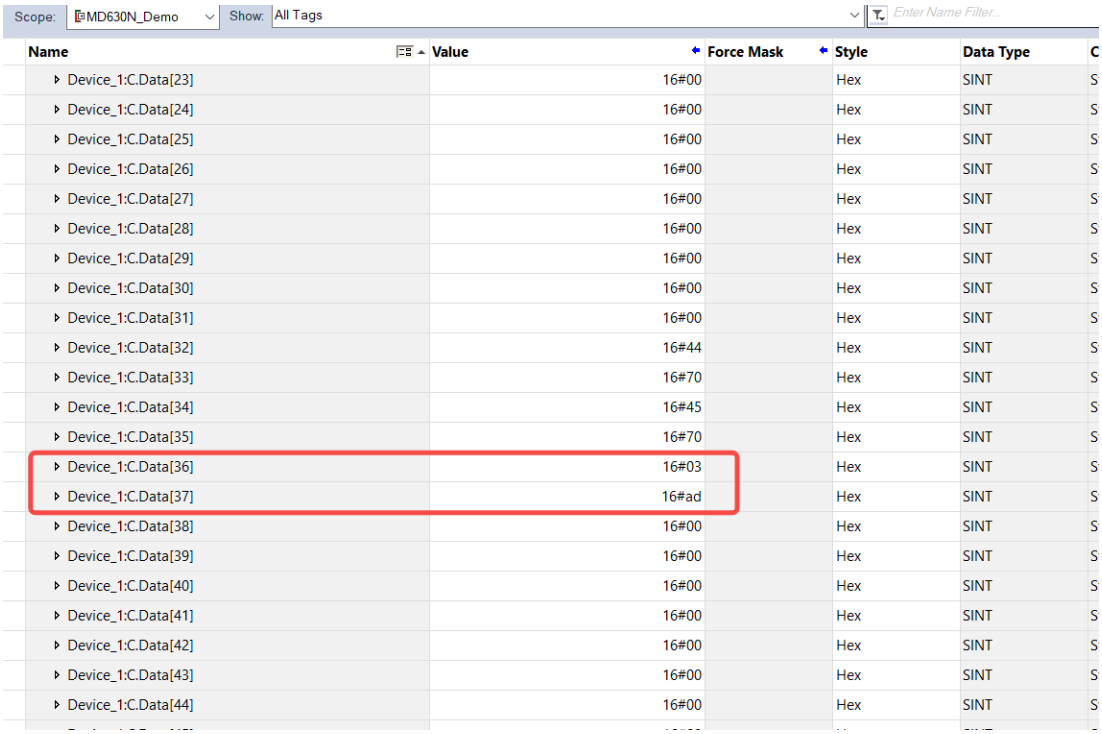


b. Select current project and set the data format in the configuration data (that is, Device_1: C_Data) to "Hex".



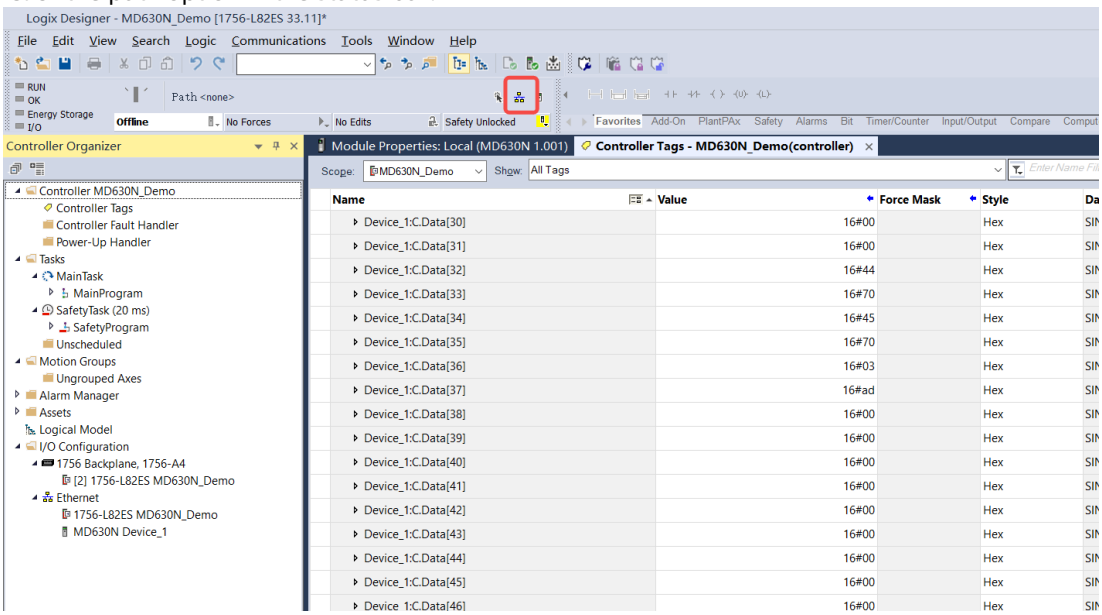
c. Expand the configuration data and fill in the table with the control word and status word addresses that need to be mapped.

Each of the two parameters form a group of addresses. The high address is followed by the low address. In the example for getting the power-on time of the drive, the address is 0xad03, so the status word mapping C: Data[36] = 0x03. C: Data[37] = 0xad.

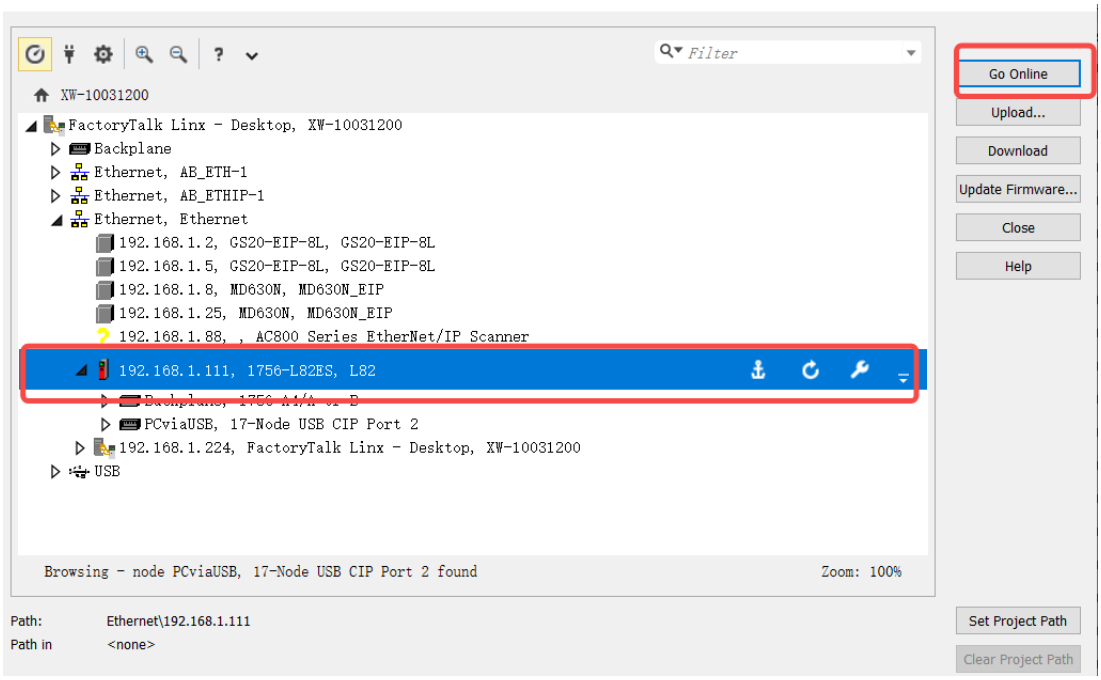


8. Download the project to the PLC.

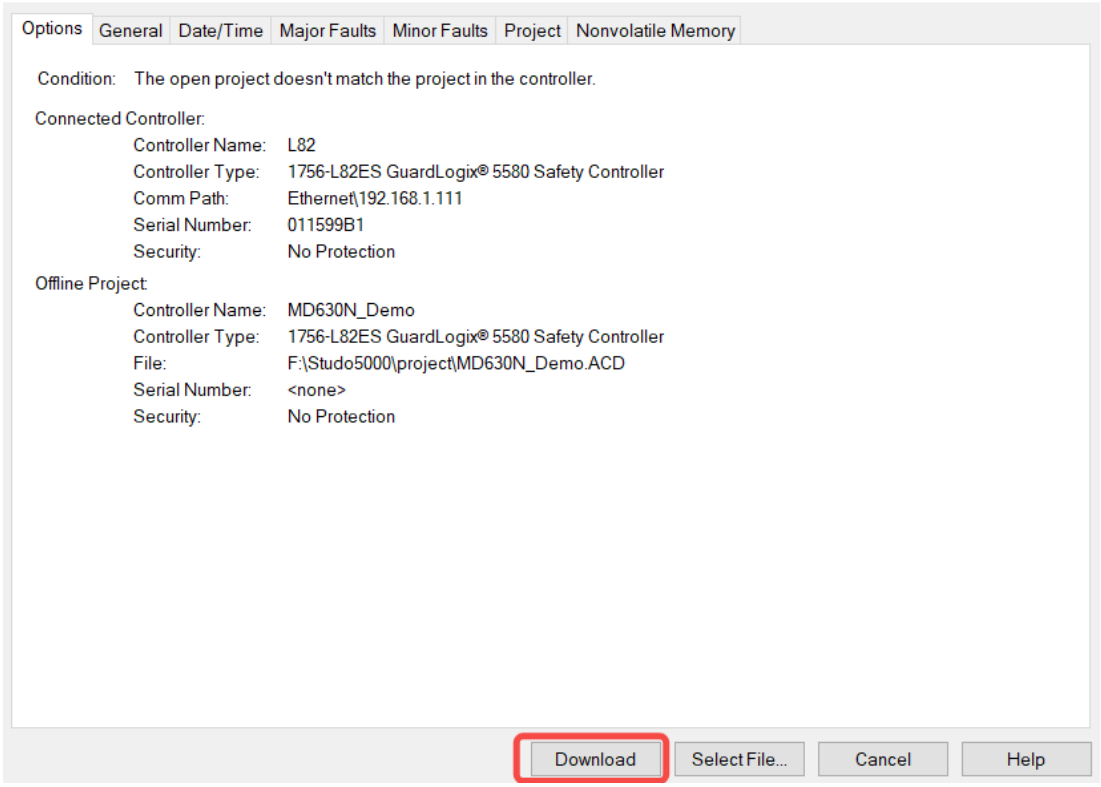
a. Click the path option in the status bar.



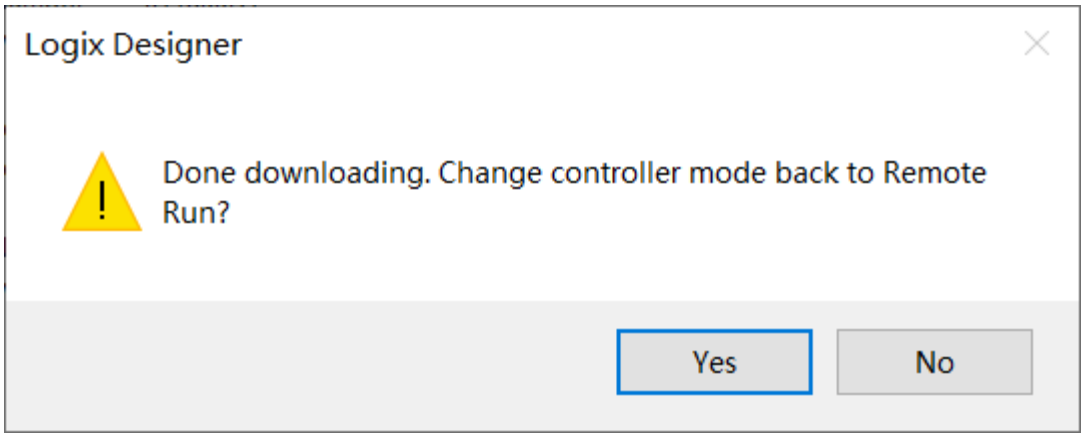
b. Select the master to download to and click "Go Online".



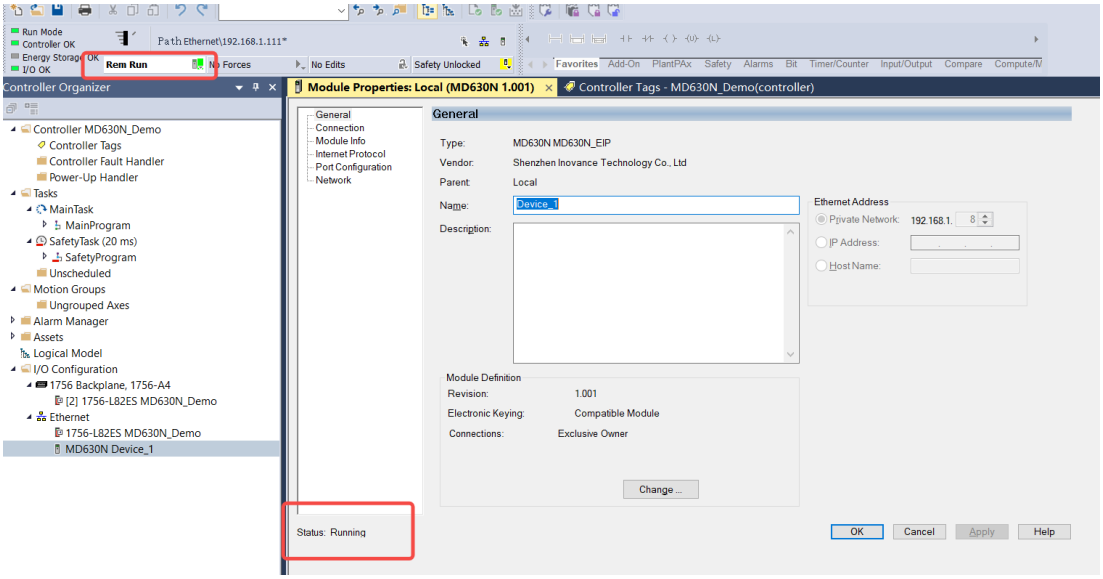
c. Select "Download".



d. Select "Yes".

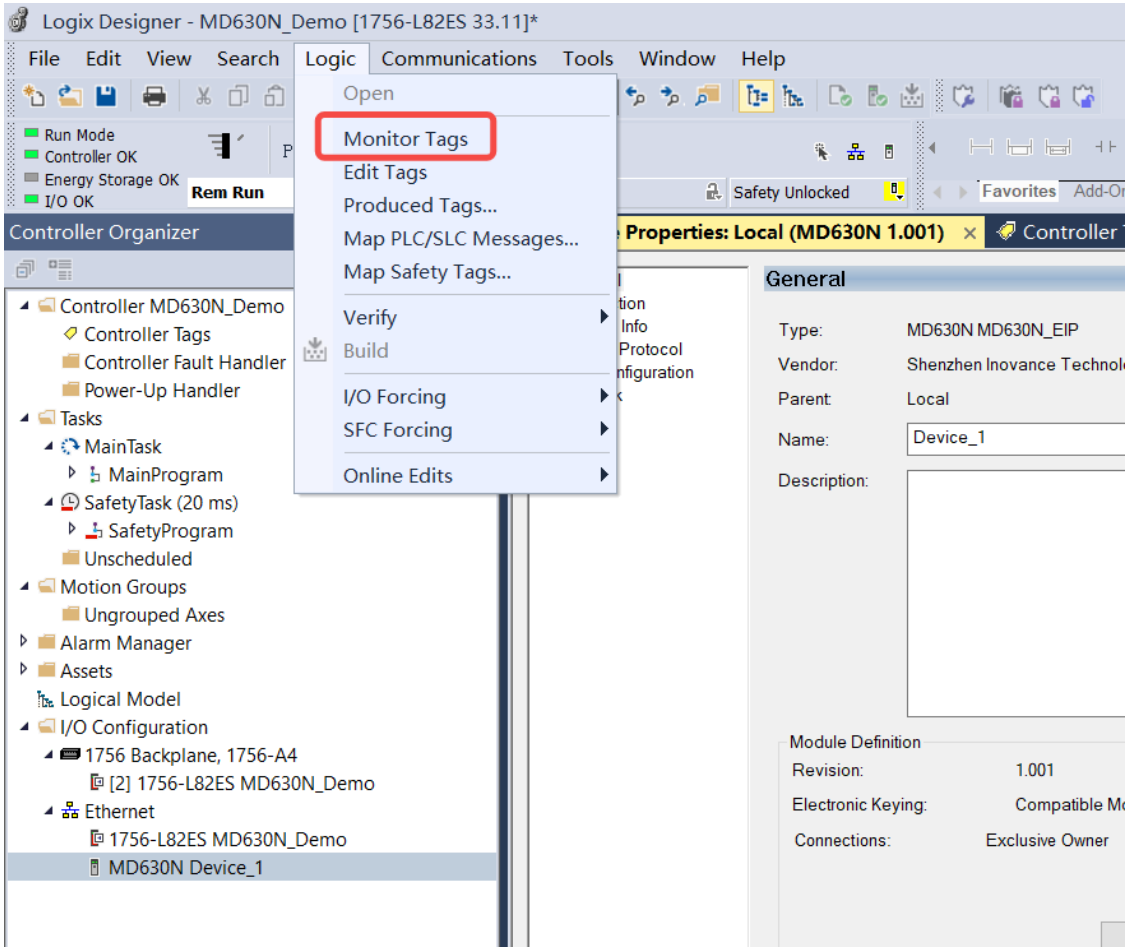


As shown in the following figure, the master is online and device interaction is normal.

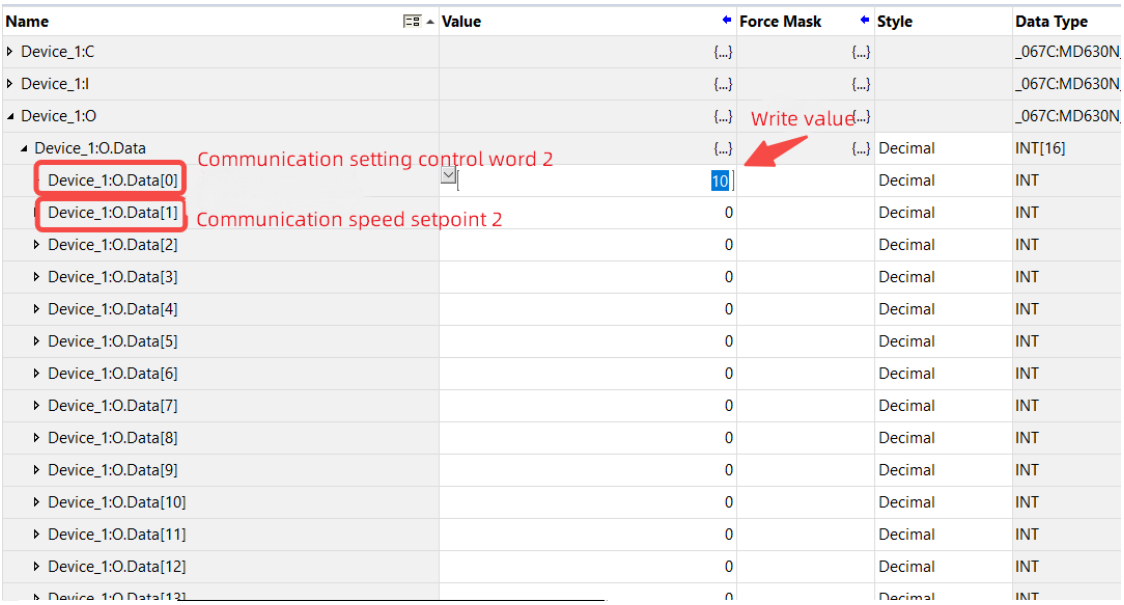


Step 4: Control the drive through communication.

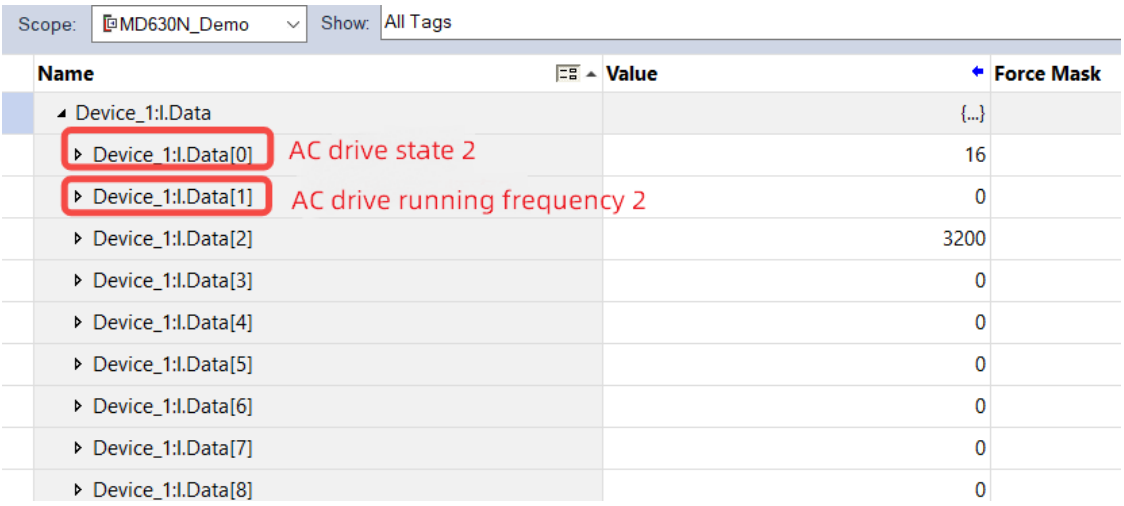
1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.
   Click "Logic > Monitor Tags" in the menu to display the communication data mapping table.



Write the reference parameters as shown in the following figure.



The following figure shows the communication feedback data.



2. For start/stop control and frequency/torque reference through EtherNet/IP communication, read and write specific communication addresses of the drive. In other words, the specific addresses need to be mapped to the PDO data of EtherNet/IP.
   For simple start/stop control and frequency/torque reference, 7311H and 7310H need to be mapped to the PDO data.

   7311H is one of the communication addresses supported by the drive, which is defined as follows.

Comm. address		Description
Control word 2 set through communication	7311H	The setpoint of 7311H is in decimal. References corresponding to different values are shown below. 0: Stop as defined by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop as defined by F2-17 7: Reset fault 8: Emergency stop

   For example, writing 1 to 7311H activates forward run. Writing 0 to 7311H stops the drive as defined by F2-17 [OFF1 stop mode].

   7310H is one of the communication addresses supported by the drive, which is defined as follows.

Comm. address		Description
Speed reference 2 set through communication	7310H	The target frequency can be set through this address. The property of values written by this address is switched by n0-14 [7310H Reference selection]. The setting range of n0-14 is as follows. 0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to rated frequency/signed 16-bit/2 decimal places) 4: Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)

In default settings, when n0-14 [7310H Reference selection] is set to 1 [Frequency (signed 16-bit)], writing 1000 to 7310H sets the main frequency to 10.00 Hz. Writing -1000 sets the main frequency to -10.00 Hz.

The corresponding feedback states are defined in the following table.

Comm. address		Description
Drive state 2	7044H	The status value of 7044H is hexadecimal. The drive states corresponding to bit values are as follows. bit0: Operation status. 0: Stopped; 1: Operating bit1: Operating direction. 0: Forward; 1: Reverse bit2: Fault state. 0: No fault; 1: Faulty bit3: Frequency arrival. 0: Inactive; 1: Active bit4 to bit7: Reserved bit8 to bit15: Fault code. For details, see specific fault descriptions.
AC drive operating frequency 2	7045H	Default: 2 decimal places, signed number, in units of Hz. The decimal places are switchable.

6.9.11 Replacing the Faulty Device

When using EtherNet/IP, the drive supports direct replacement of a faulty device without reconfiguration or reassignment of the device.

The following conditions must be met when replacing a faulty device.

The new device and the device being replaced must be of the same model.

Replacement procedure:

1. Record the communication-related parameters of the faulty device, unplug the cables from the faulty device, and remove the faulty device from the network.
2. Connect the new device of the same model to the network using the original physical connection method.
3. Configure communication parameters of the new device based on *"6.9.6 Connecting the Drive To Bus System" on page 1012*. The communication parameters of the new device must match those of the faulty device.

6.10 Profinet Drive Control

6.10.1 Overview

PROFINET communication is a real-time industrial fieldbus communication protocol based on Ethernet, with high performance, flexible topology, and low cost. High precision and simple application.

6.10.2 Communication Specifications

Table 6–26 PROFINET communication specifications

Item	Content
Communication protocol	PROFINET
Services available	Cyclic data exchange Acyclic data exchange Media redundancy protocol (MRP) Discovery and basic configuration protocol (DCP) Link layer discovery protocol (LLDP) Prioritized startup (FSU)
Physical layer	100BASE-TX
Duplex mode	Full duplex
Topology	Linear, star, tree, ring
Transmission rate	100 Mbps (100Base-TX)
Transmission medium	Shielded cables of Cat 5e or higher
Communication ports	RJ45
Communication type	RT Class1
PROFINET frame length	40 bytes to 1440 bytes
Cyclic data	A maximum of 1440 bytes per node (a maximum of 32 bytes for MD630N)
Acyclic data	Up to 24 bytes
Communication cycle	≥ 1 ms
Maximum cable length	< 100 m (with proper cables and environment)
Maximum number of connected slaves	65535 (depends on master performance)
Number of request messages that can be received at the same time	1

6.10.3 Communication System Connection

PROFINET networks support three basic topologies: bus, star, and ring, and tree topologies.

Bus topology

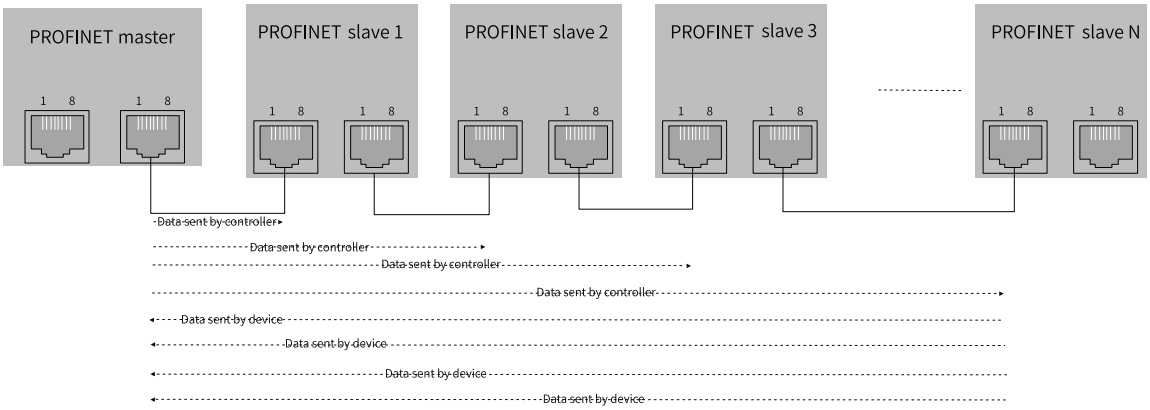


Figure 6-75 Bus topology diagram

In bus topology, the cable is routed out from the PROFINET master and connected to any RJ45 communication port on the drive, then routed out from another RJ45 communication port and connected to the next drive.

PROFINET does not distinguish between IN and OUT ports. Any network port can serve as the port connected to the master. In general applications, the master does not check the specific network connection. However, if specific ports are configured in the topology, the connection must follow the sequence specified in the topology diagram. Otherwise, an error can be reported by the master.

The bus topology features simple wiring and low cost. However, if an upstream device fails (for example communication interruption or power loss), all the downstream devices cannot communicate normally.

The PN master-slave interaction uses a peer-to-peer communication method. Regardless of the topology used, devices exchange data only with the master. See the format of the PN data exchange frame in *"6.10.4.1 Message Structure" on page 1040*.

Star topology

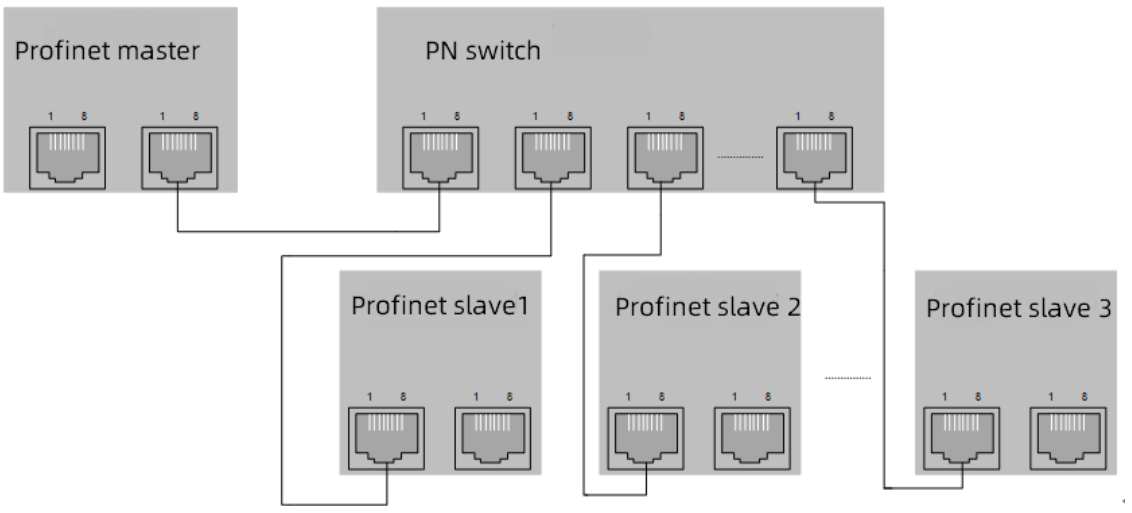


Figure 6-76 Star topology diagram

In star topology, the network cable is routed out from the master to a PN switch, and then to each slave. In a star topology, a failure of a single slave node does not affect communication of other slave nodes. However, this increases the cost of the switch, and if the switch fails, communication of all nodes will be interrupted.

Ring topology

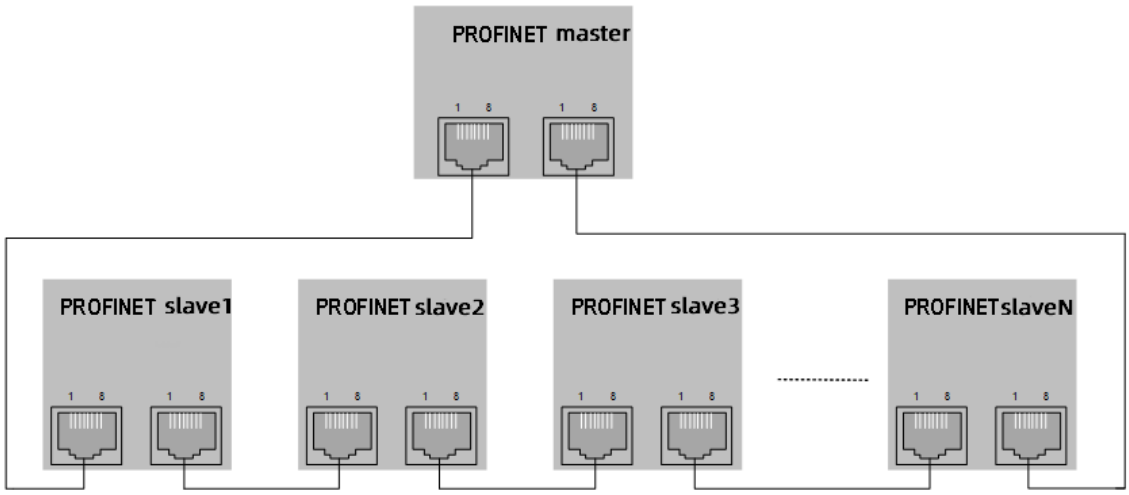


Figure 6-77 Ring topology diagram

The ring topology is derived from the bus topology. A network cable is routed out from the spare port of the last device and connected to an idle port on the PLC to form a loop.

The ring topology avoids the issue in the bus topology where a single node failure interferes with other nodes. However, it requires that both the PN master and all slave in the topology support the MRP function.

Tree topology

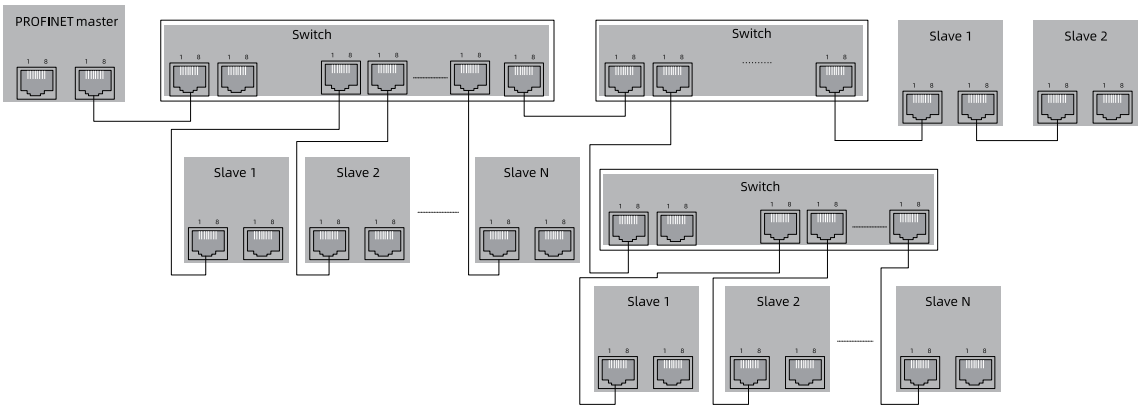


Figure 6-78 Tree topology diagram

Tree topology combines bus and star topologies, allowing for more flexible networking options.

6.10.4 Message

6.10.4.1 Message Structure

PROFINET data is transmitted in the form of Ethernet frames, following the IEEE802 standard, as shown in the figure below. See the following table for definition of the PROFINET data frame structure.

Figure 6-79 PROFINET message structure

Table 6–27 PROFINET frame structure definition

Field	Definition
Preamble	Used for time synchronization between transmitter and receiver. All the 7 bytes are fixed to 10101010.
Frame start flag (SFD, Start Frame Delimiter)	Ethernet frame start flag, fixed to 10101011
Destination MAC	Destination MAC address
Source MAC	Source MAC address
Type and VLAN_ID	TYPE: 0x8100 Priority: 3 bits Preserve (0): 1 bit VLAN_ID: 12 bits
Ethernet type	IP: 0x0800 ARP: 0x0806 VLAN: 0x8100 PN: 0x8892
Frame ID	0x0000 to 0x00FF: Reserved 0x0100 to 0x7FFF: RT Class 3 Frames (namely IRT frames) 0x8000 to 0xBFFF: RT Class 1 Frames (namely RT frames) 0xC000 to 0xFBFF: RT Class UDP 0xFC00 to 0xFCFF: High-priority acyclic transmission 0xFE00 to 0xFEFC: Low-priority acyclic transmission 0xFEFC to 0xFEFF: DCP
Data	Data area
APDU (Application protocol data unit) status	Cycle counter: 2 bytes Data status: 1 byte Transmission status: 1 byte
Verification	FCS (Frame check sequence)

6.10.4.2 Process Data Interconnection

The master achieves real-time read/write of the drive data and acyclic data exchange through the data in PDO area. The data communication addresses are directly configured by the drive. The following content is included:

- Control word set through communication and communication speed setting word of the drive
- Drive state and actual motor frequency

- Function parameter data are exchanged in real time between the drive and PROFINET master.

The PDO is used for periodic data exchange between the master and drive, as described in the following table.

Table 6–28 PDO exchange data

PDO area for transmission by master		
Default PZD		Variable PZD
Control word 2 set through communication (7311H)	Speed reference (7310H) set through communication	Real-time change of function parameters
PZD1	PZD2	PZD3 to PZD16
Response data PDO of the drive		
Default PZD		Variable PZD
Drive state 2 (7044H)	Actual motor frequency (7045H)	Real-time reading of function parameters
PZD1	PZD2	PZD3 to PZD16

6.10.4.3 Message Instances

6.10.4.3.1 Cyclic Process Data Communication

Cyclic process data is transmitted through RT Class 1 Frames. The frames transmitted from the master to the slave contain all written PZD data (out_data) for the node, while the frames transmitted from the slave to the master contain all PZD data (in_data) required by the master to read. The frame structure is shown in the table below (Ethernet header and trailer fields are omitted).

The cyclic communication frame structure is shown in the table below.

Table 6–29 Cyclic data transmission frame structure from controller to device

VLAN	Ethernet type	Frame ID	IOCS	Data	IOPS	…	Data	IOPS	APDU
4 bytes	2 bytes	2 bytes	xx bytes	xx bytes	1 byte	…	xx bytes	1 byte	4 bytes
-	0x8892	-	-	Submodule 1		-	Submodule N		-

Table 6–30 Cyclic data transmission frame structure from device to controller

VLAN	Ethernet type	Frame ID	Data	IOPS	…	Data	IOPS	IOCS	APDU
4 bytes	2 bytes	2 bytes	xx bytes	1 byte	…	xx bytes	1 byte	1 byte	4 bytes
-	0x8892	-	Submodule 1		-	Submodule N		-	-

IOPS: Input Output Object Provider Status

IOCS: Input Output Object Consumer Status

6.10.4.3.2 Acyclic Mailbox Data Communication

Acyclic mailbox data communication is initiated by the PN master, conducted in a request-response manner, and transmitted using UDP packets. The frame structure for acyclic transmission is shown in the following table (Ethernet frame header part omitted).

See the following table for the acyclic communication frame structure.

Table 6–31 Read request

…	Ethernet type	IP/UDP	RPC	NDR	Read block	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	4 bytes
-	0x0800	-	-	-	-	-

Table 6–32 Read response

…	Ethernet type	IP/UDP	RPC	NDR	Read block	Read data	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	xx bytes	4 bytes
-	0x0800	-	-	-	-	-	-

Table 6–33 Write request

…	Ethernet type	IP/UDP	RPC	NDR	Write block	Write data	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	xx bytes	4 bytes
-	0x0800	-	-	-	-	-	-

Table 6–34 Write response

…	Ethernet type	IP/UDP	RPC	NDR	Write block	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	4 bytes
-	0x0800	-	-	-	-	-

Field	Description
Ethernet type	Ethernet type, acyclic and fixed at 0x0800
IP/UDP	Standard IP/UDP segment (See IPv4 protocol for detailed meaning.)
RPC	RPC (Remote Procedure Call) specifies the data format used for data transmission and identifies the target object accurately.
NDR	Specifies the size of the addressed data block.
Read block	Contains the ARUUID, API, slot number, sub-slot number, and index of the device to be read.
Read data	Data being read
Write block	Contains the ARUUID, API, slot number, sub-slot number, and index of the device to be written.
Write data	Data being written
FCS	FCS (Frame check sequence)

6.10.4.3.3 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 908*.

6.10.4.3.4 Mapping Table (AC Drive Data)

For details, see *"6.5.3 Mapping Table" on page 910*.

6.10.5 Communication Terminals

The PROFINET bus adopts standard RJ45 network port and standard RJ45 connector. Use Cat 5e shielded twisted pairs and injection cables with iron housing. The cable between devices cannot exceed 100 m when the PROFINET bus is used, exceeding of which may attenuate the signal and affect normal communication.

PROFINET does not distinguish between IN/OUT, that is, the master station can be imported from any port of the MD630N-INT and then routed from another port to the next slave device.

In the topology view or port configuration, two ports, Port1 and Port2, exist on the MD630N-INT, which is EtherCAT and PROFINET. For products with three protocols in EtherNet/IP, the terminal markings are only matched according to EtherCAT, and do not reflect the characteristics of PROFINET. In actual use, Port1 corresponds to J9 (terminal mark IN) and Port2 to J5 (terminal mark OUT), as shown in the following figure.

When the topology view is not configured (that is, whether to specify the corresponding port interconnection), the insertion of any port does not affect the use of the port or cause an error. However, when the topology view is configured, the port connection needs to be performed according to the configured connection relationship. Otherwise, the PLC will report a fault (communication is not affected).

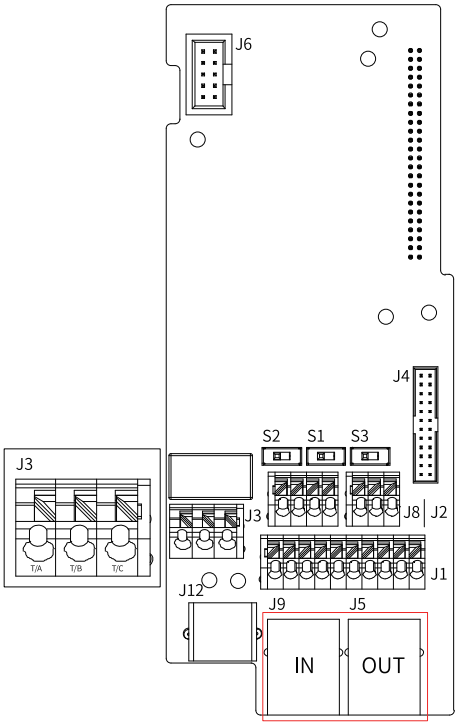


Figure 6-80 PROFINET communication terminal location

Table 6–35 Profinet communication terminal

External Interface	Terminal type	Transmission information type	Terminal identification	Name	Terminal function description
J9	RJ45 terminal	100M bus	IN	100M bus cascaded terminal	ECAT/EIP/PN communication protocols are supported. Select the protocol type through n0-10. When ECAT is selected, it is the IN port. The EIP/PN does not distinguish the direction.
J5	RJ45 terminal	100M bus	OUT	100M bus cascaded terminal	ECAT/EIP/PN communication protocols are supported. Select the protocol type through n0-10. When ECAT is selected, it is the OUT port. The EIP/PN does not distinguish the direction.

Indicator name	Status	Remarks
LED0 (green)	Off	Connection between devices is not established.
	Solid ON	Connection between devices is established.
LED1 (yellow)	Off	Connection between devices is not established.
	Solid ON	Connection between devices is established.

6.10.6 Connecting the Drive To Bus System

Connect the PROFINET network cable to the shielded network port. The maximum cable length between two devices is 100 m, with a theoretical maximum number of 65535 stations supported. Common connection topologies are shown in *"6.10.3 Communication System Connection" on page 1037*.

Connection procedure

1. Switch off the system power supply.
2. Use a shielded network cable to connect the PROFINET master to the PROFINET drive slave.
   See the communication network topology shown in *"6.10.3 Communication System Connection" on page 1037*, and connect the network cable to the shielded network port. The IN and OUT ports of the drive are direction-insensitive. For communication interface specifications, see *"6.10.2 Communication Specifications" on page 1037*.

Note

For PROFINET communication, IN and OUT of the communication port are not directional-sensitive.

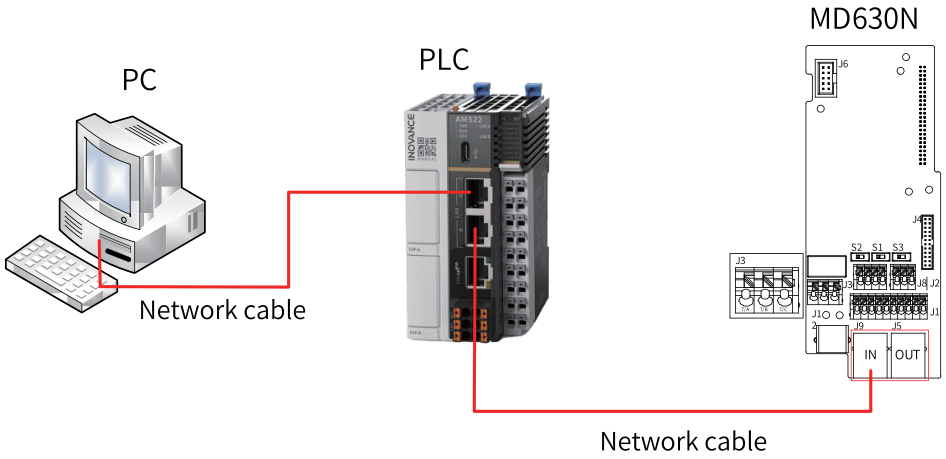


Figure 6-81 PROFINET communication connection

3. Power on the system only after ensuring all connections other than communication are correct.
4. Restart the device power supply.

6.10.7 Configuring Communication between the Drive and Controller

The MD630N drive supports standard PROFINET master devices, which includes Siemens S7-1200, S7-1500, S7-300, S7-400, and SMART200.

The following basic operations are required to perform PROFINET communication.

1. Perform wiring according to *"6.10.6 Connecting the Drive To Bus System" on page 1044*.
2. Switch the device communication mode to PROFINET communication (n0-10 = 3), set communication as the active command source (F0-03 = 2), and select communication as the main frequency command source for setting channel 1 (b0-03 = 0, b5-00 = 9). (This operation can be performed through the operating panel or software tool.)
3. Wait a few seconds until LED0 (green) and LED1 (yellow) are steady on, indicating successful establishment of the Ethernet link.
4. Configure communication between the master (controller) and slave (drive) as shown in *"6.10.10.1 Example for Communicating with TIA Portal" on page 1048*.

6.10.8 Communication Parameters

Group n6 of the AC drive function code defines PROFINET communication parameters.

Table 6–36 Parameters related to Modbus communication

Item	Name	Default	Value Range	Change Method	Parameter description:
n6-01 Fd-76	Highest order byte of the IP address	0	0 to 255	This is not modifiable.	The highest byte of the IP address. If the IP address is 192.168.0.2, the function code is displayed as 192. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-02 Fd-77	Second highest order byte of the IP address	0	0 to 255	This is not modifiable.	The second highest byte of the IP address. If the IP address is 192.168.0.2, the function code is displayed as 168. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-03 Fd-78	Third highest order byte of the IP address	0	0 to 255	This is not modifiable.	The third byte of the IP address. If the IP address is 192.168.0.2, this parameter is displayed as 0. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-04 Fd-79	Lowest order byte of the IP address	0	0 to 255	This is not modifiable.	The lowest byte of the IP address. If the IP address is 192.168.0.2, this parameter is displayed as 2. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-05 Fd-80	Highest order byte of the subnet mask	0	0 to 255	This is not modifiable.	The highest byte of the subnet mask. If the subnet mask is 255.255.255.0, the function code is 255. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-06 Fd-81	Second highest order byte of the subnet mask	0	0 to 255	This is not modifiable.	The second highest byte of the subnet mask. If the subnet mask is 255.255.255.0, the function code is 255. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-07 Fd-82	Third highest order byte of the subnet mask	0	0 to 255	This is not modifiable.	The third byte of the subnet mask. If the subnet mask is 255.255.255.0, the function code is 255. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-08 Fd-83	Lowest order byte of the subnet mask	0	0 to 255	This is not modifiable.	The lowest byte of the subnet mask. If the subnet mask is 255.255.255.0, the function code is displayed as 0. Additional information: It is automatically displayed after the PN master configures and assigns the device name.

Item	Name	Default	Value Range	Change Method	Parameter description:
n6-09 Fd-84	Highest order byte of the gateway IP address	0	0 to 255	This is not modifiable.	The highest byte of the gateway address. If the subnet mask is 192.168.0.1, the function code is displayed as 192. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-10 Fd-85	Second highest order byte of the gateway IP address	0	0 to 255	This is not modifiable.	The second highest byte of the gateway address. If the subnet mask is 192.168.0.1, the function code is displayed as 168. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-11 Fd-86	Third highest order byte of the gateway IP address	0	0 to 255	This is not modifiable.	The third byte of the gateway address. If the subnet mask is 192.168.0.1, the function code is displayed as 0. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-12 Fd-87	Lowest order byte of the gateway IP address	0	0 to 255	This is not modifiable.	The lowest byte of the gateway address. If the subnet mask is 192.168.0.1, the function code is displayed as 1. Additional information: It is automatically displayed after the PN master configures and assigns the device name.
n6-20	Message number	-	0 to 65535	This is not modifiable.	Displays the communication message. Additional information: It is automatically displayed after the PN master configures and assigns the device name.

6.10.9 Communication Fault Diagnosis

When communication problems occur, the operating panel of MD630N-INT displays the corresponding fault code. The following table describes the communication fault and diagnostic methods related to PROFINET.

Table 6–37 PROFINET communication troubleshooting method

Fault Code	Fault Name	Cause	Check Method	Solution
E166.1	PROFINET communication timeout	The master or slave is disconnected during communication.	The operating panel displays the fault code.	Check the communication lines between the master and slave.
E166.4	MAC address not programmed to PROFINET	The MAC address is lost or not programmed.	The operating panel displays the fault code.	Ask for technical support.
E166.5	PROFINET mapping address error	The mapping configured during configuration is illegal.	The operating panel displays the fault code and the master cannot establish data interaction with the slave.	Modify the illegal mapping address.

6.10.10 Communication Configuration Examples

6.10.10.1 Example for Communicating with TIA Portal

The following shows the configuration example for controlling MD630N with TIA PORTAL and S7-315.

Prerequisite

Connect the drive to the bus system, as shown in *"6.10.6 Connecting the Drive To Bus System" on page 1044*.

Procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.

Step 2: Set the frequency or torque through communication.

Set the frequency as follows:

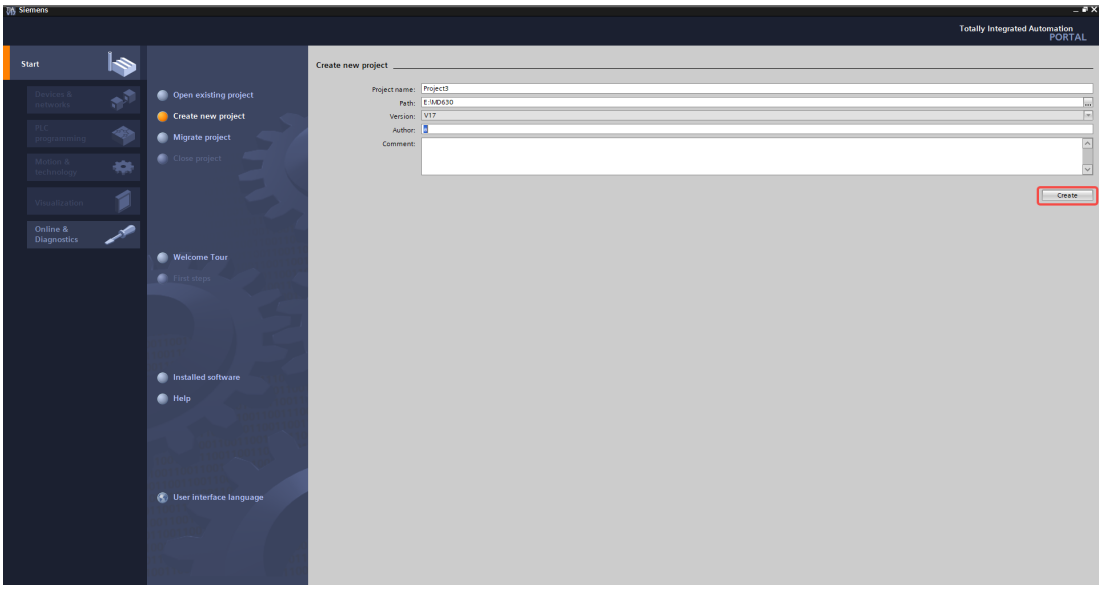
1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 3: Percentage (corresponding to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponding to the maximum frequency/signed 16-bit/two decimal places)

Set the torque as follows:

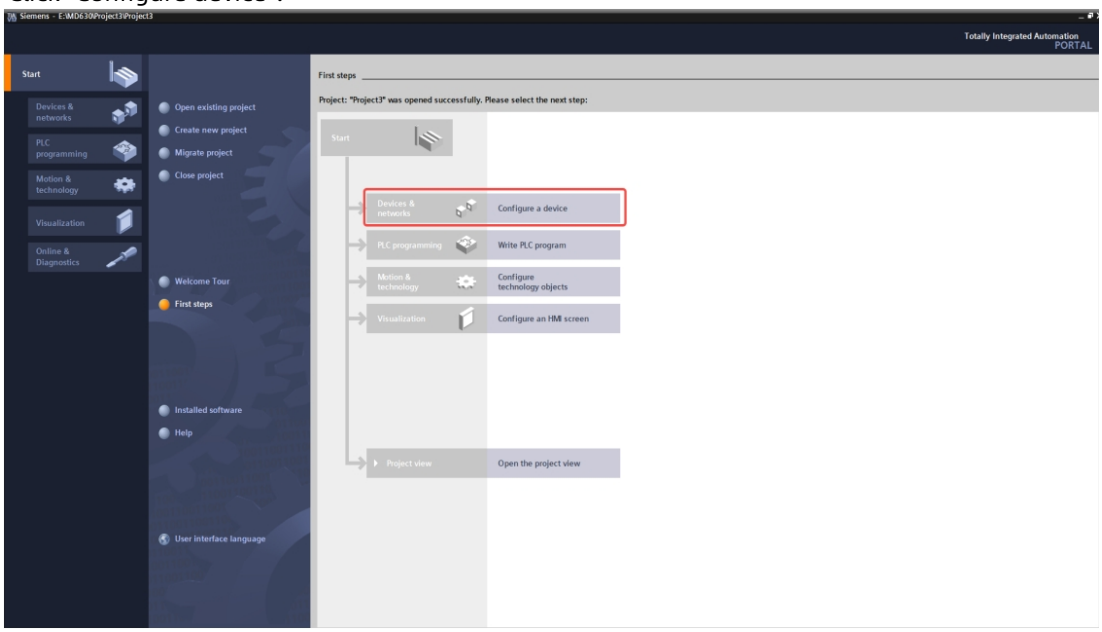
1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish PROFINET communication.

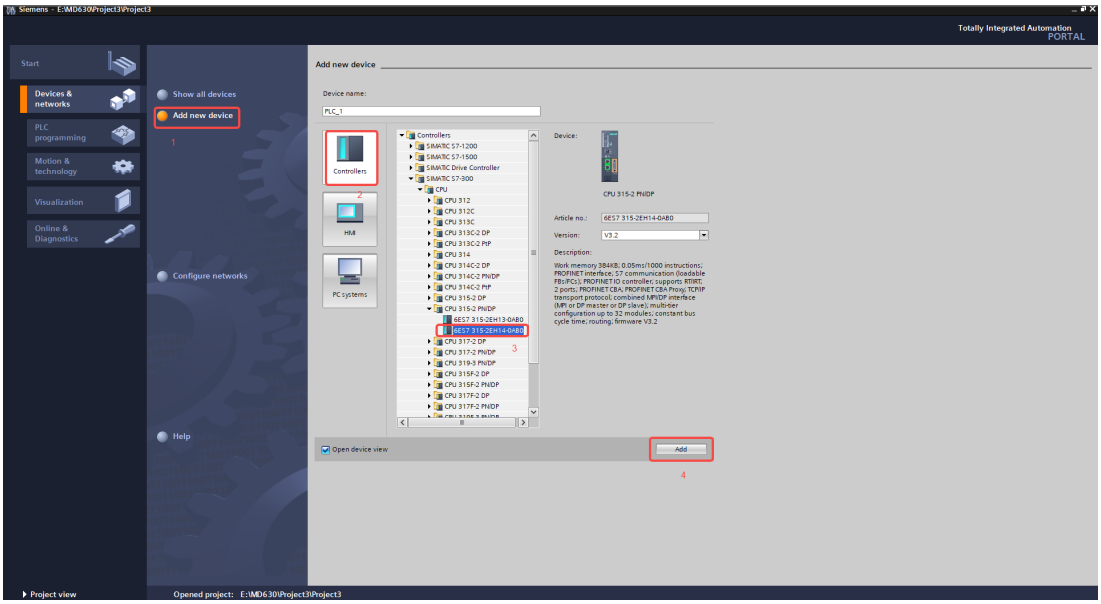
1. Set n0-10 to 3 (through the operating panel or software tool). Switch the device communication mode to PROFINET.
2. Wait for a few seconds until LED0 flashes green and LED1 turns yellow (steady). This indicates that the connection between slave and master is established successfully, and data exchange is available.
3. Create a project.
   a. Open the TIA PORTAL software, modify the project name and storage path on the "Create" interface, and click "Create".



b. Click "Configure device".

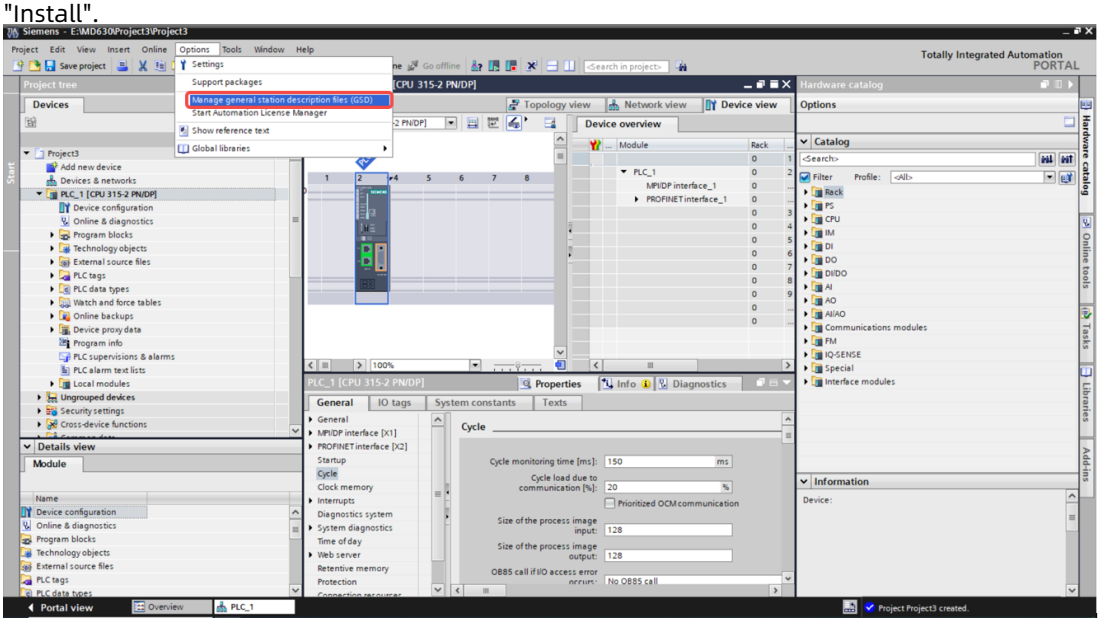


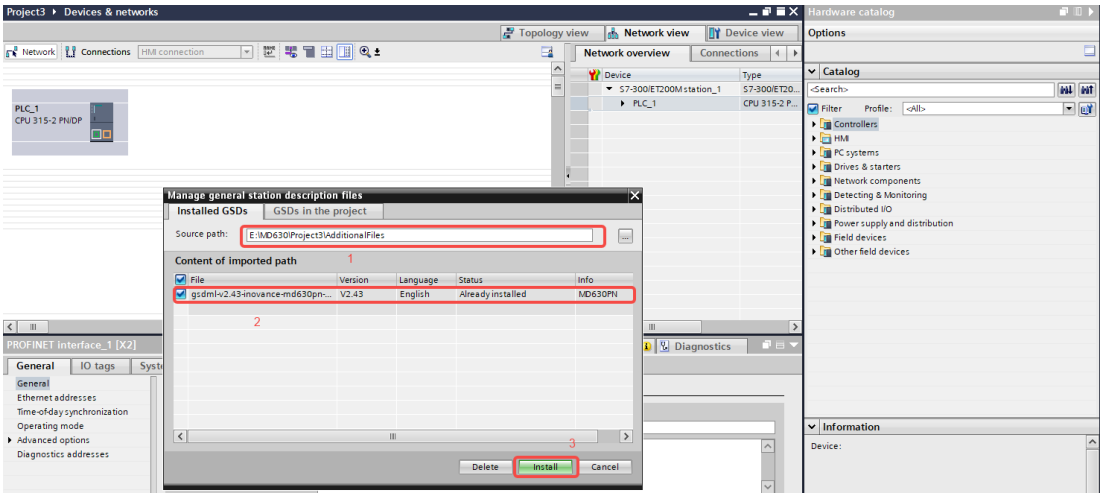
c. Click "Add new device", select the correct PLC model in the "Controller". Note that the order number must be the same as the PLC used, and then click "Add", as shown below.



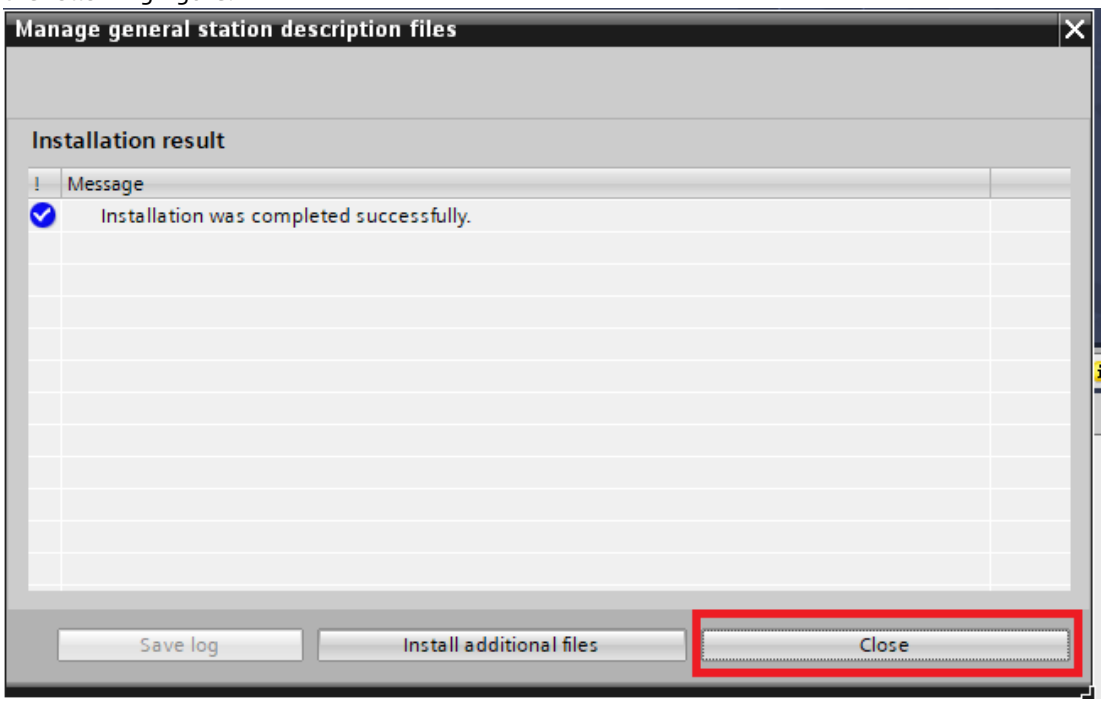
4. Import the device description file (XML) of the drive. Otherwise, the drive cannot be added.

   a. Select "Options" in the toolbar, click "Manage general station description file (GSD)", and then select the path where the current XML file is saved and check the XML file to be installed. Click "Install".



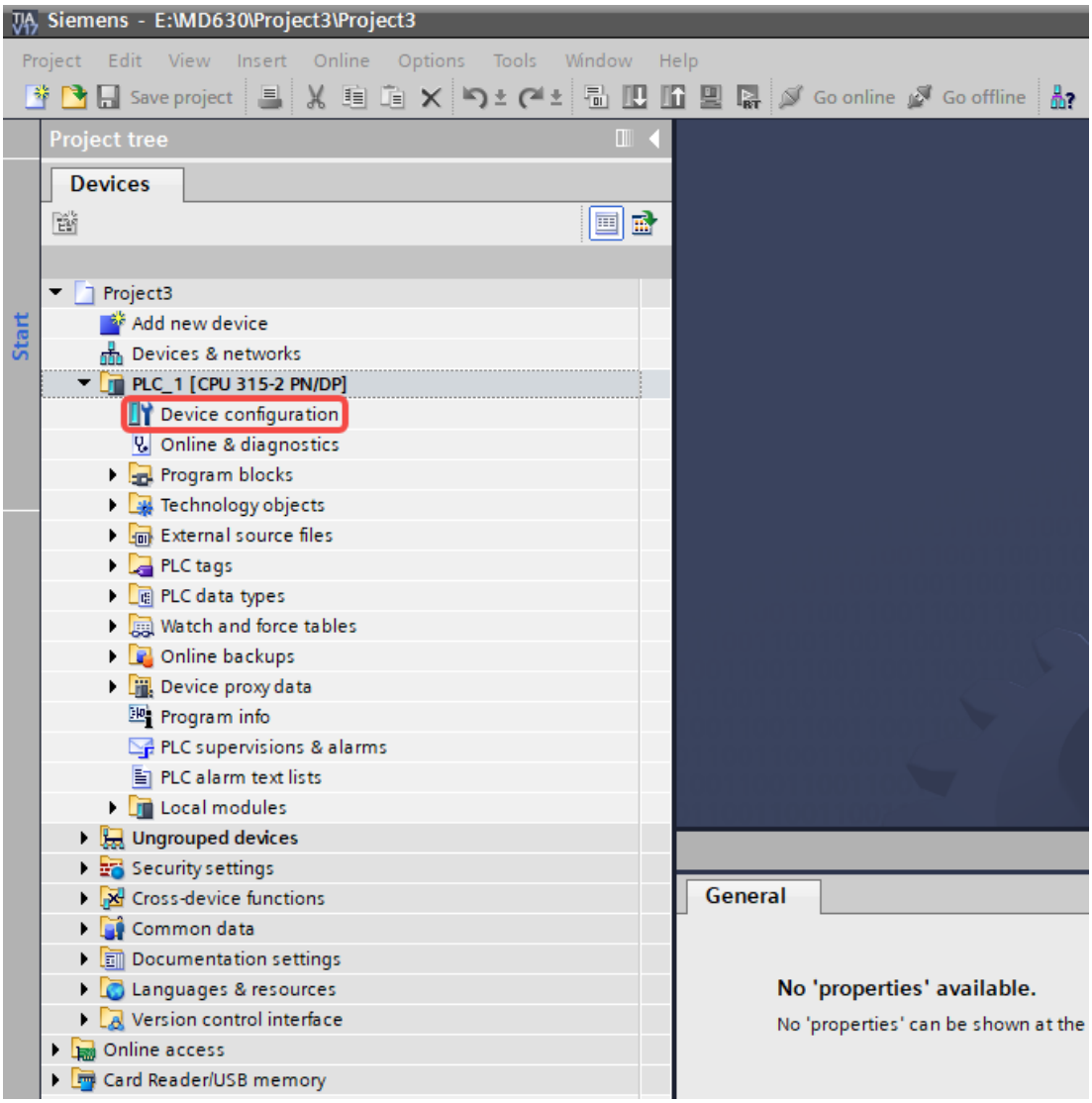


b. Click "Close" when the message "Installation completed successfully" is displayed, as shown in the following figure.

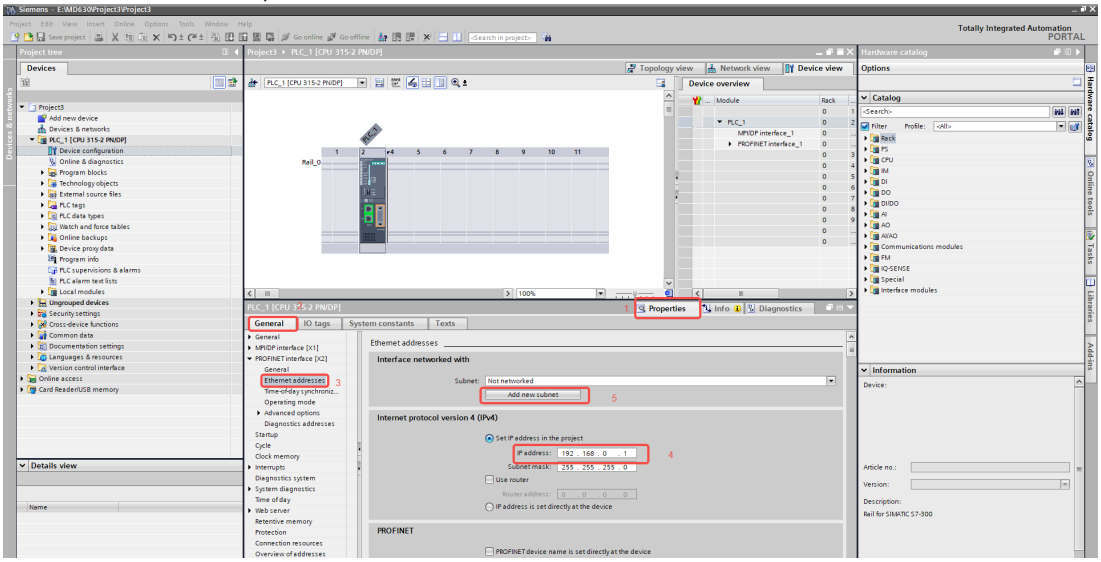


5. Set the device configuration.

a. When the XML file is installed, the TIA PORTAL software automatically closes the current configuration to update the hardware directory. After you close the "Manage general station description file", double-click "Device configuration" at the location shown in the following figure.

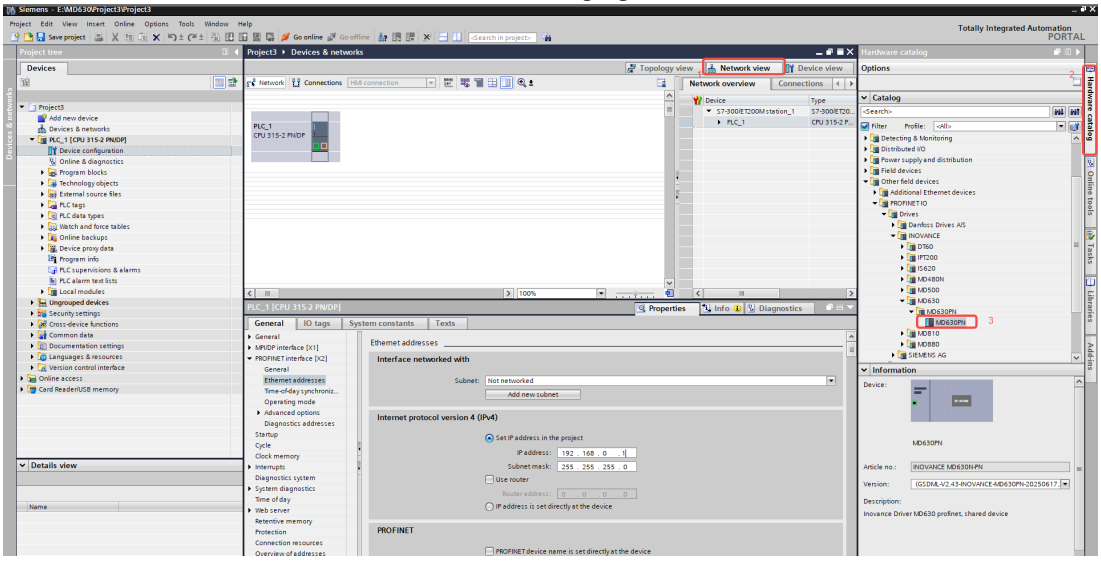


b. In "Property" > "General", select "Ethernet address", set the IP address of the master PLC, and click "Add new subnet", as shown below.

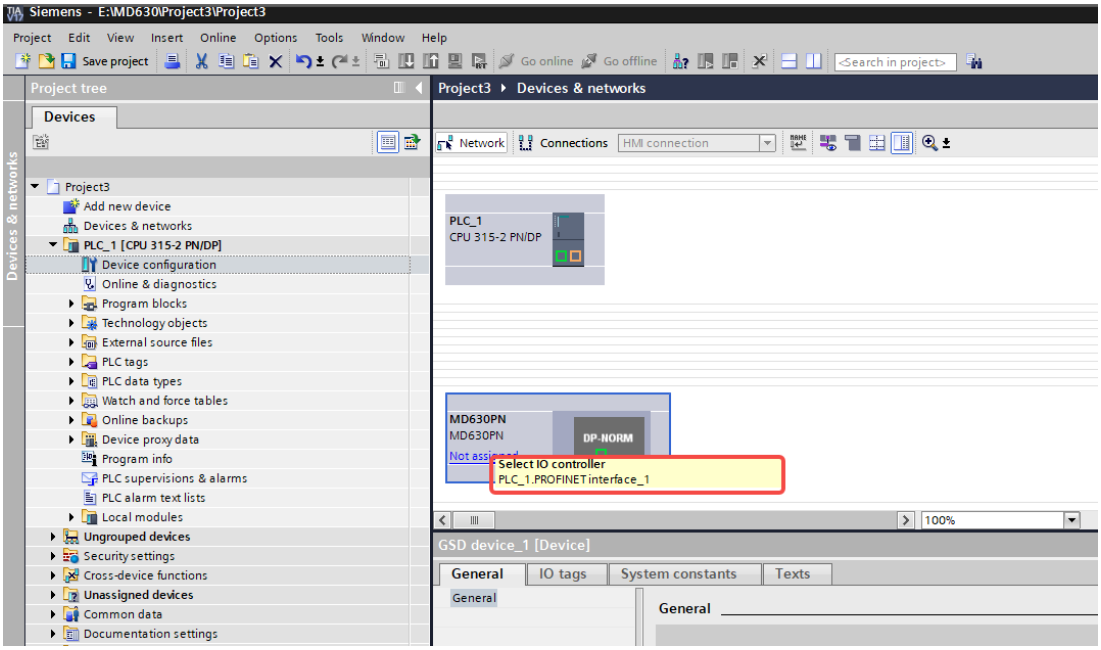


6. After adding the PN network, you can add the slave device.

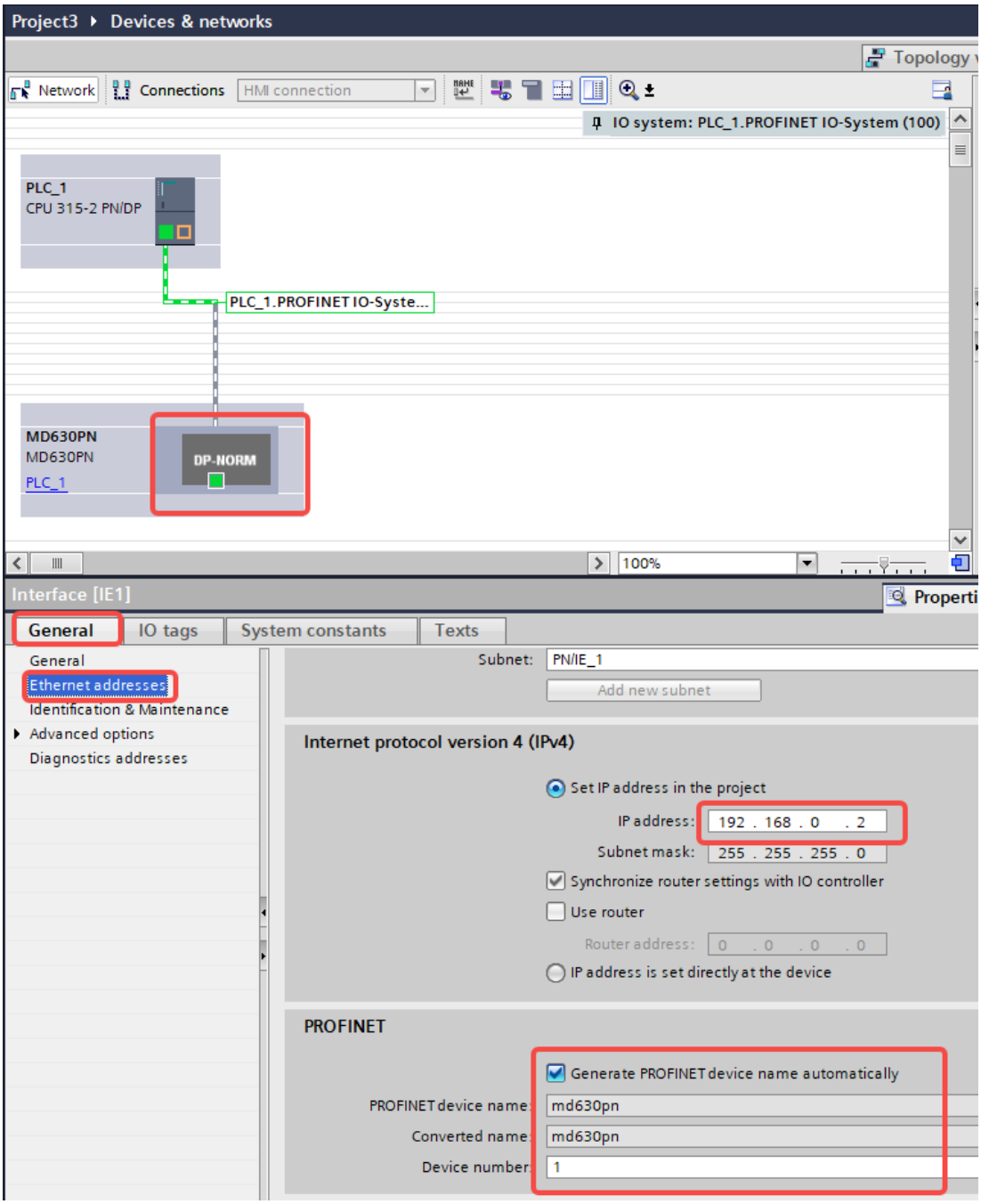
a. Click "Network view" and locate the MD630PN in the "Hardware catalog" on the right. Double-click to add the MD630PN, as shown in the following figure.



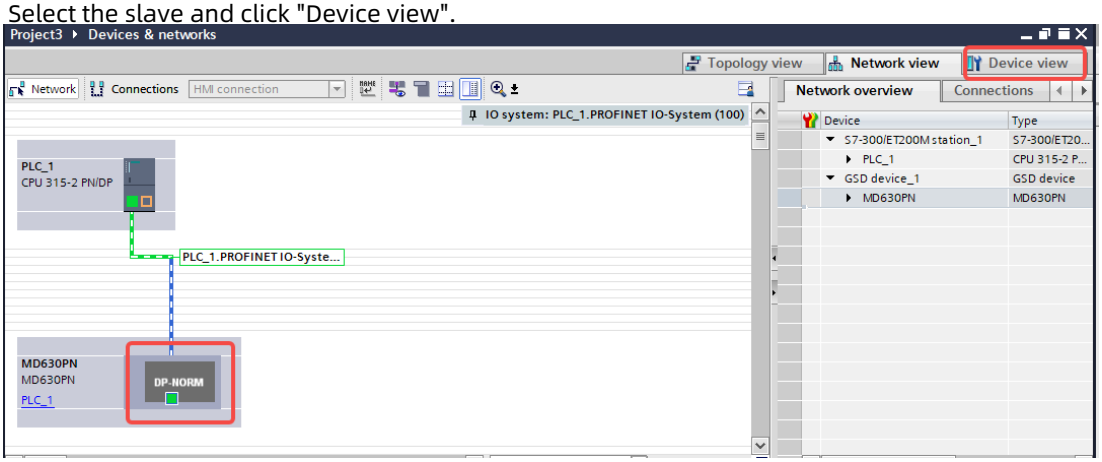
b. In this case, the MD630 slave is still in the "unassigned" state, and the master cannot control it. Click "Unassigned", the words "Select I/O controller" will pop up, and the available Profinet network list is displayed. Click this network to add the device to the master PN network.



c. Select the slave. You can modify the IP address and device name in the "Ethernet address" under "General". (To modify the device name, de-select "Generate Profinet device name automatically".)

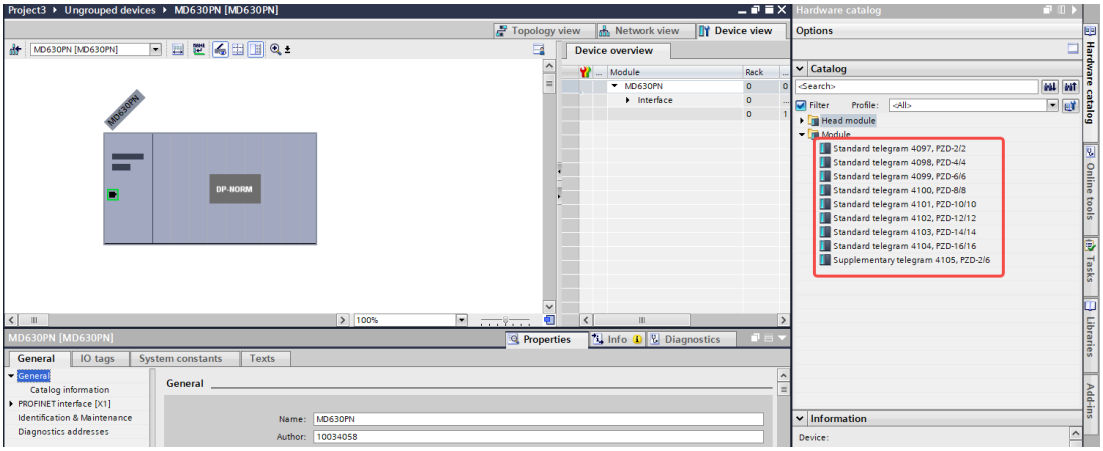


d. Select the slave and click "Device view".

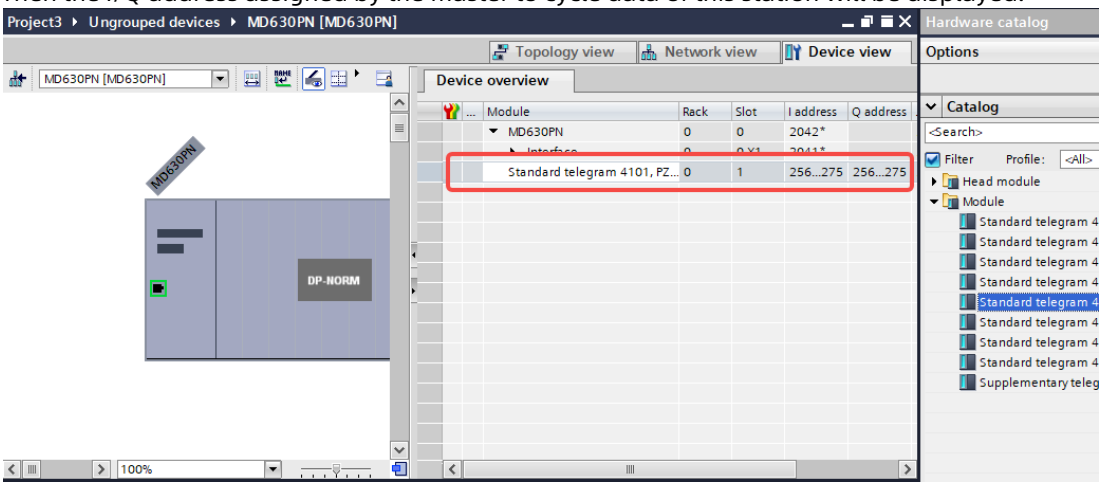


e. In the "Hardware catalog", select the module type needed and double-click to add it to the slave.

You can select the corresponding module as needed. The number after PZD indicates the number of data written/read (calculated by words). For example, "PZD-2/2" indicates that the module has two words written and two words read. The number before PZD indicates the message number, such as "4097". If a communication error occurs, check whether the message number is consistent with the message number of the parameter.



f. Then the I/Q address assigned by the master to cycle data of this station will be displayed.

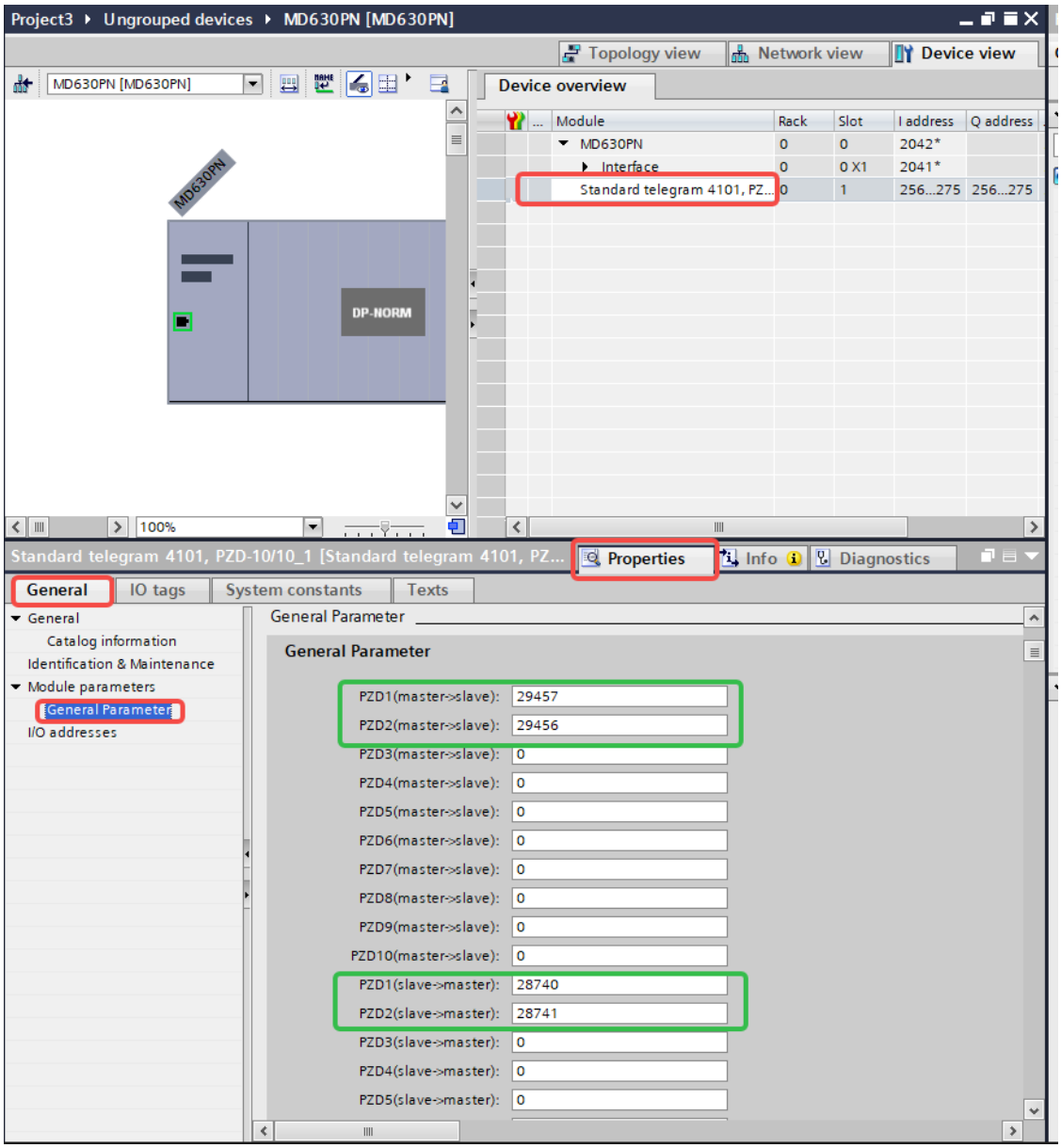


7. After adding a module, you can configure the module to set the corresponding parameter of each PZD.

As shown in the following figure, PZDx (master->slave) indicates the PZD (out-data) written by the master to the slave, and PZDx (slave->master) indicates the PZD (in-data) returned by the slave to the master. The initial values of PZD1 and PZD2 in the green marked part of the figure are preset. PZD3 written in the master is configured to 61488 (0xF030, ramp 1 acceleration time) and PZD4 written in the master is configured to 61489 (0xF031, ramp 1 deceleration time). PZD3 read by the master is configured to 28674 (0x7002, bus voltage), PZD4 read by the master is configured to 28675 (0x7003, output voltage).

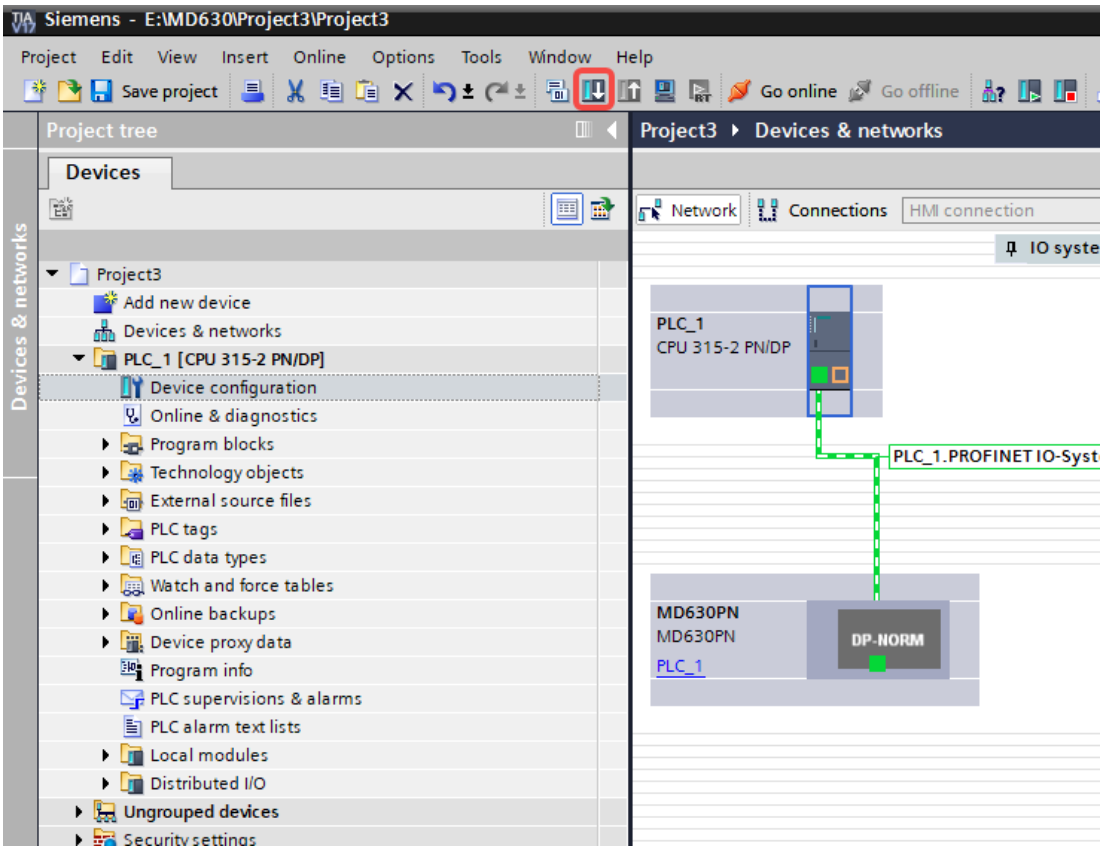
Caution

The PZD configuration must be consecutive. For example, configurations such as setting PZD1...PZD4 and PZD6, but with PZD5 keeping its original value of 0 are not permitted, as this can deactivate the mapping of PZD6.

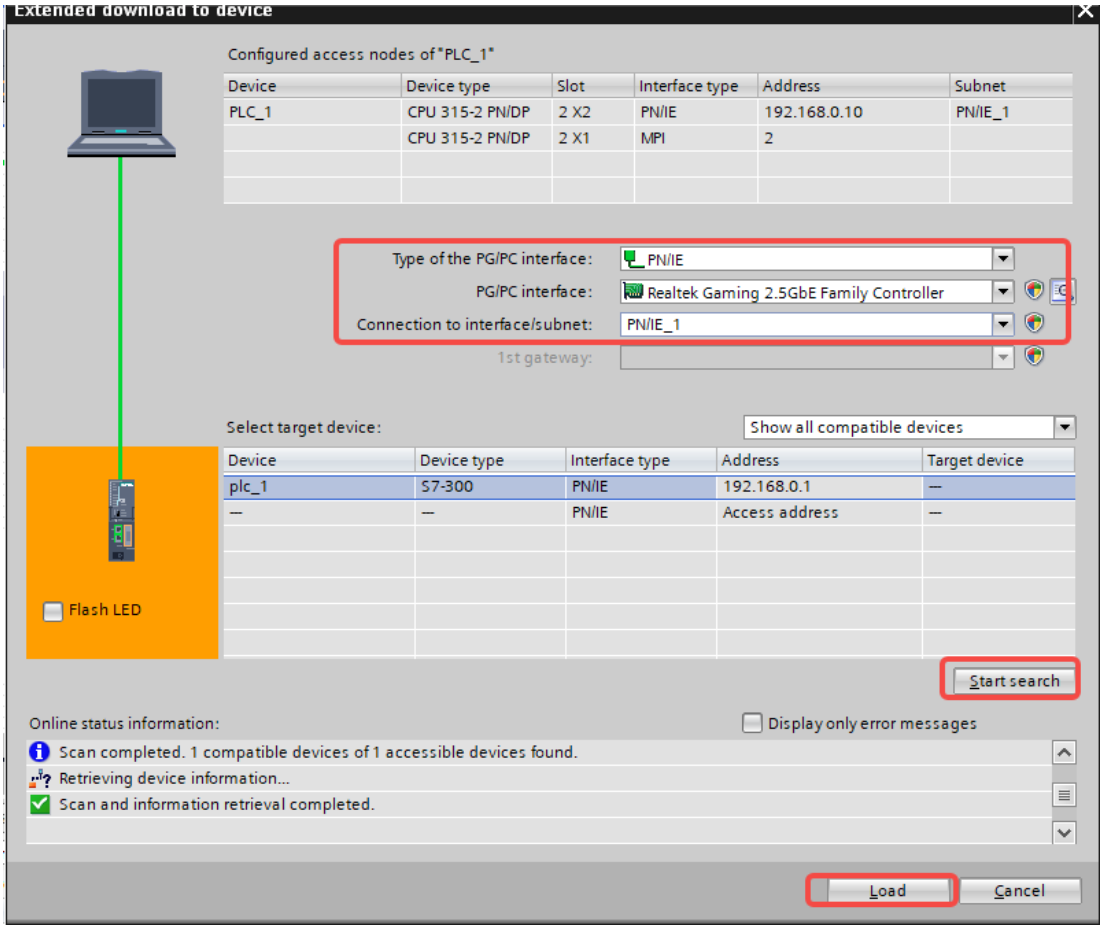


8. After the configuration is done, download the configuration to the PLC.

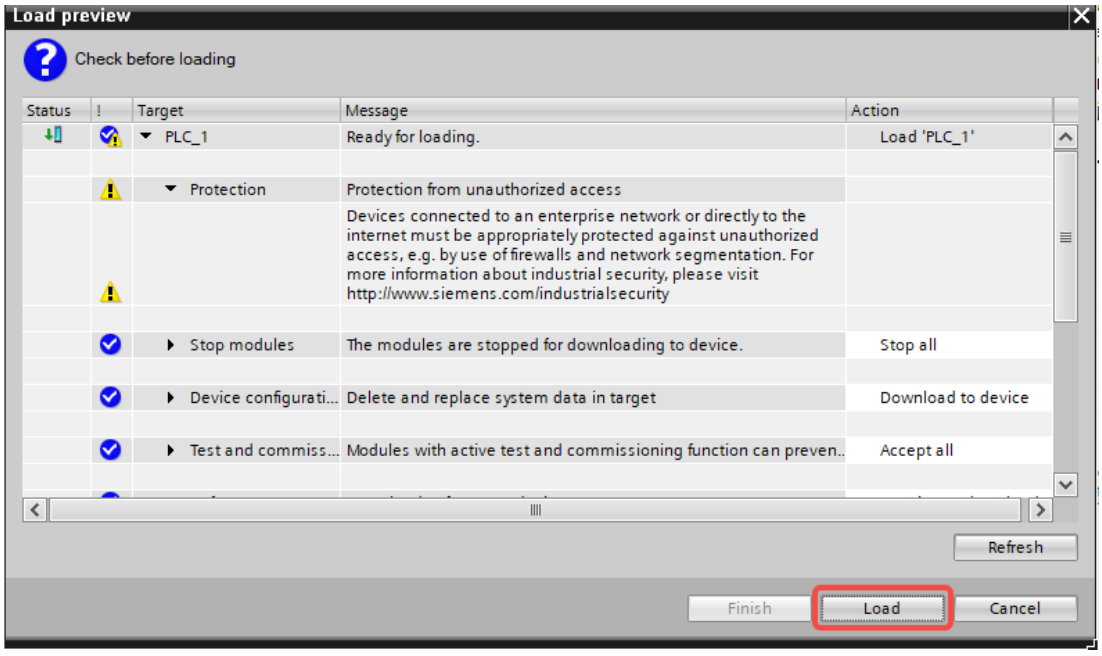
   a. Click the download icon, as shown in the following figure.



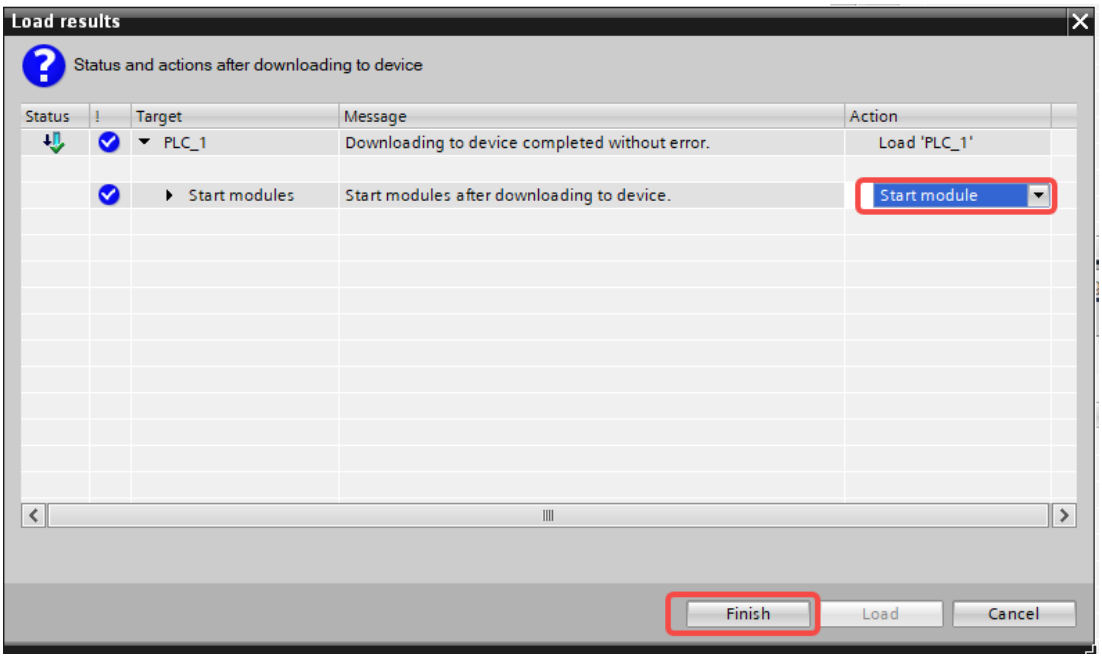
b. In the interface displayed, set the terminal parameters according to the terminals connected between the PC and the PLC. Click "Start searching", select the PLC to be downloaded, and click "Download".



On the "Download preview" page, click "Load".

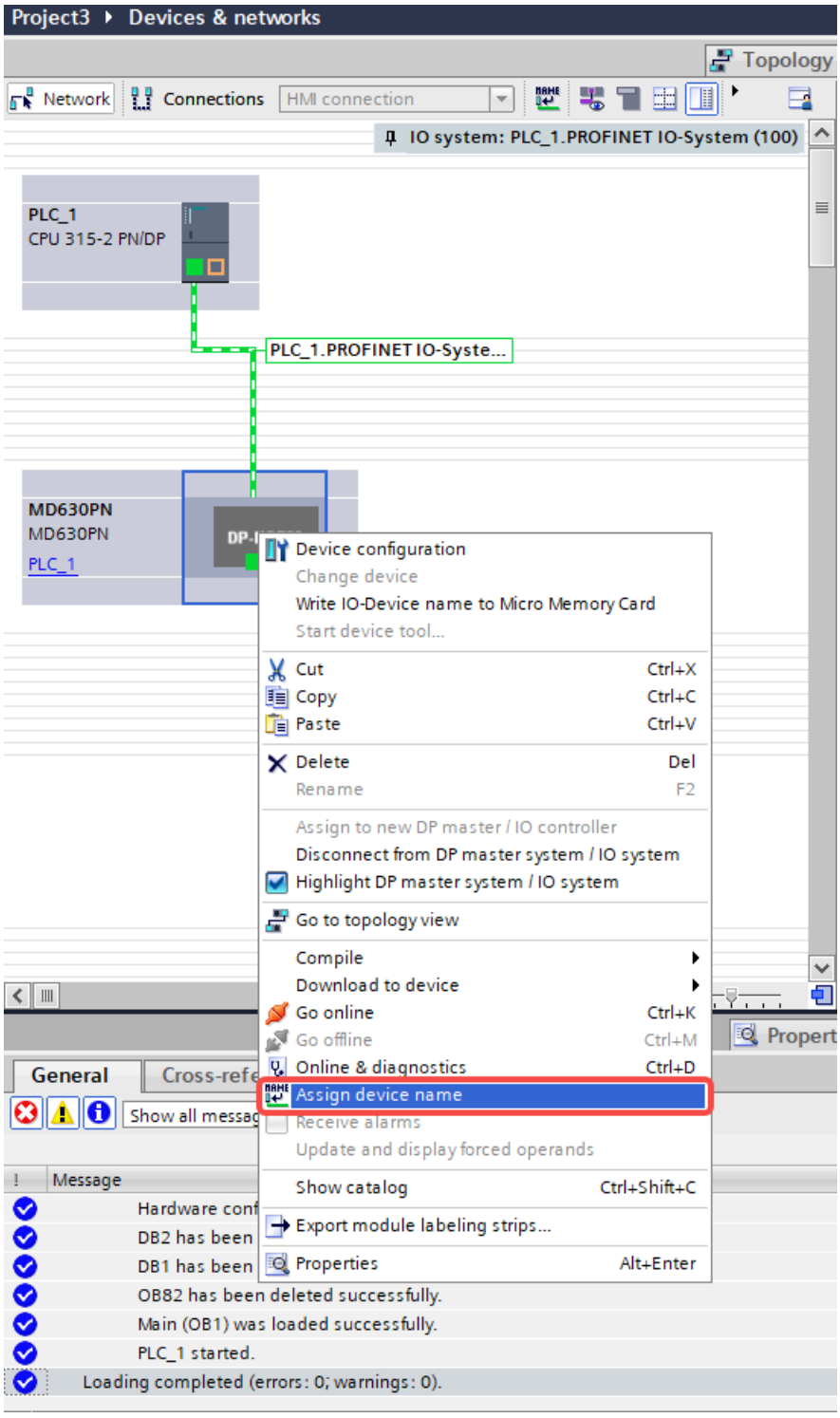


c. Select "Start module" and "Finish" on the interface that prompts download completion.

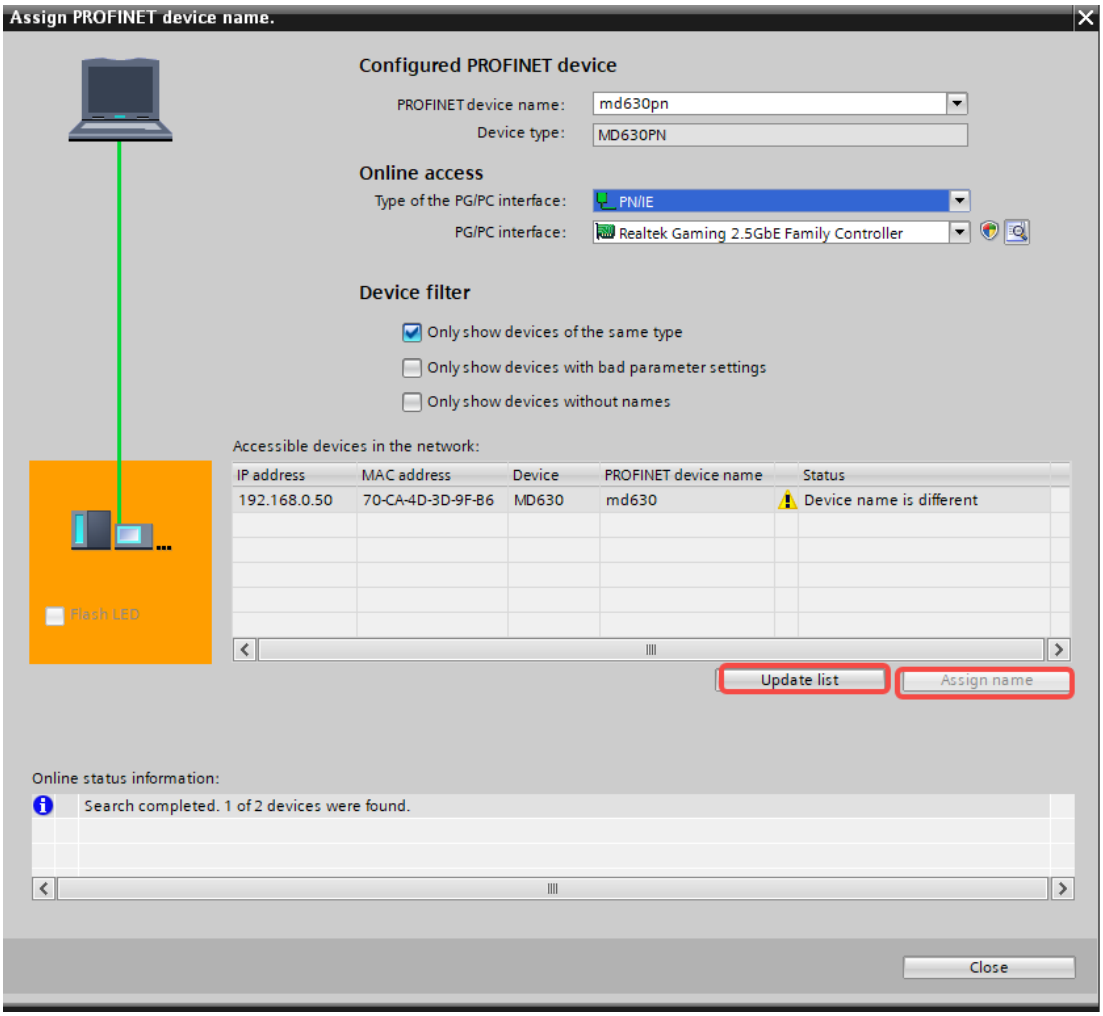


9. After the download is done, assign the device name to the slave.

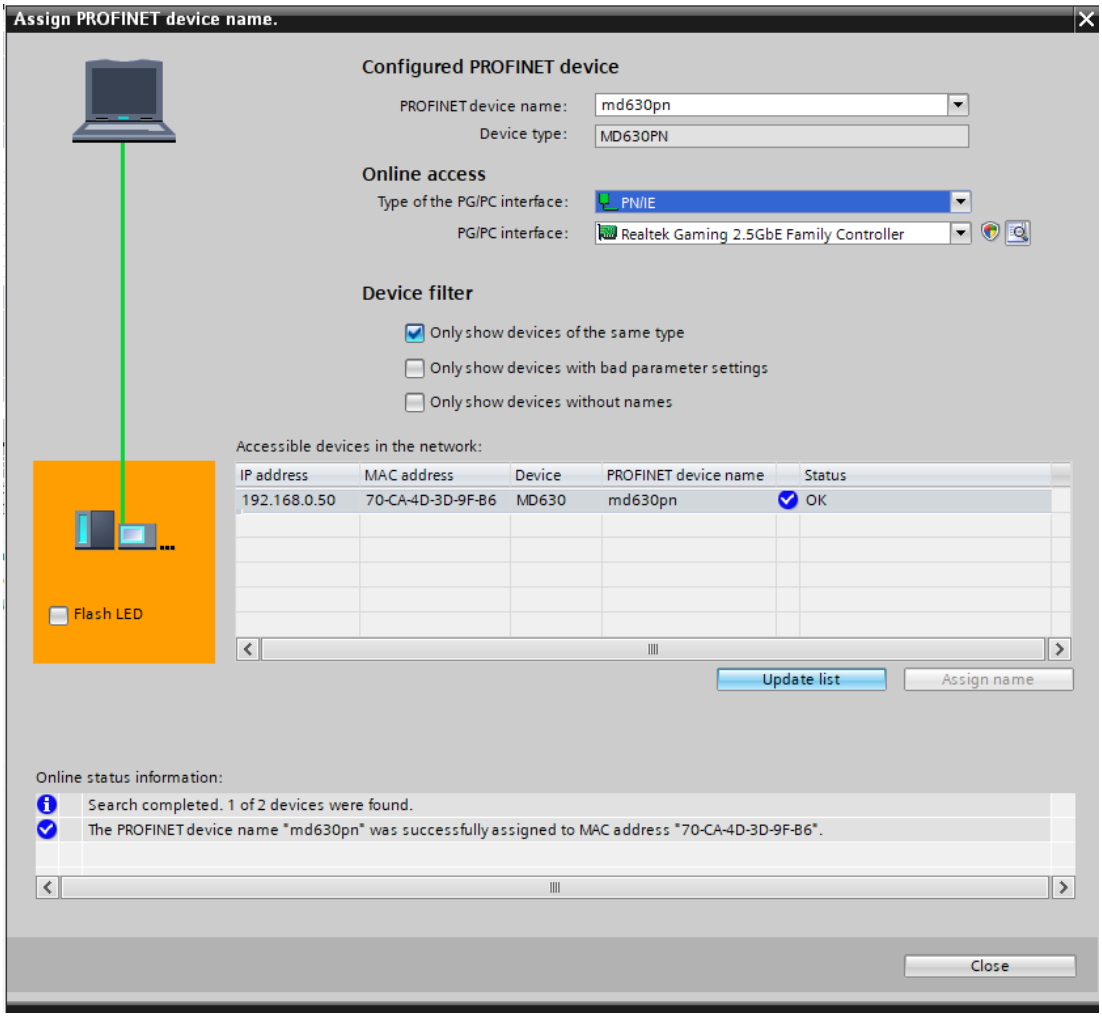
   a. Select the slave, right-click, and click "Assign device name".



b. After selecting the correct PC interface, click "Update list" and select the device to be assigned from the scanned devices (distinguished by MAC address or by checking "flashing LED"). After being checked, the device panel of the corresponding MAC flashes. After determining the device to be assigned, click "Assign name".



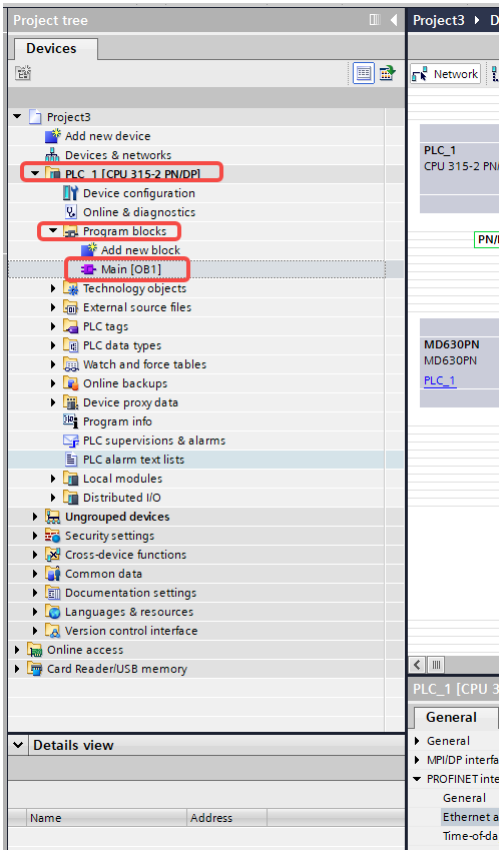
c. After the assignment is done, the word "OK" is displayed in the status bar of the corresponding device.



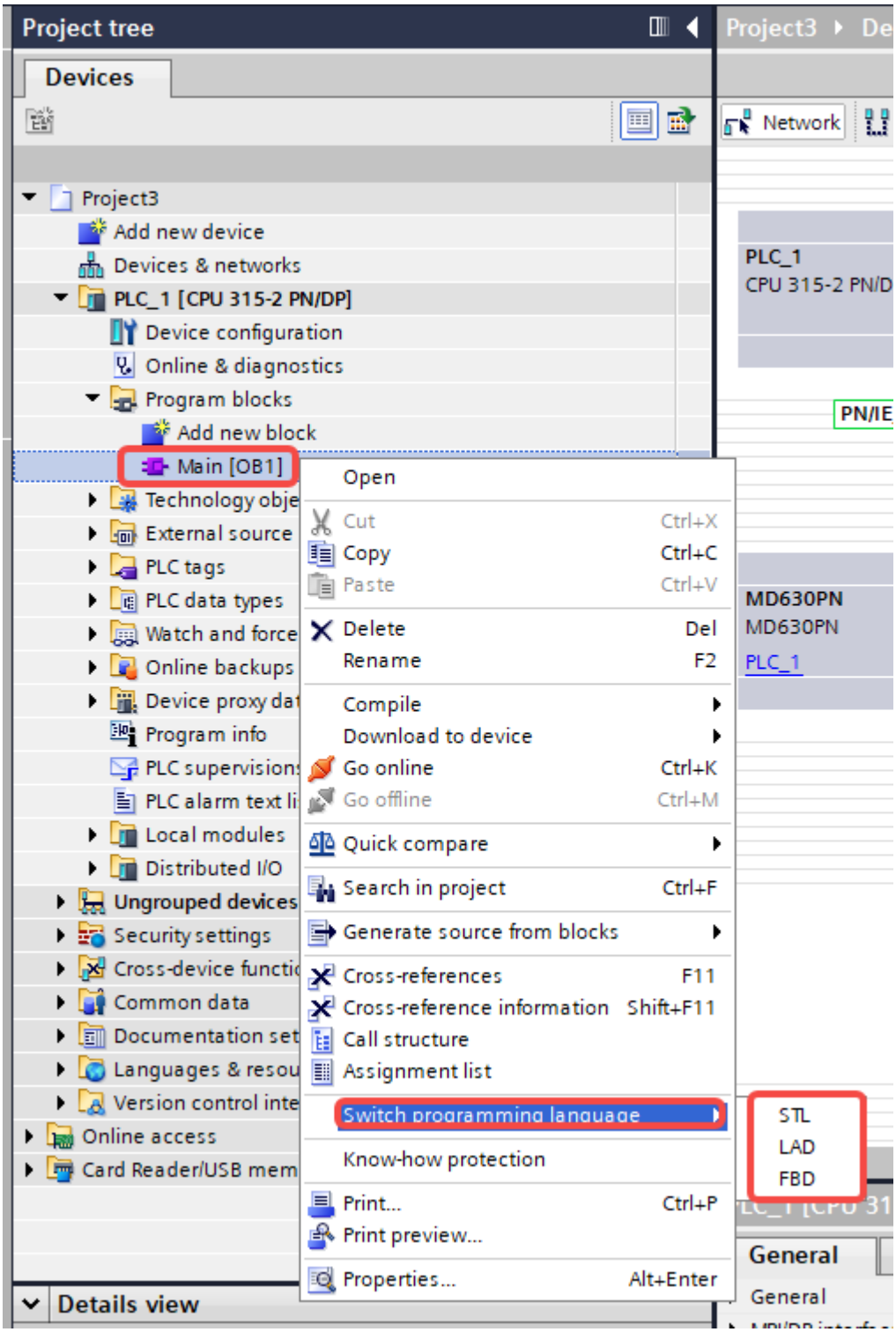
In this case, you can configure the configuration and control the MD630 by modifying the value in the Q address (in this case, PQW256 to PQW274, corresponding to output PZD1 to 10). You can also read the value in the I address to obtain the status and parameter values of the MD630 (in this example, PIW256 to PIW274, corresponding to input PZD1 to 10).

Step 4: Control the drive through communication.

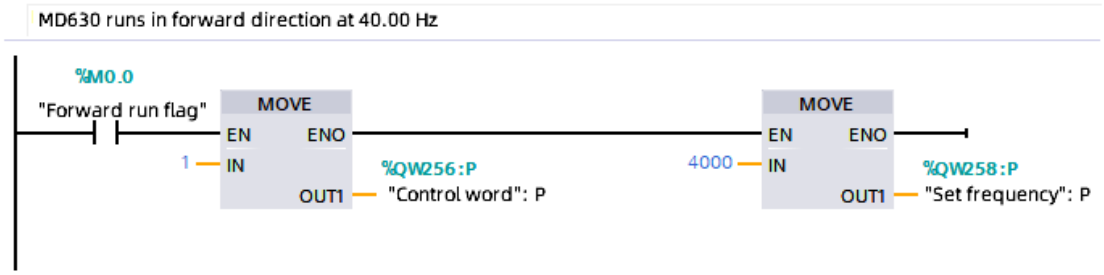
In the "Project tree" on the left, expand PLC_1 [CPU 315-2 PN/DP] and double-click "Main[OB1]" under "Program Block" to open the PLC main function.



Select the program block and right-click to select the programming language through "Switch programming language". The LAD (ladder diagram) is used by default.



The value transmission is generally done through MOVE instruction or SFC14 and SFC15. Take MOVE instruction as an example. If SFC is used, you can select the SFC block and press F1 to shown the help information for the SFC function block.



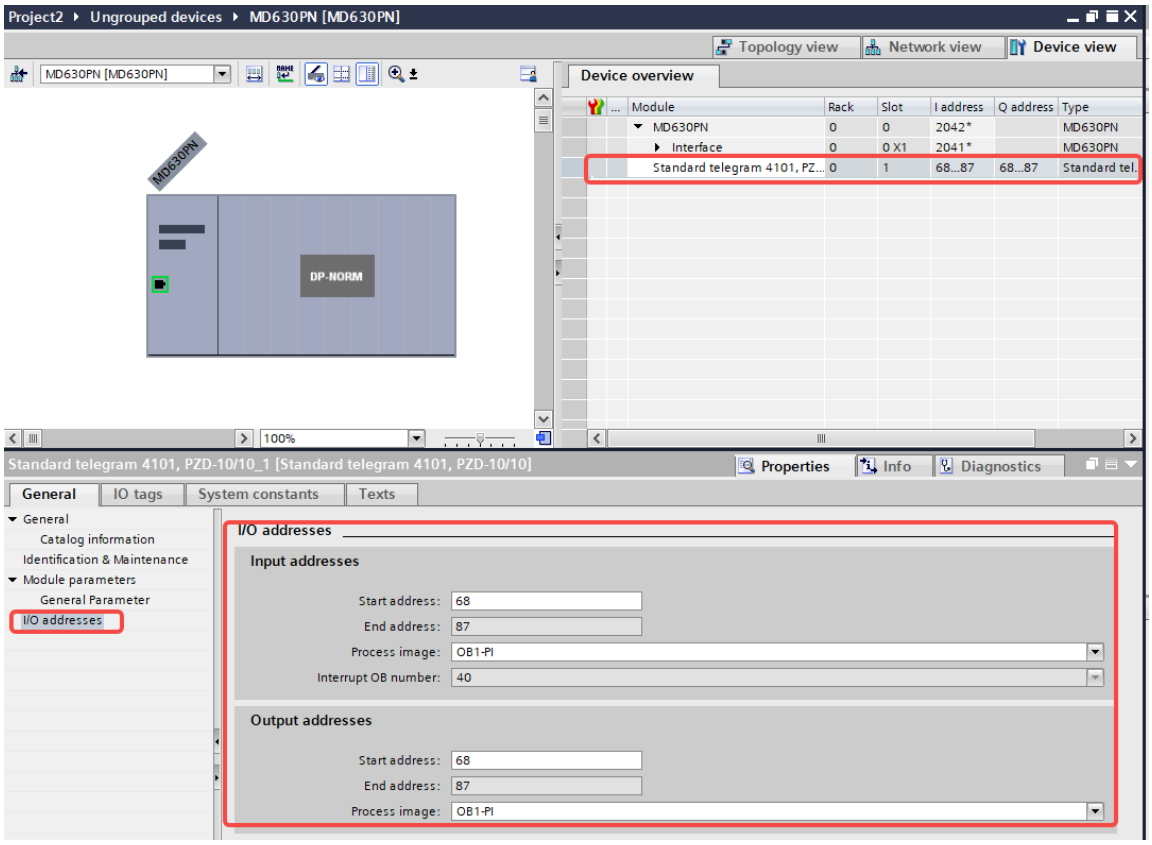
When "%M0.0 output switch value changed to 1 (closed)", the value 1 (Forward run command) is written to PZD1 (corresponding to PQW256, mapping relation 29457, hexadecimal 7311H), and the value 4000 (frequency, two decimal places) is written to PZD2 (corresponding to PQW258, mapping relation 29456, and hexadecimal 7310H) simultaneously.

Note:

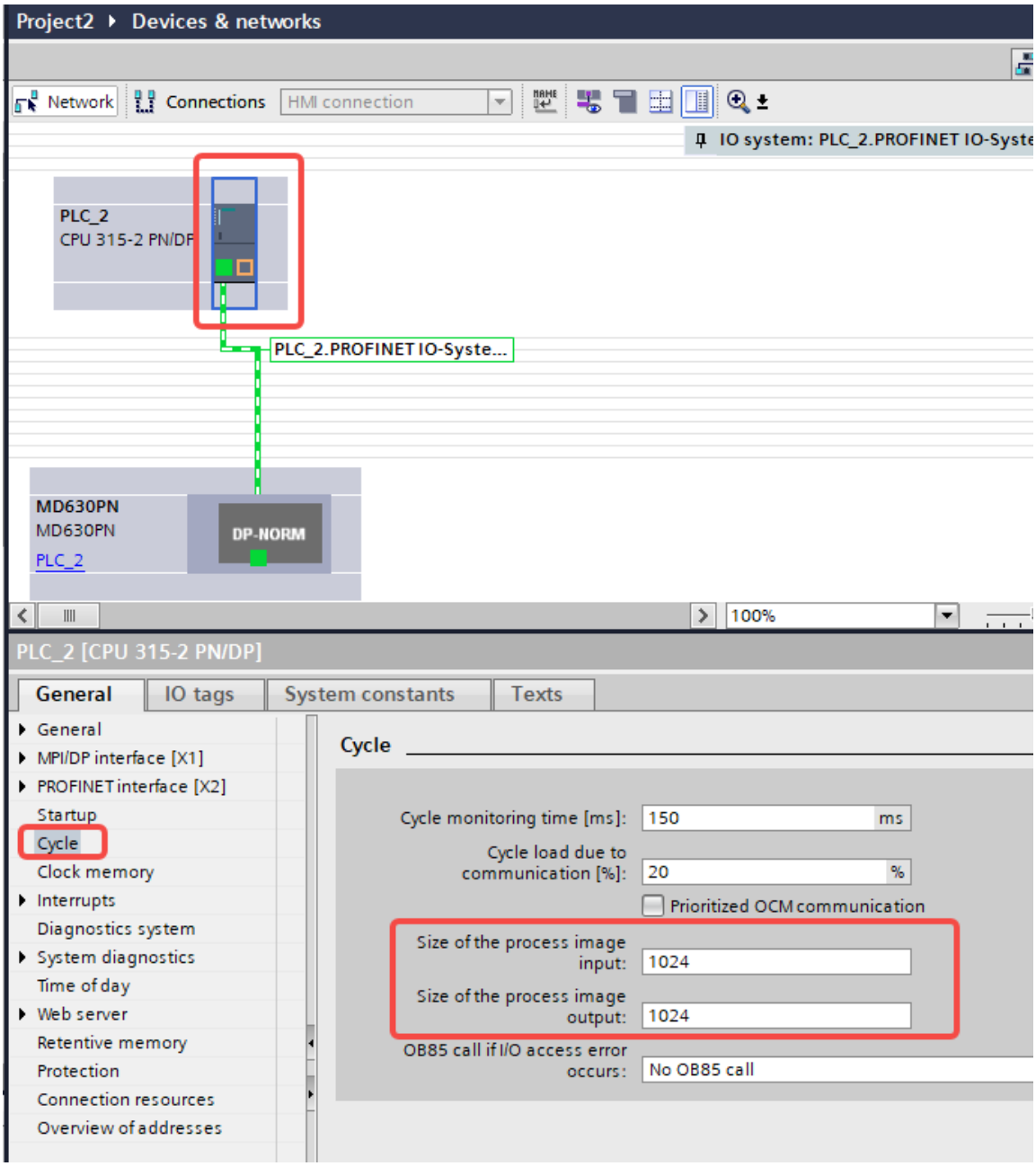
- To control the drive through communication, you need to set the command source and frequency source as the communication source according to section *" Special Communication Address" on page 899*.
- PZD1 and PZD2 are already configured by default. You can also change the configuration and download it to the PLC.
- By default, the S7-300 PLC cannot perform write operations on addresses similar to QW256 through commands directly or perform read operations on the address of IW256.

PQW and PIW are external addresses. If you want to access them directly, you need to change them to process mirror addresses.

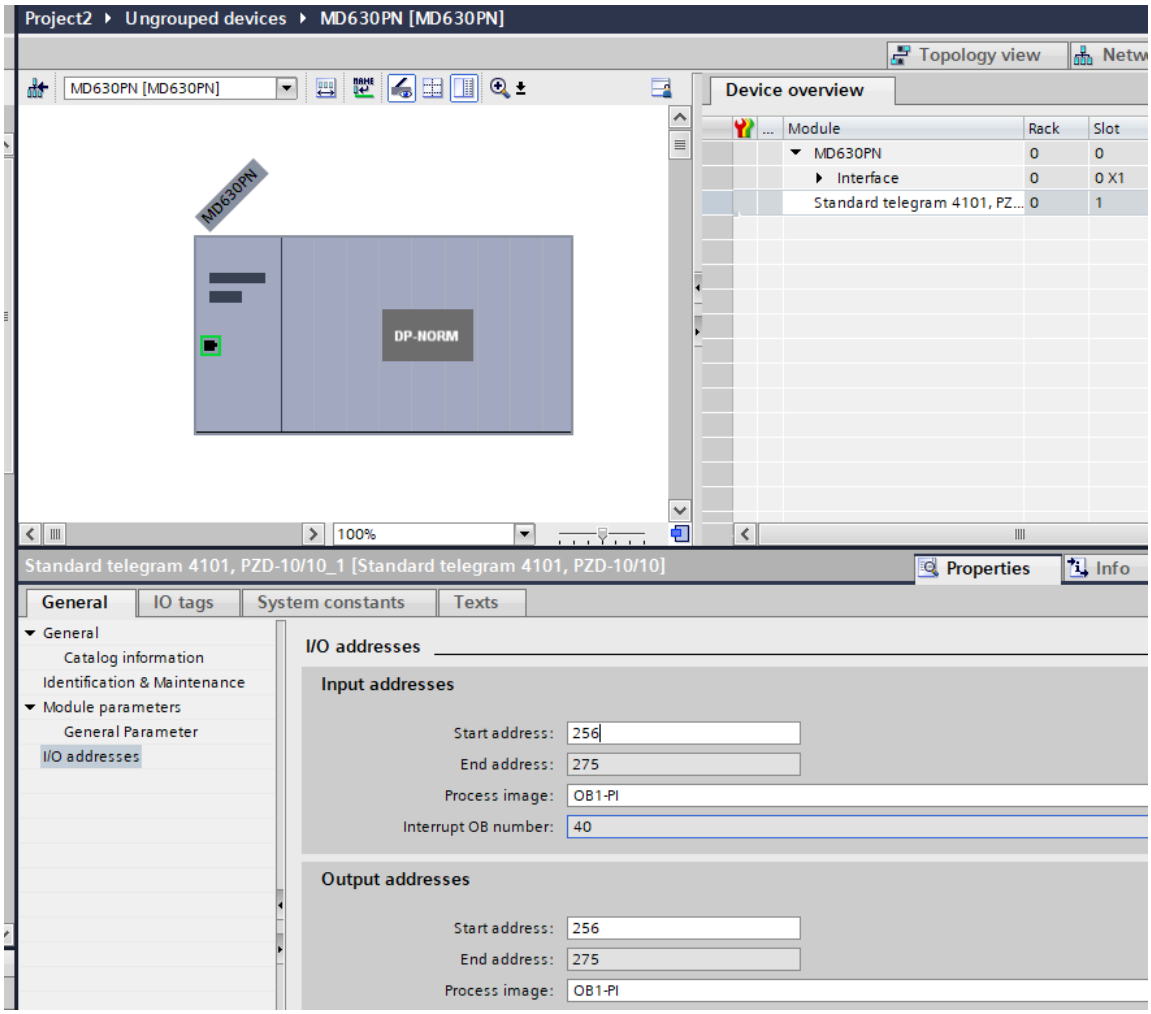
Method 1: Change the input/output address of the slave to the process mirror area. The process mirror area of S7-300 is the addresses 0 to 127 of I and Q. Select the slave and switch to the "Device view". After selecting the message, change the start address of the input/output to the process mirror area in the I/O address (the end address must also be in the process mirror area). After modification, the "process image" will be automatically switched from "None" in gray to "OB1-PI", as shown in the following figure:



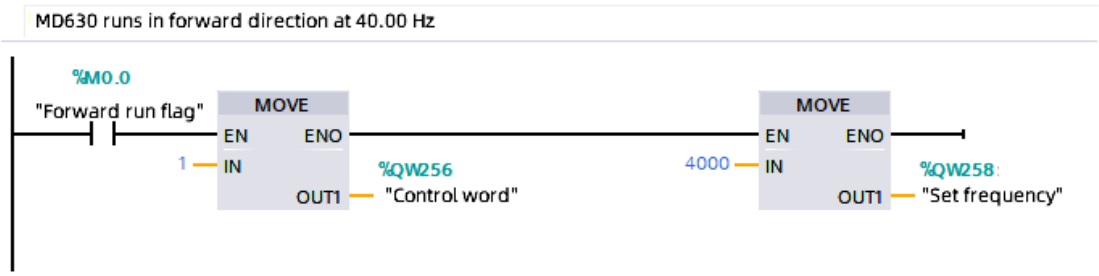
Method 2: Expand the process mirror area of the PLC. Because the process mirror area of S7-300 is small, when an excessively large number of PN nodes are present, the input/output addresses of some nodes will not in the process mirror area, which may also happen to other types of PLCs. In this case, you can expand the process mirror area of the PLC. Select the PLC in the configuration interface, and modify the "Size of the image input area" and "Size of the image output area" in "Cycle" in the "Properties" interface, as shown below. The default value of 128 is changed to 1024 (be careful not to exceed the memory size of the PLC).



Similarly, after modification, the slave I/O address that outside the process image area will be automatically switched to the process image area.



After changing the input/output addresses to the process image area, you can directly use the addresses corresponding to these slaves in the monitoring table (The Q addresses correspond to output, which is the data written to the slaves. The I addresses correspond to input, which is the data returned from the slaves.) In addition, QW and IW can be directly used for the corresponding instructions in the user program, as shown below.



6.10.10.2 Communication Configuration Example for STEP7

The following shows how to control MD630N communication through STEP7 configuration S7-315.

Prerequisite

Connect the drive to the bus system, as shown in *"6.10.6 Connecting the Drive To Bus System" on page 1044*.

Procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.

Step 2: Set the frequency or torque through communication.

Set the frequency as follows:

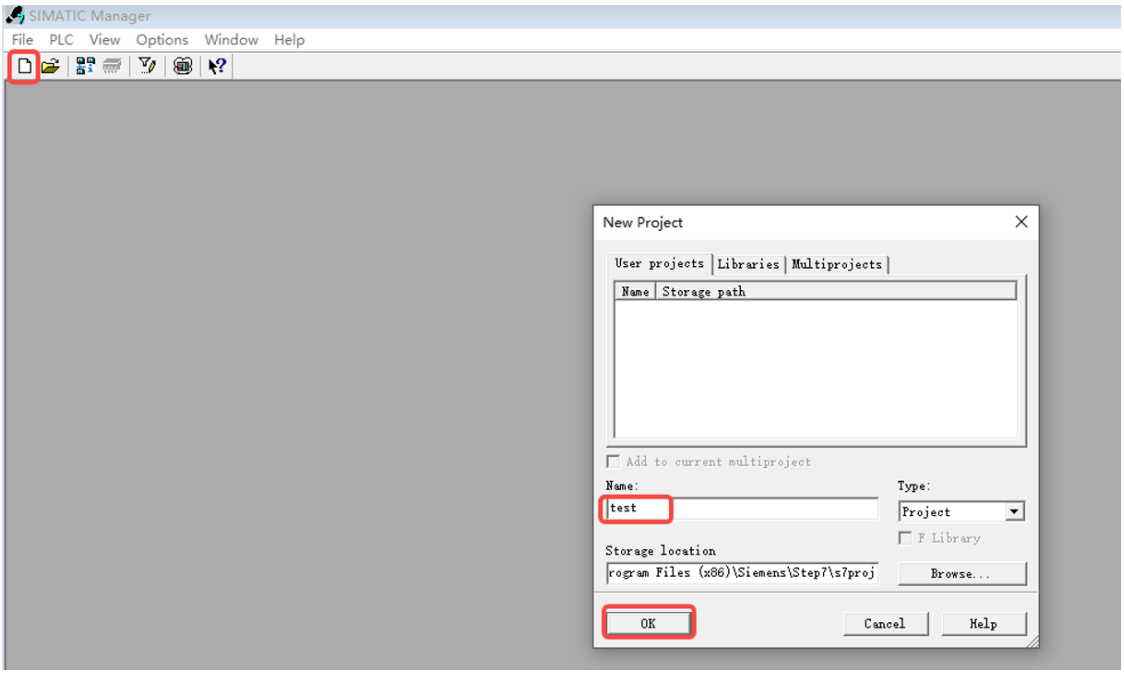
1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Set the torque as follows:

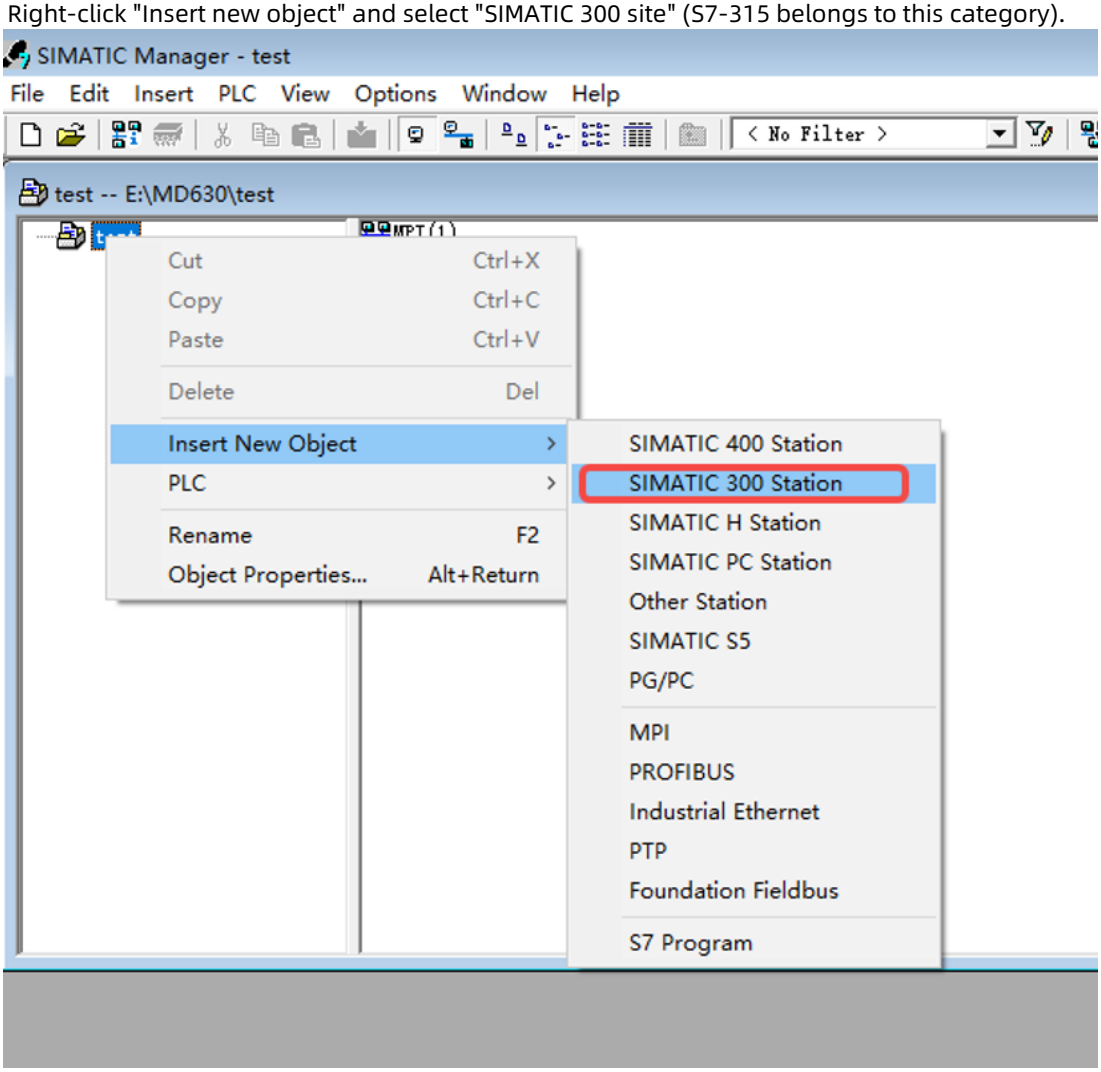
1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed.
   0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places); 4: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places)

Step 3: Establish PROFINET communication.

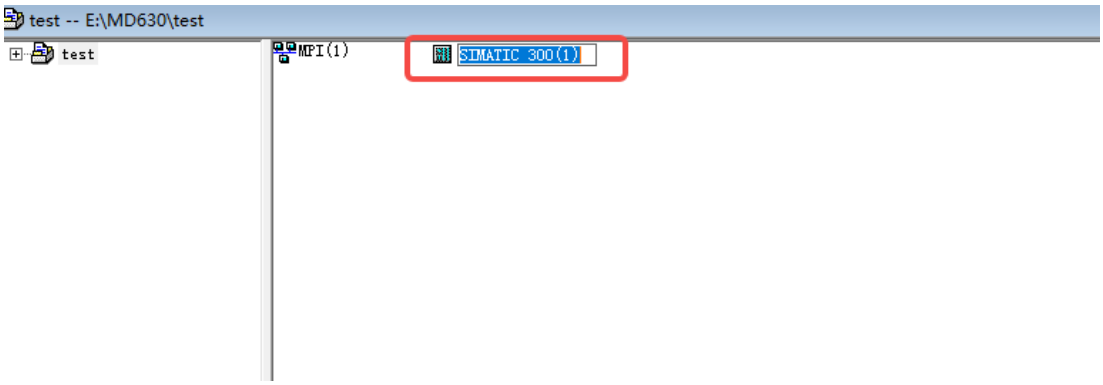
1. Set n0-10 to 3 (through the operating panel or software tool). Switch the device communication mode to PROFINET.
2. Wait for a few seconds until LED0 flashes green and LED1 turns yellow (steady). This indicates that the connection between slave and master is established successfully, and data exchange is available.
3. Create a project.
   Open STEP7 software, create a project, enter the project name, and click "OK".



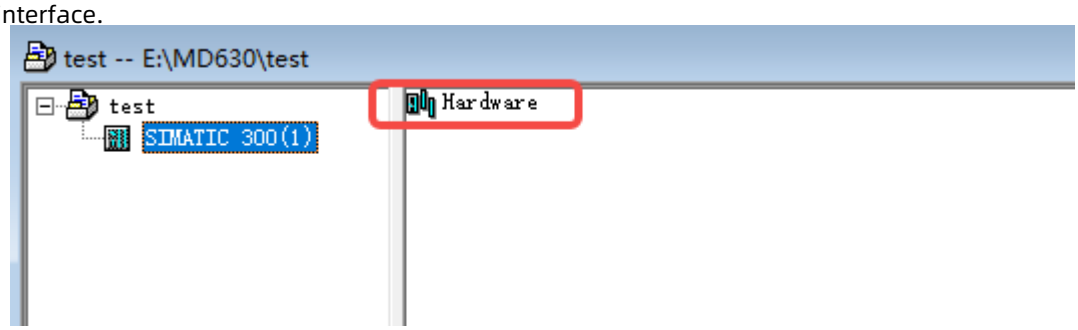
a. Right-click "Insert new object" and select "SIMATIC 300 site" (S7-315 belongs to this category).



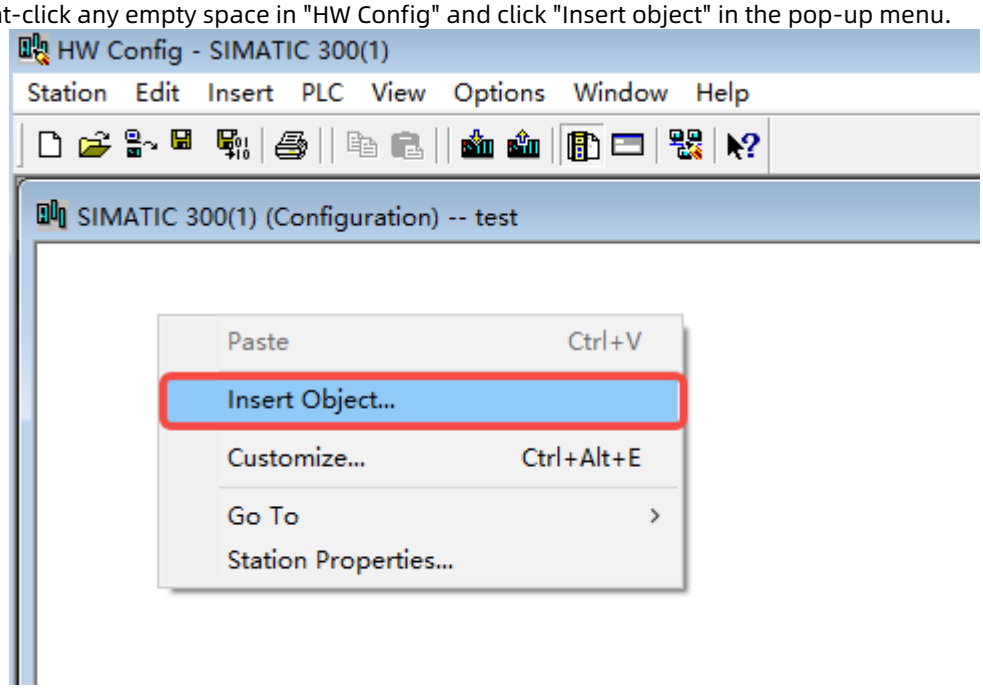
b. Double-click SIMATIC 300 (1) generated.



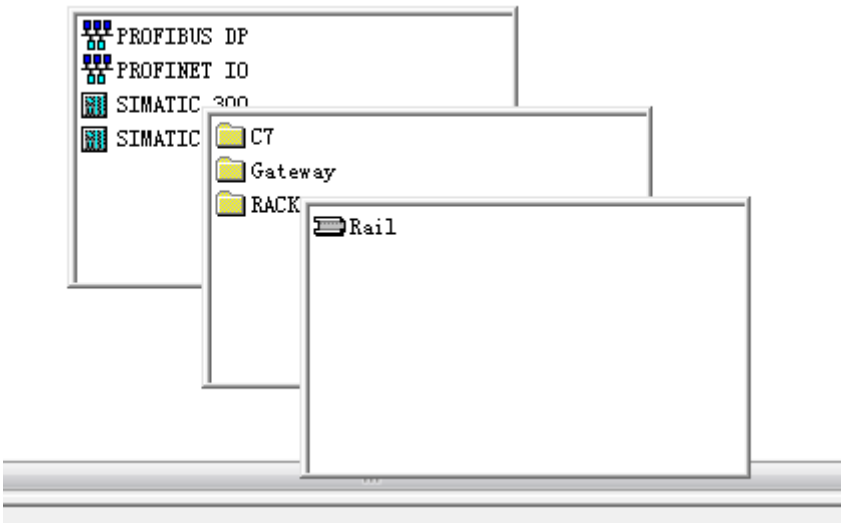
c. Double-click "Hardware" in the expanded interface to enter the hardware configuration interface.



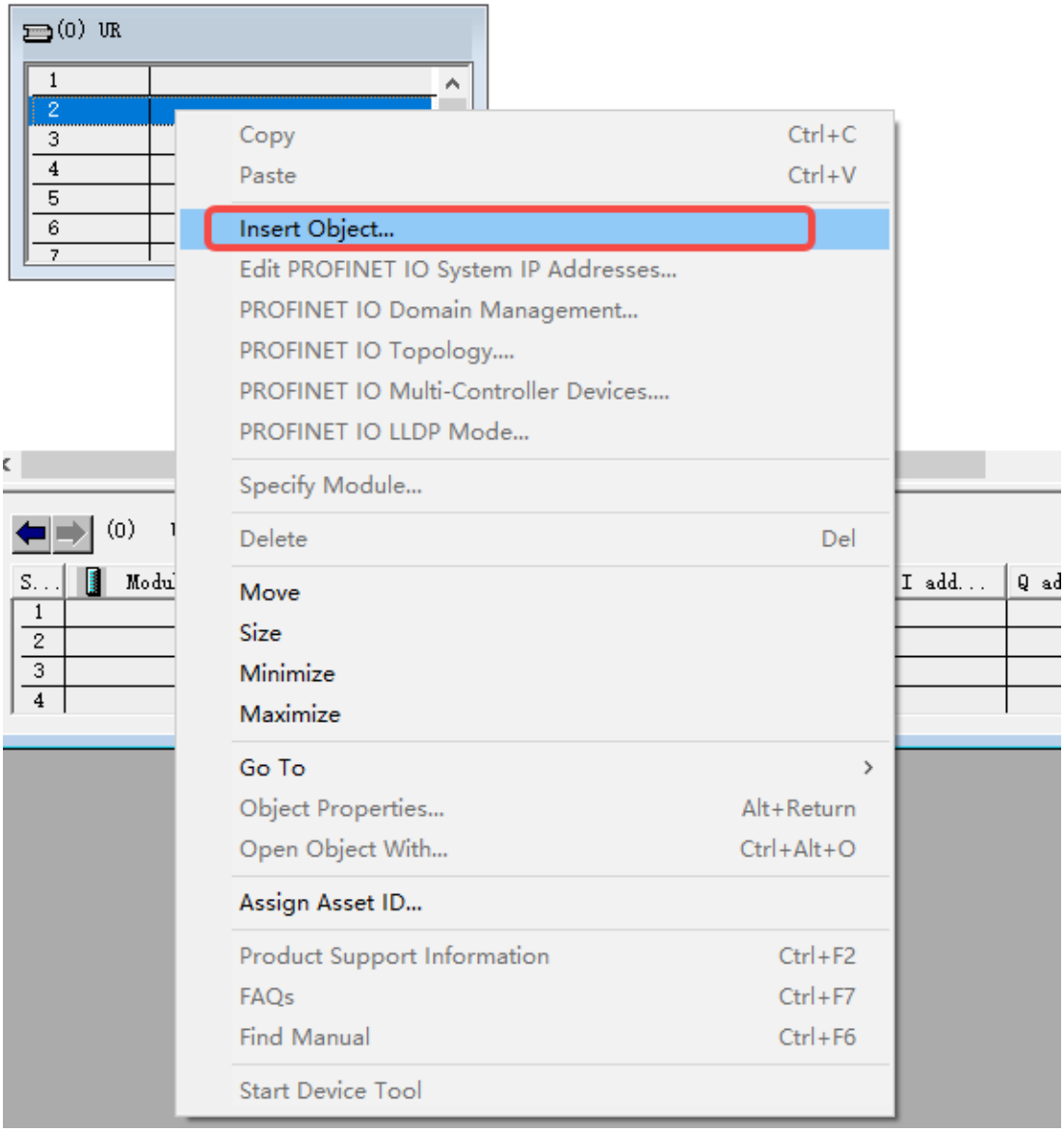
d. Right-click any empty space in "HW Config" and click "Insert object" in the pop-up menu.



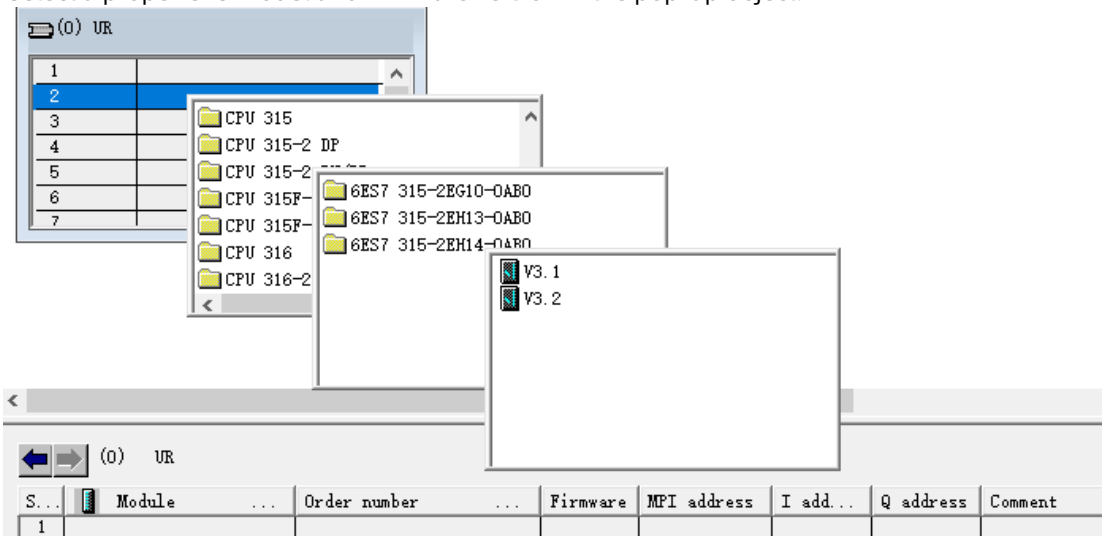
e. Click "SIMATIC 300", "RACK", and "Rail" in sequence.



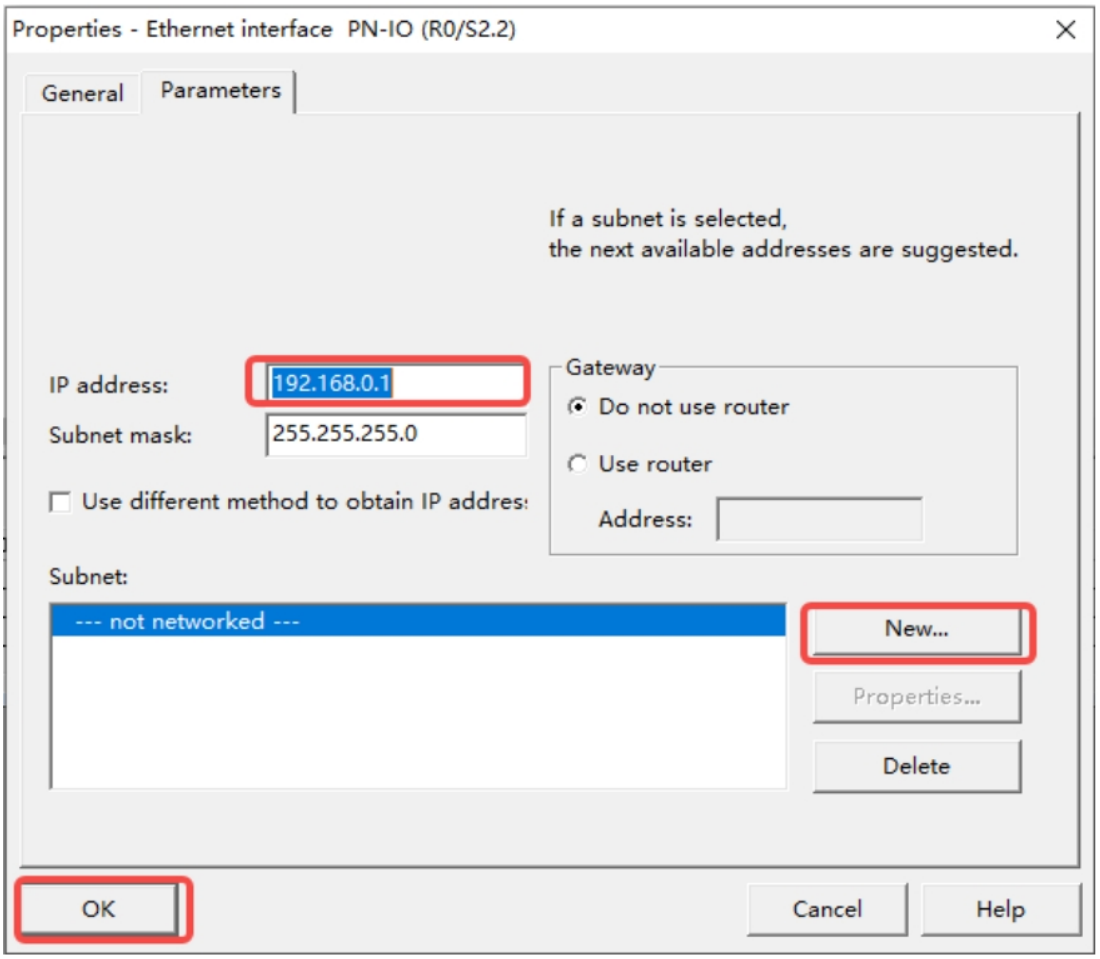
f. In this way UR is established. Then right-click on slot 2 (slot 1 can only be the power supply) and click "Insert object" in the right-click menu.



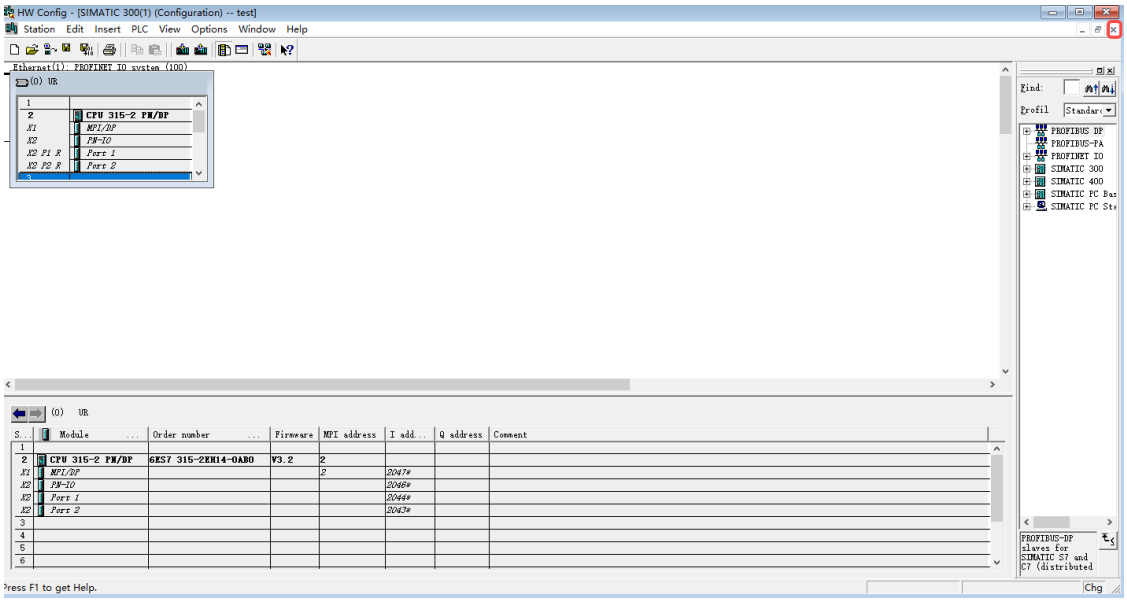
g. Select a proper CPU model and firmware version in the pop-up object.



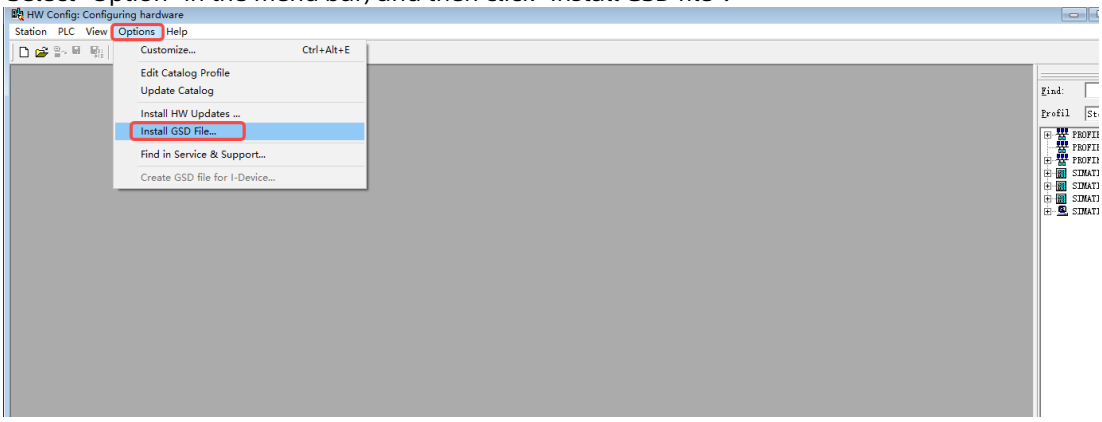
h. After you set the IP address, click "Create". After the Ethernet network is established, click "OK".



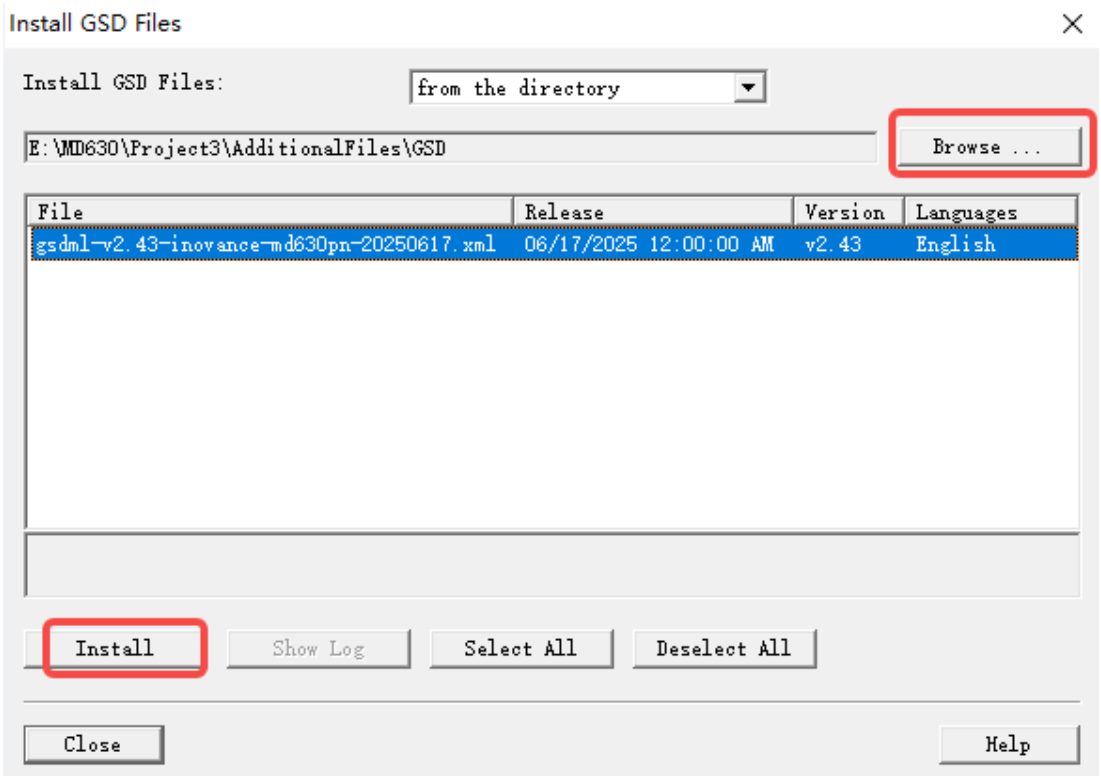
4. After the PLC master is configured, you need to import the XML file of the MD630N (you can skip this step if it is already imported). Close the current configuration file (otherwise, you cannot perform the import operation) and click the red mark in the upper right corner of the following figure.



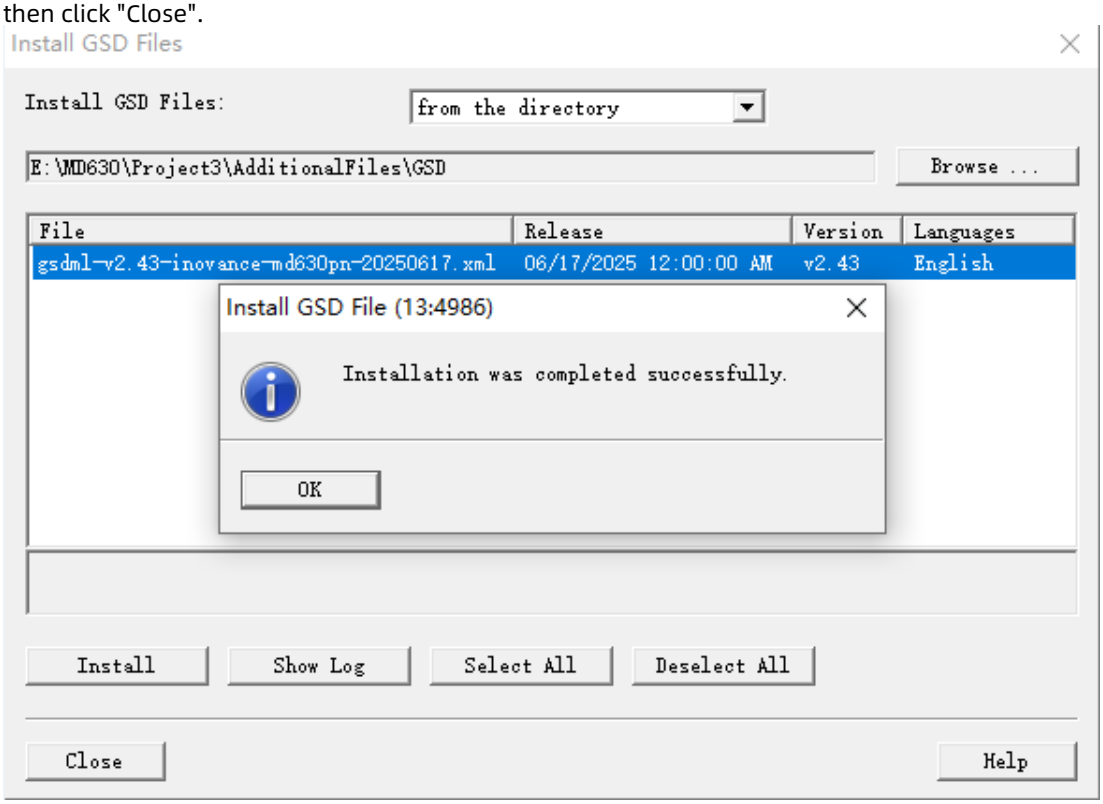
a. Select "Option" in the menu bar, and then click "Install GSD file".



b. Set the current GSD storage path, select the XML file to be imported, and click "Install".



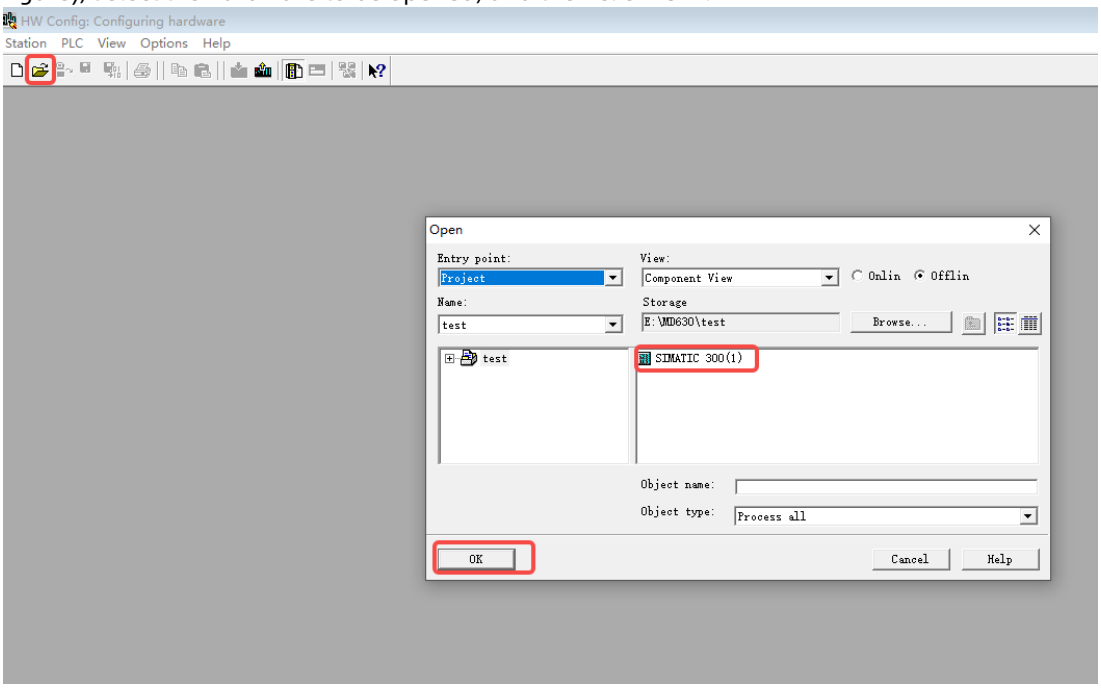
c. When the message indicating that Installation is done successfully is displayed, click "OK", and then click "Close".



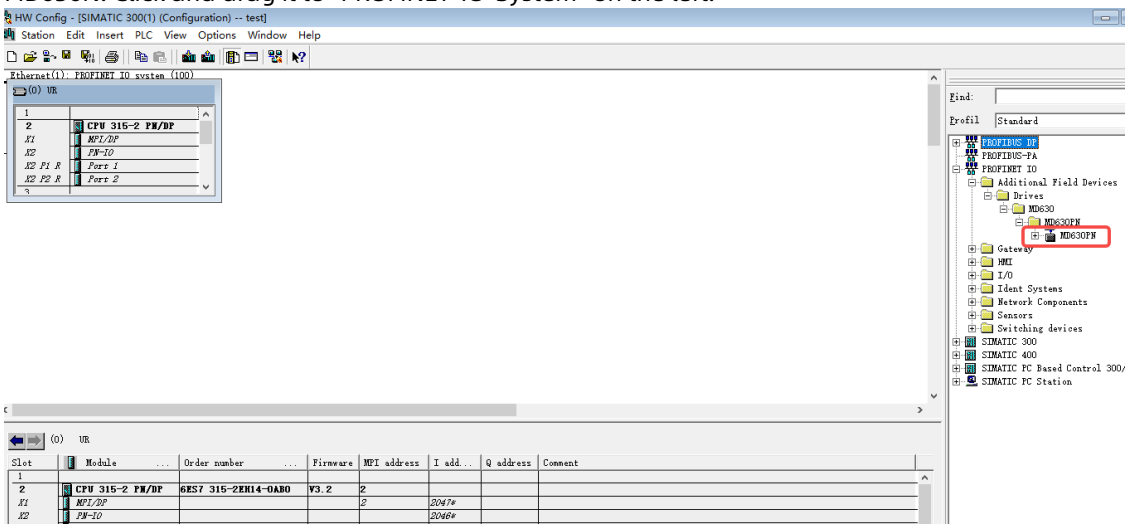
Caution

The XML file of the MD630 is version 2.42. The earlier version of STEP7 indicates that some functions are unavailable. You can ignore this alarm.

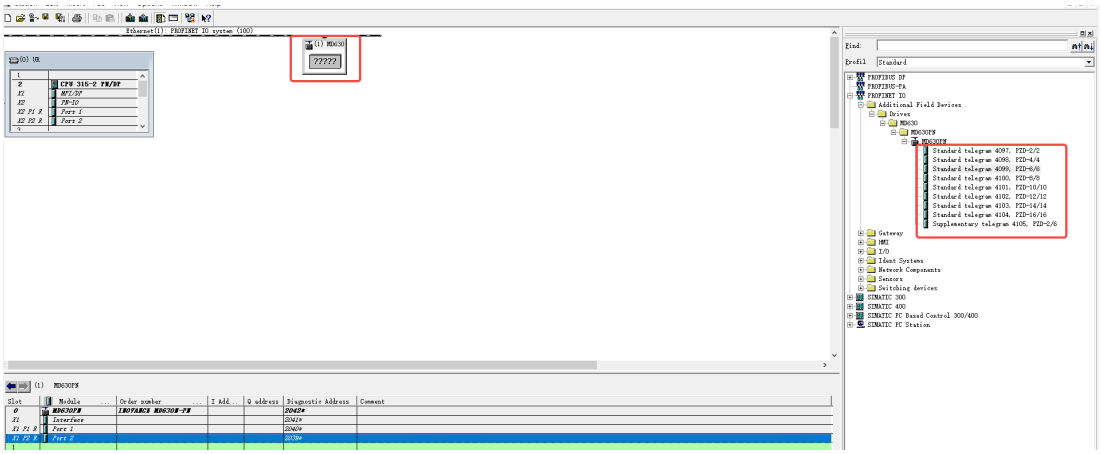
d. After the XML file is installed, click "Open" (marked in the upper left corner of the following figure), select the hardware to be opened, and then click "OK".



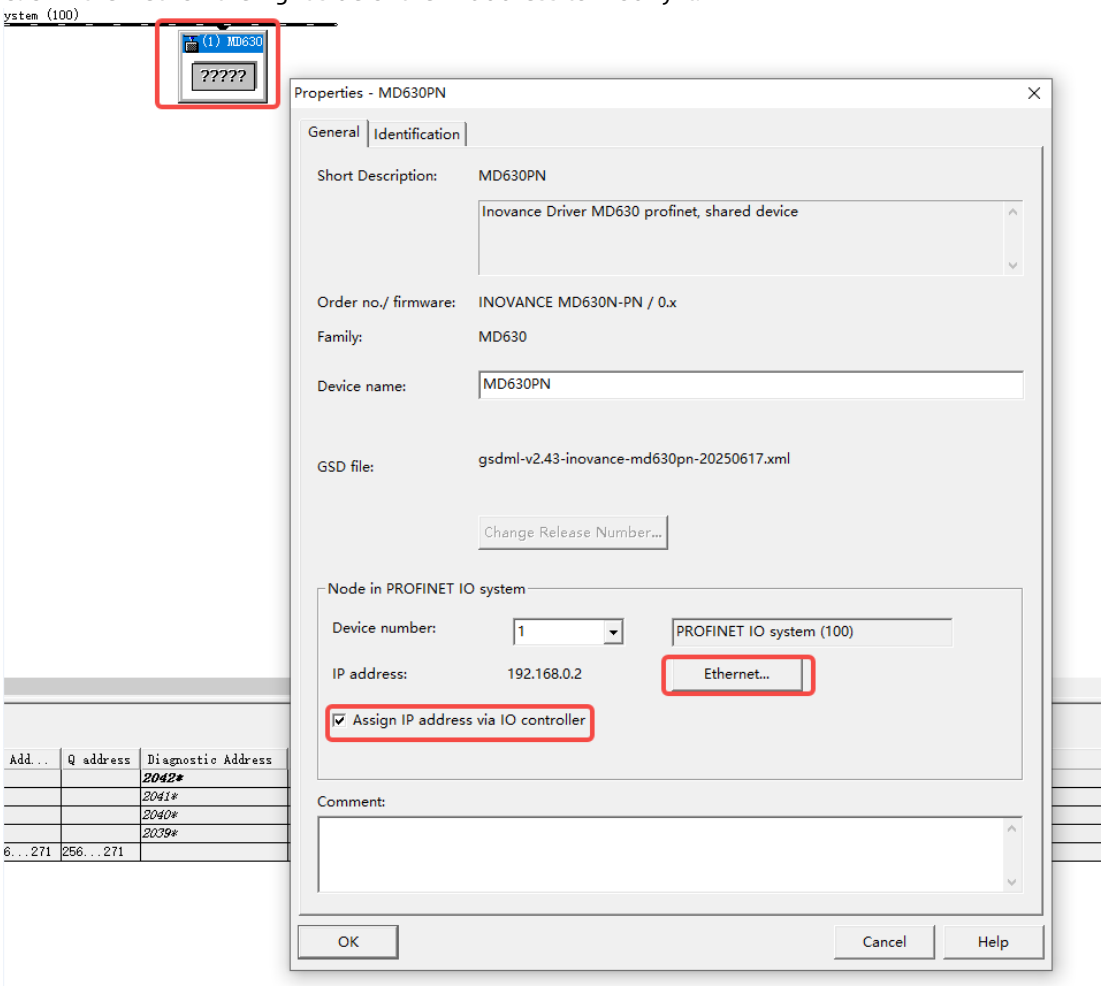
5. After XML is installed, configure the slave device. In the hardware directory, expand "PROFINET IO", "Additional Field Devices", "Drivers" and "MD630" to find the PN device corresponding to the MD630N. Click and drag it to "PROFINET-IO-System" on the left.



a. Select the slave, then choose a message module in the right-side hardware directory and double-click to add it to the slave.



b. Double-click the slave, and in the pop-up screen, select "Assign IP address through the IO controller". Then the slave is automatically assigned with an IP address. If this IP is not suitable, click "Ethernet" on the right side of the IP address to modify it.

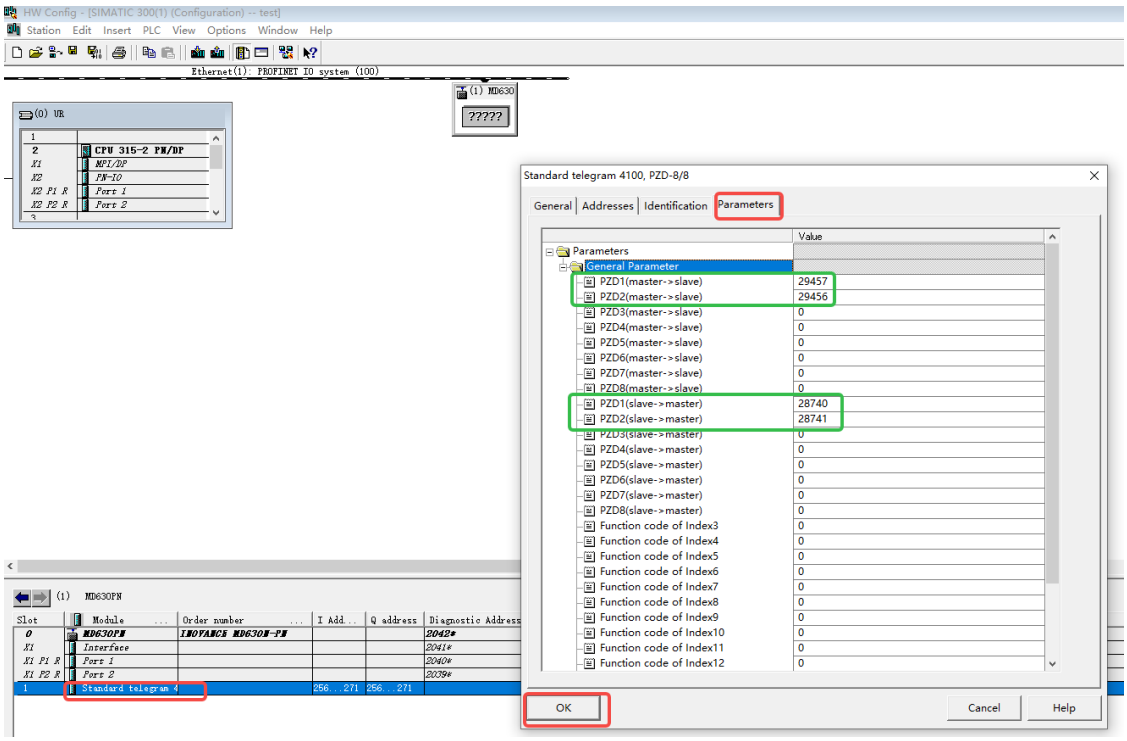


6. After adding the module, you can configure the module and set the parameter corresponding to each PZD. To do this, double-click the message module and select "Parameters" in the dialog box that appears.

   As shown in the following figure, PZDx (master->slave) indicates the PZD (out-data) written by the master to the slave, and PZDx (slave->master) indicates the PZD (in-data) returned by the slave to the master. The initial values of PZD1 and PZD2 in the green marked part of the figure are preset.

PZD3 written in the master is configured to 61488 (0xF030, ramp 1 acceleration time) and PZD4 written in the master is configured to 61489 (0xF031, ramp 1 deceleration time). PZD3 read by the master is configured to 28674 (0x7002, bus voltage), PZD4 read by the master is configured to 28675 (0x7003, output voltage).

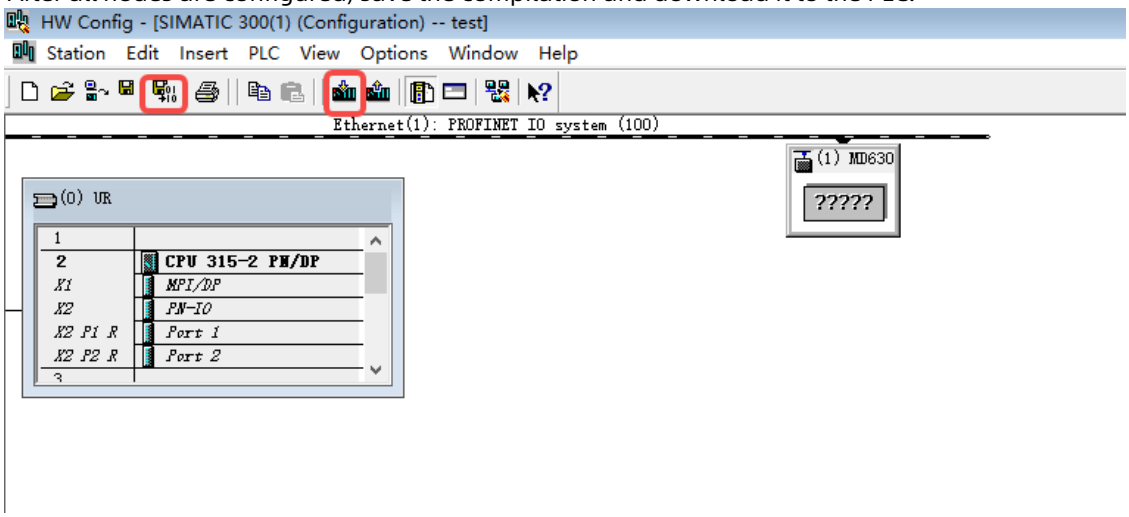
Click "OK" to complete the configuration.



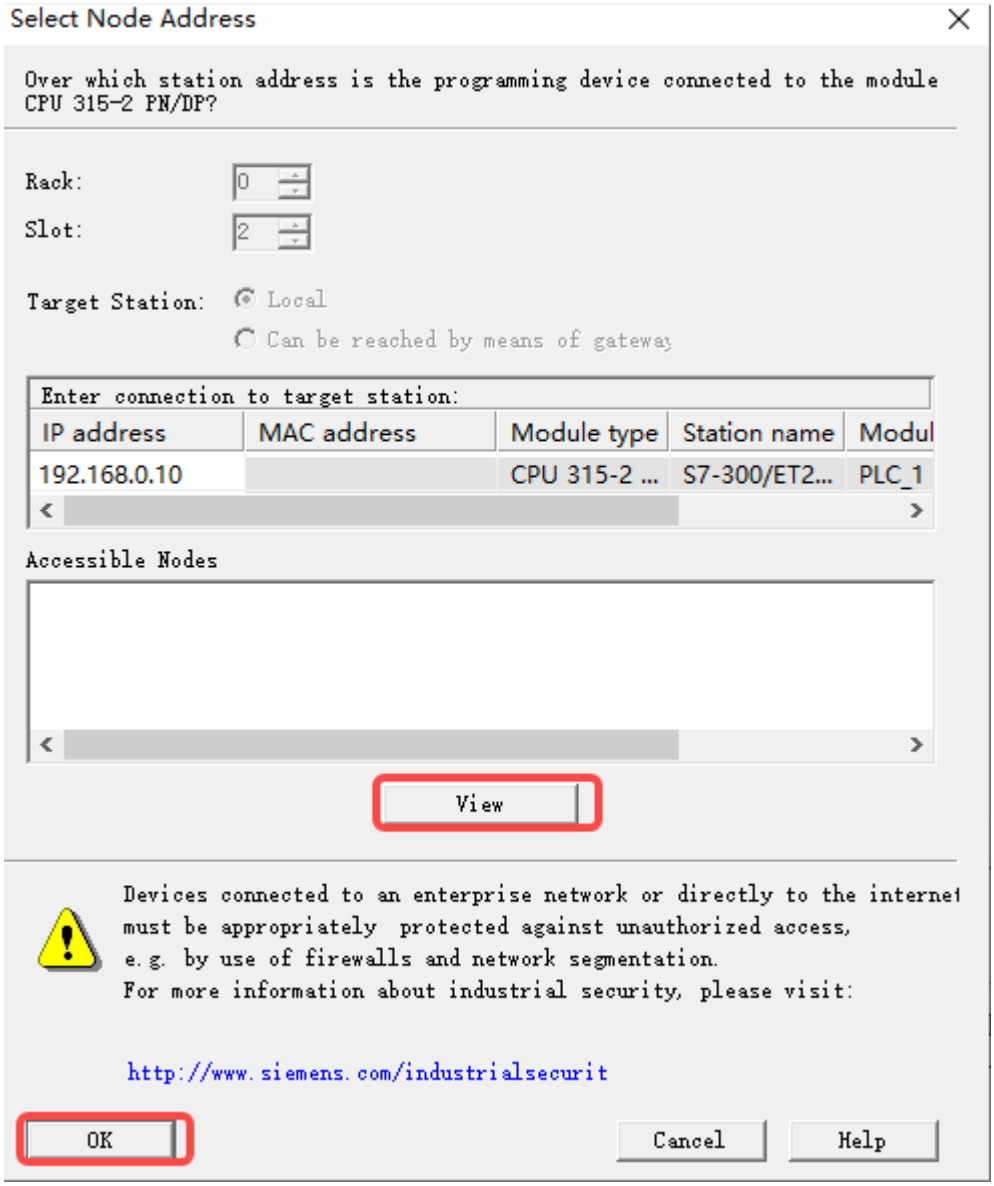
Caution

The PZD configuration must be consecutive. For example, configurations such as setting PZD1...PZD4 and PZD6, but with PZD5 keeping its original value of 0 are not permitted, as this can deactivate the mapping of PZD6.

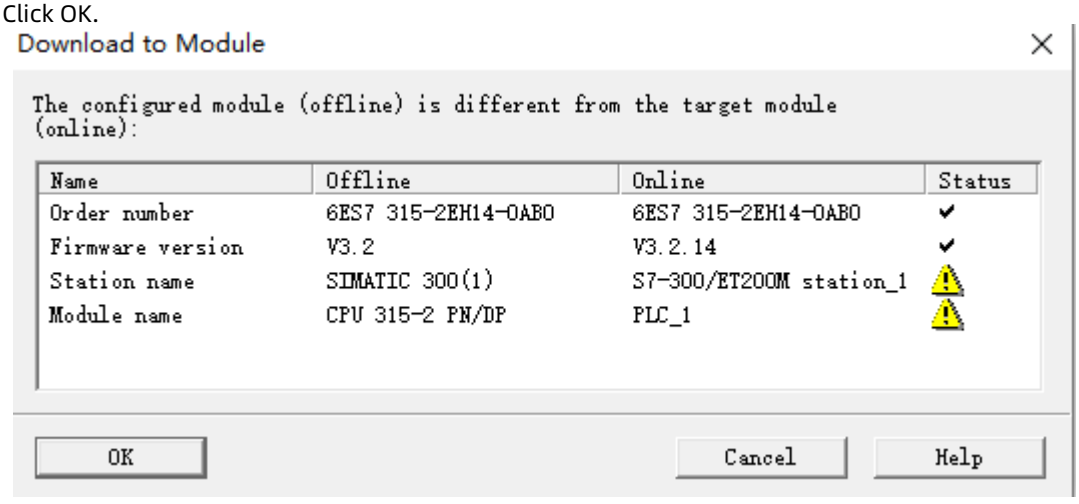
7. After all nodes are configured, save the compilation and download it to the PLC.



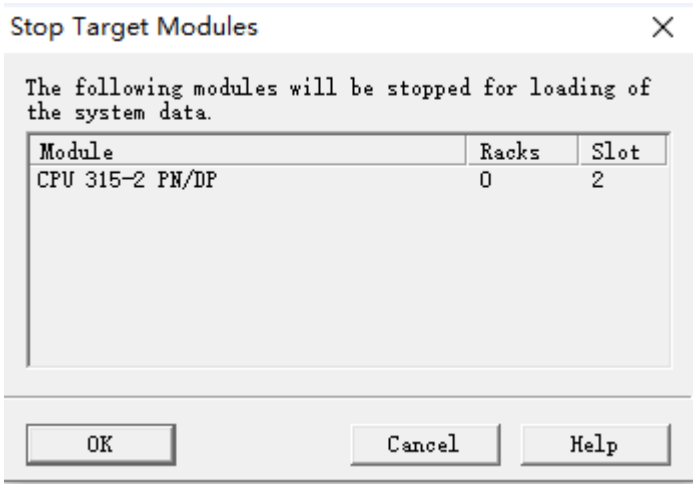
a. Click "Display" to refresh the master found in STEP7. Click "OK".



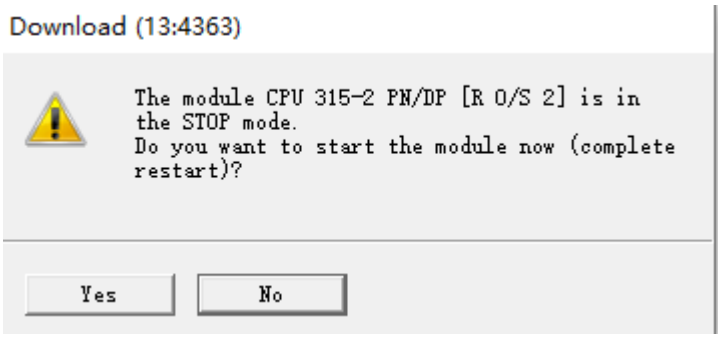
b. Click OK.



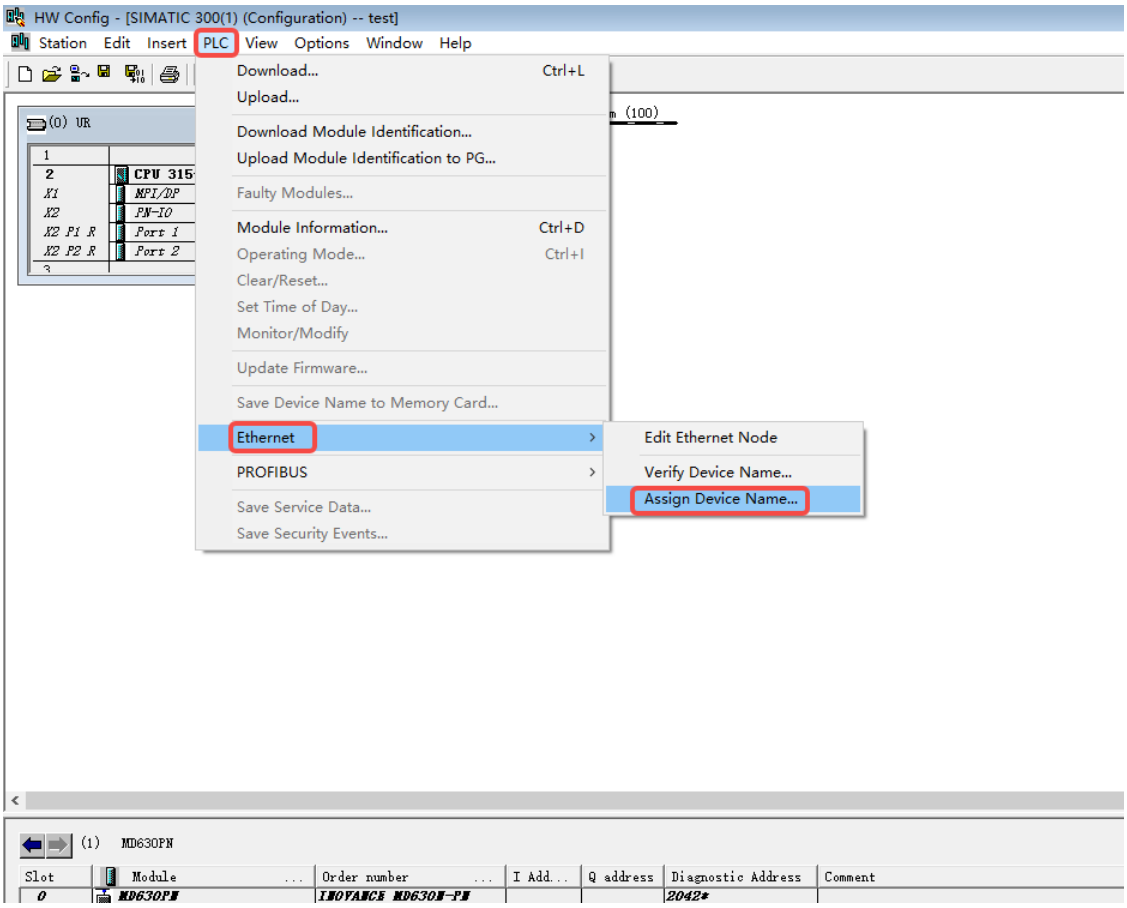
c. During download , click "OK" in the prompt that asks you whether to stop the target module.



d. After download is down, click "Yes" in the prompt that asks you whether to start the module right now. If you select "No", the master remains in the STOP state until the master is manually started.



8. Without selecting the master, click "Assign device name" in "PLC" > "Ethernet".



a. Select the target "Device name," click "Update" to list all PN nodes in the current network. Select the node to be assigned (distinguished by MAC address). You may also check "Blink LED" to identify the specific device. After selection, the corresponding device panel blinks. Click "Assign name".



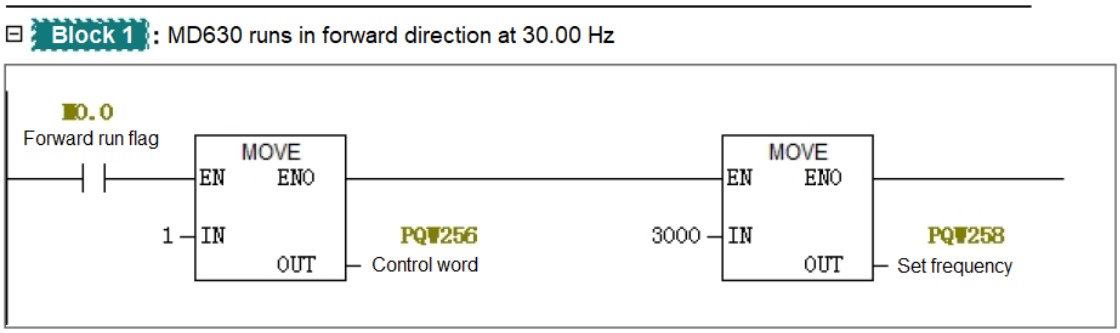
b. After assignment, click "Close".

In this case, you can configure the configuration and control the MD630 by modifying the value in the Q address (in this case, PQW256 to PQW267, corresponding to output PZD1 to 6). You can also read the value in the I address to obtain the status and parameter values of the MD630 (in this example, PIW256 to PIW267, corresponding to input PZD1 to 6).

Numerical data transfer is generally performed through the MOVE instruction or SFC14/SFC15.

Step 4: Control the drive through communication.

Data transfer is generally performed through the MOVE instruction or SFC14/SFC15. The following takes the MOVE instruction as an example. For SFC, see the help file of STEP7 help (press F1 after selecting the SFC block).



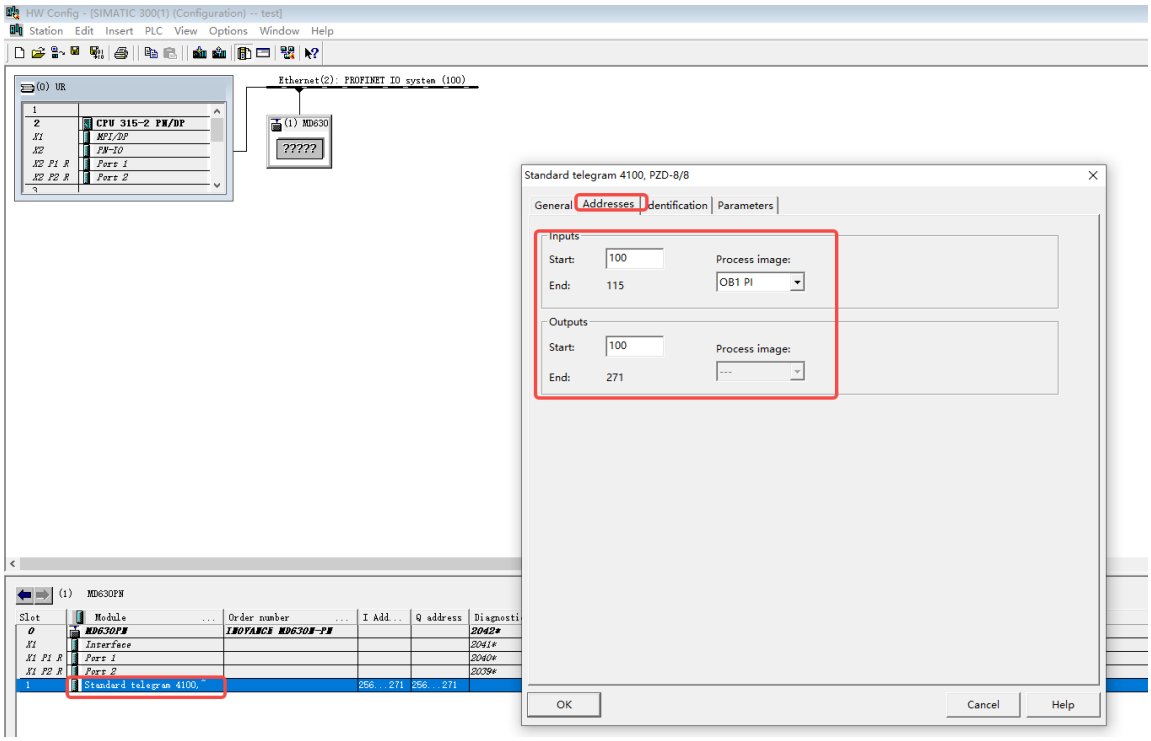
When M0.0 is set, the value 1 (Forward run) is written to PZD1 (corresponding to mapping relation 29457, hexadecimal 7311H) and the value 3000 (Frequency reference) is written to PZD2 (corresponding to mapping relation 29456, hexadecimal 7310H).

Similarly, the data returned by MD630N can be retrieved from the PIW (PIW256 corresponds to PZD1, mapping relation 28740, hexadecimal H7044; PIW258 corresponds to PZD2, mapping relation 28741, hexadecimal H7045, and so on).

Note:

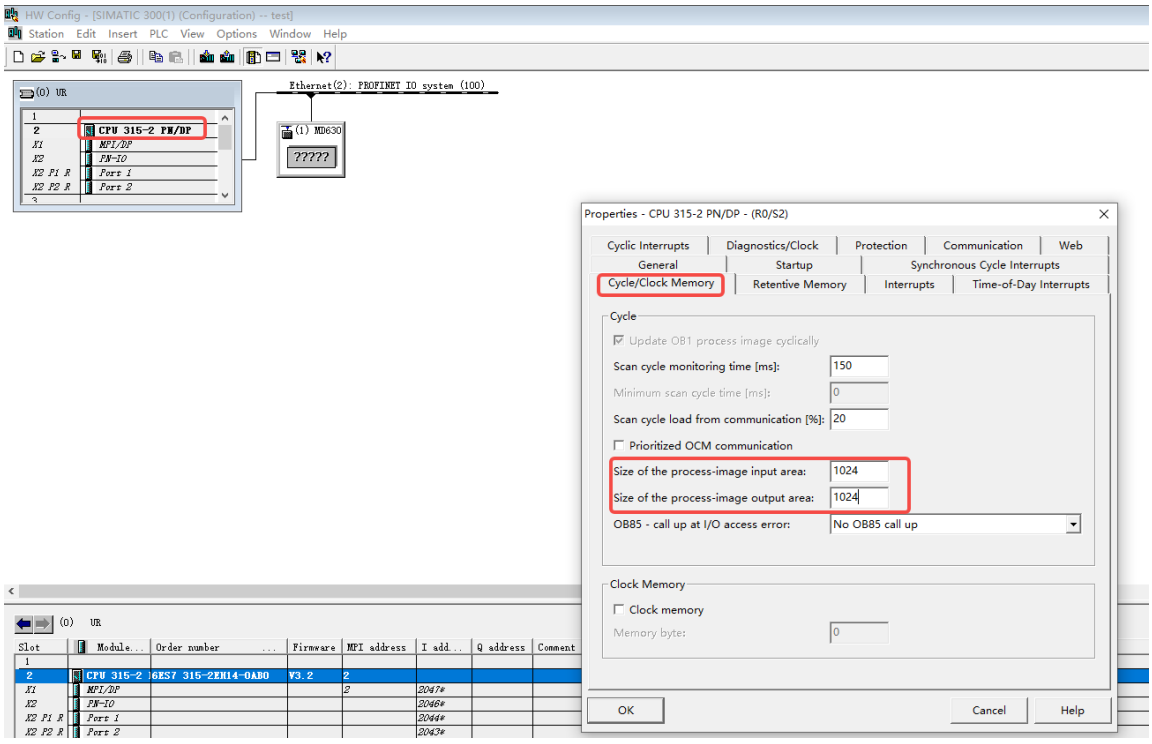
- The command source and frequency source have been set to "Communication" according to *" Special Communication Address" on page 899*.
- PZD1 and PZD2 are already configured by default. You can also change the configuration and download it to the PLC.

By default, the S7-300 PLC cannot write to addresses similar to QW256 directly using commands or read addresses similar to IW256. If such operation is required, the I/O address of the slave needs to be modified to the process mirror area (the process mirror area of S7-300 is in addresses 0 to 127), as shown in the following figure.



If this address does not need to be modified by every station, you can also change the process mirror area size of the PLC (the default process mirror area size of S7-300 is 128 bytes for I and Q addresses respectively), as shown in the following figure.

After the modification is done, the input/output address of the slave is displayed in the process mirror area (grayed out when not in the process mirror area).



After modifying the input/output address or changing the process mirror area size, you need to recompile and download it to the PLC.

If the modified address is in the process mirror area, you can directly use IW and QW.

6.10.10.3 Example for Communication Between SMART and the Drive

The following shows the configuration example of MD630N with S7-200 SMART.

Prerequisite

Connect the drive to the bus system, as shown by *"6.10.6 Connecting the Drive To Bus System" on page 1044*.

Procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.

Step 2: Set the frequency or torque through communication.

1. Frequency reference: Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.

2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed.

- 0: Frequency (unsigned 16-bit)
- 1: Frequency (signed 16-bit)
- 3: Percentage (corresponds to rated frequency/signed 16-bit/2 decimal places)
- 4: Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)

3. Set b0-03 to 0 and b5-13 to 9 to select communication as the main torque reference source of setting channel 1.

4. It is recommended to set n0-14 [7310H Reference selection] to 2 [Speed (signed 16-bit)].

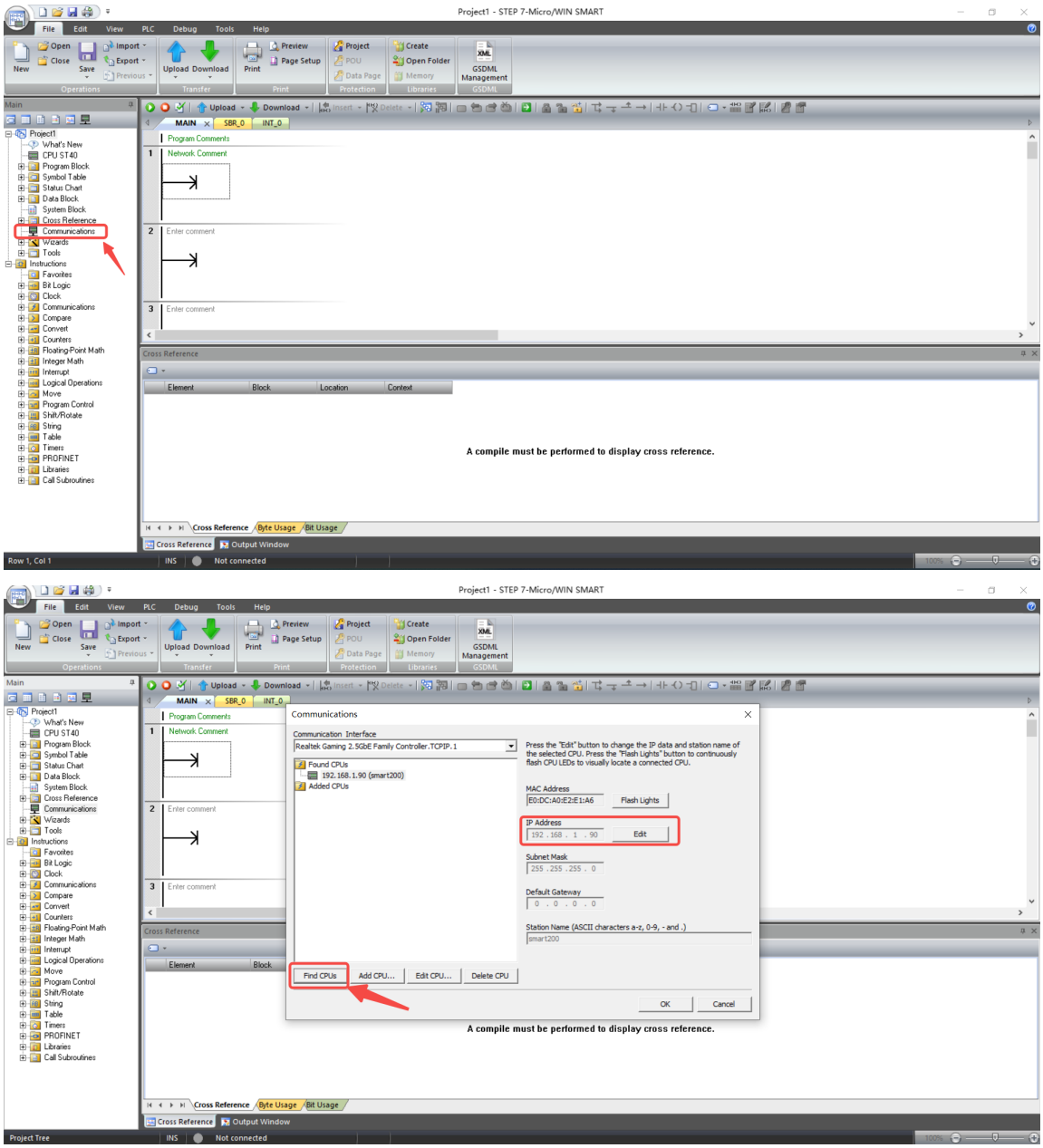
Step 3: Establish PROFINET communication.

1. Set n0-10 to 3 (through the operating panel or software tool). Switch the device communication mode to PROFINET.

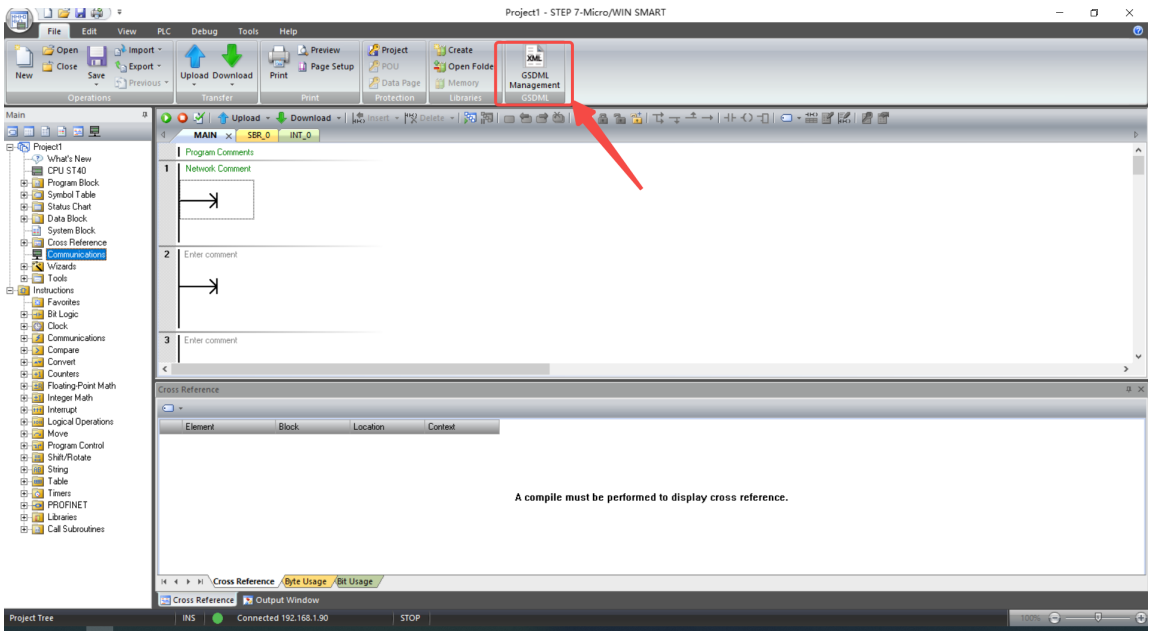
2. Wait for a few seconds until LED0 flashes green and LED1 turns yellow (steady), which indicates that the slave and master are connected successfully, with data exchange generated.

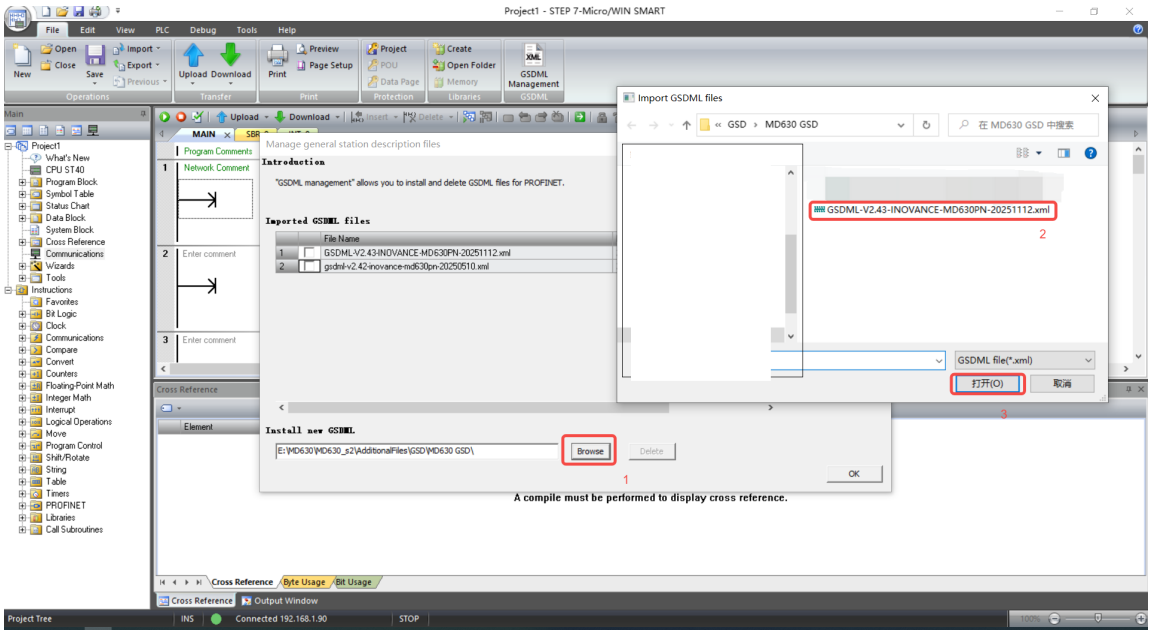
3. Create a project.

a. Open the STEP7-Micro/WIN SMART software, click "Communication", search for the PLC, confirm the PLC's IP address, and connect to the PLC.

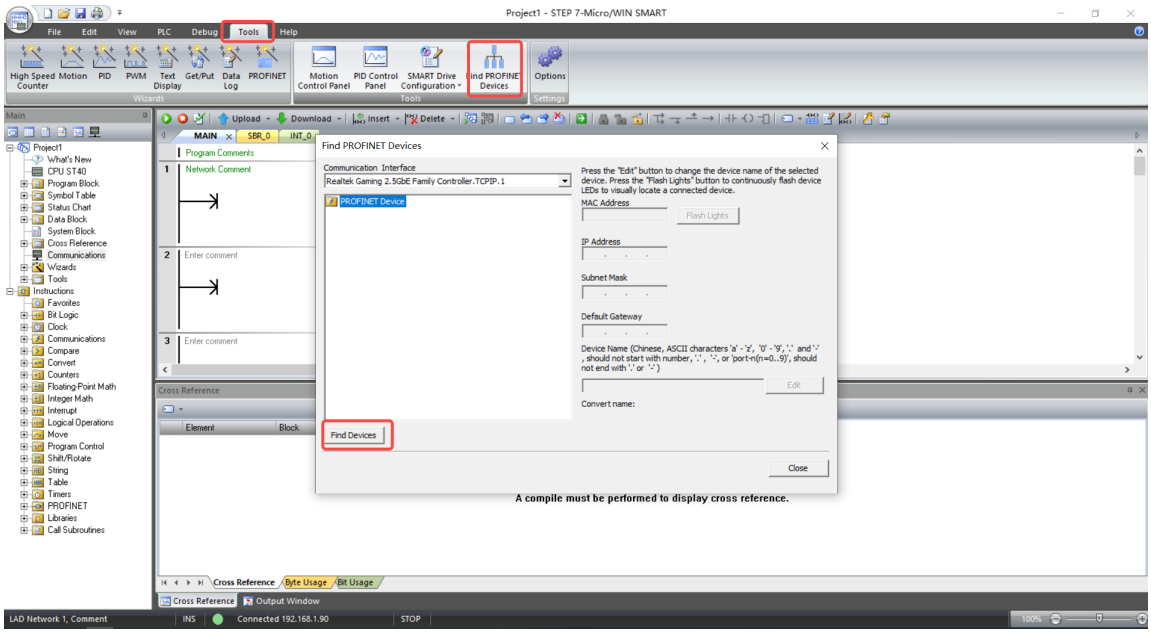


b. Add the GSD file in STEP7.

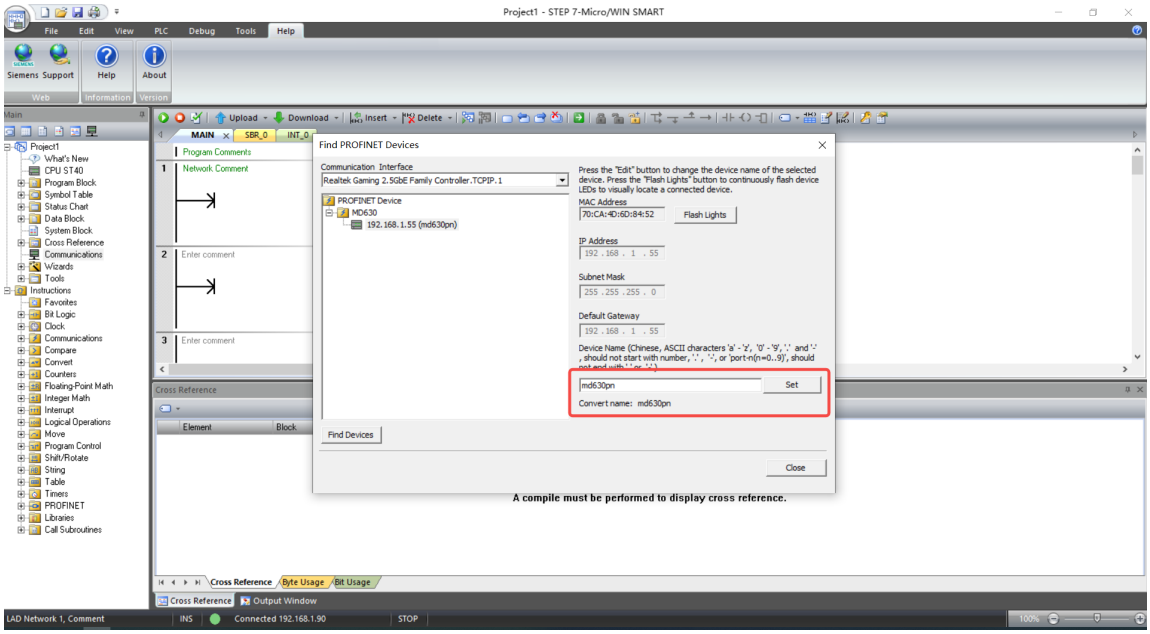




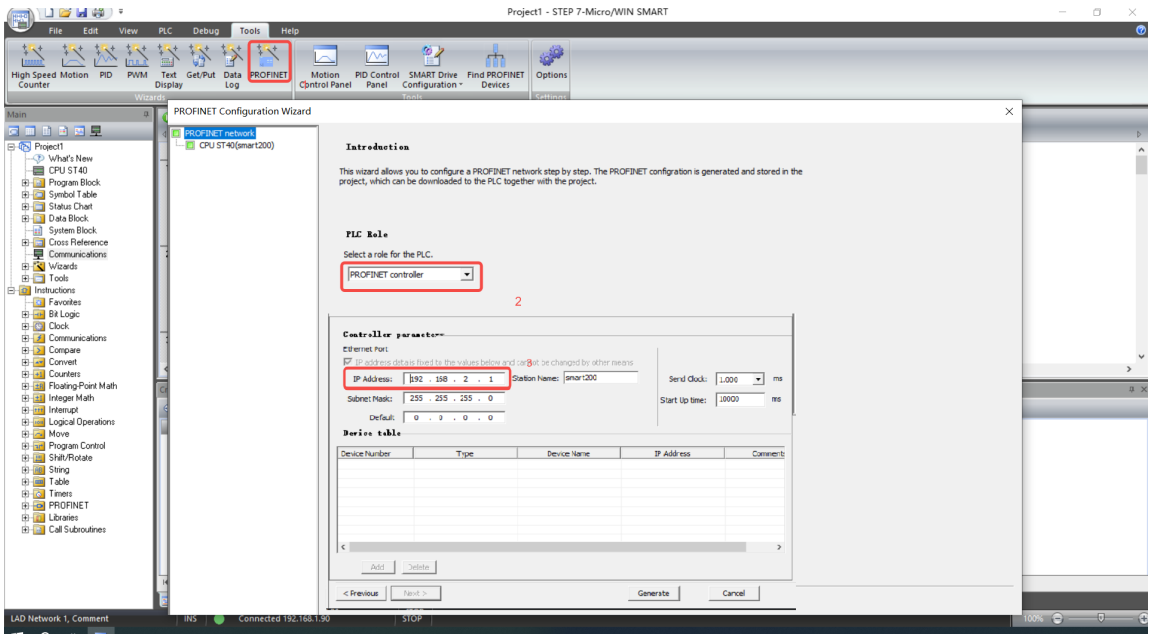
Next, configure the PN network. First, click "Tools" → "Find PROFINET Devices", then click "Find Devices" in the pop-up window.



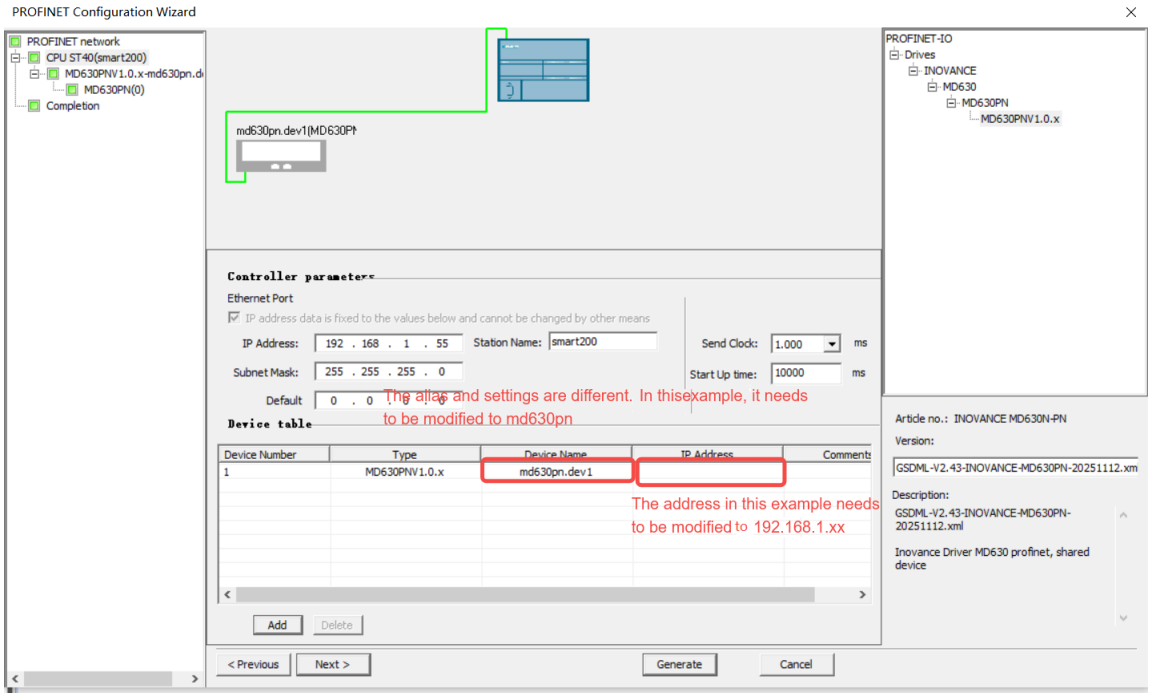
After MD630N is found, you can modify the alias in the "Station name" field. In this example, change it to md630pn.



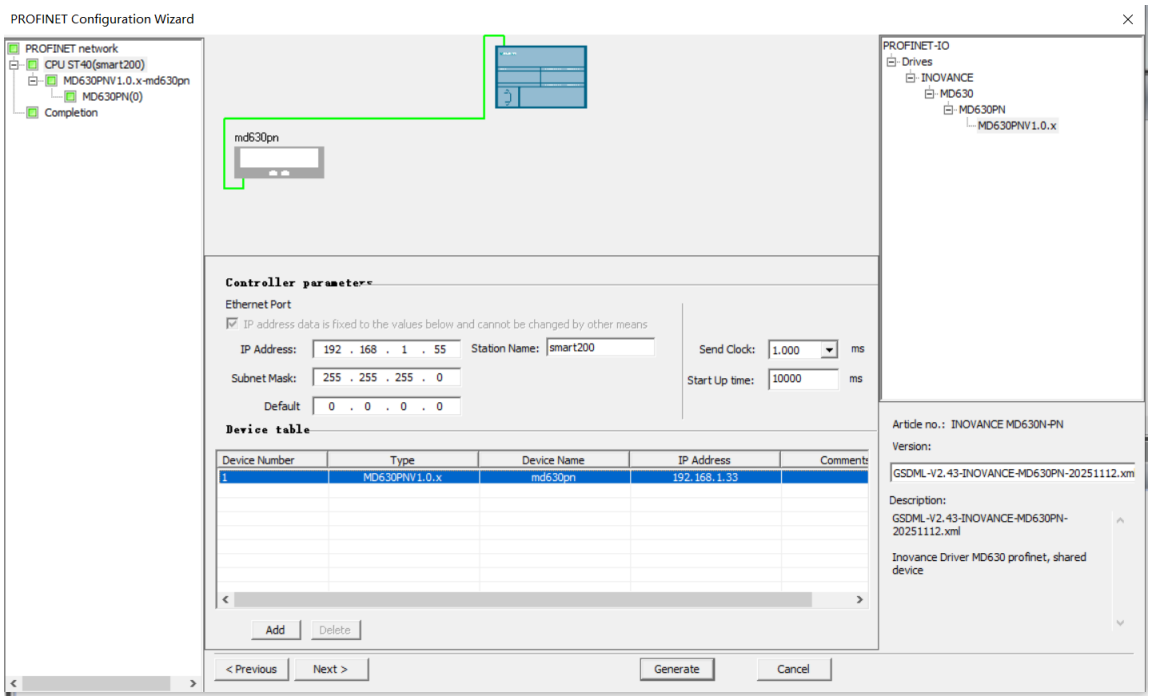
Then click "PROFINET" (1). In the pop-up selection window, set the PLC role to "Controller" (2), and modify the IP address (3) to the corresponding PLC address. Click "Next" after completion.



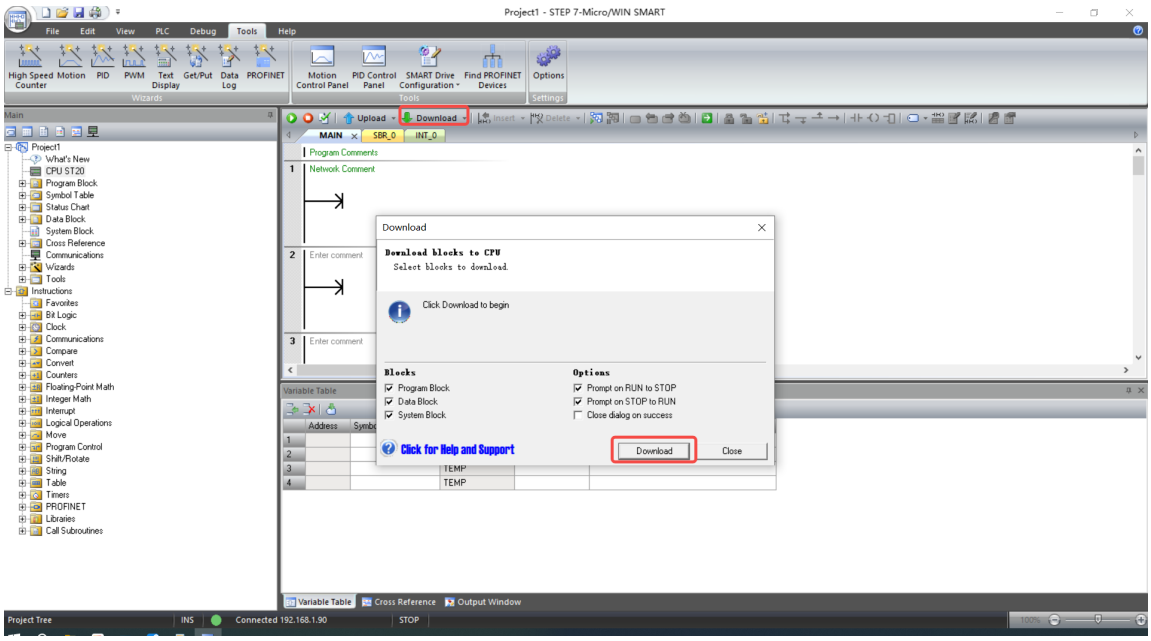
Drag the GSD file corresponding to MD630N into the device list, and change the device name to the alias set during searching for the PROFINET device. This step is crucial for correctly modifying the drive IP address and establishing PROFINET connection. In this example, it is md630pn. Select "User setting" for IP configuration. The address must be set to a subnet address that matches the PLC's network; otherwise, communication cannot be established normally.



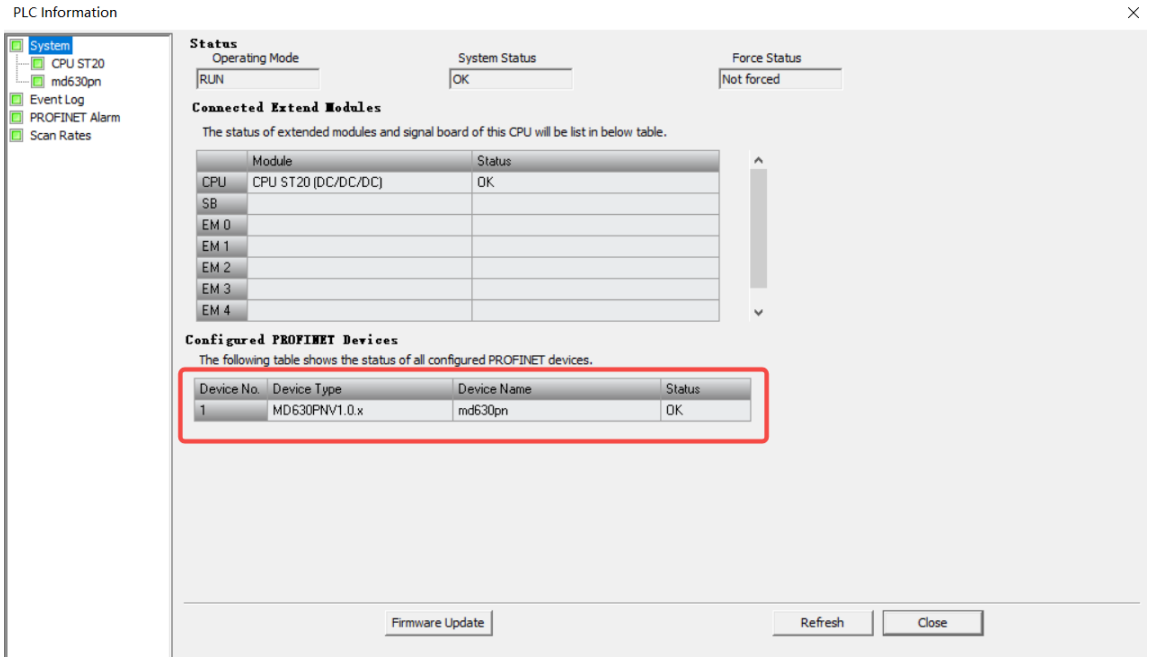
After settings are done, as shown below. Click "Generate".



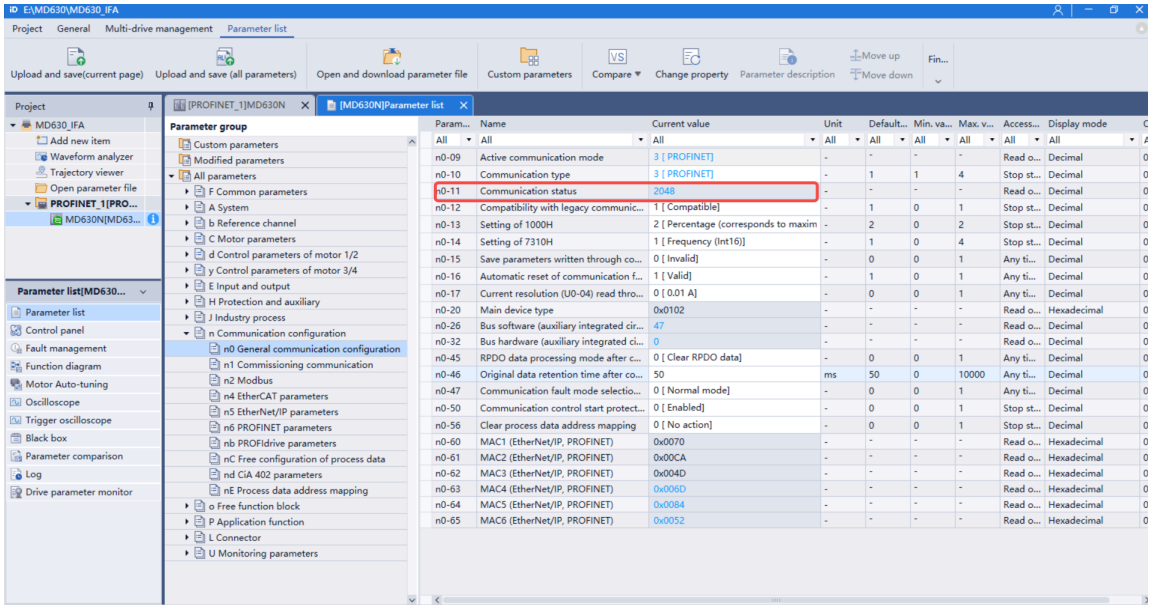
Download the configured PROFINET network to the PLC. After download is done, click the Run button (1), wait until the status bar at the bottom (2) turns to "RUN", then click PLC in the menu bar (3), and select PLC (4).

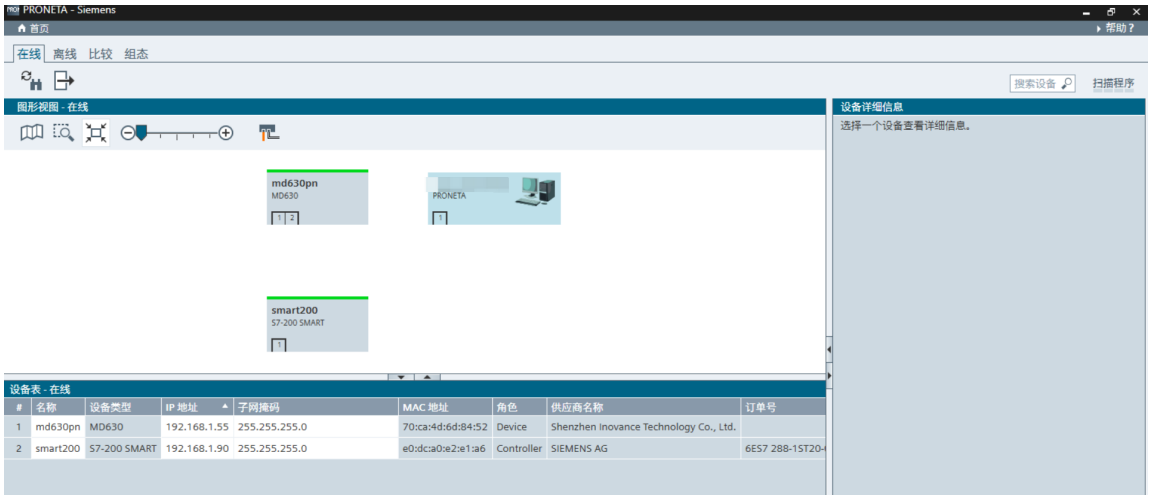


As shown in the figure below, communication has been successfully established.



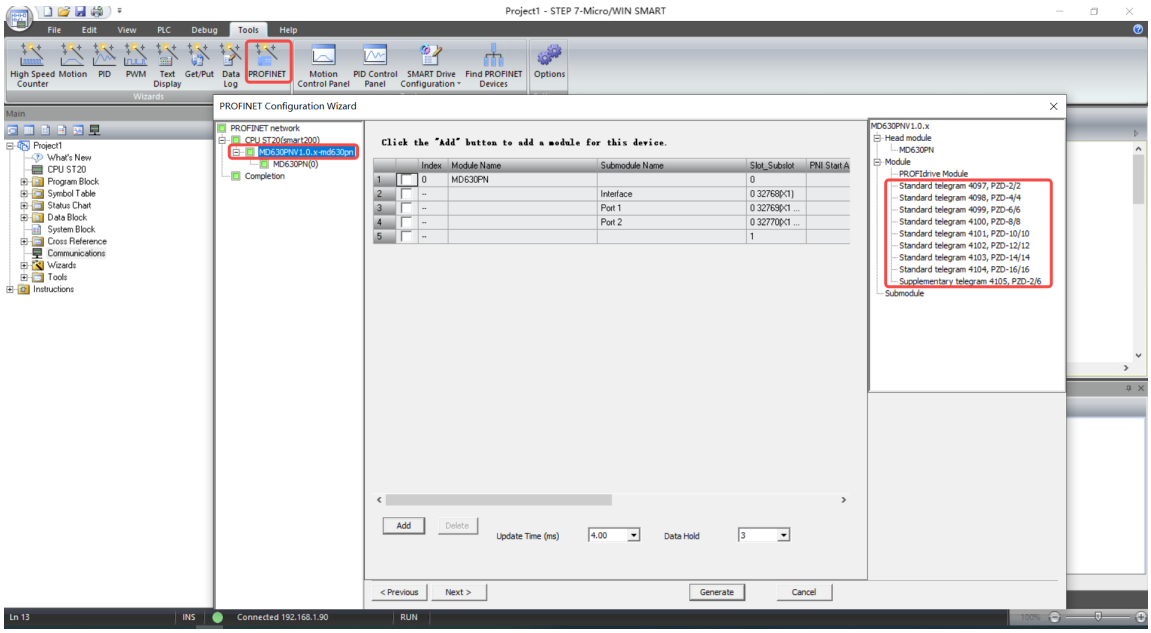
The parameter n0-11 is set to 2048, indicates that the communication state machine is running. You can see that the drive IP address and alias have been successfully modified through Siemens PRONETA tool, which indicates that communication has been successfully established.





Step 4: Read and write parameters.

In the STEP7 software, click "PROFINET". In the left PROFINET network list, select MD630PNV1.0. In the right module list, select the corresponding PZD type.



The master achieves real-time read/write of the drive data and cyclic data exchange through the data in PDO area. Data communication addresses are directly configured by the drive. The following content is included:

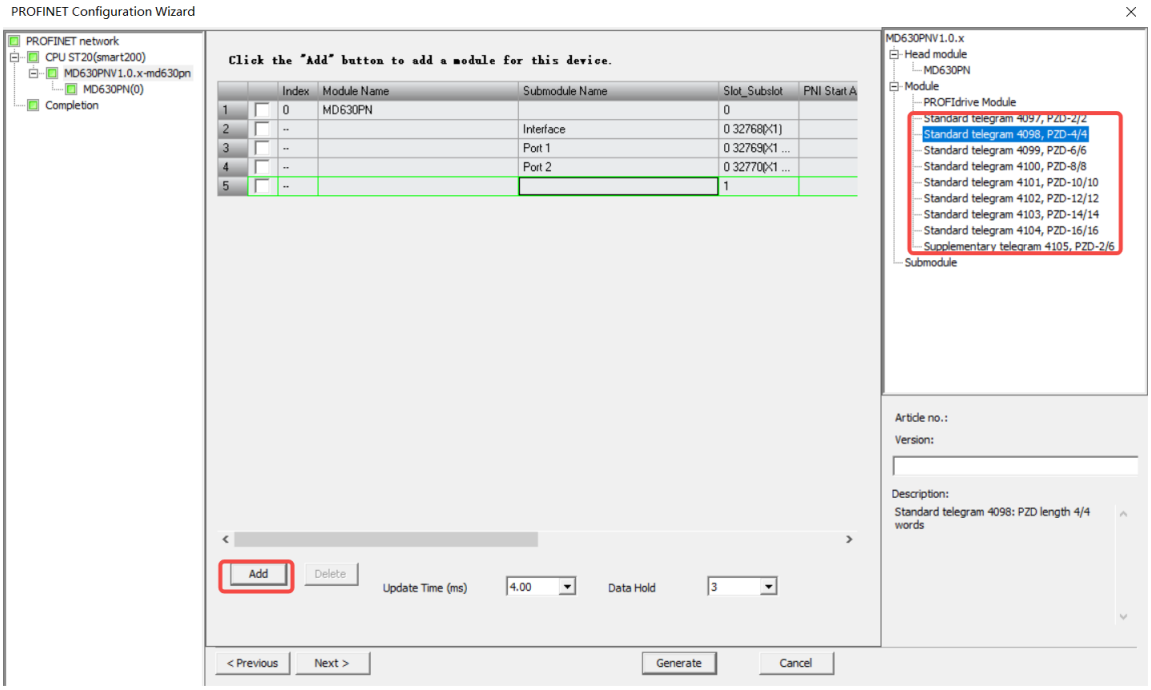
- Control word set through communication and communication speed setting word of the drive
- Drive state and actual motor frequency
- Function parameter data are exchanged in real time between the drive and PROFINET master.

The PDO is used for cyclic data exchange between the master and the drive, as described in the following table.

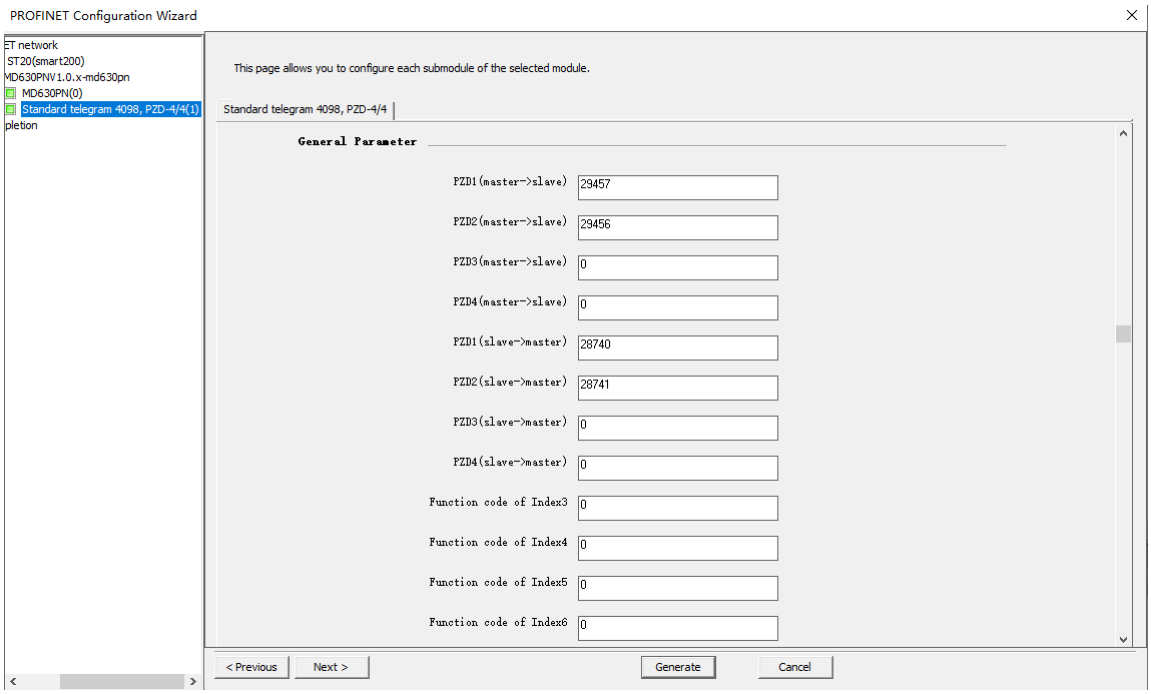
PDO area for transmission by master	
Default PZD	Variable PZD

Control word 2 set through communication (0x7311)	Speed reference set through communication (0x7310)	Real-time change of function parameters
PZD1	PZD2	PZD3 to PZD16
Response data PDO of the drive		
Default PZD		Variable PZD
Drive state 2 (0x7044)	Actual motor frequency (0x7045)	Real-time reading of function parameters
PZD1	Real-time reading of function parameters	PZD3 to PZD16

Select the corresponding PZD standard. The following takes PZD-4/4 as an example. Click "Add", then click "Next".

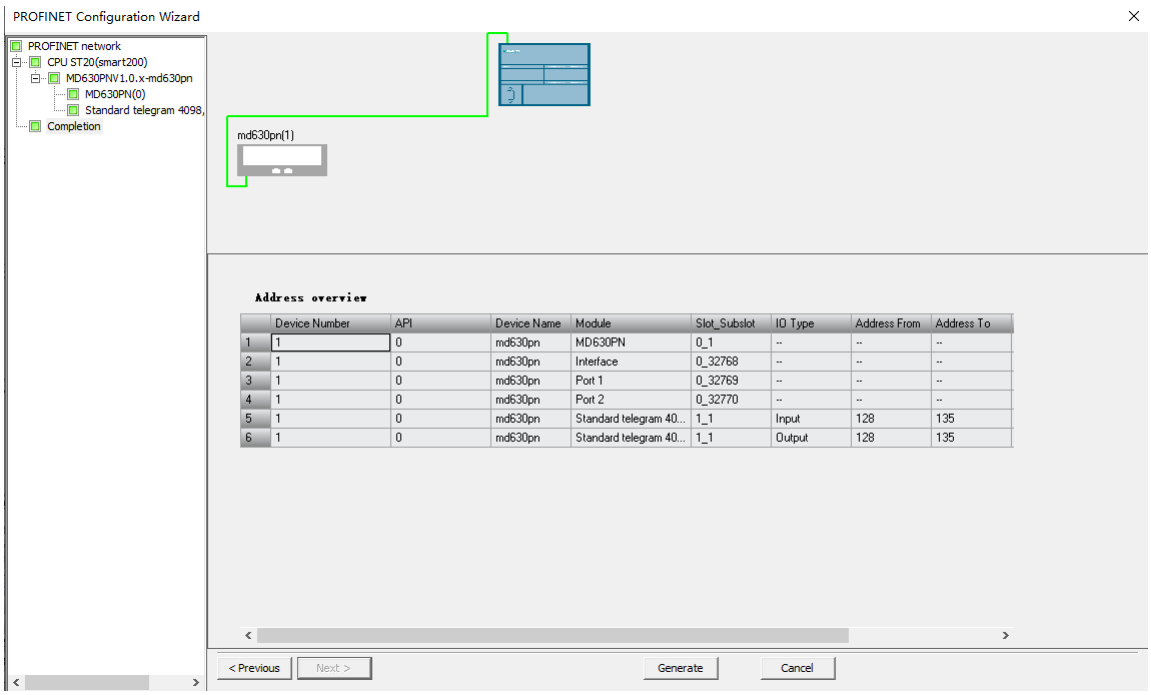


On the sub-module configuration page, scroll down with the mouse wheel to view the PZD configuration interface. PZD1 to PZD4 (master → slave) are the transmitted PZDs, and PZD1 to PZD4 (slave → master) are the received PZDs. The "Function code of Index" indicates the address for acyclic read/write operations.



The following takes reading the bus voltage (0x7002) and writing the ramp 1 ramp-up time (0xF030) as an example. The decimal equivalents of 7002 and F030 are 28674 and 61488, respectively. After writing to PZD3, click "Next".

Note to modify the start and end addresses. After modification, click "Generate", then download it to the PLC.

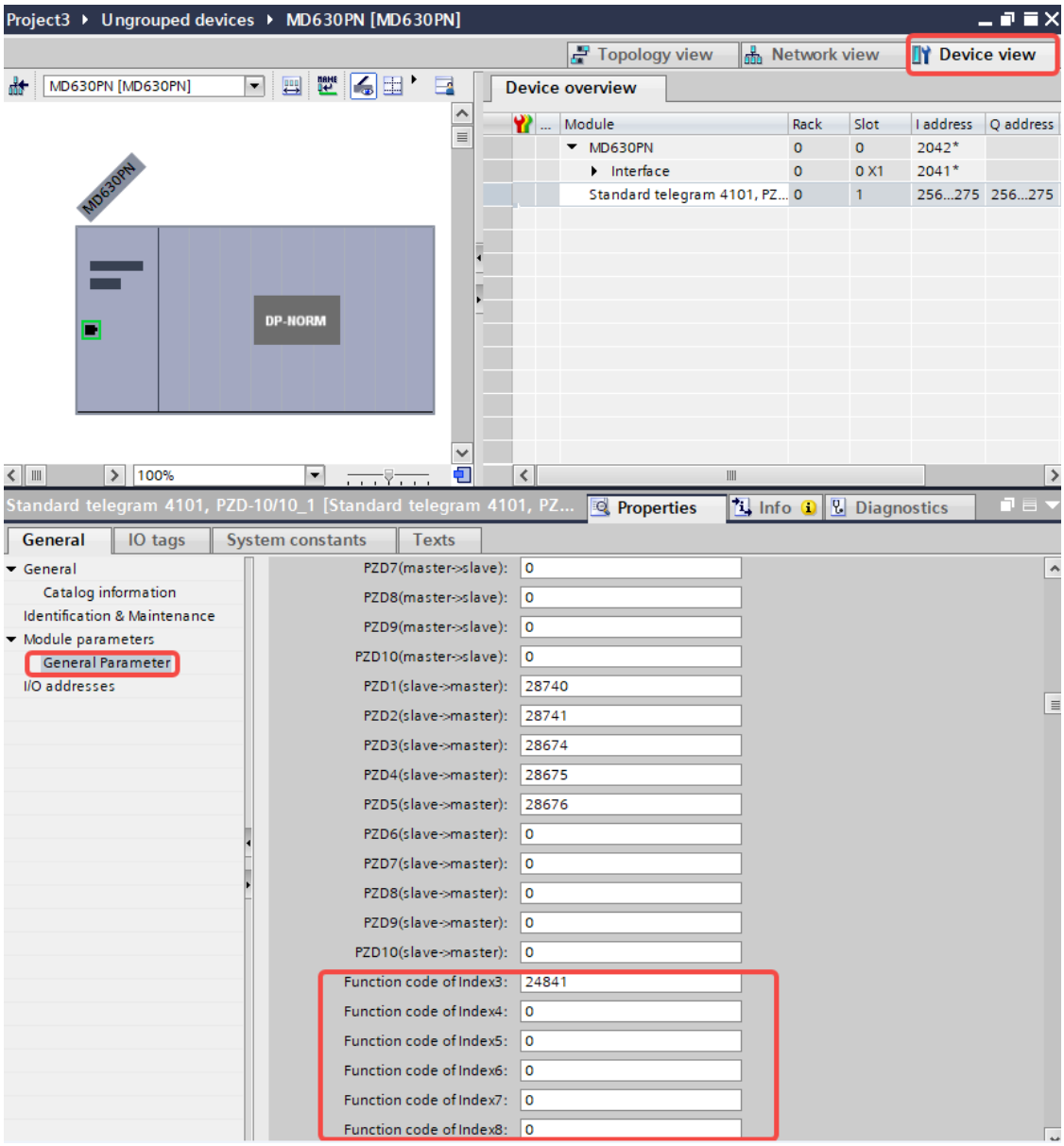


6.10.11 Non-cyclic Read/Write Operation Example

PROFINET of MD630N-INT supports acyclic read and write operations. You can read and write the parameters of the AC drive through the corresponding function block.

6.10.11.1 Acyclic Read/Write in TIA Portal

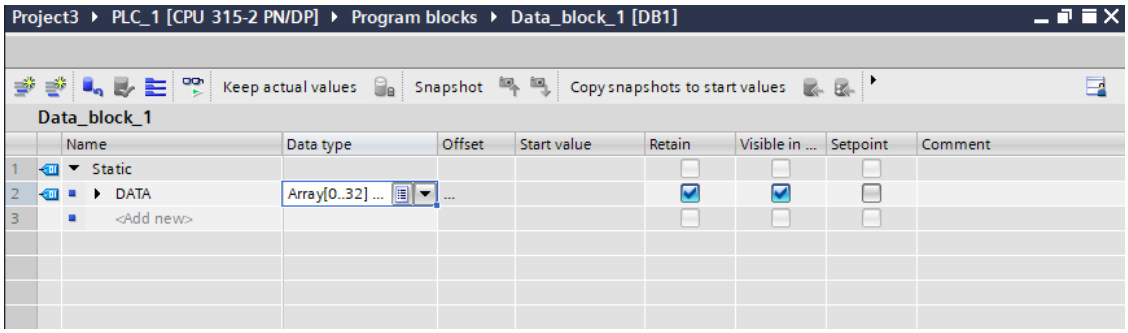
1. The parameter address of the corresponding index must be configured first for acyclic read/write. Select the slave station, switch to “Device view”, select the message module (slot 1), and fill in the “Function code of Index” (as shown in 24841 in the following figure, which corresponds to 0x6109, or P1-09).



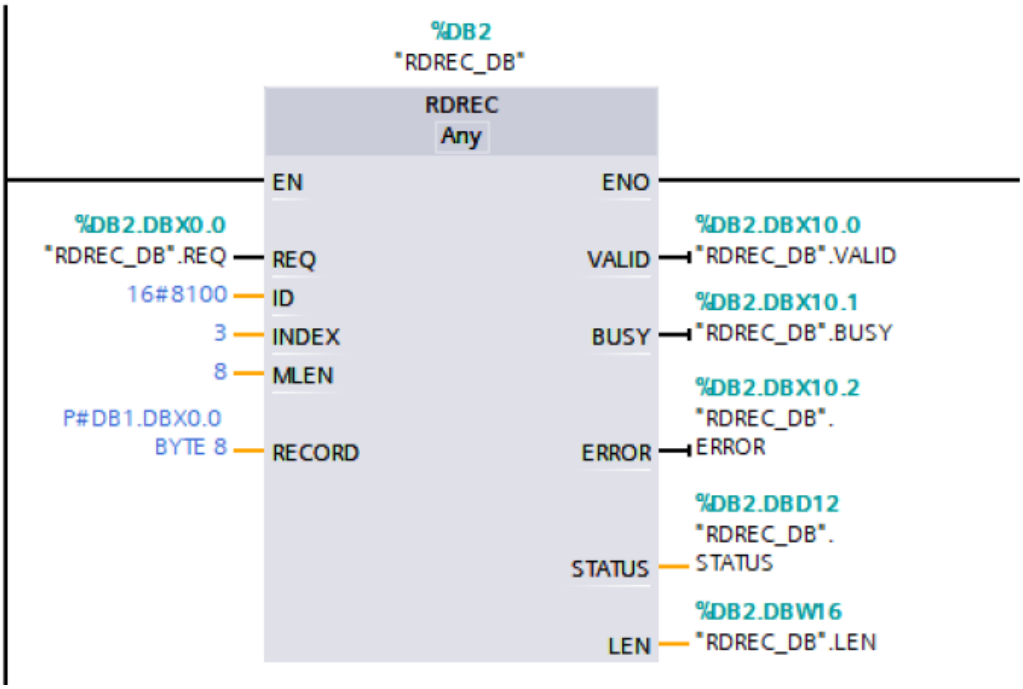
Note

1. The index must be set to a valid parameter address.
2. Unused index is kept at the initial value 0.
3. The address in the index indicates the starting address. The acyclic read/write operation starts from the set parameter address and continues based on the number of calls.
4. The index configuration does not need to comply with the rule that requires starting from the first point, which means you can keep Index3 to 0 and configure Index4 only.

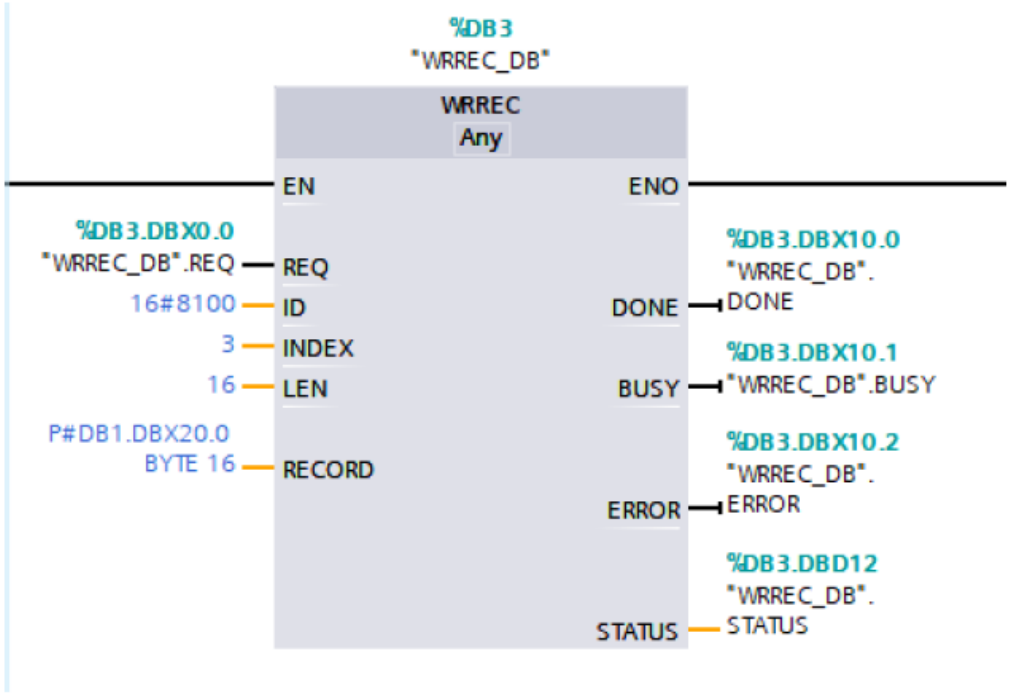
2. After the configuration is complete, click “Save Project” to compile and download the project to the master.
   Then create a new data block DB1 in data block, as configured in the following figure.



3. Create an OB1 in the program block to open and call the acyclic function block (acyclic read input RDREC or SFB52, acyclic write input WRREC or SFB53).



4. Read the 8-byte function code values (that is, four consecutive parameters starting from P1-09) from the start address of Index3 through acyclic reading. These values are saved to DB1.DBW0 to DB1.DBW6 (or DB1.DATA[0] to DB1.DATA[3]).



5. Write 16 bytes of data (that is, eight consecutive function codes starting from P1-09) to consecutive function codes starting from the corresponding starting address in Index3 through acyclic writing. The data is from DB1.DBW20 to DB1.DBW34 (or from DB1.DATA[10] to DB1.DATA [17]).

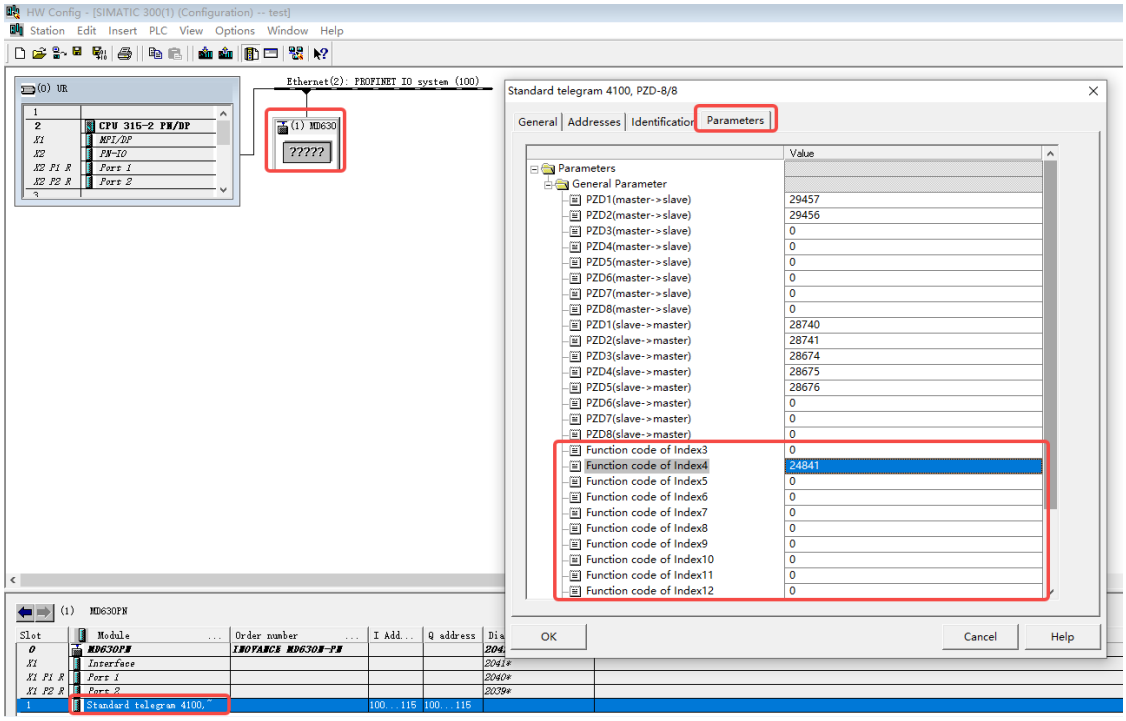
Item	Description
REQ	The acyclic enable is used to start acyclic read/write when 1 is set.
ID	The logical address of the PROFINET I/O component and hexadecimal of the start address of the Q address must be set to bit15 in the format "16#xxxx".
INDEX	Data record number, which requires acyclic execution, is the same as the index number of the corresponding address configured in the parameter. An error will be returned if the illegal address is operated.
MLEN	The maximum number of bytes for acyclic operations is set in the range 2 to 24. If a function code corresponds to two bytes, an error will be returned if the number is not within the range or odd.
VALID	When this bit is set, the acyclic read data is received and valid.
DONE	When this bit is set, the acyclic write transmission is done.
BUSY	When this bit is set, the acyclic operation is not done.
ERROR	When this bit is set, an error occurs during acyclic operation.
Status	The current error code (most significant bit set to 1) is indicated when the block status or error information is negative.
LEN	The length of data obtained during acyclic read.
RECORD	Data record position: For acyclic read, it indicates the acyclic data storage position. For acyclic write, it indicates the acyclic data storage area to be written to the node.

6.10.11.2 Acyclic Read/Write in STEP7

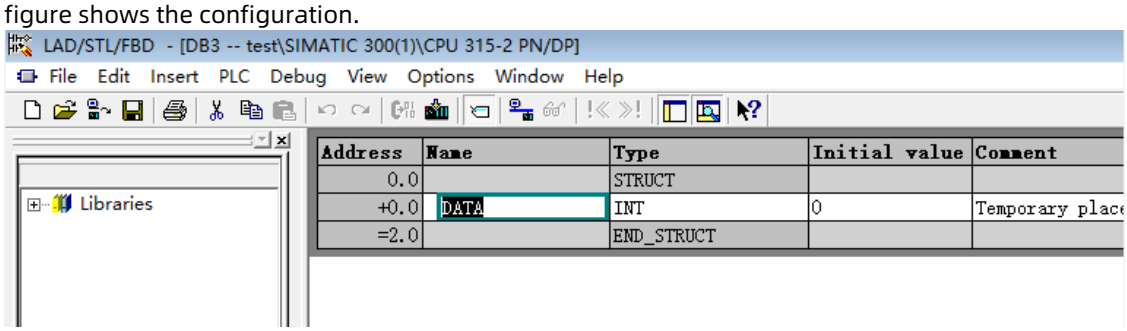
1. The parameter address of the corresponding index must be configured first for acyclic read/write.

In the HW Config interface, select the slave, double-click the message module (slot 1), and select "Parameters" in the pop-up interface. Fill in the function code of index address (as shown in 24841 in the following figure, corresponding to 0x6109, or P1-09).

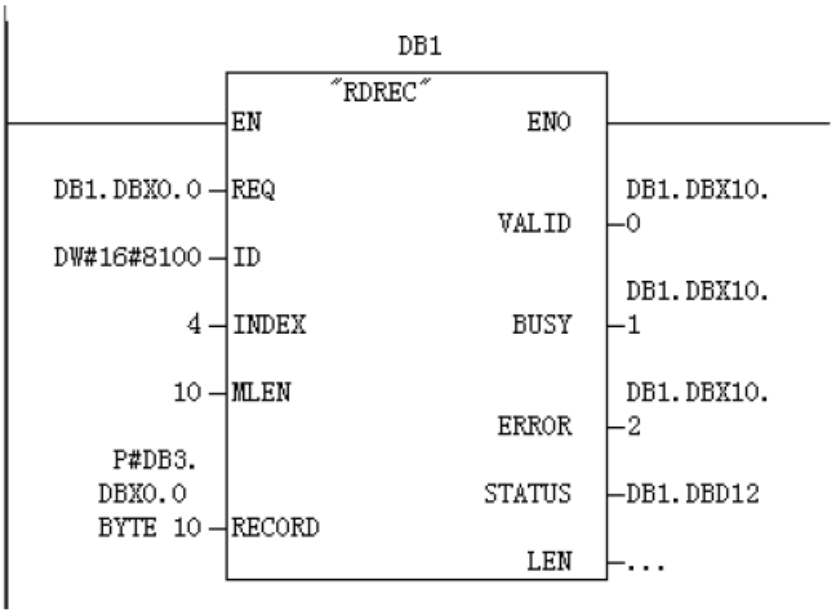
After the configuration is complete, click OK to save the compilation and download it to the master.



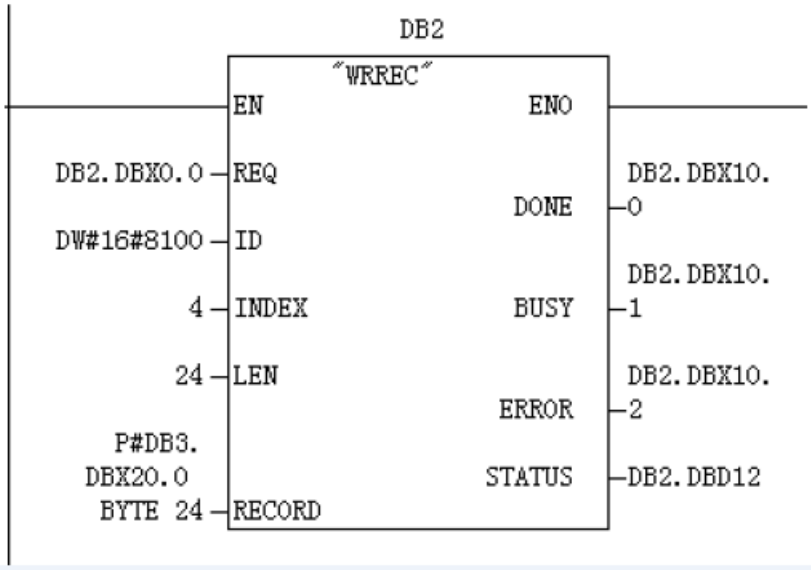
2. After the configuration is done, you can program acyclic read/write operations. Configure a data block first. In DB3, for example, create a new DB3 and double-click it to open it. The following figure shows the configuration.



Acyclic reading example:



3. Read the 10-byte function code values (that is, five consecutive function codes from P1-09) from the start address of Index 4 through acyclic reading, and save these values to DB3DBW0 to DB3.DBW8 (or DB3.DATA[0] to DB3.DATA[4]).
   Example of acyclic writing:



4. Write 24 bytes of data (that is, 12 consecutive function codes starting from P1-09) to consecutive function codes starting from the corresponding starting address in Index4 through acyclic writing. The data is from DB3.DBW20 to DB3.DBW42 (or from DB3.DATA[10] to DB3.DATA[21]).

Item	Description
REQ	The acyclic enable is used to start acyclic read/write when 1 is set.
ID	The logical address of the PROFINET I/O component and hexadecimal of the start address of the Q address must be set to bit15 in the format of "DW#16#xxxx".

Item	Description
INDEX	Data record number, which requires acyclic execution, is the same as the index number of the corresponding address configured in the parameter. An error will be returned if the illegal address is operated.
MLEN	The maximum number of bytes for acyclic operations is set in the range 2 to 24. If a function code corresponds to two bytes, an error will be returned if the number is not within the range or odd.
VALID	When this bit is set, the acyclic read data is received and valid.
DONE	When this bit is set, the acyclic write transmission is completed.
BUSY	When this bit is set, the acyclic operation is not completed.
ERROR	When this bit is set, an error occurs during acyclic operation.
Status	The current error code (most significant bit set to 1) is indicated when the block status or error information is negative.
LEN	The length of data obtained during non-periodic read.
RECORD	Data record position: For acyclic read (SFB52), it indicates the acyclic data storage position. For acyclic write (SFB53), it indicates the acyclic data storage area to be written to the node.

6.10.12 Replacing Faulty Device

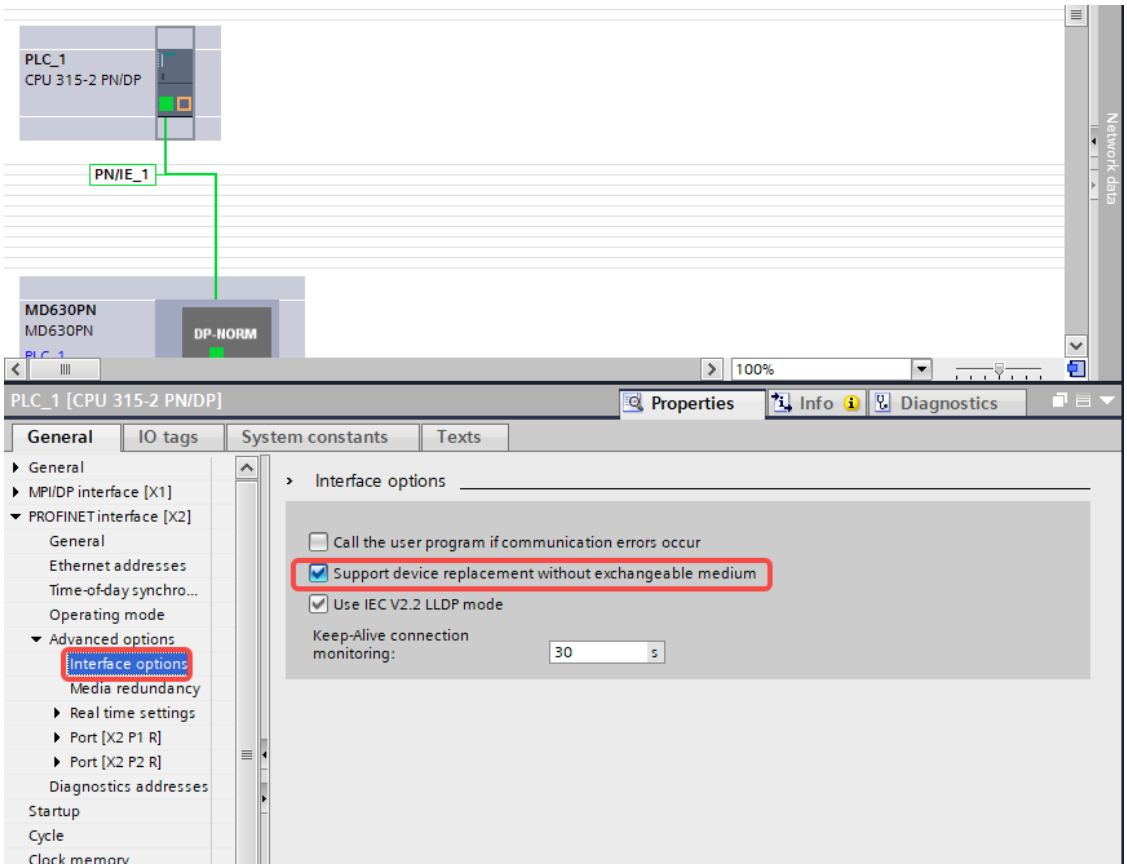
When using PROFINET, MD630N-INT supports directly replacing faulty device without having to reconfigure and assign the device.

The following conditions must be met to replace the failed device:

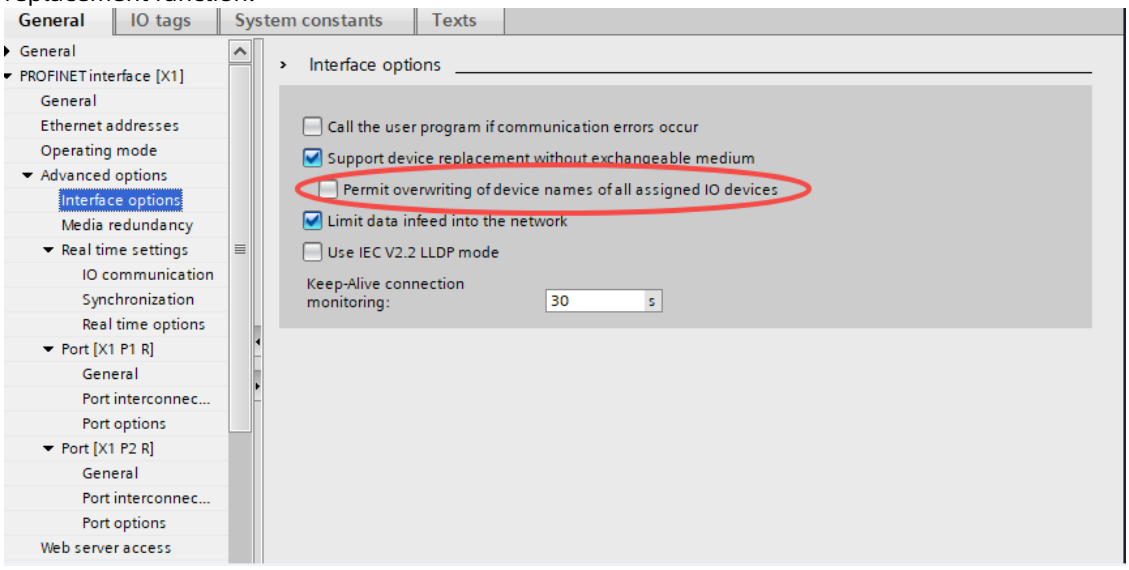
1. The alternative component and the component to be replaced are both the MD630N-INT;
2. The component to be replaced has not been assigned a device name (if it has been assigned, it needs to be reset by the PC).
3. During configuration, the topology was already defined and verified—every cable is mapped to its actual port.
4. The Support device replacement without exchangeable medium option is enabled during master configuration.

6.10.12.1 Selecting "Support Device Replacement Without Exchangeable Medium" and Setting the Topology in TIA Portal

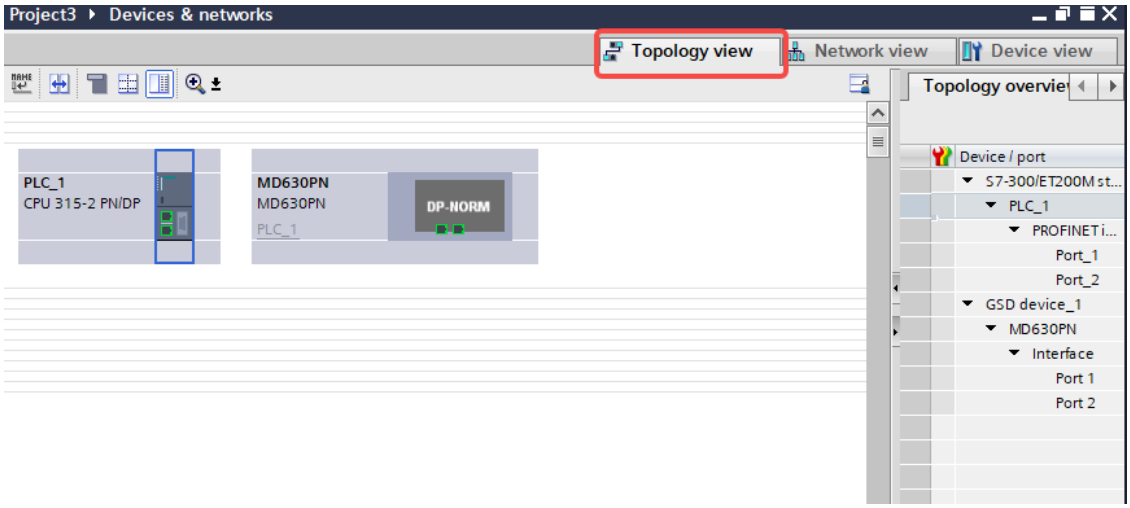
1. Select the slave in "Network view" select “Interface options" in "Advanced options" under "General", and check "Support device replacement without exchangeable medium". (Note: This option is checked by default.)



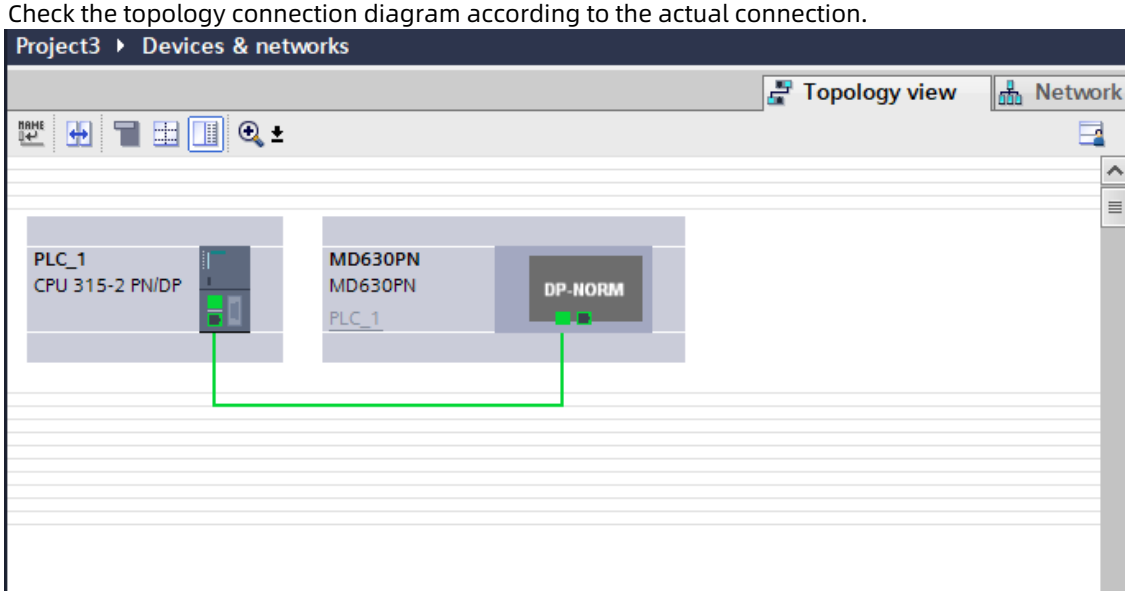
2. If the PLC is S7-1200 or S7-1500, the option to "Permit overwriting of device names of all assigned IO devices" is available on this interface. If this option is also checked (unchecked by default), the condition defined by *" Replacing Faulty Device" on page 1099* can be ignored in terms of replacement function.



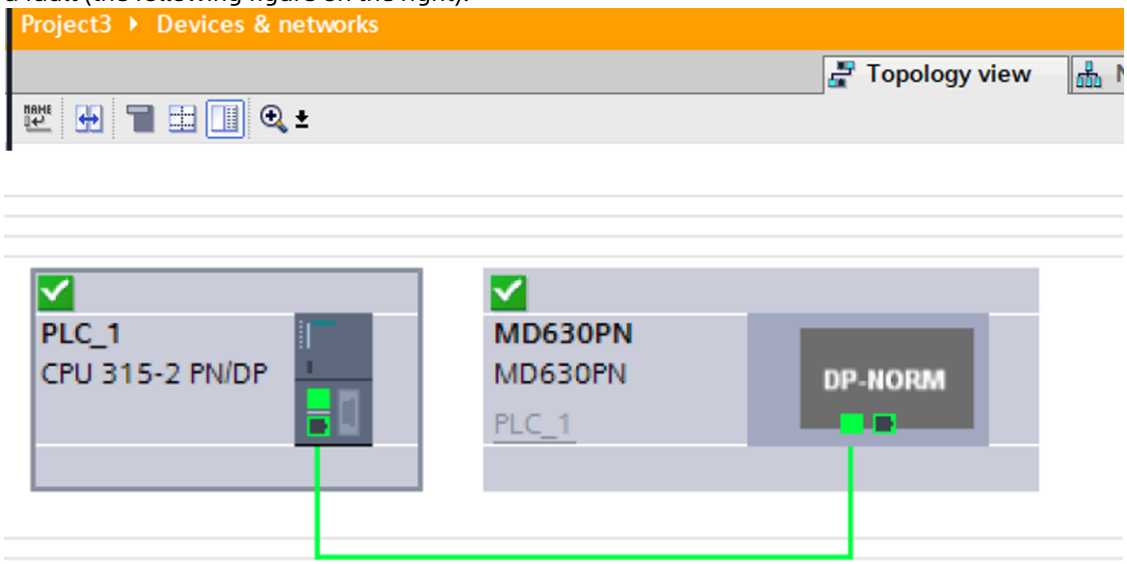
3. Switch to "Topology view".

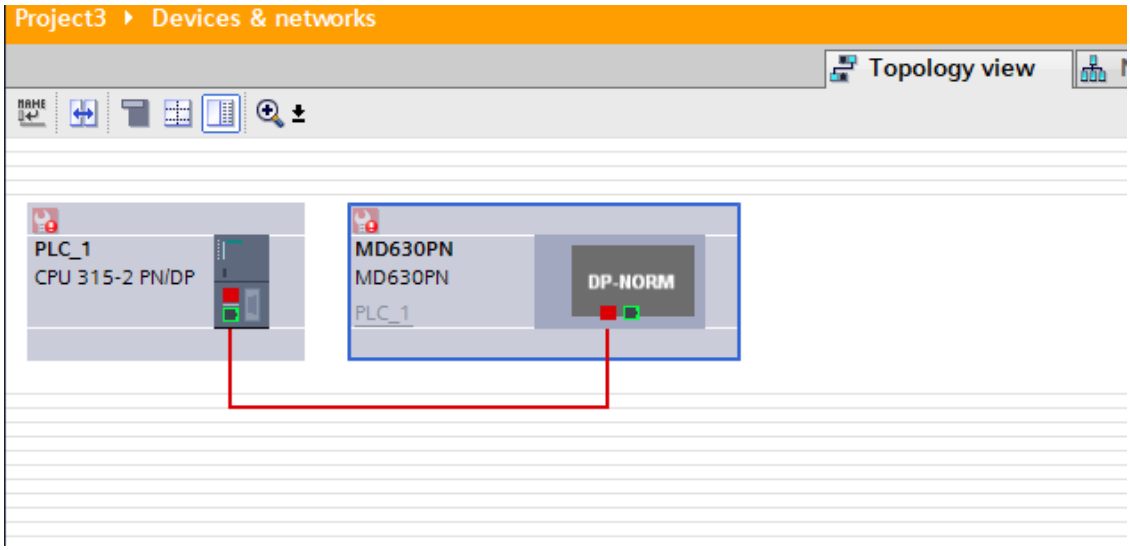


4. Check the topology connection diagram according to the actual connection.



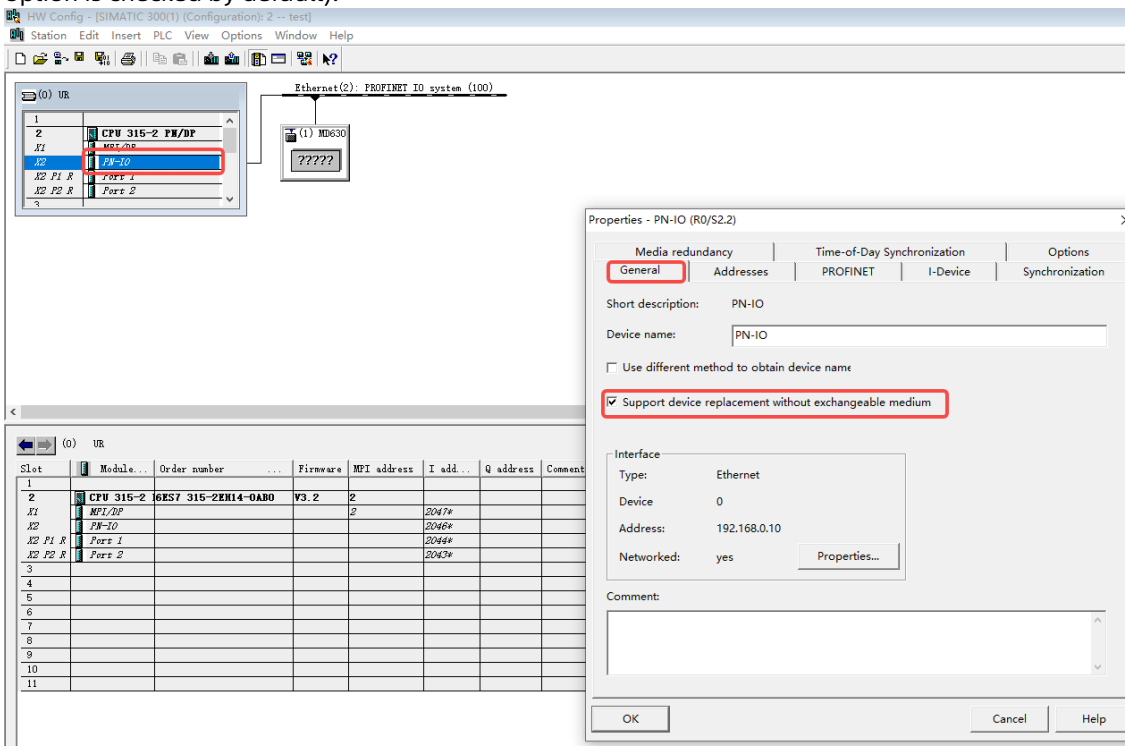
5. Compile and download to the master. If the topology is correct, the line will be displayed green (bottom left) in the online state. Otherwise, it will be displayed red. In this case, the master reports a fault (the following figure on the right).



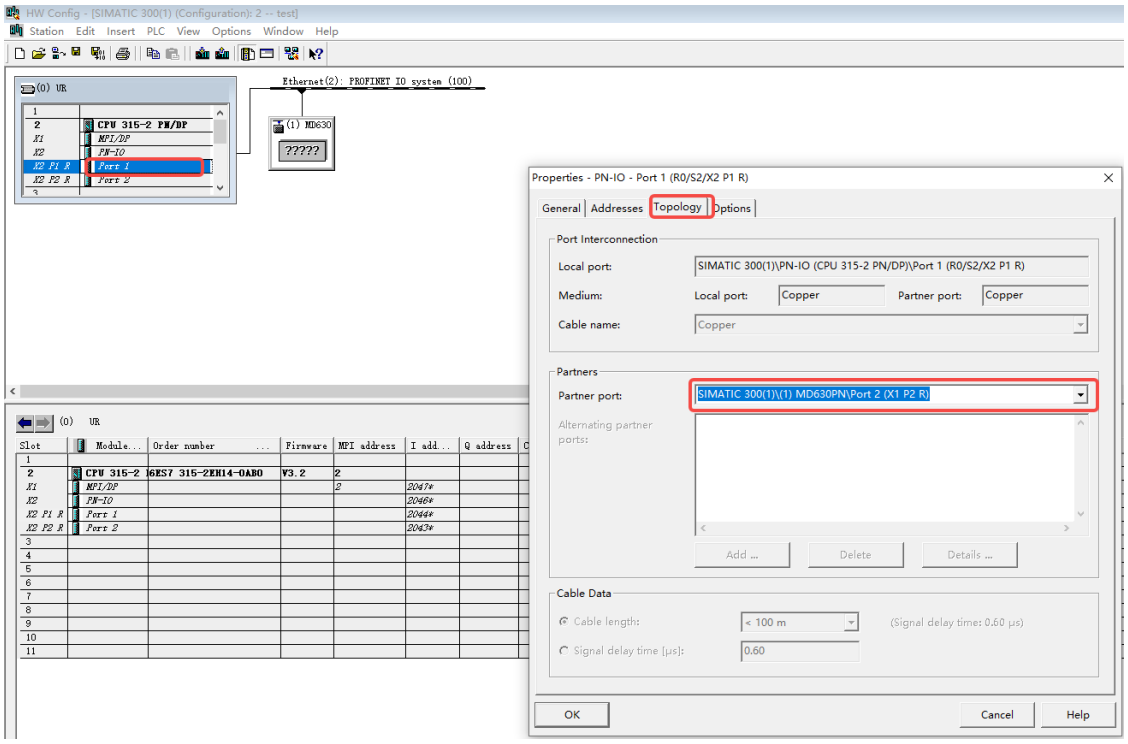


6.10.12.2 Selecting "Support Device Replacement Without Exchangeable Medium" and Setting the Topology in STEP 7

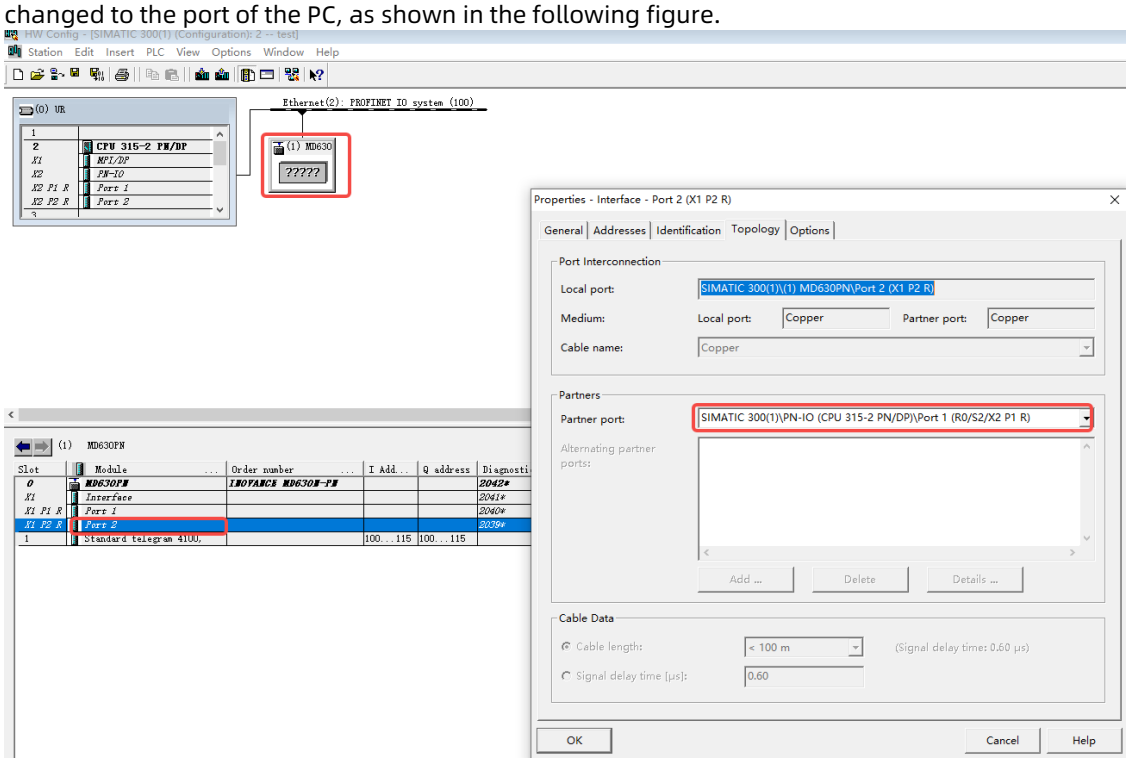
1. In the HW Config interface, double-click the PN-I/O interface of the master, click "General" in the pop-up screen, and check "Support Device Replacement Without Exchangeable Medium" (this option is checked by default).



2. Double-click the port of the master, select "Topology" in the pop-up screen, and then drop-down the port of other devices connected to the port in "Partner port" (the default value is "Any partner"), as shown in the following figure. Connect PLC port 1 to MD630PN port 2. Click "OK".



3. After the configuration of the PLC is done, the corresponding port of the newly set device is also changed to the port of the PC, as shown in the following figure.



4. Continue to configure other cascaded ports until all ports are configured, and then compile and download them to the PLC.

Caution

Communication is normal when the topology is incorrect. Normal switches do not support the topology. If you need to draw a topology, select a managed PN switch. Otherwise, the topology will be wrong.

6.10.13 Configuration of Ring Network Redundancy

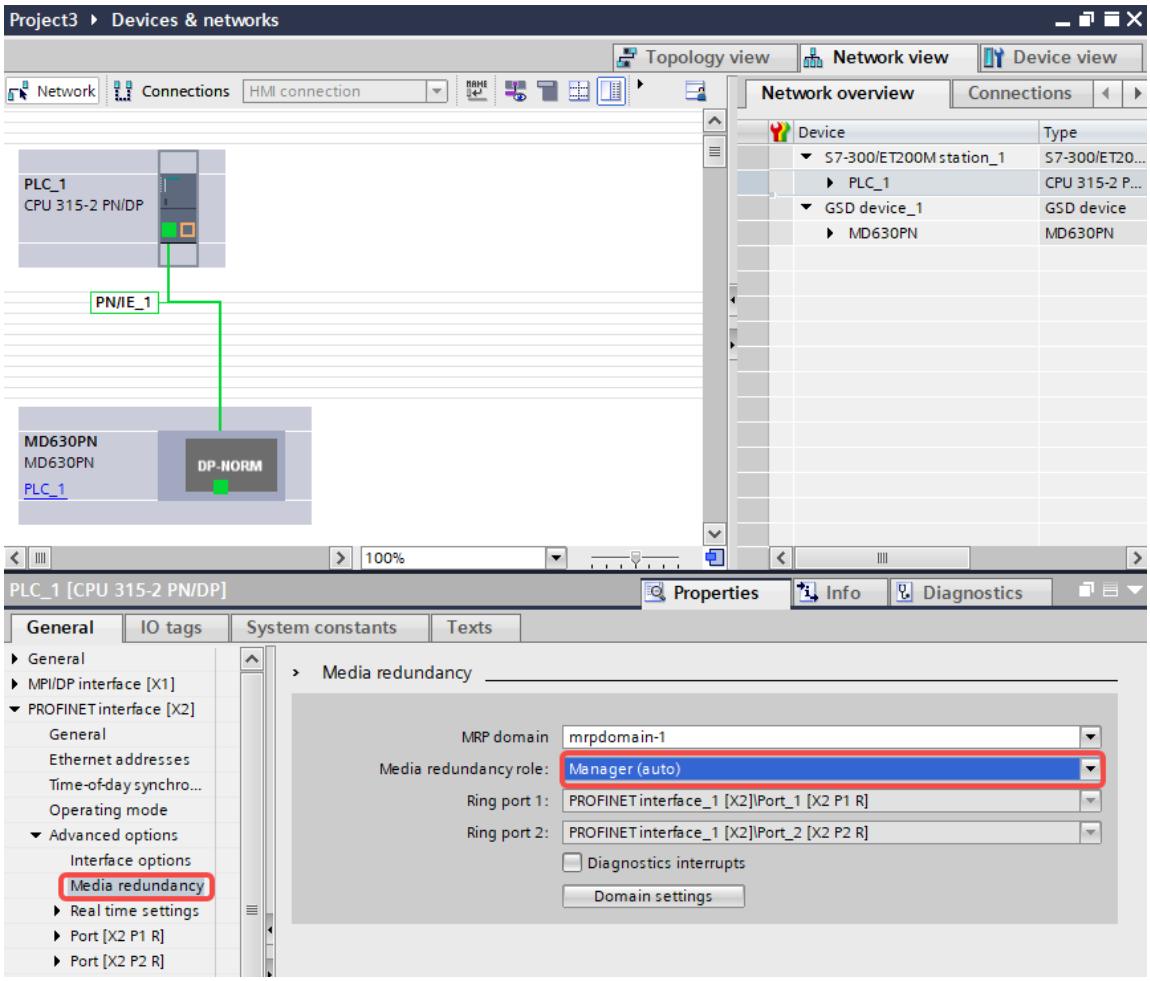
MD630N-INT supports ring topology when using PROFINET communication. When configuring a ring network, enable MRP (Media Redundancy Protocol). MRP includes two roles: MRP Manager and MRP Client. All devices in the ring network must be configured to one of these roles, and MD630N-INT can only be an MRP client.

6.10.13.1 Configuring MRP in TIA Portal

Configure the MRP manager.

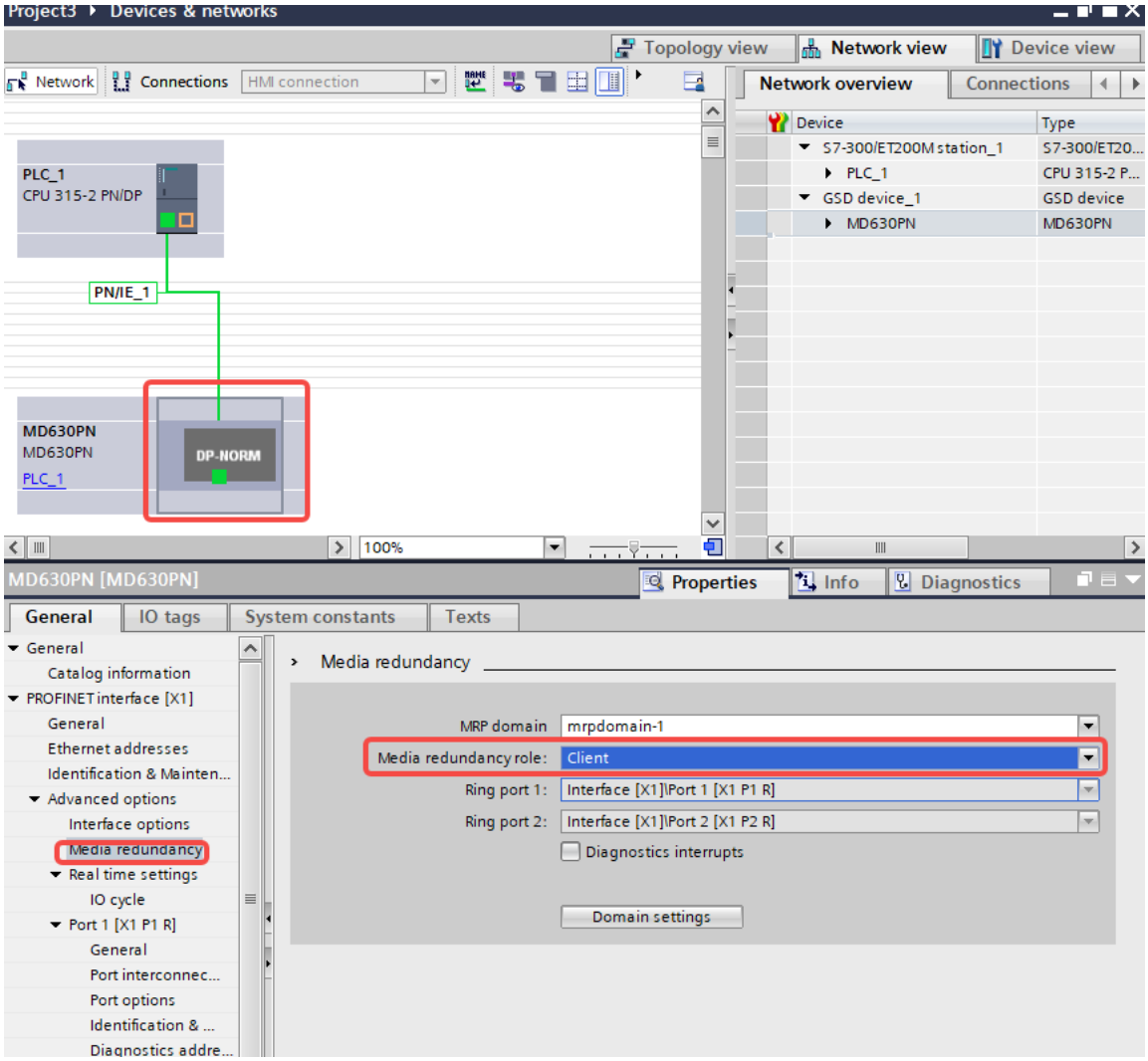
There must be a unique MRP manager in the ring network (configured before the MRP client), which is usually the master station or managed PN switch (if a certain part of a complex network topology forms the ring network, only the switches in that part can act as the manager).

Select the station to be used as the manager, and select "Manager (auto)" from "Media redundancy role" drop-down list, as shown in the following figure.



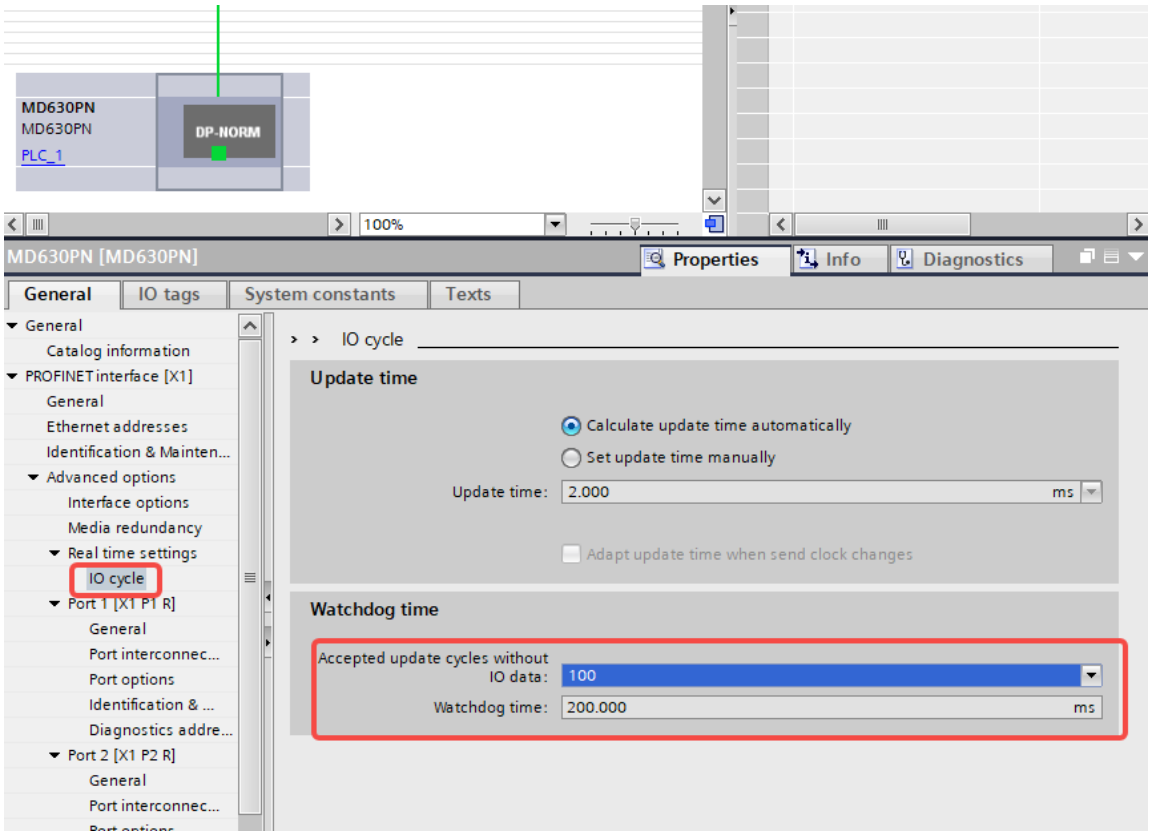
Configure the MRP client.

Select the slave in the network. In the interface shown in the following figure, drop down "Client" in "Media redundancy role". You need to configure the MRP manager first. Otherwise, an error will be reported.



Configure the watchdog time.

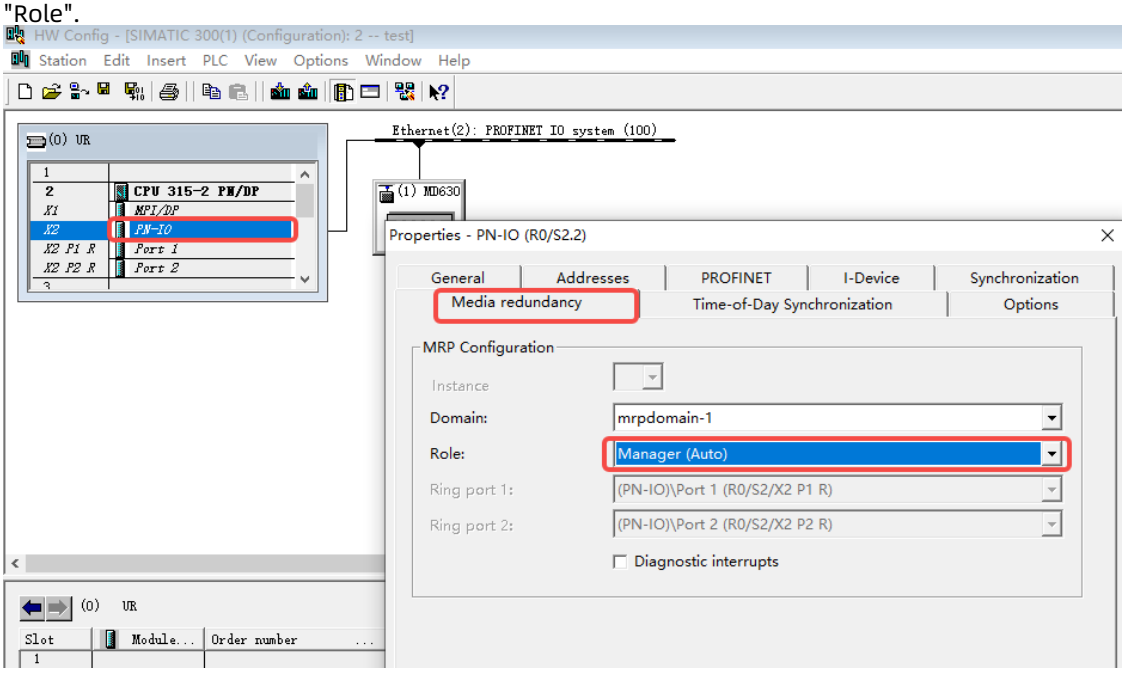
The MRP function requires that the watchdog time cannot be shorter than 200 ms. Therefore, you need to modify the watchdog time, as shown in the following figure. Go to "IO cycle" > "Watchdog time", and modify "Accepted update cycles without IO data" to a value not lower than 200 ms.



6.10.13.2 Configuring the MRP Function in STEP 7

Configure the MRP manager.

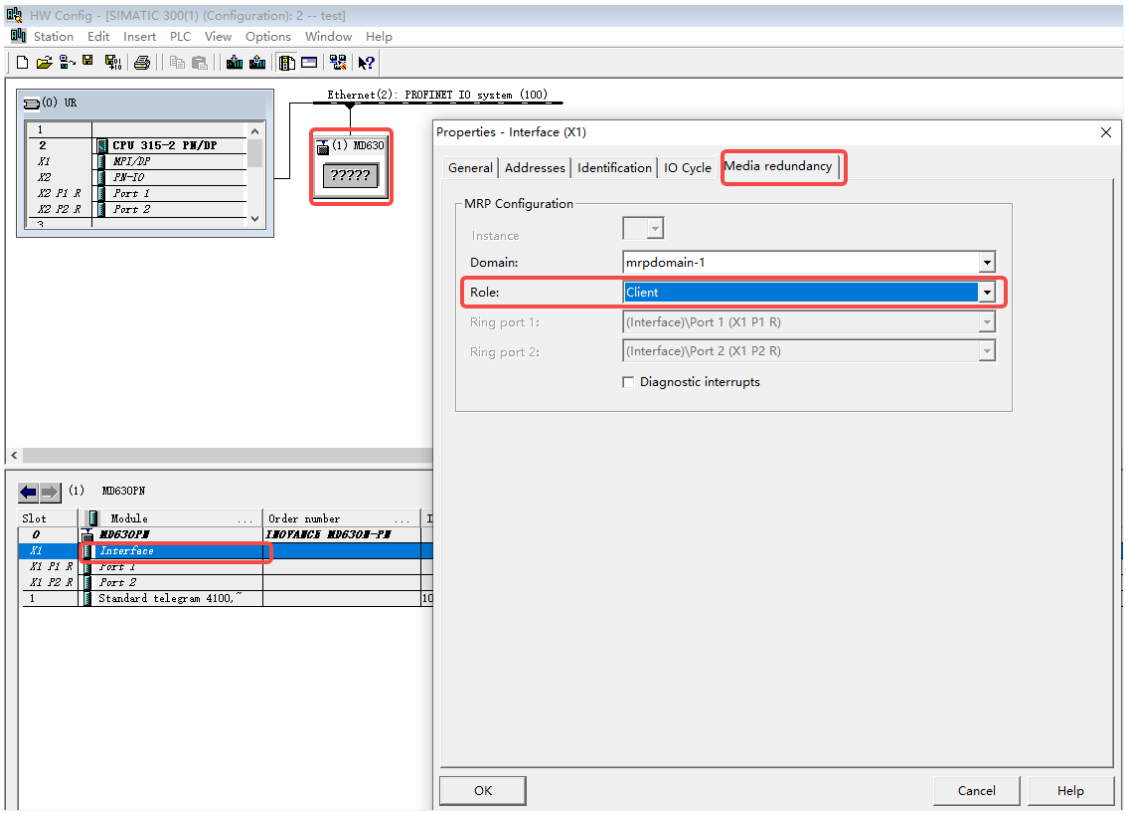
1. In the HW Config interface, double-click the PN-I/O interface of the PLC master station, select "Media redundancy" in the pop-up interface, and drop down and select "Manager (Auto)" in "Role".



2. Click "OK" below when finished.

Configure the MRP client.

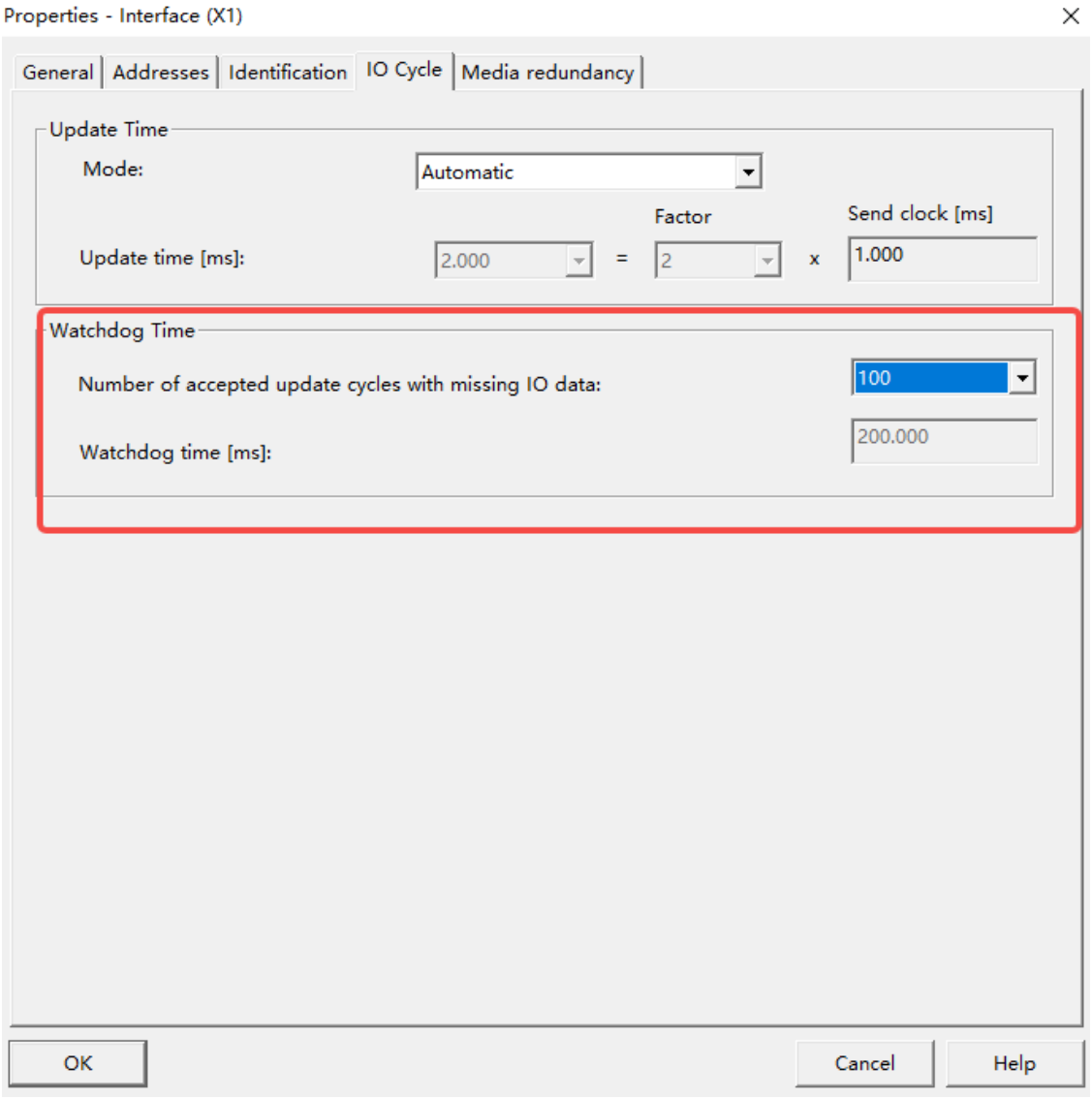
1. After you configure the MRP manager, you can configure the client.
   Select the slave, double-click "Interface", and in the pop-up screen, select "Media redundancy".
   Select "Client" in "Role".



2. Click "OK".

Configure the watchdog time.

1. The MRP function requires that the watchdog time cannot be shorter than 200 ms. Therefore, you need to modify the watchdog time.
   Go to "IO cycle"> "Watchdog time", and modify "Accepted update cycles without IO data" to a value not lower than 200 ms.



2. Click "OK".

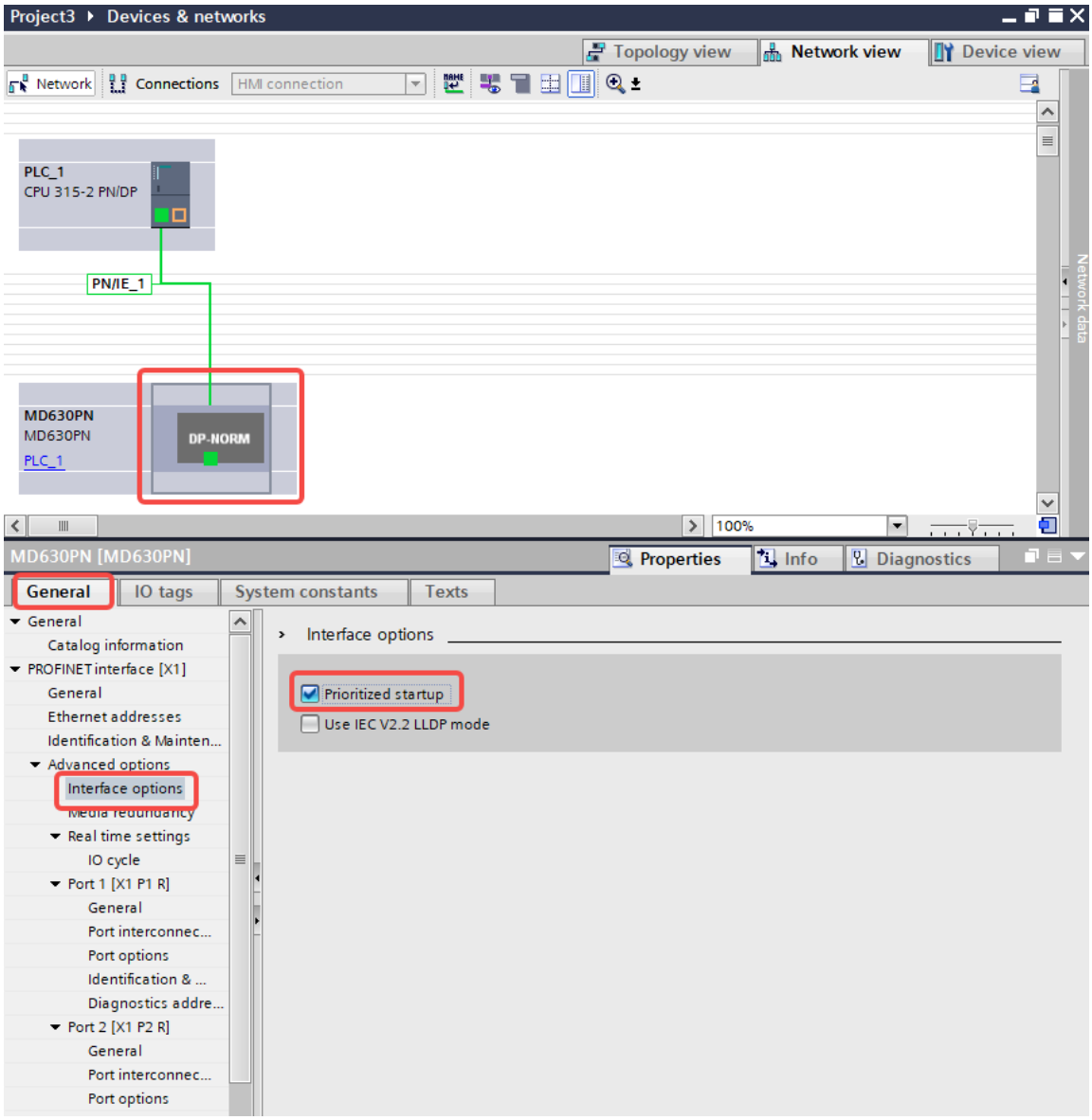
After all nodes in the ring network are configured, download the configuration to the PLC to enable the ring network function. After the ring network is formed, When any of the middle network cables is disconnected, all nodes can still communicate normally.

6.10.14 Boot Priority

MD630N-INT PROFINET supports the boot priority settings. When the device is configured with boot priority, it is connected to the master station firstly. That is, the device configured to start first will establish communication with the master station before the device not configured with boot priority.

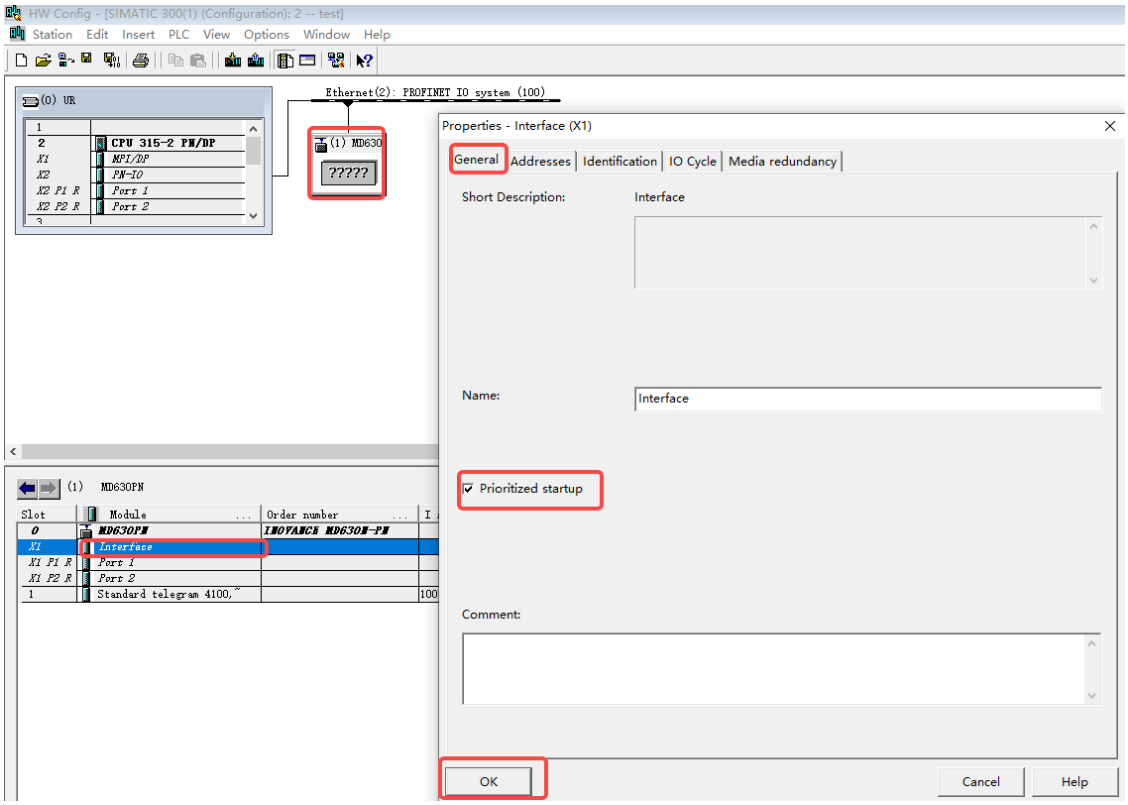
6.10.14.1 Configuring the Boot Priority in TIA Portal

Select the slave. In "General", select "Advanced Options", and then select "Prioritized startup" in "Interface Options" to save and compile. Then download it to the master.



6.10.14.2 Configuring the Boot Priority Function in STEP 7

1. Select the slave, double-click "Interface", and select "General" in the "Properties" page. Check "Start first" and click "OK".



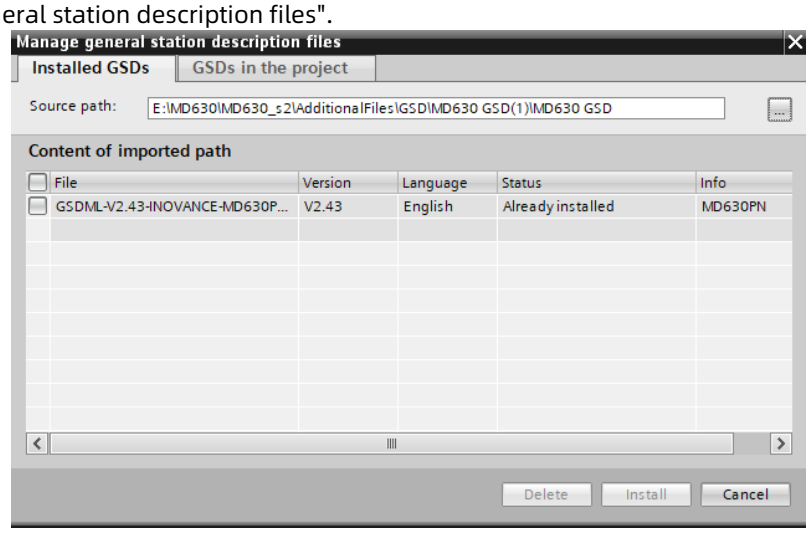
2. After the configuration is done, save the compilation and download it to the master.

6.10.15 Configuring PROFIDrive AC1 Mode Function

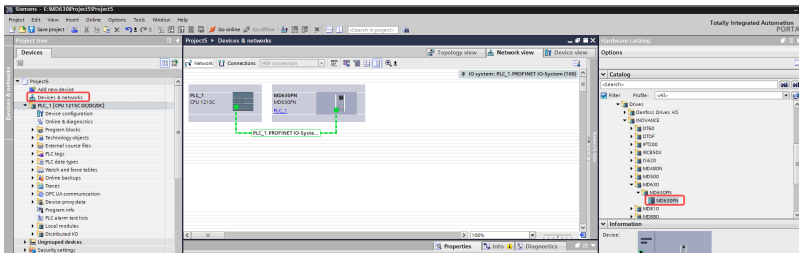
Siemens S7-200 Smart, S7-1200, S7-1500PLC can perform speed control with the drive through PROFINET. These PLCs use PROFINET RT and standard telegram 1 to start and stop the drive and control the drive speed.

Configuration steps

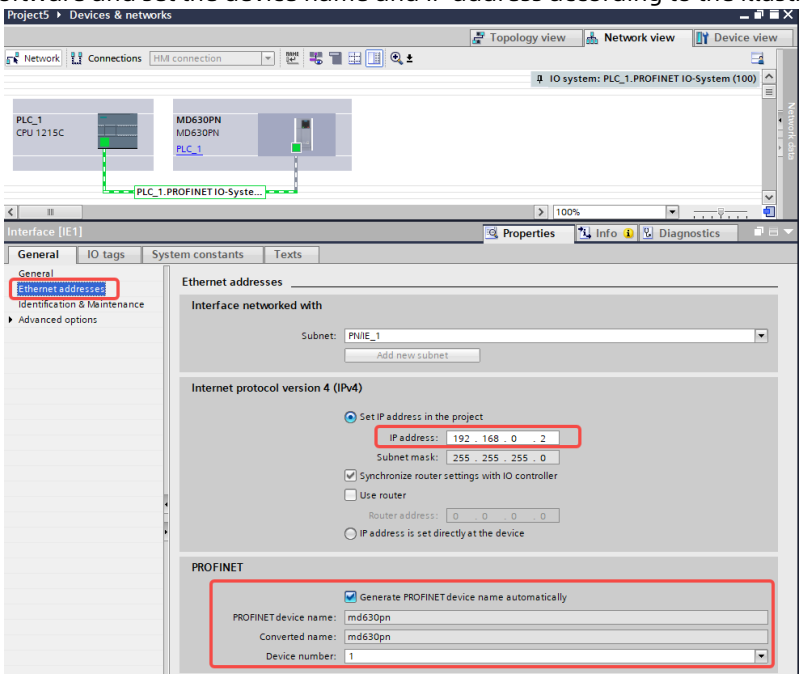
1. To install the MD630N GSD file, run the PLC programming software, and choose "Options" > "Manage general station description files".



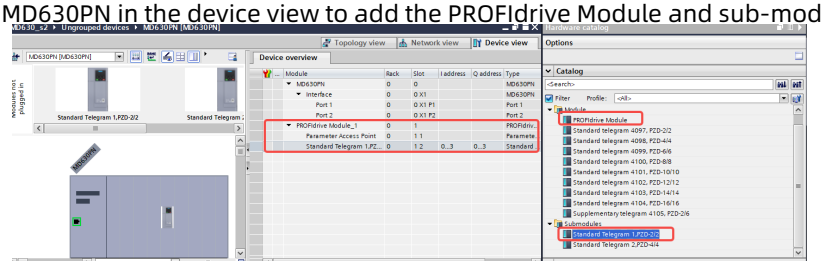
2. Select "Device and Network", and import MD630 and establish connection with the PLC in the network view.



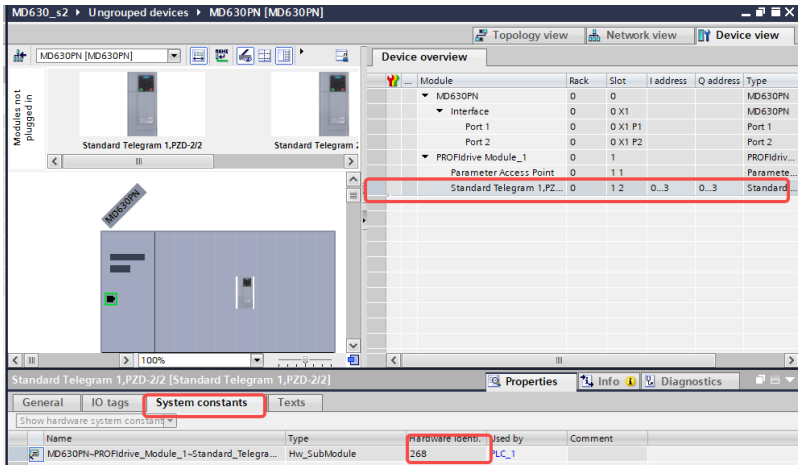
3. Connect the PC to the CN3 or CN4 port of the MD630N using a communication cable. Open the Siemens TIA software and set the device name and IP address according to the illustration.



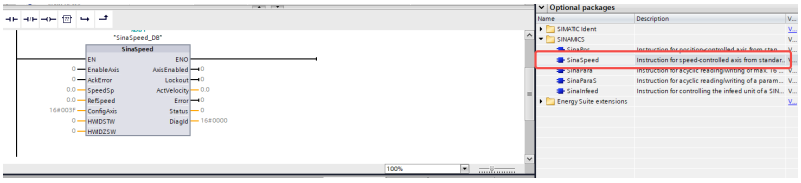
4. Double-click MD630PN in the device view to add the PROFIdrive Module and sub-module.



5. To view the hardware identifier, right-click "Telegram 1", choose "Properties" > "System constants", and view the value under "Hardware identifier".



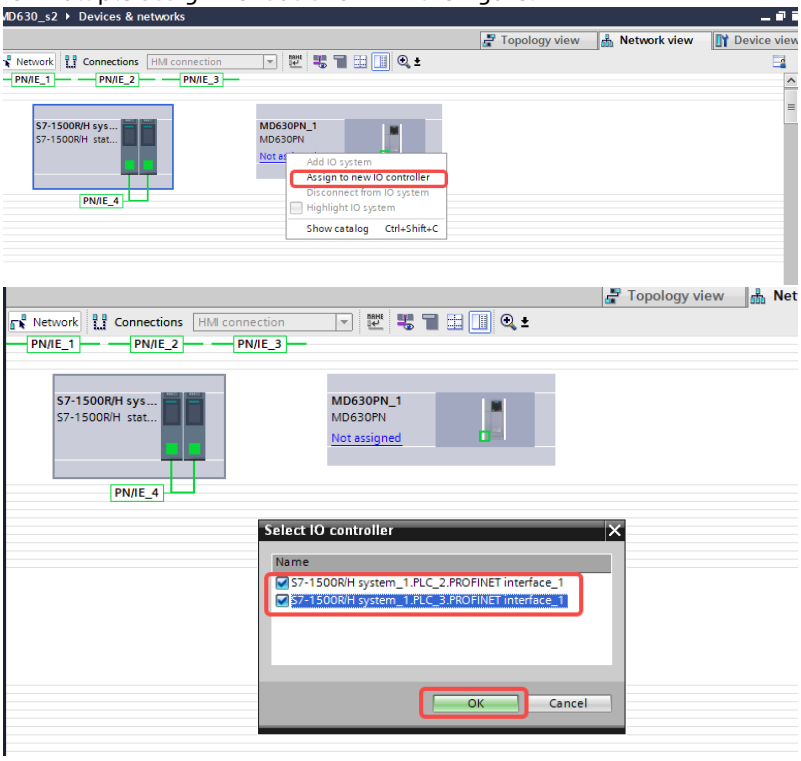
6. Go to OB1, drag the SINA_Speed (FB285) function block and drop it in the programming network section.



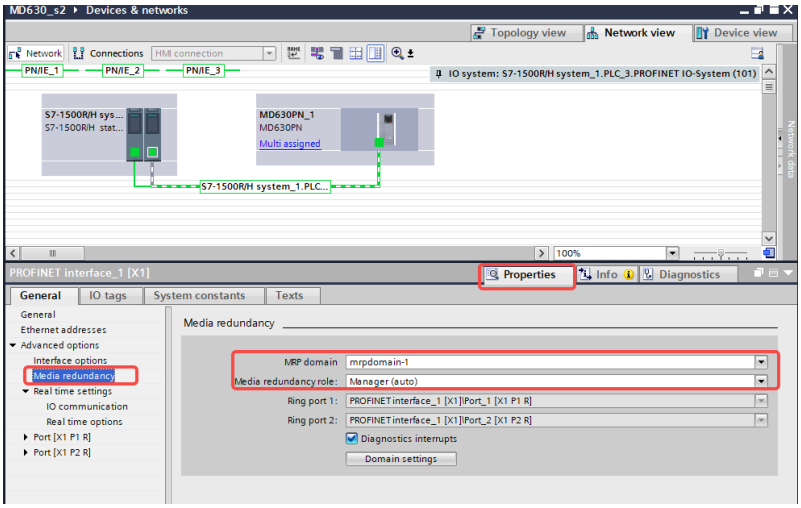
6.10.16 Configuring S2 Redundancy Function

Configure S2 redundancy function in TIA Portal.

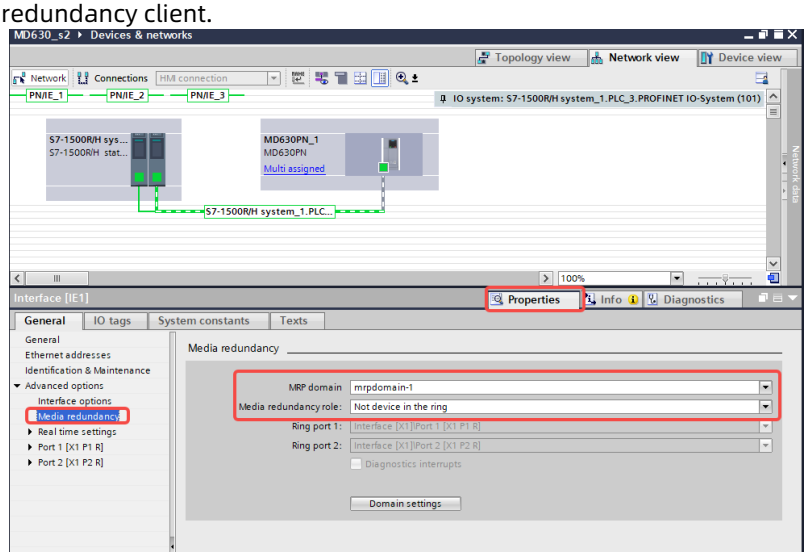
1. Select the slave, right-click and choose "Assign to new IO controller", then select the PLC configuration for multiple assignment as shown in the figure.



2. Configure S2 redundancy manager.



3. Configure S2 redundancy client.



Note

Set the watchdog time factor (a multiple of the update time). When the update time is 2 ms, the redundant system requires the watchdog time factor of the I/O device to be greater than 111, and the watchdog time must be greater than 224 ms.

6.11 CiA-402 Protocol

The CANopen communication of MD630S supports CiA402 protocol. The EtherCAT communication of MD630N supports CiA402 protocol.

Currently supported CiA402 modes:

- Velocity mode (VL): Applied to general speed control, acceleration and deceleration speed curve planning is executed by the drive side.
- Cyclic synchronous velocity mode (CSV): Speed curve is planned by the master station.

6.11.1 CiA 402 Mode Configuration

1. Restore factory settings by setting A0-00 to 1. After parameters are restored to factory settings, parameters related to CiA 402 are restored to default values.
2. Check motor parameters F1-00 to F1-05 and encoder parameters F1-27 to F1-28.
3. Set the motor control mode (F0-01) according to actual conditions. If motor parameters are not tuned in the vector control mode, perform parameter auto-tuning first.
4. Set the command source to communication (F0-03 = 2).
5. Set the frequency source to communication (F0-29 = 9).
6. Enable the CiA 402 protocol (nd-00 = 1).

Related parameters

Param.	Name	Value range	Default
nd-00	CiA 402 enable	0: Disable 1: Enable	0
nd-01	Save parameters written through CiA402	0: Disable 1: Enable	0
nd-02	Speed reference type of CiA 402	0: Frequency; 1: Speed	0
nd-03	CiA 402 parameter source selection	Ones: Acceleration/ Deceleration time selection 0: System acceleration/ deceleration time 1: CiA 402 acceleration/ deceleration time Tens: Frequency upper and lower limit selection 0: Frequency upper and lower limit is not written based on CiA 402. 1: Frequency upper and lower limit is written based on CiA 402.	2

6.11.2 Drive State Machine

The drive runs in the specified status only when it is instructed according to the flowchart defined in CiA 402.

Table 6–38 State description

State	Description
Not ready to switch on	Initialization of the drive and internal self-inspection are done. Parameters cannot be set and the driving function cannot be executed.
Switch on disabled	No fault occurs or errors have been cleared. The drive parameters can be set.
Ready to switch on	The drive is ready to switch on and drive parameters can be set.

State	Description
Switch on	Drive parameters can be set.
Operation enabled	The drive is running properly and a certain operation mode is enabled. The motor is energized and starts rotating when the speed reference is not 0. Only parameters whose "Setting Condition" is "During running" can be set.
Quick stop active	Quick stop is activated and the drive is in the process of quick stop. Only parameters whose "Setting Condition" is "During running" can be set.
Fault reaction active	A fault occurs and the drive is in the process of stop.
Fault	The stop process is done and all the drive functions are disabled. Parameters can be modified for troubleshooting purpose. For resettable faults, after the parameters are modified, set control word 6040h to 0x0080 to reset the fault.

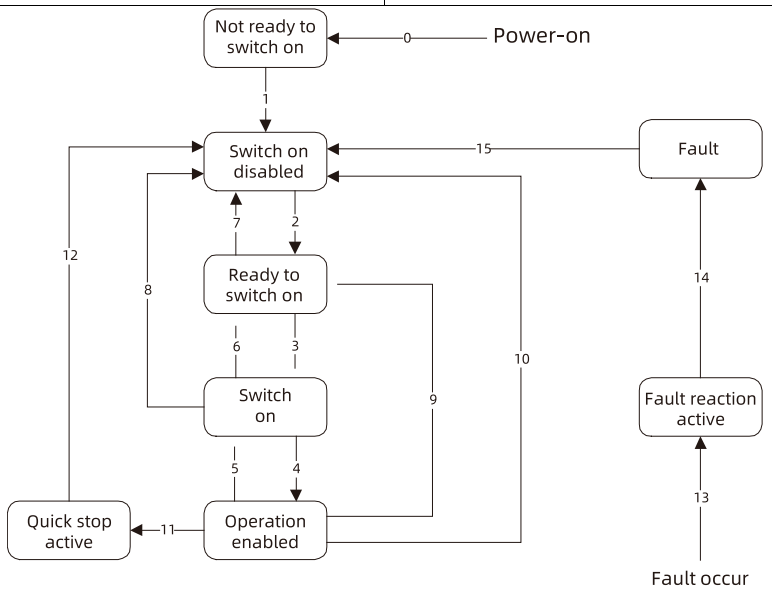


Figure 6-82 Switchover of CiA 402 state machine

Table 6–39 Relation between status switchover and control commands

Sequence number in the switchover of CiA 402 state machine diagram	CiA402 state switchover	Control word 6040h	State word 6041h (bit0 to bit9)
0	Power on → Not ready to switch on	Natural transition, control command not required	0x0000
1	Not ready to switch on → Switch on disabled	Natural transition, control command not required If an error occurs during initialization, the drive directly goes to state 13.	0x0250

Sequence number in the switchover of CiA 402 state machine diagram	CiA402 state switchover	Control word 6040h	State word 6041h (bit0 to bit9)
2	No drive fault → Ready to switch on	0x06	0x0231
3	Ready to switch on → Switch on	0x07	0x0233
4	Switch on → Operational	0x0F	0x0237
5	Operational → Switch on	0x07	0x0233
6	Switch on → Ready to switch on	0x06	0x0231
7	Ready to switch on → No drive fault	0x00	0x0250
8	Operational → Ready to switch on	0x00	0x0231
9	Operational → No drive fault	0x06	0x0250
10	Switch on → No drive fault	0x00	0x0250
11	Operational → Quick stop active	0x02	0x0217
12	Quick stop active → No drive fault	Set 605Ah to a value among 0 to 2. Natural transition is performed after stop, and no control command is required.	0x0250
13	→ Fault reaction active	If a fault occurs in any status other than "fault", the drive automatically switches to the stop-at-fault state, without the need for a control command.	0x021F
14	Fault reaction active → Fault	Natural transition applies after stop and no control command is required.	0x0218
15	Fault → No drive fault	bit7 (fault reset) of control word 6040 is valid on the rising edge. If bit7 remains 1, all other control commands are invalid.	0x0250

6.11.3 Mapping Relationship Between PDO Mapping Objects and Parameters

U4 Object Dictionary Inspection Group Parameters	
U4-00	6502 high-order bit
U4-01	6502 low-order bit
U4-02	603F
U4-03	6040
U4-04	6041
U4-05	6042
U4-06	6043
U4-07	6044
U4-08	6046-01 high-order bit
U4-09	6046-01 low-order bit
U4-10	6046-02 high-order bit
U4-11	6046-02 low-order bit
U4-12	6048-01 high-order bit

U4 Object Dictionary Inspection Group Parameters	
U4-13	6048-01 low-order bit
U4-14	6048-02
U4-15	6049-01 high-order bit
U4-16	6049-01 high-order bit
U4-17	6049-02
U4-18	605 A
U4-19	605 B
U4-20	605C
U4-22	605E
U4-23	6060
U4-24	6061
U4-27	6063 high-order bit
U4-28	6063 low-order bit
U4-36	606C high-order bit
U4-37	606C low-order bit
U4-43	6077
U4-52	607E
U4-79	60B1 high-order bit
U4-80	60B1 low-order bit
U4-89	60FD high-order bit
U4-90	60FD low-order bit
U4-95	60FF high-order bit
U4-96	60FF low-order bit

6.11.4 Object Dictionary Descriptions

6.11.4.1 List of Object Group 6000H

Table 6–40

Index	Subindex	Name	Access	SDO	PDO	Data type	Unit	Data range	Default setting	Link
603Fh	-	Fault code	RO	Yes	Yes	Uint16	-	0 to 65535	-	*"6.11.4.2 Fault Code 603Fh" on page 1121*
6040h	-	Control word	RW	Yes	Yes	Uint16	-	0 to 65535	0	*"6.11.4.3 Control Word 6040h" on page 1121*
6041h	-	Status word	RO	Yes	Yes	Uint16	-	0 to 65535	-	*"6.11.4.4 Status Word 6041h" on page 1122*
6042h	-	Target velocity	RW	Yes	Yes	Int16	Determined by nd-02 (0: Hz; 1: rpm)	-32768 to 32767	0	*"6.11.4.5 Target Velocity 6042h" on page 1123*

Index	Subindex	Name	Access	SDO	PDO	Data type	Unit	Data range	Default setting	Link
6043h	-	Velocity demand value (after acceleration/ deceleration)	RO	Yes	Yes	Int16	Same as 6042h	-32768 to 32767	-	"6.11.4.6 Speed Demand Value 6043h" on page 1123
6044h	-	Output speed	RO	Yes	Yes	Uint16	Same as 6042h	0 to 65535	-	"6.11.4.7 Output Speed 6044h" on page 1123
6046h	0h	Max. and min. speed	RO	Yes	NO	Uint8	-	-	2	"6.11.4.8 Minimum and Maximum Speed 6046h" on page 1124
	1h	Min. speed	RW	Yes	Yes	Uint32	Hz	0 to 65535	0	
	2h	Max. speed	RW	Yes	Yes	Uint32	Hz	0 to 65535	5000	
6048h	-	Velocity acceleration	RO	Yes	NO	Uint8	-	-	2	"6.11.4.9 Velocity Acceleration 6048h" on page 1124
	1h	Delta speed	RW	Yes	NO	Uint32	Same as 6042h	0 to 65535	5000	
	2h	Delta time	RW	Yes	NO	Uint16	Determined by F0-09	0 to 65535	20	
6049h	-	Velocity deceleration	RO	Yes	NO	Uint8	-	-	2	"6.11.4.10 Velocity Deceleration 6049h" on page 1125
	1h	Delta speed	RW	Yes	NO	Uint32	Same as 6042h	0 to 65535	5000	
	2h	Delta time	RW	Yes	NO	Uint16	Determined by F0-09	0 to 65535	20	
605Ah	-	Quick stop option code	RW	Yes	NO	Int16	-	0 to 2	1	"6.11.4.11 Quick Stop Option Code 605Ah" on page 1126
605Bh	-	Shutdown option code	RW	Yes	NO	Int16	-	0 to 1	1	"6.11.4.12 Shut-down Option Code 605Bh" on page 1126
605Ch	-	Disable operation option code	RW	Yes	NO	Int16	-	0 to 1	1	"6.11.4.13 Disable Operation Option Code (605Ch)" on page 1127
6060h	-	Modes of operation	RW	Yes	Yes	Int8	-	0 to 9	2	"6.11.4.14 Modes of Operation 6060h" on page 1128

Index	Subindex	Name	Access	SDO	PDO	Data type	Unit	Data range	Default setting	Link
6061h	-	Modes of operation display	RO	Yes	Yes	Int8	-	0 to 9	-	"6.11.4.15 Modes of Operation Display 6061h" on page 1128
6063h	-	Position actual value	RO	Yes	Yes	Int32	Encoder unit	-2^{31} to (2^{31}-1)	-	"6.11.4.16 Position Actual Value 6063h" on page 1129
606Ch	-	Velocity actual value	RO	Yes	Yes	Int32	rpm	-300000 to 300000	-	"6.11.4.17 Velocity Actual Value 606Ch" on page 1129
6077h	-	Torque actual value	RO	Yes	Yes	Int16	-	-2000 to 2000	-	"6.11.4.18 Torque Actual Value 6077h" on page 1129
60B1h	-	Velocity offset	RW	Yes	Yes	Uint32	Same as 6042	-300000 to 300000		"6.11.4.19 Velocity Offset 60B1h" on page 1129
60FDh	-	Digital input	RO	Yes	Yes	Uint32	-	0 to (2^{32}-1)	-	"6.11.4.20 Digital Input 60FDh" on page 1130
60FFh		Target velocity	RW	Yes	Yes	Uint32	Same as 6042	-300000 to 300000		"6.11.4.21 Target Velocity 60FFh" on page 1130
6502h	-	Supported drive modes	RO	Yes	Yes	Uint32	-	0 to (2^{32}-1)	-	"6.11.4.22 Supported Drive Modes 6502h" on page 1131

6.11.4.2 Fault Code 603Fh

Index 603Fh	Name	Fault code			Setting condition and effective time	-	Data structure	VAR	Data type	Uint16
	Access	RO	Mapping	TPDO	Related mode	All	Data range	0 to 65535	Default setting	-
The fault code read is a manufacturer-defined fault code. For details, see *"7.9.2 Fault Description" on page 1190*. Example: When the drive encounters an encoder error (E015.1), 603Fh is read and 151 is returned. Note: If 0 is returned, no error occurs on the drive.										

6.11.4.3 Control Word 6040h

Index 6040h	Name	Control word			Setting condition and effective time	During operation	Data structure	VAR	Data type	Uint16
	Access	RW	Mapping	RPDO	Related mode	All	Data range	During operation	Default setting	0

Table 6–41 Control command

bit	Name	Description
0	Switch on	1: Active; 0: Inactive
1	Enable voltage	1: Active; 0: Inactive
2	Quick stop	1: Active; 0: Inactive
3	Enable operation	1: Active; 0: Inactive
4-6	Reserved	Undefined
7	Fault reset	Fault reset. It is active at the rising edge and inactive if the value remains at 1.
8	Reserved	Undefined
9	Reserved	Undefined
10	Reserved	Undefined
11-15	Manufacturer-specific	Manufacturer-specific

bit9 to bi10: Reserved. Set bit9 to bit10 to 0.

bit11 to bit15 are manufacturer-defined.

6.11.4.4 Status Word 6041h

Index 6040h	Name	Status word			Setting condition and effective time	-	Data structure	VAR	Data type	Uint16
	Access	RO	Mapping	TPDO	Related mode	All	Data range	0 to 65535	Default setting	0

Table 6–42 Inverter status

bit	Name	Description
0	Ready to switch on	1: Active; 0: Inactive
1	Switch on	1: Active; 0: Inactive
2	Operation enabled	1: Active; 0: Inactive
3	Fault	1: Active; 0: Inactive
4	Voltage enabled	1: Active; 0: Inactive
5	Quick stop	1: Active; 0: Inactive
6	Switch on disabled	1: Active; 0: Inactive
7	Undefined	/
8	Manufacturer-specific	/
9	Remote control	1: Active; 0: Inactive
10	Target reach	1: Active; 0: Inactive
11-15	Undefined	/

Value (binary)	Description
Xxxx xxxx x0xx 0000	Not ready to switch on
Xxxx xxxx x1xx 0000	Switch-on disabled
Xxxx xxxx x01x 0001	Ready to switch on
Xxxx xxxx x01x 0011	Switch on
Xxxx xxxx x01x 0111	Operation enabled
Xxxx xxxx x00x 0111	Quick stop active
Xxxx xxxx x0xx 1111	Fault reaction active
Xxxx xxxx x0xx 1000	Fault

6.11.4.5 Target Velocity 6042h

Index 6042h	Name	Target velocity			Setting condition and effective time	During operation	Data structure	VAR	Data type	Uint16
	Access	RO	Mapping	RPDO	Related mode	VL	Data range	-32768 to 32767	Default setting	0

1 .The unit of the target velocity is determined by nd-02. The value 0 of nd-02 indicates Hz and 1 indicates rpm.
2 .When the unit is Hz, you need to set F0-25. If F0-25 is set to 2 and the frequency resolution is 0.01 Hz, to set the target frequency to 10.00 Hz, write 1000 through communication. If F0-25 is set to 1 and the frequency resolution is 0.1 Hz, to set the target frequency to 10.0 Hz, write 100 through communication.
3 .When the unit is rpm, the supported speed ranges from -32768 to 32767. If the speed exceeds this range, use the unit of Hz to support a higher speed.
4 .The AC drive output frequency is converted to the motor operating frequency (Hz), which can be viewed by U0-01.

6.11.4.6 Speed Demand Value 6043h

Index 6043h	Name	Speed demand value			Setting condition and effective time		Data structure	VAR	Data type	Uint16
	Access	RO	Mapping	TPDO	Related mode	VL	Data range	-32768 to 32767	Default setting	0

1 .This parameter indicates the value processed by the ramp generator.
2 .The unit is the same as the unit of the target velocity 6042h.
3 .When the unit is Hz, the decimal place is set by F0-25.

6.11.4.7 Output Speed 6044h

Index 6044h	Name	Output speed			Setting condition and effective time		Data structure	VAR	Data type	Uint16
	Access	RO	Mapping	TPDO	Related mode	VL	Data range	-32768 to 32767	Default setting	0

1 .This parameter indicates the actual running speed of the inverter.
2 .The unit is the same as the unit of the target velocity 6042h.
3 .When the unit is Hz, the decimal place is set by the tens place of F0-25.

6.11.4.8 Minimum and Maximum Speed 6046h

Index 6046h	Name	Minimum and maximum speed			Setting condition and effective time		Data structure	ARR	Data type	Uint32
	Access	RW	Mapping	RPDO	Related mode	VL	Data range	OD data range	Default setting	OD default value
It indicates the minimum or maximum running speed in the unit of 6042h at which the inverter is allowed to run.										

Subindex 0h	Name	Number of subindexes for the minimum and maximum speed			Setting condition and effective time		Data structure	-	Data type	Uint8
	Access	RO	Mapping	NO	Related mode	VL	Data range	-	Default setting	2

Subindex 1h	Name	Minimum speed			Setting condition and effective time		Data structure	VAR	Data type	Uint32
	Access	RW	Mapping	RPDO	Related mode	VL	Data range	0 to 65535	Default setting	0
It indicates the minimum frequency (with the same unit and precision as those of 6042h) at which the inverter is allowed to run. This value is limited by the maximum frequency (F0-10) and subindex 2.										

Subindex 2h	Name	Maximum speed			Setting condition and effective time		Data structure	VAR	Data type	Uint32
	Access	RW	Mapping	RPDO	Related mode	VL	Data range	0 to 65535	Default setting	5000
It indicates the maximum frequency (with the same unit and precision as those of 6042h) at which the inverter is allowed to run. The value is limited by the maximum frequency (F0-10).										

6.11.4.9 Velocity Acceleration 6048h

Index 6048h	Name	Velocity acceleration			Setting condition and effective time		Data structure	ARR	Data type	Uint32
	Access	RW	Mapping	RPDO	Related mode	VL	Data range	OD data range	Default setting	OD default value
Used to set the acceleration time of the drive.										

Subindex 0h	Name	Number of acceleration subindexes			Setting condition and effective time		Data structure	-	Data type	Uint8
	Access	RO	Mapping	NO	Related mode	VL	Data range	-	Default setting	2

Subindex 1h	Name	Delta speed			Setting condition and effective time		Data structure	VAR	Data type	Uint32
	Access	RW	Mapping	RPDO	Related mode	VL	Data range	0 to 65535 (Hz)	Default setting	5000
1 .The unit is the same as the unit of the target velocity 6042h. 2 .When the unit is Hz, the decimal place is set by F0-25. When the unit is rpm, the value is an integer.										

Subindex 2h	Name	Delta time			Setting condition and effective time		Data structure	VAR	Data type	Uint16
	Access	RW	Mapping	RPDO	Related mode	VL	Data range	0 to 65536 (s)	Default setting	20

6.11.4.10 Velocity Deceleration 6049h

Index 6049h	Name	Velocity deceleration			Setting condition and effective time		Data structure	ARR	Data type	Uint32
	Access	RW	Mapping	RPDO	Related mode	VL	Data range	OD data range	Default setting	OD default value

Subindex 0h	Name	Number of deceleration subindexes			Setting condition and effective time		Data structure	-	Data type	Uint8
	Access	RO	Mapping	NO	Related mode	VL	Data range	-	Default setting	2

Subindex 1h	Name	Delta speed			Setting condition and effective time		Data structure	VAR	Data type	Uint32
	Access	RW	Mapping	RPDO	Related mode	VL	Data range	0 to 65535 (Hz)	Default setting	5000
1 .The unit is the same as the unit of the target velocity 6042h. 2 .When the unit is Hz, the decimal place is set by F0-25. When the unit is rpm, the value is an integer.										

Subindex 2h	Name	Delta time			Setting condition and effective time		Data structure	VAR	Data type	Uint16
	Access	RW	Mapping	RPDO	Related mode	VL	Data range	0 to 65536 (s)	Default setting	20

6.11.4.11 Quick Stop Option Code 605Ah

In the non-faulty state, when bit2 (Quick stop) of the control word 6040 is set to 0, the drive implements quick stop in the mode selected by 605A.

This function can be set only in the stop state. After quick stop, bit6 of the control word 6041 is set to 1 and the drive is in the stop state.

Index 605Ah	Name	Quick stop option code			Setting condition and effective time		Data structure	VAR	Data type	Uint16
	Access	RW	Mapping	NO	Related mode	All	Data range	0 to 2	Default setting	1

Table 6–43 Value description

Value	Stop mode
0	Coast to stop
1	Decelerate to stop with the deceleration time set by F0-49, which is the time set by 6049h in the VL mode
2	Emergency stop with the deceleration time set by b7-34

6.11.4.12 Shutdown Option Code 605Bh

In the non-faulty state, when bit1 (Enable voltage) of the control word 6040 is set to 0, the drive implements shutdown in the stop mode selected by 605A.

Index 605Bh	Name	Shutdown option code			Setting condition and effective time	-	Data structure	VAR	Data type	Uint16
	Access	RW	Mapping	NO	Related mode	All	Data range	0 to 1	Default setting	1

Table 6–44 Value description

Value	Stop mode
-32768 to -1	Manufacturer-defined
0	Coast to stop
1	Decelerate to stop with the deceleration time set by F0-49, which is the time set by 6049h in the VL mode
2 to 32767	Reserved

6.11.4.13 Disable Operation Option Code (605Ch)

In the non-faulty state, when bit3 (Enable operation) of the control word 6040 is set to 0, the drive stops by disabling operation in the mode selected by 605C.

Index 605Ch	Name	Disable operation option code			Setting condition and effective time	-	Data structure	VAR	Data type	Uint16
	Access	RW	Mapping	NO	Related mode	All	Data range	0 to 1	Default setting	1

Table 6–45 Value description

Value	Stop mode
-32768 to -1	Manufacturer-defined
0	Coast to stop
1	Decelerate to stop with the deceleration time set by F0-49, which is the time set by 6049h in the VL mode
2 to 32767	Reserved

6.11.4.14 Modes of Operation 6060h

Index 6060h	Name	Modes of operation			Setting condition and effective time	-	Data structure	VAR	Data type	Uint8
	Access	RW	Mapping	RPDO	Related mode	All	Data range	0 to 9	Default setting	2

Table 6–46 Value description

Value	Operation mode
0	N/A
1	N/A
2	Velocity (VL) mode
3	N/A
4	N/A
5	N/A
6	N/A
7	N/A
8	N/A
9	CSV

6.11.4.15 Modes of Operation Display 6061h

Index 6061h	Name	Mode of operation display			Setting condition and effective time	-	Data structure	VAR	Data type	Uint8
	Access	RO	Mapping	TPDO	Related mode	All	Data range	0 to 9	Default setting	2

Table 6–47 Value description

Value	Operation mode
0	N/A
1	N/A
2	Velocity (VL) mode
3	N/A
4	N/A
5	N/A
6	N/A
7	N/A
8	N/A
9	CSV

6.11.4.16 Position Actual Value 6063h

Index 6063h	Name	Position actual value			Setting condition and effective time	-	Data structure	VAR	Data type	Uint32
	Access	RO	Mapping	TPDO	Related mode	All	Data range	-2^{31} to $+(2^{31}-1)$	Default setting	-
It indicates the motor position in the encoder unit.										

6.11.4.17 Velocity Actual Value 606Ch

Index 606Ch	Name	Velocity actual value			Setting condition and effective time	-	Data structure	VAR	Data type	Uint32
	Access	RO	Mapping	TPDO	Related mode	CSV	Data range	-2^{31} to $+(2^{31}-1)$	Default setting	-
1 .This parameter indicates the actual running speed of the inverter. 2 .The unit of the velocity is determined by nd-02. The value 0 of nd-02 indicates Hz and 1 indicates rpm.										

6.11.4.18 Torque Actual Value 6077h

Index 6077h	Name	Torque actual value			Setting condition and effective time	-	Data structure	VAR	Data type	Uint16
	Access	RO	Mapping	TPDO	Related mode	All	Data range	(Unit: 0.1%)	Default setting	-
The unit uses the rated motor torque as the base value.										

6.11.4.19 Velocity Offset 60B1h

Index 60B1h	Name	Velocity offset			Setting condition and effective time	-	Data structure	VAR	Data type	Uint32
	Access	RW	Mapping	RPDO	Related mode	CSV	Data range	-300000 to 300000	Default setting	-
1 .In CSV mode, actual target velocity = target velocity (0x60FFh) + velocity offset (0x60B1h) 2 .The unit of the target velocity is determined by nd-02. The value 0 of nd-02 indicates Hz and 1 indicates rpm.										

6.11.4.20 Digital Input 60FDh

Index 60FDh	Name	Digital input			Setting condition and effective time	-	Data structure	VAR	Data type	Uint32
	Access	RO	Mapping	TPDO	Related mode	All	Data range	0 to (2^{32}-1)	Default setting	-

Indicates current DI logic status of the drive.

0: Inactive

1: Active

Table 6–48 DI signal indicated by each bit

31-30	29	28	27	26-0
Manufacturer-defined (undefined)	EDM	STO2	STO1	Reserved

6.11.4.21 Target Velocity 60FFh

Index 60FFh	Name	Target velocity			Setting condition and effective time	-	Data structure	VAR	Data type	Uint32
	Access	RW	Mapping	RPDO	Related mode	CSV	Data range	-300000 to 300000	Default setting	-

1 .The unit of the target velocity is determined by nd-02. The value 0 of nd-02 indicates Hz and 1 indicates rpm.
2 .When the unit is Hz, you need to set F0-25. If F0-25 is set to 2 and the frequency resolution is 0.01 Hz, to set the target frequency to 10.00 Hz, write 1000 through communication. If F0-25 is set to 1 and the frequency resolution is 0.1 Hz, to set the target frequency to 10.0 Hz, write 100 through communication.
3 .When the unit is rpm, the supported speed ranges from -32768 to 32767. If the speed exceeds this range, use the unit of Hz to support a higher speed.
4 .The AC drive output frequency is converted to the motor operating frequency (Hz), which can be viewed by U0-01.

6.11.4.22 Supported Drive Modes 6502h

Index 6502h	Name	Supported drive modes			Setting condition and effective time	-	Data structure	VAR	Data type	Uint32
	Access	RO	Mapping	RO	Related mode	All	Data range	0 to 2^{32}	Default setting	0x0000-0002

bit	Running mode
0	N/A
1	Velocity (VL) mode supported
2	N/A
3	N/A
4	N/A
5	N/A
6	N/A
7	NA
8	Cyclic synchronous velocity (CSV) mode supported
9-31	Reserved

7 Troubleshooting

7.1 Troubleshooting

Step	Step instructions
1	Check the following items before troubleshooting: a. Input/output status b. Device actions (such as stop/run/vibrate) c. Parameters d. Wiring status e. DIP switch status
2	Check the operating panel or the iFA Drive software to see whether a fault is reported. See *"7.7 Troubleshooting of Common Faults" on page 1146* and *" " on page* to perform troubleshooting.
3	Perform a reset. If the reset fails, restart the power supply module.
4	If the fault persists, contact the technical support.

7.2 Fault Type and Level

7.2.1 Fault Type

The drive enters the fault state when certain limits are reached. Faults can be classified into four types, ranked from most severe to least severe as: Fault (E) > Minor fault (L) > Alarm (A) > Prompt (N). See the table below for description of each fault type.

Fault type	Display format	Description
Fault (E)	Example: E015.1	1 . Indicates a system fault has occurred, and continued operation is not allowed. 2 . What can happen after a fault occurs?The drive stops immediately and waits for the fault to be rectified. 3 .How to clear the fault? a. Rectify the causes. b. Reset the fault. c. If the fault persists, contact the technical support.
Minor fault (L)	Example: L015.1	1 . Indicates a minor fault has occurred, and continued operation is allowed after derating. However, the operational results may deviate from the control settings. 2 . What can happen after a minor fault occurs?The drive may operate at limited speed, power, current, or torque as defined by the user. 3 . How to clear the minor fault? a. Rectify the causes. A minor fault can be automatically reset, without need to reset the minor fault manually. b. If the minor fault persists, contact the technical support.
Alarm (A)	Example: A015.1	1 . Indicates an alarm occurred, and continued operation is allowed. You can configure output signals for alarms through output terminals. 2 . What can happen after an alarm occurs?An alarm does not affect the operation of the drive. Actions for alarms are user-defined. 3 . How to clear the alarm? a. Rectify the causes. Alarms can be reset automatically. b. If the alarm persists, contact the technical support.
Prompt (N)	Example: N015.1	1 . Indicates a prompt occurs, which is only displayed on the operating panel or the software tool, without affecting operation of the drive. Prompts cannot be configured with an output signal through the output terminal [Note 1]. 2 . What can happen after a prompt occurs?A prompt does not affect the operation of the drive. Actions for prompts are user-defined. 3 . How to clear the prompt? a. Rectify the causes. Prompts can be reset automatically. b. If the prompt persists, contact the technical support.

Note

[Note 1] The output terminal signal of a issue can be configured by E1-04 (DO1 output function selection):

- E1-04 = 2 (output upon a fault): When the AC drive stops due to a fault (coast-to-stop, maximum-capability stop, quick stop, or decelerate-to-stop), the terminal outputs an active signal.
- E1-04 = 38 (output upon a fault/light fault/alarm): When the AC drive encounters a fault, a light fault, or an alarm, the terminal outputs an active signal.
- E1-04 = 41 (output upon an issue excluding undervoltage): When the AC drive encounters a fault, a light fault, or an alarm (excluding undervoltage), the terminal outputs an active signal.
- E1-04 = 43 (output upon a light fault/alarm): When the AC drive encounters a light fault or an alarm, the terminal outputs an active signal.

7.2.2 Fault Levels

The drive can be set with 11 fault levels, allowing the drive to act accordingly upon fault.

Ranked from most severe to least severe, the fault levels can be divided into: coast to stop > stop with maximum capacity > quick stop > decelerate to stop > limited operation (operating with limited speed, power, current, and torque) > alarm > prompt > ignore. For details, see the following table.

Fault level	Description
Coast to stop	The drive stops output and the load coasts to stop upon fault.
Stop with maximum capability	The drive stops the load as quick as possible with maximum output capability upon fault. The ramp-down time during stop with maximum capability is fixed to 50 ms.
Quick stop	After a fault occurs, the drive stops according to the quick stop time defined by b7-34 [Quick stop ramp-down time].
Decelerate to stop	The drive stops according to the set ramp-down time upon fault. The following parameters are involved, which may vary in actual applications based on the ramp-down time defined by the user. b7-05 [Ramp-down time of ramp 1] b7-11 [Ramp-down time of ramp 2] b7-17 [Ramp-down time of ramp 3] b7-23 [Ramp-down time of ramp 4]
Operating at limited speed	After a fault occurs, the drive continues operating based on the operation mode defined by H1-60 [Operating at limited speed] and the setpoints of parameters associated to H1-60. The associated parameters are as follows. H1-61 [Designated safe operating frequency] H1-62 [Maximum positive frequency limit] H1-63 [Maximum negative frequency limit]
Operating at limited power	After a fault occurs, the drive continues operating, but the power output cannot exceed the power limits defined by H1-64 [Maximum motoring power limit] and H1-65 [Maximum regenerative power limit].
Operating at limited current	After a fault occurs, the drive continues operating, but the maximum output current cannot exceed the current limit defined by H1-68.
Operating at limited torque	After a fault occurs, the drive continues operating, but the maximum output torque cannot exceed the torque limits defined by H1-66 [Maximum positive torque limit] and H1-67 [Maximum negative torque limit].
Alarm	After a fault occurs, the drive displays an alarm code, without interrupting operation.
Prompt	After a fault occurs, the drive displays a prompt code, without interrupting operation.
Ignore	This fault is masked.

Caution

- When an ignorable issue occurs, no prompts will be displayed. Therefore, this setting must be used with caution.
- For the fault codes set, you can modify the fault level and the corresponding action as needed to keep the drive in the expected state upon fault. See details in *"7.2.4 Modifying Fault Level" on page 1135*. Not all faults can be set with any fault level. The drive automatically determines whether the configured fault level is active.

7.2.3 Correspondence Between Fault Types and Fault Levels

See the table below for the correspondence between fault type and fault level (action).

Table 7–1 Correspondence between fault type and fault level

Fault type	Fault level
Fault	Coast to stop
	Stop with maximum capability
	Quick stop
	Decelerate to stop
Minor fault	Operating at limited speed
	Operating at limited power
	Operating at limited current
	Operating at limited torque
Alarm	Alarm
Prompt	Prompt
-	Ignore

7.2.4 Modifying Fault Level

[Application scenario]

You can modify the fault level and the corresponding action as needed to keep the drive in the expected state upon fault.

- If the drive needs to stop when a fault occurs, set the fault action to "coast to stop", "stop with maximum capability", or "quick stop".
- If the drive needs to operate with limited conditions upon fault, set the fault action to "operating at limited speed", "operating at limited power", or "operating at limited torque".
- If the drive needs to continue operation after a fault occurs, set the fault action to "alarm", "prompt", or "ignore".

[Switchover method]

There are two switchover methods: modifying the fault level of the fault code, or modifying the fault level of an individual fault code.

1. Modifying the fault level of the fault code

You can set the levels of all the subcodes under the fault code through H1-00 to H1-18. With this method, for the same fault code, all subcodes under it can only be set to the same level; different levels cannot be assigned to individual subcodes.

For example, you can set the fault level of all the subcodes (E021.X) under E021 through the hundreds of H1-03 (as shown below). Note: With this method, all subcodes under E021 must be set to the same level. For example, you cannot set the fault level of a certain subcodes (such as E021.1) to "coast to stop" while setting another subcode (such as E021.2) to "decelerate to stop".

Param.	Name	Default value	Value range
H1-03	Protective action selection 3 upon fault	0	Ones: Parameter auto-tuning error (E019) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: EEPROM fault (E021) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop Thousands: Power unit EEPROM fault (E186) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop F: Ignore

2. Modifying the fault level of an individual fault code

   You can set the fault level of an individual fault code through H1-30 (1st set of fault codes) to H1-49 (10th set of fault codes).

   For example, you can set the fault level of E021.1 to "0: Coast to stop" through H1-30 (1st set of fault codes) and H1-31 (1st set of fault level), or set the fault level of E021.2 to "2: Quick stop" through H1-32 (2nd set of fault code) and H1-33 (2nd set of fault level), as shown below.

   - H1-30 = 21.1
   - H1-31 = 0: Coast to stop
   - H1-32 = 21.2
   - H1-33 = 2: Quick stop

Note:

- When modifying the fault level of an individual fault code, the setting must be within the allowable range of the fault code.
  For example, if only four options (0 [Coast to stop], 1 [Stop with maximum capability], 2 [Quick stop], 3 [Decelerate to stop]) are available for the hundreds of H1-03, you can only set the fault level to one of these options.
- When the fault level set for an individual fault code through H1-30 (1st set of fault codes) to H1-49 [10th set of fault codes] is not consistent with the fault level defined by H1-00 (Protective

action selection 0 upon fault) to H1-18 (Protective action selection 18 upon fault), the former prevails (the prerequisite is that the fault level configured in the former falls within the configurable fault level range of the latter).

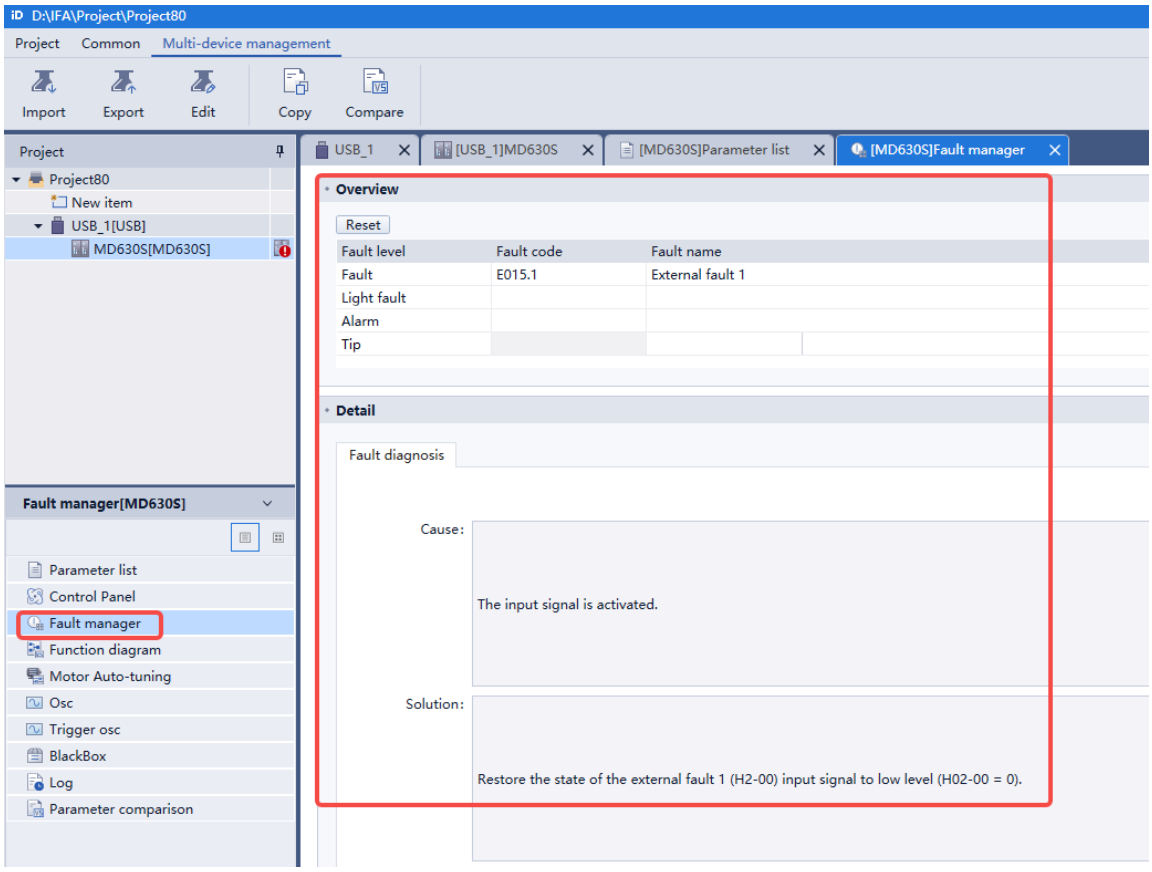
Modifying the fault level of the fault code	Modifying the fault level of an individual fault code	Fault level
Set the hundreds of H1-03 (EEPROM fault E021) to "0: Coast to stop".	H1-30 = 021.1 H1-31 = "2: Quick stop" Note: "2: Quick stop" is within the range of fault levels available for the hundreds of H1-03 (0 to 3).	The fault level of E021.1 is "2: Quick stop". The fault level of other subcodes under E021 is "0: Coast to stop".
	H1-30 = 021.1 H1-31 = "9: Operating at limited speed" Note: "9: Operating at limited speed" is outside the range of fault levels available for the hundreds of H1-03 (0 to 3).	The fault level of E021.1 and other subcodes under E021 is "0: Coast to stop".

7.3 Fault Display

The fault protection action defined by parameters in group H1 will be executed when a fault occurs on the drive. Meanwhile, the operating panel displays the corresponding fault code. When a fault (error) occurs, the drive cuts off the output, and the contact of the fault replay acts (provided that the relay contact function is selected as fault output). In this case, the fault indicator  on the operating panel turns on. As shown in the following figure, E015.1 (External fault 1) is displayed.



The fault code can also be displayed on the iFA Drive commissioning software, as shown in the following figure.

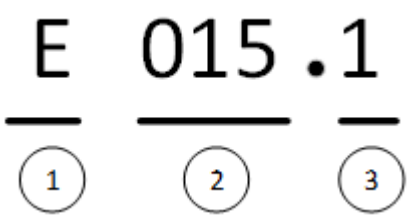


[Display logic]

1. When multiple faults occur, the operating panel displays the fault occurred first. When this fault is reset, the operating panel displays the fault occurred first among the remaining faults.
2. When multiple types of faults occur simultaneously, the operating panel displays the fault with the highest severity. For example, when faults and alarms occur simultaneously, the operating panel only displays the fault code. Only when all faults are reset will the operating panel display the alarm code.

[Display format of fault code]

An fault code is displayed in three segments, representing fault type, fault code, and fault subcode, as shown in the following figure.



① indicates the fault type. "E" for a fault, "L" for a light fault, "A" for an alarm, and "N" for a prompt.

② indicates the fault code with three digits.

③ indicates the fault subcode with one digit. Each fault code supports a maximum of nine subcodes (1 to 9).

7.4 Fault Log Inquiry and Clear

Faults are divided into active faults and historical faults.

- Active faults: Faults that have occurred but not rectified yet
- Historical faults: Faults that have occurred and rectified

Active fault log inquiry

The drive can record up to six active faults of the same type. When more than six faults occur simultaneously, subsequent faults will not be recorded.

There are two methods to check the active fault log: check through the parameters in group A1 or through the operation panel.

- Method 1: View the active faults through parameters in group A1.

Table 7–2 Parameter table corresponding to active fault information

Fault type		Parameter corresponding to code	Parameter corresponding to additional information
Fault	Active fault 1	A1-00	A1-01
	Active fault 2	A1-02	A1-03
	Active fault 3	A1-04	A1-05
	Active fault 4	A1-06	A1-07
	Active fault 5	A1-08	A1-09
	Active fault 6	A1-10	A1-11
Minor fault	Active minor fault 1	A1-12	A1-13
	Active minor fault 2	A1-14	A1-15
	Active minor fault 3	A1-16	A1-17
	Active minor fault 4	A1-18	A1-19
	Active minor fault 5	A1-20	A1-21
	Active minor fault 6	A1-22	A1-23
Alarm	Active alarm 1	A1-24	A1-25
	Active alarm 2	A1-26	A1-27
	Active alarm 3	A1-28	A1-29
	Active alarm 4	A1-30	A1-31
	Active alarm 5	A1-32	A1-33
	Active alarm 6	A1-34	A1-35
Prompt	Active prompt 1	A1-36	A1-37
	Active prompt 2	A1-38	A1-39
	Active prompt 3	A1-40	A1-41
	Active prompt 4	A1-42	A1-43
	Active prompt 5	A1-44	A1-45
	Active prompt 6	A1-46	A1-47

- Method 2: View the active faults by pressing  and  on the operating panel under the fault menu. The following show how to view active faults.

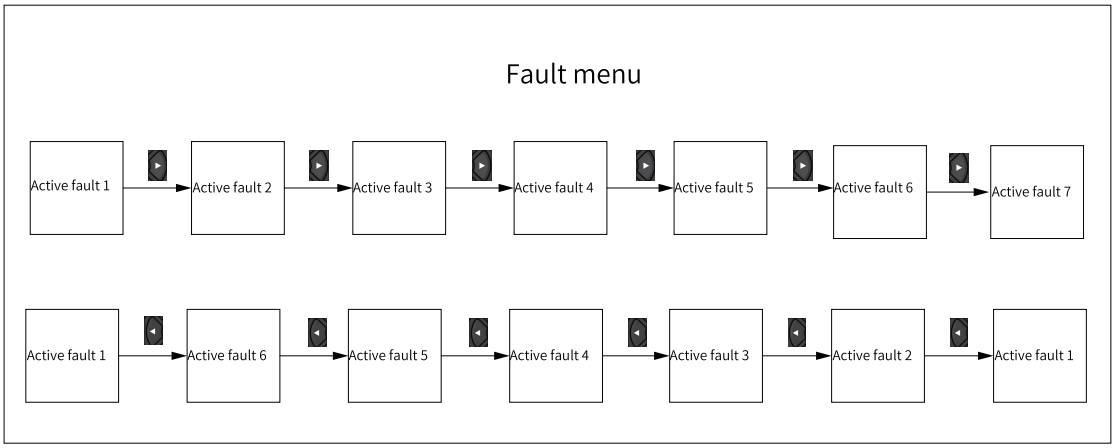


Figure 7-1 Viewing active faults

Historical fault log inquiry

You can view six historical faults and related drive information upon occurrence of the fault. When more than 6 historical faults have occurred, only the most recent 6 faults will be recorded. You can view historical faults through parameters in groups H6 (Historical fault log 1) to Hb (Historical fault log 6), as shown below.

Table 7–3 Parameters related to historical fault codes

Parameter group	Name	Description
H6	Historical fault log 1	Records the code and related information of historical fault 1.
H7	Historical fault log 2	Records the code and related information of historical fault 2.
H8	Historical fault log 3	Records the code and related information of historical fault 3.
H9	Historical fault log 4	Records the code and related information of historical fault 4.
HA	Historical fault log 5	Records the code and related information of historical fault 5.
Hb	Historical fault log 6	Records the code and related information of historical fault 6.

Clearing fault log

You can clear the historical fault information in groups H6 to Hb through A0-00 [Parameter initialization]. Setting A0-00 to 2, 5, or 503 clears the historical fault information. The differences among these methods are as follows.

- A0-00 = 2 (Clear log information): Fault log information, cumulative operating time, cumulative power-on time, and cumulative power consumption are cleared.
- A0-00 = 5 (Clear fault information): The fault log information in groups H6 to Hb are cleared.
- A0-00 = 503 (Restore default parameters (including motor parameters) and clear log information): Except for specific parameters that cannot be restored, all other function parameters, including motor parameters and log information, are restored to default values.

Note

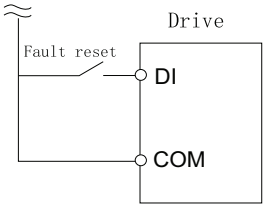
With the above-mentioned methods, the records of the current and historical issues can be cleared.

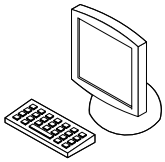
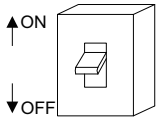
7.5 Fault Reset Methods

After rectifying fault causes, reset the fault to exit the drive from the error state. The fault types and solutions are shown below.

- For minor faults, alarms, or prompts, the drive performs a reset operation automatically.
- For faults, the drive keeps in the fault state after the fault causes are rectified, requiring a manual reset operation, which means the fault can be cleared after an external reset command is received by the drive.
- For special faults, the fault can be cleared only after the drive is restarted when fault causes are rectified.

Manual reset applies to all fault codes. The method for manual reset is shown in the table below.

No.	Manual reset methods	Description	Applicable scenario
1	Reset through the operating panel	In the stop state, you can press the stop key to reset the fault. 	This method can be applied when direct access to the operating panel is convenient.
2	Reset through terminals	Assign function 9 (Fault reset) to any DI. You can reset the fault by activating this DI signal. 	This method applies when terminal control is used in multi-speed operation.

No.	Manual reset methods	Description	Applicable scenario
3	Reset through communication	When the current main command source (channel 1 is F0-03/b1-00, channel 2 is b3-00) is set to communication (option 2), the fault can be reset by writing the reset command to the communication control word address through the host controller (for example, in Modbus-RTU communication, write the fault reset command 7 to address 7311H). 	This method applies when the drive is difficult to access and located far from the host controller.
4	Reset through custom reset signal	In the current control channels, the corresponding custom fault reset source 1 (b1-05 or b3-05), source 2 (b2-04 or b4-04), and source 3 (b2-05 or b4-05) can be configured as the source for custom fault reset signal. The fault can be reset by setting the custom reset signal. The custom fault reset source 1 is valid only when the main command source (set by F0-03/b1-00 for channel 1 or b3-00 for channel 2) is set to 3 (User-defined).	The reset signal source can be configured to a custom signal source.
5	Reset through iFA Drive software	Click the fault reset button in the "Fault management" or "Control panel" of iFA Drive software to reset the fault.	This method applies when the drive is commissioned through iFA Drive software.
6	Reset through restart	Disconnect the main circuit power supply. Wait until the fault code disappears, and then connect the power supply again. 	When the fault cannot be reset through the preceding methods, try restarting the drive.

Caution

The manual reset command is effective only on the rising edge of the reset signal. Do not keep it at high level.

7.6 Automatic Fault Reset

In certain applications, a limited number of automatic fault resets can be set to ensure continuous application when a fault occurs.

Note

The fault code E009.1 has the independent automatic reset function.

The following fault codes require that the function code n0-16 is set to 1 to start the automatic reset function (default configuration is 1):

- Standard version E160.1, E161, E162, E164
- Bus version: E165, E166, E167; E168, E169, E197

The MD630-INT fault automatic reset function is disabled by default. To enable the automatic fault reset function, configure the following parameters. For other related parameters, see Table Automatic fault reset parameters.

- Set H3-00 (Automatic fault reset) to 1 (enable).
- Set H3-01 (Number of automatic fault resets). You can set the appropriate number according to the requirements.
- Set H3-02 (interval for automatic fault reset). This parameter is used to set the duration from the time when the drive reports a fault to the time when automatic fault reset is performed. You can set an appropriate time interval according to the actual requirements.

Most fault codes of MD630-INT drives can be configured for automatic reset, except in the following cases:

- Fault codes that cannot be configured for automatic reset are E032.8, E032.9, E047.5, E060.1, E177.1 and E177.2.
- You can configure ten faults that are inhibited from automatic fault reset through H3-13 (fault code 1 inhibited from automatic fault reset) to H3-22 (fault code 10 inhibited from automatic fault reset). These codes cannot be reset automatically even if the automatic fault reset function is enabled.

Related parameters

Table 7–4 Parameters related to automatic fault reset

Parameter code	Parameter name	Default value	Range	Description
H3-00	Automatic fault reset	1	0: Disable 1: Disable	This parameter sets whether to enable automatic fault reset. Value description 0: Automatic fault reset is disabled. 1: Automatic fault reset is enabled.
H3-01	Number of automatic fault resets	0	0 to 100	This parameter sets the number of automatic fault resets. Remarks: If the number of reset times exceeds the value of this parameter, the AC drive remains in the faulty state.

Parameter code	Parameter name	Default value	Range	Description
H3-02	Time interval for automatic fault reset	1	0.1 to 600	This parameter sets the time interval for automatic fault reset. Remarks: This parameter sets the duration from the time when the drive reports a fault to the time when automatic fault reset is performed.
H3-03	Automatic reset disabled when manual reset applies	1	0: Automatic reset terminated 1: Automatic reset continues	This parameter sets whether automatic reset can be terminated by manual reset during the automatic reset process. Value description 0: Automatic reset is terminated upon manual reset. 1: Automatic reset continues after manual reset.
H3-04	Time for restoring the number of automatic fault resets	10	0 to 6000	This parameter sets the time for restoring the number of automatic fault resets. Remarks: When it is not set to 0, the number of automatic fault reset times is restored after the time set by H3-04 elapses; when it is set to 0, the number of automatic fault reset times is restored all the time.
H3-05	Cumulative number of automatic fault resets	0	-	This parameter displays the cumulative number of automatic fault resets, which cannot be modified. When the number of manual resets and automatic resets are reached, the number will be cleared.
H3-06	Action when the number of automatic fault resets reaches	0	0: Number of automatic fault resets restored. 1: Number of automatic fault resets not restored.	This parameter sets whether to restore the number of automatic fault resets after the number is exhausted. Value description 0: When the number of automatic fault resets is exhausted and time for restoring the number of automatic fault resets reach, the number of automatic fault resets can be restored automatically. 1: When the number of automatic fault resets is exhausted, the number cannot be restored automatically.
H3-07	Fault output selection	0	0: No output during automatic fault reset 1: Output during automatic fault reset	This parameter sets whether there is output during automatic fault reset. Value description 0: No output during automatic fault reset 1: Output during automatic fault reset

Parameter code	Parameter name	Default value	Range	Description
H3-13	Fault code 1 inhibited from automatic fault reset	0	0 to 255.9	This parameter specifies the fault code 1 that is inhibited from automatic fault reset. Remarks: For example, after the main code and subcode of the fault, such as 187.1, is set, the power unit EEPROM junction temperature parameter storage error (E187.1) cannot be reset automatically.
H3-14	Fault code 2 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-15	Fault code 3 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-16	Fault code 4 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-17	Fault code 5 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-18	Fault code 6 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-19	Fault code 7 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-20	Fault code 8 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-21	Fault code 9 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13
H3-22	Fault code 10 inhibited from automatic fault reset	0	0 to 255.9	Same as H3-13

7.7 Troubleshooting of Common Faults

Table 7–5 Solutions to common faults (function)

No.	Fault symptom	Possible cause	Verification method	Solution
1	There is no display upon power-on. 	The grid voltage is excessively low.	Measure the input power supply and check whether the voltage is outside the normal voltage range of the drive.	Ensure that the grid voltage is within the normal range (380 V to 480 V, -15% to +10%).
		The control board or the operating panel is faulty.	-	1. Replace the control board and operating panel. 2. Contact the technical support.
		The switched-mode power supply on the driver board of the drive is faulty.	Measure the voltage values of the 24 V and 10 V output interfaces on the driver board to check whether the values reach 24 V and 10 V. If not, a fault occurs.	Contact the technical support.
		The pre-charge resistor of the drive is damaged.	-	Contact the technical support.
		The rectifier bridge is damaged.	Measure the DC bus voltage of the drive and check whether it is lower than A3-56 (Undervoltage threshold). If yes, the rectifier bridge is damaged.	Contact the technical support.
2	"-H-C" is displayed after power-on. 	The output circuit of the drive is grounded or short-circuited.	Use a megger to measure the voltage on the U/V/W terminals of the drive. If the voltage is close to 0, short circuit occurs.	Replace the U/V/W cables at the output terminals and re-connect them.
		The grid voltage is excessively low.	Measure the input power supply and check whether the voltage is outside the normal voltage range of the drive.	Ensure that the grid voltage is within the normal range (380 V to 480 V, -15% to +10%).
		Components on the control board are damaged.	If the fault persists after preceding fault causes are rectified, components on the control board may be damaged.	Contact the technical support.

No.	Fault symptom	Possible cause	Verification method	Solution
3	"-sto" is displayed upon power-on. 	The STO input signal is disconnected.	Check whether the STO input switch is open.	Close the STO input switch.
		The wiring or power supply of the STO circuit is faulty.	Check whether the STO circuit wiring and power supply are normal.	Ensure that the STO circuit wiring and power supply are normal.
4	The display is normal upon power-on. However, after the drive starts to run, "-H-C-" is displayed and the drive stops immediately. 	The peripheral control terminals are short-circuited.	Measure the voltage of the external control terminals to determine whether short circuit occurs.	Reconnect the short-circuited terminals.
		The fan is damaged or short-circuited.	1 .Check whether the fan operates properly. 2 .Check whether the line voltage is close to 0. If yes, short circuit occurs.	1. Reconnect the cables. 2. Replace the damaged fan.
		The drive is damaged.	If the fault persists after the preceding fault caused are rectified, the drive may be damaged.	Contact the technical support.
5	The motor does not rotate after the drive runs.	The cable between the drive and motor is wired improperly.	Check whether the cable between the drive and motor is wired improperly.	Re-connect the drive and the motor according to the wiring diagram in the user guide.
		The motor control method or mode is set incorrectly.	Check whether motor control parameters are set correctly.	Set motor control parameters according to the operating conditions, such as F0-01 (Motor control method) and F0-02 (Motor control mode).
		AC drive parameters (motor parameters) are set improperly.	Check whether the rated motor parameters (C4-01 to C4-11) are consistent with those on the motor nameplate, such as the rated motor frequency and rated motor speed.	Set the rated motor parameters (C4-01 to C4-11) according to the motor nameplate.
		V/f control parameters are set improperly.	Start the drive under heavy load in V/f control mode and check whether the motor rotates. If not, d2-14 (Manual torque boost) is excessively low.	Increase the setpoint of d2-14 (Manual torque boost) properly.
		The driver board is faulty.	If the fault persists after the preceding fault causes are rectified, the driver board may be faulty.	Contact the technical support.

No.	Fault symptom	Possible cause	Verification method	Solution
6	DI terminals are deactivated.	Parameters are set improperly.	Check whether parameters (group E0) related to terminal setting are set properly.	Reset parameters related to terminal setting in group E0.
		External signals are incorrect.	Check whether the external signal cables are wired properly.	See the *MD630 Series General-Purpose AC Drive Operation Guide* for how to connect external signal cables.
		The control board is faulty.	If the fault persists after the preceding fault causes are rectified, the control board may be faulty.	1. Replace the control board. 2. Contact Inovance for technical support.
7	APPE1 is displayed after power-on. 	The auxiliary integrated circuit program on the control board is incomplete.	Check whether the program in the control board has been programmed or erased once.	Re-program the auxiliary integrated circuit program.
		Components on the control board are damaged.	If the fault persists after preceding fault causes are rectified, components on the control board may be damaged.	Contact the technical support.

Table 7–6 Solutions to common faults (performance)

No.	Fault symptom		Possible cause	Verification method	Solution
1	Errors on the input side	The input power factor on the grid side is excessively low.	The absence of a line reactor and a DC reactor can result in high harmonic current on the grid side, which can in turn cause a low power factor.	Check whether the model selected matches the requirements.	If a specific power factor on the grid side is required, use a model with reactors. If this product series does not have a reactor, install an external input reactor. **Note:** There is no obvious correlation between the rectification power factor and efficiency. Common diode rectifiers have low power factors but high efficiency.
		The input current measured by the clamp meter deviates greatly from the theoretical value.	The grid-side current harmonics are relatively large, and the current waveform is not a standard sine wave. Therefore, measuring the input current directly using a clamp meter will result in significant deviations.	Check whether the rectifier unit of the drive is AFE (active front end).	Measure the input current using an oscilloscope current clamp in RMS (root mean square) mode. Measure the input current using the current clamp of a power quality analyzer.
		The three-phase current on the grid side is unbal anced.	Unbalanced grid-side impedance can cause fluctuations at twice the grid frequency (that is, 100 Hz fluctuations for a 50 Hz grid), resulting in unbalanced current.	Check whether the bus voltage fluctuates at 100 Hz and ensure that no phase loss occurs on the input side. The built-in DC input reactor may resonate with unbalanced grid impedance, resulting in grid harmonics at twice the grid frequency.	The power supply unit is designed with sufficient margin to accommodate unbalanced grid impedance. If the three-phase input current imbalance is within 10% of the driver's rated current, no action is required. To address three-phase input current imbalance, use a three-phase reactor on the input side or select models without DC input reactors.
			The rectifier diode is damaged.	Set the multimeter to the diode test mode. Connect the red probe to R/S/T and the black probe to the positive bus to measure the upper bridge. Connect the black probe to R/S/T and the red probe to the negative bus to measure the lower bridge. A consistent voltage drop of around 0.25 V to 0.6 V indicates that the rectifier diode is normal. A damaged diode typically features a voltage drop of 0 or infinite.	Contact the technical support.

No.	Fault symptom		Possible cause	Verification method	Solution
1	Errors on the input side	The input grid voltage is normal when the drive is stopped. However, when the drive operates under load, the output voltage is low, and both input and output currents are high.	1 .The grid is a weak grid. 2 .There is a reactor on the input side and the voltage drop across the reactor is significant.	During motor startup, check whether the bus voltage decreases significantly as the output power increases.	• Appropriately increase the overmodulation coefficient (A5-06) to a value not exceeding 108% to increase the output voltage and reduce the output current. • Select a reactor with moderate inductance. Excessive inductance results in voltage drop when input current rises, thereby influencing the input voltage. • Increase the grid voltage. For example, the user can adjust the transformer tap to increase the grid voltage by 5%. Most transformers are equipped with a tap that can slightly increase the grid voltage, but not all.

No.	Fault symptom		Possible cause	Verification method	Solution
2	Errors on the output side	The output voltage and output current fluctuate significantly.	1 .The filtering magnitudes of the output voltage and output current are different. 2 .The motor fluctuates.	1 .Compare the fluctuation amplitude of the output voltage and output current within the same filter time. 2 .For actual motor speed fluctuation, targeted analysis and optimization are required.	1. Check the filtered output current and set an appropriate filter time (Ab-94 to Ab-98 for group U0). 2. Contact Inovance for technical support.
		The output voltage of the drive exceeds the rated voltage of the motor.	The input grid voltage is excessively high, resulting in high bus voltage.	Check whether the grid output voltage is significantly higher than the rated voltage of the motor, which is certain to occur when the motor is operating at high speed and under heavy load.	This is normal and requires no intervention. The output phase voltage of the drive is a square wave pulse voltage over the carrier frequency cycle. The amplitude of the square wave voltage matches the bus voltage. Different output voltages result in different pulse widths. The voltage shock to the motor is directly related to the bus voltage, not the output voltage. Therefore, it is recommended to maximize the output voltage to save energy.
		The low-speed output current measured by the oscillo scope and AC current clamp/ clamp meter is too low, and the waveform shows distortion.	The measurement of both the clamp meter and the AC current clamp are based on the AC inductance. The AC magnetic field generated by low-frequency output current is weak, resulting in measurement deviations and waveform distortions.	1 .Increase the output frequency and check whether the output current waveform and magnitude are correct. 2 .Decrease the output frequency and check whether the output current of the drive fluctuates significantly.	It is recommended to use a DC current probe to measure the output current. **Note:** The low-frequency current waveform is based on the waveform of the drive, as the drive can accurately sample the DC current.

No.	Fault symptom		Possible cause	Verification method	Solution
3	Errors in V/f control	The drive shakes during stop.	The acceleration abruptly changes during stop, resulting in torque shock.	1 .Increase the deceleration time and check whether the shock amplitude decreases. 2 .Set b7-09 [Ramp deceleration end arc time] to check whether the shock decreases.	1 .Set F0-45 to 1 to enable the S-curve function of RFG and set b7-09 [Ramp 1 deceleration end arc]. If the deceleration time is short, set b7-08 [Ramp 1 deceleration start arc] properly. 2 .Increase d0-28 [Waiting time of DC braking at stop] as needed.
		When the motor deceler ates to stop according to the DI stop signal, the stop position of the motor exceeds the limit.	1 .There is a delay in the transmission of the stop signal to the drive. 2 .The drive filters input reference signals like DI signals. 3 .The deceleration time does not match the actual mechanical requirements. 4 .Power generation results in overvoltage or overcurrent suppression. 5 .The deceleration capacity is insufficient, with torque or current reaching limits.	1 .Check whether there is a delay in the transmission of the stop signal through the PLC, such as the delay in the PLC scan cycle. 2 .Check the DI input filter time 1 (E0-16). If the deceleration time is very short (such as 100 ms), set the DI filter time to 0. 3 .Check the actual deceleration time. The default base value for acceleration and deceleration time corresponds to the time at the maximum frequency. 4 .Monitor the waveform. During deceleration, power generation occurs. If the bus voltage reaches the overvoltage suppression threshold (d1-55), the feedback speed deviates from the reference, resulting in position overshoot. Set d1-54 to 0 to disable overvoltage suppression and operate the drive for several times to check whether overvoltage occurs. 5 .Check the monitored waveform to see whether the output torque in vector control mode reaches the limit (set by F2-30 and F2-31). Check whether the output current in V/f control mode reaches the overcurrent suppression threshold (d2-27).	1 .Connect the DI directly to the drive for quicker response. 2 .Set the DI input filter time 1 (E0-16) to 0. 3 .If the deceleration time is too short, decrease the ramp 1 deceleration time (F0-49). 4 .In vector control mode, set d0-39 to 1 to enable overexcitation. In V/f control mode, set d0-41 to a non-zero value to enable overexcitation, which is default to be enabled. Increase the overexcitation coefficient (d0-40 for vector control mode, and d0-41 for V/f control mode) to increase the deceleration time if the process allows. If it does not work, connect a braking resistor to the drive. Increase the overcurrent suppression threshold (d2-27) properly. 5 .The same rule applies in vector control. In vector control mode, increase the torque limit (d1-09/d1-10) properly.

No.	Fault symptom		Possible cause	Verification method	Solution
3	Errors in V/f control	The output current is excessively high.	1 .The load is excessive. 2 .The V/f torque boost is excessively high. 3 .For loads such as fans and water pumps, the output current may be excessively high when energy-saving control is not used. 4 .If the operating current is high only during high-speed operation under heavy duty in field-weakening range, the grid voltage may be excessively low. 5 .Incorrect motor rated parameters or incorrect motor connection method (Y-type or delta type) result in motor operation errors. 6 .There may be a deviation in current sampling, even if the output current deviation is small.	1 .Compare the output current of two drives with the same power. If only one drive shows a high output current, it may indicate a mechanical issue. 2 .Insufficient torque boost can result in high V/f low-frequency output current during low-speed, heavy-load startup. 3 .Check whether energy-saving control is enabled under loads such as fans and water pumps. 4 .Check whether the grid voltage is excessively low. If yes, increase overmodulation. 5 .Check whether the basic motor parameters are faulty. If the output current of the motor is still high during no-load operation in V/f mode, the rated motor parameters may be incorrect. 6 .There may be a 1% deviation in output current sampling of the drive. If there is a small current deviation, use the same current clamp to test whether the high output current is caused by sampling deviation.	1 .If a mechanical fault occurs, optimize the mechanical design and assembly. If the fault persists, select a drive of higher power rating. 2 .Increase the torque boost coefficient properly. Note that an excessively high torque boost value can also result in high output current. 3 .For steady-state loads such as fans and water pumps, set d5-25 to 1 to enable energy-saving control of asynchronous motor, which can effectively reduce energy consumption. 4 .In the high-speed field weakening range, set A5-06 to 107% to increase voltage utilization, which can decrease the output current. 5 .Set the rated motor parameters correctly. Some motor nameplates list multiple sets of motor parameters, so ensure the correct set is selected. If motor parameters are set correctly but the output current is still high, decrease the rated motor voltage. 6 .Use the same current clamp for output current measurement and sampling.

No.	Fault symptom		Possible cause	Verification method	Solution
3	Errors in V/f control	The output voltage of the drive is lower than other machines during field-weakening operation.	Low grid voltage or a weak, loaded grid that experiences voltage drop can result in lower output voltage and higher output current under the same load.	Check whether the bus voltage drops significantly during operation with high load.	1 .Set A5-06 to 107% to increase the overmodulation coefficient. 2 .Adjust the transformer tap to increase the input voltage properly.
		The V/f control speed is not accurate enough.	During loaded operation in V/f mode, there is a deviation (slip) between the rotor speed of the asynchronous motor and the frequency reference. Without slip compensation, there will be a deviation between the rotor output speed and the speed reference.	Use a frequency sweeper to check whether the actual motor speed deviates significantly from the speed reference.	The response of V/f slip compensation is relatively slow. For steady-state loads, set d2-41 to 1 to enable slip compensation, which can effectively increase the speed accuracy of asynchronous motor in V/f control mode. For dynamic loads, vector control is required for high speed accuracy.
3	Errors in V/f control	The drive starts slowly in quick start mode.	1 .There is a delay in the start command. 2 .The torque boost in V/f control mode is set incorrectly, resulting in insufficient starting torque. 3 .The output current limit is low, resulting in a deviation between the output acceleration frequency and the reference. 4 .The setting of the starting frequency or DC braking at start can result in a delay at startup.	1 .For fast start/stop control, check whether the DI terminal filter is set to 0 ms. 2 .Increase the torque boost properly and check whether the startup delay is reduced. 3 .Check whether the transient output current reaches the overcurrent suppression threshold. 4 .Check whether the DC braking time at start (d0-25) is set to 0 s and whether the starting frequency hold time (d0-24) is set to 0 s.	1 .Ensure that the DI terminal filter (E0-16) is set to 0 ms. 2 .Increase the torque boost (d2-14) properly. Keep it below 6% to prevent high current and overload. 3 .Increase the overcurrent suppression threshold (d2-27) properly. If the output current reaches the limit, use a drive with higher power rating. 4 .Set the DC braking time at start (d0-25) to 0s and the starting frequency hold time (d0-24) to 0s.
		When multiple drives are used to drive the same load, the output current among drives is unbal anced.	With multiple drives are used to drive the same load, each drive controls its own speed. During this process, minor mechanical errors can result in significant load deviation among the motors.	Check whether the loads are controlled in a balanced way. Faults are likely to occur when each drive controls its own speed.	Use droop control to balance the current among different drives; otherwise, the output current cannot be balanced. It is recommended to set the droop rate as a percentage to the motor rated slip. For details see *"V/f Droop Control"* in *MD630 Series General-Purpose AC Drive Operation Guide*.

No.	Fault symptom		Possible cause	Verification method	Solution
4	SVC control errors	The motor operates in reverse direction during decelerating to stop.	1 .Integral overshoot occurs when the speed loop integral time (Ti) and the proportional gain (Kp) are excessively low, causing the motor to operate in reverse direction. 2 .When the motor stops suddenly, the output torque drops to 0 and elastic mechanical parts rebound, resulting in shaking at the mechanical end.	1 .Increase the integral time (F2-03) to 0.5s for regular models and 1.0s for large inertia models. Gradually increase Kp (F2-02) to check whether the speed overshoot decreases. 2 .Enable the S-curve function of RFG (F0-45 = 1) to gradually release the elastic torque and decrease the shock caused by sudden changes in acceleration.	1 .Increase the integral time (F2-03) to 0.5s for regular models and 1.0s for large inertia models, and then gradually increase Kp (F2-02). 2 .Enable the S-curve function of RFG (F0-45 = 1) to gradually release the elastic energy and decrease the elastic deformation caused by sudden changes in output torque. Set a shorter arc time for ramp-down end arc of ramp 1 (F0-53). Set a short shut-down delay time (d0-16) to ensure the machine stops securely before shut-down. Set a short DC braking time at stop (d0-29) to check whether the fault is rectified.

No.	Fault symptom		Possible cause	Verification method	Solution
4	SVC control errors	The output current is excessively high in vector control mode.	1 .The load is excessive. 2 .For loads such as fans and water pumps, the output current may be excessively high when energy-saving control is not used. 3 .If the output current is high only during high-speed, field-weakening operation, it may be due to low grid voltage. 4 .Incorrect motor rated parameters or wrong motor connection method (Y-type or delta type) can result in abnormal motor operation.. 5 .There may be a deviation in current sampling, even if the output current deviation is small. 6 .Dynamic auto-tuning is not performed. 7 .The output current of synchronous motor during low-speed operation in SVC mode is high. 8 .With overmodulation enabled in vector control mode, asynchronous motors output slightly higher current when operating in no-load, field-weakening range. 9 .The output current is excessively high during normal operation.	1 .Compare the output current of two drives with the same power. If only one drive shows a high output current, it may indicate a mechanical issue. 2 .Check whether energy-saving control is enabled under loads such as fans and water pumps. 3 .Check whether the grid voltage is excessively low. If yes, increase overmodulation. 4 .Check whether the basic motor parameters are faulty. If the output current of the motor is still high during no-load operation in V/f mode, the rated motor parameters may be incorrect. 5 .There may be a 1% deviation in output current sampling of the drive. If there is a small current deviation, use the same current clamp to test whether the high output current is caused by sampling deviation. 6 .It is recommended to perform a complete dynamic auto-tuning in vector control mode. For the initial commissioning of batch applications, a complete no-load auto-tuning is recommended. Download complete parameter files for batch replication. 7 .Inject current to low-speed synchronous motors in SVC mode to ensure current stability. 8 .During high-speed, no-load operation, the field-weakening depth of the asynchronous motors decreases, output current slightly increases, and load-carrying capacity improves. During loaded operation, the output current decreases. 9 .Other possible causes lead to the fault.	1 .If a mechanical fault occurs, optimize the mechanical design and assembly. If the fault persists, select a motor of higher power rating. 2 .For steady-state loads such as fans and water pumps, set d5-25 to 1 to enable energy-saving control of asynchronous motor, which can effectively reduce energy consumption. 3 .In the high-speed field weakening range, set A5-06 to 107% to increase voltage utilization, which can decrease the output current. 4 .Set the rated motor parameters correctly. Some motor nameplates list multiple sets of motor parameters, so ensure the correct set is selected. If motor parameters are set correctly but the output current is still high, decrease the rated motor voltage. 5 .Use the same current clamp for output current measurement and sampling. 6 .Performing dynamic auto-tuning or downloading all parameters after dynamic auto-tuning can partially address the issue of high output current. 7 .This is normal and requires no intervention. 8 .This is normal and requires no intervention. 9 .Contact Inovance for technical support.

No.	Fault symptom		Possible cause	Verification method	Solution
4	SVC control errors	The deceleration time for large inertia models is excessively long.	1 .The set deceleration time does not match the deceleration time required by the user. 2 .Without a braking resistor, the motor generates power during deceleration, which causes the bus voltage to rise and trigger overvoltage suppression, slowing down the motor deceleration. 3 .The generating torque limit is too low.	1 .Check whether the feedback speed (U6-00) matches the set speed (U6-01). If so, the fault can be attributed to the improper deceleration time. 2 .Check whether the bus voltage (L32-48) rises to the overvoltage suppression threshold (F2-40) and the feedback speed deviates from the set speed. If yes, the fault can be attributed to overvoltage suppression. 3 .Increase F2-30/F2-31 properly to check whether the deceleration is quickened. Excessively low generating torque rarely occurs.	1 .Decrease the ramp-down time of ramp 1 (F0-49). 2 .In vector control mode, overvoltage suppression is disabled by default. You can enable over-excitation (d0-39) to reduce the overvoltage suppression time. If the fault persists, it is recommended to install a braking resistor. 3 .Increase F2-30/F2-31 properly to raise the generating torque limit. Then, check whether the braking resistor can consume energy in quick generating state and whether there is a risk of overvoltage.
		The speed fluctuates greatly during high-speed, field-weakening operation.	The field-weakening control bandwidth is insufficient, resulting in motor resonance.	Motor resonance occurs in field-weakening range. When the output voltage no longer increases as the speed increases, it indicates that the motor enters field-weakening range.	Set d4-17 to 5 and restart the drive.

No.	Fault symptom		Possible cause	Verification method	Solution
4	SVC control errors	The actual speed during high-speed, field-weakening operation cannot reach the set value.	1 .The torque is limited. 2 .The torque limit results in insufficient power output.	1 .Check whether the output torque reaches the torque limit (d1-09). 2 .Increase the disturbance torque coefficient (d1-23) and check whether the actual speed can follow the set speed.	1 .Increase the torque limit (d1-09). 2 .Increase the disturbance torque coefficient (d1-23).
		During quick accelera tion/ decelera tion, the motor output torque fluctuates, with unusual noise generated.	The acceleration and deceleration is too fast, resulting in deviation between the feedback current and the current reference.	Set d4-17 to 5 and restart the drive.	Set d4-17 to 5 and restart the drive.

No.	Fault symptom		Possible cause	Verification method	Solution
4	SVC control errors	The motor starts in reverse direction.	1 .The magnetic pole position auto-tuning angle of the synchronous motor is incorrect. 2 .The SVC control at low speed is unstable. 3 .There is an additional torque in the reverse direction, which causes the motor to operate in reverse direction upon startup. 4 .For active loads, when the output torque is lower than the load during startup, the motor operates in reverse direction. This usually occurs in applications with a brake.	1 .Keep the motor in a stopped state and repeatedly start it at 0 speed. Check whether the flux angle (magnetic pole position auto-tuning angle) is stable. 2 .Check whether the feedback speed fluctuates greatly and whether the output torque is excessively high. 3 .Check whether additional torque (b5-24/b5-25/b5-26/b5-27) is set, as this can result in abnormal shock to the motor upon startup. 4 .Active loads are mainly hoisting loads or elastic loads. During startup, the release of gravity or elastic potential energy can cause the motor to operate in reverse direction.	1 .Increase the magnetic pole position auto-tuning current (d0-75/d6-53). 2 .Contact the technical support. 3 .Set b5-24/b5-25/b5-26/b5-27 to 0. The default value is 0. 4 .Increase the speed loop Kp (F2-02) properly to speed up the response. The user can also set a proper starting frequency (d0-23) and starting frequency hold time (d0-24) to speed up the response.
		The torque output capacity of the motor in SVC mode is insuffi cient, but the displayed output torque is much higher than the actual load.	1 .The motor inductance is incorrect. 2 .The back EMF of the synchronous motor or the motor stator resistance is incorrect, which can affect the low-speed torque output capacity in SVC mode. 3 .The model parameters of the drive does not match the actual model, resulting in incorrect auto-tuning parameters and operation failure.	1 .Check whether a complete parameter auto-tuning is performed. 2 .Disconnect the motor and perform a complete no-load dynamic auto-tuning to obtain the correct motor parameters. 3 .Check whether the model parameters (A3-02 to A3-04) correspond to the nameplate.	1 .It is recommended to perform a complete parameter auto-tuning. Values recommended by the motor manufacturer may differ from the auto-tuned values. The auto-tuned values should prevail. 2 .Disconnect the motor and perform a complete no-load dynamic auto-tuning to obtain the correct motor parameters. 3 .Ensure that the model parameters (A3-02 to A3-04) match the values indicated on the nameplate.

No.	Fault symptom		Possible cause	Verification method	Solution
4	SVC control errors	The load-carrying capacity of the drive during startup in SVC mode is insufficient and low-frequency operation occasionally gets stuck.	1 .The motor model parameters are incorrect. 2 .The acceleration time in SVC mode is too long, which causes the drive to operate near 0 speed for a long time, resulting in occasional divergence. 3 .The speed loop parameters at 0 speed are too low, resulting in slow output torque rise and divergence when the motor operates at 0 speed for too long. 4 .The magnetic pole position auto-tuning is incorrect, resulting in insufficient load-carrying capacity during startup.	1 .It is recommended to perform a complete dynamic parameter auto-tuning to check whether the condition improves and to check whether the drive model setting is correct. 2 .Decrease the acceleration time to check whether the drive still gets stuck during startup in SVC mode. 3 .Increase d3-07 and decrease d3-08 to intensify the speed loop near speed 0. Check whether the motor still gets stuck during startup. 4 .Increase the initial position detection current of the synchronous motor (d0-75/d6-53).	1 .Ensure that the drive model and the motor auto-tuning parameters are correct. It is recommended to perform a complete no-load dynamic auto-tuning. If not possible, write correct back EMF values and perform a static auto-tuning (C2-00 = 13). 2 .If the system is not sensitive to acceleration time, reduce the acceleration time coefficient at low speed (b7-41) and set b7-42 to 3% to accelerate the drive at low speed. 3 .Increase d3-07 and decrease d3-08 to intensify the speed loop near speed 0. 4 .Increase the initial position detection current of the synchronous motor (d0-75/d6-53).
		The operating speed overshoot is high.	In vector control mode, the integral effect of the speed loop parameters is strong (integral Ti is too small) and Kp is small, resulting in slow integral reset and output overshoot.	Increase Kp (F2-02) and Ti (F2-03) to check whether overshoot is alleviated.	1 .Increase Kp (F2-02) and Ti (F2-03). 2 .Enable feedforward control. See section "Acceleration Torque Feedforward Adjustment" in the user guide for how to adjust the feedforward.
		The acceleration of high inertia models is slow.	1 .The output torque limit is excessively low, resulting in a low average output torque during acceleration. 2 .The speed loop parameters are excessively low, resulting in a long time to reach the maximum torque.	1 .Increase the output torque limit (F2-30/F2-31) properly and check whether the acceleration time becomes faster. 2 .Increase the speed loop Kp (F2-02) properly and check whether the acceleration time becomes faster.	1 .Increase the output torque limit (F2-30/F2-31) properly. 2 .Increase the speed loop Kp (F2-02) properly.

No.	Fault symptom		Possible cause	Verification method	Solution
4	SVC control errors	The motor creeps at 0 rpm in SVC mode, which may result in overcurrent occasionally.	When the drive operates at low speed in SVC mode, the back EMF is low and the observed speed is inaccurate. Prolonged operation at 0 speed may result in faults such as model divergence and overload.	Slightly increase the motor operating speed (2%) to stabilize the motor operation. When the set speed is 0, the motor runs unstably. If I/F mode is not enabled when running at zero speed, faults can occur.	For synchronous motors in SVC mode, I/F control can be enabled (set the tens of d0-85 to 1) to keep the motor speed at 0 rpm. For asynchronous motors in SVC mode, you can make the asynchronous motor enter DC mode at zero speed (d6-27 = 2) to keep the motor speed at 0 rpm.
		There is a significant delay in the actual operation of the motor after the start key is pressed.	1 .Pre-excitation of the asynchronous motor is delayed. 2 .The DC braking start time and starting frequency time have been set.	1 .Observe through an oscilloscope whether acceleration starts after the set time elapses upon an operation command and whether the feedback speed is consistent with the speed reference during acceleration. 2 .Check whether the DC braking start time or starting frequency time is not 0.	1 .Increase the pre-excitation current (d0-19) properly to enhance startup capability. 2 .Set the DC braking start time and starting frequency time to 0 (d0-24 = 0/d0-25 = 0).
		Multiple asynchronous motors receive the start command at the same time but motors does not start at the same time.	Asynchronous motors vary in size and pre-excitation completion time. Therefore, even if the start command is sent at the same time, acceleration is not started at the same time	The motor size and specifications are different. Generally, the startup time is not consistent.	Set d0-17 (Pre-excitation mode) to 0 (Pre-excitation based on time) for all drives and then set the pre-excitation time (d0-18) of the drives to the same value.

No.	Fault symptom		Possible cause	Verification method	Solution
5	Motor errors	Electric corrosion occurs on the motor bearing.	Electric corrosion is usually caused by improper grounding and non-insulated bearing in the non-drive end bearing of the motor.	Pits and depressions exist on the inner and outer rings of the bearing and the rolling elements, with discoloration due to metal burning.	Connect the grounding terminal of the motor to the grounding terminal of the drive, and ensure the ground of the drive is grounded properly to the earth. The motor non-drive end must be equipped with an insulated bearing.
		The synchro nous motor is demagne tized.	1 .The carrier frequency is set improperly, resulting in excessive current harmonics and abnormal motor temperature rise. 2 .The motor oscillates and generates excessive heat during operation. 3 .The motor back EMF harmonics are excessive and the coercivity is low, which may easily incur demagnetization. 4 .The motor is not in a well-ventilated environment.	1 .Use an oscilloscope to check whether the U/V/W phase current waveforms demonstrate adequate sinusoidal integrity. 2 .Check that the carrier frequency setting is sufficient, with a carrier ratio higher than 12 at least. 3 .For high-speed motors and motors with low inductance, select a proper reactor or LC filter. 4 .Measure whether the motor temperature rise during operation is normal.	1 .Perform complete parameter auto-tuning. 2 .Set the carrier frequency to a value higher than the maximum output frequency x 12. 3 .For high-speed motors and motors with low inductance, select a proper reactor or LC filter. Observe whether the excitation current, torque current, and rotor speed fluctuate greatly (higher than 6%) during operation. 4 .Take external heat dissipation measures. For example, improve the cooling conditions, increase the flow of the water-cooled motor to reduce the water temperature, and prevent the hot air from entering the fan of an air-cooled motor. Keep the motor away from other heating sources and check whether the air duct is blocked.

No.	Fault symptom		Possible cause	Verification method	Solution
5	Motor errors	The system efficiency is not good.	The process does not match the pump's optimal efficiency point in terms of head, flow rate, and velocity.The process mismatch leads to poor efficiency, mismatch between the forward flow rate and the actual optimal efficiency point of the pump, energy loss due to improper piping design, and large pressure flow fluctuation due to improper process parameters.	1 .Check whether the operating speed of the drive fluctuates dramatically and regularly. 2 .Check whether the actual efficiency deviates greatly from the design efficiency.	Contact the technical support.
			Misalignment in installation of the motor output shaft results in energy loss.	1 .Measure the installation alignment accuracy of the motor with an alignment tool. 2 .Measure the radial runout using a micrometer.	Ensure proper alignment is achieved, then measure the efficiency again.
			The commissioning parameters of the drive are set improperly, resulting in poor system efficiency.	After checking that mechanical conditions are proper, observe whether the motor speed fluctuates cyclically.	Perform commissioning again according to the process. If the fault persists, contact the technical support.
5	Motor errors	The noise is excessive.	1 .The excessive noise may be caused by mechanical noise, improper mechanical installation alignment, and mechanical damage. 2 .The electromagnetic noise is excessive.	1 .For mechanical noise, increase the operating speed and then perform a coast-to-stop to check whether the noise is cleared. 2 .For electromagnetic noise, change the carrier frequency and check whether the noise is reduced.	1 .Optimize the mechanical system. 2 .Increase the carrier frequency (A5-01) properly. Enable random PWM (set different depths through A5-11) in V/f mode.
		The motor vibration is excessive.	1 .Jitter occurs in the speed control. 2 .The motor installation is misaligned, resulting in jitter. 3 .Excessive vibration occurs during operation of the motor due to jitter on the load end. 4 .The motor cogging torque fluctuation results in speed fluctuation.	1 .Observe whether the output torque and output speed oscillate through waveforms in the software tool. 2 .Disassemble the coupling and observe whether jitter is cleared. 3 .Increase the operating speed and then perform a coast-to-stop after the drive stops to check whether vibration is cleared. 4 .Obvious torque fluctuation occurs during no-load operation of the motor, especially during operation at low speed. The fluctuation is significantly reduced after the speed is increased.	1 .Adjust the AC drive control. If the fault persists, contact Inovance for technical support. 2 .Ensure the motor shaft is correctly aligned. 3 .Analyze the mechanical causes. 4 .Contact the technical support.

No.	Fault symptom		Possible cause	Verification method	Solution
5	Motor errors	Motor temperature rise is excessive.	1 .The output current is high, and the load is excessive. 2 .The heat dissipation conditions of the motor are improper. 3 .The carrier frequency is low, and the current harmonics are excessive. 4 .High input voltage causes high bus voltage, large voltage harmonics, leading to increased current harmonics. 5 .In long cable applications, current harmonics increase, resulting in motor temperature rise.	1 .Check whether the motor load is excessive. 2 .Check whether the cooling fan of the motor works properly, whether the air duct is blocked, and whether the cooling water temperature and flow of the water-cooled motor meet the requirements. 3 .Check whether the carrier frequency of the drive meets the control requirements and whether the carrier frequency ratio is greater than 12. 4 .Check whether the grid voltage is excessively high (> 420 V). 5 .In long cable applications, ground capacitance is present. Extended cable lengths induce natural reflections that intensify output current harmonics. The higher the carrier frequency, the higher the current harmonics, and the higher the temperature rise can be.	1 .Reduce the load properly. 2 .Ensure that the fan works properly, the air duct is not blocked, and the cooling water temperature and flow meet the requirements. 3 .Ensure the carrier frequency is greater than 12, and check whether the carrier frequency meets motor requirements. 4 .If high grid voltage causes increased motor temperature, increase the carrier frequency (A5-01) properly. 5 .In long cable applications, reduce the carrier frequency properly to effectively reduce motor temperature rise and the overvoltage surge caused by voltage reflection.

No.	Fault symptom		Possible cause	Verification method	Solution
5	Motor errors	The motor generates noise upon start and the noise disappears during operation.	1 .Asynchronous motor: By default, the motor starts with current excitation. Some motors may generate excitation noise when the pre-excitation current is high. 2 .Synchronous motor: A bumping sound can be generated when magnetic pole position auto-tuning is performed through the pulse method.	1 .Asynchronous motor: Check whether the pre-excitation method is time-based excitation. 2 .Synchronous motor: Check the magnetic pole position auto-tuning method, try auto-tuning with high frequency injection.	1 .Asynchronous motor: Set the pre-excitation method to time-based excitation (d0-17 = 0), and increase the pre-excitation time properly. 2 .Synchronous motor: Try magnetic pole position auto-tuning with high frequency injection (d0-71 = 1) to reduce the noise during initial position auto-tuning.
		Motor resonance occurs.	An inherent oscillation frequency is present in the machine. When the motor runs to this frequency, resonance can occur between the motor and the machine.	In motor resonance, obvious current/torque oscillation occurs at a specific speed point. Operations at speeds lower than or higher than this specific point are normal without resonance.	1 .Set frequency jump function to prevent the set speed from being equal to the resonance frequency, avoiding the machine from running in the resonance state for a long time. 2 .Reduce the speed loop Kp (F2-02) properly and increase Ti. 3 .Set a low torque current filtering time, such as d3-48 = 5 ms. The above measures are used to mitigate the impact of the resonance point. To eliminate resonance, the root cause must be rectified.
6	FVC control errors	The motor is stalled during operation in FVC mode.	1 .The encoder slips. 2 .The encoder signal is being disturbed seriously.	1 .In the SVC mode, observe whether the speed deviation between L3000 (actual motor speed) and L3004 (encoder feedback speed) occurs during acceleration/deceleration and high-speed operation. If L3000 is normal but L3004 deviates greatly, the encoder slips. 2 .In the SVC mode, observe whether obvious spikes exist in the encoder feedback speed. The higher the number of spikes, the more serious the interference can be. Be aware that even an individual spike that occur occasionally need to be handled properly.	1 .Ensure the encoder is installed securely and perform parameter auto-tuning again on the synchronous motor. Set C2-00 to 12 to perform no-load dynamic complete auto-tuning of permanent magnet motors. 2 .The encoder shield is grounded on the encoder card. The motor grounding terminal and the input end of the drive need to be grounded. If interference persists, contact technical support.

No.	Fault symptom		Possible cause	Verification method	Solution
6	FVC control errors	The synchro nous motor has high output current but poor load-carrying capability.	1 .The load is excessive. 2 .The motor is demagnetized. 3 .High friction or high load inertia exists in the system. 4 .Motor parameters are inaccurate or not auto-tuned. 5 .The orientation angle is incorrect.	1 .Check the mechanical coupling and system structure. Check whether the output torque has reached the set torque limit. 2 .Record the current back EMF value [F1-12] and perform no-load complete auto-tuning again to check whether the newly auto-tuned back EMF is lower than the initially auto-tuned value. 3 .Check the output torque in no-load or low-load operations. If the value is high, friction torque exists in the system. Run the motor at a high speed and make the motor coast to stop. If the coast-to-stop process is long, the load inertia is high. 4 .Check motor nameplate parameters and verify whether parameters in group F1 have been updated. 5 .Check encoder-related parameters and perform complete no-load auto-tuning again.	1 .Adjust the load. If the output torque reaches the limit, replace with a motor of higher power rating. If drive overload occurs, re-confirm the drive selection. 2 .Analyze the demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, excessive motor back EMF, and excessive output current harmonics. If the motor is replaced directly, demagnetization may occur again. If the fault persists though preceding measures are taken, use a drive with a higher power rating. 3 .Increase the feedforward torque coefficient through d3-39 [RFG feedforward torque coefficient selection] to perform inertia compensation. 4 .Check motor nameplate parameters and perform complete no-load auto-tuning again. 5 .Check encoder-related parameters and perform complete no-load auto-tuning again.

No.	Fault symptom		Possible cause	Verification method	Solution
6	FVC control errors	Unusual noise is generated by the device once upon revolution of the synchro nous motor with an ABZ encoder.	1. Passive load mechanical couplings have non-smooth characteristics, such as insufficient circularity in rotating structures. 2. The encoder has significant radial runout.	1. Run in SVC mode to a high speed, select coast-to-stop as the stop mode, and observe with an oscilloscope whether the encoder feedback speed fluctuates. If the mechanical coupling is improper, cyclic unusual noise can be generated. 2. Use a dial indicator to measure the radial runout of the encoder shaft end. For applications requiring high speed accuracy, the runout should generally be less than 0.01 micrometer.	1. Verify mechanical connections to ensure proper frictional engagement. 2. Check encoder radial runout. You can re-install the encoder or shorten the encoder output shaft length.
		The load-carrying capacity at start of the asynchro nous motor in FVC mode is insuffi cient.	1 .The load is excessive. 2 .The pre-excitation is insufficient. 3 .High friction or high load inertia exists in the system. 4 .Motor parameters are inaccurate or not auto-tuned. 5 .The orientation angle is incorrect.	1 .Check the mechanical coupling and system structure. Check whether the output torque has reached the set torque limit. 2 .Run the motor without load with the shaft disconnected and verify that the flux detection value (U6-37) is lower than 80%. 3 .Check the output torque in no-load or low-load operations. If the value is high, friction torque exists in the system. Run the motor at a high speed and make the motor coast to stop. If the coast-to-stop process is long, the load inertia is high. 4 .Check motor nameplate parameters and verify whether parameters in group F1 have been updated. 5 .Check encoder-related parameters and perform complete no-load auto-tuning again.	1 .Adjust the load. If the output torque reaches the limit, replace with a motor of higher power rating. If drive overload occurs, re-confirm the drive selection. 2 .Perform static auto-tuning again and check whether the pre-excitation time setting (d0-18) changes. If not, appropriately extend the pre-excitation time. 3 .Increase the feedforward torque coefficient through d3-39 [RFG feedforward torque coefficient selection] to perform inertia compensation. 4 .Check motor nameplate parameters and perform complete no-load auto-tuning again. 5 .Check encoder-related parameters and perform complete no-load auto-tuning again.

No.	Fault symptom		Possible cause	Verification method	Solution
6	FVC control errors	The torque accuracy and torque linearity are insuffi cient.	1. Motor parameters are not accurate or auto-tuned. 2. The alignment angle is not correct. 3. Encoder feedback speed fluctuates. 4. Bearing wear or uneven lubrication distribution exists in the system.	1. Check the motor nameplate parameters and verify whether parameters in group F1 have been updated. 2. Check encoder-related parameters and perform complete no-load auto-tuning again. 3. Refer to the verification methods for abnormal encoder speed fluctuation. 4. Check the output torque during no-load operation. If significant fluctuation at mechanical frequency is present, the fault is caused by the fluctuation. Unusual noise can be generated together with the mechanical factors, which is easy to detect.	1. Check the motor nameplate parameters and perform complete no-load auto-tuning again. 2. Check encoder-related parameters and perform complete no-load auto-tuning again. 3. Refer to the verification methods for abnormal encoder speed fluctuation. 4. Check the mechanical installation and lubrication.
		Excessive speed fluctuation	1. Fluctuation exists in the active loads. 2. Passive load mechanical couplings have non-smooth characteristics, such as insufficient circularity in rotating structures. 3. The encoder has significant radial runout. 4. The loop gain is too high.	1. Run in SVC mode to a high speed, select coast-to-stop as the stop mode, and observe with an oscilloscope whether the encoder feedback speed fluctuates. 2. Run in SVC mode to a high speed, select coast-to-stop as the stop mode, and observe with an oscilloscope whether the encoder feedback speed fluctuates. If the mechanical coupling is improper, cyclic unusual noise can be generated. 3. Use a dial indicator to measure the radial runout of the encoder shaft end. For applications requiring high speed accuracy, the runout should generally be less than 0.01 micrometer. 4. If the fluctuation is not caused by feedback signal or load, the loop gain may be too high. Try reducing F2-00 [Speed loop Kp in FVC] and increasing F2-01 [Speed loop Ti in FVC], then check whether the speed fluctuation decreases.	1. Properly increase F2-00 [Speed loop Kp in FVC] and decrease F2-01 [Speed loop Ti in SVC]. Adjust the encoder speed filter time properly and increase loop values for active loads. 2. Check mechanical coupling to ensure proper frictional engagement. 3. Check encoder radial runout. You can re-install the encoder or shorten the encoder output shaft length. 4. Try reducing F2-00 [Speed loop Kp in FVC], increasing F2-01 [Speed loop Ti in FVC], and increasing the encoder speed measurement filter time.
		The speed overshoot is high.	In vector control, overshoot is usually caused by excessive integral gain and inadequate proportional gain in the speed loop, resulting in sluggish integral desaturation that induces output overshoot.	Increase F2-00 [Speed loop Kp in FVC] and F2-01 [Speed loop Ti in FVC], and observe whether overshoot is alleviated.	1. Increase F2-00 [Speed loop Kp in FVC] and F2-01 [Speed loop Ti in FVC]. 2. Enable feedforward control. For details, see the user guide.

No.	Fault symptom		Possible cause	Verification method	Solution
6	FVC control errors	The motor speed is unstable during operation at low speed.	1. The DC bus voltage fluctuation is excessive. 2. Bearing wear or uneven lubrication distribution exists in the system. 3. The load fluctuates. 4. The speed reference fluctuates. 5. The encoder feedback signal fluctuates greatly. 6. Speed loop or current loop parameters are set improperly.	1. Check the fluctuation of DC bus voltage (L3248). If the peak fluctuation is higher than 15 V, check the upstream power grid. 2. Check the output torque during no-load operation. If significant fluctuation at mechanical frequency is present, the fault is caused by the fluctuation. Unusual noise can be generated together with the mechanical factors, which is easy to detect. 3. Run the motor with load to the medium speed and then perform coast-to-stop. Check whether fluctuation exists in the system with an oscilloscope. If yes, the fault is caused by the load. 4. Check whether the final motor speed reference (L3002) fluctuates with an oscilloscope. 5. Check whether interference exists in the encoder feedback signal through the oscilloscope. 6. Check the torque current reference (L3222) and torque current feedback (L3226) through the oscilloscope. If the torque current reference fluctuates, the speed loop parameters need to be adjusted. If the torque current reference does not fluctuate, but the torque current feedback fluctuates, the current loop parameters need to be adjusted.	1. Check the cause of fluctuation in the upstream power grid. 2. Check mechanical installation and lubrication. 3. Re-check the load installation method. 4. Check the signal sent from the host controller. 5. Check whether the encoder shielded cable is connected properly. Rule out the interference source. Increase the encoder speed measurement filter time constant (C0-05). 6. If the torque current reference fluctuates, decrease F2-00 [Speed loop Kp in FVC mode] and increase F2-01 [Speed loop Ti in FVC mode]. If the torque current reference (L3222) does not fluctuate, but the torque current feedback (L3226) fluctuates, reduce d4-02 [Current loop q-axis Kp coefficient] and d4-03 [Current loop q-axis Ki coefficient].
		The motor operates properly at low speed but is stalled with speed loss at high speed.	1. The bus voltage is low. 2. The voltage margin is insufficient. 3. The motor parameters are not accurate. 4. The encoder feedback signal is being disturbed.	1. Use the oscilloscope in the software tool to check the value of the DC bus voltage (L3248). If the DC bus voltage is low, check the upstream power grid. 2. Use the oscilloscope in the software tool to check whether the output voltage stops increasing after a certain speed. 3. Check the motor nameplate parameters and perform complete no-load auto-tuning again. 4. Check whether interference exists in the encoder feedback signal through the oscilloscope.	1. Check whether the encoder shielded cable is connected properly and remove the interference source. 2. Calibrate the encoder installation. Ensure that the misalignment error between the coupling and encoder rotor shaft is within 0.03 mm. Reduce the length of the encoder mounting shaft to effectively reduce speed fluctuation. If the fault persists, set d7-02 to 1 to switch to SVC control at high speed.

No.	Fault symptom		Possible cause	Verification method	Solution
7	Encoder-related errors	No speed feedback is received from the ABZ encoder.	1. The encoder is wired improperly. 2. The encoder is installed improperly. 3. The encoder signal cable output is abnormal. 4. Encoder parameters are set improperly. 5. The PG card operates improperly. 6. Other fault causes lead to the fault.	1. Check the encoder wiring according to the user guide. Ensure that signal cables, power cables, and shield cables are connected properly. 2. Check that the encoder is installed properly, the shaft is aligned, and the shielded cable is not loose or displaced during operation in SVC mode. 3. Use a differential probe to check whether the encoder A, B, and Z signal cables generate output normally. 4. Check that the encoder type (C0-00), encoder phase sequence (C0-03), and encoder pulses per revolution (C0-02) are set correctly. 5. Check that the PG card is installed correctly and the indicators operate properly. 6. Contact Inovance for technical support.	1. Check the wiring, especially ensuring proper connection of the shielded cables. 2. Set the control mode to SVC, run within the operational range, and observe whether the encoder installation is secure and whether any displacement occurs. If yes, install the encoder again. 3. Use a differential probe to check whether the encoder A and B outputs are differential signals, and whether the Z signal output frequency matches the motor mechanical frequency. If interference is excessive, remove the interference source and check the shielded cable. 4. Check that the encoder type (C0-00), encoder phase sequence (C0-03), and encoder pulses per revolution (C0-02) are set correctly, and perform complete auto-tuning. 5. See the PG card user guide for troubleshooting. 6. Contact Inovance for technical support.
		Encoder feedback speed fluctuates.	1. Fluctuation exists in the active loads. 2. Passive load mechanical couplings have non-smooth characteristics, such as insufficient circularity in rotating structures. 3. The encoder has significant radial runout. 4. The loop gain is too high.	1. Run in SVC mode to a high speed, select coast-to-stop, and observe with an oscilloscope whether the encoder feedback speed fluctuates. 2. Run in SVC mode to a high speed, select coast-to-stop, and observe with an oscilloscope whether the encoder feedback speed fluctuates. If the mechanical coupling is improper, cyclic unusual noise can be generated. 3. Use a dial indicator to measure the radial runout of the encoder shaft end. For applications requiring high speed accuracy, the runout must be less than 0.01 micrometer. 4. If fluctuation is not caused by feedback signal or load, the loop gain may be too high. Try reducing speed loop Kp in FVC mode and increasing speed loop Ti in FVC mode. Then check whether the speed fluctuation is alleviated.	1. Increase F2-00 and decrease F2-02 properly. Reduce C0-05 properly and increase loop values for active loads. 2. Check mechanical coupling to ensure proper frictional engagement. 3. Check encoder radial runout. You can re-install the encoder or shorten the encoder output shaft length. 4. Try reducing F2-00 and increasing F2-02 and C0-05].

No.	Fault symptom		Possible cause	Verification method	Solution
7	Encoder-related errors	Encoder feedback speed spikes exist.	Interference exists during the transmission of encoder feedback signals.	1. Check whether the shielded cable is connected properly. 2. Use a differential probe to check whether there are spikes in the original encoder signal output. You can increase the value of n5-17.	1. Pay attention to the proper connection of the shielded cable. 2. You can increase C0-05 [Encoder speed filter time constant] to reduce feedback spikes, but the system dynamic response is reduced as well.

7.8 Solutions to Common EMC Problems

The drive draws current from the power grid in a pulsating and intermittent manner to absorb energy, which can result in significant harmonic emissions from the drive. When there are power quality requirements on site, take the measures described in *"7.8.1 Harmonic Suppression Solution" on page 1171*.

The drive is a strong interference source. If the cabinet wiring, grounding, and system configuration are improper during use, electromagnetic noise interference such as cable coupling interference and common ground impedance interference may be generated, resulting in malfunction or performance degradation of the system, such as residual current device malfunction, common I/O signal jump, high-speed pulse I/O count error, and communication interruption. When mutual interference occurs between the drive and other devices, take the measures described in *"7.8.2 Residual Current Device Malfunction" on page 1172*, *"7.8.3.2 Common I/O Signal Interference" on page 1174*, *"7.8.4 RS485 Communication Interference" on page 1175*, and *"7.8.5 EtherCAT, EtherNet IP, and PROFINET communication interference" on page 1175*.

7.8.1 Harmonic Suppression Solution

The drive draws energy from the power grid by sourcing current in a pulsating and discontinuous manner. This pulsating current, combined with the line impedance of the grid, generates a pulsating voltage drop that superimposed on the grid voltage, resulting in voltage distortion.

The harmonics generated by the AC drive can cause power loss and interference due to the following:

- Increased mean root value of the total input current (up to 50%)
- Voltage distortion of the power supply (voltage harmonics)
- Power factor reduction
- Overload, noise, and vibration of transformers, cables, and other electrical components
- Interference to sensitive surrounding devices
- Resonance hazard: Parallel resonance and series resonance in the public power grid

Therefore, harmonic suppression is required in the following cases:

- The relevant standards must be met.
- High quality of the on-site power grid is required.

- A certain power factor of the device is required.

No.	Requirement	Remarks
1	The requirements of class A or table 4 in IEC 61800-3/IEC 61000-3-12 must be met	/
2	High harmonics requirements include IEEE519, GB/T14549, or customized harmonics < 10%	The passive harmonic filter is recommended.

7.8.2 Residual Current Device Malfunction

To prevent the leakage current protection circuit breaker from acting improperly, we need to select a proper type of leakage current protection circuit breaker. During AC drive use, the high frequency leakage current caused by IGBT action will affect the action of the leakage circuit breaker. Therefore, select a leakage protection of not less than 100 mA for each AC drive.

When multiple AC drives connected in parallel share one RCD, the operating current of the RCD must be not lower than 300 mA.

It is recommended to use Chint or Schneider RCDs.

In case of on-site current leakage or tripping, see the following table for specific solutions.

Table 7–7 Measures against leakage current

Tripping	Possible cause	Step
Tripped upon power-on	The anti-interference performance of the RCD is poor.	1 .Use an ELCB of a recommended brand. 2 .Use an ELCB with a higher tripping current. 3 .Move the unbalanced load to the front end of the ELCB. 4 .Disconnect the EMC screw or the grounding terminal of the external EMC filter to reduce the ground capacity of the input end.
	The action current of the RCD is too low.	
	Unbalanced load is connected to the back end of the RCD.	
	The capacitance to the ground at the front end of the AC drive is large.	
Trip during operation	The anti-interference performance of the earth leakage circuit breaker is poor.	1 .Use a RCD from a recommended manufacturer. 2 .For an individual AC drive, tighten the EMC screw. For multiple AC drives, disconnect the optional EMC grounding screw, as shown in the following figures . 3 . 4 .Install a simple filter on the input side of the drive, and wind the LN/RST cables through a magnetic ring near the RCD, as shown in the following figure . 5 .Replace with an ELCB with a higher rated tripping current. 6 .Reduce the carrier frequency while ensuring performance. 7 .Use shorter motor cables.
	The action current of the RCD is too low.	
	Unbalanced load is connected to the back end of the RCD.	
	For motor cables and the motor, the distributed capacitance to ground is too high.	

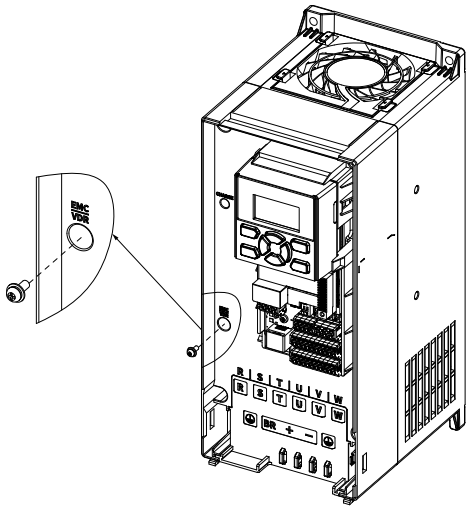


Figure 7-2 Disconnecting optional EMC grounding screw

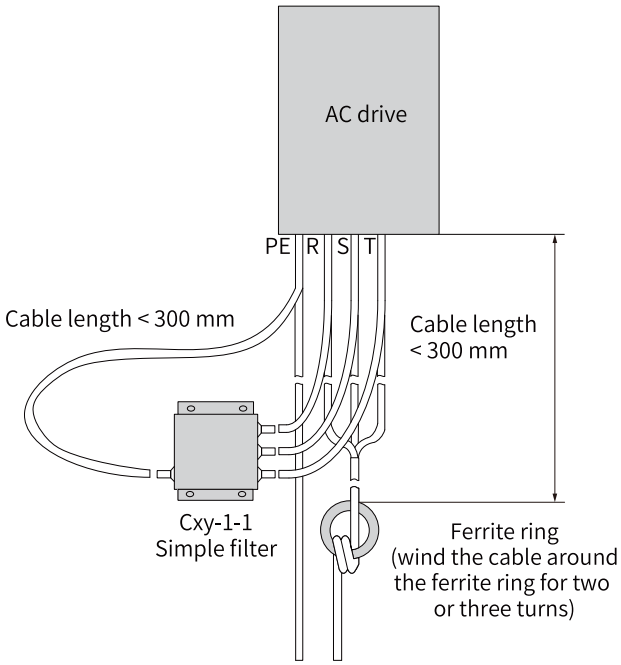


Figure 7-3 Installing a simple filter and magnetic ring on the input side

7.8.3 I/O Signal Interference

7.8.3.1 High-Speed Pulse Interference

Refer to the following table to rectify the high-speed pulse interference.

No.	Step
1	Use shielded twisted pair cables and ground them at both ends (see *" Control Circuit Connection" on page 100* for details).
2	The motor enclosure is connected to the PE end of the AC drive.
3	Connect the PE end of the AC drive to the PE end of the grid.
4	Add an equipotential grounding cable between the host controller and the AC drive (see *"3.4.1 EMC-Compliant Cabinet Design" on page 78* for details).
5	Separate signal cables from power cables with a distance of at least 30 cm.

No.	Step
6	Install a ferrite clamp to the signal cable or wind the signal cable around the ferrite core by 2 to 4 turns (see the installation diagram of ferrite core).
7	Wind the U/V/W cables of the drive around the ferrite core by 2 to 4 turns (see the ferrite core installation diagram for details).
8	Use shielded power cables and ground the shield properly.

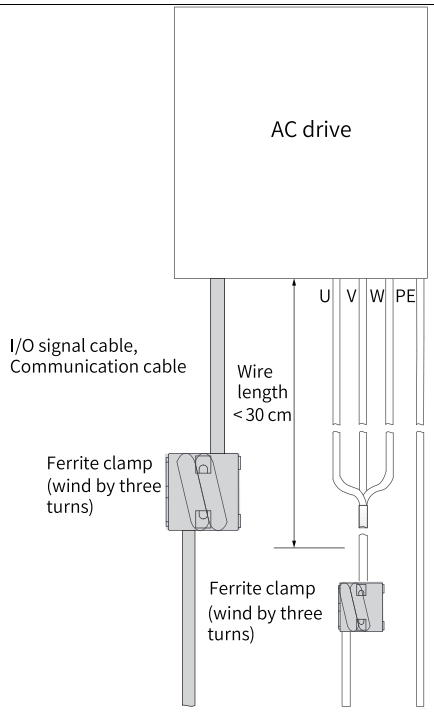


Figure 7-4 Ferrite core installation

7.8.3.2 Common I/O Signal Interference

Refer to the following table for troubleshooting common I/O signal interference.

No.	Step
1	The I/O signal cable is shielded with the shield connected to the PE terminal (see for details *" Control Circuit Connection" on page 100*).
2	Connect the motor PE to the PE terminal of the AC drive that connects to the PE of the mains power supply.
3	Add an equipotential grounding cable between the host controller and the AC drive (see for details) *"3.4.1 EMC-Compliant Cabinet Design" on page 78*.
4	Add a magnetic ring to the output UVW of the AC drive, and wind it around for two to four turns (see the *"7.8.3.1 High-Speed Pulse Interference" on page 1173*installation of the magnetic ring diagram).
5	Increase the capacitor filter at low-speed DI, with a maximum recommended value of 0.1 μF (see the diagram of increasing the filter on the I/O signal cable for details).
6	Increase the capacitor filter between AI and GND to a maximum of 0.22 μF (for details, see the diagram of increasing the filter on the I/O signal cable).
7	Add a magnetic buckle or magnetic ring to *"7.8.3.1 High-Speed Pulse Interference" on page 1173*the signal cable, and turn 1-2 turns (see the installation of the magnetic ring).
8	Use shielded power cables and ground the shield properly.

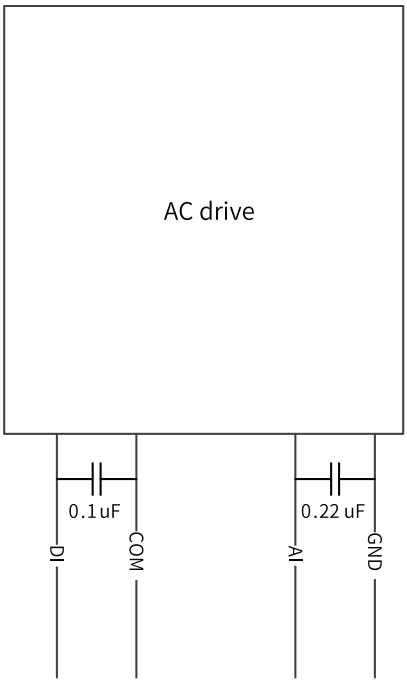


Figure 7-5 Diagram of adding filter on the I/O signal cable

7.8.4 RS485 Communication Interference

Refer to the following table to eliminate the common RS485 communication interference.

No.	Step
1	Install a 120 Ω termination resistor on each end of the bus.
2	Replace with multi-conductor shielded twisted pair cables and ground both ends of the shield.
3	Separate communication cables from power cables with a distance of at least 30 cm.
4	Adopt daisy chain mode for multi-node communication layout.
5	For multi-node communication, add an equipotential bonding grounding cable between nodes (see *"3.4.1 EMC-Compliant Cabinet Design" on page 78*).
6	Add a ferrite clamp at both ends of the communication cable or add a ferrite core at both ends of the communication cable and wind the communication cable around the ferrite core by one to two turns (see *"7.8.3.1 High-Speed Pulse Interference" on page 1173*).
7	Wind the U/V/W cables of the AC drive around the ferrite core by two to four turns (see details in *"7.8.3.1 High-Speed Pulse Interference" on page 1173*).
8	Use shielded power cables and ground the shield properly.

7.8.5 EtherCAT, EtherNet IP, and PROFINET communication interference

See the following table to rectify the communication interference of EtherCAT, EtherNet/IP, and PROFINET.

No.	Step
1	Check that the communication network cables meet the specification requirements for shielded Cat 5e cables.
2	Check that the communication port is secure and in good contact.
3	Separate communication cables from power cables with a distance of at least 30 cm.
4	For multi-node communication, add an equipotential bonding grounding cable between nodes.

5	Ensure the length of the cable between two nodes does not exceed 100 m.
6	Add ferrite clamp on both sides of the communication cable and wind it by 1 to 2 turns (see details in *"7.8.3.1 High-Speed Pulse Interference" on page 1173*).
7	Wind the U/V/W cables of the drive around the ferrite core by two to four turns (see details in *"7.8.3.1 High-Speed Pulse Interference" on page 1173*).
8	Use shielded power cables and ground the shield properly.

7.9 List of Fault Codes

7.9.1 List of Fault Codes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E002.1	Hardware overcurrent	0: Coast to stop	0: Coast to stop	Yes
E002.2	Software overcurrent	0: Coast to stop	0: Coast to stop	Yes
E002.3	Phase-W overcurrent	0: Coast to stop	0: Coast to stop	Yes
E002.4	Hardware VCE fault	0: Coast to stop	0: Coast to stop	Yes
E005.1	Bus overvoltage	0: Coast to stop	0: Coast to stop	Yes
E008.1	Contactor acting frequently	0: Coast to stop	0: Coast to stop	Yes
E009.1	Bus undervoltage	0: Coast to stop	0: Coast to stop	Yes
E009.3	Pre-drive timeout	0: Coast to stop	0: Coast to stop	Yes
E010.1	Drive overload	0: Coast to stop	0: Coast to stop	Yes
E010.2	PCB overload	0: Coast to stop	0: Coast to stop	Yes
E011.1	Motor overload	0: Coast to stop	0: Coast to stop	Yes
E012.1/A012.1/L012.1/ N012.1	Input phase loss	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Yes
E013.1	U phase loss	0: Coast to stop	0: Coast to stop	Yes
E013.2	V phase loss	0: Coast to stop	0: Coast to stop	Yes
E013.3	W phase loss	0: Coast to stop	0: Coast to stop	Yes
E014.1	Drive overtemperature	0: Coast to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E015.1/A015.1/L015.1/ N015.1	External fault 1	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Yes
E015.2/A015.2/L015.2/ N015.2	External fault 2	Same as external fault 1	0: Coast to stop	Yes
E017.1	Pre-charge contactor fault	0: Coast to stop	0: Coast to stop	Yes
E018.1	Current detection circuit fault	0: Coast to stop	0: Coast to stop	Yes
E019.1	Motor auto-tuning timeout	0: Coast to stop	0: Coast to stop	Yes
E019.2	Motor auto-tuning interrupted	0: Coast to stop	0: Coast to stop	Yes
E019.4	Back EMF auto-tuning error	0: Coast to stop	0: Coast to stop	Yes
E019.5	Incorrect motor type	0: Coast to stop	0: Coast to stop	Yes
E019.6	Current sampling phase-to-phase gain deviation auto-tuning error	0: Coast to stop	0: Coast to stop	Yes
E019.7	Auto-tuned no-load current outside the limit	0: Coast to stop	0: Coast to stop	Yes
E020.1	Encoder open circuit	0: Coast to stop	0: Coast to stop	Yes
E020.2	Encoder PPR incorrect	0: Coast to stop	0: Coast to stop	Yes
E020.3	No feedback from the encoder	0: Coast to stop	0: Coast to stop	Yes
E020.4	Encoder direction incorrect	0: Coast to stop	0: Coast to stop	Yes
E020.5	Encoder software disconnected	0: Coast to stop	0: Coast to stop	Yes
E020.6	Motor stall during zero position auto-tuning	0: Coast to stop	0: Coast to stop	Yes
E020.7	Z signal interference	0: Coast to stop	0: Coast to stop	Yes
E020.8	Z signal lost	0: Coast to stop	0: Coast to stop	Yes
E020.9	Encoder pulse disturbed	0: Coast to stop	0: Coast to stop	Yes
E021.1	Uninterrupted operation on the EEPROM timeout	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E021.2	EEPROM read error	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Yes
E021.3	EEPROM write error	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Yes
E021.4	Number of write-read operations of the EEPROM outside the setpoint within 1s	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Yes
E021.5	Internal cache of EEPROM outside the limit	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Yes
E022.1	Encoder card not activated	0: Coast to stop	0: Coast to stop	Yes
E022.4	Resolver encoder card overtemperature	0: Coast to stop	0: Coast to stop	Yes
E022.5	Encoder orientation deviation	0: Coast to stop	0: Coast to stop	Yes
E022.7	Encoder communication fault	0: Coast to stop	0: Coast to stop	Yes
E022.8	Encoder communication error	0: Coast to stop	0: Coast to stop	Yes
E022.9	PG card type error	0: Coast to stop	0: Coast to stop	Yes
E023.1	Output ground fault	0: Coast to stop	0: Coast to stop	Yes
E026.1/A026.1/L026.1/ N026.1.	Operating time reached	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E027.1/A027.1/L027.1/ N027.1	User-defined fault 1	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Yes
E027.2/A027.2/L027.2/ N027.2	User-defined fault 2	Same as user-defined fault 1	0: Coast to stop	Yes
E027.3/A027.3/L027.3/ N027.3	User-defined fault 3	Same as user-defined fault 1	0: Coast to stop	Yes
E027.4/A027.4/L027.4/ N027.4	User-defined fault 4	Same as user-defined fault 1	0: Coast to stop	Yes
E027.5/A027.5/L027.5/ N027.5	User-defined fault 5	Same as user-defined fault 1	0: Coast to stop	Yes
E027.6/A027.6/L027.6/ N027.6	User-defined fault 6	Same as user-defined fault 1	0: Coast to stop	Yes
E027.7/A027.7/L027.7/ N027.7	User-defined fault 7	Same as user-defined fault 1	0: Coast to stop	Yes
E027.8/A027.8/L027.8/ N027.8	User-defined fault 8	Same as user-defined fault 1	0: Coast to stop	Yes
E028.1/A028.1/L028.1/ N028.1	User-defined alarm 1	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	13: Alarm	Yes
E028.2/A028.2/L028.2/ N028.2	User-defined alarm 2	Same as user-defined alarm 1	13: Alarm	Yes
E028.3/A028.3/L028.3/ N028.3	User-defined alarm 3	Same as user-defined alarm 1	13: Alarm	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E028.4/A028.4/L028.4/ N028.4	User-defined alarm 4	Same as user-defined alarm 1	13: Alarm	Yes
E028.5/A028.5/L028.5/ N028.5	User-defined alarm 5	Same as user-defined alarm 1	13: Alarm	Yes
E028.6/A028.6/L028.6/ N028.6	User-defined alarm 6	Same as user-defined alarm 1	13: Alarm	Yes
E028.7/A028.7/L028.7/ N028.7	User-defined alarm 7	Same as user-defined alarm 1	13: Alarm	Yes
E028.8/A028.8/L028.8/ N028.8	User-defined alarm 8	Same as user-defined alarm 1	13: Alarm	Yes
E029.1/A029.1/L029.1/ N029.1	Cumulative power-on time reached	Same as user-defined alarm 1	13: Alarm	Yes
E030.1/A030.1/L030.1/ N030.1	Phase loss on the three output phases	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Yes
E031.1/A031.1/L031.1/ N031.1	PID feedback lost	Same as E030.1	0: Coast to stop	Yes
E032.1/A032.1/L032.1/ N032.1	Parameter reset improperly	Same as E030.1	13: Alarm	Yes
E032.2/A032.2/L032.2/ N032.2	Parameter backup error	Same as E030.1	13: Alarm	Yes
E032.4/A032.4/L032.4/ N032.4	Parameter setting error	Same as E030.1	13: Alarm	Yes
E032.6/A032.6/L032.6/ N032.6	Parameter check error upon power-on	Same as E030.1	0: Coast to stop	Yes
E032.7/A032.7/L032.7/ N032.7	Parameter backup invalid	Same as E030.1	13: Alarm	Yes
E032.8/A032.8/L032.8/ N032.8	Parameter initialization error upon power-on	Same as E030.1	0: Coast to stop	No
E032.9/A032.9/L032.9/ N032.9	Property change error	Same as E030.1	0: Coast to stop	No
E040.1	Pulse-by-pulse current limit fault	0: Coast to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E042.1/A042.1/L042.1/ N042.1	Excessive speed deviation	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	13: Alarm	Yes
E042.2/A042.2/L042.2/ N042.2	Actual speed opposite to the set speed	Same as E042.1	13: Alarm	Yes
E043.1/A043.1/L043.1/ N043.1	Motor overspeed	Same as E042.1	0: Coast to stop	Yes
E043.2/A043.2/L043.2/ N043.2	Asynchronous motor (SVC) stall	Same as E042.1	0: Coast to stop	Yes
E043.3/A043.3/L043.3/ N043.3	Synchronous motor FVC runaway	Same as E042.1	0: Coast to stop	Yes
E045.1/A045.1/L045.1/ N045.1	Motor overtemperature	Same as E042.1	0: Coast to stop	Yes
E045.2/A045.2/L045.2/ N045.2	Motor pre-overtemperature	Same as E042.1	0: Coast to stop	Yes
E046.1	Load monitoring overload fault	Same as E042.1	0: Coast to stop	Yes
A046.2	Load monitoring overload alarm	Same as E042.1	0: Coast to stop	Yes
E046.3	Load monitoring load loss fault	Same as E042.1	0: Coast to stop	Yes
A046.4	Load monitoring load loss alarm	Same as E042.1	13: Alarm	Yes
E047.1	STO1 disconnection	0: Coast to stop	0: Coast to stop	Yes
E047.2	STO2 disconnected	0: Coast to stop	0: Coast to stop	Yes
E047.3	STO circuit power supply error	0: Coast to stop	0: Coast to stop	Yes
E047.4	STO input subsystem fault	0: Coast to stop	0: Coast to stop	Yes
E047.5	STO BUFFER integrated circuit fault	0: Coast to stop	0: Coast to stop	No
E047.7	STO FLASH check error	0: Coast to stop	0: Coast to stop	Yes
E047.8	STO RAM check failure	0: Coast to stop	0: Coast to stop	Yes
E047.9	STO check configuration failure	0: Coast to stop	0: Coast to stop	Yes
E051.1	Magnetic pole position auto-tuning error	0: Coast to stop	0: Coast to stop	Yes
E056.1	Self-test interrupted	0: Coast to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E056.2	IGBT phase U upper bridge arm short-circuited	0: Coast to stop	0: Coast to stop	Yes
E056.3	IGBT phase U lower bridge arm short-circuited	0: Coast to stop	0: Coast to stop	Yes
E056.4	IGBT phase V upper bridge arm short circuited	0: Coast to stop	0: Coast to stop	Yes
E056.5	IGBT phase V lower bridge arm short-circuited	0: Coast to stop	0: Coast to stop	Yes
E056.6	Self-check timeout	0: Coast to stop	0: Coast to stop	Yes
E056.9	Self-test: Output phase loss	0: Coast to stop	0: Coast to stop	Yes
E057.1	IGBT in the upper bridge of phase U or lower bridge of phase V cannot be turned on	0: Coast to stop	0: Coast to stop	Yes
E057.2	IGBT in the lower bridge of phase U or upper bridge of phase V cannot be turned on	0: Coast to stop	0: Coast to stop	Yes
E057.3	IGBT in the upper bridge of phase V or lower bridge of phase W cannot be turned on	0: Coast to stop	0: Coast to stop	Yes
E057.4	IGBT in the lower bridge of phase V or upper bridge of phase W cannot be turned on	0: Coast to stop	0: Coast to stop	Yes
E057.5	IGBT in the upper bridge of phase W or lower bridge of phase U cannot be turned on	0: Coast to stop	0: Coast to stop	Yes
E057.6	IGBT in the lower bridge of phase W or upper bridge of phase U cannot be turned on	0: Coast to stop	0: Coast to stop	Yes
E057.7	UV output short circuit	0: Coast to stop	0: Coast to stop	Yes
E057.8	VW output short circuit	0: Coast to stop	0: Coast to stop	Yes
E057.9	WU output short circuit	0: Coast to stop	0: Coast to stop	Yes
E058.1	Phse U current sensor installed improperly	0: Coast to stop	0: Coast to stop	Yes
E058.2	Phse V current sensor installed improperly	0: Coast to stop	0: Coast to stop	Yes
E058.3	Phse W current sensor installed improperly	0: Coast to stop	0: Coast to stop	Yes
E058.4	Phase U and phase V current sensors misplaced	0: Coast to stop	0: Coast to stop	Yes
E058.5	Phase V/ W current sensors misplaced	0: Coast to stop	0: Coast to stop	Yes
E058.6	Phase W/U current sensors are misplaced	0: Coast to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E059.1/A059.1/L059.1/ N059.1	Phase U/V unbalanced	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Yes
E059.2/A059.2/L059.2/ N059.2	Phase V/W unbalanced	Same as E059.1	0: Coast to stop	Yes
E059.3/A059.3/L059.3/ N059.3	Phase W/U unbalanced	Same as E059.1	0: Coast to stop	Yes
E060.1	Capacitor leakage	0: Coast to stop	0: Coast to stop	No
E080.1/A080.1/L080.1/ N080.1	Fan speed feedback error	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	15: Ignore	Yes
E080.2/A080.2/L080.2/ N080.2	Fan initialization failed	Same as E080.1	0: Coast to stop	Yes
E080.3/A080.3/L080.3/ N080.3	PWM fan blocked	Same as E080.1	0: Coast to stop	Yes
E084.1	Brake release failure	0: Coast to stop	0: Coast to stop	Yes
E084.2	Brake apply failure	0: Coast to stop	0: Coast to stop	Yes
E084.3	Brake torque verification failure	0: Coast to stop	0: Coast to stop	Yes
E084.4	Brake speed verification failure	0: Coast to stop	0: Coast to stop	Yes
E084.6	Brake release not allowed during auto-tuning	0: Coast to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E085.1/A085.1/L085.1/ N085.1	Sequence fault 1	Same as E080.1	15: Ignore	Yes
E085.2/A085.2/L085.2/ N085.2	Sequence fault 2	Same as E080.1	15: Ignore	Yes
E085.3/A085.3/L085.3/ N085.3	Sequence fault 3	Same as E080.1	15: Ignore	Yes
E085.4/A085.4/L085.4/ N085.4	Sequence fault 4	Same as E080.1	15: Ignore	Yes
E085.5/A085.5/L085.5/ N085.5	Sequence fault 5	Same as E080.1	15: Ignore	Yes
E085.6/A085.6/L085.6/ N085.6	Sequence fault 6	Same as E080.1	15: Ignore	Yes
E093.1/A093.1/L093.1/ N093.1	Motor stall	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Yes
E093.2/A093.2/L093.2/ N093.2	Motor step loss	Same as E093.1	0: Coast to stop	Yes
E093.3/A093.3/L093.3/ N093.3	Current control error	Same as E093.1	0: Coast to stop	Yes
E094.1/A094.1/L094.1/ N094.1	Inconsistency between calculated and set number of pole pairs	Same as E093.1	13: Alarm	Yes
E094.2/A094.2/L094.2/ N094.2	Rated power, voltage, and current of the motor mismatch	Same as E093.1	13: Alarm	Yes
E094.3/A094.3/L094.3/ N094.3	No-load current parameter range error	Same as E093.1	13: Alarm	Yes
E094.4/A094.4/L094.4/ N094.4	Mutual inductance and no-load current inconsistent with the rated voltage	Same as E093.1	13: Alarm	Yes
E094.5/A094.5/L094.5/ N094.5	Rotor resistance parameter range error	Same as E093.1	13: Alarm	Yes
E094.8/A094.8/L094.8/ N094.8	Random PWM parameter setting error	Same as E093.1	13: Alarm	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E110.1/A110.1/L110.1/ N110.1	AC drive pre-overload	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	13: Alarm	Yes
E110.2/A110.2/L110.2/ N110.2	PCB pre-overload	Same as E110.1	13: Alarm	Yes
E111.1/A111.1/L111.1/ N111.1	Motor pre-overload	Same as E110.1	13: Alarm	Yes
E114.1/A114.1/L114.1/ N114.1	Drive pre-overtemperature	Same as E110.1	13: Alarm	Yes
E132.3	Parameter error upon power-off	0: Coast to stop	0: Coast to stop	Yes
E151.1/A151.1/L151.1/ N151.1	Cable drum vertical application parameter setting error	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	3: Decelerate to stop	Yes
E153.1/A153.1/L153.1/ N153.1	Material run-out fault	Same as E151.1	3: Decelerate to stop	Yes
E154.1/A154.1/L154.1/ N154.1	HDI open circuit	Same as E151.1	15: Ignore	Yes
E154.3/A154.3/L154.3/ N154.3	AI1 error	Same as E151.1	15: Ignore	Yes
E154.4/A154.4/L154.4/ N154.4	AI2 error	Same as E151.1	15: Ignore	Yes
E154.8/A154.8/L154.8/ N154.8	I/O expansion card 1-AI1 input error	Same as E151.1	15: Ignore	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E154.9/A154.9/L154.9/ N154.9	I/O expansion card 2 - AI1 input error	Same as E151.1	15: Ignore	Yes
E155.1/A155.1/L155.1/ N155.1	IO expansion card 1 communication timeout	Same as E151.1	0: Coast to stop	Yes
E155.2/A155.2/L155.2/ N155.2	IO expansion card 2 communication timeout	Same as E151.1	0: Coast to stop	Yes
E159.1	Automatic fault reset failure	0: Coast to stop	0: Coast to stop	Yes
E160.1/A160.1/L160.1/ N160.1	Modbus-RTU communication timeout	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	3: Decelerate to stop	Yes
E161.1/A161.1/L161.1/ N161.1	CANopen heartbeat message timeout	Same as E160.1	3: Decelerate to stop	Yes
E161.2/A161.2/L161.2/ N161.2	CANopen PDO length error	Same as E160.1	3: Decelerate to stop	Yes
E161.4/A161.4/L161.4/ N161.4	CANopen status switchover error	Same as E160.1	3: Decelerate to stop	Yes
E162.1/A162.1/L162.1/ N162.1	CANlink heartbeat timeout	Same as E160.1	3: Decelerate to stop	Yes
E162.2/A162.2/L162.2/ N162.2	CANlink station number conflict	Same as E160.1	3: Decelerate to stop	Yes
E165.1/A165.1/L165.1/ N165.1	EtherNet/IP Ethernet communication timeout	Same as E160.1	0: Coast to stop	Yes
E165.2/A165.2/L165.2/ N165.2	Ethernet/IP hardware error	Same as E160.1	0: Coast to stop	Yes
E165.3/A165.3/L165.3/ N165.3	MAC address not programmed for Ethernet/IP	Same as E160.1	0: Coast to stop	Yes
E165.4/A165.4/L165.4/ N165.4	Ethernet/IP IP conflict	Same as E160.1	0: Coast to stop	Yes
E166.1/A166.1/L166.1/ N166.1	PROFINET communication timeout	Same as E160.1	0: Coast to stop	Yes
E166.2/A166.2/L166.2/ N166.2	MAC address not programmed to PROFINET	Same as E160.1	0: Coast to stop	Yes
E166.3/A166.3/L166.3/ N166.3	PROFINET mapping address error	Same as E160.1	0: Coast to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E167.1/A167.1/L167.1/ N167.1	EtherCAT sync loss	Same as E160.1	0: Coast to stop	Yes
E167.2/A167.2/L167.2/ N167.2	EtherCAT link loss	Same as E160.1	0: Coast to stop	Yes
E167.3/A167.3/L167.3/ N167.3	EtherCAT read-only memory loading error	Same as E160.1	0: Coast to stop	Yes
E167.4/A167.4/L167.4/ N167.4	EtherCAT initialization error	Same as E160.1	0: Coast to stop	Yes
E167.6/A167.6/L167.6/ N167.6	Distributed clock not enabled in EtherCAT	Same as E160.1	0: Coast to stop	Yes
E167.7/A167.7/L167.7/ N167.7	Number or length of EtherCAT PDO mapping outside the limit	Same as E160.1	0: Coast to stop	Yes
E167.8/A167.8/L167.8/ N167.8	EtherCAT process data reception timeout	Same as E160.1	0: Coast to stop	Yes
E167.9/A167.9/L167.9/ N167.9	EtherCAT ESC port 0 reception error	Same as E160.1	0: Coast to stop	Yes
E168.1/A168.1/L168.1/ N168.1	EtherCAT ESC port transfer and EPU processing error	Same as E160.1	0: Coast to stop	Yes
E168.2/A168.2/L168.2/ N168.2	EtherCAT MailBox setting error protection	Same as E160.1	0: Coast to stop	Yes
E168.3/A168.3/L168.3/ N168.3	EtherCAT SM2 setting error	Same as E160.1	0: Coast to stop	Yes
E168.4/A168.4/L168.4/ N168.4	EtherCAT SM3 setting error	Same as E160.1	0: Coast to stop	Yes
E168.5/A168.5/L168.5/ N168.5	PDO watchdog setting error	Same as E160.1	0: Coast to stop	Yes
E168.6/A168.6/L168.6/ N168.6	No sync signal from EtherCAT	Same as E160.1	0: Coast to stop	Yes
E168.7/A168.7/L168.7/ N168.7	EtherCAT Phy initialization configuration error	Same as E160.1	0: Coast to stop	Yes
E168.8/A168.8/L168.8/ N168.8	Abnormal pulse length of the synchronous data signal configured in the EtherCAT read-only memory	Same as E160.1	0: Coast to stop	Yes
E169.1/A169.1/L169.1/ N169.1	Modbus TCP Ethernet communication timeout	Same as E160.1	3: Decelerate to stop	Yes
E169.2/A169.2/L169.2/ N169.2	Modbus TCP Ethernet hardware error	Same as E160.1	3: Decelerate to stop	Yes
E169.3/A169.3/L169.3/ N169.3	Modbus TCP MAC address not programmed	Same as E160.1	3: Decelerate to stop	Yes
E169.4/A169.4/L169.4/ N169.4	Modbus TCP IP conflict	Same as E160.1	3: Decelerate to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E170.1/A170.1/L170.1/ N170.1	Internal communication disturbed or module operation stopped	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	3: Decelerate to stop	Yes
E170.2/A170.2/L170.2/ N170.2	Internal communication synchronization frame on the MCB side lost	Same as E170.1	3: Decelerate to stop	Yes
A176.1	External 24 V power supply error of the control board	13: Alarm	13: Alarm	Yes
E177.1	Model hardware auto-tuning error	0: Coast to stop	0: Coast to stop	No
E177.2	Hardware type of the model not matching the software type	0: Coast to stop	0: Coast to stop	No
E179.1/A179.1/L179.1/ N179.1	Main circuit capacitor lifetime alarm	Same as E170.1	13: Alarm	Yes
E179.3/A179.3/L179.3/ N179.3	IGBT lifetime alarm	Same as E170.1	13: Alarm	Yes
E179.4/A179.4/L179.4/ N179.4	Cooling fan lifetime pre-alarm	Same as E170.1	13: Alarm	Yes
E186.1	Model parameter read-write failure	0: Coast to stop 2: Quick stop 3: Decelerate to stop 15: Ignore	0: Coast to stop	Yes
E186.2	Parameter unit parameter error	0: Coast to stop 2: Quick stop 3: Decelerate to stop 15: Ignore	0: Coast to stop	Yes
E186.3	Preset model parameters of the MCB not matching the power board	0: Coast to stop 2: Quick stop 3: Decelerate to stop 15: Ignore	0: Coast to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
E187.2/A187.2/L187.2/ N187.2	Check on power unit junction temperature parameter failed	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Yes
E187.3/A187.3/L187.3/ N187.3	Junction temperature parameter in the EEPROM of the power unit failed to be read or written	Same as E187.2	0: Coast to stop	Yes
E187.4/A187.4/L187.4/ N187.4	Attempt to read EEPROM junction temperature parameter of the power unit timed out upon power-on	Same as E187.2	0: Coast to stop	Yes
E187.6/A187.6/L187.6/ N187.6	Power module EEPROM junction temperature parameter model code inconsistent with control board setting model code	Same as E187.2	0: Coast to stop	Yes
E188.2/A188.2/L188.2/ N188.2	Attempt to read parameters in the EEPROM power-down area of the power unit failed	Same as E187.2	0: Coast to stop	Yes
E188.3/A188.3/L188.3/ N188.3	Attempt to read data in the EEPROM power-down area of the power unit timed out	Same as E187.2	0: Coast to stop	Yes
E189.1/A189.1/L189.1/ N189.1	Commissioning software communication timeout	Same as E187.2	0: Coast to stop	Yes
E189.2/A189.2/L189.2/ N189.2	Keyboard MD-IP-S communication timeout	Same as E187.2	0: Coast to stop	Yes
E190.1	Application macro parameter write error	13: Alarm	13: Alarm	Yes
E191.1	IGBT over-temperature	0: Coast to stop	0: Coast to stop	Yes
E192.1	Speed tracking timeout	0: Coast to stop	0: Coast to stop	Yes
E193.1	Undervoltage suppression reaches the limit	0: Coast to stop	0: Coast to stop	Yes
N194.1	STO1 and STO2 disconnected	14: Prompt	14: Prompt	Yes
E195.1	Parameter downloading interrupted	0: Coast to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault level	Default fault level	Resettable
A196.1	External flash data read/write fault of black box	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Alarm 14: Prompt 15: Ignore	13: Alarm	Yes
A196.2	External flash data read/write fault of log	Same as A196.1	13: Alarm	Yes
N197.1	Fire mode activated	13: Alarm 14: Prompt 15: Ignore	13: Alarm	Yes
A199.1	Low carrier ratio alarm	13: Alarm	13: Alarm	Yes
A201.1	Resolver encoder overtemperature	13: Alarm	13: Alarm	Yes
A201.2	Z signal loss alarm	13: Alarm	13: Alarm	Yes
A201.3	FVC switch to SVC alarm	13: Alarm	13: Alarm	Yes
A202.1	Bus voltage bias during shutdown	13: Alarm	13: Alarm	Yes
N202.2	Overvoltage suppression activated	14: Prompt	14: Prompt	Yes
N202.3	Undervoltage suppression activated	14: Prompt	14: Prompt	Yes

7.9.2 Fault Description

E002.1: Hardware overcurrent

Fault cause:

The instantaneous output current exceeds 3.535 times the AC drive rated current (A3-03).

Troubleshooting:

Cause	Check Method	Solution
Output grounded	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.. (When the grid is an IT system, short circuit to ground cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.)	Check the short circuit to ground part. Replace the UVW output cables or motor.
Output phase short circuit	Method 1: Measure the resistance between UV, VW, and WU with a multimeter to check whether the resistances are symmetrical. If resistances are not symmetric, an exception occurs. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs..	Check the short-circuited output phases. Replace the UVW output cables or motor.
Speed loop parameter setpoints too high (SVC/FVC)	-	1. Reduce the speed loop Kp (F2-02 for SVC control, F2-00 for FVC control) to half of its current value, set the speed loop Ti (F2-03 for SVC control, F2-01 for FVC control) to 2s, and start operation to observe if the operation is stable. If the fault persists, halve the speed loop Kp again. 2. If the fault persists, the fault is not caused by excessively high parameter setpoints (SVC/FVC).
Synchronous motor demagnetization (SVC/FVC)	1. Check whether the carrier frequency A5-01 is set to an excessively low value. 2. Check whether the speed control oscillates. Check whether the actual speed jitters excessively through the continuous oscilloscope function of the iFA drive commissioning software. 3. Check whether the motor back EMF harmonics and output current harmonics are excessively high. 4. Check whether the motor EMF is too low. Record the current back EMF (F1-12). Disconnect the motor coupling and perform dynamic auto-tuning of the synchronous motor again (F1-69 = 12). Compare whether the auto-tuned back EMF (F1-12) is lower than the original back EMF. If yes, an exception occurs. Note: When the motor temperature increases, the back EMF decreases by less than 10%. If back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0/1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
Low carrier frequency during high-speed operation	Check whether the carrier frequency (A5-01) set for the motor during high-speed operation is higher than the output frequency x 12. If not, overcurrent may occur due to dissipated control.	1. Increase the carrier frequency during high-speed motor control. 2. Calculate the derating rate based on the required carrier frequency (12 x output frequency) during model selection.

Cause	Check Method	Solution
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1), and then start the drive again.
V/f oscillation overload (asynchronous motor V/f)	Use the continuous oscilloscope function of the iFA Drive software tool to check whether the actual excitation (L3224), torque current (L3226), and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the fluctuation range does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, see V/f oscillation suppression section. 2. Change the motor control mode to SVC (F0-01 = 0) and perform parameter auto-tuning.
Overcurrent suppression parameters are improperly (asynchronous motor in V/f control mode).	Ensure that overcurrent suppression is enabled (d2-26 = 1). Check whether the overcurrent suppression point (d2-27) and overcurrent suppression Kp/Ki (d2-28/d2-29) are too large or small.	Decrease the overcurrent suppression setpoints Kp/Ki setting first. If the fault persists, increase the setpoint. (For high-power motors, reduce the overcurrent suppression Kp/Ki properly.)
Overvoltage suppression or undervoltage suppression parameters are set improperly (asynchronous motor in V/f mode).	Check whether overvoltage suppression (d1-39) or undervoltage suppression (d1-63) is enabled and observe whether overcurrent occurs in the overvoltage or undervoltage stage.	Adjust undervoltage suppression Kp/Ki (d1-66/d1-67) under undervoltage suppression. Adjust overvoltage suppression Kp/Ki (d1-57/d1-58) under overvoltage suppression. Decrease the setpoint first. If the fault persists, increase the setpoint again. For details, refer to the sections "V/f Overvoltage Suppression" and "Vf Undervoltage Suppression".
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). and perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02 to A3-04) are consistent with those on the nameplate.	Set the drive model parameters (A3-02 to A3-04) according to the nameplate label of the drive.

Cause	Check Method	Solution
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/ frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
Braking resistor overcurrent	Braking resistor overcurrent occurs when the bus voltage increases to the actual operating voltage of the braking unit (A4-01) due to motor deceleration or speed fluctuation. Remove the braking resistor and enable the drive to run again. Check whether overcurrent occurs again after the bus voltage increases. If not, the braking resistor is faulty. In this case, check the following: 1. Check whether the braking output is short-circuited. 2. Check whether the braking resistor is wired correctly. 3. The resistance of the braking resistor is too small.	1. Re-connect the braking resistor. 2. Replace with a braking resistor of higher resistance.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set speed (U0-01) is near 0, check whether violent feedback speed fluctuation, unusual motor noise, motor stall, or slightly continuous reverse rotation occurs. If yes, an exception occurs.	1. Avoid the long-term operation in SVC mode at speeds close to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). For details, refer to the section "Motor Auto-tuning". 3. Enable IF control (set the tens place of d0-85 to 1 for low-speed processing mode). For details, refer to the section "Vector Control".
The encoder parameter settings are incorrect in the FVC control mode.	Check for settings of encoder parameters.	Set encoder parameters properly.
The encoder wiring is abnormal in the FVC control mode.	Check if the encoder wiring is correct; confirm whether there is interference.	Correctly wire the encoder and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether the encoder zero point position angle has changed after auo-tuning.	Perform accurate parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder is installed correctly.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation
Hardware fault	Contact the agent or Inovance.	Contact the agent or Inovance.

E002.2: Software overcurrent

Fault cause:

The output instantaneous current exceeds the self-defined software overcurrent threshold (A3-54).

Troubleshooting:

Cause	Check Method	Solution
Output grounded	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.. (When the grid is an IT system, short circuit to ground cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.)	Check the short circuit to ground part. Replace the UVW output cables or motor.
Output phase short circuit	Method 1: Measure the resistance between UV, VW, and WU with a multimeter to check whether the resistances are symmetrical. If resistances are not symmetric, an exception occurs. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs..	Check the short-circuited output phases. Replace the UVW output cables or motor.
Speed loop parameter setpoints too high (SVC/FVC)	-	1. Reduce the speed loop Kp (F2-02 for SVC control, F2-00 for FVC control) to half of its current value, set the speed loop Ti (F2-03 for SVC control, F2-01 for FVC control) to 2s, and start operation to observe if the operation is stable. If the fault persists, halve the speed loop Kp again. 2. If the fault persists, the fault is not caused by excessively high parameter setpoints (SVC/FVC).
Synchronous motor demagnetization (SVC/FVC)	1. Check whether the carrier frequency A5-01 is set to an excessively low value. 2. Check whether the speed control oscillates. Check whether the actual speed jitters excessively through the continuous oscilloscope function of the iFA drive commissioning software. 3. Check whether the motor back EMF harmonics and output current harmonics are excessively high. 4. Check whether the motor EMF is too low. Record the current back EMF (F1-12). Disconnect the motor coupling and perform dynamic auto-tuning of the synchronous motor again (F1-69 = 12). Compare whether the auto-tuned back EMF (F1-12) is lower than the original back EMF. If yes, an exception occurs. Note: When the motor temperature increases, the back EMF decreases by less than 10%. If back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/ FVC).	In the SVC/FVC control mode (F0-01 = 0/1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.

Cause	Check Method	Solution
Low carrier frequency during high-speed operation	Check whether the carrier frequency (A5-01) set for the motor during high-speed operation is higher than the output frequency x 12. If not, overcurrent may occur due to dissipated control.	1. Increase the carrier frequency during high-speed motor control. 2. Calculate the derating rate based on the required carrier frequency (12 x output frequency) during model selection.
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1), and then start the drive again.
V/f oscillation overload (asynchronous motor V/f)	Use the continuous oscilloscope function of the iFA Drive software tool to check whether the actual excitation (L3224), torque current (L3226), and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the fluctuation range does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, see V/f oscillation suppression section. 2. Change the motor control mode to SVC (F0-01 = 0) and perform parameter auto-tuning.
Overcurrent suppression parameters are improperly (asynchronous motor in V/f control mode).	Ensure that overcurrent suppression is enabled (d2-26 = 1). Check whether the overcurrent suppression point (d2-27) and overcurrent suppression Kp/Ki (d2-28/d2-29) are too large or small.	Decrease the overcurrent suppression setpoints Kp/Ki setting first. If the fault persists, increase the setpoint. (For high-power motors, reduce the overcurrent suppression Kp/Ki properly.)
Overvoltage suppression or undervoltage suppression parameters are set improperly (asynchronous motor in V/f mode).	Check whether overvoltage suppression (d1-39) or undervoltage suppression (d1-63) is enabled and observe whether overcurrent occurs in the overvoltage or undervoltage stage.	Adjust undervoltage suppression Kp/Ki (d1-66/d1-67) under undervoltage suppression. Adjust overvoltage suppression Kp/Ki (d1-57/d1-58) under overvoltage suppression. Decrease the setpoint first. If the fault persists, increase the setpoint again. For details, refer to the sections "V/f Overvoltage Suppression" and "Vf Undervoltage Suppression".
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). and perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.

Cause	Check Method	Solution
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02 to A3-04) are consistent with those on the nameplate.	Set the drive model parameters (A3-02 to A3-04) according to the nameplate label of the drive.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/ frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set speed (U0-01) is near 0, check whether violent feedback speed fluctuation, unusual motor noise, motor stall, or slightly continuous reverse rotation occurs. If yes, an exception occurs.	1. Avoid the long-term operation in SVC mode at speeds close to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). For details, refer to the section "Motor Auto-tuning". 3. Enable IF control (set the tens place of d0-85 to 1 for low-speed processing mode). For details, refer to the section "Vector Control".
The encoder parameter settings are incorrect in the FVC control mode.	Check for settings of encoder parameters.	Set encoder parameters properly.
The encoder wiring is abnormal in the FVC control mode.	Check if the encoder wiring is correct; confirm whether there is interference.	Correctly wire the encoder and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether the encoder zero point position angle has changed after auo-tuning.	Perform accurate parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder is installed correctly.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation
The custom software overcurrent threshold (A4-29) is set to excessively low value.	Check whether the custom software overcurrent threshold is excessively low.	Increase the custom software overcurrent threshold.
Hardware fault	Contact Inovance for technical support.	Contact Inovance for technical support.

E002.3: Phase W overcurrent

Fault cause:

The instantaneous output current of phase W exceeds the overcurrent threshold.

Troubleshooting:

Cause	Check Method	Solution
Synchronous motor demagnetization (SVC/FVC)	1. Check whether the carrier frequency A5-01 is set to an excessively low value. 2. Check whether the speed control oscillates. Check whether the actual speed jitters excessively through the continuous oscilloscope function of the iFA drive commissioning software. 3. Check whether the motor back EMF harmonics and output current harmonics are excessively high. 4. Check whether the motor EMF is too low. Record the current back EMF (F1-12). Disconnect the motor coupling and perform dynamic auto-tuning of the synchronous motor again (F1-69 = 12). Compare whether the auto-tuned back EMF (F1-12) is lower than the original back EMF. If yes, an exception occurs. Note: When the motor temperature increases, the back EMF decreases by less than 10%. If back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/ FVC).	In the SVC/FVC control mode (F0-01 = 0/1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
Low carrier frequency during high-speed operation	Check whether the carrier frequency set for the motor during high-speed operation is higher than the result of output frequency x 12. If no, control dissipation may result in overcurrent.	The carrier frequency of high-power machines is low by default. In this case, increase the carrier frequency during high-speed motor operation. Calculate derating according to the carrier frequency and select the model according to the derating coefficient.
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
V/f oscillation overload (asynchronous motor V/f)	Use the continuous oscilloscope function in the commissioning software to check whether the actual excitation/torque current (L3224/3226) and operating frequency (U0-00) of the motor are oscillating. The fluctuation range of the actual excitation/torque current of the motor does not exceed 10% under normal conditions.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, see V/f oscillation suppression section. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applied.
Overvoltage suppression or undervoltage suppression parameters are set improperly (asynchronous motor in V/f mode).	Check whether overvoltage suppression (d1-39) or undervoltage suppression (d1-63) is enabled and observe whether overcurrent occurs in the overvoltage or undervoltage stage.	Adjust undervoltage suppression Kp/Ki (d1-66/d1-67) under undervoltage suppression. Adjust overvoltage suppression Kp/Ki (d1-57/d1-58) under overvoltage suppression. Decrease the setpoint first. If the fault persists, increase the setpoint again. For details, refer to the sections "V/f Overvoltage Suppression" and "Vf Undervoltage Suppression".

Cause	Check Method	Solution
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). and perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/ deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/ deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/ A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/ frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
Braking resistor overcurrent	Braking resistor overcurrent occurs when the bus voltage increases to the actual operating voltage of the braking unit (A4-01) due to motor deceleration or speed fluctuation. After removing the braking resistor, run again and confirm if the overcurrent fault reappears after the bus voltage rises. If the fault disappears, then: 1. Confirm if the braking output is shorted; 2. Confirm if the braking resistor wiring is incorrect; 3. Confirm if the braking resistor value is too small.	1. Re-connect the braking resistor. 2. Select a braking resistor with large resistance.

Cause	Check Method	Solution
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set speed (U0-01) is near 0, the feedback speed fluctuates greatly and abnormal noise, motor stall, or slightly continuous reverse rotation occurs.	1. Avoid long-term operation at zero speed in the SVC mode. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control. Set the ten place of d0-85 (Low-speed processing mode) to 1. For details, see the section "Vector Control".
The encoder parameter settings are incorrect in the FVC control mode.	Check for settings of encoder parameters.	Set encoder parameters properly.
The encoder wiring is abnormal in the FVC control mode.	Check if the encoder wiring is correct; confirm whether there is interference.	Correctly wire the encoder and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether the encoder zero point position angle has changed after auo-tuning.	Perform accurate parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder is installed correctly.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation
Hardware fault	Contact Inovance for technical support.	Contact Inovance for technical support.

E002.4: Hardware VCE fault

Fault cause:

Monitored VCE signal error

Troubleshooting:

Cause	Check Method	Solution
Hardware fault	Contact Inovance for technical support.	Contact Inovance for technical support.

E005.1: Bus overvoltage

Fault cause:

The bus voltage exceeds the effective overvoltage threshold (A3-58).

Troubleshooting:

Cause	Check Method	Solution
Output grounded	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.. (Note: When the grid is an IT system, short circuit to ground cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.)	Check the short circuit to ground part. Replace the UVW output cables or motor.
In the power generation state, the braking recovery power is insufficient (synchronous motor/asynchronous motor in SVC/FVC mode).	1. Check whether the motor is in the generating state. 2. Use a multimeter to check whether the braking resistor power is too low. 3. Check whether the braking resistor is connected securely.	1. Increase the deceleration time (F0-49) to reduce the generating power. 2. Replace with a braking resistor of higher power. 3. Re-connect the braking resistor. 4. Enable overvoltage suppression when the load allows (d1-54 = 0). Note: Active loads such as cranes does not support overvoltage suppression.
Sudden removal of the load causes speed overshoot and generation (synchronous motor/asynchronous motor in SVC/FVC mode).	Check whether the actual motor speed increases significantly after the load is suddenly removed. If yes, an exception occurs.	1. Increase the speed loop Kp (F2-02). 2. Add the speed loop Ti (F2-03). The recommended value is 2s.
The value of the speed loop gain is too low, resulting in feedback power generation after feedback speed overshoot when the speed reference reaches the target value (synchronous motor/asynchronous motor in SVC/FVC mode).	Observe whether overvoltage occurs after the speed reaches the target value during acceleration.	1. Increase the speed loop Kp (F2-02) and increase the speed loop Ti (F2-03) to 2s. 2. Enable S-curve (b7-00 = 1) to set the ramp acceleration end arc (F0-51).
Speed loop parameter setpoints too high (SVC/FVC)	Reduce the speed loop Kp (F2-02 for SVC control, F2-00 for FVC control) to half of the current value, set the speed loop Ti (F2-03 for SVC control, F2-01 for FVC control) to 2s, start operation, and observe if it can run stably. If the fault persists, reduce the Kp to half the current value several times. If the fault still occurs, the fault is not caused by the cause.	Reduce the speed loop Kp (F2-02 for SVC control, F2-00 for FVC control) to half of the current value, set the speed loop Ti (F2-03 for SVC control, F2-01 for FVC control) to 2s.
The motor is started during rotation (synchronous/asynchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
V/f oscillation caused by overvoltage (asynchronous motors in V/f control mode)	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/torque current fluctuation range of the motor does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, see V/f oscillation suppression section. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applied.

Cause	Check Method	Solution
The deceleration time is too short.	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, extend the acceleration/deceleration time properly. 2. Enable overvoltage suppression (F2-39 = 1) for working conditions where requirements on speed following are low. For working conditions where requirements on speed following are high, install a braking resistor. 3. For applications where a braking resistor cannot be installed, increase the excitation current (d0-40 for SVC d0-41 for V/f). In the SVC mode, enable vector overexcitation (d0-39 = 1).
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The starting voltage of the braking unit is too high.	Check whether the effective action voltage of the braking unit (A4-01) reaches the overvoltage threshold (A3-57).	The effective action voltage of the braking unit varies with the voltage level of the machine. Manual modification is not required under normal conditions. In extreme cases, reduce the action voltage of the braking unit (A4-00).
The input voltage is too high.	Check whether the input voltage is within the normal range (380 V to 480 V).	1. Reduce the input voltage to a value within the normal range (380 V to 480 V). 2. Increase the overvoltage suppression action voltage (F2-40) and the braking unit action voltage (A4-00).
The overvoltage suppression parameters are set improperly.	Enable overvoltage suppression (d1-39 = 1) and check whether the overvoltage suppression Kp/Ki (d1-57/d1-58) is set to excessively low or high values (based on actual operating conditions).	Decrease the setpoint of kp or ki first. If the fault persists, increase the setpoint again. In addition, for large inertia models, reduce the setpoint further. Adjust overvoltage suppression Kp/Ki (d1-57/58), for details, refer to the section "V/f Overvoltage Suppression"
The synchronous motor triggers a fault after overspeed or coasts to stop manually. Overspeed occurs on the synchronous motor. The synchronous motor coasts to stop manually or to coasts to stop upon fault.	Check whether the output voltage (F1-12 x U0-00 x 1.414) of the synchronous motor exceeds the overvoltage threshold A4-39. If yes, interruption of the operation may result in overvoltage, leading to explosion of the drive. Note: When the synchronous motor overspeed occurs, the output voltage (F1-12 x U0-00 x 1.414) can be much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time, leading to back EMF short circuit in the output diode during switch-on in the reverse direction.	1. Limit the speed upper limit by setting d1-03 (Digital setting of positive frequency upper limit) to a value lower than or equal to A4-39/ (1.414 x F1-12). 2. Replace with a motor with a higher back EMF. Note: A motor with high back EMF can effectively reduce the output current. However, operating at a speed above the limit may result in damage caused by overvoltage.

Cause	Check Method	Solution
The encoder parameter settings are incorrect in the FVC control mode.	Check for settings of encoder parameters.	Set encoder parameters properly.
The encoder wiring is abnormal in the FVC control mode.	Check if the encoder wiring is correct; confirm whether there is interference.	Correctly wire the encoder and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether the encoder zero point position angle has changed after auo-tuning.	Perform accurate parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder is installed correctly.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation
Other causes lead to the fault.	Contact the agent or Inovance.	Contact the agent or Inovance.

E008.1: Frequent contactor action

Fault cause:

When the AC drive is not powered off, soft start is triggered on the relay multiple times within a short period of time.

Troubleshooting:

Cause	Check Method	Solution
The grid inlet contactor is faulty.	-	Replace the inlet contactor.
ON/OFF operations are performed frequently.	-	Ensure that the input voltage is within the normal range (380 V to 480 V) or wait until the input voltage stabilizes.
The pre-charge contactor of the drive is faulty.	-	Contact the agent or Inovance.

E009.1: Bus undervoltage

Fault cause:

The bus voltage is lower than the unervoltage threshold (A3-56).

Troubleshooting:

Cause	Check Method	Solution
Input phase loss	Measure whether the line voltages between RS, ST, and RT are symmetrical at the mains input side.	Check whether the input switches, contactors, and wiring terminals are abnormal and re-connect them.
Power dip occurs and the grid voltage is unstable.	Check whether undervoltage occurs in other devices in the same cabinet at the same time. Note：Undervoltage is mostly caused by power dip.	In load scenarios such as fans, water pumps, air compressors, and electric drums, enable undervoltage suppression (d1-63 = 1). Note: When undervoltage suppression is enabled (d1-63 = 1), a brief speed drop occurs during undervoltage suppression and the drive converts the motor kinetic energy into electrical energy to stabilize the bus voltage, preventing the undervoltage fault.

Cause	Check Method	Solution
The input voltage is too low.	1. Check whether the input voltage is within the normal range (380 V to 480 V). 2. Check whether the upstream circuit breaker or contactor trips or cannot be closed.	1. Increase the input voltage to a value within the normal range. 2. Ensure that the upstream circuit breaker or contactor is normal.
The undervoltage suppression parameters are set improperly.	1. Check whether undervoltage suppression (d1-63 = 1) is enabled and whether the undervoltage suppression Kp/Ki (d1-66/-67) are set to excessively high or low values. 2. During undervoltage suppression, undervoltage fault is triggered when the actual speed is lower than the minimum operating frequency (d1-72) of undervoltage suppression. In this case, the drive stops.	1. Adjust the undervoltage suppression Kp/Ki (d1-66/67). Decrease the setpoint first. If the fault persists, increase the setpoint again. 2. If you need to run with a low speed, modify the minimum operating frequency (d1-72) for undervoltage suppression. For details, see V/f Undervoltage Suppression.
Undervoltage occurs during motor oscillation	Check whether the output torque (U0-06) and bus voltage (U0-02) are subject to large oscillation (fluctuation above 10%) in the same frequency as that of bus fluctuation.	Rectify the motor oscillation fault.
The pre-charge contactor is abnormal and the pre-charge resistor cannot be disconnected properly.	Check whether the undervoltage fault occurs after power-on, whether the bus recovers after stop, and whether the undervoltage fault disappears after stop.	Contact technical support to replace the relay.
Hardware error (circuit board)	-	Contact Inovance for technical support.

E009.3: Pre-drive timeout

Fault cause:

The bus voltage falls below the undervoltage threshold (A3-56) within the specified time after the start command is triggered.

Troubleshooting:

Cause	Check Method	Solution
The input circuit is not connected properly.	Check whether cables are connected properly.	Reconnect the AC drive.
Too low input voltage.	Check whether the input voltage is within the normal range (380 V to 480 V).	Increase the input voltage to a value within the normal range (380 V to 480 V).
Hardware error (circuit board)	If the input fault persists, the hardware may be damaged.	Contact Inovance for technical support.

E010.1: Drive overload

Fault cause:

The cumulative overload coefficient (L3208) of the drive reaches 100%.

Troubleshooting:

Cause	Check Method	Solution
The load is excessive, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC mode at speeds closed to 0. 2. Enable IF control. Set the tens of the low-speed processing mode (d0-85) to 1. For details, see the Vector Control section.
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous motor demagnetization (SVC/FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0 or 1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".

Cause	Check Method	Solution
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/ deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). and perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
The motor is started during rotation (synchronous/asynchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
V/f oscillation overload (asynchronous motor V/f)	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/torque current fluctuation range of the motor does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, refer to the section "V/f Oscillation Suppression." 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applied.

Cause	Check Method	Solution
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC/ FVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/ Ld (F1-34/ F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The power rating of the drive is excessively low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.
The synchronous motor reports a fault after overspeed or the synchronous motor coasts to stop after manual settings.	When the synchronous motor overspeed occurs, the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time. This causes the output diode to energize in the reverse direction and back EMF short circuit. If the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is higher than the overvoltage threshold, operation interruption may cause overvoltage of the AC drive and may damage the drive.	Set the positive frequency upper limit (d1-03) to the result of overvoltage threshold (A4-39)/ (1.414 x back EMF of synchronous motor). Keep the maximum operating speed below this limit. Select the motor type properly. A motor with high back EMF can effectively reduce the output current. However, running at a speed above the limit may result in overvoltage or damage.
Derated operation applies due to long-term operation at low frequencies.	Check whether the current operating frequency is 0 Hz to 5 Hz at low frequency. If yes, the system is in the low-frequency derating range. (In this range, the power of the drive is lower than the rated power.) Note 1: During low-frequency operation, large fluctuation in IGBT temperature may easily occur, resulting in thermal stress and damage the IGBT. Note 2: When the frequency is in the low frequency range from 0 Hz to 5 Hz, the derating is reduced from 20% to 0%.	Replace with a drive of higher power.

Cause	Check Method	Solution
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
Derating occurs due to excessive carrier frequency.	Setting the carrier frequency (A5-01) to a value higher than the default can result in derating of the output with load.	Set a proper carrier frequency. If the high carrier frequency output capability is insufficient, it is recommended to use a drive with higher power.
The encoder parameter settings are incorrect in the FVC control mode.	Check for settings of encoder parameters.	Set encoder parameters properly.
The encoder wiring is abnormal in the FVC control mode.	Check if the encoder wiring is correct; confirm whether there is interference.	Correctly wire the encoder and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether the encoder zero point position angle has changed after auo-tuning.	Perform accurate parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder is installed correctly.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation
Other fault causes lead to the fault.	Contact the agent or Inovance.	Contact the agent or Inovance.

E010.2: PCB overload

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The load is excessive, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC mode at speeds closed to 0. 2. Enable IF control. Set the tens of the low-speed processing mode (d0-85) to 1. For details, see the Vector Control section.
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous motor demagnetization (SVC/FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0 or 1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".

Cause	Check Method	Solution
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/ deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). and perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
The motor is started during rotation (synchronous/asynchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
V/f oscillation overload (asynchronous motor V/f)	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/torque current fluctuation range of the motor does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, refer to the section "V/f Oscillation Suppression." 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applied.

Cause	Check Method	Solution
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC/ FVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/ Ld (F1-34/ F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The power rating of the drive is excessively low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.
The synchronous motor reports a fault after overspeed or the synchronous motor coasts to stop after manual settings.	When the synchronous motor overspeed occurs, the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time. This causes the output diode to energize in the reverse direction and back EMF short circuit. If the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is higher than the overvoltage threshold, operation interruption may cause overvoltage of the AC drive and may damage the drive.	Set the positive frequency upper limit (d1-03) to the result of overvoltage threshold (A4-39)/ (1.414 x back EMF of synchronous motor). Keep the maximum operating speed below this limit. Select the motor type properly. A motor with high back EMF can effectively reduce the output current. However, running at a speed above the limit may result in overvoltage or damage.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The encoder parameter settings are incorrect in the FVC control mode.	Check for settings of encoder parameters.	Set encoder parameters properly.
The encoder wiring is abnormal in the FVC control mode.	Check if the encoder wiring is correct; confirm whether there is interference.	Correctly wire the encoder and ensure proper shielding.

Cause	Check Method	Solution
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether the encoder zero point position angle has changed after auo-tuning.	Perform accurate parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder is installed correctly.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation
Other fault causes lead to the fault.	Contact the agent or Inovance.	Contact the agent or Inovance.

E011.1: Motor overload

Fault cause:

The cumulative overload coefficient (L3210) of the motor reaches 100%.

Troubleshooting:

Cause	Check Method	Solution
Too heavy load	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
Synchronous motor demagnetization (SVC/ FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.

Cause	Check Method	Solution
The input voltage is too low.	Check whether the input voltage meets the design requirements (380 V models: 380 V to 480 V). Check whether the upstream circuit breaker or contactor trips or cannot be closed.	Increase the input voltage to a value within the normal range. Ensure that the inlet switch is normal.
The motor overload protection coefficient (d1-46) is set to an excessively low value.	-	1. Increase the motor overload protection coefficient (d1-46). 2. If the fault persists after long-term operation, switch off the motor overload protection (d1-45 = 0).

E012.1/A012.1/L012.1/N012.1: Input phase loss

Fault cause:

Input phase loss is detected in the hardware circuit.

Troubleshooting:

Cause	Check Method	Solution
The input cables of the AC drive are connected improperly.	Check whether the input cables of the drive are connected properly.	Re-connect the AC drive according to the wiring diagram.
The input voltage is too low.	Check whether the input voltage meets the design requirements (380 V models: 380 V to 480 V). Check whether the upstream circuit breaker or contactor trips or cannot be closed.	Increase the input voltage to a value within the normal range. Ensure that the inlet switch is normal.
The diode of the AC drive is damaged.	-	Contact the agent or Inovance.

E013.1: Phase U loss

Fault cause:

The phase U current in the operating state is much lower than the other two phases.

Troubleshooting:

Cause	Check Method	Solution
The output cables of the drive are connected improperly.	Check whether the output cables of the drive are connected properly.	Re-connect the output circuit of the AC drive.
The output contactor is faulty or trips.	Check whether the output contactor is disconnected and whether the circuit is tripped.	Close the output contactor or brake.

Cause	Check Method	Solution
Motor fault	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see the section Self-check.	Check the short circuit to ground part. Replace the UVW output cables or motor.
The motor winding is unbalanced.	Measure the phase-to-phase resistance between UV, UW, and VW phases of the motor with a multimeter to check whether they are equal.	Repair or replace the three-phase winding of the motor.

E013.2: Phase V loss

Fault cause:

The phase V current in the operating state is much lower than the other two phases.

Troubleshooting:

Cause	Check Method	Solution
The output cables of the drive are connected improperly.	Check whether the output cables of the drive are connected properly.	Re-connect the output circuit of the AC drive.
The output contactor is faulty or trips.	Check whether the output contactor is disconnected and whether the circuit trips..	Close the output contactor or brake.
Motor fault	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see the section Self-check.	Check the short circuit to ground part. Replace the UVW output cables or motor.
The motor winding is unbalanced.	Measure the phase-to-phase resistance between UV, UW, and VW phases of the motor with a multimeter to check whether they are equal.	Repair or replace the three-phase winding of the motor.

E013.3: Phase W loss

Fault cause:

The phase W current in the operating state is much lower than the other two phases.

Troubleshooting:

Cause	Check Method	Solution
The output cables of the drive are connected improperly.	Check whether the output cables of the drive are connected properly.	Re-connect the output circuit of the AC drive.
The output contactor is faulty or trips.	Check whether the output contactor is disconnected and whether the circuit is tripped.	Close the output contactor or brake.
Motor fault	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see the section Self-check.	Check the short circuit to ground part. Replace the UVW output cables or motor.
The motor winding is unbalanced.	Measure the phase-to-phase resistance between UV, UW, and VW phases of the motor with a multimeter to check whether they are equal.	Repair or replace the three-phase winding of the motor.

E014.1: Drive overtemperature

Fault cause:

The power module temperature exceeds the overtemperature threshold (A3-51).

Troubleshooting:

Cause	Check Method	Solution
The ambient temperature is excessively high.	Measure the ambient temperature to check whether it is higher than 50°C.	Lower down the ambient temperature.
The air duct is blocked.	Check whether the air filter of the fan is blocked.	Clean the air duct.
The fan is damaged.	After cooling down, start the AC drive and observe whether the fan rotates.	Replace the fan.
The thermistor is damaged.	Contact Inovance for technical support.	Contact Inovance for technical support.
The IGBT module is damaged.	The fault persists after the preceding measures are taken.	Contact Inovance for technical support.

E015.1/A015.1/L015.1/N015.1: External fault 1

Fault cause:

The signal state that corresponds to external fault 1 (H02-00) is high level.

Troubleshooting:

Cause	Check Method	Solution
The input signal is activated.	Check whether the state of the input signal corresponding to external fault 1 (H2-00) is high level (H2-00 = 1).	Restore the state of the external fault 1 (H2-00) input signal to low level (H02-00 = 0).

E015.2/A015.2/L015.2/N015.2: External fault 2

Fault cause:

Check whether the state of the input signal corresponding to external fault 2 (H2-01) is low level.

Troubleshooting:

Cause	Check Method	Solution
The input signal is activated.	Check whether the state of the input signal corresponding to external fault 2 (H2-01) is low level (H2-00 = 0).	Restore the state of the external fault 2 (H2-01) input signal to high level (H2-00 = 1).

E017.1: Pre-charge contactor failure

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The driver board and power supply are faulty.	-	Replace the drive board and the power supply board.
Contactor fault	-	Replace the contactor.
The lightning protection board is abnormal.	-	Replacing the Lightning Protection Board

E018.1: Current detection circuit fault

Fault cause:

The current zero drift detected in the stop state is excessively high.

Troubleshooting:

Cause	Check Method	Solution
The current sampling hardware is abnormal.	Contact the agent or Inovance.	Contact the agent or Inovance.

E019.1: Motor auto-tuning timeout

Fault cause:

The auto-tuning is not completed for a long time.

Troubleshooting:

Cause	Check Method	Solution
The motor parameter is set incorrectly.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.2: Motor auto-tuning interrupted

Fault cause:

Auto-tuning interruption

Troubleshooting:

Cause	Check Method	Solution
The drive stops during parameter auto-tuning.	Check whether the drive stops during parameter auto-tuning.	Perform parameter auto-tuning again.
Voltage dip occurs during parameter auto-tuning.	Check whether transient power off occurs due to input voltage fluctuation.	Wait for the input voltage to stabilize before starting the drive. If power-on fails for a long time, check if the main contactor and grid are normal.

E019.4: Back EMF auto-tuning error

Fault cause:

The auto-tuned back EMF is not within the allowable range.

Troubleshooting:

Cause	Check Method	Solution
The load is excessive or the motor is stalled.	21. During high-speed operation in vector control, if the output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is large, the load is too heavy. 2. Check whether the brake releases normally.	1. Reduce the load. 2. Release the brake.
The motor does not rotate.	-	Remove the brake or device that prevents the motor from rotating.
Overcurrent occurs during auto-tuning of the magnetic pole position.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly. Improper setting may result in overcurrent in magnetic pole position auto-tuning.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.5: Motor type incorrect

Fault cause:

The motor auto-tuning mode (F1-69) does not match the motor type (F1-00).

Troubleshooting:

Cause	Check Method	Solution
The motor type setting is incorrect.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.6: Current sampling phase-to-phase gain deviation auto-tuning error

Fault cause:

This fault is reported when the current sampling gain deviation between UV/VW phases is higher than that set by the software.

Troubleshooting:

Cause	Check Method	Solution
The current sampling phase-to-phase gain deviation auto-tuning error occurs.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly. Improper setting may lead to abnormal auto-tuning of gain deviation between current sampling phases.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.7: Auto-tuned no-load current outside the limit

Fault cause:

This fault is triggered when the no-load current is not within the allowable range specified by the software.

Troubleshooting:

Cause	Check Method	Solution
The auto-tuned no-load current result is abnormal.	Check the no-load current (C4-30) of the asynchronous motor. If the value is not within 20% to 50% of the rated motor current (C4-04), the auto-tuned values are abnormal.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E020.1 Encoder cable hardware disconnected

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The encoder is damaged.	Check and ensure that the encoder is intact.	Replace the encoder.
The encoder power supply is abnormal.	Check and ensure that the encoder power supply wiring is normal.	Ensure the encoder is powered properly.
The encoder wiring is incorrect.	1. Check whether the AB connection of the encoder is correct. 2. Check whether the encoder connection is reliable.	Ensure that the encoder cable is connected properly.
The encoder disconnection detection method is abnormal.	1. Check whether C0-01 bit3 hardware disconnection detection is set incorrectly. 2. Check whether d7-02/dF-02/y7-02/yF-02 is set incorrectly.	1. Set encoder disconnection hardware detection mode (C0-01) properly. 2. Set FVC switchover SVC mode to 2. The switch will be switched to SVC after the switch is disconnected. The encoder disconnection fault will be reported after stop.
The encoder does not support setting the baud rate	1. Modify different baud rates and click Reset to see whether the fault disappears. 2. Check whether the current set baud rate is supported through the encoder manual	1. Set the baud rate correctly. 2. Check the encoder manual to confirm that the encoder supports the current set baud rate.
Wrong number of single-turn/multi-turn bits of communication-type encoder	Check whether the number of single-turn/ multi-turn bits of the communication encoder is consistent with the encoder nameplate or manual.	Set single-turn bits (C0-51) and multi-turn bits (C0-52) of the communication encoder correctly.

Cause	Check Method	Solution
The encoder cable is incorrect or too long	1. Modify the encoder baud rate to the minimum baud rate supported in the encoder manual. Click Reset to see whether the fault disappears.2. Check whether the cable is longer than the cable length described in the encoder card manual.3. Check whether the cable specifications are recommended in the encoder card manual.	1. Decrease the baud rate gradually and click Reset until the fault disappears. 2. Replace the cable with the recommended cable in the encoder card manual and not longer than the recommended length.
Incorrectly set encoder type.	Check whether the encoder type is incorrectly set.	Set the encoder type C0-01 correctly
Other causes	Contact the agent or Inovance.	Contact Inovance for technical support.

E020.2: Encoder PPR error

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The pulse per revolution (PPR) of the encoder is set incorrectly.	Check whether the encoder resolution C0-02 is set correctly.	Set the encoder resolution C0-02 correctly
Encoder abnormality	Check and ensure that the encoder is intact.	Replace the encoder.
The encoder feedback speed does not match the actual motor speed.	Run the motor in SVC mode and check whether the actual motor frequency (U0-19) is equal to the feedback speed (U0-29).	The PPR of the ABZ encoder is wrong or the number of resolver pole pairs is wrong.
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E020.3: No feedback from the encoder

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The encoder wiring is incorrect.	Check and ensure that the encoder wiring is secure.	Ensure that the encoder cable is connected properly.
The pulse per revolution (PPR) of the encoder is set incorrectly.	Check whether the encoder resolution C0-02 is set correctly	Set the encoder resolution C0-02 correctly
Wrong number of single-turn and multi-turn bits of communication-type encoder	Check whether the number of single-turn/ multi-turn bits of the communication encoder is consistent with the encoder nameplate or manual.	Set single-turn bits (C0-51) and multi-turn bits (C0-52) of the communication encoder correctly.
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E020.4: Encoder direction incorrect

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Encoder phase sequence error	Confirm the encoder phase sequence.	Set the phase sequence of the encoder (C0-03) correctly
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E020.5: Encoder software disconnected

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The encoder is damaged.	Check and ensure that the encoder is intact.	Replace the encoder.
The encoder power supply is abnormal.	Check and ensure that the encoder power supply wiring is normal.	Ensure the encoder is powered properly.
The encoder wiring is incorrect.	1. Check whether the AB connection of the encoder is correct. 2. Check whether the encoder connection is reliable.	Ensure that the encoder cable is connected properly.
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E020.6: Motor stall during zero position auto-tuning

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
During zero position angle auto-tuning with load auto-tuning, the motor stalled.	1. Check whether the motor brake is not released. 2. Check whether the motor has a large load and cannot rotate.	Ensure that the motor rotates freely.
The encoder PPR is incorrect.	Check whether the number of encoder PPR in the encoder manual or nameplate is consistent with the value of C0-02.	Set the encoder PPR (C0-02) correctly.
Encoder phase sequence error	Confirm the encoder phase sequence.	Set the phase sequence of the encoder (C0-03) correctly
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E020.7: Z signal interference

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The Z signal or AB pulse exist interference when a synchronous motor is equipped with an ABZ encoder or sine-cosine encoder and operates in closed-loop FVC.	1. Check motor grounding and encoder grounding; 2. Check if the encoder is damaged;	1. Correct wiring; 2. Encoder shielding layer grounded at the drive end; 3. Motor housing reliably grounded; 4. Replace the encoder;
The encoder PPR is incorrect.	Check whether the number of encoder PPR in the encoder manual or nameplate is consistent with the value of C0-02.	Set the encoder PPR (C0-02) correctly.
Other fault causes lead to the fault.	Contact the agent or Inovance.	Contact the agent or Inovance.

E020.8: Z signal lost

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The encoder wiring is incorrect.	1. Check if the encoder Z signal is connected. 2. Check whether the encoder connection is reliable.	Ensure that the encoder cable is connected properly.
The encoder is faulty.	Switch control mode (d0-00) to SVC, and check if the number of L1107Z signals in the background increases correctly.	Replace or repair the encoder
Signal interference	1. Switch control mode (d0-00) to SVC, and check if the number of L1107Z signals in the background increases correctly. 2. Check the encoder and motor grounding.	1. Correct wiring; 2. Encoder shielding layer grounded at the drive end; 3. Motor housing reliably grounded;
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E020.9: Encoder pulse interference

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The encoder is not grounded properly.	Check the encoder and motor grounding.	1. Connect the three-phase power supply to the AC drive properly. 2. Connect the ground of the output motor properly to the AC drive. 3. Connect the shield of the encoder cable to the PE interface of the PG card
Encoder wiring is not appropriate	-	Encoder cables should not be run parallel to power cables.

Cause	Check Method	Solution
The encoder cable is incorrect or too long	1. Modify the encoder baud rate to the minimum baud rate supported in the encoder manual. Click Reset to see whether the fault disappears.2. Check whether the cable is longer than the cable length described in the encoder card manual.3. Check whether the cable specifications are recommended in the encoder card manual.	1. Decrease the baud rate gradually and click Reset until the fault disappears. 2. Replace the cable with the recommended cable in the encoder card manual and not longer than the recommended length.
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E021.1: Uninterrupted operation on the EEPROM timeout

Fault cause:

The continuous operation of the EEPROM exceeds 60 seconds.

Troubleshooting:

Cause	Check Method	Solution
EEPROM read/write errors occur.		1. Reduce the number of modifications made through the host controller. 2. If parameter writing through communication is incorrect, set a correct RAM address. 3. If the fault persists after the preceding measures are taken, contact Inovance for technical support.

E021.2: EEPROM read fault

Fault cause:

EEPROM parameter read failure

Troubleshooting:

Cause	Check Method	Solution
EEPROM read/write errors occur.	Check whether a certain parameter is modified frequently by the host controller. Check whether the RAM address for parameter writing is correct and whether the RAM address mapping for each group of parameters is correct. If the fault persists after the preceding two causes are ruled out, the EEPROM chip may be damaged.	1. Reduce the number of modifications made through the host controller. 2. If parameter writing through communication is incorrect, set a correct RAM address. 3. If the fault persists after the preceding measures are taken, contact Inovance for technical support.

E021.3: EEPROM write fault

Fault cause:

EEPROM parameter write failure

Troubleshooting:

Cause	Check Method	Solution
EEPROM read/write errors occur.	Check whether a certain parameter is modified frequently by the host controller. Check whether the RAM address for parameter writing is correct and whether the RAM address mapping for each group of parameters is correct. If the fault persists after the preceding two causes are ruled out, the EEPROM chip may be damaged.	1. Reduce the number of modifications made through the host controller. 2. If parameter writing through communication is incorrect, set a correct RAM address. 3. If the fault persists after the preceding measures are taken, contact Inovance for technical support.

E021.4: Number of write-read operations on the EEPROM outside the setpoint within 1s

Fault cause:

The number of read/write operations in 1s exceeds the value of P0-62.

Troubleshooting:

Cause	Check Method	Solution
EEPROM read/write errors occur.	Check through the host controller whether the memory operation on the user side within 1s is frequent.	Reduce the number of write/read operations within 1s.

E021.5: Internal buffer of the EEPROM outside the limit

Fault cause:

The number of EEPROM operations exceeds the number of EEPROM operation queues.

Troubleshooting:

Cause	Check Method	Solution
Internal cache of EEPROM exceeding the limit	In the case of parameter writing through communication, check through the host controller whether the write operation is too frequent.	Reduce the number of write operations within 1s.

E022.1: Encoder card not activated

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Encoder type not selected	Confirm if it is FVC mode and C0-00 is set to 0	Set encoder type (C0-00) correctly, ensuring that the encoder type matches the actual encoder type connected.
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E022.4: Resolver encoder card overtemperature

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The resolver encoder temperature is too high.	Scan the encoder card chip temperature through thermograph.	1. Reduce the temperature of the encoder card. 2. Contact the manufacturer for technical support.

E022.5: Encoder orientation deviation

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
No auto-tuning of encoder installation angle (C0-04)	Confirm whether the permanent magnet motor no-load dynamic auto-tuning (C2-00=12) or permanent magnet motor with-load auto-tuning (C2-00=12) has been performed for synchronous motor, and whether synchronous reluctance motor dynamic auto-tuning (C2-00=22) or synchronous reluctance motor static auto-tuning (C2-00=21) has been performed for the reluctance motor.	Perform the permanent magnet motor no-load dynamic auto-tuning (C2-00=12) or permanent magnet motor with-load auto-tuning (C2-00=12) for synchronous motor, and perform synchronous reluctance motor dynamic auto-tuning (C2-00=22) or synchronous reluctance motor static auto-tuning (C2-00=21) for the reluctance motor.
Encoder slides with motor shaft	Confirm whether the encoder installation is secure by performing rapid acceleration and deceleration, as well as performing synchronous reluctance motor dynamic auto-tuning (C2-00=22) or permanent magnet motor no-load dynamic auto-tuning (C2-00=12) to observe whether the C0-04 encoder installation angle changes.	Strengthen the connection between the encoder installation and the shaft.
The angle of the magnetic pole position auto-tuning is inaccurate.	Switch control mode (d0-00) to SVC, repeatedly start and stop, and observe whether the motor is stuck and cannot start;	Increase the magnetic pole position auto-tuning current (d0-75), select adaptive method for magnetic pole position auto-tuning (d0-71), and for salient pole motors, select high-frequency injection method;
The Z signal or AB pulse exist interference when a synchronous motor is equipped with an ABZ encoder or sine-cosine encoder and operates in closed-loop FVC.	1. Check motor grounding and encoder grounding; 2. Check if the encoder is damaged;	1. Correct wiring; 2. Encoder shielding layer grounded at the drive end; 3. Motor housing reliably grounded; 4. Replace the encoder;
The encoder cable is incorrect or too long	1. Check whether the cable length is longer than the cable length described in the encoder card manual; 2. Check whether the cable specification is the recommended cable specification in the encoder card manual.	Replace the cable with the recommended cable in the encoder card manual, and ensure the length is not greater than the recommended length.
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E022.7: Encoder card communication error

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Encoder card not installed	Check whether the encoder card is not installed.	Confirm that the encoder card is installed correctly.
The handshake between the encoder card and the main controller fails.	After the power-on relay is engaged, wait about 30 seconds before starting. If the fault still occurs, it indicates an abnormal handshake between the encoder card and the main controller.	Test with a new encoder card
The encoder is damaged.	Whether the encoder indicator light is abnormal.	Test with a new encoder card
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E022.8: Encoder communication error

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The encoder is damaged.	Check and ensure that the encoder is intact.	Replace the encoder.
The encoder power supply is abnormal.	Check and ensure that the encoder power supply wiring is normal.	Ensure the encoder is powered properly.
The encoder wiring is incorrect.	1. Check whether the encoder AB wiring is incorrect. 2. Check whether the encoder wiring is reliable.	Ensure that the encoder cable is connected properly.
Incorrectly set encoder type.	Check whether the encoder type is incorrectly set.	Set the encoder type C0-01 correctly
Carrier frequency is set too high, causing communication between the encoder card and the encoder to be interrupted.	Set the carrier frequency of F2-50 to a lower value and run again, observe if the fault disappears.	Ensure that encoder communication is normal at the set carrier frequency of F2-50.
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

E022.9: PG card type error

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
PG card type does not match the set encoder type.	If the selected encoder is ABZ, 23-bit, SSI, EnDat, or BISS type, check if the PG card model is MD-PG-AU1; if the selected encoder is a resolver, check if the PG card model is MD-PG-R1; if the selected encoder is a sine-cosine encoder, check if the PG card model is MD-PG-S1;	If the selected encoder is ABZ, 23-bit, SSI, EnDat, or BISS, the required PG card model is MD-PG-AU1; if the selected encoder is a resolver, the required PG card model is MD-PG-R1; if the selected encoder is a sine-cosine encoder, the required PG card model is MD-PG-S1;

E023.1: Drive output ground fault

Fault cause:

Check the current between the output phase and ground exists.

Troubleshooting:

Cause	Check Method	Solution
Output grounded	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see the section Self-check.	Check the short circuit to ground part. Replace the UVW output cables or motor.

E026.1/A026.1/L026.1/N026.1: Operating time reached

Fault cause:

The accumulative operating time (Ad-00, Ad-01) reaches the set value (P0-18, P0-19).

Troubleshooting:

Cause	Check Method	Solution
The accumulative operating time reaches the setpoint.	Check that the cumulative operating time (Ad-00, Ad-01) reaches the set value (P0-18, P0-19).	Set parameter initialization (A0-00) to 2 to clear the accumulative running time.

E027.1/A027.1/L027.1/N027.1: User-defined fault 1

Fault cause:

User-defined fault 1 triggered

Troubleshooting:

Cause	Check Method	Solution
The signal of user-defined fault is inputted through the contactor.	Check whether the user-defined fault 1 source is valid (H2-02 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 1 to “Inactive” (H2-02 = 0) and disable the fault.

E027.2/A027.2/L027.2/N027.2: User-defined fault 2

Fault cause:

User-defined fault 2 triggered

Troubleshooting:

Cause	Check Method	Solution
The signal of user-defined fault is inputted through the contactor.	Check whether the user-defined fault 2 source is valid (H2-03 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 2 to "Inactive" (H2-03 = 0) and disable the fault.

E027.3/A027.3/L027.3/N027.3: User-defined fault 3

Fault cause:

User-defined fault 3 triggered

Troubleshooting:

Cause	Check Method	Solution
The signal of user-defined fault is inputted through the contactor.	Check whether the user-defined fault 3 source is valid (H2-04 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 3 to "Inactive" (H2-04 = 0) and disable the fault.

E027.4/A027.4/L027.4/N027.4: User-defined fault 4

Fault cause:

User-defined fault 4 triggered

Troubleshooting:

Cause	Check Method	Solution
The signal of user-defined fault is inputted through the contactor.	Check whether the user-defined fault 4 source is valid (H2-05 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 4 to "Inactive" (H2-05 = 0) and disable the fault.

E027.5/A027.5/L027.5/N027.5: User-defined fault 5

Fault cause:

User-defined fault 5 triggered

Troubleshooting:

Cause	Check Method	Solution
The signal of user-defined fault is inputted through the contactor.	Check whether the user-defined fault 5 source is valid (H2-06 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 5 to "Inactive" (H2-06 = 0) and disable the fault.

E027.6/A027.6/L027.6/N027.6: User-defined fault 6

Fault cause:

User-defined fault 6 triggered

Troubleshooting:

Cause	Check Method	Solution
The signal of user-defined fault is inputted through the contactor.	Check whether the user-defined fault 6 source is valid (H2-07 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 6 to "Inactive" (H2-07 = 0) and disable the fault.

E027.7/A027.7/L027.7/N027.7: User-defined fault 7

Fault cause:

User-defined fault 7 triggered

Troubleshooting:

Cause	Check Method	Solution
The signal of user-defined fault is inputted through the contactor.	Check whether the user-defined fault 7 source is valid (H2-08 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 7 to "Inactive" (H2-08 = 0) and disable the fault.

E027.8/A027.8/L027.8/N027.8: User-defined fault 8

Fault cause:

User-defined fault 8 triggered

Troubleshooting:

Cause	Check Method	Solution
The signal of user-defined fault is inputted through the contactor.	Check whether the user-defined fault 8 source is valid (H2-09 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 8 to "Inactive" (H2-09 = 0) and disable the fault.

E028.1/A028.1/L028.1/N028.1: User-defined alarm 1

Fault cause:

User-defined alarm 1 triggered

Troubleshooting:

Cause	Check Method	Solution
The user-defined alarm is input through the connector.	Check whether the source of user-defined alarm 1 is valid (H2-10 = 1). This alarm is reported if the alarm source is valid.	Set the source of user-defined alarm 1 to "invalid" (H2-10 = 0).

E028.2/A028.2/L028.2/N028.2: User-defined alarm 2

Fault cause:

User-defined alarm 2 triggered

Troubleshooting:

Cause	Check Method	Solution
The user-defined alarm is input through the connector.	Check whether the source of user-defined alarm 2 is valid (H2-11 = 1). This alarm is reported if the alarm source is valid.	Set the source of user-defined alarm 2 to "invalid" (H2-11 = 0).

E028.3/A028.3/L028.3/N028.3: User-defined alarm 3

Fault cause:

User-defined alarm 3 triggered

Troubleshooting:

Cause	Check Method	Solution
The user-defined alarm is input through the connector.	Check whether the source of user-defined alarm 3 is valid (H2-12 = 1). This alarm is reported if the alarm source is valid.	Set the source of user-defined alarm 3 to "invalid" (H2-12 = 0).

E028.4/A028.4/L028.4/N028.4: User-defined alarm 4

Fault cause:

User-defined alarm 4 triggered

Troubleshooting:

Cause	Check Method	Solution
The user-defined alarm is input through the connector.	Check whether the source of user-defined alarm 4 is valid (H2-13 = 1). This alarm is reported if the alarm source is valid.	Set the source of user-defined alarm 4 to "invalid" (H2-13 = 0).

E028.5/A028.5/L028.5/N028.5: User-defined alarm 5

Fault cause:

User-defined alarm 5 triggered

Troubleshooting:

Cause	Check Method	Solution
The user-defined alarm is input through the connector.	Check whether the source of user-defined alarm 5 is valid (H2-14 = 1). This alarm is reported if the alarm source is valid.	Set the source of user-defined alarm 5 to "invalid" (H2-14 = 0).

E028.6/A028.6/L028.6/N028.6: User-defined alarm 6

Fault cause:

User-defined alarm 6 triggered

Troubleshooting:

Cause	Check Method	Solution
The user-defined alarm is input through the connector.	Check whether the source of user-defined alarm 6 is valid (H2-15 = 1). This alarm is reported if the alarm source is valid.	Set the source of user-defined alarm 6 to "invalid" (H2-15 = 0).

E028.7/A028.7/L028.7/N028.7: User-defined alarm 7

Fault cause:

User-defined alarm 7 triggered

Troubleshooting:

Cause	Check Method	Solution
The user-defined alarm is input through the connector.	Check whether the source of user-defined alarm 7 is valid (H2-16 = 1). This alarm is reported if the alarm source is valid.	Set the source of user-defined alarm 7 to "invalid" (H2-16 = 0).

E028.8/A028.8/L028.8/N028.8: User-defined alarm 8

Fault cause:

User-defined alarm 8 triggered

Troubleshooting:

Cause	Check Method	Solution
The user-defined alarm is input through the connector.	Check whether the source of user-defined alarm 8 is valid (H2-17 = 1). This alarm is reported if the alarm source is valid.	Set the source of user-defined alarm 8 to "invalid" (H2-17 = 0).

E029.1/A029.1/L029.1/N029.1: Cumulative power-on time reached

Fault cause:

Check whether the cumulative power-on time (Ad-02 and Ad-03) has reached the set power-on time threshold (P0-16 and P0-18).

Troubleshooting:

Cause	Check Method	Solution
The cumulative power-on time reaches the setpoint.	Defines whether the cumulative power-on time (Ad-02 and Ad-03) reaches the set power-on time (P0-16 and P0-18).	Set parameter initialization (A0-00) to 2 to clear the cumulative power-on time.

E030.1/A030.1/L030.1/N030.1: Output three-phase loss

Fault cause:

When the three-phase loss protection is enabled, this fault is triggered when the three-phase output current keeps lower than the three-phase output phase loss detection threshold (d1-84) for the time defined by d1-85 (Three-phase output phase loss detection time).

Troubleshooting:

Cause	Check Method	Solution
The AC drive runs without the motor.	Check whether the output cables of the drive are connected properly.	Reconnect the AC drive.

E031.1/A031.1/L031.1/N031.1: PID feedback lost

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
PID feedback is not within the loss detection range.	Check the input value of the corresponding PID feedback source according to the setpoint of PID feedback source selection (P2-04). For example, when the PID feedback source is set to "0: AI1" , the input value of the PID feedback source is AI1. Determine whether the PID feedback value is higher than the upper limit of PID detection (P2-30) or lower than the lower limit of PID detection (P2-31).	Adjust the input value of the PID feedback source or set the PID feedback parameter (P2-30\P2-31) properly to ensure that the PID feedback value is within the upper and lower limits of PID detection. Increase the upper limit of PID detection (P2-30) by 10% in sequence, or decrease the lower limit of PID detection (P2-31) by 10% in sequence.

E032.1/A032.1/L032.1/N032.1: Parameter reset fault

Fault cause:

When parameter reset is performed through parameter initialization (A0-00), the execution fails.

Troubleshooting:

Cause	Check Method	Solution
Parameter reset improperly	When parameter reset is performed through parameter initialization (A0-00), the execution fails.	Perform parameter initialization (A0-00) again.

E032.2/A032.2/L032.2/N032.2: Parameter backup fault

Fault cause:

Parameter backup by setting the user backup (A0-39) parameter fails.

Troubleshooting:

Cause	Check Method	Solution
Parameter backup error	Parameter backup by setting the user backup (A0-39) parameter fails.	Perform parameter backup again.

E032.4/A032.4/L032.4/N032.4: Parameter setting incorrect

Fault cause:

Improper parameter setting

Troubleshooting:

Cause	Check Method	Solution
Parameter setting error	1. If the value of U2-98 (Prompt for parameter setting error) is 1, the parameter setting is incorrect. 2. Check the user load curve of group P0 is correct. In group P0, check whether the x-coordinate increases in sequence. If not, a fault occurs.In group P0, check whether the lower limit exceeds the upper limit in the x-coordinate. If yes, a fault occurs.	Ensure that the user load curve in group P0 is set correctly. The x-coordinate must be increased by 1/2/3 in sequence, and the upper limit must be greater than the lower limit.

E032.6/A032.6/L032.6/N032.6: Parameter power-on check error

Fault cause:

Attributes of parameters read through EEPROM upon power-on are incorrect. For example, the parameter value read is not within the upper and lower limits.

Troubleshooting:

Cause	Check Method	Solution
Parameter check error upon power-on	When the parameter check at power-on is abnormal and the 16-bit parameter error type (U2-95) is not 0, it indicates a parameter check exception occurs.	Contact Inovance for technical support.

E032.7/A032.7/L032.7/N032.7: Parameter backup invalid

Fault cause:

Parameter backup failed

Troubleshooting:

Cause	Check Method	Solution
The number of backup parameters exceeds the upper limit.	When the value of U2-99 is 1, it indicates that the number of backup parameters exceeds the upper limit (A0-39).	After clearing the parameter backup record, perform parameter backup again.

E032.8/A032.8/L032.8/N032.8: Parameter power-on initialization error

Fault cause:

Parameter upper limit initialization fails.

Troubleshooting:

Cause	Check Method	Solution
Error occurs on parameter initialization upon power-on	When the value of the power-on initialization completion flag (U2-91) is 0, it indicates that parameter initialization fails.	Power on again or contact the technical support.

E032.9/A032.9/L032.9/N032.9: Parameter property change error

Fault cause:

The parameter setpoint exceeds the upper and lower limits.

Troubleshooting:

Cause	Check Method	Solution
Parameter attribute change error	When the value of the power-on initialization completion flag (U2-92) is 0, it indicates that parameter initialization fails.	Power on again or contact the technical support.

E040.1: Pulse-by-pulse current limiting fault

Fault cause:

This fault is reported when the output current exceeds the pulse-by-pulse limit and the duration of the pulse-by-pulse limit reaches the threshold in the V/f control mode of asynchronous motor.

Troubleshooting:

Cause	Check Method	Solution
The load is excessive, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: Check whether the brake releases normally.	For scenario 1, when the asynchronous motor runs at low speed and overloads, appropriately increase the no-load current (F1-30), and reduce the mutual inductance (F1-28), ensuring the product of the two remains unchanged; for scenario 2, open the brake; if the above methods are ineffective, it is recommended to change the AC drive selection for higher specifications.
The power rating of the drive is excessively low.	The rated current of motor (F1-04) is higher than that of the drive (A3-03).	Reduce the load or replace with a drive of higher power rating.
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
Output grounded	Method 1: Measure the resistance of the output side to ground with a tramegger. If it is not at the MΩ level, the resistance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs.. Note: When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. For details, see the section Self-check.	Check the short circuit to ground part. Replace the UVW output cables or motor.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.

Cause	Check Method	Solution
Output phase short circuit	Method 1: Measure the resistance between UV, VW, and WU with a multimeter to check whether the resistances are symmetrical. If resistances are not symmetric, an exception occurs. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an exception occurs..	Check the inter-phase short circuit part and replace the motor or cable.
V/f oscillation (asynchronous motor V/f)	Use the continuous oscilloscope function in the commissioning software to check whether the actual excitation/torque current (L3224/ 3226) and operating frequency (U0-00) of the motor are oscillating. The fluctuation range of the actual excitation/torque current of the motor does not exceed 10% under normal conditions.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether oscillation gets weaker. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, use the SVC mode.
Output phase loss	Method 1: Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If output phase loss occurs, the resistance is infinite. Method 2: Enable manual self-test (C2-04 = 1) and run. If no fault is reported, the drive is normal.	Check the phase loss part and replace the motor or cable.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/ deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	1. Check whether the manual torque boost value (d2-14) is set to an excessively high value. 2. When the torque boost mode is "automatic" or "manual+automatic", check whether the stator resistance (F1-20) is auto-tuned.	1. Reduce the manual torque boost value and enable the drive to run again. 2. Perform static partial auto-tuning of the asynchronous motor (F1-69 = 1) and enable the drive to run again.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.

E042.1/A042.1/L042.1/N042.1: Excessive speed deviation

Fault cause:

The deviation between the actual motor speed and the set speed is higher than the threshold (dL-40), and such status keeps after the time defined by dL-39 elapses.

Troubleshooting:

Cause	Check Method	Solution
The load is excessive, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid long-term operation at zero speed in the SVC mode. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control. Set the ten place of d0-85 (Low-speed processing mode) to 1. For details, see the section "Vector Control".
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous motor demagnetization (SVC/ FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note: When the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0 or 1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).

Cause	Check Method	Solution
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC/ FVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/ Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The current limit is set to an excessively low value.	Check whether the maximum motor current (F1-13), the maximum AC drive current (A3-05), and the output current (U0-04) reach the limit.	Increase the current limit properly (F1-13).
The torque limit is set to an excessively low value.	Check whether the output torque (U0-06) reaches the limit.	Increase the torque limit (d1-09/d1-10) properly.
The power limit is set to an excessively low value.	Check whether the output power (U0-05) reaches the generating/motoring power limit (d1-13 to d1-17).	Increase the power limit (d1-13/d1-14) properly.
The encoder parameter settings are incorrect in the FVC control mode.	Check whether the C0 encoder parameters are set correctly.	Set encoder parameters correctly.
The encoder wiring is disconnected in the FVC control mode.	Confirm whether the encoder wiring is correct and if interference exists.	Check the encoder wiring and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether a complete auto-tuning was performed after setting the encoder parameters.	Perform complete parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation	Ensure the encoder installation meets the operational requirements.

Cause	Check Method	Solution
The encoder power supply is abnormal in the FVC control mode.	Check whether the encoder power supply cable is connected properly and whether the encoder power supply voltage is consistent with the PG card power supply voltage.	Ensure the encoder is powered properly.
The detection threshold for excessive deviation (d1-40) or the detection time for excessive deviation (d1-39) is set to an excessively low value.	Check if the settings of d1-39 and d1-40 are correct.	Correctly set the speed deviation detection parameters d1-39 and d1-40.
The acceleration/deceleration time is too short. The motor actual speed cannot follow the set speed.	Confirm if the acceleration and deceleration time is too short.	Correctly set the acceleration and deceleration time and the feedforward compensation.

E042.2/A042.2/L042.2/N042.2: Actual speed opposite to the set speed

Fault cause:

The actual speed is in opposite direction to the set speed.

Troubleshooting:

Cause	Check Method	Solution
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid long-term operation at zero speed in the SVC mode. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control. Set the ten place of d0-85 (Low-speed processing mode) to 1. For details, see the section "Vector Control".
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous motor demagnetization (SVC/ FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).

Cause	Check Method	Solution
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC/ FVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/ Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The encoder parameter settings are incorrect in the FVC control mode.	Check whether the C0 encoder parameters are set correctly.	Set encoder parameters correctly.
The encoder wiring is disconnected in the FVC control mode.	Confirm whether the encoder wiring is correct and if interference exists.	Check the encoder wiring and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether a complete auto-tuning was performed after setting the encoder parameters.	Perform complete parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation	Ensure the encoder installation meets the operational requirements.
The encoder power supply is abnormal in the FVC control mode.	Check whether the encoder power supply cable is connected properly and whether the encoder power supply voltage is consistent with the PG card power supply voltage.	Ensure the encoder is powered properly.

E043.1/A043.1/L043.1/N043.1: Motor overspeed

Fault cause:

This fault is reported when the actual motor speed exceeds the overspeed protection threshold (d1-37) and such status lasts after the time defined by d1-36 elapses.

Troubleshooting:

Cause	Check Method	Solution
Synchronous motor demagnetization (SVC/ FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0 or 1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC/ FVC)	When the motor rotates freely, select “Pre-positioning start” (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/ Ld (F1-34/ F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The power rating of the drive is excessively low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.

Cause	Check Method	Solution
The motor overspeed detection parameter is set improperly.	Check whether the motor overspeed detection parameters (d1-36/d1-37) meet the requirements of the current operating conditions. If the detection parameters can override the actual motor speed change range, the parameters comply.	Set the detection parameters (d1-36 and d1-37) properly as needed so that the motor overspeed detection parameters can cover the actual speed change range of the motor.
The current limit is set to an excessively low value.	Check whether the maximum motor current (F1-13), the maximum AC drive current (A3-05), and the output current (U0-02) reach the limit.	Increase the current limit properly (F1-13).
The torque limit is set to an excessively low value.	Check whether the output torque (U0-06) reaches the limit.	Increase the torque limit (d1-09/d1-10) properly.
The power limit is set to an excessively low value.	Check whether the output power (U0-05) reaches the generating/motoring power limit (d1-13 to d1-17).	Increase the power limit (d1-13/d1-14) properly.
The starting torque is too large during torque control.	Check whether the motor control mode is torque control (F0-02 = 1) and whether a large torque reference is set.	Do not start in the torque control mode with a large torque reference at no load.
The encoder parameter settings are incorrect in the FVC control mode.	Check whether the C0 encoder parameters are set correctly.	Set encoder parameters correctly.
The encoder wiring is disconnected in the FVC control mode.	Confirm whether the encoder wiring is correct and if interference exists.	Check the encoder wiring and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether a complete auto-tuning was performed after setting the encoder parameters.	Perform complete parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation	Ensure the encoder installation meets the operational requirements.
The encoder power supply is abnormal in the FVC control mode.	Check whether the encoder power supply cable is connected properly and whether the encoder power supply voltage is consistent with the PG card power supply voltage.	Ensure the encoder is powered properly.

E043.2/A043.2/L043.2/N043.2: SVC stall of asynchronous motor

Fault cause:

This fault is triggered when the actual motor speed exceeds the asynchronous motor SVC runaway protection threshold (d1-92) and lasts for the time defined by d1-91.

Troubleshooting:

Cause	Check Method	Solution
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	1. Avoid the long-term operation of the SVC at speeds close to zero. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control. Set the tens of the low-speed processing mode (d0-85) to 1. For details, see .	Avoid the long-term operation in the SVC mode at speeds near 0.
Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC).	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.

E043.3/A043.3/L043.3/N043.3: Synchronous motor runaway in FVC mode

Fault cause:

This fault is triggered when the actual motor speed exceeds the synchronous motor SVC runaway protection threshold (d1-94) and lasts for the time defined by d1-93.

Troubleshooting:

Cause	Check Method	Solution
The encoder mounting angle auto-tuning is not performed, or "13-Synchronous motor static auto-tuning" is used, resulting in the wrong start angle and flying start fault.	Check whether encoder mounting angle auto-tuning is not performed and whether C0-03 encoder phase sequence is set.	If rotation auto-tuning cannot be performed, connect the encoder, change the control mode to SVC, and observe during operation whether the encoder speed direction matches the actual speed direction. Modify the C0-03 encoder phase sequence based on the result. After modification, re-perform the synchronous motor partially static auto-tuning (without auto-tuning of back EMF). If conditions allow, the phase sequence of encoder (C0-03) and the installation angle of encoder (C0-04) can be directly auto-tuned through dynamic no-load auto-tuning of the synchronous motor.
If the encoder AB phase sequence defined by F1-30 is not confirmed but "13- synchronous motor partially static auto-tuning (back EMF excluded)" is performed, then zero position angle auto-tuning error may occur when the encoder phase sequence is opposite to the actual direction, leading to zero position angle auto-tuning error and runaway fault.	Connect the encoder, change the control mode to SVC, and observe during operation whether the encoder speed direction matches the actual speed direction. Modify the C0-03 encoder phase sequence based on the result. After modification, re-perform the synchronous motor partially static auto-tuning (without auto-tuning of back EMF). If conditions allow, the phase sequence of encoder (C0-03) and the installation angle of encoder (C0-04) can be directly auto-tuned through dynamic no-load auto-tuning of the synchronous motor.	Connect the encoder, change the control mode to SVC, and observe during operation whether the encoder speed direction matches the actual speed direction. Modify the C0-03 encoder phase sequence based on the result. After modification, re-perform the synchronous motor partially static auto-tuning (without auto-tuning of back EMF). If conditions allow, the phase sequence of encoder (C0-03) and the installation angle of encoder (C0-04) can be directly auto-tuned through dynamic no-load auto-tuning of the synchronous motor.
The encoder is connected loosely or communication is faulty, resulting in encoder pulse loss of encoder transmission position error.	Check whether the encoder is installed reliably and whether the grounding operation is proper.	Install the encoder properly and ground the encoder.

E045.1/A045.1/L045.1/N045.1: Motor overtemperature

Fault cause:

The read-out temperature of the expansion card is higher than the motor overtemperature protection threshold (E2-76).

Troubleshooting:

Cause	Check Method	Solution
The temperature sensor is connected loosely.	Check the wiring of the temperature sensor.	Ensure that the temperature sensor is connected securely.
Motor overtemperature	Check whether the motor temperature is higher than the motor overtemperature protection threshold (E2-76).	Increase the carrier frequency or take other heat dissipation measures to cool the motor.
The motor overtemperature protection threshold is set to an excessively low value.	Check whether the motor overtemperature protection threshold (E2-76) is set to an excessively low value.	Increase the motor overtemperature protection threshold (90℃ to 100℃ for normal motors).

E045.2/A045.2/L045.2/N045.2: Motor pre-overtemperature

Fault cause:

The read-out temperature of the expansion card is higher than the motor pre-overtemperature alarm threshold (E2-75).

Troubleshooting:

Cause	Check Method	Solution
The temperature sensor is connected loosely.	Check the wiring of the temperature sensor.	Ensure that the temperature sensor is connected securely.
Motor overtemperature	Check whether the motor temperature is higher than the motor overtemperature protection threshold (E2-75).	Increase the carrier frequency or take other heat dissipation measures to cool the motor.
The motor pre-overtemperature alarm threshold is too low.	Check whether the motor pre-overtemperature alarm threshold (E2-75) is set to an excessively low value.	Increase the motor overtemperature protection threshold (90℃ to 100℃ for normal motors).

E046.1: Load monitoring overload fault

Fault cause:

Load monitoring overload action (P0-68) is selected as fault. The load monitoring signal keeps exceeding the upper limit defined by P0-75 to P0-79 for the time defined by P0-85 (Permissible overload time).

Troubleshooting:

Cause	Check Method	Solution
The load monitoring parameter is set improperly.	1. Check that the load monitoring overload action (P0-68) is switched on (P0-68 is a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and the permissible overload time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

A046.2: Load monitoring overload alarm

Fault cause:

Load monitoring overload action (P0-68) is selected as a alarm. The load monitoring signal keeps exceeding the lower limit of the load set by P0-75 to P0-79 after the time defined by P0-85 (Permissible overload time) elapses.

Troubleshooting:

Cause	Check Method	Solution
The load monitoring parameter is set improperly.	1. Check that the load monitoring overload action (P0-68) is switched on (P0-68 is a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and the permissible overload time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

E046.3 Load monitoring load loss fault

Fault cause:

Load monitoring load loss action (P0-69) is selected as fault. The load monitoring signal keeps exceeding the upper limit defined by P0-75 to P0-79 after the time defined by P0-86 (Permissible load loss time) elapses.

Troubleshooting:

Cause	Check Method	Solution
The load monitoring parameter is set improperly.	1. Check that the load monitoring overload action (P0-68) is switched on (P0-68 is a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and the permissible overload time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

A046.4: Load monitoring load loss alarm

Fault cause:

Load monitoring load loss action (P0-69) is selected as alarm. The load monitoring signal keeps exceeding the lower limit defined by P0-80 to P0-84 after the time defined by P0-86 (Permissible load loss time) elapses.

Troubleshooting:

Cause	Check Method	Solution
The load monitoring parameter is set improperly.	1. Check that the load monitoring overload action (P0-68) is switched on (P0-68 is a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and the permissible overload time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

E047.1: STO1 disconnected

Fault cause:

The 24 V input detection of STO1 fails.

Troubleshooting:

Cause	Check Method	Solution
The STO1 signal is disconnected.	Check whether the 24 V power supply of STO1 is normal.	Ensure that the STO1 is connected properly.

E047.2: STO2 disconnected

Fault cause:

The 24 V input detection of STO2 fails.

Troubleshooting:

Cause	Check Method	Solution
The STO2 signal is disconnected.	Check whether the 24 V power supply of STO2 is normal.	Ensure that the STO2 is connected properly.

E047.3: STO circuit power supply fault

Fault cause:

The power supply of some components of the STO circuit is abnormal.

Troubleshooting:

Cause	Check Method	Solution
Undervoltage or overvoltage occurs on the STO circuit.	Check whether the control board power supply is normal.	Check whether the control board is normal. If the control board is abnormal, replace the control board.

E047.4: STO circuit input subsystem fault

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The STO circuit input subsystem is abnormal.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact Inovance for technical support.

E047.5: STO BUFFER integrated circuit fault

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The STO output block chip is abnormal.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact Inovance for technical support.

E047.7: STOFLASH check error

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The STO FLASH check fails.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact Inovance for technical support.

E047.8: STORAM check error

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The STO RAM check fails.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact Inovance for technical support.

E047.9: STO check configuration failure

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Configuration of the STO function safety library fails.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact Inovance for technical support.

E051.1: Magnetic pole position auto-tuning error

Fault cause:

The magnetic pole position auto-tuning is interrupted due to an exception.

Troubleshooting:

Cause	Check Method	Solution
Magnetic pole position auto-tuning error	Method 1: Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If output phase loss occurs, the resistance is infinite. Method 2: Enable manual self-test (C2-04 = 1) and run. If no fault is reported, the drive is normal.	Check the phase loss part and replace the motor or cable.

E056.1: Self-test interrupted

Fault cause:

A stop command is sent during system auto-inspection, leading to unusual interruption.

Troubleshooting:

Cause	Check Method	Solution
The self-test process is interrupted.	Check whether the AC drive stops during the self-test.	Perform the self-test again and ensure that no stop command is entered during the self-test.
An error occurred during self-test.	Check whether any other fault is reported.	Rectify the fault reported.

E056.2: Phase U upper bridge IGBT short-circuited

Fault cause:

The IGBT has detected an abnormal VCE signal.

Troubleshooting:

Cause	Check Method	Solution
VCE signal exception of phase U upper bridge IGBT	Contact Inovance for technical support.	Contact Inovance for technical support.

E056.3: Phase U lower bridge IGBT short-circuited

Fault cause:

The IGBT has detected an abnormal VCE signal.

Troubleshooting:

Cause	Check Method	Solution
VCE signal exception of phase U lower bridge IGBT	Contact Inovance for technical support.	Contact Inovance for technical support.

E056.4: Phase V upper bridge IGBT short circuited

Fault cause:

The IGBT has detected an abnormal VCE signal.

Troubleshooting:

Cause	Check Method	Solution
The VCE signal of phase V upper bridge IGBT is detected to be abnormal.	Contact Inovance for technical support.	Contact Inovance for technical support.

E056.5: Phase V lower bridge IGBT short-circuited

Fault cause:

The IGBT has detected an abnormal VCE signal.

Troubleshooting:

Cause	Check Method	Solution
The VCE signal of phase V lower bridge IGBT is abnormal.	Contact Inovance for technical support.	Contact Inovance for technical support.

E056.6: Self-check timeout

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Self-check execution time is too long.	When stopped, observe the U phase current (instantaneous value) of L3328 and the V phase current (instantaneous value) of L3330 through the software to see if they are basically stable at 0.	1. Check the sampling module of the drive and the sampling circuit on the control board; 2. Contact the manufacturer;

E056.9: Output phase loss during self-test

Fault cause:

Phase loss occurs on the cable connecting the drive and motor.

Troubleshooting:

Cause	Check Method	Solution
Output phase loss is detected during self-test of the drive.	Perform manual self-test (C2-04 = 1) and start the drive to check whether output phase loss exists.	Re-connect the output circuit of the drive.

E057.1: Phase U upper bridge or phase V lower bridge IGBT cannot be turned on

Fault cause:

U+V-IGBT open circuit is detected.

Troubleshooting:

Cause	Check Method	Solution
The phase U upper bridge or phase V lower bridge IGBT is faulty.	Contact Inovance for technical support.	Contact Inovance for technical support.

E057.2: Phase U lower bridge or phase V upper bridge IGBT cannot be turned on

Fault cause:

U+V-IGBT open circuit is detected.

Troubleshooting:

Cause	Check Method	Solution
The phase U lower bridge or phase V upper bridge IGBT is faulty.	Contact Inovance for technical support.	Contact Inovance for technical support.

E057.3: Phase V upper bridge or phase W lower bridge IGBT cannot be turned on

Fault cause:

V+W-IGBT open circuit is detected.

Troubleshooting:

Cause	Check Method	Solution
The phase V upper bridge or phase W lower bridge IGBT is faulty.	Contact Inovance for technical support.	Contact Inovance for technical support.

E057.4: Phase V lower bridge or phase W upper bridge IGBT cannot be turned on

Fault cause:

V+W-IGBT open circuit is detected.

Troubleshooting:

Cause	Check Method	Solution
The phase V lower bridge or phase W upper bridge IGBT is faulty.	Contact Inovance for technical support.	Contact Inovance for technical support.

E057.5: Phase W upper bridge or phase U lower bridge IGBT cannot be turned on

Fault cause:

W+U-IGBT open circuit is detected.

Troubleshooting:

Cause	Check Method	Solution
The phase W upper bridge or phase U lower bridge IGBT is faulty.	Contact Inovance for technical support.	Contact Inovance for technical support.

E057.6: Phase W lower bridge or phase U upper bridge IGBT cannot be turned on

Fault cause:

W+U-IGBT open circuit is detected.

Troubleshooting:

Cause	Check Method	Solution
The phase W lower bridge or phase U upper bridge IGBT is faulty.	Contact Inovance for technical support.	Contact Inovance for technical support.

E057.7: Phase-to-phase short circuit on phase U/V

Fault cause:

Output phase-to-phase output short circuit occurs on U/V end.

Troubleshooting:

Cause	Check Method	Solution
Output inter-phase short circuit occurs in phase UV.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.
The phase UV output is short-circuited to ground.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.

E057.8: Phase-to-phase output short circuit on phase U/W

Fault cause:

Phase-to-phase output short circuit is detected on the V/W end.

Troubleshooting:

Cause	Check Method	Solution
Output phase-to-phase short circuit occurs in phase V/W.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.
The phase V/W output is short-circuited to ground.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.

E057.9: Phase-to-phase output short circuit on phase W/U.

Fault cause:

Phase-to-phase output short circuit is detected on the W/U end.

Troubleshooting:

Cause	Check Method	Solution
Output inter-phase short circuit occurs in phase W/U.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.
The phase W/U output is short-circuited to ground.	Check with a tramegger whether short circuit exists.	Re-connect the output circuit of the drive.

E058.1: Phase U current sensor installed improperly

Fault cause:

The phase U current direction is detected to be reversed.

Troubleshooting:

Cause	Check Method	Solution
The phase U sensor is installed improperly.	Contact Inovance for technical support.	Contact Inovance for technical support.

E058.2: Phase V current sensor installed improperly

Fault cause:

The phase V current direction is detected to be reversed.

Troubleshooting:

Cause	Check Method	Solution
The phase V sensor is installed improperly.	Contact Inovance for technical support.	Contact Inovance for technical support.

E058.3: Phase W current sensor installed improperly

Fault cause:

Phase W current is reversed.

Troubleshooting:

Cause	Check Method	Solution
The phase W sensor is installed improperly.	Contact Inovance for technical support.	Contact Inovance for technical support.

E058.4: Phase U/V current sensors misplaced

Fault cause:

The phase U/V current sampling is abnormal.

Troubleshooting:

Cause	Check Method	Solution
Phase U/V current sensors are misplaced.	Contact Inovance for technical support.	Contact Inovance for technical support.

E058.5: Phase V/ W current sensors misplaced

Fault cause:

The phase V/W current sampling is abnormal.

Troubleshooting:

Cause	Check Method	Solution
Phase V/ W current sensors are misplaced.	Contact Inovance for technical support.	Contact Inovance for technical support.

E058.6: Phase W/U current sensors misplaced

Fault cause:

The phase W/U current sampling is abnormal.

Troubleshooting:

Cause	Check Method	Solution
Phase W/U current sensors are misplaced.	Contact Inovance for technical support.	Contact Inovance for technical support.

E059.1/A059.1/L059.1/N059.1: Phase U/V unbalanced

Fault cause:

Phase U/V is unbalanced.

Troubleshooting:

Cause	Check Method	Solution
The load at the output side is unbalanced.	Check whether the phase U/V current on the load side is balanced.	Adjust the output current on the load side to ensure that the phase U/V current does not differ greatly.
The accuracy of the current sensor is insufficient.	Contact Inovance for technical support.	Contact Inovance for technical support.

E059.2/A059.2/L059.2/N059.2: Phase V/W unbalanced

Fault cause:

Phase U/W is unbalanced.

Troubleshooting:

Cause	Check Method	Solution
The load at the output side is unbalanced.	Check whether the phase V/W current on the load side is balanced.	Adjust the output current on the load side to ensure that the phase V/W current does not differ greatly.
The accuracy of the current sensor is insufficient.	Contact Inovance for technical support.	Contact Inovance for technical support.

E059.3/A059.3/L059.3/N059.3: Phase W/U unbalanced

Fault cause:

Phase W/V is unbalanced.

Troubleshooting:

Cause	Check Method	Solution
The load at the output side is unbalanced.	Check whether the phase W/U current on the load side is balanced.	Adjust the output current on the load side to ensure that the phase W/U current does not differ greatly.
The accuracy of the current sensor is insufficient.	Contact Inovance for technical support.	Contact Inovance for technical support.

E060.1: Capacitor leakage

Fault cause:

The bus voltage fluctuation range exceeds the threshold for a certain period.

Troubleshooting:

Cause	Check Method	Solution
Capacitor leakage occurs.	Check whether leakage occurs on the bus capacitor.	Replace the bus capacitor.

E080.1/A080.1/L080.1/N080.1: Fan speed feedback error

Fault cause:

The fan operates improperly.

Troubleshooting:

Cause	Check Method	Solution
The fan is blocked.	Check whether the fan is blocked and whether the air duct is blocked.	Ensure that the air duct is not blocked.
The fan is not connected.	Check whether the fan is connected improperly.	Re-connect the fan properly.

E080.2/A080.2/L080.2/N080.2: Fan initialization failure

Fault cause:

The fan chip is damaged or communication between the MCB and the fan chip is faulty.

Troubleshooting:

Cause	Check Method	Solution
The fan chip is damaged.	Check whether the power supply of the fan is normal.	1. Ensure that the fan chip is normal. 2. If the fault persists, contact the technical support.
The fan does not exists.	Check whether the auto-cooling model is wrong. The non-self-cooling model is selected.	1. Ensure that the self-cooling model is correct. 2. If the fault persists, contact the technical support.

E080.3/A080.3/L080.3/N080.3: PWM fan stall

Fault cause:

The PWM fan is blocked.

Troubleshooting:

Cause	Check Method	Solution
The PWM fan is blocked.	Check if the wrong machine type was selected, and whether the fan is blocked.	1. Ensure the machine type is selected correctly and the fan circuit is normal; 2. If the fault still exists, seek technical support.

E084.1: Brake release failure

Fault cause:

The brake release command is generated but there is no feedback signal within the specified time.

Troubleshooting:

Cause	Check Method	Solution
The brake apply feedback signal is abnormal.	Check the positive and negative logic of the brake feedback source (P4-04).	Check signal feedback point or feedback source wiring, or positive and negative logic.
Brake release action time is improper.	Check the brake release action time (P4-02).	Check whether the set action time is proper.

E084.2: Brake apply failure

Fault cause:

The brake apply command is generated but there is no feedback signal.

Troubleshooting:

Cause	Check Method	Solution
The brake apply feedback signal is abnormal.	Check the brake feedback point source (P4-04).	Check signal feedback point or feedback source wiring, or positive and negative logic.
The brake apply action time is set improperly.	Check the brake apply action time (P4-03).	Check whether the set action time is proper.

E084.3: Brake torque verification failure

Fault cause:

During brake verification, the torque is outputted. After reaching the set time, the feedback torque is detected to be less than 50% of the set torque.

Troubleshooting:

Cause	Check Method	Solution
During brake verification, the torque cannot reach 50% of the set value.	1. Check that the brake can close normally and whether the motor is equipped with a brake. 2. Check that the motor parameters are set correctly and cables are connected properly. 3. Check the brake for excessive abrasion. 4. Disable brake verification (P4-40= 0) in the V/f control mode.	1. Replace the brake if it is worn out. 2. Ensure that the motor is connected correctly.

E084.4: Brake speed verification failure

Fault cause:

During brake verification, the encoder generates displacement.

Troubleshooting:

Cause	Check Method	Solution
During brake verification, the encoder generates displacement.	1. Check that the brake can be closed properly. 2. Check that the motor parameters are set correctly and cables are connected properly. 3. Check the brake for excessive abrasion. 4. Disable brake verification (P4-40= 0) in the V/F control mode.	1. Replace the brake if it is worn out. 2. Ensure that the motor is connected correctly.

E084.6: Brake not allowed to be released during auto-tuning

Fault cause:

After the brake function is enabled, the software assumes that the motor actually has a brake. For safety reasons, brake release is not allowed when it is required to run during auto-tuning.

Troubleshooting:

Cause	Check Method	Solution
Brake release is required during auto-tuning. For safety reasons, brake release is prohibited.	1. Check whether the motor has a brake. 2. Check whether the brake function (P4-00) is enabled.	1. When the motor is not equipped with a brake, disable the brake function (P4-00 = 0) and restart auto-tuning. 2. When the motor is equipped with a brake and the value of P4-00 is not 0, switch off the brake function (P4-00 = 0) and restart auto-tuning again. 3. When the motor is equipped with a brake and the value of P4-00 is not 0, set bit3 of P4-07 to 1 [Brake release allowed]. Then select the source of RO1 output as the brake command output (E1-00 = L0211), and then restart auto-tuning.

E085.1/A085.1/L085.1/N085.1: Sequence fault 1

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.2/A085.2/L085.2/N085.2: Sequence fault 2

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.3/A085.3/L085.3/N085.3: Sequence fault 3

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.4/A085.4/L085.4/N085.4: Sequence fault 4

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.5/A085.5/L085.5/N085.5: Sequence fault 5

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.6/A085.6/L085.6/N085.6: Sequence fault 6

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Software sequence calling error	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E093.1/A093.1/L093.1/N093.1: Motor stall fault

Fault cause:

When the motor reaches the torque limit and the motor operating frequency keeps lower than the stall fault detection frequency (d1-81) within the time defined by d1-80, a motor stall fault can be reported.

Troubleshooting:

Cause	Check Method	Solution
A motor stall fault is reported when the torque is limited in the speed control mode.	Check whether the torque is limited in the speed control mode.	Disable motor stall detection (d1-79 = 0).
The load is excessive, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC at speeds closed to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control, and set the tens of the low-speed processing mode (d0-85) to 1. For details, see the Vector Control section.
Synchronous motor demagnetization (SVC/ FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0 or 1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".
The motor is started during rotation (synchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).

Cause	Check Method	Solution
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC/ FVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/ Ld (F1-34/ F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The current limit is set to an excessively low value.	Check whether the maximum motor current (F1-13), the maximum AC drive current (A3-05), and the output current (U0-04) reach the limit.	Increase the current limit properly (F1-13).
The torque limit is set to an excessively low value.	Check whether the output torque (U0-06) reaches the limit.	Increase the torque limit (d1-09/d1-10) properly.
The power limit is set to an excessively low value.	Check whether the output power (U0-05) reaches generating/motoring power limit (d1-13 to d1-17). For details, see section "Power limit" in the function guide.	Increase the power limit (d1-13/d1-14) properly.
The encoder parameter settings are incorrect in the FVC control mode.	Check whether the C0 encoder parameters are set correctly.	Set encoder parameters correctly.
The encoder wiring is disconnected in the FVC control mode.	Confirm whether the encoder wiring is correct and if interference exists.	Check the encoder wiring and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether a complete auto-tuning was performed after setting the encoder parameters.	Perform complete parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.

Cause	Check Method	Solution
The encoder installation is incorrect in the FVC control mode.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation	Ensure the encoder installation meets the operational requirements.
The encoder power supply is abnormal in the FVC control mode.	Check whether the encoder power supply cable is connected properly and whether the encoder power supply voltage is consistent with the PG card power supply voltage.	Ensure the encoder is powered properly.

E093.2/A093.2/L093.2/N093.2: Motor step loss fault

Fault cause:

After motor step loss detection is enabled, when the deviation between the magnetic flux setpoint and the feedback value keeps exceeding the step loss fault detection threshold (d1-86) within the time defined by d1-85, this fault can be reported. It is active only for asynchronous motors.

Troubleshooting:

Cause	Check Method	Solution
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0 or 1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
Output phase loss	1. Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If output phase loss occurs, the resistance is infinite. 2. Enable manual self-test (C2-04 = 1) and enable the drive to run. If no fault is reported, the drive is normal.	Check the phase loss part and replace the motor or cable.
The encoder parameter settings are incorrect in the FVC control mode.	Check whether the C0 encoder parameters are set correctly.	Set encoder parameters correctly.
The encoder wiring is disconnected in the FVC control mode.	Confirm whether the encoder wiring is correct and if interference exists.	Check the encoder wiring and ensure proper shielding.

Cause	Check Method	Solution
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether a complete auto-tuning was performed after setting the encoder parameters.	Perform complete parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation	Ensure the encoder installation meets the operational requirements.
The encoder power supply is abnormal in the FVC control mode.	Check whether the encoder power supply cable is connected properly and whether the encoder power supply voltage is consistent with the PG card power supply voltage.	Ensure the encoder is powered properly.

E093.3/A093.3/L093.3/N093.3: Current control error

Fault cause:

After current control error detection is enabled, when the deviation between the set current and feedback current keeps exceeding the current control error detection threshold (d1-88) within the time defined by (d1-87), this fault can be reported.

Troubleshooting:

Cause	Check Method	Solution
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0 or 1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".
Output phase loss	1. Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If output phase loss occurs, the resistance is infinite. 2. Enable manual self-test (C2-04 = 1) and enable the drive to run. If no fault is reported, the drive is normal.	Check the phase loss part and replace the motor or cable.
The droop coefficient is set to an excessively high value (synchronous motor/asynchronous motor SVC/FVC).	Check whether the droop function (d3-27 = 1) is enabled, ensure that the droop coefficient (d3-29) does not exceed the rated slip of the motor, and check whether the set frequency (U0-01) shows obvious oscillation every time.	The droop coefficient (d3-29) is lower than the rated slip of the motor.
The encoder parameter settings are incorrect in the FVC control mode.	Check whether the C0 encoder parameters are set correctly.	Set encoder parameters correctly.
The encoder wiring is disconnected in the FVC control mode.	Confirm whether the encoder wiring is correct and if interference exists.	Check the encoder wiring and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether a complete auto-tuning was performed after setting the encoder parameters.	Perform complete parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.

Cause	Check Method	Solution
The encoder installation is incorrect in the FVC control mode.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation	Ensure the encoder installation meets the operational requirements.
The encoder power supply is abnormal in the FVC control mode.	Check whether the encoder power supply cable is connected properly and whether the encoder power supply voltage is consistent with the PG card power supply voltage.	Ensure the encoder is powered properly.

E094.1/A094.1/L094.1/N094.1: Calculated value of the pole pairs not matching the set value

Fault cause:

The set number of motor pole pairs (F1-14) is different from the auto-tuned number of motor pole pairs.

Troubleshooting:

Cause	Check Method	Solution
The set number of motor pole pairs is inconsistent with the actual number.	Check whether the number of active pole pairs (F1-15) of the motor is consistent with the parameters provided by the motor manufacturer.	Set the number of motor pole pairs correctly (F1-14).

E094.2/A094.2/L094.2/N094.2: Rated power, voltage, and current of the motor mismatch

Fault cause:

The set motor power factor is not within the allowable range.

Troubleshooting:

Cause	Check Method	Solution
The set rated power, voltage, and current of the motor do not match each other.	Check whether the rated motor power P (F1-01), rated voltage U (F1-03), rated current I (F1-04), and power factor (C4-09) are set outside the normal range.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.

E094.3/A094.3/L094.3/N094.3: No-load current parameter range error

Fault cause:

The auto-tuned no-load current value is outside the allowable range.

Troubleshooting:

Cause	Check Method	Solution
The rated motor parameters are set incorrectly. Therefore, the auto-tuned no-load current is outside the allowable range.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E094.4/A094.4/L094.4/N094.4: Mutual inductance and no-load current inconsistent with the rated voltage

Fault cause:

The deviation between the rated flux and the flux calculated based on the rated voltage and frequency exceeds the allowable range.

Troubleshooting:

Cause	Check Method	Solution
The auto-tuned mutual inductance and no-load current are inconsistent with the rated voltage and rated frequency.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E094.5/A094.5/L094.5/N094.5: Rotor resistance parameter range error

Fault cause:

The auto-tuned rotor resistance is not within the allowable range.

Troubleshooting:

Cause	Check Method	Solution
The auto-tuned rotor resistance is not within the allowable range.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E094.8/A094.8/L094.8/N094.8: Random PWM parameter setting fault

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Random PWM range is limited by the carrier frequency upper or lower limit, and cannot reach the set fluctuation range.	Appropriately reduce the random PWM depth of A5-11. If the alarm disappears, it indicates that the random range has reached the limit.	Appropriately reduce the random PWM depth of A5-11.

E110.1/A110.1/L110.1/N110.1: Pre-overload of the drive

Fault cause:

The cumulative value of drive overload is reached (100% - AC drive pre-overload threshold (A4-28)).

Troubleshooting:

Cause	Check Method	Solution
The load is excessive, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC at speeds closed to 0. 2. Enable IF control, and set the tens of the low-speed processing mode (d0 -85) to 1. For details, refer to the section "Vector Control".
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous motor demagnetization (SVC/ FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0 or 1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".

Cause	Check Method	Solution
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, extend the acceleration/deceleration time properly 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking for stop to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). and perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
The motor is started during rotation (synchronous/asynchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
V/f oscillation overload (asynchronous motor V/f)	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/torque current fluctuation range of the motor does not exceed 10%.	Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. See the section "Vf Oscillation Suppression" for details. The motor control mode is changed to SVC (F0-01 = 0). After parameter auto-tuning, the motor runs in SVC.

Cause	Check Method	Solution
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC/ FVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/ Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The power rating of the drive is excessively low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.
The synchronous motor reports a fault after overspeed or the synchronous motor coasts to stop after manual settings.	When the synchronous motor overspeed occurs, the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time. This causes the output diode to energize in the reverse direction and back EMF short circuit. If the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is higher than the overvoltage threshold, operation interruption may cause overvoltage of the AC drive and may damage the drive.	Set the positive frequency upper limit (d1-03) to the result of overvoltage threshold (A4-39)/ (1.414 x back EMF of synchronous motor). Keep the maximum operating speed below this limit. Select the motor type properly. A motor with high back EMF can effectively reduce the output current. However, running at a speed above the limit may result in overvoltage or damage.
Derated operation applies due to long-term operation at low frequencies.	During low-frequency operation, large fluctuation in IGBT temperature may easily occur, resulting in thermal stress and damage the IGBT. The derating ratio increases from 0% to 20% when frequency changes from 5 Hz to 0 Hz.	Use a drive with higher power rating.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.

Cause	Check Method	Solution
Derating occurs due to excessive carrier frequency.	Setting the carrier frequency (A5-01) to a value higher than the default can result in derating of the output with load.	Set a proper carrier frequency. If the high carrier frequency output capability is insufficient, it is recommended to use a drive with higher power.
The encoder parameter settings are incorrect in the FVC control mode.	Check whether the C0 encoder parameters are set correctly.	Set encoder parameters correctly.
The encoder wiring is disconnected in the FVC control mode.	Confirm whether the encoder wiring is correct and if interference exists.	Check the encoder wiring and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether a complete auto-tuning was performed after setting the encoder parameters.	Perform complete parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation	Ensure the encoder installation meets the operational requirements.
The encoder power supply is abnormal in the FVC control mode.	Check whether the encoder power supply cable is connected properly and whether the encoder power supply voltage is consistent with the PG card power supply voltage.	Ensure the encoder is powered properly.

E110.2/A110.2/L110.2/N110.2: PCB pre-overload

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The load is excessive, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC at speeds closed to 0. 2. Enable IF control, and set the tens of the low-speed processing mode (d0 -85) to 1. For details, refer to the section "Vector Control".

Cause	Check Method	Solution
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous motor demagnetization (SVC/ FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0 or 1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, extend the acceleration/deceleration time properly 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking for stop to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/ deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.

Cause	Check Method	Solution
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). and perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
The motor is started during rotation (synchronous/asynchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
V/f oscillation overload (asynchronous motor V/f)	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/torque current fluctuation range of the motor does not exceed 10%.	Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. See the section "Vf Oscillation Suppression" for details. The motor control mode is changed to SVC (F0-01 = 0). After parameter auto-tuning, the motor runs in SVC.
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC/ FVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/ Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The power rating of the drive is excessively low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.

Cause	Check Method	Solution
The synchronous motor reports a fault after overspeed or the synchronous motor coasts to stop after manual settings.	When the synchronous motor overspeed occurs, the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time. This causes the output diode to energize in the reverse direction and back EMF short circuit. If the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is higher than the overvoltage threshold, operation interruption may cause overvoltage of the AC drive and may damage the drive.	Set the positive frequency upper limit (d1-03) to the result of overvoltage threshold (A4-39)/ (1.414 x back EMF of synchronous motor). Keep the maximum operating speed below this limit. Select the motor type properly. A motor with high back EMF can effectively reduce the output current. However, running at a speed above the limit may result in overvoltage or damage.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
The encoder parameter settings are incorrect in the FVC control mode.	Check whether the C0 encoder parameters are set correctly.	Set encoder parameters correctly.
The encoder wiring is disconnected in the FVC control mode.	Confirm whether the encoder wiring is correct and if interference exists.	Check the encoder wiring and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether a complete auto-tuning was performed after setting the encoder parameters.	Perform complete parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation	Ensure the encoder installation meets the operational requirements.
The encoder power supply is abnormal in the FVC control mode.	Check whether the encoder power supply cable is connected properly and whether the encoder power supply voltage is consistent with the PG card power supply voltage.	Ensure the encoder is powered properly.

E111.1/A111.1/L111.1/N111.1: Motor pre-overload

Fault cause:

When pre-overload protection is enabled, the cumulative overload of the motor exceeds the motor overload alarm coefficient (d1-47).

Troubleshooting:

Cause	Check Method	Solution
The load is excessive, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
Synchronous motor demagnetization (SVC/ FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The input voltage is too low.	1. Check whether the input voltage meets the design requirements (380 V models: 380 V to 480 V). 2. Check whether the upstream circuit breaker or contactor trips or cannot be closed.	1. Increase the input voltage to a value within the normal range. 2. Ensure that the inlet switch is normal.
The motor pre-overload alarm coefficient (d1-47) is set improperly.	The default motor overload data of the drive does not match the actual motor. The actual motor temperature rise is not high.	Increase the motor pre-overload alarm coefficient (d1-47) to extend the time for the motor to report an overload. If the motor continues to report a fault during long-term operation, you can directly turn off the motor overload protection.

E114.1/A114.1/L114.1/N114.1: Module pre-overtemperature

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The ambient temperature is excessively high.	Measure the ambient temperature to check whether it is higher than 50°C.	Lower down the ambient temperature.
The air duct is blocked.	Check whether the air filter of the fan is blocked.	Clean the air duct.
The fan is damaged.	After cooling down, start the AC drive and observe whether the fan rotates.	Replace the fan.
The thermistor is damaged.	Test the thermistor of the drive.	Contact Inovance for technical support.
The IGBT module is damaged.	The fault persists after the preceding measures are taken.	Contact Inovance for technical support.

E132.3: Parameter power-off error

Fault cause:

Parameter storage failure upon power-off

Troubleshooting:

Cause	Check Method	Solution
Parameter error upon power-off	Parameters are not saved upon power-off.	Contact Inovance for technical support.

E151.1/A151.1/L151.1/N151.1: Cable drum vertical application parameter setting error

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The max. tension, min. tension, max. torque setpoint, or min. torque setpoint are set improperly during cable drum vertical application.	Obtain the [Toque max. value of vertical cable drum application] through [PD-02 Max. tension] x [PC-11 Min. reel diameter]/[PC-03 Mechanical transmission ratio]/[Rated motor torque]. Obtain the [Torque min. of vertical cable drum application] through [PC-51 Min. tension setpoint of vertical cable drum application] x [PC-10 Max. reel diameter]/[PC-03 Mechanical transmission ratio]/[Rated motor torque]. If the [Torque min. value of vertical cable drum application] is higher than [Torque max. value of vertical cable drum application] after preceding calculation, Err150.01 is reported, indicating vertical application parameters are set improperly.	Reset parameters properly.

E153.1/A153.1/L153.1/N153.1: Material run-out

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
Material run-out is detected under tension process run-out detection.	The material run-out fault occurs when the reel diameter change keeps exceeding the material run-out detection error after continuous material run-out detection time elapses.	Check the material condition and re-load the material.

E154.1/A154.1/L154.1/N154.1: HDI disconnected

Fault cause:

No HDI input signal is detected or the input frequency signal is lower than the specification.

Troubleshooting:

Cause	Check Method	Solution
Pulse signal disconnected	Check whether the HDI input circuit is intact.	Perform wiring again.
The set pulse signal is incorrect.	Check the pulse input signal. If the pulse signal is not continuous or the pulse input signal is lower than half of the minimum input, the pulse signal input is abnormal.	Ensure that the HDI input signal and wiring are correct.

E154.3/A154.3/L154.3/N154.3: AI1 input error

Fault cause:

AI1 input voltage (current) is not within the range of E2-14 (AI1 input protection upper limit) and E2-15 (AI1 input protection lower limit).

Troubleshooting:

Cause	Check Method	Solution
AI1 input signal disconnected	Check whether the AI input circuit is intact.	Perform wiring again.
The AI input signal voltage or current is abnormal.	Check the AI input voltage or current change. The input can be determined as abnormal if the change exceeds the upper or lower limit of AI input protection (E2-14 or E2-15).	Ensure that the input voltage (current) does not exceed the upper and lower limits of protection (E2-14/E2-15). If the upper and lower limits are exceeded, do as follows:Mode 1: Change the setting of E2-14/ E2-15 to avoid false alarms caused by signal interference.Mode 2: Change H1-14 to select a proper fault response level or shield the fault.

E154.4/A154.4/L154.4/N154.4: AI2 input error

Fault cause:

AI2 input voltage (current) is not within the range of E2-23 (AI2 input protection upper limit) and E2-24 (AI2 input protection lower limit).

Troubleshooting:

Cause	Check Method	Solution
AI2 input signal disconnected	Check whether the AI input circuit is intact.	Perform wiring again.
The AI2 input signal voltage or current is abnormal.	Check the AI input voltage or current change. The input can be determined as abnormal if the change exceeds the upper or lower limit of AI input protection (E2-23 or E2-24).	Ensure that the input voltage (current) does not exceed the upper and lower limits of protection (E2-23/E2-24). If the upper and lower limits are exceeded, proceed as follows:Mode 1: Change the setting of E2-23 and E2-24 to avoid false alarms caused by signal interference.Mode 2: Change H1-14 to select a proper fault response level or shield the fault.

E154.8/A154.8/L154.8/N154.8: I/O expansion card 1-AI input error

Fault cause:

1. Check whether the AI input circuit is intact. 2. Detect changes in AI input line voltage or current values, exceeding AI input protection upper and lower limits. If the input is out of (EA-43/44) range, input abnormality occurs.

Troubleshooting:

Cause	Check Method	Solution
1. Check whether AI1 input signal is disconnected. 2. Check whether AI1 input signal voltage or current is normal.	1. Check whether the AI input cable is intact. 2. Check the AI input voltage or current change. The input can be determined as abnormal if the change exceeds the upper or lower limit of AI input protection (EA-43/44).	1. Reconnect the cable. 2. Ensure that the input voltage (current) does not exceed the upper and lower protection limits. 3. Modify EA-43/44 to avoid false alarms caused by signal interference. 4. Modify H1-14 to select an appropriate fault response level, or mask this fault.

E154.9/A154.9/L154.9/N154.9: I/O expansion card 2-AI input error

Fault cause:

1. Check whether the AI input circuit is intact. 2. Detect changes in AI input line voltage or current values, exceeding AI input protection upper and lower limits. If the input is out of (Eb-43/44) range, input abnormality occurs.

Troubleshooting:

Cause	Check Method	Solution
1. Check whether AI1 input signal is disconnected. 2. Check whether AI1 input signal voltage or current is normal.	1. Check whether the AI input cable is intact. 2. Check the AI input voltage or current change. The input can be determined as abnormal if the change exceeds the upper or lower limit of AI input protection (EB-43 or E2-44).	1. Reconnect the cable. 2. Ensure that the input voltage (current) does not exceed the upper and lower protection limits. 3. Modify Eb-43/44 to avoid false alarms caused by signal interference. 4. Modify H1-14 to select an appropriate fault response level, or mask this fault.

E155.1/A155.1/L155.1/N155.1: Communication of I/O expansion card 1 timeout

Fault cause:

IO expansion card 1 wiring loose, or communication abnormality with the AC drive

Troubleshooting:

Cause	Check Method	Solution
1. Check whether the wiring of the I/O expansion card is correct. 2. Check whether the breathing light of the I/O card is normal. 3. Check whether communication with the AC drive is normal.	1. Check whether the wiring of the I/O expansion card is correct. 2. Check whether the breathing light of the I/O card is normal. 3. Check whether communication with the AC drive is normal.	1. Check that the wiring is normal. 2. Contact technical support.

E155.2/A155.2/L155.2/N155.2:Communication of I/O expansion card 2 timeout

Fault cause:

IO expansion card 2 wiring loose, or communication abnormality with the AC drive

Troubleshooting:

Cause	Check Method	Solution
1. Check whether the wiring of the I/O expansion card is correct. 2. Check whether the breathing light of the I/O card is normal. 3. Check whether communication with the AC drive is normal.	1. Check whether the wiring of the I/O expansion card is correct. 2. Check whether the breathing light of the I/O card is normal. 3. Check whether communication with the AC drive is normal.	1. Check that the wiring is normal. 2. Contact technical support.

E159.1: Fault auto reset failure

Fault cause:

The fault reset function is configured and the fault cause is eliminated, but the fault is not automatically reset.

Troubleshooting:

Cause	Check Method	Solution
Faults that inhibit automatic fault reset have been reset.	Check whether faults that cannot be reset are set in H3-13...H3-22.	If H3-13 to H3-22 are set with faults that cannot be reset, check whether to remove the fault that cannot be reset according to actual requirements. If H3-13 to H3-22 are not set with faults that cannot be reset, power off and on again. If the fault still persists, contact the technical support.

E160.1/A160.1/L160.1/N160.1: Modbus-RTU communication timeout

Fault cause:

Modbus timeout (not 0) is configured and no data is received after the timeout period elapses.

Troubleshooting:

Cause	Check Method	Solution
Ambient interference exists.	Check whether the RS485 communication cable is connected properly.	Connect the RS485 communication cable.
The baud rate and data format of the master and slave are inconsistent.	Check whether communication parameters such as station number (n2-02), communication baud rate (n2-00), and data format (n2-01) are set correctly. The baud rate and data format set by the host controller and the AC drive must be consistent. The station number must be unique. Otherwise, communication can fail.	Ensure that the baud rate, data format, and station number set by the host controller and those set in the AC drive are consistent.
The master does not send request data to the slave within the timeout period.	1. Check whether the master configures data request commands for the slave that reports errors. 2. Check whether the values of the Modbus communication timeout (n2-04) and the PLC communication cycle are proper. The Modbus communication timeout (n2-04) must be greater than the PLC communication cycle.	1. Ensure that the master configures data request command for the slave that reports errors. 2. Ensure that the value of the Modbus communication timeout (n2-04) is higher than the PLC communication cycle.

E161.1/A161.1/L161.1/N161.1: CANopen heartbeat timeout

Fault cause:

1. The heartbeat consumption time (1016) of the CANopen object dictionary is configured and exceeds the heartbeat consumption time. The device does not receive the heartbeat of the target node. 2. The heartbeat protection coefficient (100C) and the protection cycle (100D) are configured. The product of them is the lifetime, after which the node does not receive a remote request frame.

Troubleshooting:

Cause	Check Method	Solution
Ambient interference affects the CAN signal.	1. Check whether the CAN communication cable is correctly connected. 2. If the cable is connected properly, check parameters n3-10 to n3-12. If n3-12 is not 0, the values of n3-10 and n3-11 change, it indicates that strong interference exists.	1. Connect the CAN communication cable. 2. Install the termination resistor, magnetic ring, and filter.
The master heartbeat production cycle is larger than the slave heartbeat consumption cycle.	Check whether the heartbeat cycle set by the master and the heartbeat consumption time set by the slave are proper. It is recommended that the heartbeat consumption time be set to at least 2.5 x heartbeat cycle of the master.	Ensure that the heartbeat consumption period is larger than the heartbeat production cycle of the master.

E161.2/A161.2/L161.2/N161.2: CANopenPDO length error

Fault cause:

The received PDO length is inconsistent with the configured PDO mapping length.

Troubleshooting:

Cause	Check Method	Solution
The length of the PDO sent by the master is incorrect.	Check whether the PDO mapping length configured by the master is consistent with the length of the PDO data sent (using the packet capture tool).	If the length of the PDO data sent is inconsistent with the configuration, the master may be faulty. In this case, contact the master manufacturer. To eliminate this fault, stop and restart or reset the slave.

E161.4/A161.4/L161.4/N161.4: CANopen state switchover error

Fault cause:

The device receives a reset command from the master during normal operation.

Troubleshooting:

Cause	Check Method	Solution
The master sends a reset node command to reset the communication command.	Check whether the master sends reset node commands and reset communication commands (with the aid of the packet capture tool) when the device is operating normally.	If you confirm that the master sends a reset node command or resets the communication command, it indicates that the master is faulty. In this case, contact the manufacturer of the master. To eliminate this fault, stop and restart. If the fault persists, contact technical support.

E162.1/A162.1/L162.1/N162.1: CANlink heartbeat timeout

Fault cause:

The CANlink timeout (not 0) is configured and the device does not receive any requested data after the time that greater than 2.5 x timeout time elapses.

Troubleshooting:

Cause	Check Method	Solution
Ambient interference affects the CAN signal.	1. Check whether the CAN communication cable is correctly connected. 2. If the cable is connected properly, check parameters n3-10 to n3-12. If n3-12 is not 0, the values of n3-10 and n3-11 change, it indicates that strong interference exists.	1. Connect the CAN communication cable. 2. Install the termination resistor, magnetic ring, and filter.
The master heartbeat production cycle is larger than the slave heartbeat consumption cycle.	Check whether the heartbeat cycle set by the master and the slave are proper. The heartbeat cycle of the master must be lower than 2.5 x heartbeat cycle of the slave.	Ensure that the slave heartbeat cycle is larger than the master heartbeat production cycle.

E162.2/A162.2/L162.2/N162.2: CANlink station number conflict

Fault cause:

The same station number exists in the same CAN network.

Troubleshooting:

Cause	Check Method	Solution
In the same CANlink network, n3-07 of two or more devices is set to the same value.	Check whether n3-07 of other devices in the CANlink network is the same as n3-07 of the device reporting the fault.	Modify n3-07 of the device that reports the fault to ensure that this parameter is different from other devices in the CANLink network.

E165.1/A165.1/L165.1/N165.1: EtherNet/IP Ethernet communication timeout

Fault cause:

The device cannot receive the data packets sent by the controller within the set communication cycle or the data packets received are incorrect.

Troubleshooting:

Cause	Check Method	Solution
The power supply of the device is unstable or the network topology is disturbed.	1. Check whether the power supply of the equipment is stable. Measure whether the bus voltage is within the operating voltage range. If not, check whether a high-power device is using the same power supply. The same power supply is used for high-power devices. This may cause voltage instability. In this case, an independent power supply is required. 2. Check whether the communication cable and power cable are routed through different routes. If the communication cable is routed together with the power cable, interference may occur. It is recommended to route the cables through different routes according to the cable routing specifications.	1. Ensure that no high-power devices share the same power supply. Use an independent power supply. 2. Route the communication cables and power cables through different routes. 3. If the voltage is still unstable after preceding measures are taken, replace the power supply.
A fault occurs on the network device.	1. Ping the device continuously, check whether the device responds and whether the response delay is greater than the set communication service cycle. If no response or response delay is greater than the communication service cycle, the network equipment may be faulty. Use the step-by-step ping method to locate the faulty device and replace it. If the response delay is lower than the communication service cycle, check whether the delay fluctuation is stable or too large. If it is unstable or too large, the network equipment may be faulty or the network bandwidth may be insufficient. 2. Check whether the network bandwidth is sufficient with the command ifconfig.	1. Replace the network device that is faulty in the network topology. 2. If the network bandwidth is insufficient, reduce the number of nodes in the network topology or upgrade the network bandwidth.
The controller is faulty.	Check whether the controller works properly and whether there is any data sent. If not, the controller is abnormal and needs to be replaced.	Replace the controller.

E165.2/A165.2/L165.2/N165.2: EtherNet/IP Ethernet hardware error

Fault cause:

The Ethernet chip cannot be configured.

Troubleshooting:

Cause	Check Method	Solution
The Ethernet chip is faulty.	Check whether the MCB network port, PHY chip, and network transformer are dirty.	Clean the dirty parts. If this is not possible, contact technical support.

E165.3/A165.3/L165.3/N165.3: No MAC address programmed in EtherNet/IP

Fault cause:

No MAC address or illegal MAC address is detected after power-on.

Troubleshooting:

Cause	Check Method	Solution
MAC address is lost.	Check whether the MAC address of the drive can be read by the host controller through the iFA commissioning software. If it cannot be read, the MAC address is lost.	Contact the technical support.

E165.4/A165.4/L165.4/N165.4: IP conflict for EtherNet/IP

Fault cause:

Two identical IP addresses are detected in the communication network.

Troubleshooting:

Cause	Check Method	Solution
IP address conflict exists in the communication network.	Disconnect the device from the network and check whether the fault disappears. If there is no fault when the device is not connected to the network, the fault is reported after connection. The IP address of this device conflicts with other devices in the network.	Modify the IP address of the conflict device.

E166.1/A166.1/L166.1/N166.1: PROFINET communication timeout

Fault cause:

After normal communication with the master is established, the connection is interrupted.

Troubleshooting:

Cause	Check Method	Solution
The master or slave is disconnected during communication.	The keypad displays the fault code.	Check the communication lines between the master and slave.

E166.2/A166.2/L166.2/N166.2: MAC address not programmed in PROFINET

Fault cause:

No MAC address or illegal MAC address is detected after power-on.

Troubleshooting:

Cause	Check Method	Solution
The MAC address is lost or not programmed.	The keypad displays the fault code.	Contact Inovance for technical support.

E166.3/A166.3/L166.3/N166.3: PROFINET mapping address error

Fault cause:

The slave receives the PZD mapping configured by the master, but some or all of the mapped addresses are illegal, such as no parameter available, read-only parameters are being written.

Troubleshooting:

Cause	Check Method	Solution
The mapping configured during configuration is illegal.	The operating panel displays the fault code and the master cannot establish data interaction with the slave.	Modify the illegal mapping address.

E167.1/A167.1/L167.1/N167.1: EtherCAT sync lost

Fault cause:

In OP state, the synchronization signal is lost.

Troubleshooting:

Cause	Check Method	Solution
The slave hardware (for example, the ESC register) causes the synchronization signal to be lost and the drive runs improperly.	Observe whether the indicator (difference between SYNC and IRQ phases) is larger than the synchronization cycle set by the master through the continuous oscilloscope function of Inovance software, If yes, it indicates an error.	Replace the drive or contact technical support.

E167.2/A167.2/L167.2/N167.2: EtherCAT link lost

Fault cause:

When the device is not powered on again, the value of the link loss register increases, indicating that process data is lost.

Troubleshooting:

Cause	Check Method	Solution
The physical connection of the data link is unstable or the process data is lost due to plug-in/plug-out of the network cable.	When the device is not powered on again, view the value of the link loss register through the software tool of the master. If it is not zero or the value increases continuously, the process data is lost.	Check whether the network cable of the drive is connected reliably. Check whether the network cable is loose due to strong vibration in the field. Ensure that the network cable is connected securely.

E167.3/A167.3/L167.3/N167.3: EtherCAT read-only memory loading error

Fault cause:

During program start, EEPROM read failure is detected.

Troubleshooting:

Cause	Check Method	Solution
The information saved in EEPROM is incorrect.	The version number defined by n4-33 is not 0, but E167.3 is still reported.	Program the XML file again.
The XML file is not programmed in Flash.	The version defined by n4-33 is 655.35.	Program the XML file again.

E167.4/A167.4/L167.4/N167.4: EtherCAT initialization error

Fault cause:

EtherCAT peripheral initialization failed after power-on.

Troubleshooting:

Cause	Check Method	Solution
Hardware fault (such as ESC chip fault)	EtherCAT cannot communicate properly. The master cannot scan and identify the slave device.	Replace the AC drive or contact technical support.

E167.6/A167.6/L167.6/N167.6: DC not enabled by EtherCAT

Fault cause:

The host controller requests the EtherCAT slave to switch to OP state, but the DC mode is not enabled.

Troubleshooting:

Cause	Check Method	Solution
The master is faulty or the master is operating improperly.	Check whether the master is configured correctly or analyze whether the master is faulty by capturing the packet.	Configure the master properly or ask for technical support.

E167.7/A167.7/L167.7/N167.7: Number or length of EtherCAT PDO mapping outside the limit

Fault cause:

The number of PDOs or configured bytes of the TXPDO or RXPDO exceeds the limit. The MD630N specifies that a maximum of 16 PDOs can be configured for each group, and a maximum of 32 bytes can be configured for each group of PDOs.

Troubleshooting:

Cause	Check Method	Solution
The master configuration information is incorrect.	Check whether the PDO is configured correctly.	Configure the number of mapped PDOs and bytes correctly. You can configure a maximum of 16 PDOs per group, and a maximum of 32 bytes per group of PDOs.

E167.8/A167.8/L167.8/N167.8: EtherCAT process data reception timeout

Fault cause:

Check whether the IRQ is lost through SYNC interrupt. The error count is incremented by 1 each time the IRQ is lost. The error count is cleared every time the IRQ is lost. The error count exceeds the set value, and there is no data frame error exception protection fault, data frame transfer error exception protection fault, or link loss exception protection fault.

Troubleshooting:

Cause	Check Method	Solution
The data frame is lost at the upstream station and the upstream station is faulty.	If master communication is not recovered, view the synchronous loss counter value (n4-30) of the drive. When a fault occurs, the value is not 0.	Check whether link loss occurs on the upstream station. Check that the wiring is correct.
The performance of the master is poor, the jitter of the IRQ exceeds the set value x communication cycle.	Observe the SYNC and Irq phases through the online oscilloscope function in the software tool of the drive. When a fault occurs, the phase is greater than or equal to the synchronization loss threshold x communication cycle.	Check whether the CPU operation load of the master is too large. You can optimize load reduction of the master by reducing the communication time and setting a high synchronization loss threshold.

E167.9/A167.9/L167.9/N167.9: EtherCAT ESC port 0 reception error

Fault cause:

Check whether Rx_ERR occurs in Port0 and the link does not change upon occurrence of the fault.

Troubleshooting:

Cause	Check Method	Solution
The data is lost due to EMC interference, poor quality of the network cable or improper connection.	View the error counter values of port 0 and port 1 in the master software tool, or view the corresponding port parameter of the drive. The values of port 0 (n4-25) and port 1 (n4-26) are not 0.	Check whether proper grounding is performed and rectify EMC measures. Check whether the network cable used is provided by Inovance and whether the network cable is reliable.

E168.1/A168.1/L168.1/N168.1: EtherCAT ESC port forwarding and EPU processing error

Fault cause:

Check whether a processing unit error occurs due to transfer error or invalid frames upon occurrence of the fault, and check whether no counting is performed in RX-ERR of Port0.

Troubleshooting:

Cause	Check Method	Solution
The data frame is damaged due to an upstream station fault or a link fault.	The values of the transfer error counter (n4-27) and the processing unit error counter (n4-28) change.	The upstream station may be disturbed, the link layer may be faulty, and the hardware is faulty. Replace the upstream station or contact technical support if necessary.

E168.2/A168.2/L168.2/N168.2: EtherCAT MailBox setting exception protection

Fault cause:

The following error occurs during EtherCAT communication startup configuration check: 1. Check whether the SM channel is enabled. 2. Check whether the read/write direction is configured correctly. 3. Check whether the mailbox mode applies (single buffer mode). 4. Check whether the length of the data received is within the setting range. 5. Check whether the address of the data received is within the setting range. 6. Check whether the memory of the read/write mailbox overlaps.

Troubleshooting:

Cause	Check Method	Solution
The master imports the wrong XML file.	Check whether the correct XML file is imported and the XML file shall meet the following conditions: 1. The SM channel is enabled. 2. The read/write direction is configured correctly. 3. The mailbox mode applies (single buffer mode). 4. The length of the data received is within the setting range. 5. The address of the data received is within the setting range. 6. The memory of the read/ write mailbox does not overlap.	1. Re-import the XML file and restart the connection. 2. If the problem persists after the master is restarted, contact technical support to rectify the XML configuration.

E168.3/A168.3/L168.3/N168.3: EtherCAT SM2 configuration error

Fault cause:

The following error occurs during EtherCAT communication startup configuration check: 1. The length of SM and RxPDO is not 0 when SM2 is not enabled. 2. The SM2 channel is not in the write direction. 3. SM2 overlaps with the adjacent SM1 or SM3 memory. 4. The length of the RxPDO does not match. 5. In the preop state, the address of RxPDO is not in the set address field (maximum and minimum address) or the preop state. The address of SM2 is equal to the start address of RxPDO 6. The PDO mapping object dictionary index exceeds the set maximum value (0x1600-0x170A).

Troubleshooting:

Cause	Check Method	Solution
The master imports the wrong XML file.	1. Check whether the master imported the correct XML file. Check the following configuration:Check whether the SM2 channel is configured incorrectly. The following conditions must be met:1) The length of SM2 and the length of RxPDO are equal to 0 without enabling.2) SM2 channel is in the write direction.3) SM2 does not overlap with adjacent SM1 or SM3 memory. Check whether the index of the RxPDO mapping object dictionary is out of bounds (the maximum index is 0x0A). 1) The length of RxPDO is matching. 2) In the preop state, the address of RxPDO is in the set address field (maximum and minimum address) or not in the preop state, the address of SM2 is not equal to the start address of RxPDO. 3) The PDO mapping object dictionary index does not exceed the set maximum value (0x1600-0x170A).	1. Re-import the XML file and restart the connection. 2. If the problem persists after the master is restarted, contact technical support to rectify the XML configuration.

E168.4/A168.4/L168.4/N168.4: EtherCAT SM3 configuration error

Fault cause:

The following error occurs during EtherCAT communication startup configuration check: 1. The length of SM3 and TxPDO is not 0 when SM3 is not enabled. 2. The SM3 channel is not in the read direction. 3. Buffer limit is violated (SM2 overlaps with SM3 and SM0 or SM1 memory) 4. The length of

TxPDO does not match. 5. In the preop state, the address of TxPDO is not in the set address field (maximum and minimum address), or is not in the preop state. The address of SM3 is equal to the start address of TxPDO 6. The PDO mapping object dictionary index exceeds the set maximum value (0x1A00-0x1B0A).

Troubleshooting:

Cause	Check Method	Solution
The master imports the wrong XML file.	1. Check whether the master imported the correct XML file. Check the following configuration:Check whether the SM3 channel is configured incorrectly. The following conditions must be met:1) The length of SM3 and the length of TxPDO are equal to 0 without enabling.2) SM3 channel is in the read direction.3) SM2 does not overlap with SM3 and SM0 or SM1 memory. Check whether the index of the RxPDO mapping object dictionary is out of bounds (the maximum index is 0x1A). 1) The length of TxPDO is matching. 2) In the preop state, the address of TxPDO is in the set address field (maximum and minimum address) or not in the preop state, the address of SM3 is not equal to the start address of TxPDO. 3) The PDO mapping object dictionary index does not exceed the set maximum value (0x1A00-0x1B0A).	1. Re-import the XML file and restart the connection. 2. If the problem persists after the master is restarted, contact technical support to rectify the XML configuration.

E168.5/A168.5/L168.5/N168.5: EtherCAT PDO watchdog setting error

Fault cause:

1. The watchdog is enabled but the counting value is 0. 2. The watchdog is disabled but the counting value is non-zero.

Troubleshooting:

Cause	Check Method	Solution
The master is configured incorrectly or the attempt to configure the master failed.	The value of ESC state register 0x0134 read through the master software tool is 0x001F.	Restart the master and check whether the fault disappears. Otherwise, contact technical support.

E168.6/A168.6/L168.6/N168.6: No sync signal from EtherCAT

Fault cause:

1. The 0x990 register DC startup time and 0x981 register DC activation time defined by the master are lower than the slave local system time. 2. The start time of 0x990 register DC and 0x981 register DC activation time are too long, which exceeds 17.2s of the slave local system time. 3. The pulse width of the sync signal in the 0x982 register is 0, and no pulse signal exists.

Troubleshooting:

Cause	Check Method	Solution
DC is enabled during slave station switchover from SAFEOP to OP, but the DC is not running for the following reasons:1. The DC start time and DC activation time are set incorrectly. 2. There is no pulse signal input.	The value of ESC state register 0x0134 read through the master software tool is 0x002D.	Restart the master and check whether the fault disappears. Otherwise, contact technical support.

E168.7/A168.7/L168.7/N168.7: EtherCAT PHY initialization configuration error

Fault cause:

The PHY ID register is read incorrectly during initialization.

Troubleshooting:

Cause	Check Method	Solution
1. The ESC is not working properly before reading the PHY ID. 2. The PHY chip is damaged. 3. The data is disturbed. 4. The model configured is different from the actual model of the PHY.	Check the hardware to see whether the PHY chip is working properly.	Replace the AC drive and contact technical support,

E168.8/A168.8/L168.8/N168.8: Abnormal pulse length of the synchronous data signal configured in the EtherCAT read-only memory

Fault cause:

During the sync signal pulse width check of the configuration data of the EEPROM, the sync pulse width length in the EEPROM does not match the sync pulse width length in the XML file.

Troubleshooting:

Cause	Check Method	Solution
1. The master writes the EEPROM configuration data incorrectly. 2. There is a difference between the XML file imported by the master and the information in the slave.	Check whether there is any difference between the XML file information saved in the slave device (which can be read through the master software tool) and the XML file information imported to the software tool.	Reset the ESI file by setting n4-41 to 1 or re-program the XML file. If the fault persists, contact technical support.

E169.1/A169.1/L169.1/N169.1: ModbusTCP Ethernet communication timeout

Fault cause:

The device cannot receive the data packets sent by the controller within the set communication cycle or the data packets received are incorrect.

Troubleshooting:

Cause	Check Method	Solution
The power supply of the device is unstable or the network topology is disturbed.	1. Check whether the power supply of the equipment is stable. Measure whether the bus voltage is within the operating voltage range. If not, check whether a high-power device is using the same power supply. The same power supply is used for high-power devices. This may cause voltage instability. In this case, an independent power supply is required. 2. Check whether the communication cable and power cable are routed through different routes. If the communication cable is routed together with the power cable, interference may occur. It is recommended to route the cables through different routes according to the cable routing specifications.	1. Ensure that no high-power devices share the same power supply. Use an independent power supply. 2. Route the communication cables and power cables through different routes. 3. If the voltage is still unstable after preceding measures are taken, replace the power supply.
A fault occurs on the network device.	1. Ping the device continuously, check whether the device responds and whether the response delay is greater than the set communication service cycle. If no response or response delay is greater than the communication service cycle, the network equipment may be faulty. Use the step-by-step ping method to locate the faulty device and replace it. If the response delay is lower than the communication service cycle, check whether the delay fluctuation is stable or too large. If it is unstable or too large, the network equipment may be faulty or the network bandwidth may be insufficient. 2. Check whether the network bandwidth is sufficient with the command ifconfig.	1. Replace the network device that is faulty in the network topology. 2. If the network bandwidth is insufficient, reduce the number of nodes in the network topology or upgrade the network bandwidth.
The controller is faulty.	Check whether the controller works properly and whether there is any data sent. If not, the controller is abnormal and needs to be replaced.	Replace the controller.

E169.2/A169.2/L169.2/N169.2: ModbusTCP Ethernet hardware error

Fault cause:

The Ethernet chip cannot be configured.

Troubleshooting:

Cause	Check Method	Solution
The Ethernet chip is faulty.	Check whether the MCB network port, PHY chip, and network transformer are dirty.	Clean the dirty parts. If this is not possible, contact technical support.

E169.3/A169.3/L169.3/N169.3: MAC address not programmed in Modbus TCP

Fault cause:

No MAC address or illegal MAC address is detected after power-on.

Troubleshooting:

Cause	Check Method	Solution
MAC address is lost.	Check whether the MAC address of the drive can be read by the host controller through the iFA commissioning software. If it cannot be read, the MAC address is lost.	Contact the technical support.

E169.4/A169.4/L169.4/N169.4: ModbusTCP IP conflict

Fault cause:

Two identical IP addresses are detected in the communication network.

Troubleshooting:

Cause	Check Method	Solution
IP address conflict exists in the communication network.	Disconnect the device from the network and check whether the fault disappears. If there is no fault when the device is not connected to the network, the fault is reported after connection. The IP address of this device conflicts with other devices in the network.	Modify the IP address of the conflict device.

E170.1/A170.1/L170.1/N170.1: Internal communication disturbed or the module operation stopped

Fault cause:

The internal bus data is being disturbed, resulting in check failure.

Troubleshooting:

Cause	Check Method	Solution
The power supply is unstable.	Check whether the main power supply of the equipment is stable, whether the wiring is complete, and whether the power supply is shared by other high-power equipment.	Replace with a stable independent power supply.
There is a strong electromagnetic radiation source near the equipment.	Check whether high-power devices that can generate electromagnetic radiation are near the drive.	Remove such high-power devices or install metal shield to the devices.
A fault occurred on the device.	Check whether the main control board and components of the device are contaminated or damaged.	Clean the MCB or replace it with a new one.

E170.2/A170.2/L170.2/N170.2: Internal communication synchronization frame on the MCB side lost

Fault cause:

The synchronous frame cannot be received or the received synchronous frame data is abnormal.

Troubleshooting:

Cause	Check Method	Solution
The power supply is unstable.	Check whether the main power supply of the equipment is stable, whether the wiring is complete, and whether the power supply is shared by other high-power equipment.	Replace with a stable independent power supply.
There is a strong electromagnetic radiation source near the equipment.	Check whether high-power devices that can generate electromagnetic radiation are near the drive.	Remove such high-power devices or install metal shield to the devices.
A fault occurred on the device.	Check whether the main control board and components of the device are contaminated or damaged.	Clean the MCB or replace it with a new one.

A176.1: External 24 V power supply error of the control board

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The external 24 power supply voltage of the control board is lower than the limit threshold.	Measure whether the external 24 V voltage is too low.	Increase the external 24 V power supply voltage.

E177.1: Model hardware auto-tuning error

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The hardware sampling voltage is not within the range of the active model.	This fault on the panel indicates that the control board is abnormal.	Replace the control board.

E177.2: Hardware type of the model not matching the software type

Fault cause:

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Troubleshooting:

Cause	Check Method	Solution
The hardware identification model and software type do not match.	The software does not match the model.	Contact technical support to re-program the software.

E179.1/A179.1/L179.1/N179.1: Capacitor lifetime alarm of the main circuit

Fault cause:

The residual life of the capacitor in the main circuit is lower than the alarm threshold.

Troubleshooting:

Cause	Check Method	Solution
The main circuit capacitor is used for a long time and enters the lifetime alarm phase.	The predicted lifetime margin of the main circuit capacitor (AD-45) is lower than the capacitor lifetime alarm threshold defined by Ad-49.	Contact technical support to maintain the main capacitor.

E179.3/A179.3/L179.3/N179.3: IGBT lifetime alarm

Fault cause:

The remaining lifetime margin of the IGBT is below the alarm threshold.

Troubleshooting:

Cause	Check Method	Solution
The IGBT is used for a long time and enters the lifetime alarm phase.	The estimated lifetime margin of the IGBT (Ad-59) is lower than the threshold defined by Ad-61.	Contact technical support to maintain the IGBT.

E179.4/A179.4/L179.4/N179.4: Cooling fan lifetime alarm

Fault cause:

The remaining lifetime margin of the fan is below the alarm threshold.

Troubleshooting:

Cause	Check Method	Solution
The cooling fan is used for a long time and enters the lifetime alarm phase.	The estimated life margin of the fan (Ad-65) is lower than the alarm threshold defined by Ad-67.	Contact technical support to maintain the cooling fan.

E186.1: Model parameter read-write failure

Fault cause:

Model parameters are not written or read successfully.

Troubleshooting:

Cause	Check Method	Solution
Power unit EEPROM read/write timeout	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact the technical support.

E186.2: Parameter unit parameter error

Fault cause:

There is not storage-type parameters in the power unit.

Troubleshooting:

Cause	Check Method	Solution
The power body is replaced with a new one.	Check whether the power unit is new.	Set A3-19 to 1 and reset after downloading the model parameters.

E186.3: Preset model parameters of the MCB not matching the power board

Fault cause:

The model parameters in the main control board are not completely consistent with those in the power unit.

Troubleshooting:

Cause	Check Method	Solution
The power unit is replaced and the parameters of the power unit are inconsistent with those of the MCB.	Check whether the power unit has been replaced.	Reset the operation.
The control board is replaced and the parameters of the control board are inconsistent with the power unit.	Check whether the control board has been replaced.	Reset the operation.

E187.2/A187.2/L187.2/N187.2: Power unit junction temperature parameter file check failed

Fault cause:

The junction temperature parameter format in the power unit read by the control board is inconsistent or CRC fails.

Troubleshooting:

Cause	Check Method	Solution
1. The junction temperature parameter format saved by the power unit is inconsistent with the junction temperature parameter format specified by the control board. 2. The CRC on the junction temperature parameter file fails.	1. Check whether the power unit matches the current product. 2. Check whether there is significant interference on site.	Contact the technical support.

E187.3/A187.3/L187.3/N187.3: Junction temperature parameter read/write failure in the EEPROM of the power unit

Fault cause:

The junction temperature parameter is not written or read successfully.

Troubleshooting:

Cause	Check Method	Solution
The control board and the power unit cannot communicate properly.	Check the communication line between the control board and the power unit.	Contact the technical support.

E187.4/A187.4/L187.4/N187.4: Attempt to read EEPROM junction temperature parameter of the power unit timed out upon power-on

Fault cause:

The junction temperature parameter read during power-on initialization is stuck in an exception state.

Troubleshooting:

Cause	Check Method	Solution
Power-on exception	Check whether the value of A3-00 is consistent with Ub-95.	If the fault persists after restart, contact the technical support.

E187.6/A187.6/L187.6/N187.6: Model code of the EEPROM junction temperature parameter of the power unit not consistent with the model code set by the control board

Fault cause:

The model of the junction temperature parameter downloaded to the EEPROM of the power unit is inconsistent with the current set model

Troubleshooting:

Cause	Check Method	Solution
The model code A3-00 does not match Ub-95.	Check whether the A3-00 model code does not match the Ub-95 model code.	Set A3-00 and Ub-95 to be consistent.

E188.2/A188.2/L188.2/N188.2: Power-down area of the EEPROM of the power unit read failure

Fault cause:

Parameters in the power-down area of the EEPROM of the power unit is not read or written successfully.

Troubleshooting:

Cause	Check Method	Solution
The control board and the power unit cannot communicate properly.	Check the communication line between the control board and the power unit.	Power on and off again to check whether the fault disappears. If the fault persists, contact technical support.

E188.3/A188.3/L188.3/N188.3: Attempt to read data in the EEPROM power-down area of the power unit timed out

Fault cause:

The data process read in the power-down area during power-on initialization is stuck in an exception state.

Troubleshooting:

Cause	Check Method	Solution
Power-on exception	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact the technical support.

E189.1/A189.1/L189.1/N189.1: Commissioning software communication timeout

Fault cause:

Communication between the commissioning software and the AC drive failed

Troubleshooting:

Cause	Check Method	Solution
The IDS communication fault is triggered when the software tool is disconnected from the drive after obtaining control permissions and controlling the motor operation.	Check whether SOP-20 is connected to the PC properly. Check whether SOP-20 is connected to the AC drive properly. Check whether cables are routed properly.	Ensure that the SOP-20 is connected to the PC properly. Ensure that the SOP-20 is connected to the drive properly. Ensure that the wiring is properly routed. You can install a magnetic ring to suppress interference.

E189.2/A189.2/L189.2/N189.2: Keypad MD-IP-S communication timeout

Fault cause:

Communication failure between keypad and AC drive

Troubleshooting:

Cause	Check Method	Solution
If the keypad MD-IP-S gains control authority and controls motor operation, and then disconnects from the drive, a keypad communication timeout fault is triggered	Check if the connection between keypad and drive is reliable; check if the wiring is reasonable.	Ensure the connection between keypad and drive is reliable; ensure wiring is reasonable, consider adding magnetic ring to eliminate interference.

E190.1: Application macro parameter write error

Fault cause:

-

Troubleshooting:

Cause	Check Method	Solution
After setting A0-48 interface macro or A0-50 industry macro, the parameter writing process is interrupted due to an exception.	After setting A0-48 or A0-50, check whether the drive is powered off due to an exception.	Set A0-48 interface macro or A0-50 industry macro again when the power supply of the drive is proper.

E191.1: IGBT overtemperature

Fault cause:

-

Troubleshooting:

Cause	Check Method	Solution
The load is excessive, or locked rotor occurs on the motor	Scenario 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is excessively high. If motor parameters are set properly, but overload still occurs during slow acceleration when starting with load in the V/f mode, then the load is too heavy. Scenario 2: In high-speed operation in vector control, if the product of output torque (U0-06) and operating frequency (U0-00) is close to the output power (U0-05), but the output torque is large, then the load is too heavy. Scenario 3: Check whether the brake releases normally.	In scenario 1, when the motor runs at low speed, increase the no-load current (F1-30) properly and reduce the mutual inductance (F1-28). Ensure that the product of both is unchanged. For scenario 2, during low-speed overload of the synchronous motor, if a cam-pole motor is used, increase the MTPA tuning coefficient of the synchronous motor (d5-29) and observe whether the overall output current decreases. If overload occurs because the load in the high-speed field weakening zone is too heavy, increase the overmodulation coefficient (A5-06) to a value not exceeding 108%. For scenario 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The SVC control system cannot track or adjust the reactive power stably at extremely low frequencies (about 0 Hz), leading to unstable system operation (synchronous motor SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC mode at speeds closed to 0. 2. Enable IF control. Set the tens of the low-speed processing mode (d0-85) to 1. For details, see the Vector Control section.
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation (asynchronous motor SVC).	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous motor demagnetization (SVC/FVC)	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding exceptions are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in the vector control mode (SVC/FVC).	In the SVC/FVC control mode (F0-01 = 0 or 1), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".

Cause	Check Method	Solution
V/f acceleration/deceleration time is too short (asynchronous motor in V/f control mode).	Check whether the deceleration time is too short. If the deceleration time is too short, increase the deceleration time gradually (by 5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/deceleration time.	1. Determine whether the current acceleration/deceleration time is a value that must be set by the process. Otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). 2. Enable the overcurrent suppression function (d2-26 = 1). If overcurrent persists, decrease the value first. If it is invalid, increase the value. 3. Increase the manual torque boost value (d2-14). 4. For working conditions with frequent start/stop, enable DC braking at stop (d0-29 ≠ 0) to ensure that the DC braking time for stop (d0-29) will not expire until the next start. 5. When multiple motors are started simultaneously, apply the start DC braking with the same duration (d0-25) to all motors to significantly reduce startup current shock.
The V/f curve voltage is excessively high (asynchronous motor V/f).	When the V/f curve is multi-point V/f (d2-00 = 1), reduce the voltage at the point where the voltage/frequency is too large in the multi-point curve (d2-02 to d2-10) and observe whether the fault disappears. When the separated V/f curve is used (d2-00 = 10), set the frequency first. Then slowly try to increase the voltage. If the output voltage is lower than the voltage set upon fault when the output current reaches the rated value, the voltage set in the separated V/f mode is improper.	1. Reduce the voltage/frequency ratio on the multi-point V/f curve to prevent it from being larger than the ratio on the linear V/f, resulting in the motor overexcitation. 2. For separated V/f, set the voltage acceleration/ deceleration time (d2-50/d2-51) that matches the frequency to avoid excessive voltage acceleration time or output voltage.
The value of the torque boost parameters (asynchronous motor in V/f control mode) are excessively high.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). and perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
The motor is started during rotation (synchronous/asynchronous motor in SVC).	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
V/f oscillation overload (asynchronous motor V/f)	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/torque current fluctuation range of the motor does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. For details, refer to the section "V/f Oscillation Suppression." 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applied.

Cause	Check Method	Solution
Synchronous motor magnetic pole angle auto-tuning error (synchronous motor SVC/ FVC)	When the motor rotates freely, select "Pre-positioning start" (d0-71 = 3) to check whether the motor starts normally. When the motor does not rotate freely, check whether the motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor used is a synchronous motor with squirrel cage.	When the motor rotates freely, the motor rotates slightly at the start of pre-positioning. It is recommended to use this start mode if the process will not be affected by this mode. When the motor cannot rotate freely and Lq/ Ld (F1-34/ F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
The motor parameter is set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The power rating of the drive is excessively low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.
The synchronous motor reports a fault after overspeed or the synchronous motor coasts to stop after manual settings.	When the synchronous motor overspeed occurs, the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time. This causes the output diode to energize in the reverse direction and back EMF short circuit. If the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is higher than the overvoltage threshold, operation interruption may cause overvoltage of the AC drive and may damage the drive.	Set the positive frequency upper limit (d1-03) to the result of overvoltage threshold (A4-39)/ (1.414 x back EMF of synchronous motor). Keep the maximum operating speed below this limit. Select the motor type properly. A motor with high back EMF can effectively reduce the output current. However, running at a speed above the limit may result in overvoltage or damage.
Derated operation applies due to long-term operation at low frequencies.	Check whether the current operating frequency is 0 Hz to 5 Hz at low frequency. If yes, the system is in the low-frequency derating range. (In this range, the power of the drive is lower than the rated power.) Note 1: During low-frequency operation, large fluctuation in IGBT temperature may easily occur, resulting in thermal stress and damage the IGBT. Note 2: When the frequency is in the low frequency range from 0 Hz to 5 Hz, the derating is reduced from 20% to 0%.	Replace with a drive of higher power.

Cause	Check Method	Solution
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model-related parameters correctly.
Derating occurs due to excessive carrier frequency.	Setting the carrier frequency (A5-01) to a value higher than the default can result in derating of the output with load.	Set a proper carrier frequency. If the high carrier frequency output capability is insufficient, it is recommended to use a drive with higher power.
The encoder parameter settings are incorrect in the FVC control mode.	Check for settings of encoder parameters.	Set encoder parameters properly.
The encoder wiring is abnormal in the FVC control mode.	Check if the encoder wiring is correct; confirm whether there is interference.	Correctly wire the encoder and ensure proper shielding.
The encoder-related parameters have not been auto-tuned in the FVC control mode.	Confirm whether the encoder zero point position angle has changed after auo-tuning.	Perform accurate parameter auto-tuning or download all auto-tuning parameters when d0-00 is 1.
The encoder installation is incorrect in the FVC control mode.	Check if the encoder is installed correctly.	Check if the encoder installation is secure; check the coaxiality of the encoder shaft and motor shaft when stationary; check radial runout of the encoder during rotation
Other fault causes lead to the fault.	Contact the agent or Inovance.	Contact the agent or Inovance.

E192.1: Speed tracking timeout

Fault cause:

The speed tracking time exceeds the threshold.

Troubleshooting:

Cause	Check Method	Solution
The speed of the synchronous motor exceeds the traceable range.	Check whether the synchronous motor speed is too high (U0-00).	After the speed of the synchronous motor is reduced (F0-30), the speed tracking starts (d0-02 = 1).
Asynchronous motor parameters are incorrect.	Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters. For details, refer to the section "Motor Auto-tuning".

E193.1: Undervoltage suppression reaching the limit

Fault cause:

The speed reaches the minimum operating frequency (d1-72) or the maximum operating time (d1-68) during undervoltage suppression in the vector control mode.

Troubleshooting:

Cause	Check Method	Solution
In the vector control mode, the undervoltage suppression decelerates to the frequency lower limit (d1-72), and the bus voltage cannot be maintained.	1. Check whether the operating frequency (U0-00) at fault is lower than the minimum operating frequency in undervoltage suppression (d1-72). If yes, an exception occurs. 2. Start the drive after the bus voltage is stabilized. Check whether the main contactor/grid is normal if power-on is not possible for a long time.	Replace the main contactor. Ensure that the power grid is normal.
Check that the undervoltage suppression operating time limit function is enabled (bit2 of d1-76 = 1) and that the undervoltage suppression operating time reaches the maximum operating time (d1-68).	Check that the undervoltage suppression operating time limit function is enabled (bit2 of d1-76 = 1) and that the undervoltage suppression operating time reaches the maximum operating time (d1-68).	If you do not need to limit the undervoltage suppression operating time, turn off the undervoltage suppression operating time limit.

N194.1: STO1 and STO2 disconnected

Fault cause:

The 24 V inputs of STO1 and STO2 are abnormal.

Troubleshooting:

Cause	Check Method	Solution
Both STO1 and STO2 are disconnected.	Check whether the 24 V power supply of the STO is normal.	1. Check that the wiring is normal. 2. Contact technical support.

E195.1: Parameter downloading interrupted

Fault cause:

The attempt to download parameters through the commissioning software fails.

Troubleshooting:

Cause	Check Method	Solution
The drive powers off during parameter downloading.	Check whether the operating panel or commissioning software has a corresponding fault code.	Perform any of the following steps to restore the parameters, and then reset the fault. 1. Perform parameter initialization. 2. Perform parameter download.

A196.1: External flash data read/write fault of black box fault

Fault cause:

The data read-write operation on the external flash of black box failed.

Troubleshooting:

Cause	Check Method	Solution
The data read-write operation on the external flash of black box failed.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact technical support to maintain the external flash used for data saved in the black box.

A196.2: External flash data read/write fault of log

Fault cause:

The data read-write operation on the external flash of log failed.

Troubleshooting:

Cause	Check Method	Solution
The data read-write operation on the external flash of log failed.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact technical support to maintain the external flash used for data saved in log.

N197.1: Fire mode activated

Fault cause:

The fire mode is activated

Troubleshooting:

Cause	Check Method	Solution
The fire mode is activated	The fire mode is activated	If you exit the fire mode, it will not be reported again

A199.1: Low carrier ratio alarm

Fault cause:

-

Troubleshooting:

Cause	Check Method	Solution
The ratio of the actual effective carrier frequency to the maximum frequency is low, which may lead to abnormal operation	Check if the minimum carrier ratio calculation (d1-86) is lower than the low carrier ratio alarm threshold (d1-85).	1. If the d1-85 carrier ratio threshold was manually increased, reduce the value or directly set it to the minimum value; 2. If the actual operating conditions will not reach the maximum frequency of F1-10 or the frequency corresponding to d1-07/08, appropriately reduce the maximum frequency; 3. If d1-85 has already reached its minimum value, increase the F2-50 carrier frequency setting to ensure the minimum carrier ratio requirement is met. 4. If the system can operate normally and you do not wish to report the current fault, disable it by setting bit11 in d1-33 motor protection configuration.

A201.1: Resolver overtemperature

Fault cause:

-

Troubleshooting:

Cause	Check Method	Solution
Resolver encoder hardware fault, leading to encoder overtemperature.	Check whether the encoder temperature is normal.	1. Check if the encoder card is abnormal; 2. Replace the encoder card; 3. Contact the manufacturer;

A201.2: Z signal loss alarm

Fault cause:

-

Troubleshooting:

Cause	Check Method	Solution
The encoder wiring is incorrect.	1. Check if the encoder Z signal is connected. 2. Check whether the encoder connection is reliable.	Ensure that the encoder cable is connected properly.
Encoder abnormality	Switch the control mode (d0-00) to SVC, set a safe low-speed state to high-speed state transition, observe the number of L1107 in the background, if the number of Z signals does not increase, a fault exists.	Ensure that the encoder cable is connected properly.
Signal interference	1. Switch control mode (d0-00) to SVC, and check if the number of L1107Z signals in the background increases correctly. 2. Check the encoder and motor grounding.	1. Correct wiring; 2. Encoder shielding layer grounded at the drive end; 3. Motor housing reliably grounded;
Other causes	Contact Inovance for technical support.	Contact Inovance for technical support.

A201.3: FVC-to-SVC activation alarm

Fault cause:

-

Troubleshooting:

Cause	Check Method	Solution
The operation mode is passively switched to SVC due to an encoder feedback error when FVC is enabled.	Check whether the feedback from the encoder is normal.	1. Check the encoder and the wiring of the encoder. 2. Switch to the SVC mode when possible.

A202.1: Bus voltage deviation during shutdown

Fault cause:

-

Troubleshooting:

Cause	Check Method	Solution
During shutdown, if the bus voltage is higher than the overvoltage suppression point or braking point, direct start-up may lead to braking state or overvoltage suppression state.	Check whether the bus voltage value U0-02 displayed on the backend is higher than the overvoltage suppression point d1-55 or braking point A4-00.	Increase the overvoltage suppression point d1-55 or braking point A4-00

N202.2: Overvoltage suppression activated

Fault cause:

-

Troubleshooting:

Cause	Check Method	Solution
Enter overvoltage suppression processing state	Check whether the bus voltage value U0-02 displayed on the backend is higher than the overvoltage suppression point d1-55.	This is a normal processing state that will be entered when the bus voltage is high, generally no special handling is required.

N202.3: Undervoltage suppression activated

Fault cause:

-

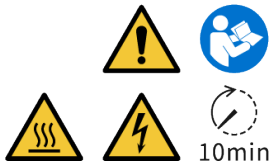
Troubleshooting:

Cause	Check Method	Solution
Enter undervoltage suppression processing state	Check whether the bus voltage value U0-02 displayed on the backend is lower than the undervoltage suppression point d1-64.	This is a normal processing state that will be entered when the bus voltage is low, generally no special handling is required.

8 Maintenance and Repair

8.1 Safety Instructions for Maintenance and Repair

- Maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not service the equipment after power-on. Failure to comply will result in an electric shock.
- Cut off all power supplies to the equipment, and wait for the time specified on the warning label before maintenance.



- Before maintenance, you must measure the voltage between the positive and negative bus terminals of the main circuit. Operations are allowed only when the voltage is below 36 V.
- Mechanical protective measures must be taken to protect personal safety during maintenance. Wear necessary protective equipment (such as anti-smashing shoes and protective gloves) to prevent damage to the product and personal injury caused by falling of heavy objects.

8.2 Daily Maintenance and Inspection

8.2.1 Routine Maintenance Checklist

8.2.1.1 Routine Checklist

Table 8–1 Daily inspection checklist

No.	Item	Checked
1	Ensure that no abnormal noise exists when the motor is running.	☐
2	Ensure that no abnormal vibration exists when the motor is running.	☐
3	Ensure normal cooling fan of the motor.	☐
4	The AC drive cooling fan runs normally.	☐
5	The electrical cabinet runs properly.	☐
6	Check whether the cabinet cable ducts are normal.	☐
7	Check whether the operating current of the AC drive exceeds the rated current of the AC drive.	☐
8	Check whether the operating current of the AC drive exceeds the rated current of the motor.	☐
9	The main circuit power supply voltage is normal.	☐
10	The power supply voltage of the control circuit is normal.	☐

8.2.1.2 Routine Cleaning Items

Table 8–2 Routine cleaning list

No.	Item	Checked
1	Remove dust on the equipment, especially metal dust, to prevent it from entering the equipment.	☐
2	Remove the liquid and oil from the surface of the equipment to prevent contaminants from corroding the equipment.	☐

Caution

- Keep the equipment clean.
- Disconnect the HV fast breaker on the battery side before cleaning. Clean the equipment with a blower gun or dry cleaning cloth.

8.2.2 Regular Checklist

Table 8–3 Regular checklist

No.	Item	Checked
1	Ensure that there are no wastes, dirt, or dust on the surface.	☐
2	Ensure that no power cables or connections discolor.	☐
3	Ensure that the cable insulation layer does not age or crack.	☐
4	Check whether the product peripheral contactor closes tightly or generates unexpected noise during operation.	☐
5	Ensure that no short circuit, water stain, expansion or cracking occurs on any peripheral device.	☐
6	Ensure that the air duct and heatsink are not clogged.	☐
7	Ensure that the fan is not damaged.	☐
8	Ensure that no control components are in poor contact.	☐
9	Ensure the product control circuit terminal screw is not loose.	☐
10	Ensure the insulation of the control cable is not cracked.	☐

8.2.3 Main Circuit Detection Method

Preparation

Before maintenance, do the following:

1. Switch off the input power supply of the AC drive.

Caution

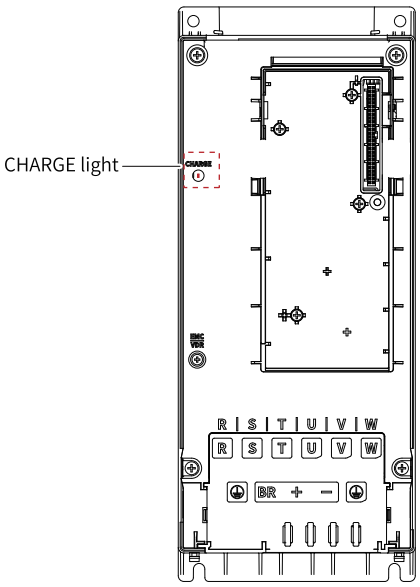
When the input power supply is cut off, the internal bus capacitor of the AC drive is still in the high voltage state. Wait for the time specified on the product warning label before proceeding to the next step.

2. Remove the upper cover of the AC drive.

Caution

Do not disassemble the AC drive without professional personnel. Contact the service personnel of the manufacturer.

3. Wait for the Charge indicator on the drive to turn off (as shown in the following figure, which takes T4 model as an example).



4. Remove the cable cover and measure the voltage between the positive and negative bus terminals of the main circuit with a multimeter. Make sure that the voltage is below 36 V.
5. Remove the power cables (R/S/T) and motor cables (U/V/W) connected to the AC drive and other main power cables (BR, +, -) that may be connected to the AC drive.

Main circuit power device detection

By measuring the diode voltage drop of the AC drive rectifier bridge, inverter bridge, and brake pipe, you can initially determine whether the power module is normal. You can use the diode range of the multimeter to test on the main circuit terminal of the AC drive, as shown in the following figure and table.

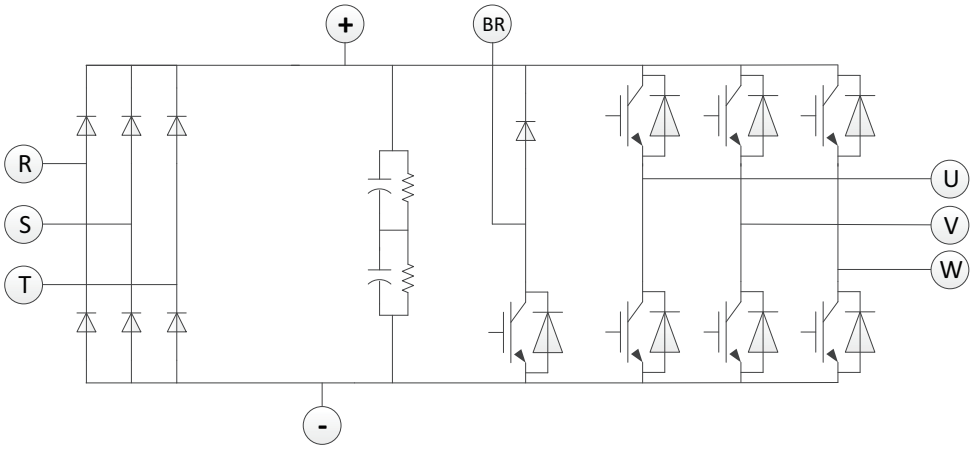


Figure 8-1 Main circuit topology

Test Item	The component under test	Test Voltage Applied between/at:		Standard of measured value
		Black lead of the multimeter	Red lead of the multimeter	
Voltage drop of the rectifier bridge transistor	R upper bridge	+	R	The typical value is about 0.4 V. (The range is 0.25 V to 0.6 V, and R/S/T must be consistent with an error within 0.1 V.)
	S upper bridge	+	S	
	T upper bridge	+	T	
	R lower bridge	R	/	
	S lower bridge	S	/	
	T lower bridge	T	/	
Voltage drop of the inverter bridge transistor	U upper bridge	+	U	The typical value is about 0.4 V. (The range is 0.25 V to 0.6 V, and the U/V/W must be consistent, with an error within 0.1 V.)
	V upper bridge	+	V	
	W upper bridge	+	W	
	U lower bridge	U	/	
	V lower bridge	V	/	
	W lower bridge	W	/	
Brake transistor voltage drop	Braking diode	+	BR	The typical value is about 0.4 V. (Range: 0.25 V to 0.6 V)
	Braking IGBT	BR	/	
Bus short circuit detection	Bus	+	-	The typical value is about 0.8 V. (Range: 0.5 V to 1.2 V)

Main circuit voltage detection

The main circuit voltage can be detected only after the AC drive is powered on. Use a multimeter to measure the voltage on the input side, DC side, and output side of the AC drive. The voltage test can help confirm whether the AC drive is normal.

1. Input voltage detection:
   Measure the effective value of the line voltage (Vrs, Vrt, and Vrt) between R, S, and T in the AC range of a multimeter. Vst). It is normal to meet the following two conditions: 1. The three-phase ratio is within ±5% of the error between the three phases; 2. The error corresponds to the typical grid voltage. The difference between the capacitance capacity and the load size under the grid may vary from time to time. Compared with the typical grid voltage, the fluctuation range is usually -15% to +10%.

2. Bus voltage detection:
   The DC bus voltage after the AC drive is rectified can be viewed through the displayed value on the keypad or measured using a multimeter. A rough method of assessing the bus voltage value is that when the AC drive is in standby mode, the bus voltage is about 1.414 times the effective value

of the AC input voltage, and the bus voltage is about 1.35 times the effective value of the AC input voltage when the AC drive is full-load.

3. Output voltage detection:
   During stable operation, the output voltage of the AC drive can be viewed through the display on the keypad or measured in AC mode using a multimeter. The three-phase output voltage is balanced under normal conditions, and the error between the three phases is generally within ±5%. Error within ±10% is normal.

Main circuit current detection (input, output)

The main circuit current can be detected only after the AC drive and the motor are in normal and stable operation. You can measure the current on the input and output sides of the AC drive using a hand-held current clamp or oscilloscope. The current detection can help confirm whether the AC drive is normal.

1. Input current detection:
   The input current value is related to the motor load and grid capacity. The heavier the load and the larger the grid capacity, the higher the current.

   The three-phase input current of R, S, and T (Irs, Irt, Ist) can be measured with a hand-held current clamp. The three-phase input current is balanced under normal conditions, and the error between the three phases is about ±5%. However, due to the amplitude and phase imbalance of the three-phase grid voltage, and the difference in line impedance, the error is sometimes larger, reaching ±10%. Error within ±10% is normal.

2. Output current detection:
   The output current is related to the motor load. The heavier the load, the greater the current.

   During stable running of the AC drive, the output current of the AC drive can be viewed through the displayed value on the keypad or measured using a hand-held current clamp or oscilloscope. Normally, the three-phase output current is balanced, and the error between the three phases is about ±5%. However, the error may be larger due to the influence of the motor. The error within ±10% is normal.

Note

The current detection instrument to be used depends on actual requirements.

- If you only analyze the general problem, measure the three-phase input current and output current directly with the hand-held current clamp. You can determine whether the AC drive is abnormal through routine inspection.
- If you need to locate complex problems, such as motor jitter, torque fluctuation, and overload fault, For overcurrent faults, more detailed detection and analysis is required. In this case, an oscilloscope and corresponding current and voltage detection probes may be required.

8.2.4 Heat Dissipation Detection Method

After the main power module inside the AC drive is heated, the heat is generally cooled by the heatsink and then routed through the cooling fan. If the AC drive reports an overtemperature fault occasionally, the cooling system of the AC drive needs to be detected as follows.

1. Detection on external ambient temperature

Check whether the ambient temperature of the AC drive is normal. If the operating temperature is too high, exceeding the AC drive specifications, or the load is excessive, an overtemperature fault may be reported. To solve this problem, reduce the ambient temperature, for example, use an air conditioning in the room.

2. Detection on the cabinet

   a. Check whether the air inlet and outlet of the cabinet are blocked by dust or flocky objects.
   b. Check whether the cooling design of the cabinet is improper: Whether the air inlet and outlet area of the cabinet are small and whether the air flow of the cabinet exhaust fan is small.
   c. Check whether the internal layout of the cabinet is proper: 1. Due to the layout, no special heat deflection measures are taken inside the cabinet. As a result, the hot air from the air outlet of the AC drive returns to the air inlet of the AC drive. The air inlet temperature of the AC drive increases significantly. 2. Multiple AC drives are arranged up and down the cabinet. The air outlet of the lower AC drive directly faces the air inlet of the upper AC drive. The air inlet temperature of the upper AC drive rises significantly due to the lack of a special guiding design. 3. The air inlet temperature of the upper AC drive does not comply with the requirements of the product manual. Allow sufficient space between the top and bottom of the AC drive, resulting in poor ventilation of the main cooling duct inside the AC drive.

3. Detection on the AC drive fan

   Generally, you can check the fan speed and fan noise to determine whether the fan is normal. Observe whether the fan is damaged in one of the following conditions. If yes, replace the fan: 1. The fan does not rotate. 2. The speed is significantly low. 3. The speed is unstable (fast/slow or rotor eccentric). 4. The fan makes abnormal noise. 5. The appearance is abnormal (leaf defect, etc.).

4. Detection on the AC drive heatsink

   Check whether the main heatsink of the AC drive is blocked (such as oil, moisture, dust, and flocky). If the heatsink is severely blocked, Maintenance and cleaning are required. In high-pollution applications, to extend the service life of the AC drive, it is recommended to clean the AC drive regularly to ensure proper protection.

8.3 Replacing the Drive

8.3.1 Replacing the Drive (When Data Backup Available)

Prerequisite:

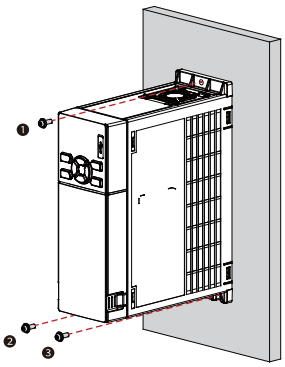
After replacing the AC drive, the data on the original drive will be lost. Before replacing the drive, back up the data first and save the parameter file to the local PC. After replacement is done, load the parameter file to the new drive. For details, see *"8.5 Parameter Upload/Download (Based on iFA Drive Software)" on page 1313*.

Procedure:

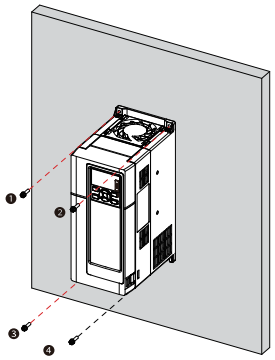
1. Disconnect the main power supply of the drive. When the digital output of the drive uses an external 24 V power supply, the external 24 V power supply must also be disconnected.

2. Remove the connection cable from the drive.
3. Remove the drive to be replaced.

- Removing backplate-mounted AC drives (T1 to T5):



T1 to T2 models

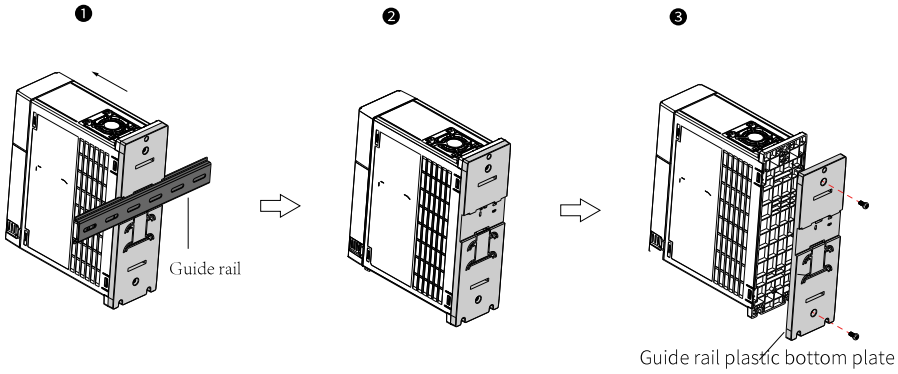


T3 to T5 models

- Removing the rail-mounted AC drives (T1 to T2):

  a. Tap the bottom of the AC drive in the direction of the arrow and pull the guide rail out, as shown in the following figure (1) and (2).

  b. Use a Phillips screwdriver to remove the two PA4 x 12 self-tapping screws from the plastic baseplate of the guide rail, and remove the plastic baseplate of the guide rail, as shown in the following figure.



- Removing the through-hole mounted AC drive (T4 to T5 models):

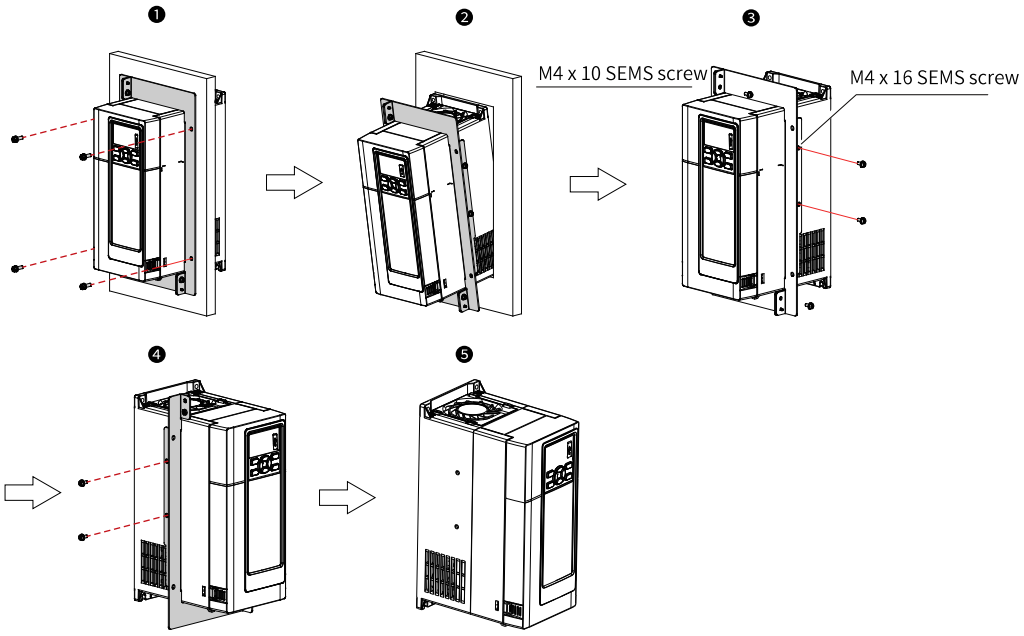
  a. Remove the four M5x20 screws around the bracket with a Phillips screwdriver, as shown in figure (1).

  b. Remove the AC drive from the fixed hole of the control cabinet, as shown in the figure (2).

  c. Remove the two M4×16 SEMS screws (M5x20 screws for the T5 model) on the left side with a Phillips screwdriver. Remove the left and right brackets with two M4x10 SEMS screws. See Figure (3).

  d. Remove the two M4x16 SEMS screws (M5x20 screws for T5 model) on the left side of the drive with a Phillips screwdriver, as shown in Figure (4).

  e. The AC drive removed is shown in the figure (5).



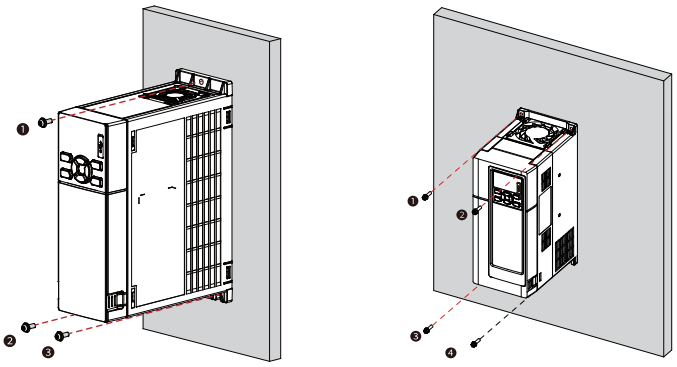
4. Reverse the steps above to install a new AC drive.
5. Connect all cables to the AC drive.
6. Reconnect the main power supply to the AC drive.
7. Load parameters to the device to enable quick parameter recovery. For details, see *"8.5 Parameter Upload/Download (Based on iFA Drive Software)" on page 1313*.
8. Perform the acceptance test.
9. Check the rotation direction of the motor, make sure that the wiring is correct, and check that the function is normal.

8.3.2 Replacing the Drive (When No Data Backup Available)

Procedure:

1. Disconnect the main power supply of the drive. When the digital output of the drive uses an external 24 V power supply, the external 24 V power supply must also be disconnected.
2. Remove the connection cable from the drive.
3. Remove the drive to be replaced.

- Removing backplate-mounted AC drives (T1 to T5):

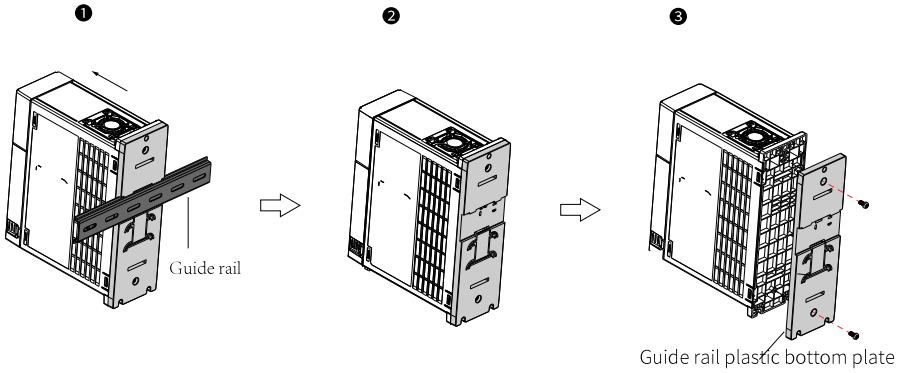


T1 to T2 models　　T3 to T5 models

- Removing the rail-mounted AC drives (T1 to T2):

  a. Tap the bottom of the AC drive in the direction of the arrow and pull the guide rail out, as shown in the following figure (1) and (2).

  b. Use a Phillips screwdriver to remove the two PA4 x 12 self-tapping screws from the plastic baseplate of the guide rail, and remove the plastic baseplate of the guide rai, as shown in the following figure.



- Removing the through-hole mounted AC drive (T4 to T5 models):

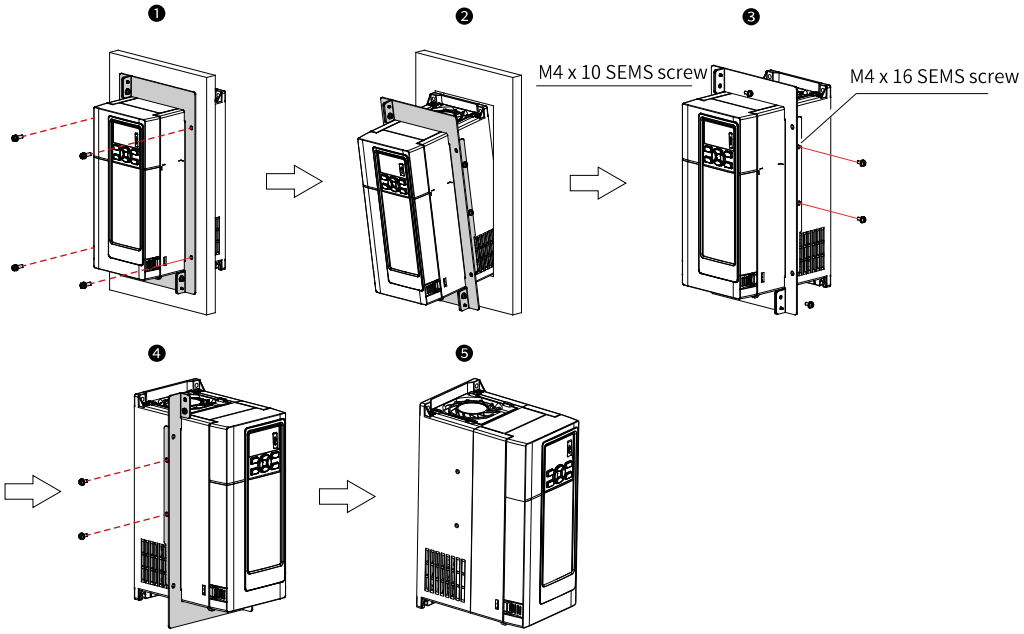
  a. Remove the four M5x20 SEMS screws around the bracket with a Phillips screwdriver, as shown in figure (1).

  b. Remove the AC drive from the fixed hole of the control cabinet, as shown in the figure (2).

  c. Remove the two M4x16 SEMS screws (M5x20 screws for the T5 model) on the left side with a Phillips screwdriver. Remove the left and right brackets with two M4x10 SEMS screws. See Figure (3).

  d. Remove the two M4x16 SEMS screws (M5x20 screws for T5 model) on the left side of the drive with a Phillips screwdriver, as shown in Figure (4).

  e. The AC drive removed is shown in the figure (5).



4. Reverse the steps above to install a new AC drive.
5. Connect all cables to the AC drive.

6. Reconnect the main power supply to the AC drive.
7. Re-commission the AC drive.

8.4 Part Replacement

8.4.1 Serviceable Components

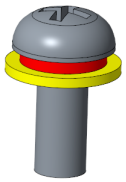
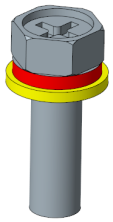
Name	Reference service life	Maintenance	Measures to extend service life
Fan	5 years	Replace the fan, see "8.4.3 Replacing the Fan" on page 1308.	Enhance the protection of the cabinet to reduce the entry of fibrous materials and dust into the air ducts. Clean the air ducts regularly based on actual conditions.
Control board	-	Replace the control board, see "8.4.4 Replacing the Control Board" on page 1310.	Do not operate with power on when connecting the control cable, and take anti-static measures.
Bus capacitor	5 years	Contact the manufacturer for technical support to replace the electrolytic capacitor.	If the cabinet ambient temperature is too high, reduce the drive ambient temperature, for example, install an air conditioner to the drive control room. If excessive imbalance exists in the grid or other capacitive load switchover devices exist on the grid side, it is recommended to install an AC reactor on the input side. Replace with a high power drive and increase the derating.
Pre-charge relay	100,000 operations	Contact the manufacturer for technical support to replace the pre-charge relay.	If you need to start and stop the drive frequently, use the operating panel or I/O terminals to control the drive. It is recommended to take vibration damping measures in high vibration applications.

Note

- The reference service life shown in the preceding table is an estimated life. It is based on the following conditions. It is not a guarantee value because the actual service life of the device may be shortened due to the harsh installation environment and use conditions.
  - Ambient: Temperature: 40℃; Humidity: Less than 95% RH, without condensation
  - Load rate: 100% rated for heavy load.
  - Operation rate: 24 hours a day, 365 days a year.

  Harsh application conditions may shorten product service life.
- The harsh installation environment and usage conditions include the following:
  - Conductive dust, greasy dirt, salty mist, and halogen corrosive gases; dust or flocculent that blocks air ducts
  - The input three-phase voltage is unbalanced.
  - When the drive is connected to a high-capacity power transformer, or when other devices on the input side are used for capacitive load switchover, excessive peak current can be generated on the input side of the drive, which also affects the service life. Therefore, it is recommended to install an input AC reactor on the input side.

8.4.2 Maintenance Tools

Tool	Applied material	Diagram	Applied position	Qty	Recommended torque (N·m)
Electric screwdriver (driver bit selected based on the bolt head)	M4 cross recessed pan head SEMS screw		Mounting feet for fixing MD630-INT T1 to T2 models	3	1.2
	M4 cross recessed pan head SEMS screw		Mounting feet for fixing MD630-INT T3 models	4	
	M5 cross recessed hexagon head SEMS screw		Mounting feet for fixing MD630-INT T4 to T5 models	4	2.8
	Self-taping screw (M3 x 12)		Control board mounting hole for all MD630-INT models	3	0.55
			Operating panel mounting hole for all MD630-INT models	1	0.55
			Expansion card mounting hole for all MD630-INT models	2	

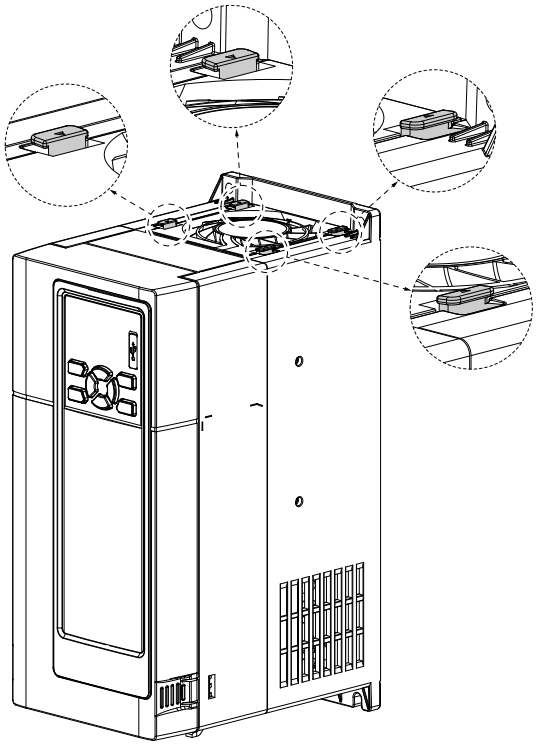
Note

- The tools shown are for reference only. You need to purchase these tools from a third party.
- Use qualified and calibrated tools.
- Unit conversion: 1 N·m ≈ 10 kgf.cm

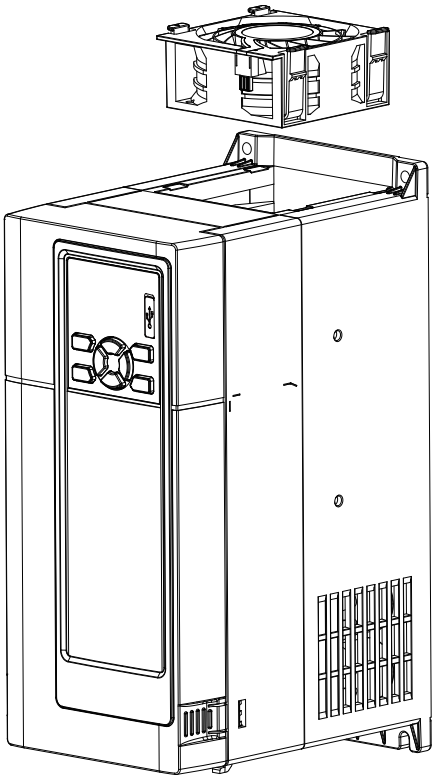
8.4.3 Replacing the Fan

Replacement procedure (T4 as an example):

1. Press down the four snap-fit positions of the top fan simultaneously.



2. Lift the fan up to remove the fan.



3. Install the new fan in reverse order. When the fan is installed, you hear a click of the fan latch. This indicates that the snap hook is installed properly.
4. Power on the product to ensure that the fan runs normally.

Note

Contact Inovance for details on how to purchase the fan.

8.4.4 Replacing the Control Board

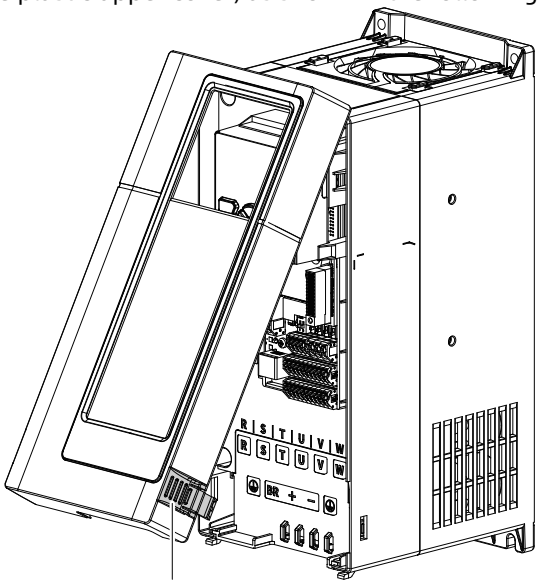
Prerequisite

Ensure that the control board to be replaced matches the device model.

After replacing the control board, the data on the original control board will be lost. Before replacing the control board, perform a data backup. Save the parameter file to the local PC. After the replacement is done, load the parameter file to the new control board to restore the parameters quickly. For details, see *"8.5 Parameter Upload/Download (Based on iFA Drive Software)" on page 1313*.

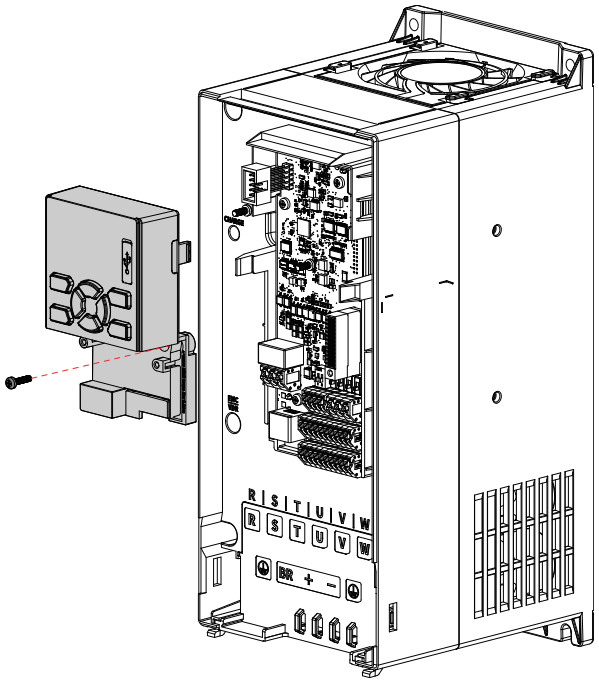
Replacement procedure (T4 as an example):

1. Press the snap-fit buttons on the lower sides of the plastic upper cover of the product, and turn them upwards to open the plastic upper cover, as shown in the following figure.



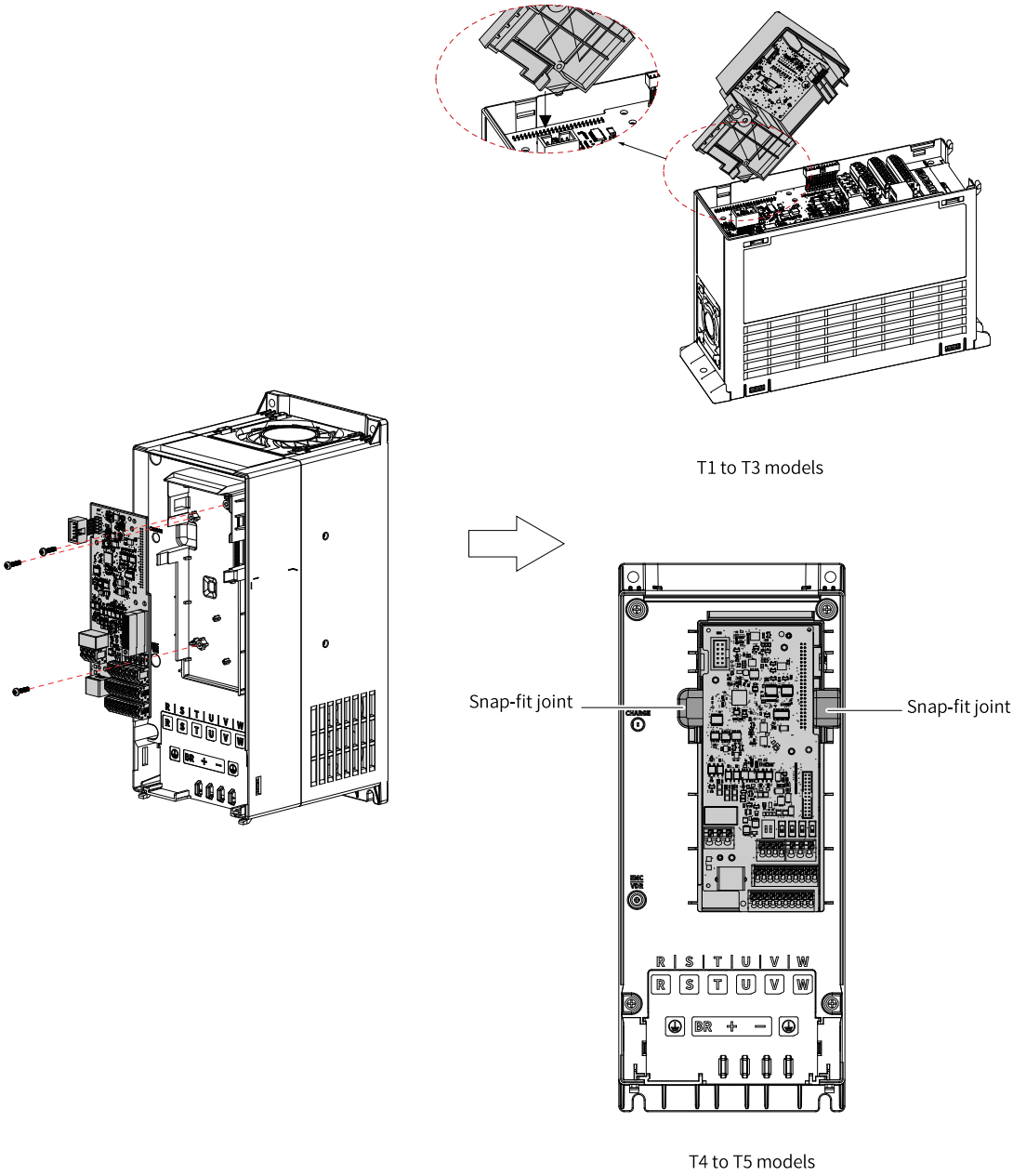
Snap-fit joint

2. Use a Phillips screwdriver to remove the ST2.9 self-tapping screw on the operating panel assembly, press the clasp on both sides of the operating panel assembly, and remove the operating panel assembly, as shown in the following figure.



3. Use a Phillips screwdriver to remove the three M3 self-tapping screws on the control board, as shown in the following figure.

- For T1 to T3 models, insert the hook on the operating panel box into the position shown in the figure and lift the control board with the hook to release the drive control terminal, as shown in the following figure.
- For T4 to T5 models, you can move the control board by using the finger grip on both sides of the control board, as shown in the following figure.



4. Install the new control board in reverse order.
5. Connect all cables to the AC drive.
6. Reconnect the main power supply of the AC drive.
7. Load parameters to the device to enable quick parameter recovery. For details, see *"8.5 Parameter Upload/Download (Based on iFA Drive Software)" on page 1313*.
8. Perform acceptance test.

Check the rotation direction of the motor and ensure that the wiring is correct. Check whether the function is normal.

Note

Do not apply excessive force when inserting/extracting connectors during maintenance/disassembly of the control board, as this can damage the pins.

Contact Inovance for details on how to purchase the control board.

8.5 Parameter Upload/Download (Based on iFA Drive Software)

Application scenarios

Before replacing the drive or control board, save the parameter file to the local PC first. After replacement is done, import the parameter file from the local PC to the new drive to quickly restore the parameters.

Function description

Parameter upload: Used to save the drive parameters to the local PC.

Parameter download: Used to download the parameter file from the local PC to the drive.

Prerequisite

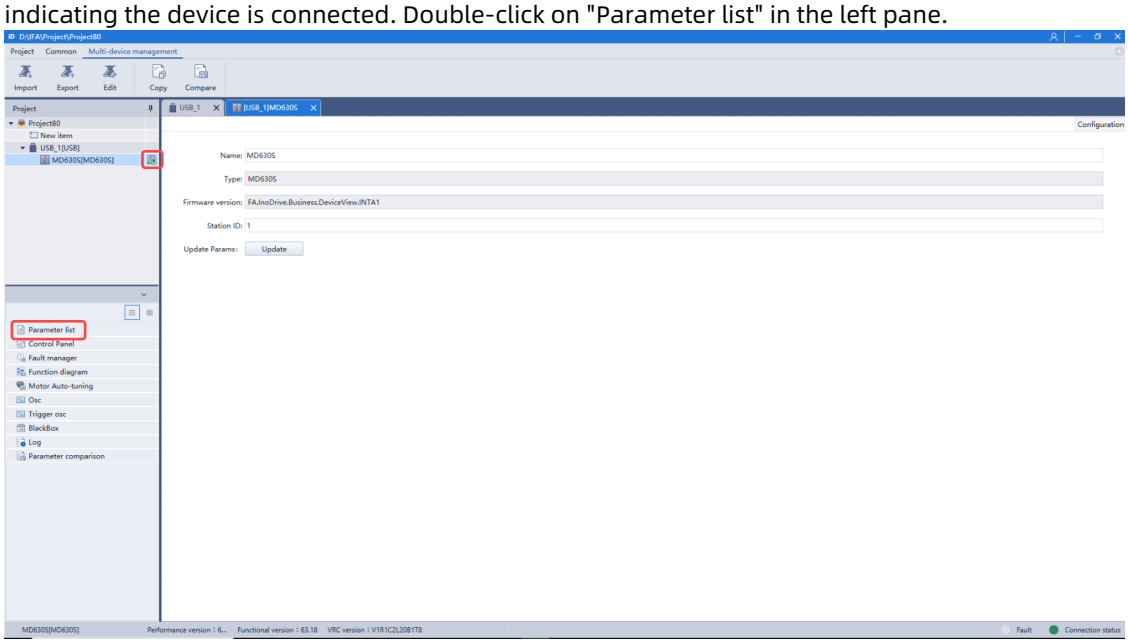
A new project has already been created in the iFA software, and the iFA software has been connected to the drive properly, as shown in *"4.2.2.2 Quick Commissioning Guide" on page 134*.

Procedure

Step 1: Backing up parameter file

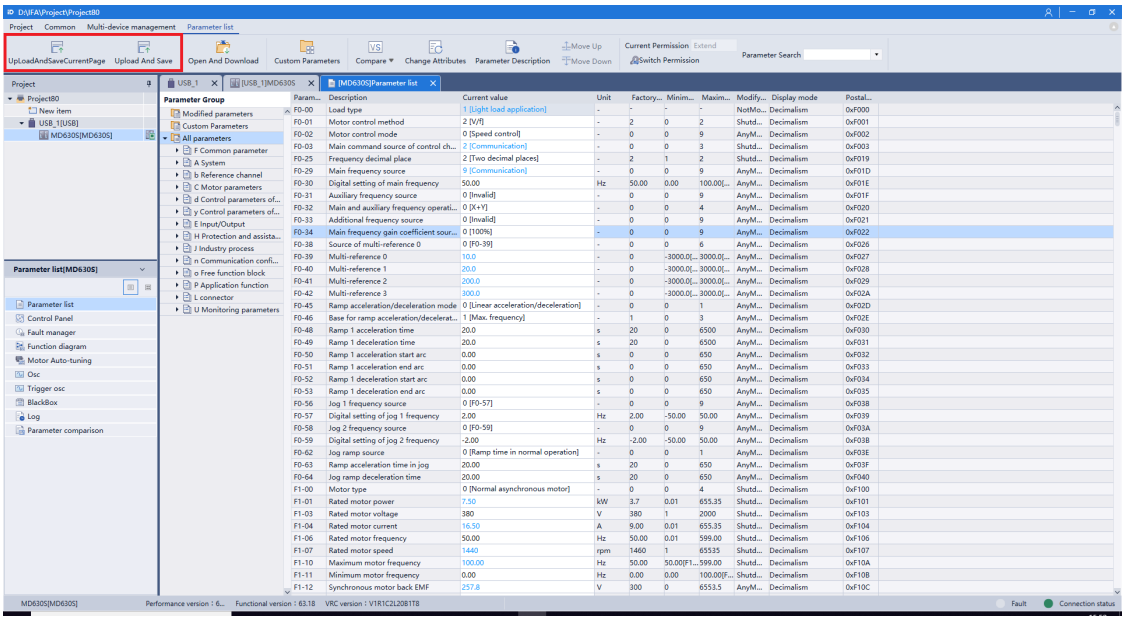
Back up the parameter file from the drive to the local PC, as shown below.

1. A green indicator appears next to the device name (MD630S-INT) in the left "Project tree", indicating the device is connected. Double-click on "Parameter list" in the left pane.

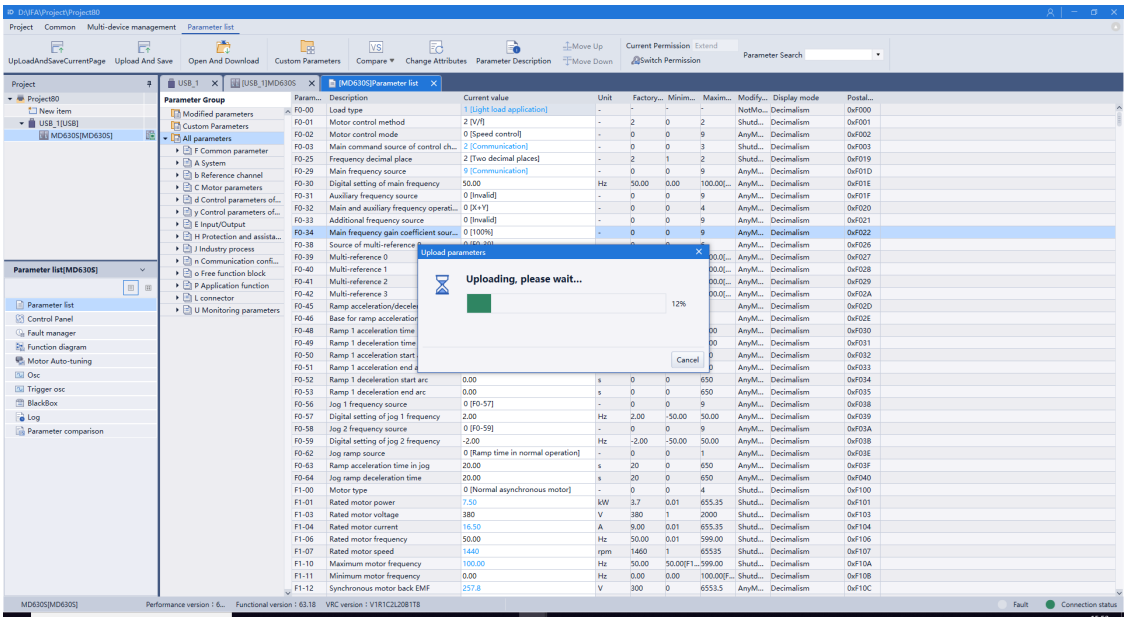


2. The parameter list for the device is displayed. Click the "Upload and save" or "Upload and save current page" button in the upper-left corner to back up the parameter file to the local PC.

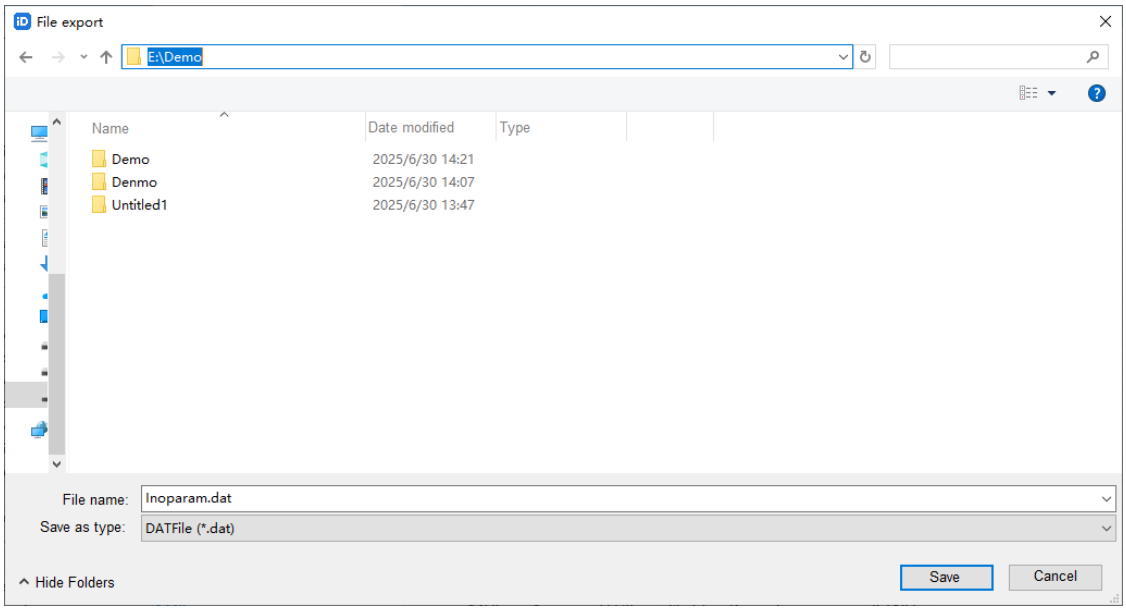
- "Upload and save": All parameters are backed up.
- "Upload and save current page": Only the parameters on the current page are backed up.



As shown in the figure below, the system starts uploading parameters. Do not operate during parameter upload.



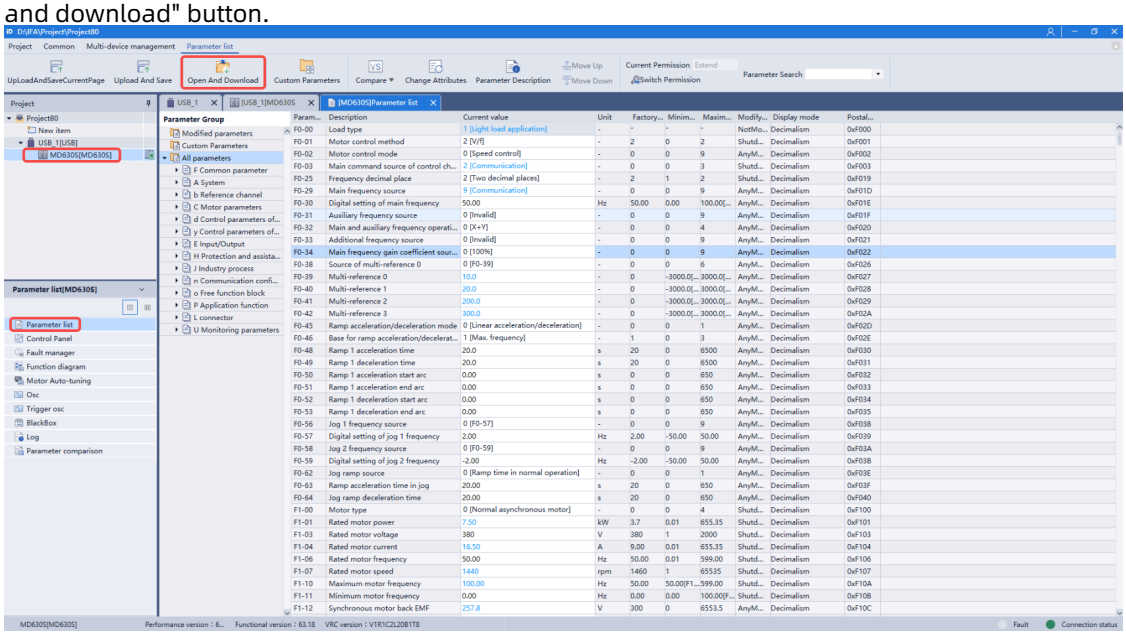
3. After parameters are uploaded, set the directory and filename for saving the parameter file, then click "Save" to complete the parameter upload.



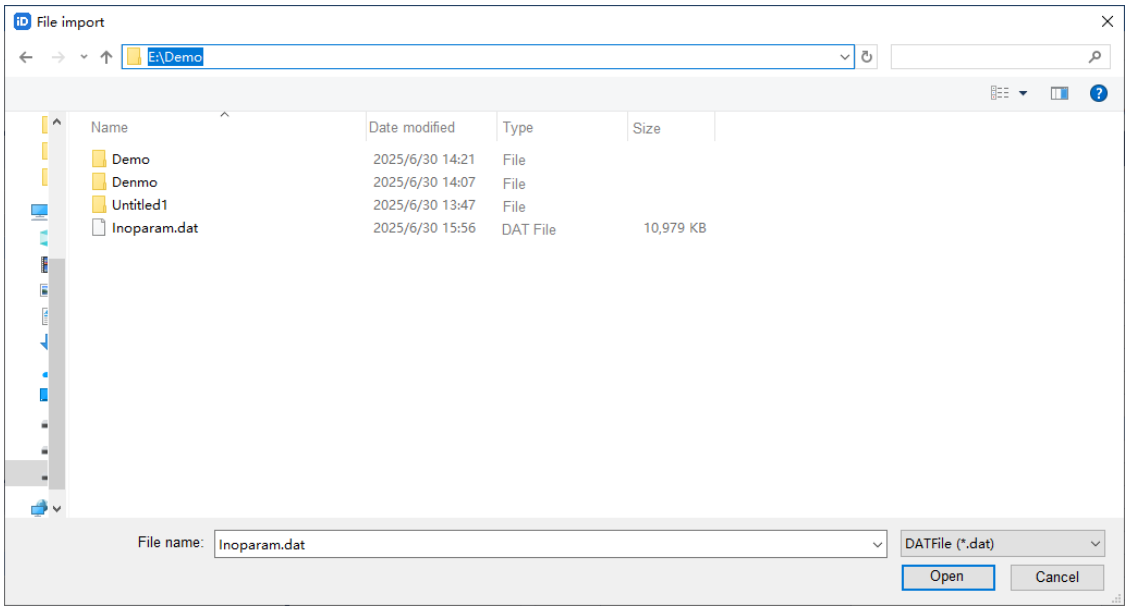
Step 2: Loading parameter file

Load the parameter file saved to the local PC to the drive or another device to achieve rapid parameter replication, as shown below.

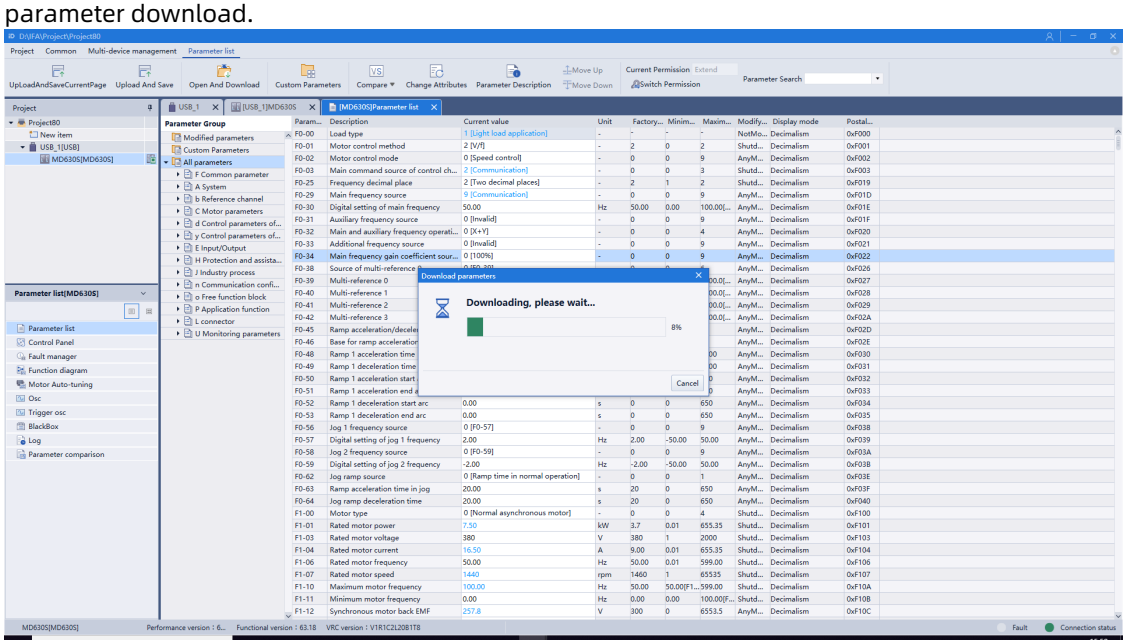
1. On the "Parameter list" page, select the corresponding project (MD630S-INT for example) in the left "Project tree", then double-click "Parameter list" to open the parameter file. Click the "Open and download" button.



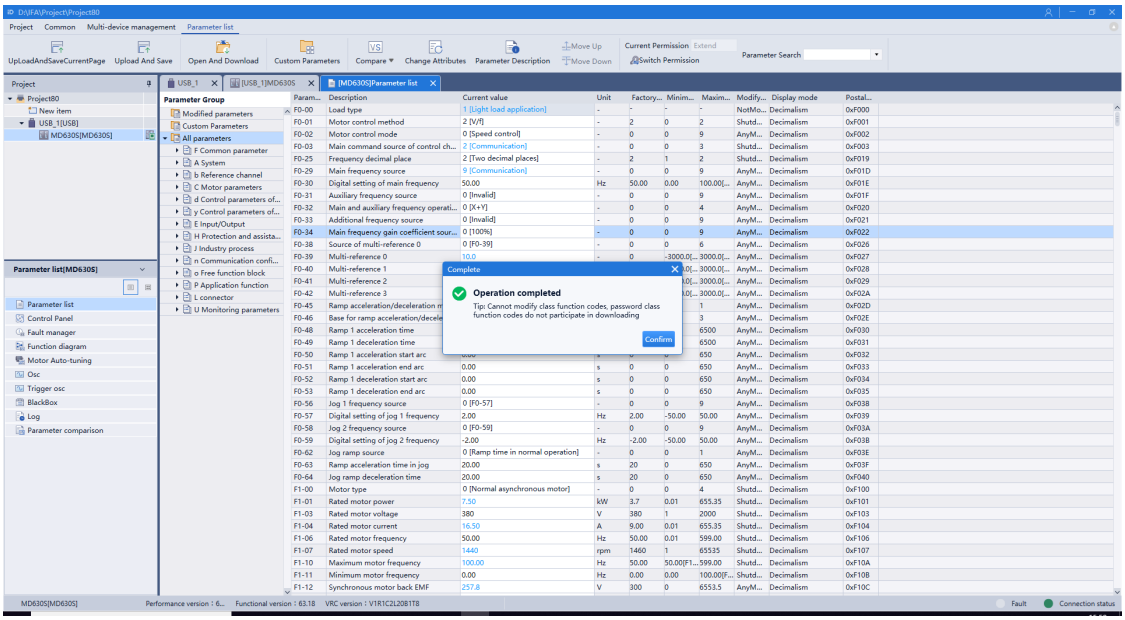
2. In the pop-up window, select the parameter file to import, then click "Open" to import the saved parameters.



3. As shown in the figure below, the system starts downloading parameters. Do not operate during parameter download.



4. After parameters are downloaded, a message indicating that operation is done will be displayed.


Project
Common
Multi-device management
Parameter list
UpLoadAndSaveCurrentPage
Upload And Save
Open And Download
Custom Parameters
Compare
Change Attributes
Parameter Description
Move Up
Move Down
Current Permission
Switch Permission
Parameter Search
Project80
New item
USB_1[USB]
MD630S[MD630S]
Parameter list[MD630S]
Parameter list
Control Panel
Fault manager
Function diagram
Motor Auto-tuning
Osc
Trigger osc
BlackBox
Log
Parameter comparison
USB_1
[USB_1]MD630S
[MD630S]Parameter list
Parameter Group
Modified parameters
Custom Parameters
All parameters
F Common parameter
A System
b Reference channel
C Motor parameters
d Control parameters of...
y Control parameters of...
E Input/Output
H Protection and assista...
J Industry process
n Communication confi...
o Free function block
P Application function
L connector
U Monitoring parameters
Complete
Operation completed
Tip: Cannot modify class function codes, password class function codes do not participate in downloading
Confirm
MD630S[MD630S]
Performance version : 6...
Functional version : 63.18
VRC version : V1R1C2L20B1T8
Fault
Connection status

9 Technical Specifications

9.1 Electrical Specifications

Note

In the following tables, the rated power of the AC drive is measured under the following conditions:

For three-phase 380 V to 480 V models, the rated power is measured at the input voltage of 400 VAC.

Three-phase 380 V to 480 V

Table 9–1 Electrical specifications for T1 to T2 models (three-phase 380 V to 480 V)

Item		Specification					
Model: MD630S/N-4Txxxxx-INT		1R5BS	2R1BS	3R8BS	5R1BS	7R2BS	9R0BS
Structure		T1			T2		
Applicable motor capacity (kW)	G-type model	0.37	0.75	1.5	2.2	3	4
	P-type model	0.75	1.5	2.2	3	4	5.5
Input	Rated input current (A) of G-type model	1.7	2.4	4.6	6.3	8.9	11.4
	Rated input current (A) of P-type model	2.4	4.6	6.4	9	11.4	17
	G-type model Rated DC bus input current (A) (upon DC input)	2.1	2.9	5.6	7.7	10.9	14
	P-type model Rated DC bus input current (A) (upon DC input)	2.9	5.6	7.8	11	14	20.8
	Rated voltage/Rated frequency	AC: Three-phase 380 V to 480 V, 50/60 Hz					
	Permissible voltage fluctuation range	-15% to +10%; actual permissible range: 323 VAC to 528 VAC					
	Permissible frequency fluctuation range	±5%; actual permissible range: 47.5 Hz to 63 Hz					
	Rated power supply capacity (kVA) of G-type model (400 V)	1.3	1.8	3.5	4.8	6.8	8.7
	Rated power supply capacity (kVA) of G-type model (480 V)	1.4	2	3.6	5	7	9
	Rated power supply capacity (kVA) of P-type model (400 V)	1.9	3.5	4.9	6.9	8.7	13
	Rated power supply capacity (kVA) of P-type model (480 V)	2	3.6	5.1	7.1	9	13.3

Item		Specification					
Model: MD630S/N-4Txxxxx-INT		1R5BS	2R1BS	3R8BS	5R1BS	7R2BS	9R0BS
Output	Rated output current (A) of G-type model	1.5	2.1	3.8	5.1	7.2	9
	Rated output current (A) of P-type model	2.1	3.8	5.1	7.2	9	13
	Output voltage	Three-phase 0 V to input voltage					
	Maximum output frequency	599 Hz					
	Carrier frequency	0.8 kHz to 16.0 kHz (automatically adjusted according to the load characteristics)					
	Braking transistor	Built-in as standard					
	Overload capacity	G-type model: 60s at 150% of the rated current P-type model: 60s at 110% of the rated current					
Thermal design	Heat dissipation (W) of G-type model	29	34	58	74	100	114
	Heat dissipation (W) of P-type model	35	54	76	103	129	174
	Exhaust airflow (CFM)	-	-	12.6	23	17	17
	Cooling method	Naturally-ventilated	Naturally-ventilated	Fan-cooled	Fan-cooled	Fan-cooled	Fan-cooled
Overvoltage category	OVC III						
Pollution degree	PD2						
Protection class	Class I						
IP rating	IP40 (excluding power distribution wiring sections and capacitor ventilation openings)						
IEC61800-9-2 energy efficiency class	IE2						

Note

G-type: Heavy-load models that support 1.5 times the rated load.

P-type: Light-load models, supporting 1.1 times the rated load.

Table 9–2 Electrical specifications for T3 to T5 models (three-phase 380 V to 480 V)

Item		Specification					
Model: MD630S/N-4Txxxxx-INT		013BS	017BS	025BS	032BS	037BS	045BS
Structure		T3		T4		T5	
Applicable motor capacity (kW)	G-type model	5.5	7.5	11	15	18.5	22
	P-type model	7.5	11	15	18.5	22	30

Item		Specification					
Model: MD630S/N-4Txxxxx-INT		013BS	017BS	025BS	032BS	037BS	045BS
Input	Rated input current (A) of G-type model	16.8	22.0	32.4	41.6	48.7	58.5
	Rated input current (A) of P-type model	22.7	33.4	42.1	49.1	60.1	71.6
	G-type model Rated DC bus input current (A) (upon DC input)	20.6	26.9	39.7	50.9	59.6	71.6
	P-type model Rated DC bus input current (A) (upon DC input)	27.8	40.9	51.6	60.1	73.6	87.7
	Rated voltage/Rated frequency	AC: Three-phase 380 V to 480 V, 50/60 Hz					
	Permissible voltage fluctuation range	-15% to +10%; actual permissible range: 323 VAC to 528 VAC					
	Permissible frequency fluctuation range	±5%; actual permissible range: 47.5 Hz to 63 Hz					
	Rated power supply capacity (kVA) of G-type model (400 V)	12.8	16.8	24.7	31.7	37.1	44.6
	Rated power supply capacity (kVA) of G-type model (480 V)	13.2	17.3	25.4	32.5	38	45.8
	Rated power supply capacity (kVA) of P-type model (400 V)	17.3	25.5	32.1	37.4	45.8	54.6
	Rated power supply capacity (kVA) of P-type model (480 V)	17.6	25.9	32.8	38.2	46.7	56.1
Output	Rated output current (A) of G-type model	13.0	17.0	25.0	32.0	37.0	45.0
	Rated output current (A) of P-type model	17.0	25.0	32.0	37.0	45.0	60.0
	Output voltage	Three-phase 0 V to input voltage					
	Maximum output frequency	599 Hz					
	Carrier frequency	0.8 kHz to 16.0 kHz (automatically adjusted according to the load characteristics)					
	Braking transistor	Built-in as standard					
	Overload capacity	G-type model: 60s at 150% of the rated current P-type model: 60s at 110% of the rated current					
Thermal Design	Heat dissipation (W) of G-type model	174	210	349	391	513	571
	Heat dissipation (W) of P-type model	242	344	491	482	674	856
	Cooling method	Fan-cooled	Fan-cooled	Fan-cooled	Fan-cooled	Fan-cooled	Fan-cooled
	Exhaust airflow (CFM)	31	31	55.7	57.5	91.8	85
Overvoltage category	OVC III						

Item		Specification					
Model: MD630S/N-4Txxxxx-INT		013BS	017BS	025BS	032BS	037BS	045BS
Pollution degree	PD2						
Protection class	Class I						
IP rating	IP40 (excluding power distribution wiring sections and capacitor ventilation openings)						
IEC61800-9-2 energy efficiency class	IE2						

Note

G-type: Heavy-load models that support 1.5 times the rated load.

P-type: Light-load models, supporting 1.1 times the rated load.

Table 9–3 Electrical specifications for T6 to T8 models (three-phase 380 V to 480 V)

Item		Specification					
Model: MD630S/N-4Txxxxx-INT		060BS	075BS	091BS	112BS	150BS	176BS
Structure		T6		T7		T8	
Applicable motor capacity (kW)	G-type model	30	37	45	55	75	90
	P-type model	37	45	55	75	90	110

Item		Specification					
Model: MD630S/N-4Txxxxx-INT		060BS	075BS	091BS	112BS	150BS	176BS
Input	Rated input current (A) of G-type model	56.3	70.4	86.3	107.6	141.6	168.4
	Rated input current (A) of P-type model	68.8	84.7	104.2	139.9	165.4	197.6
	G-type model Rated DC bus input current (A) (upon DC input)	67.7	84.7	104	128.9	170.6	202.8
	P-type model Rated DC bus input current (A) (upon DC input)	84.3	103.7	127.6	171.4	202.7	242.3
	Rated voltage/Rated frequency	AC: Three-phase 380 V to 480 V, 50/60 Hz					
	Permissible voltage fluctuation range	-15% to +10%; actual allowable range: 323 VAC to 528 VAC					
	Permissible frequency fluctuation range	±5%; actual permissible range: 47.5 Hz to 63 Hz					
	Rated power supply capacity (kVA) of G-type model (400 V)	42.9	53.7	65.8	82	107.9	128.3
	Rated power supply capacity (kVA) of G-type model (480 V)	44	55.1	67.6	84.1	110.7	131.5
	Rated power supply capacity (kVA) of P-type model (400 V)	52.4	64.6	79.4	106.6	126.1	150.6
	Rated power supply capacity (kVA) of P-type model (480 V)	53.7	66.1	81.3	108.9	128.9	154
Output	Rated output current (A) of G-type model	60	75	91	112	150	175
	Rated output current (A) of P-type model	75	91	112	150	175	210
	Output voltage	Three-phase 0 V to input voltage					
	Maximum output frequency	599 Hz					
	Carrier frequency	0.8 kHz to 16.0 kHz (automatically adjusted according to the load characteristics)					
	Braking transistor	Built-in as standard					
	Overload capacity	G-type model: 60s at 150% of the rated current P-type model: 60s at 110% of the rated current					
Thermal design	Heat dissipation (W) of G-type model	612.2	755.1	824.8	1008.1	1297	1556.5
	Heat dissipation (W) of P-type model	807.2	948.9	1057.5	1436.6	1613.1	1862.8
	Cooling method	Fan-cooled	Fan-cooled	Fan-cooled	Fan-cooled	Fan-cooled	Fan-cooled
	Exhaust airflow (CFM)	130	130	150	150	167	190
Overvoltage category	OVC III						

Item	Specification					
Model: MD630S/N-4Txxxxx-INT	060BS	075BS	091BS	112BS	150BS	176BS
IP rating	IP40 (excluding power distribution wiring sections and capacitor ventilation openings)					
IEC61800-9-2 energy efficiency class	IE2					

Note

G-type: Heavy-load models that support 1.5 times the rated load.

P-type: Light-load models that support 1.1 times the rated load.

9.2 General Specifications

Item			Technical data
Motor control performance	Applicable motor type		Asynchronous induction motors (IM), permanent magnet synchronous motors (PMSM), and synchronous reluctance motors (SynRM)
	Control mode		Sensorless vector control (SVC), feedback vector control (FVC), and voltage/frequency (V/f) control
	Asynchronous motor (V/f)	Functions available	Energy-saving control, overvoltage suppression, overcurrent suppression, undervoltage suppression (voltage dip suppression), oscillation suppression, torque boost, slip compensation, V/f curve selection, decoupled V/f, DC braking, random PWM, fast deceleration upon over-excitation, and droop control
	Synchronous reluctance motor V/f	Functions available	Speed tracking, active short circuit control, MTPA maximum torque-to-current ratio control, overvoltage suppression, undervoltage suppression (voltage dip suppression), DC braking, zero speed clamp, and I/F operation control
	Asynchronous motor (SVC)	Functions available	Energy-saving control, inertia auto-tuning, acceleration feedforward, adaptive speed loop parameters, droop control, free programming and adaptive speed loop parameters, load observer, overvoltage suppression, undervoltage suppression (voltage dip suppression), fast deceleration upon overexcitation, automatic voltage regulation, flying start, and DC braking
		Speed regulation range	1:500
		Starting torque	200%
		Torque step response	Within 2 ms
		Torque control accuracy	±3% at frequencies above 5 Hz
		Speed stability accuracy	Within 10% of the rated slip value
		Flux weakening magnification	6 x flux weakening

Item			Technical data
Motor control performance	Asynchronous motor (FVC)	Functions available	Energy-saving control, inertia auto-tuning, acceleration feedforward, adaptive speed loop parameters, droop control, free programming of adaptive speed loop parameters, load observer, overvoltage suppression, undervoltage suppression (voltage dip suppression), fast deceleration upon overexcitation, automatic output voltage regulation, speed tracking, DC braking, continuous operation after bumpless switchover to SVC upon encoder error, and FVC-to-SVC switchover at designated frequency (to avoid abnormal operation caused by high-speed jitter of the encoder)
		Applicable encoders	ABZ encoder (differential, collector, push-pull), 23-bit communication encoder, resolver, SSI encoder, sine-cosine encoder, EnDat encoder, and BiSS encoder
		Starting torque	200%
		Torque step response	Within 2 ms
		Torque control accuracy	±2%
		Speed fluctuation	0.05% (without motor or encoder defects)
		Speed stability accuracy	0.02% (without motor or encoder defects)
		Flux weakening magnification	5 x flux weakening
	PMSM and synchronous reluctance motor SVC	Functions available	Speed tracking, active short circuit control, fast deceleration upon overexcitation, MTPA maximum torque-to-current ratio control, inertia auto-tuning and acceleration feedforward, droop control, free programming of adaptive speed loop parameters, overvoltage suppression, undervoltage suppression, DC braking, I/F control in SVC
		Speed regulation range	1:200
		Starting torque	200%
		Torque step response	Within 2 ms
		Speed stability accuracy	0.05% (without motor defects)
		Torque control accuracy	±3% at frequencies above 5 Hz

Item			Technical data
Basic functions	Resolution of input frequency		Digital reference: 0.01 Hz Analog reference: maximum frequency x 0.025%
	Operation	Operation command	Independent dual channel and dual channel can be switched freely. Provides different start/stop command sources (terminal, operating panel, communication, custom, connector, etc.). Provides standard control word.
		Frequency reference	Independent dual channel and dual channel can be switched freely. Provides various sources (communication, operating panel, analog, connector, etc.). Supports main frequency, auxiliary frequency, and various operations (addition, subtraction, multiplication, Max., and Min.). Supports additional frequency. Supports multi-level frequency limits.
		Auxiliary frequency reference	Supports various auxiliary frequency references and allows fine-tuning of the auxiliary frequencies and frequency synthesis.
		Standard command word	Normal start/stop (OFF1) Emergency stop (OFF2) Quick stop, stop with maximum capability (OFF3) Operation enable, operation pause
		Torque reference	Multiple torque reference sources: digital reference, analog voltage reference, analog current reference, pulse reference, multi-reference, PID, simple PLC, and communication, which can be switched through multiple ways
		Start/Stop mode	Dual channel, which can be switched freely Supports six different start/stop modes (single-wire mode, two-wire mode 1, two-wire mode 2, two-wire mode 3, three-wire mode 1, three-wire mode 2)
		Acceleration/ Deceleration time	Linear acceleration/deceleration and S-curve acceleration/ deceleration 4 sets of acceleration/deceleration time 7-segment S-curve can be independently configured. Automatic switchover between acceleration/deceleration
		Multi-motor parameters	4 sets of independent motor parameters
	Multi-speed		Supports up to 16 multi-speed references. Supports different unit settings (Hz, rpm, rated %, maximum speed %). Supports free per-unit conversion. Supports custom limit.
	Ramp transition function		When speed references are sent through communication cyclically, automatic interpolation is supported to solve command discontinuity caused by communication intervals, ensuring smooth operation.
	Output limit		Supports torque limit, power limit, current limit, maximum/minimum torque limit, speed limit, and jump frequency.

Item			Technical data
Commissioning and configuration (human-machine interface)	Control terminal	Analog input	2 analog inputs: • AI1: -10 V to +10 V/0 mA to 20 mA • AI2: -10 V to +10 V/0 mA to 20 mA/PT100/PT1000/KTY/PTC Voltage and current: calibration accuracy 0.3%, response time shorter than 2 ms • PT100 (-25℃ to +200℃, ±0.5℃) • PT1000 (-25℃ to +200℃, ±0.5℃) • KTY84-130 (-40℃ to +260℃, ±0.5℃) • PTC (20℃ to 180℃, guaranteed accuracy ±5℃ within a range of 110℃ to 150℃)
		Analog output	MD630S-INT (standard); one analog output; AO1: 0 V to 10 V/0 mA to 20 mA; calibration accuracy: 100 mV; resolution: 12-bit; calibration accuracy: 0.5% MD630N-INT (bus type), no analog output
		Digital Input	MD630S-INT (standard): six regular inputs, one high-speed input; NPN/PNP input wiring method; DI7 used as high-speed pulse input; 20 kHz frequency MD630N-INT (bus type): Two regular inputs, NPN/PNP input wiring method
		Digital output	Relay output: two contacts, 3 A/250 V AC, 3 A/30 V DC, with normally open and normally closed functions supported: • MD630S-INT (standard): one regular digital output; frequency: 100 Hz; output voltage range: 0 V to 24 V; output current range: 0 mA to 50 mA; one high-speed digital output; frequency: 100 kHz; output voltage range: 0 V to 24 V; output current range: 0 mA to 50 mA • MD630N-INT (bus type): one regular digital output; frequency: 100 Hz, output voltage range: 0 V to 24 V; output current range: 0 mA to 50 mA
	External 24 V input		MD630S-INT (standard): not configured MD630N-INT (bus type): configured (input voltage range: 21.6 V DC to 26.4 V DC; current-carrying capacity: 1 A)
	Display and operations on the operating panel	LED operating panel	Used to display and change parameters and display drive status (forward run, reverse run, stop, operating panel, terminal, communication control, speed/torque control, and STO state).
		Key locking and function selection	To prevent inadvertent operations, some keys on the operating panel can be locked, and functions with limited availability range can be assigned to some keys.
	Commissioning software tool		The software InoDriverShop allows you to upload and download AC drive parameters, and supports the oscilloscope function and fault diagnosis. With the oscilloscope function, you can monitor the internal state of the AC drive. Function logic is presented using data flow diagrams, enabling manual-free commissioning. This helps reduce the learning cost and shorten commissioning time.
	Parameter protection		Supports parameter access write protection to prevent inadvertent parameter modification.
	User password (parameter lock)		Supports user-defined passwords to protect parameter accessibility.
	Parameter access levels		Standard: default level with access to commonly-used function parameters Extended: extended with less-used function parameters Expert: parameters for experts, which can be set with a password

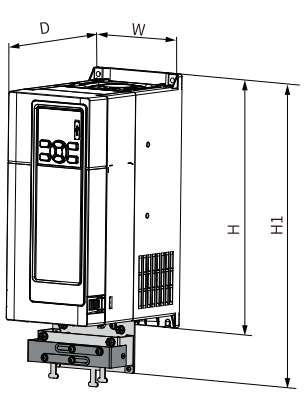
Item			Technical data
Advanced functions	Applicability and usability	Application macro	Interface macros: Pre-defined interface schemes for typical start/stop, speed references, etc., which can be configured through macro instruction with one key. Industry macros: tailored for specific industry applications and combined with classic industry application cases to allow quick parameter configuration (for water pump and ceramic industries, etc.)
		Custom user parameters	You can recombine and generate new parameters to: 1. Enable quick viewing or set parameters of interest for customers. 2. Enable quick access to single communication command.
		Auxiliary functions	Timing reached, run time reached, dead time for forward/reverse run switchover, frequency reference reached, current reference reached, and load speed conversion
		Configurable startup protection	You can freely configure startup protection methods from different command sources.
		Automatic carrier frequency adjustment	To improve the overload capacity and allow the carrier frequency to be adjusted with the output frequency.
	Standard process	Process PID	Provides two sets of PID parameters, which can be switched automatically. PID initial value, PID pause, limit, PID feedback reference filter, dead zone, windup coefficient, forced PID, and PID feedback loss detection
		Free function module	Supports custom needs through different free function modules. Supports arithmetic operations, logic operations, control functions, time control, switch selection functions, multi-point curves, data conversion, and other function modules
		Simple PLC	Supports 16 operation commands. Supports custom acceleration/deceleration time, speed, and operation time. Supports custom circulation methods. Supports retentive upon power failure. Supports pause, reset, etc..
		Droop control	Allows multiple motors to drive the same load simultaneously.
		Jump frequency	Allows the drive to avoid mechanical resonance points of the load. Supports up to four jump frequency points.
		Motorized potentiometer	Indicates the virtual potentiometer output achieved through the software.
	Industry process	Swing frequency control	In swing frequency control, the output frequency oscillates above and below a set center frequency, which is suitable for textile and chemical fiber industries, as well as applications requiring traversing or winding functions.
		Fire mode	In this mode, the drive ignores certain non-critical faults while maintaining operation to ensure safe evacuation of personnel and timely initiation of fire extinction operations in critical infrastructure including building complexes, elevator systems, and tunnels.
	Energy efficiency	Energy conservation statistics	The energy conservation statistics function enables visualization of conservation effects by converting energy savings into quantifiable metrics (kWh, CO_2 emissions, monetary equivalents), which can be read by the host controller directly.
		Sleep and wake-up	The sleep and wake-up function switched the drive to standby or sleep mode when continuous operation is not required, and restart it as needed to achieve energy-efficient operation.

Item		Technical data
Communication	Four-in-one industrial Ethernet bus	MD630S-INT (standard): Modbus (Modbus-RTU) MD630N-INT (bus type): Integrated with dual Ethernet interfaces and supports four industrial Ethernet communication protocols (PROFINET, EtherCAT, EtherNet/IP, and Modbus TCP) to reduce inventory costs and shorten the delivery time.
	Communication command word	Single-word control mode (compatible with old products) Bit control mode Free mode
	Action upon communication interrupt	Compatible actions after communication interrupt: continue operation, alarm, and stop at fault.
Faults and protection	Black box function	Faults are recorded by the black box automatically, allowing you to get the device operation state through the iFA commissioning software for quick troubleshooting. You can customize black box trigger conditions to monitor the device operation state.
	User-defined fault	User-defined faults, alarms, and prompts are supported.
	Historical fault log	Supports up to six fault logs. Fault code, fault subcode, operation data, and fault time
	Load monitoring	You can configure the normal operation range of the drive based on operating conditions such as load, speed change, etc.. When the corresponding range is exceeded, you can customize faults, alarms and so on as needed.
	Automatic fault reset	The fault can be reset automatically. If the number of automatic resets is reached, the fault cannot be reset. The fault white list and black list can be configured as needed.
	Automatic fault restart	The fault can be reset and restart automatically. When the number of automatic resets is exhausted, the fault can no longer be reset. The fault white list and black list can be configured as needed.
	Fault protection	Provides protections against ground fault upon power-on, drive overcurrent, drive overload, motor overload, drive overvoltage, drive undervoltage, drive overtemperature, input phase loss, output phase loss, communication fault, current detection fault, braking overcurrent protection, motor load loss, motor step loss, motor stall, motor overspeed, motor overtemperature, current loop error, excessive speed deviation, demagnetization protection, overspeed protection, excessive zero drift, EEPROM read fault, motor parameter auto-tuning fault, ground fault, stall in SVC, and braking state detection fault.
	Capacitor leakage detection	Supports capacitor leakage detection.
	Self-test	Supports self-test on the drive and motor, IGBT shoot-through detection, current sensor sampling error, short-circuit to ground, phase loss self-test, and inter-phase short circuit self-test.

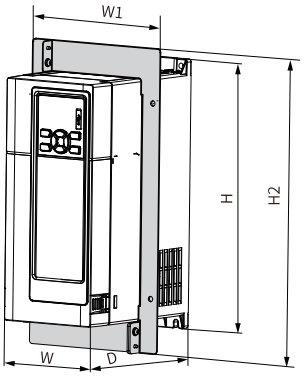
Item		Technical data
Environment	Operating location	Indoors and free from direct sunlight, conductive dust, oil mist, corrosive gas, flammable gas, vapors, water drips, and salty elements
	Altitude	For altitudes equal to or below 1000 m, derating is not required. For altitude ranging from 1000 m to 3000 m, derate 1% for every 100 m. For altitude above 3000 m, contact Inovance.
	Ambient temperature	Storage temperature: -40°C to +60°C Transportation temperature: -20°C to +60°C Operating temperature: -20°C to +60°C. For temperatures above 50°C, derate 2.5% for every additional 1°C. The maximum temperature is 60°C.
	Humidity	< 95% RH, without condensation
Long-cable drive		V/f, rated load, unshielded line: • 0.37 kW, 200 M (carrier frequency reduced to 1 kHz) • 0.75 kW/1.1 kW, 300 M (carrier frequency reduced to 1 kHz) • 1.5 kW, 500 M (carrier frequency reduced to 1 kHz) • 2.2 kW and above (inclusive), 500 M, default carrier frequency • Performance not degraded in vector mode, 100 M (full series) The length supported by shielded cable is two-thirds that of unshielded cable in terms of long-cable driving. Various types of output filters are supported.

9.3 Product Dimensions

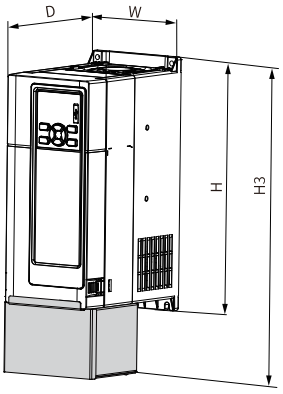
This section mainly introduces the dimensions and specifications of different models with various optional accessories (the following takes the T4 model as an example).



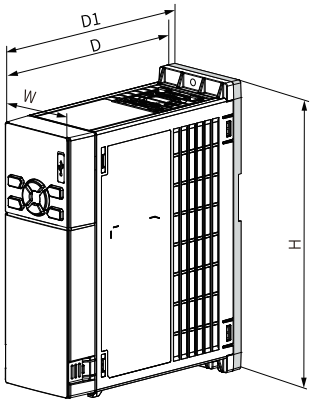
Dimension with EMC grounding bracket of cable shield



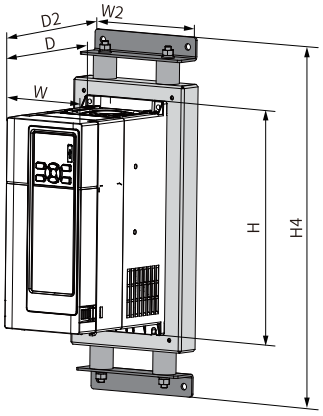
Dimension with through-hole mounting bracket



Dimension with junction box protection accessory

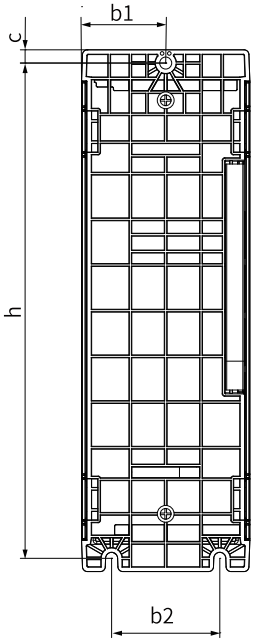


Dimension with DIN rail (optional)

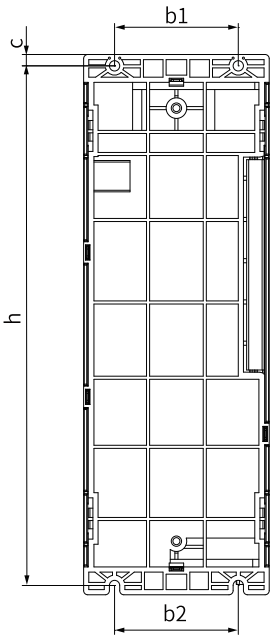


Dimension with vibration-damping bracket for punching press

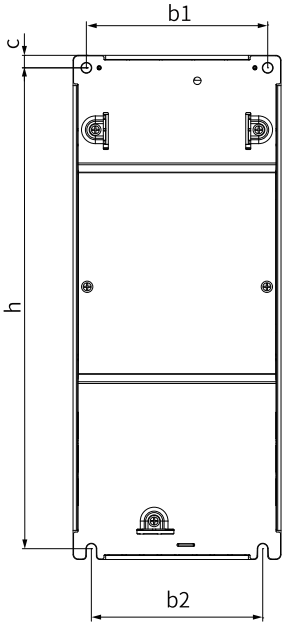
Figure 9-1 Product dimensions



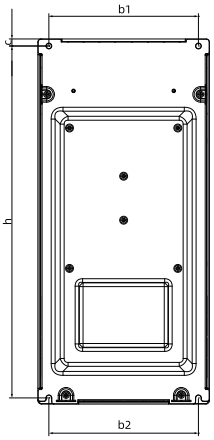
Mounting hole dimensions of T1 and T2



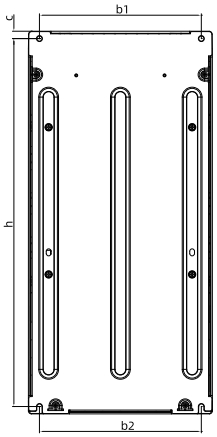
Mounting hole dimensions of T3



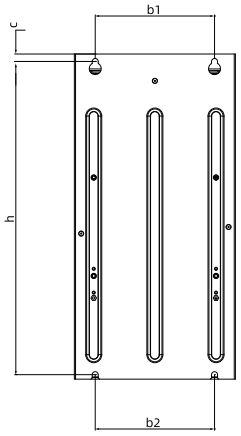
Mounting hole dimensions of T4 and T5



Mounting hole dimensions of T6



Mounting hole dimensions of T7



Mounting hole dimensions of T8

Figure 9-2 Drilling diagram

Table 9–4 Product dimensions

Dimension			Structure (kW)							
			T1 (0.37 to 1.5)	T2 (2.2 to 4)	T3 (5.5 to 7.5)	T4 (11 to 15)	T5 (18.5~22)	T6 (30 to 37)	T7 (45 to 55)	T8 (75 to 90)
Dimensions mm (in.)	Width	W (Drive body)	70 (2.76)	75 (2.95)	90 (3.54)	125 (4.92)	165 (6.50)	195 (7.68)	250 (9.84)	270 (10.63)
		W1 (with through-hole bracket)	-	-	-	174.7 (6.88)	214.7 (8.45)	274 (10.79)	330 (12.99)	360 (14.17)
		W2 (with punch press vibration damping bracket)	110 (4.33)	110 (4.33)	110 (4.33)	175 (6.89)	175 (6.89)	205 (8.07)	280 (11.02)	280 (11.02)
	Depth	D (Drive body)	169.5 (6.67)	169.5 (6.67)	190 (7.48)	186 (7.32)	200 (7.87)	220 (8.66)	270 (10.63)	296 (11.65)
		D1 (with DIN rail accessory)	177.5 (6.99)	177.5 (6.99)	-	-	-	-	-	-
		D2 (with punch press vibration damping bracket)	207.5 (8.17)	207.5 (8.17)	228 (8.98)	226 (8.90)	240 (9.45)	260 (10.24)	315 (12.40)	341 (13.43)
	Altitude	H (Drive body)	217 (8.54)	217 (8.54)	262 (10.31)	303 (11.93)	330 (12.99)	415 (16.34)	520 (20.47)	545 (21.46)
		H1 (with EMC shield grounding bracket)	248 (9.76)	248 (9.76)	303.5 (11.95)	370 (14.57)	415 (16.34)	515 (20.28)	614.5 (24.19)	663 (26.10)
		H2 (with through-hole bracket)	-	-	-	332 (13.07)	370 (14.57)	479.5 (18.88)	580 (22.83)	595 (23.43)
		H3 (with junction box accessory)	272.3 (10.72)	272.3 (10.72)	323 (12.72)	403 (15.87)	420 (16.54)	487 (19.17)	620 (24.41)	655 (25.79)
		H4 (with punch press vibration damping bracket)	415 (16.34)	415 (16.34)	415 (16.34)	466 (18.35)	466 (18.35)	552 (21.73)	722 (28.43)	722 (28.43)
Mounting hole mm (in.)	b1		35 (1.38)	37.5 (1.48)	60 (2.36)	109 (4.29)	140 (5.51)	170 (6.69)	220 (8.66)	200 (10.63)
	b2		45 (1.77)	45 (1.77)	60 (2.36)	103 (4.06)	140 (5.51)	170 (6.69)	220 (8.66)	200 (10.63)
	c		5.5 (0.22)	5.5 (0.22)	5.5 (0.22)	7.5 (0.30)	8 (0.31)	8 (0.31)	10 (0.39)	12.5 (0.49)
	h		206 (8.15)	206 (8.15)	252 (9.92)	289 (11.38)	314 (12.36)	400 (15.75)	500 (19.69)	525 (20.67)
Mounting hole mm (in.)			ϕ5 (0.20)	ϕ5 (0.20)	ϕ5 (0.20)	ϕ6 (0.24)	ϕ6 (0.24)	ϕ6 (0.24)	ϕ7 (0.28)	ϕ10 (0.39)
Tightening torque N·m			1.2	1.2	1.2	2.8	2.8	2.8	4.5	13.0
Overall weight kg (lb)			1.25 (2.76)	1.36 (3.00)	2.08 (4.59)	4.01 (8.84)	5.94 (13.10)	15.14 (33.38)	24.8 (54.68)	29.5 (65.03)

9.4 Motor compatibility

The following three motor types are supported. Select the motor type according to the actual working conditions.

- Three-phase asynchronous motor
- Three-phase permanent magnet synchronous motor
- Three-phase synchronous reluctance motor

9.5 AC Drive Overload Capacity

Definition

Overload capacity refers to the ability of the AC drive to output more than 100% of its rated load within a short period of time. Generally, the overload capacity is defined according to the normal 1-minute overload capacity, which is divided into heavy overload and light overload:

- Heavy overload: 1 minute of continuous operation at 150% of rated load allowed per every 5 minutes. 4 minutes of continuous operation at 100% of rated load allowed per every 5 minutes.
- Light overload: 1 minute of continuous operation at 110% of rated load allowed per every 5 minutes. 4 minutes of continuous operation at 150% of rated load allowed per every 5 minutes.

Typical load cycle of the AC drive

Typical applications for heavy overload include the following three categories:

- Hoisting loads such as cranes, hoists and elevators
- Metal processing applications such as machine tools and stamping presses.
- Other applications where high overload multiples such as heavy load start occur

In the above three scenarios, sudden load/sudden unload or even impact load may occur. Occasionally, output current may exceed the rated current. The heavy-overload model meets the following cycle overload conditions.

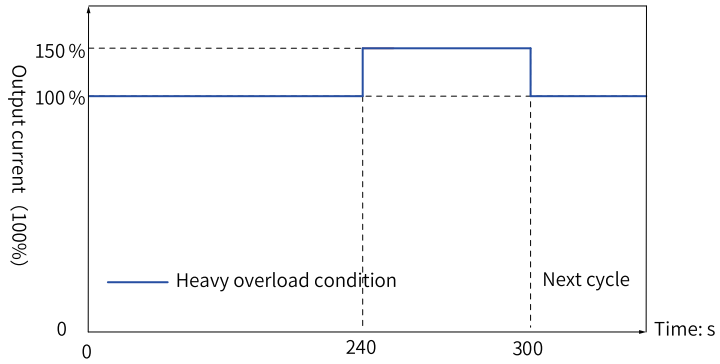


Figure 9-3 Cycle overload (heavy load)

Typical applications for light overload include the following two categories:

- Fluid machinery applications such as fans, pumps, air conditioning refrigeration, HAVC and air compressors.

- Other applications where only low overload multiples occur occasionally

In these cases, the load is generally stable, and the load rarely changes. Light overload models meet the following cycle overload conditions.

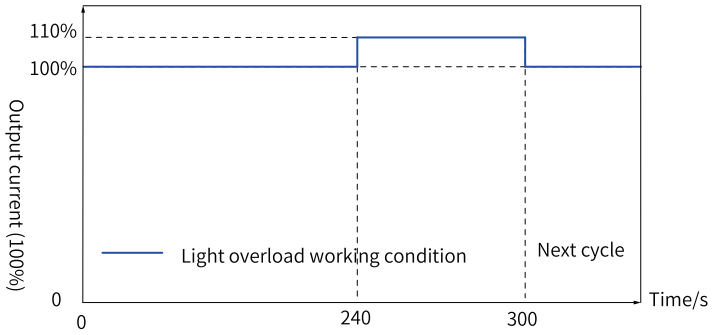


Figure 9-4 Cycle overload (light load)

9.6 Electromagnetic Compatibility of AC Drive

9.6.1 Electromagnetic compatibility

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices or systems to work properly in the electromagnetic environment without introducing electromagnetic interferences that disturb the operation of other local devices or systems. Therefore, EMC includes two requirements:

- On one hand, it specifies that the electromagnetic interference (EMI) generated by the equipment during normal operation cannot exceed defined limits in its operational environment.
- On the other hand, it requires the equipment to maintain normal functionality with a specified level of immunity to electromagnetic disturbances present in the environment, referred to as electromagnetic susceptibility (EMS).

EN IEC 61800-3 defines the following two types of environments:

- First environment: Environment that includes domestic premises, and establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes
- Second environment: Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes

Based on the intended use environment, the products are divided into the following four categories:

- C1 equipment: power drive system (PDS) of rated voltage less than 1000 V, intended for use in the first environment
- C2 equipment: PDS with rated voltage less than 1000 V, which is neither a plug-in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by professionals.
- C3 equipment: PDS with rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment.

- C4 equipment: PDS with rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

9.6.2 Electromagnetic Compatibility of AC Drive

In order to be suitable for the application in the above environment (see section *"9.6.1 Electromagnetic compatibility" on page 1335*), the AC drive shall follow the conditions:

Second environment - class C3

Interference resistance

The AC drive complies with the standard requirements.

Interference generated by the AC drive

When the following conditions are met, the AC drive meets the standard requirements.

- The AC drive is connected to a TN or TT grid with the neutral point is grounded.
- Low-capacitance shielded motor cables are used.
- The motor cable length does not exceed 10 m.
- The AC drive and motor have been installed in accordance with the EMC requirements of the installation instructions.

Second environment - class C2

Interference resistance

The AC drive complies with the standard requirements.

Interference generated by the AC drive

When the following conditions are met, the AC drive meets the standard requirements.

- Use the recommended external filter.
- The AC drive is connected to a TN or TT grid with the neutral point is grounded.
- Low-capacitance shielded motor cables are used.
- The motor cable length does not exceed 10 m.
- The AC drive and motor have been installed in accordance with the EMC requirements of the installation instructions.

9.7 Derating

When the AC drive is operating above the rated conditions (ambient temperature, altitude, and carrier frequency), derate the AC drive, that is, reduce the output current of the AC drive. Failure to comply may result in damage to the AC drive.

9.7.1 Derating Based on Carrier Frequency

The carrier frequency may need to be increased in actual applications. Increasing the carrier frequency brings a series of benefits, such as reducing motor noise, reducing output current harmonics and torque ripple, and achieving better control performance with high-speed motors. However, increasing the carrier frequency can increase the heat generation of the drive, which may easily lead to IGBT overtemperature alarm. Prolonged operation beyond rated specifications may shorten service life of the drive.

Therefore, select a drive based on the following derating values to ensure the rated current of the drive after derating is higher than or equal to the load current.

Table 9–5 Derating based on carrier frequency

Structure	Rated power (kW)	Rated output current (A)	Derating based on carrier frequency (%) (7 segments)																
			2 k	2.6 k	3 k	3.5 k	4 k	5 k	6 k	7 k	8 k	9 k	10 k	11 k	12 k	13 k	14 k	15 k	16 k
T1	0.37	1.5	100.0	100.0	100.0	100.0	100	100	100	100	100	100	100	93.8	87.5	82.8	76.6	73.4	68.8
	0.75	2.1	100.0	100.0	100.0	100.0	100	89.1	79.7	71.9	65.6	60.9	56.3	52.3	48.4	46.1	43.0	40.6	38.3
	1.5	3.8	100.0	100.0	100.0	100.0	100	89.1	79.7	72.7	66.4	60.9	57.0	53.1	50.0	46.9	43.8	41.4	39.1
T2	2.2	5.1	100.0	100.0	100.0	100.0	100	90.6	82.8	75.0	68.8	64.1	59.4	54.7	51.6	48.4	45.3	43.0	40.6
	3	7.2	100.0	100.0	100.0	100.0	100	92.2	84.4	77.3	71.9	65.6	61.7	57.8	53.9	50.0	47.7	44.5	42.2
	4	9	100.0	100.0	100.0	100.0	100	90.6	81.3	73.4	67.2	60.9	56.3	51.6	47.7	43.8	40.6	38.3	35.2
T3	5.5	13	100.0	100.0	100.0	100.0	100	92.2	84.4	78.1	72.7	67.2	62.5	58.6	54.7	51.6	48.4	45.3	43.0
	7.5	17	100.0	100.0	100.0	100.0	100	92.2	85.9	79.7	74.2	69.5	64.8	60.9	57.8	53.9	51.6	48.4	46.1
T4	11	25	100.0	100.0	100.0	100.0	100	90.6	82.0	75.0	67.2	60.9	55.5	50.8	46.1	42.2	38.3	34.4	31.3
	15	32	100.0	100.0	100.0	100.0	100	90.6	82.8	75.0	68.8	63.3	57.8	53.1	48.4	45.3	41.4	38.3	35.9
T5	18.5	37	100.0	100.0	100.0	100.0	100	92.2	82.8	76.6	69.5	64.1	57.8	53.1	48.4	45.3	41.4	37.5	34.4
	22	45	100.0	100.0	100.0	100.0	100	92.2	85.9	79.7	73.4	67.2	62.5	57.8	54.7	50.8	46.9	44.5	41.4
T6	30	60	100.0	100.0	100.0	100.0	100.0	90.9	83.2	76.4	70.3	64.8	59.9	55.5	51.5	47.9	44.6	41.6	38.8
	37	75	100.0	100.0	100.0	100.0	94.2	86.6	79.8	73.8	68.4	63.5	59.1	55.1	51.4	48.2	45.1	42.4	39.8
T7	45	91	100.0	100.0	100.0	100.0	94.2	86.5	79.7	73.6	68.1	63.2	58.8	54.8	51.2	47.9	44.9	42.2	39.6
	55	112	100.0	100.0	97.3	93.8	90.4	84.1	78.4	73.2	68.5	64.1	60.2	56.6	53.3	50.2	47.4	44.9	42.5
T8	75	150	100.0	95.8	89.5	84.9	80.4	72.5	65.5	59.3	53.9	49.1	44.8	40.9	37.4	34.3	31.5	29.0	26.7
	90	176	100.0	95.0	87.5	82.2	76.9	67.7	59.9	53.1	47.2	42.1	37.7	33.8	30.4	27.5	24.9	22.6	20.5

9.7.2 Ambient Temperature-based Derating

Current derating at ambient temperature

The operating ambient temperature of the AC drive ranges from -20℃ to +60℃. When the ambient temperature is above 50℃, derate 2.5% for every 1℃ rise, and the maximum temperature reaches 60℃. The derating curve of the ambient temperature is shown in the following figure.

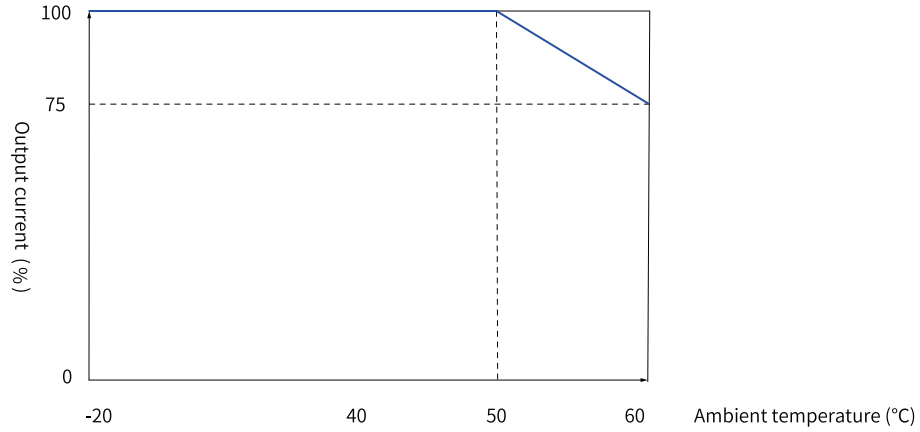


Figure 9-5 Ambient temperature-based derating curve

Current derating at installation altitude

No derating is required at altitudes below 1000 m. When the altitude is above 1000 m, derate 1% for every 100 m, and the maximum altitude is 3000 m. The derating curve is shown in the following figure.

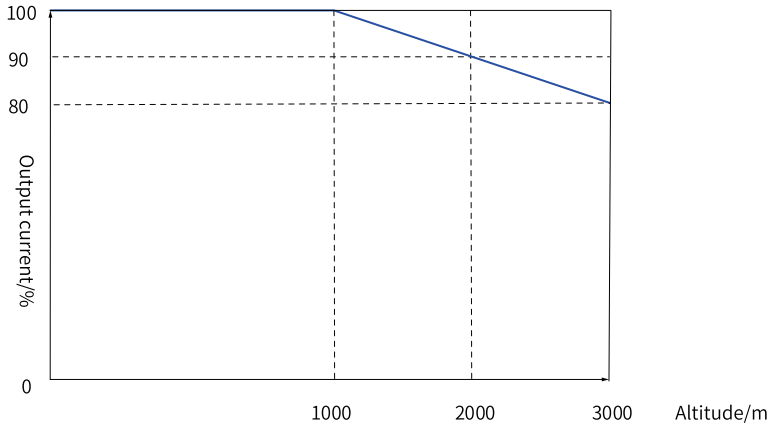


Figure 9-6 Installation altitude-based derating curve

Current derating at installation clearance

- When the installation is not performed in parallel with the machine and the installation space recommended in *"2.3.2.1 Installation Space" on page 47* is used, the system is not derated below 50℃.

- When the devices are installed in parallel with zero clearance, derating is no need for the ambient temperature below 40°C. For temperature above 40°C, derate 2.5% for every 1°C rise, and the maximum temperature is 60°C. The following figure shows the derating curve of the installation clearance.

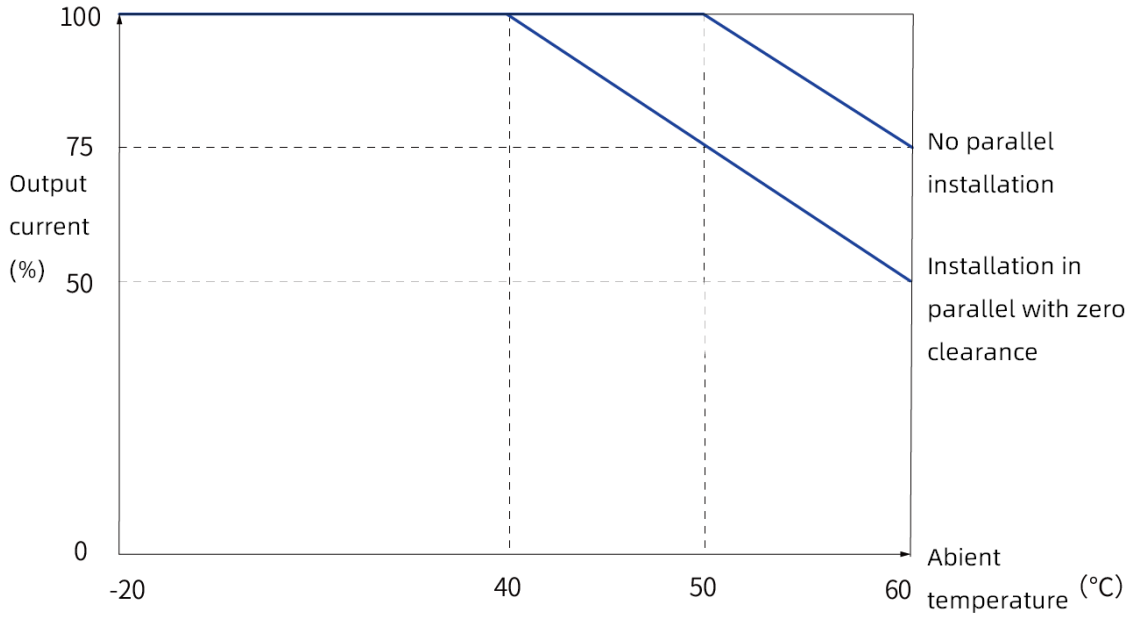


Figure 9-7 Installation clearance-based derating curve

9.8 Accessory Specifications

9.8.1 List of Options

Table 9–6 List of Options

Classification	Name	Model	Ordering number	Applicable model	Function
Braking resistor	Braking resistor	See *"9.8.6 Braking Resistor" on page 1364* for recommended brake resistor selection.		Full series compatible	When overvoltage occurs due to excessive regenerative energy, connect an external braking resistor.
Cable	Power cables	See *"9.8.12 Cable" on page 1380* for details on power cable selection.		Full series compatible	It is recommended to use symmetrical shielded cables as input and output main circuit cables. Compared with four-conductor cables, symmetrical shielded cables can reduce electromagnetic radiation in the whole transmission system. It is recommended to use symmetrical shielded cables as power cables.
	Control cables	See *"9.8.12 Cable" on page 1380* for details on control cable selection.		Full series compatible	All control circuit cables must be shielded cables. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pair (STP) cables as digital signal cables.
	Cable lug	See *"9.8.12 Cable" on page 1380* for details on cable lug selection.		Full series compatible	Connect cables properly to allow safe and reliable current transmission.

Classification	Name	Model	Ordering number	Applicable model	Function
Expansion card	Multi-function I/O expansion card	MD-IO-M1	01040335	Full series compatible	Supports two DIs, one DO, one AI, one AO, one RO, and one temperature input. AI supports voltage/current input, AO supports voltage/current output, and RO supports extended lifecycle for lifting industry applications.
	Digital PG expansion card	MD-PG-AU1	01040321	Full series compatible	Used to measure the motor speed and achieve speed and position closed loop control and encoder frequency division output.
	Resolver PG expansion card	MD-PG-R1	01040322	Full series compatible	Used to measure the motor speed and achieve speed and position closed loop control and encoder frequency division output.
	Sine-cosine PG expansion card	MD-PG-S1	01040323	Full series compatible	Used for sine-cosine analog encoder signal processing, frequency division output, and encoder data and commands exchange with control board through UART.

Classification	Name	Model	Ordering number	Applicable model	Function
Mounting accessories	DIN rail mounting accessory	MD630-AZJ-A4T1	01040314	T1 to T2 (0.37 kW to 4 kW)	Supports DIN rail mounting of the drive.
	Through-hole mounting bracket	MD630-AZJ-A1T4	01040312	T4 (11 kW to 15 kW)	Supports through-hole mounting of the drive.
		MD630-AZJ-A1T5	01040307	T5 (18.5 kW to 22 kW)	
		MD630-AZJ-A1T6	01040358	T6 (30 kW to 37 kW)	
		MD630-AZJ-A1T7	01040362	T7 (45 kW to 55 kW)	
		MD630-AZJ-A1T8	01040363	T8 (75 kW to 90 kW)	
	Junction box accessory	MD630-JXH-A5T1	01040313	T1 to T2 (0.37 kW to 4 kW)	Enhances protection capability of the drive.
		MD630-JXH-A5T3	01040317	T3 (5.5 kW to 7.5 kW)	
		MD630-JXH-A5T4	01040311	T4 (11 kW to 15 kW)	
		MD630-JXH-A5T5	01040308	T5 (18.5 kW to 22 kW)	
		MD630-JXH-A5T6	01040360	T6 (30 kW to 37 kW)	
		MD630-JXH-A5T7	01040364	T7 (45 kW to 55 kW)	
		MD630-JXH-A5T8	01040367	T8 (75 kW to 90 kW)	
	Grounding bracket for cable shield	MD630-AZJ-A3T1	01040316	T1 to T2 (0.37 kW to 4 kW)	Fulfills 360° shield grounding requirements.
		MD630-AZJ-A3T3	01040318	T3 (5.5 kW to 7.5 kW)	
		MD630-AZJ-A3T4	01040310	T4 (11 kW to 15 kW)	
		MD630-AZJ-A3T5	01040309	T5 (18.5 kW to 22 kW)	
		MD630-AZJ-A3T6	01040361	T6 (30 kW to 37 kW)	
		MD630-AZJ-A3T7	01040368	T7 (45 kW to 55 kW)	
		MD630-AZJ-A3T8	01040369	T8 (75 kW to 90 kW)	
	Punch press vibration damping bracket	MD630-AZJ-A2T1	01040315	T1 to T3 (0.37 kW to 7.5 kW)	Supports high-vibration environments for drives.
		MD630-AZJ-A2T4	01040306	T4 to T5 (11 kW to 22 kW)	
		MD630-AZJ-A2T6	01040359	T6 (30 kW to 37 kW)	
		MD630-AZJ-A2T7	01040366	T7 (45 kW to 55 kW)	
		MD630-AZJ-A2T8	01040365	T8 (75 kW to 90 kW)	

Note

For a list of peripheral electrical *"3.1 AC Drive and Peripherals" on page 75*devices, see section.

9.8.2 Circuit Breaker And Fuse

Selection of circuit breakers and fuses (CE)

Table 9–7 Selection of circuit breakers and fuses (CE)

		Heavy overload G model			Light overload P model		
Structure	Module Model	Rated Input Current (A)	Non-semiconductor fuse current (A)	Circuit breaker current (A)	Rated Input Current (A)	Non-semiconductor fuse current (A)	Circuit breaker current (A)
T1	MD630S/N-4T1R5BS-INT	1.7	5	7	2.4	5	7
	MD630S/N-4T2R1BS-INT	2.4	10	7	4.6	10	7
	MD630S/N-4T3R8BS-INT	4.6	10	15	6.4	10	15
T2	MD630S/N-4T5R1BS-INT	6.4	15	15	9	15	15
	MD630S/N-4T7R2BS-INT	9	15	15	11.4	15	15
	MD630S/N-4T9R0BS-INT	11.4	25	30	17	25	30
T3 models	MD630S/N-4T013BS-INT	16.8	30	50	22.7	30	50
	MD630S/N-4T017BS-INT	22	50	50	33.4	50	50
T4	MD630S/N-4T025BS-INT	32.4	60	70	42.1	60	70
	MD630S/N-4T032BS-INT	41.6	70	70	49.1	70	70
T5	MD630S/N-4T037BS-INT	48.7	80	100	60.1	80	100
	MD630S/N-4T045BS-INT	58.5	90	100	71.6	90	100
T6	MD630S/N-4T060BS-INT	56.3	80	100	68.8	90	100
	MD630S/N-4T075BS-INT	70.4	90	100	84.7	110	150
T7	MD630S/N-4T091BS-INT	86.3	110	150	104.2	150	150
	MD630S/N-4T112BS-INT	107.6	150	150	139.9	175	250
T8	MD630S/N-4T150BS-INT	141.6	175	250	165.4	225	250
	MD630S/N-4T176BS-INT	168.4	225	250	197.6	250	250

Note

Values recommended in the preceding table are based on:

- Ambient temperature of 40℃ without forced air-cooling
- Installation altitude of 2000 m
- Installation of an individual drive
- Copper busbar current density of 1.3 A/mm². Rated voltage of 480 V

If the conditions vary, select the model according to actual conditions.

Selection of Circuit Breaker (UL)

To comply with UL61800-5-1, install a circuit breaker on the input side of the drive to prevent accidents caused by short circuit in the internal circuit.

Install sufficient protective devices against short circuit in branch circuits according to applicable regulations and this guide. The drive is applicable to circuits with a rated breaking capacity lower than 100 kA and a maximum voltage of 480 VAC (class 400 V).

Note

All circuit breaker protective devices must be UL-certified.

Table 9–8 Selection of Circuit Breaker (UL)

Structure	Module Model	Heavy overload G model		Light overload P model	
		Rated Input Current (A)	Circuit breaker current (A)	Rated Input Current (A)	Circuit breaker current (A)
T1	MD630S/N-4T1R5BS-INT	1.7	3	2.4	3
	MD630S/N-4T2R1BS-INT	2.4	7	4.6	7
	MD630S/N-4T3R8BS-INT	4.6	15	6.4	15
T2	MD630S/N-4T5R1BS-INT	6.3	15	9	15
	MD630S/N-4T7R2BS-INT	8.9	15	11.4	15
	MD630S/N-4T9R0BS-INT	11.4	30	17	25
T3 models	MD630S/N-4T013BS-INT	16.8	35	22.7	30
	MD630S/N-4T017BS-INT	22	50	33.4	45
T4	MD630S/N-4T025BS-INT	32.4	70	42.1	60
	MD630S/N-4T032BS-INT	41.6	70	49.1	70
T5	MD630S/N-4T037BS-INT	48.7	80	60.1	80
	MD630S/N-4T045BS-INT	58.5	100	71.6	100
T6	MD630S/N-4T060BS-INT	56.3	100	68.8	90
	MD630S/N-4T075BS-INT	70.4	100	84.7	125
T7	MD630S/N-4T091BS-INT	86.3	150	104.2	150
	MD630S/N-4T112BS-INT	107.6	150	139.9	175
T8	MD630S/N-4T150BS-INT	141.6	250	165.4	225
	MD630S/N-4T176BS-INT	168.4	250	197.6	250

Note

Values recommended in the preceding table are based on:

- Ambient temperature of 40℃ without forced air-cooling
- Installation altitude of 2000 m
- Installation of an individual drive
- Copper busbar current density of 1.3 A/mm². Rated voltage of 480 V

If the conditions vary, select the model according to actual conditions.

9.8.3 AC Input Reactor

See the following table for applicable scenarios of different reactor types.

Table 9–9 Reactor

Type	Description
Input reactor	Used to suppress the harmonics and surge current at the AC ports; recommended for customers with requirements on less harmonics and surge current suppression.
Output reactor	Used to suppress output waveform oscillation when the UVW output lines are long, therefore protecting the motor.
DC reactor	Used to suppress harmonics at the AC terminal. DC reactors can be used on models where harmonic requirements exist and the DC terminal has a reserved terminal for reactor connection.

The AC input reactor is optional and mainly used to reduce harmonics in the input current. When the application environment imposes stringent harmonic requirements, external reactors can achieve compliance with the current harmonic limits stipulated in IEC 61000-3-12. The following table lists the recommended reactor manufacturer and models.

Model selection

The recommended manufacturer for input reactors is EAGTOP, with the model described as follows.

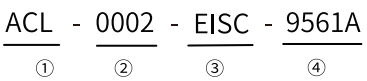


Figure 9-8 AC input reactor model

①	**Code** ACL: AC input reactor	③	**Physical configuration** EI: Iron core SC: Vertical copper strip/Copper wire foil winding SHL: Three-phase vertical type with copper-aluminum hybrid material and vertically wound coil
②	**Rated current** 0002: 2 A	④	**Code number** 9561: Manufacturer model code A: Ranking under the same current **Inductance** EM16: 0.16 mH D: Version NC: Temperature control switch

Table 9–10 Selection of AC output reactors (Three-phase 380 V to 480 V) (high-overload G-type)

Structure	Drive model	Rated Power (kW)	Rated input current (A)	Reactor model	Reactor inductance (mH)	Order Number	Loss (W)
T1	MD630S/N-4T1R5BS-INT	0.37	1.7	ACL-0002-EISC-9561A	10.5	11070911	5.9
	MD630S/N-4T2R1BS-INT	0.75	2.4	ACL-0003-EISC-9561A	7.2	11070912	9.9
	MD630S/N-4T3R8BS-INT	1.5	4.6	ACL-0005-EISC-9561A	4.4	11070914	12.6
T2	MD630S/N-4T5R1BS-INT	2.2	6.3	ACL-0007-EISC-9561A	3.1	11070915	14.7
	MD630S/N-4T7R2BS-INT	3.0	8.9	ACL-0009-EISC-9561A	2.5	11070916	15.9
	MD630S/N-4T9R0BS-INT	4.0	11.4	ACL-0013-EISC-9561A	1.7	11070917	19
T3	MD630S/N-4T013BS-INT	5.5	16.8	ACL-0017-EISHL-9561A	1.3	11070918	30.4
	MD630S/N-4T017BS-INT	7.5	22.0	ACL-0025-EISHL-9561A	0.89	11070919	43.6
T4	MD630S/N-4T025BS-INT	11	32.4	ACL-0037-EISHL-9561A	0.6	11070921	55.3
	MD630S/N-4T032BS-INT	15	41.6	ACL-0045-EISHL-9561A	0.49	11070922	58.8
T5	MD630S/N-4T037BS-INT	18.5	48.7	ACL-0060-EISHL-9561A	0.37	11070923	80
	MD630S/N-4T045BS-INT	22	58.5	ACL-0060-EISHL-9561A	0.37	11070923	80

Structure	Drive model	Rated Power (kW)	Rated input current (A)	Reactor model	Reactor inductance (mH)	Order Number	Loss (W)
T6	MD630S/N-4T060BS-INT	30	56.3	ACL-0060-EISHL-9561A	0.37	11070923	80
	MD630S/N-4T075BS-INT	37	70.4	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
T7	MD630S/N-4T91BS-INT	45	86.3	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
	MD630S/N-4T112BS-INT	55	107.6	ACL-0120-EISCL-EM12DNC	0.12	11070935	122
T8	MD630S/N-4T150BS-INT	75	141.6	ACL-0150-EISCL-E95UDNC	0.091	11070936	191
	MD630S/N-4T176BS-INT	90	168.4	ACL-0200-EISCL-E70UDNC	0.07	11070937	212

Table 9–11 Selection of AC input reactors (Three-phase 380 V to 480 V) (low-overload P-type)

Structure	Drive model	Rated Power (A)	Rated Input Current (kW)	Reactor model	Reactor inductance (mH)	Order Number	Loss (W)
T1	MD630S/N-4T1R5BS-INT	0.37	2.4	ACL-0003-EISC-9561A	7.2	11070912	9.9
	MD630S/N-4T2R1BS-INT	0.75	4.6	ACL-0005-EISC-9561A	4.4	11070914	12.6
	MD630S/N-4T3R8BS-INT	1.5	6.4	ACL-0007-EISC-9561A	3.1	11070915	14.7
T2	MD630S/N-4T5R1BS-INT	2.2	9th	ACL-0009-EISC-9561A	2.5	11070916	15.9
	MD630S/N-4T7R2BS-INT	3.0	11.4	ACL-0013-EISC-9561A	1.7	11070917	19
	MD630S/N-4T9R0BS-INT	4	17	ACL-0017-EISC-9561A	1.3	11070918	30.4
T3	MD630S/N-4T013BS-INT	5.5	22.7	ACL-0025-EISC-9561A	0.89	11070919	43.6
	MD630S/N-4T017BS-INT	7.5	33.4	ACL-0037-EISC-9561A	0.6	11070921	55.3
T4	MD630S/N-4T025BS-INT	11	42.1	ACL-0045-EISC-9561A	0.49	11070922	58.8
	MD630S/N-4T032BS-INT	15	49.1	ACL-0060-EISHL-9561A	0.37	11070923	80
T5	MD630S/N-4T037BS-INT	18.5	60.1	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
	MD630S/N-4T045BS-INT	22	71.6	ACL-0090-EISCL-EM16DNC	0.16	11070934	81

Structure	Drive model	Rated Power (A)	Rated Input Current (kW)	Reactor model	Reactor inductance (mH)	Order Number	Loss (W)
T6	MD630S/N-4T060BS-INT	30	68.8	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
	MD630S/N-4T075BS-INT	37	84.7	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
T7	MD630S/N-4T91BS-INT	45	104.2	ACL-0120-EISCL-EM12DNC	0.12	11070935	122
	MD630S/N-4T112BS-INT	55	139.9	ACL-0150-EISCL-E95UDNC	0.091	11070936	191
T8	MD630S/N-4T150BS-INT	75	165.4	ACL-0200-EISCL-E70UDNC	0.07	11070937	212
	MD630S/N-4T176BS-INT	90	197.6	ACL-0200-EISCL-E70UDNC	0.07	11070937	212

Dimensions

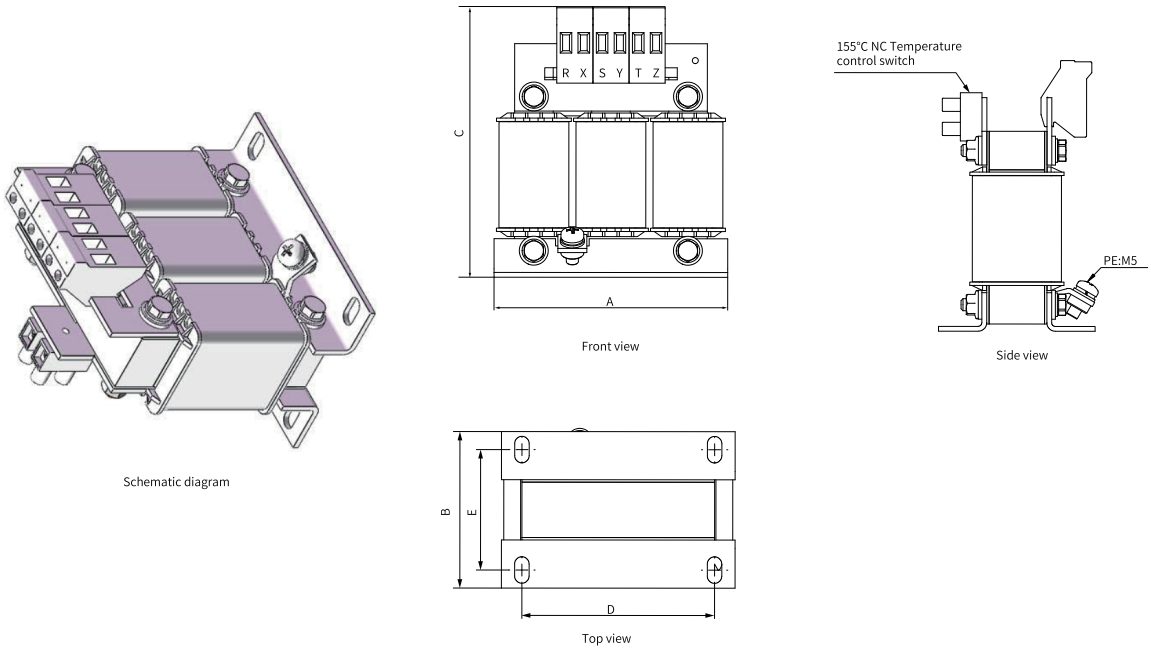


Figure 9-9 Dimensions of 2 A to 13 A AC input reactors

Table 9–12 Dimensions of 2 A to 13 A AC input reactors

Model	Overall dimensions	Drilling dimensions	Mounting screws	Torque (kgf·cm)
	Width A x Depth B x Height C	Width D x Depth E		
ACL-0002-EISC-9561A ACL-0003-EISC-9561A	**mm:** 100 x 65 (±2) x 120 **in.:** 3.94 x 2.56 (±0.08) x 4.72	**mm:** 80 (±2) x 50 (±2) **in.:** 3.15 (±0.08) x 1.97 (±0.08)	M5	28
ACL-0005-EISC-9561A ACL-0007-EISC-9561A	**mm:** 115 x 85 (±2) x 130 **in.:** 4.53 x 3.35 (±0.08) x 5.12	**mm:** 90 (±2) x 65 (±2) **in.:** 3.54 (±0.08) x 2.56 (±0.08)	M5	28
ACL-0009-EISC-9561A ACL-0013-EISC-9561A	**mm:** 135 x 90 (±2) x 140 **in.:** 5.31 x 3.54 (±0.08) x 5.51	**mm:** 100 (±2) x 70 (±2) **in.:** 3.94 (±0.08) x 2.76 (±0.08)	M5	28

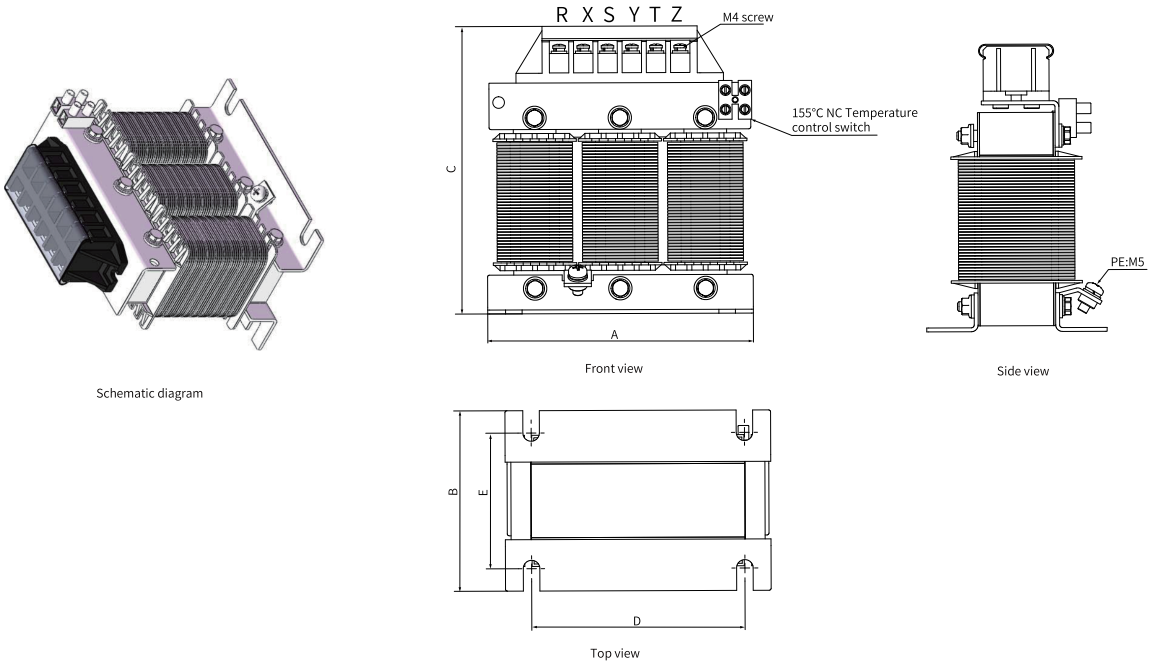


Figure 9-10 Dimensions of 17 A to 60 A AC input reactors

Table 9–13 Dimensions of 17 A to 60 A AC input reactors

Model	Overall dimensions	Drilling dimensions	Mounting screws	Torque (kgf·cm)
	Width A x Depth B x Height C	Width D x Depth E		
ACL-0017-EISC-9561A	**mm:** 140 x 93 (±2) x 160 **in.:** 5.51 x 3.66 (±0.08) x 6.30	**mm:** 110 (±2) x 70 (±2) **in.:** 4.33 (±0.08) x 2.76 (±0.08)	M6	48
ACL-0025-EISC-9561A	**mm:** 140 x 98 (±2) x 160 **in.:** 5.51 x 3.86 (±0.08) x 6.30	**mm:** 110 (±2) x 75 (±2) **in.:** 4.33 (±0.08) x 2.76 (±0.08)	M6	48
ACL-0037-EISC-9561A	**mm:** 160 x 113 (±2) x 180 **in.:** 6.30 x 4.45 (±0.08) x 7.09	**mm:** 120 (±2) x 90 (±2) **in.:** 4.72 (±0.08) x 3.54 (±0.08)	M6	48

Model	Overall dimensions	Drilling dimensions	Mounting screws	Torque (kgf·cm)
	Width A x Depth B x Height C	Width D x Depth E		
ACL-0045-EISC-9561A	**mm:** 160 x 128 (±2) x 180 **in.:** 6.30 x 5.04 (±0.08) x 7.09	**mm:** 120 (±2) x 105 (±2) **in.:** 4.72 (±0.08) x 4.13 (±0.08)	M6	48
ACL-0060-EISC-9561A				

Dimensions

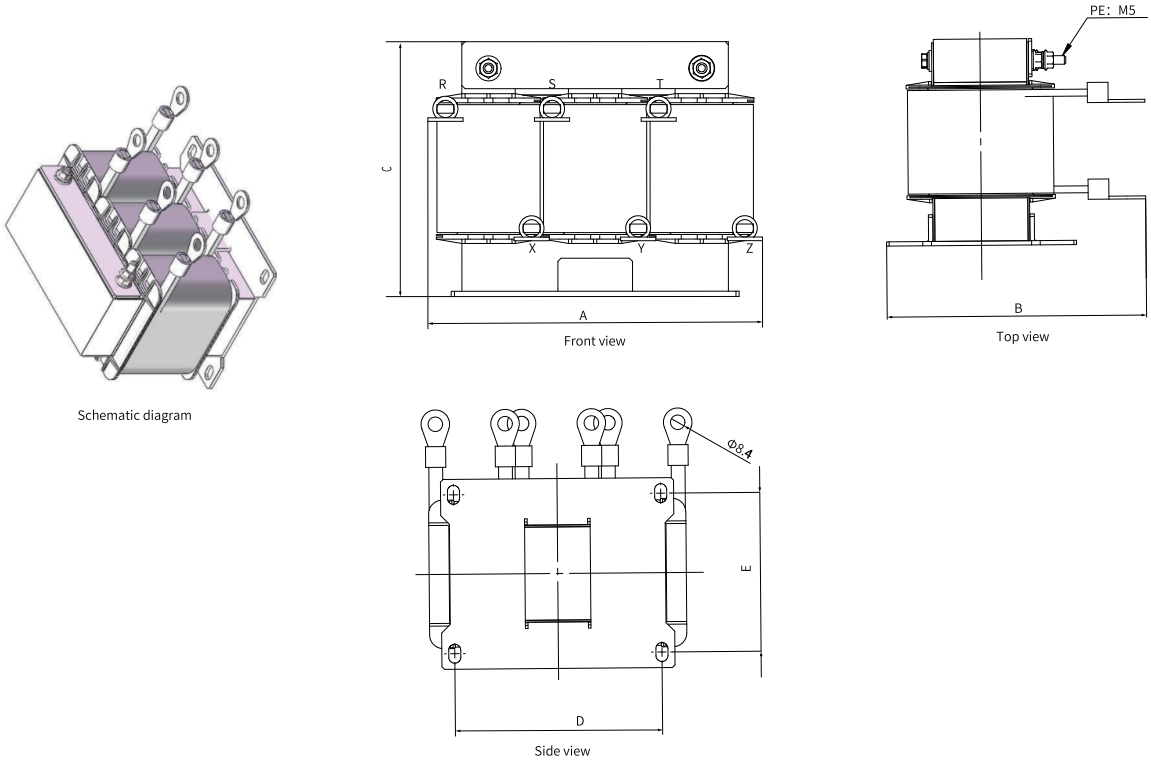
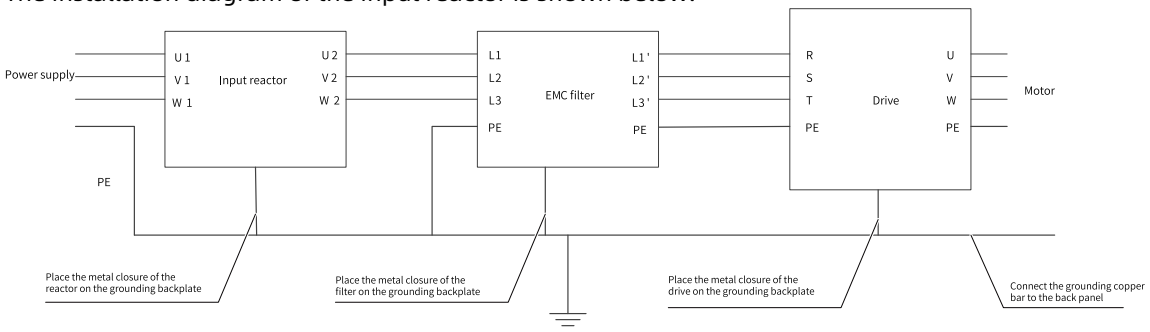


Figure 9-11 Dimensions of the AC input reactor (90 A)

Table 9–14 Dimensions of 90 A AC input reactor

Model	Overall dimensions	Drilling dimensions	Mounting screws	Torque (kgf·cm)
	Width A x Depth B x Height C	Width D x Depth E		
ACL-0090-EISCL-EM16D	**mm:** 165 x 150 (±10) x 130 **in.:** 6.50 x 5.91 (±0.39) x 5.12	**mm:** 120 (±2) x 92 (±2) **in.:** 4.72 (±0.08) x 3.62 (±0.08)	M6	48

The installation diagram of the input reactor is shown below.



9.8.4 AC Output Reactor

Installing an output reactor on the output side of the drive helps reduce excessive dV/dt and voltage stress on the motor winding, therefore protecting the motor winding, lowering the motor temperature, and extending the service life of the motor. Recommended manufacturers and models of the output reactor are shown in the following table.

Model selection

The recommended manufacturer for output reactor is EAGTOP, with the model described as follows:

OCL ① - 0005 ② - EISC ③ - E1M4DNC ④

Figure 9-12 AC output reactor model

①	**Code** OCL: AC output reactor	③	**Physical configuration** EI: Iron core SC: Vertical copper strip/Copper wire foil winding SCL: Vertical copper wire edgewise winding
②	**Rated current** 0005: 5 A	④	**Inductance** EIM4: 1.4 mH D: Version NC: Temperature control switch

Table 9–15 Selection of AC output reactors (Three-phase 380 V to 480 V) (heavy-overload G-type model)

Structure	Model	Motor capacity (kW)	Rated current (A)	Reactor model	Reactor inductance (mH)	Ordering code	Loss(W)
T1	MD630S/N-4T1R5BS-INT	0.37	1.5	OCL-0005-EISC-E1M4DNC	1.4	11070950	10
	MD630S/N-4T2R1BS-INT	0.75	2.1				
	MD630S/N-4T3R8BS-INT	1.5	3.8				
T2	MD630S/N-4T5R1BS-INT	2.2	5.1	OCL-0007-EISC-E1M0DNC	1.0	11070951	11
	MD630S/N-4T7R2BS-INT	3.0	7.2	OCL-0010-EISC-EM70DNC	0.7	11070952	14
	MD630S/N-4T9R0BS-INT	4.0	9				
T3	MD630S/N-4T013BS-INT	5.5	13	OCL-0015-EISCL-EM47DNC	0.47	11070953	20
	MD630S/N-4T017BS-INT	7.5	17	OCL-0020-EISCL-EM35DNC	0.35	11070954	25

Structure	Model	Motor capacity (kW)	Rated current (A)	Reactor model	Reactor inductance (mH)	Ordering code	Loss(W)
T4	MD630S/N-4T025BS-INT	11	25	OCL-0030-EISCL-EM23DNC	0.23	11070955	35
	MD630S/N-4T032BS-INT	15	32	OCL-0040-EISCL-EM18DNC	0.18	11070956	45
T5	MD630S/N-4T037BS-INT	18.5	37	OCL-0040-EISCL-EM18DNC	0.18	11070956	45
	MD630S/N-4T045BS-INT	22	45	OCL-0050-EISCL-EM14DNC	0.14	11070957	36
T6	MD630S/N-4T060BS-INT	30	60	OCL-0060-EI SCL-EM14D	0.12	11070958	42
	MD630S/N-4T075BS-INT	37	75	OCL-0080-EISCL-E87UDNC	0.087	11070959	47
T7	MD630S/N-4T91BS-INT	45	91	OCL-0090-EISCL-E78UDNC	0.078	11070960	55
	MD630S/N-4T112BS-INT	55	112	OCL-0120-EISCL-E58UDNC	0.058	11070961	70
T8	MD630S/N-4T150BS-INT	75	150	OCL-0150-EISCL-E47UDNC	0.047	11070962	125
	MD630S/N-4T176BS-INT	90	176	OCL-0200-EISCL-E35UDNC	0.035	11070963	140

Table 9–16 Selection of AC output reactors (Three-phase 380 V to 480 V) (light-overload P-type model)

Structure	Model	Motor capacity (kW)	Rated current (A)	Reactor model	Reactor inductance (mH)	Ordering code	Loss (W)
T1	MD630S/N-4T1R5BS-INT	0.37	2.1	OCL-0005-EISC-E1M4DNC	1.4	11070950	10
	MD630S/N-4T2R1BS-INT	0.75	3.8				
	MD630S/N-4T3R8BS-INT	1.5	5.1	OCL-0007-EISC-E1M0DNC	1.0	11070951	11
T2	MD630S/N-4T5R1BS-INT	2.2	7.2	OCL-0010-EISC-EM70DNC	0.7	11070952	14
	MD630S/N-4T7R2BS-INT	3.0	9				
	MD630S/N-4T9R0BS-INT	4	13	OCL-0015-EISCL-EM47DNC	0.47	11070953	20
T3	MD630S/N-4T013BS-INT	5.5	17	OCL-0020-EISCL-EM35DNC	0.35	11070954	25
	MD630S/N-4T017BS-INT	7.5	25	OCL-0030-EISCL-EM23DNC	0.23	11070955	35
T4	MD630S/N-4T025BS-INT	11	32	OCL-0040-EISCL-EM18DNC	0.18	11070956	45
	MD630S/N-4T032BS-INT	15	37				

Structure	Model	Motor capacity (kW)	Rated current (A)	Reactor model	Reactor inductance (mH)	Ordering code	Loss (W)
T5	MD630S/N-4T037BS-INT	18.5	45	OCL-0050-EISCL-EM14D	0.14	11070957	36
	MD630S/N-4T045BS-INT	22	60	OCL-0060-EISCL-EM14D	0.12	11070958	42
T6	MD630S/N-4T060BS-INT	30	75	OCL-0080-EISCL-E87UDNC	0.087	11070959	47
	MD630S/N-4T075BS-INT	37	91	OCL-0090-EISCL-E78UDNC	0.078	11070960	55
T7	MD630S/N-4T91BS-INT	45	112	OCL-0120-EISCL-E58UDNC	0.058	11070961	70
	MD630S/N-4T112BS-INT	55	150	OCL-0150-EISCL-E47UDNC	0.047	11070962	125
T8	MD630S/N-4T150BS-INT	75	176	OCL-0200-EISCL-E35UDNC	0.035	11070963	140
	MD630S/N-4T176BS-INT	90	210	OCL-0250-EISH-E28UDNC	0.028	11070964	150

Note

The output reactor in the preceding table can only be used for 50 Hz/60 Hz motors.

Dimensions

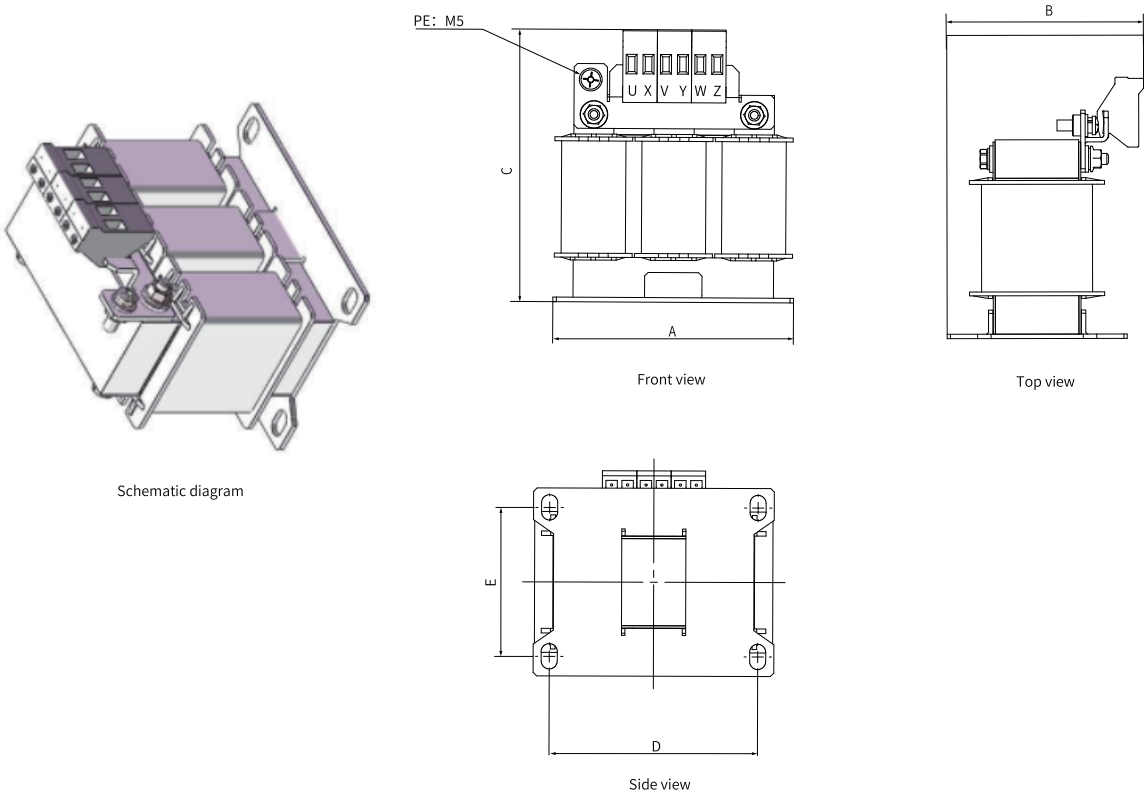


Figure 9-13 Dimensions of AC output reactors (5 A to 10 A)

Table 9–17 Dimensions of AC output reactors (5 A to 10 A)

Model	Overall dimensions	Drilling dimensions	Mounting screws	Torque (kgf·cm)
	Width A x Depth B x Height C	D x E		
OCL-0005-EISC-E1M4D	**mm:** 110 x 95 x 125 **in.:** 4.33 x 3.74 x 4.92	**mm:** 91 (±2) x 65 (±2) **in.:** 3.58 (±0.08) x 2.56 (±0.08)	M6	48
OCL-0007-EISC-E1M0D				
OCL-0010-EISC-EM70D				

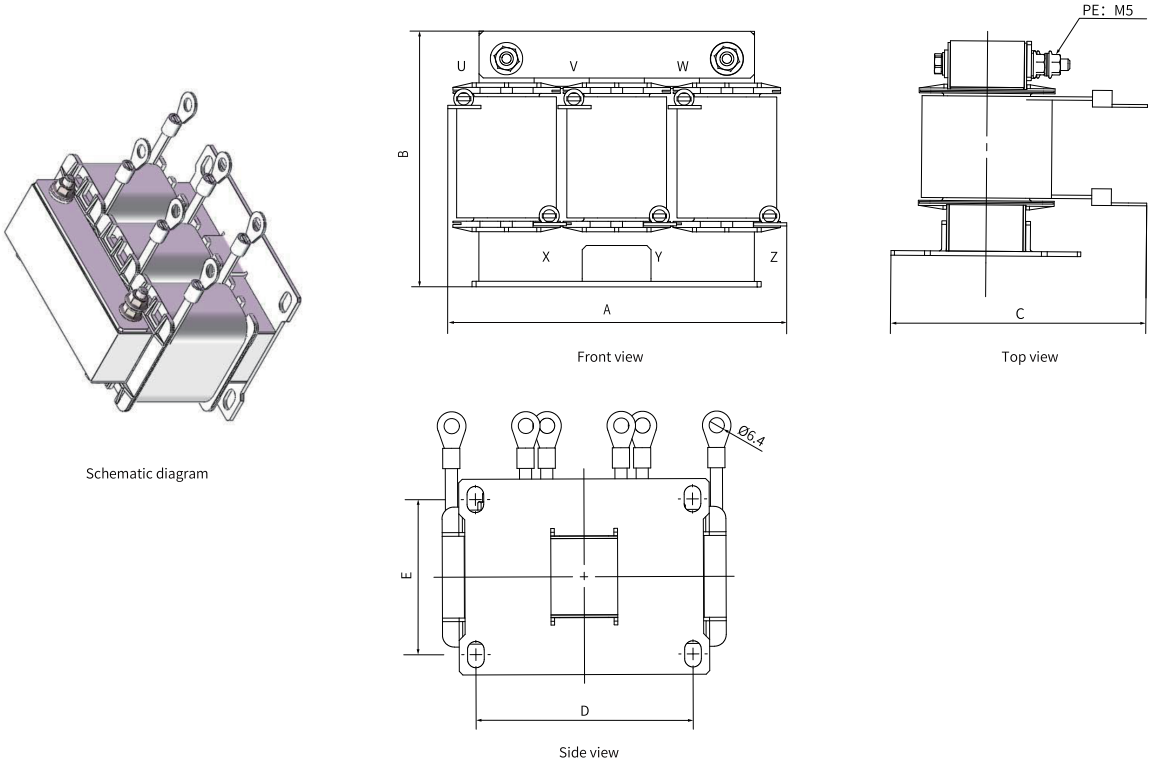


Figure 9-14 Dimensions drawing of AC output reactor (15 A to 60 A)

Table 9–18 Dimensions of AC output reactor (15 A to 60 A)

Model	Overall dimensions	Drilling dimensions	Mounting screws	Torque (kgf·cm)
	Width A x Depth B x Height C	Width D x Depth E		
OCL-0015-EISCL-EM47D	**mm:** 130 x 110 (±10) x 100 **in.:** 5.12 x 4.33 (±0.39) x 3.94	**mm:** 91 (±2) x 65 (±2) **in.:** 3.58 (±0.08) x 2.56 (±0.08)	M6	48
OCL-0020-EISCL-EM35D				
OCL-0030-EISCL-EM23D	**mm:** 130 x 120 (±10) x 100 **in.:** 5.12 x 4.72 (±0.39) x 3.94	**mm:** 91 (±2) x 72 (±2) **in.:** 3.58 (±0.08) x 2.83 (±0.08)	M6	48
OCL-0040-EISCL-EM18D				
OCL-0050-EISCL-EM14D	**mm:** 140 x 120 (±10) x 120 **in.:** 5.51 x 4.72 (±0.39) x 4.72	**mm:** 91 (±2) x 72 (±2) **in.:** 3.58 (±0.08) x 2.83 (±0.08)	M6	48
OCL-0060-EISCL-EM12D				

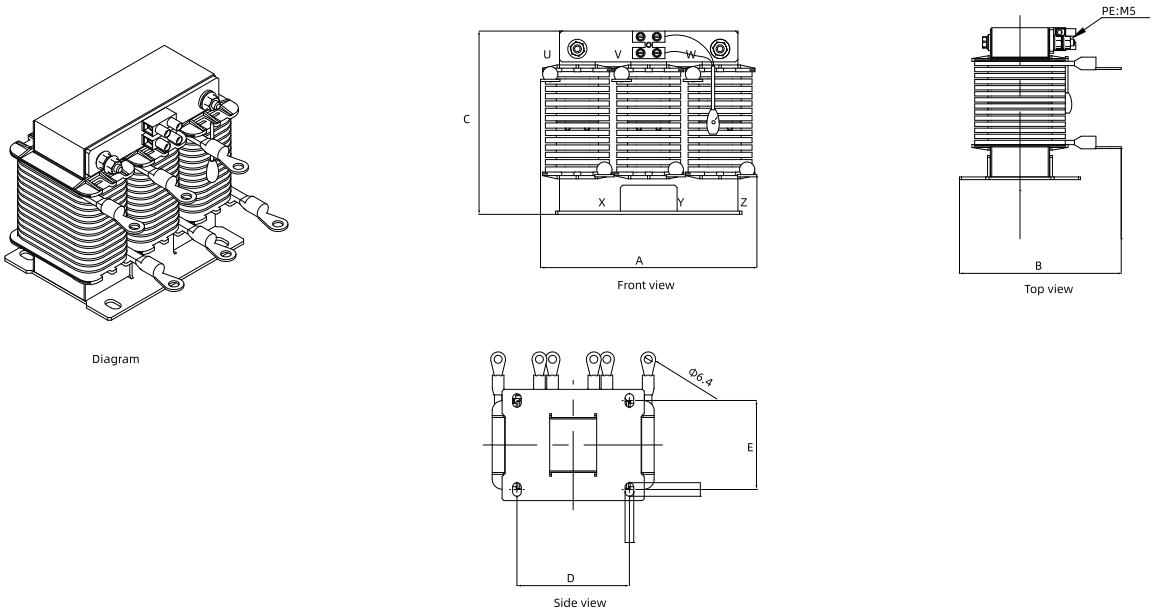


Figure 9-15 Dimensions drawing of AC output reactor (80 A to 200 A)

Table 9–19 Dimensions of AC output reactor (80 A to 200 A)

Model	Dimension	Drilling dimensions	Electrical connection mounting bolts	Torque (kgf·cm)
OCL-0080-EISCL-E87UDNC	165 x 150 (±10) x 130	120 (±2) x 92 (±2)	M8	102.0
OCL-0090-EISCL-E78UDNC	165 x 150 (±10) x 130	120 (±2) x 92 (±2)	M8	102.0
OCL-0120-EISCL-E58UDNC	165 x 150 (±10) x 130	120 (±2) x 92 (±2)	M8	102.0
OCL-0150-EISCL-E47UDNC	190 x 160 (± 10) x 120	120 (±2) x 92 (±2)	M8	102.0
OCL-0200-EISCL-E35UDNC	225 x 160 (± 10) x 170	120 (±2) x 92 (±2)	M8	102.0

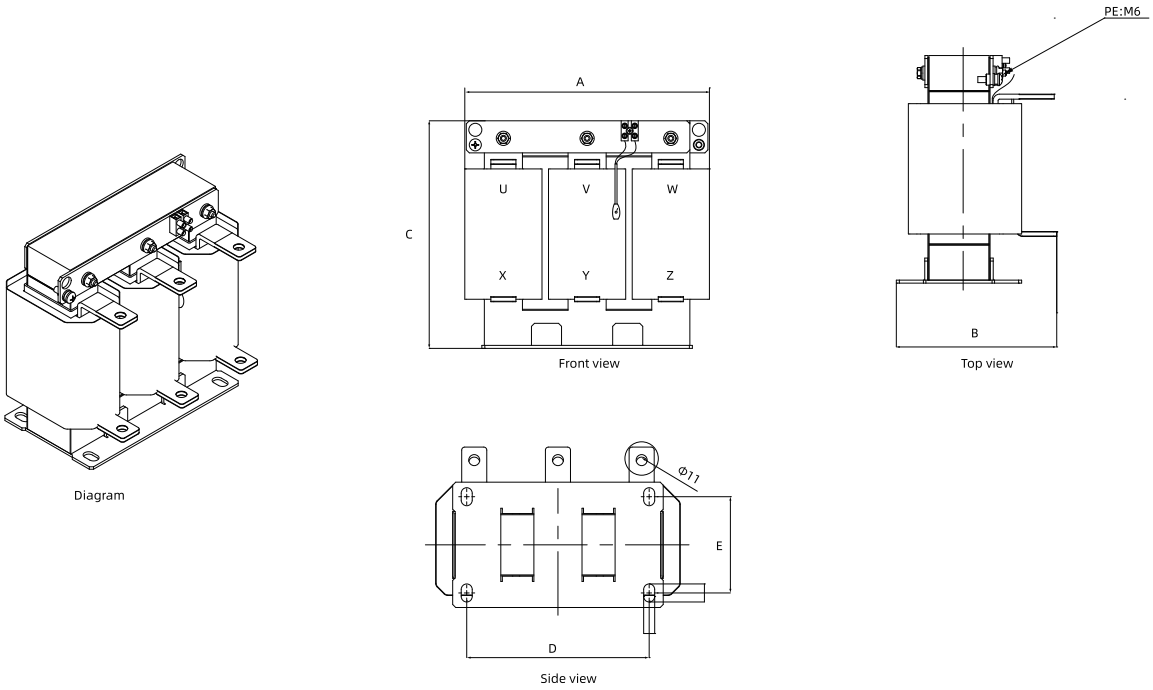
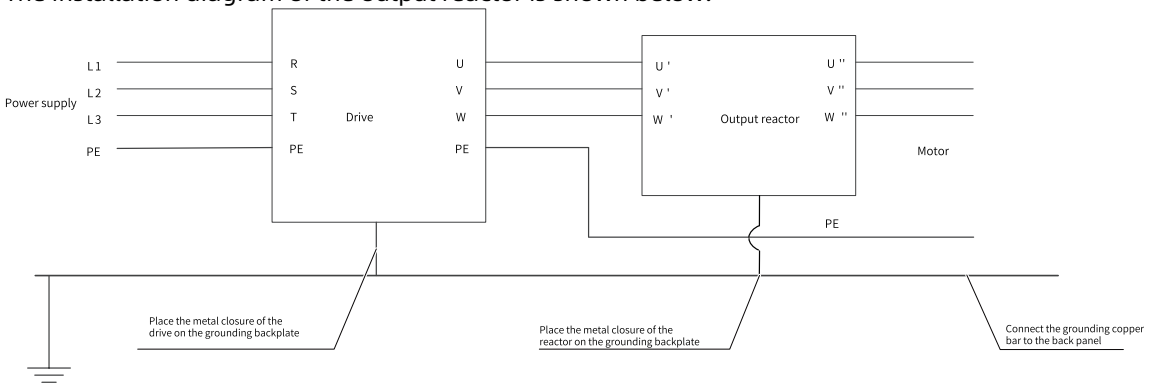


Figure 9-16 Dimensions drawing of AC output reactor (250 A)

Table 9–20 Dimensions of AC output reactor (250 A)

Model	Dimension	Drilling dimensions	Electrical connection mounting bolts	Torque (kgf·cm)
OCL-0250-EISH-E28UDNC	250 x 170 (± 10) x 240	182 (±2) x 96 (±2)	M10	203.9

The installation diagram of the output reactor is shown below.



9.8.5 EMI Filter

To comply with EN IEC 61800-3 Class C2 requirements for radiated and conducted emissions, an external EMI filter as specified in the following table must be installed. EMI filter options are FN 3287 and DL 32580 series EMC filters manufactured by Schaffner. Select the EMC filter according to the rated input current of the drive, as shown in the following table.

Note

- If you need a filter of Schaffner, you can purchase it from the manufacturer.
- For Jianli filters, contact Inovance or Jianli.

Table 9–21 Standard EMI filter model and appearance

Filter model		Appearance
Schaffner	FN 3287 series	
	FN 3258 series	
	FN 3359 series	
Jianli series	DL 32580 series	

Schaffner selection

Table 9–22 Selection of filters (heavy-overload G-type model) (three-phase 380 V to 480 V)

Structure	Model	Rated power (kW)	Rated current (A)	Filter model	Loss (W)
T1	MD630S/N-4T1R5BS-INT	0.37	1.5	FN 3287-10-44-C26-R65	6.9
	MD630S/N-4T2R1BS-INT	0.75	2.1		
	MD630S/N-4T3R8BS-INT	1.5	3.8		
T2	MD630S/N-4T5R1BS-INT	2.2	5.1	FN 3287-10-44-C26-R65	6.9
	MD630S/N-4T7R2BS-INT	3.0	7.2		
	MD630S/N-4T9R0BS-INT	4	9		
T3	MD630S/N-4T013BS-INT	5.5	13	FN 3287-16-44-C26-R65	8.5
	MD630S/N-4T017BS-INT	7.5	17	FN 3287-20-33-C26-R65	9.4
T4	MD630S/N-4T025BS-INT	11	25	FN 3287-40-33-C26-R65	19.2
	MD630S/N-4T032BS-INT	15	32		
T5	MD630S/N-4T037BS-INT	18.5	37	FN 3287-40-33-C26-R65	19.2
	MD630S/N-4T045BS-INT	22	45	FN 3287-50-53-C26-R65	21.7
T6	MD630S/N-4T060BS-INT	30	60	FN 3258-75-44	32.2
	MD630S/N-4T075BS-INT	37	75	FN 3258-75-44	32.2
T7	MD630S/N-4T91BS-INT	45	91	FN 3258-100-44	34.5
	MD630S/N-4T112BS-INT	55	112	FN 3258-130-44	43.1
T8	MD630S/N-4T150BS-INT	75	150	FN 3258-180-44	58.3
	MD630S/N-4T176BS-INT	90	176	FN 3258-180-44	58.3

Table 9–23 Selection of filters (light-overload P-type) (three-phase 380 V to 480 V)

Structure	Model	Rated power (kW)	Rated current (A)	Filter model	Loss (W)
T1	MD630S/N-4T1R5BS-INT	0.37	2.1	FN 3287-10-44-C26-R65	6.9
	MD630S/N-4T2R1BS-INT	0.75	3.8		
	MD630S/N-4T3R8BS-INT	1.5	5.1		
T2	MD630S/N-4T5R1BS-INT	2.2	7.2	FN 3287-10-44-C26-R65	6.9
	MD630S/N-4T7R2BS-INT	3.0	9		
	MD630S/N-4T9R0BS-INT	4	13	FN 3287-16-44-C26-R65	8.5
T3	MD630S/N-4T013BS-INT	5.5	17	FN 3287-20-33-C26-R65	9.4
	MD630S/N-4T017BS-INT	7.5	25	FN 3287-40-33-C26-R65	
T4	MD630S/N-4T025BS-INT	11	32	FN 3287-40-33-C26-R65	19.2
	MD630S/N-4T032BS-INT	15	37		
T5	MD630S/N-4T037BS-INT	18.5	45	FN 3287-50-53-C26-R65	21.7
	MD630S/N-4T045BS-INT	22	60	FN 3287-80-34-C26-R65	32.6
T6	MD630S/N-4T060BS-INT	30	75	FN 3258-75-44	32.2
	MD630S/N-4T075BS-INT	37	91	FN 3258-100-44	34.5
T7	MD630S/N-4T91BS-INT	45	112	FN 3258-130-44	43.1
	MD630S/N-4T112BS-INT	55	150	FN 3258-180-44	58.3
T8	MD630S/N-4T150BS-INT	75	176	FN 3258-180-44	58.3
	MD630S/N-4T176BS-INT	90	210	FN 3359-250-28	49

Dimensions of Schaffner FN 3287 series filters

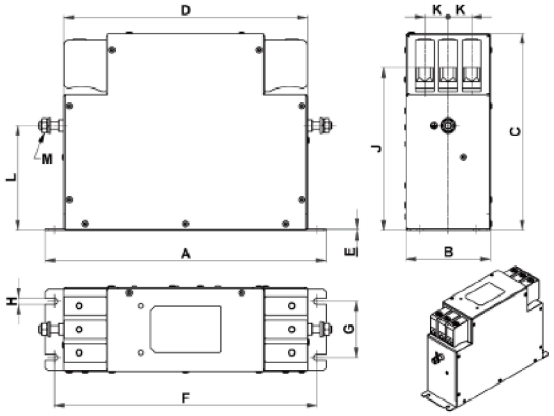


Figure 9-17 Dimensions of FN 3287 filters

Table 9–24 Dimensions of FN 3258 series filters (unit: mm)

Model	Dimension (mm)	Drilling dimensions (mm)	Mounting screws	Torque (N·m)
	Width A x Depth B x Height C	Width F x Depth G		
FN 3258-75-44	270 x 80 x 135	255 x 60	M6	4.8
FN 3258-100-44	270 x 90 x 150	255 x 65	M10	20
FN 3258-130-44	270 x 90 x 150	255 x 65	M10	20
FN 3258-180-44	380 x 120 x 170	365 x 102	M10	20

Table 9–25 Dimensions of FN 3287 filters

Model	Overall dimensions	Drilling dimensions	Mounting screws	Torque
	Width A x Depth B x Height C	Width F x Depth G		(N·m)
FN 3287-10-44-C28-R65	**mm:** 180 x 40 x 112 **in.:** 7.09 x 1.57 x 4.41	**mm:** 170 x 20 **in.:** 6.69 x 0.79	M5	2.0 to 2.2
FN 3287-16-44-C33-R65	**mm:** 200 x 45 x 120 **in.:** 7.87 x 1.77 x 4.72	**mm:** 185 x 25 **in.:** 7.28 x 0.98	M5	2.0 to 2.2
FN 3287-20-33-C33-R65	**mm:** 205 x 45 x 132 **in.:** 8.07 x 1.77 x 5.20	**mm:** 190 x 25 **in.:** 7.48 x 0.98	M5	2.0 to 2.2
FN 3287-25-33-C33-R65	**mm:** 205 x 45 x 132 **in.:** 8.07 x 1.77 x 5.20	**mm:** 190 x 25 **in.:** 7.48 x 0.98	M5	2.0 to 2.2
FN 3287-40-33-C33-R65	**mm:** 215 x 50 x 147 **in.:** 8.46 x 1.97 x 5.79	**mm:** 200 x 30 **in.:** 7.87 x 1.18	M6	3.5 to 4.0
FN 3287-50-53-C33-R65	**mm:** 220 x 65 x 180 **in.:** 8.66 x 2.56 x 7.09	**mm:** 204 x 45 **in.:** 8.03 x 1.77	M6	3.5 to 4.0
FN 3287-63-53-C33-R65	**mm:** 220 x 65 x 180 **in.:** 8.66 x 2.56 x 7.09	**mm:** 204 x 45 **in.:** 8.03 x 1.77	M6	3.5 to 4.0
FN 3287-80-34-C26-R65	**mm:** 290 x 80 x 205 **in.:** 11.42 x 3.15 x 8.07	**mm:** 270 x 50 **in.:** 10.63 x 1.97	M6	3.5 to 4.0

Table 9–26 Dimensions of FN 3359 series filters (unit: mm)

Model	Dimension (mm)	Drilling dimensions (mm)	Mounting screws	Torque (N·m)
FN 3359-250-28	300 x 230 x 125	120 x 205	M10	20

Selection of Jianli filter

Table 9–27 Selection of filters (heavy-overload G-type model)

Structure	Model	Rated power (kW)	Rated current (A)	Filter model	Ordering code	Loss (W)
T1	MD630S/N-4T1R5BS-INT	0.37	1.5	DL 32580-7-44	11090211	3.8
	MD630S/N-4T2R1BS-INT	0.75	2.1			
	MD630S/N-4T3R8BS-INT	1.5	3.8			
T2	MD630S/N-4T5R1BS-INT	2.2	5.1	DL 32580-7-44	11090211	3.8
	MD630S/N-4T7R2BS-INT	3	7.2	DL 32580-16-44	11090212	6.1
	MD630S/N-4T9R0BS-INT	4	9			
T3	MD630S/N-4T013BS-INT	5.5	13	DL 32580-16-44	11090212	6.1
	MD630S/N-4T017BS-INT	7.5	17	DL 32580-30-33	11090213	11.8
T4	MD630S/N-4T025BS-INT	11	25	DL 32580-30-33	11090213	11.8
	MD630S/N-4T032BS-INT	15	32	DL 32580-42-33	11090214	15.7
T5	MD630S/N-4T037BS-INT	18.5	37	DL 32580-42-33	11090214	15.7
	MD630S/N-4T045BS-INT	22	45	DL 32580-55-34	11090215	25.9
T6	MD630S/N-4T060BS-INT	30	60	DL 65EBK5	-	27.4
	MD630S/N-4T075BS-INT	37	75	DL 80EBK5	-	32.6
T7	MD630S/N-4T91BS-INT	45	91	DL 100EBK5	-	33
	MD630S/N-4T112BS-INT	55	112	DL 130EBK5	-	37.5
T8	MD630S/N-4T150BS-INT	75	150	DL 160EBK5	-	38.4
	MD630S/N-4T176BS-INT	90	176	DL 200EBK5	-	34

Table 9–28 Selection of filter (light-overload P-type model)

Structure	Model	Rated power (kW)	Rated current (A)	Filter model	Ordering code	Loss (W)
T1	MD630S/N-4T1R5BS-INT	0.37	2.1	DL 32580-7-44	11090211	3.8
	MD630S/N-4T2R1BS-INT	0.75	3.8			
	MD630S/N-4T3R8BS-INT	1.5	5.1			
T2	MD630S/N-4T5R1BS-INT	2.2	7.2	DL 32580-16-44	11090212	6.1
	MD630S/N-4T7R2BS-INT	3.0	9			
	MD630S/N-4T9R0BS-INT	4	13			
T3	MD630S/N-4T013BS-INT	5.5	17	DL 32580-30-33	11090213	11.8
	MD630S/N-4T017BS-INT	7.5	25			
T4	MD630S/N-4T025BS-INT	11	32	DL 32580-42-33	11090214	15.7
	MD630S/N-4T032BS-INT	15	37			
T5	MD630S/N-4T037BS-INT	18.5	45	DL 32580-55-34	11090215	25.7
	MD630S/N-4T045BS-INT	22	60	DL 32580-75-34	11090216	32.2
T6	MD630S/N-4T060BS-INT	30	75	DL 80EBK5	-	32.6
	MD630S/N-4T075BS-INT	37	91	DL 100EBK5	-	33
T7	MD630S/N-4T91BS-INT	45	112	DL 130EBK5	-	37.5
	MD630S/N-4T112BS-INT	55	150	DL 160EBK5	-	38.4
T8	MD630S/N-4T150BS-INT	75	176	DL 200EBK5	-	34
	MD630S/N-4T176BS-INT	90	210	DL 250EBK5	-	49

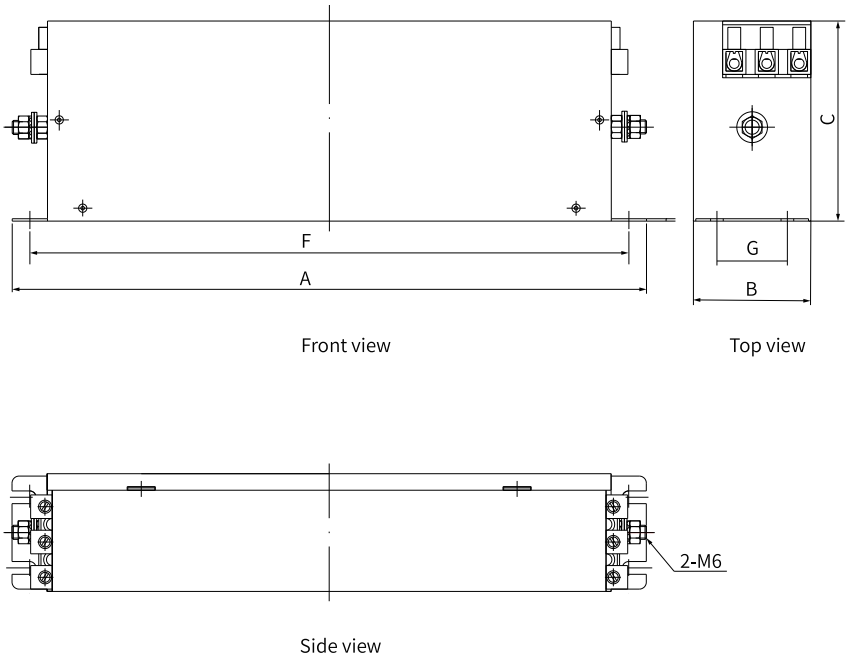


Figure 9-18 Dimensions of Jianli 3258 series filter

Table 9–29 Dimensions of Jianli series filter

Model	Overall dimensions	Drilling dimensions	Mounting screws	Torque
	Width A x Depth B x Height C	Width F x Depth G		(N·m)
DL 32580-7-44	**mm:** 190 (±2) x 40 (±1) x 70 (±2) **in.:** 7.48 (±0.08) x 1.57 (±0.04) x 2.76 (±0.08)	**mm:** 180 (±0.5) x 20 (±0.5) **in.:** 7.09 (±0.02) x 0.79 (±0.02)	M5	1.7
DL 32580-16-44	**mm:** 250 (±2) x 45 (±1) x 70 (±2) **in.:** 9.84 (±0.08) x 1.77 (±0.04) x 2.76 (±0.08)	**mm:** 235 (±0.5) x 25 (±0.5) **in.:** 9.25 (±0.02) x 0.98 (±0.02)	M5	1.7
DL 32580-30-33	**mm:** 270 (±2) x 50 (±1) x 85 (±2) **in.:** 10.63 (±0.08) x 1.97 (±0.04) x 3.35 (±0.08)	**mm:** 255 (±0.5) x 30 (±0.5) **in.:** 10.04 (±0.02) x 1.18 (±0.02)	M5	2.5
DL 32580-42-33	**mm:** 310 (±2) x 50 (±1) x 85 (±2) **in.:** 12.20 (±0.08) x 1.97 (±0.04) x 3.35 (±0.08)	**mm:** 295 (±0.5) x 30 (±0.5) **in.:** 11.61 (±0.02) x 1.18 (±0.02)	M5	2.5
DL 32580-55-34	**mm:** 250 (±2) x 80 (±1) x 90 (±2) **in.:** 9.84 (±0.08) x 3.15 (±0.04) x 3.54 (±0.08)	**mm:** 235 (±0.5) x 60 (±0.5) **in.:** 9.25 (±0.02) x 2.36 (±0.02)	M6	3.0
DL 32580-75-34	**mm:** 270 (±2) x 80 (±1) x 135 (±2) **in.:** 10.63 (±0.08) x 3.15 (±0.04) x 5.31 (±0.08)	**mm:** 255 (±0.5) x 60 (±0.5) **in.:** 10.04 (±0.02) x 2.36 (±0.02)	M6	3.0
DL65EBK5	265 x 102 x 92	243 x 70	M6	4.8
DL80EBK5	388 x 188 x 92	354 x 155	M8	13
DL100EBK5	388 x 188 x 92	354 x 155	M8	13
DL130EBK5	388 x 188 x 92	354 x 155	M8	13

Model	Overall dimensions	Drilling dimensions	Mounting screws	Torque (N·m)
	Width A x Depth B x Height C	Width F x Depth G		
DL160EBK5	388 x 188 x 92	354 x 155	M8	13
DL200EBK5	388 x 188 x 92	354 x 155	M8	13
DL250EBK5	388 x 188 x 92	354 x 155	M8	13

Installation instructions

The optional EMC filter can meet the EN IEC 61800-3 C2 emission requirements (see details in "*Second environment - class C2" on page 1336*).

- Install the EMC filter close to the input terminals, and keep the connection cable shorter than 30 cm.
- Connect the grounding terminal of the EMC filter to that of the drive, install the EMC filter and the drive on the same conductive surface, and connect the surface to the main ground of the cabinet.
- Connect the LINE terminal of the EMC filter to the power grid, and the LOAD terminal to the drive.

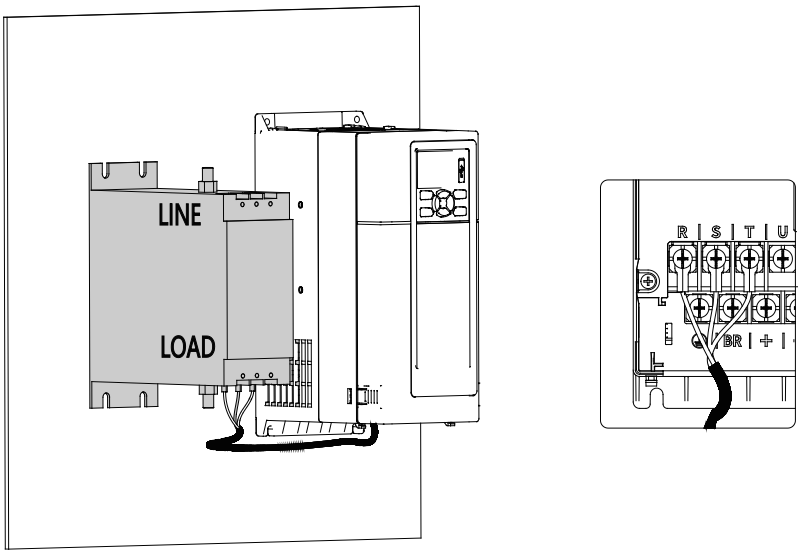


Figure 9-19 EMC filter installation

9.8.6 Braking Resistor

Selecting the resistance of the braking resistor

The built-in braking unit of the drive processes the regenerative energy generated by the motor during deceleration. When the DC bus voltage exceeds the limit set by the software, the braking unit automatically turns on and connects the braking resistor to the DC bus. The braking resistor consumes the regenerative energy to keep the bus voltage within the safe range. The braking resistor is disconnected until the bus voltage drops below a certain range. The resistance of the braking resistor is calculated based on the following formula.

$$R = \frac{U_{BR}^2}{P_{BR}} = \frac{U_{BR}^2}{P_N \times k \times \eta_{motor} \times \eta_{inverter}}$$

R: Resistance of the braking resistor

U_{BR}: Starting braking voltage of the drive (760 VDC for three-phase 380 V to 480 V models by default, which can be changed through parameter)

P_{BR}: Braking power that needs to be consumed by the braking resistor on the DC bus of the drive

P_n: Rated power of the drive

k: Braking torque (multiple of rated torque), 1.25 for most applications The k value can be adjusted as needed.

n_{motor}: Motor efficiency, which is generally set to 0.85 based on the actual motor efficiency. It can also be estimated based on the efficiency of the four-pole motor energy efficiency class IE3 specified in the IEC 60034-30-2.

$n^{inverter}$: Between 0.9 to 0.98 generally

When the braking power is fed back from the motor to the U/V/W cable, and then fed back from the U/V/W cable to the DC bus of the drive, the braking power will be derated by the motor efficiency and the drive efficiency, respectively. Therefore, the braking power actually consumed by the braking resistor will be lower. The conversion coefficient is roughly estimated to be from 0.8 to 0.9.

Selecting the power of the braking resistor

In theory, the power of the braking resistor is the same as the average power consumption of the braking resistor on the bus. However, given that the braking resistor is naturally ventilated in the power distribution cabinet, power derating must be applied. Assume that the derating coefficient is α. You can select the rated power of the braking resistor according to the following formula:

$$P_{N_BR}=\frac{P_{BR}\times ED\%}{\alpha}$$

$$ED\%=\frac{T_{on}}{T_{on}+T_{off}}\times 100\%$$

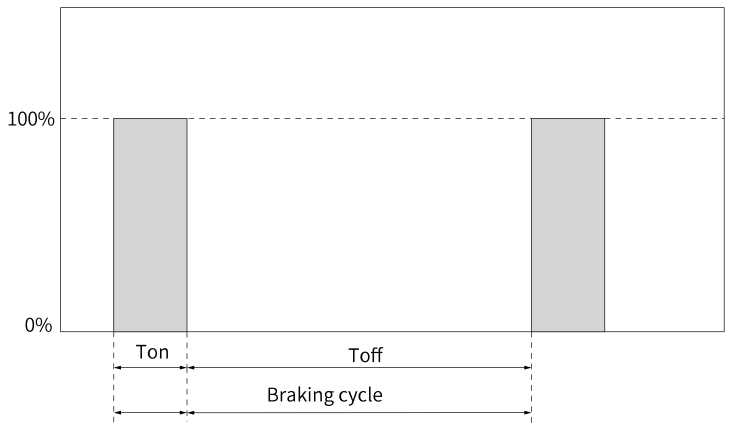


Figure 9-20 Braking cycle

P: Rated power of the braking resistor

α: Power derating of braking resistor, which is generally 50%

ED%: Braking duty cycle

T_{on} : Indicates the time during which the braking resistor is turned on within one braking cycle.

T_{off} : Indicates the time during which the braking resistor is turned off within one braking cycle.

Braking resistor temperature rise: It is affected by various factors and varies depending on the braking on-time Ton, braking duty cycle ED%, braking resistor type, and actual heat dissipation conditions of the resistor. If the resistor temperature rise is too high, a higher power derating is required; otherwise, the risk of fire can be incurred due to overtemperature of the braking resistor. Therefore, adjust the power selection according to actual conditions.

Braking duty cycle (ED%): The energy duty must be determined based on the actual braking conditions. Typical ED% values for common applications are listed in the following table.

Common applications	Elevator	Winding/ Unwinding	Centrifuge	Occasional braking load	Regular application
ED%	20% to 30%	20% to 30%	50% to 60%	5%	10%

Recommendation for typical braking resistor

The following table describes the resistance and power selection of the braking resistor when it works at 125% of the braking torque with 10s of ON time (Ton) for each braking cycle and 10% braking duty cycle (ED%).

Table 9–30 Selection of braking resistor (three-phase 380 V to 480 V)

Structure	Drive model	Heavy-duty power (kW)	Braking unit	Specifications of the recommended braking resistor (125% braking torque (ED: 10%, 10s))		Actual braking resistor selection (Inovance model)				Min. braking resistance (Ω)
				Resistance (Ω)	Power (W)	Model	Resistance of an individual resistor (Ω)	Power of an individual resistor (W)	Number of parallel resistors	
T1	MD630S/N-4T1R5BS-INT	0.37	Built-in as standard	1560	60	RXLG-50W-1560RJ-XZ1000-OE-B	1560	50	1	250
	MD630S/N-4T2R1BS-INT	0.75	Built-in as standard	770	110	RXLG-100W-770RJ-XZ1000-OE-B	770	100	1	250
	MD630S/N-4T3R8BS-INT	1.5	Built-in as standard	380	230	RXLG-200W-380RJ-XZ1000-OE-B	380	200	1	104
T2	MD630S/N-4T5R1BS-INT	2.2	Built-in as standard	260	330	RXLG-300W-260RJ-XZ1000-OE-B	260	300	1	104
	MD630S/N-4T7R2BS-INT	3	Built-in as standard	190	450	RXLG-400W-190RJ-XZ1000-OE-B	190	400	1	104
	MD630S/N-4T9R0BS-INT	4	Built-in as standard	140	600	RXLG-600W-140RJ-XZ1000-OE-B	140	600	1	124
T3	MD630S/N-4T013BS-INT	5.5	Built-in as standard	100	830	RXLG-800W-100RJ-XZ1000-OE-B	100	800	1	42
	MD630S/N-4T017BS-INT	7.5	Built-in as standard	77	1130	RXLG-1000W-76RJ-XZ1000-OT-B	76	1000	1	33
T4	MD630S/N-4T025BS-INT	11	Built-in as standard	52	1660	RXLG-1500W-52RJ-XZ1000-OT-B	52	1500	1	47
	MD630S/N-4T032BS-INT	15	Built-in as standard	38	2260	RXLG-1000W-76RJ-XZ1000-OT-B	76	1000	2	22

Structure	Drive model	Heavy-duty power (kW)	Braking unit	Specifications of the recommended braking resistor (125% braking torque (ED: 10%, 10s))		Actual braking resistor selection (Inovance model)				Min. braking resistance (Ω)
				Resistance (Ω)	Power (W)	Model	Resistance of an individual resistor (Ω)	Power of an individual resistor (W)	Number of parallel resistors	
T5	MD630S/N-4T037BS-INT	18.5	Built-in as standard	31	2790	RXLG-1500W-62RJ-XZ1000-OT-B	62	1500	2	26
	MD630S/N-4T045BS-INT	22	Built-in as standard	26	3310	RXLG-1500W-52RJ-XZ1000-OT-B	52	1500	2	26
T6	MD630S/N-4T060BS-INT	30	Built-in as standard	19.2	4500	-	-	-	-	12.2
	MD630S/N-4T075BS-INT	37	Built-in as standard	15.6	5550	-	-	-	-	11.9
T7	MD630S/N-4T91BS-INT	45	Built-in as standard	12.8	6750	-	-	-	-	10.7
	MD630S/N-4T112BS-INT	55	Built-in as standard	10.5	8300	-	-	-	-	10.4
T8	MD630S/N-4T150BS-INT	75	Built-in as standard	7.7	11300	-	-	-	-	7
	MD630S/N-4T176BS-INT	90	Built-in as standard	6.4	13500	-	-	-	-	5.4

- The braking resistor values in the preceding table are based on 125% of the braking torque. During each braking cycle, the braking resistor is switched on for 10s (Ton) and the braking usage rate is 10% (ED%).
- For 380 V to 480 V models, the default starting braking voltage of the built-in braking unit is 760 V.
- The data in the preceding table is only for reference. You can select the resistance and power of the braking resistor as required. (Note that the resistance cannot be lower than the recommended minimum value, whereas the power can exceed the recommended value.) Select the braking resistor based on the generation power of the motor in the actual system, system inertia, deceleration time, and potential energy load.
- The higher the inertia of the system, the shorter the deceleration time required and the more frequent the braking frequency, the lower the resistance of the braking resistor. The braking resistor power needs to be larger.

Recommended braking resistor power under different braking conditions

The braking resistor power in the above table is recommended under the condition of 125% braking torque, 10s braking on-time (Ton), and 10% braking duty cycle (ED%). However, in actual applications, braking conditions vary and cannot be fully summarized by a single typical condition. The following lists the recommended braking resistor power for different braking duty cycles and different braking on-time (Ton) at 125% braking torque for you reference.

Braking condition			Recommended braking resistor power (W) for different braking on-time (Ton) and different braking duty cycles (ED%) at 125% braking torque																	
Braking on-time Ton/s	Braking off-time Toff/s	Braking duty cycle ED%	T1			T2			T3		T4		T5		T6		T7		T8	
			0.37	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
3	27	10%	40	90	170	250	340	460	630	860	1250	1710	2110	2510	3420	4220	5130	6270	8560	12540
	17	15%	60	120	240	360	490	650	900	1220	1790	2450	3020	3590	4900	6040	7350	8990	12240	17980
	9	25%	100	200	390	570	780	1050	1440	1960	2870	3920	4840	5750	7840	9680	11760	14380	19630	28760
	4.5	40%	150	310	610	900	1230	1640	2250	3070	4500	6140	7570	9000	12280	15140	18420	22520	30690	45040
10	90	10%	60	110	230	330	450	600	830	1130	1660	2260	2790	3310	4500	5550	6750	8300	11300	13500
	56.7	15%	70	150	290	430	590	780	1080	1470	2150	2930	3620	4300	5860	7240	8790	10750	14680	21500
	30	25%	110	220	430	640	870	1150	1590	2160	3180	4330	5340	6350	8660	10680	12990	15880	21650	31760
	15	40%	160	320	650	950	1290	1720	2370	3230	4730	6450	7960	9460	12900	15920	19350	23650	32270	47300
20	180	10%	80	160	310	460	630	840	1150	1570	2310	3140	3880	4610	6280	7760	9420	11520	15730	23040
	113.3	15%	90	180	370	540	740	980	1350	1850	2710	3690	4550	5420	7380	9100	11070	13530	18450	27060
	60	25%	120	250	490	720	990	1320	1810	2470	3620	4940	6090	7240	9880	12180	14820	18120	24690	36240
	30	40%	170	350	690	1010	1380	1840	2530	3460	5070	6910	8520	10140	13820	17040	20730	25340	34540	50680
30	270	10%	100	200	410	600	820	1090	1500	2050	3000	4090	5050	6000	8180	10100	12270	15000	20480	30000
	170	15%	110	220	450	660	900	1200	1650	2250	3300	4500	5550	6590	9000	11100	13500	16500	22500	33000
	90	25%	140	280	560	820	1110	1480	2040	2780	4080	5560	6860	8160	11120	13720	16680	20390	27810	40780
	45	40%	180	370	740	1080	1470	1960	2700	3680	5400	7370	9090	10810	14740	18180	22110	27030	36860	54060

Braking condition			Recommended braking resistor power (W) for different braking on-time (Ton) and different braking duty cycles (ED%) at 125% braking torque																	
Braking on-time Ton/s	Braking off-time Toff/s	Braking duty cycle ED%	T1			T2			T3		T4		T5		T6		T7		T8	
			0.37	0.75	1.5	2.2	3	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
90	540	10%	170	340	680	1000	1360	1810	2490	3390	4980	6780	8370	9950	13560	16740	20340	24860	33940	49720
	340	15%	170	340	690	1010	1380	1840	2530	3450	5060	6890	8500	10110	13780	17000	20670	25270	34460	50540
	180	25%	180	370	740	1090	1490	1980	2730	3720	5460	7440	9180	10920	14880	18360	22320	27280	37220	54560
	90	40%	210	440	870	1280	1740	2320	3190	4360	6390	8710	10740	12780	17420	21480	26130	31940	43540	63880

Note

- The thermal time constant of the braking resistor (UT) ≥ 100s
- Braking rate ED% = Ton/(Ton+Toff) x 100%
- The recommended power of the braking resistor in the preceding table is given under the assumption that the braking torque is 125%. If Ton and ED% are unchanged in actual application, only the braking torque is different. The power of the braking resistor must also change linearly with the braking torque. For example, the recommended power of the braking resistor is 830W under 125% braking torque, 10% ED, and 10s. If the actual braking torque is 150% (150% braking torque is 1.2 times the braking torque of 125%), The recommended power of the braking resistor under the conditions of 150% braking torque, 10% ED, and 10s is 830W x 1.2 = 996W.
- In addition, the temperature rise of the braking resistor under different heat dissipation conditions may vary. Therefore, different heat dissipation conditions of the resistor may affect the power selection of the braking resistor.

Recommended braking resistor overtemperature protection scheme

In applications where a braking resistor is installed, it is recommended to use a resistor with a temperature switch to ensure safety and avoid overtemperature of the braking resistor. Connect the temperature switch output to the upstream electromagnetic contactor control circuit in the drive (as shown in the following figure) to implement the interlock protection function, which triggers a fault trip to prevent burnout of the resistor upon overtemperature.

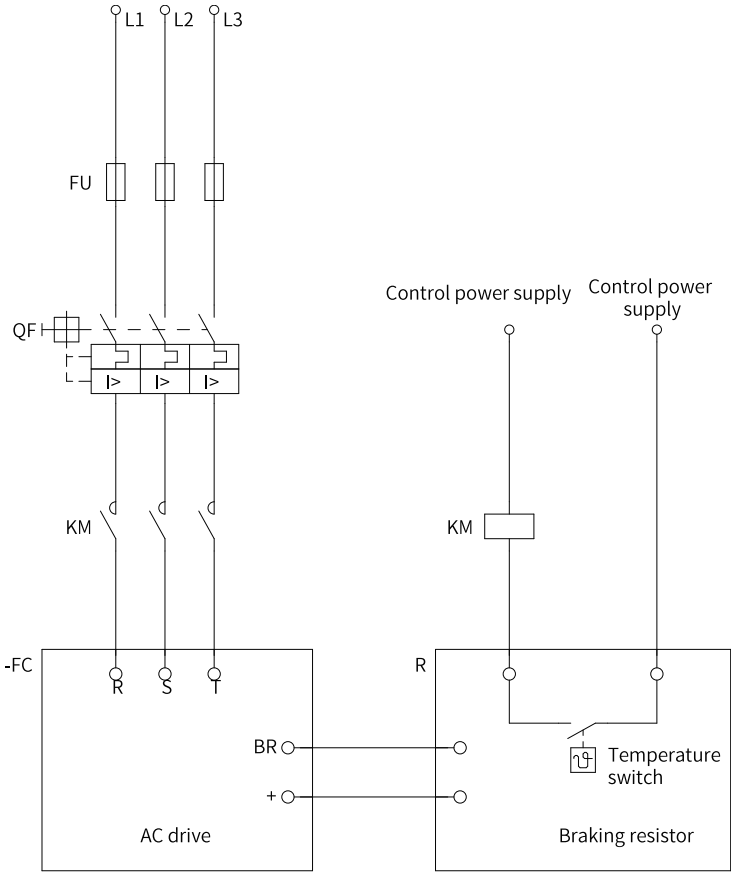


Figure 9-21 Braking resistor overtemperature protection

Note

- FU: Fuse
- KM: Contactor
- QF: Circuit breaker

9.8.7 EMC Shield Grounding Bracket

Application conditions and functions:

The EMC shield grounding brackets are used in scenarios where the cable shield requires 360° grounding.

Applicable model:

The EMC shield grounding brackets are divided into signal cable shield grounding bracket and power cable shield grounding bracket, as shown in the figure below.

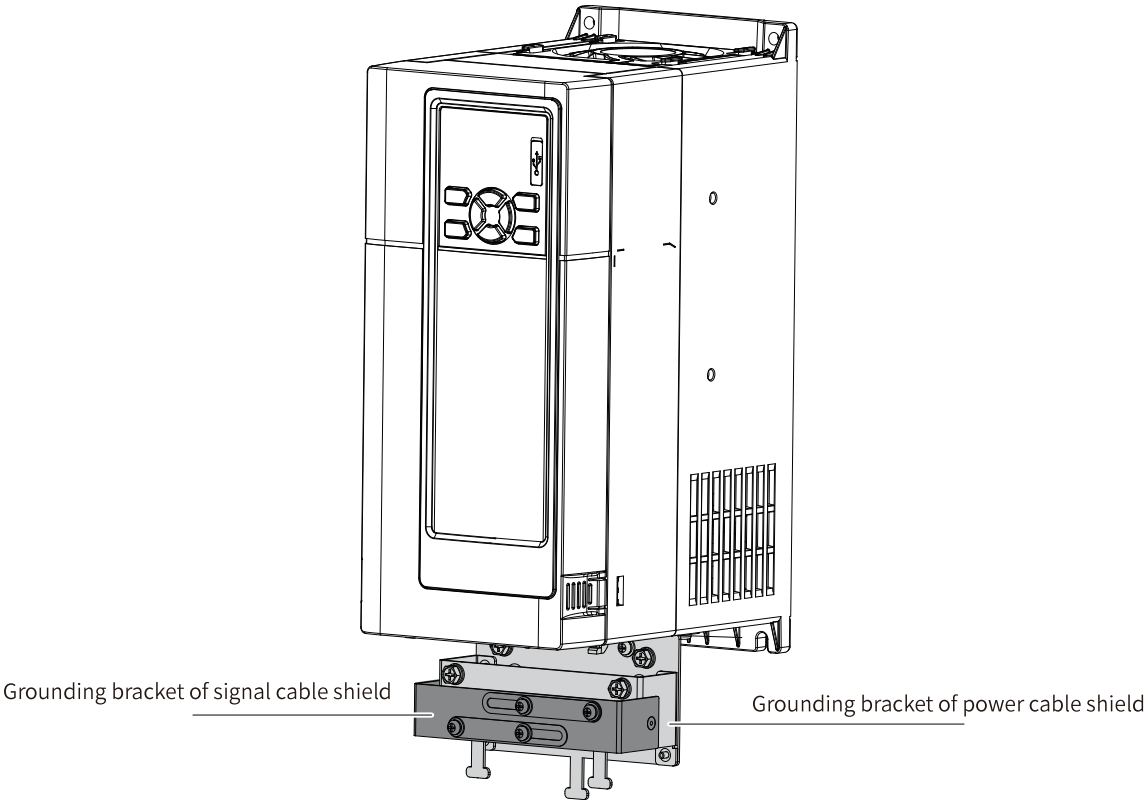


Figure 9-22 EMC shield grounding bracket

Table 9–31 EMC shield grounding bracket model

Structure (kW)	Bracket model
T1 (0.37 to 1.5)	MD630-AZJ-A3T1
T2 (2.2 to 4)	
T3 (5.5 to 7.5)	MD630-AZJ-A3T3
T4 (11 to 15)	MD630-AZJ-A3T4
T5 (18.5 to 22)	MD630-AZJ-A3T5
T6 (30 to 37)	MD630-AZJ-A3T6
T7 (45 to 55)	MD630-AZJ-A3T7
T8 (75 to 90)	MD630-AZJ-A3T8

Dimension drawing:

The installation dimensions of the EMC shield grounding bracket corresponding to different volumes are shown in the figure below. Unit: mm (in.)

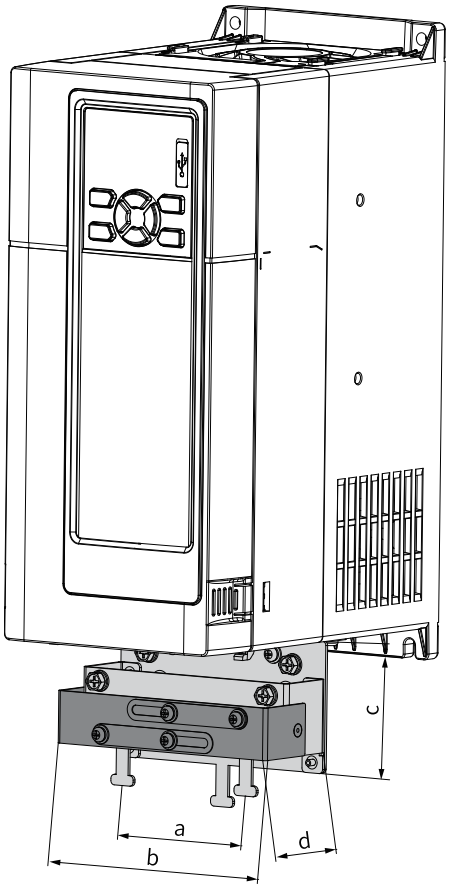


Figure 9-23 Installation dimensions of EMC shield grounding bracket

Table 9–32 Installation dimensions of EMC shield grounding bracket

Structure (kW)	Dimension (mm (in.))			
	a	b	c	d
T1 (0.37 to 1.5)	56 (2.20)	70 (2.76)	42 (1.65)	48.2 (1.90)
T2 (2.2 to 4)	56 (2.20)	70 (2.76)	42 (1.65)	48.2 (1.90)
T3 (5.5 to 7.5)	71 (2.80)	85 (3.35)	52 (2.05)	50.5 (1.99)
T4 (11 to 15)	47.1 (1.85)	122 (4.80)	82 (3.23)	44 (1.73)
T5 (18.5 to 22)	72 (2.83)	164.4 (6.47)	100 (3.94)	51 (2.01)
T6 (30 to 37)	101 (3.98)	192.6 (7.58)	80 (3.15)	42.2 (1.66)
T7 (45 to 55)	120 (4.72)	245 (9.65)	94.5 (3.72)	73.5 (2.89)
T8 (75 to 90)	140 (5.51)	265 (10.43)	118 (4.65)	77.7 (3.06)

Note

For installation of the EMC shield grounding bracket, see *"2.9.1 Installing Cable Shield Grounding Bracket" on page 65*.

9.8.8 Through-hole Mounting Bracket

Application conditions and functions:

The through-hole mounting bracket is applied in scenarios requiring air duct cleaning or when the cabinet features no internal heat dissipation.

Applicable model:

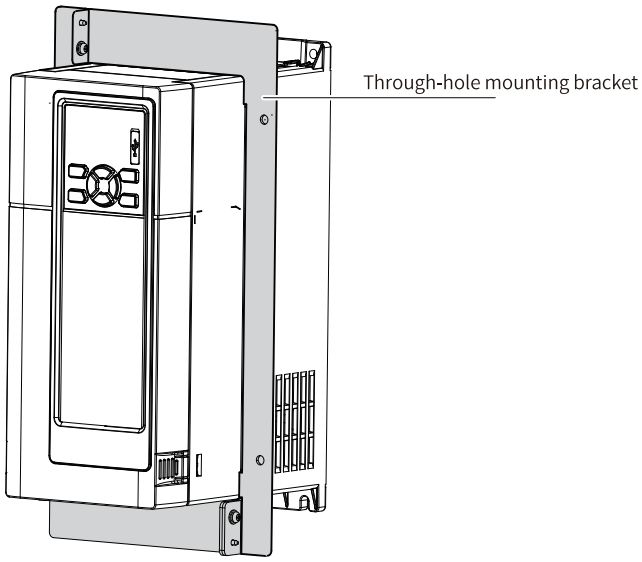


Figure 9-24 Through-hole mounting bracket

Table 9–33 Models of through-hole mounting brackets

Structure (kW)	Bracket model
T4 (11 to 15)	MD630-AZJ-A1T4
T5 (18.5 to 22)	MD630-AZJ-A1T5
T6 (30 to 37)	MD630-AZJ-A1T6
T7 (45 to 55)	MD630-AZJ-A1T7
T8 (75 to 90)	MD630-AZJ-A1T8

Dimension drawing:

The dimensions of the through-hole mounting brackets corresponding to different volumes are shown in the figure below. Unit: mm (in.)

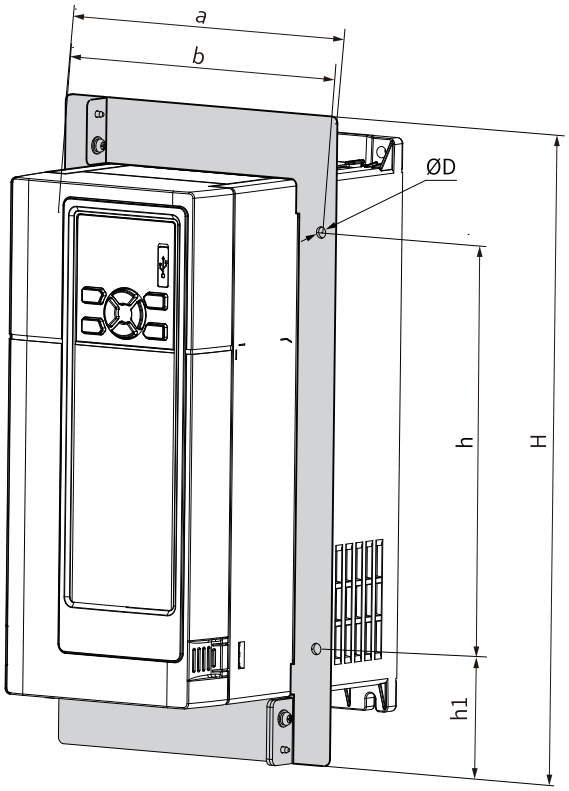


Figure 9-25 Dimensions of through-hole mounting bracket

Table 9–34 Dimensions of through-hole mounting bracket

Structure (kW)	Dimension (mm (in.))					
	a	b	H	h	h1	ΦD
T4 (11 to 15)	174.7 (6.88)	158 (6.22)	343 (13.50)	220 (8.66)	61.5 (2.42)	6 (0.24)
T5 (18.5 to 22)	214.7 (8.45)	198 (7.80)	370 (14.57)	220 (8.66)	75 (2.95)	6 (0.24)
T6 (30 to 37)	274 (10.79)	240 (9.45)	479.5 (18.88)	350 (13.78)	69.5 (2.74)	7 (0.28)
T7 (45 to 55)	330 (12.99)	300 (11.81)	580 (22.83)	450 (17.72)	50 (1.97)	8 (0.31)
T8 (75 to 90)	360 (14.17)	320 (12.60)	595 (23.43)	450 (17.72)	75 (2.95)	10 (0.39)

Note

For an in-line mounting bracket, see *"2.6 Through-hole Mounting" on page 60*.

9.8.9 DIN rail mounting accessory

Application conditions and functions:

The DIN rail mounting accessory is used to facilitate screw mounting and reduce installation time.

Applicable model

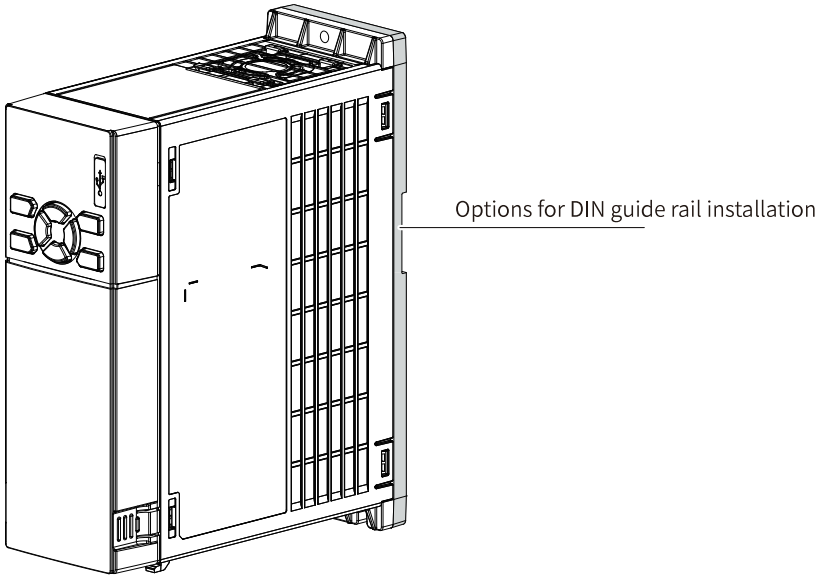


Figure 9-26 DIN rail mounting accessory

Table 9–35 List of DIN rail mounting accessory models

Structure (kW)	Model
T1 (0.37 to 1.5)	MD630-AZJ-A4T1
T2 (2.2 to 4)	MD630-AZJ-A4T1

Dimension drawing:

The mounting dimensions of the DIN rail mounting accessory corresponding to different volumes are shown in the figure below. Unit: mm (in.)

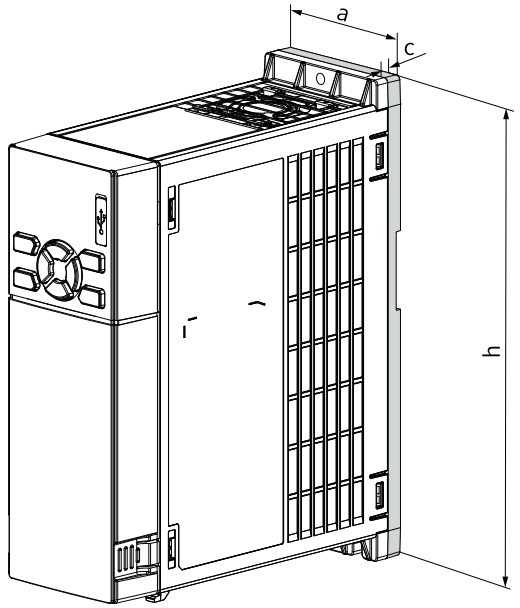


Figure 9-27 Mounting dimensions of the DIN rail mounting accessory

Table 9–36 Mounting dimensions of the DIN rail mounting accessory

Structure (kW)	Dimension (mm (in.))		
	a	c	h
T1 (0.37 to 1.5)	70 (2.76)	8 (0.31)	217 (8.54)
T2 (2.2 to 4)			

For installation of the guide rail, see *"2.7 DIN Rail Mounting" on page 64*.

9.8.10 Punch Press Vibration Damping Bracket

Application conditions and functions:

The damping bracket is used in applications with strong vibration, preventing the drive from being damaged through reducing the vibration imposed on the drive. It can be applied in mining machinery for example.

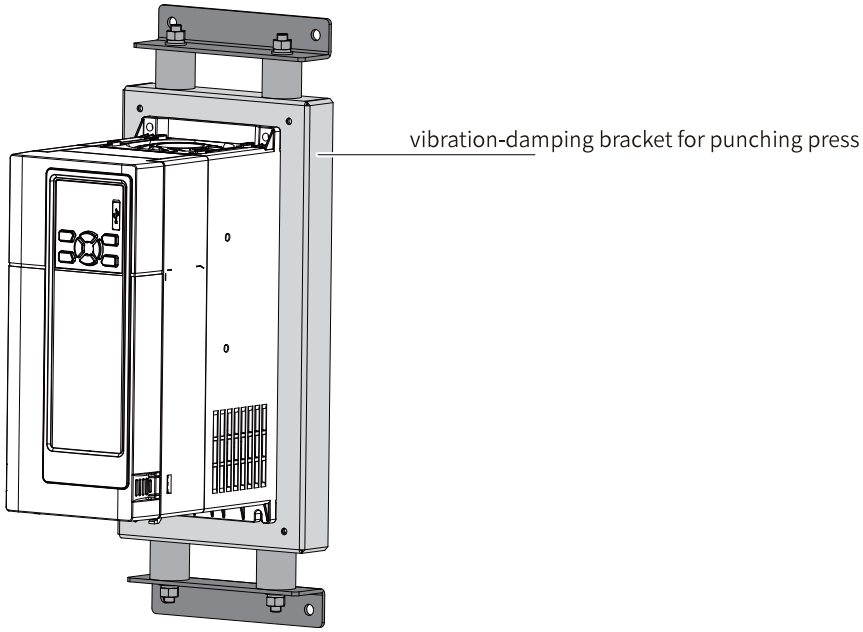


Figure 9-28 Punch press vibration damping bracket

Table 9–37 Models of punch press vibration damping bracket

Structure (kW)	Bracket model
T1 (0.37 to 1.5)	MD630-AZJ-A2T1
T2 (2.2 to 4)	MD630-AZJ-A2T1
T3 (5.5 to 7.5)	MD630-AZJ-A2T1
T4 (11 to 15)	MD630-AZJ-A2T4
T5 (18.5 to 22)	MD630-AZJ-A2T4
T6 (30 to 37)	MD630-AZJ-A2T6
T7 (45 to 55)	MD630-AZJ-A2T7
T8 (75 to 90)	MD630-AZJ-A2T8

Dimension drawing:

The installation dimensions of the damping brackets corresponding to different volumes are shown in the following table. Unit: mm (in.)

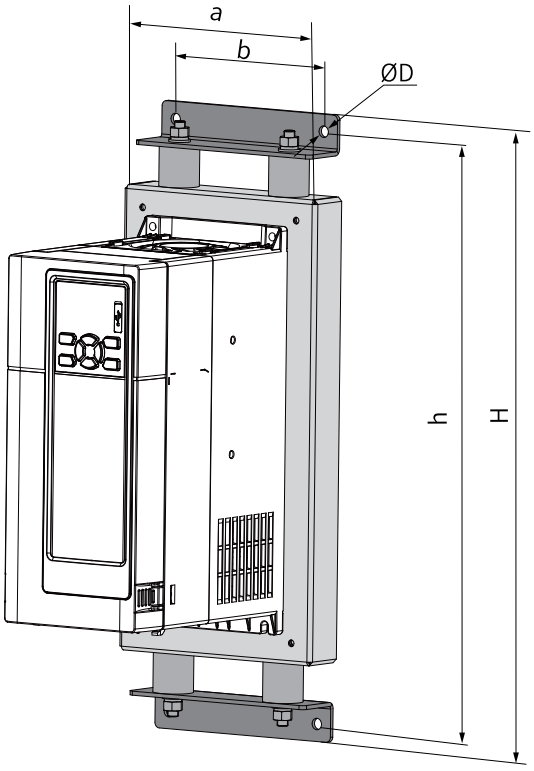


Figure 9-29 Installation dimensions of the punch press vibration damping bracket

Table 9–38 Installation dimensions of the punch press vibration damping bracket

Structure (kW)	Dimension (mm (in.))				
	a	b	H	h	ΦD
T1 (0.37 to 1.5)	110 (4.33)	85 (3.35)	415 (16.34)	389 (15.31)	8.5 (0.33)
T2 (2.2 to 4)					
T3 (5.5 to 7.5)					
T4 (11 to 15)	175 (6.90)	135 (5.31)	466 (18.35)	440 (17.32)	8.5 (0.33)
T5 (18.5 to 22)					
T6 (30 to 37)	205 (8.07)	165 (6.5)	552 (21.73)	526 (20.7)	8.5 (0.33)
T7 (45 to 55)	280 (11.02)	170 (5.31)	722 (28.43)	685 (26.97)	12 (0.47)
T8 (75 to 90)	280 (11.02)	170 (5.31)	722 (28.43)	685 (26.97)	12 (0.47)

9.8.11 Junction box accessory

Application conditions and functions:

The junction box accessory is installed below the main circuit of the drive, which is mainly used in applications with graphite dust and carbon fiber filaments (such as production halls for lithium-ion batteries), aiming to prevent external dust and other foreign objects from entering the drive.

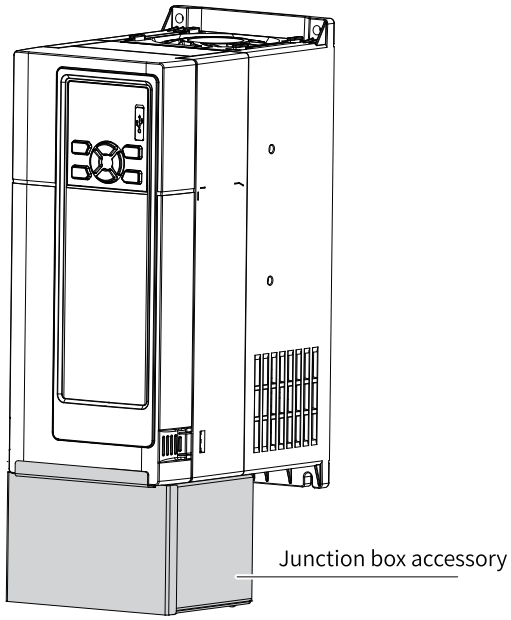


Figure 9-30 Junction box accessory

Table 9–39 Model of junction box accessory

Structure (kW)	Model
T1 (0.37 to 1.5)	MD630-JXH-A5T1
T2 (2.2 to 4)	MD630-JXH-A5T1
T3 (5.5 to 7.5)	MD630-JXH-A5T3
T4 (11 to 15)	MD630-JXH-A5T4
T5 (18.5 to 22)	MD630-JXH-A5T5
T6 (30 to 37)	MD630-JXH-A5T6
T7 (45 to 55)	MD630-JXH-A5T7
T8 (75 to 90)	MD630-JXH-A5T8

Dimension drawing:

The following table shows the dimensions of the junction box accessory corresponding to different volumes. Unit: mm (in.)

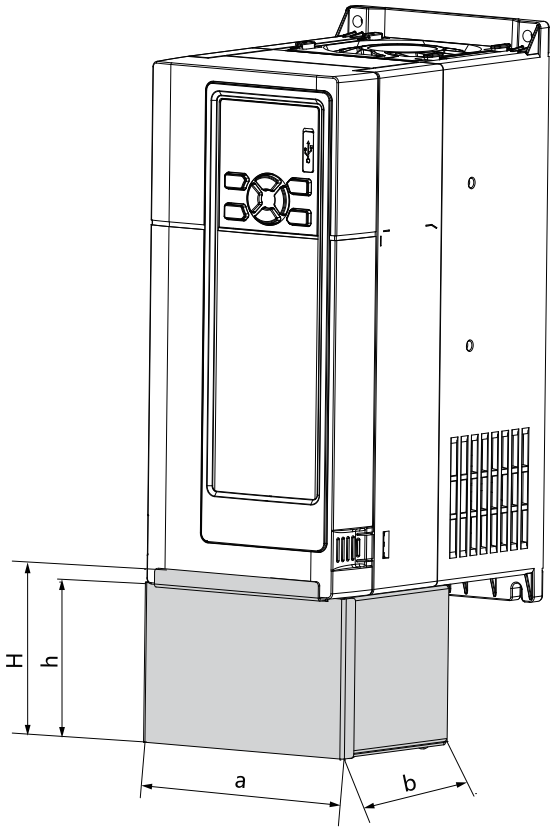


Figure 9-31 Installation dimensions of junction box accessory

Structure (kW)	Dimension (mm (in.))			
	a	b	H	h
T1 (0.37 to 1.5)	71 (2.80)	85.5 (3.37)	66.3 (2.61)	36.5 (1.44)
T2 (2.2 to 4)	71 (2.80)	85.5 (3.37)	66.3 (2.61)	36.5 (1.44)
T3 (5.5 to 7.5)	85 (3.35)	92 (3.62)	41.5 (1.63)	72.3 (2.85)
T4 (11 to 15)	125 (4.92)	96.2 (3.79)	114.2 (4.50)	83.4 (3.28)
T5 (18.5 to 22)	168.4 (6.63)	96.2 (3.79)	105 (4.13)	72 (2.83)
T6 (30 to 37)	188.4 (7.42)	81.2 (3.2)	80.8 (3.18)	72 (2.83)
T7 (45 to 55)	249 (9.80)	108.5 (4.27)	110 (4.33)	100 (3.94)
T8 (75 to 90)	269 (10.60)	96.7 (3.81)	120 (4.72)	110 (4.33)

9.8.12 Cable

Power cable selection requirements

For selection of power cables, follow national or regional regulations. Select IEC cables according to the following requirements:

- Compliant with EN 60204-1 and IEC 60364-5-52 standards
- PVC insulated cables with copper conductors
- Heat resistance: maximum cable surface temperature not exceeding 70°C at an ambient temperature of 40°C (Note: Contact the manufacturer if the ambient temperature exceeds 40°C.)
- Symmetric cable with copper-braided shield

If the recommended cables for peripheral equipment or options are not suitable for the product, contact Inovance.

To comply with the EMC standards, use shielded cables. The shielded cables are divided into three-conductor cables and four-conductor cables, as shown below. If the conductivity of the shield of the three-conductor shielded cable cannot meet requirements, add an independent PE cable. Alternatively, use a four-conductor cable with one conductor as the PE cable. The shield of the shielded cable consists of coaxial cooper braids to suppress radio frequency interference. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than 90%.

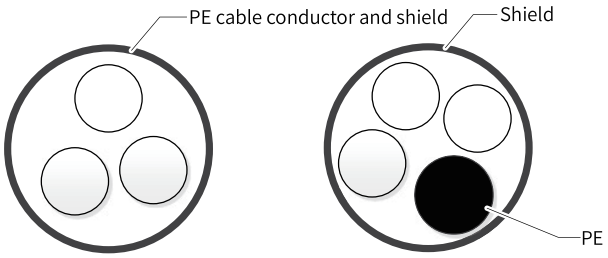


Figure 9-32 Recommended power cable

Note

- Observe national or regional regulations during selection. The preceding table is based on the following conditions.
  - Cables with PVC insulation and copper conductor
  - Heat resistance: ambient temperature of 40°C and cable surface temperature of 75°C (Note: When the ambient temperature exceeds 40°C, contact Inovance.)
  - Cable installation type E applied (See IEC60204-1.)
- If the conditions vary, select the model according to actual conditions.
- For bare OT terminals, apply heat shrink tubing to protect the terminal ends.

Note

<1> Applicable to standards in China, where 3 x 25 indicates one 3-conductor 70 mm² cable (one 70 mm² cable per phase), and 2x35 indicates one 2-conductor 35 mm² cable (one 35 mm² cable per phase).

<2> Applicable to standards in US, where 3 x 4 indicates one 3-conductor 4 AWG cable (one 4 AWG cable per phase), and 2x250 kcmil indicates one 2-conductor 7250 kcmil cable (one 250 kcmil cable per phase).

Power cables

Table 9–40 Input/Output/Grounding terminal cable specifications (P-type model)

Structure	Model	Input/Output terminal								Grounding terminal					
		IEC (mm²)		UL (AWG)		Allowable cable length	OD of UL cable (mm)	Screw specifications	Tightening torque (N·m)	IEC (mm²)		UL (AWG)		Screw specifications	Tightening torque (N·m)
		Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model					Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model		
T1	MD630S/N-4T1R5BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
	MD630S/N-4T2R1BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
	MD630S/N-4T3R8BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
T2	MD630S/N-4T5R1BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
	MD630S/N-4T7R2BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
	MD630S/N-4T9R0BS-INT	3x2.5	E2510	3x12	E4009	Customized	12.1±0.4	M3.5	1	2.5	E2510	12	E4009	M3.5	1
T3	MD630S/N-4T013BS-INT	3x4	E4009	3x10	E6010	Customized	13.5±0.3	M4	1.2	4	E4009	10	E6010	M4	1.2
	MD630S/N-4T017BS-INT	3x6	E6010	3x8	E10-12	Customized	18.6±0.4	M4	1.2	6	E6010	8	E10-12	M4	1.2

Structure	Model	Input/Output terminal								Grounding terminal					
		IEC (mm²)		UL (AWG)		Allowable cable length	OD of UL cable (mm)	Screw specifications	Tightening torque (N·m)	IEC (mm²)		UL (AWG)		Screw specifications	Tightening torque (N·m)
		Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model					Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model		
T4	MD630S/N-4T025BS-INT	3x10	RNB14-5	3x8	RNBM8-5	Customized	18.6±0.4	M5	2	10	RNB14-5	8	RNBM8-5	M5	2
	MD630S/N-4T032BS-INT	3x10	RNB14-5	3x6	RNB14-5	Customized	22.6±0.4	M5	2	10	RNB14-5	6	RNB14-5	M5	2
T5	MD630S/N-4T037BS-INT	3x16	RNBL22-6	3x6	RNBL14-6	Customized	22.6±0.4	M6	2.5	16	RNBL22-6	6	RNBL14-6	M6	2.5
	MD630S/N-4T045BS-INT	3x25	RNBL22-6	3x4	RNBL22-6	Customized	26±0.6	M6	2.5	16	RNBL22-6	4	RNBL22-6	M6	2.5
T6	MD630S/N-4T060BS-INT	3x25	RNBS22-6	3x4	RNBS22-6	Customized	30.1±0.7	M6	2.5	16	RNBL14-6	4	RNBS22-6	M6	2.5
	MD630S/N-4T075BS-INT	3x35	RNB38-6	3x2	RNB38-6	Customized	33.0±1	M6	2.5	16	RNBL14-6	4	RNBS22-6	M6	2.5
T7	MD630S/N-4T091BS-INT	3x50	RNB60-8	3x1/0	RNB60-8	Customized	36.0±1	M8	13	25	RNB22-8	2	RNBL38-8	M8	13
	MD630S/N-4T112BS-INT	3x70	RNB70-8	3x2/0	RNB70-8	Customized	40.0±1	M8	13	35	RNBL38-8	1/0	RNB60-8	M8	13

Structure	Model	Input/Output terminal								Grounding terminal					
		IEC (mm²)		UL (AWG)		Allowable cable length	OD of UL cable (mm)	Screw specifications	Tightening torque (N·m)	IEC (mm²)		UL (AWG)		Screw specifications	Tightening torque (N·m)
		Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model					Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model		
T8	MD630S/N-4T150BS-INT	3x95	SC95-10	3x3/0	SC95-10	Customized	44.0±1	M10	20	50	RNB60-10	1/0	RNB60-10	M10	20
	MD630S/N-4T176BS-INT	3x120	SC120-10	3x4/0	SC120-10	Customized	48.0±1	M10	20	70	RNB70-10	2/0	RNB70-10	M10	20

Table 9–41 Input/Output/Grounding terminal cable specifications (G-type model)

Structure	Model	Input/Output terminal								Grounding terminal					
		IEC (mm²)		UL (AWG)		Allowable cable length	Cable OD (mm)	Screw specifications	Tightening torque (N·m)	IEC (mm²)		UL (AWG)		Screw specifications	Tightening torque (N·m)
		Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model					Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model		
T1	MD630S/N-4T1R5BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
	MD630S/N-4T2R1BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
	MD630S/N-4T3R8BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
T2	MD630S/N-4T5R1BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
	MD630S/N-4T7R2BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
	MD630S/N-4T9R0BS-INT	3x2.5	E2510	3x14	E2510	Customized	9.2±0.2	M3.5	1	2.5	E2510	14	E2510	M3.5	1
T3	MD630S/N-4T013BS-INT	3x2.5	E2510	3x12	E4009	Customized	12.1±0.4	M4	1.2	2.5	E2510	12	E4009	M4	1.2
	MD630S/N-4T017BS-INT	3x4	E4009	3x10	E6010	Customized	13.5±0.3	M4	1.2	4	E4009	10	E6010	M4	1.2

Structure	Model	Input/Output terminal								Grounding terminal					
		IEC (mm²)		UL (AWG)		Allowable cable length	Cable OD (mm)	Screw specifications	Tightening torque (N·m)	IEC (mm²)		UL (AWG)		Screw specifications	Tightening torque (N·m)
		Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model					Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model		
T4	MD630S/N-4T025BS-INT	3x6	RNB5.5-5	3x8	RNBM8-5	Customized	18.6±0.4	M5	2	6	RNB5.5-5	8	RNBM8-5	M5	2
	MD630S/N-4T032BS-INT	3x10	RNB14-5	3x8	RNBM8-5	Customized	18.6±0.4	M5	2	10	RNB14-5	8	RNBM8-5	M5	2
T5	MD630S/N-4T037BS-INT	3x10	RNBL14-6	3x6	RNBL14-6	Customized	22.6±0.4	M6	2.5	10	RNBL14-6	6	RNBL14-6	M6	2.5
	MD630S/N-4T045BS-INT	3x16	RNBL22-6	3x6	RNBL14-6	Customized	22.6±0.4	M6	2.5	16	RNBL22-6	6	RNBL14-6	M6	2.5
T6	MD630S/N-4T060BS-INT	3x16	RNBL14-6	3x6	RNBL14-6	Customized	22.6±0.4	M6	2.5	16	RNBL14-6	6	RNBL14-6	M6	2.5
	MD630S/N-4T075BS-INT	3x25	RNBS22-6	3x4	RNBS22-6	Customized	30.1±0.7	M6	2.5	16	RNBL14-6	6	RNBL14-6	M6	2.5
T7	MD630S/N-4T091BS-INT	3x35	RNBL38-8	3x2	RNBL38-8	Customized	33.0±1	M8	13	16	RNB14-8	4	RNB22-8	M8	13
	MD630S/N-4T112BS-INT	3x50	RNB60-8	3x1/0	RNB60-8	Customized	36.0±1	M8	13	25	RNB22-8	2	RNBL38-8	M8	13

Structure	Model	Input/Output terminal								Grounding terminal					
		IEC (mm²)		UL (AWG)		Allowable cable length	Cable OD (mm)	Screw specifications	Tightening torque (N·m)	IEC (mm²)		UL (AWG)		Screw specifications	Tightening torque (N·m)
		Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model					Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model		
T8	MD630S/N-4T150BS-INT	3x70	RNB70-10	3x2/0	RNB70-10	Customized	40.0±1	M10	20	35	RNBS38-10	1/0	RNB60-10	M10	20
	MD630S/N-4T176BS-INT	3x95	SC95-10	3x3/0	SC95-10	Customized	44.0±1	M10	20	50	RNB60-10	1/0	RNB60-10	M10	20

Table 9–42 Specifications of braking terminal cables

Structure	Model	Braking terminal						Screw specifications	Tightening torque (N·m)
		IEC (mm²)		UL (AWG)		Allowable cable length	UL cable OD (mm)		
		Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model				
T1	MD630S/N-4T1R5BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2	M3.5	1
	MD630S/N-4T2R1BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2	M3.5	1
	MD630S/N-4T3R8BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2	M3.5	1
T2	MD630S/N-4T5R1BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2	M3.5	1
	MD630S/N-4T7R2BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2	M3.5	1
	MD630S/N-4T9R0BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2	M3.5	1
T3	MD630S/N-4T013BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2	M4	1.2
	MD630S/N-4T017BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2	M4	1.2

Structure	Model	Braking terminal						Screw specifications	Tightening torque (N·m)
		IEC (mm^2)		UL (AWG)		Allowable cable length	UL cable OD (mm)		
		Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model				
T4	MD630S/N-4T025BS-INT	2x2.5	RNBL3.5-5	2x12	RNBL3.5-5	Customized	9.5±0.2	M5	2
	MD630S/N-4T032BS-INT	2x2.5	RNBL3.5-5	2x10	RNB5.5-5	Customized	11.1±0.3	M5	2
T5	MD630S/N-4T037BS-INT	2x4	RNB5.5-6	2x10	RNB5.5-6	Customized	11.1±0.3	M6	2.5
	MD630S/N-4T045BS-INT	2x4	RNB5.5-6	2x10	RNB5.5-6	Customized	11.1±0.3	M6	2.5
T6	MD630S/N-4T060BS-INT	2x6	RNB5.5-6	2x8	RNBL8-6	Customized	14.5±0.4	M6	2.5
	MD630S/N-4T075BS-INT	2x10	RNBL8-6	2x8	RNBL8-6	Customized	14.5±0.4	M6	2.5
T7	MD630S/N-4T091BS-INT	2x16	RNB14-8	2x6	RNB14-8	Customized	18.5±0.4	M8	13
	MD630S/N-4T112BS-INT	2x16	RNB14-8	2x6	RNB14-8	Customized	18.5±0.4	M8	13
T8	MD630S/N-4T150BS-INT	2x25	RNB22-10	2x2	RNBL38-10	Customized	24.3±0.5	M10	20
	MD630S/N-4T176BS-INT	2x35	RNBL38-10	2x2	RNBL38-10	Customized	24.3±0.5	M10	20

Table 9–43 Busbar terminal cable specifications (P-type model)

Structure	Model	Braking terminal					
		IEC (mm^2)		UL (AWG)		Allowable cable length	UL cable OD (mm)
		Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model		
T1	MD630S/N-4T1R5BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2
	MD630S/N-4T2R1BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2
	MD630S/N-4T3R8BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2
T2	MD630S/N-4T5R1BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2
	MD630S/N-4T7R2BS-INT	2x2.5	E2510	2x14	E2510	Customized	8.1±0.2
	MD630S/N-4T9R0BS-INT	2x2.5	E2510	2x12	E0409	Customized	8.5±0.2
T3	MD630S/N-4T013BS-INT	2x4	E4009	2x10	E6010	Customized	11.7±0.3
	MD630S/N-4T017BS-INT	2x10	E10-12	2x8	E10-12	Customized	15.4±0.3

Structure	Model	Braking terminal					
		IEC (mm²)		UL (AWG)		Allowable cable length	UL cable OD (mm)
		Recommended cable specifications [1]	Recommended terminal model	Recommended cable specifications [2]	Recommended terminal model		
T4	MD630S/N-4T025BS-INT	2x10	RNB14-5	2x6	RNB14-5	Customized	19.3±0.5
	MD630S/N-4T032BS-INT	2x16	RNBS22-5	2x6	RNB14-5	Customized	19.3±0.5
T5	MD630S/N-4T037BS-INT	2x25	RNBL22-6	2x4	RNBL22-6	Customized	22.3±0.5
	MD630S/N-4T045BS-INT	2x25	RNBL22-6	2x2	RNB38-6	Customized	26.5±0.7
T6	MD630S/N-4T060BS-INT	2x25	RNBS22-6	2x2	RNB38-6	Customized	26.5±0.7
	MD630S/N-4T075BS-INT	2x35	RNB38-6	2x2	RNB38-6	Customized	26.5±0.7
T7	MD630S/N-4T091BS-INT	2x50	RNB60-8	2x1/0	RNB60-8	Customized	30±0.7
	MD630S/N-4T112BS-INT	2x70	RNB70-8	2x2/0	RNB70-8	Customized	34.7±1
T8	MD630S/N-4T150BS-INT	2x95	SC95-10	2x4/0	SC120-10	Customized	38.7±1
	MD630S/N-4T176BS-INT	2 x 120	SC120-10	2 x 250 kcmil	SC150-10	Customized	42.5±1

Control cables

Note

Observe the requirements in standard EN 60204-1 during connecting control circuit cables.

To ensure that I/O signal cables are not affected by peripheral interference and noise, use shielded cables as signal cables. Install the signal shield bracket at each end of the shield to bond the shield to the drive 360 degrees. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pair (STP) cables for digital signals.

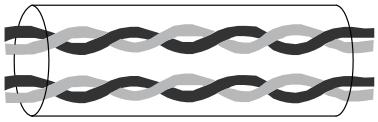


Figure 9-33 Diagram of shielded twisted pairs

Table 9–44 Control signal terminal specifications

Structure	Control signal terminal			
	Recommended cable specifications	Allowable cable length	OD (mm)	Recommended terminal specifications
T1 to T8	22	Customized	Customized	E0508

Table 9–45 Relay signal terminal specifications

Structure	Control signal terminal			
	Recommended cable specifications	Allowable cable length	OD (mm)	Recommended terminal specifications
T1 to T8	22	Customized	Customized	E0508
	20	Customized	Customized	E7508
	18	Customized	Customized	E1008
	16	Customized	Customized	E1508

Cable lug terminal

It is recommended to use the lugs produced by Zhejiang KISE Terminal Co., Ltd., including pre-insulated crimping ferrule (TG-JT type) and bare ring lug (TO type).

Pre-insulated crimping ferrule

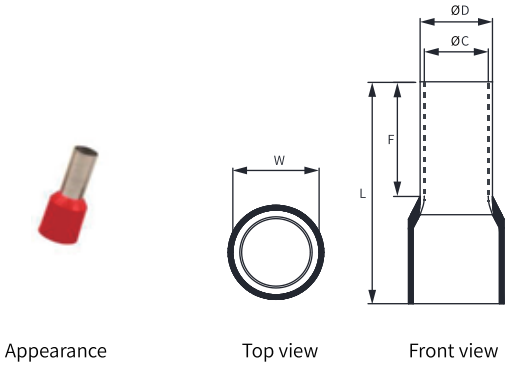


Figure 9-34 Appearance and dimensions of pre-insulated crimping ferrule (TG-JT type)

Table 9–46 Specifications and dimensions of pre-insulated crimping ferrule (TG-JT type)

Cross-sectional area	Model	Dimensions (mm)					Insulation sheath color (1) For Germany (2) For France	Crimping tool
		F	L	W	D	C		
A.W.G.22 0.5 mm^2	E0508	8.0	14	2.7	1.3	1.0	(1) Orange (2) White	OPT AN-04WF
A.W.G.20 0.75 mm^2	E7508	8.0	14	2.8	1.5	1.2	(1) White (2) Blue	OPT AN-04WF
A.W.G.18 1.0 mm^2	E1008	8.0	14.5	2.9	1.7	1.4	(1) Yellow (2) Red	OPT AN-04WF
A.W.G.16 1.5 mm^2	E1508	8.0	14.5	3.5	2.0	1.7	(1) Red (2) Black	OPT AN-04WF
A.W.G.14 2.5 mm^2	E2510	10.0	17.5	4.1	2.6	2.3	(1) Blue (2) Gray	OPT AN-04WF

Cross-sectional area	Model	Dimensions (mm)					Insulation sheath color (1) For Germany (2) For France	Crimping tool
		F	L	W	D	C		
A.W.G.10 6 mm^2	E6012	12.0	20.0	6.4	3.85	3.5	(1) Black (2) Green	OPT AN-10WF
A.W.G.8 10 mm^2	E10-12	12.0	22.5	7.7	5.05	4.7	(1) Milk white (2) Brown	OPT AN-16WF

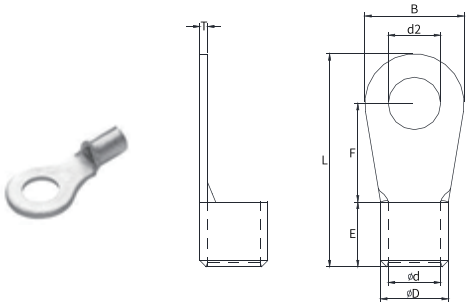


Figure 9-35 Appearance and dimensions of the bare ring lug (TO Type)

Table 9–47 Specifications and dimensions of the bare ring lug (TO Type)

Cross-sectional area	Model	Dimensions (mm)								Crimping tool
		d2	B	F	L	E	D	d	T	
A.W.G.6 14 mm^2	RNB14-5	5.3	12.0	13.5	29.5	10.5	9.0	6.0	1.4	OPT TP-150D
A.W.G.4 22 mm^2	RNBS22-6	6.4	12.0	14.5	32.5	12.0	11.5	8.0	1.7	OPT TP-150D
A.W.G.2 38 mm^2	RNB38-6	6.4	15.5	18.5	40.0	14.0	13.5	9.5	1.8	OPT TP-150D
AWG12 4 mm^2	RNB5.5-5	5.3	9.5	8.0	20.0	7.0	5.5	3.5	1.0	IZUMI 5N18
AWG12 4 mm^2	RNB5.5-6	6.4	12.2	105	23.5	7.0	5.5	3.5	1.0	IZUMI 5N18
AWG4 22 mm^2	RNBS22-5	5.3	12.0	14.5	32.5	12.0	11.5	8.0	1.7	OPT TP-150D

9.8.13 Expansion Card

9.8.13.1 Outline dimensions

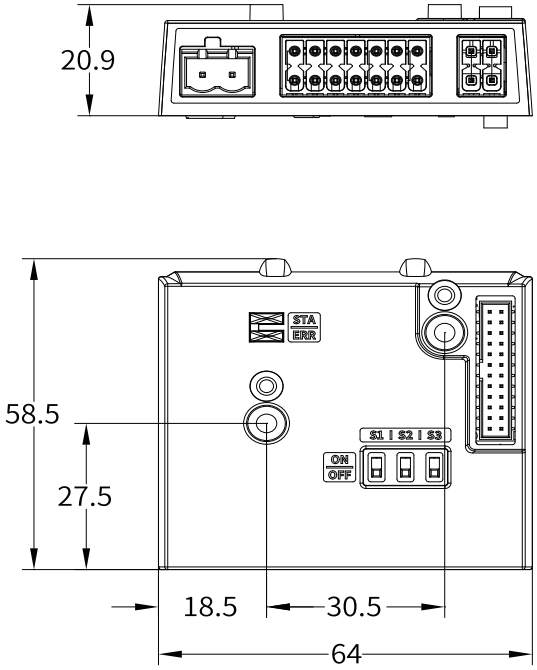


Figure 9-36 Dimensions of IO expansion card MD-IO-M1 (unit: mm)

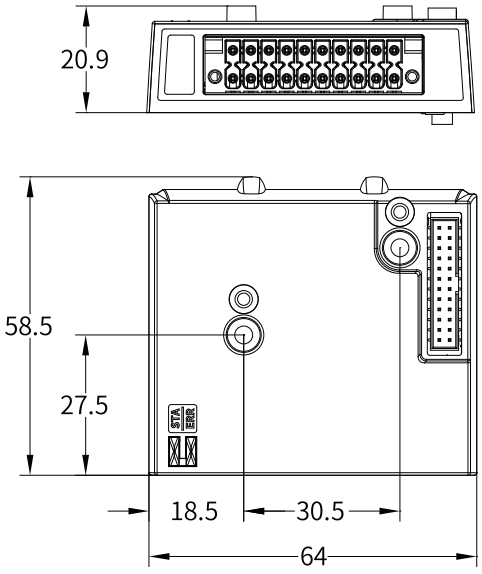
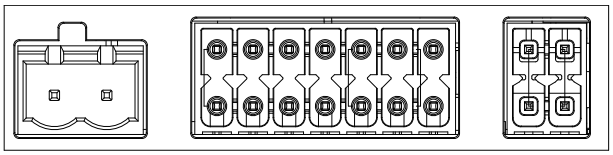


Figure 9-37 Dimensions of PG expansion cards (MD-PG-AU1, MD-PG-S1, MD-PG-R1) (unit: mm)

9.8.13.2 Description of IO Expansion Card Interface

Interface layout

The following figure shows the interface layout of the I/O expansion card.



T/A	T/C

COM	CME	DO1	+10V	GND	AI1	AO1
+24V	OP	COM	DI1	DI2	GND	GND

RTD+	RTD-
RTD_I+	RTD_I-

Figure 9-38 Interface layout

Interface description

Type	Mark	Name	Function
Power supply	+24V-COM	24 V digital power supply output	Provides external 24 V power supply for DI/DO and external sensors. Maximum output current: 200 mA[Note 1]
	+10 V-GND	10 V analog power supply output	Used as an external 10 V analog power supply for external potentiometers. The potentiometer resistance range is 1 kΩ to 5 kΩ.
	OP	Digital input common terminal	Shorted to +24 V through a jumper by default. When the DI is powered up by an external power supply, the jumper must be removed.
Analog output (AO)	AO1-GND	Analog output 1	Select the output signal type through DIP switch S5. • S1 = OFF: 0 V to 10 V (default) • S1 = ON: 0 mA to 20 mA 12-bit resolution; accuracy after calibration: 0.5%; maximum load current output in voltage mode: 2 mA; load impedance in voltage mode: 5 kΩ; load impedance in current mode: < 500 Ω
Digital output (DO)	DO1-CME	Digital output 1	Optocoupler isolation; bipolar open collector output. Do not connect DO directly to a power supply. A load must be connected in series between the DO and power supply. • Output voltage range: 0 V to 24 V • Maximum output frequency: 100 Hz • Output current range: 0 mA to 50 mA
Analog input (AI)	AI1-GND	Analog input 1	The input signal type is selected by the DIP switch S2: • S2 = OFF: -10 V to +10 V (default) • S2 = ON: 0 mA to 20 mA 12-bit resolution; accuracy after correction: 0.3%; response time: < 2 ms; input impedance in voltage mode: 22 kΩ; input impedance in current mode: 500 Ω
Digital input	DI1-COM	Digital input 1	Optocoupler isolation, compatible with dual-polarity input: • Input impedance: 4.6 kΩ • Maximum input frequency:100 Hz • Operating voltage range: 15 V to 30 V; invalid voltage: < 5 V; valid voltage: 15 V
	DI2-COM	Digital input 2	

Type	Mark	Name	Function
Temperature sensor input	RTD_I+	RTD excitation port +	By setting switch S3, you can select the type of motor temperature sensor. • S3 = OFF: PT100/PT1000/KTY84-130 • S3 = ON: PTC130 single-core/three-core Range and accuracy: PT100 (-25°C to 200°C, ±0.5°C); PT1000 (-25°C to 200°C, ±0.5°C); KTY84-130 (-40°C to 260°C, ±0.5°C); PTC130 (100 to 180°C, ±5°C)
	RTD+	RTD acquisition port +	
	RTD_I-	RTD excitation port-	
	RTD-	RTD acquisition port -	
Relay output	T/A-T/C	NO terminal	Support the long life requirements of the lifting industry Contact capacity: 250 VAC 8A, 30 VDC 8A

Note

[Note 1]: The +24 V on the control board and IO expansion card (reserved function) is the same power supply. When the +24 V power supply of the AC drive body is used, the total load current cannot exceed 200 mA.

Slide switch description

DIP Switch		Description	
S1	AO mode selection	ON	Current output
		OFF	Voltage output
S2	AI mode selection	ON	Current Input
		OFF	Voltage input
S3	Temperature sensor selection	ON	PTC130 (single-core/three-core)
		OFF	PT100/PT1000/KTY84-130

9.8.13.3 MD-PG-AU1 Terminals Descriptions

Interface layout

The following figure shows the interface layout of the expansion card.

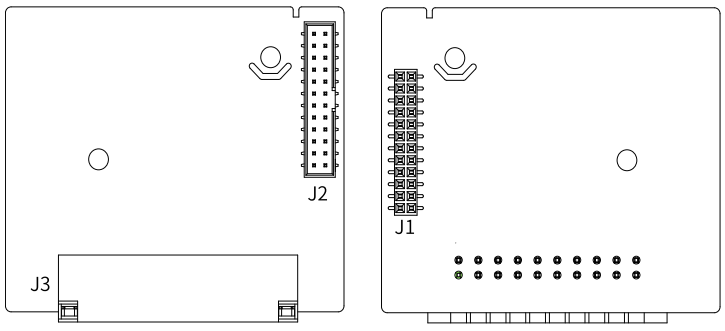


Figure 9-39 Expansion card interface

Name	Description	Remarks
J1	Interface for connecting the PG card and the control board of the drive	-
J2	PG card expansion interface for connecting another expansion card	-
J3	Encoder power supply, signal input, and frequency-division output terminals	See the following table.

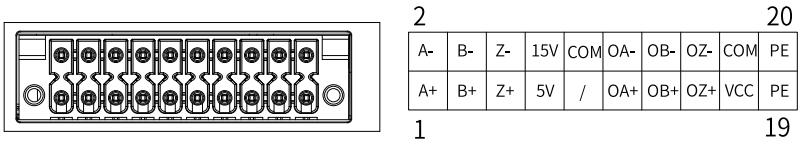


Figure 9-40 Pins of encoder signal input terminal J3

Interface description

Table 9–48 Pin definition of encoder signal input terminal J3

Pin No.	Name	Description	Notes
1	A+	External encoder input differential pair	Common/Differential mode voltage range: ±15 V Positive input threshold: VTH+ ≥ -0.02 V Negative input threshold: VTH- ≤ -0.2 V. Isolation requirement: No isolation Termination resistance requirement: Selective junction Pull-up resistance requirement: X11 + pull up 67k X11 - pull up 10k Maximum number of connected nodes: 1
2	A-		
3	B+	External encoder input differential pair	
4	B-		
5	Z+	External encoder input differential pair	
6	Z-		
7	5V	5 V power supply for the encoder	Standard voltage: +5.24 V Voltage fluctuation range: ±10% Maximum voltage ripple: 100 mV Maximum output current: 300 mA
8	15V	15 V power supply for the encoder	Standard voltage: +15.24 V Voltage fluctuation range: ±10% Maximum voltage ripple: 300 mV Maximum output current: 300 mA
9	NC	Reserved	-
10	COM	C5V/C15V power supply common ground External input power ground for frequency-division output	-

Pin No.	Name	Description	Notes
11	OA+	Frequency-division output push-pull pair	It supports both single-ended and complementary push-pull methods. When single-ended push-pull is connected, the output is from the + side. The amplitude of the frequency-division output signal follows the +EXT_VCC0 power supply, and the internal 5 V output is used by default.
12	OA–		
13	OB+	Frequency-division output push-pull pair	
14	OB–		
15	OZ+	Frequency-division output push-pull pair	
16	OZ–		
17	VCC	External input power for frequency-division output	The internal 5 V output is used by default, or a 5 V to 30 V input from external power supply can also be used.
18	COM	C5V/C15V power supply common ground External input power ground for frequency-division output	-
19	PE	Shield grounding	It is recommended that the encoder cable shield be connected to this pin.
20	PE	Shield grounding	

Note

- The ABZ incremental encoder OC level is connected to the A11+/B11+/Z11+ pins of terminal J3; the single-ended push-pull level is connected to the A11-/B11-/Z11- pins of terminal J3.
- The 23-bit magnetic encoder is connected to the A11+/A11- pins of terminal J3.
- The DATA differential signal terminal of the SSI, Endat, and BISS encoders is connected to A11+/A11- pins of terminal J3, and CLOCK to B11+/B11-pins.
- You need to select the encoder type in the background properly to enable the PG card to work.

Status indicators

Bit No.	Type	State	Function
STA	PG card status indicator (green)	Flashing	Communication between the PG card and the control board is abnormal.
		Solid ON	Communication between PG card and control board is normal.
ERR	PG card fault indicator (red)	OFF	Normal
		Flashing	PG card operation is interfered.
		Solid ON	PG card operation is abnormal. Faults such as encoder disconnection, frame fault, and data check fault occur.

9.8.13.4 MD-PG-S1 Terminals Descriptions

Interface layout

The following figure shows the interface layout of the expansion card.

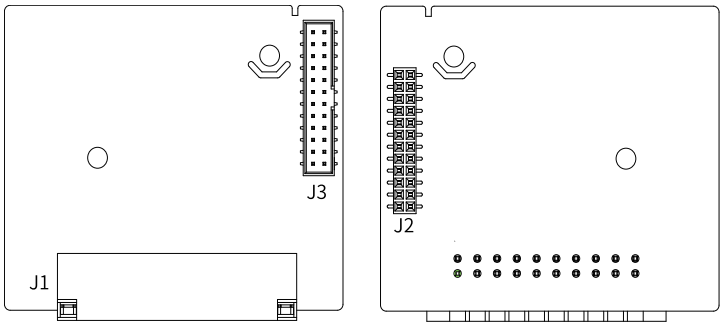


Figure 9-41 Expansion card interface

Name	Description	Remarks
J1	Encoder input and frequency-division output	User terminal
J2	Encoder power supply and communication	Connected to the control board
J3	PG card expansion interface for connecting another expansion card	Cascaded with the next-level expansion card

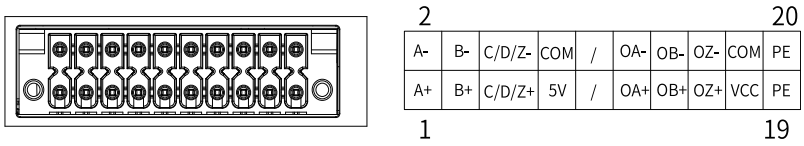


Figure 9-42 Pins of encoder signal input terminal J1

Interface description

Table 9–49 Pin definition of encoder signal input terminal J1

Pin No.	Name	Description	Notes
1	A+	Analog encoder signal differential pair	Sin/Cos: A/B/CDZ signal Differential mode voltage: Vpp = 0.6 V to 1.0 V to 1.2 V. Common mode voltage: Vcm = 3.0 V (Max.)
2	A-		
3	B+		
4	B-		
5	CDZ+		
6	CDZ-		
7	+C5V	5 V power supply	Standard voltage: +5.24 V Voltage fluctuation range: ±5% Maximum output current 300 mA
8	COM	External encoder ground	-
9	NC	Reserved	-
10	NC	Reserved	-
11	DIV_a+	Frequency-division output push-pull pair	It supports both single-ended and complementary push-pull methods. When single-ended push-pull is connected, the is from the + side.
12	DIV_a-		
13	DIV_b+	Frequency-division output push-pull pair	
14	DIV_b-		
15	DIV_Z+	Frequency-division output push-pull pair	
16	DIV_Z-		
17	+EXT_VCC0	External input power for frequency-division output	The internal 5 V is used by default, or a 5 V to 30 V input from external power supply can also be used.
18	COM	External encoder ground	-

Pin No.	Name	Description	Notes
19	PE	Shield grounding	It is recommended that the encoder cable shield be connected to this pin.
20	PE	Shield grounding	

Status indicators

Bit No.	Type	State	Function
STA	PG card status indicator (green)	Flashing	Communication between the PG card and the control board is abnormal.
		Solid ON	Communication between PG card and control board is normal.
ERR	PG card fault indicator (red)	OFF	Normal
		Flashing	PG card operation is interfered.
		Solid ON	PG card operation is abnormal. Faults such as encoder disconnection occur.

9.8.13.5 MD-PG-R1 Terminals Descriptions

Interface layout

The following figure shows the interface layout of the expansion card.

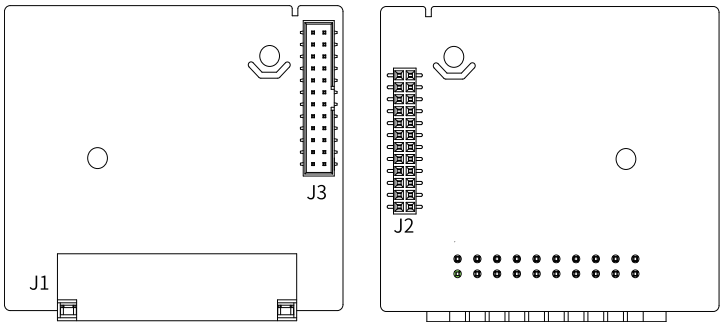


Figure 9-43 Expansion card interface

Name	Description	Remarks
J1	Encoder input and frequency-division output	User terminal
J2	Encoder power supply and communication	Connected to the control board
J3	PG card expansion interface for connecting another expansion card	Cascaded with the next-level expansion card

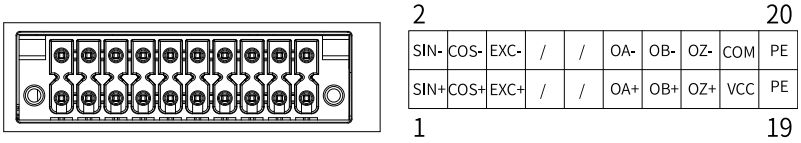


Figure 9-44 Pins of encoder signal input terminal J1

Interface description

Table 9–50 Pin definition of encoder signal input terminal J1

Pin No.	Name	Description	Notes
1	SIN+	Analog encoder signal differential pair	Resolver: SIN/COS/EXC signal Excitation output: Vpp = 18.8 V to 19.8 V to 21.1 V Excitation frequency: 10 kHz/12 kHz/15 kHz/20 kHz (adjustable)
2	SIN-		
3	COS+		
4	COS-		
5	EXC+		
6	EXC-		
7	NC	Reserved	-
8	NC		
9	NC		
10	NC		
11	DIV_a+	Frequency-division output push-pull pair	It supports both single-ended and complementary push-pull methods. When single-ended push-pull is connected, the is from the + side.
12	DIV_a-		
13	DIV_b+	Frequency-division output push-pull pair	
14	DIV_b-		
15	DIV_Z+	Frequency-division output push-pull pair	
16	DIV_Z-		
17	+EXT_VCC0	External input power for frequency-division output	The internal 5 V is used by default, or a 5 V to 30 V input from external power supply can also be used.
18	COM	External encoder ground	-
19	PE	Shield grounding	It is recommended that the encoder cable shield be connected to this pin.
20	PE	Shield grounding	

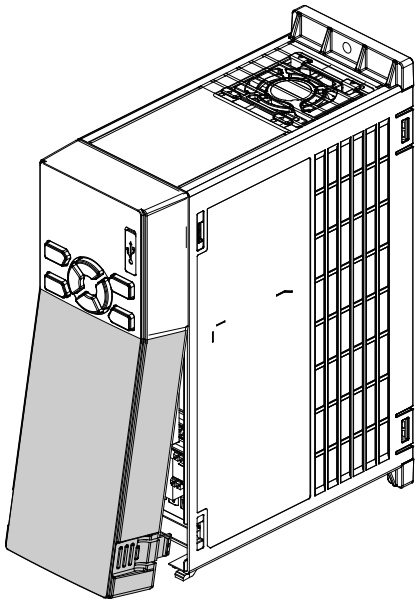
Status indicators

Bit No.	Type	State	Function
STA	PG card status indicator (green)	Flashing	Communication between the PG card and the control board is abnormal.
		Solid ON	Communication between PG card and control board is normal.
ERR	PG card fault indicator (red)	OFF	Normal
		Flashing	PG card operation is interfered.
		Solid ON	PG card operation is abnormal. Faults such as encoder disconnection occur.

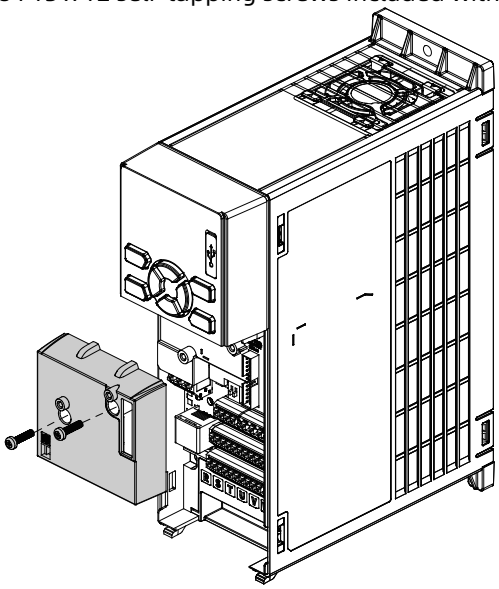
9.8.13.6 Installation

The expansion card is embedded in the MD630 series AC drive. Before installation, power off the AC drive, wait at least 10 minutes until the charging indicator on the AC drive becomes off. Then, insert the expansion card into the AC drive and fasten the screws to prevent the signal socket between boards from being damaged by external signal cable tension. The following figure describes the installation of the card.

1. Press the snap-fit joint to remove the upper cover.



2. Ensure that the expansion card and control board terminals are connected, and secure the expansion card with the two PT3 x 12 self-tapping screws included with the product.



10 Parameter

10.1 Parameter Groups

10.1.1 Introduction To Parameter Groups

Application scenarios

Parameters are grouped based on functions for easy parameter management and setup. To achieve a specific function, locate the parameter group based on the function needed.

Function description

Parameters are displayed in three-level menus.

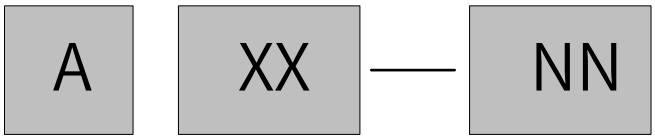


Figure 10-1 Parameter display

- The letter A indicates the level-1 menu, which is represented by one letter and corresponds to a group of complete functions. For example, group A corresponds to the system functions and group b corresponds to the command channel.
- The letter B indicates the level-2 menu, which is represented by one or two digits. The first and second level menus are combined to represent a specific group of functions. For example, group A0 is related to parameter management, and group A2 is related to system information.
- NN indicates the level-3 menu, which is represented by a 2-digit number, corresponding to a certain parameter when combined with level-1 and level-2 menus. For example, A0-00 is a system initialization parameter.
- Level-2 and level-3 menus are usually connected through the separator "-".

10.1.2 Common Parameter Groups

Application scenarios

The drive supports common parameter group (Group F), which is combined by the common parameters from other groups. You can quickly configure common functions through parameters in group F.

Function description

As shown in the figure below, all parameters in Group F are mapped from common function parameters in other groups. In this user guide, parameters that have been mapped to group F are indicated with the their locations in group F. Mapping parameters and mapped parameters in group F are equivalent in terms of function.

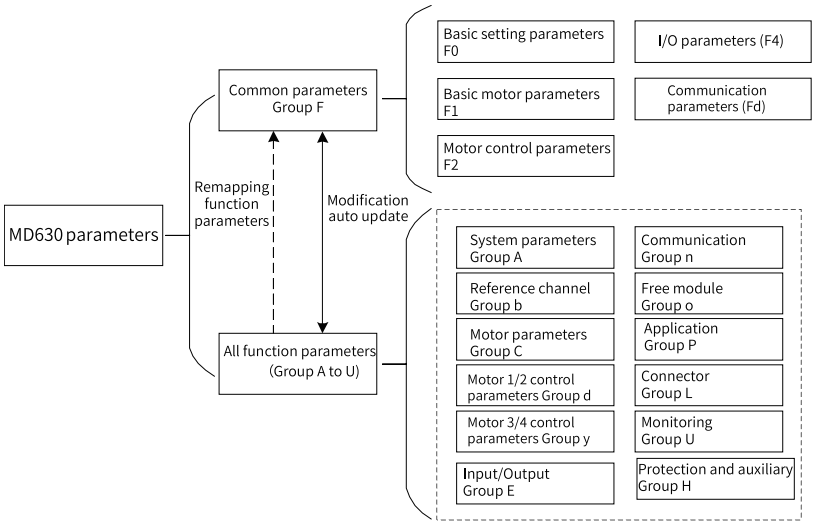


Figure 10-2 Parameter group diagram

Precautions

1. Operation commands can be set through two control channels. In group F, common parameters for operation commands in channel 1 (default channel) are provided.
2. Frequency/Torque references can be set through two setting channels. In group F, common parameters for frequency/torque references in channel 1 (default channel) are provided.
3. Multiple sets of motor parameters can be set. In group F, parameters related to motor 1 are provided.

10.2 Common Parameters (F group)

10.2.1 F0 Basic Parameter Settings

Param.	Communication address	Name	Range	Default	Unit	Change mode
F0-00	0xF000	Load type	0: High-load application 1: Light-load application	0	-	Unchangeable
F0-01	0xF001	Motor control method	0: SVC 1: FVC 2: V/f	2	-	At stop
F0-02	0xF002	Motor control mode	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
F0-03	0xF003	Main command source of control channel 1	0: Operating panel 1: Terminal 2: Communication 3: Custom	0	-	At stop
F0-06	0xF006	Input voltage class	0: 380 V to 415 V 1: 440 V to 480 V	0	-	At stop
F0-11	0xF00B	Interface macro selection	0: No action 1: Restore the parameters related to the selected interface macro to default settings 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode (valid only for MD630S) 103: Analog speed regulation in single-wire mode (valid only for MD630S) 104: Four fixed speeds in two-wire mode 2 (valid only for MD630S) 105: Analog speed regulation in two-wire mode 1 (valid only for MD630S) 106: Analog speed regulation in two-wire mode 2 (valid only for MD630S) 107: Analog speed regulation in two-wire mode 3 (valid only for MD630S) 108: Four fixed speeds in three-wire mode 2 (valid only for MD630S) 109: Analog speed regulation in three-wire mode 1 (valid only for MD630S) 110: Analog speed regulation in three-wire mode 2 (valid only for MD630S) 111: Analog PID controller (valid only for MD630S) 112: PID controller with fixed reference value (valid only for MD630S) 113: Modbus communication control macro (valid only for MD630S) 114: Modbus communication control macro with DI terminal start/stop control (valid only for MD630S) 115: Multi-channel switchover 1 (valid only for MD630S) 116: Multi-channel switchover 2 (valid only for MD630S) 117: DI terminal jog control (valid only for MD630S) 118: CANOpen communication control macro (valid only for MD630S)	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
F0-12	0xF00C	Active value of the interface macro	0: No action 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode (valid only for MD630S) 103: Analog speed regulation in single-wire mode (valid only for MD630S) 104: Four fixed speeds in two-wire mode 2 (valid only for MD630S) 105: Analog speed regulation in two-wire mode 1 (valid only for MD630S) 106: Analog speed regulation in two-wire mode 2 (valid only for MD630S) 107: Analog speed regulation in two-wire mode 3 (valid only for MD630S) 108: Four fixed speeds in three-wire mode 2 (valid only for MD630S) 109: Analog speed regulation in three-wire mode 1 (valid only for MD630S) 110: Analog speed regulation in three-wire mode 2 (valid only for MD630S) 111: Analog PID controller (valid only for MD630S) 112: PID controller with fixed reference value (valid only for MD630S) 113: Modbus communication control macro (valid only for MD630S) 114: Modbus communication control macro with DI terminal start/stop control (valid only for MD630S) 115: Multi-channel switchover 1 (valid only for MD630S) 116: Multi-channel switchover 2 (valid only for MD630S) 117: DI terminal jog control (valid only for MD630S) 118: CANOpen communication control macro (valid only for MD630S)	0	-	Unchangeable
F0-13	0xF00D	Custom macro selection	0: No action 1: Restore the parameters related to the selected custom macro to default settings 201: Standard fan (custom) 202: Standard water pump (compatible with MD100P) 203: Packaging industry (custom) 204: Ceramic industry (custom)	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
F0-14	0xF00E	Active value of the custom macro	0: No action 201: Standard fan (custom) 202: Standard water pump (compatible with MD100P) 203: Packaging industry (custom) 204: Ceramic industry (custom)	0	-	Unchangeable
F0-15	0xF00F	Load control optimization macro	0: No action 1: Restore the related parameters of the selected load control optimization macro to default settings 601: Fan and water pump macro 602: Air compressor and air conditioner macro 603: Quick start and quick stop macro 604: High dynamic response macro 605: Large inertia load macro	0	-	At stop
F0-16	0xF010	Active value of the load control optimization macro	0: No action 601: Fan and water pump macro 602: Air compressor and air conditioner macro 603: Quick start and quick stop macro 604: High dynamic response macro 605: Large inertia load macro	0	-	Unchangeable
F0-25	0xF019	Decimal places of frequency reference	1: One decimal place 2: Two decimal places	2	-	At stop
F0-29	0xF01D	Main frequency source	0: F0-30 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
F0-30	0xF01E	Digital setting of main frequency	0.00 to A2-17	50.00	Hz	Real-time
F0-31	0xF01F	Auxiliary frequency source	0: Invalid 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
F0-32	0xF020	Calculation relationship between main and auxiliary frequencies	0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max. (main frequency, auxiliary frequency) 3: Min. (main frequency, auxiliary frequency) 4: Main frequency x auxiliary frequency 5: Main/auxiliary frequency switchover	0	-	Real-time
F0-33	0xF021	Additional frequency source	0: Invalid 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
F0-34	0xF022	Source of main frequency gain factor	0: 100% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
F0-38	0xF026	Multi-reference 0 setting mode	0: F0-39 1: AI1 2: AI2 4: HDI pulse (valid only for MD630S) 5: PID 6: Digital setting of main frequency (b5-01/b6-01) for the current valid channel Others: F connector	0	-	Real-time
F0-39	0xF027	Multi-reference 0	b8-43 to b8-42	0.0	-	Real-time
F0-40	0xF028	Multi-reference 1	b8-43 to b8-42	0.0	-	Real-time
F0-41	0xF029	Multi-reference 2	b8-43 to b8-42	0.0	-	Real-time
F0-42	0xF02A	Multi-reference 3	b8-43 to b8-42	0.0	-	Real-time
F0-45	0xF02D	Ramp-up/down mode	0: Linear 1: S-curve	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
F0-46	0xF02E	Ramp-up/down time base	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	1	-	Real-time
F0-48	0xF030	Ramp-up time of ramp 1	0.0 to 6500.0	20.0	s	Real-time
F0-49	0xF031	Ramp-down time of ramp 1	0.0 to 6500.0	20.0	s	Real-time
F0-50	0xF032	Ramp-up start arc of ramp 1	0.00 to 650.00	0.00	s	Real-time
F0-51	0xF033	Ramp-up end arc of ramp 1	0.00 to 650.00	0.00	s	Real-time
F0-52	0xF034	Ramp-down start arc of ramp 1	0.00 to 650.00	0.00	s	Real-time
F0-53	0xF035	Ramp-down end arc of ramp 1	0.00 to 650.00	0.00	s	Real-time
F0-56	0xF038	Jog 1 frequency source	0: F0-57 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
F0-57	0xF039	Digital factor of jog 1 frequency	-50.00 to +50.00	2.00	Hz	Real-time
F0-58	0xF03A	Source of jog frequency 2	0: F0-59 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
F0-59	0xF03B	Digital setting of jog 2 frequency	-50.00 to +50.00	-2.00	Hz	Real-time
F0-62	0xF03E	Jog ramp source	0: Ramp time of normal operation 1: Ramp time of jog	0	-	Real-time
F0-63	0xF03F	Ramp-up time in jog	0.00 to 650.00	20.00	s	Real-time
F0-64	0xF040	Ramp-down time in jog	0.00 to 650.00	20.00	s	Real-time

10.2.2 F1 Basic Parameters of Motor 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
F1-00	0xF100	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnet 4: Synchronous reluctance motor with permanent magnet	0	-	At stop
F1-01	0xF101	Rated motor power	0.01 to 655.35	3.70	kW	At stop
F1-03	0xF103	Rated motor voltage	1 to 2000	380	V	At stop
F1-04	0xF104	Rated motor current	0.01 to 655.35	9.00	A	At stop
F1-06	0xF106	Rated motor frequency	0.01 to 599.00	50.00	Hz	At stop
F1-07	0xF107	Rated motor speed	1 to 65535	1460	rpm	At stop
F1-10	0xF10A	Maximum motor frequency	F1-06 to 599.00	50.00	Hz	At stop
F1-11	0xF10B	Minimum motor frequency	0.00 to F1-10	0.00	Hz	At stop
F1-12	0xF10C	Synchronous motor back EMF	0.0 to 6553.5	300.0	V	Real-time
F1-13	0xF10D	Maximum motor current	0.0 to 1000.0	1000.0	%	Real-time
F1-14	0xF10E	Number of motor pole pairs (number of poles/2)	0 to 128	0	-	At stop
F1-15	0xF10F	Number of effective motor pole pairs	0 to 128	0	-	Unchangeable
F1-20	0xF114	Stator resistance	0.001 to 65.535	1.204	Ω	Real-time
F1-22	0xF116	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real-time
F1-24	0xF118	Leakage inductance of asynchronous motor stator	0.01 to 655.35	5.28	mH	Real-time
F1-26	0xF11A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
F1-28	0xF11C	Asynchronous motor mutual inductance	0.1 to 6553.5	156.8	mH	Real-time
F1-30	0xF11E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real-time
F1-32	0xF120	D-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real-time
F1-34	0xF122	Q-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real-time
F1-48	0xF130	Inertia ratio	0.0 to 6553.5	120.0	%	At stop
F1-49	0xF131	Electromechanical time constant	0.01 to 655.35	1.00	s	Unchangeable
F1-55	0xF137	Motor brake control	0: Disable 1: Enable	1	-	At stop
F1-69	0xF145	Motor parameter auto-tuning mode	0: No action 1: Auto-tuning of some parameters for asynchronous motor in static state 2: Auto-tuning of asynchronous motor in dynamic state 3: Auto-tuning of all parameters for asynchronous motor in static state 4: Inertia auto-tuning 5: Dead zone auto-tuning 7: Inductance auto-tuning 8: Back EMF auto-tuning 11: With-load auto-tuning of permanent magnet motor (excluding back EMF) 12: No-load auto-tuning of permanent magnet motor in dynamic state 13: Auto-tuning of some parameters of permanent magnet motor in static state 14: UV gain deviation auto-tuning 21: Auto-tuning of synchronous reluctance motor in static state 22: Auto-tuning of synchronous reluctance motor in dynamic state	0	-	At stop

10.2.3 F2 Control Parameters of Motor 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
F2-00	0xF200	Speed loop Kp in FVC mode	0.0 to 6000.0	8.0	-	Real-time
F2-01	0xF201	Speed loop Ti in FVC mode	0.000 to 20.000	0.080	s	Real-time
F2-02	0xF202	Speed loop Kp in SVC mode	0.0 to 6000.0	5.0	-	Real-time
F2-03	0xF203	Speed loop Ti in SVC mode	0.000 to 20.000	0.127	s	Real-time
F2-04	0xF204	Zero speed switchover frequency	0.0 to d3-09	1.0	%	Real-time
F2-05	0xF205	Zero speed Kp correction coefficient	0.0 to 1000.0	100.0	%	Real-time
F2-06	0xF206	Zero speed Ti correction coefficient	0.0 to 1000.0	100.0	%	Real-time
F2-07	0xF207	Low speed switchover frequency	0.0 to d3-12	10.0	%	Real-time
F2-08	0xF208	Low speed Kp correction coefficient	0.0 to 1000.0	100.0	%	Real-time
F2-09	0xF209	Low speed Ti correction coefficient	0.0 to 1000.0	100.0	%	Real-time
F2-10	0xF20A	High speed switchover frequency	d3-09 to 400.0	100.0	%	Real-time
F2-11	0xF20B	High speed Kp correction coefficient	0.0 to 1000.0	100.0	%	Real-time
F2-12	0xF20C	High speed Ti correction coefficient	0.0 to 1000.0	100.0	%	Real-time
F2-14	0xF20E	Motor direction selection	0: Default direction 1: Opposite direction	0	-	At stop
F2-15	0xF20F	Startup mode	Ones: Asynchronous motor startup mode 0: Direct start 1: Flying start Tens: Synchronous motor startup mode 0: Same as the startup mode of the ones place 1: Forced to flying start Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	10	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
F2-16	0xF210	Flying start mode	0: Starting from the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented flying start	4	-	Real-time
F2-17	0xF211	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop with maximum capability	0	-	Real-time
F2-20	0xF214	Positive speed permission	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time
F2-21	0xF215	Negative speed selection	Same as F2-20	1	-	Real-time
F2-22	0xF216	Digital setting of forward frequency upper limit 1	F2-26 to 800.0	800.0	%	At stop
F2-23	0xF217	Digital setting of reverse frequency upper limit 1	-800.0 to F2-27	-800.0	%	At stop
F2-24	0xF218	Source of forward frequency upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
F2-25	0xF219	Source of reverse frequency upper limit 2	0: -800 % 1: Opposite to the forward frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
F2-26	0xF21A	Digital setting of forward frequency lower limit 1	0.0 to F2-22	0.0	%	At stop
F2-27	0xF21B	Digital setting of reverse frequency lower limit 1	F2-23 to 0.0	0.0	%	At stop
F2-30	0xF21E	Digital setting of torque upper limit 1	0.0 to 800.0	200.0	%	Real-time
F2-31	0xF21F	Digital setting of torque lower limit 1	-800.0 to 0.0	-200.0	%	Real-time
F2-32	0xF220	Source of torque upper limit 2	Same as F2-24	0	-	Real-time
F2-33	0xF221	Source of torque lower limit 2	Same as F2-25	1	-	Real-time
F2-36	0xF224	Overexcitation gain (V/f)	0 to 200	64	%	Real-time
F2-37	0xF225	Overcurrent suppression enable	0: Disable 1: Enable	1	-	At stop
F2-38	0xF226	Overcurrent suppression threshold	80 to 300	200	%	At stop
F2-39	0xF227	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode bit1: Overvoltage suppression enable in vector control mode bit0 to bit1: 0: Disable 1: Enable bit2 to bit15: Reserved	0x0001	-	Real-time
F2-40	0xF228	Voltage threshold for overvoltage suppression	600.0 to A3-57	770.0	V	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
F2-43	0xF22B	Response to undervoltage	0: Not act 1: Suppress undervoltage 2: Decelerate to stop	1	-	Real-time
F2-44	0xF22C	Voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Real-time
F2-48	0xF230	Overmodulation coefficient	50.0 to 110.0	105.0	%	Real-time
F2-50	0xF232	Set carrier frequency	0.8 to 20.0	4.0	kHz	Real-time
F2-51	0xF233	Effective carrier frequency	0.8 to 20.0	4.0	kHz	Unchangeable

10.2.4 F3 Encoder Parameters

Param.	Communication address	Name	Range	Default	Unit	Change mode
F3-00	0xF300	Encoder type	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BISS encoder	0	-	At stop
F3-02	0xF302	Encoder pulses per revolution	1 to 65535	1024	-	At stop
F3-03	0xF303	Phase sequence of encoder	0: Forward 1: Reverse	0	-	At stop
F3-04	0xF304	Encoder mounting position angle	0.0 to 359.9	0.0	°	At stop
F3-05	0xF305	Filter time constant for encoder speed measurement	0.0000 to 6.0000	0.0040	s	Real-time
F3-13	0xF30D	Number of resolver pole pairs	1 to 65535	1	-	At stop
F3-18	0xF312	ABZ encoder level type	1: Differential output 2: TTL complementary push-pull output 3: HTL complementary push-pull output 4: TTL single-ended push-pull output 5: HTL single-ended push-pull output 6: OC output	1	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
F3-51	0xF333	Single-turn resolution of communication-type encoder	1 to 32	23	-	At stop
F3-52	0xF334	Multi-turn resolution of communication-type encoder	0 to 32	0	-	At stop

10.2.5 F4 I/O Parameters

Param.	Communication address	Name	Range	Default	Unit	Change mode
F4-00	0xF400	Terminal start/stop module A/B selection	0: Module A 1: Module B Others: B connector	0	-	At stop
F4-01	0xF401	Mode of terminal start/stop module A	0: Disable 1: IN1 for start 2: IN1 for start and IN2 for direction 3: IN1 for forward start and IN2 for reverse start 4: IN1P (rising edge) for start and IN2 for stop 5: IN1P (rising edge) for start, IN2 for stop, and IN3 for direction 6: IN1P (rising edge) for forward start, IN2P (rising edge) for reverse start, and IN3 for stop	3	-	At stop
F4-02	0xF402	Mode of terminal start/stop module B	0: Disable 1: IN1 for start 2: IN1 for start and IN2 for direction 3: IN1 for forward start and IN2 for reverse start 4: IN1P (rising edge) for start and IN2 for stop 5: IN1P (rising edge) for start, IN2 for stop, and IN3 for direction 6: IN1P (rising edge) for forward start, IN2P (rising edge) for reverse start, and IN3 for stop	3	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
F4-03	0xF403	DI1 function selection	0: No function 1: Terminal start/stop module A_IN1 2: Terminal start/stop module A_IN2 3: Terminal start/stop module A_IN3 4: Terminal start/stop module A jog 1 (JOG1) 5: Terminal start/stop module A jog 2 (JOG2) 6: Function as UP key for frequency adjustment 7: Function as DOWN key for frequency adjustment 8: Coast to stop 9: Fault reset (RESET) 10: Operation pause (terminal control) 11: External fault NO input 12: Multi-reference selection bit0 13: Multi-reference selection bit1 14: Multi-reference selection bit2 15: Multi-reference selection bit3 16: Ramp selection bit0 17: Ramp selection bit1 19: Clear data set by terminal functioning as UP/DOWN key 21: Acceleration/Deceleration inhibited 22: PID pause 23: Simple PLC status reset 24: Swing frequency pause 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enabled 35: PID action direction reversal 36: External stop terminal 1 38: PID integral pause 39: Main/auxiliary frequency switchover (Continued)	1	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
F4-03	0xF403	DI1 function selection	(Continued) 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed/Torque control selection 47: Emergency stop 49: DC braking during deceleration 50: Clear the current operating time 61: Terminal start/stop module B_IN1 62: Terminal start/stop module B_IN2 63: Terminal start/stop module B_IN3 64: Terminal start/stop module B jog 1 (JOG1) 65: Terminal start/stop module B jog 2 (JOG2) 66: Forced to local control 67: Forced to terminal control 68: Forced to communication control 69: Forced to custom control 70: Control channel selection 71: Setting channel selection 72: Terminal start/stop module A/B selection 76: Motor selection terminal 2 77: Running enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	1	-	At stop
F4-04	0xF404	DI2 function selection	Same as F4-03	4	-	At stop
F4-05	0xF405	DI3 function selection	Same as F4-03	9	-	At stop
F4-06	0xF406	DI4 function selection	Same as F4-03	12	-	At stop
F4-07	0xF407	DI5 function selection	Same as F4-03	13	-	At stop
F4-08	0xF408	DI6 function selection	Same as F4-03	0	-	At stop
F4-09	0xF409	DI7 function selection	Same as F4-03	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
F4-14	0xF40E	RO1 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency level detection FDT1 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 11: Simple PLC cycle completed 12: Cumulative running time reached 13: Swing frequency limited 14: Torque limited 15: Ready to run 17: Frequency upper limit reached 18: Frequency lower limit reached (no output at stop) 19: Undervoltage state 20: Communication setting (address: 0x7312) 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reached 25: Frequency level detection FDT2 26: Frequency 1 reached 27: Frequency 2 reached 28: Current 1 reached 29: Current 2 reached 30: Timing reached 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature reached 36: Output current limit exceeded 37: Frequency lower limit reached (output at stop) 38: Abnormality (fault/minor fault/ warning) 40: Current operating time reached 41: Fault (excluding undervoltage) 42: STO 43: Minor fault or alarm 44: AI2 input limit exceeded 46: Component service life warning Others: B connector	2	-	Real-time
F4-15	0xF40F	DO1 function selection	Same as F4-14	0	-	Real-time
F4-16	0xF410	FMR (HDO) output function selection	Same as F4-14	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
F4-21	0xF415	AI1 filter time	0.00 to 10.00	0.10	s	Real-time
F4-22	0xF416	AI2 filter time	0.00 to 10.00	0.10	s	Real-time
F4-27	0xF41B	AI curve selection	Ones: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens: AI2 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Hundreds: Reserved Thousands: Reserved	0x0021	-	Real-time
F4-28	0xF41C	Minimum input of AI curve 1	-10.00 to F4-30	0.00	V	Real-time
F4-29	0xF41D	Percentage corresponding to the minimum input of AI curve 1	-800.0 to +800.0	0.0	%	Real-time
F4-30	0xF41E	Maximum input of AI curve 1	F4-28 to 10.00	10.00	V	Real-time
F4-31	0xF41F	Percentage corresponding to the maximum input of AI curve 1	-800.0 to +800.0	100.0	%	Real-time
F4-32	0xF420	Minimum input of AI curve 2	-10.00 to F4-34	0.00	V	Real-time
F4-33	0xF421	Percentage corresponding to the minimum input of AI curve 2	-800.0 to +800.0	0.0	%	Real-time
F4-34	0xF422	Maximum input of AI curve 2	F4-32 to 10.00	10.00	V	Real-time
F4-35	0xF423	Percentage corresponding to the maximum input of AI curve 2	-800.0 to +800.0	100.0	%	Real-time
F4-36	0xF424	Minimum input of AI curve 3	-10.00 to F4-38	0.00	V	Real-time
F4-37	0xF425	Percentage corresponding to the minimum input of AI curve 3	-800.0 to +800.0	0.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
F4-38	0xF426	Maximum input of AI curve 3	F4-36 to 10.00	10.00	V	Real-time
F4-39	0xF427	Percentage corresponding to the maximum input of AI curve 3	-800.0 to +800.0	100.0	%	Real-time
F4-40	0xF428	Minimum input of AI curve 4	-10.00 to F4-42	0.00	V	Real-time
F4-41	0xF429	Percentage corresponding to the minimum input of AI curve 4	-800.0 to +800.0	0.0	%	Real-time
F4-42	0xF42A	Inflection point 1 input of AI curve 4	F4-40 to F4-44	3.00	V	Real-time
F4-43	0xF42B	Percentage corresponding to inflection point 1 input of AI curve 4	-800.0 to +800.0	30.0	%	Real-time
F4-44	0xF42C	Inflection point 2 input of AI curve 4	F4-42 to F4-46	6.00	V	Real-time
F4-45	0xF42D	Percentage corresponding to inflection point 2 input of AI curve 4	-800.0 to +800.0	60.0	%	Real-time
F4-46	0xF42E	Maximum input of AI curve 4	F4-44 to 10.00	10.00	V	Real-time
F4-47	0xF42F	Percentage corresponding to the maximum input of AI curve 4	-800.0 to +800.0	100.0	%	Real-time
F4-48	0xF430	Minimum input of AI curve 5	-10.00 to F4-50	-10.00	V	Real-time
F4-49	0xF431	Percentage corresponding to the minimum input of AI curve 5	-800.0 to +800.0	-100.0	%	Real-time
F4-50	0xF432	Inflection point 1 input of AI curve 5	F4-48 to F4-52	-3.00	V	Real-time
F4-51	0xF433	Percentage corresponding to inflection point 1 input of AI curve 5	-800.0 to +800.0	-30.0	%	Real-time
F4-52	0xF434	Inflection point 2 input of AI curve 5	F4-50 to F4-54	3.00	V	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
F4-53	0xF435	Percentage corresponding to inflection point 2 input of AI curve 5	-800.0 to +800.0	30.0	%	Real-time
F4-54	0xF436	Maximum input of AI curve 5	F4-52 to 10.00	10.00	V	Real-time
F4-55	0xF437	Percentage corresponding to the maximum input of AI curve 5	-800.0 to +800.0	100.0	%	Real-time
F4-59	0xF43B	AO1 function selection	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (address: 0x7313) 13: Motor speed 14: Output current. 100.0% corresponds to 1000.0 A. 15: Bus voltage. 100.0% corresponds to 1000.0 V. 16: Output torque (actual value) 17: Taper output 18: Roll diameter output 19: Tension output Others: F connector	0	-	Real-time
F4-60	0xF43C	Percentage corresponding to the minimum input of AO curve	-800.0 to F4-62	0.0	%	Real-time
F4-61	0xF43D	Minimum input of AO curve	0.00 to 10.00	0.00	V	Real-time
F4-62	0xF43E	Percentage corresponding to the maximum input of AO curve	F4-60 to 800.0	100.0	%	Real-time
F4-63	0xF43F	Maximum input of AO curve	0.00 to 10.00	10.00	V	Real-time
F4-68	0xF444	HDI terminal type selection	0: Used as HDI 1: Used as DI	1	-	At stop
F4-69	0xF445	HDI input enable state	0: Disable 1: Enable Others: B connector	0	-	Unchangeable

Param.	Communication address	Name	Range	Default	Unit	Change mode
F4-70	0xF446	HDI curve setting	Ones: HDI curve selection 0: Two-point curve 1: Four-point curve Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
F4-71	0xF447	Minimum input of HDI two-point curve	0.00 to F4-73	0.00	kHz	Real-time
F4-72	0xF448	Percentage corresponding to the minimum input of HDI two-point curve	-800.0 to +800.0	0.0	%	Real-time
F4-73	0xF449	Maximum input of HDI two-point curve	F4-71 to 20.00	20.00	kHz	Real-time
F4-74	0xF44A	Percentage corresponding to the maximum input of HDI two-point curve	-800.0 to +800.0	100.0	%	Real-time
F4-75	0xF44B	Minimum input of HDI four-point curve	0.00 to F4-77	0.00	kHz	Real-time
F4-76	0xF44C	Percentage corresponding to the minimum input of HDI four-point curve	-800.0 to +800.0	-100.0	%	Real-time
F4-77	0xF44D	Inflection point 1 input of HDI four-point curve	F4-75 to F4-79	5.00	kHz	Real-time
F4-78	0xF44E	Percentage corresponding to inflection point 1 input of HDI four-point curve	-800.0 to +800.0	-30.0	%	Real-time
F4-79	0xF44F	Inflection point 2 input of HDI four-point curve	F4-77 to F4-81	10.00	kHz	Real-time
F4-80	0xF450	Percentage corresponding to inflection point 2 input of HDI four-point curve	-800.0 to +800.0	30.0	%	Real-time
F4-81	0xF451	Maximum input of HDI four-point curve	F4-79 to 20.00	20.00	kHz	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
F4-82	0xF452	Percentage corresponding to the maximum input of HDI four-point curve	-800.0 to +800.0	100.0	%	Real-time
F4-83	0xF453	HDI filter time	0.00 to 10.00	0.10	s	Real-time
F4-88	0xF458	FM multi-functional terminal output selection	0: HDO pulse output (FMP) 1: Digital output (FMR)	0	-	Real-time
F4-89	0xF459	HDO function selection	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (address: 0x7315) 13: Motor speed 14: Output current. 100.0% corresponds to 1000.0 A. 15: Bus voltage. 100.0% corresponds to 1000.0 V. 16: Output torque (actual value) 17: Taper output 18: Roll diameter output 19: Tension output Others: F connector	0	-	Real-time
F4-90	0xF45A	Minimum input of HDO curve	-100.0 to F4-92	0.0	%	Real-time
F4-91	0xF45B	Percentage corresponding to the minimum input of HDO curve	0.00 to 100.00	0.00	%	Real-time
F4-92	0xF45C	Maximum input of HDO curve	F4-90 to 100.0	100.0	%	Real-time
F4-93	0xF45D	Percentage corresponding to the maximum input of HDO curve	0.00 to 100.00	100.00	%	Real-time
F4-97	0xF461	Maximum frequency of HDO output	0.01 to 100.00	50.00	kHz	Real-time

10.2.6 Fd Basic Communication Parameters

Param.	Communication address	Name	Range	Default	Unit	Change mode
Fd-00	0xFD00	Commissioning address (used by commissioning software/operating panel)	1 to 127	1	-	At stop
Fd-01	0xFD01	Communication type selection	1: EtherCAT 2: EtherNet/IP 3: PROFINET 4: Modbus TCP	1	-	At stop
Fd-04	0xFD04	Modbus communication effectiveness	0: Not supported by the current device 1: Active	0	-	Unchangeable
Fd-05	0xFD05	Modbus communication baud rate	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5	-	At stop
Fd-06	0xFD06	Modbus data format	0: 8-N-2 (No check) 1: 8-E-1 (Even parity) 2: 8-O-1 (Odd parity) 3: 8-N-1 (No check)	0	-	Real-time
Fd-07	0xFD07	Modbus local address	1 to 247	1	-	At stop
Fd-08	0xFD08	Modbus response delay time	0 to 20	2	ms	Real-time
Fd-09	0xFD09	Modbus communication timeout time	0.0 to 6000.0	0.0	s	Real-time
Fd-13	0xFD0D	CAN communication	0: Not supported by the current device 1: Active	0	-	Unchangeable
Fd-14	0xFD0E	CAN communication protocol selection	1: CANopen 2: CANlink	2	-	Real-time
Fd-15	0xFD0F	CANopen baud rate	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	5	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
Fd-16	0xFD10	CANopen station number	1 to 127	1	-	At stop
Fd-20	0xFD14	CANlink baud rate	Same as Fd-15	5	-	At stop
Fd-21	0xFD15	CANlink station number	1 to 63	1	-	At stop
Fd-28	0xFD1C	Number of CAN frames received per unit time	0 to 65535	0	-	Unchangeable
Fd-29	0xFD1D	Maximum number of errors received through CAN	0 to 65535	0	-	Unchangeable
Fd-30	0xFD1E	Maximum number of errors transmitted through CAN	0 to 65535	0	-	Unchangeable
Fd-31	0xFD1F	Number of CAN bus disconnections per unit time	0 to 65535	0	-	Unchangeable
Fd-32	0xFD20	CAN communication disconnection coefficient	1 to 15	3	-	At stop
Fd-39	0xFD27	EtherCAT station name	0 to 65535	0	-	Unchangeable
Fd-40	0xFD28	EtherCAT slave alias	0 to 65535	0	-	Real-time
Fd-41	0xFD29	EtherCAT station alias backup	0 to 65535	0	-	Unchangeable
Fd-47	0xFD2F	MAC1 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x0070	-	Unchangeable
Fd-48	0xFD30	MAC2 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00CA	-	Unchangeable
Fd-49	0xFD31	MAC3 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x004D	-	Unchangeable
Fd-50	0xFD32	MAC4 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Unchangeable
Fd-51	0xFD33	MAC5 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Unchangeable
Fd-52	0xFD34	MAC6 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Unchangeable
Fd-58	0xFD3A	EtherNet/IP-DHCP enable	0: Disable 1: Enable	0	-	At stop
Fd-59	0xFD3B	EtherNet/IP-Most significant byte of IP address	0 to 255	0	-	At stop
Fd-60	0xFD3C	EtherNet/IP-Second most significant byte of IP address	0 to 255	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
Fd-61	0xFD3D	EtherNet/IP-Third byte of IP address	0 to 255	0	-	At stop
Fd-62	0xFD3E	EtherNet/IP-Least significant byte of IP address	0 to 255	0	-	At stop
Fd-63	0xFD3F	EtherNet/IP-Most significant byte of subnet mask	0 to 255	0	-	At stop
Fd-64	0xFD40	EtherNet/IP-Second most significant byte of subnet mask	0 to 255	0	-	At stop
Fd-65	0xFD41	EtherNet/IP-Third byte of subnet mask	0 to 255	0	-	At stop
Fd-66	0xFD42	EtherNet/IP-Least significant byte of subnet mask	0 to 255	0	-	At stop
Fd-67	0xFD43	EtherNet/IP-Most significant byte of gateway	0 to 255	0	-	At stop
Fd-68	0xFD44	EtherNet/IP-Second most significant byte of gateway	0 to 255	0	-	At stop
Fd-69	0xFD45	EtherNet/IP-Third byte of gateway	0 to 255	0	-	At stop
Fd-70	0xFD46	EtherNet/IP-Least significant byte of gateway	0 to 255	0	-	At stop
Fd-76	0xFD4C	PROFINET-Most significant byte of the IP address	0 to 65535	0	-	Unchangeable
Fd-77	0xFD4D	PROFINET-Second most significant byte of the IP address	0 to 65535	0	-	Unchangeable
Fd-78	0xFD4E	PROFINET-Third byte of the IP address	0 to 65535	0	-	Unchangeable
Fd-79	0xFD4F	PROFINET-Least significant byte of the IP address	0 to 65535	0	-	Unchangeable
Fd-80	0xFD50	PROFINET-Most significant byte of the subnet mask	0 to 65535	0	-	Unchangeable
Fd-81	0xFD51	PROFINET-Second most significant byte of the subnet mask	0 to 65535	0	-	Unchangeable
Fd-82	0xFD52	PROFINET-Third byte of subnet mask	0 to 65535	0	-	Unchangeable

Param.	Communication address	Name	Range	Default	Unit	Change mode
Fd-83	0xFD53	PROFINET-Least significant byte of subnet mask	0 to 65535	0	-	Unchangeable
Fd-84	0xFD54	PROFINET-Most significant byte of gateway	0 to 65535	0	-	Unchangeable
Fd-85	0xFD55	PROFINET-Second most significant byte of gateway	0 to 65535	0	-	Unchangeable
Fd-86	0xFD56	PROFINET-Third byte of gateway	0 to 65535	0	-	Unchangeable
Fd-87	0xFD57	PROFINET-Least significant byte of gateway	0 to 65535	0	-	Unchangeable

10.3 A System Parameters

10.3.1 A0 Parameter Management

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
A0-00	0xA000	Parameter initialization	0: No operation 1: Restore parameters excluding motor parameters to default settings 2: Clear record information 3: Restore parameters including motor parameters to default settings 4: Back up current user parameters 5: Clear fault information 501: Restore user backup parameters 503: Restore parameters including motor parameters to default settings and clear records	0	-	Change at stop
A0-10	0xA00A	System parameter access level	0: Standard 1: Expansion 2: Expert 3: Factory	0	-	Unchangeable
A0-11	0xA00B	Parameter access level setting	0: Standard 1: Expansion 2: Expert	0	-	Real-time
A0-14	0xA00E	Expert password status	0: Invalid (no expert password assigned) 1: Locked (expert password set) 2: Unlocked (expert password set)	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
A0-15	0xA00F	Expert password input	0 to 65535	0	-	Real-time
A0-20	0xA014	Manufacturer password status	1: Factory password lock 2: Factory password unlock	0	-	Unchangeable
A0-21	0xA015	Factory password input	0 to 65535	0	-	Real-time
A0-22	0xA016	Exit manufacturer level	0: No operation 1: Exit	0	-	Real-time
A0-30	0xA01E	Parameter lock status	0: Parameter lock inactive (parameter lock not set) 1: Parameter lock locked (parameter lock set) 2: Parameter lock unlocked (parameter lock set)	0	-	Unchangeable
A0-31	0xA01F	Parameter lock setting	0 to 65535	0	-	Real-time
A0-32	0xA020	Unlock effective time of parameter lock	60 to 65535	3600	s	Real-time
A0-33	0xA021	Lock parameter lock	0: No operation 1: Lock	0	-	Real-time
A0-37	0xA025	Clear backed-up parameter	0: No operation 500: Clear all user parameters that backed up	0	-	Change at stop
A0-38	0xA026	Backed-up parameter restoration	0: No operation 500: Restore user backup parameters	0	-	Change at stop
A0-39	0xA027	User backup	0: No operation 400: User parameter backup	0	-	Change at stop
A0-44	0xA02C	Parameter write protection	0: Disable 1: Enable	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
A0-47	0xA02F	Parameter group display on operating panel	bit0: Group F bit1: Group A bit2: Group b bit3: Group C bit4: Group d bit5: Group y bit6: Group E bit7: Group H bit8: Reserved Bit9: Group n Bit 10: Group o Bit 11: Group P bit12: Group L bit13: Group U bit0~bit13: 0: Hidden 1: Displayed bit14 to bit15: Reserved	0xFFFF	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
A0-48	0xA030	Interface macro selection	0: No operation 1: Restore the parameters related to the selected interface macro to default settings 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode (valid only for MD630S) 103: Analog speed regulation in single-wire mode (valid only for MD630S) 104: Four fixed speeds in two-wire mode 2 (valid only for MD630S) 105: Analog speed regulation in two-wire mode 1 (valid only for MD630S) 106: Analog speed regulation in two-wire mode 2 (valid only for MD630S) 107: Analog speed regulation in two-wire mode 3 (valid only for MD630S) 108: Four fixed speeds in three-wire mode 2 (valid only for MD630S) 109: Analog speed regulation in three-wire mode 1 (valid only for MD630S) 110: Analog speed regulation in three-wire mode 2 (valid only for MD630S) 111: Analog PID controller (valid only for MD630S) 112: PID controller with fixed reference value (valid only for MD630S) 113: Modbus communication control macro (valid only for MD630S) 114: Modbus communication control macro with DI terminal start/stop control (valid only for MD630S) 115: Multi-channel switchover 1 (valid only for MD630S) 116: Multi-channel switchover 2 (valid only for MD630S) 117: DI terminal jog control (valid only for MD630S) 118: CANOpen communication control macro (valid only for MD630S)	0	-	Change at stop

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
A0-49	0xA031	Effective value of the interface macro	0: No action 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode (valid only for MD630S) 103: Analog speed regulation in single-wire mode (valid only for MD630S) 104: Four fixed speeds in two-wire mode 2 (valid only for MD630S) 105: Analog speed regulation in two-wire mode 1 (valid only for MD630S) 106: Analog speed regulation in two-wire mode 2 (valid only for MD630S) 107: Analog speed regulation in two-wire mode 3 (valid only for MD630S) 108: Four fixed speeds in three-wire mode 2 (valid only for MD630S) 109: Analog speed regulation in three-wire mode 1 (valid only for MD630S) 110: Analog speed regulation in three-wire mode 2 (valid only for MD630S) 111: Analog PID controller (valid only for MD630S) 112: PID controller with fixed reference value (valid only for MD630S) 113: Modbus communication control macro (valid only for MD630S) 114: Modbus communication control macro with DI terminal start/stop control (valid only for MD630S) 115: Multi-channel switchover 1 (valid only for MD630S) 116: Multi-channel switchover 2 (valid only for MD630S) 117: DI terminal jog control (valid only for MD630S) 118: CANOpen communication control macro (valid only for MD630S)	0	-	Unchangeable
A0-50	0xA032	Custom macro selection	0: No operation 1: Restore the parameters related to the selected custom macro to default settings 201: Standard fan (custom) 202: Standard water pump (compatible with MD100P) 203: Packaging industry (custom) 204: Ceramic industry (custom)	0	-	Change at stop

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
A0-51	0xA033	Active value of the custom macro	0: No operation 201: Standard fan (custom) 202: Standard water pump (compatible with MD100P) 203: Packaging industry (custom) 204: Ceramic industry (custom)	0	-	Unchangeable
A0-52	0xA034	Load control optimization macro	0: No operation 1: Restore the related parameters of the selected load control optimization macro to default settings 601: Fan and water pump macro 602: Air compressor and air conditioner macro 603: Quick start and quick stop macro 604: High dynamic response macro 605: Large inertia load macro	0	-	Change at stop
A0-53	0xA035	Active value of the load control optimization macro	0: No action 601: Fan and water pump macro 602: Air compressor and air conditioner macro 603: Quick start and quick stop macro 604: High dynamic response macro 605: Large inertia load macro	0	-	Unchangeable
A0-70	0xA046	Frequency decimal place	1: One decimal place 2: Two decimal places	2	-	Change at stop

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
A0-71	0xA047	Number of decimal places for load speed display (group U0)	Ones: Number of decimal places for U0-14/U0-24 0: Zero decimal place 1: One decimal place 2: Two decimal places Tens position: Number of decimal places of U0-19/U0-29 1: One decimal place 2: Two decimal places Hundreds: Number of decimal places for U0-30/U0-31 0: 0 decimal places 1: One decimal place 2: Two decimal places Thousands: Number of decimal places for U0-69 1: One decimal place 2: Two decimal places Ten thousands: Reserved	2220	-	Real-time
A0-72	0xA048	User-defined parameter display	Ones place: User mode selection 0: Hide user mode 1: Show user mode Tens place: Calibration mode selection 0: Hide calibration mode 1: Show calibration mode Hundreds place: Error menu selection 0: Hide error menu 1: Show error menu Thousands: Reserved Ten thousands: Reserved	111	-	Real-time

10.3.2 A1 Active Fault and Alarm

Param.	Communication address	Name	Range	Default	Unit	Change mode
A1-00	0xA100	Active fault 1	0.0 to 6553.5	0.0	-	Unchangeable
A1-02	0xA102	Active fault 2	0.0 to 6553.5	0.0	-	Unchangeable
A1-04	0xA104	Active fault 3	0.0 to 6553.5	0.0	-	Unchangeable
A1-06	0xA106	Active fault 4	0.0 to 6553.5	0.0	-	Unchangeable
A1-08	0xA108	Active fault 5	0.0 to 6553.5	0.0	-	Unchangeable
A1-10	0xA10A	Active fault 6	0.0 to 6553.5	0.0	-	Unchangeable
A1-12	0xA10C	Active minor fault 1	0.0 to 6553.5	0.0	-	Unchangeable
A1-14	0xA10E	Active minor fault 2	0.0 to 6553.5	0.0	-	Unchangeable
A1-16	0xA110	Active minor fault 3	0.0 to 6553.5	0.0	-	Unchangeable
A1-18	0xA112	Active minor fault 4	0.0 to 6553.5	0.0	-	Unchangeable

Param.	Communication address	Name	Range	Default	Unit	Change mode
A1-20	0xA114	Active minor fault 5	0.0 to 6553.5	0.0	-	Unchangeable
A1-22	0xA116	Active minor fault 6	0.0 to 6553.5	0.0	-	Unchangeable
A1-24	0xA118	Active alarm 1	0.0 to 6553.5	0.0	-	Unchangeable
A1-26	0xA11A	Active alarm 2	0.0 to 6553.5	0.0	-	Unchangeable
A1-28	0xA11C	Active alarm 3	0.0 to 6553.5	0.0	-	Unchangeable
A1-30	0xA11E	Active alarm 4	0.0 to 6553.5	0.0	-	Unchangeable
A1-32	0xA120	Active alarm 5	0.0 to 6553.5	0.0	-	Unchangeable
A1-34	0xA122	Active alarm 6	0.0 to 6553.5	0.0	-	Unchangeable
A1-36	0xA124	Active prompt 1	0.0 to 6553.5	0.0	-	Unchangeable
A1-38	0xA126	Active prompt 2	0.0 to 6553.5	0.0	-	Unchangeable
A1-40	0xA128	Active prompt 3	0.0 to 6553.5	0.0	-	Unchangeable
A1-42	0xA12A	Active prompt 4	0.0 to 6553.5	0.0	-	Unchangeable
A1-44	0xA12C	Active prompt 5	0.0 to 6553.5	0.0	-	Unchangeable
A1-46	0xA12E	Active prompt 6	0.0 to 6553.5	0.0	-	Unchangeable

10.3.3 A2 System Information

Param.	0xA200	Communication address	Name	Range	Default	Unit	Change mode
A2-01	0xA201	-	Current per-unit base value	0.0 to 6553.5	0.0	A	Unchangeable
A2-02	0xA202	-	Speed per-unit base value	0 to 65535	0	rpm	Unchangeable
A2-04	0xA204	-	Frequency per-unit base value	0.0 to 6553.5	0.0	Hz	Unchangeable
A2-05	0xA205	-	Power per-unit base value	0.00 to 655.35	0.00	kW	Unchangeable
A2-06	0xA206	-	Torque per-unit base value	0.00 to 655.35	0.00	N·m	Unchangeable
A2-09	0xA209	-	DC voltage per-unit base value	0 to 65535	0	V	Unchangeable
A2-16	0xA210	-	Maximum output frequency of the system	0.0 to 599.0	599.0	Hz	Unchangeable
A2-17	0xA211	-	Maximum effective frequency of the motor	0.00 to 599.00	50.00	Hz	Unchangeable
A2-18	0xA212	-	Maximum effective frequency of the motor (fixed decimal place)	0.0 to 599.0	50.0	Hz	Unchangeable
A2-20	0xA214	-	Product code	0: Reserved 630: MD630	0	-	Unchangeable

Param.	0xA200	Communication address	Name	Range	Default	Unit	Change mode
A2-21	0xA215	-	Device type	0: MD630S (485 standard version) 1: MD630S (485 standard version + STO) 2: Reserved 3: MD630N (bus version) 4: MD630N (bus version+STO) 5: MD630S (CAN standard version) 6: MD630S (CAN standard version + STO)	0	-	Unchangeable
A2-22	0xA216	-	Performance major version	0.00 to 655.35	0.00	-	Unchangeable
A2-23	0xA217	-	Function major version	0.00 to 655.35	0.00	-	Unchangeable
A2-24	0xA218	-	Performance sub-version	0.00 to 655.35	0.00	-	Unchangeable
A2-25	0xA219	-	Function sub-version	0.00 to 655.35	0.00	-	Unchangeable
A2-45	0xA22D	-	Bus software (auxiliary chip) version	0 to 65535	0	-	Unchangeable
A2-62	0xA23E	-	Type of expansion card 1	0 to 65535	0	-	Unchangeable
A2-63	0xA23F	-	Version of expansion card 1	0.00 to 655.35	0.00	-	Unchangeable
A2-64	0xA240	-	Type of expansion card 2	0 to 65535	0	-	Unchangeable
A2-65	0xA241	-	Version of expansion card 2	0.00 to 655.35	0.00	-	Unchangeable
A2-68	0xA244	-	PG card model	0: No expansion card 32: Digital PG card 33: Analog PG card	0	-	Unchangeable
A2-69	0xA245	-	Main version of PG card	0.00 to 655.35	0.00	-	Unchangeable
A2-79	0xA24F	-	Per-unit base value of current (32-bit)	0.00 to 655.35	0.00	A	Unchangeable
A2-81	0xA251	-	Per-unit base value of speed(32-bit)	0.0 to 6553.5	0.0	rpm	Unchangeable
A2-83	0xA253	-	Per-unit base value of frequency (32-bit)	0.00 to 655.35	0.00	Hz	Unchangeable
A2-85	0xA255	-	Per-unit base value of power (32-bit)	0.00 to 655.35	0.00	kW	Unchangeable
A2-87	0xA257	-	Per-unit base value of torque (32-bit)	0.00 to 655.35	0.00	N·m	Unchangeable

Param.	0xA200	Communication address	Name	Range	Default	Unit	Change mode
A2-90	0xA25A	-	VRC version parameter 1	0.00 to 65535.00	0.00	-	Unchangeable
A2-91	0xA25B	-	VRC version parameter 2	0.00 to 65535.00	0.00	-	Unchangeable
A2-92	0xA25C	-	VRC version parameter 3	0.00 to 65535.00	0.00	-	Unchangeable
A2-93	0xA25D	-	VRC version parameter 4	0.00 to 65535.00	0.00	-	Unchangeable

10.3.4 A3 Model Information

Param.	Communication address	Name	Range	Default	Unit	Change mode
A3-01	0xA301	Load type	0: High-load application 1: Light-load application	0	-	At stop
A3-02	0xA302	Rated drive power	0.00 to 655.35	0.40	kW	Unchangeable
A3-03	0xA303	Rated drive current	0.0 to 6553.5	9.5	A	Unchangeable
A3-04	0xA304	Rated drive voltage	0 to 65535	380	V	Unchangeable
A3-05	0xA305	Maximum drive current	0 to 600	150	%	Real-time
A3-06	0xA306	Drive base current	0.0 to 6553.5	0.0	A	Unchangeable
A3-07	0xA307	Input voltage class	0: 380 V to 415 V 1: 440 V to 480 V	0	-	At stop
A3-30	0xA31E	Voltage drop of the drive	0.00 to 5.00	0.80	V	Real-time
A3-31	0xA31F	Dead zone curve current 1	0.0 to 150.0	1.0	%	Real-time
A3-32	0xA320	Dead zone curve current 2	0.0 to 150.0	2.0	%	Real-time
A3-33	0xA321	Dead zone curve current 3	0.0 to 150.0	5.0	%	Real-time
A3-34	0xA322	Dead zone curve current 4	0.0 to 150.0	10.0	%	Real-time
A3-35	0xA323	Dead zone curve current 5	0.0 to 150.0	20.0	%	Real-time
A3-36	0xA324	Dead zone curve current 6	0.0 to 150.0	40.0	%	Real-time
A3-37	0xA325	Dead zone curve current 7	0.0 to 150.0	60.0	%	Real-time
A3-38	0xA326	Dead zone curve current 8	0.0 to 150.0	80.0	%	Real-time
A3-39	0xA327	Dead zone curve time 1	0.0 to 300.0	10.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
A3-40	0xA328	Dead zone curve time 2	0.0 to 300.0	20.0	%	Real-time
A3-41	0xA329	Dead zone curve time 3	0.0 to 300.0	50.0	%	Real-time
A3-42	0xA32A	Dead zone curve time 4	0.0 to 300.0	80.0	%	Real-time
A3-43	0xA32B	Dead zone curve time 5	0.0 to 300.0	90.0	%	Real-time
A3-44	0xA32C	Dead zone curve time 6	0.0 to 300.0	90.0	%	Real-time
A3-45	0xA32D	Dead zone curve time 7	0.0 to 300.0	90.0	%	Real-time
A3-46	0xA32E	Dead zone curve time 8	0.0 to 300.0	90.0	%	Real-time
A3-51	0xA333	Module overtemperature threshold	0 to 65535	0	°C	Unchangeable
A3-52	0xA334	Module pre-overtemperature margin	0.0 to 60.0	5.0	°C	Real-time
A3-53	0xA335	Drive pre-overload threshold	0.0 to 100.0	90.0	%	Real-time
A3-54	0xA336	Custom software overcurrent threshold	0.0 to 600.0	300.0	%	Real-time
A3-55	0xA337	Undervoltage threshold	300.0 to 440.0	350.0	V	Real-time
A3-56	0xA338	Valid undervoltage threshold	300.0 to 440.0	350.0	V	Unchangeable
A3-57	0xA339	Overvoltage threshold	650.0 to 820.0	820.0	V	Real-time
A3-58	0xA33A	Valid overvoltage threshold	650.0 to 820.0	820.0	V	Unchangeable

Param.	Communication address	Name	Range	Default	Unit	Change mode
A3-59	0xA33B	Protection command word of the drive	bit0: Reserved 0: Disable 1: Enable bit1: Whether to enable input phase loss detection (software) 0: Disable 1: Enable bit2: Whether to disable derating at low frequencies 0: No 1: Yes. Derating at low frequencies is disabled. bit3: Whether to report overvoltage at stop 0: Yes 1: No bit4: Whether to enable zero drift fault 0: Disable 1: Yes. E18.01 (Current sampling error) is reported when zero drift error is detected. bit5: Whether to enable bus voltage acquisition analysis 0: Disable 1: Enable bit6: Whether to enable software overcurrent 0: Disable 1: Yes. When the phase current exceeds the threshold, the custom software overcurrent fault E02.02 is reported. bit7: Whether to enable CBC 0: Disable 1: Yes. The pulse-by-pulse current limit function is enabled. (Continued)	0x3B92	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
A3-59	0xA33B	Protection command word of the drive	(Continued) bit8: Reserved bit9: Whether to enable junction temperature protection bit10: Capacitor leakage bit11: Whether to enable bus voltage detection bit12: Whether to enable software pulse-by-pulse current limiting bit13: Whether to enhance the derating capability bit14: Whether to enable random PWM parameter detection bit9 to bit14: 0: Disable 1: Enable bit15: Whether to disable software pulse-by-pulse current limiting during power generation 0: No 1: Yes	0x3B92	-	Real-time
A3-60	0xA33C	Action threshold of software pulse-by-pulse current limiting	0.01 to 1.50	0.95	-	Real-time
A3-67	0xA343	Automatic reset of undervoltage fault	0: Enable 1: Disable	0	-	Real-time
A3-90	0xA35A	Specific function settings	0 to 65535	0	-	At stop
A3-91	0xA35B	Specified function display	0x0 to 0xFFFF	0x0	-	Unchangeable

10.3.5 A4 Hardware Configuration

Param.	Communication address	Name	Range	Default	Unit	Change mode
A4-00	0xA400	Braking unit activation voltage	600.0 to 820.0	670.0	V	At stop
A4-01	0xA401	Effective activation voltage of the braking unit	600.0 to 820.0	760.0	V	Unchangeable

Param.	Communication address	Name	Range	Default	Unit	Change mode
A4-02	0xA402	Braking duty cycle	0 to 100	100	%	Real-time
A4-17	0xA411	Fan direction	0: Default direction 1: Opposite direction	0	-	Real-time

10.3.6 A5 Carrier Frequency and Pulsing Configuration

Param.	Communication address	Name	Range	Default	Unit	Change mode
A5-00	0xA500	Maximum carrier frequency	0.0 to 24.0	16.0	kHz	Unchangeable
A5-01	0xA501	Set carrier frequency	0.8 to 20.0	4.0	kHz	Real-time
A5-02	0xA502	Effective carrier frequency	0.8 to 20.0	4.0	kHz	Unchangeable
A5-03	0xA503	DPWM switchover frequency	5.0 to 6000.0	2000.0	Hz	Real-time
A5-04	0xA504	Dead zone compensation mode	0: No compensation 1: Compensation mode 1	1	-	Real-time
A5-05	0xA505	Cut-off frequency for dead zone compensation	0.0 to 6000.0	2000.0	Hz	Real-time
A5-06	0xA506	Overmodulation coefficient	50.0 to 110.0	105.0	%	Real-time
A5-09	0xA509	Hysteresis for adjusting carrier frequency with synchronous frequency	0.0 to 100.0	3.0	Hz	Real-time
A5-10	0xA50A	Start frequency for adjusting carrier frequency with synchronous frequency	0.1 to 600.0	5.0	Hz	Real-time
A5-11	0xA50B	Random PWM depth	0 to 4	0	-	Real-time
A5-12	0xA50C	Carrier frequency upper limit at low speed (V/f or FVC)	0.8 to 20.0	4.0	kHz	Real-time
A5-13	0xA50D	Carrier frequency upper limit at low speed (SVC)	0.8 to 20.0	2.0	kHz	Real-time

10.3.7 A6 Operating Panel and Display

Param.	Communication address	Name	Range	Default	Unit	Change mode
A6-01	0xA601	STOP/RESET key function	0: Active only in the operating panel control mode 1: Active in ON_OFF1 (Start/Stop) command 2: Active in OFF2 (Coast-to-stop) command 3: Active in OFF3 (Quick stop) command	1	-	Real-time
A6-03	0xA603	Parameter 1 displayed on LED operating panel during operation	bit0: Operating frequency (Hz) bit1: Frequency reference (Hz) bit2: Bus voltage (V) bit3: Output voltage (V) bit4: Output current (A) bit5: Output power (kW) bit6: Output torque (%) bit7: DI input status bit8: DO output status bit9: AI1 voltage (V) bit10: AI2 voltage (V) bit0 to bit10: 0: Hidden 1: Displayed bit11: Reserved bit12: Reserved bit13: Reserved bit14: Load speed 0: Hidden 1: Displayed bit15: PID reference 0: Hidden 1: Displayed	0x001F	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
A6-04	0xA604	Parameter 2 displayed on LED operating panel during operation	bit0: PID feedback bit1: PLC stage bit2: HDI input pulse frequency (kHz) (valid only for MD630S) bit3: Operating frequency 2 (Hz) bit4: Remaining operating time bit5: AI1 voltage before correction (V) bit6: Free mapping 0 bit7: Free mapping 1 bit8: Motor speed bit9: Current power-on time (min.) bit10: Current running time (min.) bit0 to bit10: 0: Hidden 1: Displayed bit11: Reserved bit12: Communication setting value bit13: Encoder feedback speed bit14: Main frequency X bit15: Auxiliary frequency Y bit12 to bit15: 0: Hidden 1: Displayed	0x0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
A6-05	0xA605	Parameter displayed on LED operating panel at stop	bit0: Frequency reference (Hz) bit1: Bus voltage (V) bit2: DI input status bit3: DO output status bit4: AI1 voltage (V) bit5: AI2 voltage (V) bit0 to bit5: 0: Hidden 1: Displayed bit6: Reserved bit7: Reserved bit8: Reserved bit9: PLC stage 0: Hidden 1: Displayed bit10: Reserved bit11: PID reference 0: Hidden 1: Displayed bit12: HDI input pulse frequency (kHz) (valid only for MD630S) 0: Hidden 1: Displayed bit13: Reserved bit14: Free mapping 0 0: Hidden 1: Displayed bit15: Free mapping 1 0: Hidden 1: Displayed	0x0033	-	Real-time
A6-07	0xA607	Address displayed by free mapping 0	0: Invalid address Others: K connector	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
A6-08	0xA608	Display format of free mapping 0	Ones: Unit 0: None 1: Hz 2: A 3: rpm 4: V 5: Link 6: % 7: s 8: h 9: kW A: kWh B: ℃ Tens: Decimal point 0: Zero decimal place 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places Hundreds: Enable 0: Disable 1: Enable Thousands: Reserved	0x0	-	Real-time
A6-09	0xA609	Address displayed by free mapping 1	0: Invalid address Others: K connector	0	-	Real-time
A6-10	0xA60A	Display format of free mapping 1	Same as A6-08	0x0	-	Real-time
A6-16	0xA610	LED operating panel direction display	Ones: Whether to display the stop direction 0: Hidden 1: Displayed Tens: Operating direction judgment 0: Operating direction judged based on the output frequency 1: Operating direction judged based on the feedback frequency Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	1	-	Real-time
A6-17	0xA611	LED display of update cycle	0 to 300	10	ms	Real-time
A6-18	0xA612	LED error pop-up time	1 to 60	10	s	Real-time
A6-28	0xA61C	Save parameter displayed on the LED operating panel during operation	0 to 65535	0	-	Unchangeable

Param.	Communication address	Name	Range	Default	Unit	Change mode
A6-29	0xA61D	Save parameter displayed on the LED operating panel at stop	0 to 65535	0	-	Unchangeable
A6-34	0xA622	UP/DOWN state of UP/DOWN key on operating panel timeout time	0.00 to 655.35	0.08	s	Real-time
A6-35	0xA623	Communication timeout time in commissioning software control	0.1 to 130.0	3.0	s	Real-time
A6-45	0xA62D	Commissioning software control activation	0: Disable 1: Enable	1	-	At stop
A6-71	0xA647	MD-IP-S control	0: Disable 1: Enable Others: B connector	1	-	Real-time
A6-72	0xA648	MD-IP-S disconnection detection	0: Invalid 1: Valid	1	-	Real-time
A6-73	0xA649	MD-IP-S disconnection detection time	0.5 to 600.0	3.0	-	Real-time

10.3.8 A8 Trigger Oscilloscope

Param.	Communication address	Name	Range	Default	Unit	Change mode
A8-22	0xA816	Pre-triggering value of oscilloscope	0 to 100	0	%	Real-time

10.3.9 AA Operation Log

Param.	Communication address	Name	Range	Default	Unit	Change mode
AA-00	0xAA00	Log function	0: Enable 1: Disable	0	-	Real-time
AA-01	0xAA01	Custom log reset function	0: No action 1: Reset the number of custom log 1 triggering events 2: Reset the number of custom log 2 triggering events 3: Reset the number of custom log 3 triggering events 4: Reset the number of custom log 4 triggering events 5: Reset the number of all the custom log triggering events 6: Restore custom log configuration parameters	0	-	Real-time
AA-02	0xAA02	Reset of custom log	0: Cancel 1: OK	0	-	Real-time
AA-03	0xAA03	Number of custom log 1 triggering events	0 to 65535	0	-	Unchangeable
AA-04	0xAA04	Number of custom log 2 triggering events	0 to 65535	0	-	Unchangeable
AA-05	0xAA05	Number of custom log 3 triggering events	0 to 65535	0	-	Unchangeable
AA-06	0xAA06	Number of custom log 4 triggering events	0 to 65535	0	-	Unchangeable
AA-07	0xAA07	Trigger mode of custom log event 1	0: Invalid 1: Triggered by analog values 2: Triggered by digital values 3: Triggered by analog or digital values 4: Triggered by analog and digital values	0	-	Real-time
AA-08	0xAA08	Analog trigger mode of custom log event 1	0: Word connector 1: Float-point connector	0	-	Real-time
AA-09	0xAA09	Trigger source of custom log event 1 word connector	0: Invalid Others: K connector	0	-	Real-time
AA-10	0xAA0A	Trigger condition of custom log event 1 word connector	0: Greater than (>) 1: Lower than (<) 2: Equal to (=) 3: Greater than or equal to (≥) 4: Lower than or equal to (≤)	0	-	Real-time
AA-11	0xAA0B	Comparison value source of custom log event 1 word connector	Same as AA-09	0	-	Real-time

Param.	Communica-tion address	Name	Range	Default	Unit	Change mode
AA-12	0xAA0C	Trigger source of custom log event 1 float-point connector	0: Invalid Others: F connector	0	-	Real-time
AA-13	0xAA0D	Trigger condition of custom log event 1 float-point connector	Same as AA-10	0	-	Real-time
AA-14	0xAA0E	Comparison value source of custom log event 1 float-point connector	Same as AA-12	0	-	Real-time
AA-15	0xAA0F	Digital trigger source of custom log event 1	0: Invalid Others: B connector	0	-	Real-time
AA-16	0xAA10	Digital trigger condition of custom log event 1	0: Rising edge 1: Falling edge 2: Edge 3: Logic 1 (=1) 4: Logic 0 (=0)	0	-	Real-time
AA-17	0xAA11	Channel 1 of custom log 1	0: Invalid Others: BKF connector	0	-	Real-time
AA-18	0xAA12	Channel 2 of custom log 1	Same as AA-17	0	-	Real-time
AA-19	0xAA13	Channel 3 of custom log 1	Same as AA-17	0	-	Real-time
AA-20	0xAA14	Channel 4 of custom log 1	Same as AA-17	0	-	Real-time
AA-21	0xAA15	Channel 5 of custom log 1	Same as AA-17	0	-	Real-time
AA-22	0xAA16	Channel 6 of custom log 1	Same as AA-17	0	-	Real-time
AA-23	0xAA17	Channel 7 of custom log 1	Same as AA-17	0	-	Real-time
AA-24	0xAA18	Channel 8 of custom log 1	Same as AA-17	0	-	Real-time
AA-25	0xAA19	Trigger mode of custom log event 2	Same as AA-07	0	-	Real-time
AA-26	0xAA1A	Analog trigger mode of custom log event 2	Same as AA-08	0	-	Real-time
AA-27	0xAA1B	Trigger source of custom log event 2 word connector	Same as AA-09	0	-	Real-time
AA-28	0xAA1C	Trigger condition of custom log event 2 word connector	Same as AA-10	0	-	Real-time
AA-29	0xAA1D	Comparison value source of custom log event 2 word connector	Same as AA-09	0	-	Real-time
AA-30	0xAA1E	Trigger source of custom log event 2 float-point connector	Same as AA-12	0	-	Real-time
AA-31	0xAA1F	Trigger condition of custom log event 2 float-point connector	Same as AA-10	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
AA-32	0xAA20	Comparison value source of custom log event 2 float-point connector	Same as AA-30	0	-	Real-time
AA-33	0xAA21	Digital trigger source of custom log event 2	Same as AA-15	0	-	Real-time
AA-34	0xAA22	Digital trigger condition of custom log event 2	Same as AA-16	0	-	Real-time
AA-35	0xAA23	Channel 1 of custom log 2	Same as AA-17	0	-	Real-time
AA-36	0xAA24	Channel 2 of custom log 2	Same as AA-17	0	-	Real-time
AA-37	0xAA25	Channel 3 of custom log 2	Same as AA-17	0	-	Real-time
AA-38	0xAA26	Channel 4 of custom log 2	Same as AA-17	0	-	Real-time
AA-39	0xAA27	Channel 5 of custom log 2	Same as AA-17	0	-	Real-time
AA-40	0xAA28	Channel 6 of custom log 2	Same as AA-17	0	-	Real-time
AA-41	0xAA29	Channel 7 of custom log 2	Same as AA-17	0	-	Real-time
AA-42	0xAA2A	Channel 8 of custom log 2	Same as AA-17	0	-	Real-time
AA-43	0xAA2B	Trigger mode of custom log event 3	Same as AA-07	0	-	Real-time
AA-44	0xAA2C	Analog trigger mode of custom log event 3	Same as AA-08	0	-	Real-time
AA-45	0xAA2D	Trigger source of custom log event 3 word connector	Same as AA-09	0	-	Real-time
AA-46	0xAA2E	Trigger condition of custom log event 3 word connector	Same as AA-10	0	-	Real-time
AA-47	0xAA2F	Comparison value source of custom log event 3 word connector	Same as AA-27	0	-	Real-time
AA-48	0xAA30	Trigger source of custom log event 3 float-point connector	Same as AA-12	0	-	Real-time
AA-49	0xAA31	Trigger condition of custom log event 3 float-point connector	Same as AA-10	0	-	Real-time
AA-50	0xAA32	Comparison value source of custom log event 3 float-point connector	Same as AA-12	0	-	Real-time
AA-51	0xAA33	Digital trigger source of custom log event 3	Same as AA-15	0	-	Real-time
AA-52	0xAA34	Digital trigger condition of custom log event 3	Same as AA-16	0	-	Real-time
AA-53	0xAA35	Channel 1 of custom log 3	Same as AA-17	0	-	Real-time
AA-54	0xAA36	Channel 2 of custom log 3	Same as AA-17	0	-	Real-time
AA-55	0xAA37	Channel 3 of custom log 3	Same as AA-17	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
AA-56	0xAA38	Channel 4 of custom log 3	Same as AA-17	0	-	Real-time
AA-57	0xAA39	Channel 5 of custom log 3	Same as AA-17	0	-	Real-time
AA-58	0xAA3A	Channel 6 of custom log 3	Same as AA-17	0	-	Real-time
AA-59	0xAA3B	Channel 7 of custom log 3	Same as AA-17	0	-	Real-time
AA-60	0xAA3C	Channel 8 of custom log 3	Same as AA-17	0	-	Real-time
AA-61	0xAA3D	Trigger mode of custom log event 4	Same as AA-07	0	-	Real-time
AA-62	0xAA3E	Analog trigger mode of custom log event 4	Same as AA-08	0	-	Real-time
AA-63	0xAA3F	Trigger source of custom log event 4 word connector	Same as AA-09	0	-	Real-time
AA-64	0xAA40	Trigger condition of custom log event 4 word connector	Same as AA-10	0	-	Real-time
AA-65	0xAA41	Comparison value source of custom log event 4 word connector	Same as AA-09	0	-	Real-time
AA-66	0xAA42	Trigger source of custom log event 4 float-point connector	Same as AA-12	0	-	Real-time
AA-67	0xAA43	Trigger condition of custom log event 4 float-point connector	Same as AA-10	0	-	Real-time
AA-68	0xAA44	Comparison value source of custom log event 4 float-point connector	Same as AA-12	0	-	Real-time
AA-69	0xAA45	Digital trigger source of custom log event 4	Same as AA-15	0	-	Real-time
AA-70	0xAA46	Digital trigger condition of custom log event 4	Same as AA-16	0	-	Real-time
AA-71	0xAA47	Channel 1 of custom log 4	Same as AA-17	0	-	Real-time
AA-72	0xAA48	Channel 2 of custom log 4	Same as AA-17	0	-	Real-time
AA-73	0xAA49	Channel 3 of custom log 4	Same as AA-17	0	-	Real-time
AA-74	0xAA4A	Channel 4 of custom log 4	Same as AA-17	0	-	Real-time
AA-75	0xAA4B	Channel 5 of custom log 4	Same as AA-17	0	-	Real-time
AA-76	0xAA4C	Channel 6 of custom log 4	Same as AA-17	0	-	Real-time
AA-77	0xAA4D	Channel 7 of custom log 4	Same as AA-17	0	-	Real-time
AA-78	0xAA4E	Channel 8 of custom log 4	Same as AA-17	0	-	Real-time

Param.	Communica-tion address	Name	Range	Default	Unit	Change mode
AA-79	0xAA4F	Log event switch 1	bit0: Current state machine bit1: OFF1 state bit2: OFF2 activated bit3: OFF3 activated bit4: Operation allowed bit5: Fault activated bit6: Minor fault activated bit7: Alarm activated bit8: Prompt activated bit9: Bus voltage power-up bit10: Bus voltage undervoltage bit11: Fault reset bit12: Fault reset completed bit13: Brake released bit14: Brake closed Bit 15: Reserved bit0 to bit15: 0: Disable 1: Enable	0x7FFF	-	Real-time
AA-80	0xAA50	Log event switch 2	bit0: AI1 disconnected bit1: AI2 disconnected bit2: Jog operation effective bit3: STO output bit4: Undervoltage suppression bit5: Overvoltage suppression bit6: Motor overload bit7: Motor pre-overload bit8: Drive overload bit9: Auto-tuning performed bit10: Self-test performed bit11: Encoder cable disconnected bit12: Communication disconnected bit13: Reserved bit14: Reserved Bit 15: Reserved bit0 to bit15: 0: Disable 1: Enable	0x1FFF	-	Real-time

Param.	Communica-tion address	Name	Range	Default	Unit	Change mode
AA-81	0xAA51	Log event enable switch 3	bit0: Control channel selection bit1: Channel reference selection bit2: Motor parameter group selection bit3: Clear black box data bit4: Parameter lock bit5: Parameter-level modification bit6: Software control permission switch bit7: Model download bit8: Control method switching bit9: Control mode switching bit10: Parameter modification bit11 to bit15: Reserved bit0 to bit15: 0: Disable 1: Enable	0x07FF	-	Real-time
AA-82	0xAA52	Log event switch 4	bit0: Fire mode activated bit1: Fire mode operation bit2: Fire mode bypass bit3: Fire mode overlimit bit0 to bit3 0: Disable 1: Enable bit4 to bit15: Reserved 0: Disable 1: Enable	0x000F	-	Real-time
AA-94	0xAA5E	Clear log information	0: Invalid 1: Clear	0	-	Real-time
AA-95	0xAA5F	Confirmation of log information clearing	Same as AA-02	0	-	Real-time

10.3.10 Ab Commissioning Function

Param.	Communication address	Name	Range	Default	Unit	Change mode
Ab-94	0xAB5E	Motor frequency/ speed filter time	0 to 10000	128	ms	Real-time
Ab-95	0xAB5F	Output voltage filter time	0 to 10000	256	ms	Real-time
Ab-96	0xAB60	Output current filter time	0 to 10000	128	ms	Real-time
Ab-97	0xAB61	Output power filter time	0 to 10000	128	ms	Real-time
Ab-98	0xAB62	Output torque filter time	0 to 10000	128	ms	Real-time

10.3.11 Ad: Counting Function

Param.	Communication address	Name	Range	Default	Unit	Change mode
Ad-00	0xAD00	Cumulative operating time - hours	0 to 65535	0	h	Unchangeable
Ad-01	0xAD01	Cumulative operating time - seconds	0 to 3599	0	s	Unchangeable
Ad-02	0xAD02	Cumulative power-on time - hours	0 to 65535	0	h	Unchangeable
Ad-03	0xAD03	Cumulative power-on time - seconds	0 to 3599	0	s	Unchangeable
Ad-04	0xAD04	Cumulative power consumption	0 to 65535	0	kWh	Unchangeable
Ad-05	0xAD05	Auxiliary calculation 1 of cumulative power consumption	0 to 65535	0	-	Unchangeable
Ad-06	0xAD06	Auxiliary calculation 2 of cumulative power consumption	0 to 65535	0	-	Unchangeable
Ad-07	0xAD07	Cumulative power consumption k	0.0 to 6553.5	0.0	kWh	Unchangeable
Ad-08	0xAD08	Cumulative power consumption M	0 to 65535	0	MWh	Unchangeable
Ad-09	0xAD09	Cumulative energy auxiliary calculation 1	0 to 65535	0	-	Unchangeable
Ad-10	0xAD0A	Cumulative energy auxiliary calculation 2	0 to 65535	0	-	Unchangeable
Ad-11	0xAD0B	Cumulative energy saving (kWh)	0.0 to 999.9	0.0	kWh	Unchangeable
Ad-12	0xAD0C	Cumulative energy saving (MWh)	0 to 999	0	MWh	Unchangeable
Ad-13	0xAD0D	Cumulative energy saving (GWh)	0 to 65535	0	GWh	Unchangeable
Ad-14	0xAD0E	Cumulative cost saving	0.0 to 999.9	0.0	-	Unchangeable
Ad-15	0xAD0F	Cumulative cost saving (K)	0 to 65535	0	-	Unchangeable
Ad-16	0xAD10	Cumulative CO2 reduction (T)	0.0 to 999.9	0.0	-	Unchangeable
Ad-17	0xAD11	Cumulative CO2 reduction (KT)	0 to 65535	0	-	Unchangeable
Ad-18	0xAD12	Energy tax rate 1	0.0 to 6553.5	0.0	-	At stop
Ad-19	0xAD13	Energy tax rate 2	0.0 to 6553.5	0.0	-	At stop
Ad-20	0xAD14	Tax rate selection	0: Energy tax rate 1 1: Energy tax rate 2	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
Ad-21	0xAD15	Currency unit selection	0: RMB 1: EUR 2: USD	0	-	At stop
Ad-22	0xAD16	CO2 conversion factor	0.000 to 65.535	0.000	-	At stop
Ad-23	0xAD17	Reference power	0.0 to 6553.5	0.0	kW	At stop
Ad-24	0xAD18	Reset of cumulative energy calculation	0: No action 1: Reset	0	-	At stop
Ad-41	0xAD29	Component lifetime prediction function	bit0: Capacitor lifetime prediction of the main circuit 0: Disable 1: Enable bit1: Reserved Same as bit0 bit2: IGBT lifetime prediction function Same as bit0 bit3: Cooling fan lifetime prediction function Same as bit0 bit4 to bit15: Reserved Same as bit0	0x000D	-	Real-time
Ad-45	0xAD2D	Estimated lifetime margin of the main circuit capacitor	0.00 to 100.00	100.00	%	Unchangeable
Ad-50	0xAD32	Alarm threshold of main circuit capacitor lifetime	0.00 to 30.00	10.00	%	Real-time
Ad-59	0xAD3B	Predicted lifetime margin of IGBT	0.00 to 100.00	100.00	%	Unchangeable
Ad-62	0xAD3E	IGBT lifetime alarm threshold	0.00 to 30.00	10.00	%	Real-time
Ad-64	0xAD40	Remaining operating time of the fan predicted in real time (x 10 h)	0 to 65535	0	-	Unchangeable
Ad-65	0xAD41	Predicted lifetime margin of the fan	0.00 to 100.00	100.00	%	Unchangeable
Ad-68	0xAD44	Cooling fan lifetime alarm threshold	0.00 to 30.00	10.00	%	Real-time

10.3.12 AE User-Defined Parameters

Param.	Communication address	Name	Range	Default	Unit	Change mode
AE-00	0x2F00	User-defined parameter 0	0x0 to 0xFFFF	0x0	-	Real-time
AE-01	0x2F01	User-defined parameter 1	0x0 to 0xFFFF	0x0	-	Real-time
AE-02	0x2F02	User-defined parameter 2	0x0 to 0xFFFF	0x0	-	Real-time
AE-03	0x2F03	User-defined parameter 3	0x0 to 0xFFFF	0x0	-	Real-time
AE-04	0x2F04	User-defined parameter 4	0x0 to 0xFFFF	0x0	-	Real-time
AE-05	0x2F05	User-defined parameter 5	0x0 to 0xFFFF	0x0	-	Real-time
AE-06	0x2F06	User-defined parameter 6	0x0 to 0xFFFF	0x0	-	Real-time
AE-07	0x2F07	User-defined parameter 7	0x0 to 0xFFFF	0x0	-	Real-time
AE-08	0x2F08	User-defined parameter 8	0x0 to 0xFFFF	0x0	-	Real-time
AE-09	0x2F09	User-defined parameter 9	0x0 to 0xFFFF	0x0	-	Real-time
AE-10	0x2F0A	User-defined parameter 10	0x0 to 0xFFFF	0x0	-	Real-time
AE-11	0x2F0B	User-defined parameter 11	0x0 to 0xFFFF	0x0	-	Real-time
AE-12	0x2F0C	User-defined parameter 12	0x0 to 0xFFFF	0x0	-	Real-time
AE-13	0x2F0D	User-defined parameter 13	0x0 to 0xFFFF	0x0	-	Real-time
AE-14	0x2F0E	User-defined parameter 14	0x0 to 0xFFFF	0x0	-	Real-time
AE-15	0x2F0F	User-defined parameter 15	0x0 to 0xFFFF	0x0	-	Real-time
AE-16	0x2F10	User-defined parameter 16	0x0 to 0xFFFF	0x0	-	Real-time
AE-17	0x2F11	User-defined parameter 17	0x0 to 0xFFFF	0x0	-	Real-time
AE-18	0x2F12	User-defined parameter 18	0x0 to 0xFFFF	0x0	-	Real-time
AE-19	0x2F13	User-defined parameter 19	0x0 to 0xFFFF	0x0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
AE-20	0x2F14	User-defined parameter 20	0x0 to 0xFFFF	0x0	-	Real-time
AE-21	0x2F15	User-defined parameter 21	0x0 to 0xFFFF	0x0	-	Real-time
AE-22	0x2F16	User-defined parameter 22	0x0 to 0xFFFF	0x0	-	Real-time
AE-23	0x2F17	User-defined parameter 23	0x0 to 0xFFFF	0x0	-	Real-time
AE-24	0x2F18	User-defined parameter 24	0x0 to 0xFFFF	0x0	-	Real-time
AE-25	0x2F19	User-defined parameter 25	0x0 to 0xFFFF	0x0	-	Real-time
AE-26	0x2F1A	User-defined parameter 26	0x0 to 0xFFFF	0x0	-	Real-time
AE-27	0x2F1B	User-defined parameter 27	0x0 to 0xFFFF	0x0	-	Real-time
AE-28	0x2F1C	User-defined parameter 28	0x0 to 0xFFFF	0x0	-	Real-time
AE-29	0x2F1D	User-defined parameter 29	0x0 to 0xFFFF	0x0	-	Real-time
AE-30	0x2F1E	User-defined parameter 30	0x0 to 0xFFFF	0x0	-	Real-time
AE-31	0x2F1F	User-defined parameter 31	0x0 to 0xFFFF	0x0	-	Real-time

10.3.13 AF SN Code

Param.	Communication address	Name	Range	Default	Unit	Change mode
AF-00	0xAF00	SN code serial number 1	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-01	0xAF01	SN code serial number 2	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-02	0xAF02	SN code serial number 3	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-03	0xAF03	SN code serial number 4	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-04	0xAF04	SN code serial number 5	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-05	0xAF05	SN code serial number 6	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-06	0xAF06	SN code serial number 7	0x0 to 0xFFFF	0x0	-	Unchangeable

Param.	Communication address	Name	Range	Default	Unit	Change mode
AF-07	0xAF07	SN code serial number 8	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-08	0xAF08	SN code serial number 9	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-09	0xAF09	SN code serial number 10	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-10	0xAF0A	SN code serial number 11	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-11	0xAF0B	SN code serial number 12	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-12	0xAF0C	SN code serial number 13	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-13	0xAF0D	SN code serial number 14	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-14	0xAF0E	SN code serial number 15	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-15	0xAF0F	SN code serial number 16	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-16	0xAF10	SN code serial number 17	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-17	0xAF11	SN code serial number 18	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-18	0xAF12	SN code serial number 19	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-19	0xAF13	SN code serial number 20	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-20	0xAF14	SN code serial number 21	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-21	0xAF15	SN code serial number 22	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-22	0xAF16	SN code serial number 23	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-23	0xAF17	SN code serial number 24	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-24	0xAF18	SN code serial number 25	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-25	0xAF19	SN code serial number 26	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-26	0xAF1A	SN code serial number 27	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-27	0xAF1B	SN code serial number 28	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-28	0xAF1C	SN code serial number 29	0x0 to 0xFFFF	0x0	-	Unchangeable

Param.	Communication address	Name	Range	Default	Unit	Change mode
AF-29	0xAF1D	SN code serial number 30	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-30	0xAF1E	SN code serial number 31	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-31	0xAF1F	SN code serial number 32	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-32	0xAF20	SN code serial number 33	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-33	0xAF21	SN code serial number 34	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-34	0xAF22	SN code serial number 35	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-35	0xAF23	SN code serial number 36	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-36	0xAF24	SN code serial number 37	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-37	0xAF25	SN code serial number 38	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-38	0xAF26	SN code serial number 39	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-39	0xAF27	SN code serial number 40	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-40	0xAF28	SN code serial number 41	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-41	0xAF29	SN code serial number 42	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-42	0xAF2A	SN code serial number 43	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-43	0xAF2B	SN code serial number 44	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-44	0xAF2C	SN code serial number 45	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-45	0xAF2D	SN code serial number 46	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-46	0xAF2E	SN code serial number 47	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-47	0xAF2F	SN code serial number 48	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-48	0xAF30	SN code serial number 49	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-49	0xAF31	SN code serial number 50	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-50	0xAF32	SN code serial number 51	0x0 to 0xFFFF	0x0	-	Unchangeable

Param.	Communication address	Name	Range	Default	Unit	Change mode
AF-51	0xAF33	SN code serial number 52	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-52	0xAF34	SN code serial number 53	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-53	0xAF35	SN code serial number 54	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-54	0xAF36	SN code serial number 55	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-55	0xAF37	SN code serial number 56	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-56	0xAF38	SN code serial number 57	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-57	0xAF39	SN code serial number 58	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-58	0xAF3A	SN code serial number 59	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-59	0xAF3B	SN code serial number 60	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-60	0xAF3C	SN code serial number 61	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-61	0xAF3D	SN code serial number 62	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-62	0xAF3E	SN code serial number 63	0x0 to 0xFFFF	0x0	-	Unchangeable
AF-63	0xAF3F	SN code serial number 64	0x0 to 0xFFFF	0x0	-	Unchangeable

10.4 Group b Reference Channel

10.4.1 b0 Instruction Channel Configuration

Param.	Communication address	Name	Range	Default	Unit	Change mode
b0-00	0xB000	Motor parameter group selection 1	0: Invalid 1: Valid 2: Communication setting 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	At stop
b0-01	0xB001	Motor parameter group selection 2	Same as b0-00	0	-	At stop
b0-02	0xB002	Control channel selection	0: Control channel 1 1: Control channel 2 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	At stop
b0-03	0xB003	Setting channel selection	0: Setting channel 1 1: Setting channel 2 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	At stop

10.4.2 b1 Main Command of Control Channel 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
b1-00	0xB100	Main command source of control channel 1	0: Operating panel 1: Terminal 2: Communication 3: Custom	0	-	At stop
b1-01	0xB101	User-defined ON_OFF1 (start/stop) source	0: Invalid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
b1-02	0xB102	User-defined OFF2 (coast to stop) source 1	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time
b1-03	0xB103	User-defined OFF3 (quick stop) source 1	Same as b1-02	1	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b1-04	0xB104	Custom operation permission source	0: Operation inhibited 1: Operation allowed 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time
b1-05	0xB105	User-defined fault reset command source 1	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
b1-06	0xB106	Custom jog 1 command source	Same as b1-01	0	-	Real-time
b1-07	0xB107	Custom jog 2 command source	Same as b1-01	0	-	Real-time
b1-08	0xB108	Custom speed inversion source	Same as b1-05	0	-	Real-time
b1-09	0xB109	JOG/ON_OFF1 priority mode selection	0: Priority not differentiated 1: Jog command has priority. 2: ON_OFF1 (start/stop) has priority.	0	-	Real-time

10.4.3 b2 Auxiliary Command of Control Channel 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
b2-00	0xB200	OFF2 (coast to stop) source 2	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time
b2-01	0xB201	OFF2 (coast to stop) source 3	Same as b2-00	1	-	Real-time
b2-02	0xB202	OFF3 (quick stop) source 2	Same as b2-00	1	-	Real-time
b2-03	0xB203	OFF3 (quick stop) source 3	Same as b2-00	1	-	Real-time
b2-04	0xB204	Fault reset source 2	Same as b2-00	0	-	Real-time
b2-05	0xB205	Fault reset source 3	Same as b2-00	0	-	Real-time
b2-06	0xB206	Ramp inhibition command source	Same as b2-00	1	-	Real-time
b2-07	0xB207	Ramp pause command source	Same as b2-00	1	-	Real-time
b2-08	0xB208	Source of setting ramp reference to 0	Same as b2-00	1	-	Real-time

10.4.4 b3 Main Command of Control Channel 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
b3-00	0xB300	Main command source of control channel 2	0: Operating panel 1: Terminal 2: Communication 3: Custom	0	-	At stop
b3-01	0xB301	User-defined ON_OFF1 (start/stop) source	0: Invalid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
b3-02	0xB302	User-defined OFF2 (coast to stop) source 1	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time
b3-03	0xB303	User-defined OFF3 (quick stop) source 1	Same as b3-02	1	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b3-04	0xB304	Custom operation permission source	0: Operation inhibited 1: Operation allowed 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time
b3-05	0xB305	User-defined fault reset command source 1	Same as b3-01	0	-	Real-time
b3-06	0xB306	Custom jog 1 command source	Same as b3-01	0	-	Real-time
b3-07	0xB307	Custom jog 2 command source	Same as b3-01	0	-	Real-time
b3-08	0xB308	Custom speed inversion source	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
b3-09	0xB309	JOG/ON_OFF1 priority mode selection	0: Priority not differentiated 1: Jog command has priority. 2: ON_OFF1 (start/stop) has priority.	0	-	Real-time

10.4.5 b4 Auxiliary Command of Control Channel 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
b4-00	0xB400	OFF2 (coast to stop) source 2	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time
b4-01	0xB401	OFF2 (coast to stop) source 3	Same as b4-00	1	-	Real-time
b4-02	0xB402	OFF3 (quick stop) source 2	Same as b4-00	1	-	Real-time
b4-03	0xB403	OFF3 (quick stop) source 3	Same as b4-00	1	-	Real-time
b4-04	0xB404	Fault reset source 2	Same as b4-00	0	-	Real-time
b4-05	0xB405	Fault reset source 3	Same as b4-00	0	-	Real-time
b4-06	0xB406	Ramp inhibition command source	Same as b4-00	1	-	Real-time
b4-07	0xB407	Ramp pause command source	Same as b4-00	1	-	Real-time
b4-08	0xB408	Source of setting ramp reference to 0	Same as b4-00	1	-	Real-time

10.4.6 b5 Setting Channel 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
b5-00	0xB500	Main frequency source	0: b5-01 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b5-01	0xB501	Main frequency digital setting (Hz)	0.00 to A2-17	50.00	Hz	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b5-02	0xB502	Auxiliary frequency source	0: Invalid 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b5-03	0xB503	Calculation relationship between main and auxiliary frequencies	0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max. (main frequency, auxiliary frequency) 3: Min. (main frequency, auxiliary frequency) 4: Main frequency x auxiliary frequency 5: Main/auxiliary frequency switchover	0	-	Real-time
b5-04	0xB504	Additional frequency source	Same as b5-02	0	-	Real-time
b5-05	0xB505	Source of main frequency gain factor	0: 100% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b5-06	0xB506	Source of auxiliary frequency gain factor	Same as b5-05	0	-	Real-time
b5-07	0xB507	Jog 1 frequency source	0: b5-08 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b5-08	0xB508	Digital factor of jog 1 frequency	-50.00 to +50.00	2.00	Hz	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b5-09	0xB509	Source of jog frequency 2	0: b5-10 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b5-10	0xB50A	Digital setting of jog 2 frequency	-50.00 to +50.00	-2.00	Hz	Real-time
b5-11	0xB50B	Frequency ramp transition enable	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
b5-12	0xB50C	Frequency ramp transition interval	2 to 10000	50	ms	Real-time
b5-13	0xB50D	Torque reference source	0: b5-14 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b5-14	0xB50E	Torque reference digital setting	-800.0 to +800.0	0.0	%	Real-time
b5-15	0xB50F	Torque reference gain coefficient	Same as b5-05	0	-	Real-time
b5-16	0xB510	Torque filter time	0 to 10000	0	ms	Real-time
b5-17	0xB511	Torque acceleration time	0.000 to 60.000	0.000	s	Real-time
b5-18	0xB512	Torque deceleration time	0.000 to 60.000	0.000	s	Real-time
b5-19	0xB513	Speed limit source in torque mode	0: b5-20 1: Speed channel	0	-	Real-time
b5-20	0xB514	Digital setting of speed limit in torque control mode	-800.0 to +800.0	100.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b5-21	0xB515	Speed limit offset mode in torque mode	0: Bidirectional offset 1: Uni-directional offset 2: Overspeed control mode	0	-	Real-time
b5-22	0xB516	Speed limit offset source in torque mode	0: b5-23 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b5-23	0xB517	Digital setting of speed limit offset in torque mode	0.0 to 800.0	5.0	%	Real-time
b5-24	0xB518	Additional torque reference 1 source	0: b5-25 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b5-25	0xB519	Digital setting of additional torque reference 1	-400.0 to 400.0	0.0	%	Real-time
b5-26	0xB51A	Source of additional torque reference 2	Same as b5-02	0	-	Real-time
b5-27	0xB51B	Additional torque reference 2 enable	Same as b5-11	0	-	Real-time
b5-30	0xB51E	Main frequency digital setting (rpm)	0 to A2-15	1500	rpm	Real-time
b5-31	0xB51F	Digital setting of main frequency (%)	0.0 to A2-14	100.0	%	Real-time
b5-40	0xB528	Main/auxiliary frequency switchover source	Same as b5-11	0	-	Real-time

10.4.7 b6: Reference Channel 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
b6-00	0xB600	Main frequency source	0: b6-01 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b6-01	0xB601	Main frequency digital setting (Hz)	0.00 to A2-17	50.00	Hz	Real-time
b6-02	0xB602	Auxiliary frequency source	0: Invalid 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b6-03	0xB603	Calculation relationship between main and auxiliary frequencies	0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max. (main frequency, auxiliary frequency) 3: Min. (main frequency, auxiliary frequency) 4: Main frequency x auxiliary frequency 5: Main/auxiliary frequency switchover	0	-	Real-time
b6-04	0xB604	Additional frequency source	Same as b6-02	0	-	Real-time
b6-05	0xB605	Source of main frequency gain factor	0: 100% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b6-06	0xB606	Source of auxiliary frequency gain factor	Same as b6-05	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b6-07	0xB607	Jog 1 frequency source	0: b6-08 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b6-08	0xB608	Digital factor of jog 1 frequency	-50.00 to +50.00	2.00	Hz	Real-time
b6-09	0xB609	Source of jog frequency 2	0: b6-10 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b6-10	0xB60A	Digital setting of jog 2 frequency	-50.00 to +50.00	-2.00	Hz	Real-time
b6-11	0xB60B	Frequency ramp transition enable	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
b6-12	0xB60C	Frequency ramp transition interval	2 to 10000	50	ms	Real-time
b6-13	0xB60D	Torque reference source	0: b6-14 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b6-14	0xB60E	Torque reference digital setting	-800.0 to +800.0	0.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b6-15	0xB60F	Torque reference gain coefficient	Same as b6-05	0	-	Real-time
b6-16	0xB610	Torque filter time	0 to 10000	0	ms	Real-time
b6-17	0xB611	Torque acceleration time	0.000 to 60.000	0.000	s	Real-time
b6-18	0xB612	Torque deceleration time	0.000 to 60.000	0.000	s	Real-time
b6-19	0xB613	Speed limit source in torque mode	0: b6-20 1: Speed channel	0	-	Real-time
b6-20	0xB614	Digital setting of speed limit in torque control mode	-800.0 to +800.0	100.0	%	Real-time
b6-21	0xB615	Speed limit offset mode in torque mode	0: Bidirectional offset 1: Uni-directional offset 2: Overspeed control mode	0	-	Real-time
b6-22	0xB616	Speed limit offset source in torque mode	0: b6-23 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b6-23	0xB617	Digital setting of speed limit offset in torque mode	0.0 to 800.0	5.0	%	Real-time
b6-24	0xB618	Additional torque reference 1 source	0: b6-25 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b6-25	0xB619	Digital setting of additional torque reference 1	-400.0 to 400.0	0.0	%	Real-time
b6-26	0xB61A	Source of additional torque reference 2	Same as b6-02	0	-	Real-time
b6-27	0xB61B	Additional torque reference 2 enable	Same as b6-11	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b6-30	0xB61E	Main frequency digital setting (rpm)	0 to A2-15	1500	rpm	Real-time
b6-31	0xB61F	Digital setting of main frequency (%)	0.0 to A2-14	100.0	%	Real-time
b6-40	0xB628	Main/auxiliary frequency switchover source	Same as b6-11	0	-	Real-time

10.4.8 b7 Acceleration/Deceleration Settings (RFG)

Param.	Communication address	Name	Range	Default	Unit	Change mode
b7-00	0xB700	Ramp-up/down mode	0: Linear 1: S-curve	0	-	Real-time
b7-01	0xB701	Ramp-up/down time base	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	1	-	Real-time
b7-02	0xB702	Ramp selection bit0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
b7-03	0xB703	Ramp selection bit1	Same as b7-02	0	-	Real-time
b7-04	0xB704	Ramp-up time of ramp 1	0.0 to 6500.0	20.0	s	Real-time
b7-05	0xB705	Ramp-down time of ramp 1	0.0 to 6500.0	20.0	s	Real-time
b7-06	0xB706	Ramp-up start arc of ramp 1	0.00 to 650.00	0.00	s	Real-time
b7-07	0xB707	Ramp-up end arc of ramp 1	0.00 to 650.00	0.00	s	Real-time
b7-08	0xB708	Ramp-down start arc of ramp 1	0.00 to 650.00	0.00	s	Real-time
b7-09	0xB709	Ramp-down end arc of ramp 1	0.00 to 650.00	0.00	s	Real-time
b7-10	0xB70A	Ramp-up time of ramp 2	0.0 to 6500.0	20.0	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b7-11	0xB70B	Ramp-down time of ramp 2	0.0 to 6500.0	20.0	s	Real-time
b7-12	0xB70C	Ramp-up start arc of ramp 2	0.00 to 650.00	0.00	s	Real-time
b7-13	0xB70D	Ramp-up end arc of ramp 2	0.00 to 650.00	0.00	s	Real-time
b7-14	0xB70E	Ramp-down start arc of ramp 2	0.00 to 650.00	0.00	s	Real-time
b7-15	0xB70F	Ramp-down end arc of ramp 2	0.00 to 650.00	0.00	s	Real-time
b7-16	0xB710	Ramp-up time of ramp 3	0.00 to 650.00	20.00	s	Real-time
b7-17	0xB711	Ramp-down time of ramp 3	0.00 to 650.00	20.00	s	Real-time
b7-18	0xB712	Ramp-up start arc of ramp 3	0.00 to 650.00	0.00	s	Real-time
b7-19	0xB713	Ramp-up end arc of ramp 3	0.00 to 650.00	0.00	s	Real-time
b7-20	0xB714	Ramp-down start arc of ramp 3	0.00 to 650.00	0.00	s	Real-time
b7-21	0xB715	Ramp-down end arc of ramp 3	0.00 to 650.00	0.00	s	Real-time
b7-22	0xB716	Ramp-up time of ramp 4	0.00 to 650.00	20.00	s	Real-time
b7-23	0xB717	Ramp-down time of ramp 4	0.00 to 650.00	20.00	s	Real-time
b7-24	0xB718	Ramp-up start arc of ramp 4	0.00 to 650.00	0.00	s	Real-time
b7-25	0xB719	Ramp-up end arc of ramp 4	0.00 to 650.00	0.00	s	Real-time
b7-26	0xB71A	Ramp-down start arc of ramp 4	0.00 to 650.00	0.00	s	Real-time
b7-27	0xB71B	Ramp-down end arc of ramp 4	0.00 to 650.00	0.00	s	Real-time
b7-28	0xB71C	Ramps 1/2 frequency switchover enable	0: Disable 1: Enable	0	-	Real-time
b7-29	0xB71D	Ramp-up switchover frequency threshold of ramps 1/2	0.0 to A2-18	0.0	Hz	Real-time
b7-30	0xB71E	Ramp-down switchover frequency threshold of ramps 1/2	0.0 to A2-18	0.0	Hz	Real-time
b7-31	0xB71F	Jog ramp source	0: Ramp time of normal operation 1: Ramp time of jog	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b7-32	0xB720	Ramp-up time in jog	0.00 to 650.00	20.00	s	Real-time
b7-33	0xB721	Ramp-down time in jog	0.00 to 650.00	20.00	s	Real-time
b7-34	0xB722	Ramp-down time for quick stop	0.00 to 650.00	1.00	s	Real-time
b7-35	0xB723	Start arc of quick stop	0.00 to 650.00	0.00	s	Real-time
b7-36	0xB724	End arc of quick stop	0.00 to 650.00	0.00	s	Real-time
b7-37	0xB725	Frequency acceleration time in torque control	0.00 to 650.00	0.00	s	Real-time
b7-38	0xB726	Frequency deceleration time in torque control	0.00 to 650.00	0.00	s	Real-time
b7-39	0xB727	Ramp-up time gain factor	0: 100% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
b7-40	0xB728	Gain factor of ramp-up time	Same as b7-39	0	-	Real-time
b7-41	0xB729	Ramp-up time gain coefficient in low-speed range	1.0 to 1000.0	100.0	%	Real-time
b7-42	0xB72A	Low speed determination threshold	0.00 to 100.00	15.00	%	Real-time
b7-43	0xB72B	Ramp arc mode	0: Discontinuous smoothing 1: Continuous smoothing	0	-	Real-time
b7-44	0xB72C	Forcible enable of ramp output	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
b7-45	0xB72D	Ramp output forced value	Same as b7-39	0	-	Real-time
b7-46	0xB72E	Ramp tracking	0: Disable 1: Enable 2: Torque limit reached Others: B connector	0	-	Real-time
b7-47	0xB72F	Ramp tracking error	0.0 to 100.0	10.0	%	Real-time

10.4.9 b8 Multi-reference

Param.	Communication address	Name	Range	Default	Unit	Change mode
b8-00	0xB800	Active multi-reference value x	0: Multi-reference value 0 1: Multi-reference value 1 2: Multi-reference value 2 3: Multi-reference value 3 4: Multi-reference value 4 5: Multi-reference value 5 6: Multi-reference value 6 7: Multi-reference value 7 8: Multi-reference value 8 9: Multi-reference value 9 10: Multi-reference value 10 11: Multi-reference value 11 12: Multi-reference value 12 13: Multi-reference value 13 14: Multi-reference value 14 15: Multi-reference value 15	0	-	Unchangeable
b8-01	0xB801	Currently effective multi-reference output	-3000.0 to +3000.0	0.0	%	Unchangeable
b8-02	0xB802	Multi-reference unit selection	0: % (100% = rated frequency of the motor) 1: % (100% = maximum frequency of the motor) 2: User-defined (100% = b8-41) 3: Hz 4: rpm	0	-	At stop
b8-03	0xB803	Multi-reference selection bit0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
b8-04	0xB804	Multi-reference selection bit1	Same as b8-03	0	-	Real-time
b8-05	0xB805	Multi-reference selection bit2	Same as b8-03	0	-	Real-time
b8-06	0xB806	Multi-reference selection bit3	Same as b8-03	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
b8-08	0xB808	Multi-reference 0 setting mode	0: b8-09 1: AI1 2: AI2 4: HDI pulse 5: PID 6: Digital setting of main frequency (b5-01/b6-01) Others: F connector	0	-	Real-time
b8-09	0xB809	Multi-reference 0	b8-43 to b8-42	0.0	-	Real-time
b8-10	0xB80A	Multi-reference 1	b8-43 to b8-42	0.0	-	Real-time
b8-11	0xB80B	Multi-reference 2	b8-43 to b8-42	0.0	-	Real-time
b8-12	0xB80C	Multi-reference 3	b8-43 to b8-42	0.0	-	Real-time
b8-13	0xB80D	Multi-reference 4	b8-43 to b8-42	0.0	-	Real-time
b8-14	0xB80E	Multi-reference 5	b8-43 to b8-42	0.0	-	Real-time
b8-15	0xB80F	Multi-reference 6	b8-43 to b8-42	0.0	-	Real-time
b8-16	0xB810	Multi-reference 7	b8-43 to b8-42	0.0	-	Real-time
b8-17	0xB811	Multi-reference 8	b8-43 to b8-42	0.0	-	Real-time
b8-18	0xB812	Multi-reference 9	b8-43 to b8-42	0.0	-	Real-time
b8-19	0xB813	Multi-reference 10	b8-43 to b8-42	0.0	-	Real-time
b8-20	0xB814	Multi-reference 11	b8-43 to b8-42	0.0	-	Real-time
b8-21	0xB815	Multi-reference 12	b8-43 to b8-42	0.0	-	Real-time
b8-22	0xB816	Multi-reference 13	b8-43 to b8-42	0.0	-	Real-time
b8-23	0xB817	Multi-reference 14	b8-43 to b8-42	0.0	-	Real-time
b8-24	0xB818	Multi-reference 15	b8-43 to b8-42	0.0	-	Real-time
b8-41	0xB829	User-defined base value	0.1 to 6553.5	100.0	-	At stop
b8-42	0xB82A	Multi-reference upper limit threshold	0.0 to 3000.0	3000.0	-	Real-time
b8-43	0xB82B	Multi-reference lower limit threshold	-3000.0 to 0.0	-3000.0	-	Real-time

10.4.10 b9 Terminal Start/Stop Module

Param.	Communication address	Name	Range	Default	Unit	Change mode
b9-00	0xB900	Terminal start/stop module A/B selection	0: Module A 1: Module B Others: B connector	0	-	At stop
b9-01	0xB901	Mode of terminal start/ stop module A	0: Disable 1: IN1 for start 2: IN1 for start and IN2 for direction 3: IN1 for forward start and IN2 for reverse start 4: IN1P (rising edge) for start and IN2 for stop 5: IN1P (rising edge) for start, IN2 for stop, and IN3 for direction 6: IN1P (rising edge) for forward start, IN2P (rising edge) for reverse start, and IN3 for stop	3	-	At stop
b9-02	0xB902	Terminal start/stop module A_IN1	0: Invalid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	At stop
b9-03	0xB903	Terminal start/stop module A_IN2	Same as b9-02	0	-	At stop
b9-04	0xB904	Terminal start/stop module A_IN3	Same as b9-02	0	-	At stop
b9-05	0xB905	Operation permission source of terminal start/ stop module A	Same as b9-02	1	-	At stop
b9-06	0xB906	Fault reset source of terminal start/stop module A	Same as b9-02	0	-	At stop
b9-07	0xB907	JOG1 source of terminal start/stop module A	Same as b9-02	0	-	At stop
b9-08	0xB908	JOG2 source of terminal start/stop module A	Same as b9-02	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
b9-09	0xB909	Mode of terminal start/ stop module B	0: Disable 1: IN1 for start 2: IN1 for start and IN2 for direction 3: IN1 for forward start and IN2 for reverse start 4: IN1P (rising edge) for start and IN2 for stop 5: IN1P (rising edge) for start, IN2 for stop, and IN3 for direction 6: IN1P (rising edge) for forward start, IN2P (rising edge) for reverse start, and IN3 for stop	3	-	At stop
b9-10	0xB90A	Terminal start/stop module B_IN1	Same as b9-02	0	-	At stop
b9-11	0xB90B	Terminal start/stop module B_IN2	Same as b9-02	0	-	At stop
b9-12	0xB90C	Terminal start/stop module B_IN3	Same as b9-02	0	-	At stop
b9-13	0xB90D	Operation permission source of terminal start/ stop module B	Same as b9-02	1	-	At stop
b9-14	0xB90E	Fault reset source of terminal start/stop module B	Same as b9-02	0	-	At stop
b9-15	0xB90F	JOG1 source of terminal start/stop module B	Same as b9-02	0	-	At stop
b9-16	0xB910	JOG2 source of terminal start/stop module B	Same as b9-02	0	-	At stop

10.5 Group C Motor Parameter

10.5.1 C0 Encoder 1 Parameters

Param.	Communication address	Name	Range	Default	Unit	Change mode
C0-00	0xC000	Encoder type	0: None 1: ABZ incremental encoder 2: 23-bit encoder 3: Resolver 4: SSI encoder 5: Sine-cosine encoder 6: EnDat encoder 7: BiSS encoder	0	-	At stop
C0-01	0xC001	Encoder control word	bit0: Reserved bit1: Software open circuit detection bit2: Deburring bit3: Hardware open circuit detection bit4: Average filter bit1 to bit4 0: Disable 1: Enable bit5 to bit15: Reserved	0x000C	-	At stop
C0-02	0xC002	Encoder pulses per revolution	1 to 65535	1024	-	At stop
C0-03	0xC003	Phase sequence of encoder	0: Forward 1: Reverse	0	-	At stop
C0-04	0xC004	Encoder mounting position angle	0.0 to 359.9	0.0	°	At stop
C0-05	0xC005	Filter time constant for encoder speed measurement	0.0000 to 6.0000	0.0040	s	Real-time
C0-06	0xC006	Speed measurement mode at low speed	0: Maintain 1: Attenuate 2: Optimize	2	-	At stop
C0-07	0xC007	Disconnection detection time of digital PG card for speed feedback	0.1 to 10.0	0.5	s	At stop
C0-08	0xC008	Software detection coefficient for encoder open circuit	0.0 to 800.0	100.0	%	Real-time
C0-09	0xC009	Threshold of speed error events	1 to 100	10	-	Real-time
C0-10	0xC00A	Encoder gear ratio numerator	1 to 65535	1	-	At stop
C0-11	0xC00B	Encoder gear ratio denominator	1 to 65535	1	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C0-12	0xC00C	Signal Z correction	0: Disable 1: Enable	1	-	Real-time
C0-13	0xC00D	Number of resolver pole pairs	1 to 65535	1	-	At stop
C0-15	0xC00F	Number of frequency division output pulses	4 to 65532	4096	-	At stop
C0-16	0xC010	Frequency division factor of ABZ encoder	1 to 64	1	-	At stop
C0-17	0xC011	Configuration command word for frequency division output	bit0: Frequency-division signal source selection 0: Channel 1 1: Channel 2 bit1: A/B signal phase for frequency division output 0: Phase A leads phase B. 1: Phase B leads phase A. bit2: Z signal level for frequency division output 0: The Z signal is at a low level. 1: The Z signal is at a high level. bit3 to bit15: Reserved	0x0004	-	At stop
C0-18	0xC012	ABZ encoder level type	1: Differential output 2: TTL complementary push-pull output 3: HTL complementary push-pull output 4: TTL single-ended push-pull output 5: HTL single-ended push-pull output 6: OC output	1	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C0-19	0xC013	ABZ encoder command word	bit0: A/B pulse selection in M/T speed measurement 0: A pulse 1: B pulse bit1: Reserved bit2: Interchange of input signals A and B 0: Disable 1: Enable bit3: Interchange of A and B signals during frequency division output 0: Disable 1: Enable bit4: Z signal inversion during frequency division output 0: Disable 1: Enable bit5: Low-order bit selection for filter function 0: Disable 1: Enable bit6: High-order bit selection of filter function 0: Disable 1: Enable bit7: Reserved bit8: Reserved bit9: A pulse disconnection detection 0: Disable 1: Enable bit10: B pulse disconnection detection 0: Disable 1: Enable bit11: Z pulse disconnection detection 0: Disable 1: Enable bit12 to bit15: Reserved	0x0E60	-	At stop
C0-20	0xC014	ABZ speed measurement mode selection in quadrature counting	0: 4x 1: 4x at low speed, 1x at high speed 2: 1x	0	-	At stop
C0-23	0xC017	23-bit encoder communication frequency selection	1: 2 MHz 3: 4 MHz 4: 8 MHz	1	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C0-26	0xC01A	Disconnection detection time of analog PG card for speed feedback	0.005 to 10.000	0.050	s	At stop
C0-27	0xC01B	Resolver excitation signal selection	0: 10 kHz 1: 15 kHz 2: 12 kHz 3: 20 kHz	0	-	At stop
C0-28	0xC01C	Command word of resolver	bit0: Excitation amplification output 0: Disable 1: Enable bit1: Invert the input signal 0: Forward 1: Reverse bit2 to bit15: Reserved	0x0001	-	At stop
C0-29	0xC01D	Resolver transformation ratio selection	0: 0.5 1: 0.286	0	-	At stop
C0-31	0xC01F	SSI encoder communication baud rate	0: 2 Mbit/s 1: 1.5 Mbit/s 2: 1 Mbit/s 3: 0.5 Mbit/s 4: 0.4 Mbit/s 5: 0.25 Mbit/s 6: 0.125 Mbit/s	3	-	At stop
C0-32	0xC020	SSI encoder parity mode	0: Zero parity 1: Odd parity 2: Even parity	0	-	At stop
C0-33	0xC021	SSI encoder data encoding format	0: Binary 1: Gray code	0	-	At stop
C0-34	0xC022	Number of SSI encoder status bits	0 to 8	0	-	At stop
C0-41	0xC029	EnDat encoder communication frequency	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	1	-	At stop
C0-45	0xC02D	BiSS encoder communication frequency	1: 1 M 2: 2 M 3: 3 M 4: 5 M 5: 7.5 M 6: 10 M	1	-	At stop
C0-46	0xC02E	BiSS encoder parity mode	0: Calculated CRC inconsistent with the received CRC 1: Calculated CRC same as received CRC	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C0-47	0xC02F	Number of BiSS encoder status bits	0 to 8	0	-	At stop
C0-51	0xC033	Single-turn resolution of communication-type encoder	1 to 32	23	-	At stop
C0-52	0xC034	Multi-turn resolution of communication-type encoder	0 to 32	0	-	At stop
C0-58	0xC03A	Z signal interference detection	0: Disable 1: Enable	1	-	Real-time
C0-59	0xC03B	Z signal interference detection threshold	0.5 to 10.0	0.5	%	At stop
C0-61	0xC03D	Z signal loss detection	0: Disable 1: Enable	1	-	Real-time
C0-63	0xC03F	Oriented deviation detection	0: Disable 1: Enable	1	-	Real-time
C0-64	0xC040	Z signal interference detection threshold 2	0 to 500	12	-	At stop
C0-90	0xC05A	Encoder pulse unit conversion numerator	1 to 65535	1	-	Real-time
C0-91	0xC05B	Encoder pulse unit conversion denominator	1 to 65535	1	-	Real-time
C0-92	0xC05C	Setting of encoder pulse accumulation	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
C0-93	0xC05D	High-order bits of encoder pulse accumulation	0x0 to 0xFFFF	0x0	-	Real-time
C0-94	0xC05E	Low-order bits of encoder pulse accumulation	0x0 to 0xFFFF	0x0	-	Real-time

10.5.2 C2 Auto-tuning and Self-test

Param.	Communication address	Name	Range	Default	Unit	Change mode
C2-00	0xC200	Motor parameter auto-tuning mode	0: No action 1: Auto-tuning of some parameters for asynchronous motor in static state 2: Auto-tuning of asynchronous motor in dynamic state 3: Auto-tuning of all parameters for asynchronous motor in static state 4: Inertia auto-tuning 5: Dead zone auto-tuning 7: Inductance auto-tuning 8: Back EMF auto-tuning 11: With-load auto-tuning of permanent magnet motor (excluding back EMF) 12: No-load auto-tuning of permanent magnet motor in dynamic state 13: Auto-tuning of some parameters of permanent magnet motor in static state 14: UV gain deviation auto-tuning 21: Auto-tuning of synchronous reluctance motor in static state 22: Auto-tuning of synchronous reluctance motor in dynamic state	0	-	At stop
C2-03	0xC203	Self-test configuration before startup	bit0: Self-test on IGBT shoot-through before startup bit1: Self-test on ground short circuit before startup bit2: Self-test on phase loss before startup bit0 to bit2: 0: Disable 1: Enable bit3 to bit15: Reserved	0x0	-	At stop
C2-04	0xC204	Manual self-test	0: No command 1: Static self-test preparation	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C2-06	0xC206	Self-test configuration upon power-on	bit0: Self-test on IGBT shoot-through upon power-on bit1: Self-test on ground short circuit upon power-on bit2: Self-test on phase loss upon power-on 0: Disable 1: Enable bit0 to bit2: 0: Disable 1: Enable bit3 to bit15: Reserved	0x0002	-	At stop
C2-17	0xC211	Auto-tuning acceleration time	0.0 to 600.0	20.0	s	At stop
C2-18	0xC212	Auto-tuning deceleration time	0.0 to 600.0	20.0	s	At stop
C2-19	0xC213	Parameter calculation	0: Invalid 1: Motor nameplate parameter calculation	0	-	At stop
C2-20	0xC214	Nameplate parameter calculation acknowledgment	0: Invalid 1: Valid	0	-	At stop
C2-21	0xC215	TB calculation of synchronous motor	0: Invalid 1: Valid	0	-	At stop
C2-30	0xC21E	No-load current vector auto-tuning	0: Disable 1: Enable	0	-	At stop
C2-31	0xC21F	Speed source for no-load current vector auto-tuning	0: User-defined 1: Internal-defined	0	-	At stop
C2-64	0xC240	Quick auto-tuning for back EMF enable	0: Disable 1: Enable	0	-	At stop

10.5.3 C4 Basic Parameters of Motor 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
C4-00	0xC400	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnet 4: Synchronous reluctance motor with permanent magnet	0	-	At stop
C4-01	0xC401	Rated motor power	0.01 to 655.35	4.00	kW	At stop
C4-03	0xC403	Rated motor voltage	1 to 2000	380	V	At stop
C4-04	0xC404	Rated motor current	0.01 to 655.35	9.00	A	At stop
C4-06	0xC406	Rated motor frequency	0.01 to 599.00	50.00	Hz	At stop
C4-07	0xC407	Rated motor speed	1 to 65535	1460	rpm	At stop
C4-09	0xC409	Power factor of the motor	0.600 to 1.000	0.860	-	At stop
C4-10	0xC40A	Maximum motor frequency	C4-06 to 599.00	50.00	Hz	At stop
C4-11	0xC40B	Minimum motor frequency	0.00 to C4-10	0.00	Hz	At stop
C4-12	0xC40C	Synchronous motor back EMF	0.0 to 6553.5	300.0	V	Real-time
C4-13	0xC40D	Number of parallel motors	1 to 200	1	-	At stop
C4-14	0xC40E	Number of motor pole pairs (number of poles/2)	0 to 128	0	-	At stop
C4-15	0xC40F	Number of effective motor pole pairs	0 to 128	0	-	Unchangeable
C4-20	0xC414	Stator resistance	0.001 to 65.535	1.204	Ω	Real-time
C4-22	0xC416	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real-time
C4-24	0xC418	Leakage inductance of asynchronous motor stator	0.01 to 655.35	5.28	mH	Real-time
C4-26	0xC41A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real-time
C4-28	0xC41C	Asynchronous motor mutual inductance	0.1 to 6553.5	156.8	mH	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
C4-30	0xC41E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real-time
C4-32	0xC420	D-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real-time
C4-34	0xC422	Q-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real-time
C4-62	0xC43E	Inertia ratio	0.0 to 6553.5	120.0	%	At stop
C4-63	0xC43F	Electromechanical time constant	0.01 to 655.35	1.00	s	Unchangeable
C4-64	0xC440	System rotation inertia	0.01 to 655.35	1.00	kg·m²	Unchangeable
C4-70	0xC446	Motor brake control	0: Disable 1: Enable	1	-	At stop

10.5.4 C5 Expansion Parameters of Motor 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
C5-02	0xC502	Current coefficient 1 of mutual inductance curve	5.0 to 100.0	50.0	%	At stop
C5-03	0xC503	Current coefficient 2 of mutual inductance curve	5.0 to 100.0	75.0	%	At stop
C5-04	0xC504	Current coefficient 3 of mutual inductance curve	100.0 to 800.0	150.0	%	At stop
C5-05	0xC505	Current coefficient 4 of mutual inductance curve	100.0 to 800.0	210.0	%	At stop
C5-06	0xC506	Flux coefficient 1 of mutual inductance curve	10.0 to 100.0	50.0	%	At stop
C5-07	0xC507	Flux coefficient 2 of mutual inductance curve	10.0 to 100.0	85.0	%	At stop
C5-08	0xC508	Flux coefficient 3 of mutual inductance curve	100.0 to 300.0	115.0	%	At stop
C5-09	0xC509	Flux coefficient 4 of mutual inductance curve	100.0 to 300.0	125.0	%	At stop
C5-10	0xC50A	Speed point 1 of friction curve	0 to 30000	15	rpm	At stop
C5-11	0xC50B	Speed point 2 of friction curve	0 to 30000	30	rpm	At stop
C5-12	0xC50C	Speed point 3 of friction curve	0 to 30000	60	rpm	At stop
C5-13	0xC50D	Speed point 4 of friction curve	0 to 30000	120	rpm	At stop
C5-14	0xC50E	Speed point 5 of friction curve	0 to 30000	150	rpm	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C5-15	0xC50F	Speed point 6 of friction curve	0 to 30000	300	rpm	At stop
C5-16	0xC510	Speed point 7 of friction curve	0 to 30000	600	rpm	At stop
C5-17	0xC511	Speed point 8 of friction curve	0 to 30000	1200	rpm	At stop
C5-18	0xC512	Speed point 9 of friction curve	0 to 30000	1500	rpm	At stop
C5-19	0xC513	Speed point 10 of friction curve	0 to 30000	3000	rpm	At stop
C5-20	0xC514	Torque point 1 of friction curve	-320.00 to 320.00	0.00	N·m	At stop
C5-21	0xC515	Torque point 2 of friction curve	-320.00 to 320.00	0.00	N·m	At stop
C5-22	0xC516	Torque point 3 of friction curve	-320.00 to 320.00	0.00	N·m	At stop
C5-23	0xC517	Torque point 4 of friction curve	-320.00 to 320.00	0.00	N·m	At stop
C5-24	0xC518	Torque point 5 of friction curve	-320.00 to 320.00	0.00	N·m	At stop
C5-25	0xC519	Torque point 6 of friction curve	-320.00 to 320.00	0.00	N·m	At stop
C5-26	0xC51A	Torque point 7 of friction curve	-320.00 to 320.00	0.00	N·m	At stop
C5-27	0xC51B	Torque point 8 of friction curve	-320.00 to 320.00	0.00	N·m	At stop
C5-28	0xC51C	Torque point 9 of friction curve	-320.00 to 320.00	0.00	N·m	At stop
C5-29	0xC51D	Torque point 10 of friction curve	-320.00 to 320.00	0.00	N·m	At stop
C5-30	0xC51E	Start point of d/q-axis inductance curve current coefficient	-800.0 to +800.0	-200.0	%	At stop
C5-31	0xC51F	End point of d/q-axis inductance curve current coefficient	-800.0 to +800.0	200.0	%	At stop
C5-32	0xC520	d-axis inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-33	0xC521	d-axis inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-34	0xC522	d-axis inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-35	0xC523	d-axis inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C5-36	0xC524	d-axis inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-37	0xC525	d-axis inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-38	0xC526	d-axis inductance 7 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-39	0xC527	d-axis inductance 8 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-40	0xC528	d-axis inductance 9 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-41	0xC529	d-axis inductance 10 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-42	0xC52A	d-axis inductance 11 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-43	0xC52B	d-axis inductance 12 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-44	0xC52C	q-axis inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-45	0xC52D	q-axis inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-46	0xC52E	q-axis inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-47	0xC52F	q-axis inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-48	0xC530	q-axis inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-49	0xC531	q-axis inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-50	0xC532	q-axis inductance 7 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-51	0xC533	q-axis inductance 8 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-52	0xC534	q-axis inductance 9 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-53	0xC535	q-axis inductance 10 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-54	0xC536	q-axis inductance 11 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C5-55	0xC537	q-axis inductance 12 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-56	0xC538	d-axis low inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-57	0xC539	d-axis low inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-58	0xC53A	d-axis low inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-59	0xC53B	d-axis low inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-60	0xC53C	d-axis low inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-61	0xC53D	d-axis low inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-62	0xC53E	d-axis low inductance 7 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-63	0xC53F	d-axis low inductance 8 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-64	0xC540	d-axis low inductance 9 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-65	0xC541	d-axis low inductance 10 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-66	0xC542	d-axis low inductance 11 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-67	0xC543	d-axis low inductance 12 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-68	0xC544	q-axis low inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-69	0xC545	q-axis low inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C5-70	0xC546	q-axis low inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-71	0xC547	q-axis low inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-72	0xC548	q-axis low inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C5-73	0xC549	q-axis low inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop

10.5.5 C7 Basic Parameters of Motor 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
C7-00	0xC700	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnet 4: Synchronous reluctance motor with permanent magnet	0	-	At stop
C7-01	0xC701	Rated motor power	0.01 to 655.35	4.00	kW	At stop
C7-03	0xC703	Rated motor voltage	1 to 2000	380	V	At stop
C7-04	0xC704	Rated motor current	0.01 to 655.35	9.00	A	At stop
C7-06	0xC706	Rated motor frequency	0.01 to 599.00	50.00	Hz	At stop
C7-07	0xC707	Rated motor speed	1 to 65535	1460	rpm	At stop
C7-09	0xC709	Power factor of the motor	0.600 to 1.000	0.860	-	At stop
C7-10	0xC70A	Maximum motor frequency	C7-06 to 599.00	50.00	Hz	At stop
C7-11	0xC70B	Minimum motor frequency	0.00 to C7-10	0.00	Hz	At stop
C7-12	0xC70C	Synchronous motor back EMF	0.0 to 6553.5	300.0	V	Real-time
C7-13	0xC70D	Number of parallel motors	1 to 200	1	-	At stop
C7-14	0xC70E	Number of motor pole pairs (number of poles/2)	0 to 128	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C7-15	0xC70F	Number of effective motor pole pairs	0 to 128	0	-	Unchangeable
C7-20	0xC714	Stator resistance	0.001 to 65.535	1.204	Ω	Real-time
C7-22	0xC716	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real-time
C7-24	0xC718	Leakage inductance of asynchronous motor stator	0.01 to 655.35	5.28	mH	Real-time
C7-26	0xC71A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real-time
C7-28	0xC71C	Asynchronous motor mutual inductance	0.1 to 6553.5	156.8	mH	Real-time
C7-30	0xC71E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real-time
C7-32	0xC720	D-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real-time
C7-34	0xC722	Q-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real-time
C7-62	0xC73E	Inertia ratio	0.0 to 6553.5	120.0	%	At stop
C7-63	0xC73F	Electromechanical time constant	0.01 to 655.35	1.00	s	Unchangeable
C7-64	0xC740	System rotation inertia	0.01 to 655.35	1.00	kg·m²	Unchangeable
C7-70	0xC746	Motor brake control	0: Disable 1: Enable	1	-	At stop

10.5.6 C8 Expansion Parameters of Motor 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
C8-56	0xC838	d-axis low inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-57	0xC839	d-axis low inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-58	0xC83A	d-axis low inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-59	0xC83B	d-axis low inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
C8-60	0xC83C	d-axis low inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-61	0xC83D	d-axis low inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-62	0xC83E	d-axis low inductance 7 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-63	0xC83F	d-axis low inductance 8 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-64	0xC840	d-axis low inductance 9 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-65	0xC841	d-axis low inductance 10 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-66	0xC842	d-axis low inductance 11 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-67	0xC843	d-axis low inductance 12 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-68	0xC844	q-axis low inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-69	0xC845	q-axis low inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-70	0xC846	q-axis low inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-71	0xC847	q-axis low inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-72	0xC848	q-axis low inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
C8-73	0xC849	q-axis low inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop

10.5.7 CA Basic Parameters of Motor 3

Param.	Communication address	Name	Range	Default	Unit	Change mode
CA-00	0xCA00	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnet 4: Synchronous reluctance motor with permanent magnet	0	-	At stop
CA-01	0xCA01	Rated motor power	0.01 to 655.35	4.00	kW	At stop
CA-03	0xCA03	Rated motor voltage	1 to 2000	380	V	At stop
CA-04	0xCA04	Rated motor current	0.01 to 655.35	9.00	A	At stop
CA-06	0xCA06	Rated motor frequency	0.01 to 599.00	50.00	Hz	At stop
CA-07	0xCA07	Rated motor speed	1 to 65535	1460	rpm	At stop
CA-09	0xCA09	Power factor of the motor	0.600 to 1.000	0.860	-	At stop
CA-10	0xCA0A	Maximum motor frequency	CA-06 to 599.00	50.00	Hz	At stop
CA-11	0xCA0B	Minimum motor frequency	0.00 to CA-10	0.00	Hz	At stop
CA-12	0xCA0C	Synchronous motor back EMF	0.0 to 6553.5	300.0	V	Real-time
CA-13	0xCA0D	Number of parallel motors	1 to 200	1	-	At stop
CA-14	0xCA0E	Number of motor pole pairs (number of poles/2)	0 to 128	0	-	At stop
CA-15	0xCA0F	Number of effective motor pole pairs	0 to 128	0	-	Unchangeable
CA-20	0xCA14	Stator resistance	0.001 to 65.535	1.204	Ω	Real-time
CA-22	0xCA16	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real-time
CA-24	0xCA18	Leakage inductance of asynchronous motor stator	0.01 to 655.35	5.28	mH	Real-time
CA-26	0xCA1A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real-time
CA-28	0xCA1C	Asynchronous motor mutual inductance	0.1 to 6553.5	156.8	mH	Real-time
CA-30	0xCA1E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
CA-32	0xCA20	D-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real-time
CA-34	0xCA22	Q-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real-time
CA-62	0xCA3E	Inertia ratio	0.0 to 6553.5	120.0	%	At stop
CA-63	0xCA3F	Electromechanical time constant	0.01 to 655.35	1.00	s	Unchangeable
CA-64	0xCA40	System rotation inertia	0.01 to 655.35	1.00	kg·m²	Unchangeable
CA-70	0xCA46	Motor brake control	0: Disable 1: Enable	1	-	At stop

10.5.8 Cb Expansion Parameters of Motor 3

Param.	Communication address	Name	Range	Default	Unit	Change mode
Cb-56	0xCB38	d-axis low inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-57	0xCB39	d-axis low inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-58	0xCB3A	d-axis low inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-59	0xCB3B	d-axis low inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-60	0xCB3C	d-axis low inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-61	0xCB3D	d-axis low inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-62	0xCB3E	d-axis low inductance 7 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-63	0xCB3F	d-axis low inductance 8 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-64	0xCB40	d-axis low inductance 9 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-65	0xCB41	d-axis low inductance 10 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-66	0xCB42	d-axis low inductance 11 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-67	0xCB43	d-axis low inductance 12 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
Cb-68	0xCB44	q-axis low inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-69	0xCB45	q-axis low inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-70	0xCB46	q-axis low inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-71	0xCB47	q-axis low inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-72	0xCB48	q-axis low inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
Cb-73	0xCB49	q-axis low inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop

10.5.9 Cd Basic Parameters of Motor 4

Param.	Communication address	Name	Range	Default	Unit	Change mode
Cd-00	0xCD00	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnet 4: Synchronous reluctance motor with permanent magnet	0	-	At stop
Cd-01	0xCD01	Rated motor power	0.01 to 655.35	4.00	kW	At stop
Cd-03	0xCD03	Rated motor voltage	1 to 2000	380	V	At stop
Cd-04	0xCD04	Rated motor current	0.01 to 655.35	9.00	A	At stop
Cd-06	0xCD06	Rated motor frequency	0.01 to 599.00	50.00	Hz	At stop
Cd-07	0xCD07	Rated motor speed	1 to 65535	1460	rpm	At stop
Cd-09	0xCD09	Power factor of the motor	0.600 to 1.000	0.860	-	At stop
Cd-10	0xCD0A	Maximum motor frequency	Cd-06 to 599.00	50.00	Hz	At stop
Cd-11	0xCD0B	Minimum motor frequency	0.00 to Cd-10	0.00	Hz	At stop
Cd-12	0xCD0C	Synchronous motor back EMF	0.0 to 6553.5	300.0	V	Real-time
Cd-13	0xCD0D	Number of parallel motors	1 to 200	1	-	At stop
Cd-14	0xCD0E	Number of motor pole pairs (number of poles/2)	0 to 128	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
Cd-15	0xCD0F	Number of effective motor pole pairs	0 to 128	0	-	Unchangeable
Cd-20	0xCD14	Stator resistance	0.001 to 65.535	1.204	Ω	Real-time
Cd-22	0xCD16	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real-time
Cd-24	0xCD18	Leakage inductance of asynchronous motor stator	0.01 to 655.35	5.28	mH	Real-time
Cd-26	0xCD1A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real-time
Cd-28	0xCD1C	Asynchronous motor mutual inductance	0.1 to 6553.5	156.8	mH	Real-time
Cd-30	0xCD1E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real-time
Cd-32	0xCD20	D-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real-time
Cd-34	0xCD22	Q-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real-time
Cd-62	0xCD3E	Inertia ratio	0.0 to 6553.5	120.0	%	At stop
Cd-63	0xCD3F	Electromechanical time constant	0.01 to 655.35	1.00	s	Unchangeable
Cd-64	0xCD40	System rotation inertia	0.01 to 655.35	1.00	kg·m²	Unchangeable
Cd-70	0xCD46	Motor brake control	0: Disable 1: Enable	1	-	At stop

10.5.10 CE Expansion Parameters of Motor 4

Param.	Communication address	Name	Range	Default	Unit	Change mode
CE-56	0xCE38	d-axis low inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-57	0xCE39	d-axis low inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-58	0xCE3A	d-axis low inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-59	0xCE3B	d-axis low inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-60	0xCE3C	d-axis low inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-61	0xCE3D	d-axis low inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
CE-62	0xCE3E	d-axis low inductance 7 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-63	0xCE3F	d-axis low inductance 8 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-64	0xCE40	d-axis low inductance 9 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-65	0xCE41	d-axis low inductance 10 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-66	0xCE42	d-axis low inductance 11 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-67	0xCE43	d-axis low inductance 12 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-68	0xCE44	q-axis low inductance 1 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-69	0xCE45	q-axis low inductance 2 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-70	0xCE46	q-axis low inductance 3 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-71	0xCE47	q-axis low inductance 4 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-72	0xCE48	q-axis low inductance 5 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop
CE-73	0xCE49	q-axis low inductance 6 of d/q-axis inductance curve	0.0 to 6553.5	100.0	%	At stop

10.6 Group d Control Parameters of Motor 1/2

10.6.1 d0 Basic Control Parameters of Motor 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
d0-00	0xD000	Control mode	0: SVC 1: FVC 2: V/f	2	-	At stop
d0-01	0xD001	Motor control mode	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
d0-02	0xD002	Startup mode	Ones: Asynchronous motor startup mode 0: Direct start 1: Flying start Tens: Synchronous motor startup mode 0: Same as the startup mode of the ones place 1: Forced to flying start Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	10	-	At stop
d0-03	0xD003	Flying start mode	0: Starting from the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented flying start	4	-	Real-time
d0-04	0xD004	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop with maximum capability	0	-	Real-time
d0-05	0xD005	OFF2 (coast to stop) stop mode	0: Coast to stop	0	-	Unchangeable
d0-06	0xD006	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop with maximum capability	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d0-07	0xD007	Stop mode during running	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	-	Real-time
d0-08	0xD008	Stop mode in torque control mode	0: Coast to stop forcibly 1: Switch to speed control mode and stop 2: Keep in the torque mode until the zero speed is reached and then stop	1	-	At stop
d0-09	0xD009	Zero-speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real-time
d0-10	0xD00A	Zero speed judgment time (actual speed)	0.00 to 10.00	0.10	s	At stop
d0-11	0xD00B	Zero speed threshold for synchronous frequency stop	0.00 to 200.00	1.00	%	Real-time
d0-12	0xD00C	Zero speed judgment time of synchronous frequency	0.00 to 655.35	2.00	s	At stop
d0-13	0xD00D	Start/Stop frequency follow-up	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
d0-14	0xD00E	Motor direction selection	0: Default direction 1: Opposite direction	0	-	At stop
d0-15	0xD00F	Shutdown control function configuration	bit0: DC braking at stop enabled 0: Disable 1: Enable bit1 to bit15: Reserved 0: Disable 1: Enable	0x0	-	Real-time
d0-16	0xD010	Shut-down delay time	0.00 to 655.35	0.00	s	At stop
d0-17	0xD011	Pre-excitation mode	0: Time-based pre-excitation 1: Current reference-based pre-excitation 2: Maximum current-based pre-excitation	1	-	At stop
d0-18	0xD012	Pre-excitation time	1 to 30000	1000	ms	Real-time
d0-19	0xD013	Pre-excitation current	1 to 800	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d0-20	0xD014	Demagnetization time	0.00 to 5.00	0.50	s	Real-time
d0-22	0xD016	Startup frequency function configuration	0: Not operate when the set frequency is lower than the startup frequency 1: Operates when the set frequency is lower than the startup frequency	0	-	At stop
d0-23	0xD017	Start frequency	0.00 to 10.00	0.00	Hz	Real-time
d0-24	0xD018	Start frequency hold time	0.0 to 1000.0	0.0	s	At stop
d0-25	0xD019	DC braking time at start	0.0 to 100.0	0.0	s	At stop
d0-26	0xD01A	DC braking current at start	0 to 800	50	%	Real-time
d0-27	0xD01B	Starting frequency of DC braking at stop or active short circuit control	0.0 to 600.0	0.0	Hz	Real-time
d0-28	0xD01C	DC braking waiting time at stop	0.0 to 100.0	0.0	s	Real-time
d0-29	0xD01D	DC braking time at stop	0.0 to 100.0	0.0	s	Real-time
d0-30	0xD01E	DC braking current at stop	0 to 800	50	%	Real-time
d0-31	0xD01F	Current loop Kp adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time
d0-32	0xD020	Current loop Ki adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time
d0-35	0xD023	Current limit during constant current	50.0 to 800.0	100.0	%	Real-time
d0-39	0xD027	Over-excitation selection (vector)	0: Inactive 1: Active	0	-	Real-time
d0-40	0xD028	Over-excitation current (vector)	0 to 800	100	%	Real-time
d0-41	0xD029	Overexcitation gain (V/f)	0 to 200	64	%	Real-time
d0-61	0xD03D	Active short circuit control	0: Disable 1: Enable Others: B connector	0	-	At stop
d0-62	0xD03E	Delay for entering active short circuit control	0.0 to 5000.0	0.0	ms	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
d0-63	0xD03F	Hold time of active short circuit control at stop	0.1 to 3600.0	10.0	s	At stop
d0-70	0xD046	Magnetic pole position detection upon start of synchronous motor in SVC mode	0: Detected every time upon operation 1: Not detected 2: Detected during initial operation upon power-on	0	-	At stop
d0-71	0xD047	Initial position detection method of synchronous motor before startup	0: Voltage pulse 1: High-frequency injection 2: Self-adaptive 3: Pre-positioning	2	-	At stop
d0-72	0xD048	Auto-tuning configuration before start	bit0: Reserved bit1: Quick auto-tuning of stator resistance 0: Disable 1: Enable bit2 to bit6: Reserved bit7: Polarity auto-tuning mode based on high-frequency injection 0: Method 0 1: Method 1 bit8: High-frequency injection search method 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	At stop
d0-75	0xD04B	Initial position detection current of synchronous motor	50 to 180	80	%	At stop
d0-76	0xD04C	Initial position compensation angle	0.0 to 359.9	0.0	°	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
d0-85	0xD055	Low-speed processing method	Ones: Synchronous motor in V/f mode 0: No action 1: Speed open-loop Tens: Synchronous motor in SVC mode 0: No action 1: Speed open-loop 2: Speed open-loop advanced mode 3: High-frequency injection Hundreds: Reluctance motor in SVC mode 0: No action 1: Speed open-loop 2: Speed open-loop advanced mode 3: High-frequency injection Thousands: Reserved Ten thousands: Reserved	101	-	At stop
d0-86	0xD056	Speed open loop current	0 to 800	100	%	Real-time
d0-87	0xD057	Speed open loop switchover frequency.	0.0 to 100.0	10.0	%	Real-time
d0-88	0xD058	Speed open loop switchover hysteresis	0.0 to 100.0	2.5	%	Real-time
d0-89	0xD059	Waiting time for speed open-loop control in SVC mode	0.00 to 5.00	0.50	s	Real-time

10.6.2 d1 Limit and Protection Parameters of Motor 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
d1-00	0xD100	Maximum motor current	0.0 to 1000.0	1000.0	%	Real-time
d1-01	0xD101	Positive speed permission	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d1-02	0xD102	Negative speed selection	Same as d1-01	1	-	Real-time
d1-03	0xD103	Digital setting of forward frequency upper limit 1	d1-07 to 800.0	800.0	%	At stop
d1-04	0xD104	Digital setting of reverse frequency upper limit 1	-800.0 to d1-08	-800.0	%	At stop
d1-05	0xD105	Source of forward frequency upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
d1-06	0xD106	Source of reverse frequency upper limit 2	0: -800 % 1: Opposite to the forward frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
d1-07	0xD107	Digital setting of forward frequency lower limit 1	0.0 to d1-03	0.0	%	At stop
d1-08	0xD108	Digital setting of reverse frequency lower limit 1	d1-04 to 0.0	0.0	%	At stop
d1-09	0xD109	Digital setting of torque upper limit 1	0.0 to 800.0	200.0	%	Real-time
d1-10	0xD10A	Digital setting of torque lower limit 1	-800.0 to 0.0	-200.0	%	Real-time
d1-11	0xD10B	Source of torque upper limit 2	Same as d1-05	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d1-12	0xD10C	Source of torque lower limit 2	0: -800 % 1: Opposite to torque upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
d1-13	0xD10D	Motoring power limit 1	0.0 to 1000.0	400.0	%	Real-time
d1-14	0xD10E	Generating power limit 1	0.0 to 1000.0	400.0	%	Real-time
d1-15	0xD10F	Generating power limit 2	0: Invalid 1: Active in the whole process 2: Active during operation at constant speed 3: Active during deceleration	0	-	Real-time
d1-17	0xD111	Generating power limit 2	0.0 to 800.0	20.0	%	Real-time
d1-33	0xD121	Motor protection	bit0: Reserved bit1: Current control error detection bit2: Motor step loss error detection bit3: Reserved bit4: Demagnetization protection for permanent magnet synchronous motor bit5: Asynchronous motor runaway protection bit6: Speed reversal protection bit7: Reserved bit8: Motor parameter error check bit9: Single phase output loss detection bit10: Demagnetization protection for reluctance motor with permanent magnet bit11: Carrier ratio alarm bit12: Pole pair quantity alarm bit13: Synchronous motor runaway protection bit1 to bit13: 0: Disable 1: Enable bit14: Reserved bit15: Reserved	0x1E87	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d1-35	0xD123	Overspeed protection	0: Disable 1: Enable	1	-	Real-time
d1-36	0xD124	Overspeed protection time	0.0 to 60.0	0.1	s	Real-time
d1-37	0xD125	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real-time
d1-38	0xD126	Excessive speed deviation	Same as d1-35	1	-	Real-time
d1-39	0xD127	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real-time
d1-40	0xD128	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real-time
d1-41	0xD129	Speed reversal detection time	0.00 to 5.00	0.50	s	Real-time
d1-45	0xD12D	Motor overload protection	Same as d1-35	1	-	Real-time
d1-46	0xD12E	Motor overload protection coefficient	20 to 1000	100	%	Real-time
d1-47	0xD12F	Motor overload warning coefficient	50 to 100	80	%	Real-time
d1-50	0xD132	Instantaneous overcurrent threshold of synchronous motor	0.0 to 800.0	350.0	%	Real-time
d1-54	0xD136	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector control mode 0: Disable 1: Enable bit2 to bit15: Reserved	0x0001	-	Real-time
d1-55	0xD137	Voltage threshold for overvoltage suppression	600.0 to A3-57	740.0	V	Real-time
d1-56	0xD138	Effective voltage threshold for overvoltage suppression	600.0 to A3-57	740.0	V	Unchangeable
d1-57	0xD139	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d1-58	0xD13A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
d1-63	0xD13F	Response to undervoltage	0: Not act 1: Suppress undervoltage 2: Decelerate to stop	1	-	Real-time
d1-64	0xD140	Voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Real-time
d1-65	0xD141	Actual effective voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Unchangeable
d1-66	0xD142	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
d1-67	0xD143	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
d1-68	0xD144	Maximum operating time during undervoltage suppression	0.1 to 600.0	600.0	s	Real-time
d1-69	0xD145	Time for decelerating to stop upon undervoltage	0.0 to 300.0	20.0	s	Real-time
d1-70	0xD146	Voltage hysteresis for undervoltage recovery	1 to 100	30	V	Real-time
d1-71	0xD147	Undervoltage recovery waiting time (V/f)	0.0 to 100.0	0.5	s	At stop
d1-72	0xD148	Minimum frequency of undervoltage suppression (vector)	0.00 to 10.00	3.00	Hz	Real-time
d1-73	0xD149	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
d1-77	0xD14D	Stall detection	Same as d1-35	0	-	Real-time
d1-78	0xD14E	Three-phase loss protection	Same as d1-35	1	-	Real-time
d1-79	0xD14F	Stall fault detection time	0.0 to 65.0	2.0	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d1-80	0xD150	Stall fault detection frequency	0.0 to 600.0	6.0	%	Real-time
d1-81	0xD151	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real-time
d1-82	0xD152	Current threshold for three-phase output loss	0.0 to 100.0	10.0	%	Real-time
d1-83	0xD153	Step loss detection time	0.0 to 10.0	0.5	s	Real-time
d1-84	0xD154	Step loss detection threshold	0.0 to 100.0	30.0	%	Real-time
d1-87	0xD157	Detection time for current control fault	0.00 to 1.00	0.05	s	Real-time
d1-88	0xD158	Detection threshold for current control fault	0.0 to 200.0	25.0	%	Real-time
d1-89	0xD159	Detection time for single-phase output loss	0.05 to 650.00	0.20	s	Real-time
d1-91	0xD15B	Runaway protection time for asynchronous motor in SVC	0.05 to 0.50	0.10	s	Real-time
d1-92	0xD15C	Runaway protection threshold for asynchronous motor in SVC	10.0 to 50.0	15.0	%	Real-time
d1-93	0xD15D	Runaway protection time for synchronous motor in FVC mode	0.01 to 60.00	0.10	s	Real-time
d1-94	0xD15E	Runaway protection threshold for synchronous motor in FVC mode	5.0 to 600.0	50.0	%	Real-time

10.6.3 d2 V/f Control of Motor 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
d2-00	0xD200	V/f curve type	0: V/f line 1: Multi-point V/f curve 10: V/f decoupled mode	0	-	At stop
d2-01	0xD201	Multi-point curve selection	0: Three-point curve	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d2-02	0xD202	Frequency point 1 of multi-point V/f curve	0.0 to d2-03	0.0	Hz	Real-time
d2-03	0xD203	Frequency point 2 of multi-point V/f curve	d2-02 to d2-04	0.0	Hz	Real-time
d2-04	0xD204	Frequency point 3 of multi-point V/f curve	d2-03 to 600.0	0.0	Hz	Real-time
d2-08	0xD208	Voltage 1 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
d2-09	0xD209	Voltage 2 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
d2-10	0xD20A	Voltage 3 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
d2-14	0xD20E	Manual torque boost	0.0 to 100.0	3.0	%	Real-time
d2-15	0xD20F	Cutoff frequency of torque boost	0.0 to 100.0	100.0	%	Real-time
d2-16	0xD210	Torque boost mode	0: Manual 1: Automatic 2: Manual+Automatic	2	-	Real-time
d2-17	0xD211	Automatic torque boost filter time	10 to 1000	100	ms	Real-time
d2-18	0xD212	Automatic torque boost gain	80 to 150	100	-	Real-time
d2-22	0xD216	Oscillation suppression in V/f mode	0: Disable 1: Enable	1	-	Real-time
d2-23	0xD217	Oscillation suppression gain in V/f mode	0 to 400	100	%	Real-time
d2-24	0xD218	Cut-off frequency of oscillation suppression filter in V/f mode	1.0 to 50.0	8.0	Hz	Real-time
d2-25	0xD219	Effective cut-off frequency of oscillation suppression in V/f mode	0.0 to 600.0	400.0	%	Real-time
d2-26	0xD21A	Overcurrent suppression enable	0: Disable 1: Enable	1	-	At stop
d2-27	0xD21B	Overcurrent suppression threshold	80 to 300	200	%	At stop
d2-28	0xD21C	Overcurrent suppression Kp adjustment	1 to 500	100	%	Real-time
d2-29	0xD21D	Overcurrent suppression Ki adjustment	10 to 1000	100	%	At stop
d2-30	0xD21E	Frequency for activating field weakening for overcurrent suppression	60 to 500	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d2-31	0xD21F	Minimum suppression threshold for overcurrent suppression during field weakening	20 to 100	100	%	Real-time
d2-32	0xD220	Current coefficient for overcurrent suppression during field weakening	1 to 500	100	%	Real-time
d2-35	0xD223	Energy-saving control in V/f mode	0: Invalid 1: Valid	0	-	Real-time
d2-36	0xD224	Cutoff frequency of energy-saving control in V/f mode	20 to 100	30	%	Real-time
d2-37	0xD225	Voltage drop gain of energy-saving control in V/f mode	10 to 500	100	%	Real-time
d2-38	0xD226	Voltage boost gain of energy-saving control in V/f mode	10 to 500	100	%	Real-time
d2-41	0xD229	Slip compensation mode	0: Disable 1: Enable	0	-	At stop
d2-42	0xD22A	Slip compensation gain	0.0 to 200.0	100.0	%	Real-time
d2-43	0xD22B	Slip compensation filter time	0.1 to 10.0	0.5	s	At stop
d2-47	0xD22F	Voltage upper limit in V/f decoupled mode	50.0 to 200.0	100.0	%	At stop
d2-48	0xD230	Voltage source in V/f decoupled mode	0: d2-49 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
d2-49	0xD231	Digital setting of voltage in V/f decoupled mode	0 to C4-03	0	V	Real-time
d2-50	0xD232	Voltage acceleration time in V/f decoupled mode	0.0 to 1000.0	0.0	s	Real-time
d2-51	0xD233	Voltage deceleration time in V/f decoupled mode	0.0 to 1000.0	0.0	s	Real-time
d2-52	0xD234	RFG time of the frequency in V/f decoupled mode	0: RFG time is forcibly set to zero. 1: Preset RFG time	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
d2-53	0xD235	Stop mode in V/f decoupled mode	0: Frequency and voltage decline to 0 independently. 1: Frequency declines to 0 after voltage declines to 0. 2: Coast to stop (newly added)	0	-	Real-time
d2-60	0xD23C	Synchronous motor current loop coefficient in V/f mode	0 to 1000	100	%	Real-time
d2-61	0xD23D	Synchronous motor MTPA coefficient in V/f mode	0 to 1000	0	%	Real-time
d2-62	0xD23E	Oscillation suppression gain coefficient of synchronous motor in V/f mode	0 to 500	100	%	Real-time
d2-63	0xD23F	Filter time coefficient of synchronous motor in V/f mode	0 to 500	100	%	Real-time
d2-64	0xD240	Synchronous motor energy-saving control in V/f mode	0: Fixed V/f line 1: Fixed to 30% of reactive current 2: MTPA control	2	-	At stop

10.6.4 d3 Speed Control Parameter of Motor 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
d3-00	0xD300	Speed loop Kp in FVC mode	0.0 to 6000.0	8.0	-	Real-time
d3-01	0xD301	Speed loop Ti in FVC mode	0.000 to 20.000	0.080	s	Real-time
d3-02	0xD302	Speed loop Kp in SVC mode	0.0 to 6000.0	5.0	-	Real-time
d3-03	0xD303	Speed loop Ti in SVC mode	0.000 to 20.000	0.127	s	Real-time
d3-06	0xD306	Zero speed switchover frequency	0.0 to d3-09	1.0	%	Real-time
d3-07	0xD307	Zero speed Kp correction coefficient	0.0 to 1000.0	100.0	%	Real-time
d3-08	0xD308	Zero speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
d3-09	0xD309	Low speed switchover frequency	0.0 to d3-12	10.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d3-10	0xD30A	Low speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
d3-11	0xD30B	Low speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
d3-12	0xD30C	High speed switchover frequency	d3-09 to 400.0	100.0	%	Real-time
d3-13	0xD30D	High speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
d3-14	0xD30E	High speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
d3-19	0xD313	Adaptive source of speed loop Kp	0: Invalid 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	39888	-	Real-time
d3-21	0xD315	Lower limit of speed loop adaptive switchover	0.0 to 1000.0	40.0	%	Real-time
d3-22	0xD316	Upper limit of speed loop adaptive switchover	0.0 to 1000.0	100.0	%	Real-time
d3-23	0xD317	Lower limit of speed loop adaptive correction	0.0 to 1000.0	100.0	%	Real-time
d3-24	0xD318	Upper limit of speed loop adaptive correction	0.0 to 1000.0	100.0	%	Real-time
d3-27	0xD31B	Droop function	0: Disable 1: Enable	0	-	Real-time
d3-28	0xD31C	Droop source	0: Output torque 1: Torque reference 2: Speed regulator output 3: Integral component of speed regulator	1	-	At stop
d3-29	0xD31D	Droop coefficient	0.0 to 50.0	0.0	%	Real-time
d3-33	0xD321	Forced integral enable	0: Invalid 1: Enable Others: B connector	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d3-34	0xD322	Source of forced integral value	0: d3-35 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
d3-35	0xD323	Digital setting of integral forced value	-800.0 to +800.0	0.0	%	Real-time
d3-38	0xD326	Acceleration torque feedforward	0: Disable 1: Enable	0	-	Real-time
d3-39	0xD327	Acceleration torque feedforward coefficient	0.0 to 6553.0	100.0	%	Real-time
d3-40	0xD328	Acceleration source of acceleration torque feedforward	0: RFG reference 1: Automatic calculation Others: F connector	0	-	Real-time
d3-45	0xD32D	Speed control window	0.00 to 10.00	0.00	Hz	At stop
d3-46	0xD32E	Filter time of frequency reference	0.0 to 100.0	0.0	ms	At stop
d3-47	0xD32F	Filter time of feedback frequency	0.0 to 100.0	0.0	ms	At stop
d3-48	0xD330	Low-pass filter time of torque current reference	0.0 to 100.0	0.0	ms	At stop
d3-55	0xD337	Anti-load disturbance	0: Disable 1: Enable	0	-	Real-time
d3-57	0xD339	Anti-load disturbance bandwidth	0.01 to 300.00	1.00	Hz	Real-time
d3-58	0xD33A	Anti-load disturbance coefficient	0.0 to 1000.0	100.0	%	Real-time

10.6.5 d4 Current Control of Motor 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
d4-00	0xD400	Current loop D-axis Kp coefficient	1 to 1000	100	%	Real-time
d4-01	0xD401	Current loop D-axis Ki coefficient	1 to 1000	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d4-02	0xD402	Current loop Q-axis Kp coefficient	1 to 1000	100	%	Real-time
d4-03	0xD403	Current loop Q-axis Ki coefficient	1 to 1000	100	%	Real-time

10.6.6 d5 Excitation Control of Motor 1

Param.	Communication address	Name	Range	Default	Unit	Change mode
d5-17	0xD511	Demagnetization current limit	0 to 500	300	%	Real-time
d5-25	0xD519	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	-	Real-time

10.6.7 d7 Motor 1 Control Optimization

Param.	Communication address	Name	Range	Default	Unit	Change mode
d7-02	0xD702	Switch FVC to SVC	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC upon encoder open circuit and revert to FVC after the encoder is recovered upon stop).	0	-	At stop
d7-03	0xD703	Frequency for switching from FVC to SVC	10 to 500	50	%	At stop
d7-04	0xD704	Hysteresis for switching from FVC to SVC	10 to 100	10	%	At stop

10.6.8 d8 Basic Control Parameters of Motor 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
d8-00	0xD800	Control mode	0: SVC 1: FVC 2: V/f	2	-	At stop
d8-01	0xD801	Motor control mode	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
d8-02	0xD802	Startup mode	Ones: Asynchronous motor startup mode 0: Direct start 1: Flying start Tens: Synchronous motor startup mode 0: Same as the startup mode of the ones place 1: Forced to flying start Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	10	-	At stop
d8-03	0xD803	Flying start mode	0: Starting from the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented flying start	4	-	Real-time
d8-04	0xD804	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop with maximum capability	0	-	Real-time
d8-05	0xD805	OFF2 (coast to stop) stop mode	0: Coast to stop	0	-	Unchangeable
d8-06	0xD806	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop with maximum capability	0	-	Real-time
d8-07	0xD807	Stop mode during running	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d8-08	0xD808	Stop mode in torque control mode	0: Coast to stop forcibly 1: Switch to speed control mode and stop 2: Keep in the torque mode until the zero speed is reached and then stop	1	-	At stop
d8-09	0xD809	Zero-speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real-time
d8-10	0xD80A	Zero speed judgment time (actual speed)	0.00 to 10.00	0.10	s	At stop
d8-11	0xD80B	Zero speed threshold for synchronous frequency stop	0.00 to 200.00	1.00	%	Real-time
d8-12	0xD80C	Zero speed judgment time of synchronous frequency	0.00 to 655.35	2.00	s	At stop
d8-13	0xD80D	Start/Stop frequency follow-up	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
d8-14	0xD80E	Motor direction selection	0: Default direction 1: Opposite direction	0	-	At stop
d8-15	0xD80F	Shutdown control function configuration	bit0: DC braking at stop enabled 0: Disable 1: Enable bit1 to bit15: Reserved 0: Disable 1: Enable	0x0	-	Real-time
d8-16	0xD810	Shut-down delay time	0.00 to 655.35	0.00	s	At stop
d8-17	0xD811	Pre-excitation mode	0: Time-based pre-excitation 1: Current reference-based pre-excitation 2: Maximum current-based pre-excitation	1	-	At stop
d8-18	0xD812	Pre-excitation time	1 to 30000	1000	ms	Real-time
d8-19	0xD813	Pre-excitation current	1 to 800	100	%	Real-time
d8-20	0xD814	Demagnetization time	0.00 to 5.00	0.50	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d8-22	0xD816	Startup frequency function configuration	0: Not operate when the set frequency is lower than the startup frequency 1: Operates when the set frequency is lower than the startup frequency	0	-	At stop
d8-23	0xD817	Start frequency	0.00 to 10.00	0.00	Hz	Real-time
d8-24	0xD818	Start frequency hold time	0.0 to 1000.0	0.0	s	At stop
d8-25	0xD819	DC braking time at start	0.0 to 100.0	0.0	s	At stop
d8-26	0xD81A	DC braking current at start	0 to 800	50	%	Real-time
d8-27	0xD81B	Starting frequency of DC braking at stop or active short circuit control	0.0 to 600.0	0.0	Hz	Real-time
d8-28	0xD81C	DC braking waiting time at stop	0.0 to 100.0	0.0	s	Real-time
d8-29	0xD81D	DC braking time at stop	0.0 to 100.0	0.0	s	Real-time
d8-30	0xD81E	DC braking current at stop	0 to 800	50	%	Real-time
d8-31	0xD81F	Current loop Kp adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time
d8-32	0xD820	Current loop Ki adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time
d8-35	0xD823	Current limit during constant current	50.0 to 800.0	100.0	%	Real-time
d8-39	0xD827	Over-excitation selection (vector)	0: Inactive 1: Active	0	-	Real-time
d8-40	0xD828	Over-excitation current (vector)	0 to 800	100	%	Real-time
d8-41	0xD829	Overexcitation gain (V/f)	0 to 200	64	%	Real-time
d8-61	0xD83D	Active short circuit control	0: Disable 1: Enable Others: B connector	0	-	At stop
d8-62	0xD83E	Delay for entering active short circuit control	0.0 to 5000.0	0.0	ms	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
d8-63	0xD83F	Hold time of active short circuit control at stop	0.1 to 3600.0	10.0	s	At stop
d8-70	0xD846	Magnetic pole position detection upon start of synchronous motor in SVC mode	0: Detected every time upon operation 1: Not detected 2: Detected during initial operation upon power-on	0	-	At stop
d8-71	0xD847	Initial position detection method of synchronous motor before startup	0: Voltage pulse 1: High-frequency injection 2: Self-adaptive 3: Pre-positioning	2	-	At stop
d8-72	0xD848	Auto-tuning configuration before start	bit0: Reserved bit1: Quick auto-tuning of stator resistance 0: Disable 1: Enable bit2 to bit6: Reserved bit7: Polarity auto-tuning mode based on high-frequency injection 0: Method 0 1: Method 1 bit8: High-frequency injection search method 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	At stop
d8-75	0xD84B	Initial position detection current of synchronous motor	50 to 180	80	%	At stop
d8-76	0xD84C	Initial position compensation angle	0.0 to 359.9	0.0	°	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
d8-85	0xD855	Low-speed processing method	Ones: Synchronous motor in V/f mode 0: No action 1: Speed open-loop Tens: Synchronous motor in SVC mode 0: No action 1: Speed open-loop 2: Speed open-loop advanced mode 3: High-frequency injection Hundreds: Reluctance motor in SVC mode 0: No action 1: Speed open-loop 2: Speed open-loop advanced mode 3: High-frequency injection Thousands: Reserved Ten thousands: Reserved	101	-	At stop
d8-86	0xD856	Speed open loop current	0 to 800	100	%	Real-time
d8-87	0xD857	Speed open loop switchover frequency.	0.0 to 100.0	10.0	%	Real-time
d8-88	0xD858	Speed open loop switchover hysteresis	0.0 to 100.0	2.5	%	Real-time
d8-89	0xD859	Speed open loop waiting time	0.00 to 5.00	0.50	s	Real-time

10.6.9 d9 Limit and Protection Parameters of Motor 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
d9-00	0xD900	Maximum motor current	0.0 to 1000.0	1000.0	%	Real-time
d9-01	0xD901	Positive speed permission	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time
d9-02	0xD902	Negative speed selection	Same as d9-01	1	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d9-03	0xD903	Digital setting of forward frequency upper limit 1	d9-07 to 800.0	800.0	%	At stop
d9-04	0xD904	Digital setting of reverse frequency upper limit 1	-800.0 to d9-08	-800.0	%	At stop
d9-05	0xD905	Source of forward frequency upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
d9-06	0xD906	Source of reverse frequency upper limit 2	0: -800 % 1: Opposite to the forward frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
d9-07	0xD907	Digital setting of forward frequency lower limit 1	0.0 to d9-03	0.0	%	At stop
d9-08	0xD908	Digital setting of reverse frequency lower limit 1	d9-04 to 0.0	0.0	%	At stop
d9-09	0xD909	Digital setting of torque upper limit 1	0.0 to 800.0	200.0	%	Real-time
d9-10	0xD90A	Digital setting of torque lower limit 1	-800.0 to 0.0	-200.0	%	Real-time
d9-11	0xD90B	Source of torque upper limit 2	Same as d9-05	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d9-12	0xD90C	Source of torque lower limit 2	0: -800 % 1: Opposite to torque upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
d9-13	0xD90D	Motoring power limit	0.0 to 1000.0	400.0	%	Real-time
d9-14	0xD90E	Generating power limit	0.0 to 1000.0	400.0	%	Real-time
d9-15	0xD90F	Generating power limit selection	0: Invalid 1: Active in the whole process 2: Active during operation at constant speed 3: Active during deceleration	0	-	Real-time
d9-17	0xD911	Generating power limit selection	0.0 to 800.0	20.0	%	Real-time
d9-33	0xD921	Motor protection	bit0: Reserved bit1: Current control error detection bit2: Motor step loss error detection bit3: Reserved bit4: Demagnetization protection for permanent magnet synchronous motor bit5: Asynchronous motor runaway protection bit6: Speed reversal protection bit7: Reserved bit8: Motor parameter error check bit9: Single phase output loss detection bit10: Demagnetization protection for reluctance motor with permanent magnet bit11: Carrier ratio alarm bit12: Pole pair quantity alarm bit13: Synchronous motor runaway protection bit1 to bit13: 0: Disable 1: Enable bit14: Reserved bit15: Reserved	0x1E87	-	Real-time
d9-35	0xD923	Overspeed protection	0: Disable 1: Enable	1	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d9-36	0xD924	Overspeed protection time	0.0 to 60.0	0.1	s	Real-time
d9-37	0xD925	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real-time
d9-38	0xD926	Excessive speed deviation	0: Disable 1: Enable	1	-	Real-time
d9-39	0xD927	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real-time
d9-40	0xD928	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real-time
d9-41	0xD929	Speed reversal detection time	0.00 to 5.00	0.50	s	Real-time
d9-45	0xD92D	Motor overload protection	0: Disable 1: Enable	1	-	Real-time
d9-46	0xD92E	Motor overload protection coefficient	20 to 1000	100	%	Real-time
d9-47	0xD92F	Motor overload warning coefficient	50 to 100	80	%	Real-time
d9-50	0xD932	Instantaneous overcurrent threshold of synchronous motor	0.0 to 800.0	350.0	%	Real-time
d9-54	0xD936	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector control mode 0: Disable 1: Enable bit2 to bit15: Reserved	0x0001	-	Real-time
d9-55	0xD937	Voltage threshold for overvoltage suppression	600.0 to A3-57	740.0	V	Real-time
d9-56	0xD938	Effective voltage threshold for overvoltage suppression	600.0 to A4-38	740.0	V	Unchangeable
d9-57	0xD939	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
d9-58	0xD93A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d9-63	0xD93F	Response to undervoltage	0: Not act 1: Suppress undervoltage 2: Decelerate to stop	1	-	Real-time
d9-64	0xD940	Voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Real-time
d9-65	0xD941	Actual effective voltage threshold for undervoltage suppression	0.0 to 65535.0	0.0	V	Unchangeable
d9-66	0xD942	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
d9-67	0xD943	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
d9-68	0xD944	Maximum operating time during undervoltage suppression	0.1 to 600.0	600.0	s	Real-time
d9-69	0xD945	Time for decelerating to stop upon undervoltage	0.0 to 300.0	20.0	s	Real-time
d9-70	0xD946	Voltage hysteresis for undervoltage recovery	1 to 100	30	V	Real-time
d9-71	0xD947	Undervoltage recovery waiting time (V/f)	0.0 to 100.0	0.5	s	At stop
d9-72	0xD948	Minimum frequency for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
d9-73	0xD949	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
d9-77	0xD94D	Stall detection	0: Disable 1: Enable	0	-	Real-time
d9-78	0xD94E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real-time
d9-79	0xD94F	Stall fault detection time	0.0 to 65.0	2.0	s	Real-time
d9-80	0xD950	Stall fault detection frequency	0.0 to 600.0	6.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
d9-81	0xD951	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real-time
d9-82	0xD952	Current threshold for three-phase output loss	0.0 to 100.0	10.0	%	Real-time
d9-83	0xD953	Step loss detection time	0.0 to 10.0	0.5	s	Real-time
d9-84	0xD954	Step loss detection threshold	0.0 to 100.0	30.0	%	Real-time
d9-87	0xD957	Detection time for current control fault	0.00 to 1.00	0.05	s	Real-time
d9-88	0xD958	Detection threshold for current control fault	0.0 to 200.0	25.0	%	Real-time
d9-89	0xD959	Detection time for single-phase output loss	0.05 to 650.00	0.20	s	Real-time
d9-91	0xD95B	Runaway protection time for asynchronous motor in SVC	0.05 to 0.50	0.10	s	Real-time
d9-92	0xD95C	Runaway protection threshold for asynchronous motor in SVC	10.0 to 50.0	15.0	%	Real-time
d9-93	0xD95D	Runaway protection time for synchronous motor in FVC mode	0.01 to 60.00	0.10	s	Real-time
d9-94	0xD95E	Runaway protection threshold for synchronous motor in FVC mode	5.0 to 600.0	50.0	%	Real-time

10.6.10 dA V/f Control of Motor 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
dA-00	0xDA00	V/f curve type	0: V/f line 1: Multi-point V/f curve 10: Decoupled V/f	0	-	At stop
dA-01	0xDA01	Multi-point curve selection	0: Three-point curve	0	-	Real-time
dA-02	0xDA02	Frequency point 1 of multi-point V/f curve	0.0 to dA-03	0.0	Hz	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
dA-03	0xDA03	Frequency point 2 of multi-point V/f curve	dA-02 to dA-04	0.0	Hz	Real-time
dA-04	0xDA04	Frequency point 3 of multi-point V/f curve	dA-03 to 600.0	0.0	Hz	Real-time
dA-08	0xDA08	Voltage 1 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
dA-09	0xDA09	Voltage 2 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
dA-10	0xDA0A	Voltage 3 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
dA-14	0xDA0E	Manual torque boost	0.0 to 100.0	3.0	%	Real-time
dA-15	0xDA0F	Cutoff frequency of torque boost	0.0 to 100.0	100.0	%	Real-time
dA-16	0xDA10	Torque boost mode	0: Manual 1: Automatic 2: Manual+Automatic	2	-	Real-time
dA-17	0xDA11	Automatic torque boost filter time	10 to 1000	100	ms	Real-time
dA-18	0xDA12	Automatic torque boost gain	80 to 150	100	-	Real-time
dA-22	0xDA16	Oscillation suppression in V/f mode	0: Disable 1: Enable	1	-	Real-time
dA-23	0xDA17	Oscillation suppression gain in V/f mode	0 to 400	100	%	Real-time
dA-24	0xDA18	Cut-off frequency of oscillation suppression filter in V/f mode	1.0 to 50.0	8.0	Hz	Real-time
dA-25	0xDA19	Effective cut-off frequency of oscillation suppression in V/f mode	0.0 to 600.0	400.0	%	Real-time
dA-26	0xDA1A	Overcurrent suppression enable	0: Disable 1: Enable	1	-	At stop
dA-27	0xDA1B	Overcurrent suppression threshold	80 to 300	200	%	At stop
dA-28	0xDA1C	Overcurrent suppression Kp adjustment	1 to 500	100	%	Real-time
dA-29	0xDA1D	Overcurrent suppression Ki adjustment	10 to 1000	100	%	At stop
dA-30	0xDA1E	Frequency for activating field weakening for overcurrent suppression	60 to 500	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
dA-31	0xDA1F	Minimum suppression threshold for overcurrent suppression during field weakening	20 to 100	100	%	Real-time
dA-32	0xDA20	Current coefficient for overcurrent suppression during field weakening	1 to 500	100	%	Real-time
dA-35	0xDA23	Energy-saving control in V/f mode	0: Invalid 1: Valid	0	-	Real-time
dA-36	0xDA24	Cutoff frequency of energy-saving control in V/f mode	20 to 100	30	%	Real-time
dA-37	0xDA25	Voltage drop gain of energy-saving control in V/f mode	10 to 500	100	%	Real-time
dA-38	0xDA26	Voltage boost gain of energy-saving control in V/f mode	10 to 500	100	%	Real-time
dA-41	0xDA29	Slip compensation mode	0: Disable 1: Without PG card slip compensation	0	-	At stop
dA-42	0xDA2A	Slip compensation gain	0.0 to 200.0	100.0	%	Real-time
dA-43	0xDA2B	Filter time of slip compensation	0.1 to 10.0	0.5	s	At stop
dA-47	0xDA2F	Voltage upper limit in V/f decoupled mode	50.0 to 200.0	100.0	%	At stop
dA-48	0xDA30	Voltage source in V/f decoupled mode	0: d2-49 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
dA-49	0xDA31	Digital setting of voltage in V/f decoupled mode	0 to C7-03	0	V	Real-time
dA-50	0xDA32	Voltage acceleration time in V/f decoupled mode	0.0 to 1000.0	0.0	s	Real-time
dA-51	0xDA33	Voltage deceleration time in V/f decoupled mode	0.0 to 1000.0	0.0	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
dA-52	0xDA34	RFG time of the frequency in V/f decoupled mode	0: RFG time is forcibly set to zero. 1: Preset RFG time	0	-	At stop
dA-53	0xDA35	Stop mode in V/f decoupled mode	0: Frequency and voltage decline to 0 independently. 1: Frequency declines to 0 after voltage declines to 0. 2: Coast to stop (newly added)	0	-	Real-time
dA-60	0xDA3C	Synchronous motor current loop coefficient in V/f mode	0 to 1000	100	%	Real-time
dA-61	0xDA3D	Synchronous motor MTPA coefficient in V/f mode	0 to 1000	0	%	Real-time
dA-62	0xDA3E	Oscillation suppression gain coefficient of synchronous motor in V/f mode	0 to 500	100	%	Real-time
dA-63	0xDA3F	Filter time coefficient of synchronous motor in V/f mode	0 to 500	100	%	Real-time
dA-64	0xDA40	Synchronous motor energy-saving control in V/f mode	0: Fixed V/f line 1: Fixed to 30% of reactive current 2: MTPA control	2	-	At stop

10.6.11 db Speed Control Parameters of Motor 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
db-00	0xDB00	Speed loop Kp in FVC mode	0.0 to 6000.0	8.0	-	Real-time
db-01	0xDB01	Speed loop Ti in FVC mode	0.000 to 20.000	0.080	s	Real-time
db-02	0xDB02	Speed loop Kp in SVC mode	0.0 to 6000.0	5.0	-	Real-time
db-03	0xDB03	Speed loop Ti in SVC mode	0.000 to 20.000	0.127	s	Real-time
db-06	0xDB06	Zero speed switchover frequency	0.0 to db-09	1.0	%	Real-time
db-07	0xDB07	Zero speed Kp correction coefficient	0.0 to 1000.0	100.0	%	Real-time
db-08	0xDB08	Zero speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
db-09	0xDB09	Low speed switchover frequency	0.0 to db-12	10.0	%	Real-time
db-10	0xDB0A	Low speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
db-11	0xDB0B	Low speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
db-12	0xDB0C	High speed switchover frequency	db-09 to 400.0	100.0	%	Real-time
db-13	0xDB0D	High speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
db-14	0xDB0E	High speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
db-19	0xDB13	Adaptive source of speed loop Kp	0: Invalid 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	39888	-	Real-time
db-21	0xDB15	Lower limit of speed loop adaptive switchover	0.0 to 1000.0	40.0	%	Real-time
db-22	0xDB16	Upper limit of speed loop adaptive switchover	0.0 to 1000.0	100.0	%	Real-time
db-23	0xDB17	Lower limit of speed loop adaptive correction	0.0 to 1000.0	100.0	%	Real-time
db-24	0xDB18	Upper limit of speed loop adaptive correction	0.0 to 1000.0	100.0	%	Real-time
db-27	0xDB1B	Droop function	0: Disable 1: Enable	0	-	Real-time
db-28	0xDB1C	Droop source	0: Output torque 1: Torque reference 2: Speed regulator output 3: Integral component of speed regulator	1	-	At stop
db-29	0xDB1D	Droop coefficient	0.0 to 50.0	0.0	%	Real-time
db-33	0xDB21	Forced integral enable	0: Invalid 1: Enable Others: B connector	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
db-34	0xDB22	Source of forced integral value	0: db-35 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
db-35	0xDB23	Digital setting of integral forced value	-800.0 to +800.0	0.0	%	Real-time
db-38	0xDB26	Acceleration torque feedforward	0: Disable 1: Enable	0	-	Real-time
db-39	0xDB27	Acceleration torque feedforward coefficient	0.0 to 6553.0	100.0	%	Real-time
db-40	0xDB28	Acceleration source of acceleration torque feedforward	0: RFG reference 1: Automatic calculation Others: F connector	0	-	Real-time
db-45	0xDB2D	Speed control window	0.00 to 10.00	0.00	Hz	At stop
db-46	0xDB2E	Filter time of frequency reference	0.0 to 100.0	0.0	ms	At stop
db-47	0xDB2F	Filter time of feedback frequency	0.0 to 100.0	0.0	ms	At stop
db-48	0xDB30	Current filter time for torque reference	0.0 to 100.0	0.0	ms	At stop
db-55	0xDB37	Anti-load disturbance	0: Disable 1: Enable	0	-	Real-time
db-57	0xDB39	Load observation bandwidth	0.01 to 300.00	1.00	Hz	Real-time
db-58	0xDB3A	Load observation coefficient	0.0 to 1000.0	100.0	%	Real-time

10.6.12 dC Current Control Parameters of Motor 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
dC-00	0xDC00	Current loop D-axis Kp coefficient	1 to 1000	100	%	Real-time
dC-01	0xDC01	Current loop D-axis Ki coefficient	1 to 1000	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
dC-02	0xDC02	Current loop Q-axis Kp adjustment	1 to 1000	100	%	Real-time
dC-03	0xDC03	Current loop Q-axis Ki adjustment	1 to 1000	100	%	Real-time

10.6.13 dd Excitation Control Parameters of Motor 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
dd-17	0xDD11	Demagnetization current limit	0 to 500	300	%	Real-time
dd-25	0xDD19	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	-	Real-time

10.6.14 dF Control Optimization Parameters of Motor 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
dF-02	0xDF02	Switch FVC to SVC	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC upon encoder open circuit and revert to FVC after the encoder is recovered upon stop).	0	-	At stop
dF-03	0xDF03	Frequency for switching from FVC to SVC	10 to 500	50	%	At stop
dF-04	0xDF04	Hysteresis for switching from FVC to SVC	10 to 100	10	%	At stop

10.7 Group y Control Parameters of Motor 1/2

10.7.1 y0 Basic Control Parameters of Motor 3

Param.	Communication address	Name	Range	Default	Unit	Change mode
y0-00	0x4000	Control mode	0: SVC 1: FVC 2: V/f	2	-	At stop
y0-01	0x4001	Motor control mode	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
y0-02	0x4002	Startup mode	Ones: Asynchronous motor startup mode 0: Direct start 1: Flying start Tens: Synchronous motor startup mode 0: Same as the startup mode of the ones place 1: Forced to flying start Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	10	-	At stop
y0-03	0x4003	Flying start mode	0: Starting from the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented flying start	4	-	Real-time
y0-04	0x4004	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop with maximum capability	0	-	Real-time
y0-05	0x4005	OFF2 (coast to stop) stop mode	0: Coast to stop	0	-	Unchangeable
y0-06	0x4006	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop with maximum capability	0	-	Real-time
y0-07	0x4007	Stop mode during running	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y0-08	0x4008	Stop mode in torque control mode	0: Coast to stop forcibly 1: Switch to speed control mode and stop 2: Keep in the torque mode until the zero speed is reached and then stop	1	-	At stop
y0-09	0x4009	Zero-speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real-time
y0-10	0x400A	Zero speed judgment time (actual speed)	0.00 to 10.00	0.10	s	At stop
y0-11	0x400B	Zero speed threshold for synchronous frequency stop	0.00 to 200.00	1.00	%	Real-time
y0-12	0x400C	Zero speed judgment time of synchronous frequency	0.00 to 655.35	2.00	s	At stop
y0-13	0x400D	Start/Stop frequency follow-up	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
y0-14	0x400E	Motor direction selection	0: Default direction 1: Opposite direction	0	-	At stop
y0-15	0x400F	Shutdown control function configuration	bit0: DC braking at stop enabled 0: Disable 1: Enable bit1 to bit15: Reserved 0: Disable 1: Enable	0x0	-	Real-time
y0-16	0x4010	Shut-down delay time	0.00 to 655.35	0.00	s	At stop
y0-17	0x4011	Pre-excitation mode	0: Time-based pre-excitation 1: Current reference-based pre-excitation 2: Maximum current-based pre-excitation	1	-	At stop
y0-18	0x4012	Pre-excitation time	1 to 30000	1000	ms	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y0-19	0x4013	Pre-excitation current	1 to 800	100	%	Real-time
y0-20	0x4014	Demagnetization time	0.00 to 5.00	0.50	s	Real-time
y0-22	0x4016	Startup frequency function configuration	0: Not operate when the set frequency is lower than the startup frequency 1: Operates when the set frequency is lower than the startup frequency	0	-	At stop
y0-23	0x4017	Start frequency	0.00 to 10.00	0.00	Hz	Real-time
y0-24	0x4018	Start frequency hold time	0.0 to 1000.0	0.0	s	At stop
y0-25	0x4019	DC braking time at start	0.0 to 100.0	0.0	s	At stop
y0-26	0x401A	DC braking current at start	0 to 800	50	%	Real-time
y0-27	0x401B	Starting frequency of DC braking at stop or active short circuit control	0.0 to 600.0	0.0	Hz	Real-time
y0-28	0x401C	DC braking waiting time at stop	0.0 to 100.0	0.0	s	Real-time
y0-29	0x401D	DC braking time at stop	0.0 to 100.0	0.0	s	Real-time
y0-30	0x401E	DC braking current at stop	0 to 800	50	%	Real-time
y0-31	0x401F	Current loop Kp adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time
y0-32	0x4020	Current loop Ki adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time
y0-35	0x4023	Current limit during constant current	50.0 to 800.0	100.0	%	Real-time
y0-39	0x4027	Over-excitation selection (vector)	0: Inactive 1: Active	0	-	Real-time
y0-40	0x4028	Over-excitation current (vector)	0 to 800	100	%	Real-time
y0-41	0x4029	Overexcitation gain (V/f)	0 to 200	64	%	Real-time
y0-61	0x403D	Active short circuit control	0: Disable 1: Enable Others: B connector	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
y0-62	0x403E	Delay for entering active short circuit control	0.0 to 5000.0	0.0	ms	At stop
y0-63	0x403F	Hold time of active short circuit control at stop	0.1 to 3600.0	10.0	s	At stop
y0-70	0x4046	Magnetic pole position detection upon start of synchronous motor in SVC mode	0: Detected every time upon operation 1: Not detected 2: Detected during initial operation upon power-on	0	-	At stop
y0-71	0x4047	Initial position detection method of synchronous motor before startup	0: Voltage pulse 1: High-frequency injection 2: Self-adaptive 3: Pre-positioning	2	-	At stop
y0-72	0x4048	Auto-tuning configuration before start	bit0: Reserved bit1: Quick auto-tuning of stator resistance 0: Disable 1: Enable bit2 to bit6: Reserved bit7: Polarity auto-tuning mode based on high-frequency injection 0: Method 0 1: Method 1 bit8: High-frequency injection search method 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	At stop
y0-75	0x404B	Initial position detection current of synchronous motor	50 to 180	80	%	At stop
y0-76	0x404C	Initial position compensation angle	0.0 to 359.9	0.0	°	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
y0-85	0x4055	Low-speed processing method	Ones: Synchronous motor in V/f mode 0: No action 1: Speed open-loop Tens: Synchronous motor in SVC mode 0: No action 1: Speed open-loop 2: Speed open-loop advanced mode 3: High-frequency injection Hundreds: Reluctance motor in SVC mode 0: No action 1: Speed open-loop 2: Speed open-loop advanced mode 3: High-frequency injection Thousands: Reserved Ten thousands: Reserved	101	-	At stop
y0-86	0x4056	Speed open loop current	0 to 800	100	%	Real-time
y0-87	0x4057	Speed open loop switchover frequency.	0.0 to 100.0	10.0	%	Real-time
y0-88	0x4058	Speed open loop switchover hysteresis	0.0 to 100.0	2.5	%	Real-time
y0-89	0x4059	Speed open loop waiting time	0.00 to 5.00	0.50	s	Real-time

10.7.2 y1 Limit and Protection parameters of Motor 3

Param.	Communication address	Name	Range	Default	Unit	Change mode
y1-00	0x4100	Maximum motor current	0.0 to 1000.0	1000.0	%	Real-time
y1-01	0x4101	Positive speed permission	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time
y1-02	0x4102	Negative speed selection	Same as y1-01	1	-	Real-time
y1-03	0x4103	Digital setting of forward frequency upper limit 1	y1-07 to 800.0	800.0	%	At stop
y1-04	0x4104	Digital setting of reverse frequency upper limit 1	-800.0 to y1-08	-800.0	%	At stop
y1-05	0x4105	Source of forward frequency upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
y1-06	0x4106	Source of reverse frequency upper limit 2	0: -800 % 1: Opposite to the forward frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y1-07	0x4107	Digital setting of forward frequency lower limit 1	0.0 to y1-03	0.0	%	At stop
y1-08	0x4108	Digital setting of reverse frequency lower limit 1	y1-04 to 0.0	0.0	%	At stop
y1-09	0x4109	Digital setting of torque upper limit 1	0.0 to 800.0	200.0	%	Real-time
y1-10	0x410A	Digital setting of torque lower limit 1	-800.0 to 0.0	-200.0	%	Real-time
y1-11	0x410B	Source of torque upper limit 2	Same as y1-05	0	-	Real-time
y1-12	0x410C	Source of torque lower limit 2	0: -800 % 1: Opposite to torque upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
y1-13	0x410D	Motoring power limit	0.0 to 1000.0	400.0	%	Real-time
y1-14	0x410E	Generating power limit	0.0 to 1000.0	400.0	%	Real-time
y1-15	0x410F	Generating power limit selection	0: Invalid 1: Active in the whole process 2: Active during operation at constant speed 3: Active during deceleration	0	-	Real-time
y1-17	0x4111	Generating power limit selection	0.0 to 800.0	20.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y1-33	0x4121	Motor protection	bit0: Reserved bit1: Current control error detection bit2: Motor step loss error detection bit3: Reserved bit4: Demagnetization protection for permanent magnet synchronous motor bit5: Asynchronous motor runaway protection bit6: Speed reversal protection bit7: Reserved bit8: Motor parameter error check bit9: Single phase output loss detection bit10: Demagnetization protection for reluctance motor with permanent magnet bit11: Carrier ratio alarm bit12: Pole pair quantity alarm bit13: Synchronous motor runaway protection bit1 to bit13: 0: Disable 1: Enable bit14: Reserved bit15: Reserved	0x1E87	-	Real-time
y1-35	0x4123	Overspeed protection	0: Disable 1: Enable	1	-	Real-time
y1-36	0x4124	Overspeed protection time	0.0 to 60.0	0.1	s	Real-time
y1-37	0x4125	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real-time
y1-38	0x4126	Excessive speed deviation	0: Disable 1: Enable	1	-	Real-time
y1-39	0x4127	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real-time
y1-40	0x4128	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real-time
y1-41	0x4129	Speed reversal detection time	0.00 to 5.00	0.50	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y1-45	0x412D	Motor overload protection	0: Disable 1: Enable	1	-	Real-time
y1-46	0x412E	Motor overload protection coefficient	20 to 1000	100	%	Real-time
y1-47	0x412F	Motor overload warning coefficient	50 to 100	80	%	Real-time
y1-50	0x4132	Instantaneous overcurrent threshold of synchronous motor	0.0 to 800.0	350.0	%	Real-time
y1-54	0x4136	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector control mode 0: Disable 1: Enable bit2 to bit15: Reserved	0x0001	-	Real-time
y1-55	0x4137	Voltage threshold for overvoltage suppression	600.0 to A3-57	740.0	V	Real-time
y1-56	0x4138	Effective voltage threshold for overvoltage suppression	600.0 to A4-38	740.0	V	Unchangeable
y1-57	0x4139	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
y1-58	0x413A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
y1-63	0x413F	Response to undervoltage	0: Not act 1: Suppress undervoltage 2: Decelerate to stop	1	-	Real-time
y1-64	0x4140	Voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Real-time
y1-65	0x4141	Actual effective voltage threshold for undervoltage suppression	A4-35 to 500.0	430.0	V	Unchangeable
y1-66	0x4142	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y1-67	0x4143	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
y1-68	0x4144	Maximum operating time during undervoltage suppression	0.1 to 600.0	600.0	s	Real-time
y1-69	0x4145	Time for decelerating to stop upon undervoltage	0.0 to 300.0	20.0	s	Real-time
y1-70	0x4146	Voltage hysteresis for undervoltage recovery	1 to 100	30	V	Real-time
y1-71	0x4147	Undervoltage recovery waiting time (V/f)	0.0 to 100.0	0.5	s	At stop
y1-72	0x4148	Minimum frequency for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
y1-73	0x4149	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
y1-77	0x414D	Stall detection	0: Disable 1: Enable	0	-	Real-time
y1-78	0x414E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real-time
y1-79	0x414F	Stall fault detection time	0.0 to 65.0	2.0	s	Real-time
y1-80	0x4150	Stall fault detection frequency	0.0 to 600.0	6.0	%	Real-time
y1-81	0x4151	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real-time
y1-82	0x4152	Current threshold for three-phase output loss	0.0 to 100.0	10.0	%	Real-time
y1-83	0x4153	Step loss detection time	0.0 to 10.0	0.5	s	Real-time
y1-84	0x4154	Step loss detection threshold	0.0 to 100.0	30.0	%	Real-time
y1-87	0x4157	Detection time for current control fault	0.00 to 1.00	0.05	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y1-88	0x4158	Detection threshold for current control fault	0.0 to 200.0	25.0	%	Real-time
y1-89	0x4159	Detection time for single-phase output loss	0.05 to 650.00	0.20	s	Real-time
y1-91	0x415B	Runaway protection time for asynchronous motor in SVC	0.05 to 0.50	0.10	s	Real-time
y1-92	0x415C	Runaway protection threshold for asynchronous motor in SVC	10.0 to 50.0	15.0	%	Real-time
y1-93	0x415D	Runaway protection time for synchronous motor in FVC mode	0.01 to 60.00	0.10	s	Real-time
y1-94	0x415E	Runaway protection threshold for synchronous motor in FVC mode	5.0 to 600.0	50.0	%	Real-time

10.7.3 y2 V/f Control of Motor 3

Param.	Communication address	Name	Range	Default	Unit	Change mode
y2-00	0x4200	V/f curve type	0: V/f line 1: Multi-point V/f curve 10: Decoupled V/f	0	-	At stop
y2-01	0x4201	Multi-point curve selection	0: Three-point curve	0	-	Real-time
y2-02	0x4202	Frequency point 1 of multi-point V/f curve	0.0 to y2-03	0.0	Hz	Real-time
y2-03	0x4203	Frequency point 2 of multi-point V/f curve	y2-02 to y2-04	0.0	Hz	Real-time
y2-04	0x4204	Frequency point 3 of multi-point V/f curve	y2-03 to 600.0	0.0	Hz	Real-time
y2-08	0x4208	Voltage 1 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
y2-09	0x4209	Voltage 2 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
y2-10	0x420A	Voltage 3 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
y2-14	0x420E	Manual torque boost	0.0 to 100.0	3.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y2-15	0x420F	Cutoff frequency of torque boost	0.0 to 100.0	100.0	%	Real-time
y2-16	0x4210	Torque boost mode	0: Manual 1: Automatic 2: Manual+Automatic	2	-	Real-time
y2-17	0x4211	Automatic torque boost filter time	10 to 1000	100	ms	Real-time
y2-18	0x4212	Automatic torque boost gain	80 to 150	100	-	Real-time
y2-22	0x4216	Oscillation suppression in V/f mode	0: Disable 1: Enable	1	-	Real-time
y2-23	0x4217	Oscillation suppression gain in V/f mode	0 to 400	100	%	Real-time
y2-24	0x4218	Cut-off frequency of oscillation suppression filter in V/f mode	1.0 to 50.0	8.0	Hz	Real-time
y2-25	0x4219	Effective cut-off frequency of oscillation suppression in V/f mode	0.0 to 600.0	400.0	%	Real-time
y2-26	0x421A	Overcurrent suppression enable	0: Disable 1: Enable	1	-	At stop
y2-27	0x421B	Overcurrent suppression threshold	80 to 300	200	%	At stop
y2-28	0x421C	Overcurrent suppression Kp adjustment	1 to 500	100	%	Real-time
y2-29	0x421D	Overcurrent suppression Ki adjustment	10 to 1000	100	%	At stop
y2-30	0x421E	Frequency for activating field weakening for overcurrent suppression	60 to 500	100	%	Real-time
y2-31	0x421F	Minimum suppression threshold for overcurrent suppression during field weakening	20 to 100	100	%	Real-time
y2-32	0x4220	Current coefficient for overcurrent suppression during field weakening	1 to 500	100	%	Real-time
y2-35	0x4223	Energy-saving control in V/f mode	0: Invalid 1: Valid	0	-	Real-time
y2-36	0x4224	Cutoff frequency of energy-saving control in V/f mode	20 to 100	30	%	Real-time
y2-37	0x4225	Voltage drop gain of energy-saving control in V/f mode	10 to 500	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y2-38	0x4226	Voltage boost gain of energy-saving control in V/f mode	10 to 500	100	%	Real-time
y2-41	0x4229	Slip compensation mode	0: Disable 1: Without PG card slip compensation	0	-	At stop
y2-42	0x422A	Slip compensation gain	0.0 to 200.0	100.0	%	Real-time
y2-43	0x422B	Filter time of slip compensation	0.1 to 10.0	0.5	s	At stop
y2-47	0x422F	Voltage upper limit in V/f decoupled mode	50.0 to 200.0	100.0	%	At stop
y2-48	0x4230	Voltage source in V/f decoupled mode	0: d2-49 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
y2-49	0x4231	Digital setting of voltage in V/f decoupled mode	0 to CA-03	0	V	Real-time
y2-50	0x4232	Voltage acceleration time in V/f decoupled mode	0.0 to 1000.0	0.0	s	Real-time
y2-51	0x4233	Voltage deceleration time in V/f decoupled mode	0.0 to 1000.0	0.0	s	Real-time
y2-52	0x4234	RFG time of the frequency in V/f decoupled mode	0: RFG time is forcibly set to zero. 1: Preset RFG time	0	-	At stop
y2-53	0x4235	Stop mode in V/f decoupled mode	0: Frequency and voltage decline to 0 independently. 1: Frequency declines to 0 after voltage declines to 0. 2: Coast to stop (newly added)	0	-	Real-time
y2-60	0x423C	Synchronous motor current loop coefficient in V/f mode	0 to 1000	100	%	Real-time
y2-61	0x423D	Synchronous motor MTPA coefficient in V/f mode	0 to 1000	0	%	Real-time
y2-62	0x423E	Oscillation suppression gain coefficient of synchronous motor in V/f mode	0 to 500	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y2-63	0x423F	Filter time coefficient of synchronous motor in V/f mode	0 to 500	100	%	Real-time
y2-64	0x4240	Synchronous motor energy-saving control in V/f mode	0: Fixed V/f line 1: Fixed to 30% of reactive current 2: MTPA control	2	-	At stop

10.7.4 y3 Speed Control Parameters of Motor 3

Param.	Communication address	Name	Range	Default	Unit	Change mode
y3-00	0x4300	Speed loop Kp in FVC mode	0.0 to 6000.0	8.0	-	Real-time
y3-01	0x4301	Speed loop Ti in FVC mode	0.000 to 20.000	0.080	s	Real-time
y3-02	0x4302	Speed loop Kp in SVC mode	0.0 to 6000.0	5.0	-	Real-time
y3-03	0x4303	Speed loop Ti in SVC mode	0.000 to 20.000	0.127	s	Real-time
y3-06	0x4306	Zero speed switchover frequency	0.0 to y3-09	1.0	%	Real-time
y3-07	0x4307	Zero speed Kp correction coefficient	0.0 to 1000.0	100.0	%	Real-time
y3-08	0x4308	Zero speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
y3-09	0x4309	Low speed switchover frequency	0.0 to y3-12	10.0	%	Real-time
y3-10	0x430A	Low speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
y3-11	0x430B	Low speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
y3-12	0x430C	High speed switchover frequency	y3-09 to 400.0	100.0	%	Real-time
y3-13	0x430D	High speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
y3-14	0x430E	High speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y3-19	0x4313	Adaptive source of speed loop Kp	0: Invalid 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	39888	-	Real-time
y3-21	0x4315	Lower limit of speed loop adaptive switchover	0.0 to 1000.0	40.0	%	Real-time
y3-22	0x4316	Upper limit of speed loop adaptive switchover	0.0 to 1000.0	100.0	%	Real-time
y3-23	0x4317	Lower limit of speed loop adaptive correction	0.0 to 1000.0	100.0	%	Real-time
y3-24	0x4318	Upper limit of speed loop adaptive correction	0.0 to 1000.0	100.0	%	Real-time
y3-27	0x431B	Droop function	0: Disable 1: Enable	0	-	Real-time
y3-28	0x431C	Droop source	0: Output torque 1: Torque reference 2: Speed regulator output 3: Integral component of speed regulator	1	-	At stop
y3-29	0x431D	Droop coefficient	0.0 to 50.0	0.0	%	Real-time
y3-33	0x4321	Forced integral enable	0: Invalid 1: Enable Others: B connector	0	-	Real-time
y3-34	0x4322	Source of forced integral value	0: y3-35 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
y3-35	0x4323	Digital setting of integral forced value	-800.0 to +800.0	0.0	%	Real-time
y3-38	0x4326	Acceleration torque feedforward	0: Disable 1: Enable	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y3-39	0x4327	Acceleration torque feedforward coefficient	0.0 to 6553.0	100.0	%	Real-time
y3-40	0x4328	Acceleration source of acceleration torque feedforward	0: RFG reference 1: Automatic calculation Others: F connector	0	-	Real-time
y3-45	0x432D	Speed control window	0.00 to 10.00	0.00	Hz	At stop
y3-46	0x432E	Filter time of frequency reference	0.0 to 100.0	0.0	ms	At stop
y3-47	0x432F	Filter time of feedback frequency	0.0 to 100.0	0.0	ms	At stop
y3-48	0x4330	Current filter time for torque reference	0.0 to 100.0	0.0	ms	At stop
y3-55	0x4337	Anti-load disturbance	0: Disable 1: Enable	0	-	Real-time
y3-57	0x4339	Load observation bandwidth	0.01 to 300.00	1.00	Hz	Real-time
y3-58	0x433A	Load observation coefficient	0.0 to 1000.0	100.0	%	Real-time

10.7.5 y4 Current Control of Motor 3

Param.	Communication address	Name	Range	Default	Unit	Change mode
y4-00	0x4400	Current loop D-axis Kp coefficient	1 to 1000	100	%	Real-time
y4-01	0x4401	Current loop D-axis Ki coefficient	1 to 1000	100	%	Real-time
y4-02	0x4402	Current loop Q-axis Kp adjustment	1 to 1000	100	%	Real-time
y4-03	0x4403	Current loop Q-axis Ki adjustment	1 to 1000	100	%	Real-time

10.7.6 y5 Excitation Control of Motor 3

Param.	Communication address	Name	Range	Default	Unit	Change mode
y5-17	0x4511	Demagnetization current limit	0 to 500	300	%	Real-time
y5-25	0x4519	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	-	Real-time

10.7.7 y7 Motor 3 Control Optimization

Param.	Communication address	Name	Range	Default	Unit	Change mode
y7-02	0x4702	Switch FVC to SVC	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC upon encoder open circuit and revert to FVC after the encoder is recovered upon stop).	0	-	At stop
y7-03	0x4703	Frequency for switching from FVC to SVC	10 to 500	50	%	At stop
y7-04	0x4704	Hysteresis for switching from FVC to SVC	10 to 100	10	%	At stop

10.7.8 y8 Basic Control Parameters of Motor 4

Param.	Communication address	Name	Range	Default	Unit	Change mode
y8-00	0x4800	Control mode	0: SVC 1: FVC 2: V/f	2	-	At stop
y8-01	0x4801	Motor control mode	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
y8-02	0x4802	Startup mode	Ones: Asynchronous motor startup mode 0: Direct start 1: Flying start Tens: Synchronous motor startup mode 0: Same as the startup mode of the ones place 1: Forced to flying start Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	10	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
y8-03	0x4803	Flying start mode	0: Starting from the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented flying start	4	-	Real-time
y8-04	0x4804	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop with maximum capability	0	-	Real-time
y8-05	0x4805	OFF2 (coast to stop) stop mode	0: Coast to stop	0	-	Unchangeable
y8-06	0x4806	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop with maximum capability	0	-	Real-time
y8-07	0x4807	Stop mode during running	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	-	Real-time
y8-08	0x4808	Stop mode in torque control mode	0: Coast to stop forcibly 1: Switch to speed control mode and stop 2: Keep in the torque mode until the zero speed is reached and then stop	1	-	At stop
y8-09	0x4809	Zero-speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real-time
y8-10	0x480A	Zero speed judgment time (actual speed)	0.00 to 10.00	0.10	s	At stop
y8-11	0x480B	Zero speed threshold for synchronous frequency stop	0.00 to 200.00	1.00	%	Real-time
y8-12	0x480C	Zero speed judgment time of synchronous frequency	0.00 to 655.35	2.00	s	At stop
y8-13	0x480D	Start/Stop frequency follow-up	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
y8-14	0x480E	Motor direction selection	0: Default direction 1: Opposite direction	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
y8-15	0x480F	Shutdown control function configuration	bit0: DC braking at stop enabled 0: Disable 1: Enable bit1 to bit15: Reserved 0: Disable 1: Enable	0x0	-	Real-time
y8-16	0x4810	Shut-down delay time	0.00 to 655.35	0.00	s	At stop
y8-17	0x4811	Pre-excitation mode	0: Time-based pre-excitation 1: Current reference-based pre-excitation 2: Maximum current-based pre-excitation	1	-	At stop
y8-18	0x4812	Pre-excitation time	1 to 30000	1000	ms	Real-time
y8-19	0x4813	Pre-excitation current	1 to 800	100	%	Real-time
y8-20	0x4814	Demagnetization time	0.00 to 5.00	0.50	s	Real-time
y8-22	0x4816	Startup frequency function configuration	0: Not operate when the set frequency is lower than the startup frequency 1: Operates when the set frequency is lower than the startup frequency	0	-	At stop
y8-23	0x4817	Start frequency	0.00 to 10.00	0.00	Hz	Real-time
y8-24	0x4818	Start frequency hold time	0.0 to 1000.0	0.0	s	At stop
y8-25	0x4819	DC braking time at start	0.0 to 100.0	0.0	s	At stop
y8-26	0x481A	DC braking current at start	0 to 800	50	%	Real-time
y8-27	0x481B	Starting frequency of DC braking at stop or active short circuit control	0.0 to 600.0	0.0	Hz	Real-time
y8-28	0x481C	DC braking waiting time at stop	0.0 to 100.0	0.0	s	Real-time
y8-29	0x481D	DC braking time at stop	0.0 to 100.0	0.0	s	Real-time
y8-30	0x481E	DC braking current at stop	0 to 800	50	%	Real-time
y8-31	0x481F	Current loop Kp adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time
y8-32	0x4820	Current loop Ki adjustment of DC braking	0.1 to 800.0	100.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y8-35	0x4823	Current limit during constant current	50.0 to 800.0	100.0	%	Real-time
y8-39	0x4827	Over-excitation selection (vector)	0: Inactive 1: Active	0	-	Real-time
y8-40	0x4828	Over-excitation current (vector)	0 to 800	100	%	Real-time
y8-41	0x4829	Overexcitation gain (V/f)	0 to 200	64	%	Real-time
y8-61	0x483D	Active short circuit control	0: Disable 1: Enable Others: B connector	0	-	At stop
y8-62	0x483E	Delay for entering active short circuit control	0.0 to 5000.0	0.0	ms	At stop
y8-63	0x483F	Hold time of active short circuit control at stop	0.1 to 3600.0	10.0	s	At stop
y8-70	0x4846	Magnetic pole position detection upon start of synchronous motor in SVC mode	0: Detected every time upon operation 1: Not detected 2: Detected during initial operation upon power-on	0	-	At stop
y8-71	0x4847	Initial position detection method of synchronous motor before startup	0: Voltage pulse 1: High-frequency injection 2: Self-adaptive 3: Pre-positioning	2	-	At stop
y8-72	0x4848	Auto-tuning configuration before start	bit0: Reserved bit1: Quick auto-tuning of stator resistance 0: Disable 1: Enable bit2 to bit7: Reserved bit7: Polarity auto-tuning mode based on high-frequency injection 0: Method 0 1: Method 1 bit8: High-frequency injection search method 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	At stop
y8-75	0x484B	Initial position detection current of synchronous motor	50 to 180	80	%	At stop
y8-76	0x484C	Initial position compensation angle	0.0 to 359.9	0.0	°	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
y8-85	0x4855	Low-speed processing method	Ones: Synchronous motor in V/f mode 0: No action 1: Speed open-loop Tens: Synchronous motor in SVC mode 0: No action 1: Speed open-loop 2: Speed open-loop advanced mode 3: High-frequency injection Hundreds: Reluctance motor in SVC mode 0: No action 1: Speed open-loop 2: Speed open-loop advanced mode 3: High-frequency injection Thousands: Reserved Ten thousands: Reserved	101	-	At stop
y8-86	0x4856	Speed open loop current	0 to 800	100	%	Real-time
y8-87	0x4857	Speed open loop switchover frequency.	0.0 to 100.0	10.0	%	Real-time
y8-88	0x4858	Speed open loop switchover hysteresis	0.0 to 100.0	2.5	%	Real-time
y8-89	0x4859	Speed open loop waiting time	0.00 to 5.00	0.50	s	Real-time

10.7.9 y9 Limit and Protection Parameters of Motor 4

Param.	Communication address	Name	Range	Default	Unit	Change mode
y9-00	0x4900	Maximum motor current	0.0 to 1000.0	1000.0	%	Real-time
y9-01	0x4901	Positive speed permission	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	1	-	Real-time
y9-02	0x4902	Negative speed selection	Same as y9-01	1	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y9-03	0x4903	Digital setting of forward frequency upper limit 1	y9-07 to 800.0	800.0	%	At stop
y9-04	0x4904	Digital setting of reverse frequency upper limit 1	-800.0–y9-08	-800.0	%	At stop
y9-05	0x4905	Source of forward frequency upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
y9-06	0x4906	Source of reverse frequency upper limit 2	0: -800 % 1: Opposite to the forward frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
y9-07	0x4907	Digital setting of forward frequency lower limit 1	0.0 to y9-03	0.0	%	At stop
y9-08	0x4908	Digital setting of reverse frequency lower limit 1	y9-04 to 0.0	0.0	%	At stop
y9-09	0x4909	Digital setting of torque upper limit 1	0.0 to 800.0	200.0	%	Real-time
y9-10	0x490A	Digital setting of torque lower limit 1	-800.0 to 0.0	-200.0	%	Real-time
y9-11	0x490B	Source of torque upper limit 2	Same as y9-05	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y9-12	0x490C	Source of torque lower limit 2	0: -800 % 1: Opposite to torque upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	1	-	Real-time
y9-13	0x490D	Motoring power limit	0.0 to 1000.0	400.0	%	Real-time
y9-14	0x490E	Generating power limit	0.0 to 1000.0	400.0	%	Real-time
y9-15	0x490F	Generating power limit selection	0: Invalid 1: Active in the whole process 2: Active during operation at constant speed 3: Active during deceleration	0	-	Real-time
y9-17	0x4911	Generating power limit selection	0.0 to 800.0	20.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y9-33	0x4921	Motor protection	bit0: Reserved bit1: Current control error detection 0: Disable 1: Enable bit2: Motor step loss error detection Same as bit1 bit3: Reserved bit4: Demagnetization protection for permanent magnet synchronous motor Same as bit1 bit5: Asynchronous motor runaway protection Same as bit1 bit6: Speed reversal protection Same as bit1 bit7: Reserved bit8: Motor parameter error check bit9: Single phase output loss detection bit10: Demagnetization protection for reluctance motor with permanent magnet bit11: Carrier ratio alarm bit12: Pole pair quantity alarm bit13: Synchronous motor runaway protection bit7 to bit13: 0: Disable 1: Enable bit14: Reserved bit15: Reserved	0x1E87	-	Real-time
y9-35	0x4923	Overspeed protection	0: Disable 1: Enable	1	-	Real-time
y9-36	0x4924	Overspeed protection time	0.0 to 60.0	0.1	s	Real-time
y9-37	0x4925	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real-time
y9-38	0x4926	Excessive speed deviation	0: Disable 1: Enable	1	-	Real-time
y9-39	0x4927	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real-time
y9-40	0x4928	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real-time
y9-41	0x4929	Speed reversal detection time	0.00 to 5.00	0.50	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y9-45	0x492D	Motor overload protection	0: Disable 1: Enable	1	-	Real-time
y9-46	0x492E	Motor overload protection coefficient	20 to 1000	100	%	Real-time
y9-47	0x492F	Motor overload warning coefficient	50 to 100	80	%	Real-time
y9-50	0x4932	Instantaneous overcurrent threshold of synchronous motor	0.0 to 800.0	350.0	%	Real-time
y9-54	0x4936	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector control mode 0: Disable 1: Enable bit2 to bit15: Reserved	0x0001	-	Real-time
y9-55	0x4937	Voltage threshold for overvoltage suppression	600.0 to A3-57	740.0	V	Real-time
y9-56	0x4938	Effective voltage threshold for overvoltage suppression	600.0 to A4-38	740.0	V	Unchangeable
y9-57	0x4939	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real-time
y9-58	0x493A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
y9-63	0x493F	Response to undervoltage	0: Not act 1: Suppress undervoltage 2: Decelerate to stop	1	-	Real-time
y9-64	0x4940	Voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Real-time
y9-65	0x4941	Actual effective voltage threshold for undervoltage suppression	A4-35 to 500.0	430.0	V	Unchangeable
y9-66	0x4942	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y9-67	0x4943	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real-time
y9-68	0x4944	Maximum operating time during undervoltage suppression	0.1 to 600.0	600.0	s	Real-time
y9-69	0x4945	Time for decelerating to stop upon undervoltage	0.0 to 300.0	20.0	s	Real-time
y9-70	0x4946	Voltage hysteresis for undervoltage recovery	1 to 100	30	V	Real-time
y9-71	0x4947	Undervoltage recovery waiting time (V/f)	0.0 to 100.0	0.5	s	At stop
y9-72	0x4948	Minimum frequency for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
y9-73	0x4949	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 to 10.00	3.00	Hz	Real-time
y9-77	0x494D	Stall detection	0: Disable 1: Enable	0	-	Real-time
y9-78	0x494E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real-time
y9-79	0x494F	Stall fault detection time	0.0 to 65.0	2.0	s	Real-time
y9-80	0x4950	Stall fault detection frequency	0.0 to 600.0	6.0	%	Real-time
y9-81	0x4951	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real-time
y9-82	0x4952	Current threshold for three-phase output loss	0.0 to 100.0	10.0	%	Real-time
y9-83	0x4953	Step loss detection time	0.0 to 10.0	0.5	s	Real-time
y9-84	0x4954	Step loss detection threshold	0.0 to 100.0	30.0	%	Real-time
y9-87	0x4957	Detection time for current control fault	0.00 to 1.00	0.05	s	Real-time
y9-88	0x4958	Detection threshold for current control fault	0.0 to 200.0	25.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
y9-89	0x4959	Detection time for single-phase output loss	0.05 to 650.00	0.20	s	Real-time
y9-91	0x495B	Runaway protection time for asynchronous motor in SVC	0.05 to 0.50	0.10	s	Real-time
y9-92	0x495C	Runaway protection threshold for asynchronous motor in SVC	10.0 to 50.0	15.0	%	Real-time
y9-93	0x495D	Runaway protection time for synchronous motor in FVC mode	0.01 to 60.00	0.10	s	Real-time
y9-94	0x495E	Runaway protection threshold for synchronous motor in FVC mode	5.0 to 600.0	50.0	%	Real-time

10.7.10 yA V/f Control of Motor 4

Param.	Communication address	Name	Range	Default	Unit	Change mode
yA-00	0x4A00	V/f curve type	0: V/f line 1: Multi-point V/f curve 10: Decoupled V/f	0	-	At stop
yA-01	0x4A01	Multi-point curve selection	0: Three-point curve	0	-	Real-time
yA-02	0x4A02	Frequency point 1 of multi-point V/f curve	0.0 to yA-03	0.0	Hz	Real-time
yA-03	0x4A03	Frequency point 2 of multi-point V/f curve	yA-02 to yA-04	0.0	Hz	Real-time
yA-04	0x4A04	Frequency point 3 of multi-point V/f curve	yA-03 to 600.0	0.0	Hz	Real-time
yA-08	0x4A08	Voltage 1 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
yA-09	0x4A09	Voltage 2 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
yA-10	0x4A0A	Voltage 3 on multi-point V/f curve	0.0 to 1000.0	0.0	V	Real-time
yA-14	0x4A0E	Manual torque boost	0.0 to 100.0	3.0	%	Real-time
yA-15	0x4A0F	Cutoff frequency of torque boost	0.0 to 100.0	100.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
yA-16	0x4A10	Torque boost mode	0: Manual 1: Automatic 2: Manual+Automatic	2	-	Real-time
yA-17	0x4A11	Automatic torque boost filter time	10 to 1000	100	ms	Real-time
yA-18	0x4A12	Automatic torque boost gain	80 to 150	100	-	Real-time
yA-22	0x4A16	Oscillation suppression in V/f mode	0: Disable 1: Enable	1	-	Real-time
yA-23	0x4A17	Oscillation suppression gain in V/f mode	0 to 400	100	%	Real-time
yA-24	0x4A18	Cut-off frequency of oscillation suppression filter in V/f mode	1.0 to 50.0	8.0	Hz	Real-time
yA-25	0x4A19	Effective cut-off frequency of oscillation suppression in V/f mode	0.0 to 600.0	400.0	%	Real-time
yA-26	0x4A1A	Overcurrent suppression enable	0: Disable 1: Enable	1	-	At stop
yA-27	0x4A1B	Overcurrent suppression threshold	80 to 300	200	%	At stop
yA-28	0x4A1C	Overcurrent suppression Kp adjustment	1 to 500	100	%	Real-time
yA-29	0x4A1D	Overcurrent suppression Ki adjustment	10 to 1000	100	%	At stop
yA-30	0x4A1E	Frequency for activating field weakening for overcurrent suppression	60 to 500	100	%	Real-time
yA-31	0x4A1F	Minimum suppression threshold for overcurrent suppression during field weakening	20 to 100	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
yA-32	0x4A20	Current coefficient for overcurrent suppression during field weakening	1 to 500	100	%	Real-time
yA-35	0x4A23	Energy-saving control in V/f mode	0: Invalid 1: Valid	0	-	Real-time
yA-36	0x4A24	Cutoff frequency of energy-saving control in V/f mode	20 to 100	30	%	Real-time
yA-37	0x4A25	Voltage drop gain of energy-saving control in V/f mode	10 to 500	100	%	Real-time
yA-38	0x4A26	Voltage boost gain of energy-saving control in V/f mode	10 to 500	100	%	Real-time
yA-41	0x4A29	Slip compensation mode	0: Disable 1: Without PG card slip compensation	0	-	At stop
yA-42	0x4A2A	Slip compensation gain	0.0 to 200.0	100.0	%	Real-time
yA-43	0x4A2B	Filter time of slip compensation	0.1 to 10.0	0.5	s	At stop
yA-47	0x4A2F	Voltage upper limit in V/f decoupled mode	50.0 to 200.0	100.0	%	At stop
yA-48	0x4A30	Voltage source in V/f decoupled mode	0: d2-49 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
yA-49	0x4A31	Digital setting of voltage in V/f decoupled mode	0 to Cd-03	0	V	Real-time
yA-50	0x4A32	Voltage acceleration time in V/f decoupled mode	0.0 to 1000.0	0.0	s	Real-time
yA-51	0x4A33	Voltage deceleration time in V/f decoupled mode	0.0 to 1000.0	0.0	s	Real-time
yA-52	0x4A34	RFG time of the frequency in V/f decoupled mode	0: RFG time is forcibly set to zero. 1: Preset RFG time	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
yA-53	0x4A35	Stop mode in V/f decoupled mode	0: Frequency and voltage decline to 0 independently. 1: Frequency declines to 0 after voltage declines to 0. 2: Coast to stop (newly added)	0	-	Real-time
yA-60	0x4A3C	Synchronous motor current loop coefficient in V/f mode	0 to 1000	100	%	Real-time
yA-61	0x4A3D	Synchronous motor MTPA coefficient in V/f mode	0 to 1000	0	%	Real-time
yA-62	0x4A3E	Oscillation suppression gain coefficient of synchronous motor in V/f mode	0 to 500	100	%	Real-time
yA-63	0x4A3F	Filter time coefficient of synchronous motor in V/f mode	0 to 500	100	%	Real-time
yA-64	0x4A40	Synchronous motor energy-saving control in V/f mode	0: Fixed V/f line 1: Fixed to 30% of reactive current 2: MTPA control	2	-	At stop

10.7.11 yb Speed Control of Motor 4

Param.	Communication address	Name	Range	Default	Unit	Change mode
yb-00	0x4B00	Speed loop Kp in FVC mode	0.0 to 6000.0	8.0	-	Real-time
yb-01	0x4B01	Speed loop Ti in FVC mode	0.000 to 20.000	0.080	s	Real-time
yb-02	0x4B02	Speed loop Kp in SVC mode	0.0 to 6000.0	5.0	-	Real-time
yb-03	0x4B03	Speed loop Ti in SVC mode	0.000 to 20.000	0.127	s	Real-time
yb-06	0x4B06	Zero speed switchover frequency	0.0% to yb-09	1.0	%	Real-time
yb-07	0x4B07	Zero speed Kp correction coefficient	0.0 to 1000.0	100.0	%	Real-time
yb-08	0x4B08	Zero speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
yb-09	0x4B09	Low speed switchover frequency	0.0 to yb-12	10.0	%	Real-time
yb-10	0x4B0A	Low speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
yb-11	0x4B0B	Low speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
yb-12	0x4B0C	High speed switchover frequency	yb-09 to 400.0	100.0	%	Real-time
yb-13	0x4B0D	High speed Kp correction factor	0.0 to 1000.0	100.0	%	Real-time
yb-14	0x4B0E	High speed Ti correction factor	0.0 to 1000.0	100.0	%	Real-time
yb-19	0x4B13	Adaptive source of speed loop Kp	0: Invalid 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	39888	-	Real-time
yb-21	0x4B15	Lower limit of speed loop adaptive switchover	0.0 to 1000.0	40.0	%	Real-time
yb-22	0x4B16	Upper limit of speed loop adaptive switchover	0.0 to 1000.0	100.0	%	Real-time
yb-23	0x4B17	Lower limit of speed loop adaptive correction	0.0 to 1000.0	100.0	%	Real-time
yb-24	0x4B18	Upper limit of speed loop adaptive correction	0.0 to 1000.0	100.0	%	Real-time
yb-27	0x4B1B	Droop function	0: Disable 1: Enable	0	-	Real-time
yb-28	0x4B1C	Droop source	0: Output torque 1: Torque reference 2: Speed regulator output 3: Integral component of speed regulator	1	-	At stop
yb-29	0x4B1D	Droop coefficient	0.0 to 50.0	0.0	%	Real-time
yb-33	0x4B21	Forced integral enable	0: Invalid 1: Enable Others: B connector	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
yb-34	0x4B22	Source of forced integral value	0: yb-35 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
yb-35	0x4B23	Digital setting of integral forced value	-800.0 to +800.0	0.0	%	Real-time
yb-38	0x4B26	Acceleration torque feedforward	0: Disable 1: Enable	0	-	Real-time
yb-39	0x4B27	Acceleration torque feedforward coefficient	0.0 to 6553.0	100.0	%	Real-time
yb-40	0x4B28	Acceleration source of acceleration torque feedforward	0: RFG reference 1: Automatic calculation Others: F connector	0	-	Real-time
yb-45	0x4B2D	Speed control window	0.00 to 10.00	0.00	Hz	At stop
yb-46	0x4B2E	Filter time of frequency reference	0.0 to 100.0	0.0	ms	At stop
yb-47	0x4B2F	Filter time of feedback frequency	0.0 to 100.0	0.0	ms	At stop
yb-48	0x4B30	Current filter time for torque reference	0.0 to 100.0	0.0	ms	At stop
yb-55	0x4B37	Anti-load disturbance	0: Disable 1: Enable	0	-	Real-time
yb-57	0x4B39	Load observation bandwidth	0.01 to 300.00	1.00	Hz	Real-time
yb-58	0x4B3A	Load observation coefficient	0.0 to 1000.0	100.0	%	Real-time

10.7.12 yC Current Control of Motor 4

Param.	Communication address	Name	Range	Default	Unit	Change mode
yC-00	0x4C00	Current loop D-axis Kp coefficient	1 to 1000	100	%	Real-time
yC-01	0x4C01	Current loop D-axis Ki coefficient	1 to 1000	100	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
yC-02	0x4C02	Current loop Q-axis Kp adjustment	1 to 1000	100	%	Real-time
yC-03	0x4C03	Current loop Q-axis Ki adjustment	1 to 1000	100	%	Real-time

10.7.13 yd Excitation Control of Motor 4

Param.	Communication address	Name	Range	Default	Unit	Change mode
yd-17	0x4D11	Demagnetization current limit	0 to 500	300	%	Real-time
yd-25	0x4D19	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	-	Real-time

10.7.14 yF Control Optimization of Motor 4

Param.	Communication address	Name	Range	Default	Unit	Change mode
yF-02	0x4F02	Switch FVC to SVC	0: Not switched 1: Switched actively 2: Switched passively (Switch to SVC upon encoder open circuit and revert to FVC after the encoder is recovered upon stop).	0	-	At stop
yF-03	0x4F03	Frequency for switching from FVC to SVC	10 to 500	50	%	At stop
yF-04	0x4F04	Hysteresis for switching from FVC to SVC	10 to 100	10	%	At stop

10.8 Group E Input/Output

10.8.1 E0: DI

Param.	Communication address	Name	Range	Default	Unit	Change mode
E0-00	0xE000	DI1 function selection	0: No function 1: Terminal start/stop module A_IN1 2: Terminal start/stop module A_IN2 3: Terminal start/stop module A_IN3 4: Terminal start/stop module A jog 1 (JOG1) 5: Terminal start/stop module A jog 2 (JOG2) 6: Function as UP key for frequency adjustment 7: Function as DOWN key for frequency adjustment 8: Coast to stop 9: Fault reset (RESET) 10: Operation pause (terminal control) 11: External fault NO input 12: Multi-reference selection bit0 13: Multi-reference selection bit1 14: Multi-reference selection bit2 15: Multi-reference selection bit3 16: Ramp selection bit0 17: Ramp selection bit1 19: Clear data set by terminal functioning as UP/DOWN key 21: Acceleration/Deceleration inhibited 22: PID pause 23: Simple PLC status reset 24: Swing frequency pause 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enabled 35: PID action direction reversal 36: External stop terminal 1 38: PID integral pause 39: Main/auxiliary frequency switchover (Continued)	1	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
E0-00	0xE000	DI1 function selection	(Continued) 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed/Torque control selection 47: Emergency stop 49: DC braking during deceleration 50: Clear the current operating time 61: Terminal start/stop module B_ IN1 62: Terminal start/stop module B_ IN2 63: Terminal start/stop module B_ IN3 64: Terminal start/stop module B jog 1 (JOG1) 65: Terminal start/stop module B jog 2 (JOG2) 66: Forced to local control 67: Forced to terminal control 68: Forced to communication control 69: Forced to custom control 70: Control channel selection 71: Setting channel selection 72: Terminal start/stop module A/B selection 76: Motor selection terminal 2 77: Running enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	1	-	At stop
E0-01	0xE001	DI2 function selection	Same as E0-00	4	-	At stop
E0-02	0xE002	DI3 function selection	Same as E0-00	9	-	At stop
E0-03	0xE003	DI4 function selection	Same as E0-00	12	-	At stop
E0-04	0xE004	DI5 function selection	Same as E0-00	13	-	At stop
E0-05	0xE005	DI6 function selection	Same as E0-00	0	-	At stop
E0-06	0xE006	DI7 function selection	Same as E0-00	0	-	At stop
E0-10	0xE00A	VDI1 function selection	Same as E0-00	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
E0-11	0xE00B	VDI2 function selection	Same as E0-00	0	-	At stop
E0-12	0xE00C	VDI3 function selection	Same as E0-00	0	-	At stop
E0-13	0xE00D	VDI4 function selection	Same as E0-00	0	-	At stop
E0-14	0xE00E	VDI5 function selection	Same as E0-00	0	-	At stop
E0-15	0xE00F	VDI6 function selection	Same as E0-00	0	-	At stop
E0-16	0xE010	DI input filter time 1	0.000 to 1.000	0.010	s	Real-time
E0-17	0xE011	DI input filter time 2	0.000 to 1.000	0.010	s	Real-time
E0-18	0xE012	DI input filter time selection	bit0: DI1 filter time bit1: DI2 filter time bit2: DI3 filter time (active only for MD630S) bit3: DI4 filter time (active only for MD630S) bit4: DI5 filter time (active only for MD630S) bit5: DI6 filter time (active only for MD630S) bit6: DI7 filter time (active only for MD630S) bit0 to bit6 0: Filter time 1 1: Filter time 2 bit7 to bit15: Reserved	0x0	-	Real-time
E0-19	0xE013	Step value of frequency adjusted by terminal functioning as UP/ DOWN keys	0.001 to 65.535	1.000	Hz/s	Real-time
E0-20	0xE014	DI1 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-21	0xE015	DI1 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-22	0xE016	DI2 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-23	0xE017	DI2 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-24	0xE018	DI3 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-25	0xE019	DI3 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-26	0xE01A	DI4 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-27	0xE01B	DI4 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-28	0xE01C	DI5 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-29	0xE01D	DI5 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-30	0xE01E	DI6 switch-on delay	0.0 to 3600.0	0.0	s	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
E0-31	0xE01F	DI6 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-32	0xE020	DI7 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-33	0xE021	DI7 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-50	0xE032	VDI1 source	1: Forced value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 (active only for MD630S) 14: DI4 (active only for MD630S) 15: DI5 (active only for MD630S) 16: DI6 (active only for MD630S) 17: DI7/HDI (active only for MD630S) 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 27: DI1 on I/O card 1 28: DI2 on I/O card 1 30: DI1 on IO card 2 31: DI2 on IO card 2 51: RO1 55: DO1 59: FMR (active only for MD630S) 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO6 Others: B connector	1	-	At stop
E0-51	0xE033	VDI2 source	Same as E0-50	1	-	At stop
E0-52	0xE034	VDI3 source	Same as E0-50	1	-	At stop
E0-53	0xE035	VDI4 source	Same as E0-50	1	-	At stop
E0-54	0xE036	VDI5 source	Same as E0-50	1	-	At stop
E0-55	0xE037	VDI6 source	Same as E0-50	1	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
E0-56	0xE038	Set DI value to forced value	bit0: DI1 bit1: DI2 bit2: DI3 bit3: DI4 bit4: DI5 bit5: DI6 bit6: DI7 bit0 to bit6: 0: Hardware 1: Forced value bit7 to bit15: Reserved	0x0	-	At stop
E0-57	0xE039	Force DI data	bit0: DI1 bit1: DI2 bit2: DI3 (active only for MD630S) bit3: DI4 (active only for MD630S) bit4: DI5 (active only for MD630S) bit5: DI6 (active only for MD630S) bit6: DI7/HDI setting (active only for MD630S) bit0 to bit6 0: Low level 1: High level bit7 to bit9: Reserved bit10: VDI1 bit11: VDI2 bit12: VDI3 bit13: VDI4 bit14: VDI5 bit15: VDI6 bit10 to bit15 0: Low level 1: High level	0x0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E0-58	0xE03A	DI active mode selection	bit0: DI1 active mode bit1: DI2 active mode bit2: DI3 active mode (active only for MD630S) bit3: DI4 active mode (active only for MD630S) bit4: DI5 active mode (active only for MD630S) bit5: DI6 active mode (active only for MD630S) bit6: DI7 active mode (active only for MD630S) bit0 to bit6: 0: Active high 1: Active low bit7 to bit9: Reserved bit10: VDI1 active mode bit11: VDI2 active mode bit12: VDI3 active mode bit13: VDI4 active mode bit14: VDI5 active mode bit15: VDI6 active mode bit10 to bit15: 0: Active high 1: Active low	0x0	-	Real-time

10.8.2 E1: DO or RO

Param.	Communication address	Name	Range	Default	Unit	Change mode
E1-00	0xE100	RO1 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency level detection FDT1 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 11: Simple PLC cycle completed 12: Cumulative running time reached 13: Swing frequency limited 14: Torque limited 15: Ready to run 17: Frequency upper limit reached 18: Frequency lower limit reached (no output at stop) 19: Undervoltage state 20: Communication setting (address: 0x7312) 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reached 25: Frequency level detection FDT2 26: Frequency 1 reached 27: Frequency 2 reached 28: Current 1 reached 29: Current 2 reached 30: Timing reached (Continued)	2	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E1-00	0xE100	RO1 function selection	(Continued) 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature reached 36: Output current limit exceeded 37: Frequency lower limit reached (output at stop) 38: Abnormality (fault/minor fault/warning) 40: Current operating time reached 41: Fault (excluding undervoltage) 42: STO 43: Minor fault or alarm 44: AI2 input limit exceeded 46: Component service life warning Others: B connector	2	-	Real-time
E1-04	0xE104	DO1 function selection	Same as E1-00	0	-	Real-time
E1-08	0xE108	FMR (HDO) output function selection	Same as E1-00	0	-	Real-time
E1-10	0xE10A	VDO1 function selection	Same as E1-00	0	-	Real-time
E1-11	0xE10B	VDO2 function selection	Same as E1-00	0	-	Real-time
E1-12	0xE10C	VDO3 function selection	Same as E1-00	0	-	Real-time
E1-13	0xE10D	VDO4 function selection	Same as E1-00	0	-	Real-time
E1-14	0xE10E	VDO5 function selection	Same as E1-00	0	-	Real-time
E1-15	0xE10F	VDO6 function selection	Same as E1-00	0	-	Real-time
E1-16	0xE110	RO1 switch-on delay	0.0 to 3600.0	0.0	s	Real-time
E1-17	0xE111	RO1 switch-off delay	0.0 to 3600.0	0.0	s	Real-time
E1-24	0xE118	DO1 output switch-on delay	0.0 to 3600.0	0.0	s	Real-time
E1-25	0xE119	DO1 output switch-off delay	0.0 to 3600.0	0.0	s	Real-time
E1-32	0xE120	FMR switch-on delay	0.0 to 3600.0	0.0	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E1-33	0xE121	FMR switch-off delay	0.0 to 3600.0	0.0	s	Real-time
E1-36	0xE124	DO/RO/VDO output source	bit0: RO output source 0: Output function 1: Forced value bit1: Reserved bit2: Reserved bit3: Reserved bit4: DO output source 0: Output function 1: Forced value bit5: Reserved bit6: Reserved bit7: Reserved bit8: FMR output source (active only for MD630S) 0: Output function 1: Forced value bit9: Reserved bit10: VDO1 output source bit11: VDO2 output source bit12: VDO3 output source bit13: VDO4 output source bit14: VDO5 output source bit15: VDO6 output source bit10 to bit15: 0: Output function 1: Forced value	0x0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E1-37	0xE125	Force value of DO/ RO/VDO	bit0: RO setting 0: Low level 1: High level bit1 to bit3: Reserved bit4: DO setting 0: Low level 1: High level bit5 to bit7: Reserved bit8: FMR output source (active only for MD630S) 0: Low level 1: High level bit9: Reserved bit10: VDO1 bit11: VDO2 bit12: VDO3 bit13: VDO4 bit14: VDO5 bit15: VDO6 bit10 to bit15: 0: Low level 1: High level	0x0	-	Real-time
E1-38	0xE126	DO/RO/VDO terminal polarity selection	bit0: RO 0: Positive logic 1: Negative logic bit1 to bit3: Reserved bit4: DO 0: Positive logic 1: Negative logic bit5 to bit7: Reserved bit8: FMR output source (active only for MD630S) 0: Positive logic 1: Negative logic bit9: Reserved bit10: VDO1 bit11: VDO2 bit12: VDO3 bit13: VDO4 bit14: VDO5 bit15: VDO6 bit10 to bit15 0: Positive logic 1: Negative logic	0x0	-	Real-time

10.8.3 E2 AI

Param.	Communication address	Name	Range	Default	Unit	Change mode
E2-07	0xE207	AI1 gain	-10.00 to +10.00	1.00	-	Real-time
E2-08	0xE208	AI1 offset	-10.00 to +10.00	0.00	V	Real-time
E2-09	0xE209	AI1 denoising threshold	0.0 to 100.0	0.0	%	Real-time
E2-10	0xE20A	AI1 filter time	0.00 to 10.00	0.10	s	Real-time
E2-11	0xE20B	AI1 zero-crossing threshold	0.0 to 100.0	0.0	%	Real-time
E2-12	0xE20C	AI1 jump point	-800.0 to +800.0	0.0	%	Real-time
E2-13	0xE20D	AI1 jump amplitude	0.0 to 100.0	0.1	%	Real-time
E2-14	0xE20E	Upper limit of AI1 input protection	E2-15 to 10.00	8.00	V	Real-time
E2-15	0xE20F	Lower limit of AI1 input protection	0.00 to E2-14	2.00	V	Real-time
E2-16	0xE210	AI2 gain	-10.00 to +10.00	1.00	-	Real-time
E2-17	0xE211	AI2 offset	-10.00 to +10.00	0.00	V	Real-time
E2-18	0xE212	AI2 denoising threshold	0.0 to 100.0	0.0	%	Real-time
E2-19	0xE213	AI2 filter time	0.00 to 10.00	0.10	s	Real-time
E2-20	0xE214	AI2 zero-crossing threshold	0.0 to 100.0	0.0	%	Real-time
E2-21	0xE215	AI2 jump point	-800.0 to +800.0	0.0	%	Real-time
E2-22	0xE216	AI2 jump amplitude	0.0 to 100.0	0.1	%	Real-time
E2-23	0xE217	Upper limit of AI2 input protection	E2-24 to 10.00	8.00	V	Real-time
E2-24	0xE218	Lower limit of AI2 input protection	0.00 to E2-23	2.00	V	Real-time
E2-34	0xE222	AI input protection time	0.00 to 1.00	0.01	s	Real-time
E2-35	0xE223	High level threshold when AI is used as DI	5.5 to 9.0	7.0	V	Real-time
E2-36	0xE224	Low level threshold when AI is used as DI	1.0 to 4.5	3.0	V	Real-time
E2-37	0xE225	Inversion calculation of AI curve absolute value	Ones: AI1 selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: AI2 selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E2-38	0xE226	AI curve selection	Ones: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens: AI2 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Hundreds: Reserved Thousands: Reserved	0x21	-	Real-time
E2-39	0xE227	AI lower limit selection	Ones: Setting for AI1 lower than minimum input 0: Minimum value 1: 0.0% Tens: Setting for AI2 lower than minimum input 0: Minimum value 1: 0.0% Hundreds: Reserved Thousands: Reserved	0x0	-	Real-time
E2-40	0xE228	Minimum input of AI curve 1	-10.00 to E2-42	0.00	V	Real-time
E2-41	0xE229	Percentage corresponding to the minimum input of AI curve 1	-800.0 to +800.0	0.0	%	Real-time
E2-42	0xE22A	Maximum input of AI curve 1	E2-40 to 10.00	10.00	V	Real-time
E2-43	0xE22B	Percentage corresponding to the maximum input of AI curve 1	-800.0 to +800.0	100.0	%	Real-time
E2-44	0xE22C	Minimum input of AI curve 2	-10.00 to E2-46	0.00	V	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E2-45	0xE22D	Percentage corresponding to the minimum input of AI curve 2	-800.0 to +800.0	0.0	%	Real-time
E2-46	0xE22E	Maximum input of AI curve 2	E2-44 to 10.00	10.00	V	Real-time
E2-47	0xE22F	Percentage corresponding to the maximum input of AI curve 2	-800.0 to +800.0	100.0	%	Real-time
E2-48	0xE230	Minimum input of AI curve 3	-10.00 to E2-50	0.00	V	Real-time
E2-49	0xE231	Percentage corresponding to the minimum input of AI curve 3	-800.0 to +800.0	0.0	%	Real-time
E2-50	0xE232	Maximum input of AI curve 3	E2-48 to 10.00	10.00	V	Real-time
E2-51	0xE233	Percentage corresponding to the maximum input of AI curve 3	-800.0 to +800.0	100.0	%	Real-time
E2-52	0xE234	Minimum input of AI curve 4	-10.00 to E2-54	0.00	V	Real-time
E2-53	0xE235	Percentage corresponding to the minimum input of AI curve 4	-800.0 to +800.0	0.0	%	Real-time
E2-54	0xE236	Inflection point 1 input of AI curve 4	E2-52 to E2-56	3.00	V	Real-time
E2-55	0xE237	Percentage corresponding to inflection point 1 input of AI curve 4	-800.0 to +800.0	30.0	%	Real-time
E2-56	0xE238	Inflection point 2 input of AI curve 4	E2-54 to E2-58	6.00	V	Real-time
E2-57	0xE239	Percentage corresponding to inflection point 2 input of AI curve 4	-800.0 to +800.0	60.0	%	Real-time
E2-58	0xE23A	Maximum input of AI curve 4	E2-56 to 10.00	10.00	V	Real-time
E2-59	0xE23B	Percentage corresponding to the maximum input of AI curve 4	-800.0 to +800.0	100.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E2-60	0xE23C	Minimum input of AI curve 5	-10.00 to E2-62	-10.00	V	Real-time
E2-61	0xE23D	Percentage corresponding to the minimum input of AI curve 5	-800.0 to +800.0	-100.0	%	Real-time
E2-62	0xE23E	Inflection point 1 input of AI curve 5	E2-60 to E2-64	-3.00	V	Real-time
E2-63	0xE23F	Percentage corresponding to inflection point 1 input of AI curve 5	-800.0 to +800.0	-30.0	%	Real-time
E2-64	0xE240	Inflection point 2 input of AI curve 5	E2-62 to E2-66	3.00	V	Real-time
E2-65	0xE241	Percentage corresponding to inflection point 2 input of AI curve 5	-800.0 to +800.0	30.0	%	Real-time
E2-66	0xE242	Maximum input of AI curve 5	E2-64 to 10.00	10.00	V	Real-time
E2-67	0xE243	Percentage corresponding to the maximum input of AI curve 5	-800.0 to +800.0	100.0	%	Real-time
E2-73	0xE249	AI2 temperature mode - Motor temperature sensor type	0: Analog input 1: PT100 2: PT1000 3: KTY84-130 4: PTC130	0	-	Real-time
E2-74	0xE24A	AI2 temperature mode - Motor temperature arrival	0 to 100	75	°C	Real-time
E2-75	0xE24B	AI2 temperature mode - Motor overtemperature pre-alarm threshold	0 to E2-76	110	°C	Real-time
E2-76	0xE24C	AI2 temperature mode - Motor overtemperature protection threshold	E2-75 to 200	130	°C	Real-time
E2-81	0xE251	AI hardware source selection	Ones: AI1 source 0: Hardware sampling 1: Forced value Tens: AI2 source 0: Hardware sampling 1: Forced value Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
E2-82	0xE252	AI1 forced value	-10.00 to +10.00	0.00	V	Real-time
E2-83	0xE253	AI2 forced value	-10.00 to +10.00	0.00	V	Real-time
E2-96	0xE260	Action upon AI hardware sampling upon power-off	0: Normal sampling upon power-off 1: Stop sampling upon power-off	0	-	Real-time
E2-97	0xE261	Bus voltage threshold for AI hardware sampling upon power-off	40.0 to 70.0	60.0	%	Real-time
E2-98	0xE262	AI hardware sampling state	0: Normal sampling 1: Stop sampling	0	-	Unchangeable

10.8.4 E3 AO

Param.	Communication address	Name	Range	Default	Unit	Change mode
E3-00	0xE300	AO1 function selection	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (address: 0x7313) 13: Motor speed 14: Output current. 100.0% corresponds to 1000.0 A. 15: Bus voltage. 100.0% corresponds to 1000.0 V. 16: Output torque (actual value) 17: Taper output 18: Roll diameter output 19: Tension output Others: F connector	0	-	Real-time
E3-03	0xE303	AO polarity selection	Ones: AO selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E3-04	0xE304	AO curve selection	Ones: AO curve 0: Two-point curve 1: Gain+Offset Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
E3-05	0xE305	Percentage corresponding to the minimum input of AO curve	-800.0 to E3-07	0.0	%	Real-time
E3-06	0xE306	Minimum input of AO curve	0.00 to 10.00	0.00	V	Real-time
E3-07	0xE307	Percentage corresponding to the maximum input of AO curve	E3-05 to 800.0	100.0	%	Real-time
E3-08	0xE308	Maximum input of AO curve	0.00 to 10.00	10.00	V	Real-time
E3-17	0xE311	AO1 zero offset coefficient	-100.0 to +100.0	0.0	%	Real-time
E3-18	0xE312	AO1 gain	-10.00 to +10.00	1.00	-	Real-time
E3-23	0xE317	AO1 output offset	-10.00 to +10.00	0.00	V	Real-time
E3-26	0xE31A	AO hardware source	Ones: AO source 0: Output function 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
E3-27	0xE31B	AO1 forced value	0.00 to 10.00	0.00	V	Real-time

10.8.5 E4 HDI (DI7)

Param.	Communication address	Name	Range	Default	Unit	Change mode
E4-00	0xE400	HDI terminal type selection	0: Used as HDI 1: Used as DI	1	-	At stop
E4-01	0xE401	HDI input enable state	0: Disable 1: Enable Others: B connector	0	-	Unchangeable
E4-02	0xE402	HDI hardware source	0: Hardware sampling 1: Forced value	0	-	Real-time
E4-03	0xE403	HDI forced value	0.00 to 20.00	1.00	kHz	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E4-07	0xE407	HDI curve setting	Ones: HDI curve selection 0: Two-point curve 1: Four-point curve Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
E4-08	0xE408	Minimum input of HDI two-point curve	0.00 to E4-10	0.00	kHz	Real-time
E4-09	0xE409	Percentage corresponding to the minimum input of HDI two-point curve	-800.0 to +800.0	0.0	%	Real-time
E4-10	0xE40A	Maximum input of HDI two-point curve	E4-08 to 20.00	20.00	kHz	Real-time
E4-11	0xE40B	Percentage corresponding to the maximum input of HDI two-point curve	-800.0 to +800.0	100.0	%	Real-time
E4-12	0xE40C	Minimum input of HDI four-point curve	0.00 to E4-14	0.00	kHz	Real-time
E4-13	0xE40D	Percentage corresponding to the minimum input of HDI four-point curve	-800.0 to +800.0	-100.0	%	Real-time
E4-14	0xE40E	Inflection point 1 input of HDI four-point curve	E4-12 to E4-16	5.00	kHz	Real-time
E4-15	0xE40F	Percentage corresponding to inflection point 1 input of HDI four-point curve	-800.0 to +800.0	-30.0	%	Real-time
E4-16	0xE410	Inflection point 2 input of HDI four-point curve	E4-14 to E4-18	10.00	kHz	Real-time
E4-17	0xE411	Percentage corresponding to inflection point 2 input of HDI four-point curve	-800.0 to +800.0	30.0	%	Real-time
E4-18	0xE412	Maximum input of HDI four-point curve	E4-16 to 20.00	20.00	kHz	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E4-19	0xE413	Percentage corresponding to the maximum input of HDI four-point curve	-800.0 to +800.0	100.0	%	Real-time
E4-32	0xE420	HDI filter time	0.00 to 10.00	0.10	s	Real-time
E4-33	0xE421	Inversion calculation of HDI curve absolute value	Ones: HDI 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
E4-34	0xE422	HDI de-noising threshold	0.0 to 10.0	0.0	%	Real-time
E4-35	0xE423	HDI curve upper/ lower limit selection	Ones: HDI 0: Limited 1: Not limited Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
E4-36	0xE424	Salt-and-pepper noise of the HDI	0 to 1000	0	ms	Real-time

10.8.6 E5 HDO (FM)

Param.	Communication address	Name	Range	Default	Unit	Change mode
E5-00	0xE500	FM multi-functional terminal output selection	0: HDO pulse output (FMP) 1: Digital output (FMR)	0	-	Real-time
E5-01	0xE501	HDO function selection	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (address: 0x7315) 13: Motor speed 14: Output current. 100.0% corresponds to 1000.0 A. 15: Bus voltage. 100.0% corresponds to 1000.0 V. 16: Output torque (actual value) 17: Taper output 18: Roll diameter output 19: Tension output Others: F connector	0	-	Real-time
E5-03	0xE503	Minimum input of HDO curve	-100.0 to E5-05	0.0	%	Real-time
E5-04	0xE504	Percentage corresponding to the minimum input of HDO curve	0.00 to 100.00	0.00	%	Real-time
E5-05	0xE505	Maximum input of HDO curve	E5-03 to 100.0	100.0	%	Real-time
E5-06	0xE506	Percentage corresponding to the maximum input of HDO curve	0.00 to 100.00	100.00	%	Real-time
E5-11	0xE50B	HDO output polarity selection	Ones: HDO selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
E5-12	0xE50C	HDO hardware source	Ones: HDO selection 0: Output function 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
E5-13	0xE50D	HDO forced value	0.00 to 100.00	0.00	%	Real-time
E5-15	0xE50F	Maximum frequency of HDO output	0.01 to 100.00	50.00	kHz	Real-time

10.8.7 EA I/O Expansion Card 1 Parameters

Param.	Communication address	Name	Range	Default	Unit	Change mode
EA-00	0xEA00	Set DI value to forced value	bit0: DI1 0: Hardware 1: Forced value bit1: DI2 0: Hardware 1: Forced value bit2 to bit15: Reserved	0x0	-	At stop
EA-01	0xEA01	Force DI data	bit0: DI1 0: Low level 1: High level bit1: DI2 0: Low level 1: High level bit2 to bit15: Reserved	0x0	-	Real-time
EA-02	0xEA02	DI1 switch-on delay	0.0 to 3600.0	0.0	s	At stop
EA-03	0xEA03	DI1 switch-off delay	0.0 to 3600.0	0.0	s	At stop
EA-04	0xEA04	DI2 switch-on delay	0.0 to 3600.0	0.0	s	At stop
EA-05	0xEA05	DI2 switch-off delay	0.0 to 3600.0	0.0	s	At stop
EA-08	0xEA08	DI input filter time selection	bit0: DI1 filter time 0: Filter time 1 1: Filter time 2 bit1: DI2 filter time 0: Filter time 1 1: Filter time 2	0x0	-	Real-time
EA-09	0xEA09	DI input filter time 1	0.000 to 1.000	0.010	s	Real-time
EA-10	0xEA0A	DI input filter time 2	0.000 to 1.000	0.010	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
EA-11	0xEA0B	DI1 function selection	0: No function 1: Terminal start/stop module A_ IN1 2: Terminal start/stop module A_ IN2 3: Terminal start/stop module A_ IN3 4: Terminal start/stop module A jog 1 (JOG1) 5: Terminal start/stop module A jog 2 (JOG2) 6: Function as UP key for frequency adjustment 7: Function as DOWN key for frequency adjustment 8: Coast to stop 9: Fault reset (RESET) 10: Operation pause (terminal control) 11: External fault NO input 12: Multi-reference selection bit0 13: Multi-reference selection bit1 14: Multi-reference selection bit2 15: Multi-reference selection bit3 16: Ramp selection bit0 17: Ramp selection bit1 19: Clear data set by terminal functioning as UP/DOWN key 21: Acceleration/Deceleration inhibited 22: PID pause 23: Simple PLC status reset 24: Swing frequency pause 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enabled 35: PID action direction reversal 36: External stop terminal 1 38: PID integral pause 39: Main/auxiliary frequency switchover (Continued)	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
EA-11	0xEA0B	DI1 function selection	(Continued) 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed/Torque control selection 47: Emergency stop 49: DC braking during deceleration 50: Clear the current operating time 61: Terminal start/stop module B_IN1 62: Terminal start/stop module B_IN2 63: Terminal start/stop module B_IN3 64: Terminal start/stop module B jog 1 (JOG1) 65: Terminal start/stop module B jog 2 (JOG2) 66: Forced to local control 67: Forced to terminal control 68: Forced to communication control 69: Forced to custom control 70: Control channel selection 71: Setting channel selection 72: Terminal start/stop module A/B selection 76: Motor selection terminal 2 77: Running enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	0	-	At stop
EA-12	0xEA0C	DI2 function selection	Same as EA-11	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
EA-16	0xEA10	DO1 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency level detection FDT1 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 11: Simple PLC cycle completed 12: Cumulative running time reached 13: Swing frequency limited 14: Torque limited 15: Ready to run 17: Frequency upper limit reached 18: Frequency lower limit reached (no output at stop) 19: Undervoltage state 20: Communication setting (address: 0x7322) 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reached 25: Frequency level detection FDT2 26: Frequency 1 reached 27: Frequency 2 reached 28: Current 1 reached 29: Current 2 reached 30: Timing reached 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature reached 36: Output current limit exceeded 37: Frequency lower limit reached (output at stop) 38: Abnormality (fault/minor fault/warning) 40: Current operating time reached 41: Fault (excluding undervoltage) 42: STO 43: Minor fault or alarm 44: AI2 input limit exceeded 46: Component service life warning Others: B connector	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
EA-17	0xEA11	RO1 function selection	Same as EA-16	0	-	Real-time
EA-18	0xEA12	DO/RO output source	bit0: DO output source 0: Output function 1: Forced value bit1: RO output source 0: Output function 1: Forced value bit2 to bit15: Reserved	0x0	-	Real-time
EA-19	0xEA13	Forced DO/RO data	bit0: DO 0: Low level 1: High level bit1: RO 0: Low level 1: High level bit2 to bit15: Reserved	0x0	-	Real-time
EA-20	0xEA14	DO/RO polarity selection	bit0: DO output source 0: Positive logic 1: Negative logic bit1: RO output source 0: Positive logic 1: Negative logic bit2 to bit15: Reserved	0x0	-	Real-time
EA-21	0xEA15	DO1 switch-on delay	0.0 to 3600.0	0.0	s	Real-time
EA-22	0xEA16	DO1 switch-off delay	0.0 to 3600.0	0.0	s	Real-time
EA-23	0xEA17	RO1 switch-on delay	0.0 to 3600.0	0.0	s	Real-time
EA-24	0xEA18	RO1 switch-off delay	0.0 to 3600.0	0.0	s	Real-time
EA-25	0xEA19	Forced output state of DO/RO upon communication disconnection	bit0: DO disconnection forced output 0: Low level 1: High level bit1: RO disconnection forced output 0: Low level 1: High level bit2 to bit15: Reserved	0x0	-	Real-time
EA-31	0xEA1F	AI hardware source selection	Ones: AI1 source 0: Hardware sampling 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	At stop
EA-32	0xEA20	AI1 forced value	-10.00 to +10.00	0.00	V	Real-time
EA-36	0xEA24	AI1 gain	-10.00 to +10.00	1.00	-	Real-time
EA-37	0xEA25	AI1 offset	-10.00 to +10.00	0.00	V	Real-time
EA-38	0xEA26	AI1 denoising threshold	0.0 to 100.0	0.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
EA-39	0xEA27	AI1 filter time	0.00 to 10.00	0.10	s	Real-time
EA-40	0xEA28	AI1 zero-crossing threshold	0.0 to 100.0	0.0	%	Real-time
EA-41	0xEA29	AI1 jump point	-800.0 to +800.0	0.0	%	Real-time
EA-42	0xEA2A	AI1 jump amplitude	0.0 to 100.0	0.1	%	Real-time
EA-43	0xEA2B	Upper limit of AI1 input protection	EA-44 to 10.00	8.00	V	Real-time
EA-44	0xEA2C	Lower limit of AI1 input protection	0.00 to EA-43	2.00	V	Real-time
EA-45	0xEA2D	AI input protection time	0.00 to 1.00	0.01	s	Real-time
EA-46	0xEA2E	High level threshold when AI is used as DI	5.5 to 9.0	7.0	V	Real-time
EA-47	0xEA2F	Low level threshold when AI is used as DI	1.0 to 4.5	3.0	V	Real-time
EA-48	0xEA30	AI polarity selection	Ones: AI1 selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
EA-49	0xEA31	AI curve selection	Ones: AI1 curve selection 1: Curve 1 (2 points, see EA-51 to EA-54) 2: Curve 2 (2 points, see EA-55 to EA-58) Tens: Reserved Hundreds: Reserved Thousands: Reserved	0x0001	-	Real-time
EA-50	0xEA32	AI lower limit selection	Ones: Setting for AI1 lower than minimum input 0: Minimum value 1: 0.0% Tens: Reserved Hundreds: Reserved Thousands: Reserved	0x0	-	Real-time
EA-51	0xEA33	Minimum input of AI curve 1	-10.00 to EA-53	0.00	V	Real-time
EA-52	0xEA34	Percentage corresponding to the minimum input of AI curve 1	-800.0 to +800.0	0.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
EA-53	0xEA35	Maximum input of AI curve 1	EA-51 to 10.00	10.00	V	Real-time
EA-54	0xEA36	Percentage corresponding to the maximum input of AI curve 1	-800.0 to +800.0	100.0	%	Real-time
EA-55	0xEA37	Minimum input of AI curve 2	-10.00 to EA-57	0.00	V	Real-time
EA-56	0xEA38	Percentage corresponding to the minimum input of AI curve 2	-800.0 to +800.0	0.0	%	Real-time
EA-57	0xEA39	Maximum input of AI curve 2	EA-55 to 10.00	10.00	V	Real-time
EA-58	0xEA3A	Percentage corresponding to the maximum input of AI curve 2	-800.0 to +800.0	100.0	%	Real-time
EA-59	0xEA3B	RTD temperature sensor type	0: Invalid 1: PT100 2: PT1000 3: KTY84-130 4: PTC130 (single-conductor) 5: PTC130 (three-conductor)	0	-	Real-time
EA-60	0xEA3C	RTD over-temperature protection threshold	EA-61 to 200	130	℃	Real-time
EA-61	0xEA3D	RTD over-temperature pre-alarm threshold	0 to EA-60	110	℃	Real-time
EA-62	0xEA3E	RTD temperature threshold	0 to 100	75	℃	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
EA-71	0xEA47	AO1 function selection	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (address: 0x7323) 13: Motor speed 14: Output current. 100.0% corresponds to 1000.0 A. 15: Bus voltage. 100.0% corresponds to 1000.0 V. 16: Output torque (actual value) 17: Taper output 18: Roll diameter output 19: Tension output Others: F connector	0	-	Real-time
EA-72	0xEA48	AO polarity selection	Ones: AO selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
EA-73	0xEA49	AO curve selection	Ones: AO curve 0: Two-point curve 1: Gain+Offset Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
EA-74	0xEA4A	Minimum input of AO curve	-800.0 to EA-76	0.0	%	Real-time
EA-75	0xEA4B	Percentage corresponding to the minimum input of AO curve	0.00 to 10.00	0.00	V	Real-time
EA-76	0xEA4C	Maximum input of AO curve	EA-74 to 800.0	100.0	%	Real-time
EA-77	0xEA4D	Percentage corresponding to the maximum input of AO curve	0.00 to 10.00	10.00	V	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
EA-78	0xEA4E	AO1 zero offset coefficient	-100.0 to +100.0	0.0	%	Real-time
EA-79	0xEA4F	AO1 gain	-10.00 to +10.00	1.00	-	Real-time
EA-80	0xEA50	AO1 output offset	-10.00 to +10.00	0.00	V	Real-time
EA-81	0xEA51	AO hardware source	Ones: AO source 0: Output function 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
EA-82	0xEA52	AO1 forced value	0.00 to 10.00	0.00	V	Real-time

10.8.8 Eb Parameters of I/O Expansion Card 2

Param.	Communication address	Name	Range	Default	Unit	Change mode
Eb-00	0xEB00	Set DI value to forced value	bit0: DI1 0: Hardware 1: Forced value bit1: DI2 0: Hardware 1: Forced value bit2 to bit15: Reserved	0x0	-	At stop
Eb-01	0xEB01	Force DI data	bit0: DI1 0: Low level 1: High level bit1: DI2 0: Low level 1: High level bit2 to bit15: Reserved	0x0	-	Real-time
Eb-02	0xEB02	DI1 switch-on delay	0.0 to 3600.0	0.0	s	At stop
Eb-03	0xEB03	DI1 switch-off delay	0.0 to 3600.0	0.0	s	At stop
Eb-04	0xEB04	DI2 switch-on delay	0.0 to 3600.0	0.0	s	At stop
Eb-05	0xEB05	DI2 switch-off delay	0.0 to 3600.0	0.0	s	At stop
Fb-08	0xEB08	DI input filter time selection	bit0: DI1 filter time 0: Filter time 1 1: Filter time 2 bit1: DI2 filter time 0: Filter time 1 1: Filter time 2 bit2 to bit15: Reserved	0x0	-	Real-time
Eb-09	0xEB09	DI input filter time 1	0.000 to 1.000	0.010	s	Real-time
Eb-10	0xEB0A	DI input filter time 2	0.000 to 1.000	0.010	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
Eb-11	0xEB0B	DI1 function selection	0: No function 1: Terminal start/stop module A_IN1 2: Terminal start/stop module A_IN2 3: Terminal start/stop module A_IN3 4: Terminal start/stop module A jog 1 (JOG1) 5: Terminal start/stop module A jog 2 (JOG2) 6: Function as UP key for frequency adjustment 7: Function as DOWN key for frequency adjustment 8: Coast to stop 9: Fault reset (RESET) 10: Operation pause (terminal control) 11: External fault NO input 12: Multi-reference selection bit0 13: Multi-reference selection bit1 14: Multi-reference selection bit2 15: Multi-reference selection bit3 16: Ramp selection bit0 17: Ramp selection bit1 19: Clear data set by terminal functioning as UP/DOWN key 21: Acceleration/Deceleration inhibited 22: PID pause 23: Simple PLC status reset 24: Swing frequency pause 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enabled 35: PID action direction reversal 36: External stop terminal 1 38: PID integral pause 39: Main/auxiliary frequency switchover (Continued)	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
Eb-11	0xEB0B	DI1 function selection	(Continued) 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed/Torque control selection 47: Emergency stop 49: DC braking during deceleration 50: Clear the current operating time 61: Terminal start/stop module B_IN1 62: Terminal start/stop module B_IN2 63: Terminal start/stop module B_IN3 64: Terminal start/stop module B jog 1 (JOG1) 65: Terminal start/stop module B jog 2 (JOG2) 66: Forced to local control 67: Forced to terminal control 68: Forced to communication control 69: Forced to custom control 70: Control channel selection 71: Setting channel selection 72: Terminal start/stop module A/B selection 76: Motor selection terminal 2 77: Running enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	0	-	At stop
Eb-12	0xEB0C	DI2 function selection	Same as Eb-11	0	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
Eb-16	0xEB10	DO1 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency level detection FDT1 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 11: Simple PLC cycle completed 12: Cumulative running time reached 13: Swing frequency limited 14: Torque limited 15: Ready to run 17: Frequency upper limit reached 18: Frequency lower limit reached (no output at stop) 19: Undervoltage state 20: Communication (7322) 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reached 25: Frequency level detection FDT2 26: Frequency 1 reached 27: Frequency 2 reached 28: Current 1 reached 29: Current 2 reached 30: Timing reached 31: AI1 input limit exceeded (Continued)	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
Eb-16	0xEB10	DO1 function selection	(Continued) 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature reached 36: Output current limit exceeded 37: Frequency lower limit reached (output at stop) 38: Abnormality (fault/ minor fault/warning) 40: Current operating time reached 41: Fault (excluding undervoltage) 42: STO 43: Minor fault or alarm 44: AI2 input limit exceeded 46: Component service life warning Others: B connector	0	-	Real-time
Eb-17	0xEB11	RO1 function selection	Same as Eb-16	0	-	Real-time
Eb-18	0xEB12	DO/RO output source	bit0: DO output source 0: Output function 1: Forced value bit1: RO output source 0: Output function 1: Forced value bit2 to bit15: Reserved	0x0	-	Real-time
Eb-19	0xEB13	Forced DO/RO data	bit0: DO 0: Low level 1: High level bit1: RO 0: Low level 1: High level bit2 to bit15: Reserved	0x0	-	Real-time
Eb-20	0xEB14	DO/RO polarity selection	bit0: DO output source 0: Positive logic 1: Negative logic bit1: RO output source 0: Positive logic 1: Negative logic bit2 to bit15: Reserved	0x0	-	Real-time
Eb-21	0xEB15	DO1 switch-on delay	0.0 to 3600.0	0.0	s	Real-time
Eb-22	0xEB16	DO1 switch-off delay	0.0 to 3600.0	0.0	s	Real-time
Eb-23	0xEB17	RO1 switch-on delay	0.0 to 3600.0	0.0	s	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
Eb-24	0xEB18	RO1 switch-off delay	0.0 to 3600.0	0.0	s	Real-time
Eb-25	0xEB19	Forced output state of DO/RO upon communication disconnection	bit0: DO disconnection forced output 0: Low level 1: High level bit1: RO disconnection forced output 0: Low level 1: High level bit2 to bit15: Reserved	0x0	-	Real-time
Eb-31	0xEB1F	AI hardware source selection	Ones: AI1 source 0: Hardware sampling 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	At stop
Eb-32	0xEB20	AI1 forced value	-10.00 to +10.00	0.00	V	Real-time
Eb-36	0xEB24	AI1 gain	-10.00 to +10.00	1.00	-	Real-time
Eb-37	0xEB25	AI1 offset	-10.00 to +10.00	0.00	V	Real-time
Eb-38	0xEB26	AI1 denoising threshold	0.0 to 100.0	0.0	%	Real-time
Eb-39	0xEB27	AI1 filter time	0.00 to 10.00	0.10	s	Real-time
Eb-40	0xEB28	AI1 zero-crossing threshold	0.0 to 100.0	0.0	%	Real-time
Eb-41	0xEB29	AI1 jump point	-800.0 to +800.0	0.0	%	Real-time
Eb-42	0xEB2A	AI1 jump amplitude	0.0 to 100.0	0.1	%	Real-time
Eb-43	0xEB2B	Upper limit of AI1 input protection	Eb-44 to 10.00	8.00	V	Real-time
Eb-44	0xEB2C	Lower limit of AI1 input protection	0.00 to Eb-43	2.00	V	Real-time
Eb-45	0xEB2D	AI input protection time	0.00 to 1.00	0.01	s	Real-time
Eb-46	0xEB2E	High level threshold when AI is used as DI	5.5 to 9.0	7.0	V	Real-time
Eb-47	0xEB2F	Low level threshold when AI is used as DI	1.0 to 4.5	3.0	V	Real-time
Eb-48	0xEB30	AI polarity selection	Ones: AI1 selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
Eb-49	0xEB31	AI curve selection	Ones: AI1 curve selection 1: Curve 1 (2 points, see EB-51 to EB-54) 2: Curve 2 (2 points, see EB-55 to EB-58) Tens: Reserved Hundreds: Reserved Thousands: Reserved	0x0001	-	Real-time
Eb-50	0xEB32	AI lower limit selection	Ones: Setting for AI1 lower than minimum input 0: Minimum value 1: 0.0% Tens: Reserved Hundreds: Reserved Thousands: Reserved	0x0	-	Real-time
Eb-51	0xEB33	Minimum input of AI curve 1	-10.00 to Eb-53	0.00	V	Real-time
Eb-52	0xEB34	Percentage corresponding to the minimum input of AI curve 1	-800.0 to +800.0	0.0	%	Real-time
Eb-53	0xEB35	Maximum input of AI curve 1	Eb-51 to 10.00	10.00	V	Real-time
Eb-54	0xEB36	Percentage corresponding to the maximum input of AI curve 1	-800.0 to +800.0	100.0	%	Real-time
Eb-55	0xEB37	Minimum input of AI curve 2	-10.00 to Eb-57	0.00	V	Real-time
Eb-56	0xEB38	Percentage corresponding to the minimum input of AI curve 2	-800.0 to +800.0	0.0	%	Real-time
Eb-57	0xEB39	Maximum input of AI curve 2	Eb-55 to 10.00	10.00	V	Real-time
Eb-58	0xEB3A	Percentage corresponding to the maximum input of AI curve 2	-800.0 to +800.0	100.0	%	Real-time
Eb-59	0xEB3B	RTD temperature sensor type	0: Invalid 1: PT100 2: PT1000 3: KTY84-130 4: PTC130 (single-conductor) 5: PTC130 (three-conductor)	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
Eb-60	0xEB3C	RTD over-temperature protection threshold	Eb-61 to 200	130	°C	Real-time
Eb-61	0xEB3D	RTD over-temperature pre-alarm threshold	0 to Eb-60	110	°C	Real-time
Eb-62	0xEB3E	RTD temperature threshold	0 to 100	75	°C	Real-time
Eb-71	0xEB47	AO1 function selection	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 8: AI2 12: Communication setting (address: 0x7324) 13: Motor speed 14: Output current. 100.0% corresponds to 1000.0 A. 15: Bus voltage. 100.0% corresponds to 1000.0 V. 16: Output torque (actual value) 17: Taper output 18: Roll diameter output 19: Tension output Others: F connector	0	-	Real-time
Eb-72	0xEB48	AO polarity selection	Ones: AO selection 0: Normal value 1: Absolute value 2: Inverted value 3: Inverted absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
Eb-73	0xEB49	AO curve selection	Ones: AO curve 0: Two-point curve 1: Gain+Offset Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
Eb-74	0xEB4A	Percentage corresponding to the minimum input of AO curve	-800.0 to Eb-76	0.0	%	Real-time
Eb-75	0xEB4B	Minimum input of AO curve	0.00 to 10.00	0.00	V	Real-time
Eb-76	0xEB4C	Percentage corresponding to the maximum input of AO curve	Eb-74 to 800.0	100.0	%	Real-time
Eb-77	0xEB4D	Maximum input of AO curve	0.00 to 10.00	10.00	V	Real-time
Eb-78	0xEB4E	AO1 zero offset coefficient	-100.0 to +100.0	0.0	%	Real-time
Eb-79	0xEB4F	AO1 gain	-10.00 to +10.00	1.00	-	Real-time
Eb-80	0xEB50	AO1 output offset	-10.00 to +10.00	0.00	V	Real-time
Eb-81	0xEB51	AO hardware source	Ones: AO source 0: Output function 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
Eb-82	0xEB52	AO1 forced value	0.00 to 10.00	0.00	V	Real-time

10.8.9 EE Input and Output Correction

Param.	Communication address	Name	Range	Default	Unit	Change mode
EE-00	0xEE00	AI1 measured voltage 1	-10.000 to 10.000	2.000	V	At stop
EE-01	0xEE01	AI1 displayed voltage 1	-10.000 to 10.000	2.000	V	At stop
EE-02	0xEE02	AI1 measured voltage 2	-10.000 to 10.000	8.000	V	At stop
EE-03	0xEE03	AI1 displayed voltage 2	-10.000 to 10.000	8.000	V	At stop
EE-04	0xEE04	AI2 measured voltage 1	-10.000 to 10.000	2.000	V	At stop
EE-05	0xEE05	AI2 displayed voltage 1	-10.000 to 10.000	2.000	V	At stop
EE-06	0xEE06	AI2 measured voltage 2	-10.000 to 10.000	8.000	V	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
EE-07	0xEE07	AI2 displayed voltage 2	-10.000 to 10.000	8.000	V	At stop
EE-12	0xEE0C	AO1 target voltage 1	-10.000 to 10.000	2.000	V	At stop
EE-13	0xEE0D	AO1 measured voltage 1	-10.000 to 10.000	2.000	V	At stop
EE-14	0xEE0E	AO1 target voltage 2	-10.000 to 10.000	8.000	V	At stop
EE-15	0xEE0F	AO1 measured voltage 2	-10.000 to 10.000	8.000	V	At stop

10.9 Group H Protection and Auxiliary

10.9.1 H1 Fault Level Settings

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-00	0x8100	Protective action selection 0 upon fault	Ones: Overcurrent (E002) 0: Coast to stop Tens: Overvoltage (E005) 0: Coast to stop Hundreds: Pre-charge fault (E008) 0: Coast to stop Thousands: Undervoltage (E009) 0: Coast to stop	0x0	-	Unchangeable
H1-01	0x8101	Protective action selection 1 upon fault	Ones: Inverter overload (E010) 0: Coast to stop Ones: Motor overload (E011) 0: Coast to stop Hundreds: Input phase loss (E012) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Thousands: Output phase loss (E013) 0: Coast to stop	0x0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-02	0x8102	Protective action selection 2 upon fault	Ones: Module overtemperature (E014) 0: Coast to stop Tens: External fault (E015) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Hundreds: Reserved 0: Coast to stop Thousands: Current sampling error (E018) 0: Coast to stop	0x0	-	Real-time
H1-03	0x8103	Protective action selection 3 upon fault	Ones: Parameter auto-tuning error (E019) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: EEPROM fault (E021) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop Thousands: Power unit EEPROM fault (E186) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop F: Not detected	0x0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-04	0x8104	Protective action selection 4 upon fault	Ones: Output short-circuited to ground (E023) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Cumulative running time reached (E026) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Thousands: User-defined fault (E027) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected	0x0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-05	0x8105	Protective action selection 5 upon fault	Ones: User-defined alarm (E028) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: Cumulative power-on time reached (E029) Same as the ones place Hundreds: Three-phase loss (E030) Same as the ones place Thousands: PID fault feedback loss (E031) Same as the ones place	0x00DD	-	Real-time
H1-06	0x8106	Protective action selection 6 upon fault	Ones: Parameter reset error (E032) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: Reserved 0: Coast to stop Hundreds: Excessive speed deviation (E042) Same as the ones place Thousands: Motor speed error (E043) Same as the ones place	0x0D0D	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-07	0x8107	Protective action selection 7 upon fault	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Error in magnetic pole position auto-tuning (E051) 0: Coast to stop	0x0	-	Unchangeable
H1-08	0x8108	Protective action selection 8 upon fault	Ones: Reserved 0: Coast to stop Tens: Self-check fault 1 (E056) 0: Coast to stop Hundreds: Self-check fault 2 (E057) 0: Coast to stop Thousands: Self-check fault 3 (E058) 0: Coast to stop	0x0	-	Unchangeable
H1-09	0x8109	Protective action selection 9 upon fault	Ones: Self-check fault 4 (E059) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-10	0x810A	Protective action selection 10 upon fault	Ones: Fan fault (E080) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x0	-	Real-time
H1-11	0x810B	Protective action selection 11 upon fault	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Sequence fault (E085) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Thousands: Motor control error 1 (E093) Same as the hundreds place	0x0F00	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-12	0x810C	Protective action selection 12 upon fault	Ones: Motor control error 2 (E094) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: Drive pre-overload (E110) Same as the ones place Hundreds: Motor pre-overload (E111) Same as the ones place Thousands: Module pre-overtemperature (E114) Same as the ones place	0xDDDD	-	Real-time
H1-13	0x810D	Protective action selection 13 upon fault	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x0	-	Real-time
H1-14	0x810E	Protective action selection 14 upon fault	Ones: AI/HDI disconnection (E154) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: I/O expansion card communication timeout Same as the ones place Hundreds: Reserved 0: Coast to stop Thousands: Automatic fault reset failure (E159) 0: Coast to stop	0x00DF	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-15	0x810F	Protective action selection 15 upon fault	Ones: Modbus communication timeout (E160) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: CANopen fault (E161) Same as the ones place Hundreds: CANlink fault (E162) Same as the ones place Thousands: Modbus TCP communication timeout (E169) Same as the ones place	0x0333	-	Real-time
H1-16	0x8110	Protective action selection 16 upon fault	Ones: EtherNet/IP fault (active only for MD630N) (E165) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: PROFINET fault (active only for MD630N) (E166) Same as the ones place Hundreds: EtherCAT fault 1 (active only for MD630N) (E167) Same as the ones place Thousands: EtherCAT fault 2 (active only for MD630N) (E168) Same as the ones place	0x0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-17	0x8111	Protective action selection 17 upon fault	Ones: Inobus expansion protocol (E170) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: Reserved 0: Coast to stop Hundreds: Flying start fault (E192) Same as the ones place Thousands: Undervoltage suppression limit reached (E193) Same as the ones place	0x0	-	Real-time
H1-18	0x8112	Protective action selection 18 upon fault	Ones: Component service life pre-alarm (E179) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: Junction temperature parameter fault (E187) Same as the ones place Hundreds: Parameter fault in power loss area of the power EEPROM (Err188) Same as the ones place Thousands: Junction temperature fault (E191) 0: Coast to stop	0x000D	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-19	0x8113	Protective action selection 19 upon fault	Ones: External flash data read/ write fault of black box 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: Fire mode activated D: Alarm E: Prompt F: Not detected Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x00DD	-	Real-time
H1-30	0x811E	Setting of the 1st group of fault codes	0.0-255.9	0.0	-	At stop
H1-31	0x811F	Setting of the first group of fault level	0000H: Coast to stop 0001H: Stop at maximum capability 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-32	0x8120	Setting of the 2nd group of fault codes	0.0-255.9	0.0	-	At stop
H1-33	0x8121	Setting of the 2nd group of fault level	Same as H1-19	0x000F	-	At stop
H1-34	0x8122	Setting of the 3rd group of fault codes	0.0-255.9	0.0	-	At stop
H1-35	0x8123	Setting of the 3rd group of fault level	Same as H1-19	0x000F	-	At stop
H1-36	0x8124	Setting of the 4th group of fault codes	0.0-255.9	0.0	-	At stop
H1-37	0x8125	Setting of the 4th group of fault level	Same as H1-19	0x000F	-	At stop

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-38	0x8126	Setting of the 5th group of fault codes	0.0-255.9	0.0	-	At stop
H1-39	0x8127	Setting of the 5th group of fault level	Same as H1-19	0x000F	-	At stop
H1-40	0x8128	Setting of the 6th group of fault codes	0.0-255.9	0.0	-	At stop
H1-41	0x8129	Setting of the 6th group of fault level	Same as H1-19	0x000F	-	At stop
H1-42	0x812A	Setting of the 7th group of fault codes	0.0-255.9	0.0	-	At stop
H1-43	0x812B	Setting of the 7th group of fault level	Same as H1-19	0x000F	-	At stop
H1-44	0x812C	Setting of the 8th group of fault codes	0.0-255.9	0.0	-	At stop
H1-45	0x812D	Setting of the 8th group of fault level	Same as H1-19	0x000F	-	At stop
H1-46	0x812E	Setting of the 9th group of fault codes	0.0-255.9	0.0	-	At stop
H1-47	0x812F	Setting of the 9th group of fault level	Same as H1-19	0x000F	-	At stop
H1-48	0x8130	Setting of the 10th group of fault codes	0.0-255.9	0.0	-	At stop
H1-49	0x8131	Setting of the 10th group of fault level	Same as H1-19	0x000F	-	At stop
H1-60	0x813C	Operation mode at limited speed	0: Operating at limited frequency 1: Operating at the operating frequency upon fault 2: Operating at the designated safe frequency 3: Operating at the frequency reference 4: Operating at the frequency upper limit in the current direction 5: Operating at the frequency lower limit in the current direction	1	-	Real-time
H1-61	0x813D	Designated safe operating frequency	0.0 to 800.0	0.0	%	Real-time
H1-62	0x813E	Maximum positive frequency limit	0.0 to 800.0	100.0	%	Real-time
H1-63	0x813F	Maximum negative frequency limit	0.0 to 800.0	100.0	%	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H1-64	0x8140	Maximum motoring power limit	0.0 to 400.0	50.0	%	Real-time
H1-65	0x8141	Maximum regenerative power limit	0.0 to 400.0	50.0	%	Real-time
H1-66	0x8142	Maximum positive torque limit	0.0 to 400.0	50.0	%	Real-time
H1-67	0x8143	Maximum negative torque limit	0.0 to 400.0	50.0	%	Real-time
H1-68	0x8144	Maximum current limit	0.0 to 400.0	50.0	%	Real-time

10.9.2 H2 User-Defined Fault

Param.	Communication address	Name	Range	Default	Unit	Change mode
H2-00	0x8200	Source of external fault 1 (NO)	0: Invalid 1: Valid Others: B connector	0	-	Real-time
H2-01	0x8201	Source of external fault 2 (NC)	Same as H2-00	1	-	Real-time
H2-02	0x8202	Source of user-defined fault 1	Same as H2-00	0	-	Real-time
H2-03	0x8203	Source of user-defined fault 2	Same as H2-00	0	-	Real-time
H2-04	0x8204	Source of user-defined fault 3	Same as H2-00	0	-	Real-time
H2-05	0x8205	Source of user-defined fault 4	Same as H2-00	0	-	Real-time
H2-06	0x8206	Source of user-defined fault 5	Same as H2-00	0	-	Real-time
H2-07	0x8207	Source of user-defined fault 6	Same as H2-00	0	-	Real-time
H2-08	0x8208	Source of user-defined fault 7	Same as H2-00	0	-	Real-time
H2-09	0x8209	Source of user-defined fault 8	Same as H2-00	0	-	Real-time
H2-10	0x820A	Source of user-defined alarm 1	Same as H2-00	0	-	Real-time
H2-11	0x820B	Source of user-defined alarm 2	Same as H2-00	0	-	Real-time
H2-12	0x820C	Source of user-defined alarm 3	Same as H2-00	0	-	Real-time

Param.	Communication address	Name	Range	Default	Unit	Change mode
H2-13	0x820D	Source of user-defined alarm 4	Same as H2-00	0	-	Real-time
H2-14	0x820E	Source of user-defined alarm 5	Same as H2-00	0	-	Real-time
H2-15	0x820F	Source of user-defined alarm 6	Same as H2-00	0	-	Real-time
H2-16	0x8210	Source of user-defined alarm 7	Same as H2-00	0	-	Real-time
H2-17	0x8211	Source of user-defined alarm 8	Same as H2-00	0	-	Real-time

10.9.3 H3 Automatic Fault Reset/Restart

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H3-00	0x8300	Automatic fault reset	0: Disable 1: Enable	1	-	Real-time
H3-01	0x8301	Number of automatic fault reset	0 to 100	0	-	Real-time
H3-02	0x8302	Automatic fault reset interval	0.1 to 600.0	1.0	s	Real-time
H3-03	0x8303	Auto reset terminated upon manual reset	0: Automatic reset is canceled. 1: Automatic reset continues.	1	-	Real-time
H3-04	0x8304	Time for restoring the number of automatic reset times	0–6000	10	min.	Real-time
H3-05	0x8305	Accumulative number of fault resets	0 to 65535	0	-	Unchangeable
H3-06	0x8306	Action upon exhausting the number of issue resets	0: Cleared1: Not cleared	0	-	Real-time
H3-07	0x8307	Fault output selection	0: No output during automatic fault reset 1: Output during automatic fault reset	0	-	Real-time
H3-13	0x830D	Automatic fault reset inhibited issue code 1	0.0 to 255.9	0.0	-	Real-time
H3-14	0x830E	Automatic fault reset inhibited issue code 2	0.0 to 255.9	0.0	-	Real-time
H3-15	0x830F	Automatic fault reset inhibited issue code 3	0.0 to 255.9	0.0	-	Real-time
H3-16	0x8310	Automatic fault reset inhibited issue code 4	0.0 to 255.9	0.0	-	Real-time
H3-17	0x8311	Automatic fault reset inhibited issue code 5	0.0 to 255.9	0.0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H3-18	0x8312	Automatic fault reset inhibited issue code 6	0.0 to 255.9	0.0	-	Real-time
H3-19	0x8313	Automatic fault reset inhibited issue code 7	0.0 to 255.9	0.0	-	Real-time
H3-20	0x8314	Automatic fault reset inhibited issue code 8	0.0 to 255.9	0.0	-	Real-time
H3-21	0x8315	Automatic fault reset inhibited issue code 9	0.0 to 255.9	0.0	-	Real-time
H3-22	0x8316	Automatic fault reset inhibited issue code 10	0.0 to 255.9	0.0	-	Real-time
H3-28	0x831C	Restart after automatic fault reset	0: Disable 1: Enable	0	-	Real-time
H3-29	0x831D	Restart delay time after automatic fault reset	0.0 to 600.0	0.5	s	Real-time
H3-30	0x831E	Adopt flying start after automatic fault reset	0: Flying start is not adopted after automatic fault reset. 1: Flying start is adopted after automatic fault reset.	0	-	Real-time
H3-31	0x831F	List that allows restart after automatic fault reset	0: Whitelist 1: Blacklist	1	-	Real-time
H3-34	0x8322	Designated fault code 1	0.0 to 255.9	0.0	-	Real-time
H3-35	0x8323	Designated fault code 2	0.0 to 255.9	0.0	-	Real-time
H3-36	0x8324	Designated fault code 3	0.0 to 255.9	0.0	-	Real-time
H3-37	0x8325	Designated fault code 4	0.0 to 255.9	0.0	-	Real-time
H3-38	0x8326	Designated fault code 5	0.0 to 255.9	0.0	-	Real-time
H3-39	0x8327	Designated fault code 6	0.0 to 255.9	0.0	-	Real-time

10.9.4 H6 Historical Fault Record 1

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H6-00	0x8600	Latest fault code 1	0.0 to 6553.5	0.0	-	Unchangeable
H6-06	0x8606	Fault code 2 of the last fault	0.0 to 6553.5	0.0	-	Unchangeable
H6-12	0x860C	Fault code 1 of the third latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H6-18	0x8612	Fault code 1 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H6-24	0x8618	Latest fault code 5	0.0 to 6553.5	0.0	-	Unchangeable
H6-30	0x861E	Latest fault code 6	0.0 to 6553.5	0.0	-	Unchangeable
H6-36	0x8624	Frequency upon the latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H6-37	0x8625	Current upon the latest fault	0.00 to 655.35	0.00	A	Unchangeable
H6-38	0x8626	Bus voltage upon the latest fault	0.0 to 6553.5	0.0	V	Unchangeable
H6-39	0x8627	Input terminal status upon the latest fault	bit0: DI1 state bit1: DI2 state bit2: DI3 state (active only for MD630S) bit3: DI4 state (active only for MD630S) bit4: DI5 state (active only for MD630S) bit5: DI6 state (active only for MD630S) bit6: DI7/HDI state (active only for MD630S) bit0 to bit6: 0: Low level 1: High level bit7 to bit9: Reserved bit10: VDI1 state bit11: VDI2 state bit12: VDI3 state bit13: VDI4 state bit14: VDI5 state bit15: VDI6 state bit10 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
H6-40	0x8628	Output terminal status upon the latest fault	bit0: RO state 0: Low level 1: High level bit1: FMR state (valid only for MD630S) Same as bit0 bit2: DO state Same as bit0 bit3 to bit9: Reserved Same as bit0 bit10: VDO1 state bit11: VDO2 state bit12: VDO3 state bit13: VDO4 state bit14: VDO5 state bit15: VDO6 state bit10 to bit15 Same as bit0	0x0	-	Unchangeable
H6-41	0x8629	Drive state upon the latest fault	0 to 65535	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H6-42	0x862A	Power-on time upon the latest fault	0 to 65535	0	min.	Unchangeable
H6-43	0x862B	Running time upon the latest fault	0.0 to 6553.5	0.0	min.	Unchangeable
H6-44	0x862C	Status word 1 upon the latest fault	bit0: Ready to switch on bit1: Ready to run bit2: Running bit3: Faulty bit4: OFF2 (coast to stop) stop bit5: OFF3 (quick stop) stop bit6: Switch-on inhibited bit7: Alarm/Limited operation bit8: No speed deviation bit9: Local/Remote bit10: Target speed reached bit11: Torque limited bit12: Forward speed bit13: Reverse speed bit14: Running (wave generation) bit15: Custom state 0 bit0 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable
H6-45	0x862D	Status word 2 upon the latest fault	bit0: Self-test bit1: Parameter auto-tuning bit2: Light fault state bit3: Alarm state bit4: Speed mode bit5: Torque mode bit6: Reserved bit7: RFG enable bit8: RFG operating bit9: Stop at fault bit10: Non-jog running bit11: Jogging bit12: Decelerate to stop Bit13: Reserved bit14: Terminal control bit15: Custom state 1 bit0 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H6-46	0x862E	Command word upon the latest fault	bit0: ON_OFF1 (Start/Stop) 0: Stop 1: Operating bit1: OFF2 (coast to stop) stop 0: Active 1: Normal bit2: OFF3 (quick stop) stop 0: Active 1: Normal bit3: Running permitted 0: Operation inhibited 1: Operation allowed bit4: RFG output forced to 0 0: Normal value 1: The RFG output is forced to 0. bit5: RFG paused 0: Normal value 1: RFG pause bit6: RFG input forced to 0 0: Normal value 1: The RFG input is forced to 0. bit7: Fault reset 0: Invalid 1: Enabled bit8: Jog 1 0: Invalid 1: Enabled bit9: Jog 2 0: Invalid 1: Enabled bit10: Remote control reserved 0: Invalid 1: Enabled bit11: Speed inversion 0: Inversion disabled 1: Inversion bit12: Start signal 0: Invalid 1: Enabled Bit13: Internal start command 0: Invalid 1: Enabled bit14: Reserved bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H6-47	0x862F	RFG status word upon the latest fault	bit0-bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit2-bit3: Acceleration/ deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8-bit9: Previous cycle acceleration/deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit10-bit11: Previous cycle arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Unchangeable

10.9.5 H7: Historical Fault Record 2

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H7-00	0x8700	Fault code 1 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-06	0x8706	Fault code 2 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-12	0x870C	Fault code 3 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-18	0x8712	Fault code 4 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-24	0x8718	Fault code 5 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-30	0x871E	Fault code 6 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H7-36	0x8724	Frequency upon the second latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable
H7-37	0x8725	Current upon the second latest fault	0.00 to 655.35	0.00	A	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H7-38	0x8726	Bus voltage upon the second latest fault	0.0 to 6553.5	0.0	V	Unchangeable
H7-39	0x8727	Input terminal status upon the second latest fault	bit0: DI1 state bit1: DI2 state bit2: DI3 state (active only for MD630S) bit3: DI4 state (active only for MD630S) bit4: DI5 state (active only for MD630S) bit5: DI6 state (active only for MD630S) bit6: DI7/HDI state (active only for MD630S) bit7 to bit9: Reserved bit10: VDI1 state bit11: VDI2 state bit12: VDI3 state bit13: VDI4 state bit14: VDI5 state bit15: VDI6 state bit0 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
H7-40	0x8728	Output terminal status upon the second latest fault	bit0: RO state bit1: FMR state (valid only for MD630S) bit2: DO state bit3 to bit9: Reserved bit10: VDO1 state bit11: VDO2 state bit12: VDO3 state bit13: VDO4 state bit14: VDO5 state bit15: VDO6 state bit0 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
H7-41	0x8729	Drive state upon the second latest fault	0 to 65535	0	-	Unchangeable
H7-42	0x872A	Power-on time upon the second latest fault	0 to 65535	0	min.	Unchangeable
H7-43	0x872B	Running time upon the second latest fault	0.0 to 6553.5	0.0	min.	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H7-44	0x872C	Status word 1 upon the 2nd latest fault	bit0: Ready to switch on 0: Invalid 1: Enabled bit1: Ready to run bit2: Running bit3: Faulty bit4: OFF2 (coast to stop) stop bit5: OFF3 (quick stop) stop bit6: Switch-on inhibited bit7: Alarm/Limited operation bit8: No speed deviation bit9: Local/Remote bit10: Target speed reached bit11: Torque limited bit12: Forward speed bit13: Reverse speed bit14: Running (wave generation) bit15: Custom state 0 bit1~bit15: 0: Low level 1: High level	0x0	-	Unchangeable
H7-45	0x872D	Status word 2 upon the 2nd latest fault	bit0: Self-test 0: Invalid 1: Enabled bit1: Parameter auto-tuning bit2: Light fault state bit3: Alarm state bit4: Speed mode bit5: Torque mode bit6: Reserved bit7: RFG enable bit8: RFG operating bit9: Stop at fault bit10: Non-jog running bit11: Jogging bit12: Decelerate to stop Bit13: Reserved bit14: Terminal control bit15: Custom state 1 bit1~bit15: 0: Low level 1: High level; same as bit0	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H7-46	0x872E	Command word upon the 2nd latest fault	bit0: ON_OFF1 (Start/Stop) 0: Stop 1: Operating bit1: OFF2 (coast to stop) stop 0: Active 1: Normal bit2: OFF3 (quick stop) stop 0: Active 1: Normal bit3: Running permitted 0: Operation inhibited 1: Operation allowed bit4: RFG output forced to 0 0: Normal value 1: The RFG output is forced to 0. bit5: RFG paused 0: Normal value 1: RFG pause bit6: RFG input forced to 0 0: Normal value 1: The RFG input is forced to 0. bit7: Fault reset 0: Invalid 1: Enabled bit8: Jog 1 0: Invalid 1: Enabled bit9: Jog 2 0: Invalid 1: Enabled bit10: Remote control reserved 0: Invalid 1: Enabled bit11: Speed inversion 0: Inversion disabled 1: Inversion bit12: Start signal 0: Invalid 1: Enabled Bit13: Internal start command 0: Invalid 1: Enabled bit14: Reserved bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H7-47	0x872F	RFG status word upon the 2nd latest fault	bit0-bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit2-bit3: Acceleration/ deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8-bit9: Previous cycle acceleration/deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit10-bit11: Previous cycle arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Unchangeable

10.9.6 H8 Historical Fault Record 3

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H8-00	0x8800	Fault code 1 of the third latest time	0.0 to 6553.5	0.0	-	Unchangeable
H8-06	0x8806	Fault code 2 of the 3rd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H8-12	0x880C	Fault code 3 of the third latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H8-18	0x8812	Fault code 3 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H8-24	0x8818	Fault code 5 of the 3rd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H8-30	0x881E	Fault code 6 of the 3rd latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H8-36	0x8824	Frequency upon the third latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable
H8-37	0x8825	Current upon the third latest fault	0.00 to 655.35	0.00	A	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H8-38	0x8826	Bus voltage upon the third latest fault	0.0 to 6553.5	0.0	V	Unchangeable
H8-39	0x8827	Input terminal status upon the third latest fault	bit0: DI1 state bit1: DI2 state bit2: DI3 state (active only for MD630S) bit3: DI4 state (active only for MD630S) bit4: DI5 state (active only for MD630S) bit5: DI6 state (active only for MD630S) bit6: DI7/HDI state (active only for MD630S) bit7 to bit9: Reserved bit10: VDI1 state bit11: VDI2 state bit12: VDI3 state bit13: VDI4 state bit14: VDI5 state bit15: VDI6 state bit0 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
H8-40	0x8828	Output terminal status upon the third latest fault	bit0: RO state bit1: FMR state (valid only for MD630S) bit2: DO state bit3 to bit9: Reserved bit10: VDO1 state bit11: VDO2 state bit12: VDO3 state bit13: VDO4 state bit14: VDO5 state bit15: VDO6 state bit0 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
H8-41	0x8829	Drive state upon the third latest fault	0 to 65535	0	-	Unchangeable
H8-42	0x882A	Power-on time upon the third latest fault	0 to 65535	0	min.	Unchangeable
H8-43	0x882B	Running time upon the third latest fault	0.0 to 6553.5	0.0	min.	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H8-44	0x882C	Status word 1 upon the third latest fault	bit0: Ready to switch on bit1: Ready to run bit2: Running bit3: Faulty bit4: OFF2 (coast to stop) stop bit5: OFF3 (quick stop) stop bit6: Switch-on inhibited bit7: Alarm/Limited operation bit8: No speed deviation bit9: Local/Remote bit10: Target speed reached bit11: Torque limited bit12: Forward speed bit13: Reverse speed bit14: Running (wave generation) bit15: Custom state 0 bit0 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable
H8-45	0x882D	Status word 2 upon the 3rd latest fault	bit0: Self-test bit1: Parameter auto-tuning bit2: Light fault state bit3: Alarm state bit4: Speed mode bit5: Torque mode bit6: Reserved bit7: RFG enable bit8: RFG operating bit9: Stop at fault bit10: Non-jog running bit11: Jogging bit12: Decelerate to stop Bit13: Reserved bit14: Terminal control bit15: Custom state 1 bit0 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H8-46	0x882E	Command word upon the third latest fault	bit0: ON_OFF1 (Start/Stop) 0: Stop 1: Operating bit1: OFF2 (coast to stop) stop 0: Active 1: Normal bit2: OFF3 (quick stop) stop 0: Active 1: Normal bit3: Running permitted 0: Operation inhibited 1: Operation allowed bit4: RFG output forced to 0 0: Normal value 1: The RFG output is forced to 0. bit5: RFG paused 0: Normal value 1: RFG pause bit6: RFG input forced to 0 0: Normal value 1: The RFG input is forced to 0. bit7: Fault reset 0: Invalid 1: Enabled bit8: Jog 1 0: Invalid 1: Enabled bit9: Jog 2 0: Invalid 1: Enabled bit10: Remote control reserved 0: Invalid 1: Enabled bit11: Speed inversion 0: Inversion disabled 1: Inversion bit12: Start signal 0: Invalid 1: Enabled Bit13: Internal start command 0: Invalid 1: Enabled bit14: Reserved bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H8-47	0x882F	RFG status word upon the third latest fault	bit0-bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit2-bit3: Acceleration/ deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8-bit9: Previous cycle acceleration/deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit10-bit11: Previous cycle arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Unchangeable

10.9.7 H9 Historical Fault Record 4

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H9-00	0x8900	Fault code 1 of the fourth latest time	0.0 to 6553.5	0.0	-	Unchangeable
H9-06	0x8906	Fault code 2 of the 4thlatest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-12	0x890C	Fault code 3 of the 4thlatest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-18	0x8912	Fault code 4 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-24	0x8918	Fault code 5 of the 4thlatest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-30	0x891E	Fault code 6 of the 4thlatest fault	0.0 to 6553.5	0.0	-	Unchangeable
H9-36	0x8924	Frequency upon the fourth latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H9-37	0x8925	Current upon the fourth latest fault	0.00 to 655.35	0.00	A	Unchangeable
H9-38	0x8926	Bus voltage upon the fourth latest fault	0.0 to 6553.5	0.0	V	Unchangeable
H9-39	0x8927	Input terminal status upon the fourth latest fault	bit0: DI1 state bit1: DI2 state bit2: DI3 state (active only for MD630S) bit3: DI4 state (active only for MD630S) bit4: DI5 state (active only for MD630S) bit5: DI6 state (active only for MD630S) bit6: DI7/HDI state (active only for MD630S) bit7 to bit9: Reserved bit10: VDI1 state bit11: VDI2 state bit12: VDI3 state bit13: VDI4 state bit14: VDI5 state bit15: VDI6 state bit0 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
H9-40	0x8928	Output terminal status upon the fourth latest fault	bit0: RO state bit1: FMR state (valid only for MD630S) bit2: DO state bit1~bit3: 0: Low level 1: High level bit3 to bit9: Reserved bit10: VDO1 state bit11: VDO2 state bit12: VDO3 state bit13: VDO4 state bit14: VDO5 state bit15: VDO6 state bit10 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
H9-41	0x8929	Drive state upon the fourth latest fault	0 to 65535	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H9-42	0x892A	Power-on time upon the fourth latest fault	0 to 65535	0	min.	Unchangeable
H9-43	0x892B	Running time upon the fourth latest fault	0.0 to 6553.5	0.0	min.	Unchangeable
H9-44	0x892C	Status word 1 upon the fourth latest fault	bit0: Ready to switch on bit1: Ready to run bit2: Running bit3: Faulty bit4: OFF2 (coast to stop) stop bit5: OFF3 (quick stop) stop bit6: Switch-on inhibited bit7: Alarm/Limited operation bit8: No speed deviation bit9: Local/Remote bit10: Target speed reached bit11: Torque limited bit12: Forward speed bit13: Reverse speed bit14: Running (wave generation) bit15: Custom state 0 bit10 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable
H9-45	0x892D	Status word 2 upon the fourth latest fault	bit0: Self-test 0: Invalid 1: Enabled bit1: Parameter auto-tuning bit2: Light fault state bit3: Alarm state bit4: Speed mode bit5: Torque mode bit6: Reserved bit7: RFG enable bit8: RFG operating bit9: Stop at fault bit10: Non-jog running bit11: Jogging bit12: Decelerate to stop Bit13: Reserved bit14: Terminal control bit15: Custom state 1 bit10 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H9-46	0x892E	Command word upon the fourth latest fault	bit0: ON_OFF1 (Start/Stop) 0: Stop 1: Operating bit1: OFF2 (coast to stop) stop 0: Active 1: Normal bit2: OFF3 (quick stop) stop 0: Active 1: Normal bit3: Running permitted 0: Operation inhibited 1: Operation allowed bit4: RFG output forced to 0 0: Normal value 1: The RFG output is forced to 0. bit5: RFG paused 0: Normal value 1: RFG pause bit6: RFG input forced to 0 0: Normal value 1: The RFG input is forced to 0. bit7: Fault reset 0: Invalid 1: Enabled bit8: Jog 1 0: Invalid 1: Enabled bit9: Jog 2 0: Invalid 1: Enabled bit10: Remote control reserved 0: Invalid 1: Enabled bit11: Speed inversion 0: Inversion disabled 1: Inversion bit12: Start signal 0: Invalid 1: Enabled Bit13: Internal start command 0: Invalid 1: Enabled bit14: Reserved bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
H9-47	0x892F	RFG status word upon the fourth latest fault	bit0-bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit2-bit3: Acceleration/ deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8-bit9: Previous cycle acceleration/deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit10-bit11: Previous cycle arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Unchangeable

10.9.8 HA Historical Fault Record 5

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
HA-00	0x8A00	Fault code 1 of the fifth latest time	0.0 to 6553.5	0.0	-	Unchangeable
HA-06	0x8A06	Fault code 2 of the 5th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-12	0x8A0C	Fault code 5 of the third latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-18	0x8A12	Fault code 5 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-24	0x8A18	Fault code 5 of the 5th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-30	0x8A1E	Fault code 6 of the 5th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
HA-36	0x8A24	Frequency upon the fifth latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable
HA-37	0x8A25	Current upon the fifth latest fault	0.00 to 655.35	0.00	A	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
HA-38	0x8A26	Bus voltage upon the fifth latest fault	0.0 to 6553.5	0.0	V	Unchangeable
HA-39	0x8A27	Input terminal status upon the fifth latest fault	bit0: DI1 state bit1: DI2 state bit2: DI3 state (active only for MD630S) bit3: DI4 state (active only for MD630S) bit4: DI5 state (active only for MD630S) bit5: DI6 state (active only for MD630S) bit6: DI7/HDI state (active only for MD630S) bit7 to bit9: Reserved bit10: VDI1 state bit11: VDI2 state bit12: VDI3 state bit13: VDI4 state bit14: VDI5 state bit15: VDI6 state bit0 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
HA-40	0x8A28	Output terminal status upon the fifth latest fault	bit0: RO state bit1: FMR state (valid only for MD630S) bit2: DO state bit3 to bit9: Reserved bit10: VDO1 state bit11: VDO2 state bit12: VDO3 state bit13: VDO4 state bit14: VDO5 state bit15: VDO6 state bit0 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
HA-41	0x8A29	Drive state upon the fifth latest fault	0 to 65535	0	-	Unchangeable
HA-42	0x8A2A	Power-on time upon the fifth latest fault	0 to 65535	0	min.	Unchangeable
HA-43	0x8A2B	Running time upon the fifth latest fault	0.0 to 6553.5	0.0	min.	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
HA-44	0x8A2C	Status word 1 upon the fifth latest fault	bit0: Ready to switch on 0: Invalid 1: Enabled bit1: Ready to run bit2: Running bit3: Faulty bit4: OFF2 (coast to stop) stop bit5: OFF3 (quick stop) stop bit6: Switch-on inhibited bit7: Alarm/Limited operation bit8: No speed deviation bit9: Local/Remote bit10: Target speed reached bit11: Torque limited bit12: Forward speed bit13: Reverse speed bit14: Running (wave generation) bit15: Custom state 0 bit0 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable
HA-45	0x8A2D	Status word 2 upon the fifth latest fault	bit0: Self-test bit1: Parameter auto-tuning bit2: Light fault state bit3: Alarm state bit4: Speed mode bit5: Torque mode bit6: Reserved bit7: RFG enable bit8: RFG operating bit9: Stop at fault bit10: Non-jog running bit11: Jogging bit12: Decelerate to stop Bit13: Reserved bit14: Terminal control bit15: Custom state 1 bit0 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
HA-46	0x8A2E	Command word upon the fifth latest fault	bit0: ON_OFF1 (Start/Stop) 0: Stop 1: Operating bit1: OFF2 (coast to stop) stop 0: Active 1: Normal bit2: OFF3 (quick stop) stop 0: Active 1: Normal bit3: Running permitted 0: Operation inhibited 1: Operation allowed bit4: RFG output forced to 0 0: Normal value 1: The RFG output is forced to 0. bit5: RFG paused 0: Normal value 1: RFG pause bit6: RFG input forced to 0 0: Normal value 1: The RFG input is forced to 0. bit7: Fault reset 0: Invalid 1: Enabled bit8: Jog 1 0: Invalid 1: Enabled bit9: Jog 2 0: Invalid 1: Enabled bit10: Remote control reserved 0: Invalid 1: Enabled bit11: Speed inversion 0: Inversion disabled 1: Inversion bit12: Start signal 0: Invalid 1: Enabled Bit13: Internal start command 0: Invalid 1: Enabled bit14: Reserved bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
HA-47	0x8A2F	RFG status word upon the fifth latest fault	bit0-bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit2-bit3: Acceleration/ deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8-bit9: Previous cycle acceleration/deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit10-bit11: Previous cycle arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Unchangeable

10.9.9 Hb Historical Fault Record 6

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
Hb-00	0x8B00	Fault code 1 of the sixth latest time	0.0 to 6553.5	0.0	-	Unchangeable
Hb-06	0x8B06	Fault code 2 of the 6th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
Hb-12	0x8B0C	Fault code 3 of the sixth latest fault	0.0 to 6553.5	0.0	-	Unchangeable
Hb-18	0x8B12	Fault code 6 of the 4th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
Hb-24	0x8B18	Fault code 5 of the 6th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
Hb-30	0x8B1E	Fault code 6 of the 6th latest fault	0.0 to 6553.5	0.0	-	Unchangeable
Hb-36	0x8B24	Frequency upon the sixth latest fault	0.0 to 6553.5	0.0	Hz	Unchangeable
Hb-37	0x8B25	Current upon the sixth latest fault	0.00 to 655.35	0.00	A	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
Hb-38	0x8B26	Bus voltage upon the sixth latest fault	0.0 to 6553.5	0.0	V	Unchangeable
Hb-39	0x8B27	Input terminal status upon the sixth latest fault	bit0: DI1 state bit1: DI2 state bit2: DI3 state (active only for MD630S) bit3: DI4 state (active only for MD630S) bit4: DI5 state (active only for MD630S) bit5: DI6 state (active only for MD630S) bit6: DI7/HDI state (active only for MD630S) bit7 to bit9: Reserved bit10: VDI1 state bit11: VDI2 state bit12: VDI3 state bit13: VDI4 state bit14: VDI5 state bit15: VDI6 state bit0~bit15 0: Low level 1: High level	0x0	-	Unchangeable
Hb-40	0x8B28	Output terminal status upon the sixth latest fault	bit0: RO state bit1: FMR state (valid only for MD630S) bit2: DO state bit3 to bit9: Reserved bit10: VDO1 state bit11: VDO2 state bit12: VDO3 state bit13: VDO4 state bit14: VDO5 state bit15: VDO6 state bit0~bit15 0: Low level 1: High level	0x0	-	Unchangeable
Hb-41	0x8B29	Drive state upon the sixth latest fault	0 to 65535	0	-	Unchangeable
Hb-42	0x8B2A	Power-on time upon the sixth latest fault	0 to 65535	0	min.	Unchangeable
Hb-43	0x8B2B	Running time upon the sixth latest fault	0.0 to 6553.5	0.0	min.	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
Hb-44	0x8B2C	Status word 1 upon the sixth latest fault	bit0: Ready to switch on bit1: Ready to run bit2: Running bit3: Faulty bit4: OFF2 (coast to stop) stop bit5: OFF3 (quick stop) stop bit6: Switch-on inhibited bit7: Alarm/Limited operation bit8: No speed deviation bit9: Local/Remote bit10: Target speed reached bit11: Torque limited bit12: Forward speed bit13: Reverse speed bit14: Running (wave generation) bit15: Custom state 0 bit0~bit15 0: Invalid 1: Enabled	0x0	-	Unchangeable
Hb-45	0x8B2D	Status word 2 upon the 6th latest fault	bit0: Self-test bit1: Parameter auto-tuning bit2: Light fault state bit3: Alarm state bit4: Speed mode bit5: Torque mode bit6: Reserved bit7: RFG enable bit8: RFG operating bit9: Stop at fault bit10: Non-jog running bit11: Jogging bit12: Decelerate to stop Bit13: Reserved bit14: Terminal control bit15: Custom state 1 bit0~bit15 0: Invalid 1: Enabled	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
Hb-46	0x8B2E	Command word upon the sixth latest fault	bit0: ON_OFF1 (Start/Stop) 0: Stop 1: Operating bit1: OFF2 (coast to stop) stop 0: Active 1: Normal bit2: OFF3 (quick stop) stop 0: Active 1: Normal bit3: Running permitted 0: Operation inhibited 1: Operation allowed bit4: RFG output forced to 0 0: Normal value 1: The RFG output is forced to 0. bit5: RFG paused 0: Normal value 1: RFG pause bit6: RFG input forced to 0 0: Normal value 1: The RFG input is forced to 0. bit7: Fault reset 0: Invalid 1: Enabled bit8: Jog 1 0: Invalid 1: Enabled bit9: Jog 2 0: Invalid 1: Enabled bit10: Remote control reserved 0: Invalid 1: Enabled bit11: Speed inversion 0: Inversion disabled 1: Inversion bit12: Start signal 0: Invalid 1: Enabled Bit13: Internal start command 0: Invalid 1: Enabled bit14: Reserved bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
Hb-47	0x8B2F	RFG status word upon the sixth latest fault	bit0-bit1: Acceleration/deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit2-bit3: Acceleration/deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8-bit9: Previous cycle acceleration/deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit10-bit11: Previous cycle arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Unchangeable

10.10 Group J Industry-specific processes

10.10.1 J6 Fire Mode

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
J6-00	0x3600	Fire mode password	0 to 65535	0	-	Real-time
J6-01	0x3601	Status of the fire function	0: Fire mode function locked 1: Fire mode function unlocked	0	-	Unchangeable
J6-02	0x3602	Fire mode enable	0: Disable 1: Enable 2: Fire mode test	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
J6-03	0x3603	Operating source in fire mode	0: Invalid 1: Enabled 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
J6-06	0x3606	Operating direction in fire mode	0: Default direction 1: Direction opposite to the default direction	0	-	Real-time
J6-07	0x3607	Acceleration time in fire mode	0.0 to 6500.0	20.0	s	Real-time
J6-08	0x3608	Deceleration time in fire mode	0.0 to 6500.0	20.0	s	Real-time
J6-11	0x360B	Fire mode frequency source	0: Fire mode frequency digital setting 1: Frequency filter value before fire mode operation 2: AI1 3: AI2 8: PID 9: Communication	0	-	Change at stop
J6-12	0x360C	Fire mode backup frequency source	0: Fire mode frequency digital setting 1: Frequency filter value before fire mode operation 2: Maximum operating frequency	0	-	Change at stop
J6-13	0x360D	Frequency set by digital setting	0.00 to A2-17	50.00	Hz	Real-time
J6-16	0x3610	Operating frequency filter time before the fire	0.0 to 300.0	1.0	s	Real-time
J6-17	0x3611	Time for determining effective operating frequency before the fire	0.0 to 6000.0	30.0	s	Real-time
J6-20	0x3614	Number of automatic fault reset times in fire mode	0 to 100	80	-	Real-time
J6-21	0x3615	Delay for automatic fault reset in fire mode	0.0 to 300.0	1.0	s	Real-time
J6-22	0x3616	Waiting time for fault waiting to be reset 1	0–J6-23	10	s	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
J6-23	0x3617	Waiting time for fault waiting to be reset 2	J6-22~3600	30	s	Real-time
J6-27	0x361B	Enable bypass function in fire mode	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
J6-28	0x361C	Fire bypass delay	0.0 to 300.0	5.0	s	Real-time
J6-31	0x361F	Total number of fires	0 to 65535	0	-	Unchangeable
J6-33	0x3621	Total number of fire bypass triggered times	0 to 65535	0	-	Unchangeable

10.11 n Communication Configuration

10.11.1 n Communication Configuration

10.11.2 n0 Communication General Configuration

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
n0-09	0x2009	Active communication mode	0: Invalid 1: EtherCAT 2: EtherNet/IP 3: PROFINET 4: Modbus TCP	0	-	Unchangeable
n0-10	0x200A	Communication type	1: EtherCAT 2: EtherNet/IP 3: PROFINET 4: Modbus TCP	1	-	Change at stop
n0-11	0x200B	Communication state	0 to 65535	0	-	Unchangeable
n0-12	0x200C	Compatible with old communication address	0: Not compatible 1: Compatible	1	-	Change at stop

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
n0-13	0x200D	1000 H setting selection	0: Percentage (corresponds to the rated frequency/one decimal place) 1: Percentage (corresponds to the rated frequency/two decimal places) 2: Percentage (corresponds to the maximum frequency/two decimal places)	2	-	Change at stop
n0-14	0x200E	7310H setting selection	0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the maximum frequency/signed 16-bit/two decimal places) 4: Percentage (corresponds to the rated frequency/signed 16-bit/two decimal places)	1	-	Change at stop
n0-15	0x200F	Save parameters written through communication (group AE)	0: Disable 1: Enable	0	-	Real-time
n0-16	0x2010	Communication fault automatic reset	0: Disable 1: Enable	1	-	Real-time
n0-17	0x2011	Current resolution (U0-04) read through communication	0: 0.01 A 1: 0.1 A	0	-	Real-time
n0-20	0x2014	Main device type	0x0 to 0xFFFF	0x0102	-	Unchangeable
n0-32	0x2020	Bus hardware (auxiliary integrated circuit) version	0 to 65535	1	-	Unchangeable
n0-56	0x2038	Process data address mapping clear	0: No operation 1: Clear	0	-	Change at stop
n0-60	0x203C	MAC1 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x0070	-	Unchangeable
n0-61	0x203D	MAC2 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00CA	-	Unchangeable
n0-62	0x203E	MAC3 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x004D	-	Unchangeable
n0-63	0x203F	MAC4 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Unchangeable
n0-64	0x2040	MAC5 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Unchangeable
n0-65	0x2041	MAC6 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Unchangeable

10.11.3 n1 Commissioning Communication

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
n1-00	0x2100	Commissioning baud rate	9: 115200 bps 12: 500 kbps 16: 1 Mbps	9	-	Change at stop
n1-02	0x2102	Commissioning address	1 to 127	1	-	Change at stop

10.11.4 n2 Modbus

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
n2-00	0x2200	Modbus baud rate	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5	-	Change at stop
n2-01	0x2201	Modbus data format	0: 8-N-2 (No check) 1: 8-E-1 (Even parity check) 2: 8-O-1 (Odd parity check) 3: 8- N-1 (No check)	0	-	Real-time
n2-02	0x2202	Modbus local address	1 to 247	1	-	Change at stop
n2-03	0x2203	Modbus response delay time	0 to 20	2	ms	Real-time
n2-04	0x2204	Modbus timeout time	0.0 to 6000.0	0.0	s	Real-time
n2-20	0x2214	Modbus communication enable	0: Not supported by the current device 1: Effective	0	-	Unchangeable
n2-51	0x2233	Most significant byte of Modbus TCP IP address	0 to 255	0	-	Change at stop
n2-52	0x2234	Second significant byte of Modbus TCP IP address	0 to 255	0	-	Change at stop
n2-53	0x2235	Third byte of Modbus TCP IP address	0 to 255	0	-	Change at stop
n2-54	0x2236	Least significant byte of Modbus TCP IP address	0 to 255	0	-	Change at stop

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
n2-55	0x2237	Most significant byte of Modbus TCP subnet mask	0 to 255	0	-	Change at stop
n2-56	0x2238	Second most significant byte of Modbus TCP subnet mask	0 to 255	0	-	Change at stop
n2-57	0x2239	Third byte of Modbus TCP subnet mask	0 to 255	0	-	Change at stop
n2-58	0x223A	Lease significant byte of Modbus TCP subnet mask	0 to 255	0	-	Change at stop
n2-59	0x223B	Most significant byte of Modbus TCP gateway	0 to 255	0	-	Change at stop
n2-60	0x223C	Second most significant byte of Modbus TCP gateway	0 to 255	0	-	Change at stop
n2-61	0x223D	Third byte of Modbus TCP gateway	0 to 255	0	-	Change at stop
n2-62	0x223E	Least significant byte of Modbus TCP gateway	0 to 255	0	-	Change at stop
n2-69	0x2245	Modbus TCP communication timeout period	0.0 to 6000.0	0.0	s	Real-time
n2-77	0x224D	Modbus TCP PHY error statistics enable	0: Disable 1: Enable	0	-	Real-time
n2-78	0x224E	Modbus TCP port 0-Link down count	0 to 65535	0	-	Unchangeable
n2-79	0x224F	Modbus TCP port 1-Link down count	0 to 65535	0	-	Unchangeable
n2-80	0x2250	Modbus TCP port 0-Receive error count	0 to 65535	0	-	Unchangeable
n2-81	0x2251	Modbus TCP port 1-Receive error count	0 to 65535	0	-	Unchangeable
n2-82	0x2252	Modbus TCP communication timeout count	0 to 65535	0	-	Unchangeable
n2-83	0x2253	Modbus TCP port 0-Transmit error count	0 to 65535	0	-	Unchangeable
n2-84	0x2254	Modbus TCP port 1-Transmit error count	0 to 65535	0	-	Unchangeable

10.11.5 n3 CAN communication

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
n3-00	0x2300	CAN communication	0: Not supported by the current device 1: Effective	0	-	Unchangeable
n3-01	0x2301	CAN communication protocol selection	1: CANopen 2: CANlink	2	-	Real-time
n3-02	0x2302	CANopen baud rate	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	5	-	Change at stop
n3-03	0x2303	CANopen station number	1 to 127	1	-	Change at stop
n3-06	0x2306	CANlink baud rate	Same as n3-02	5	-	Change at stop
n3-07	0x2307	CANlink station number	1 to 63	1	-	Change at stop
n3-09	0x2309	Number of CAN frames received per unit time	0 to 65535	0	-	Unchangeable
n3-10	0x230A	Maximum CAN reception error count	0 to 65535	0	-	Unchangeable
n3-11	0x230B	Maximum CAN transmission error count	0 to 65535	0	-	Unchangeable
n3-12	0x230C	Number of CAN bus disconnections per unit time	0 to 65535	0	-	Unchangeable
n3-14	0x230E	CAN communication interruption coefficient	1 to 15	3	-	Change at stop
n3-25	0x2319	CANopen mode	0: Default mode 1: Expert mode	0	-	Change at stop
n3-26	0x231A	CANopen disable time	0 to 65535	0	-	Change at stop
n3-27	0x231B	CANopen event time	0 to 65535	0	-	Change at stop
n3-32	0x2320	CANopen NMT length error count	0 to 65535	0	-	Unchangeable
n3-33	0x2321	CANopen NMT command error count	0 to 65535	0	-	Unchangeable
n3-34	0x2322	CANopen heartbeat frame length error count	0 to 65535	0	-	Unchangeable

10.11.6 n4 EtherCAT parameters

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
n4-05	0x2405	Number of SYNC interruption loss allowed	0 to 65535	20	-	Real-time
n4-06	0x2406	Enhanced link function switch	0: Disable 1: Enable	0	-	Real-time
n4-10	0x240A	PHY-related configuration	0 to 65535	0	-	Real-time
n4-16	0x2410	Station name	0 to 65535	0	-	Unchangeable
n4-17	0x2411	Station alias	0 to 65535	0	-	Real-time
n4-18	0x2412	Station alias backup	0 to 65535	0	-	Unchangeable
n4-25	0x2419	Number of errors received by port 0	0 to 65535	0	-	Unchangeable
n4-26	0x241A	Number of errors received by port 1	0 to 65535	0	-	Unchangeable
n4-27	0x241B	Transfer error count	0 to 65535	0	-	Unchangeable
n4-28	0x241C	Number of processing unit errors of EtherCAT	0 to 65535	0	-	Unchangeable
n4-29	0x241D	Connection loss count	0 to 65535	0	-	Unchangeable
n4-30	0x241E	Sync loss counter value	0 to 65535	0	-	Unchangeable
n4-31	0x241F	Application layer status error code	0 to 65535	0	-	Unchangeable
n4-32	0x2420	ESC register port control and status	0 to 65535	0	-	Unchangeable
n4-33	0x2421	XML file version No.	0 to 65535	0	-	Unchangeable
n4-34	0x2422	Device synchronization mode	0 to 65535	0	-	Unchangeable
n4-35	0x2423	Synchronization cycle	0 to 65535	0	-	Unchangeable
n4-41	0x2429	EtherCAT reset XML	0: Invalid 1: Valid	0	-	Real-time

10.11.7 n5 EtherNet/IP parameters

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
n5-00	0x2500	DHCP function	0: Disable 1: Enable	0	-	Change at stop
n5-01	0x2501	IP address highest byte	0 to 255	0	-	Change at stop
n5-02	0x2502	IP address second highest byte	0 to 255	0	-	Change at stop
n5-03	0x2503	IP address third byte	0 to 255	0	-	Change at stop
n5-04	0x2504	IP address lowest byte	0 to 255	0	-	Change at stop
n5-05	0x2505	Subnet mask highest byte	0 to 255	0	-	Change at stop
n5-06	0x2506	Subnet mask second highest byte	0 to 255	0	-	Change at stop
n5-07	0x2507	Third highest order byte of the subnet mask	0 to 255	0	-	Change at stop
n5-08	0x2508	Subnet mask lowest byte	0 to 255	0	-	Change at stop
n5-09	0x2509	Gateway highest byte	0 to 255	0	-	Change at stop
n5-10	0x250A	Gateway second highest byte	0 to 255	0	-	Change at stop
n5-11	0x250B	Gateway third highest byte	0 to 255	0	-	Change at stop
n5-12	0x250C	Gateway lowest byte	0 to 255	0	-	Change at stop
n5-21	0x2515	Packet loss count value	0 to 65535	0	-	Unchangeable
n5-22	0x2516	Port 0-linkdown counts	0 to 65535	0	-	Unchangeable
n5-23	0x2517	Port 1-linkdown counts	0 to 65535	0	-	Unchangeable
n5-24	0x2518	Port 0-Number of errors received	0 to 65535	0	-	Unchangeable
n5-25	0x2519	Port 1-Number of errors received	0 to 65535	0	-	Unchangeable
n5-26	0x251A	Number of communication timeout events	0 to 65535	0	-	Unchangeable
n5-27	0x251B	Port 0 - Number of transmission errors	0 to 65535	0	-	Unchangeable
n5-28	0x251C	Port 1 - Number of transmission errors	0 to 65535	0	-	Unchangeable

10.11.8 n6 PROFINET parameters

Param.	Communication Address	Name	Range	Default	Unit	Change mode
n6-01	0x2601	IP address highest byte	0 to 65535	0	-	Unchangeable
n6-02	0x2602	IP address second highest byte	0 to 65535	0	-	Unchangeable
n6-03	0x2603	IP address third byte	0 to 65535	0	-	Unchangeable
n6-04	0x2604	IP address lowest byte	0 to 65535	0	-	Unchangeable
n6-05	0x2605	Subnet mask highest byte	0 to 65535	0	-	Unchangeable
n6-06	0x2606	Subnet mask second highest byte	0 to 65535	0	-	Unchangeable
n6-07	0x2607	Third byte of subnet mask	0 to 65535	0	-	Unchangeable
n6-08	0x2608	Subnet mask lowest byte	0 to 65535	0	-	Unchangeable
n6-09	0x2609	Gateway highest byte	0 to 65535	0	-	Unchangeable
n6-10	0x260A	Gateway second highest byte	0 to 65535	0	-	Unchangeable
n6-11	0x260B	Third byte of gateway	0 to 65535	0	-	Unchangeable
n6-12	0x260C	Gateway lowest byte	0 to 65535	0	-	Unchangeable
n6-20	0x2614	Number	0 to 65535	0	-	Unchangeable
n6-21	0x2615	Control word for node search	0 to 65535	0	-	Unchangeable

10.11.9 nC Process Data Free Configuration

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-00	0x2C00	Output PZD1 source selection	0: 0 1: Output frequency (L2200) 2: Motor speed (L2202) 3: Output current (L2204) 4: Output voltage (L2206) 5: Output power (L2208) 6: Output torque (L2210) 7: System status word 1 (L1002) 8: System status word 2 (L1003) 9: Bit-to-word module A output (L1208) 10: Bit-to-word module B output (L1209) Others: KF connector	7	-	Real-time
nC-01	0x2C01	Output PZD2 source selection	Same as nC-00	2	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-02	0x2C02	Output PZD3 source selection	Same as nC-00	3	-	Real-time
nC-03	0x2C03	Output PZD4 source selection	Same as nC-00	6	-	Real-time
nC-04	0x2C04	Output PZD5 source selection	Same as nC-00	1	-	Real-time
nC-05	0x2C05	Output PZD6 source selection	Same as nC-00	5	-	Real-time
nC-06	0x2C06	Output PZD7 source selection	Same as nC-00	4	-	Real-time
nC-07	0x2C07	Output PZD8 source selection	Same as nC-00	0	-	Real-time
nC-08	0x2C08	Output PZD9 source selection	Same as nC-00	0	-	Real-time
nC-09	0x2C09	Output PZD10 source selection	Same as nC-00	0	-	Real-time
nC-10	0x2C0A	Output PZD11 source selection	Same as nC-00	0	-	Real-time
nC-11	0x2C0B	Output PZD12 source selection	Same as nC-00	0	-	Real-time
nC-12	0x2C0C	Output PZD13 source selection	Same as nC-00	0	-	Real-time
nC-13	0x2C0D	Output PZD14 source selection	Same as nC-00	0	-	Real-time
nC-14	0x2C0E	Output PZD15 source selection	Same as nC-00	0	-	Real-time
nC-15	0x2C0F	Output PZD16 source selection	Same as nC-00	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-16	0x2C10	Output PZD1~PZD4 conversion coefficient configuration	Ones place: Output PZD1 conversion coefficient configuration 0: Free configuration (determined by numerator and denominator of conversion coefficient) 1: Numerator = 10000, denominator = 1 2: Numerator = 4096, denominator = 1 3: Numerator = 16384, denominator = 1 4: High word of double word and floating-point connector (Numerator = 1, denominator = 1) 5: Low word of double word and floating-point connector (Numerator = 1, denominator = 1) 6: Voltage (100% corresponds to A2-00, unit 0.1 V) 7: Current (100% corresponds to A2-01, unit 0.1 A) 8: Speed (100% corresponds to A2-02, unit 1 rpm) 9: Frequency (100% corresponds to A2-04, unit 0.1 Hz) A: Power (100% corresponds to A2-05, unit 0.01 kW) B: Torque (100% corresponds to A2-06, unit 0.01 N·m) To be continued	0xB780	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-16	0x2C10	Output PZD1~PZD4 conversion coefficient configuration	Tens place: Output PZD2 conversion coefficient configuration 0: Free configuration (determined by numerator and denominator of conversion coefficient) 1: Numerator = 10000, denominator = 1 2: Numerator = 4096, denominator = 1 3: Numerator = 16384, denominator = 1 4: High word of double word and floating-point connector (Numerator = 1, denominator = 1) 5: Low word of double word and floating-point connector (Numerator = 1, denominator = 1) 6: Voltage (100% corresponds to A2-00, unit 0.1 V) 7: Current (100% corresponds to A2-01, unit 0.1 A) 8: Speed (100% corresponds to A2-02, unit 1 rpm) 9: Frequency (100% corresponds to A2-04, unit 0.1 Hz) A: Power (100% corresponds to A2-05, unit 0.01 kW) B: Torque (100% corresponds to A2-06, unit 0.01 N·m) To be continued	0xB780	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-16	0x2C10	Output PZD1~PZD4 conversion coefficient configuration	(Continued) Hundreds place: Output PZD3 conversion coefficient configuration 0: Free configuration (determined by numerator and denominator of conversion coefficient) 1: Numerator = 10000, denominator = 1 2: Numerator = 4096, denominator = 1 3: Numerator = 16384, denominator = 1 4: High word of double word and floating-point connector (Numerator = 1, denominator = 1) 5: Low word of double word and floating-point connector (Numerator = 1, denominator = 1) 6: Voltage (100% corresponds to A2-00, unit 0.1 V) 7: Current (100% corresponds to A2-01, unit 0.1 A) 8: Speed (100% corresponds to A2-02, unit 1 rpm) 9: Frequency (100% corresponds to A2-04, unit 0.1 Hz) A: Power (100% corresponds to A2-05, unit 0.01 kW) B: Torque (100% corresponds to A2-06, unit 0.01 N·m) (Continued)	0xB780	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-16	0x2C10	Output PZD1~PZD4 conversion coefficient configuration	(Continued) Thousands place: Output PZD4 conversion coefficient configuration 0: Free configuration (determined by numerator and denominator of conversion coefficient) 1: Numerator = 10000, denominator = 1 2: Numerator = 4096, denominator = 1 3: Numerator = 16384, denominator = 1 4: High word of double word and floating-point connector (Numerator = 1, denominator = 1) 5: Low word of double word and floating-point connector (Numerator = 1, denominator = 1) 6: Voltage (100% corresponds to A2-00, unit 0.1 V) 7: Current (100% corresponds to A2-01, unit 0.1 A) 8: Speed (100% corresponds to A2-02, unit 1 rpm) 9: Frequency (100% corresponds to A2-04, unit 0.1 Hz) A: Power (100% corresponds to A2-05, unit 0.01 kW) B: Torque (100% corresponds to A2-06, unit 0.01 N·m)	0xB780	-	Real-time
nC-17	0x2C11	Output PZD5~PZD8 conversion coefficient configuration	Same as nC-16	0x06A9	-	Real-time
nC-18	0x2C12	Output PZD9~PZD12 conversion coefficient configuration	Same as nC-16	0x0	-	Real-time
nC-19	0x2C13	Output PZD13~PZD16 conversion coefficient configuration	Same as nC-16	0x0	-	Real-time
nC-20	0x2C14	Output PZD1 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-21	0x2C15	Output PZD1 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-22	0x2C16	Output PZD2 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-23	0x2C17	Output PZD2 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-24	0x2C18	Output PZD3 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-25	0x2C19	Output PZD3 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-26	0x2C1A	Output PZD4 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-27	0x2C1B	Output PZD4 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-28	0x2C1C	Output PZD5 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-29	0x2C1D	Output PZD5 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-30	0x2C1E	Output PZD6 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-31	0x2C1F	Output PZD6 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-32	0x2C20	Output PZD7 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-33	0x2C21	Output PZD7 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-34	0x2C22	Output PZD8 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-35	0x2C23	Output PZD8 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-36	0x2C24	Output PZD9 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-37	0x2C25	Output PZD9 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-38	0x2C26	Output PZD10 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-39	0x2C27	Output PZD10 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-40	0x2C28	Output PZD11 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-41	0x2C29	Output PZD11 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-42	0x2C2A	Output PZD12 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-43	0x2C2B	Output PZD12 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-44	0x2C2C	Output PZD13 conversion coefficient numerator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-45	0x2C2D	Output PZD13 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-46	0x2C2E	Output PZD14 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-47	0x2C2F	Output PZD14 conversion coefficient denominator (effective only in free configuration)	1 to 65535	1	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-48	0x2C30	Output PZD15 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-49	0x2C31	Output PZD15 conversion coefficient denominator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-50	0x2C32	Output PZD16 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-51	0x2C33	Output PZD16 conversion coefficient denominator (effective only in free configuration)	1 to 65535	1	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-52	0x2C34	Input PZD1~PZD4 conversion coefficient configuration	Ones place: Input PZD1 conversion coefficient configuration 0: Free configuration (determined by numerator and denominator of conversion coefficient) 1: Numerator = 1, denominator = 10000 2: Numerator = 1, denominator = 4096 3: Numerator = 1, denominator = 16384 4: Frequency (100% corresponds to A2-04, unit 0.1 Hz) 5: Speed (100% corresponds to A2-02, unit 1 rpm) B: Torque (100% corresponds to A2-06, unit 0.01 N·m) Tens place: Input PZD2 conversion coefficient configuration 0: Free configuration (determined by numerator and denominator of conversion coefficient) 1: Numerator = 1, denominator = 10000 2: Numerator = 1, denominator = 4096 3: Numerator = 1, denominator = 16384 4: Frequency (100% corresponds to A2-04, unit 0.1 Hz) 5: Speed (100% corresponds to A2-02, unit 1 rpm) B: Torque (100% corresponds to A2-06, unit 0.01 N·m) (Continued)	0x0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-52	0x2C34	Input PZD1~PZD4 conversion coefficient configuration	(Continued) Hundreds place: Input PZD3 conversion coefficient configuration 0: Free configuration (determined by numerator and denominator of conversion coefficient) 1: Numerator = 1, denominator = 10000 2: Numerator = 1, denominator = 4096 3: Numerator = 1, denominator = 16384 4: Frequency (100% corresponds to A2-04, unit 0.1 Hz) 5: Speed (100% corresponds to A2-02, unit 1 rpm) B: Torque (100% corresponds to A2-06, unit 0.01 N·m) Thousands place: Input PZD4 conversion coefficient configuration 0: Free configuration (determined by numerator and denominator of conversion coefficient) 1: Numerator = 1, denominator = 10000 2: Numerator = 1, denominator = 4096 3: Numerator = 1, denominator = 16384 4: Frequency (100% corresponds to A2-04, unit 0.1 Hz) 5: Speed (100% corresponds to A2-02, unit 1 rpm) B: Torque (100% corresponds to A2-06, unit 0.01 N·m)	0x0	-	Real-time
nC-53	0x2C35	Input PZD5~PZD8 conversion coefficient configuration	Same as nC-52	0x0	-	Real-time
nC-54	0x2C36	Input PZD9~PZD12 conversion coefficient configuration	Same as nC-52	0x0	-	Real-time
nC-55	0x2C37	Input PZD13~PZD16 conversion coefficient configuration	Same as nC-52	0x0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-56	0x2C38	Input PZD1 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-57	0x2C39	Input PZD1 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-58	0x2C3A	Input PZD2 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-59	0x2C3B	Input PZD2 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-60	0x2C3C	Input PZD3 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-61	0x2C3D	Input PZD3 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-62	0x2C3E	Input PZD4 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-63	0x2C3F	Input PZD4 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-64	0x2C40	Input PZD5 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-65	0x2C41	Input PZD5 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-66	0x2C42	Input PZD6 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-67	0x2C43	Input PZD6 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-68	0x2C44	Input PZD7 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-69	0x2C45	Input PZD7 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-70	0x2C46	Input PZD8 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-71	0x2C47	Input PZD8 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-72	0x2C48	Input PZD9 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-73	0x2C49	Input PZD9 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-74	0x2C4A	Input PZD10 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-75	0x2C4B	Input PZD10 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-76	0x2C4C	Input PZD11 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-77	0x2C4D	Input PZD11 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-78	0x2C4E	Input PZD12 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-79	0x2C4F	Input PZD12 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-80	0x2C50	Input PZD13 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-81	0x2C51	Input PZD13 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-82	0x2C52	Input PZD14 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nC-83	0x2C53	Input PZD14 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-84	0x2C54	Input PZD15 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-85	0x2C55	Input PZD15 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-86	0x2C56	Input PZD16 conversion coefficient numerator (effective only in free configuration)	1 to 65535	1	-	Real-time
nC-87	0x2C57	Input PZD16 conversion coefficient denominator (effective only for free configuration)	1 to 65535	1	-	Real-time
nC-96	0x2C60	Input PZD bit-word conversion source selection	0: Input PZD1 1: Input PZD2 2: Input PZD3 3: Input PZD4 4: Input PZD5 5: Input PZD6 6: Input PZD7 7: Input PZD8 8: Input PZD9 9: Input PZD10 10: Input PZD11 11: Input PZD12 12: Input PZD13 13: Input PZD14 14: Input PZD15 15: Input PZD16	0	-	Real-time

10.11.10 nd CIA402 parameters

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nd-00	0x2D00	CIA 402	0: Disable 1: Enable	0	-	Change at stop
nd-01	0x2D01	CIA 402 parameter-write storage	0: Disable 1: Enable	0	-	Change at stop
nd-02	0x2D02	Speed reference type of CIA402	0: Frequency 1: Speed	0	-	Change at stop
nd-03	0x2D03	CIA402 acceleration/ deceleration time selection	Ones place: Acceleration/ Deceleration time selection 0: System acceleration/ deceleration time 1: CIA402 acceleration/ deceleration time Tens place: Frequency upper/ lower limit selection 0: Not writing frequency upper/lower limit to CIA402 1: Writing frequency upper/ lower limit to CIA402 Hundreds place: Reserved Thousands place: Reserved Ten thousands place: Reserved	0	-	Change at stop

10.11.11 nE Process Data Address Mapping

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nE-00	0x2E00	RPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-01	0x2E01	RPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-02	0x2E02	RPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-03	0x2E03	RPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-04	0x2E04	RPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-05	0x2E05	RPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-06	0x2E06	RPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-07	0x2E07	RPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-08	0x2E08	RPDO2-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-09	0x2E09	RPDO2-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-10	0x2E0A	RPDO2-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-11	0x2E0B	RPDO2-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-12	0x2E0C	RPDO2-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-13	0x2E0D	RPDO2-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-14	0x2E0E	RPDO2-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-15	0x2E0F	RPDO2-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nE-16	0x2E10	RPDO3-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-17	0x2E11	RPDO3-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-18	0x2E12	RPDO3-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-19	0x2E13	RPDO3-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-20	0x2E14	RPDO3-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-21	0x2E15	RPDO3-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-22	0x2E16	RPDO3-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-23	0x2E17	RPDO3-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-24	0x2E18	RPDO4-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-25	0x2E19	RPDO4-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-26	0x2E1A	RPDO4-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-27	0x2E1B	RPDO4-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-28	0x2E1C	RPDO4-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-29	0x2E1D	RPDO4-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-30	0x2E1E	RPDO4-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-31	0x2E1F	RPDO4-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-32	0x2E20	TPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-33	0x2E21	TPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-34	0x2E22	TPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-35	0x2E23	TPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-36	0x2E24	TPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-37	0x2E25	TPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-38	0x2E26	TPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-39	0x2E27	TPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-40	0x2E28	TPDO2-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-41	0x2E29	TPDO2-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-42	0x2E2A	TPDO2-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-43	0x2E2B	TPDO2-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-44	0x2E2C	TPDO2-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-45	0x2E2D	TPDO2-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-46	0x2E2E	TPDO2-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-47	0x2E2F	TPDO2-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-48	0x2E30	TPDO3-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-49	0x2E31	TPDO3-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-50	0x2E32	TPDO3-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-51	0x2E33	TPDO3-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-52	0x2E34	TPDO3-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-53	0x2E35	TPDO3-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-54	0x2E36	TPDO3-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-55	0x2E37	TPDO3-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
nE-56	0x2E38	TPDO4-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-57	0x2E39	TPDO4-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-58	0x2E3A	TPDO4-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-59	0x2E3B	TPDO4-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-60	0x2E3C	TPDO4-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-61	0x2E3D	TPDO4-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-62	0x2E3E	TPDO4-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real-time
nE-63	0x2E3F	TPDO4-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real-time
nE-66	0x2E42	Valid RPDO count	0x0 to 0xFFFF	0x0	-	Unchangeable
nE-67	0x2E43	Number of valid TPDOs	0x0 to 0xFFFF	0x0	-	Unchangeable

10.12 Group o Free Function Block

10.12.1 o1 Constant Setpoint

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o1-00	0x5100	Constant value setting 1 (per-unit value)	-300.00 to 300.00	0.00	%	Real-time
o1-01	0x5101	Constant value setting 2 (per-unit value)	-300.00 to 300.00	100.00	%	Real-time
o1-02	0x5102	Constant value setting 3 (per-unit value)	-300.00 to 300.00	-100.00	%	Real-time
o1-03	0x5103	Constant value setting 4 (per-unit value)	-300.00 to 300.00	0.00	%	Real-time
o1-04	0x5104	Constant value setting 5 (per-unit value)	-3000.0 to 3000.0	0.0	%	Real-time
o1-05	0x5105	Constant value setting 6 (per-unit value)	-3000.0 to 3000.0	0.0	%	Real-time
o1-06	0x5106	Constant value setting 7 (per-unit value)	-3000.0 to 3000.0	0.0	%	Real-time
o1-07	0x5107	Constant value setting 8 (per-unit value)	-3000.0 to 3000.0	0.0	%	Real-time
o1-08	0x5108	Constant value setting 1 (single word)	-32768 to 32767	0	-	Real-time
o1-09	0x5109	Constant value setting 2 (single word)	-32768 to 32767	0	-	Real-time
o1-10	0x510A	Constant value setting 3 (single word)	-32768 to 32767	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o1-11	0x510B	Constant value setting 4 (single word)	-32768 to 32767	0	-	Real-time
o1-12	0x510C	Constant value setting 5 (single word)	-32768 to 32767	0	-	Real-time
o1-13	0x510D	Constant value setting 6 (single word)	-32768 to 32767	0	-	Real-time
o1-14	0x510E	Constant value setting 7 (single word)	-32768 to 32767	0	-	Real-time
o1-15	0x510F	Constant value setting 8 (single word)	-32768 to 32767	0	-	Real-time

10.12.2 o2 Multi-point Curve Parameters

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o2-00	0x5200	Input of multi-point curve module A	0: DisabledOthers : F connector	0	-	Real-time
o2-01	0x5201	Setpoint X1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-02	0x5202	Setpoint X2 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-03	0x5203	Setpoint X3 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-04	0x5204	Setpoint X4 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-05	0x5205	Setpoint X5 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-06	0x5206	Setpoint X6 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-07	0x5207	Setpoint X7 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-08	0x5208	Setpoint X8 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-09	0x5209	Setpoint X9 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-10	0x520A	Setpoint X10 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-11	0x520B	Setpoint Y1 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-12	0x520C	Setpoint Y2 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-13	0x520D	Setpoint Y3 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o2-14	0x520E	Setpoint Y4 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-15	0x520F	Setpoint Y5 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-16	0x5210	Setpoint Y6 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-17	0x5211	Setpoint Y7 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-18	0x5212	Setpoint Y8 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-19	0x5213	Setpoint Y9 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-20	0x5214	Setpoint Y10 of multi-point curve module A	-600.0 to 600.0	0.0	%	Real-time
o2-21	0x5215	Input of multi-point curve module B	0: DisabledOthers : F connector	0	-	Real-time
o2-22	0x5216	Setpoint X1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-23	0x5217	Setpoint X2 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-24	0x5218	Setpoint X3 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-25	0x5219	Setpoint X4 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-26	0x521A	Setpoint X5 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-27	0x521B	Setpoint X6 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-28	0x521C	Setpoint X7 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-29	0x521D	Setpoint X8 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-30	0x521E	Setpoint X9 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-31	0x521F	Setpoint X10 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-32	0x5220	Setpoint Y1 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-33	0x5221	Setpoint Y2 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-34	0x5222	Setpoint Y3 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-35	0x5223	Setpoint Y4 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o2-36	0x5224	Setpoint Y5 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-37	0x5225	Setpoint Y6 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-38	0x5226	Setpoint Y7 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-39	0x5227	Setpoint Y8 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-40	0x5228	Setpoint Y9 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time
o2-41	0x5229	Setpoint Y10 of multi-point curve module B	-600.0 to 600.0	0.0	%	Real-time

10.12.3 o3 Word-to-Bit Module

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o3-00	0x5300	Input of word-to-bit function A	0: Invalid Others: K connector	0	-	Real-time
o3-01	0x5301	Input of word-to-bit function B	Same as o3-00	0	-	Real-time
o3-02	0x5302	Input of word-to-bit function C	Same as o3-00	0	-	Real-time
o3-03	0x5303	Input of word-to-bit function D	Same as o3-00	0	-	Real-time
o3-04	0x5304	Positive and negative logic of word-to-bit function A	bit0: Bit00 bit1: Bit01 bit2: Bit02 bit3: Bit03 bit4: Bit04 Bit 5: Bit05 bit6: Bit06 bit7: Bit07 bit8: Bit08 bit9: Bit09 bit10: Bit10 bit11: Bit11 bit12: Bit12 bit13: Bit13 bit14: Bit14 bit15: Bit15 bit0 to bit15: 0: no inverse 1: Inverse	0x0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o3-05	0x5305	Positive and negative logic of word-to-bit function B	Same as o3-04	0x0	-	Real-time
o3-06	0x5306	Positive and negative logic of word-to-bit function C	Same as o3-04	0x0	-	Real-time
o3-07	0x5307	Positive and negative logic of word-to-bit function D	Same as o3-04	0x0	-	Real-time
o3-08	0x5308	Bit-to-word module A enable	0: Disable 1: Enable	0	-	Real-time
o3-09	0x5309	Positive and negative logic selection for bit-to-word module A	Same as o3-04	0x0	-	Real-time
o3-10	0x530A	Bit 00 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
o3-11	0x530B	Bit 01 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-12	0x530C	Bit 02 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-13	0x530D	Bit 03 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-14	0x530E	Bit 04 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-15	0x530F	Bit 05 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-16	0x5310	Bit 06 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-17	0x5311	Bit 07 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-18	0x5312	Bit 08 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-19	0x5313	Bit 09 selection of bit-to-word module A	Same as o3-10	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o3-20	0x5314	Bit 10 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-21	0x5315	Bit 11 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-22	0x5316	Bit 12 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-23	0x5317	Bit 13 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-24	0x5318	Bit 14 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-25	0x5319	Bit 15 selection of bit-to-word module A	Same as o3-10	0	-	Real-time
o3-26	0x531A	Bit-to-word module B enable	0: Disable 1: Enable	0	-	Real-time
o3-27	0x531B	Positive and negative logic selection for bit-to-word module B	Same as o3-04	0x0	-	Real-time
o3-28	0x531C	Bit 00 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-29	0x531D	Bit 01 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-30	0x531E	Bit 02 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-31	0x531F	Bit 03 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-32	0x5320	Bit 04 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-33	0x5321	Bit 05 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-34	0x5322	Bit 06 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-35	0x5323	Bit 07 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-36	0x5324	Bit 08 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-37	0x5325	Bit 09 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-38	0x5326	Bit 10 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-39	0x5327	Bit 11 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-40	0x5328	Bit 12 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-41	0x5329	Bit 13 selection of bit-to-word module B	Same as o3-10	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o3-42	0x532A	Bit 14 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-43	0x532B	Bit 15 selection of bit-to-word module B	Same as o3-10	0	-	Real-time
o3-44	0x532C	Bit-to-word module C enable	0: Disable 1: Enable	0	-	Real-time
o3-45	0x532D	Positive and negative logic selection for bit-to-word module C	Same as o3-04	0x0	-	Real-time
o3-46	0x532E	Bit 00 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-47	0x532F	Bit 01 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-48	0x5330	Bit 02 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-49	0x5331	Bit 03 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-50	0x5332	Bit 04 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-51	0x5333	Bit 05 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-52	0x5334	Bit 06 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-53	0x5335	Bit 07 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-54	0x5336	Bit 08 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-55	0x5337	Bit 09 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-56	0x5338	Bit 10 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-57	0x5339	Bit 11 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-58	0x533A	Bit 12 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-59	0x533B	Bit 13 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-60	0x533C	Bit 14 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-61	0x533D	Bit 15 selection of bit-to-word module C	Same as o3-10	0	-	Real-time
o3-62	0x533E	Bit-to-word module D enable	0: Disable 1: Enable	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o3-63	0x533F	Positive and negative logic selection for bit-to-word module D	Same as o3-04	0x0	-	Real-time
o3-64	0x5340	Bit 00 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-65	0x5341	Bit 01 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-66	0x5342	Bit 02 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-67	0x5343	Bit 03 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-68	0x5344	Bit 04 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-69	0x5345	Bit 05 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-70	0x5346	Bit 06 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-71	0x5347	Bit 07 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-72	0x5348	Bit 08 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-73	0x5349	Bit 09 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-74	0x534A	Bit 10 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-75	0x534B	Bit 11 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-76	0x534C	Bit 12 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-77	0x534D	Bit 13 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-78	0x534E	Bit 14 selection of bit-to-word module D	Same as o3-10	0	-	Real-time
o3-79	0x534F	Bit 15 selection of bit-to-word module D	Same as o3-10	0	-	Real-time

10.12.4 o5 Data conversion module

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o5-00	0x5500	Low word of word-to-double word module A	0: 0 Others: K connector	0	-	Real-time
o5-01	0x5501	High word of word-to-double word module A	0: Disabled Others: K connector	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o5-02	0x5502	Low-order bits of base value of W-DW conversion module A	0 to 65535	0	-	Real-time
o5-03	0x5503	High-order bits of base value of W-DW conversion module A	0 to 65535	0	-	Real-time
o5-04	0x5504	Low word of word-to-double word module B	Same as o5-00	0	-	Real-time
o5-05	0x5505	High word of word-to-double word module B	Same as o5-01	0	-	Real-time
o5-06	0x5506	Low-order bits of base value of W-DW conversion module B	0 to 65535	0	-	Real-time
o5-07	0x5507	High-order bits of base value of W-DW conversion module B	0 to 65535	0	-	Real-time
o5-08	0x5508	Low word of word-to-double word module C	Same as o5-00	0	-	Real-time
o5-09	0x5509	High word of word-to-double word module C	Same as o5-01	0	-	Real-time
o5-10	0x550A	Low-order bits of base value of W-DW conversion module C	0 to 65535	0	-	Real-time
o5-11	0x550B	High-order bits of base value of W-DW conversion module C	0 to 65535	0	-	Real-time
o5-12	0x550C	Low word of word-to-double word module D	Same as o5-00	0	-	Real-time
o5-13	0x550D	High word of word-to-double word module D	Same as o5-01	0	-	Real-time
o5-14	0x550E	Low-order bits of base value of W-DW conversion module D	0 to 65535	0	-	Real-time
o5-15	0x550F	High-order bits of base value of W-DW conversion module D	0 to 65535	0	-	Real-time
o5-32	0x5520	DW-W module A selection	Same as o5-01	0	-	Real-time
o5-33	0x5521	Low-order bits of base value of DW-W conversion module A	0 to 65535	0	-	Real-time
o5-34	0x5522	High-order bits of base value of DW-W conversion module A	0 to 65535	0	-	Real-time
o5-35	0x5523	DW-W module B selection	Same as o5-01	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o5-36	0x5524	Low-order bits of base value of DW-W conversion module B	0 to 65535	0	-	Real-time
o5-37	0x5525	High-order bits of base value of DW-W conversion module B	0 to 65535	0	-	Real-time
o5-38	0x5526	DW-W module C selection	Same as o5-01	0	-	Real-time
o5-39	0x5527	Low-order bits of base value of DW-W conversion module C	0 to 65535	0	-	Real-time
o5-40	0x5528	High-order bits of base value of DW-W conversion module C	0 to 65535	0	-	Real-time
o5-41	0x5529	DW-W module D selection	Same as o5-01	0	-	Real-time
o5-42	0x552A	Low-order bits of base value of DW-W conversion module D	0 to 65535	0	-	Real-time
o5-43	0x552B	High-order bits of base value of DW-W conversion module D	0 to 65535	0	-	Real-time
o5-60	0x553C	Floating-point connector-to-monitoring parameter module A input	0: DisabledOthers : F connector	0	-	Real-time
o5-61	0x553D	Number of decimal places of floating-point concatenator-to-monitoring parameter module A	0: No decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	-	Real-time
o5-62	0x553E	Floating-point connector-to-monitoring parameter module A coefficient (multiply)	0 to 65535	1	-	Real-time
o5-63	0x553F	Floating-point concatenator-to-monitoring parameter module A coefficient (divide)	1 to 65535	1	-	Real-time
o5-64	0x5540	Floating-point concatenator-to-monitoring parameter module B input	Same as o5-60	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o5-65	0x5541	Number of decimal places for floating-point concatenator-to-monitoring parameter module B	Same as o5-61	0	-	Real-time
o5-66	0x5542	Floating-point connector-to-monitoring parameter module B coefficient (multiply)	0 to 65535	1	-	Real-time
o5-67	0x5543	Floating-point connector-to-monitoring parameter module B coefficient (divide)	1 to 65535	1	-	Real-time
o5-68	0x5544	Floating-point concatenator-to-monitoring parameter module C input	Same as o5-60	0	-	Real-time
o5-69	0x5545	Number of decimal places for floating-point connector-to-monitoring parameter module C	Same as o5-61	0	-	Real-time
o5-70	0x5546	Floating-point connector-to-monitoring parameter module C coefficient (multiply)	0 to 65535	1	-	Real-time
o5-71	0x5547	Floating-point connector-to-monitoring parameter module C coefficient (divide)	1 to 65535	1	-	Real-time
o5-72	0x5548	Floating-point concatenator-to-monitoring parameter module D input	Same as o5-60	0	-	Real-time
o5-73	0x5549	Number of decimal places for floating-point concatenator-to-monitoring parameter module D	Same as o5-61	0	-	Real-time
o5-74	0x554A	Floating-point connector-to-monitoring parameter module D coefficient (multiply)	0 to 65535	1	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o5-75	0x554B	Floating-point connector-to-monitoring parameter module D coefficient (divide)	1 to 65535	1	-	Real-time
o5-76	0x554C	Floating-point concatenator-to-monitoring parameter module E input	Same as o5-60	0	-	Real-time
o5-77	0x554D	Number of decimal places for floating-point concatenator-to-monitoring parameter module E	Same as o5-61	0	-	Real-time
o5-78	0x554E	Floating-point connector-to-monitoring parameter module E coefficient (multiply)	0 to 65535	1	-	Real-time
o5-79	0x554F	Floating-point connector-to-monitoring parameter module E coefficient (divide)	1 to 65535	1	-	Real-time
o5-80	0x5550	Floating-point concatenator-to-monitoring parameter module F input	Same as o5-60	0	-	Real-time
o5-81	0x5551	Number of decimal places for floating-point concatenator-to-monitoring parameter module F	Same as o5-61	0	-	Real-time
o5-82	0x5552	Floating-point connector-to-monitoring parameter module F coefficient (multiply)	0 to 65535	1	-	Real-time
o5-83	0x5553	Floating-point connector-to-monitoring parameter module F coefficient (divide)	1 to 65535	1	-	Real-time
o5-84	0x5554	Floating-point concatenator-to-monitoring parameter module G input	Same as o5-60	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o5-85	0x5555	Number of decimal places for floating-point concatenator-to-monitoring parameter module G	Same as o5-61	0	-	Real-time
o5-86	0x5556	Floating-point connector-to-monitoring parameter module F coefficient (multiply)	0 to 65535	1	-	Real-time
o5-87	0x5557	Floating-point connector-to-monitoring parameter module G coefficient (divide)	1 to 65535	1	-	Real-time
o5-88	0x5558	Floating-point concatenator-to-monitoring parameter module H input	Same as o5-60	0	-	Real-time
o5-89	0x5559	Number of decimal places for floating-point concatenator-to-monitoring parameter module H	Same as o5-61	0	-	Real-time
o5-90	0x555A	Floating-point connector-to-monitoring parameter module G coefficient (multiply)	0 to 65535	1	-	Real-time
o5-91	0x555B	Floating-point connector-to-monitoring parameter module H coefficient (divide)	1 to 65535	1	-	Real-time

10.12.5 o6 Logic Operation 1

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o6-00	0x5600	Function selection for logic AND/OR module A	0: Disabled 1: AND 2: OR	0	-	Real-time
o6-01	0x5601	Input 1 of logic AND/ OR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 (valid only for MD630S) 6: DI4 (valid only for MD630S) 7: DI5 (valid only for MD630S) 8: DI6 (valid only for MD630S) 9: DI7 (valid only for MD630S) Others: B connector	0	-	Real-time
o6-02	0x5602	Input 2 of logic AND/ OR module A	Same as o6-01	0	-	Real-time
o6-03	0x5603	Input 3 of logic AND/ OR module A	Same as o6-01	0	-	Real-time
o6-04	0x5604	Input 4 of logic AND/ OR module A	Same as o6-01	0	-	Real-time
o6-05	0x5605	Function selection for logic AND/OR module B	Same as o6-00	0	-	Real-time
o6-06	0x5606	Input 1 of logic AND/ OR module B	Same as o6-01	0	-	Real-time
o6-07	0x5607	Input 2 of logic AND/ OR module B	Same as o6-01	0	-	Real-time
o6-08	0x5608	Input 3 of logic AND/ OR module B	Same as o6-01	0	-	Real-time
o6-09	0x5609	Input 4 of logic AND/ OR module B	Same as o6-01	0	-	Real-time
o6-10	0x560A	Function of logic AND/ OR module C	Same as o6-00	0	-	Real-time
o6-11	0x560B	Input 1 of logic AND/ OR module C	Same as o6-01	0	-	Real-time
o6-12	0x560C	Input 2 of logic AND/ OR module C	Same as o6-01	0	-	Real-time
o6-13	0x560D	Input 3 of logic AND/ OR module C	Same as o6-01	0	-	Real-time
o6-14	0x560E	Input 4 of logic AND/ OR module C	Same as o6-01	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o6-15	0x560F	Function of logic AND/ OR module D	Same as o6-00	0	-	Real-time
o6-16	0x5610	Input 1 of logic AND/ OR module D	Same as o6-01	0	-	Real-time
o6-17	0x5611	Input 2 of logic AND/ OR module D	Same as o6-01	0	-	Real-time
o6-18	0x5612	Input 3 of logic AND/ OR module D	Same as o6-01	0	-	Real-time
o6-19	0x5613	Input 4 of logic AND/ OR module D	Same as o6-01	0	-	Real-time
o6-20	0x5614	Function of logic AND/ OR module E	Same as o6-00	0	-	Real-time
o6-21	0x5615	Input 1 of logic AND/ OR module E	Same as o6-01	0	-	Real-time
o6-22	0x5616	Input 2 of logic AND/ OR module E	Same as o6-01	0	-	Real-time
o6-23	0x5617	Input 3 of logic AND/ OR module E	Same as o6-01	0	-	Real-time
o6-24	0x5618	Logic AND/OR module F func. selection	Same as o6-00	0	-	Real-time
o6-25	0x5619	Logic AND/OR module F input 1	Same as o6-01	0	-	Real-time
o6-26	0x561A	Logic AND/OR module F input 2	Same as o6-01	0	-	Real-time
o6-27	0x561B	Logic AND/OR module F input 3	Same as o6-01	0	-	Real-time
o6-28	0x561C	Logic AND/OR module G func. selection	Same as o6-00	0	-	Real-time
o6-29	0x561D	Logic AND/OR module G input 1	Same as o6-01	0	-	Real-time
o6-30	0x561E	Logic AND/OR module G input 2	Same as o6-01	0	-	Real-time
o6-31	0x561F	Logic AND/OR module G input 3	Same as o6-01	0	-	Real-time
o6-32	0x5620	Logic AND/OR module H func. selection	Same as o6-00	0	-	Real-time
o6-33	0x5621	Logic AND/OR module H input 1	Same as o6-01	0	-	Real-time
o6-34	0x5622	Logic AND/OR module H input 2	Same as o6-01	0	-	Real-time
o6-35	0x5623	Logic AND/OR module H input 3	Same as o6-01	0	-	Real-time
o6-80	0x5650	Input of logic NOT module A	Same as o6-01	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o6-81	0x5651	Input of logic NOT module B	Same as o6-01	0	-	Real-time
o6-82	0x5652	Input of logic NOT module C	Same as o6-01	0	-	Real-time
o6-83	0x5653	Input of logic NOT module D	Same as o6-01	0	-	Real-time
o6-84	0x5654	Input of logic NOT module E	Same as o6-01	0	-	Real-time
o6-85	0x5655	Input of logic NOT module F	Same as o6-01	0	-	Real-time
o6-86	0x5656	Input of logic NOT module G	Same as o6-01	0	-	Real-time
o6-87	0x5657	Input of logic NOT module H	Same as o6-01	0	-	Real-time

10.12.6 o7 Logic operation 2

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o7-00	0x5700	Function selection for logic XOR/XNOR module A	0: Disable 1: XOR 2: XNOR	0	-	Real-time
o7-01	0x5701	Input 1 of logic XOR/ XNOR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
o7-02	0x5702	Input 2 of logic XOR/ XNOR module A	Same as o7-01	0	-	Real-time
o7-03	0x5703	Function selection for logic XOR/XNOR module B	Same as o7-00	0	-	Real-time
o7-04	0x5704	Input 1 of logic XOR/ XNOR module B	Same as o7-01	0	-	Real-time
o7-05	0x5705	Input 2 of logic XOR/ XNOR module B	Same as o7-01	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o7-06	0x5706	Function selection for logic XOR/XNOR module C	Same as o7-00	0	-	Real-time
o7-07	0x5707	Input 1 of logic XOR/ XNOR module C	Same as o7-01	0	-	Real-time
o7-08	0x5708	Input 2 of logic XOR/ XNOR module C	Same as o7-01	0	-	Real-time
o7-09	0x5709	Function selection for logic XOR/XNOR module D	Same as o7-00	0	-	Real-time
o7-10	0x570A	Input 1 of logic XOR/ XNOR module D	Same as o7-01	0	-	Real-time
o7-11	0x570B	Input 2 of logic XOR/ XNOR module D	Same as o7-01	0	-	Real-time
o7-12	0x570C	Function selection for logic XOR/XNOR module E	Same as o7-00	0	-	Real-time
o7-13	0x570D	Input 1 of logic XOR/ XNOR module E	Same as o7-01	0	-	Real-time
o7-14	0x570E	Input 2 of logic XOR/ XNOR module E	Same as o7-01	0	-	Real-time
o7-15	0x570F	Function selection for logic XOR/XNOR module F	Same as o7-00	0	-	Real-time
o7-16	0x5710	Input 1 of logic XOR/ XNOR module F	Same as o7-01	0	-	Real-time
o7-17	0x5711	Input 2 of logic XOR/ XNOR module F	Same as o7-01	0	-	Real-time
o7-18	0x5712	Function selection for logic XOR/XNOR module G	Same as o7-00	0	-	Real-time
o7-19	0x5713	Input 1 of logic XOR/ XNOR module G	Same as o7-01	0	-	Real-time
o7-20	0x5714	Input 2 of logic XOR/ XNOR module G	Same as o7-01	0	-	Real-time
o7-21	0x5715	Function selection for logic XOR/XNOR module H	Same as o7-00	0	-	Real-time
o7-22	0x5716	Input 1 of logic XOR/ XNOR module H	Same as o7-01	0	-	Real-time
o7-23	0x5717	Input 2 of logic XOR/ XNOR module H	Same as o7-01	0	-	Real-time

10.12.7 o8 Arithmetic operation 1

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o8-00	0x5800	Input 1 of addition/ subtraction module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
o8-01	0x5801	Input 2 of addition/ subtraction module A (ADD)	Same as o8-00	0	-	Real-time
o8-02	0x5802	Input 3 of addition/ subtraction module A (ADD)	Same as o8-00	0	-	Real-time
o8-03	0x5803	Input 4 of addition/ subtraction module A (SUBTRACT)	Same as o8-00	0	-	Real-time
o8-04	0x5804	Input 1 of addition/ subtraction module B	Same as o8-00	0	-	Real-time
o8-05	0x5805	Input 2 of addition/ subtraction module B (ADD)	Same as o8-00	0	-	Real-time
o8-06	0x5806	Input 3 of addition/ subtraction module B (ADD)	Same as o8-00	0	-	Real-time
o8-07	0x5807	Input 4 of addition/ subtraction module B (SUBTRACT)	Same as o8-00	0	-	Real-time
o8-08	0x5808	Input 1 of addition/ subtraction module C	Same as o8-00	0	-	Real-time
o8-09	0x5809	Input 2 of addition/ subtraction module C (ADD)	Same as o8-00	0	-	Real-time
o8-10	0x580A	Input 3 of addition/ subtraction module C (ADD)	Same as o8-00	0	-	Real-time
o8-11	0x580B	Input 4 of addition/ subtraction module C (SUBTRACT)	Same as o8-00	0	-	Real-time
o8-12	0x580C	Input 1 of addition/ subtraction module D	Same as o8-00	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o8-13	0x580D	Input 2 of addition/ subtraction module D (ADD)	Same as o8-00	0	-	Real-time
o8-14	0x580E	Input 3 of addition/ subtraction module D (ADD)	Same as o8-00	0	-	Real-time
o8-15	0x580F	Input 4 of addition/ subtraction module D (SUBTRACT)	Same as o8-00	0	-	Real-time
o8-16	0x5810	Input 1 of addition/ subtraction module E	Same as o8-00	0	-	Real-time
o8-17	0x5811	Input 2 of addition/ subtraction module E (ADD)	Same as o8-00	0	-	Real-time
o8-18	0x5812	Input 3 of addition/ subtraction module E (ADD)	Same as o8-00	0	-	Real-time
o8-19	0x5813	Input 4 of addition/ subtraction module E (SUBTRACT)	Same as o8-00	0	-	Real-time
o8-20	0x5814	Input 1 of addition/ subtraction module F	Same as o8-00	0	-	Real-time
o8-21	0x5815	Input 2 of addition/ subtraction module F (ADD)	Same as o8-00	0	-	Real-time
o8-22	0x5816	Input 3 of addition/ subtraction module F (ADD)	Same as o8-00	0	-	Real-time
o8-23	0x5817	Input 4 of addition/ subtraction module F (SUBTRACT)	Same as o8-00	0	-	Real-time
o8-24	0x5818	Input 1 of addition/ subtraction module G	Same as o8-00	0	-	Real-time
o8-25	0x5819	Input 2 of addition/ subtraction module G (ADD)	Same as o8-00	0	-	Real-time
o8-26	0x581A	Input 3 of addition/ subtraction module G (ADD)	Same as o8-00	0	-	Real-time
o8-27	0x581B	Input 4 of addition/ subtraction module G (SUBTRACT)	Same as o8-00	0	-	Real-time
o8-28	0x581C	Input 1 of addition/ subtraction module H	Same as o8-00	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o8-29	0x581D	Input 2 of addition/ subtraction module H (ADD)	Same as o8-00	0	-	Real-time
o8-30	0x581E	Input 3 of addition/ subtraction module H (ADD)	Same as o8-00	0	-	Real-time
o8-31	0x581F	Input 4 of addition/ subtraction module H (SUBTRACT)	Same as o8-00	0	-	Real-time
o8-48	0x5830	Input 1 of multiplication/ division module A	Same as o8-00	0	-	Real-time
o8-49	0x5831	Input 2 of multiplication/ division module A (MULTIPLY)	Same as o8-00	0	-	Real-time
o8-50	0x5832	Input 3 of multiplication/ division module A (DIVIDE)	Same as o8-00	0	-	Real-time
o8-51	0x5833	Input 1 of multiplication/ division module B	Same as o8-00	0	-	Real-time
o8-52	0x5834	Input 2 of multiplication/ division module B (MULTIPLY)	Same as o8-00	0	-	Real-time
o8-53	0x5835	Input 3 of multiplication/ division module B (DIVIDE)	Same as o8-00	0	-	Real-time
o8-54	0x5836	Input 1 of multiplication/ division module C	Same as o8-00	0	-	Real-time
o8-55	0x5837	Input 2 of multiplication/ division module C (MULTIPLY)	Same as o8-00	0	-	Real-time
o8-56	0x5838	Input 3 of multiplication/ division module C (DIVIDE)	Same as o8-00	0	-	Real-time
o8-57	0x5839	Input 1 of multiplication/ division module D	Same as o8-00	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o8-58	0x583A	Input 2 of multiplication/ division module D (MULTIPLY)	Same as o8-00	0	-	Real-time
o8-59	0x583B	Input 3 of multiplication/ division module D (DIVIDE)	Same as o8-00	0	-	Real-time
o8-60	0x583C	Input 1 of multiplication/ division module E	Same as o8-00	0	-	Real-time
o8-61	0x583D	Input 2 of multiplication/ division module E (MULTIPLY)	Same as o8-00	0	-	Real-time
o8-62	0x583E	Input 3 of multiplication/ division module E (DIVIDE)	Same as o8-00	0	-	Real-time
o8-63	0x583F	Input 1 of multiplication/ division module F	Same as o8-00	0	-	Real-time
o8-64	0x5840	Input 2 of multiplication/ division module F (MULTIPLY)	Same as o8-00	0	-	Real-time
o8-65	0x5841	Input 3 of multiplication/ division module F (DIVIDE)	Same as o8-00	0	-	Real-time
o8-66	0x5842	Input 1 of multiplication/ division module G	Same as o8-00	0	-	Real-time
o8-67	0x5843	Input 2 of multiplication/ division module G (MULTIPLY)	Same as o8-00	0	-	Real-time
o8-68	0x5844	Input 3 of multiplication/ division module G (DIVIDE)	Same as o8-00	0	-	Real-time
o8-69	0x5845	Input 1 of multiplication/ division module H	Same as o8-00	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o8-70	0x5846	Input 2 of multiplication/ division module H (MULTIPLY)	Same as o8-00	0	-	Real-time
o8-71	0x5847	Input 3 of multiplication/ division module H (DIVIDE)	Same as o8-00	0	-	Real-time

10.12.8 o9 Arithmetic operation 2

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o9-00	0x5900	Input of absolute value module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
o9-01	0x5901	Input of absolute value module B	Same as o9-00	0	-	Real-time
o9-02	0x5902	Input of absolute value module C	Same as o9-00	0	-	Real-time
o9-03	0x5903	Input of absolute value module D	Same as o9-00	0	-	Real-time
o9-04	0x5904	Input of absolute value module E	Same as o9-00	0	-	Real-time
o9-05	0x5905	Input of absolute value module F	Same as o9-00	0	-	Real-time
o9-06	0x5906	Input of absolute value module G	Same as o9-00	0	-	Real-time
o9-07	0x5907	Input of absolute value module H	Same as o9-00	0	-	Real-time
o9-16	0x5910	Function selection for comparison module A	0: Disable 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real-time
o9-17	0x5911	Input 1 of comparison module A	Same as o9-00	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o9-18	0x5912	Input 2 of comparison module A	Same as o9-00	0	-	Real-time
o9-19	0x5913	Hysteresis input of comparison module A	0.00 to 655.35	0.00	%	Real-time
o9-20	0x5914	Function selection for comparison module B	Same as o9-16	0	-	Real-time
o9-21	0x5915	Input 1 of comparison module B	Same as o9-00	0	-	Real-time
o9-22	0x5916	Input 2 of comparison module B	Same as o9-00	0	-	Real-time
o9-23	0x5917	Hysteresis input of comparison module B	0.00 to 655.35	0.00	%	Real-time
o9-24	0x5918	Function selection for comparison module C	Same as o9-16	0	-	Real-time
o9-25	0x5919	Input 1 of comparison module C	Same as o9-00	0	-	Real-time
o9-26	0x591A	Input 2 of comparison module C	Same as o9-00	0	-	Real-time
o9-27	0x591B	Hysteresis input of comparison module C	0.00 to 655.35	0.00	%	Real-time
o9-28	0x591C	Function selection for comparison module D	Same as o9-16	0	-	Real-time
o9-29	0x591D	Input 1 of comparison module D	Same as o9-00	0	-	Real-time
o9-30	0x591E	Input 2 of comparison module D	Same as o9-00	0	-	Real-time
o9-31	0x591F	Hysteresis input of comparison module D	0.00 to 655.35	0.00	%	Real-time
o9-32	0x5920	Function selection for comparison module E	Same as o9-16	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
o9-33	0x5921	Input 1 of comparison module E	Same as o9-00	0	-	Real-time
o9-34	0x5922	Input 2 of comparison module E	Same as o9-00	0	-	Real-time
o9-35	0x5923	Hysteresis input of comparison module E	0.00 to 655.35	0.00	%	Real-time
o9-36	0x5924	Function selection for comparison module F	Same as o9-16	0	-	Real-time
o9-37	0x5925	Input 1 of comparison module F	Same as o9-00	0	-	Real-time
o9-38	0x5926	Input 2 of comparison module F	Same as o9-00	0	-	Real-time
o9-39	0x5927	Hysteresis input of comparison module F	0.00 to 655.35	0.00	%	Real-time
o9-40	0x5928	Function selection for comparison module G	Same as o9-16	0	-	Real-time
o9-41	0x5929	Input 1 of comparison module G	Same as o9-00	0	-	Real-time
o9-42	0x592A	Input 2 of comparison module G	Same as o9-00	0	-	Real-time
o9-43	0x592B	Hysteresis input of comparison module G	0.00 to 655.35	0.00	%	Real-time
o9-44	0x592C	Function selection for comparison module H	Same as o9-16	0	-	Real-time
o9-45	0x592D	Input 1 of comparison module H	Same as o9-00	0	-	Real-time
o9-46	0x592E	Input 2 of comparison module H	Same as o9-00	0	-	Real-time
o9-47	0x592F	Hysteresis input of comparison module H	0.00 to 655.35	0.00	%	Real-time

10.12.9 oA Switch selection function

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-00	0x5A00	Input selection for binary multiplexer module A	0: Invalid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
oA-01	0x5A01	Input 1 of binary switch module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
oA-02	0x5A02	Input 2 of binary selector module A	Same as oA-01	0	-	Real-time
oA-03	0x5A03	Input selection for binary switch module B	Same as oA-00	0	-	Real-time
oA-04	0x5A04	Input 1 of binary switch module B	Same as oA-01	0	-	Real-time
oA-05	0x5A05	Input 2 of binary multiplexer module B	Same as oA-01	0	-	Real-time
oA-06	0x5A06	Input selection for binary switch module C	Same as oA-00	0	-	Real-time
oA-07	0x5A07	Input 1 of binary switch module C	Same as oA-01	0	-	Real-time
oA-08	0x5A08	Input 2 of binary switch module C	Same as oA-01	0	-	Real-time
oA-09	0x5A09	Input selection for binary switch module D	Same as oA-00	0	-	Real-time
oA-10	0x5A0A	Input 1 of binary switch module D	Same as oA-01	0	-	Real-time
oA-11	0x5A0B	Input 2 of binary switch module D	Same as oA-01	0	-	Real-time
oA-12	0x5A0C	Input selection for binary switch module E	Same as oA-00	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-13	0x5A0D	Input 1 of binary switch module E	Same as oA-01	0	-	Real-time
oA-14	0x5A0E	Input 2 of binary switch module E	Same as oA-01	0	-	Real-time
oA-15	0x5A0F	Input selection for binary switch module F	Same as oA-00	0	-	Real-time
oA-16	0x5A10	Input 1 of binary switch module F	Same as oA-01	0	-	Real-time
oA-17	0x5A11	Input 2 of binary switch module F	Same as oA-01	0	-	Real-time
oA-18	0x5A12	Input selection for binary switch module G	Same as oA-00	0	-	Real-time
oA-19	0x5A13	Input 1 of binary switch module G	Same as oA-01	0	-	Real-time
oA-20	0x5A14	Input 2 of binary switch module G	Same as oA-01	0	-	Real-time
oA-21	0x5A15	Input selection for binary switch module H	Same as oA-00	0	-	Real-time
oA-22	0x5A16	Input 1 of binary switch module H	Same as oA-01	0	-	Real-time
oA-23	0x5A17	Input 2 of binary switch module H	Same as oA-01	0	-	Real-time
oA-24	0x5A18	Input selection for numeric switch module A	Same as oA-00	0	-	Real-time
oA-25	0x5A19	Input 1 of numeric switch module A	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
oA-26	0x5A1A	Input 2 of digital selector module A	Same as oA-25	0	-	Real-time
oA-27	0x5A1B	Input selection for numeric switch module B	Same as oA-00	0	-	Real-time
oA-28	0x5A1C	Input 1 of numeric switch module B	Same as oA-25	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oA-29	0x5A1D	Input 2 of numeric switch module B	Same as oA-25	0	-	Real-time
oA-30	0x5A1E	Input selection for numeric switch module C	Same as oA-00	0	-	Real-time
oA-31	0x5A1F	Input 1 of numeric switch module C	Same as oA-25	0	-	Real-time
oA-32	0x5A20	Input 2 of numeric switch module C	Same as oA-25	0	-	Real-time
oA-33	0x5A21	Input selection for numeric switch module D	Same as oA-00	0	-	Real-time
oA-34	0x5A22	Input 1 of numeric switch module D	Same as oA-25	0	-	Real-time
oA-35	0x5A23	Input 2 of numeric switch module D	Same as oA-25	0	-	Real-time
oA-36	0x5A24	Input selection for numeric switch module E	Same as oA-00	0	-	Real-time
oA-37	0x5A25	Input 1 of numeric switch module E	Same as oA-25	0	-	Real-time
oA-38	0x5A26	Input 2 of numeric switch module E	Same as oA-25	0	-	Real-time
oA-39	0x5A27	Input selection for numeric switch module F	Same as oA-00	0	-	Real-time
oA-40	0x5A28	Input 1 of numeric switch module F	Same as oA-25	0	-	Real-time
oA-41	0x5A29	Input 2 of numeric switch module F	Same as oA-25	0	-	Real-time
oA-42	0x5A2A	Input selection for numeric switch module G	Same as oA-00	0	-	Real-time
oA-43	0x5A2B	Input 1 of numeric switch module G	Same as oA-25	0	-	Real-time
oA-44	0x5A2C	Input 2 of numeric switch module G	Same as oA-25	0	-	Real-time
oA-45	0x5A2D	Input selection for numeric switch module H	Same as oA-00	0	-	Real-time
oA-46	0x5A2E	Input 1 of numeric switch module H	Same as oA-25	0	-	Real-time
oA-47	0x5A2F	Input 2 of numeric switch module H	Same as oA-25	0	-	Real-time

10.12.10 ob Control Function 1

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
ob-00	0x5B00	Function selection for filter module A	0: Filter function invalid 1: Filter function valid 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
ob-01	0x5B01	Input of filter module A	0: Value 0 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
ob-02	0x5B02	Filter time of filter module A	0.000 to 30.000	0.000	s	Real-time
ob-03	0x5B03	Function selection for filter module B	Same as ob-00	0	-	Real-time
Fb-03	0x5B04	Input of filter module B	Same as ob-01	0	-	Real-time
ob-05	0x5B05	Filter time of filter module B	0.000 to 30.000	0.000	s	Real-time
ob-06	0x5B06	Function selection for filter module C	Same as ob-00	0	-	Real-time
ob-07	0x5B07	Input of filter module C	Same as ob-01	0	-	Real-time
ob-08	0x5B08	Filter time of filter module C	0.000 to 30.000	0.000	s	Real-time
ob-09	0x5B09	Function selection for filter module D	Same as ob-00	0	-	Real-time
ob-10	0x5B0A	Input of filter module D	Same as ob-01	0	-	Real-time
ob-11	0x5B0B	Filter time of filter module D	0.000 to 30.000	0.000	s	Real-time
ob-24	0x5B18	Function selection for level-pulse conversion module A	0: Disable 1: Level to pulse 2: Pulse to level	0	-	Real-time
ob-25	0x5B19	Input of level-pulse conversion module A	Same as ob-00	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
ob-26	0x5B1A	Pulse Width of level-pulse conversion module A	0.00 to 655.35	0.00	s	Real-time
ob-27	0x5B1B	Function selection for level-pulse conversion module B	Same as ob-24	0	-	Real-time
ob-28	0x5B1C	Input of level-pulse conversion module B	Same as ob-00	0	-	Real-time
ob-29	0x5B1D	Pulse Width of level-pulse conversion module B	0.00 to 655.35	0.00	s	Real-time
ob-30	0x5B1E	Function selection for level-pulse conversion module C	Same as ob-24	0	-	Real-time
ob-31	0x5B1F	Input of level-pulse conversion module C	Same as ob-00	0	-	Real-time
ob-32	0x5B20	Pulse Width of level-pulse conversion module C	0.00 to 655.35	0.00	s	Real-time
ob-33	0x5B21	Function selection for level-pulse conversion module D	Same as ob-24	0	-	Real-time
ob-34	0x5B22	Input of level-pulse conversion module D	Same as ob-00	0	-	Real-time
ob-35	0x5B23	Pulse Width of level-pulse conversion module D	0.00 to 655.35	0.00	s	Real-time

10.12.11 oC Control Function 2

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oC-00	0x5C00	Input of limiter module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
oC-01	0x5C01	Upper limit of limiter module A	Same as oC-00	0	-	Real-time
oC-02	0x5C02	Lower limit of limiter module A	Same as oC-00	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oC-03	0x5C03	Input of limiter module B	Same as oC-00	0	-	Real-time
oC-04	0x5C04	Upper limit of limiter module B	Same as oC-00	0	-	Real-time
oC-05	0x5C05	Lower limit of limiter module B	Same as oC-00	0	-	Real-time
oC-06	0x5C06	Input of limiter module C	Same as oC-00	0	-	Real-time
oC-07	0x5C07	Upper limit of limiter module C	Same as oC-00	0	-	Real-time
oC-08	0x5C08	Lower limit of limiter module C	Same as oC-00	0	-	Real-time
oC-09	0x5C09	Input of limiter module D	Same as oC-00	0	-	Real-time
oC-10	0x5C0A	Upper limit of limiter module D	Same as oC-00	0	-	Real-time
oC-11	0x5C0B	Lower limit of limiter module D	Same as oC-00	0	-	Real-time
oC-28	0x5C1C	Input of logic delay module A	0: Disable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
oC-29	0x5C1D	Logic delay module A switch-on delay	0 to 65535	0	-	Real-time
oC-30	0x5C1E	Logic delay module A switch-off delay	0 to 65535	0	-	Real-time
oC-31	0x5C1F	Delay time unit of logic delay module A	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1Min 6: 2Min	1	-	Real-time
oC-32	0x5C20	Input of logic delay module B	Same as oC-28	0	-	Real-time
oC-33	0x5C21	Logic delay module B switch-on delay	0 to 65535	0	-	Real-time
oC-34	0x5C22	Switch-off delay time of logic delay module B	0 to 65535	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oC-35	0x5C23	Delay time unit of logic delay module B	Same as oC-31	1	-	Real-time
oC-36	0x5C24	Input of logic delay module C	Same as oC-28	0	-	Real-time
oC-37	0x5C25	Logic delay module C switch-on delay	0 to 65535	0	-	Real-time
oC-38	0x5C26	Logic delay module C switch-off delay	0 to 65535	0	-	Real-time
oC-39	0x5C27	Delay time unit of logic delay module C	Same as oC-31	1	-	Real-time
oC-40	0x5C28	Input of logic delay module D	Same as oC-28	0	-	Real-time
oC-41	0x5C29	Logic delay module D switch-on delay	0 to 65535	0	-	Real-time
oC-42	0x5C2A	Logic delay module D switch-off delay	0 to 65535	0	-	Real-time
oC-43	0x5C2B	Delay time unit of logic delay module D	Same as oC-31	1	-	Real-time
oC-44	0x5C2C	Logic delay module E input	Same as oC-28	0	-	Real-time
oC-45	0x5C2D	Logic delay module E switch-on delay	0 to 65535	0	-	Real-time
oC-46	0x5C2E	Logic delay module E switch-off delay	0 to 65535	0	-	Real-time
oC-47	0x5C2F	Delay time unit of logic delay module E	Same as oC-31	1	-	Real-time
oC-48	0x5C30	Logic delay module F input	Same as oC-28	0	-	Real-time
oC-49	0x5C31	Logic delay module F switch-on delay	0 to 65535	0	-	Real-time
oC-50	0x5C32	Logic delay module F switch-off delay	0 to 65535	0	-	Real-time
oC-51	0x5C33	Delay time unit of logic delay module F	Same as oC-31	1	-	Real-time
oC-52	0x5C34	Logic delay module G input	Same as oC-28	0	-	Real-time
oC-53	0x5C35	Logic delay module G switch-on delay	0 to 65535	0	-	Real-time
oC-54	0x5C36	Logic delay module G switch-off delay	0 to 65535	0	-	Real-time
oC-55	0x5C37	Delay time unit of logic delay module G	Same as oC-31	1	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
oC-56	0x5C38	Logic delay module H input	Same as oC-28	0	-	Real-time
oC-57	0x5C39	Logic delay module H switch-on delay	0 to 65535	0	-	Real-time
oC-58	0x5C3A	Logic delay module H switch-off delay	0 to 65535	0	-	Real-time
oC-59	0x5C3B	Delay time unit of logic delay module H	Same as oC-31	1	-	Real-time

10.13 Group P Application Function

10.13.1 P0 Auxiliary Functions

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P0-05	0x6005	Jump frequency during acceleration/ deceleration	0: Disable 1: Enable	0	-	Change at stop
P0-06	0x6006	Jump frequency 1	0.0 to 800.0	0.0	Hz	Real-time
P0-07	0x6007	Jump frequency 2	0.0 to 800.0	0.0	Hz	Real-time
P0-08	0x6008	Jump frequency 3	0.0 to 800.0	0.0	Hz	Real-time
P0-09	0x6009	Jump frequency 4	0.0 to 800.0	0.0	Hz	Real-time
P0-10	0x600A	Jump frequency amplitude	0.0 to 800.0	0.0	Hz	Real-time
P0-11	0x600B	Operation mode for frequency references lower than the effective lower limit	0: Operating at the effective lower limit 1: Stop 2: Run at zero speed 3: Coast to stop	0	-	Real-time
P0-12	0x600C	Encoder counter clear	0: Invalid 1: Enable	0	-	Real-time
P0-13	0x600D	Timing function	0: Invalid 1: Enabled	0	-	Change at stop
P0-14	0x600E	Timing operation duration source	0: P0-15 1: AI1 2: AI2 Others: F connector	0	-	Change at stop
P0-15	0x600F	Digital setting of timing operation duration	0.0 to 6500.0	0.0	min.	Change at stop
P0-16	0x6010	Cumulative power-on hours reached	0 to 65535	0	h	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P0-17	0x6011	Cumulative power-on seconds reached	0 to 3599	0	s	Real-time
P0-18	0x6012	Cumulative running hours reached	0 to 65535	0	h	Real-time
P0-19	0x6013	Running time threshold (second)	0 to 3599	0	s	Real-time
P0-20	0x6014	Curent running time arrival	0.0 to 6500.0	0.0	min.	Change at stop
P0-21	0x6015	Protection upon start	0: Disable 1: Enable	1	-	Real-time
P0-22	0x6016	Wakeup frequency source	P0-24 to A2-17	0.00	Hz	Real-time
P0-23	0x6017	Wakeup delay time	0.0 to 6500.0	0.0	s	Real-time
P0-24	0x6018	Hibernation frequency	0.00 to P0-22	0.00	Hz	Real-time
P0-25	0x6019	Hibernation delay time	0.0 to 6500.0	0.0	s	Real-time
P0-26	0x601A	Dead time for forward/reverse run switchover	0.0 to 3000.0	0.0	s	Real-time
P0-29	0x601D	Auto reset of STO state	0: Reset manually 1: Reset automatically	1	-	Real-time
P0-30	0x601E	Detection time for inconsistent STO status	0.020 to 1.000	0.050	s	Real-time
P0-33	0x6021	Module temperature reach (threshold)	0 to 100	75	℃	Real-time
P0-34	0x6022	Frequency detection value (FDT1)	0.00 to A2-17	50.00	Hz	Real-time
P0-35	0x6023	Frequency detection hysteresis coefficient (FDT1)	0.0 to 100.0	5.0	%	Real-time
P0-36	0x6024	Frequency detection value (FDT2)	0.00 to A2-17	50.00	Hz	Real-time
P0-37	0x6025	Frequency detection hysteresis coefficient (FDT2)	0.0 to 100.0	5.0	%	Real-time
P0-38	0x6026	Frequency detection window	0.0 to 100.0	0.0	%	Real-time
P0-39	0x6027	Frequency detection value 1	0.00 to A2-17	50.00	Hz	Real-time
P0-40	0x6028	Frequency arrival amplitude 1	0.1 to 100.0	0.1	%	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P0-41	0x6029	Frequency detection value 2	0.00 to A2-17	50.00	Hz	Real-time
P0-42	0x602A	Frequency arrival amplitude 2	0.1 to 100.0	0.1	%	Real-time
P0-43	0x602B	Detection value 1 of any current reached	0.0 to 300.0	100.0	%	Real-time
P0-44	0x602C	Detection amplitude 1 of any current reached	0.0 to 300.0	0.0	%	Real-time
P0-45	0x602D	Detection value 2 of any current reached	0.0 to 300.0	100.0	%	Real-time
P0-46	0x602E	Current detection width 2	0.0 to 300.0	0.0	%	Real-time
P0-47	0x602F	Zero current detection level	0.0 to 300.0	5.0	%	Real-time
P0-48	0x6030	Zero current detection delay time	0.01 to 600.00	0.10	s	Real-time
P0-49	0x6031	Output current overlimit threshold	0.0 to 300.0	200.0	%	Real-time
P0-50	0x6032	Delay time for output current overlimit detection	0.00 to 600.00	0.00	s	Real-time
P0-51	0x6033	Target speed amplitude	0.0 to 600.0	3.0	%	Real-time
P0-52	0x6034	Target speed arrival time	0.00 to 100.00	3.00	s	Real-time
P0-53	0x6035	Speed comparison arrival threshold 1	0.0 to 600.0	100.0	%	Real-time
P0-54	0x6036	Speed comparison arrival hysteresis 1	0.0 to 600.0	3.0	%	Real-time
P0-55	0x6037	Speed comparison arrival time 1	0.00 to 100.00	3.00	s	Real-time
P0-56	0x6038	Speed comparison arrival threshold 2	0.0 to 600.0	100.0	%	Real-time
P0-57	0x6039	Speed comparison arrival hysteresis 2	0.0 to 600.0	3.0	%	Real-time
P0-58	0x603A	Speed comparison arrival time 2	0.00 to 100.00	3.00	s	Real-time
P0-59	0x603B	Bit 15 setting of system status word 1	0: Invalid 1: Set to 1 Others: B connector	0	-	Real-time
P0-60	0x603C	Bit 15 setting of system status word 2	0: Invalid 1: Set to 1 Others: B connector	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P0-66	0x6042	Load monitoring signal selection	0: Monitoring not enabled 1: Monitor output current 2: Monitor output torque 3: Monitor motor object output power Others: F connector	0	-	Real-time
P0-67	0x6043	Load monitoring signal state	0 to 65535	0	-	Unchangeable
P0-68	0x6044	Load monitoring overload action	0: No warning/no fault 1: Alarm 2: Fault 3: Alarm/fault	0	-	Real-time
P0-69	0x6045	Load monitoring load loss action	0: No warning/no fault 1: Alarm 2: Fault 3: Alarm/fault	0	-	Real-time
P0-70	0x6046	X-coordinate 1 in load monitoring state	0.0 to 600.0	0.0	%	Real-time
P0-71	0x6047	X-coordinate 2 in load monitoring state	0.0 to 600.0	0.0	%	Real-time
P0-72	0x6048	X-coordinate 3 in load monitoring state	0.0 to 600.0	0.0	%	Real-time
P0-73	0x6049	X-coordinate 4 in load monitoring state	0.0 to 600.0	0.0	%	Real-time
P0-74	0x604A	X-coordinate 5 in load monitoring state	0.0 to 600.0	0.0	%	Real-time
P0-75	0x604B	Upper limit 1 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-76	0x604C	Upper limit 2 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-77	0x604D	Upper limit 3 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-78	0x604E	Upper limit 4 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-79	0x604F	Upper limit 5 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-80	0x6050	Lower limit 1 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-81	0x6051	Lower limit 2 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-82	0x6052	Lower limit 3 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-83	0x6053	Lower limit 4 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P0-84	0x6054	Lower limit 5 on load monitoring curve	0.0 to 400.0	0.0	%	Real-time
P0-85	0x6055	Permissible overload time	0.0 to 6553.5	20.0	s	Real-time
P0-86	0x6056	Permissible load loss time	0.0 to 6553.5	20.0	s	Real-time
P0-87	0x6057	UPDOWN reference during running	0: Operating frequency 1: Frequency reference	0	-	Real-time
P0-88	0x6058	UP/DOWN retention selection upon stop	0: Not retentive 1: Retentive	0	-	Real-time
P0-89	0x6059	UP/DOWN retention selection upon power failure	0: Disable 1: Enable	0	-	Real-time
P0-90	0x605A	Retention of frequency adjusted by UP/DOWN key upon channel switch-over	0: Disable 1: Enable	0	-	Real-time
P0-92	0x605C	Numerator of load speed display coefficient	1 to 32767	1	-	Real-time
P0-93	0x605D	Denominator of load speed display coefficient	1 to 32767	1	-	Real-time
P0-94	0x605E	Wobble setting mode	0: Relative to the central frequency 1: Relative to maximum frequency	0	-	Real-time
P0-95	0x605F	Wobble amplitude	0.0 to 100.0	0.0	%	Real-time
P0-96	0x6060	Wobble step	0.0 to 50.0	0.0	%	Real-time
P0-97	0x6061	Wobble cycle	0.1 to 3000.0	10.0	s	Real-time
P0-98	0x6062	Triangular wave rising time of wobble frequency	0.1 to 100.0	50.0	%	Real-time

10.13.2 P1 Simple PLC

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P1-00	0x6100	Simple PLC module enable	0: Disable 1: Enable	0	-	Change at stop
P1-01	0x6101	Simple PLC calculation source	0: Invalid 1: Enabled 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	36978	-	Change at stop
P1-02	0x6102	Simple PLC running mode	0: Keep multi-reference 0 output after running for one cycle 1: Keep final values after running for one cycle 2: Repeat after running one cycle 3: Output 0 after running for one cycle	0	-	Real-time
P1-03	0x6103	Simple PLC function selection	Ones: Retention at power failure 0: Not retentive 1: Yes Tens position: Calculation enablement configuration 0: Current STEP retained when disabled, and recalculated when enabled 1: Current STEP retained when disabled, and continue when enabled Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real-time
P1-04	0x6104	PLC status reset	Same as P1-01	0	-	Change at stop
P1-05	0x6105	Current STEP of the simple PLC	0 to 65535	0	-	Unchangeable
P1-06	0x6106	Current STEP running time in hours of the simple PLC	0 to 65535	0	-	Unchangeable
P1-07	0x6107	Current STEP running time in seconds of the simple PLC	0.0 to 3599.9	0.0	-	Unchangeable
P1-08	0x6108	Time unit of simple PLC running	0: s (second) 1: h (hour)	0	-	Real-time
P1-09	0x6109	Multi-reference 0 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P1-10	0x610A	Running time of simple PLC reference 0	0.0 to 6553.5	0.0	-	Real-time
P1-11	0x610B	Acceleration/ deceleration time of simple PLC reference 0	0: Acceleration/Deceleration time of ramp 1 (b7-04[Ramp 1 acceleration time]/b7-05[Ramp 1 deceleration time]) 1: Acceleration/Deceleration time of ramp 2 (b7-10[Ramp 2 acceleration time]/b7-11[Ramp 2 deceleration time]) 2: Acceleration/Deceleration time of ramp 3 (b7-16[Ramp 3 acceleration time]/b7-17[Ramp 3 deceleration time]) 3: Acceleration/Deceleration time of ramp 4 (b7-22[Ramp 4 acceleration time]/b7-23[Ramp 4 deceleration time])	0	-	Real-time
P1-12	0x610C	Multi-reference 1 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-13	0x610D	Running time of simple PLC reference 1	0.0 to 6553.5	0.0	-	Real-time
P1-14	0x610E	Acceleration/ Deceleration time of multi-reference 1 set by simple PLC	Same as P1-11	0	-	Real-time
P1-15	0x610F	Multi-reference 2 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-16	0x6110	Running time of multi-reference 2 set by simple PLC	0.0 to 6553.5	0.0	-	Real-time
P1-17	0x6111	Acceleration/ Deceleration time of multi-reference 2 set through simple PLC	Same as P1-11	0	-	Real-time
P1-18	0x6112	Multi-reference 3 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-19	0x6113	Running time of multi-reference 3 set by simple PLC	0.0 to 6553.5	0.0	-	Real-time
P1-20	0x6114	Acceleration/ deceleration time of simple PLC reference 3	Same as P1-11	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P1-21	0x6115	Multi-reference 4 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-22	0x6116	Running time of multi-reference 4 set by simple PLC	0.0 to 6553.5	0.0	-	Real-time
P1-23	0x6117	Acceleration/ deceleration time of simple PLC reference 4	Same as P1-11	0	-	Real-time
P1-24	0x6118	Multi-reference 5 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-25	0x6119	Running time of simple PLC reference 5	0.0 to 6553.5	0.0	-	Real-time
P1-26	0x611A	Acceleration/ deceleration time of simple PLC reference 5	Same as P1-11	0	-	Real-time
P1-27	0x611B	Multi-reference 6 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-28	0x611C	Running time of simple PLC reference 6	0.0 to 6553.5	0.0	-	Real-time
P1-29	0x611D	Acceleration/ Deceleration time of multi-reference 6 set by simple PLC	Same as P1-11	0	-	Real-time
P1-30	0x611E	Multi-reference 7 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-31	0x611F	Running time of simple PLC reference 7	0.0 to 6553.5	0.0	-	Real-time
P1-32	0x6120	Acceleration/ Deceleration time of multi-reference 7 set by simple PLC	Same as P1-11	0	-	Real-time
P1-33	0x6121	Multi-reference 8 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-34	0x6122	Running time of simple PLC reference 8	0.0 to 6553.5	0.0	-	Real-time
P1-35	0x6123	Acceleration/ Deceleration time of multi-reference 8 set by simple PLC	Same as P1-11	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P1-36	0x6124	Multi-reference 9 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-37	0x6125	Running time of simple PLC reference 9	0.0 to 6553.5	0.0	-	Real-time
P1-38	0x6126	Acceleration/ deceleration time of simple PLC reference 9	Same as P1-11	0	-	Real-time
P1-39	0x6127	Multi-reference 10 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-40	0x6128	Running time of simple PLC reference 10	0.0 to 6553.5	0.0	-	Real-time
P1-41	0x6129	Acceleration/ deceleration time of simple PLC reference 10	Same as P1-11	0	-	Real-time
P1-42	0x612A	Multi-reference 11 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-43	0x612B	Running time of simple PLC reference 11	0.0 to 6553.5	0.0	-	Real-time
P1-44	0x612C	Acceleration/ deceleration time of simple PLC reference 11	Same as P1-11	0	-	Real-time
P1-45	0x612D	Multi-reference 12 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-46	0x612E	Running time of simple PLC reference 12	0.0 to 6553.5	0.0	-	Real-time
P1-47	0x612F	Acceleration/ deceleration time of simple PLC reference 12	Same as P1-11	0	-	Real-time
P1-48	0x6130	Multi-reference 13 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-49	0x6131	Running time of simple PLC reference 13	0.0 to 6553.5	0.0	-	Real-time
P1-50	0x6132	Acceleration/ deceleration time of simple PLC reference 13	Same as P1-11	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P1-51	0x6133	Multi-reference 14 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-52	0x6134	Running time of simple PLC reference 14	0.0 to 6553.5	0.0	-	Real-time
P1-53	0x6135	Acceleration/ deceleration time of simple PLC reference 14	Same as P1-11	0	-	Real-time
P1-54	0x6136	Multi-reference 15 set by simple PLC	-800.0 to 800.0	0.0	%	Real-time
P1-55	0x6137	Running time of simple PLC reference 15	0.0 to 6553.5	0.0	-	Real-time
P1-56	0x6138	Acceleration/ deceleration time of simple PLC reference 15	Same as P1-11	0	-	Real-time

10.13.3 P2 Process PID Parameters

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P2-00	0x6200	PID enable	0: Disable 1: Enable Others: B connector	0	-	Real-time
P2-01	0x6201	PID action direction	0: Direction acting 1: Reverse acting Others: B connector	0	-	Real-time
P2-02	0x6202	PID reference source	0: PID digital setting 1: AI1 2: AI2 4: HDI pulse reference (active only for MD630S) 5: Multi-reference 6: Simple PLC 8: Communication setting Others: F connector	0	-	Real-time
P2-03	0x6203	PID value reference	0.0 to 800.0	50.0	%	Real-time
P2-04	0x6204	PID feedback source	0: AI1 1: AI2 4: HDI reference (active only for MD630S) 5: Communication Others: F connector	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P2-05	0x6205	PID reference and feedback range	0 to 65535	1000	-	Real-time
P2-06	0x6206	PID reference change time	0.00 to 655.00	0.00	s	Real-time
P2-07	0x6207	PID feedback filter time	0.00 to 60.00	0.00	s	Real-time
P2-08	0x6208	PID output filter time	0.00 to 60.00	0.00	s	Real-time
P2-09	0x6209	PID output limit in reverse direction	0.00 to A2-17	2.00	Hz	Real-time
P2-11	0x620B	PID parameter switchover condition	0: No switchover, default PID parameter 1 1: Switchover via DI 2: Automatic switchover based on deviation 3: Automatic switchover based on the running frequency 4: Auto-adjustment mode 1 based on roll diameter (Only valid when closed-loop speed mode or closed-loop torque mode in tension process) 5: Auto-adjustment mode 2 based on roll diameter (Only valid when closed-loop speed mode or closed-loop torque mode in tension process)	0	-	Real-time
P2-12	0x620C	PID parameter switchover deviation 1	0.0 to P2-13	20.0	%	Real-time
P2-13	0x620D	PID parameter switchover deviation 2	P2-12 to 800.0	80.0	%	Real-time
P2-14	0x620E	PID parameter 1 proportional gain Kp1	0.0 to 1000.0	20.0	-	Real-time
P2-15	0x620F	PID parameter 1 integral time Ti1	0.01 to 10.00	2.00	s	Real-time
P2-16	0x6210	Derivative time Td1 of PID parameter 1	0.000 to 10.000	0.000	s	Real-time
P2-17	0x6211	Proportional gain Kp2 of PID parameter 2	0.0 to 1000.0	20.0	-	Real-time
P2-18	0x6212	Integral time Ti2 of PID parameter 2	0.01 to 10.00	2.00	s	Real-time
P2-19	0x6213	Derivative time Td2 of PID parameter 2	0.000 to 10.000	0.000	s	Real-time
P2-20	0x6214	PID initial value	0.0 to 800.0	0.0	%	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P2-21	0x6215	PID initial value holding time	0.00 to 655.00	0.00	s	Real-time
P2-22	0x6216	PID deviation dead zone	0.0 to 800.0	0.0	%	Real-time
P2-23	0x6217	PID differential limit	0.00 to 600.00	0.10	%	Real-time
P2-26	0x621A	Source of maximum PID output	0: 100% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
P2-27	0x621B	Source of minimum PID output	0: -100 % 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
P2-28	0x621C	Forced value of PID output	0: 0 % 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
P2-29	0x621D	Forced assignment of PID output enable	0: Invalid 1: Enable Others: B connector	0	-	Real-time
P2-30	0x621E	Upper limit for PID feedback loss detection	P2-31 to 800.0	100.0	%	Real-time
P2-31	0x621F	Lower limit for PID feedback loss detection	0.0 to P2-30	0.0	%	Real-time
P2-32	0x6220	Detection time for PID feedback loss	0.0 to 20.0	0.0	s	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P2-33	0x6221	Selection of PID operation at stop selection	0: Disabled 1: Enabled Others: B connector	0	-	Real-time
P2-34	0x6222	PID integral property	Ones position: Integral pause/ separation 0: Invalid 1: Enabled Tens position: Whether to stop integral operation when the output reaches the limit 0: Continue integral operation 1: Stop integral operation Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	10	-	Real-time
P2-36	0x6224	PID calculation during jog	0: Disable 1: Enable Others: B connector	0	-	Real-time
P2-37	0x6225	PID execution interval	0 to 20	1	-	Change at stop
P2-38	0x6226	Active mode for PID ramp reference	0: Activated when PID enabled 1: Activated when PID operation starts Others: B connector	0	-	Change at stop

10.13.4 P3 Motor-driven Potentiometer

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P3-00	0x6300	Motor-driven potentiometer enable	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
P3-01	0x6301	Motor-driven potentiometer memory retention enable	0: Disable 1: Enable	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P3-02	0x6302	Initial value of motorized potentiometer	-600.0 to 600.0	0.0	%	Real-time
P3-03	0x6303	Motor-driven potentiometer time increase benchmark	0.00 to 655.35	20.00	s	Real-time
P3-04	0x6304	Motor-driven potentiometer time decrease benchmark	0.00 to 655.35	20.00	s	Real-time
P3-05	0x6305	Motor-driven potentiometer increase command source	Same as P3-00	0	-	Real-time
P3-06	0x6306	Motor-driven potentiometer decrease command source	Same as P3-00	0	-	Real-time
P3-07	0x6307	Motor-driven potentiometer max. output	P3-08 to 600.0	600.0	%	Real-time
P3-08	0x6308	Motor-driven potentiometer min. output	-600.0 to P3-07	-600.0	%	Real-time
P3-09	0x6309	Motor-driven potentiometer pause command source 1	Same as P3-00	0	-	Real-time
P3-10	0x630A	Source 2 of motorized potentiometer pause command	Same as P3-00	0	-	Real-time
P3-11	0x630B	Motor-driven potentiometer reset command source 1	Same as P3-00	0	-	Real-time
P3-12	0x630C	Source 2 of motorized potentiometer reset command	Same as P3-00	0	-	Real-time
P3-13	0x630D	Source of reset value of motor-driven potentiometer	0: Digital setting 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P3-14	0x630E	Motor-driven potentiometer reset value digital setting	-600.0 to 600.0	0.0	%	Real-time
P3-15	0x630F	Motor-driven potentiometer force command source	Same as P3-00	0	-	Real-time
P3-16	0x6310	Source of motor-driven potentiometer force value	Same as P3-13	0	-	Real-time
P3-17	0x6311	Motor-driven potentiometer force value digital setting	-600.0 to 600.0	0.0	%	Real-time

10.13.5 P4 Brake Control Parameters

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P4-00	0x6400	Brake function	0: Disable brake 1: Enable brake without detection information 2: Enable brake with detection information	0	-	Change at stop
P4-02	0x6402	Brake release action time	0.00 to 30.00	0.20	s	Real-time
P4-03	0x6403	Brake apply action time (Actuating time of brake-apply)	0.00 to 30.00	0.20	s	Real-time
P4-04	0x6404	Brake feedback source	0: Invalid 1: Enabled 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S) Others: B connector	0	-	Real-time
P4-05	0x6405	Brake feedback fault delay time	0.00 to 30.00	2.00	s	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P4-07	0x6407	Brake auxiliary function selection	bit0: Braking with detection - completion judgment of releasing/applying 0: Action time + Detection signal 1: Detect signal only bit1: Braking with detection - fault judgment of detection signal 0: Full-time judgment 1: No detection when already released/applied bit2: Start speed logic selection 0: Active when brake is released 1: Active at the moment when brake is released. bit3: Brake release enable during tuning 0: Brake release prohibited 1: Brake release allowed bit4 to bit15: Reserved	0x0	-	Change at stop
P4-08	0x6408	Starting torque source in the vector control mode	0: Disable 1: Retentive torque 2: Digital setting of starting torque 3: Determined by digital setting and motor operating direction Others: F connector	0	-	Real-time
P4-09	0x6409	Digital setting of starting torque	-200.0 to 200.0	0.0	%	Real-time
P4-10	0x640A	Retentive start torque gain coefficient	0.0 to 300.0	100.0	%	Real-time
P4-11	0x640B	Starting torque increment time	0.00 to 5.00	0.04	s	Real-time
P4-13	0x640D	Starting speed source	0: Disable 1: Digital setting of starting speed 2: Determined by digital setting of start speed and motor operating direction	0	-	Real-time
P4-14	0x640E	Digital setting of torque reference	-30.0 to 30.0	0.0	%	Real-time
P4-17	0x6411	Forced brake close command source	Same as P4-04	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P4-18	0x6412	Actual speed monitoring threshold for brake apply	0.0 to 100.0	1.0	%	Real-time
P4-19	0x6413	Actual speed monitoring time for brake apply	0.00 to 300.00	0.10	s	Real-time
P4-20	0x6414	Set speed monitoring threshold for brake apply	0.0 to 100.0	0.0	%	Real-time
P4-21	0x6415	Set speed monitoring time for brake apply	0.00 to 60.00	5.00	s	Real-time
P4-24	0x6418	Brake open command source	Same as P4-04	1	-	Real-time
P4-25	0x6419	Comparative value source of brake open	0: Disable 2: AI1 3: AI2 5: HDI pulse reference (active only for MD630S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real-time
P4-26	0x641A	Brake opening comparison threshold	0.0 to 300.0	0.0	%	Real-time
P4-27	0x641B	Brake apply delay time	0.00 to 30.00	0.20	s	Real-time
P4-28	0x641C	Positive speed - Starting torque gain coefficient	0.0 to 200.0	100.0	%	Real-time
P4-29	0x641D	Negative speed - Starting torque gain coefficient	0.0 to 200.0	100.0	%	Real-time
P4-34	0x6422	Brake torque ramp-down time	0.00 to 10.00	0.20	s	Real-time
P4-40	0x6428	Braking self-test enable	0: Disable 1: Enable Others: B connector	0	-	Real-time
P4-41	0x6429	Brake test duration	0.20 to 30.00	0.30	s	Real-time
P4-42	0x642A	Max. verification torque for brake test	0.0 to 200.0	10.0	%	Real-time
P4-43	0x642B	Torque direction of braking test	0: Not reversed 1: Reverse Others: B connector	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
P4-44	0x642C	Slip speed threshold of braking test	0.00 to 30.00	0.10	%	Real-time
P4-45	0x642D	Slip speed duration in braking test	0.000 to 10.000	0.004	s	Real-time

10.13.6 Pd Basic Parameters of Tension Control

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
Pd-00	0x6D00	Tension control mode	0: Disabled 1: Open loop torque control 2: Closed loop speed control 3: Closed loop torque control 4: Constant linear speed control	0	-	Change at stop
Pd-01	0x6D01	Winding mode	0: Winding 1: Unwinding	0	-	Real-time
Pd-02	0x6D02	Unwinding reverse tightening selection	0.0 to 500.0	0.0	m/min	Real-time
Pd-03	0x6D03	Mechanical transmission ratio	0.01 to 300.00	1.00	-	Real-time
Pd-04	0x6D04	Linear speed input source	0: Digital setting (PD-05) 1: AI1 2: AI2 4: Pulse input (DI7) 5: Communication (1000H)	0	-	Change at stop
Pd-05	0x6D05	Digital setting of linear speed input	0.0 to PD-06	0.0	m/min	Real-time
Pd-06	0x6D06	Maximum linear speed	0.0 to 6500.0	1000.0	m/min	Real-time
Pd-07	0x6D07	Minimum linear speed for roll diameter calculation	0.0 to PD-06	20.0	m/min	Real-time
Pd-08	0x6D08	Roll diameter not calculated in jogging	0: Disable 1: Enable	0	-	Change at stop
Pd-09	0x6D09	Roll diameter calculation method	0: Calculated based on linear speed 1:Calculated based on cumulative thickness 2: AI1 3: AI2 5: Pulse input (DI7) 6: Communication 7: PD-16	0	-	Change at stop
Pd-10	0x6D0A	Maximum roll diameter	PD-11 to 6000.0	500.0	mm	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
Pd-11	0x6D0B	Empty roll diameter	0.1 to PD-10	100.0	mm	Real-time
Pd-12	0x6D0C	Initial roll diameter source	0: PD-13 to PD-15 1: AI1 2: AI2 4: Communication (1000H)	0	-	Change at stop
Pd-13	0x6D0D	Initial roll diameter 1	PD-11 to PD-10	100.0	mm	Real-time
Pd-14	0x6D0E	Initial roll diameter 2	PD-11 to PD-10	100.0	mm	Real-time
Pd-15	0x6D0F	Initial roll diameter 3	PD-11 to PD-10	100.0	mm	Real-time
Pd-16	0x6D10	Current roll diameter	PD-11 to PD-10	100.0	mm	Real-time
Pd-17	0x6D11	Roll diameter not reset upon stop	0: Disable 1: Enable	0	-	Real-time
Pd-18	0x6D12	Roll diameter filter time	0.00 to 10.00	5.00	s	Real-time
Pd-19	0x6D13	Roll diameter change rate	0.0 to 1000.0	0.0	-	Real-time
Pd-20	0x6D14	Roll diameter change direction limit	0: Disabled 1: Decrease disabled during winding, and increase disabled during unwinding	0	-	Real-time
Pd-21	0x6D15	Roll diameter reset allowed during running	0 to 1	0	-	Real-time
Pd-22	0x6D16	Pre-drive speed gain	-100.0 to 200.0	0.0	%	Real-time
Pd-23	0x6D17	Pre-drive torque limit source	0: Set based on d1-09 to d1-12 1: Set based on tension control torque	1	-	Change at stop
Pd-24	0x6D18	Pre-drive torque correction	-100.0 to 100.0	0.0	%	Real-time
Pd-26	0x6D1A	Pre-drive acceleration time	0.0 to 6000.0	20.0	s	Real-time
Pd-27	0x6D1B	Pre-drive deceleration time	0.0 to 6000.0	20.0	s	Real-time
Pd-28	0x6D1C	Minimum pre-drive torque limit	0.0 to 100.0	0.0	-	Real-time
Pd-29	0x6D1D	Pre-drive roll diameter calculation function	0 to 1	0	-	Real-time
Pd-30	0x6D1E	Tension frequency limit	0.0 to 100.0	50.0	%	Real-time
Pd-31	0x6D1F	Tension frequency limit offset	0.00 to 100.00	5.00	Hz	Real-time
Pd-32	0x6D20	Tension frequency limit enable	0: Disable 1: Enable	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
Pd-33	0x6D21	Closed-loop tension torque mode selection	0: Torque calculated through PID only 1: Torque calculated through main + PID	0	-	Change at stop
Pd-34	0x6D22	Tension closed-loop torque limit	0.0 to 200.0	100.0	%	Real-time
Pd-35	0x6D23	Pulses per revolution	1 to 60000	1	-	Real-time
Pd-36	0x6D24	Revolutions per layer	1 to 10000	1	-	Real-time
Pd-37	0x6D25	Material thickness setting source	0: Digital setting 1: AI12: AI2	0	-	Change at stop
Pd-38	0x6D26	Material thickness 0	0.01 to 100.00	1	mm	Real-time
Pd-39	0x6D27	Material thickness 1	0.01 to 100.00	1	mm	Real-time
Pd-40	0x6D28	Material thickness 2	0.01 to 100.00	1	mm	Real-time
Pd-41	0x6D29	Material thickness 3	0.01 to 100.00	1	mm	Real-time
Pd-42	0x6D2A	Maximum thickness	0.01 to 100.00	1.00	mm	Real-time
Pd-44	0x6D2C	Constant linear speed source selection	0: Digital setting (PD-45) 1: AI1 2: AI2 4: Pulse reference (DI7) 5: Communication (1000H)	0	-	Change at stop
Pd-45	0x6D2D	Digital setting of constant linear speed input	0.0 to PD-06	0.0	m/min	Real-time
Pd-46	0x6D2E	Tension control speed limit offset	0.00 to A2-17	0.00	Hz	Real-time
Pd-47	0x6D2F	Tension control torque mode	0: Bidirectional offset1: Unidirectional offset	1	-	Change at stop
Pd-48	0x6D30	Cable drum application mode	0: Horizontal cable drum application1 : Vertical cable drum application	0	-	Change at stop
Pd-49	0x6D31	Pulse counting mode	0: Calculated based on the winding/unwinding mode1: Calculated based on the motor operating direction	0	-	Change at stop
Pd-50	0x6D32	Unwinding compensation	0.0 to 100.0	0.0	%	Real-time
Pd-51	0x6D33	Min. tension for vertical cable drum applications	0 to PE-02	500	N	Real-time
Pd-52	0x6D34	Max. tension for vertical cable drum applications	PD-53 to 200.0	0.0	%	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
Pd-53	0x6D35	Min. tension for vertical cable drum applications	0.0 to PD-52	0.0	%	Real-time
Pd-54	0x6D36	Automatic material run-out detection	0: Disable 1: Enable	0	-	Change at stop
Pd-55	0x6D37	Min. linear speed of automatic material run-out detection	PD-07 to PD-06	20.0	-	Real-time
Pd-56	0x6D38	Error range of automatic material run-out detection	0.1 to 50.0	10.0	%	Real-time
Pd-57	0x6D39	Judgement delay of automatic material run-out detection	0.1 to 60.0	2.0	-	Real-time

10.13.7 PE Tension Setting Parameters

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
PE-00	0x6E00	Tension setting source	0: PE-01 setting 1: AI1 setting 2: AI2 setting 4: Pulse setting (DI7) 5: Communication setting (1000H)	0	-	Change at stop
PE-01	0x6E01	Tension digital setting	0 to PE-02	50	N	Real-time
PE-02	0x6E02	Maximum tension	0 to 65000	500	N	Real-time
PE-03	0x6E03	Zero speed threshold	0.0 to 20.0	0.0	%	Real-time
PE-04	0x6E04	Zero-speed tension rise	0.0 to 100.0	0.0	%	Real-time
PE-05	0x6E05	Frequency acceleration time in torque control mode	0.0 to 6500.0	0.0	s	Real-time
PE-06	0x6E06	Frequency deceleration time in torque control mode	0.0 to 6500.0	0.0	s	Real-time
PE-07	0x6E07	Friction force compensation	0.0 to 50.0	0.0	%	Real-time
PE-08	0x6E08	Mechanical inertia compensation coefficient	0 to 65535	0	$N \cdot m^2$	Real-time
PE-09	0x6E09	Correction of acceleration inertia compensation	0.0 to 200.0	100.0	%	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
PE-10	0x6E0A	Correction of deceleration inertia compensation	0.0 to 200.0	100.0	%	Real-time
PE-11	0x6E0B	Material density	0 to 65535	0	kg/m³	Real-time
PE-12	0x6E0C	Material width	0 to 65535	0	mm	Real-time
PE-13	0x6E0D	Inertia compensation exit delay	0 to 1000	0	ms	Real-time
PE-14	0x6E0E	Zero-speed compensation over-frequency	0.00 to 20.00	2.00	Hz	Real-time
PE-15	0x6E0F	Open-loop torque reversal	0: Disabled 1: Enabled	0	-	Real-time
PE-16	0x6E10	Friction force compensation correction coefficient	-50.0 to 50.0	0.0	-	Real-time
PE-17	0x6E11	Friction force compensation curve	0: Frequency 1: Linear speed 2: Multi-friction compensation curve 1 3: Multi-friction compensation curve 2	0	-	Change at stop
PE-18	0x6E12	Multi-friction force compensation torque 1	0.0 to 50.0	0.0	%	Real-time
PE-19	0x6E13	Multi-friction force compensation torque 2	0.0 to 50.0	0.0	%	Real-time
PE-20	0x6E14	Multi-friction force compensation torque 3	0.0 to 50.0	0.0	%	Real-time
PE-21	0x6E15	Multi-friction force compensation torque 4	0.0 to 50.0	0.0	%	Real-time
PE-22	0x6E16	Multi-friction force compensation torque 5	0.0 to 50.0	0.0	%	Real-time
PE-23	0x6E17	Multi-friction force compensation torque 6	0.0 to 50.0	0.0	%	Real-time
PE-24	0x6E18	Multi-friction force compensation inflection point 1	0.00 to A2-17	0.00	Hz	Real-time
PE-25	0x6E19	Multi-friction force compensation inflection point 2	0.00 to A2-17	0.00	Hz	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
PE-26	0x6E1A	Multi-friction force compensation inflection point 3	0.00 to A2-17	0.00	Hz	Real-time
PE-27	0x6E1B	Multi-friction force compensation inflection point 4	0.00 to A2-17	0.00	Hz	Real-time
PE-28	0x6E1C	Multi-friction force compensation inflection point 5	0.00 to A2-17	0.00	Hz	Real-time
PE-29	0x6E1D	Multi-friction force compensation inflection point 6	0.00 to A2-17	0.00	Hz	Real-time
PE-30	0x6E1E	Tension setup	0: Disable 1: Enable	0	-	Change at stop
PE-31	0x6E1F	Tension setup dead zone	0.0 to 100.0	2.0	%	Real-time
PE-32	0x6E20	Tension setup frequency	0.00 to A2-17	0.10	Hz	Real-time
PE-33	0x6E21	Terminal torque boost proportion	0.0 to 500.0	50.0	%	Real-time
PE-34	0x6E22	Terminal torque boost cancellation time	0.0 to 50.0	0.0	s	Real-time
PE-35	0x6E23	Reel diameter auto-tuning coefficient	0 to 60000	100	%	Real-time
PE-36	0x6E24	Initial roll diameter auto-tuning	0: Disable 1: Enable	0	-	Change at stop
PE-37	0x6E25	Rod length	1 to 65535	300	mm	Change at stop
PE-38	0x6E26	Rod angle	0.1 to 360.0	40.0	°	Change at stop
PE-39	0x6E27	Swing rod angle auto-tuning for reel diameter	0.0 to 100.0	50.0	%	Real-time
PE-40	0x6E28	Acceleration/ deceleration time of tension setup	0.0 to 60.0	10.0	s	Real-time
PE-41	0x6E29	Filter time of torque compensation	0 to 1000	20	-	Real-time
PE-42	0x6E2A	Torque compensation gain	0.0 to 6000.0	100.0	%	Real-time
PE-44	0x6E2C	Proportional gain KP1 for tension setup	0.0 to 1000.0	20.0	-	Real-time
PE-45	0x6E2D	Integral time Ti1 for tension setup	0.01 to 10.00	2.00	s	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
PE-46	0x6E2E	Derivative time Td1 for tension setup	0.000 to 10.000	0.000	s	Real-time
PE-47	0x6E2F	Linear speed zero-crossing judgement	0.0 to 100.0	0.0	-	Real-time
PE-48	0x6E30	Minimum frequency of tension setup (under maximum reel diameter)	0.00 to A2-17	0.10	Hz	Real-time
PE-49	0x6E31	Torque compensation effective time	0.00 to 655.00	2.00	s	Real-time
PE-50	0x6E32	Minimum torque compensation gain	0.0 to 6000.0	100.0	%	Real-time
PE-51	0x6E33	Proportional gain KP1 for emergency stop	0.0 to 1000.0	20.0	-	Real-time
PE-52	0x6E34	Integral time Ti1 for emergency stop	0.01 to 10.00	2.00	s	Real-time
PE-53	0x6E35	Derivative time Td1 for emergency stop	0.000 to 10.000	0.000	s	Real-time
PE-54	0x6E36	PI function selection for emergency stop	0 to 1	0	-	Real-time

10.13.8 PF Tension Setting Parameter + Taper Setting Parameter

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
PF-00	0x6F00	Taper curve	0: Curve 1: Multi taper	0	-	Change at stop
PF-01	0x6F01	Setting source of tension taper	0: PF-02 1: AI1 2: AI2 4: Communication (1000H)	0	-	Change at stop
PF-02	0x6F02	Taper digital setting	0.0 to 100.0	0.0	%	Real-time
PF-03	0x6F03	Taper compensation change	0 to 10000	0	mm	Real-time
PF-05	0x6F05	Setting channel of external taper AO	Same as PF-01	0	-	Change at stop
PF-06	0x6F06	External taper setting	0.0 to 100.0	100.0	%	Real-time
PF-08	0x6F08	Minimum roll diameter taper	0.0 to 100.0	100.0	%	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
PF-09	0x6F09	Linear taper switchover point 1	PD-11~PF-11	150.0	mm	Real-time
PF-10	0x6F0A	Taper of switchover point 1	0.0 to 100.0	100.0	%	Real-time
PF-11	0x6F0B	Linear taper switchover point 2	PF-09~PF-13	200.0	mm	Real-time
PF-12	0x6F0C	Taper of switchover point 2	0.0 to 100.0	90.0	%	Real-time
PF-13	0x6F0D	Linear taper switchover point 3	PF-11~PF-15	250.0	mm	Real-time
PF-14	0x6F0E	Taper of switchover point 3	0.0 to 100.0	80.0	%	Real-time
PF-15	0x6F0F	Linear taper switchover point 4	PF-13~PF-17	300.0	mm	Real-time
PF-16	0x6F10	Taper of switchover point 4	0.0 to 100.0	70.0	%	Real-time
PF-17	0x6F11	Linear taper switchover point 5	PF-15~PD-10	400.0	mm	Real-time
PF-18	0x6F12	Taper of switchover point 5	0.0 to 100.0	50.0	%	Real-time
PF-19	0x6F13	Max. roll diameter taper	0.0 to 100.0	30.0	-	Real-time
PF-30	0x6F1E	Roll diameter calculation based on the number of pulses	0: Invalid 1: Enabled 3: DI1 4: DI2 5: DI3 (active only for MD630S) 6: DI4 (active only for MD630S) 7: DI5 (active only for MD630S) 8: DI6 (active only for MD630S) 9: DI7 (active only for MD630S)	0	-	Real-time
PF-31	0x6F1F	Roll diameter reset	Same as PF-30	0	-	Real-time
PF-32	0x6F20	Initial reel diameter source selection terminal 1	Same as PF-30	0	-	Real-time
PF-33	0x6F21	Initial reel diameter source selection terminal 2	Same as PF-30	0	-	Real-time
PF-34	0x6F22	Pre-charge	Same as PF-30	0	-	Real-time

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
PF-35	0x6F23	Winding/Unwinding switchover	Same as PF-30	0	-	Real-time
PF-36	0x6F24	Roll diameter calculation stopped	Same as PF-30	0	-	Real-time
PF-37	0x6F25	Exiting from tension mode	Same as PF-30	0	-	Real-time
PF-38	0x6F26	Terminal tension rise	Same as PF-30	0	-	Real-time
PF-39	0x6F27	Material thickness selection terminal 1	Same as PF-30	0	-	Real-time
PF-40	0x6F28	Material thickness selection terminal 2	Same as PF-30	0	-	Real-time
PF-41	0x6F29	Passive unwinding (cable drum application)	Same as PF-30	0	-	Real-time
PF-42	0x6F2A	Emergency stop - Tension torque compensation enable	Same as PF-30	0	-	Real-time

10.14 U Common Monitoring

10.14.1 U0: General Monitoring Parameter 0

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U0-00	0x7000	Operating frequency	0.00 to 600.00	0.00	Hz	Unchangeable
U0-01	0x7001	Frequency reference	0.00 to 600.00	0.00	Hz	Unchangeable
U0-02	0x7002	Bus voltage	0.0 to 6553.5	0.0	V	Unchangeable
U0-03	0x7003	Output voltage	0 to 65535	0	V	Unchangeable
U0-04	0x7004	Output current	0.00 to 655.35	0.00	A	Unchangeable
U0-05	0x7005	Output power	-3276.8 to 3276.7	0.0	kW	Unchangeable
U0-06	0x7006	output torque	-3276.8 to 3276.7	0.0	%	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U0-07	0x7007	DI state	bit0: DI1 state bit1: DI2 state bit2: DI3 state (active only for MD630S) bit3: DI4 state (active only for MD630S) bit4: DI5 state (active only for MD630S) bit5: DI6 state (active only for MD630S) bit6: DI7 state (active only for MD630S) Bit 7: Reserved bit8: Reserved bit9: Reserved bit10: VDO1 state bit11: VDO2 state bit12: VDO3 state bit13: VDO4 state bit14: VDO5 state bit15: VDO6 state bit0 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
U0-08	0x7008	DO state	Same as U0-07	0x0	-	Unchangeable
U0-09	0x7009	AI1 voltage	-10.570 to 10.570	0.000	V	Unchangeable
U0-10	0x700A	AI2 voltage	-10.570 to 10.570	0.000	V	Unchangeable
U0-14	0x700E	Load speed display	0 to 65535	0	rpm	Unchangeable
U0-15	0x700F	PID setting	-32768 to 32767	0	-	Unchangeable
U0-16	0x7010	PID feedback	-32768 to 32767	0	-	Unchangeable
U0-17	0x7011	PLC stage	0 to 65535	0	-	Unchangeable
U0-18	0x7012	HDI input pulse frequency	0.00 to 20.00	0.00	kHz	Unchangeable
U0-19	0x7013	Actual motor frequency	-327.67 to 327.67	0.00	Hz	Unchangeable
U0-20	0x7014	Remaining running time	0.0 to 6553.5	0.0	min.	Unchangeable
U0-21	0x7015	AI1 voltage before correction	-10.570 to 10.570	0.000	V	Unchangeable
U0-22	0x7016	AI2 voltage before correction	-10.570 to 10.570	0.000	V	Unchangeable
U0-24	0x7018	Motor speed actual value	0 to 65535	0	rpm	Unchangeable
U0-25	0x7019	Current power-on time	0 to 65535	0	min.	Unchangeable
U0-26	0x701A	Current running time	0.0 to 6553.5	0.0	min.	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U0-28	0x701C	Communication setpoint	-300.00 to 300.00	0.00	%	Unchangeable
U0-29	0x701D	Encoder feedback speed	-500.00 to 500.00	0.00	Hz	Unchangeable
U0-30	0x701E	Digital setting of main frequency	-327.68 to 327.67	0.00	Hz	Unchangeable
U0-31	0x701F	Digital setting of auxiliary frequency	-327.68 to 327.67	0.00	Hz	Unchangeable
U0-34	0x7022	Actual motor torque	0.0 to 6553.5	0.0	N·m	Unchangeable
U0-35	0x7023	Target torque	-200.0 to 200.0	0.0	%	Unchangeable
U0-37	0x7025	Power factor angle	-3276.8 to 3276.7	0.0	°	Unchangeable
U0-39	0x7027	Target voltage upon V/f separation	0 to 65535	0	V	Unchangeable
U0-40	0x7028	Output voltage upon V/f separation	0 to 65535	0	V	Unchangeable
U0-41	0x7029	Output current	0.00 to 65535.00	0.00	%	Unchangeable
U0-44	0x702C	Current error code	0.0 to 65535.0	0.0	-	Unchangeable
U0-45	0x702D	Fault Code	0.0 to 6553.5	0.0	-	Unchangeable
U0-46	0x702E	Minor fault code	0.0 to 6553.5	0.0	-	Unchangeable
U0-47	0x702F	Alarm code	0.0 to 6553.5	0.0	-	Unchangeable
U0-48	0x7030	Prompt code	0.0 to 6553.5	0.0	-	Unchangeable
U0-49	0x7031	Set fan speed	0 to 65535	0	rpm	Unchangeable
U0-50	0x7032	Actual fan speed	-32768 to 32767	0	rpm	Unchangeable
U0-51	0x7033	Channel 1 simple UP/ DOWN key output	-327.68 to 327.67	0.00	Hz	Unchangeable
U0-52	0x7034	Internal temperature of the fan chip	0 to 65535	0	-	Unchangeable
U0-53	0x7035	Encoder position feedback (high-order 16 bits)	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-54	0x7036	Encoder position feedback (low-order 16 bits)	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-55	0x7037	High-order 16 bits of encoder cumulative pulses	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-56	0x7038	Middle/High-order 16 bits of cumulative encoder pulses	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-57	0x7039	Low/Middle-order 16 bits of cumulative encoder pulses	0x0 to 0xFFFF	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U0-58	0x703A	Low-order 16 bits of cumulative encoder pulses	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-59	0x703B	Frequency reference (%)	-3276.8 to 3276.7	0.0	%	Unchangeable
U0-60	0x703C	Operating frequency (%)	-3276.8 to 3276.7	0.0	%	Unchangeable
U0-61	0x703D	AC drive state 1	1: Forward running 2: Reverse running 3: At stop 4: Auto-tuning 5: Faulty	0	-	Unchangeable
U0-62	0x703E	Channel 2 simple UP/ DOWN key output	-327.68 to 327.67	0.00	Hz	Unchangeable
U0-65	0x7041	Torque Upper Limit	-2000.0 to 2000.0	0.0	%	Unchangeable
U0-68	0x7044	Drive state 2	Bit 0: Running status 0: Stop 1: Operating bit1: Running direction 0: Forward run 1: Reverse run bit2: Fault state 0: No fault 1: Fault present bit3: Target frequency reach 0: Not reached 1: Reached bit4: Reserved; bit5: Reserved bit6: Reserved Bit 7: Reserved Bits 8 to Bit 15: Fault codes	0x0	-	Unchangeable
U0-69	0x7045	Actual motor frequency (signed)	-327.67 to 327.67	0.00	Hz	Unchangeable
U0-70	0x7046	Actual motor speed (signed)	-32768 to 32767	0	rpm	Unchangeable
U0-71	0x7047	Output current (one decimal place)	0.0 to 6553.5	0.0	A	Unchangeable
U0-75	0x704B	Actual motor frequency (unsigned)	0.00 to 655.35	0.00	Hz	Unchangeable
U0-76	0x704C	Low bits of accumulative power consumption	0.0 to 6553.5	0.0	kWh	Unchangeable
U0-77	0x704D	High bits of accumulative power consumption	0 to 65535	0	kWh	Unchangeable
U0-82	0x7052	Module temperature	-20.0 to 120.0	0.0	℃	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U0-83	0x7053	Ambient temperature	-20.0 to 120.0	0.0	℃	Unchangeable
U0-84	0x7054	Load type	0: High-load application 1: Light-load application	0	-	Unchangeable
U0-85	0x7055	Auto-tuning and self-test procedures	0 to 65535	0	-	Unchangeable
U0-86	0x7056	Proportional coefficient of the speed loop	0.00 to 655.35	0.00	-	Unchangeable
U0-87	0x7057	Integral coefficient of the speed loop	0.00 to 655.35	0.00	-	Unchangeable
U0-90	0x705A	AI2 temperature mode - motor temperature value	-50 to 300	0	℃	Unchangeable
U0-92	0x705C	Conversion result of encoder pulse unit (high-order 16 bits)	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-93	0x705D	Conversion result of encoder pulse unit (low-order 16 bits)	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-94	0x705E	Motor rotation count (high-order 16 bits)	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-95	0x705F	Motor rotation count (low-order 16 bits)	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-96	0x7060	Motor real-time angle	0.00 to 65535.00	0.00	°	Unchangeable
U0-97	0x7061	U-phase current (RMS value)	0.00 to 655.35	0.00	%	Unchangeable
U0-98	0x7062	V-phase current (RMS value)	0.00 to 655.35	0.00	%	Unchangeable
U0-99	0x7063	W-phase current (RMS value)	0.00 to 655.35	0.00	%	Unchangeable

10.14.2 U1 Monitoring parameters 1

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U1-05	0x7105	Input value of AI1 curve	-327.68 to 327.67	0.00	V	Unchangeable
U1-06	0x7106	Input value of AI2 curve	-327.68 to 327.67	0.00	V	Unchangeable
U1-08	0x7108	AO output	-327.68 to 327.67	0.00	V	Unchangeable
U1-10	0x710A	AO output (after correction curve)	-327.680 to 32.767	0.000	V	Unchangeable
U1-12	0x710C	AO current mode	-327.68 to 327.67	0.00	mA	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U1-14	0x710E	Defines the frequency per-unit value after display source is selected for HDO.	-327.68 to 327.67	0.00	%	Unchangeable
U1-15	0x710F	Defines the frequency per-unit value before correction of HDO curve	-327.68 to 327.67	0.00	%	Unchangeable
U1-16	0x7110	Defines the final frequency per-unit value of HDO	-327.68 to 327.67	0.00	%	Unchangeable
U1-17	0x7111	Defines the actual frequency outputted finally by HDO.	0.00 to 655.35	0.00	kHz	Unchangeable
U1-41	0x7129	I/O expansion card 1-AI1 input	-32.767 to 32.767	0.000	V	Unchangeable
U1-42	0x712A	I/O expansion card 1-AI1 curve input value	-327.67 to 327.67	0.00	V	Unchangeable
U1-43	0x712B	I/O expansion card 1-AO output	-327.67 to 327.67	0.00	V	Unchangeable
U1-45	0x712D	I/O expansion card 1-RTD temperature value	-50.0 to 300.0	0.0	℃	Unchangeable
U1-51	0x7133	I/O expansion card 1 -AI1 input	-32.767 to 32.767	0.000	V	Unchangeable
U1-52	0x7134	I/O expansion card 2-AI1 curve input value	-327.67 to 327.67	0.00	V	Unchangeable
U1-53	0x7135	I/O expansion card 2-AO output	-327.67 to 327.67	0.00	V	Unchangeable
U1-55	0x7137	I/O expansion card 2-RTD temperature value	-50.0 to 300.0	0.0	℃	Unchangeable

10.14.3 U2 Monitoring parameters 2

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U2-00	0x7200	Current motor parameter group	0: Motor parameter group 1 1: Motor parameter group 2 2: Motor parameter group 3 3: Motor parameter group 4	0	-	Unchangeable
U2-01	0x7201	Current control channel	0: Control channel 1 1: Control channel 2	0	-	Unchangeable
U2-02	0x7202	Current reference channel	0: Reference channel 1 1: Reference channel 2	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U2-03	0x7203	Current stop mode	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop	0	-	Unchangeable
U2-05	0x7205	Current multi-reference selection	0 to 65535	0	-	Unchangeable
U2-06	0x7206	Current multi-reference effective value	-3276.8 to 3276.7	0.0	%	Unchangeable
U2-07	0x7207	Current running mode	0: Operating improperly 1: Jog	0	-	Unchangeable
U2-08	0x7208	Current jog source	0: Jog Source 1 1: Jog Source 2	0	-	Unchangeable
U2-09	0x7209	Current control mode	0: Speed control mode 1: Torque control mode 2: Position mode (Reserved)	0	-	Unchangeable
U2-10	0x720A	Effective carrier frequency	0 to 65535	0	Hz	Unchangeable
U2-11	0x720B	Local/remote	0: Remote 1: Local	0	-	Unchangeable
U2-18	0x7212	Jump frequency flag	0 to 65535	0	-	Unchangeable
U2-19	0x7213	Self-test/Auto-tuning pre-state	0: Invalid 1: Waiting for auto-tuning 2: Waiting for self-check 3: Forced DC braking	0	-	Unchangeable
U2-20	0x7214	Self-test/Auto-tuning request	0 to 65535	0	-	Unchangeable
U2-21	0x7215	Self-test/Auto-tuning completed	0 to 65535	0	-	Unchangeable
U2-22	0x7216	Current items auto-tuned/tested upon power-on	0 to 65535	0	-	Unchangeable
U2-23	0x7217	Decelerate to stop/DC braking	0 to 65535	0	-	Unchangeable
U2-24	0x7218	Immediate DC braking of DI	0: Invalid 1: Immediate DC injection braking 2: Deceleration DC injection braking	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U2-25	0x7219	Fault and limit severity	bit0: Coast to stop bit1: Stop at maximum capability bit2: Quick stop bit3: Decelerate to stop bit4 to bit8: Reserved bit9: Limited operation bit10 (Warning output) bit11: Prompt bit0~bit11: 0: Invalid 1: Enabled Bit 12 to bit15: Reserved	0x0	-	Unchangeable
U2-26	0x721A	Fault automatic reset and restart step	0 to 65535	0	-	Unchangeable
U2-27	0x721B	Automatic reset command flag for communication fault	0: Invalid 1: Enabled	0	-	Unchangeable
U2-35	0x7223	Undervoltage fault flag bit	Same as U2-27	0	-	Unchangeable
U2-36	0x7224	Fault restart clear command	0 to 65535	0	-	Unchangeable
U2-37	0x7225	Torque control frequency offset mode	0 to 65535	0	-	Unchangeable
U2-38	0x7226	Separated V/f RFG clear command	Same as U2-27	0	-	Unchangeable
U2-39	0x7227	Separated V/f selection	Same as U2-27	0	-	Unchangeable
U2-40	0x7228	Stop frequency control for separated V/f	Same as U2-27	0	-	Unchangeable
U2-41	0x7229	RFG performance forcing enable	Same as U2-27	0	-	Unchangeable
U2-42	0x722A	RFG acceleration/ deceleration state	0 to 65535	0	-	Unchangeable
U2-43	0x722B	RFG arc state	0 to 65535	0	-	Unchangeable
U2-44	0x722C	Active RFG selection	0: Ramp 1 1: Ramp 2 2: Ramp 3 3: Ramp 4	0	-	Unchangeable
U2-45	0x722D	Current additional torque 2 state	bit0: Setting channel 1 0: Invalid 1: Enabled bit1: Setting channel 2 0: Invalid 1: Enabled bit2 to bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U2-49	0x7231	Remaining running time view	0.0 to 6553.5	0.0	min.	Unchangeable
U2-50	0x7232	Change the decimal place flag according to the power parameter.	0.0 to 6553.5	0.0	-	Unchangeable
U2-51	0x7233	Wobble frequency acceleration/ deceleration timeout flag	0 to 65535	0	-	Unchangeable
U2-55	0x7237	Parameter record information 0	0 to 65535	0	-	Unchangeable

10.14.4 U3 Monitoring parameters 3

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U3-00	0x7300	LCD command word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-02	0x7302	IDS command word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-03	0x7303	Command used by commissioning software to obtain control permission	0 to 65535	0	-	Unchangeable
U3-07	0x7307	LED control word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-08	0x7308	Control word of the commissioning software	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-09	0x7309	SOP control word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-11	0x730B	LED command clear flag	0 to 65535	0	-	Unchangeable
U3-12	0x730C	SOP command clear flag	0 to 65535	0	-	Unchangeable
U3-13	0x730D	IDS command clear flag	0 to 65535	0	-	Unchangeable
U3-14	0x730E	Automatic reset command flag for communication fault	0 to 65535	0	-	Unchangeable
U3-16	0x7310	Communication speed setting value 2 (0x7310)	0 to 65535	0	-	Unchangeable
U3-17	0x7311	Communication setting control word 2 (0x7311)	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-18	0x7312	DO state setting (DO function setting source: communication)	0 to 65535	0	-	Unchangeable
U3-19	0x7313	AO1 output (AO1 function setting source: communication)	0 to 65535	0	-	Unchangeable
U3-21	0x7315	HDO output reference (HDO function option: communication)	0 to 65535	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U3-23	0x7317	Monitoring of communication speed setting value 1 (0x1000)	-32768 to 32767	0	-	Unchangeable
U3-24	0x7318	0x1000H decimal places set through communication	0 to 65535	0	-	Unchangeable
U3-28	0x731C	Communication status word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-29	0x731D	Communication error reset enable	0 to 65535	0	-	Unchangeable
U3-33	0x7321	Communication setting control word 1 (0x7321)	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-34	0x7322	IO expand card DO state setting (DO function setting source: communication)	0 to 65535	0	-	Unchangeable
U3-35	0x7323	Expansion card 1 AO1 output reference (AO1 function setting source: communication)	0 to 65535	0	-	Unchangeable
U3-36	0x7324	Expansion card 2 AO1 output reference (AO1 function setting source: communication)	0 to 65535	0	-	Unchangeable
U3-37	0x7325	Software tool control flag	0 to 65535	0	-	Unchangeable
U3-38	0x7326	Command channel command (last cycle)	0 to 65535	0	-	Unchangeable
U3-41	0x7329	Communication command clear flag	0 to 65535	0	-	Unchangeable
U3-50	0x7332	Fault code reading	0 to 65535	0	-	Unchangeable
U3-51	0x7333	Fault sub-code reading	0 to 65535	0	-	Unchangeable
U3-52	0x7334	Minor fault code reading	0 to 65535	0	-	Unchangeable
U3-53	0x7335	Minor fault sub-code reading	0 to 65535	0	-	Unchangeable
U3-54	0x7336	Warning code reading	0 to 65535	0	-	Unchangeable
U3-55	0x7337	Warning code reading	0 to 65535	0	-	Unchangeable
U3-56	0x7338	Prompt code reading	0 to 65535	0	-	Unchangeable
U3-57	0x7339	Prompt sub-code reading	0 to 65535	0	-	Unchangeable
U3-90	0x735A	Floating-point concatenator-to-monitoring parameter module A output	-32768 to 32767	0	-	Unchangeable
U3-91	0x735B	Floating-point concatenator-to-monitoring parameter module B output	-32768 to 32767	0	-	Unchangeable
U3-92	0x735C	Floating-point concatenator-to-monitoring parameter module C output	-32768 to 32767	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U3-93	0x735D	Floating-point concatenator-to-monitoring parameter module D output	-32768 to 32767	0	-	Unchangeable
U3-94	0x735E	Floating-point concatenator-to-monitoring parameter module E output	-32768 to 32767	0	-	Unchangeable
U3-95	0x735F	Floating-point concatenator-to-monitoring parameter module F output	-32768 to 32767	0	-	Unchangeable
U3-96	0x7360	Floating-point concatenator-to-monitoring parameter module G output	-32768 to 32767	0	-	Unchangeable
U3-97	0x7361	Floating-point concatenator-to-monitoring parameter module H output	-32768 to 32767	0	-	Unchangeable

10.14.5 U4 Monitoring parameters 4

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U4-00	0x7400	Supported mode (high bits of 6502H)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-01	0x7401	Supported mode (low bits of 6502H)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-02	0x7402	Fault code (603FH)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-03	0x7403	Control word (6040H)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-04	0x7404	Status word (6041H)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-05	0x7405	Target velocity (6042H)	-32768 to 32767	0	-	Unchangeable
U4-06	0x7406	Velocity demand (6043H)	-32768 to 32767	0	-	Unchangeable
U4-07	0x7407	Actual operating speed (6044H)	-32768 to 32767	0	-	Unchangeable
U4-08	0x7408	Minimum speed (high bits of 6046H-1)	0 to 65535	0	-	Unchangeable
U4-09	0x7409	Minimum speed (low bits of 6046H-1)	0 to 65535	0	-	Unchangeable
U4-10	0x740A	Maximum speed (high bits of 6046H-2)	0 to 65535	0	-	Unchangeable
U4-11	0x740B	Maximum speed (low bits of 6046H-2)	0 to 65535	0	-	Unchangeable
U4-12	0x740C	Acceleration setting (high bits of 6048H-1)	0 to 65535	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U4-13	0x740D	Acceleration setting (low bits of 6048H-1)	0 to 65535	0	-	Unchangeable
U4-14	0x740E	Acceleration time (6048H-2)	0 to 65535	0	-	Unchangeable
U4-15	0x740F	Deceleration setting (high bits of 6049H-1)	0 to 65535	0	-	Unchangeable
U4-16	0x7410	Deceleration setting (low bits of 6049H-1)	0 to 65535	0	-	Unchangeable
U4-17	0x7411	Deceleration time (6049H-2)	0 to 65535	0	-	Unchangeable
U4-18	0x7412	Stop mode upon emergency (605AH)	-32768 to 32767	0	-	Unchangeable
U4-19	0x7413	Shutdown option code (605BH)	-32768 to 32767	0	-	Unchangeable
U4-20	0x7414	Disable operation option code (605CH)	-32768 to 32767	0	-	Unchangeable
U4-23	0x7417	Modes of operation (6060H)	-32768 to 32767	0	-	Unchangeable
U4-24	0x7418	Modes of operation display (6061H)	-32768 to 32767	0	-	Unchangeable
U4-43	0x742B	Torque actual value (6077H)	-32768 to 32767	0	-	Unchangeable
U4-79	0x744F	Speed offset (high bits of 60B1H)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-80	0x7450	Speed offset (low bits of 60B1H)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-89	0x7459	DI status (high bits of 60FDH)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-90	0x745A	DI status (low bits of 60FDH)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-95	0x745F	Target speed (high bits of 60FFH)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-96	0x7460	Target speed (low bits of 60FFH)	0x0 to 0xFFFF	0x0	-	Unchangeable
U4-97	0x7461	VL - Acceleration time	0 to 65535	0	-	Unchangeable
U4-98	0x7462	VL - Deceleration time	0 to 65535	0	S	Unchangeable

10.14.6 U6 Monitoring parameters 6

Param.	Communication Address	Name	Range	Default	Unit	Change Mode
U6-00	0x7600	Actual motor speed	-3276.8 to 3276.7	0	%	Unchangeable
U6-01	0x7601	Final motor speed setting	-3276.8 to 3276.7	0	%	Unchangeable
U6-02	0x7602	RFG reference input	-3276.8 to 3276.7	0	%	Unchangeable
U6-03	0x7603	RFG calculation input	-3276.8 to 3276.7	0	%	Unchangeable
U6-04	0x7604	RFG actual target	-3276.8 to 3276.7	0	%	Unchangeable
U6-05	0x7605	RFG calculation output	-3276.8 to 3276.7	0	%	Unchangeable
U6-06	0x7606	RFG acceleration	-3276.8 to 3276.7	0	%	Unchangeable
U6-07	0x7607	Maximum forward frequency	-3276.8 to 3276.7	0	%	Unchangeable
U6-08	0x7608	Minimum forward frequency	-3276.8 to 3276.7	0	%	Unchangeable
U6-09	0x7609	Maximum reverse frequency	-3276.8 to 3276.7	0	%	Unchangeable
U6-10	0x760A	Minimum reverse frequency	-3276.8 to 3276.7	0	%	Unchangeable
U6-11	0x760B	Torque reference	-3276.8 to 3276.7	0	%	Unchangeable
U6-12	0x760C	Additional torque	-3276.8 to 3276.7	0	%	Unchangeable
U6-13	0x760D	Target set torque	-3276.8 to 3276.7	0	%	Unchangeable
U6-14	0x760E	Maximum forward torque	-3276.8 to 3276.7	0	%	Unchangeable
U6-15	0x760F	Maximum reverse torque	-3276.8 to 3276.7	0	%	Unchangeable
U6-16	0x7610	Drive overload cumulative value	-3276.8 to 3276.7	0	%	Unchangeable
U6-17	0x7611	Motor overload cumulative value	-3276.8 to 3276.7	0	%	Unchangeable
U6-20	0x7614	Controlled torque reference	-3276.8 to 3276.7	0	%	Unchangeable
U6-21	0x7615	Control flux setpoint	-3276.8 to 3276.7	0	%	Unchangeable
U6-22	0x7616	Exciting current reference	-3276.8 to 3276.7	0	%	Unchangeable
U6-23	0x7617	Torque current reference	-3276.8 to 3276.7	0	%	Unchangeable
U6-24	0x7618	Actual excitation current	-3276.8 to 3276.7	0	%	Unchangeable
U6-25	0x7619	Actual torque current	-3276.8 to 3276.7	0	%	Unchangeable
U6-33	0x7621	Drive bus voltage	-3276.8 to 3276.7	0	%	Unchangeable
U6-34	0x7622	Maximum output voltage	-3276.8 to 3276.7	0	%	Unchangeable
U6-35	0x7623	Output torque	-3276.8 to 3276.7	0	%	Unchangeable
U6-36	0x7624	Flux amplitude	-3276.8 to 3276.7	0	%	Unchangeable
U6-37	0x7625	Flux angle	-3276.8 to 3276.7	0	%	Unchangeable
U6-38	0x7626	Motor object output power	-3276.8 to 3276.7	0	%	Unchangeable

Param.	Communication Address	Name	Range	Default	Unit	Change Mode
U6-39	0x7627	Output power	-3276.8 to 3276.7	0	%	Unchangeable
U6-40	0x7628	Power factor angle	-3276.8 to 3276.7	0	%	Unchangeable
U6-51	0x7633	Encoder feedback speed	-3276.8 to 3276.7	0	%	Unchangeable
U6-52	0x7634	Encoder position	-3276.8 to 3276.7	0	%	Unchangeable
U6-55	0x7637	Angle before encoder correction	-3276.8 to 3276.7	0	%	Unchangeable
U6-56	0x7638	Encoder original angle	-3276.8 to 3276.7	0	%	Unchangeable
U6-57	0x7639	Non-filtered encoder speed	-3276.8 to 3276.7	0	%	Unchangeable
U6-58	0x763A	Filtered encoder speed	-3276.8 to 3276.7	0	%	Unchangeable
U6-59	0x763B	Z signal angle	-3276.8 to 3276.7	0	%	Unchangeable
U6-62	0x763E	STO fault exception flag	0 to 65535	0	-	Unchangeable
U6-63	0x763F	STO initialization flag	0 to 1	0	-	Unchangeable
U6-64	0x7640	STO status monitoring word	0 to 65535	0	-	Unchangeable
U6-65	0x7641	STO model	0 to 65535	0	-	Unchangeable
U6-66	0x7642	STO_1.2 V_AD sampling value	0 to 65535	0	-	Unchangeable
U6-67	0x7643	STO_5v_AD sampling value	0 to 65535	0	-	Unchangeable
U6-70	0x7646	Power-off time display	0 to 65535	0	-	Unchangeable
U6-71	0x7647	Address mapping enable state	0: Invalid 1: Valid	0	-	Unchangeable
U6-72	0x7648	User load curve enable	0: Invalid 1: Valid	0	-	Unchangeable
U6-73	0x7649	User load curve setting error flag	0 to 65535	0	-	Unchangeable
U6-74	0x764A	Multi-point curve setup error flag	bit0: Multi-point curve A 0: No error 1: Error present bit1: Multi-point curve B 0: No error 1: Error present bit2 to bit15: Reserved	0x0	-	Unchangeable
U6-76	0x764C	Power-on initialization completion flag	0 to 65535	0	-	Unchangeable
U6-77	0x764D	Model-related parameter update flag	0 to 65535	0	-	Unchangeable
U6-84	0x7654	Parameter setting exception prompt	0 to 65535	0	-	Unchangeable

Param.	Communication Address	Name	Range	Default	Unit	Change Mode
U6-85	0x7655	Macro parameter backup exception prompt	0 to 65535	0	-	Unchangeable
U6-86	0x7656	Backup parameter recovery failure flag	0 to 65535	0	-	Unchangeable

10.14.7 U8 General Monitoring Parameter 8

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U8-00	0x7800	Current state of brake control	0: Initialization 1: Disable 2: Applying 3: Applied 4: Release waiting 5: Releasing 6: Released 7: Apply waiting 8: Brake test	0	-	Unchangeable
U8-01	0x7801	Brake module control word	0 to 65535	0	-	Unchangeable
U8-02	0x7802	Status word of brake module	0 to 65535	0	-	Unchangeable
U8-03	0x7803	Status word for brake module ON uncompleted	0 to 65535	0	-	Unchangeable
U8-04	0x7804	Status word for brake module OFF uncompleted	0 to 65535	0	-	Unchangeable
U8-05	0x7805	Starting frequency enable state of brake module	0 to 65535	0	-	Unchangeable
U8-06	0x7806	Starting torque enable state of brake module	0 to 65535	0	-	Unchangeable
U8-07	0x7807	Brake feedback state during auto-tuning	0 to 65535	0	-	Unchangeable

10.14.8 U9: General Monitoring Parameter 9

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U9-00	0x7900	Linear speed	0.0 to 6553.5	0.0	m/min	Unchangeable
U9-01	0x7901	Current roll diameter	0.0 to 6553.5	0.0	mm	Unchangeable
U9-02	0x7902	Linear speed synchronization frequency	-327.68 to 327.67	0.00	Hz	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U9-03	0x7903	Closed loop speed output	-327.68 to 327.67	0.00	Hz	Unchangeable
U9-04	0x7904	Tension reference (before taper)	0 to 65535	0	N	Unchangeable
U9-05	0x7905	Tension reference (after taper)	0 to 65535	0	N	Unchangeable
U9-06	0x7906	Torque setting	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-07	0x7907	Closed loop torque output	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-08	0x7908	Tension control state machine	0 to 65535	0	-	Unchangeable
U9-09	0x7909	Closed loop tension (speed/torque) PID setting display	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-10	0x790A	Closed loop tension (speed/torque) PID feedback display	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-11	0x790B	Closed loop tension (speed/torque) PID proportional output	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-12	0x790C	Closed loop tension (speed/torque) PID integral output	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-13	0x790D	Closed loop tension (speed/torque) PID derivative output	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-14	0x790E	Tension process execution time	0 to 65535	0	-	Unchangeable
U9-15	0x790F	Winding mode	0 to 65535	0	-	Unchangeable
U9-16	0x7910	Tension torque setpoint	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-17	0x7911	Static friction torque	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-18	0x7912	Dynamic friction torque	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-19	0x7913	Inertia torque	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-20	0x7914	Terminal lift torque	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-21	0x7915	Torque upper limit in vertical cable drum application (calculated value)	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-22	0x7916	Torque lower limit in vertical cable drum application (calculated value)	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-23	0x7917	Torque upper limit in vertical cable drum application (actual value)	-3276.8 to 3276.7	0.0	%	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
U9-24	0x7918	Torque lower limit in vertical cable drum application (actual value)	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-25	0x7919	Closed loop tension (speed/torque) PID output	-3276.8 to 3276.7	0.0	%	Unchangeable
U9-26	0x791A	Linear acceleration	-32768 to 32767	0	-	Unchangeable

10.14.9 Ub General monitoring parameter 11

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
Ub-10	0x7B0A	Component lifetime alarm state output	0x0 to 0xFFFF	0x0	-	Unchangeable
Ub-12	0x7B0C	Displayed value of the predicted lifetime margin of the main circuit capacitor	0.00 to 100.00	0.00	%	Unchangeable
Ub-17	0x7B11	Displayed value of predicted lifetime margin of IGBT	0.00 to 100.00	0.00	%	Unchangeable
Ub-18	0x7B12	Remaining operating time of the fan predicted in real time (x 10 h) (display value)	0 to 65535	0	-	Unchangeable
Ub-19	0x7B13	Predicted lifetime margin of the fan (display value)	0.00 to 100.00	0.00	%	Unchangeable
Ub-96	0x7B60	Drive overload protection mode	0 to 65535	0	-	Unchangeable

10.15 L Connector

10.15.1 L00 Bit Connector 1

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0000	0x9000	Logic 0	0 to 1	0	-	Unchangeable
L0001	0x9001	Logic 1	0 to 1	0	-	Unchangeable
L0002	0x9002	DI1	0 to 1	0	-	Unchangeable
L0003	0x9003	DI2	0 to 1	0	-	Unchangeable
L0004	0x9004	5: DI3 (valid only for MD630S)	0 to 1	0	-	Unchangeable
L0005	0x9005	5: DI4 (valid only for MD630S)	0 to 1	0	-	Unchangeable
L0006	0x9006	5: DI5 (valid only for MD630S)	0 to 1	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0007	0x9007	5: DI6 (valid only for MD630S)	0 to 1	0	-	Unchangeable
L0008	0x9008	5: DI7 (valid only for MD630S)	0 to 1	0	-	Unchangeable
L0012	0x900C	VDI1	0 to 1	0	-	Unchangeable
L0013	0x900D	VDI2	0 to 1	0	-	Unchangeable
L0014	0x900E	VDI3	0 to 1	0	-	Unchangeable
L0015	0x900F	VDI4	0 to 1	0	-	Unchangeable
L0016	0x9010	VDI5	0 to 1	0	-	Unchangeable
L0017	0x9011	VDI6	0 to 1	0	-	Unchangeable
L0018	0x9012	DI1 negation	0 to 1	0	-	Unchangeable
L0019	0x9013	DI2 inversion	0 to 1	0	-	Unchangeable
L0020	0x9014	DI3 inversion (valid only for MD630S)	0 to 1	0	-	Unchangeable
L0021	0x9015	DI4 inversion (valid only for MD630S)	0 to 1	0	-	Unchangeable
L0022	0x9016	DI5 inversion (valid only for MD630S)	0 to 1	0	-	Unchangeable
L0023	0x9017	DI6 inversion (valid only for MD630S)	0 to 1	0	-	Unchangeable
L0024	0x9018	DI7 inversion (valid only for MD630S)	0 to 1	0	-	Unchangeable
L0028	0x901C	Opposite to VDI1	0 to 1	0	-	Unchangeable
L0029	0x901D	Opposite to VDI2	0 to 1	0	-	Unchangeable
L0030	0x901E	Opposite to VDI3	0 to 1	0	-	Unchangeable
L0031	0x901F	Opposite to VDI4	0 to 1	0	-	Unchangeable
L0032	0x9020	Opposite to VDI5	0 to 1	0	-	Unchangeable
L0033	0x9021	Opposite to VDI6	0 to 1	0	-	Unchangeable
L0034	0x9022	RO	0 to 1	0	-	Unchangeable
L0038	0x9026	DO	0 to 1	0	-	Unchangeable
L0042	0x902A	FMR (valid only for MD630S)	0 to 1	0	-	Unchangeable
L0044	0x902C	VDO1	0 to 1	0	-	Unchangeable
L0045	0x902D	VDO2	0 to 1	0	-	Unchangeable
L0046	0x902E	VDO3	0 to 1	0	-	Unchangeable
L0047	0x902F	VDO4	0 to 1	0	-	Unchangeable
L0048	0x9030	VDO5	0 to 1	0	-	Unchangeable
L0049	0x9031	VDO6	0 to 1	0	-	Unchangeable
L0050	0x9032	AI1 input limit exceeded	0: Not exceeded 1: Exceeded	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0051	0x9033	AI2 input limit violated	Same as L0050	0	-	Unchangeable
L0053	0x9035	HDI input wire breakage	0: Not disconnected 1: Disconnected	0	-	Unchangeable
L0054	0x9036	Level state of the AI1 used as DI	0: Low level 1: High level	0	-	Unchangeable
L0055	0x9037	Level state of the AI2 used as DI	Same as L0054	0	-	Unchangeable
L0057	0x9039	AI2 temperature mode - motor temperature arrival	0: Temperature not reached 1: Temperature reached	0	-	Unchangeable
L0058	0x903A	AI2 temperature mode - motor overtemperature	0: Overtemperature not occur 1: Overtemperature occur	0	-	Unchangeable
L0059	0x903B	AI2 temperature mode - Motor overtemperature pre-alarm	0: Overtemperature alarm not reported 1: Overtemperature pre-alarm reported	0	-	Unchangeable

10.15.2 L01 Bit Connector 2

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0100	0x9064	Ready to switch on	0: Not ready to switch on 1: Ready to switch on	0	-	Unchangeable
L0101	0x9065	Ready to run	Same as L0100	0	-	Unchangeable
L0102	0x9066	Operation	0: Not in operation 1: In operation	0	-	Unchangeable
L0103	0x9067	Fault activated	0: Not faulty1: Faulty	0	-	Unchangeable
L0104	0x9068	OFF2 (Coast to stop) flag	0: OFF2 (Coast to stop) valid 1: OFF2 (Coast to stop) invalid	0	-	Unchangeable
L0105	0x9069	OFF3 (Quick stop) flag	Same as L0104	0	-	Unchangeable
L0106	0x906A	Switch-on blocked	0: Switch-on allowed 1: Switch-on inhibited	0	-	Unchangeable
L0107	0x906B	Alarm/Minor fault activated	0: No alarm/minor fault 1: Alarms/minor faults occur.	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0108	0x906C	Actual speed following speed reference	0: There is no deviation between the reference and actual value. 1: The deviation between the reference and actual value is in the allowed range.	0	-	Unchangeable
L0109	0x906D	Local/remote	0: Local1: Remote	0	-	Unchangeable
L0110	0x906E	Target speed reached	0: Not reached 1: Reached	0	-	Unchangeable
L0111	0x906F	Torque limit reach	0: Torque/Current not limited 1: Torque/Current limited	0	-	Unchangeable
L0112	0x9070	Forward speed	0: Disable 1: Enable	0	-	Unchangeable
L0113	0x9071	Reverse speed	Same as L0112	0	-	Unchangeable
L0114	0x9072	Motor running flag	0: Stopped1 : Running (pulse output)	0	-	Unchangeable
L0116	0x9074	Low bit of current motor parameter group	0: Logic 0 1: Logic 1	0	-	Unchangeable
L0117	0x9075	High bit of current motor parameter group	Same as L0116	0	-	Unchangeable
L0118	0x9076	Current control channel	0: Control channel 1 1: Control channel 2	0	-	Unchangeable
L0119	0x9077	Current set channel	Same as L0118	0	-	Unchangeable
L0120	0x9078	Active terminal start/ stop module	0: Terminal start/stop module A 1: Terminal start/stop module B	0	-	Unchangeable
L0121	0x9079	Terminal control selection	Same as L0112	0	-	Unchangeable
L0122	0x907A	Torque control selection	Same as L0112	0	-	Unchangeable
L0123	0x907B	Speed control selection	Same as L0112	0	-	Unchangeable
L0124	0x907C	Position control selection	Same as L0112	0	-	Unchangeable
L0125	0x907D	Separated V/f selection	Same as L0112	0	-	Unchangeable
L0126	0x907E	RFG enable	0: Disable 1: Enable	0	-	Unchangeable
L0127	0x907F	RFG module operation	0: Stopped1: Operating	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0132	0x9084	Error output	0: No error is reported. 1: Errors are reported.	0	-	Unchangeable
L0133	0x9085	Error output (undervoltage fault excluded)	Same as L0132	0	-	Unchangeable
L0134	0x9086	Fault output	0: A fault occurs and the relay is invalid during automatic reset. 1: A fault occurs and the relay is valid during automatic reset.	0	-	Unchangeable
L0135	0x9087	Stop at fault	Same as L0112	0	-	Unchangeable
L0136	0x9088	Normal operation	0: Abnormal operation 1: Normal operation	0	-	Unchangeable
L0137	0x9089	Jog	0: Normal operation 1: Jogging	0	-	Unchangeable
L0138	0x908A	Decelerate-to-stop state	0: Disable 1: Deceleration to stop	0	-	Unchangeable
L0141	0x908D	Self testing	0: Invalid 1: Self-check in progress	0	-	Unchangeable
L0142	0x908E	Auto-tuning state	0: Invalid 1: Auto-tuning in progress	0	-	Unchangeable
L0152	0x9098	Operating at zero speed (inactive at stop)	Same as L0112	0	-	Unchangeable
L0153	0x9099	Operating at zero speed (active at stop)	Same as L0112	0	-	Unchangeable
L0156	0x909C	Reverse running	0: Invalid 1: Reverse run	0	-	Unchangeable
L0157	0x909D	Wobble frequency limited	0: Unlimited 1: Limited	0	-	Unchangeable
L0158	0x909E	Torque limit state	Same as L0157	0	-	Unchangeable
L0159	0x909F	Motor speed positive	0: Reverse1: Forward	0	-	Unchangeable
L0160	0x90A0	Motor speed negative	Same as L0159	0	-	Unchangeable
L0161	0x90A1	Starting frequency forced RFG	0: Not Forced 1: Forced	0	-	Unchangeable
L0162	0x90A2	Stop at frequencies lower than lower limit/starting frequency	0: Inactive 1: Active	0	-	Unchangeable
L0163	0x90A3	Coast to stop at frequencies lower than lower limit	Same as L0162	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0164	0x90A4	Power dip ride-through deceleration and clear	Same as L0162	0	-	Unchangeable
L0165	0x90A5	Decelerate to stop upon power dip ride-through	Same as L0162	0	-	Unchangeable
L0171	0x90AB	MD-IP-S acquire control	0: Not acquired 1: acquired	0	-	Unchangeable
L0172	0x90AC	Internal USB mode	Same as L0162	0	-	Unchangeable
L0174	0x90AE	Bus undervoltage state	0: Abnormal bus voltage 1: Normal bus voltage	0	-	Unchangeable
L0175	0x90AF	Excessive speed deviation	0: Invalid 1: Excessive motor speed deviation	0	-	Unchangeable
L0176	0x90B0	Motor overspeed	0: Invalid 1: Motor overspeed	0	-	Unchangeable
L0177	0x90B1	Overcurrent	0: Invalid 1: Overcurrent	0	-	Unchangeable
L0178	0x90B2	Bus overvoltage	0: Invalid 1: Bus overvoltage	0	-	Unchangeable
L0179	0x90B3	Bus undervoltage	0: Invalid 1: Bus undervoltage	0	-	Unchangeable
L0180	0x90B4	Motor pre-overload	0: Invalid 1: Motor pre-overload activated	0	-	Unchangeable
L0181	0x90B5	Motor overload fault	0: Invalid 1: Bus overvoltage	0	-	Unchangeable
L0182	0x90B6	AC drive pre-overload	0: Invalid 1: Drive pre-overload	0	-	Unchangeable
L0183	0x90B7	AC drive overload	0: Invalid 1: AC drive overload	0	-	Unchangeable
L0185	0x90B9	Motor overtemperature	0: Invalid 1: Motor overheat	0	-	Unchangeable
L0186	0x90BA	Drive pre-overtemperature	0: Invalid 1: Drive pre-overtemperature	0	-	Unchangeable
L0187	0x90BB	Drive overtemperature	0: Invalid 1: Drive overtemperature	0	-	Unchangeable
L0188	0x90BC	Input phase loss	0: Invalid 1: Input phase loss	0	-	Unchangeable
L0189	0x90BD	Output phase loss	0: Invalid 1: Output phase loss	0	-	Unchangeable
L0190	0x90BE	Motor stall	0: Invalid 1: Motor stall	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0192	0x90C0	Motor disconnected	0: Invalid 1: Motor disconnected	0	-	Unchangeable
L0193	0x90C1	Communication error	0: Invalid 1: Communication error	0	-	Unchangeable
L0195	0x90C3	External fault 1	0: Invalid 1: External fault 1	0	-	Unchangeable
L0196	0x90C4	External fault 2	0: Invalid 1: External fault 2	0	-	Unchangeable
L0197	0x90C5	User-defined fault 1	0: Invalid 1: User-defined fault 1	0	-	Unchangeable
L0198	0x90C6	User-defined fault 2	0: Invalid 1: User-defined fault 2	0	-	Unchangeable

10.15.3 L02 Bit Connector 3

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0200	0x90C8	STO output	0: Disable 1: Enable	0	-	Unchangeable
L0208	0x90D0	Input PZD word-to-bit. bit 0	0 to 65535	0	-	Unchangeable
L0209	0x90D1	Input PZD word-to-bit. bit 1	0 to 65535	0	-	Unchangeable
L0210	0x90D2	Input PZD word-to-bit. bit 2	0 to 65535	0	-	Unchangeable
L0211	0x90D3	Input PZD word-to-bit. bit 3	0 to 65535	0	-	Unchangeable
L0212	0x90D4	Input PZD word-to-bit. bit 4	0 to 65535	0	-	Unchangeable
L0213	0x90D5	Input PZD word-to-bit. bit 5	0 to 65535	0	-	Unchangeable
L0214	0x90D6	Input PZD word-to-bit. bit 6	0 to 65535	0	-	Unchangeable
L0215	0x90D7	Input PZD word-to-bit. bit 7	0 to 65535	0	-	Unchangeable
L0216	0x90D8	Input PZD word-to-bit. bit 8	0 to 65535	0	-	Unchangeable
L0217	0x90D9	Input PZD word-to-bit. bit 9	0 to 65535	0	-	Unchangeable
L0218	0x90DA	Input PZD word-to-bit. bit 10	0 to 65535	0	-	Unchangeable
L0219	0x90DB	Input PZD word-to-bit. bit 11	0 to 65535	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0220	0x90DC	Input PZD word-to-bit. bit 12	0 to 65535	0	-	Unchangeable
L0221	0x90DD	Input PZD word-to-bit. bit 13	0 to 65535	0	-	Unchangeable
L0222	0x90DE	Input PZD word-to-bit. bit 14	0 to 65535	0	-	Unchangeable
L0223	0x90DF	Input PZD word-to-bit. bit 15	0 to 65535	0	-	Unchangeable
L0244	0x90F4	Power-on time reach	0: Not reached 1: Reached	0	-	Unchangeable
L0245	0x90F5	Operating time reached	Same as L0244	0	-	Unchangeable
L0246	0x90F6	Timing duration reach	Same as L0244	0	-	Unchangeable
L0247	0x90F7	Current Running Time Reached	Same as L0244	0	-	Unchangeable
L0250	0x90FA	Hibernation enable flag	0: Inactive 1: Active	0	-	Unchangeable
L0251	0x90FB	Individual stop of simple PLC	Same as L0250	0	-	Unchangeable
L0252	0x90FC	Simple PLC module operation for one cycle	0: Not completed 1: Completed	0	-	Unchangeable
L0253	0x90FD	Simple PLC cycle completed	Same as L0252	0	-	Unchangeable
L0258	0x9102	Current 1 reached	Same as L0244	0	-	Unchangeable
L0259	0x9103	Current 2 reached	Same as L0244	0	-	Unchangeable
L0260	0x9104	Zero current state	0: Disable 1: Enable	0	-	Unchangeable
L0261	0x9105	Output current limit exceeded	Same as L0260	0	-	Unchangeable
L0262	0x9106	Frequency detection value 1	Same as L0260	0	-	Unchangeable
L0263	0x9107	Frequency level detection FDT2 output	Same as L0260	0	-	Unchangeable
L0264	0x9108	Frequency reached	Same as L0244	0	-	Unchangeable
L0265	0x9109	Frequency reach 1	Same as L0244	0	-	Unchangeable
L0266	0x910A	Detection frequency 2 reached	Same as L0244	0	-	Unchangeable
L0267	0x910B	Frequency upper limit reached	Same as L0244	0	-	Unchangeable
L0268	0x910C	Frequency lower limit reached (No output at stop)	Same as L0244	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0269	0x910D	Frequency lower limit reached (outputted even at stop)	Same as L0244	0	-	Unchangeable
L0270	0x910E	Speed comparison reach 1	Same as L0244	0	-	Unchangeable
L0271	0x910F	Speed comparison reached 2	Same as L0244	0	-	Unchangeable
L0279	0x9117	Module temperature reached	Same as L0244	0	-	Unchangeable
L0280	0x9118	Lifetime pre-alarm output	0: No alarm output 1: Component alarm outputted	0	-	Unchangeable
L0281	0x9119	Main circuit capacitor lifetime pre-alarm output	0: No output 1: Alarm outputted	0	-	Unchangeable
L0283	0x911B	IGBT lifetime pre-alarm output	Same as L0281	0	-	Unchangeable
L0284	0x911C	Cooling fan lifetime pre-alarm output	Same as L0281	0	-	Unchangeable

10.15.4 L03 Bit Connector 4

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0304	0x9130	W2B module A output bit00	0: Disable 1: Enable	0	-	Unchangeable
L0305	0x9131	W2B module A output bit01	Same as L0304	0	-	Unchangeable
L0306	0x9132	W2B module A output bit02	Same as L0304	0	-	Unchangeable
L0307	0x9133	W2B module A output bit03	Same as L0304	0	-	Unchangeable
L0308	0x9134	W2B module A output bit04	Same as L0304	0	-	Unchangeable
L0309	0x9135	W2B module A output bit05	Same as L0304	0	-	Unchangeable
L0310	0x9136	W2B module A output bit06	Same as L0304	0	-	Unchangeable
L0311	0x9137	W2B module A output bit07	Same as L0304	0	-	Unchangeable
L0312	0x9138	W2B module A output bit08	Same as L0304	0	-	Unchangeable
L0313	0x9139	W2B module A output bit09	Same as L0304	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0314	0x913A	W2B module A output bit10	Same as L0304	0	-	Unchangeable
L0315	0x913B	W2B module A output bit11	Same as L0304	0	-	Unchangeable
L0316	0x913C	W2B module A output bit12	Same as L0304	0	-	Unchangeable
L0317	0x913D	W2B module A output bit13	Same as L0304	0	-	Unchangeable
L0318	0x913E	W2B module A output bit14	Same as L0304	0	-	Unchangeable
L0319	0x913F	W2B module A output bit15	Same as L0304	0	-	Unchangeable
L0320	0x9140	W2B module B output bit00	Same as L0304	0	-	Unchangeable
L0321	0x9141	W2B module B output bit01	Same as L0304	0	-	Unchangeable
L0322	0x9142	W2B module B output bit02	Same as L0304	0	-	Unchangeable
L0323	0x9143	W2B module B output bit03	Same as L0304	0	-	Unchangeable
L0324	0x9144	W2B module B output bit04	Same as L0304	0	-	Unchangeable
L0325	0x9145	W2B module B output bit05	Same as L0304	0	-	Unchangeable
L0326	0x9146	W2B module B output bit06	Same as L0304	0	-	Unchangeable
L0327	0x9147	W2B module B output bit07	Same as L0304	0	-	Unchangeable
L0328	0x9148	W2B module B output bit08	Same as L0304	0	-	Unchangeable
L0329	0x9149	W2B module B output bit09	Same as L0304	0	-	Unchangeable
L0330	0x914A	W2B module B output bit10	Same as L0304	0	-	Unchangeable
L0331	0x914B	W2B module B output bit11	Same as L0304	0	-	Unchangeable
L0332	0x914C	W2B module B output bit12	Same as L0304	0	-	Unchangeable
L0333	0x914D	W2B module B output bit13	Same as L0304	0	-	Unchangeable
L0334	0x914E	W2B module B output bit14	Same as L0304	0	-	Unchangeable
L0335	0x914F	W2B module B output bit15	Same as L0304	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0336	0x9150	W2B module C output bit00	Same as L0304	0	-	Unchangeable
L0337	0x9151	W2B module C output bit01	Same as L0304	0	-	Unchangeable
L0338	0x9152	W2B module C output bit02	Same as L0304	0	-	Unchangeable
L0339	0x9153	W2B module C output bit03	Same as L0304	0	-	Unchangeable
L0340	0x9154	W2B module C output bit04	Same as L0304	0	-	Unchangeable
L0341	0x9155	W2B module C output bit05	Same as L0304	0	-	Unchangeable
L0342	0x9156	W2B module C output bit06	Same as L0304	0	-	Unchangeable
L0343	0x9157	W2B module C output bit07	Same as L0304	0	-	Unchangeable
L0344	0x9158	W2B module C output bit08	Same as L0304	0	-	Unchangeable
L0345	0x9159	W2B module C output bit09	Same as L0304	0	-	Unchangeable
L0346	0x915A	W2B module C output bit10	Same as L0304	0	-	Unchangeable
L0347	0x915B	W2B module C output bit11	Same as L0304	0	-	Unchangeable
L0348	0x915C	W2B module C output bit12	Same as L0304	0	-	Unchangeable
L0349	0x915D	W2B module C output bit13	Same as L0304	0	-	Unchangeable
L0350	0x915E	W2B module C output bit14	Same as L0304	0	-	Unchangeable
L0351	0x915F	W2B module C output bit15	Same as L0304	0	-	Unchangeable
L0352	0x9160	W2B module D output bit00	Same as L0304	0	-	Unchangeable
L0353	0x9161	W2B module D output bit01	Same as L0304	0	-	Unchangeable
L0354	0x9162	W2B module D output bit02	Same as L0304	0	-	Unchangeable
L0355	0x9163	W2B module D output bit03	Same as L0304	0	-	Unchangeable
L0356	0x9164	W2B module D output bit04	Same as L0304	0	-	Unchangeable
L0357	0x9165	W2B module D output bit05	Same as L0304	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0358	0x9166	W2B module D output bit06	Same as L0304	0	-	Unchangeable
L0359	0x9167	W2B module D output bit07	Same as L0304	0	-	Unchangeable
L0360	0x9168	W2B module D output bit08	Same as L0304	0	-	Unchangeable
L0361	0x9169	W2B module D output bit09	Same as L0304	0	-	Unchangeable
L0362	0x916A	W2B module D output bit10	Same as L0304	0	-	Unchangeable
L0363	0x916B	W2B module D output bit11	Same as L0304	0	-	Unchangeable
L0364	0x916C	W2B module D output bit12	Same as L0304	0	-	Unchangeable
L0365	0x916D	W2B module D output bit13	Same as L0304	0	-	Unchangeable
L0366	0x916E	W2B module D output bit14	Same as L0304	0	-	Unchangeable
L0367	0x916F	W2B module D output bit15	Same as L0304	0	-	Unchangeable
L0368	0x9170	Output of binary switch module A	Same as L0304	0	-	Unchangeable
L0369	0x9171	Output of binary switch module B	Same as L0304	0	-	Unchangeable
L0370	0x9172	Output of binary switch module C	Same as L0304	0	-	Unchangeable
L0371	0x9173	Output of binary switch module D	Same as L0304	0	-	Unchangeable
L0372	0x9174	Output of binary switch module E	Same as L0304	0	-	Unchangeable
L0373	0x9175	Output of binary switch module F	Same as L0304	0	-	Unchangeable
L0374	0x9176	Output of binary switch module G	Same as L0304	0	-	Unchangeable
L0375	0x9177	Output of binary switch module H	Same as L0304	0	-	Unchangeable
L0376	0x9178	Output of logic AND/OR module A	Same as L0304	0	-	Unchangeable
L0377	0x9179	Output of logic AND/OR module B	Same as L0304	0	-	Unchangeable
L0378	0x917A	Output of logic AND/OR module C	Same as L0304	0	-	Unchangeable
L0379	0x917B	Output of logic AND/OR module D	Same as L0304	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0380	0x917C	Output of logic AND/OR module E	Same as L0304	0	-	Unchangeable
L0381	0x917D	Output of logic AND/OR module F	Same as L0304	0	-	Unchangeable
L0382	0x917E	Output of logic AND/OR module G	Same as L0304	0	-	Unchangeable
L0383	0x917F	Output of logic AND/OR module H	Same as L0304	0	-	Unchangeable
L0384	0x9180	Output of logic NOT module A	Same as L0304	0	-	Unchangeable
L0385	0x9181	Output of logic NOT module B	Same as L0304	0	-	Unchangeable
L0386	0x9182	Output of logic NOT module C	Same as L0304	0	-	Unchangeable
L0387	0x9183	Output of logic NOT module D	Same as L0304	0	-	Unchangeable
L0388	0x9184	Output of logic NOT module E	Same as L0304	0	-	Unchangeable
L0389	0x9185	Output of logic NOT module F	Same as L0304	0	-	Unchangeable
L0390	0x9186	Output of logic NOT module G	Same as L0304	0	-	Unchangeable
L0391	0x9187	Output of logic NOT module H	Same as L0304	0	-	Unchangeable
L0392	0x9188	Output of logic XOR/ XNOR module A	Same as L0304	0	-	Unchangeable
L0393	0x9189	Output of logic XOR/ XNOR module B	Same as L0304	0	-	Unchangeable
L0394	0x918A	Output of logic XOR/ XNOR module C	Same as L0304	0	-	Unchangeable
L0395	0x918B	Output of logic XOR/ XNOR module D	Same as L0304	0	-	Unchangeable
L0396	0x918C	Output of logic XOR/ XNOR module E	Same as L0304	0	-	Unchangeable
L0397	0x918D	Output of logic XOR/ XNOR module F	Same as L0304	0	-	Unchangeable
L0398	0x918E	Output of logic XOR/ XNOR module G	Same as L0304	0	-	Unchangeable
L0399	0x918F	Output of logic XOR/ XNOR module H	Same as L0304	0	-	Unchangeable

10.15.5 L04 Bit Connector 5

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0400	0x9190	Output of comparison module A	0: Disable 1: Enable	0	-	Unchangeable
L0401	0x9191	Output of comparison module B	Same as L0400	0	-	Unchangeable
L0402	0x9192	Output of comparison module C	Same as L0400	0	-	Unchangeable
L0403	0x9193	Output of comparison module D	Same as L0400	0	-	Unchangeable
L0404	0x9194	Output of comparison module E	Same as L0400	0	-	Unchangeable
L0405	0x9195	Comparison module F output	Same as L0400	0	-	Unchangeable
L0406	0x9196	Comparison module G output	Same as L0400	0	-	Unchangeable
L0407	0x9197	Comparison module H output	Same as L0400	0	-	Unchangeable
L0408	0x9198	Output of level-pulse conversion module A	Same as L0400	0	-	Unchangeable
L0409	0x9199	Output of level-pulse conversion module B	Same as L0400	0	-	Unchangeable
L0410	0x919A	Output of level-pulse conversion module C	Same as L0400	0	-	Unchangeable
L0411	0x919B	Output of level-pulse conversion module D	Same as L0400	0	-	Unchangeable
L0412	0x919C	Divisor being 0 flag of MULTIPLY/DIVIDE module A	0: Not 0 1: 0	0	-	Unchangeable
L0413	0x919D	Divisor being 0 flag of MULTIPLY/DIVIDE module B	Same as L0412	0	-	Unchangeable
L0414	0x919E	Divisor being 0 flag of MULTIPLY/DIVIDE module C	Same as L0412	0	-	Unchangeable
L0415	0x919F	Divisor being 0 flag of MULTIPLY/DIVIDE module D	Same as L0412	0	-	Unchangeable
L0416	0x91A0	Divisor being 0 flag of multiplier and divider block E	Same as L0412	0	-	Unchangeable
L0417	0x91A1	Divisor being 0 flag of multiplier and divider block F	Same as L0412	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0418	0x91A2	Divisor being 0 flag of multiplier and divider block G	Same as L0412	0	-	Unchangeable
L0419	0x91A3	Divisor being 0 flag of multiplier and divider block H	Same as L0412	0	-	Unchangeable
L0420	0x91A4	Absolute value module A negative input flag	0: Not negative 1: Negative	0	-	Unchangeable
L0421	0x91A5	Absolute value module B negative input flag	Same as L0420	0	-	Unchangeable
L0422	0x91A6	Absolute value module C negative input flag	Same as L0420	0	-	Unchangeable
L0423	0x91A7	Absolute value module D negative input flag	Same as L0420	0	-	Unchangeable
L0424	0x91A8	Absolute value module E negative input flag	Same as L0420	0	-	Unchangeable
L0425	0x91A9	Absolute value module F negative input flag	Same as L0420	0	-	Unchangeable
L0426	0x91AA	Absolute value module G negative input flag	Same as L0420	0	-	Unchangeable
L0427	0x91AB	Absolute value module H negative input flag	Same as L0420	0	-	Unchangeable
L0428	0x91AC	Lower limit flag of limit module A	Same as L0400	0	-	Unchangeable
L0429	0x91AD	Upper limit flag of limit module A	Same as L0400	0	-	Unchangeable
L0430	0x91AE	Lower limit flag of limit module B	Same as L0400	0	-	Unchangeable
L0431	0x91AF	Upper limit flag of limit module B	Same as L0400	0	-	Unchangeable
L0432	0x91B0	Lower limit flag of limit module C	Same as L0400	0	-	Unchangeable
L0433	0x91B1	Upper limit flag of limit module C	Same as L0400	0	-	Unchangeable
L0434	0x91B2	Lower limit flag of limit module D	Same as L0400	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0435	0x91B3	Upper limit flag of limit module D	Same as L0400	0	-	Unchangeable
L0456	0x91C8	Output of logical delay module A	Same as L0400	0	-	Unchangeable
L0457	0x91C9	Output of logical delay module B	Same as L0400	0	-	Unchangeable
L0458	0x91CA	Output of logical delay module C	Same as L0400	0	-	Unchangeable
L0459	0x91CB	Output of logical delay module D	Same as L0400	0	-	Unchangeable
L0460	0x91CC	Output of logical delay module E	Same as L0400	0	-	Unchangeable
L0461	0x91CD	Output of logical delay module F	Same as L0400	0	-	Unchangeable
L0462	0x91CE	Output of logical delay module G	Same as L0400	0	-	Unchangeable
L0463	0x91CF	Output of logical delay module H	Same as L0400	0	-	Unchangeable
L0484	0x91E4	DI1 (modified by E0-00 forcibly)	0 to 1	0	-	Unchangeable
L0485	0x91E5	DI2 (modified by E0-01 forcibly)	0 to 1	0	-	Unchangeable
L0486	0x91E6	DI3 (modified by E0-02 forcibly) (valid for MD630S)	0 to 1	0	-	Unchangeable
L0487	0x91E7	DI4 (modified by E0-03 forcibly) (valid for MD630S)	0 to 1	0	-	Unchangeable
L0488	0x91E8	DI5 (modified by E0-04 forcibly) (valid for MD630S)	0 to 1	0	-	Unchangeable
L0489	0x91E9	DI6 (modified by E0-05 forcibly) (valid for MD630S)	0 to 1	0	-	Unchangeable
L0490	0x91EA	DI7 (modified by E0-06 forcibly) (valid for MD630S)	0 to 1	0	-	Unchangeable
L0494	0x91EE	VDI1 (modified by E0-10 forcibly)	0 to 1	0	-	Unchangeable
L0495	0x91EF	VDI2 (modified by E0-11 forcibly)	0 to 1	0	-	Unchangeable
L0496	0x91F0	VDI3 (modified by E0-12 forcibly)	0 to 1	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0497	0x91F1	VDI4 (modified by E0-13 forcibly)	0 to 1	0	-	Unchangeable
L0498	0x91F2	VDI5 (modified by E0-14 forcibly)	0 to 1	0	-	Unchangeable
L0499	0x91F3	VDI6 (modified by E0-15 forcibly)	0 to 1	0	-	Unchangeable

10.15.6 L06 Bit Connector 7

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0600	0x9258	I/O expansion card 1-DI1	0 to 1	0	-	Unchangeable
L0601	0x9259	I/O expansion card 1-DI2	0 to 1	0	-	Unchangeable
L0603	0x925B	I/O expansion card 1-DI1 inverted	0 to 1	0	-	Unchangeable
L0604	0x925C	I/O expansion card 1-DI2 inverted	0 to 1	0	-	Unchangeable
L0606	0x925E	I/O expansion card 1-DO	0 to 1	0	-	Unchangeable
L0607	0x925F	I/O expansion card 1-RO	0 to 1	0	-	Unchangeable
L0608	0x9260	I/O expansion card 1-Motor temperature reached	0: Temperature not reached 1: Temperature reached	0	-	Unchangeable
L0609	0x9261	I/O expansion card 1-Motor overtemperature	0: Overtemperature not occur 1: Overtemperature occur	0	-	Unchangeable
L0610	0x9262	I/O expansion card 1-Motor overtemperature alarm	0: Overtemperature alarm not reported 1: Overtemperature pre-alarm reported	0	-	Unchangeable
L0611	0x9263	I/O expansion card 1-AI1 input limit violated	0: Not exceeded 1: Exceeded	0	-	Unchangeable
L0612	0x9264	I/O expansion card 1-AI1 used as the DI level	0: Low level 1: High level	0	-	Unchangeable
L0616	0x9268	I/O expansion card 2-DI1	0 to 1	0	-	Unchangeable
L0617	0x9269	I/O expansion card 2-DI2	0 to 1	0	-	Unchangeable
L0619	0x926B	I/O expansion card 2-DI1 inverted	0 to 1	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0620	0x926C	I/O expansion card 2-DI2 inverted	0 to 1	0	-	Unchangeable
L0622	0x926E	I/O expansion card 2-DO	0 to 1	0	-	Unchangeable
L0623	0x926F	I/O expansion card 2-RO	0 to 1	0	-	Unchangeable
L0624	0x9270	I/O expansion card 2-Motor temperature reached	Same as L0608	0	-	Unchangeable
L0625	0x9271	I/O expansion card 2-Motor overtemperature	Same as L0609	0	-	Unchangeable
L0626	0x9272	I/O expansion card 2 -Motor overtemperature alarm	Same as L0610	0	-	Unchangeable
L0627	0x9273	I/O expansion card 2-AI1 input limit violated	Same as L0611	0	-	Unchangeable
L0628	0x9274	I/O expansion card 2-AI1 used as the DI level	Same as L0612	0	-	Unchangeable
L0648	0x9288	IO expansion card 1-DI1 (Forced modified by EA-11 terminal function)	0 to 1	0	-	Unchangeable
L0649	0x9289	IO expansion card 1-DI2 (Forced modified by EA-12 terminal function)	0 to 1	0	-	Unchangeable
L0650	0x928A	IO expansion card 2-DI1 (Forced modified by Eb-11 terminal function)	0 to 1	0	-	Unchangeable
L0651	0x928B	IO expansion card 2-DI2 (Forced modified by Eb-12 terminal function)	0 to 1	0	-	Unchangeable

10.15.7 L07 Bit Connector 8

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L0700	0x92BC	Brake command output	0: Apply 1: Release	0	-	Unchangeable
L0701	0x92BD	Brake released	0 to 1	0	-	Unchangeable
L0702	0x92BE	Brake closed	0 to 1	0	-	Unchangeable

10.15.8 L10 Word Connector 1

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1000	0x93E8	Current state of system status machine	0: Initialization 1: Switch-on prohibited 2: Switch-on permitted 3: Running permission 4: Start 5: Run 6: Stop 7: Self-test 8: Auto-tuning	0	-	Unchangeable
L1001	0x93E9	Switchover command of system status machine	bit0: Start command active bit1: Stop active bit2: OFF2 (coast to stop) state bit3: OFF3 (quick stop) state bit4: Operation permission (non-sleep state) bit5: Running prohibition active bit6: Stop at fault bit0 to bit6: 0: Invalid 1: Enabled bit7 to bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1002	0x93EA	System status word 1	bit0: Ready to switch on bit1: Ready to run bit2: Running bit3: Faulty bit4: OFF2 (coast to stop) stop bit5: OFF3 (quick stop) stop bit6: Switch-on inhibited bit7: Alarm/Limited operation bit8: No speed deviation bit0 to bit8: 0: Invalid 1: Enabled bit9: Local/Remote 0: Local 1: Remote bit10: Target speed reached bit11: Torque limited bit12: Forward speed bit13: Reverse speed bit14: Running (wave generation) bit15: Custom state 0 bit10 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable
L1003	0x93EB	System status word 2	bit0: Self-test bit1: Parameter auto-tuning bit2: Light fault state bit3: Alarm state bit4: Speed mode bit5: Torque mode bit6: Position control mode (reserved) bit7: RFG enable bit8: RFG operating bit9: Stop at fault bit10: Normal operation bit11: Jogging bit12: Decelerate to stop bit13: Brake (reserved) bit14: Terminal control bit15: Custom state 1 bit10 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1004	0x93EC	System status word 3	bit0: Control channel selection 0: Control channel 1 1: Control channel 2 bit1: Setting channel selection 0: Set channel 1 1: Setting channel 2 bit2: Motor selection bit0 0: Logic 0 1: Logic 1 bit3: Motor selection bit1 0: Logic 0 1: Logic 1 bit4: Error (fault/alarm) 0: No error 1: Error (fault) occurred bit5: EEPROM idle 0: EEPROM idle 1: EEPROM in use bit6: Communication control 0: Invalid 1: Enabled bit7: Relay action during automatic fault reset 0: Relay during automatic fault reset is inactive. 1: Relay during automatic fault reset is active. bit8: IGBT pulsing status 0: Stop 1: Operating bit9: System command direction 0: Forward run 1: Reverse run bit10: IGBT pulsing state with delay 0: Stop 1: Operating bit11: Internal parameter processing flag 0: No operation 1: Processing bit12: Internal voltage OK 0: Under voltage or uninitialized 1: Normal bit13: Reserved 0: Invalid 1: Enabled bit14-bit15: Power board initialization state 0: Uninitialized 1: Initializing; 2: Initialization completed; 3: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1005	0x93ED	System status word 4	bit0: Operating at zero speed (invalid at stop) bit1: Operating at zero speed (valid at stop) bit2: Frequency level detection 1 bit3: Frequency level detection 2 bit0 to bit3: 0: Invalid 1: Enabled bit4: AI1/AI2 bit5: Simple PLC cycle completed 0: Not completed 1: Completed bit6: Communication reference value bit7: Reserved bit8: Current 1 reached bit9: Current 2 reached bit10: Zero current state bit11: Output current limit exceeded bit12: Motor overload pre-alarm bit13: AC drive overload pre-alarm bit14: Undervoltage bit15: Three-phase loss bit6 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable
L1006	0x93EE	Main status word of drive	bit0 to bit1: Running status 0: Initialization 1: Sampling preparation 2: Undervoltage 3: Preparation is complete bit2: Hardware information status 0: Not ready 1: Ready bit3: Running/stop state 0: Stop 1: Running bit4: Output blocked forcibly at fault 0: Invalid 1: Enabled bit5: Bus undervoltage state 0: Invalid 1: Enabled bit6 to bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1012	0x93F4	Drive protection status word	bit0: Pulse-by-pulse current limit protection state bit1: Pulse-by-pulse current limiting disabled bit2: Input phase loss bit3: Output phase loss bit4: Pre-charge resistor abnormal bit5: Servo drive overload bit8: Drive overload bit7: Bus overvoltage bit8: Bus under-voltage bit9: Output overcurrent bit10: Drive overtemperature bit11: Drive pre-overtemperature bit12: Leakage current protection bit13: Current control abnormal bit14: Software overcurrent bit15: Short circuit to ground (reserved) bit0 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1015	0x93F7	Motor protection status word	bit0: Motor in overload state bit1: Motor in pre-overload state bit2: Three-phase phase loss state (reserved) bit3: Motor overheat (reserved) bit4: PG detection fault (reserved) bit5: Current control error bit6: Motor stall bit7: Motor open circuit, two-phase or three-phase phase loss bit8: Motor constant current load too large (reserved) bit9: Motor flux abnormal causing SVC out-of-step operation bit10: Speed measurement fluctuation abnormal (reserved) bit11: Motor parameter setting error (reserved) bit12: HSVM sampling card open circuit or phase error (reserved) bit13: Synchronous motor overcurrent (reserved) bit14: Synchronous output voltage abnormal (reserved) bit15: Encoder disconnection (reserved) bit0 to bit15: 0: Invalid 1: Enabled	0x0	-	Unchangeable
L1017	0x93F9	Vector Vdc status word	bit0: Undervoltage suppression activated 0: Invalid 1: Enabled bit1: Overvoltage suppression activated 0: Invalid 1: Enabled bit2: Enter low frequency limit during undervoltage suppression 0: Invalid 1: Enabled bit3 to bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1022	0x93FE	Motor torque limit status word	bit0 to bit2: Upper limit selection 0: Not limited 1: Torque limit 1 2: Current limit 1 3: External torque limit 4: Power limit 5: Current limit 2 or torque limit 2 bit3 to bit5: Lower limit selection 0: Not limited 1: Torque limit 1 2: Current limit 1 3: External torque limit 4: Power limit 5: Current limit 2 or torque limit 2 bit6: Positive speed limit 0: Invalid 1: Enabled bit7: Reverse speed limit 0: Invalid 1: Enabled bit8: External forced torque limit 0: Invalid 1: Enabled bit9: Torque release effective 0: Invalid 1: Enabled bit10 to bit15: Reserved	0x0	-	Unchangeable
L1024	0x9400	Encoder output status word	0x0 to 0xFFFF	0x0	-	Unchangeable
L1025	0x9401	Maximum permissible speed measurement of the encoder	0 to 65535	0	-	Unchangeable
L1030	0x9406	Active control mode	0: Speed control 1: Torque control 2: Position control (reserved)	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1044	0x9414	Custom command word of control channel 1	bit0: ON_OFF1 (start/stop) state 0：Stop 1: Operating bit1: OFF2 (coast to stop) stop 0：Stop 1: Operating bit2: OFF3 (quick stop) stop 0：Stop 1: Operating bit3: Running permitted 0: Disable 1: Enable bit4: Reset command 0: Disable 1: enable bit5: Jog 1 0: Invalid 1: Enabled bit6: Jog 2 0: Invalid 1: Enabled bit7: Speed inversion 0: no inverse 1: Inverse bit8 to bit15: Reserved	0x0	-	Unchangeable
L1045	0x9415	Control channel 2 custom command word	Same as L1044	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1046	0x9416	Auxiliary command word of control channel 1	bit0: OFF2 (coast to stop) state 2 0：Stop 1: Operating bit1: OFF2 (coast to stop) state 3 0：Stop 1: Operating bit2: OFF3 (quick stop) state 2 0：Stop 1: Operating bit3: OFF3 (quick stop) state 3 0: Disable 1: Enable bit4: Reset command 2 0: Disable 1: enable bit5: Reset command 3 0: Disable 1: enable bit6: RFG disabled 0: Active 1: Disable bit7: RFG paused 0: Active 1: Disable bit8: RFG mandatory 0: Active 1: Disable bit9 to bit15: Reserved	0x0	-	Unchangeable
L1047	0x9417	Auxiliary command word of control channel 2	Same as L1046	0x0	-	Unchangeable
L1050	0x941A	STO output status word	0x0 to 0xFFFF	0x0	-	Unchangeable
L1051	0x941B	LED control word	Bit 0: Start bit:1: Stop bit:2: Jog 1 bit3: Local control bit:4: Reset bit:5: Jog 2 bit6: Direction switching bit0 to bit6: 0: Invalid 1: Enabled bit7 to bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1052	0x941C	IDS control word	bit0: Start bit:1: Stop bit:2: Jog 1 bit:3: Jog 2 bit:4: Reset bit:5: Forward bit:6: Reverse bit:7: Tuning bit:8: Self-test bit0 to bit8: 0: Invalid 1: Enabled bit9 to bit15: Reserved	0x0	-	Unchangeable
L1053	0x941D	SOP control word	Same as L1052	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1054	0x941E	Command channel control word	bit0: ON_OFF1 (start/stop) state 0: Stop 1: Operating bit1: OFF2 (coast to stop) stop 0: Active 1: Normal bit2: OFF3 (quick stop) stop 0: Active 1: Normal bit3: Operation permission 0: Operation inhibited 1: Operation allowed bit4: RFG output forced to 0 0: Normal value 1: The RFG output is forced to 0. bit5: RFG paused 0: Normal value 1: RFG pause bit6: RFG input forced to 0 0: Normal value 1: The RFG input is forced to 0. bit7: Fault reset 0: Invalid 1: Enabled bit8: Jog 1 0: Invalid 1: Enabled bit9: Jog 2 0: Invalid 1: Enabled bit10: Remote control reserved 0: Invalid 1: Enabled bit11: Speed inversion 0: Inversion disabled 1: Inversion bit12: Start signal 0: Invalid 1: Enabled bit13: Internal start command 0: Invalid 1: Enabled bit14: Reserved bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1055	0x941F	Control word set through communication	bit0: ON_OFF1 (start/stop) state 0：Stop 1: Operating bit1: OFF2 (coast to stop) stop 0：Stop 1: Operating bit2: OFF3 (quick stop) stop 0：Stop 1: Operating bit3: Running permitted 0: Disable 1: Enable bit4: Reset command 0: Disable 1: Enable bit5: Jog 1 0: Invalid 1: Enabled bit6: Jog 2 0: Invalid 1: Enabled bit7: Speed inversion 0: no inverse 1: Inverse bit8 to bit15: Reserved	0x0	-	Unchangeable
L1056	0x9420	Software tool control flag	0: Uncontrolled 1: Controlled	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1057	0x9421	Terminal module control word	bit0: ON_OFF1 (start/stop) state 0：Stop 1: Operating bit1: OFF2 (coast to stop) stop 0：Stop 1: Operating bit2: OFF3 (quick stop) stop 0：Stop 1: Operating bit3: Running permitted 0: Disable 1: Enable bit4: Reset command 0: Disable 1: Enable bit5: Jog 1 0: Invalid 1: Enabled bit6: Jog 2 0: Invalid 1: Enabled bit7: Speed inversion 0: no inverse 1: Inverse bit8 to bit15: Reserved	0x0	-	Unchangeable
L1058	0x9422	Input state of terminal module A	bit0: ON_OFF1 (start/stop) state bit1: Reverse operation (Rev) bit2: Running permitted (Enable) bit3: Reset command (Reset) bit4: Jog 1 (JOG1) bit5: Jog 2 (JOG2) bit6: Reserved (Rsvd1) bit7: Terminal function input (In1) bit8: Terminal function input (In2) bit9: Terminal function input (In3) bit0 to bit9: 0: Invalid 1: Enabled bit10 to bit15: Reserved	0x0	-	Unchangeable
L1059	0x9423	Input state of terminal module B	Same as L1058	0x0	-	Unchangeable
L1060	0x9424	Active external command source	0: Operating panel 1: Terminal 2: Communication 3: Custom	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1062	0x9426	RFG status word	bit0 to bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit2 to bit3: Acceleration/ deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit7 to bit7: Reserved bit8 to bit9: Previous cycle acceleration/deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit10 to bit11: Previous cycle arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit 6 to bit 15: Reserved	0x0	-	Unchangeable
L1063	0x9427	RFG command word	bit0: Calculation enable 0: Disable 1: Calculation bit1: Output force enable 0: Disable 1: Enabled bit2: Calculation pause 0: Disable 1: Halt bit3: Bypass enable 0: Disable 1: Bypass bit4: Reserved bit5: Arc type 0: Continuous arc 1: Non-continuous arc bit9 to bit15: Reserved	0x0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1065	0x9429	DI state	bit0: DI1 state bit1: DI2 state bit2: DI3 state (reserved for MD630N) bit3: DI4 state (reserved for MD630N) bit4: DI5 state (reserved for MD630N) bit5: DI6 state (reserved for MD630N) bit6: DI7 state (reserved for MD630N) bit7 to bit9: Reserved bit10: VDI1 state bit11: VDI2 state bit12: VDI3 state bit13: VDI4 state bit14: VDI5 state bit15: VDI6 state bit0 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable
L1068	0x942C	Highest sub-index supported	bit0: RO state 0: Low level 1: High level bit1 to bit3: Reserved bit4: DO state 0: Low level 1: High level bit5 to bit7: Reserved bit8: FMR state (active only for MD630S) bit9: Reserved bit10: VDO1 state bit11: VDO2 state bit12: VDO3 state bit13: VDO4 state bit14: VDO5 state bit15: VDO6 state bit8 to bit15: 0: Low level 1: High level	0x0	-	Unchangeable

10.15.9 L11 Word Connector 2

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1100	0x944C	Base value of speed per unit value	0 to 65535	0	rpm	Unchangeable
L1101	0x944D	Base value of frequency per unit value	0.0 to 6553.5	0.0	Hz	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1102	0x944E	Base value of voltage per-unit value	0.0 to 6553.5	0.0	V	Unchangeable
L1103	0x944F	Base value of current per unit value	0.0 to 6553.5	0.0	A	Unchangeable
L1104	0x9450	Base value of power per unit value	0.00 to 655.35	0.00	kW	Unchangeable
L1105	0x9451	Base value of torque per unit value	0.00 to 655.35	0.00	N·m	Unchangeable
L1106	0x9452	Base value of DC bus voltage per unit value	0 to 65535	0	V	Unchangeable

10.15.10 L12 Word Connector 3

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1200	0x94B0	Constant setpoint 1 (word)	-32768 to 32767	0	-	Unchangeable
L1201	0x94B1	Constant setpoint 2 (word)	-32768 to 32767	0	-	Unchangeable
L1202	0x94B2	Constant setpoint 3 (word)	-32768 to 32767	0	-	Unchangeable
L1203	0x94B3	Constant setpoint 4 (word)	-32768 to 32767	0	-	Unchangeable
L1204	0x94B4	Constant setpoint 5 (word)	-32768 to 32767	0	-	Unchangeable
L1205	0x94B5	Constant setpoint 6 (word)	-32768 to 32767	0	-	Unchangeable
L1206	0x94B6	Constant setpoint 7 (word)	-32768 to 32767	0	-	Unchangeable
L1207	0x94B7	Constant setpoint 8 (word)	-32768 to 32767	0	-	Unchangeable
L1208	0x94B8	Output of bit-to-word module A	0x0 to 0xFFFF	0x0	-	Unchangeable
L1209	0x94B9	Output of bit-to-word module B	0x0 to 0xFFFF	0x0	-	Unchangeable
L1210	0x94BA	Output of bit-to-word module C	0x0 to 0xFFFF	0x0	-	Unchangeable
L1211	0x94BB	Output of bit-to-word module D	0x0 to 0xFFFF	0x0	-	Unchangeable
L1212	0x94BC	DW-W module A output HIWORD	0 to 65535	0	-	Unchangeable
L1213	0x94BD	DW-W module A output LOWORD	0 to 65535	0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1214	0x94BE	DW-W module B output HIWORD	0 to 65535	0	-	Unchangeable
L1215	0x94BF	DW-W module B output LOWORD	0 to 65535	0	-	Unchangeable
L1216	0x94C0	DW-W module C output HIWORD	0 to 65535	0	-	Unchangeable
L1217	0x94C1	DW-W module C output LOWORD	0 to 65535	0	-	Unchangeable
L1218	0x94C2	DW-W module D output HIWORD	0 to 65535	0	-	Unchangeable
L1219	0x94C3	DW-W module D output LOWORD	0 to 65535	0	-	Unchangeable
L1234	0x94D2	Input selection state of binary selector module	bit0: Module A bit1: Module B bit2: Module C bit3: Module D bit4: Module E bit5: Module F bit6: Module G bit7: Module H bit0~bit7: 0: Input 1 1: Input 2 bit8~bit15: Reserved	0x0	-	Unchangeable
L1235	0x94D3	Input selection state for digital selector module	Same as L1234	0x0	-	Unchangeable

10.15.11 L15 Word Connector 6

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1500	0x95DC	Tension process control mode	0 to 65535	0	-	Unchangeable
L1501	0x95DD	Operation mode of tension process	0 to 65535	0	-	Unchangeable
L1502	0x95DE	Initial reel diameter	0.0 to 6553.5	0.0	mm	Unchangeable
L1503	0x95DF	Taper setting	0.0 to 6553.5	0.0	%	Unchangeable
L1504	0x95E0	Constant linear speed	0.0 to 6553.5	0.0	m/min	Unchangeable
L1505	0x95E1	Tension process mask	0 to 65535	0	-	Unchangeable

10.15.12 L17 Word Connector 8

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L1700	0x96A4	PZD1 output	0 to 65535	0	-	Unchangeable
L1701	0x96A5	PZD2 output	0 to 65535	0	-	Unchangeable
L1702	0x96A6	PZD3 output	0 to 65535	0	-	Unchangeable
L1703	0x96A7	PZD4 output	0 to 65535	0	-	Unchangeable
L1704	0x96A8	PZD5 output	0 to 65535	0	-	Unchangeable
L1705	0x96A9	PZD6 output	0 to 65535	0	-	Unchangeable
L1706	0x96AA	PZD7 output	0 to 65535	0	-	Unchangeable
L1707	0x96AB	PZD8 output	0 to 65535	0	-	Unchangeable
L1708	0x96AC	PZD9 output	0 to 65535	0	-	Unchangeable
L1709	0x96AD	PZD10 output	0 to 65535	0	-	Unchangeable
L1710	0x96AE	PZD11 output	0 to 65535	0	-	Unchangeable
L1711	0x96AF	PZD12 output	0 to 65535	0	-	Unchangeable
L1712	0x96B0	PZD13 output	0 to 65535	0	-	Unchangeable
L1713	0x96B1	PZD14 output	0 to 65535	0	-	Unchangeable
L1714	0x96B2	PZD15 output	0 to 65535	0	-	Unchangeable
L1715	0x96B3	PZD16 output	0 to 65535	0	-	Unchangeable
L1732	0x96C4	PZD1 input	0 to 65535	0	-	Unchangeable
L1733	0x96C5	PZD2 input	0 to 65535	0	-	Unchangeable
L1734	0x96C6	PZD3 input	0 to 65535	0	-	Unchangeable
L1735	0x96C7	PZD4 input	0 to 65535	0	-	Unchangeable
L1736	0x96C8	PZD5 input	0 to 65535	0	-	Unchangeable
L1737	0x96C9	PZD6 input	0 to 65535	0	-	Unchangeable
L1738	0x96CA	PZD7 input	0 to 65535	0	-	Unchangeable
L1739	0x96CB	PZD8 input	0 to 65535	0	-	Unchangeable
L1740	0x96CC	PZD9 input	0 to 65535	0	-	Unchangeable
L1741	0x96CD	PZD10 input	0 to 65535	0	-	Unchangeable
L1742	0x96CE	PZD11 input	0 to 65535	0	-	Unchangeable
L1743	0x96CF	PZD12 input	0 to 65535	0	-	Unchangeable
L1744	0x96D0	PZD13 input	0 to 65535	0	-	Unchangeable
L1745	0x96D1	PZD14 input	0 to 65535	0	-	Unchangeable
L1746	0x96D2	PZD15 input	0 to 65535	0	-	Unchangeable
L1747	0x96D3	PZD16 input	0 to 65535	0	-	Unchangeable

10.15.13 L20 Double-word Connector 1

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2000	0x97D0	W-DW module A output	0x0~0xFFFFFFFF	0x0	-	Unchangeable
L2002	0x97D2	W-DW module B output	0x0~0xFFFFFFFF	0x0	-	Unchangeable
L2004	0x97D4	W-DW module C output	0x0~0xFFFFFFFF	0x0	-	Unchangeable
L2006	0x97D6	W-DW module D output	0x0~0xFFFFFFFF	0x0	-	Unchangeable

10.15.14 L22 Floating-point Connector 1

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2200	0x9898	Output frequency	-8 to 8	0.0	-	Unchangeable
L2202	0x989A	Motor speed	-8 to 8	0.0	-	Unchangeable
L2204	0x989C	Output current	-8 to 8	0.0	-	Unchangeable
L2206	0x989E	Output voltage	-8 to 8	0.0	-	Unchangeable
L2208	0x98A0	Output power	-8 to 8	0.0	-	Unchangeable
L2210	0x98A2	output torque	-8 to 8	0.0	-	Unchangeable
L2214	0x98A6	Output torque utilization rate	0 to 65535	0.00	%	Unchangeable
L2216	0x98A8	Output torque idle rate	0 to 65535	0.00	%	Unchangeable
L2244	0x98C4	AI1 input value	-8 to 8	0.0	-	Unchangeable
L2246	0x98C6	AI2 input value	-8 to 8	0.0	-	Unchangeable
L2250	0x98CA	HDI input value	-8 to 8	0.0	-	Unchangeable
L2252	0x98CC	AO value percentage written through communication	-8 to 8	0.0	%	Unchangeable
L2258	0x98D2	Current value based on max. 1000A per-unit	-8 to 8	0.0	-	Unchangeable
L2260	0x98D4	Voltage value based on max. 1000V per-unit	-8 to 8	0.0	-	Unchangeable
L2262	0x98D6	AO output torque absolute output	-8 to 8	0.0	-	Unchangeable
L2264	0x98D8	AO output torque -200.0% to +200.0%	-8 to 8	0.0	-	Unchangeable
L2266	0x98DA	I/O standard card 1-AI1 input value	-8 to 8	0.0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2268	0x98DC	I/O standard card 2-AI1 input value	-8 to 8	0.0	-	Unchangeable
L2272	0x98E0	Estimated lifetime margin of the main circuit capacitor	0 to 100	0.00	-	Unchangeable
L2276	0x98E4	Predicted lifetime margin of IGBT	0 to 100	0.00	-	Unchangeable
L2278	0x98E6	Predicted lifetime margin of the fan	0 to 100	0.00	-	Unchangeable

10.15.15 L23 Floating-point Connector 2

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2300	0x98FC	Fixed value 0%	-8 to 8	0.0	-	Unchangeable
L2302	0x98FE	Fixed value 100%	-8 to 8	0.0	-	Unchangeable
L2304	0x9900	Fixed value 200%	-8 to 8	0.0	-	Unchangeable
L2306	0x9902	Fixed value 400%	-8 to 8	0.0	-	Unchangeable
L2308	0x9904	Fixed value 600%	-8 to 8	0.0	-	Unchangeable
L2310	0x9906	Fixed value -100%	-8 to 8	0.0	-	Unchangeable
L2312	0x9908	Fixed value -200%	-8 to 8	0.0	-	Unchangeable
L2314	0x990A	Fixed value -400%	-8 to 8	0.0	-	Unchangeable
L2316	0x990C	Fixed value -600%	-8 to 8	0.0	-	Unchangeable
L2318	0x990E	Multi-step reference selection output	-8 to 8	0.0	-	Unchangeable
L2320	0x9910	Output corresponding to multi-reference 0	-8 to 8	0.0	-	Unchangeable
L2322	0x9912	Output corresponding to multi-reference 1	-8 to 8	0.0	-	Unchangeable
L2324	0x9914	Output corresponding to multi-reference 2	-8 to 8	0.0	-	Unchangeable
L2326	0x9916	Output corresponding to multi-reference 3	-8 to 8	0.0	-	Unchangeable
L2328	0x9918	Output corresponding to multi-reference 4	-8 to 8	0.0	-	Unchangeable
L2330	0x991A	Output corresponding to multi-reference 5	-8 to 8	0.0	-	Unchangeable
L2332	0x991C	Output corresponding to multi-reference 6	-8 to 8	0.0	-	Unchangeable
L2334	0x991E	Output corresponding to multi-reference 7	-8 to 8	0.0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2336	0x9920	Output corresponding to multi-reference 8	-8 to 8	0.0	-	Unchangeable
L2338	0x9922	Output corresponding to multi-reference 9	-8 to 8	0.0	-	Unchangeable
L2340	0x9924	Output corresponding to multi-reference 10	-8 to 8	0.0	-	Unchangeable
L2342	0x9926	Output corresponding to multi-reference 11	-8 to 8	0.0	-	Unchangeable
L2344	0x9928	Output corresponding to multi-reference 12	-8 to 8	0.0	-	Unchangeable
L2346	0x992A	Output corresponding to multi-reference 13	-8 to 8	0.0	-	Unchangeable
L2348	0x992C	Output corresponding to multi-reference 14	-8 to 8	0.0	-	Unchangeable
L2350	0x992E	Output corresponding to multi-reference 15	-8 to 8	0.0	-	Unchangeable
L2352	0x9930	Constant setpoint 1 (per-unit value)	-8 to 8	0.0	-	Unchangeable
L2354	0x9932	Constant setpoint 2 (per-unit value)	-8 to 8	0.0	-	Unchangeable
L2356	0x9934	Constant setpoint 3 (per-unit value)	-8 to 8	0.0	-	Unchangeable
L2358	0x9936	Constant setpoint 4 (per-unit value)	-8 to 8	0.0	-	Unchangeable
L2360	0x9938	Constant setpoint 5 (per-unit value)	-8 to 8	0.0	-	Unchangeable
L2362	0x993A	Constant setpoint 6 (per-unit value)	-8 to 8	0.0	-	Unchangeable
L2364	0x993C	Constant setpoint 7 (per-unit value)	-8 to 8	0.0	-	Unchangeable
L2366	0x993E	Constant setpoint 8 (per-unit value)	-8 to 8	0.0	-	Unchangeable
L2368	0x9940	Output of ADD/ SUBTRACT module A	-8 to 8	0.0	-	Unchangeable
L2370	0x9942	Output of ADD/ SUBTRACT module B	-8 to 8	0.0	-	Unchangeable
L2372	0x9944	Output of ADD/ SUBTRACT module C	-8 to 8	0.0	-	Unchangeable
L2374	0x9946	Output of ADD/ SUBTRACT module D	-8 to 8	0.0	-	Unchangeable
L2376	0x9948	Output of ADD/ SUBTRACT module E	-8 to 8	0.0	-	Unchangeable
L2378	0x994A	Output of ADD/ SUBTRACT module F	-8 to 8	0.0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2380	0x994C	Output of ADD/ SUBTRACT module G	-8 to 8	0.0	-	Unchangeable
L2382	0x994E	Output of ADD/ SUBTRACT module H	-8 to 8	0.0	-	Unchangeable
L2384	0x9950	Output of MULTIPLY/ DIVIDE module A	-8 to 8	0.0	-	Unchangeable
L2386	0x9952	Output of MULTIPLY/ DIVIDE module B	-8 to 8	0.0	-	Unchangeable
L2388	0x9954	Output of MULTIPLY/ DIVIDE module C	-8 to 8	0.0	-	Unchangeable
L2390	0x9956	Output of MULTIPLY/ DIVIDE module D	-8 to 8	0.0	-	Unchangeable
L2392	0x9958	Output of MULTIPLY/ DIVIDE module E	-8 to 8	0.0	-	Unchangeable
L2394	0x995A	Output of MULTIPLY/ DIVIDE module F	-8 to 8	0.0	-	Unchangeable
L2396	0x995C	Output of MULTIPLY/ DIVIDE module G	-8 to 8	0.0	-	Unchangeable
L2398	0x995E	Output of MULTIPLY/ DIVIDE module H	-8 to 8	0.0	-	Unchangeable

10.15.16 L24 Floating-point Connector 3

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2400	0x9960	Output of absolute value module A	-8 to 8	0.0	-	Unchangeable
L2402	0x9962	Output of absolute value module B	-8 to 8	0.0	-	Unchangeable
L2404	0x9964	Output of absolute value module C	-8 to 8	0.0	-	Unchangeable
L2406	0x9966	Output of absolute value module D	-8 to 8	0.0	-	Unchangeable
L2408	0x9968	Output of absolute value module E	-8 to 8	0.0	-	Unchangeable
L2410	0x996A	Output of absolute value module F	-8 to 8	0.0	-	Unchangeable
L2412	0x996C	Output of absolute value module G	-8 to 8	0.0	-	Unchangeable
L2414	0x996E	Output of absolute value module H	-8 to 8	0.0	-	Unchangeable
L2416	0x9970	Output of digital selector A	-8 to 8	0.0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2418	0x9972	Output of digital selector B	-8 to 8	0.0	-	Unchangeable
L2420	0x9974	Output of digital selector C	-8 to 8	0.0	-	Unchangeable
L2422	0x9976	Output of digital selector D	-8 to 8	0.0	-	Unchangeable
L2424	0x9978	Output of digital selector E	-8 to 8	0.0	-	Unchangeable
L2426	0x997A	Output of digital selector F	-8 to 8	0.0	-	Unchangeable
L2428	0x997C	Output of digital selector G	-8 to 8	0.0	-	Unchangeable
L2430	0x997E	Output of digital selector H	-8 to 8	0.0	-	Unchangeable
L2432	0x9980	Output of limit module A	-8 to 8	0.0	-	Unchangeable
L2434	0x9982	Output of limit module B	-8 to 8	0.0	-	Unchangeable
L2436	0x9984	Output of limit module C	-8 to 8	0.0	-	Unchangeable
L2438	0x9986	Output of limit module D	-8 to 8	0.0	-	Unchangeable
L2440	0x9988	Output of filter module A	-8 to 8	0.0	-	Unchangeable
L2442	0x998A	Output of filter module B	-8 to 8	0.0	-	Unchangeable
L2444	0x998C	Output of filter module C	-8 to 8	0.0	-	Unchangeable
L2446	0x998E	Output of filter module D	-8 to 8	0.0	-	Unchangeable
L2448	0x9990	Output of multi-point curve A	-8 to 8	0.0	-	Unchangeable
L2450	0x9992	Output of multi-point curve B	-8 to 8	0.0	-	Unchangeable
L2452	0x9994	Forced value of motorized potentiometer	-8 to 8	0.0	-	Unchangeable
L2454	0x9996	Reset value of motorized potentiometer	-8 to 8	0.0	-	Unchangeable
L2456	0x9998	Max. value of motor-driven potentiometer	-8 to 8	0.0	-	Unchangeable
L2458	0x999A	Min. value of motor-driven potentiometer	-8 to 8	0.0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2460	0x999C	Initial value of motorized potentiometer	-8 to 8	0.0	-	Unchangeable
L2462	0x999E	Process operation value of motorized potentiometer	-8 to 8	0.0	-	Unchangeable
L2464	0x99A0	Final output value of motorized potentiometer	-8 to 8	0.0	-	Unchangeable
L2466	0x99A2	General PID output	-8 to 8	0.0	-	Unchangeable
L2468	0x99A4	General PID error	-8 to 8	0.0	-	Unchangeable
L2470	0x99A6	General PID reference	-8 to 8	0.0	-	Unchangeable
L2472	0x99A8	General PID feedback	-8 to 8	0.0	-	Unchangeable
L2474	0x99AA	General PID proportional output	-8 to 8	0.0	-	Unchangeable
L2476	0x99AC	General PID integral output	-8 to 8	0.0	-	Unchangeable
L2478	0x99AE	General PID derivative output	-8 to 8	0.0	-	Unchangeable
L2480	0x99B0	General PID reverse action cutoff output	-8 to 8	0.0	-	Unchangeable
L2482	0x99B2	Value after simple PLC step per-unit	-8 to 8	0.0	-	Unchangeable

10.15.17 L25 Floating-point Connector 4

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2500	0x99C4	Floating output of word-to-double word module A	-8 to 8	0.00	-	Unchangeable
L2502	0x99C6	Floating output of word-to-double word module B	-8 to 8	0.00	-	Unchangeable
L2504	0x99C8	Floating output of word-to-double word module C	-8 to 8	0.00	-	Unchangeable
L2506	0x99CA	Floating output of word-to-double word module D	-8 to 8	0.00	-	Unchangeable
L2508	0x99CC	Floating output of double word-to-word module A	-8 to 8	0.00	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L2510	0x99CE	Floating output of double word-to-word module B	-8 to 8	0.00	-	Unchangeable
L2512	0x99D0	Floating output of double word-to-word module C	-8 to 8	0.00	-	Unchangeable
L2514	0x99D2	Floating output of double word-to-word module D	-8 to 8	0.00	-	Unchangeable

10.15.18 L30 Floating-point Connector 9

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L3000	0x9BB8	Actual motor speed	-8 to 8	0.0	-	Unchangeable
L3002	0x9BBA	Final motor speed reference	-8 to 8	0.0	-	Unchangeable
L3004	0x9BBC	Encoder feedback speed	-8 to 8	0.0	-	Unchangeable
L3006	0x9BBE	Frequency reference	-8 to 8	0.0	-	Unchangeable
L3008	0x9BC0	Operating frequency	-8 to 8	0.0	-	Unchangeable
L3010	0x9BC2	Target frequency of the channel	-8 to 8	0.0	-	Unchangeable
L3012	0x9BC4	Additional frequency of the channel	-8 to 8	0.0	-	Unchangeable
L3014	0x9BC6	Digital setting of additional frequency	-8 to 8	0.0	-	Unchangeable
L3016	0x9BC8	Jog 1 frequency	-8 to 8	0.0	-	Unchangeable
L3018	0x9BCA	Jog 2 frequency	-8 to 8	0.0	-	Unchangeable
L3024	0x9BD0	Speed deviation abosulte value	-8 to 8	0.00	-	Unchangeable
L3026	0x9BD2	Main frequency reference after gain processing	-8 to 8	0.0	-	Unchangeable
L3028	0x9BD4	Auxiliary frequency reference after gain processing	-8 to 8	0.0	-	Unchangeable
L3030	0x9BD6	Frequency reference after direction inversion	-8 to 8	0.0	-	Unchangeable
L3032	0x9BD8	Frequency reference after speed limit	-8 to 8	0.0	-	Unchangeable
L3034	0x9BDA	Frequency reference after UP/DOWN offset	-8 to 8	0.0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L3036	0x9BDC	Frequency reference after direction limit	-8 to 8	0.0	-	Unchangeable
L3038	0x9BDE	Frequency reference after limit	-8 to 8	0.0	-	Unchangeable
L3040	0x9BE0	Frequency reference after frequency jump	-8 to 8	0.0	-	Unchangeable
L3042	0x9BE2	Frequency reference after ramp change	-8 to 8	0.0	-	Unchangeable
L3046	0x9BE6	RFG setting input	-8 to 8	0.0	-	Unchangeable
L3048	0x9BE8	RFG calculation input	-8 to 8	0.0	-	Unchangeable
L3050	0x9BEA	RFG actual target	-8 to 8	0.0	-	Unchangeable
L3052	0x9BEC	RFG calculation output	-8 to 8	0.0	-	Unchangeable
L3054	0x9BEE	RFG speed ramping up	-8 to 8	0.0	-	Unchangeable
L3056	0x9BF0	RFG forced value of startup frequency function	-8 to 8	0.0	-	Unchangeable
L3058	0x9BF2	Offset amount of channel 1 UPDOWN	-8 to 8	0.0	-	Unchangeable
L3060	0x9BF4	UP/DOWN upper limit	-8 to 8	0.0	-	Unchangeable
L3062	0x9BF6	UP/DOWN lower limit	-8 to 8	0.0	-	Unchangeable
L3064	0x9BF8	Speed reference set through communication	-8 to 8	0.0	-	Unchangeable
L3066	0x9BFA	Communication setting	-8 to 8	0.0	-	Unchangeable
L3068	0x9BFC	Maximum forward frequency	-8 to 8	0.0	-	Unchangeable
L3070	0x9BFE	Minimum forward frequency	-8 to 8	0.0	-	Unchangeable
L3072	0x9C00	Maximum reverse frequency	-8 to 8	0.0	-	Unchangeable
L3074	0x9C02	Minimum reverse frequency	-8 to 8	0.0	-	Unchangeable
L3076	0x9C04	Forward frequency limit after the additional frequency	-8 to 8	0.0	-	Unchangeable
L3078	0x9C06	Reverse frequency limit after the additional frequency	-8 to 8	0.0	-	Unchangeable
L3080	0x9C08	Offset amount of channel 2 UPDOWN	0 to 6553.5	0.0	-	Unchangeable
L3094	0x9C16	Encoder position	-8 to 8	0.0	-	Unchangeable

10.15.19 L31 Floating-point Connector 10

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L3100	0x9C1C	Torque setting	-8 to 8	0.0	-	Unchangeable
L3102	0x9C1E	Additional torque	-8 to 8	0.0	-	Unchangeable
L3104	0x9C20	Filtered torque reference	-8 to 8	0.0	-	Unchangeable
L3106	0x9C22	Target torque setpoint	-8 to 8	0.0	-	Unchangeable
L3108	0x9C24	Speed limit in torque control	-8 to 8	0.0	-	Unchangeable
L3110	0x9C26	Torque control frequency offset	-8 to 8	0.0	-	Unchangeable
L3112	0x9C28	Max. forward torque	-8 to 8	0.0	-	Unchangeable
L3114	0x9C2A	Max. reverse torque	-8 to 8	0.0	-	Unchangeable
L3120	0x9C30	Target voltage upon V/f separation	-8 to 8	0.0	-	Unchangeable
L3122	0x9C32	V/f separation voltage output	-8 to 8	0.0	-	Unchangeable
L3144	0x9C48	D-axis output voltage	-8 to 8	0.0	-	Unchangeable
L3146	0x9C4A	Q-axis output voltage	-8 to 8	0.0	-	Unchangeable

10.15.20 L32 Floating-point Connector 11

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L3204	0x9C84	Single/double time pulse sending switchover point	0 to 65535	0	-	Unchangeable
L3206	0x9C86	Drive PCB overload accumulated value	-8 to 8	0.0	-	Unchangeable
L3208	0x9C88	Drive overload accumulated value	-8 to 8	0.0	-	Unchangeable
L3210	0x9C8A	Motor overload accumulated value	-8 to 8	0.0	-	Unchangeable
L3212	0x9C8C	Synchronization frequency	-8 to 8	0.0	-	Unchangeable
L3214	0x9C8E	Synchronous rotation angle	-8 to 8	0.0	-	Unchangeable
L3216	0x9C90	Control torque setpoint	-8 to 8	0.0	-	Unchangeable
L3218	0x9C92	Control flux setpoint	-8 to 8	0.0	-	Unchangeable
L3220	0x9C94	Excitation current setpoint	-8 to 8	0.0	-	Unchangeable
L3222	0x9C96	Torque current setpoint	-8 to 8	0.0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L3224	0x9C98	Actual excitation current	-8 to 8	0.0	-	Unchangeable
L3226	0x9C9A	Actual torque current	-8 to 8	0.0	-	Unchangeable
L3228	0x9C9C	Phase U current (transient value)	-8 to 8	0.0	-	Unchangeable
L3230	0x9C9E	Phase V current (transient value)	-8 to 8	0.0	-	Unchangeable
L3232	0x9CA0	Phase W current (transient value)	-8 to 8	0.0	-	Unchangeable
L3234	0x9CA2	Output current amplitude	-8 to 8	0.0	-	Unchangeable
L3238	0x9CA6	Output voltage amplitude	-8 to 8	0.0	-	Unchangeable
L3240	0x9CA8	Output voltage phase	-8 to 8	0.0	-	Unchangeable
L3248	0x9CB0	Drive bus voltage	0.0 to 6553.5	0.0	V	Unchangeable
L3288	0x9CD8	Capacitor core temperature	0.00 to 655.35	0.00	-	Unchangeable
L3290	0x9CDA	Effective value of capacitor current	0.00 to 655.35	0.00	-	Unchangeable
L3292	0x9CDC	U-phase loss	0.00 to 655.35	0.00	-	Unchangeable
L3294	0x9CDE	V-phase loss	0.00 to 655.35	0.00	-	Unchangeable
L3296	0x9CE0	W-phase loss	0.00 to 655.35	0.00	-	Unchangeable
L3298	0x9CE2	Rec average loss	0.00 to 655.35	0.00	-	Unchangeable

10.15.21 L33 Floating-point Connector 12

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L3354	0x9D1A	Speed loop active Kp	0 to 6553.5	0.0	-	Unchangeable
L3356	0x9D1C	Speed loop active Ti	0 to 6553.5	0.0	-	Unchangeable
L3358	0x9D1E	Speed loop output	0 to 6553.5	0.0	-	Unchangeable
L3360	0x9D20	Speed loop output Kp	0 to 6553.5	0.0	-	Unchangeable
L3362	0x9D22	Speed loop output Ti	0 to 6553.5	0.0	-	Unchangeable
L3364	0x9D24	Forward torque limit value	0 to 6553.5	0.0	-	Unchangeable
L3366	0x9D26	Reverse torque limit value	0 to 6553.5	0.0	-	Unchangeable
L3368	0x9D28	Forward limit of torque current	0 to 6553.5	0.0	-	Unchangeable
L3370	0x9D2A	Reverse limit of torque current	0 to 6553.5	0.0	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L3372	0x9D2C	Unlimited speed loop output	0 to 6553.5	0.0	-	Unchangeable
L3374	0x9D2E	Torque feedforward output	0 to 6553.5	0.0	-	Unchangeable
L3376	0x9D30	Torque of load observer	0 to 6553.5	0.0	-	Unchangeable
L3378	0x9D32	Total additional torque	0 to 6553.5	0.0	-	Unchangeable

10.15.22 L34 Floating-point Connector 13

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L3400	0x9D48	Tension process target speed	-3276.8 to 3276.7	0.0	%	Unchangeable
L3402	0x9D4A	Tension process target torque	-3276.8 to 3276.7	0.0	%	Unchangeable
L3404	0x9D4C	Tension process speed limit	-3276.8 to 3276.7	0.0	%	Unchangeable
L3406	0x9D4E	Tension process speed limit offset	-3276.8 to 3276.7	0.0	%	Unchangeable
L3408	0x9D50	Tension process torque limit	-3276.8 to 3276.7	0.0	%	Unchangeable
L3410	0x9D52	Taper AO output	-3276.8 to 3276.7	0.0	%	Unchangeable
L3412	0x9D54	Roll diameter AO output	-3276.8 to 3276.7	0.0	%	Unchangeable
L3414	0x9D56	Tension AO output	-3276.8 to 3276.7	0.0	%	Unchangeable
L3440	0x9D70	Retentive value of brake torque	-8 to 8	0.00	-	Unchangeable
L3442	0x9D72	Starting speed of the brake	-8 to 8	0.00	-	Unchangeable
L3444	0x9D74	Starting torque of the torque	-8 to 8	0.00	-	Unchangeable

10.15.23 L36 Floating-point Connector 15

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L3600	0x9E10	Input PZD1 (Converted)	-8 to 8	0.00	-	Unchangeable
L3602	0x9E12	Input PZD2 (Converted)	-8 to 8	0.00	-	Unchangeable
L3604	0x9E14	Input PZD3 (Converted)	-8 to 8	0.00	-	Unchangeable
L3606	0x9E16	Input PZD4 (Converted)	-8 to 8	0.00	-	Unchangeable

Param.	Communication Address	Name	Value Range	Default	Unit	Change Mode
L3608	0x9E18	Input PZD5 (Converted)	-8 to 8	0.00	-	Unchangeable
L3610	0x9E1A	Input PZD6 (Converted)	-8 to 8	0.00	-	Unchangeable
L3612	0x9E1C	Input PZD7 (Converted)	-8 to 8	0.00	-	Unchangeable
L3614	0x9E1E	Input PZD8 (Converted)	-8 to 8	0.00	-	Unchangeable
L3616	0x9E20	Input PZD9 (Converted)	-8 to 8	0.00	-	Unchangeable
L3618	0x9E22	Input PZD10 (Converted)	-8 to 8	0.00	-	Unchangeable
L3620	0x9E24	Input PZD11 (Converted)	-8 to 8	0.00	-	Unchangeable
L3622	0x9E26	Input PZD12 (Converted)	-8 to 8	0.00	-	Unchangeable
L3624	0x9E28	Input PZD13 (Converted)	-8 to 8	0.00	-	Unchangeable
L3626	0x9E2A	Input PZD14 (Converted)	-8 to 8	0.00	-	Unchangeable
L3628	0x9E2C	Input PZD15 (Converted)	-8 to 8	0.00	-	Unchangeable
L3630	0x9E2E	Input PZD16 (Converted)	-8 to 8	0.00	-	Unchangeable

11 Certification and Standard Compliance

Table 11–1 List of application standards

Application standard	Application scenario
IEC/EN 61800-5-1	Electrical drive system for speed regulation Part 5-1: Safety requirements Electrical, thermal, and energy
IEC/EN 61800-3:	Electrical drive system for speed regulation Part 3: Electromagnetic compatibility requirements and specific test methods
IEC/EN 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
EN/ISO 13849-2	Safety-related components of the mechanical safety control system Part 2: Confirm
UL 61800-5-1	Electrical drive system for speed regulation Part 5-1: Safety requirements Electrical, thermal, and energy
CSA C22.2 No. 274	Adjustable speed drive
IEC/EN 63000	Technical document for assessing hazardous substances in electrical and electronic products

The following directives and standards apply to this series of AC drives (actual certification is subject to the product nameplate certification information).

Certification Mark	Compliance with the instruction	Standards compliance	Remarks
c UL us LISTED	/	UL 61800-5-1	The AC drive complies with the drive component access requirements in North America
	/	CSA C22.2 No. 274	
CE	2014/35/EU	IEC/EN 61800-5-1	The AC drive complies with the requirements of the EU Low Voltage Directive 2014/35/EU
	2014/30/EU	IEC/EN 61800-3:	The AC drive complies with EU EMC Directive 2014/30/EU
	2011/65/EU	IEC/EN 63000	The AC drive complies with the requirements of the EU Hazardous Substances Directive 2011/65/EU
SGS TÜV SAAR FUNKTIONALE SICHERHEIT GEPRÜFT FUNCTIONAL SAFETY APPROVED	/	IEC/EN 61508	The AC drive complies with functional safety standards
	/	EN/ISO 13849-2	

Certificate download:

To download the certificate, go to:

https://www.inovance.com/portal/serviceSupport/download

12 Appendix

12.1 Service and Support

12.1.1 Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

12.2 List of Terms

Table 12–1 List of Terms

Function	Name	Explanation	Alias
Input/Output	DI	Functions of digital input terminals	/
	AI	AI Terminals	/
	VDI	Virtual digital input terminal	/
	HDI	High-speed digital input	/
	DO	Functions of digital output terminals	/
	AO	Analog output terminal	/
	VDO	Virtual digital output terminal functions	/
	HDO	High-speed digital output	/
	HDO pulse output (FMP)	High-speed pulse output terminal	/
	Digital output (FMR)	Open collector digital output terminals	/
	RO	Relay output terminal	/
Application Macro	Application macro	Multiple parameter group. The user can modify some parameters based on the function requirements based on one of the macros, and save the parameters as the user-defined parameters. This simplifies the commissioning process. Application macros are divided into interface macros and industry macros.	/
	Interface macro	The parameter set in the interface macro is mainly control interfaces such as digital input (DI), digital output (DO), and analog input (AI), facilitating user commissioning of control interface parameters.	/
	Industry macro	Mainly oriented to specific industrial applications, such as fans and water pumps, to facilitate user commissioning during application.	/
Frequency Detection	Frequency detection (FDT)	This function sets the detection value of the output frequency as well as the hysteresis value upon output cancellation. The hysteresis value is valid only during deceleration. Hysteresis does not occur in detection during acceleration.	/
	Jump frequency	The jump frequency enables the AC drive to avoid mechanical resonance points of the load.	/
Current Detection	Current detection	When the output current of the AC drive is lower than the threshold for a period, the DO outputs an active signal.	/

Function	Name	Explanation	Alias
Load Monitoring	Load monitoring	The load monitoring function monitors input signals (such as output current, output torque, and output power) related to the AC drive output speed including the overload or load loss monitoring.	/
	Load loss monitoring	Load loss monitoring is used to detect whether a load is lost, such as belt breakage or mechanical shaft breakage.	/
	Overload monitoring	Overload monitoring is used to detect whether the load is blocked, such as motor stall.	/
	Overload	After the actual motor speed enters the monitoring range set by the user, the AC drive collects the current motor speed and monitoring signal. It then uses a multi-point curve to determine the upper and lower limit areas of the monitoring signal that correspond to the current motor speed. If the current monitoring signal exceeds the upper limit, the load is overlimit.	/
	Load loss	If the current monitoring signal exceeds the lower limit, load loss occurs.	/
Process PID control	Process PID control	PID control is a common method of process control. By performing proportional, integral, and derivative operations on the difference between the feedback signal and the target signal of the controlled variable, and adjusting the output of the AC drive, a closed-loop system is formed to stabilize the controlled variable at the target level.	/
	PID	Proportion integration differentiation	/
	Kp	Proportional coefficient	/
	Ti	Integral time	/
	Td	Differential time	/
Acceleration/ Deceleration, motoring	Ramp function generator	Ramp-function generator	/
	JOG1/2	Jogging command 1/2	/
Motorized potentiometer	Motorized potentiometer	Virtual potentiometer output implemented by the software, which can be set by parameters in group P3.	/
Connector	Connector	Read-only display parameters that allow you to view the drive status and data, or can be read or used by other parameters.	/
	Bit connector (B connector)	It is a bit from which the value can only be 0 or 1. It is used to monitor the switching state of the system or as a binary signal source for certain functions.	/
	Word connector (K connector)	It is divided into single-word and double-word connectors, which enable status word monitoring in the system or serve as a signal source for certain functions.	/
	Floating-point connector	The floating-point number in the system is used to monitor floating-point type data in the system or as a signal source for certain functions.	/

Function	Name	Explanation	Alias
Free function module	Free function module	Associate multiple status signals and control signals together to achieve project control requirements. This module include logic operation, arithmetic function, word-to-bit conversion, data conversion, switch function, control function, multi-point curve, constant setting module. You can set related parameters to achieve simple logic operation.	/
Speed reference	Droop control	The operating frequency is automatically reduced when the load is heavy.	Softening control, speed drop
	Jump frequency	The set target frequency automatically jumps the resonance point.	Dangerous speed, jump speed
	Motor running direction	Switches the motor running direction without changing the positive and negative of the set frequency.	Motor phase sequence switchover, motor phase sequence

Function	Name	Explanation	Alias
Vector control	Vector control	The three-phase UVW current is divided into id/iq and the flux and torque are controlled separately. Speed and torque can be controlled, with good accuracy and dynamic response performance. DTC control has similar performance.	/
	FVC/SVC	Vector control with sensors / Vector control without sensors	/
	Acceleration feedforward torque	Calculate the acceleration/deceleration torque and perform compensation when speed reference changes, which can greatly reduce the demand for dynamic response of the speed loop Kp and Ti.	Acceleration feedforward, acceleration feedforward compensation, torque feedforward, acceleration compensation
	Kp	Proportional gain of the PI controller. The larger the Kp, the stronger the control effect, such as the SVC speed loop Kp.	/
	Ti	Integral time of the PI controller. The smaller the Ti, the stronger the integral control effect, such as the speed loop Ti in the SVC mode.	/
	Ki	The integral gain of the PI controller, the larger the Ki, the stronger the integral, and the Ki=Kp/Ti	/
	IF control	In the SVC control mode and at the zero speed, the set speed is used as the frequency of the output current. It is open-loop conrol. It improves the stability of the SVC mode at 0 speed.	Speed open-loop control
	Electromechanical time constant	Defines the time for the motor to accelerate to the rated speed with loads.	Mechanical time constant, rated motor start time
	Overspeed control	The overspeed controller runs after the motor is overspeed to prevent further acceleration.	Stall control
	V/f control	Constant voltage frequency ratio control. This mode is not highly dependent on parameters. It is simple, reliable, but has relatively poor dynamic performance and speed accuracy.	Scaler control
	DTC control	Direct torque control, which can control speed and torque, has good accuracy and dynamic response performance, and corresponds to vector control mode	/

Function	Name	Explanation	Alias
V/f control	Slip compensation	The rotor speed of the asynchronous motor is lower than the set speed after load is applied. The slip compensation can estimate the load size and automatically increase the frequency reference to improve the speed accuracy.	V/F slip compensation gain
	Overcurrent suppression	When the output torque is large, the frequency reference is automatically adjusted to reduce the output current to prevent overcurrent during heavy load or acceleration/deceleration.	Overcurrent stall suppression
	Torque boost	Used to compensate the voltage loss on the stator resistor to ensure the constant flux (voltage/frequency) of the motor in the V/f mode, improving the load capacity of the motor at a low speed.	Torque compensation, voltage boost, IR compensation
	Oscillation suppression	In the V/f control mode, oscillation may occur for motors with no load. Oscillation suppression prevents oscillation.	Resonance suppression

Function	Name	Explanation	Alias
Basic control	Shorting motor stator control	Synchronous motor control. The AC drive shorts the UVW output terminals together through IGBT control to form the braking torque. The higher the speed, the higher the braking torque. It prevents the motor from runaway, rotating at low speed and sliding freely for a long time.	Electronic short winding braking, internal short-circuited braking
	Carrier frequency	Output pulse voltage frequency	Pulse frequency, switching frequency
	DPWM/PWM	5-reference IGBT trigger: IGBT switch 4 times for one carrier cycle; 7-reference IGBT trigger: IGBT switch 6 times for one carrier cycle.	5-reference wave generation/ 7-reference wave generation
	Overmodulation	The output voltage in general control mode is low in the weak magnetic zone. Overmodulation can increase the output voltage by up to 5%. The output current can be reduced effectively under the same load. However, the output harmonics become slightly larger.	Edge modulation, Hexagon flux weakening
	Carrier ratio	The carrier ratio is the number of pulses in a sinusoidal wave current cycle. A low carrier ratio means fewer pulses within a sinusoidal current period, and the waveform of the output current will not achieve the ideal sinusoidal shape. Therefore, the performance of motor control is affected, and the motor generates severe heat. The synchronous motor may demagnetization.	Carrier frequency / output frequency
	Random PWM	The carrier frequency changes randomly during running. The sharp electromagnetic noise of the motor caused by the carrier frequency is dispersed. After random PWM is enabled, the motor has relatively soft "rustling" sound.	Pulse frequency wobble
	Overvoltage suppression	The motor deceleration time is automatically prolonged during deceleration and power generation to prevent overvoltage from motor power generation.	Vdc Max, overvoltage stall suppression, overvoltage control
	Undervoltage suppression	The motor speed is automatically reduced during the voltage dip of power grid to generate power to keep the AC drive bus free from undervoltage. After the power grid is restored, normal operation is restored. During long-term power failure of the power grid, this function reliably stops the motor to prevent the motor from rotating freely.	Power dip ride-through, voltage dip resistance, Vdc Min, undervoltage stall suppression, undervoltage control
	Overexcitation	The excitation current is automatically increased during deceleration, which increases the energy loss. The overvoltage during deceleration can be reduced and the motor can decelerate faster	Flux braking
	Speed tracking	For V/f and SVC controlled motors that rotate freely, the motor speed must be obtained before starting normally. The speed tracking algorithm can estimate the motor speed at startup and start without disturbance.	Speed tracking startup, flying start

Function	Name	Explanation	Alias
Basic control	Energy saving control	Energy-saving control of asynchronous motor, which automatically adjusts the output voltage according to the load size, reduces the output current to achieve energy-saving effect.	Efficiency optimization
	Back EMF	When the motor is dragged to the rated speed of no-load, the effective value of the output terminal (UV/VW/WU) voltage is the rated back EMF of the motor.	/
	No-load current	The output excitation current is the no-load current when the asynchronous motor is running without load in the non-weak field of V/f	/
	Mutual inductance	The main flux that can be generated per unit of current also represents the conductivity of the magnetic circuit between the stator and the rotor.	/
	Inertia ratio	Different motors have an inertia reference value calculated internally. After the inertia auto-tuning is accurate, the reference value is divided to the inertia ratio	/
	Number of motor pole pairs	The internal structure of the motor is determined by the same parameters. The higher the number of poles, the higher the output torque. The lower the mechanical speed.	/
	Rated motor slip	When the asynchronous motor is running with a rated load, the deviation between the actual output rotor frequency and the given frequency is the rated slip	/
	Current loop	Control the feedback current to a given current through different models to ensure dynamic response.	/
	Speed loop	The actual motor speed is controlled to a given speed, which meets the speed control requirements.	/

Function	Name	Explanation	Alias
Parameter auto-tuning	Motor auto-tuning	In vector control mode, motor resistance, inductance, and other parameters shall be known to establish an accurate calculation model, which is used to calculate the flux, torque, and speed of the motor. Parameter auto-tuning must be performed in FVC/SVC control. It is also recommended to perform parameter auto-tuning in V/f control for better performance.	Auto-tuning, parameter auto-tuning
	Static auto-tuning	Auto-tuning for motors that do not need to rotate and is performed with load.	/
	Dynamic auto-tuning	Auto-tuning for motors that need to rotate and is performed without load.	/
	With-load auto-tuning	The motor can be auto-tuned with a load, and the motor may rotate.	/
	Magnetic pole position auto-tuning	Before the synchronous motor starts, search for the magnetic field position. The accurate magnetic field position ensures the motor to start with a load.	Phase searching, magnetic pole position identification
	Stator resistance, per-unit value of rotor resistance	The per-unit value is generally in percentage. The actual motor parameters can be calculated according to the base value. Per-unit base value of resistance = rated motor voltage ÷ (1.732 x rated current) in Ω. Actual value of resistance = Per-unit value of resistance x base value of resistance.	/
	Leakage inductance, mutual inductance, Ld/Lq inductance per unit value	The per-unit value is generally in percentage. The actual motor parameters can be calculated according to the base value. Per-unit base value of inductance = Per-unit base value of resistance ÷ (2 x PI x rated frequency). The unit is H. Actual value of inductance = Per-unit value of inductance x base value of resistance.	/

12.3 Data flow description

Description
PXXX(0)

Description
PXXXX

Set values through parameters.

CC0001

This parameter stores a 16-bit or 32-bit value, which can be read by other parameters through address.

CC0001

This parameter stores a bit value (0 or 1), which can be read by other parameters through address.

Description
XXXXZ
YYYY

Read the value of another parameter (16- or 32-bit) through the parameter address.

Description
XXXXZ
YYYY

Read the value of another parameter (one bit) through the parameter address.

Description z
XXXX1
XXXX2

If EXT1 is active, the value is set by parameter 1.

Description z
XXXX1
XXXX2

If EXT2 is active, the value is set by parameter 2.

Description
XXXXZ
XXXXZ
YYYY

Read a 16- or 32-bit value through the parameter address.
If EXT1 is active, the value is set by parameter 1.
If EXT2 is active, the value is set by parameter 2.

Description
XXXXZ
XXXXZ
YYYY

Read a bit value (0 or 1) through the parameter address.
If EXT1 is active, the value is set by parameter 1.
If EXT2 is active, the value is set by parameter 2.

du/dt

Calculate the differential

Calculate the integral

Kp Tn Yp Y Yn

PID regulator

-1 0

1 2 3

Selection switch. Select one output from several inputs based on the condition

& ≥1 ≠

Logic AND/OR/XOR

Logic NOT/OR/XOR

X>Y X<Y X=Y
X≥Y X≤Y X≠Y

Compare the two input values

MAX MIN

Select the maximum/minimum value

Limit the input value

Description z
XXXX.1

Description z
XXXX.1

Current motor and motor control parameters.
Four groups of parameters corresponding to different motors can be set.
Current motor data is selected through MDS1/2.

Description
XXXX.Z
YYYY

Read a 16- or 32-bit value through the parameter address.
4 groups of motors can be set separately.
Current motor data is selected through MDS1/2, corresponding to current motor control parameters.

Description
XXXX.2
YYYY

Read a bit value (0 or 1) through the parameter address.
4 groups of motors can be set separately.
Current motor data is selected through MDS1/2, corresponding to current motor control parameters.

y t

Low-pass filter

y t

High-pass filter
with integral of small inertial element

t1 t2

Low-pass filter. When the input signal increases or decreases, it has different time constants.

Rate of change of the input signal is limited, with a rise time of 1/T.

+ + + −

Add/subtract the input value

Multiply the input value

x ÷ y

Divide the input value(x/y)

Absolute value of signed values

-1

Opposite to the signed values

Set dead zone. When the input value is in the dead zone, the output is always 0.

T 0

Enable delay, delay occurs when in the rising edge (0->1).

0 T

Disable delay, delay occurs when in the falling edge (1->0).

T T

Bi-directional delay, delay occurs when the level changes.

Z^{-1}

Delay the input signal by one pulse.

PS00019852B01

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