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MD610-INT Series Standard AC Drive

User Guide

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

Data code PS00022483A01

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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 MD610 is a standard AC drive specifically designed for fan and pump applications, delivering enhanced performance for these loads.

The AC drive is suitable for varies industries including lithium batteries, logistics, air compressors, PCB manufacturing, and forging presses.

Revision history

Date	Document version	Software version	Revision
June 2026	A01	Version: A00 Firmware code: 0302D929 Version tag: A2-22=163.14/ A2-23=163.22/A2-24=000.00/ A2-25=000.00	**Added:** • Added *" Parameter List" on page 1022*. • Added the "SOP-20-MD6 Intelligent External Operating Panel" section. • Added *"7.6 External operating panel disconnection detection" on page 179*. • Added the "CE Certification", "STO Safety Function Certification", and "KC Certification" sections. **Revision:** • Added protection categories and short circuit rated values in *"16.1 Electrical Specifications" on page 1521*. • Deleted UL-related content from *"16.6.2 Circuit Breaker And Fuse" on page 1538*. • Deleted UL-related content from *"16.6.6 Cable" on page 1561*.
May 2026	A00	-	First issue

Access to the guide

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1 Fundamental Safety Instructions

1.1 Safety Precautions

Safety Disclaimer

- This chapter provides essential safety instructions for proper use of the product. Before using this product, read through the guide and comprehend all the safety instructions. Failure to comply with the safety instructions may result in death, severe injury, or equipment damage.
- "DANGER", "WARNING", and "CAUTION" signs in this guide are only supplements to the safety instructions, and do not reflect all safety instructions to be followed.
- Use this product according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injury or property damage caused by improper use.

Safety levels and definitions

	Indicates that failure to comply with the notice can result in death or severe personal injury.
	Indicates that failure to comply with the notice may result in severe personal injury or death.
	Indicates that failure to comply with the notice may result in minor or moderate injury or equipment damage.

Safety Precautions

- Drawings in the guide are sometimes shown without covers or protective guards. Install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.
- Operators must take mechanical protection measures to protect their safety. For example, they must wear safety shoes, safety clothing, safety glasses, protective gloves and sleeves, or other protective equipment.

Unpacking
 • Do not install the product in the case of any damage, rust, or signs of use on the product or accessories upon unpacking. • Do not install the product in the case of water seepage into the product or missing or damaged components upon unpacking. • Do not install the product in the case of any discrepancy between the product you received and the product name on the packing list.

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package by following the unpacking sequence. Do not strike the package violently.
- Check whether there is damage, rust, or signs of bumping on the surface of the equipment and equipment accessories before unpacking.
- Check whether the package contents are consistent with the packing list before unpacking.

Storage and transportation

- Large or heavy equipment must be handled by qualified professionals using specialized hoisting equipment. Failure to comply could result in personal injury or equipment damage.
- Before hoisting the equipment, ensure that 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.
- Do not stand or stay below the equipment when it 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 could result in personal injury or equipment damage.

- Handle the equipment with care and mind your steps during transportation to prevent personal injury 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 could result in personal injury.
- Store and transport the equipment strictly based on the requirements. Failure to comply may result in equipment damage.
- Do not store or transport the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Do not store the equipment for more than three months. If the storage duration exceeds this limit, enhance protective measures and conduct necessary inspections.
- 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

- Ensure peripheral power distribution requirements are met, and select air switches, fuses, cables, and cable terminals correctly.
- Use standard torque for screw fastening, and use appropriate terminal crimping design for crimping terminals.
- Ensure heat dissipation requirements are met and design inlet and outlet airflow duct properly.
- Avoid environments with dripping water, conductive foreign objects (such as carbon fiber filaments, conductive metal dust, metal chips), salt spray, etc.

Failure to follow the above instructions will pose a fire risk.

- The equipment must be installed by professionals who have received the electrical trainings and have sufficient electrical knowledge. Non-professionals must not operate this equipment.

WARNING

- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic field.
- 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 an electric shock.
- Before installing the equipment in an enclosed environment (for example, a cabinet or case), use a cooling device (for example, a fan or air conditioner) to cool the environment to the required temperature. Failure to comply may result in equipment over-temperature or a 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 an incombustible object such as metal and do not touch or attach the equipment to combustibles. Failure to comply can result in fire.

The edges of the equipment metal enclosure are sharp. Note the following precautions during installation to avoid personal injury or cable damage:

- When performing installation, handling, or maintenance operations, always wear cut-resistant gloves.
- Avoid direct skin contact with enclosure edges and cut surfaces during operation.

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 product 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 executes variable speed operations. 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, switch off all the power supplies of the equipment. Wait for at least the time designated on the warning label before further operations because residual voltage still exists after power-off. Measure the DC voltage of the main circuit and ensure that the voltage is within the safety range. Failure to comply can result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board and other exposed live parts 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 can result in equipment damage or even 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 one end.
- 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.
- Avoid direct skin contact with enclosure edges and cut surfaces during operation.
- Route cables carefully during wiring. Avoid pressing them against sharp edges, which may cause squeezing or cutting. It is recommended to use protective sleeves or route cables away from such edges.
- If the enclosure has a protective film, remove it only after installation is completed and all work involving sharp edges has been finished.

CAUTION

- Follow the electrostatic discharge (ESD) procedure and wear an anti-static wrist strap to perform wiring. Failure to comply may result in damage to the equipment or to the internal circuit.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding. Failure to comply can result in equipment malfunction.

Power-on

DANGER

- Before powering on, check that the equipment is installed properly with secure wiring and the motor can be restarted.
- Before power-on, make sure that the power supply meets equipment requirements to prevent equipment damage or even 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

- After wiring and parameter setting, perform a trial run to ensure the equipment operates safely. Failure to comply may result in personal 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 a fire. Failure to comply may result in fire.
- Before powering on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injuries.

Operation

DANGER

- The equipment must be operated only by professionals. Failure to comply can result in injury or death.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply could result in electric shock.

The equipment features automatic restart. Never restore power supply or clear faults when the equipment is in operation or under maintenance, or when personnel are in contact with the mechanism. Before enabling the automatic restart function, ensure the following:

- No personnel are working on the load side, and no foreign objects cause blockages.
- All safety protection devices (such as safety doors, emergency stop circuits) are properly engaged.
- Prominent "Automatic restart" safety warning signs have been posted on the equipment and the site.

- Do not touch the enclosure, fan, or resistor with bare hands. Failure to comply may result in burns.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.
- If the branch circuit protection device trips, the fault current may have been cut off. To reduce the risk of fire or electric shock, inspect the current-carrying components and other parts of the equipment. Replace any damage parts immediately. If the current element of the overload relay is burned out, replace the entire overload relay.

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 may result in an electric shock.
- Before maintenance, disconnect all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- When using a permanent magnet (PM) motor, do not touch the motor terminals while the motor is rotating, because induced voltage may be present at the terminals even after the product is powered off. Failure to comply can result in electric shock.

- Perform routine and periodic inspection and maintenance on the equipment in accordance with maintenance requirements and keep a record.

Repair

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not repair the equipment with power-on. Failure to comply may result in electric shock.
- Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.

- Submit a request for repair based on the warranty agreement.
- When the fuse is blown or the circuit breaker or residual current device (RCD) 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 injury or equipment damage.
- Troubleshooting and repair must be performed by professionals according to the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment in accordance with the replacement instructions.
- Do not operate on damaged equipment. Failure to comply may result in death, personal injuries, or equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.

Disposal

- Dispose of the retired equipment in accordance with applicable national regulations and standards. Failure to comply can result in property damage, personal injury, or death.
- Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Additional Precautions

Cautions for the dynamic brake

- Dynamic braking can only be used for emergency shutdown in case of equipment faults and sudden power failure. Do not trigger faults or power failure frequently.
- When the equipment is operating at high speed, ensure an interval of more than five minutes for the dynamic braking function. Failure to comply may result in damage to the internal dynamic braking circuit.
- Dynamic braking is common in rotating mechanical structures. For example, when a motor has stopped running, it keeps rotating due to the inertia of its load. In this case, this motor is in the generating state and short circuit current passes through the dynamic brake. If this situation continues, the drive, and even the motor, may be burned.

Precautions for grounding

When applications such as electric welders are involved, connect the PE cable of the motor to the screws of the die-cast structural component of the drive. Failure to comply may result in motor burnout.

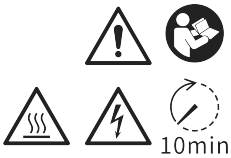
Effects of electromagnetic fields on medical implants

The motor is hazardous to persons wearing medical implants nearby the equipment.

The electromagnetic field affects the function of medical implants being used (such as cardiac pacemakers), resulting in malfunctioning.

Safety Labels

To ensure safe operation, comply with safety labels on the equipment and do not damage or remove the labels. The following table describes the meanings of the safety labels.

Safety Labels	Description
	• Before using the equipment, read the guide and safety precautions carefully. Failure to comply may result in personal injury, death, or equipment damage. • Do not touch the terminals or remove the cover with power-on or within 10 min after power-off. Failure to comply may result in electric shock.

1.2 Industrial Information Security

The product provides interfaces for network connection and data transmission. To protect factories, systems, machines, and networks from cyberattacks, it is essential to implement proper protection mechanism for industrial security.

Customers are responsible for providing and maintaining a secure connection between the product and their network or any other network to protect their factories, systems, machines, and networks from unauthorized access. Such systems or machines can be connected to an enterprise network or the Internet only when a secure connection is established and appropriate security measures (such as using antivirus software or installing firewalls) are in place.

Inovance continuously develops and improves its products and solutions to enhance safety. It is strongly recommended that you update the product promptly and always use the latest version.

Tampering with software (such as viruses, Trojans, and Worms) can lead to unsafe drive state, which can put the device in an unsafe operation state. This may result in death, serious injury, and property damage. Observe the following strictly.

- Always use the latest software version. If the product version is no longer supported or the latest version of the program is not applied, customers are at increased risk of cyber-attacks.
- Take proper protection measures (including but not limited to deploying antivirus software, firewall, WAF, IPS/IDS, situational awareness system, ID verification, and data encryption) to prevent files in the mobile storage device from being damaged by malware and protect products, networks, systems, and interfaces from unauthorized access, disturbance, intrusion, data disclosure, or information theft.
- Check all safety-related interfaces and settings after commissioning.

List of Terms

Table –1 List of Terms

Function	Name	Description	Alias
Input/Output	DI	Digital input terminal	-
	AI	AI Terminals	-
	VDI	Virtual digital input terminal	-
	HDI	High-speed digital input	-
	DO	Digital output terminal	-
	AO	AO terminal	-
	VDO	Virtual digital output terminal	-
	HDO	High-speed digital output	-
	HDO pulse output (FMP)	High-speed pulse output terminal	-
	Digital output (FMR)	Open-collector digital output terminal	-
	RO	Relay output terminal	-
Application Macro	Application Macro	Multiple default parameter sets are available. One macro is usually selected by users as the basis, with some parameters modified based on function requirements. The modified parameters are then saved by users as the user-defined parameter set, which can simplify the commissioning process. Application macros are divided into interface macros and industry-specific macros.	-
	Interface macro	The parameter set in the interface macro mainly applies to control interfaces such as digital input (DI), digital output (DO), and analog input (AI), facilitating commissioning on control interface parameters.	-
	Industry macros	The application macro mainly applies to specific industrial applications, such as fans and water pumps, facilitating commissioning during application.	-
Frequency detection	Frequency Detection (FDT)	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.	-
	Jump Frequency	Defines the jump frequency. The frequency jump function enables the AC drive to avoid mechanical resonance point of load.	-
Current detection	Current detection	The DO terminal outputs an active signal when the output current of the drive keeps lower than the setpoint for a period of time.	-

Function	Name	Description	Alias
Load monitoring	Load monitoring	Used to monitor input signals related to the output speed (such as output current, output torque, output power) of the drive, including load loss monitoring and overload monitoring.	-
	Load loss monitoring	Used to monitor whether load loss occurs (see the description load loss below).	-
	Overload monitoring	Used to monitor whether overload occurs (see the description of overload below).	-
	Overload	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 load monitoring signal exceeds the upper limit, the load is overlimit.	-
	Load loss	If the current load monitoring signal exceeds the lower limit, load loss occurs.	-
PID Process Control	PID Process Control	As a general process control method, PID process control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and derivative 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.	-
	PID	Proportional Integral Derivative	-
	Kp	Proportional coefficient	-
	Ti	Integral time	-
	Td	Derivative time	-
Acceleration and deceleration/ Jog	Ramp function generator (RFG)	Ramp function generator	-
	JOG1/2	Jog 1/2	-
Motorized potentiometer	Motorized potentiometer	Refers to the virtual potentiometer output by the software, which can be set through parameters in group P3.	-
Connector	Connector	Read-only parameters that allow you to view the drive status and data or allow read and use by other parameters.	-
	Bit connector (B connector)	The bit connector is sourced from the bit, which can be 0 or 1 only. It can be used to monitor the digital signal status in the system or used as a binary signal source for certain functions.	-
	Word connector (K connector)	The word connector is divided into single-word connector and double-word connector. This connector can be used as the signal source of some functions or used to monitor the status word in the system.	-
	Floating-point connector (F connector)	This connector is used to monitor floating-point type data in the system or act as a signal source for certain functions.	-

Function	Name	Description	Alias
Free function module	Free function module	Multiple status signals and control signals are used together to implement engineering control requirements. Such signals include logic operation, arithmetic function, word-bit conversion, data conversion, switch function, control function, multi-point curve, constant setting. You can set related parameters as needed to achieve simple logic operation.	-
Speed reference	Droop control	The operating frequency is automatically reduced upon excessive load.	Softening control, speed drop
	Jump Frequency	The target frequency is automatically adjusted to skip the resonance point.	Dangerous speed, jump speed
	Rotational direction of the motor	Used to switch the motor operating direction without changing the positive and negative signs of the frequency reference.	Motor phase sequence switchover, motor phase sequence

Function	Name	Description	Alias
Vector control	Vector control	The three-phase U/V/W current is divided into id/iq to control the magnetic flux and torque respectively. Direct torque control, which can control speed and torque and features high accuracy and dynamic responsiveness (similar to DTC control)	-
	Acceleration Torque Feedforward	Used to calculate the acceleration/deceleration torque and compensate for the speed change, which can greatly reduce the demand for speed loop Kp, Ti, and dynamic response of the loop.	Acceleration feedforward, acceleration feedforward compensation, torque feedforward, acceleration compensation
	Kp	Indicates the proportional gain of the PI controller. The higher the Kp, the stronger the control effect can be, such as the SVC speed loop Kp.	-
	Ti	Indicates the integral time of the PI controller. The lower the Ti, the stronger the integral effect can be, such as the SVC speed loop Ti.	-
	Ki	Indicates the integral gain of the PI controller. The higher the Ki, the stronger the integral effect can be (Ki = Kp/Ti).	-
	I/F control	The reference speed is used as the frequency for the output current at speeds close to 0 rpm in SVC mode. The speed is not in closed-loop control. It improves the stability at zero speed in SVC mode.	Speed open loop control
	Electromechanical time constant	Indicates the time for the motor to drive the load at rated torque to reach rated speed.	Mechanical time constant, rated motor start time
	Overspeed control	The overspeed controller operates once motor overspeed occurs to prevent further acceleration.	Stall control
	V/f control	Indicates constant voltage/frequency ratio control, which features stable control and is insensitive to parameters. However, the dynamic responsiveness and accuracy of V/f control mode is not as high as other control modes.	Scaler control, V/f control
	DTC control	Indicates direct torque control, which can control the speed and torque and features high accuracy and dynamic responsiveness. This mode corresponds to the vector control mode.	-

Function	Name	Description	Alias
V/f control	Slip compensation	The rotor speed of the asynchronous motor is lower than the set speed after the load is applied. In slip compensation, the magnitude of the load is estimated and the reference frequency is boosted automatically to improve the speed accuracy.	Slip compensation
	Overcurrent suppression	When the output torque is high, the frequency is automatically adjusted to reduce the output current to prevent overcurrent during high load or acceleration/deceleration.	Overcurrent stall suppression
	Torque boost	Indicates low-speed compensation for the stator resistance voltage drop to ensure a constant air gap flux (voltage/frequency) of the motor during operation in V/f mode, keeping a good load carrying capacity at low speed.	Torque compensation, voltage boost, IR compensation
	Oscillation suppression	In V/f control, the motor may oscillate during no-load operation. In this case, use the oscillation suppression function.	Resonance suppression

Function	Name	Description	Alias
Basic control	Active short circuit control	In synchronous motor control, the drive shorts the UVW output terminals together through IGBT control to form a braking torque. The higher the speed, the higher the braking torque. This function can prevent motor runaway, preventing the motor from rotating reversely at low speed or coasting for a long time.	Electronic motor stator shorting function, internal short-circuited braking
	Carrier frequency	Indicates the frequency of the output pulse voltage.	Pulse frequency, switching frequency
	DPWM/PWM	5-segment pulsing: The IGBT switches on and off four times for one carrier frequency cycle; 7-segment pulsing: The IGBT switches on and off six times for one carrier frequency cycle.	5-segment discontinuous pulse width modulation/7-segment continuous pulse width modulation
	Overmodulation	The output voltage in general control is low in the field weakening range. Overmodulation can increase the output voltage by up to 5%, reducing the output current effectively under the same load. However, the output harmonics may be increased slightly.	Edge modulation
	Carrier ratio	Indicates the ratio of effective carrier frequency to the output frequency. The carrier ratio indicates the number of pulses in a sinusoidal wave current cycle. If the carrier ratio is low, the pulse voltage is low, and the output current cannot be controlled properly, which may result in motor control error, overtemperature, and demagnetization.	Carrier frequency / output frequency
	Random PWM	The carrier frequency changes randomly during operation, so that the sharp noise of the carrier frequency can be dispersed. After random PWM is enabled, the motor may generate rustling sound.	Pulse frequency wobble
	Overvoltage Suppression	Used to prolong the motor deceleration time during regenerative braking, preventing overvoltage during quick deceleration.	V DCMax, 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, V DCMin, undervoltage stall suppression, undervoltage control

Function	Name	Description	Alias
Basic control	Over-excitation	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	In V/f and SVC control, a rotating motor can be started only after the motor speed is tracked before start. The speed tracking algorithm can estimate the motor speed upon start to allow bumpless start.	Flying start, restart at rotating
	Energy-saving control	In energy-saving control of the asynchronous motor, the output voltage is adjusted automatically based on the magnitude of the load to achieve the energy-saving effect by reducing the output current.	Efficiency optimization
	Back EMF	When the motor is being driven to operate at rated speed without load, the effective voltage on the output cables (UV/VW/WU) is the rated back EMF of the motor.	-
	No-load current	During no-load operation in the non-field weakening range of the asynchronous motor in V/f mode, the output excitation current is the no-load current.	-
Basic control	Mutual inductance	Indicates the main flux that can be generated per unit current and the conductivity of the magnetic circuit between the stator and the rotor.	-
	Inertia ratio	Indicates the inertia reference value for internal calculation of the motor (Inertia ratio = Auto-tuned inertia/Inertia reference value).	-
	Number of motor pole pairs	Determined by the internal structure of the motor. The higher the number of poles, the higher the output torque, and the lower the mechanical speed can be.	-
	Rated motor slip	Indicates the deviation between the actual rotor frequency output and the reference frequency during operation of asynchronous motors with rated load.	-
	Current Loop	Used to keep the feedback current consistent with the current reference through different model control to ensure dynamic responsiveness.	-
	Speed Loop	Used to keep the motor speed feedback be consistent with the speed reference to meet the requirements for speed control.	-

Function	Name	Description	Alias
Parameter auto-tuning	Parameter 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 SVC control mode. It is also recommended to perform auto-tuning in V/f control mode to obtain better performance.	Motor parameter auto-tuning
	Static auto-tuning	In static auto-tuning, the motor does not need to rotate or disconnected from the load.	-
	Dynamic auto-tuning	In dynamic auto-tuning, the motor must rotate and be disconnected from the load.	-
	With-load auto-tuning	In with-load auto-tuning, the motor can be connected to the load and the motor may rotate during auto-tuning.	-
	Magnetic pole position auto-tuning	Before starting the motor, perform magnetic pole position auto-tuning because a motor that connected to the load can be started properly only with an accurate field position.	Phase searching and magnetic pole position auto-tuning
	Stator resistance, per-unit value of rotor resistance	The standard per-unit value is generally a percentage. The actual motor parameters can be calculated through the reference value. Per-unit reference value of the resistor = Rated motor voltage/(1.732 x Rated current) in Ω. Actual resistance value = Per-unit value of the resistor x Reference value of the resistor.	-
	Leakage inductance, mutual inductance, Ld/Lq inductance per unit value	The standard per-unit value is generally a percentage. The actual motor parameters can be calculated through the reference value. Per-unit reference value of inductance = Per-unit reference value of the resistor /(2 x pi x rated frequency) in units of H. Actual inductance value = Per-unit inductance x Reference value of the resistor.	-

Description of Data Flow Diagram

Set values through parameters.

This parameter stores a 16-bit or 32-bit value, which can be read by other parameters through address.

This parameter stores a bit value (0 or 1), which can be read by other parameters through address.

Read the value of another parameter (16- or 32-bit) through the parameter address.

Read the value of another parameter (one bit) 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.

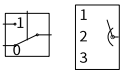
Read a 16- or 32-bit value through the parameter address.
If EXT1 is active, the value is set by parameter 1.
If EXT2 is active, the value is set by parameter 2.

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.

Calculate the differential

Calculate the integral

PID regulator



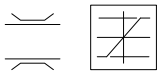
Selection switch. Select one output from several inputs based on the condition

Logic AND/OR/XOR

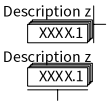
Logic NOT/OR/XOR

Compare the two input values

Select the maximum/minimum value



Limit the input value



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.

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.

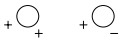
Read a bit value (0 or 1) through the parameter address.
4 groups of motors can be set separately.
Current motor data is selected through MDS1/2,
corresponding to current motor control parameters.

Low-pass filter

High-pass filter
with integral of small inertial element

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

Divide the input value(x/y)

Absolute value of signed values

Opposite to the signed values

Set dead zone. When the input value is in the dead zone, the output is always 0.

Enable delay, delay occurs when in the rising edge (0->1).

Disable delay, delay occurs when in the falling edge (1->0).

Bi-directional delay, delay occurs when the level changes.

Delay the input signal by one pulse.

2 Product Information

2.1 Components

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

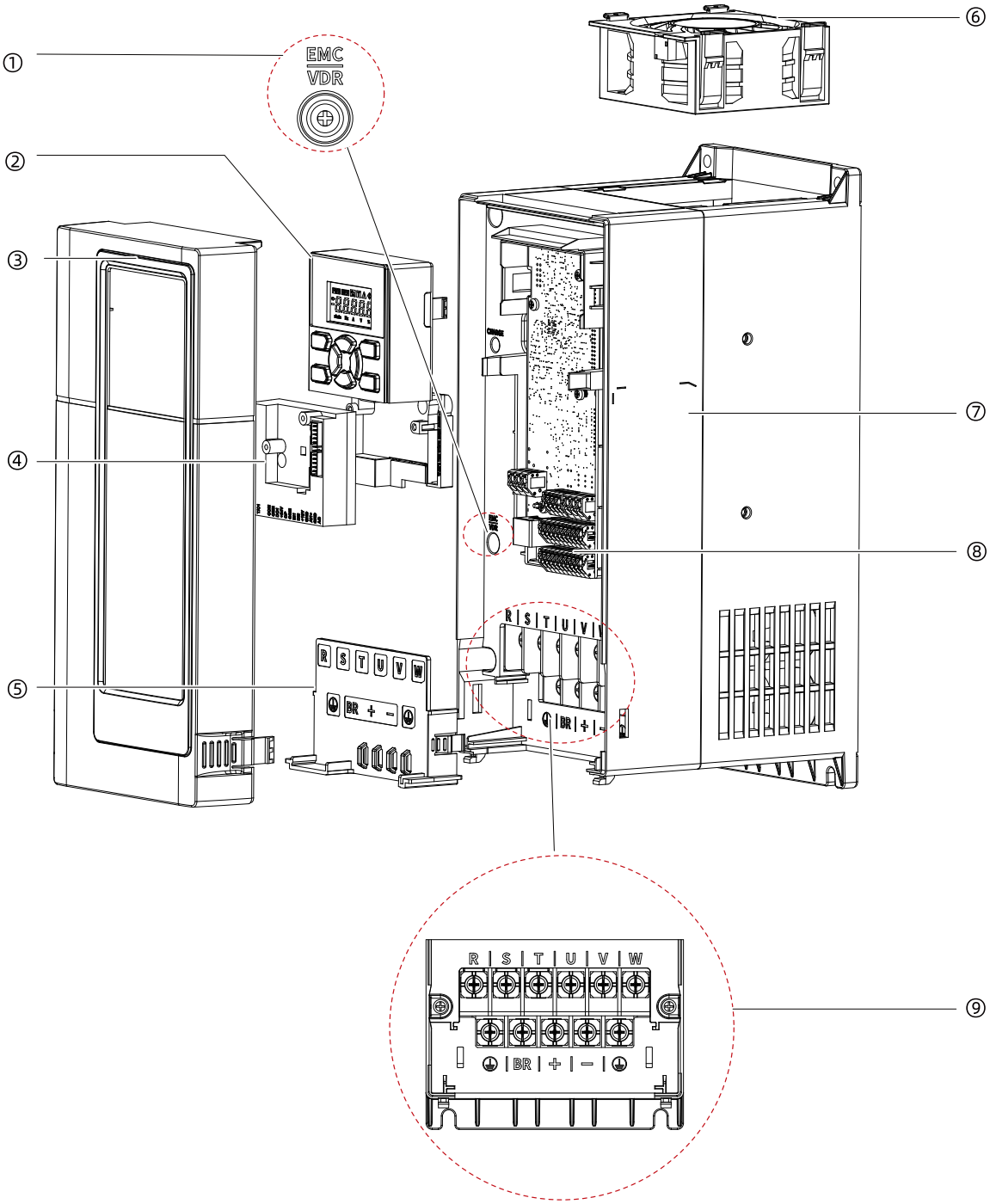


Figure 2-1 Product components

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 *"6.1 Operating Panel"*.
③	Plastic top cover	Used to protect the control section of the drive.	-
④	Expansion card	Optional card assembly (non-standard)	Reserved function
⑤	Terminal cover	Used to protect main circuit terminals.	-
⑥	Fan	Used for heat dissipation.	See details in *"4.5.2.2 Air Duct Design and Cooling" on page 80*.
⑦	Nameplate	Displays the product information.	See details in *"2.2 Nameplate and Model" on page 37*.
⑧	Control circuit terminal	Used to transmit and feed back control signals.	See details in *"4.7.1 Description of Control Circuit Terminals" on page 98*.
⑨	Main circuit terminals	Used to connect input and output cables.	See details in *"4.6.1 Descriptions of Main Circuit Terminals" on page 87*.

2.2 Nameplate and Model

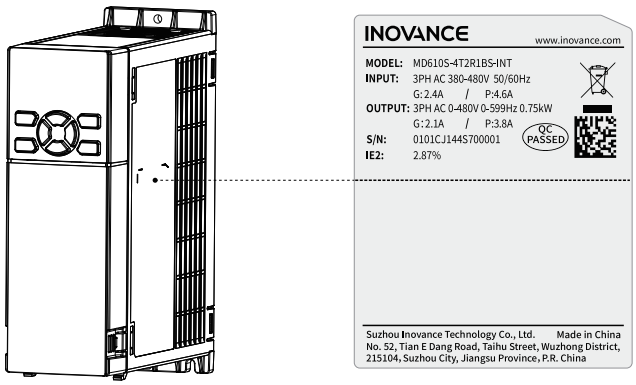
Model

$$\underset{①}{\text{MD610}}\ \underset{②}{\text{S}}\ \text{-}\ \underset{③}{\text{4T}}\ \underset{④}{\text{2R1}}\ \underset{⑤}{\text{B}}\ \underset{⑥}{\text{S}}\ \text{-}\ \underset{⑦}{\text{INT}}$$

①	**Product name** MD610: AC drive series	⑤	**Braking unit** B: With the braking unit
②	**Model** S: Standard	⑥	S: with the STO function
③	**Voltage class (V)** 4T: Three-phase 380 V to 480 V	⑦	INT: International version
④	**Output current (A)** 1R5: 1.5 2R1: 2.1 3R8: 3.8 ... 9R0: 9.0 ... 176: 176 Note: The rated current is configured based on heavy-duty models, which is composed of two digits and one letter. The letter R represents the decimal point ".".		

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

Nameplate



Description of serial number

0101D059 4 S 7 00001

① ② ③ ④ ⑤

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

2.3 Product Model List

Refer to the table below for the product model.

Table 2–1 Product models (three-phase 380 V to 480 V)

Structure	Model	Code	G-type model (150% overload capacity)					P-type machine (110% overload capacity)				
			Power (kW)	Output current (A)	Input current (A)	Power capacity (kVA) under 400 V power grid	Power capacity (kVA) under 480 V power grid	Power (kW)	Output current (A)	Input current (A)	Power capacity (kVA) under 400 V power grid	Power capacity (kVA) under 480 V power grid
T1	MD610S-4T1R5-INT	0101E834	0.37	1.5	1.7	1.3	1.4	0.75	2.1	2.4	1.9	2
	MD610S-4T1R5BS-INT	0101E840										
	MD610S-4T2R1-INT	0101E827	0.75	2.1	2.4	1.8	2	1.5	3.8	4.6	3.5	3.6
	MD610S-4T2R1BS-INT	0101E850										
	MD610S-4T3R8-INT	0101E824	1.5	3.8	4.6	3.5	3.6	2.2	5.1	6.4	4.9	5.1
	MD610S-4T3R8BS-INT	0101E843										
T2	MD610S-4T5R1-INT	0101E822	2.2	5.1	6.3	4.8	5	3	7.2	9	6.9	7.1
	MD610S-4T5R1BS-INT	0101E842										
	MD610S-4T7R2-INT	0101E829	3	7.2	8.9	6.8	7	4	9	11.4	8.7	9
	MD610S-4T7R2BS-INT	0101E836										
	MD610S-4T9R0-INT	0101E828	4	9	11.4	8.7	9	5.5	13	17	13	13.3
	MD610S-4T9R0BS-INT	0101E845										
T3	MD610S-4T013-INT	0101E856	5.5	13	16.8	12.8	13.2	7.5	17	22.7	17.3	17.6
	MD610S-4T013BS-INT	0101E823										
	MD610S-4T017-INT	0101E839	7.5	17	22	16.8	17.3	11	25	33.4	25.5	25.9
	MD610S-4T017BS-INT	0101E825										

Structure	Model	Code	G-type model (150% overload capacity)					P-type machine (110% overload capacity)				
			Power (kW)	Output current (A)	Input current (A)	Power capacity (kVA) under 400 V power grid	Power capacity (kVA) under 480 V power grid	Power (kW)	Output current (A)	Input current (A)	Power capacity (kVA) under 400 V power grid	Power capacity (kVA) under 480 V power grid
T4	MD610S-4T025-INT	0101E837	11	25	32.4	24.7	25.4	15	32	42.1	32.1	32.8
	MD610S-4T025BS-INT	0101E857										
	MD610S-4T032-INT	0101E838	15	32	41.6	31.7	32.5	18.5	37	49.1	37.4	38.2
	MD610S-4T032BS-INT	0101E852										
T5	MD610S-4T037-INT	0101E853	18.5	37	48.7	37.1	38	22	45	60.1	45.8	46.7
	MD610S-4T037BS-INT	0101E830										
	MD610S-4T045-INT	0101E847	22	45	58.5	44.6	45.8	30	60	71.6	54.6	56.1
	MD610S-4T045BS-INT	0101E851										
T6	MD610S-4T060-INT	0101E835	30	60	56.3	42.9	44	37	75	68.8	52.4	53.7
	MD610S-4T060BS-INT	0101E846										
	MD610S-4T075-INT	0101E832	37	75	70.4	53.7	55.1	45	91	84.7	64.6	66.1
	MD610S-4T075BS-INT	0101E854										
T7	MD610S-4T091-INT	0101E831	45	91	86.3	65.8	67.6	55	112	104.2	81.9	81.3
	MD610S-4T091BS-INT	0101E849										
	MD610S-4T112-INT	0101E848	55	112	107.6	82	84.1	75	150	139.9	106.6	108.9
	MD610S-4T112BS-INT	0101E833										

Structure	Model	Code	G-type model (150% overload capacity)					P-type machine (110% overload capacity)				
			Power (kW)	Output current (A)	Input current (A)	Power capacity (kVA) under 400 V power grid	Power capacity (kVA) under 480 V power grid	Power (kW)	Output current (A)	Input current (A)	Power capacity (kVA) under 400 V power grid	Power capacity (kVA) under 480 V power grid
T8	MD610S-4T150-INT	0101E841	75	150	141.6	107.9	110.7	90	176	165.4	126.1	128.9
	MD610S-4T150BS-INT	0101E826										
	MD610S-4T176-INT	0101E844	90	176	168.4	128.3	131.5	110	210	197.6	150.6	154
	MD610S-4T176BS-INT	0101E855										

Note

The power capacity of the 400 V and 480 V grid is calculated based on 440 V AC and 528 V AC, respectively, considering the voltage fluctuation of the grid.

3 Mechanical Design

3.1 Requirements for Extending Device Service Life

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, conductive dust, oil, salt mist, or halogen-containing corrosive gases; balanced three-phase power supply voltage, no 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.

3.2 Environmental Requirements

3.2.1 Environment Requirements

3.2.2 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: -40°C to +70°C Relative humidity: <95% RH, without condensation Compliant with IEC60721-3-2 2K3 (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: three times per direction Compliant with IEC 60068-2-27 (GB/T 2423.5)
Protection requirements	Harmful chemical prevention: 2C2; Compliant with IEC 60721-3-2 2C2 (GB/T 4798.2 2C2)
	Mechanically active substance: 2S2; Compliant with IEC 60721-3-2 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 Compliant with IEC 60721-3-3 3K3
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 requirements	Harmful chemical prevention: 3C2; Compliant with IEC 60721-3-2 3C2 (GB/T 4798.2 3C2)
	Mechanically active substance: 3S2; Complies with IEC60721-3-2 3S2 (GB/T 4798.2 3S2)
Environmental conditions for 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)

Property	Specifications
Protection requirements	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)

3.2.3 Reliable Design in Special Environment

Special 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 *"3.2.2 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 *"4.5.2.1 Clearance Requirements" on page 77* 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 *"3.2.2 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.

Countermeasures:

- 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.

Countermeasures:

- 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.

Countermeasures:

- Use a drive with high IP rating. Contact Inovance for details.
- Install the AC drive in a sealed control cabinet (seal the door with sealing strips, and protect the cable inlet and outlet holes by high-protection connectors such as gland heads or seal with fire-resistant mud).
- 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.

Countermeasures:

- Use a drive with high IP rating. Contact Inovance for details.

- Install the AC drive in a sealed control cabinet (seal the door with sealing strips, and protect the cable inlet and outlet holes by high-protection connectors such as gland heads or seal with fire-resistant mud).
- 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.

Countermeasures:

- Use a drive with high IP rating. Contact Inovance for details.
- Install the AC drive in a sealed control cabinet (seal the door with sealing strips, and protect the cable inlet and outlet holes by high-protection connectors such as gland heads or seal with fire-resistant mud).
- 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.

Countermeasures:

- Use a drive with high IP rating. Contact Inovance for details.
- Use air conditioners for heat dissipation in the cabinet.
- Install the AC drive in a sealed control cabinet (seal the door with sealing strips, and protect the cable inlet and outlet holes by high-protection connectors such as gland heads or seal with fire-resistant mud).
- 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.

Countermeasures:

- Use a drive with high IP rating. Contact Inovance for details.
- Install the AC drive in a sealed control cabinet (seal the door with sealing strips, and protect the cable inlet and outlet holes by high-protection connectors such as gland heads or seal with fire-resistant mud).
- Use air conditioners for heat dissipation in the cabinet.

Vibration/Shock

Use the drive within the vibration level range specified in *"3.2.2 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.

Countermeasures:

Use a drive of high IP rating, with vibration damping bracket installed (*"3.5.4 Anti-vibration Bracket" on page 58*). 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.

3.3 Product Dimensions

This section describes the dimensions of different models with different options.

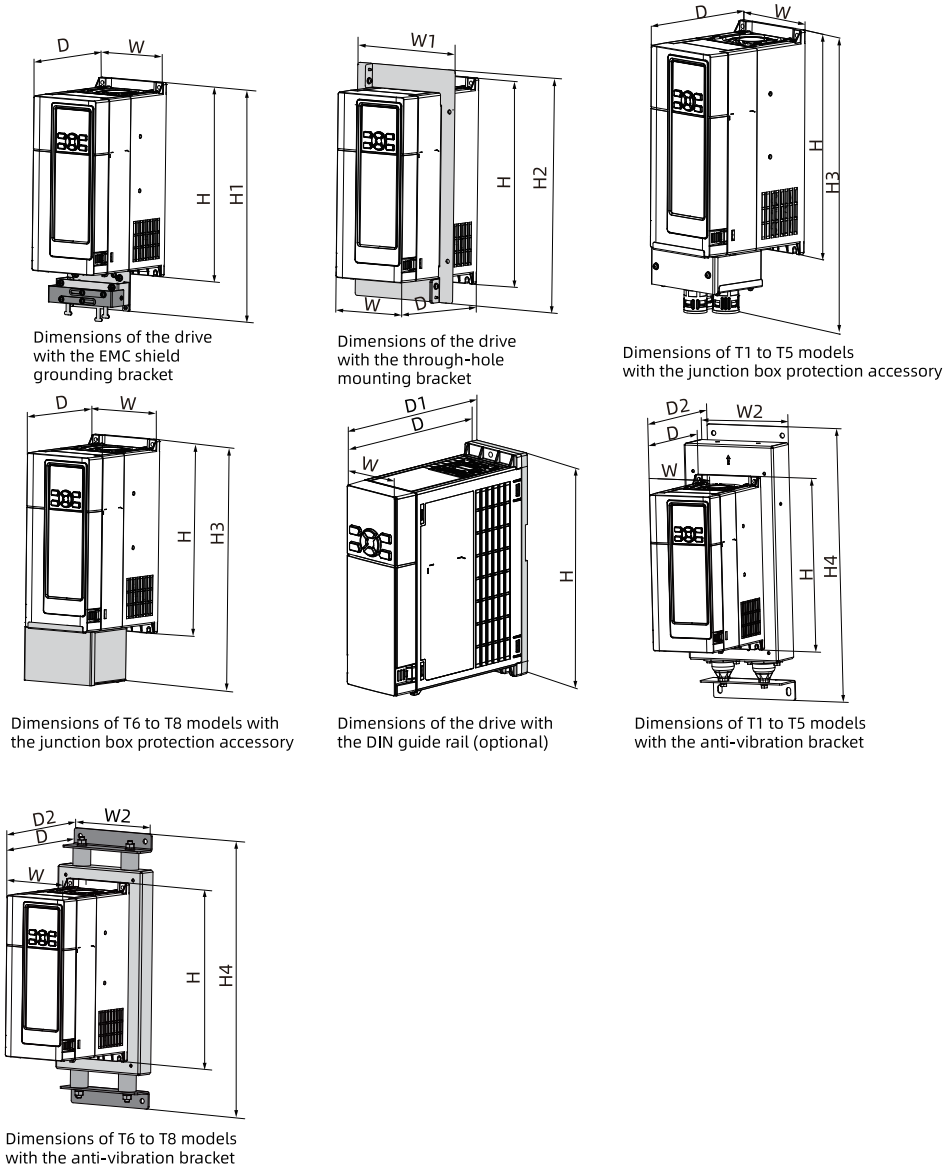


Figure 3-1 Product dimensions

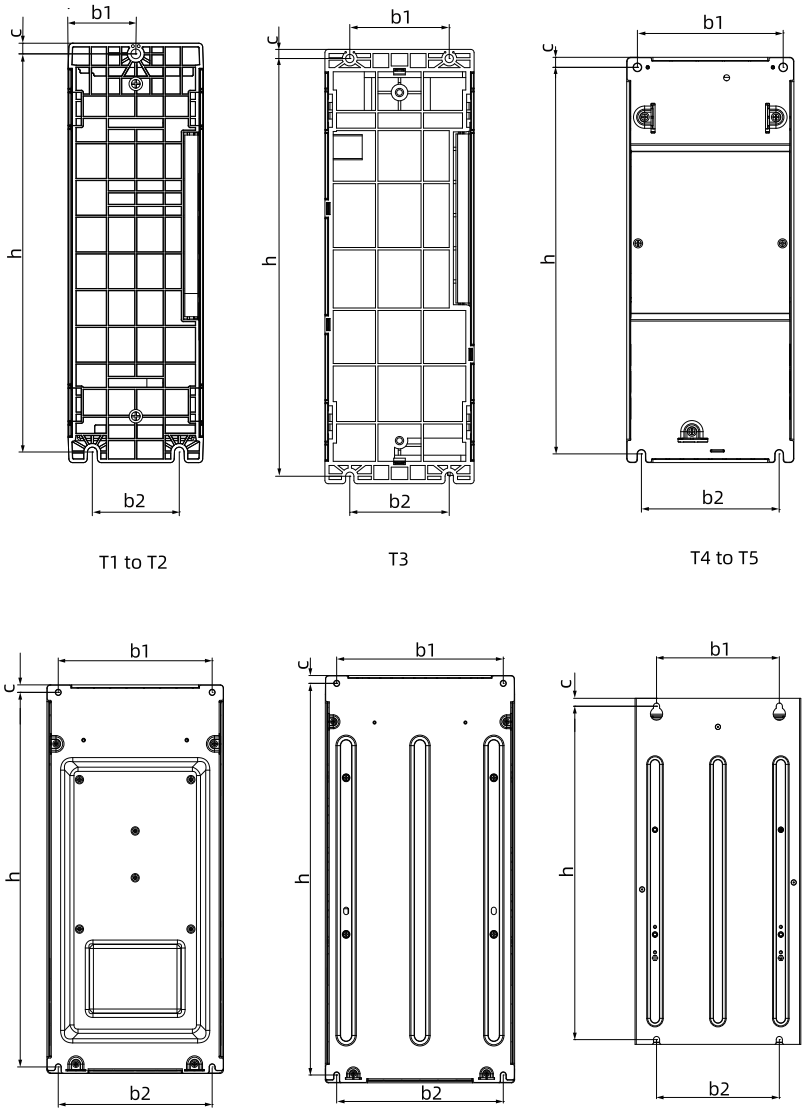


Figure 3-2 Mounting hole

Table 3–1 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 to 22)	T6 (30 to 37)	T7 (45 to 55)	T8 (75 to 90)
Outline dimensions mm (in.)	Width	W (drive)	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 anti-vibration bracket)	159 (6.26)	159 (6.26)	159 (6.26)	175 (6.89)	175 (6.89)	205 (8.07)	280 (11.02)	280 (11.02)
	Depth	D (drive)	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 anti-vibration bracket)	246.5 (9.70)	246.5 (9.70)	267 (10.51)	263 (10.35)	277 (10.91)	260 (10.24)	315 (12.40)	341 (13.43)
	Altitude	H (drive)	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)	-	-	-	343 (13.50)	370 (14.57)	479.5 (18.88)	580 (22.83)	595 (23.43)
		H3 (with junction box accessory)	274.2 (10.80)	274.2 (10.80)	326 (12.83)	372 (14.65)	404 (15.91)	487 (19.17)	620 (24.41)	655 (25.79)
		H4 (with anti-vibration bracket)	384.5 (15.14)	384.5 (15.14)	384.5 (15.14)	478.5 (18.84)	478.5 (18.84)	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)

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 to 22)	T6 (30 to 37)	T7 (45 to 55)	T8 (75 to 90)
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)

3.4 Installation Instructions

3.4.1 Safety Description

This equipment must be operated only by trained and qualified electrical personnel. Non-professionals are not allowed.

- 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.

3.4.2 Installation Method

Table 3–2 List of installation methods

Rated voltage (V)	Structure (kW)	Installation method		
		Backplate mounting	Through-hole mounting	Guide rail mounting
380	T1 (0.37 to 1.5)	Yes	-	Yes
	T2 (2.2 to 4)	Yes	-	Yes
	T3 (5.5 to 7.5)	Yes	-	-
	T4 (11 to 15)	Yes	Yes	-
	T5 (18.5 to 22)	Yes	Yes	-
	T6 (30 to 37)	Yes	Yes	-
	T7 (45 to 55)	Yes	Yes	-
	T8 (75 to 90)	Yes	Yes	-

Note

- For details on backplate mounting methods, see *"5.3 Backplate Mounting" on page 117*.

3.4.3 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.

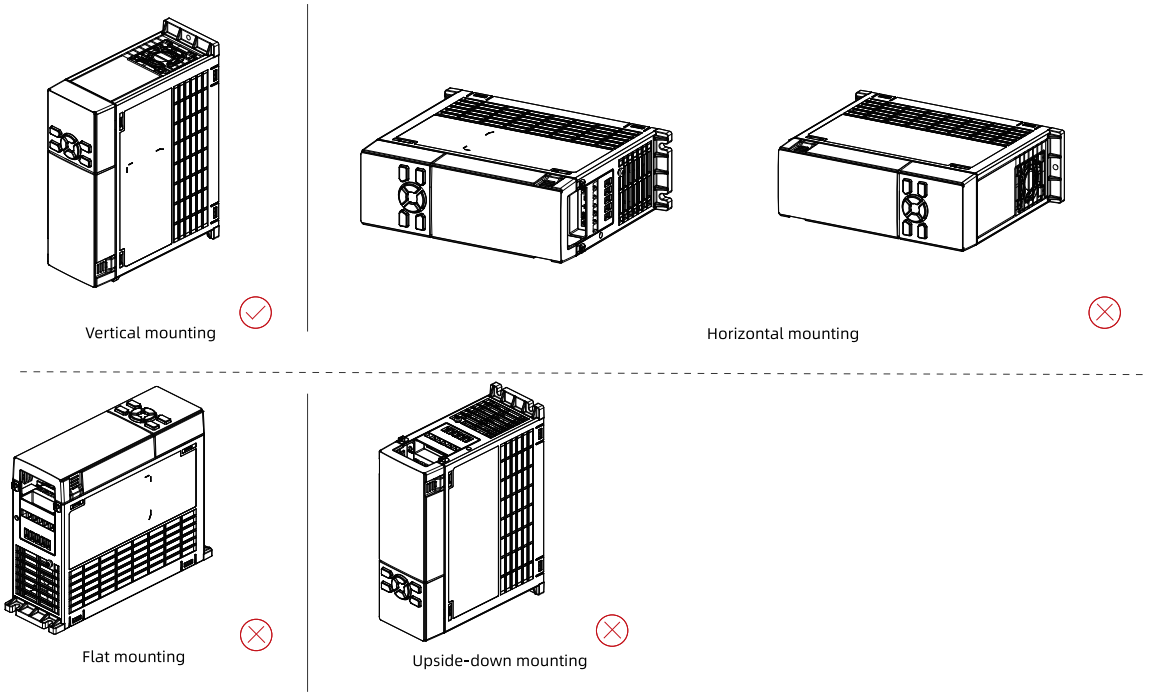


Figure 3-3 Installation direction

3.4.4 Installation Tools

Table 3–3 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 2-4.	
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 3–4 Specifications of the screw and screwdriver

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

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

3.5 Mounting Accessories

3.5.1 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.

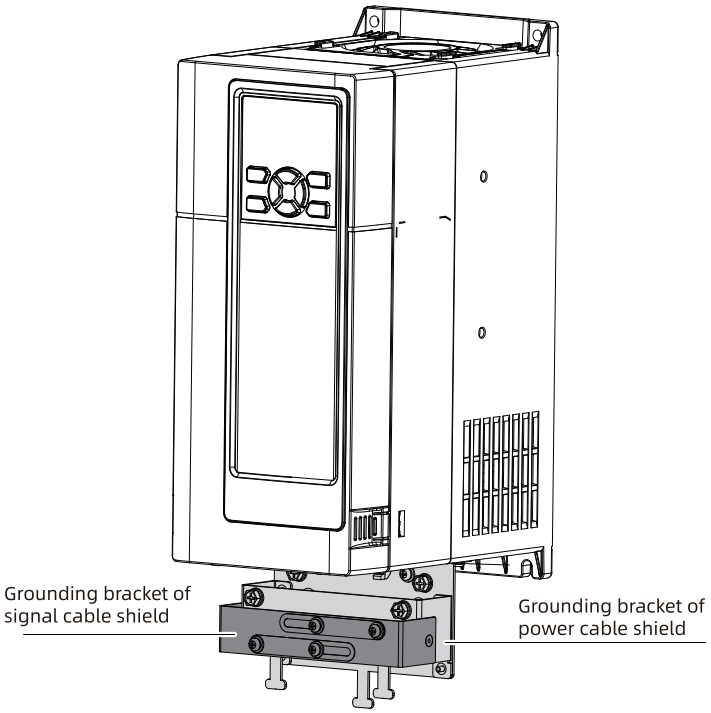


Figure 3-4 EMC shield grounding bracket

Table 3–5 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

Structure (kW)	Bracket model
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.)

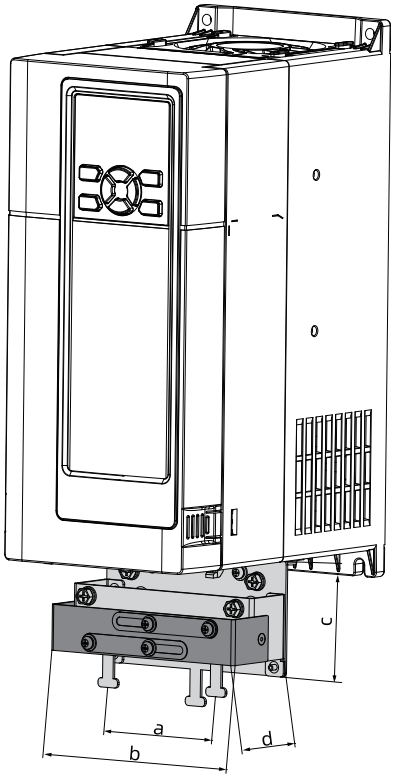


Figure 3-5 Installation dimensions of EMC shield grounding bracket

Table 3–6 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 details on installing the EMC shield grounding bracket, see *"5.7 Installation of Cable Shield Grounding Bracket" on page 128*.

3.5.2 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:

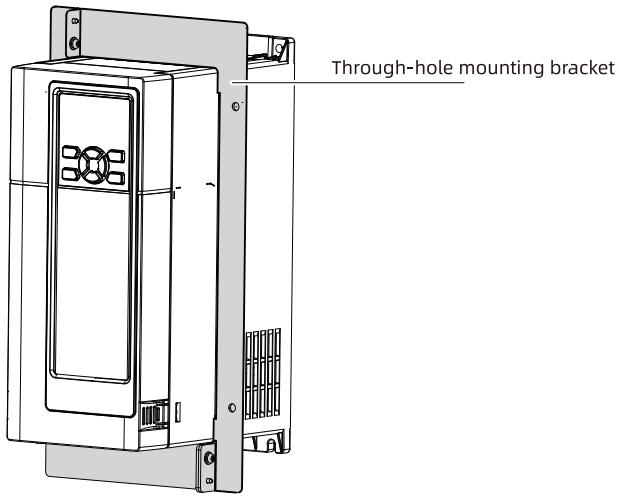


Figure 3-6 Through-hole mounting bracket

Table 3–7 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.)

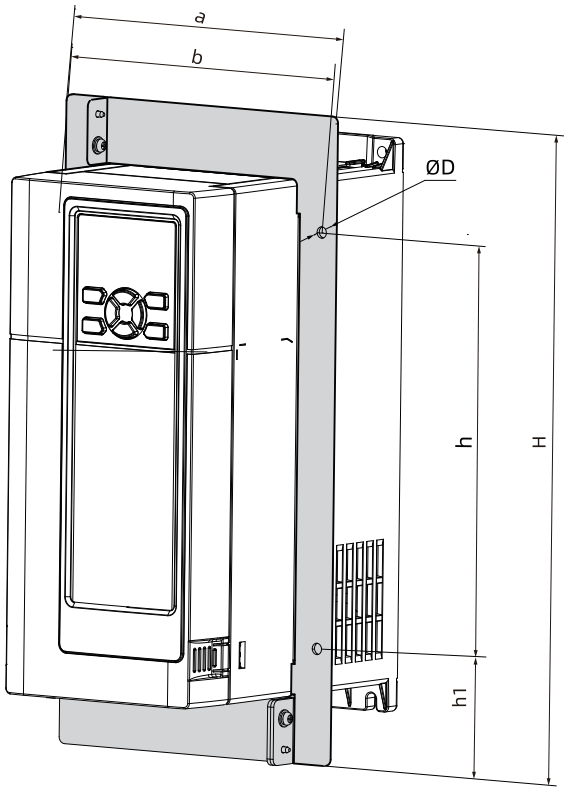


Figure 3-7 Dimensions of through-hole mounting bracket

Table 3–8 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 details on mounting embedded brackets, see *"5.4 Through-hole Mounting" on page 118*.

3.5.3 Options for Guide Rail Installation

Application conditions and functions:

The DIN rail mounting accessory is used to facilitate screw mounting and reduce installation time.

Applicable model

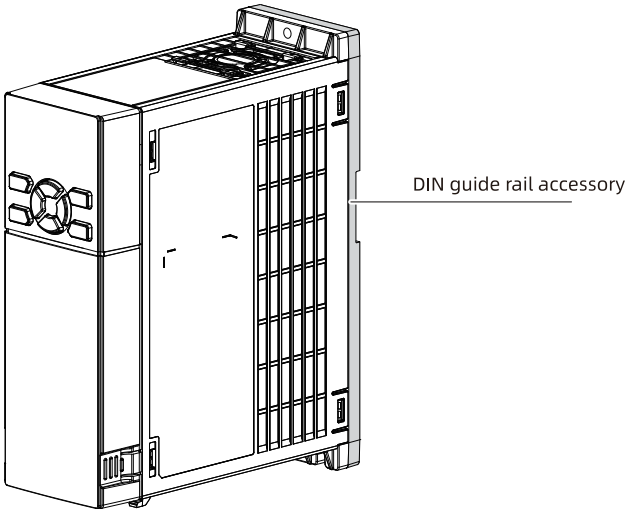


Figure 3-8 DIN rail mounting accessory

Table 3–9 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.)

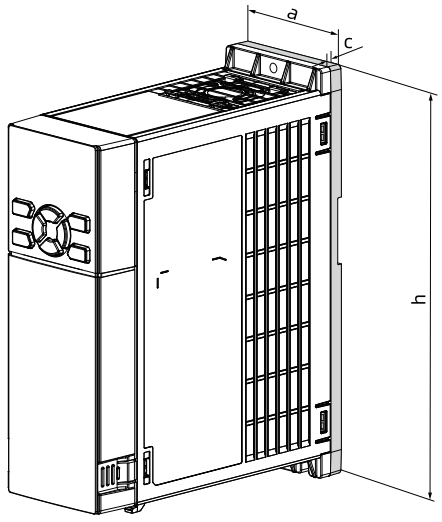


Figure 3-9 Mounting dimensions of the DIN rail mounting accessory

Table 3–10 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)			

Note

For details on mounting guide rails, see *"5.5 Guide Rail Mounting" on page 123*.

3.5.4 Anti-vibration Bracket

Application conditions and functions:

Anti-vibration brackets are designed for use in high-vibration and high-shock environments, such as punch presses, to reduce the impact of vibration on the drive.

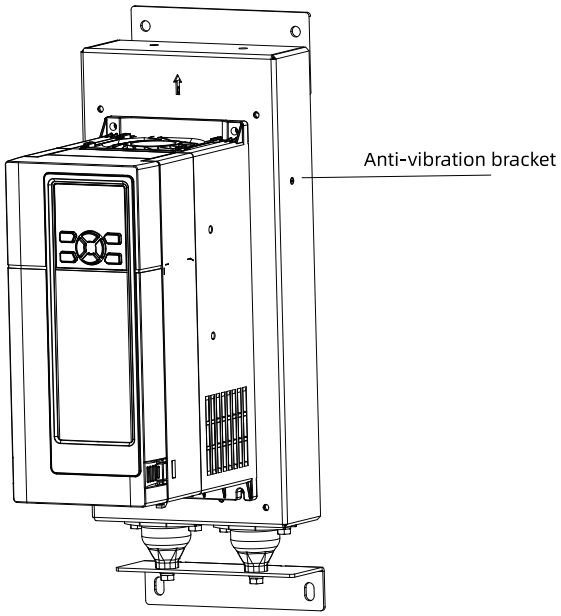


Figure 3-10 Anti-vibration bracket for T1 to T5 models

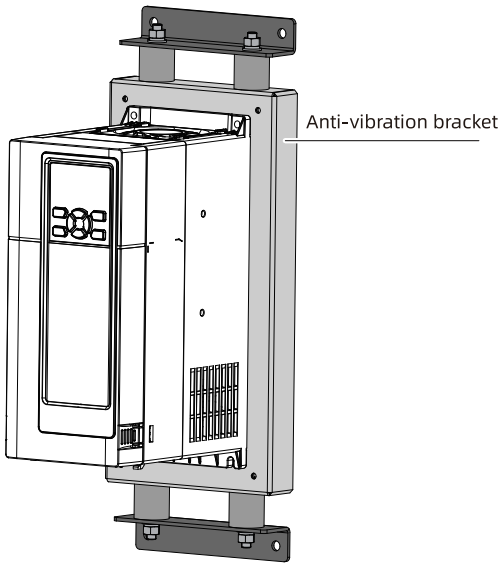


Figure 3-11 Anti-vibration bracket for T6 to T8 models

Table 3–11 Models of anti-vibration brackets

Structure (kW)	Bracket model
T1 (0.37 to 1.5)	MD610-AZJ-A2T2
T2 (2.2 to 4)	MD610-AZJ-A2T2
T3 (5.5 to 7.5)	MD610-AZJ-A2T2
T4 (11 to 15)	MD610-AZJ-A2T4
T5 (18.5 to 22)	MD610-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 anti-vibration brackets corresponding to different structures are shown in the following table. Unit: mm (in.)

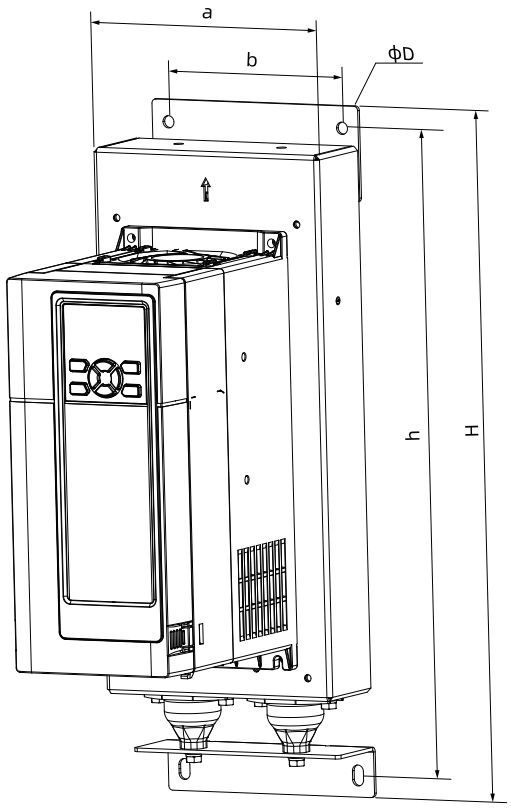


Figure 3-12 Mounting dimensions of the anti-vibration bracket for T1 to T5 models

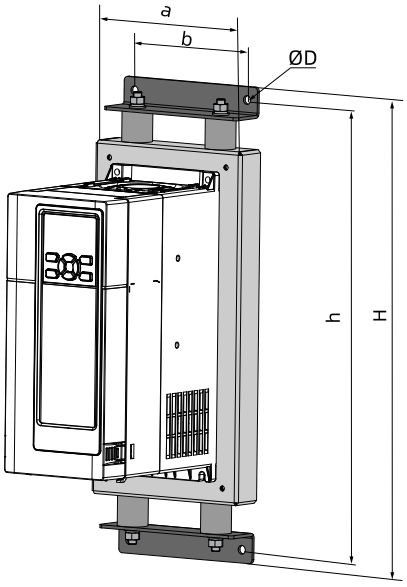


Figure 3-13 Mounting dimensions of the anti-vibration bracket for T6 to T8 models

Table 3–12 Mounting dimensions of the anti-vibration bracket

Structure (kW)	Dimension (mm (in.))				
	a	b	H	h	ΦD
T1 (0.37 to 1.5)	159 (6.26)	130 (5.12)	384.5 (15.12)	356.5 (23.29)	9 (0.35)
T2 (2.2 to 4)					
T3 (5.5 to 7.5)					
T4 (11 to 15)	175 (6.89)	135 (5.31)	478.5 (18.84)	448 (17.64)	9 (0.35)
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)

3.5.5 Junction box accessory

Application conditions and functions:

The junction box protection accessory is installed below the main circuit terminals of the drive. It is primarily used in environments with graphite dust or carbon fiber filaments to prevent foreign particles such as dust from entering the drive. Its main application is in lithium battery production workshops.

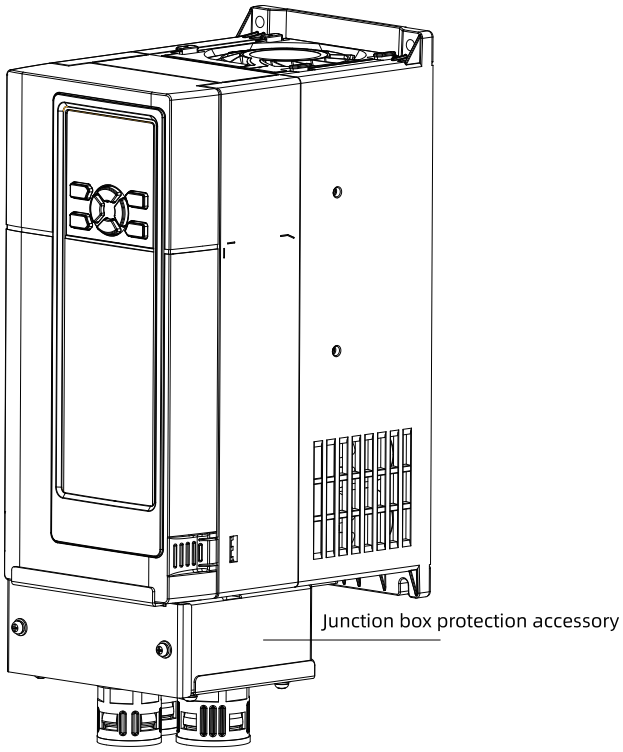


Figure 3-14 Junction box protection accessory for T1 to T5 models

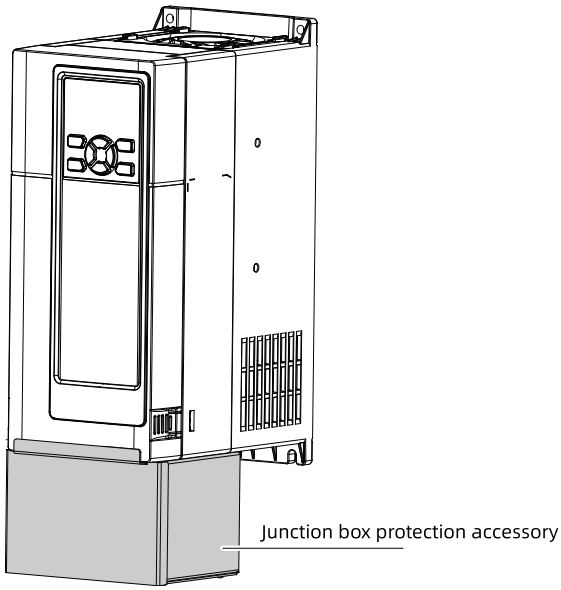


Figure 3-15 Junction box protection accessory for T6 to T8 models

Table 3–13 Model of junction box protection accessory

Structure (kW)	Bracket 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

Structure (kW)	Bracket model
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.)

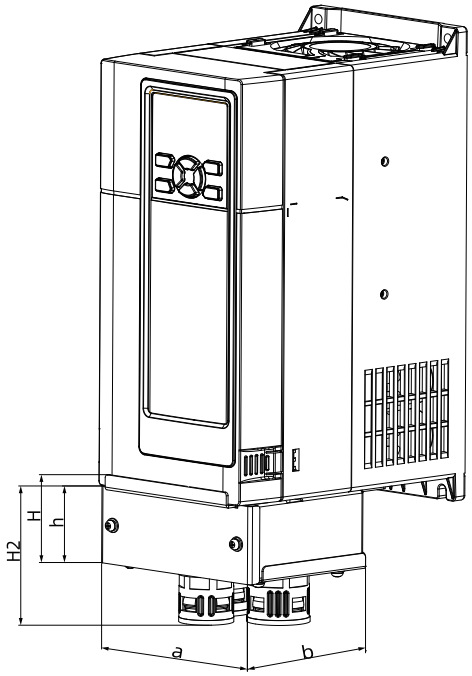


Figure 3-16 Mounting dimensions of the junction box accessory protection for T1 to T5 models

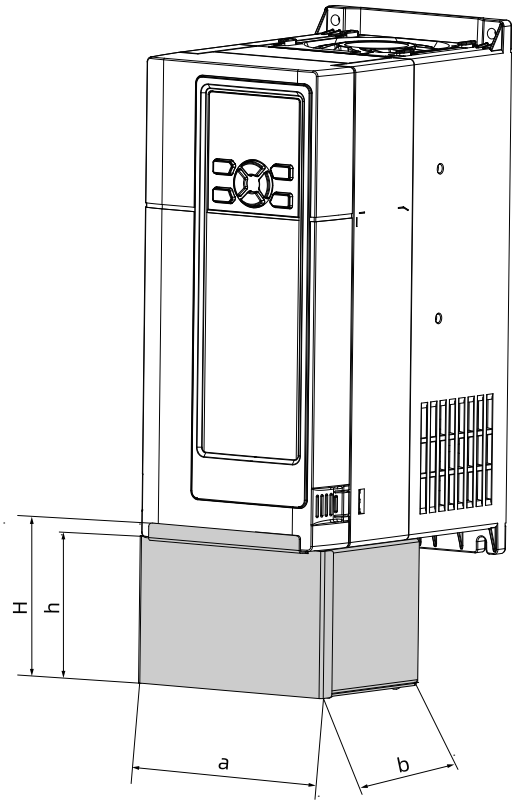


Figure 3-17 Mounting dimensions of the junction box accessory protection for T6 to T8 models

Structure (kW)	Dimension (mm (in.))				
	a	b	H	h	H2
T1 (0.37 to 1.5)	71 (2.80)	85.5 (3.37)	66.3 (2.61)	36.5 (1.44)	69.7 (2.74)
T2 (2.2 to 4)	71 (2.80)	85.5 (3.37)	66.3 (2.61)	36.5 (1.44)	69.7 (2.74)
T3 (5.5 to 7.5)	85 (3.35)	92 (3.62)	41.5 (1.63)	72.3 (2.85)	76.5 (3.01)
T4 (11 to 15)	125 (4.92)	96.2 (3.79)	114.2 (4.50)	83.4 (3.28)	84.1 (3.31)
T5 (18.5 to 22)	168.4 (6.63)	96.2 (3.79)	105 (4.13)	72 (2.83)	88.7 (3.49)
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)	-

4 Electrical Design

4.1 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.

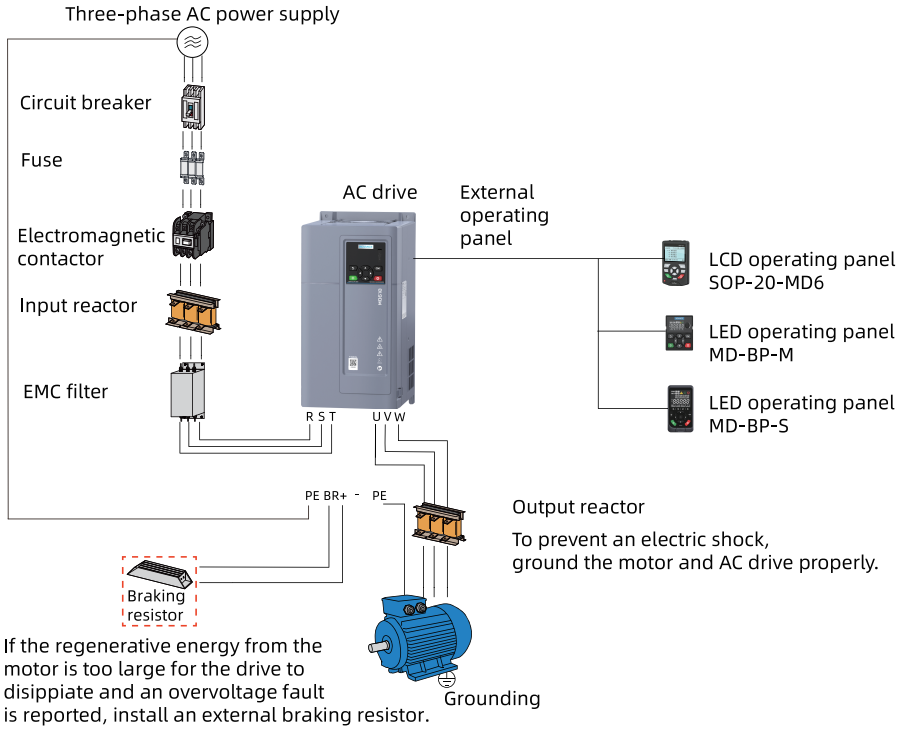


Figure 4-1 System connection diagram

Table 4–1 Description of electrical peripherals

Component	Installation position	Function description
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. 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.

Component	Installation position	Function description
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.
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 AC drive, there is excessive distributed capacitance 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 1537*.		

4.2 Electrical wiring diagram

The typical wiring diagrams for the standard model and bus model of the AC drive are shown in the figure below.

◯: The symbol represents the main circuit terminals.

⊗: The symbol represents the control circuit terminals.

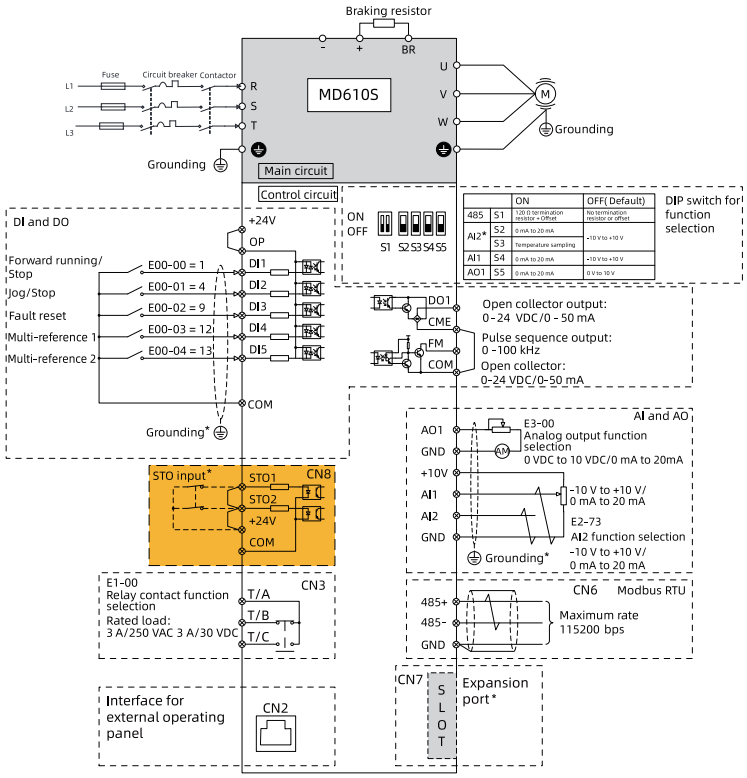


Figure 4-2 MD610S wiring

Note

- DI5*: DI5 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*: By default, no functions are preset for the terminals. The terminal functions are determined by parameters.

4.3 Requirements on Power Grid System Compatibility

Grid systems compatible

According to IEC 60364-1-2005 standard, this series of drives do not support delta-connected grids and are suitable for the following grid systems:

- TN
- TT
- IT

The meanings of the letters for the three grid systems TN, TT, and IT are as follows:

- First letter: Indicates the relationship between the power supply and ground.
  - T: A specific live part of the power supply is directly grounded.

  - I: All live parts of the power supply are isolated from the ground, or a specific live part is grounded through a high resistance.
- Second letter: Indicates the relationship between the equipment enclosure and ground.
  - T: The equipment enclosure is directly grounded, and this grounding system is independent of the power supply grounding.
  - N: The equipment enclosure grounding is directly bonded to the power supply grounding (in AC systems, the system grounding point is the neutral point where available. In the absence of a neutral point, a specific live conductor of the power system can be used as the grounding point).

General grid requirements

Input grid voltage range: three-phase 380 V to 480 V, -15% to +10%; frequency: 50/60 Hz ± 5%
Overvoltage category of the grid is OVCIII and pollution degree is PD2.

Installation altitude requirements

The maximum installation altitude is 3000 m, with rated height lower than or equal to 1000 m. For altitudes above 1000 m, derate 1% for every additional 100 m. The maximum altitude is 3000 m. Derating is not needed for altitudes lower than 1000 m.

Requirements in special environments

See *"16.5.2 Environment-based Derating" on page 1535* for requirements in special environments.

4.3.1 TN

TN system: The neutral point of the power transformer is grounded (the neutral point is grounded; in the absence of the neutral point, one of the phase conductors is grounded). Protective grounding is applied on the electrical device enclosure, and the power supply ground is connected to the device ground. The TN system is divided into three types, TN-S, TN-C, and TN-C-S based on the connection relationship between the neutral conductor N and the protective grounding conductor PE.

- TN-S system: The neutral conductor N and the protective grounding conductor PE are separate, but these two conductors are connected only at the power supply side, as shown in the figure below.
  Models with built-in filters and models with optional external EMI filters can be used in TN-S systems.

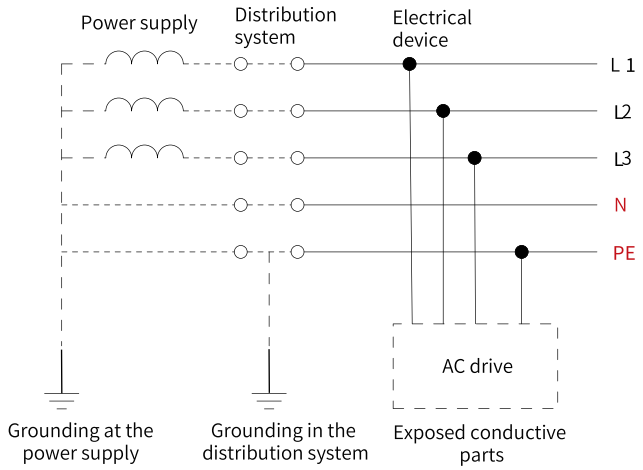


Figure 4-3 TN-S system (neutral conductor N and protective grounding conductor PE are separate)

- TN-C system: The neutral conductor N and the protective grounding conductor PE are combined into a single cable PEN, which runs throughout the entire system, as shown in the figure below. Models with built-in filters and models with optional external EMI filters can be used in TN-C systems.

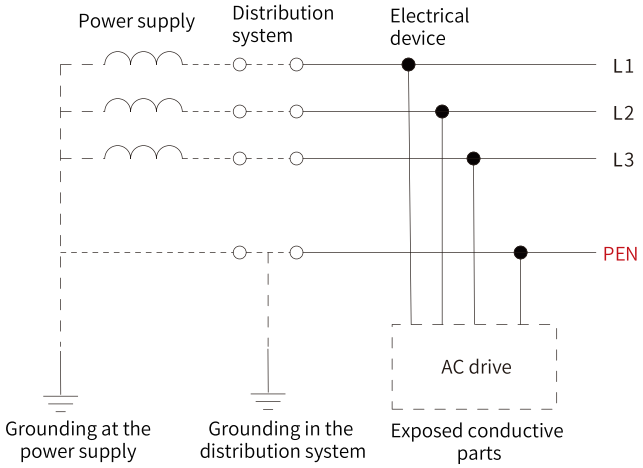


Figure 4-4 TN-C system (neutral conductor N and protective grounding conductor PE combined into a single cable PEN)

- TN-C-S system: The neutral conductor N and the protective grounding conductor PE are combined into a single cable PEN in a specific area of the system. From a designated separation point onward, they are divided into two independent conductors, N and PE, as shown in the diagram below.
  Models with built-in filters and models with optional external EMI filters can be used in TN-C-S systems.

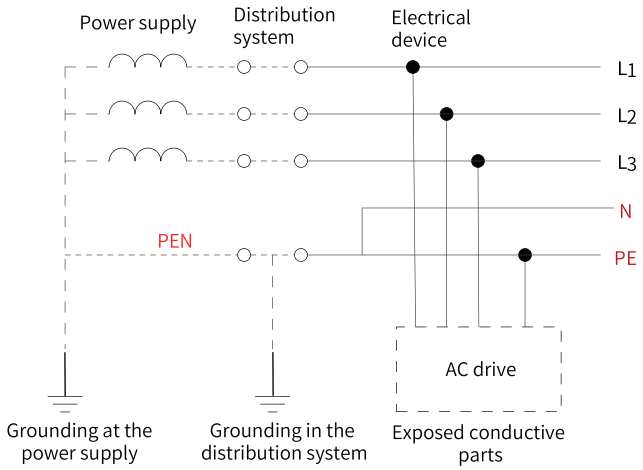


Figure 4-5 TN-C-S system (neutral conductor N and protective grounding conductor PE are separate)

- This series of drives are applicable only to star-connected power grids. Therefore, it can be used in TN systems of star-connected power grids (where the neutral conductor N is grounded), but cannot be used in TN systems of delta-connected power grids.
- This series of drives equipped with built-in filters and external optional EMI filters cannot be used on TN systems with delta-connected power grids.

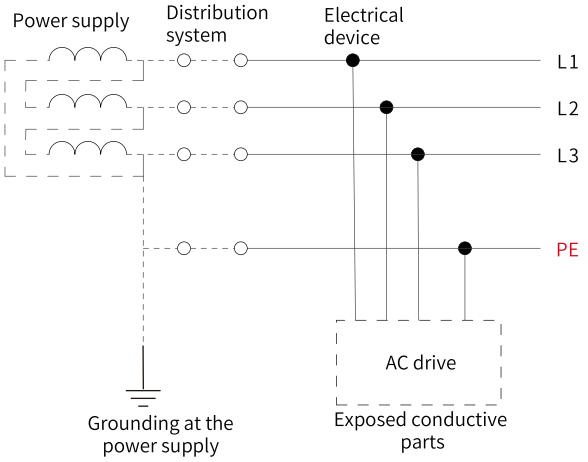


Figure 4-6 TS-S system (delta-connected power grid, with power grid grounded through one phase conductor)

Phase conductor grounding in TN system: In cases where asymmetrical grounding occurs in a TN system (phase conductor L1 grounded for example), the grounding switches for both the Y-capacitors (line-to-ground) and line-to-ground varistors of the drive must be disconnected.

4.3.2 TT

TT system: The neutral point of the power supply transformer is grounded, and the equipment enclosure has been applied with protective grounding. However, the grounding of the power supply transformer and the grounding of the electrical equipment are independent of each other, with no

electrical connection between the two grounding points. There are two types of TT systems: one with a neutral conductor N, and one without a neutral conductor N, as shown in the figure below.

- Models with built-in filters and models with optional EMI filters can be used on TT systems with a neutral conductor N.
- Models with built-in filters and models with optional EMI filters cannot be used on TT systems without a neutral conductor N. On such systems, the EMC/VDR grounding screw for the internal Y capacitor and line-to-ground varistor in the drive must be disconnected.

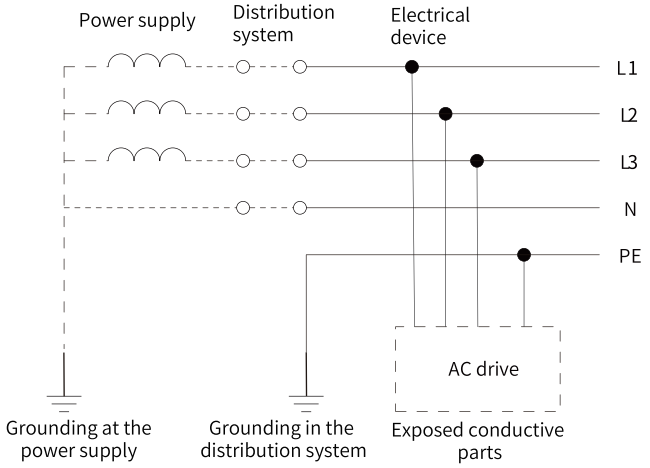


Figure 4-7 TT system (with independent neutral conductor and protective grounding conductor)

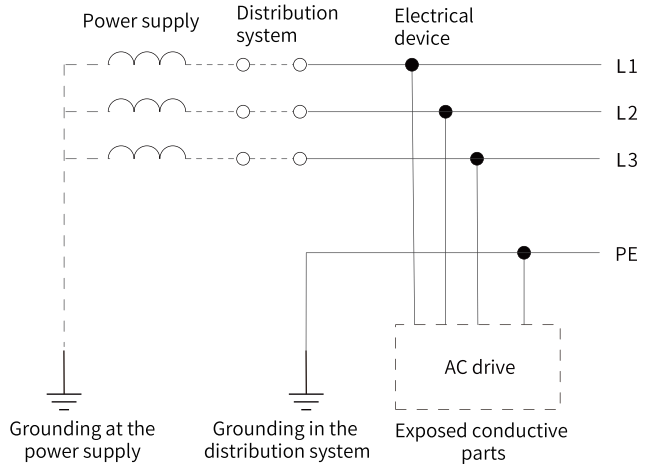


Figure 4-8 TT system (without neutral conductor but with protective grounding conductor)

4.3.3 IT

IT system: The neutral point of the power transformer is ungrounded (or grounded through a high impedance), and protective grounding is applied on the equipment enclosure.

When the drive is installed on an IT power grid, the line-to-ground voltage of one phase may exceed the line voltage. To prevent damage to the drive, disconnect the EMC/VDR grounding screws for both the Y-capacitor (line-to-ground) and line-to-ground varistor of the drive, as shown in the following figure.

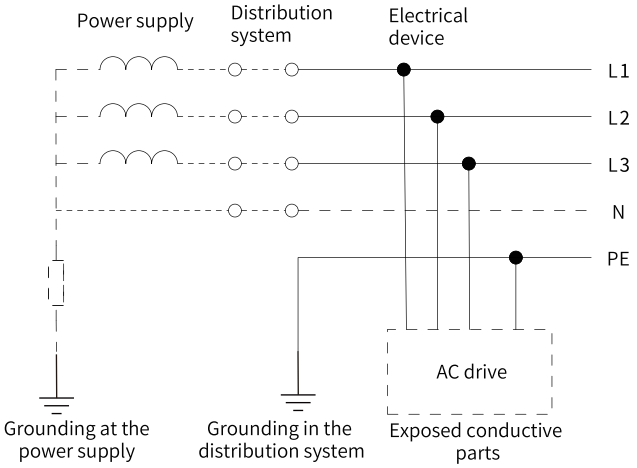


Figure 4-9 IT system (with N connector and without N conductor)

4.4 Basic Electrical Safety Precautions

4.4.1 Short-circuit protection

Warning

An excessively high grid impedance can result in an electric shock or fire.

When the short-circuit current is excessively low, the protective device may not operate at all or may not operate in time, which may result in an electric shock or a fire.

- Ensure that the short-circuit current at the power input terminals of the drive can reach the tripping current of the protective device when short circuit or ground fault occurs between cables.
- If the short-circuit current during a ground fault is insufficient and does not reach the tripping current of the protective device, especially on a TT grid where the required short-circuit current may be extremely low, install an additional residual current device (RCD).

Note

A residual current device (RCD) is defined as a mechanical switching device or a combination thereof, capable of making, carrying, and breaking currents under normal operating conditions, and designed to open its contacts when the residual current reaches a specified value under defined conditions. Residual current devices (RCDs) are primarily used to provide protection against dangerous and potentially fatal electric shocks, as well as to protect against fire hazards caused by sustained ground fault currents.

Warning

An excessively low power grid impedance may cause electric shock or fire.

When the short-circuit current is excessively high, the protective device may be damaged due to its inability to interrupt this current, which can result in an electric shock or a fire.

Ensure that the unregulated short-circuit current at the power input terminals of drive does not exceed the breaking capacity of the protective device.

Causes of short circuit:

Unusual impedance reduction or insulation failure occurs between two live conductors with a high potential difference, causing electrical breakdown or arcing, which leads to a short circuit. The short-circuit current in this case is excessively high, which can easily result in device damage, grid tripping, or a fire. General causes:

- Conductive solid particles: Environments in industries such as metalworking, plastic machinery, mining, and metallurgy often contain metal shavings, carbon powder, conductive carbon fibers or similar, which can easily enter the device and cause short circuit.
- Conductive liquids: Cutting fluid from machine tools can enter the device, or water may enter the device due to inadequate protection.
- Corrosive gases: Gases containing halogen elements (such as sulfides, bromine) or ammonia can cause internal corrosion of the device, leading to arcing and short circuit.
- External short circuit: The insulation of cables after prolonged operation in high temperature can be degraded and damaged, leading to phase-to-phase arcing, phase-to-ground arcing, or ground fault of the braking resistor. The drive can provide protection against this type of short circuit generally.
- Motor insulation damage: The insulation degradation causes short circuit between winding turns or between windings and ground. The drive can provide protection against this type of short circuit generally.

In what situations must a short-circuit protection device be used?

To prevent internal short circuit in the drive due to uncontrollable factors such as component or insulation failure, install a fuse or circuit breaker. This protects the drive and input cables and prevents damage to adjacent devices, which reduces the risk of fire and electric shocks.

Use the specifications recommended in *"16.6.2 Circuit Breaker And Fuse" on page 1538*.

The safe configuration diagram for fuses/circuit breakers is shown below.

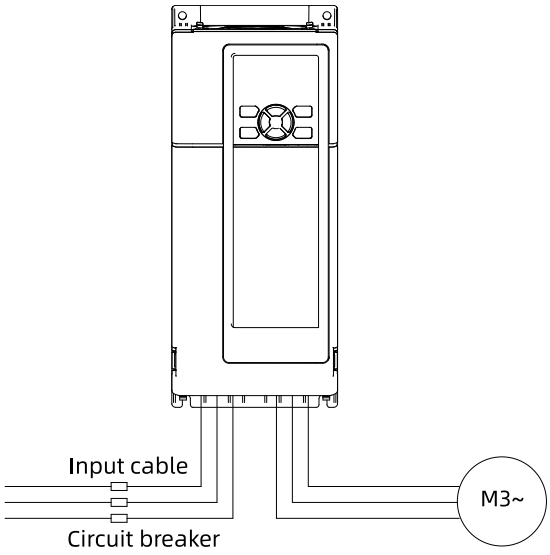


Figure 4-10 Fuse configuration diagram

Figure 4-11 Circuit breaker configuration diagram

Note

Use the AC drive strictly based on the requirements in the user guide to prevent unnecessary short circuit events.

- Use the specifications recommended in *"16.6.2 Circuit Breaker And Fuse" on page 1538*. When a short circuit occurs, an improperly selected drive may fail to protect itself in time, causing the fault to escalate and potentially resulting in property damage or even personal injury.
- Use of aged cables and motors may result in short circuit, which can damage the device or lead to a fire.

4.4.2 Overload protection

Warning

- Use the drive within the rated specifications. Derate the drive for use outside the specifications. Failure to comply can damage the drive.
- When one drive is used to drive multiple motors simultaneously (one-to-multiple), install a thermal relay on each motor. Failure to comply can damage the motor, or even cause a fire.

Principle of overload protection:

The drive provides protective functions against drive overload and motor overload. The drive monitors key parameters such as the internal DC bus voltage, output voltage, output current, and heatsink temperature in real time, ensuring that the power semiconductor devices and other main power components inside the drive operate within the allowable range, preventing damage such as overcurrent or overtemperature of the main power components. In addition, the drive checks whether the motor is overloaded based on the rated motor parameters, actual operating state of the motor, and motor overload protection time curve, protecting the motor with different loads. When drive overload or motor overload is detected and the specified time is reached, the drive immediately stops output and reports an overload fault.

Measures to avoid overload:

Normally, the drive power and motor power must meet the steady-state mechanical load requirements, with the allowable overload capacity and startup capability of the drive and motor taken into account. If the overload capacity of the drive or motor is exceeded due to excessively low power rating, user a higher power rating of the drive or motor. Common causes of overload and corresponding precautions are listed in the table below.

Common causes of overload	Precautions
The load is excessive.	Reduce the load.
The acceleration/deceleration time is excessively short and the acceleration/deceleration frequency is excessively high.	Adjust the acceleration/deceleration time and acceleration/deceleration frequency.
Overload occurs during low-speed operation.	1. Reduce the current during low-speed operation. 2. Increase the motor speed. 3. In applications with frequent operations at low speed, user a drive with higher power rating and replace with a variable frequency motor, as demonstrated below. • Effect of low-speed operation on the drive: During low-speed operation, temperature rise of power semiconductor devices inside the drive is intensified. Therefore, long-term operation at low speed requires derating or higher power rating. • Effect of low-speed operation on the motor: Standard motors are typically designed for power frequency and can operate stably for long periods at rated frequency and rated speed. However, the cooling fan of a standard motor is usually shaft-mounted, so when the motor runs at low speed, the fan speed decreases, resulting in reduced cooling capacity. When using a standard motor, even if operating below the rated current, motor overload may still occur during low-speed operation (in this case, the motor is indirectly overloaded and should be derated for use). Long-term low-speed operation can damage the motor due to improper heat dissipation. In this case, it is recommended to take additional auxiliary cooling measures on the motor, use a motor with higher power rating, or use a variable frequency motor. This is because the cooling fan of a variable frequency motor usually operates on an independent power supply, unaffected by motor speed, which can ensure continuous cooling of the motor.
Overload occurs due to motor demagnetization.	Over-excitation operation of the motor or improper control parameter settings may lead to motor demagnetization (magnetic saturation) and increased losses. Adjust related parameters properly.
Overload occurs due to improper parameter settings	For example, the V/f curve setting does not match the motor characteristics. Improper parameter setting can cause motor control oscillation and trigger an overload fault. Adjust the related parameters.

Common causes of overload	Precautions
Overload occurs due to excessively long motor cables and excessively high carrier frequency.	Due to leakage current, in certain harsh load conditions, the drive overload fault may be triggered. Select the appropriate motor cable length and carrier frequency derating requirements according to the model specifications. When the cable length is excessively long, install an output AC reactor. If the load requirement is still not met when the carrier frequency is derated, use a drive with higher power rating.
Overload occurs when multiple motors are driven by one drive.	When one drive is used to control one motor, the drive can protect the motor against overload. However, when one drive is used to drive multiple motors simultaneously (one-to-multiple), the current detected by the drive is the total output current instead of the actual current of each motor. In this case, the drive cannot effectively protect the motor against overload. Therefore, install a thermal relay between the drive and motor, so that the motor power supply can be disconnected by the thermal relay upon motor overload.

4.5 Cabinet Design

4.5.1 Recommended Cabinet Layout

Typical scenario description

The cabinet contains the Easy series PLC and related modules. The customer's host controller connects to the 485 interface of the PLC controller to send commands. The PLC controller, acting as the master station, connects to the 485 interface of the MD610 AC drive and the SV630 servo drive to achieve multi-axis control. Feedback signals (speed and angle) of the motor are transmitted to the AC drive and servo drive through the encoder interface.

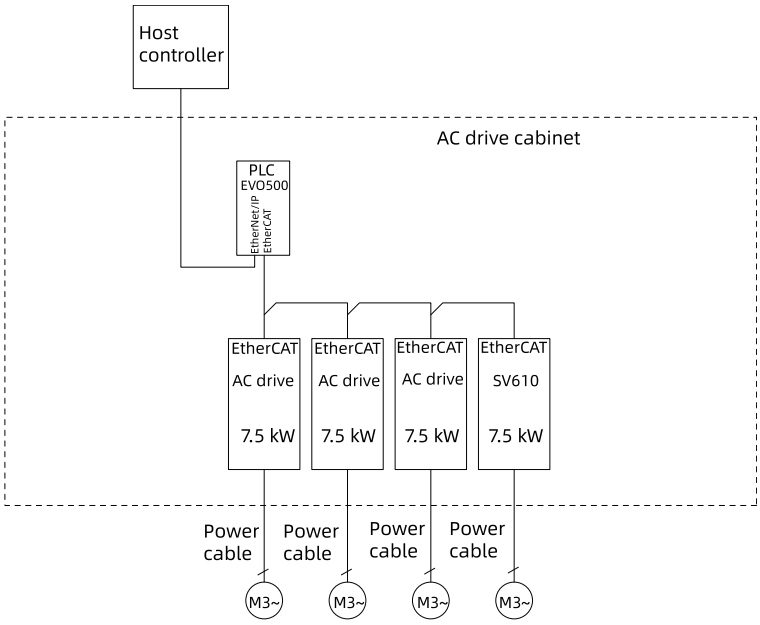


Figure 4-12 Communication topology

Recommended cabinet layout

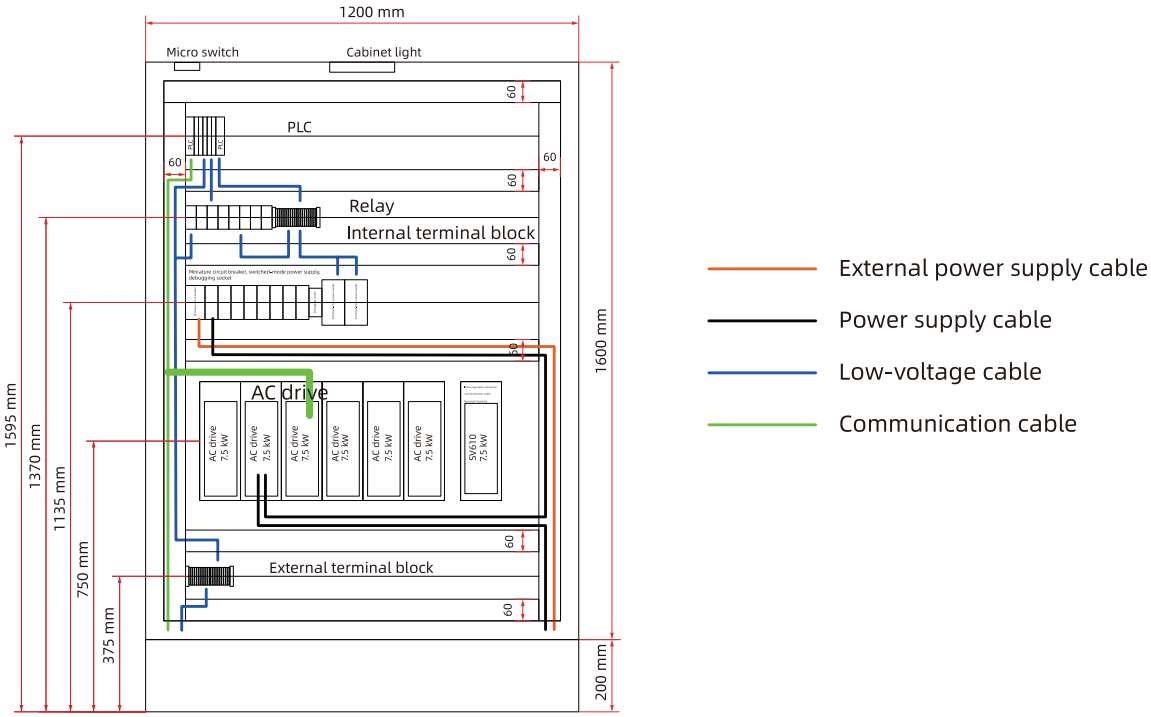


Figure 4-13 Low-height cabinet

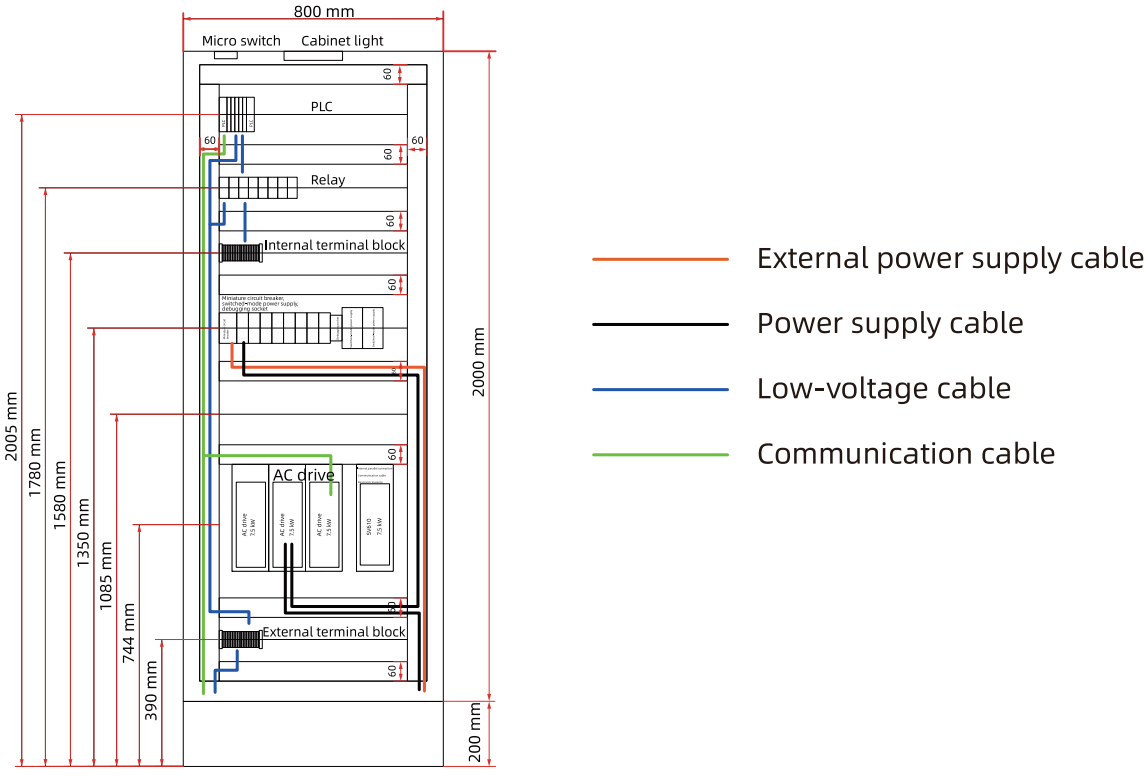


Figure 4-14 High-height cabinet

Table 4–2 Equipment wiring color

Type	Color	Wiring diagram	English	Abbreviation
AC and DC power supply	Black		Black	BK
External power supply	Orange		Orange	OG
Neutral wire	Light blue		Light blue	LBU
AC control	Red		Red	RD
DC control	Blue		Blue	BU
Grounding cable	Yellow-green		Yellow/Green	GNYE

4.5.2 Heat Dissipation Design

4.5.2.1 Clearance Requirements

Note Before installing the AC drive in the cabinet, design the cabinet to ensure sufficient clearance for installation and heat dissipation. Take the following factors into consideration:

- When multiple AC drives are installed together, install them side by side and align their top edges, especially when using drives of different sizes.
- In applications requiring AC drives to be installed in multiple rows, install an air guide plate to prevent overtemperature or overload faults caused by 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 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.

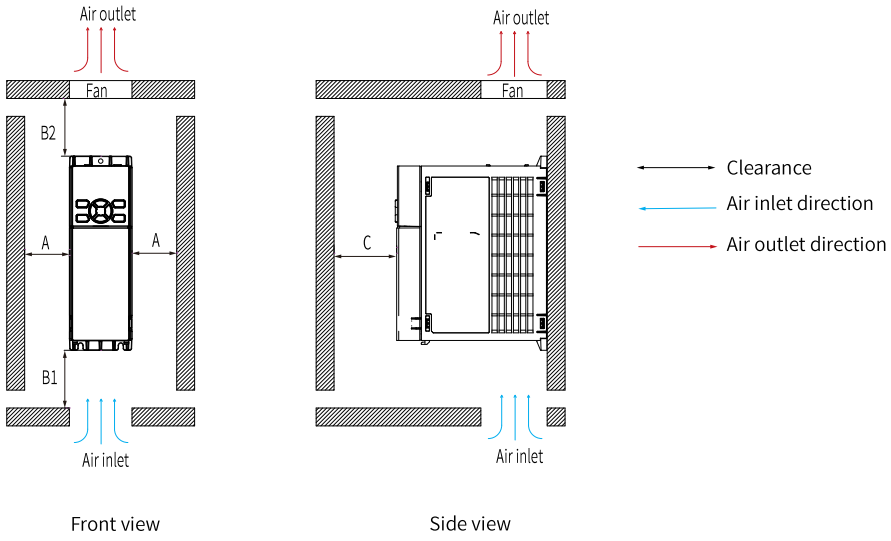


Figure 4-15 Installation space for an individual drive

Table 4–3 Installation space requirement for an individual drive

Model/Power rating (kW)	Clearance (mm)			
	A	B1	B2	C
0.37 to 2.2	20	100	100	40
3 to 7.5	30	100	100	40
11 to 15	30	150	150	40
18.5 to 22	30	200	150	40
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.

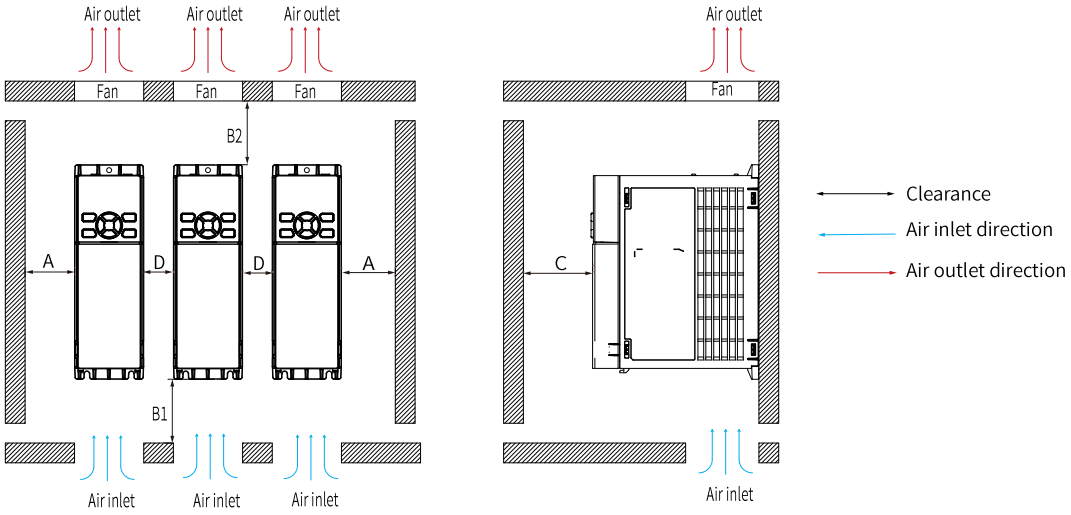


Table 4–4 Installation space requirements (side-by-side installation of drives)

Model/ Power rating (kW)	**Clearance (mm)**				
	A	B1	B2	C	D
0.37 to 2.2	20	100	100	40	30 (ambient temperature: 50°C)
					0 (ambient temperature: 40°C)
3 to 7.5	30	100	100	40	30 (ambient temperature: 50°C)
					0 (ambient temperature: 40°C)
11 to 15	30	150	150	40	30 (ambient temperature: 50°C)
					0 (ambient temperature: 40°C)

Model/ Power rating (kW)	Clearance (mm)				
	A	B1	B2	C	D
18.5 to 22	30	200	150	40	30 (ambient temperature: 50°C)
					0 (ambient temperature: 40°C)
30 to 37	50	200	200	50	50 (ambient temperature: 50°C)
					0 (ambient temperature: 40°C)
45 to 55	50	300	300	50	50 (ambient temperature: 50°C)
					0 (ambient temperature: 40°C)
75 to 90	50	300	300	50	50 (ambient temperature: 50°C)
					0 (ambient temperature: 40°C)

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

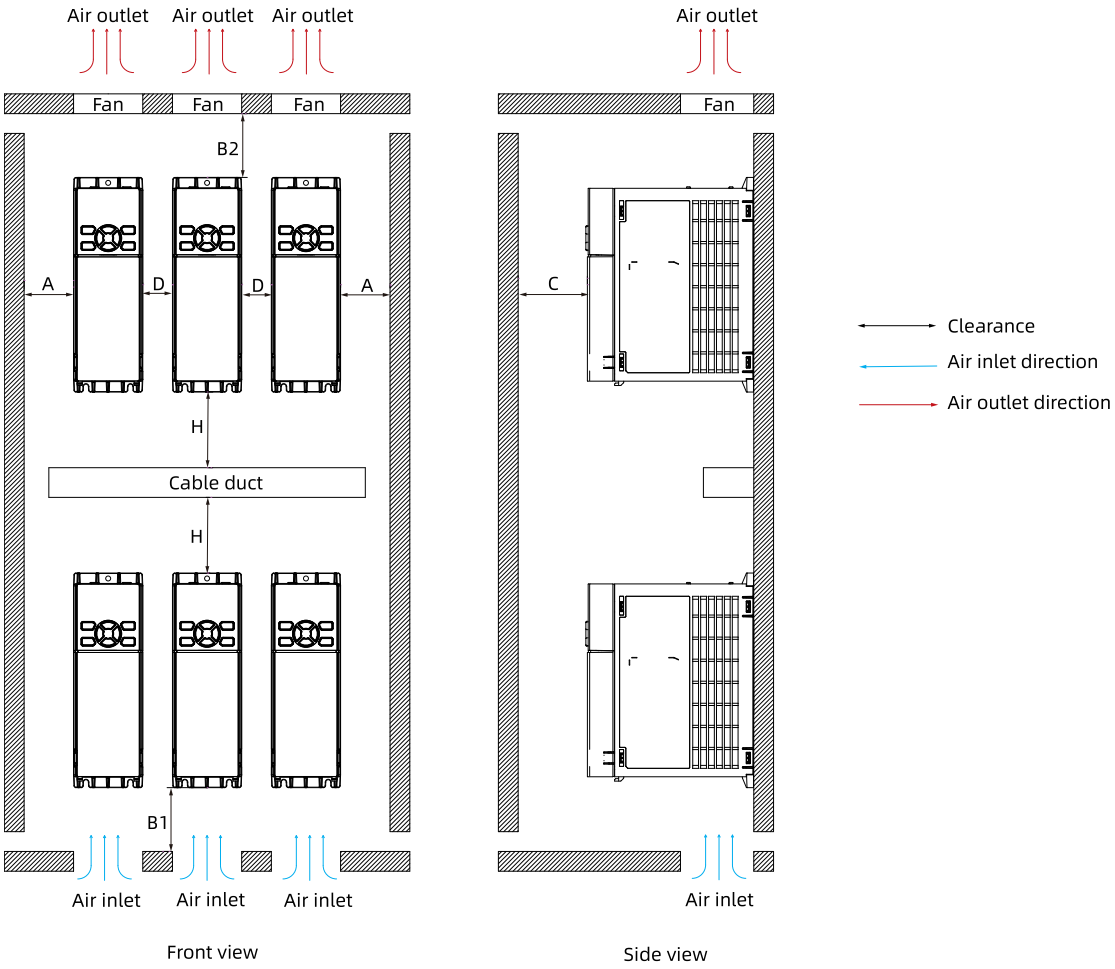


Figure 4-16 Installation space (multi-row installation of drives)

Table 4–5 Installation space (multi-row installation of drives)

Power rating (kW)	Clearance (mm)					
	A	B1	B2	C	D	H
0.37 to 2.2	20	100	100	40	30 (ambient temperature: 50°C)	125
					0 (ambient temperature: 40°C)	
3 to 7.5	30	100	100	40	30 (ambient temperature: 50°C)	125
					0 (ambient temperature: 40°C)	
11 to 15	30	150	150	40	30 (ambient temperature: 50°C)	150
					0 (ambient temperature: 40°C)	
18.5 to 22	30	200	150	40	30 (ambient temperature: 50°C)	150
					0 (ambient temperature: 40°C)	
30 to 37	50	200	200	50	50 (ambient temperature: 50°C)	400
					0 (ambient temperature: 40°C)	
45 to 55	50	300	200	50	50 (ambient temperature: 50°C)	400
					0 (ambient temperature: 40°C)	
75 to 90	50	300	300	50	50 (ambient temperature: 50°C)	400
					0 (ambient temperature: 40°C)	

4.5.2.2 Air Duct Design and Cooling

Air duct design for the naturally-ventilated cabinet

- Air intake requirements
  - The air inlet of the cabinet must be at least 50 mm lower than that of the AC 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

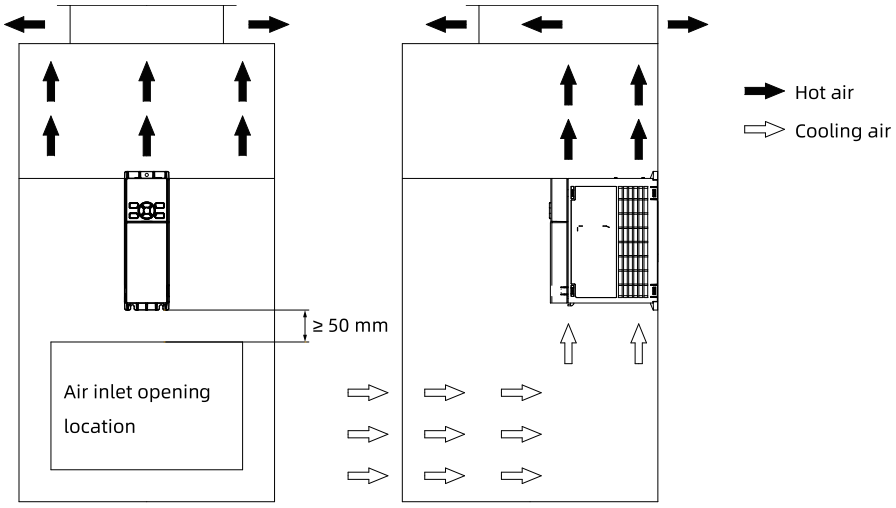


Figure 4-17 Air intake channel of a naturally-ventilated cabinet

- 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

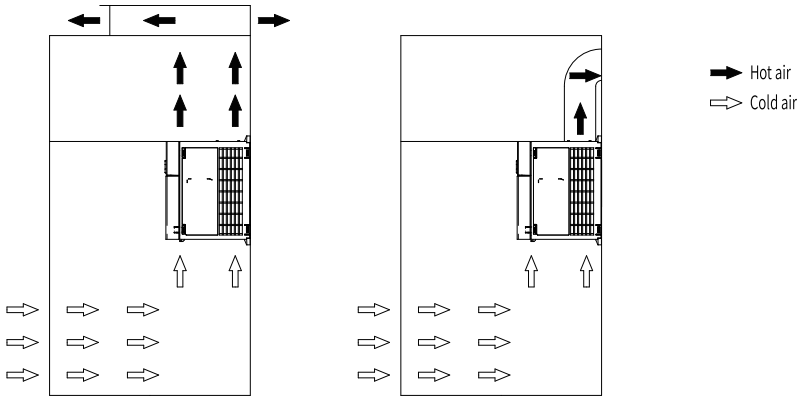


Figure 4-18 Exhaust duct of a naturally-ventilated cabinet

Air duct design for the fan-cooled cabinet:

- Air intake requirements:
  - The air inlet of the cabinet must be at least 50 mm lower than that of the AC 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

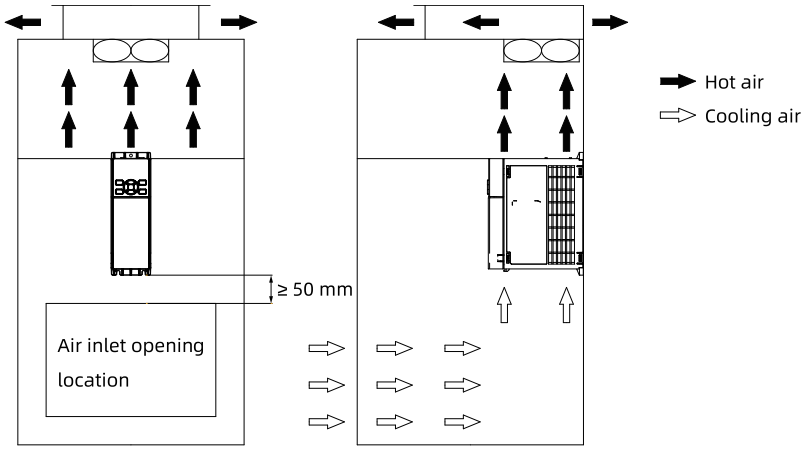


Figure 4-19 Air intake channel of the fan-cooled cabinet

- 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.

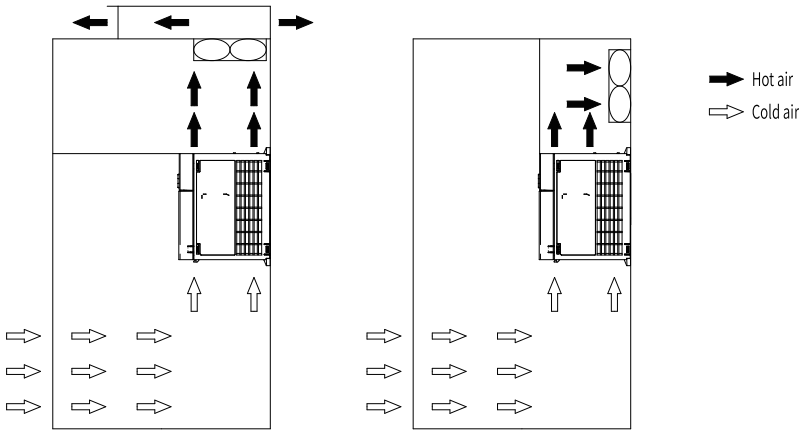


Figure 4-20 Air outlet channel diagram 1 for the fan-cooled cabinet

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 away from the air outlet of the exhaust fan, as shown in .

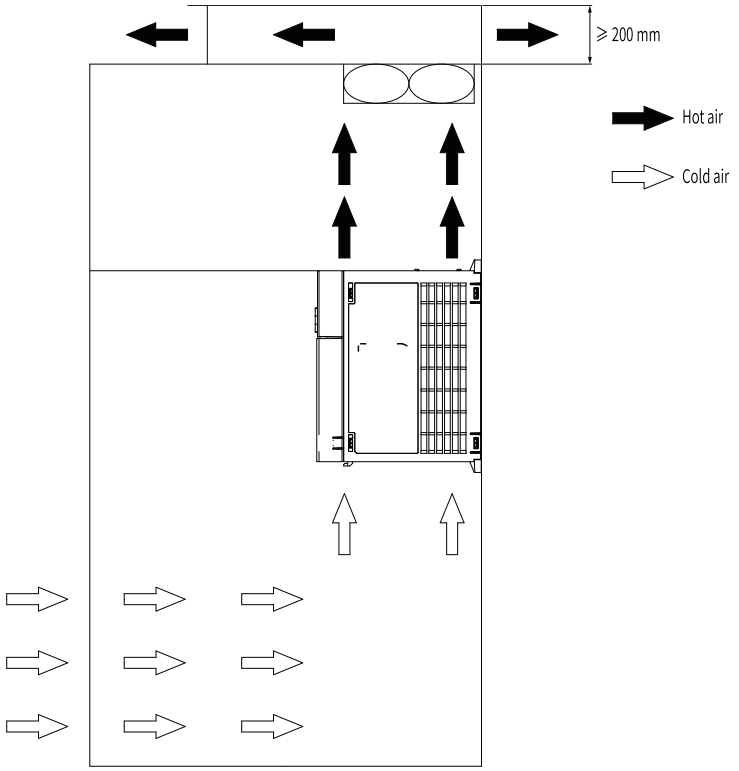


Figure 4-21 Air outlet channel diagram 2 for the fan-cooled cabinet

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:	Mini mum 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.

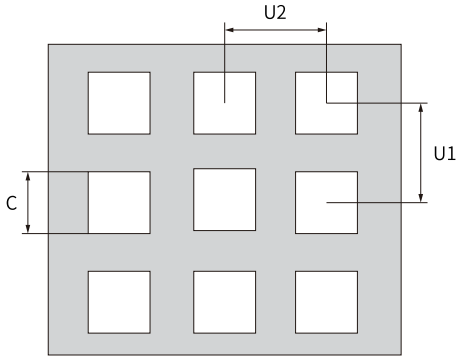


Figure 4-22 Cut-out board of air intake

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 total required ventilation area is the sum of the air inlet and outlet areas of each drive. For example, when a 22 kW drive and an 11 kW drive are installed together, the cabinet's required air inlet area is 126.96 + 96 = 222.96 cm^2, and the required air outlet area is 128 + 169.28 = 297.28 cm^2.

In 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.

4.5.2.3 Cooling Mode of AC 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.

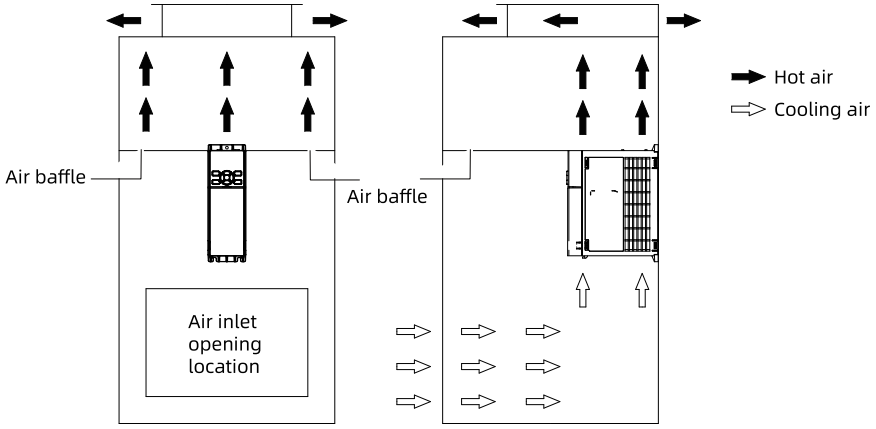


Figure 4-23 Using air deflector to prevent hot air recirculation

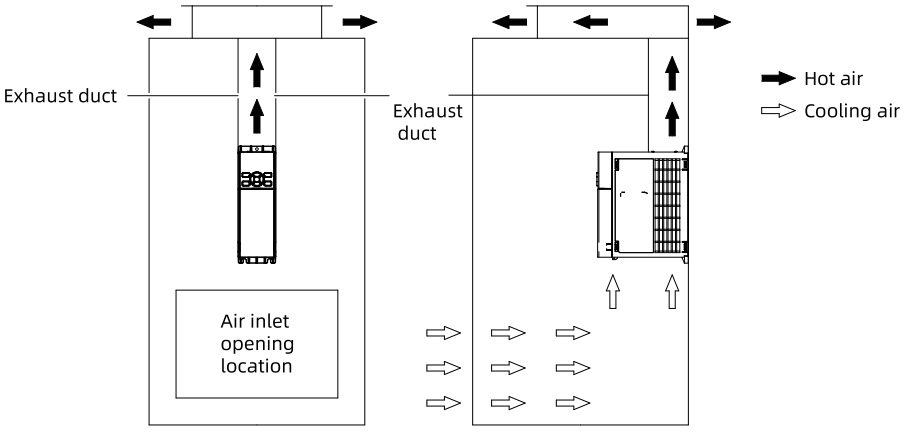


Figure 4-24 Using exhaust duct to prevent hot air recirculation

4.5.3 Cabinet Design that Meets EMC Requirements

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 a hole on the metal contact surface in the cabinet is 100 mm. 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.
- Make sure that a high-frequency grounding system has been established in the cabinet. This is to prevent voltage difference and form structures that can shield against radiation. Use short and flat low-inductance copper braids to improve the performance of 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 to design 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 mm^2 to connect the cabinets. This is to ensure equipotentiality between the 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.

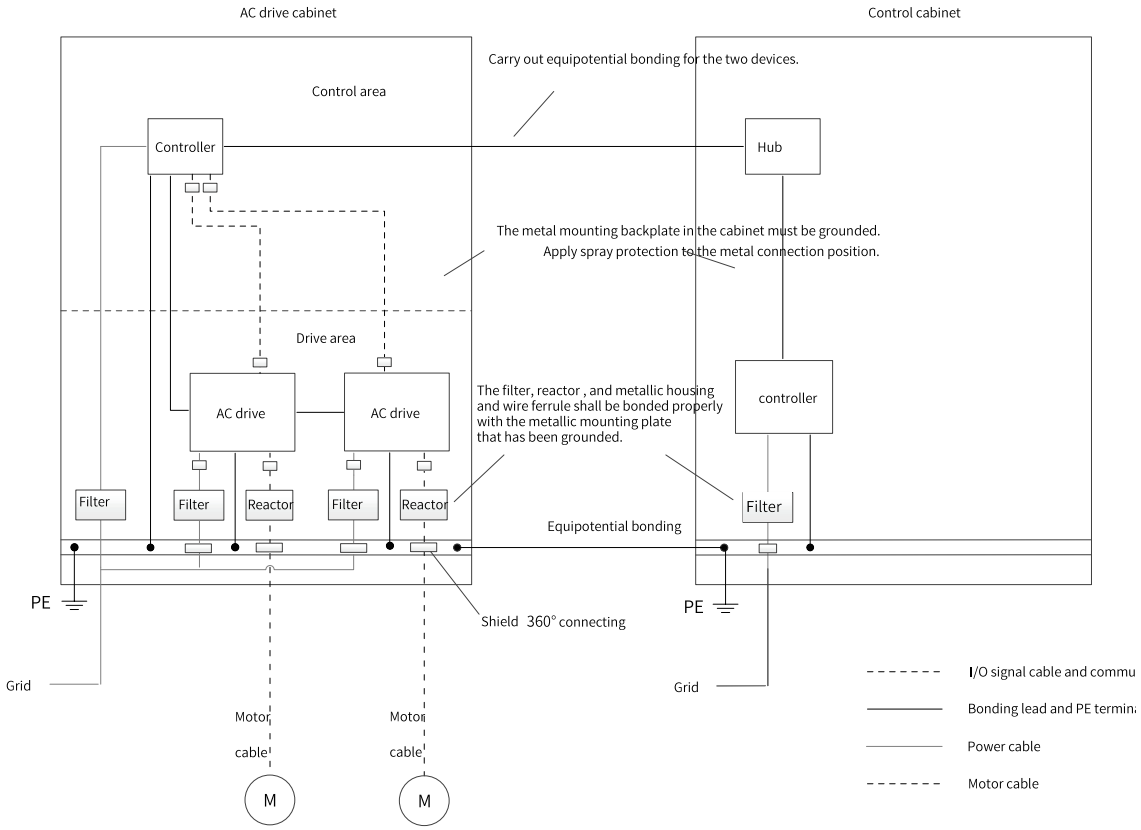


Figure 4-25 Recommended wiring of the cabinet system

4.6 Main Circuit Connection

4.6.1 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.

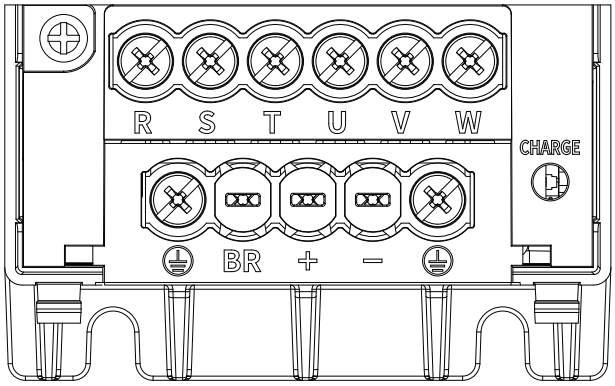


Figure 4-26 Main circuit terminal layout diagram for T1 (0.37kW–1.5kW) to T2 (2.2kW–4kW) models

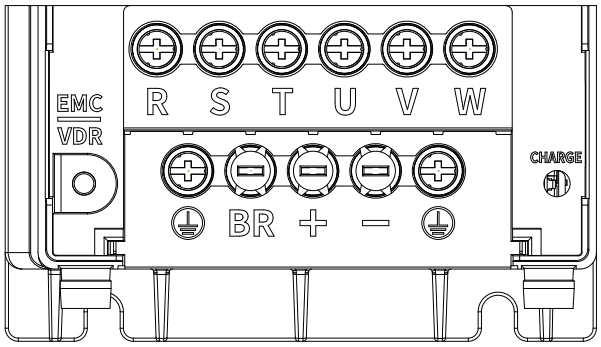


Figure 4-27 Main circuit terminal layout diagram for T3 (5.5kW–7.5kW) models

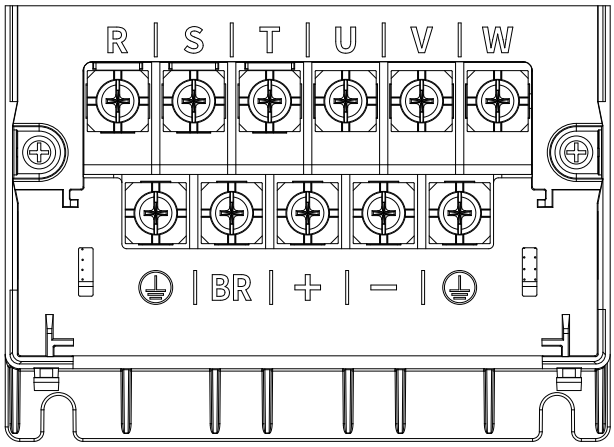


Figure 4-28 Main circuit terminal layout diagram for T4 (11kW–15kW) to T5 (18.5kW–22kW) models

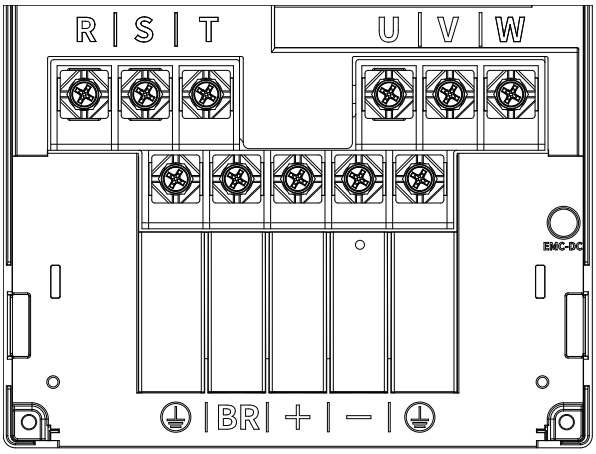


Figure 4-29 Main circuit terminal layout diagram for T6 (30kW–37kW) models

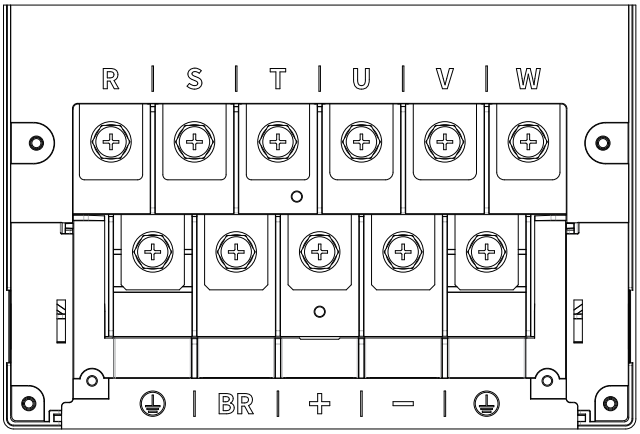


Figure 4-30 Main circuit terminal layout diagram for T7 (45kW–55kW) models

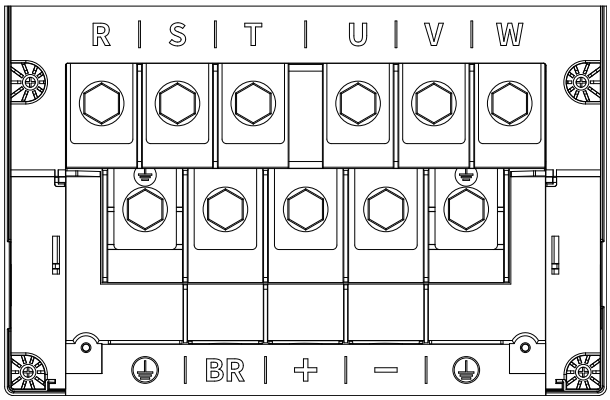


Figure 4-31 Main circuit terminal layout diagram for T8 (75kW–90kW) models

The following table describes the function of main circuit terminals.

Table 4–6 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.

Mark	Name	Function
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.

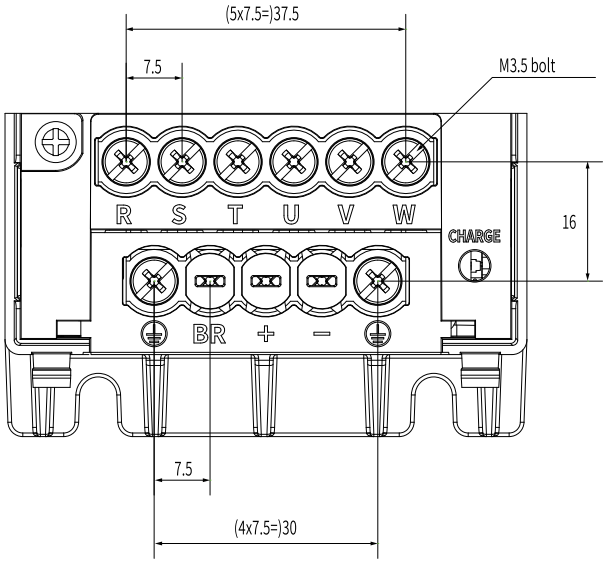


Figure 4-32 Main circuit terminal dimension diagram for T1 (0.37 kW–1.5 kW) to T2 (2.2 kW–4 kW) (unit: mm)

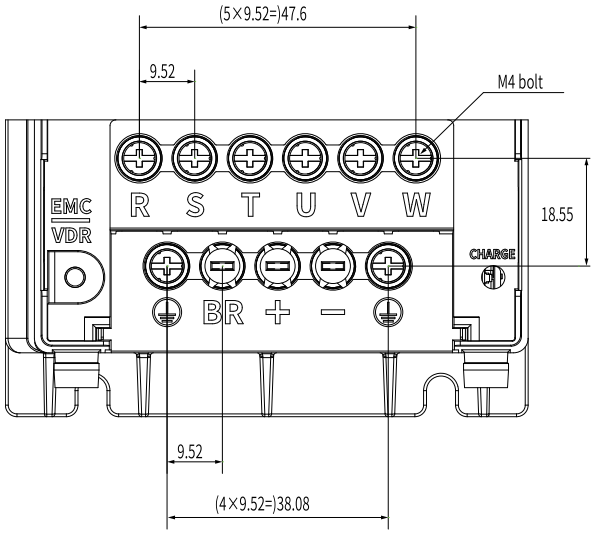


Figure 4-33 Main circuit terminal dimension diagram for T3 (5.5 kW–7.5 kW) (unit: mm)

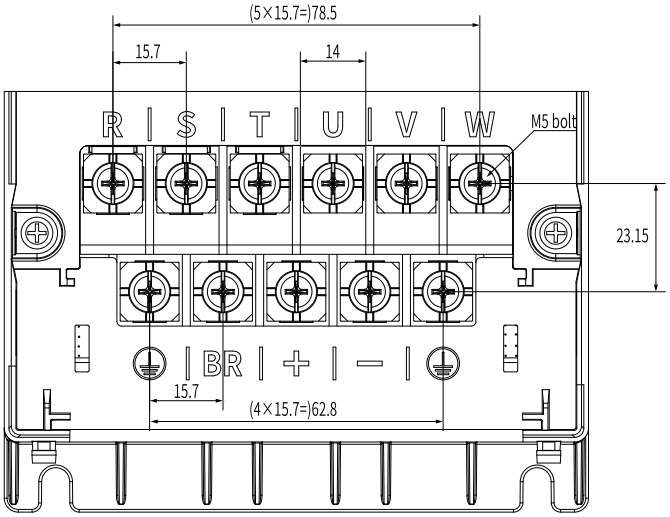


Figure 4-34 Main circuit terminal dimension diagram for T4 (11 kW–15 kW) (unit: mm)

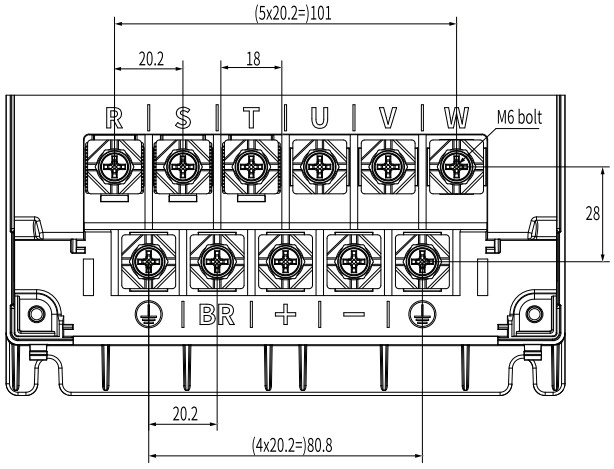


Figure 4-35 Main circuit terminal dimension diagram for T5 (18.5 kW–22 kW) (unit: mm)

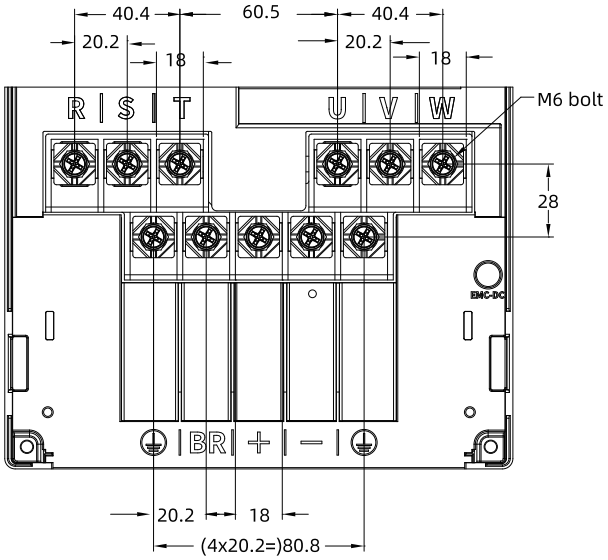


Figure 4-36 Main circuit terminal dimension diagram for T6 (30 kW–37 kW) (unit: mm)

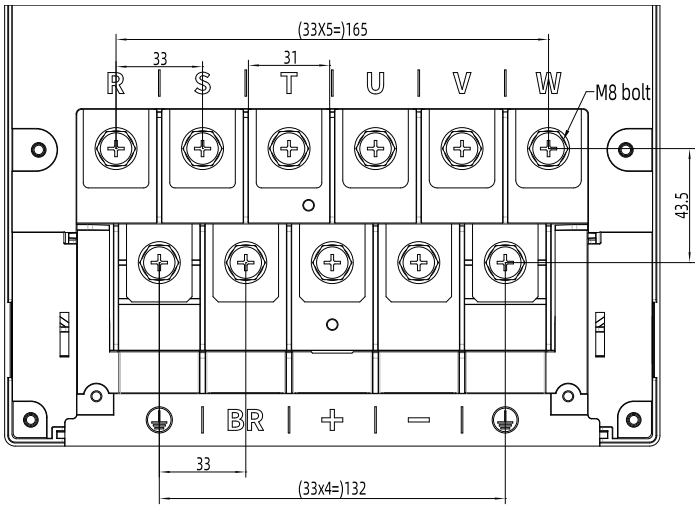


Figure 4-37 Main circuit terminal dimension diagram for T7 (45 kW–55 kW) (unit: mm)

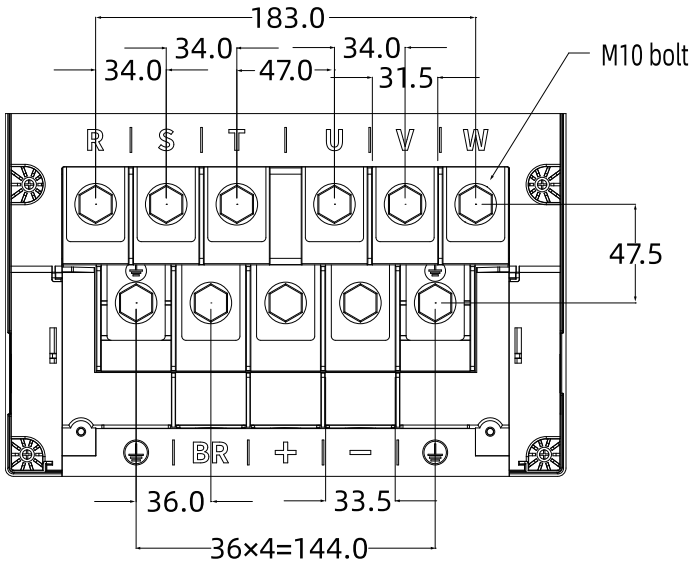


Figure 4-38 Main circuit terminal dimension diagram for T8 (75 kW–90 kW) (unit: mm)

4.6.2 Connection Between Main Circuit Terminal and 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.

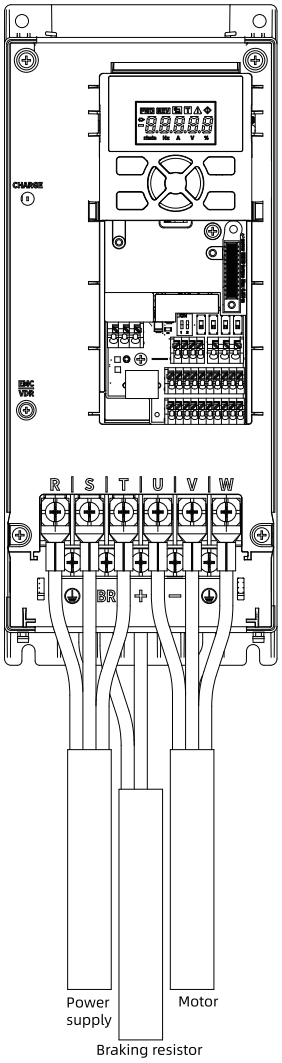


Figure 4-39 Wiring of the terminal block in the main circuit

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.

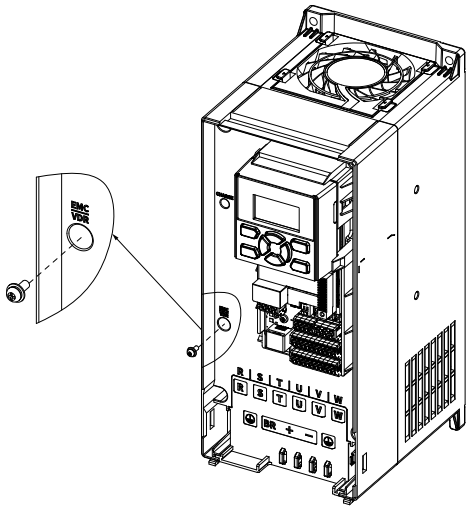


Figure 4-40 Disconnecting EMC selective grounding screw for T1 (0.37 kW to 1.5 kW) to T5 (18.5 kW to 22 kW) models

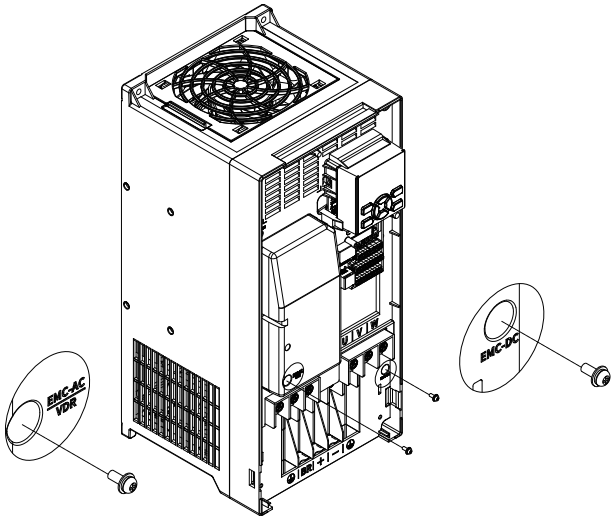


Figure 4-41 Disconnecting EMC selective grounding screw for T6 (30 kW to 37 kW) models

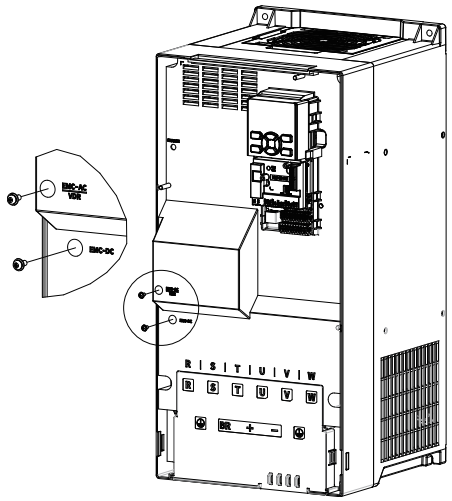


Figure 4-42 Disconnecting EMC selective grounding screw for T7 (45 kW to 55 kW) models

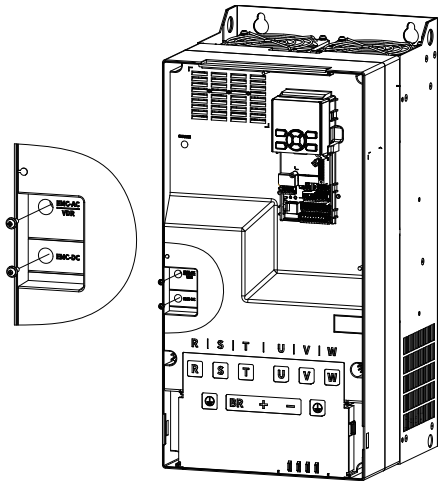


Figure 4-43 Disconnecting EMC selective grounding screw for T8 (75 kW to 90 kW) models

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, distributed capacitance on a cable increases linearly with the length of the cable, and may easily result 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 (carrier frequency reduced to 2 kHz)	> 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 *"3.5.1 EMC Shield Grounding Bracket" on page 53*.

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

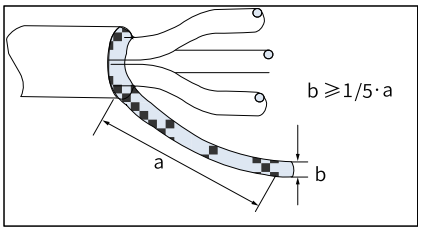


Figure 4-44 Drain wire of the motor cable shield

4.6.3 Requirements for Grounding Cable Protection

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

CAUTION

- To prevent 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 length of 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 mm² according to IEC/EN 61800-5-1, or two protective grounding conductors with the same cross-sectional area.

CAUTION

To comply with EMC standards, ground the neutral point of the power supply. When the neutral point is ungrounded or grounded through a high resistance, a risk of electric shock can be incurred if the selective grounding screw of the EMC filter is not removed.

CAUTION

- When multiple devices are used, ground all the devices. Incorrect grounding can result in 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.

CAUTION

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 can lead to unstable

potential in the grounding terminals away from the grounding point due to leakage current, resulting in an electric shock.

CAUTION

Do not share the grounding cable with other devices (such as welding machines or high-current electrical devices). Improper grounding of the device will lead to drive or device faults caused by electrical interference.

CAUTION

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 drive on a conductive metal mounting surface. Ensure that the whole conductive bottom of the drive is attached properly to 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.

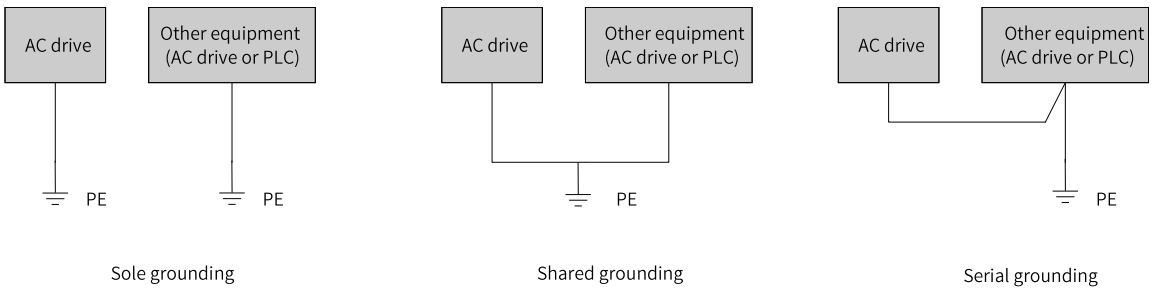


Figure 4-45 Grounding diagram

- 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.

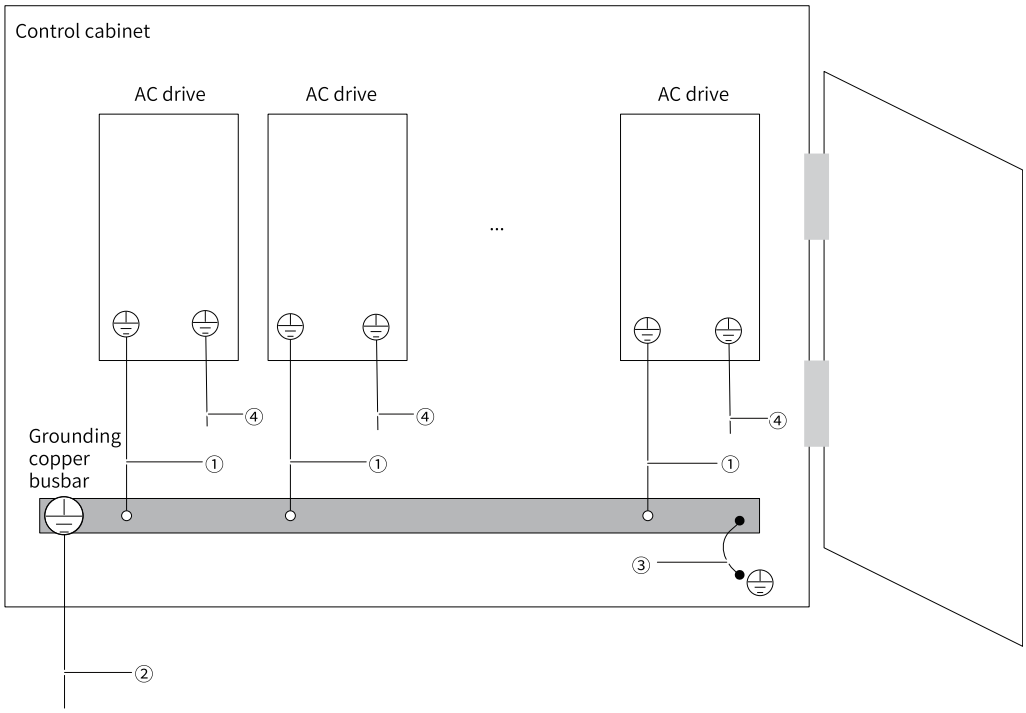


Figure 4-46 Parallel grounding of multiple drives

Grounding multiple servo drives installed side by side	
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.

4.7 Control Circuit Connection

4.7.1 Description of Control Circuit Terminals

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

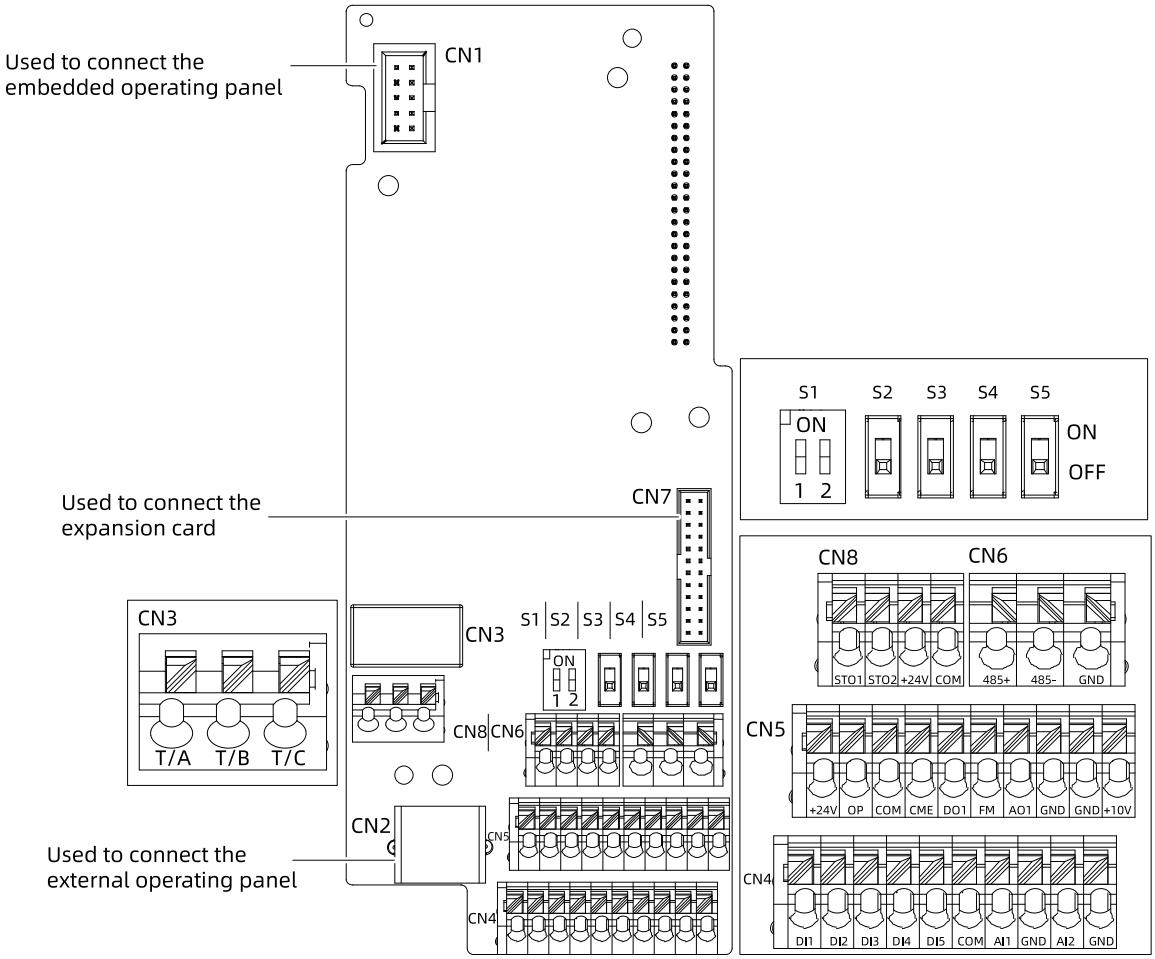


Figure 4-47 Layout of control circuit terminals of standard models

Table 4–7 Description of Control Circuit Terminals

External terminal	Type	Type of information transmitted	Mark	Name	Function
CN1	2x5P box header	Local operating panel terminal	-	-	-
CN2	RJ45 terminal	External operating panel terminal	-	-	An LCD operating panel (SOP-20-MD6) or LED operating panel (MD-BP-M or MD-BP-S) can be connected via this terminal.

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	10P crimping terminal block - 3.5 mm	DI/AI	DI1	Digital input 1	1 .Photocoupler isolation; compatible with dual-polarity input. 2 .Input impedance: 6 kΩ 3 .Input voltage: 15 VDC to 56 VDC; 20 VAC to 54 VAC; compatible with 24 VDC, 36 VDC, 48 VDC, 36 VAC, and 48 VAC 4 .Input current: 1.5 mA to 10 mA
			DI2	Digital input 2	
			DI3	Digital input 3	
			DI4	Digital input 4	
			DI5	DI5	Photocoupler isolation; compatible with dual-polarity input. • Input impedance: 1.49 kΩ • Maximum input frequency:20 kHz • The working voltage ranges from 15 V to 30 V. The voltage lower than 5 V is invalid and the voltage higher than 15 V is valid. • DI5 can serve as a high-speed pulse input channel.
			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 correction: 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 S2 & S3: • S2 & S3 = OFF: -10 V to +10 V (default) • S2 = ON & S3 = OFF: 0 mA to 20 mA • S2 = OFF & S3 = ON: Temperature sampling • PT100: -25°C to +200°C; accuracy ±8°C • PT1000: -25°C to +200°C; accuracy ±8°C • KTY84-130: -40°C to +260°C; accuracy ±15°C • PTC130: -20°C to +180°C; accuracy ±15°C 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.

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; correction accuracy: 0.5%; maximum load output current 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 Communication	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 *"4.8.1 RS485 Communication Wiring" on page 108*.
CN7	2x12P box header	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 the I/O expansion card (reserved function) share the same power supply. When using the +24 V power supply of the AC drive, note that the total load current cannot exceed 200 mA.

Table 4–8 Descriptions of control circuit DIP switches

Name	DIP switch function
S1	DIP switch for RS485 communication termination and bias resistor selection • When both DIP switch S1_1 and DIP switch S1_2 are set to ON, 485± signals are used for termination resistor connection. • When both DIP switch S1_1 and DIP switch S1_2 are set to OFF (default), 485± signals are not used for termination resistor connection. **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 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 input 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.

4.7.2 I/O Wiring

Wiring of AI1 terminal

Generally, AI1 is used for external potentiometer input, with DIP switch S4 set to OFF. When AI1 is used for current input, set the switch S4 to ON. In this case, AI1 supports current input of 0 mA to 20 mA, with input impedance of AI1 being 500 Ω. The following figure shows the wiring of AI1 in voltage and current mode.

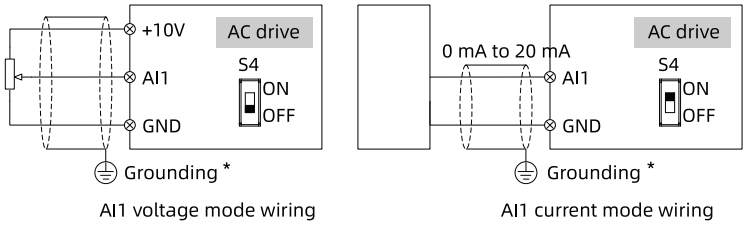


Figure 4-48 Wiring of AI1 terminal

Wiring of AI2 terminal

When AI2 is used as voltage/current input, the wiring method of AI2 is the same as that of AI1. The difference is that AI2 is controlled by DIP switches S2 and S3. The specific switch states are shown in the figure below. In addition, AI2 supports external temperature sensor input. Connect a two-wire temperature sensor (PT100/PT1000/KTY84-130/PTC130) to the AI2 and GND terminals, select the appropriate DIP switch positions as required, and set the correct temperature sensor type in E2-73.

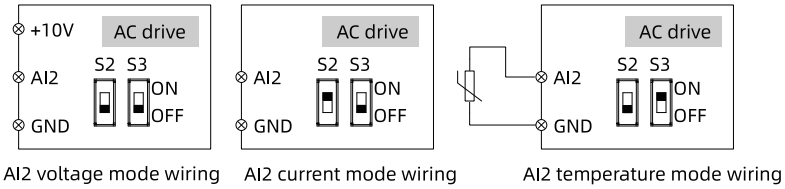


Figure 4-49 Wiring of AI2 terminal

CAUTION

The type of AI1/AI2 input signal must correspond to the DIP switches. Failure to comply will result in analog input exception.

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.

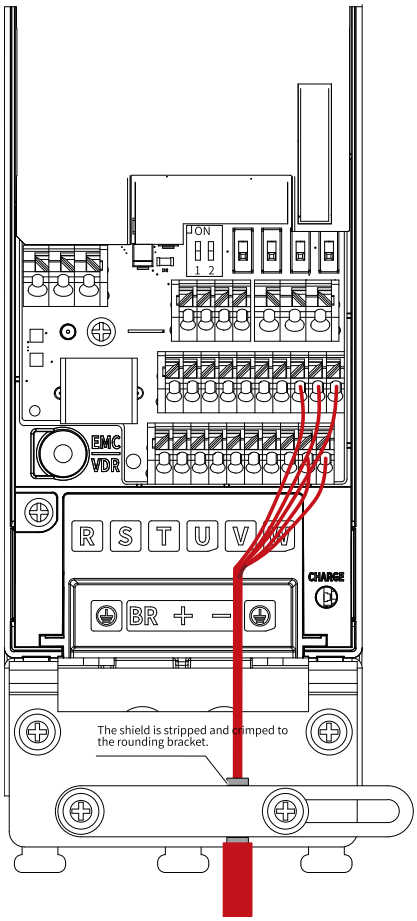


Figure 4-50 Grounding of the AI cable shield

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.

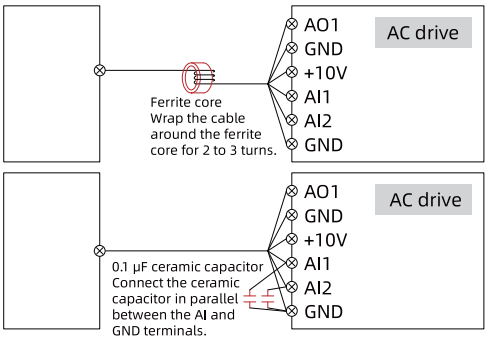


Figure 4-51 Filtering of analog signal cable

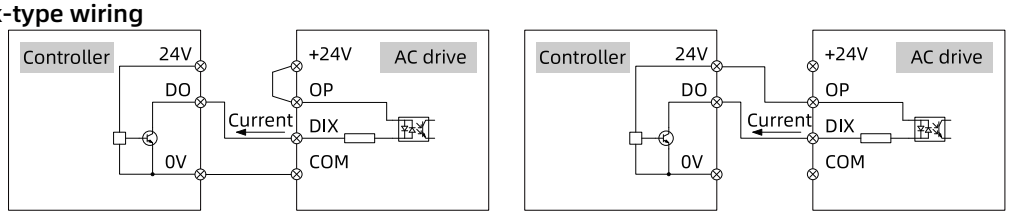
Wiring of the DI terminal

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.

DC signal terminals:

- **Sink-type wiring**

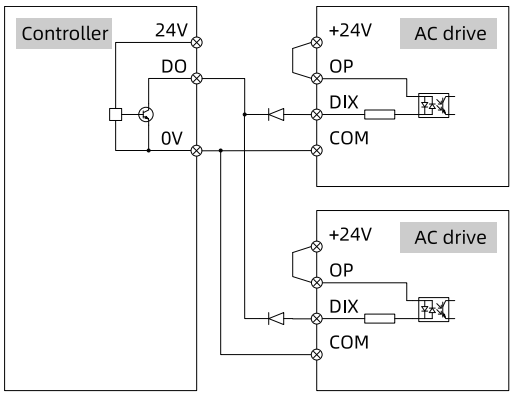


Sink wiring method using the internal 24 V of the AC drive

Sink wiring method using the external 24 V of the AC drive

Figure 4-52 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.



Sink wiring method using the internal 24 V of the AC drive in DI-based parallel connection

Figure 4-53 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.

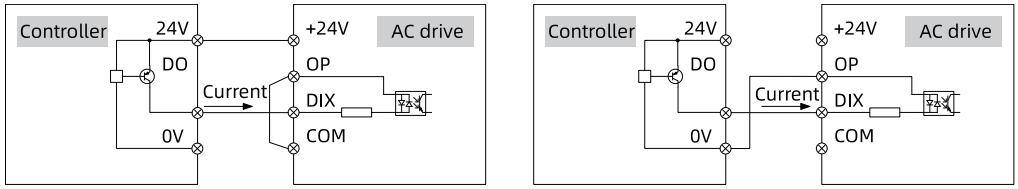


Figure 4-54 Source-type wiring of the DI

The following figure shows the wiring of AC signal terminals.

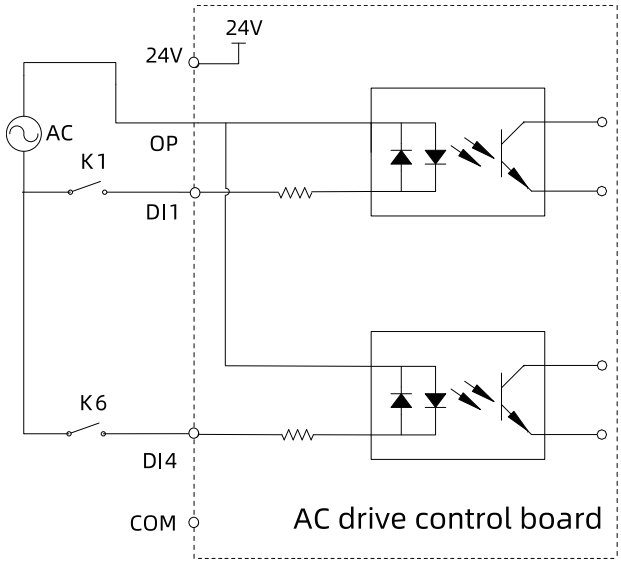


Figure 4-55 Schematic diagram of AC signal wiring

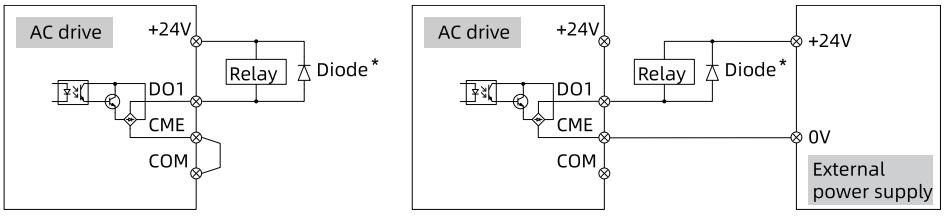
Note

For AC wiring, the shorting jumper between 24V and OP must be disconnected. DI1 to DI4 can connect to AC signal cables. As illustrated in *"Figure 4-55 Schematic diagram of AC signal wiring" on page 105AC signal wiring*, connect one side of the AC power supply to OP, and use the other side as the common terminal for the input section.

Wiring of the DOs

The DO of the AC drive 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 method when the DO is used to drive the relay (internal 24 V)

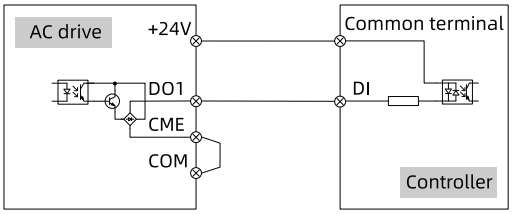
Wiring method when the DO is used to drive the relay (external 24 V)

Figure 4-56 Wiring for driving relay with DO

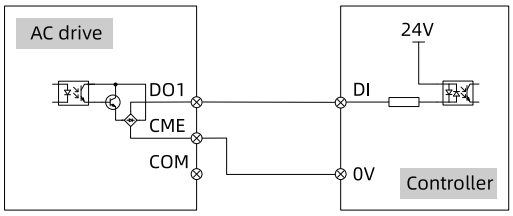
CAUTION

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.

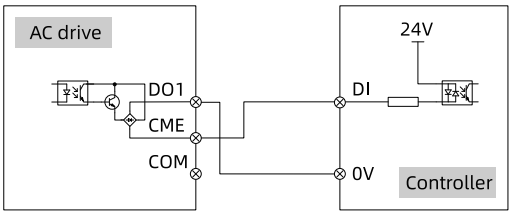
The DO1 supports bidirectional output and the following five wiring methods.



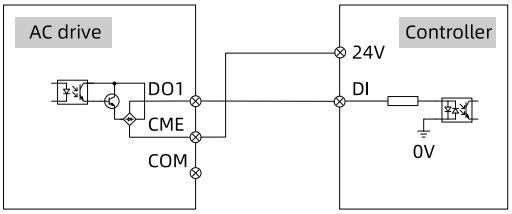
Wiring method when the DO is used to drive the controller (internal 24 V)



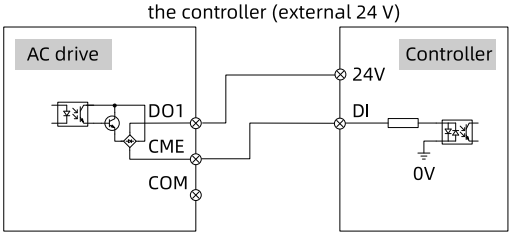
Wiring method 1: Use the DO to drive the controller (external 24 V)



Wiring method 2: Use the DO to drive the controller (external 24 V)



Wiring method 3: Use the DO to drive the controller (external 24 V)



Wiring method 4: Use the DO to drive the controller (external 24 V)

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.

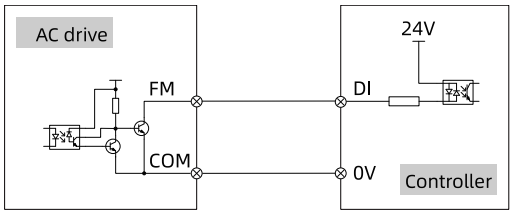


Figure 4-57 Wiring of FM terminal

4.7.3 Wiring of 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.

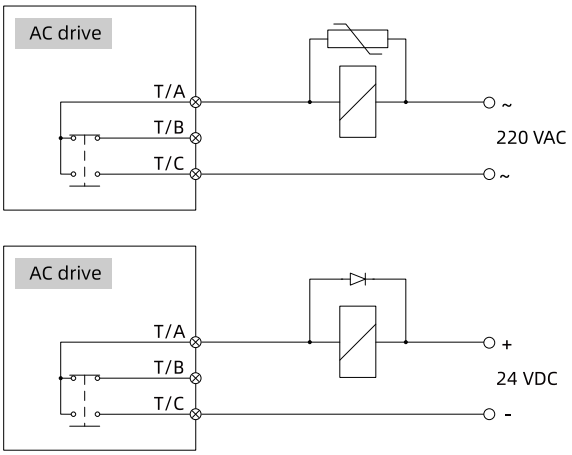


Figure 4-58 Wiring of the relay output terminals

4.7.4 Wiring of STO Terminals

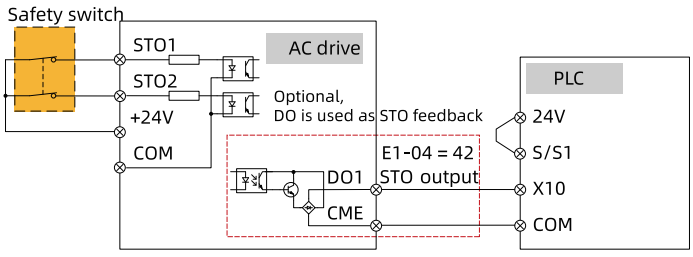


Figure 4-59 STO wiring (internal 24 V)

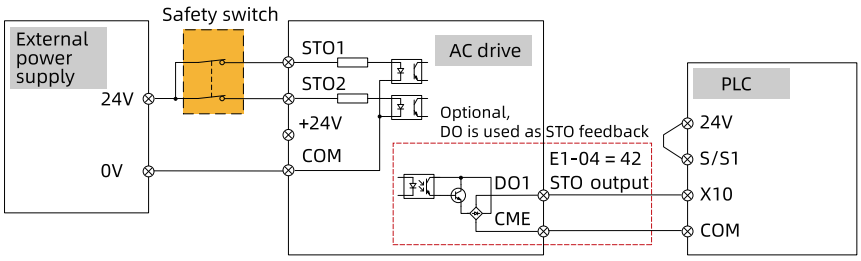


Figure 4-60 STO wiring diagram (external 24 V)

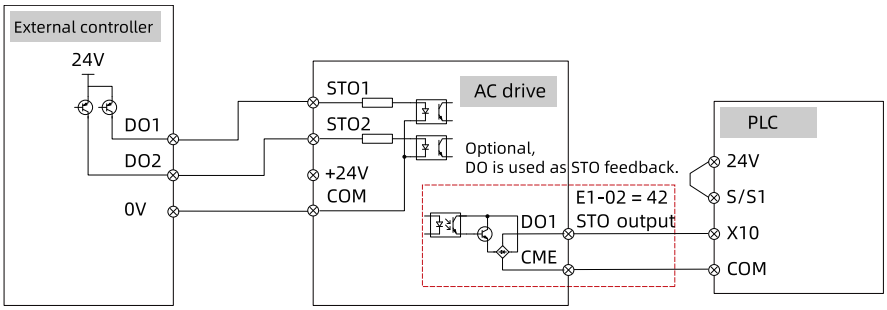


Figure 4-61 External control PNP output used as STO input

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.

4.8 Communication Wiring

4.8.1 RS485 Communication Wiring

Communication networking

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. 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.

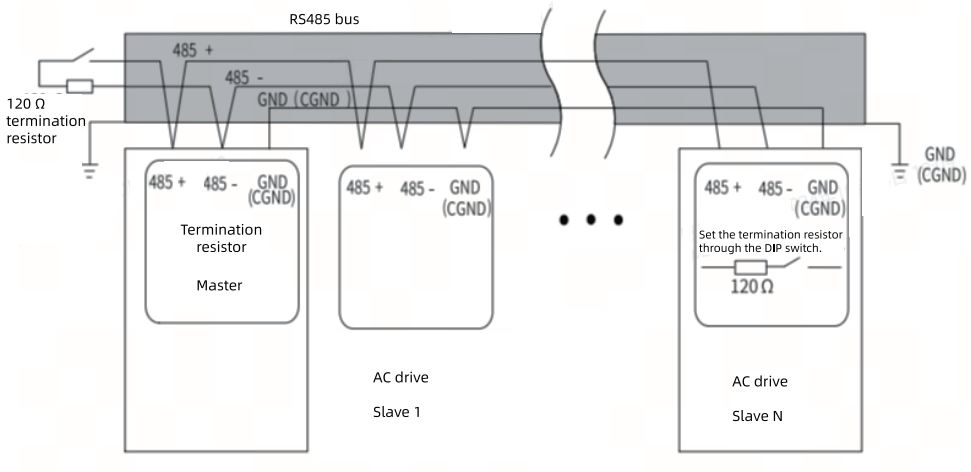


Figure 4-62 Bus topology

In case of a large number of nodes, connect the RS485 bus using the daisy chain mode shown below. The RS485 signal reference ground of all nodes must be connected together. Up to 128 nodes can be connected.

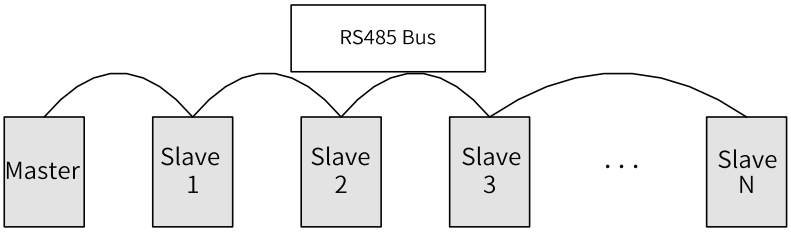


Figure 4-63 Daisy-chain topology

The transmission distance of the RS485 bus is directly related to the baud rate and the communication cable. The following table describes the relationship between the maximum bus length and the baud rate.

Table 4–9 Transmission distance and number of nodes

Transmission distance (m)	Transmission rate (kbps)	Number of nodes	Cross-sectional area
100	115.2	128	26AWG
1000	9.6	128	26AWG

4.9 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 *"16.6.6 Cable" on page 1561*.

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-voltage cables (such as power supply input cables, inverter output cables, braking resistor cables) through different routes with a distance of at least 50 cm. This reduces 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 the analog control signal cables. Minimize the length of the stripped part of the cable (about 5-7 mm) and wrap the shield with the insulation tape to prevent the shield from contacting other equipment and causing interference.
- 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.
- 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.

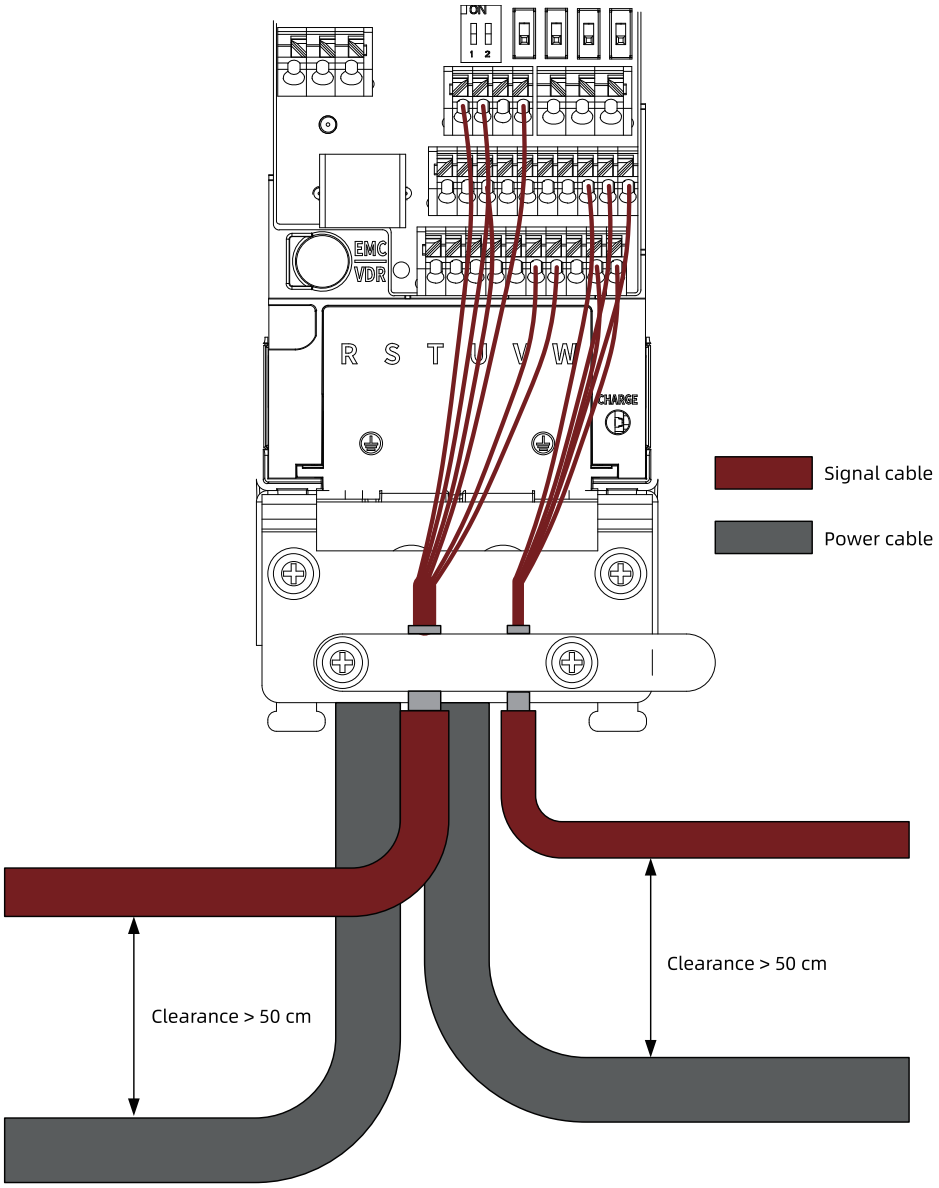


Figure 4-64 Routing diagram

Routing recommendations

- **Routing of disturbing cables and sensitive cables**
  During routing, route cables that transmit different types of signals through different routes. Separate the disturbing cables from sensitive cables by a distance of 20 cm wherever possible. When two types of cables must be intersected, the intersection angle must be 90 degrees to avoid interference, as shown in the following figure.

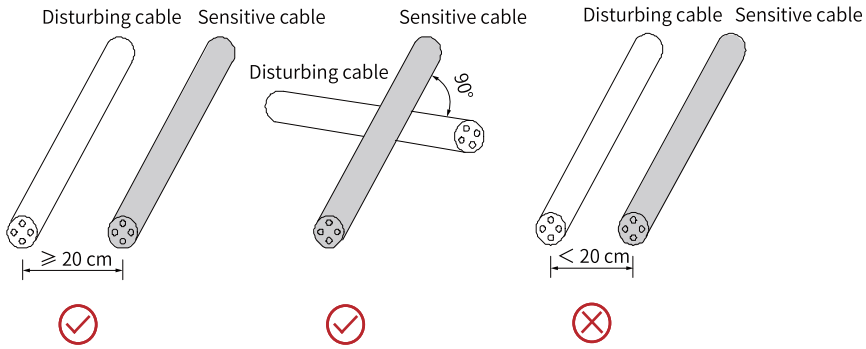


Figure 4-65 Routing of disturbing cables and sensitive cables

- **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.

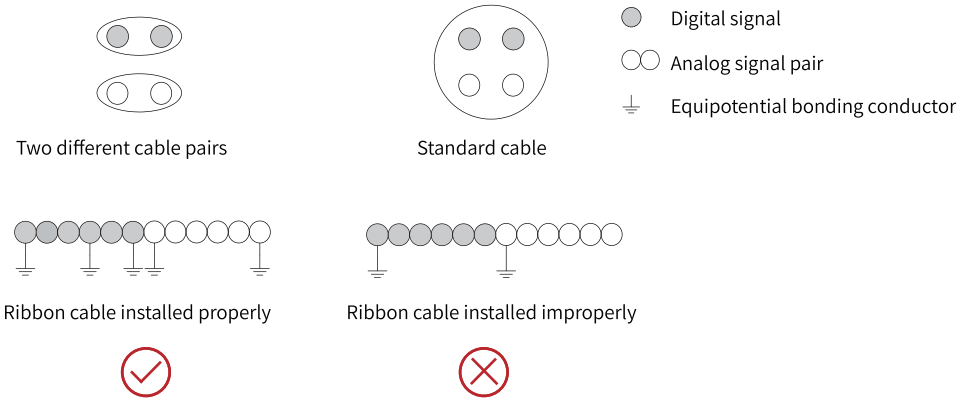


Figure 4-66 Routing different types of signal cables

- **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.

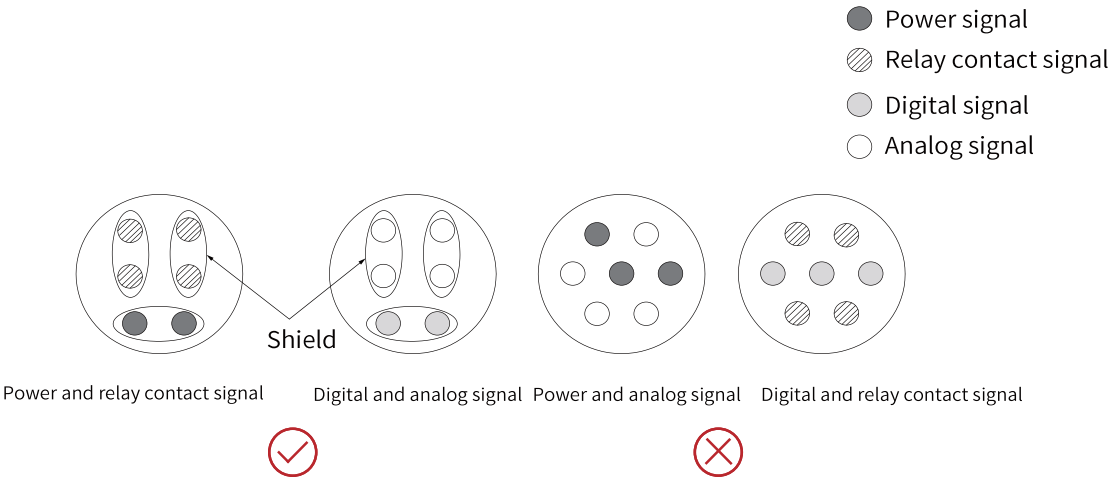


Figure 4-67 Routing of multi-conductor cables

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

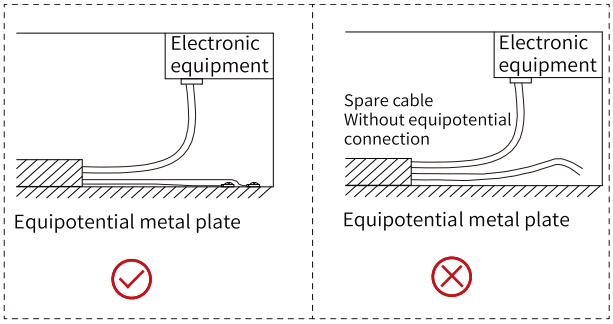


Figure 4-68 Handling of unused conductors in a multi-conductor cable

- **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.

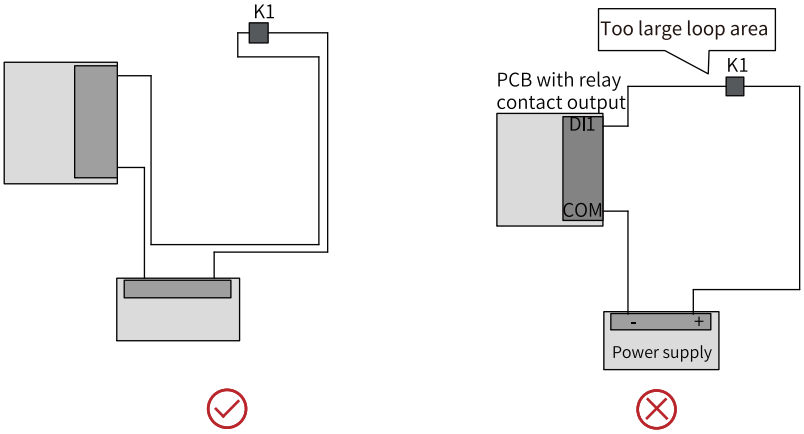


Figure 4-69 Recommended wiring loop area

- **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.

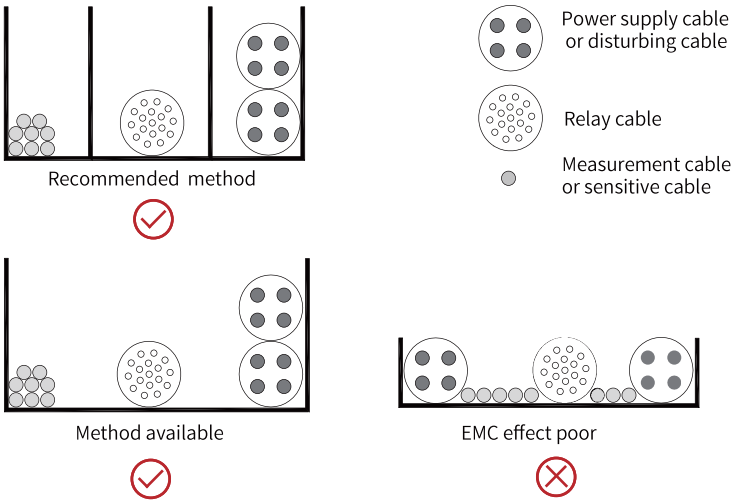


Figure 4-70 Laying multiple types of cables

- **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.

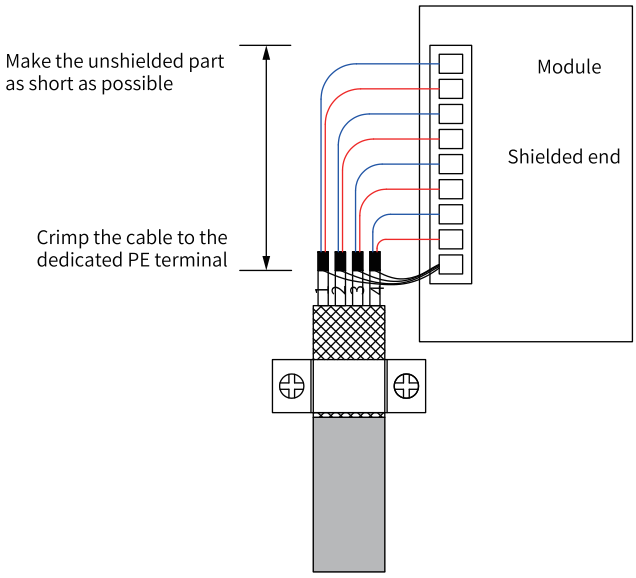


Figure 4-71 Requirements on shielded cable

5 AC Drive Installation

5.1 Unpacking and Handling

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.

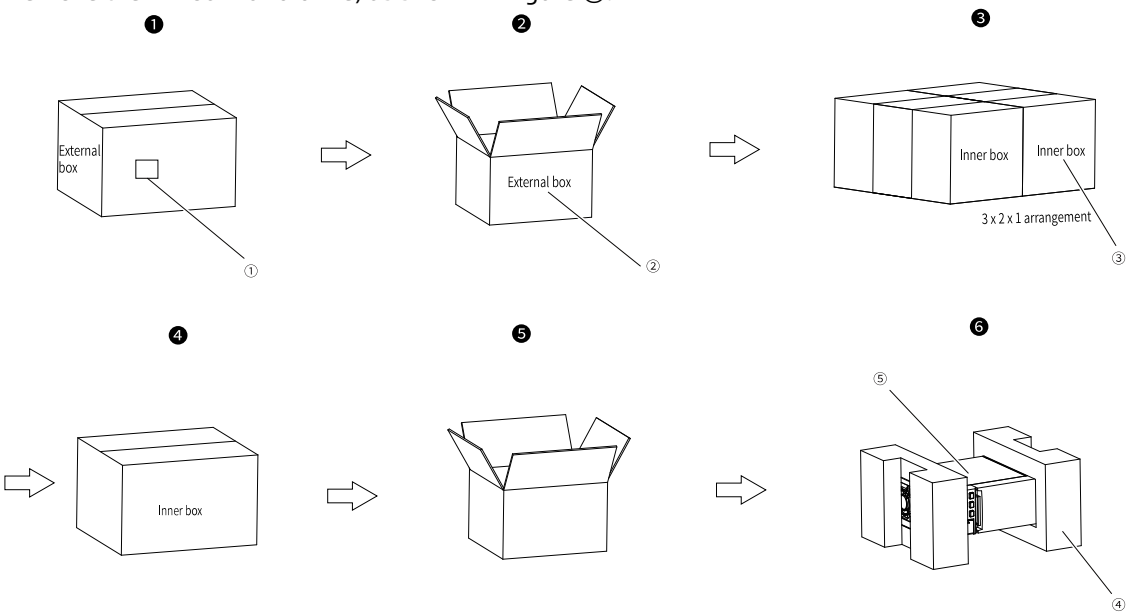


Figure 5-1 Unpacking

Table 5–1 Unpacking list

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

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 equipment in locations where the equipment may be exposed to splashing water or rain, direct sunlight, strong electric field, strong magnetic field, or 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 adverse environmental impacts.
- Pack the drive with the original packing box provided by Inovance.
- Store the equipment for up to three months. Take stricter protective measures and carry out the necessary inspections for a longer storage time.
- The electrolytic capacitor will deteriorate after long-term storage. Therefore, switch on the drive once for at least 5 hours every 6 months. Increase the input voltage slowly to the rated value by using a voltage regulator. Contact Inovance for technical support if necessary.
- Pack the equipment securely and properly before transportation. Use a fully enclosed container 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.

5.2 Pre-installation Inspection

Check the following items before installation:

- Check that the installation environment, space, and direction can meet installation requirements of the product.
- Prepare installation tools and accessories.
- Inspect the package, check the items after unpacking, and handle with care
- Perform the following check items before installation.

Table 5-2 Pre-installation checklist

No.	Check Item	Confirmation
1	The mechanical strength of the mounting position can bear the weight of the equipment.	□
2	The environment and load-bearing capacity of the mounting position fulfill the installation requirements.	□
3	Sufficient space for heat dissipation has been reserved, with heat dissipation of other components inside the cabinet being considered.	□
4	The mounting bracket (if needed) is made of incombustible materials.	□
5	If the application site is exposed to metal dust, install the equipment in an enclosed cabinet to isolate the equipment 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 combustible and explosive materials away from the equipment.	□

5.3 Backplate Mounting

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 SEMS screws), 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 SEMS screws), as shown in Figures 2 and 3.

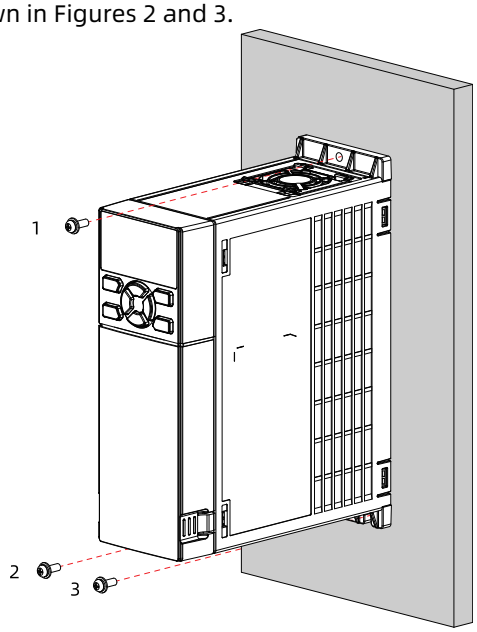


Figure 5-2 Screw-based mounting for T1 (0.37-1.5 kW) and T2 (2.2-4 kW) models

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 tighten the screws on the upper left and upper right sides of the drive, as shown in figures 1 and 2. The screw specifications vary by model: T3 (5.5-7.5 kW): M4 Phillips cross recessed pan head SEMS screw; T4 (11-15 kW)/T5 (18.5-22 kW)/T6 (30-37 kW): M5 Phillips cross recessed hexagon head SEMS screw; T7 (45-55 kW): M6 Phillips cross recessed pan head SEMS screw; T8 (75-90 kW): M8 Phillips cross recessed pan head SEMS screw.

b. Repeat the previous step to tighten the screws on the lower left and lower right sides of the AC drive, as shown in figures 3 and 4. The screw specifications vary by model: T3 (5.5-7.5 kW): M4 cross recessed pan head SEMS screw; T4 (11-15 kW)/T5 (18.5-22 kW)/T6 (30-37kW): M5 cross recessed hexagon head SEMS screw; T7 (45-55 kW): M6 cross recessed pan head SEMS screw; T8 (75-90 kW): M8 cross recessed pan head SEMS screw.

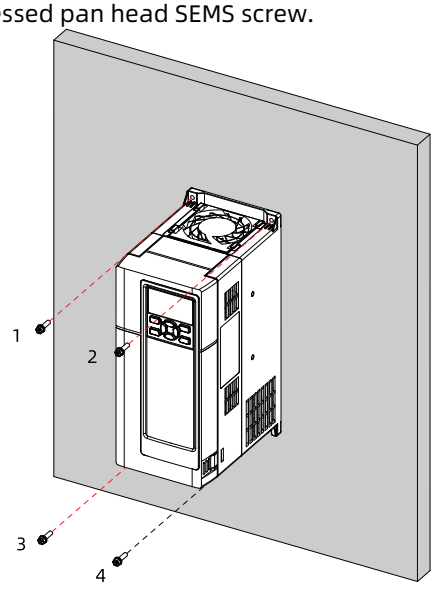


Figure 5-3 Screw mounting diagram [T3 (5.5–7.5kW) to T8 (75–90kW)]

Note

For details on torque, see the screw and screwdriver specification table in *"3.4.4 Installation Tools" on page 52*.

5.4 Through-hole Mounting

For T4 to T8 (11-90 kW) models, follow the steps below to install the through-hole bracket.

Through-hole mounting of T4 and T5 models (11 kW to 22 kW)

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 (M5x20 screws for 18.5–22 kW T5 models) on the left side of the drive with a Phillips screwdriver, 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 cross recessed pan head screws (M5x20 cross recessed hexagon head screw for 18.5-22 kW T5 models) on the right side of the housing with a Phillips screwdriver. Then, secure the left and right brackets together with two M4x10 cross recessed pan head 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.

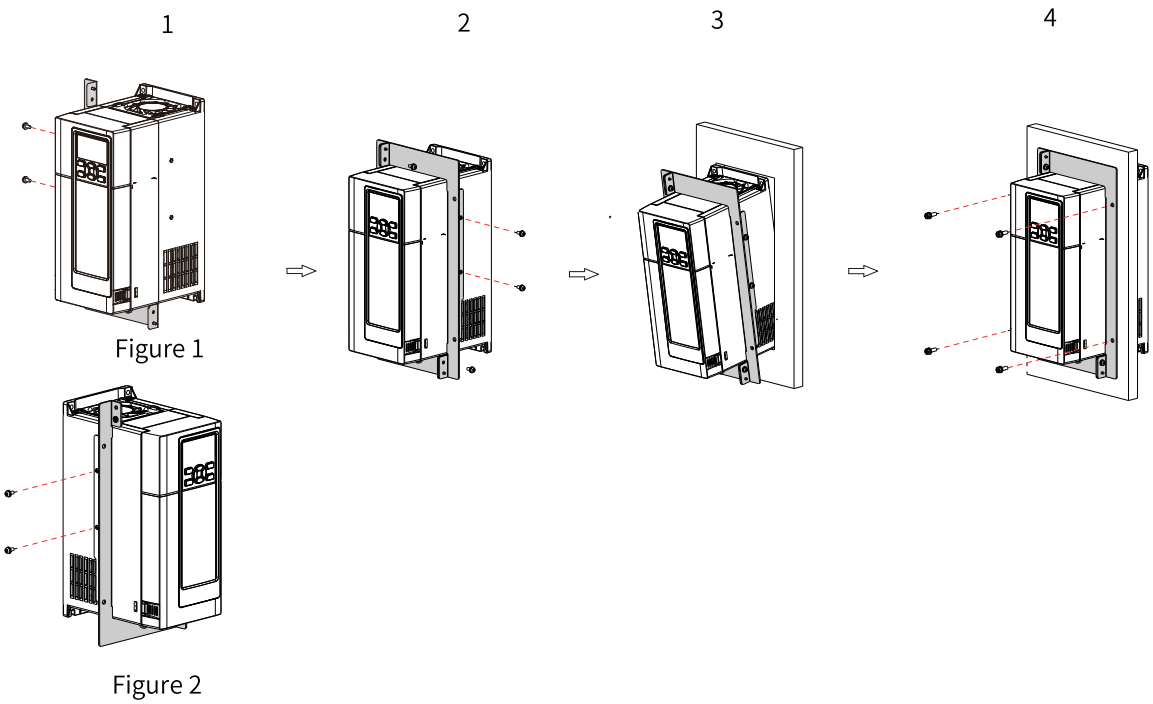


Figure 5-4 Through-hole mounting of T4 to T5 models (11 kW to 22 kW)

Through-hole mounting of T6 and T7 models (30 kW to 55 kW)

1. Place the left bracket against the drive, and tighten the four M5x16 cross recessed hexagon head SEMS screws (M5x20 cross recessed hexagon head SEMS screws for 45-55 kW T7 models) on the left side of the drive with a Phillips screwdriver, as shown in step 1 of the figure.
2. Place the right bracket against the drive, and tighten the four M5x16 cross recessed hexagon head SEMS screws (M5x20 cross recessed hexagon head SEMS screws for 45-55 kW T7 models) on the right side of the drive with a Phillips screwdriver, as shown in step 2 of the figure.
3. Place the upper bracket against the drive and align the screw holes with the holes on both sides of the brackets. Use a Phillips screwdriver to tighten the two M5x16 cross recessed hexagon head SEMS screws (M5x20 cross recessed hexagon head SEMS screws for 45-55 kW T7 models) on both the left and right sides of the AC drive, as shown in step 3 of the figure.
4. Place the lower bracket against the drive and align the screw holes with the holes on both sides of the brackets. Use a Phillips screwdriver to tighten one M5x16 cross recessed hexagon head SEMS screw (M5x20 cross recessed hexagon head SEMS screw for 45-55 kW T7 models) on both the left and right sides of the AC drive, as shown in step 4 of the figure.
5. Tilt the assembled drive with brackets into the mounting opening of the control cabinet mounting surface, as shown in step 5 of the following figure.
6. Gently push the drive upwards to make the bracket fit flat against the mounting surface of the control cabinet. Use a Phillips screwdriver to tighten the four M5x16 cross recessed hexagon head

SEMS screws (M6x20 cross recessed hexagon head SEMS screw for 45-55 kW T7 models) around the bracket, as shown in step 6 of the following figure.

Note

- Screw torque of M5: 2.8 N·m; screw torque of M6: 4.8 N·m
- Use a torque wrench instead of a Phillips screwdriver for M6 cross recessed hexagon SEMS screw.

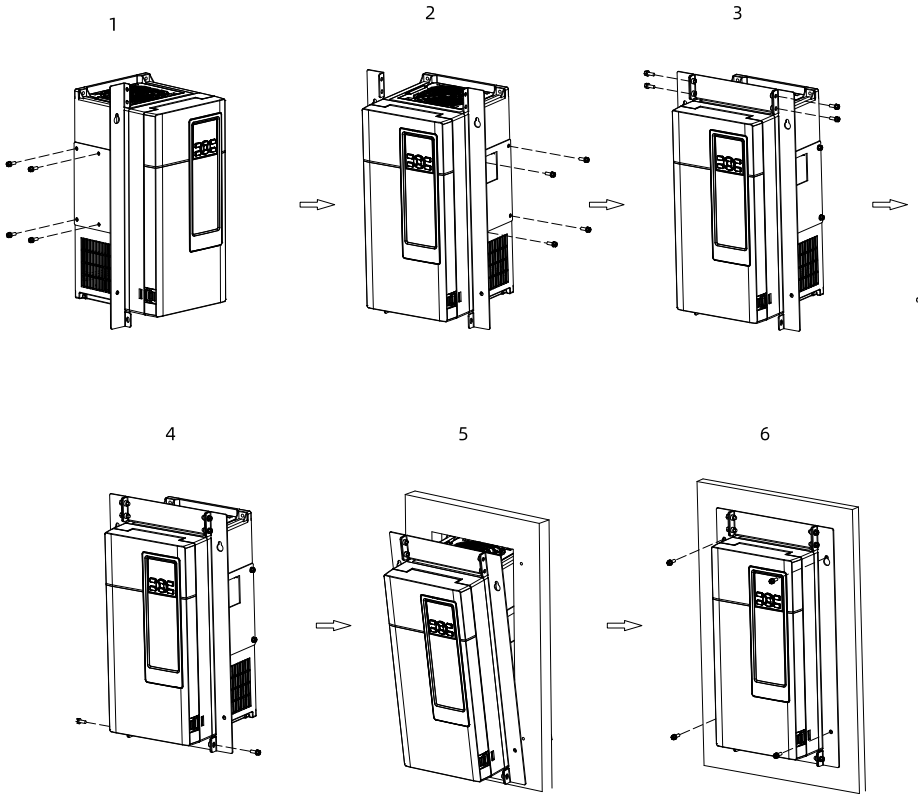


Figure 5-5 Through-hole mounting of T6 and T7 models (30 kW to 55 kW)

Through-hole mounting of T8 models (75 kW to 90 kW)

1. Place the through-hole mounting bracket from the top of the operating panel downwards to align the holes on the bracket with those on both sides of the drive. Then, use a Phillips screwdriver to tighten the four M5x12 cross recessed hexagon head SEMS screws on each side, as shown in figures 1 and 2 in the following figure.
2. Tilt the assembled drive with brackets into the mounting opening of the control cabinet mounting surface, as shown in step 2 of the following figure.
3. Gently push the drive upward so that the bracket fits flat against the control cabinet mounting surface. Tighten the four M8x20 cross recessed hexagon head screws around the bracket with a torque wrench, as shown in step 3 in the following figure.

Note

Screw torque of M5: 2.8 N·m; screw torque of M8: 13 N·m

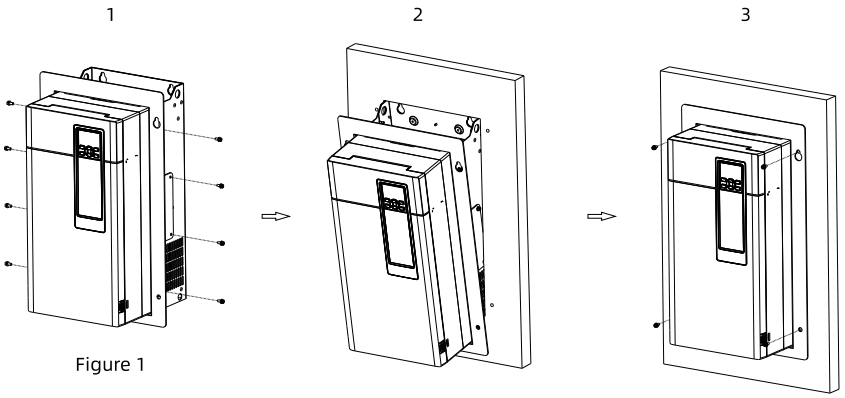


Figure 1

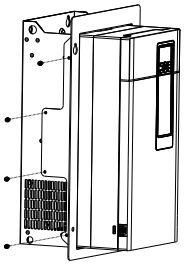


Figure 2

Figure 5-6 Through-hole mounting of T8 models (75 kW to 90 kW)

Cutout dimensions

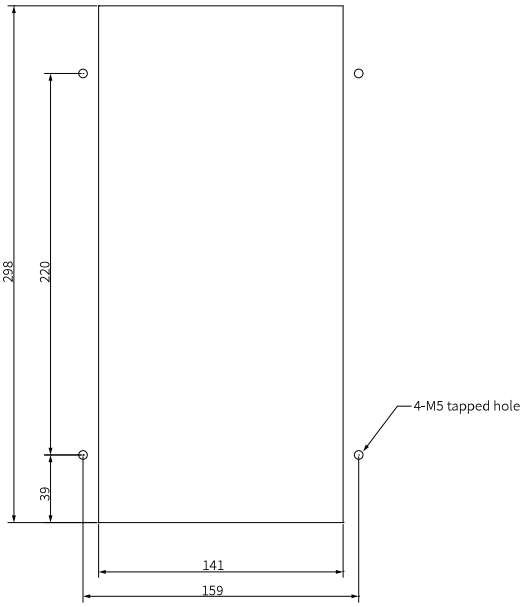


Figure 5-7 Recommended cut-out dimensions (mm) for T4 models (11 kW to 15 kW)

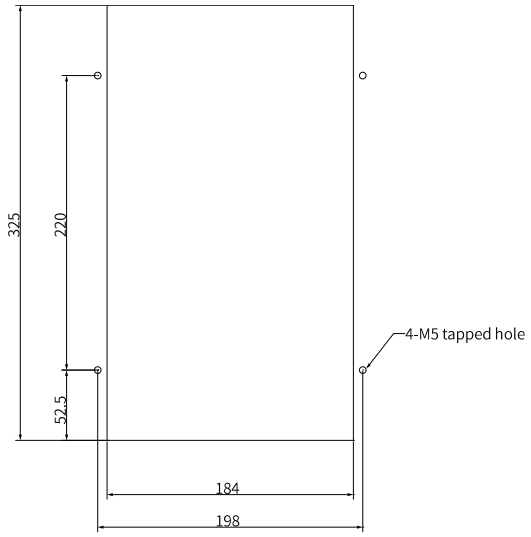


Figure 5-8 Recommended cut-out dimensions (mm) for T5 models (18.5 kW to 22 kW)

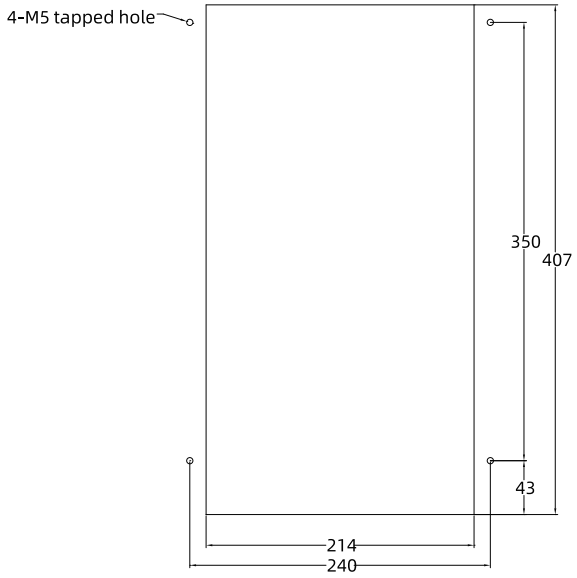


Figure 5-9 Recommended cut-out dimensions (mm) for T6 models (30 kW to 37 kW)

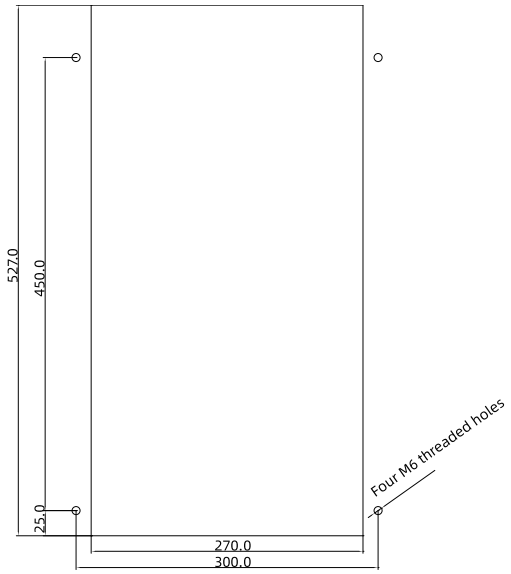


Figure 5-10 Recommended cut-out dimensions (mm) for T7 models (45 kW to 55 kW)

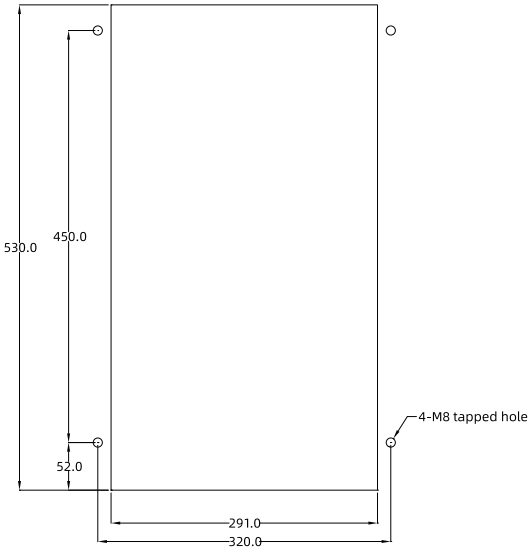


Figure 5-11 Recommended cut-out dimensions (mm) for T8 models (75 kW to 90 kW)

5.5 Guide Rail Mounting

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. Install the optional plastic base plate of the DIN rail to the bottom of the product with PA4x12 self-tapping screws, as shown in figure 1.
2. Snap the upper snap-fit joint of the plastic base plate into the guide rail, and then tap the bottom of the product with your hand in the direction of the arrow. Then, snap the lower snap-fit joint of the plastic base plate into the guide rail, as shown in figure 2.

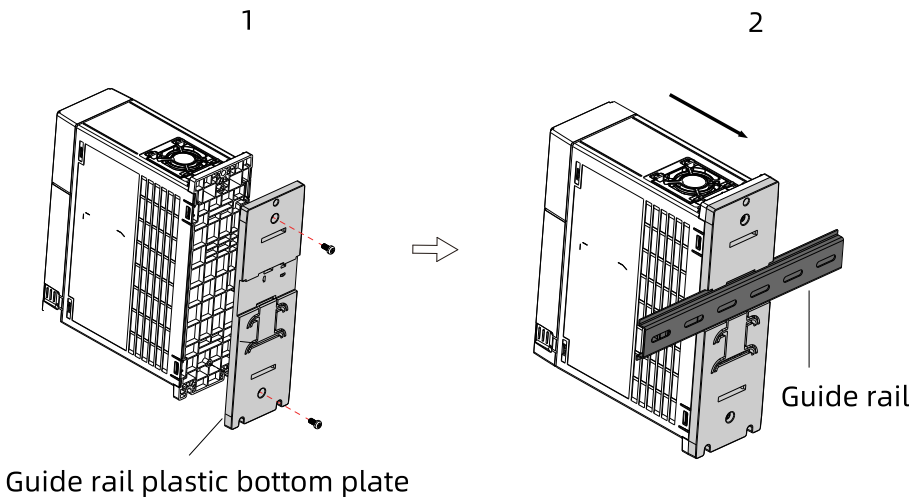


Figure 5-12 Rail mounting

Note

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

5.6 Installation of Junction Box Protection Accessory

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. Remove the protective plate of the main power terminals by pulling it upwards, as shown in Figure 2.
   c. Figure 3 shows the product after the plastic upper cover and plastic cable plate are removed.
   d. Remove the M4 screws on the upper cover of the junction box to lift off the cover and draw out the cable plate upwards.
   e. Use a Phillips screwdriver to remove the two grounding terminal bolts on both sides of the main power terminal block. Insert the upper end of the junction box frame into the plastic mounting lugs, and insert the lower end into the two grounding terminals of the terminal block. Re-tighten the grounding terminal bolts. Then secure the junction box frame to the drive using two PT4x8 self-tapping screws, as shown in the following figure 4.
   f. Perform the following operations:

      - Install the waterproof plug. Place the waterproof plug delivered with the product into the corresponding opening on the cable plate of the junction box. Then pass the cable through the opening.
      - Connect the terminal. Fasten the cables to the grounding terminal bolts on both sides of the terminal block (connect the PE cable to the grounding symbol on the junction box) and the terminal on the control board.
      - After wiring, re-install the main power terminal protective board.
      - Fix the cable plate. Insert the cable plate with a waterproof plug into the junction box frame.
      - Re-install the upper plastic cover, as shown in figure 5.

g. Use the M4 screws delivered to tighten the upper cover of the junction box, 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.

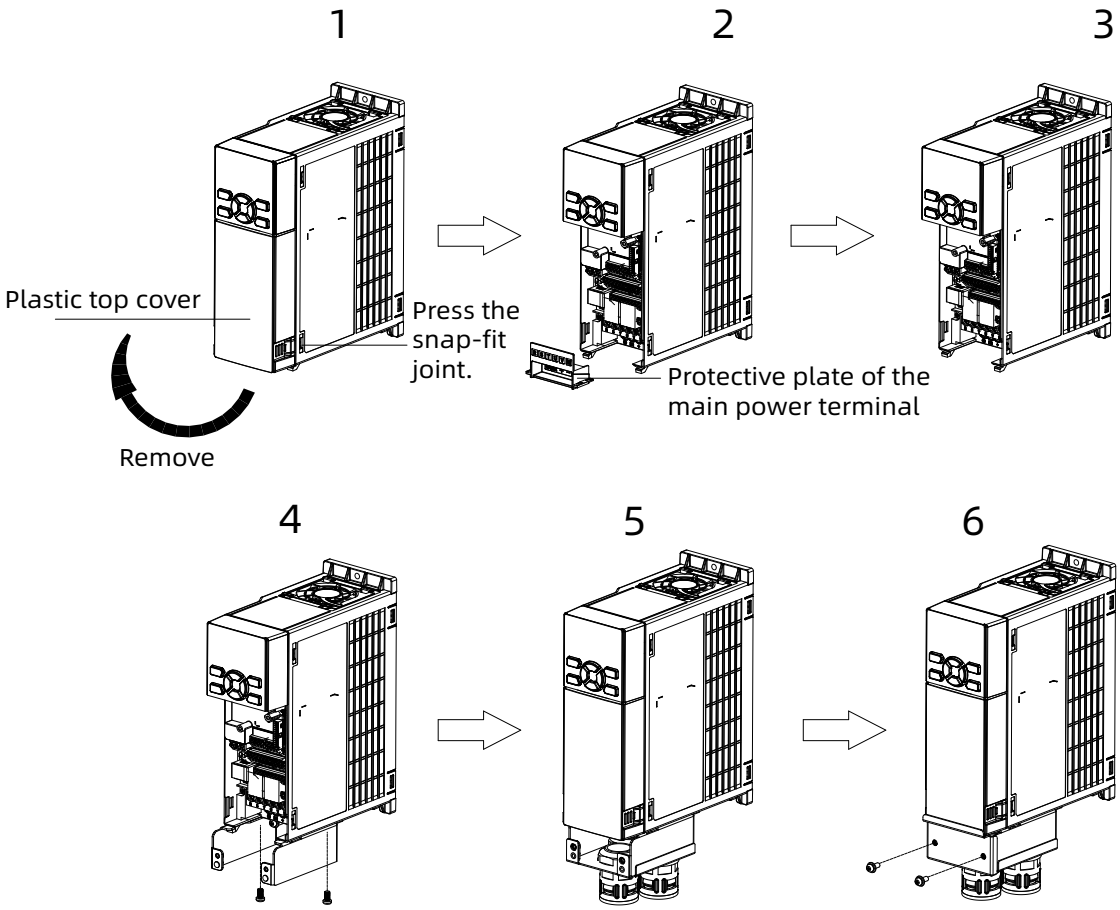


Figure 5-13 Mounting diagram of the junction box (T1 to T3)

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. Remove the protective plate of the main power terminals by pulling it upwards, as shown in Figure 2.
   c. Figure 3 shows the product after the plastic upper cover and plastic cable plate are removed.
   d. Remove the M4 screws on the junction box upper cover and cable plate to detach the junction box upper cover and cable plate from the junction box frame.
   e. Use a Phillips screwdriver to remove the two grounding terminal bolts on both sides of the main power terminal block. Insert the upper end of the junction box frame into the plastic mounting lugs, and insert the lower end into the two grounding terminals of the terminal block. Re-tighten the grounding terminal bolts. Then secure the bracket to the drive using two PT4x8 self-tapping screws at the bottom of the junction box frame, as shown in the following figure 4.
   f. Perform the following operations:

- Install the waterproof plug. Place the waterproof plug delivered with the product into the corresponding opening on the cable plate of the junction box. Then pass the cable through the opening.
- Connect the terminal. Fasten the cables to the grounding terminal bolts on both sides of the terminal block (connect the PE cable to the grounding symbol on the junction box) and the terminal on the control board.
- After wiring, re-install the main power terminal protective board.
- Fix the cable plate. Use the M4 screws provided with the product to fix the cable plate with a waterproof plug of the junction box.
- Re-install the upper plastic cover, as shown in figure 5.

g. Use the M4 screws delivered to tighten the upper cover of the junction box, 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.

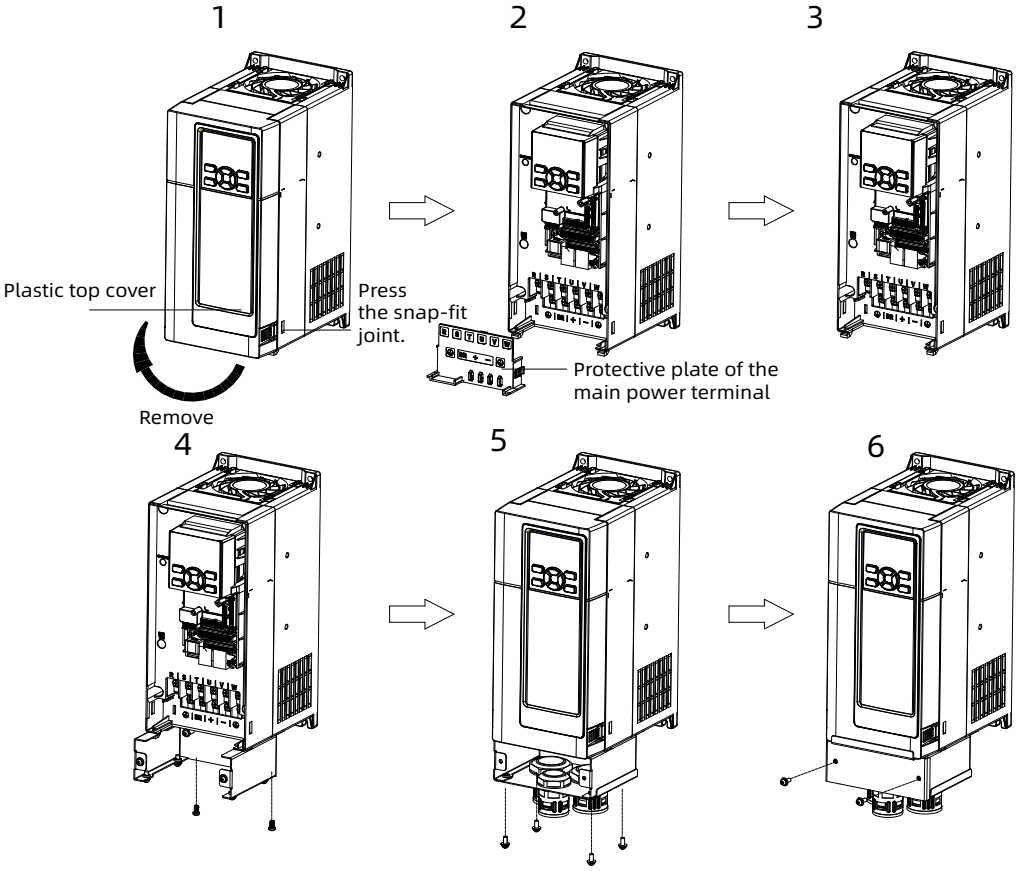


Figure 5-14 Mounting diagram of the junction box (T4 and T5)

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 a Phillips screwdriver (for T6), #13 socket (for T7), or #17 socket (for T8), 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 of M6 for T6 models is 2.5 N·m. The torque of M8 for T7 model is 13 N·m. The torque of M10 for T8 models is 20 N·m.

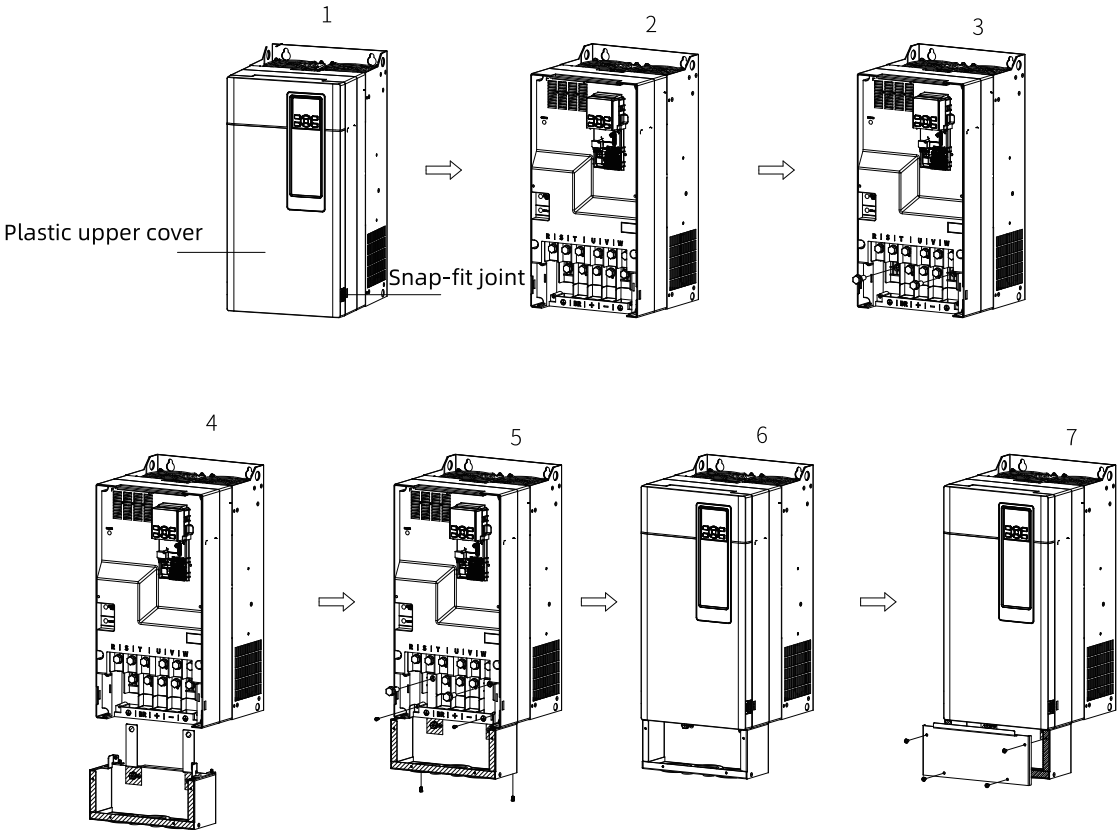


Figure 5-15 Mounting diagram of the junction box accessory (T6 to T8)

5.7 Installation of Cable Shield Grounding Bracket

1. For models T1 (0.37–1.5 kW) to T3 (5.5–7.5 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 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.

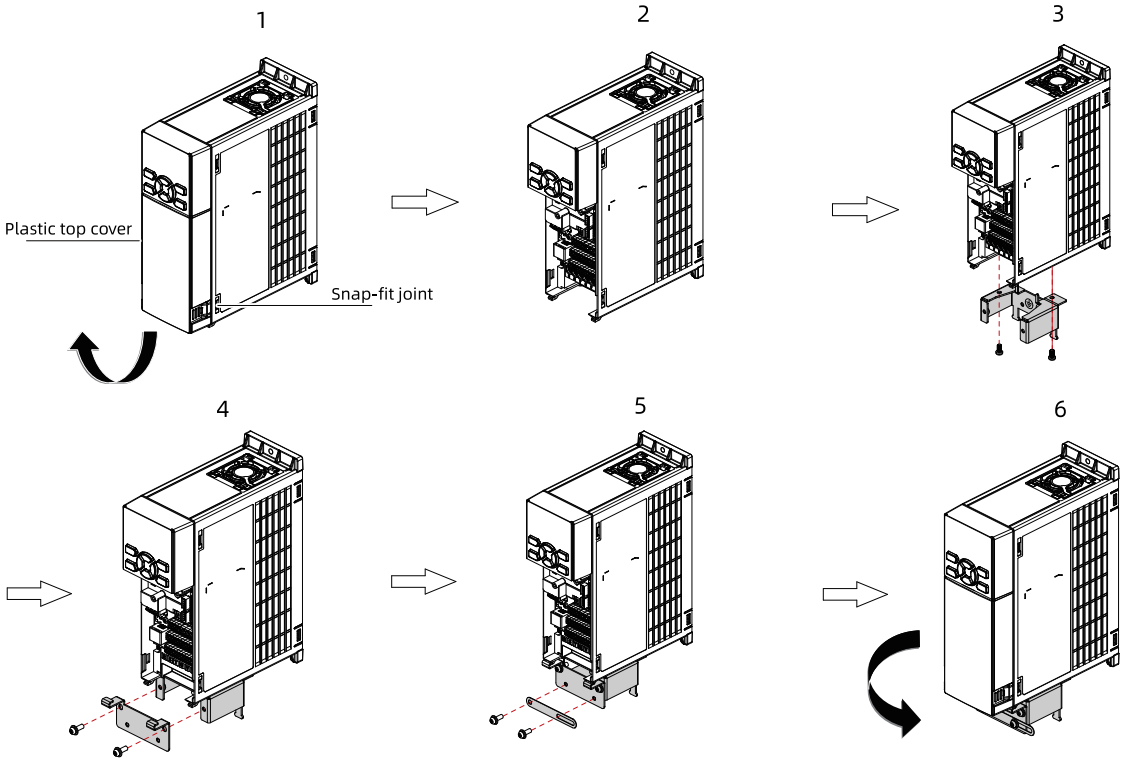


Figure 5-16 Installing the cable shield grounding bracket for models T1 (0.37–1.5 kW) to T3 (5.5–7.5 kW)

2. For models T4 (11–15 kW) to T5 (18.5–22 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 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.

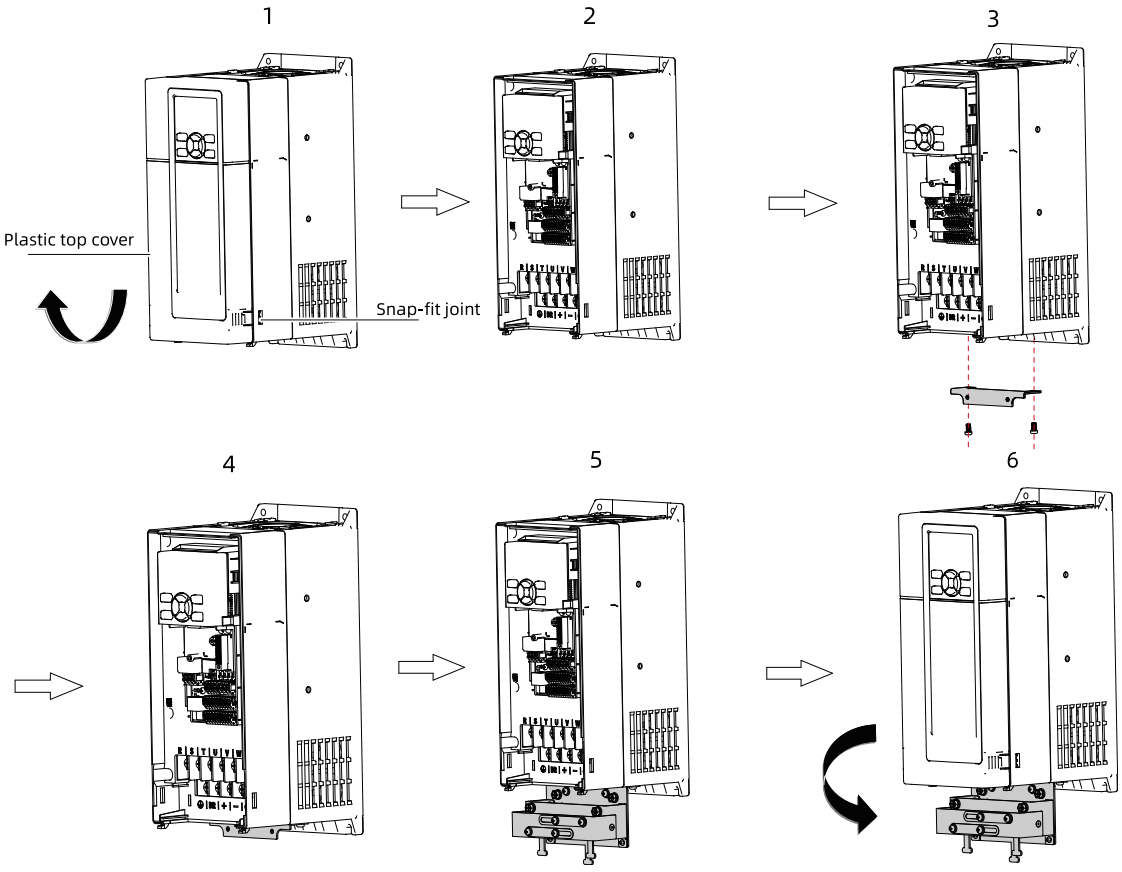


Figure 5-17 Installing the cable shield grounding bracket for models T4 (11–15 kW) to T5 (18.5–22 kW)

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 a Phillips screwdriver for T6 models (30–37 kW), #13 socket for T7 models (45–55 kW), or #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

The torque for self-tapping screws PT4x8 and SEMS screws M4x10 is 1.2 N·m. The torque of M6 for T6 models (30 kW to 37 kW) is 4.8 N·m. The torque of M8 for T7 models (45 kW to 55 kW) is 13 N·m. The torque of M10 for T8 models (75 kW to 90 kW) is 20 N·m.

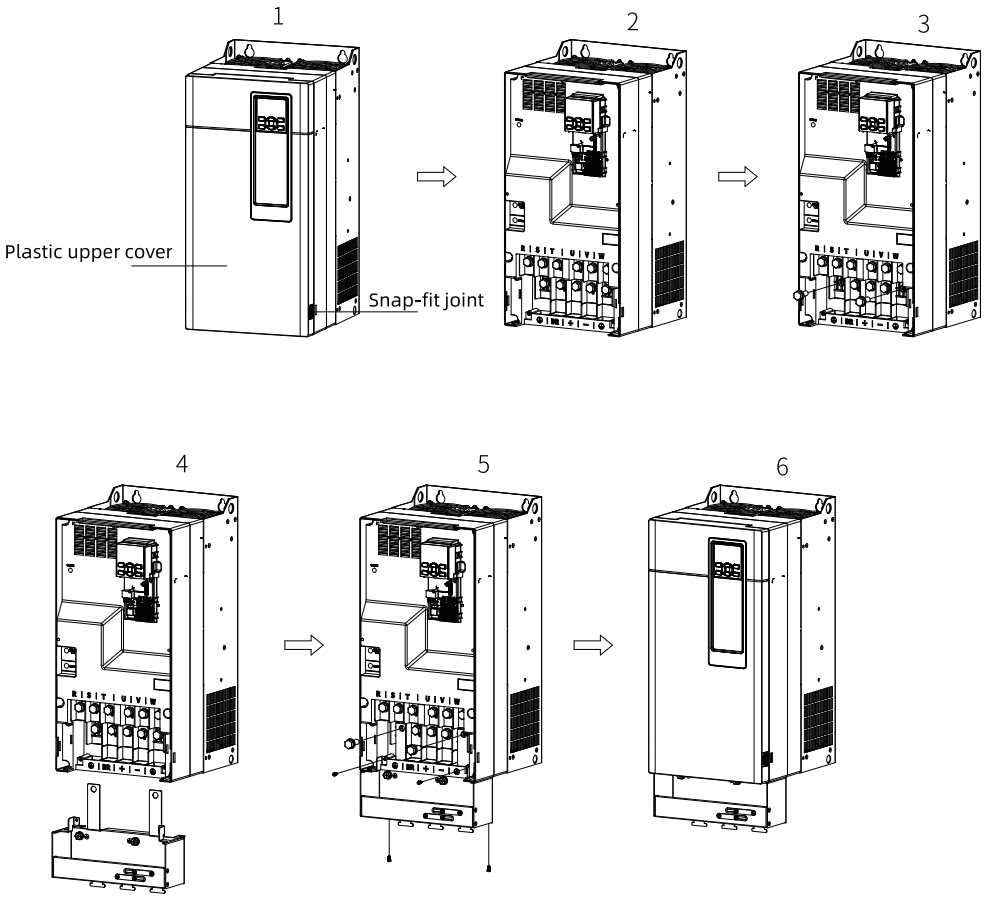


Figure 5-18 Installing the cable shield grounding bracket for models T6 (30–37 kW) to T8 (75–90 kW)

5.8 Installation of Anti-vibration Bracket

Procedure:

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

1. For models T1 (0.37–1.5 kW) to T5 (18.5–22 kW), secure the drive to the anti-vibration bracket using a Phillips 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 T5 (18.5–22 kW), use four M5x16 cross recessed hexagon head SEMS bolts to secure the drive, as shown in figure 2.

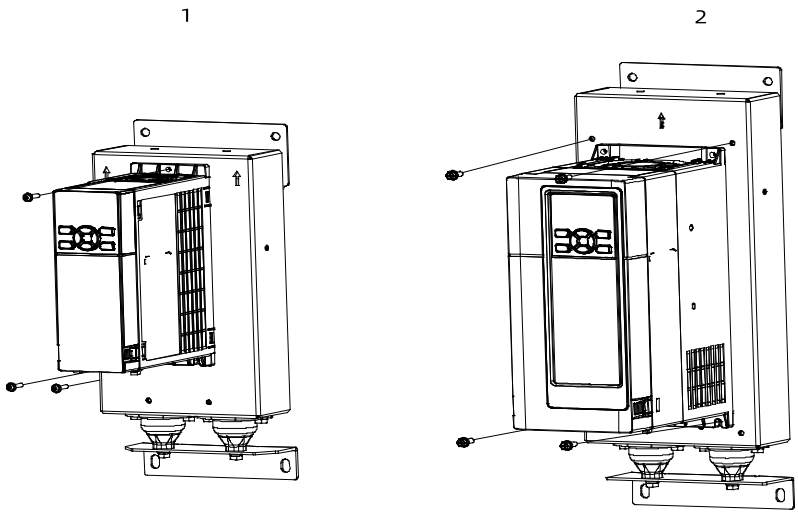


Figure 5-19 Installation of anti-vibration brackets for T1 to T5 models

2. Fix the drive to the anti-vibration bracket by using a Phillips screwdriver (for 30-37 kW T6), #10 socket (for 45-55 kW T7), or #13 socket (for 75-90 kW T8). The screw specifications are as follows:

   - For models T6 (30–37 kW), use four M5x25 cross recessed hexagon head bolts, as shown in figure 2.
   - 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.

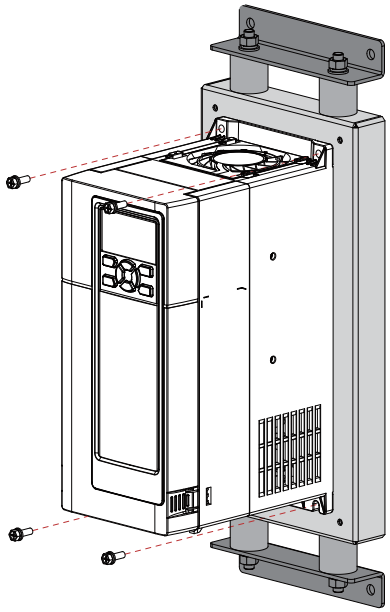


Figure 5-20 Installation of the anti-vibration bracket for T6 to T8 models

Note

The above screw torque values are as follows: M4: 1.2 N·m; M5: 2.8 N·m; M6: 4.8 N·m; M8: 13 N·m.

5.9 Post-installation Inspection

After installation is done, check the following items.

Table 5–3 Post-installation checklist

No.	Check Item	Confirmation
1	The minimum ceiling height required for unblocked air passage is reserved. The air inlet and air outlet are unblocked, with sufficient space reserved for dissipation. Sufficient space after the cabinet door opens has been reserved as safety passageway.	☐
2	All the internal and external contact protection devices (such as protective plates) for the cabinet unit have been installed.	☐

6 AC Drive Wiring

6.1 Cable Preparation

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

- Input/Output cable

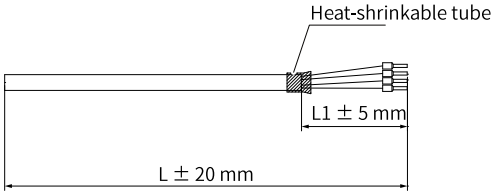


Figure 6-1 Input/Output cable for T1 (0.37 kW ~1.5 kW)~T3 (5.5 kW ~7.5 kW)

- DC bus input cables

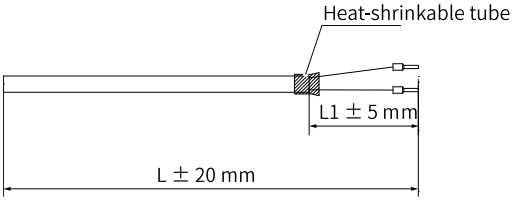


Figure 6-2 DC bus input cables

- Braking cable

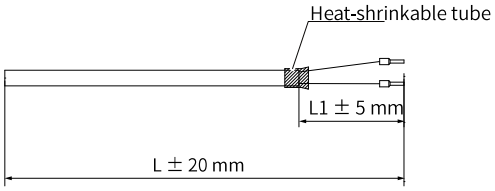


Figure 6-3 Braking cable

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

- Input/Output cable

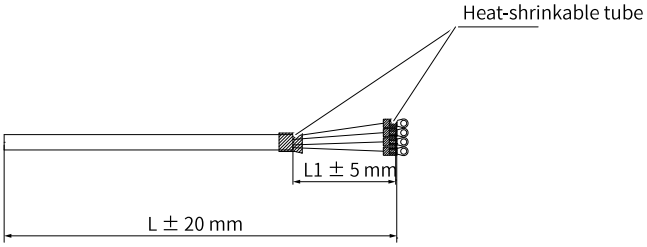


Figure 6-4 Input/Output cable for T4 (11 kW ~15 kW)~T8 (75 kW~90 kW)

- DC bus input cables

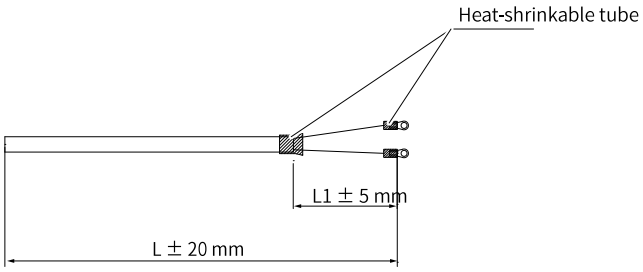


Figure 6-5 DC bus input cables

- Braking cable

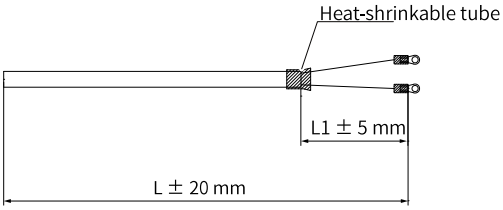


Figure 6-6 Braking cable

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.

6.2 Pre-wiring inspection

Check the following items before wiring.

Table 6–1 Pre-wiring checklist

No.	Item	Pass
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.	☐
4	When wiring multiple motors, ensure the connections are correct and avoid cross-wiring between the motors and the drive. Cross-wring may cause abnormal motor operation.	☐

6.3 Power Cable Connection

1. Before connecting the power cable, ensure that the input power supply is disconnected. Connect power cables based on the following procedure.
   a. Remove the top cover in the arrow direction, as shown by figure ①.
   b. Remove the power terminal protective plate in the arrow direction, as shown in figure ②.

c. 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 *"16.6.6 Cable" on page 1561* (tighten the screws of the main circuit terminals), as shown in figure ③.

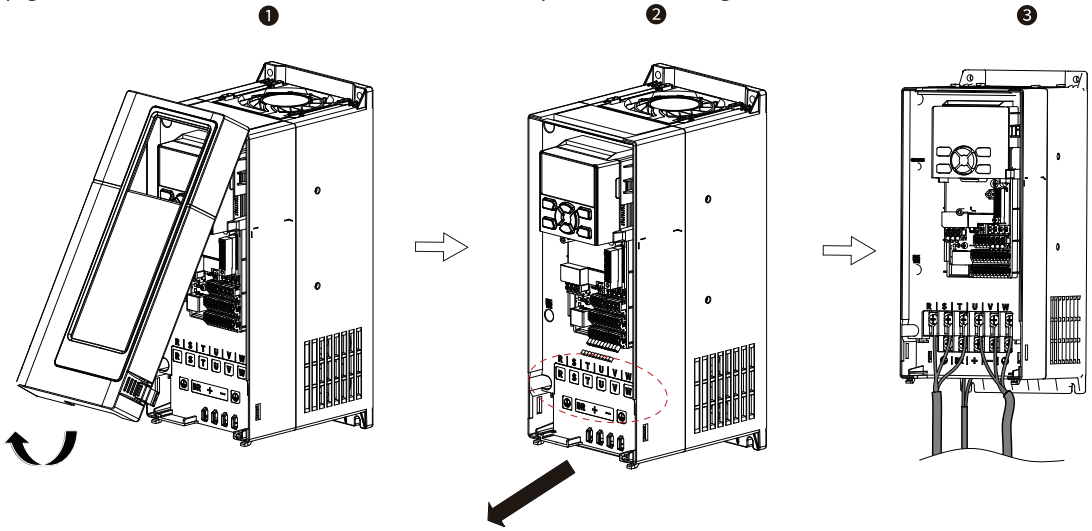


Figure 6-7 Connecting the power cables

6.4 Connecting Control Cable

1. Connect control cables.
   a. Remove the front cover in the direction indicated by the arrow, as shown in figure ①.
   b. Find the terminal to be connected according to the definition in *"4.7.1 Description of Control Circuit Terminals" on page 98*, 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.

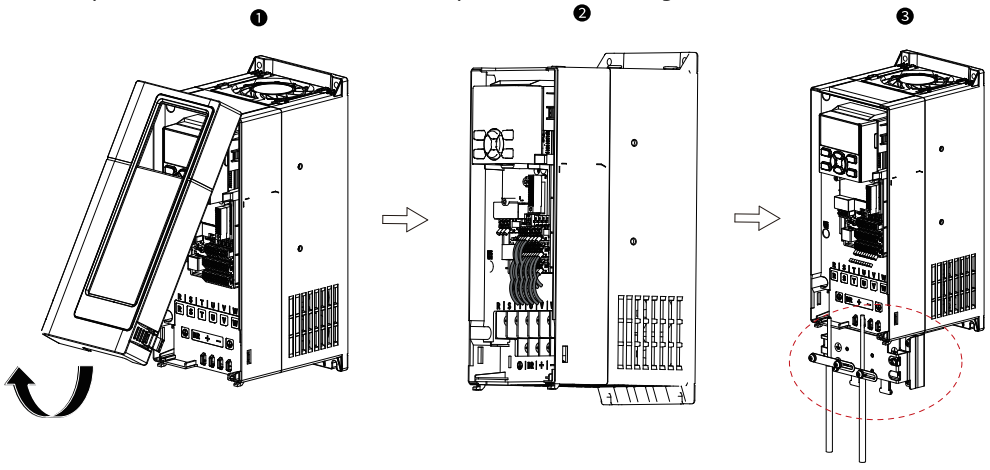


Figure 6-8 Connecting the control cable

2. **I/O connection**
   The following section uses the MD610S model as an example to illustrate I/O connections. For detailed information on I/O connections supported by all models, refer to *"4.7.2 I/O Wiring" on page 102*.

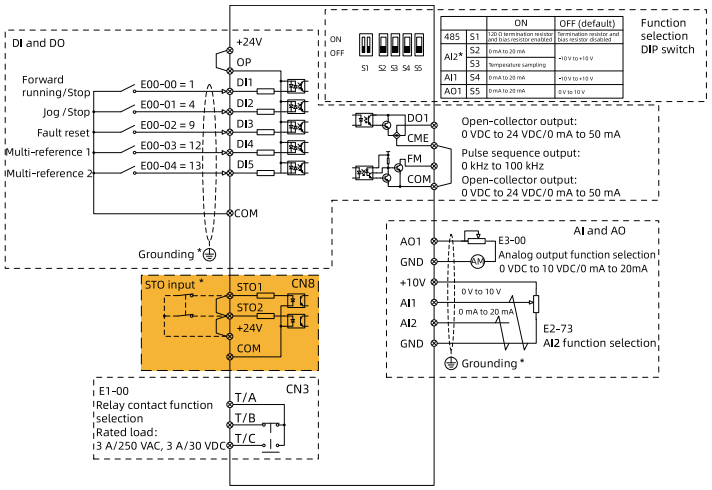


Figure 6-9 I/O connection

6.5 Post-wiring Inspection

After wiring is done, check the following 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.	☐

7 Commissioning Tool

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

Table 7–1 Commissioning tool list

Tool type			Function	Application scenario	Remarks
Operating panel			The local operating panel is the standard operating panel of the drive. • 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.	Suitable for single-machine commissioning scenario.	Standard
External operating panel	LED	MD-BP-M	MD-BP-M is an optional external keyboard. It features functions such as value display, parameter setting, status monitoring, and frequency setting,	It is suitable for simple commissioning of a single device or for commissioning scenarios where the installation location makes operation inconvenient.	Optional
		MD-BP-S	MD-BP-S is an optional external keyboard. It features numeric display, parameter setting, status monitoring, system status information prompts, and USB relay functions,		
	LCD	SOP-20-MD6	SOP-20-MD6 is an optional external intelligent operating panel. It provides functions such as graphical display, parameter copy, fault analysis and diagnosis, and USB relay. Different from the conventional LED operating panel, the display and physical key of the SOP-20-MD6 are independent of the drive.		
iFA Drive commissioning software			iFA Drive debugging 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 include AC drives, servo systems, and electro-hydraulic servo systems.	It is applicable to complex commissioning with a PC.	Optional

7.1 Operating Panel

7.1.1 Overview

The operating panel of the AC drive includes LED and keys, with the following functions:

- Parameter 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).

7.1.2 Description

The operation panel is shown in the figure below, including the symbol display area, parameter display area, status display area, unit display area, key area, and USB interface.

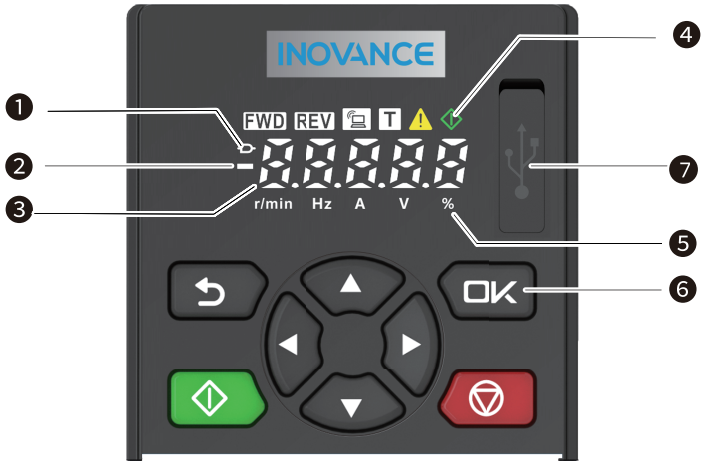


Figure 7-1 Operating panel

Table 7–2 Panel description

No.	Name	Description
①	Connector sign	Steady ON: Indicates that the parameters accessed currently are connector parameters.
②	Minus sign	Steady ON: Indicates that the current parameter value is negative or reverse direction applies.
③	Parameter display	Displays parameters of the drive. For details, see *"7.1.3 Display" on page 140*.
④	Status display area	Displays the operation state of the drive. For details, see *"Table 7-3" on page 139*.
⑤	Unit display area	Displays the unit of the currently displayed data.
⑥	Key area	For details, see *"Table 7-4" on page 140*.
⑦	USB port	Used to connect to the backend software via a Type-C data cable. For details, see *"Figure 7-3" on page 152* .

Table 7–3 Description of status bar

Symbol	Name	Function	Description
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.

Symbol	Name	Function	Description
	Local/remote	Local/remote connection mode	Steady OFF: Local (operating panel) control Steady ON: Terminal control Slow blink (0.83 Hz): Communication control mode Fast blink (3.3 Hz): Custom control mode Double blink: Background control mode
	Torque control	Torque control mode	Steady OFF: Speed control mode Steady ON: Torque control mode
	Fault	Fault state	Steady ON: faulty
	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.

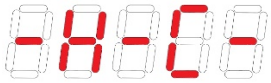
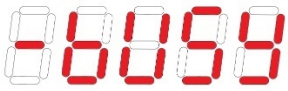
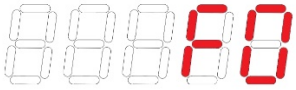
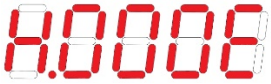
Table 7–4 Description of keys

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. • Press and hold the right button to forcibly switch to the operating panel control mode. For details, refer to *"Loc/Rem Key Operation" on page 171*
	Run	• Used for start operations in operating panel control mode.
	Stop key	• Used for stop operations in the operation state. • Used for reset operations in the fault/alarm state.

7.1.3 Display

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 7–5 Description of the displayed contents

Category	Keypad 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		Connector is L2202.
Parameter value display		Parameter value is 321.5 (decimal).
		Parameter value is 0x000E (hexadecimal).
Fault Display		Fault code E027.1
		Alarm code A028.1
		Minor fault code L028.3
		Prompt code N028.2

7.1.4 Parameter View and Setting

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 reference of main frequency] to 30.00 Hz through the operating panel.

Figure 7-2 Parameter setting procedure

7.1.5 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).

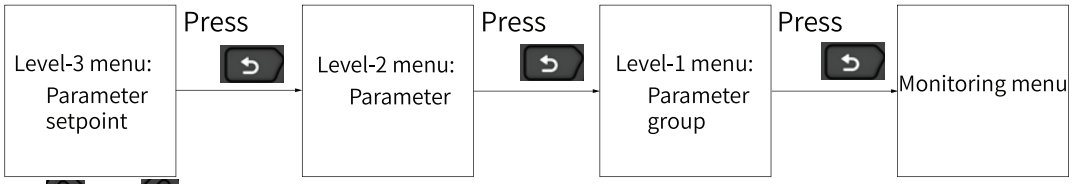
7.1.5.1 Check Monitoring Parameters in Stop State

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].

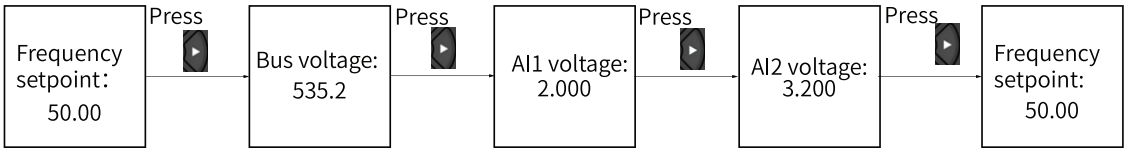
Procedure

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 *"7.1.2 Description" on page 139*.

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.

Related parameters

Table 7–6 Monitoring parameter selection in stop state

Param.	Name	Default value	Value range
A6-05	Parameter displayed on LED operating panel at stop	0x0033	bit0: Set frequency (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 MD610S) bit14: Free mapping 0 bit15: Free mapping 1 Bit values are shown below. 0: Hide 1: Displayed

Note

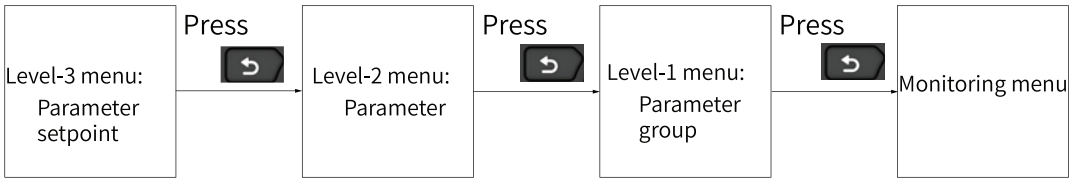
This parameter is an extended parameter, which can be displayed only when the parameter access level of the current system (A0-10) is higher than "Extended".

7.1.5.2 Check Monitoring Parameters in Running State

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 parameters

Table 7–7 Monitoring parameter selection in operation state

Param.	Name	Default value	Value range
A6-03	Parameter 1 displayed on LED operating panel during operation	0x001F	bit0: Operating frequency (Hz) bit1: Set frequency (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: Hide 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 MD610S) 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 Bit 9: Current power-on time (min) bit10: Present operating time (min.) bit11: Reserved bit12: Reference set through communication bit13: Reserved bit14: Display of main frequency X bit15: Display of auxiliary frequency Y Bit values are shown below. 0: Hide 1: Displayed

Note

This parameter is an extended parameter, which can be displayed only when the parameter access level of the current system (A0-10) is higher than “Extended”.

7.2 iFA Commissioning Software

7.2.1 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.

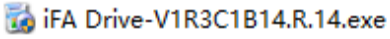
1. Visit the official website of Inovance (*https://www.inovance.com/global*).

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.

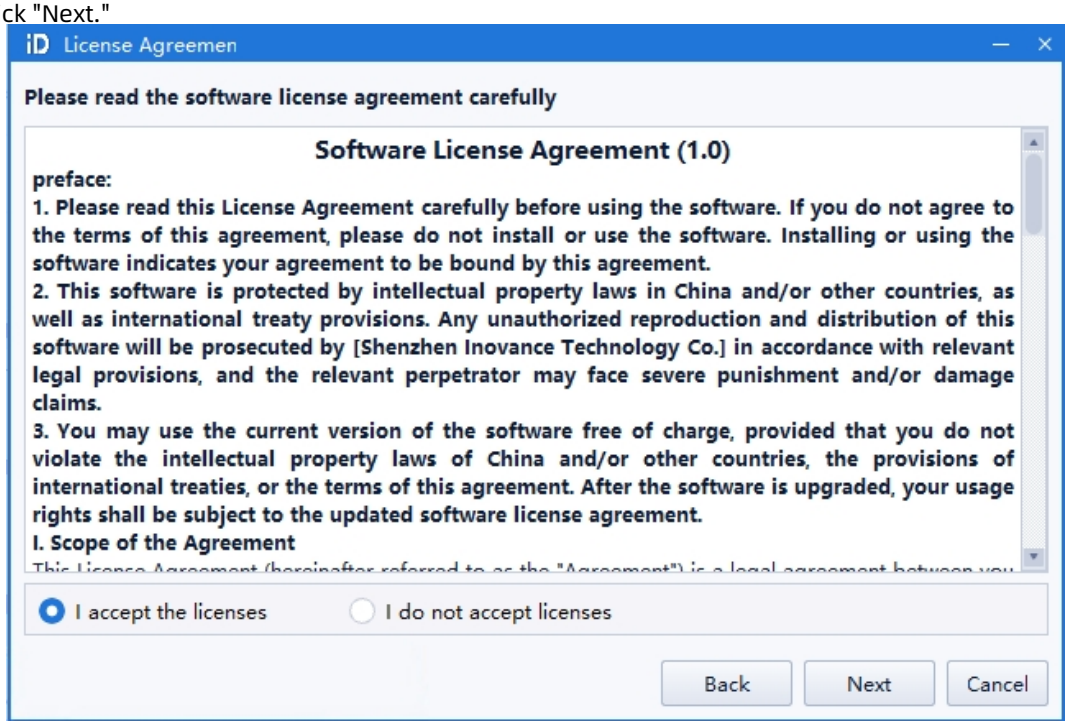
Software installation

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.

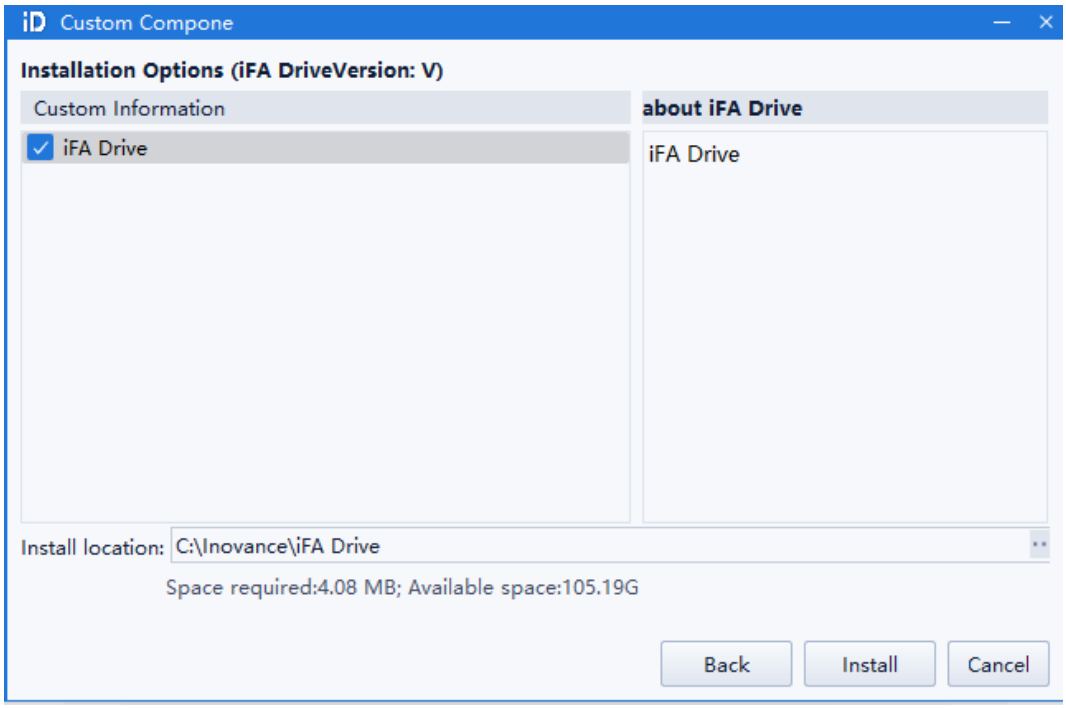
1. Double-click 

to enter the iFA Drive installation wizard.

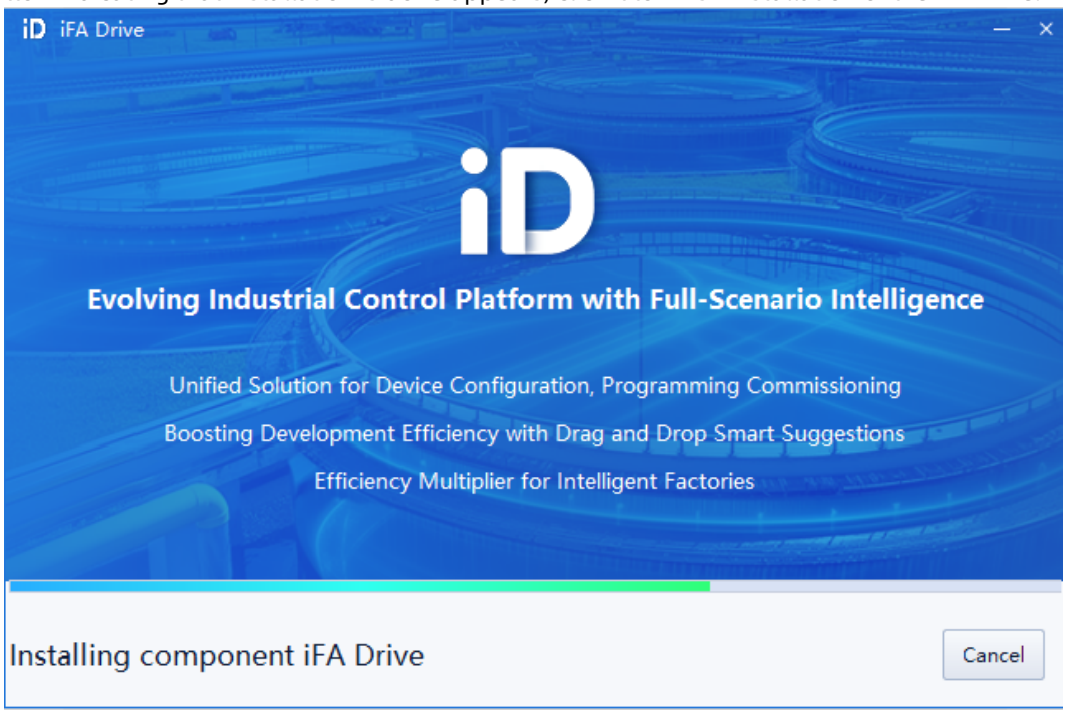
2. After reading the license agreement, if you agree to the terms, select "I accept the licenses," then click "Next."

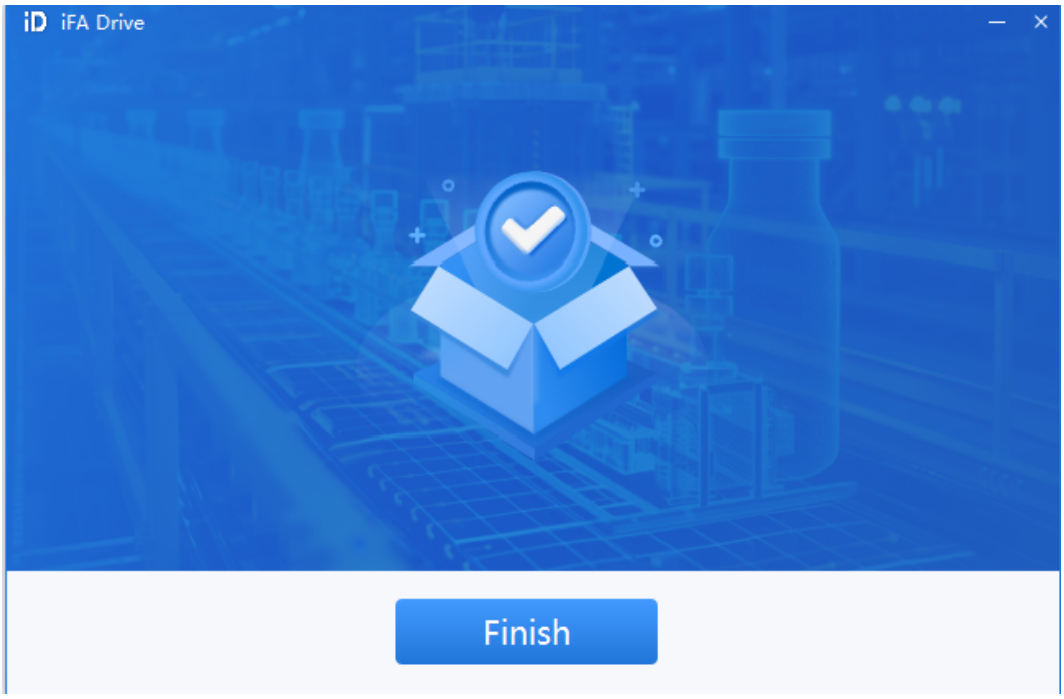


3. After setting the installation path, click "Install."



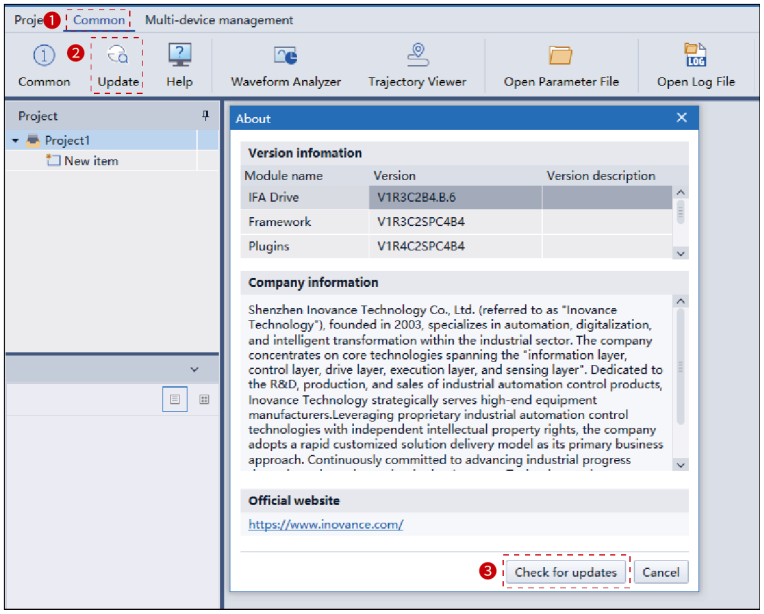
4. After the following page appears, wait for the installation progress bar to complete. When the button indicating that installation is done appears, click it to finish installation of the iFA Drive.





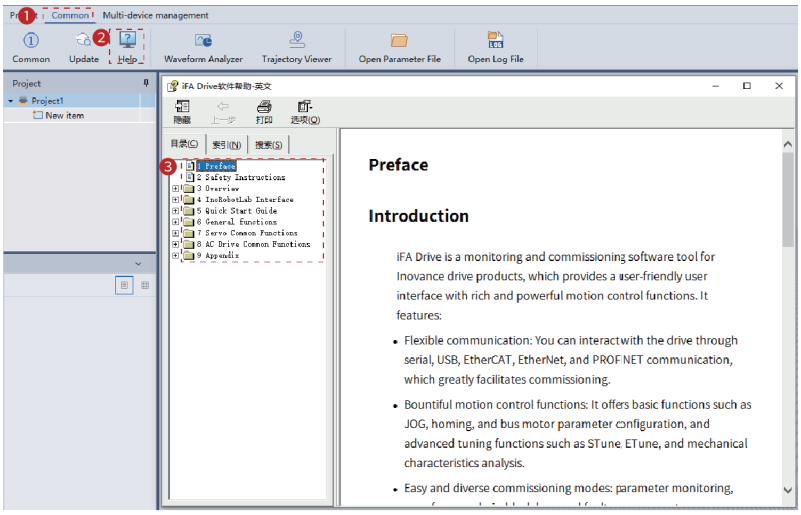
Software upgrade

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.



7.2.2 Quick Commissioning Guide

Note

For information about how to download, install, update, and use the iFA Drive, see *"7.2.1 Downloading and Installing Software" on page 147*.

Connect to backend software

Installation environment Requirements

The PC on which iFA Drive software is installed must meet the requirements shown in the table below:

Item	Requirement
Operating system	Windows 10 x64
CPU	Intel Core i5 or higher
Memory	8 GB and larger
Hard disk capacity	50 GB and larger
Display	1366 x 768 or higher; optimal resolution: 1920 x 1080
Interface	USB interface

Therefore are two ways to connect to the iFA Drive: USB interface and relay mode of the external operating panel.

USB interface cable

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

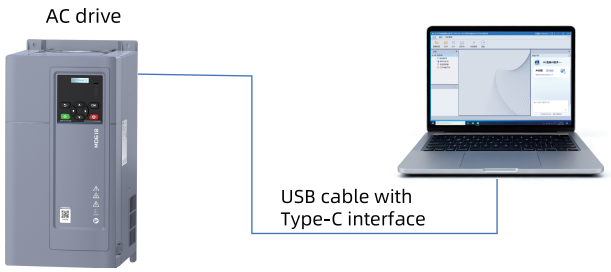


Figure 7-3 PC connection diagram

Connection through external operating panel in relay mode

Select the relay mode for the SOP-20 operating panel and connect the cable as shown in the figure below.

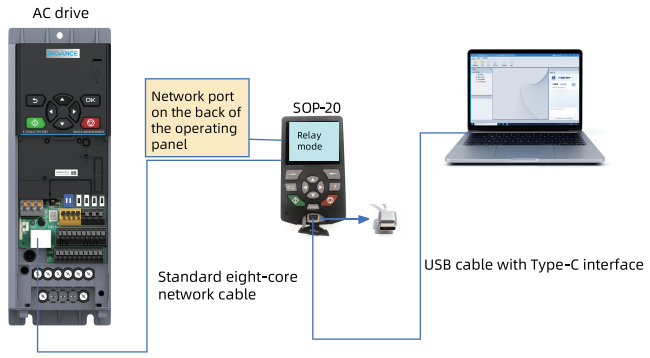
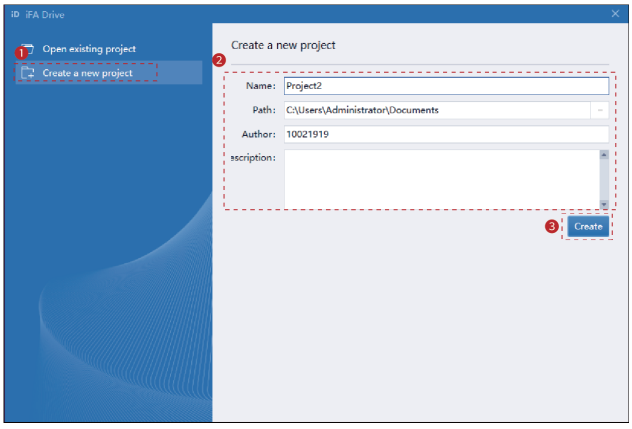
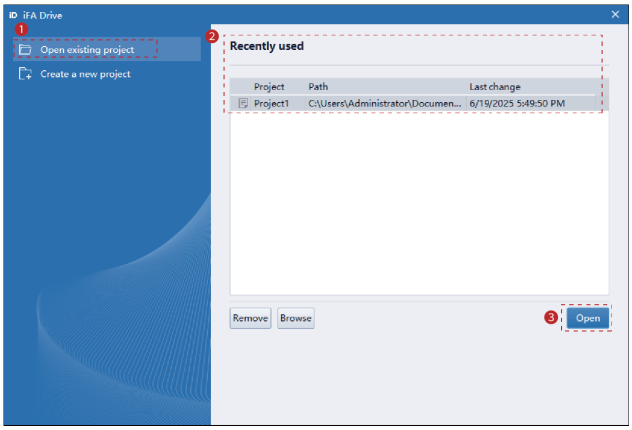


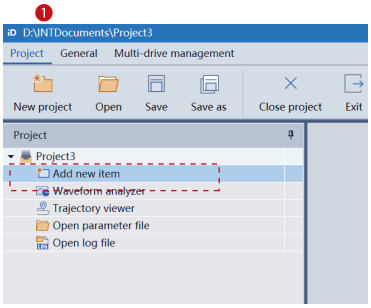
Figure 7-4 Connection through external operating panel in relay mode

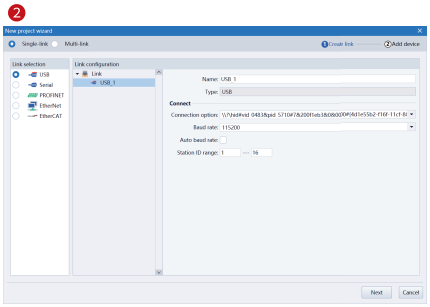
Entering a project

Creating a project	Opening an existing project
1. Click "Create 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.
	

Creating a project

1. Double-click the "Add new item" button on the left (①). The "New project wizard" dialog box appears (②).





2. Select and configure links.

   The iFA supports five types of links, including USB, serial, PROFINET, EtherCAT, and EtherNet.

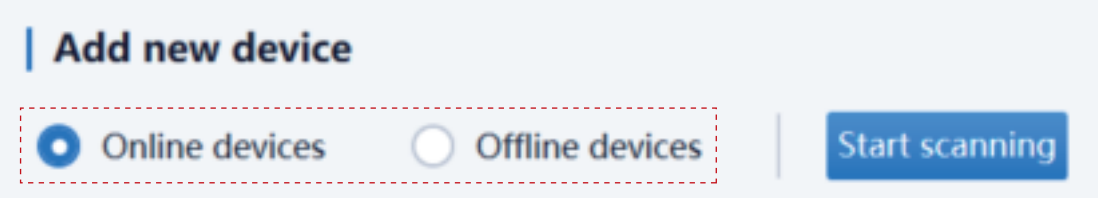
   Note that the MD610 supports only USB link and serial port link.

   You can create a single link or multiple links. Creating multiple links allows you to scan devices on multiple links or add offline devices.

   The following procedure uses a USB link as an example to describe how to create a single link and multiple links.

<table>
<tr><th>Step</th><th>Single link</th><th>Multiple links</th></tr>
<tr><td>Step 1:
Add a link.</td><td>1 .Select the desired link "USB" (①).
2 .Select the required link configuration (②).
3 .Fill in "Connection option", "Baud rate", and "Station ID Range" (③) as required.
4 .Click "Next" (④) to create the corresponding link.</td><td>1 .Select the "Multi-link" button (①).
2 .Select a link type under "Link selection" (②).
3 .Click "Create" (③).The configuration interface for this link will appear (④).
4 .Fill in the corresponding link configuration parameters (⑤).
5 .Click "Next" (⑥).</td></tr>
<tr><td></td><td colspan="2">The EtherNet link (EIP communication) supports direct connection.</td></tr>
</table>

Step	Single link	Multiple links
Step 2: Add devices.	After adding links, proceed to add devices. There are two ways to add devices: manual scanning of "Online devices" and manual addition of "Offline devices".	

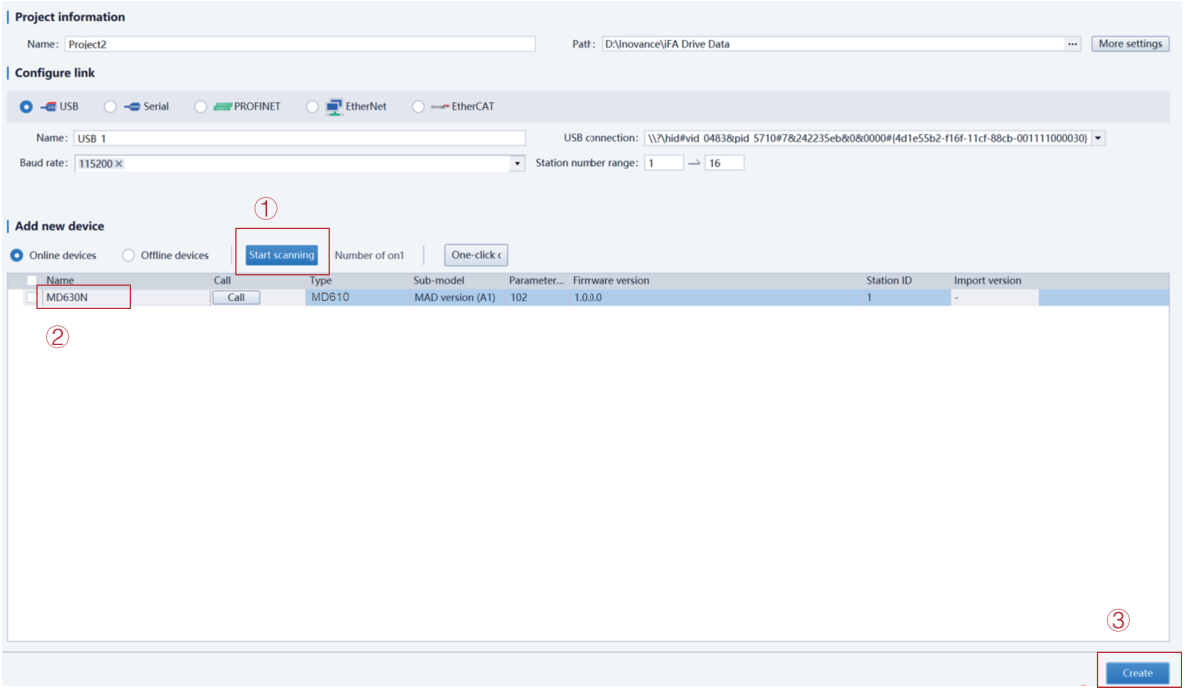


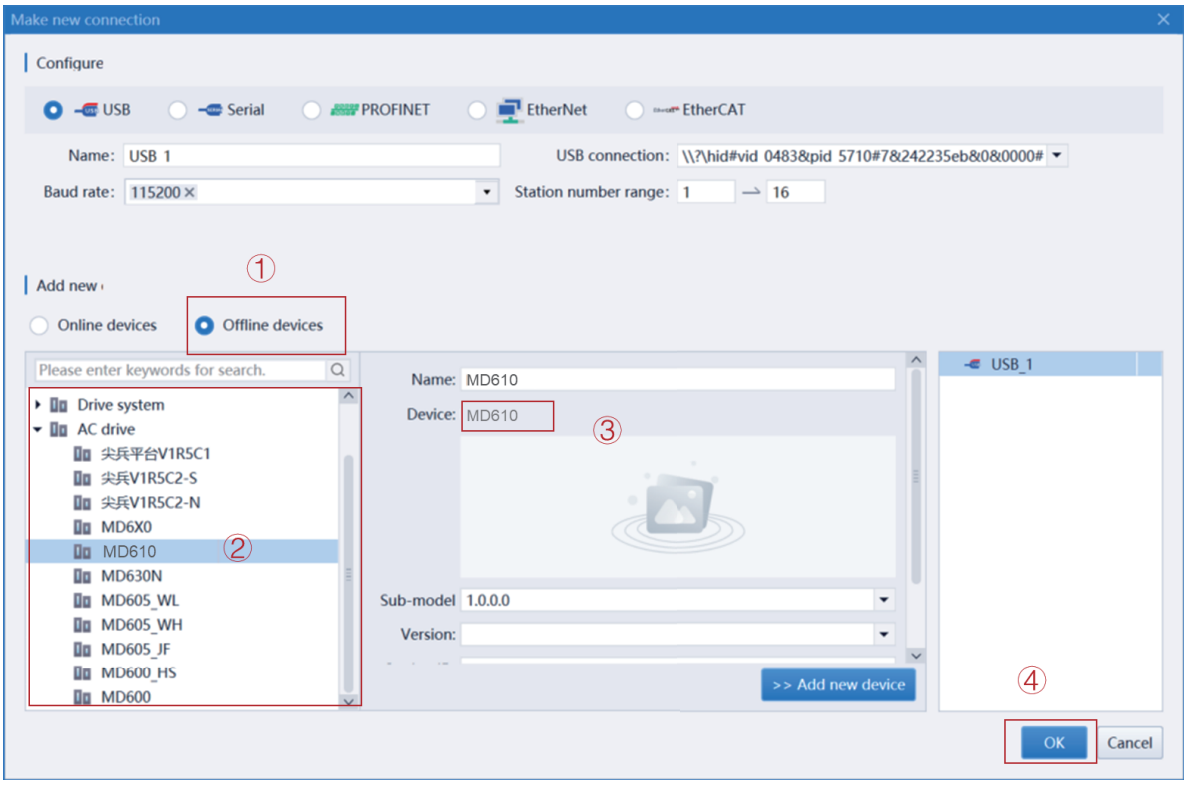
Adding devices in online mode

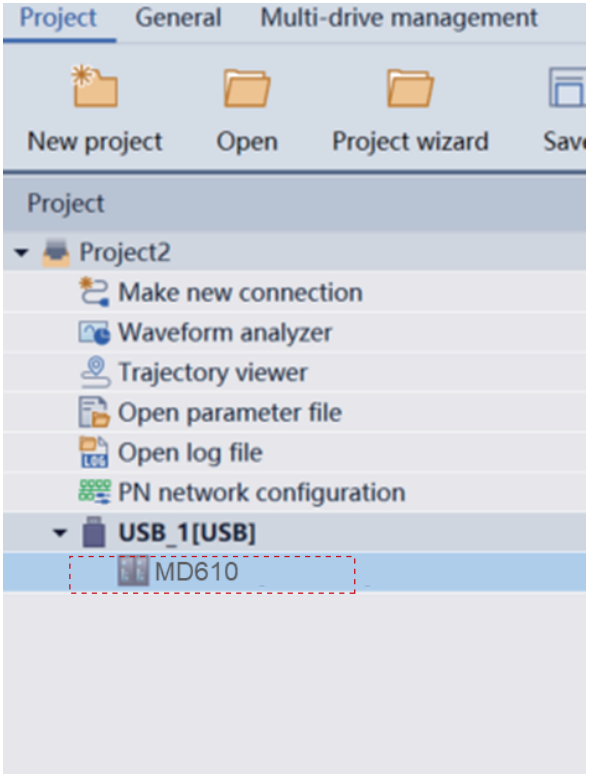
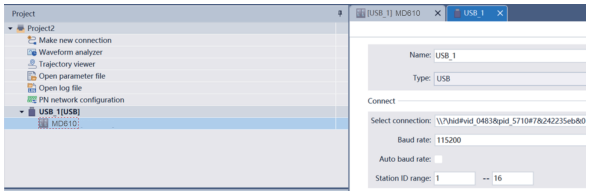
1 .Select "Online devices".
2 .Click "Start scanning". After the progress bar completes, the scanned devices will be listed below.
3 .Click "Create" in the lower right corner. You can then add the scanned devices to the project tree.

Note:

If scanning is stopped manually during USB link creation, only the devices already scanned are displayed. Unscanned devices will not appear.



Step	Single link	Multiple links
Step 2: Add devices.	**Adding devices in offline mode** 1 .Select "Offline devices" (①). 2 .Click the device node to be added (②). 3 .Click "Add new device" (③). The device will be added to the USB list box in the right pane. 4 .Click "OK" (④). 	

<table>
<tr><th>Step</th><th>Single link</th><th>Multiple links</th></tr>
<tr><td rowspan="2">Step 3:
Complete adding devices.</td><td colspan="2">After a new project is added, the iFA automatically returns to the main interface. The device name will be displayed under the project tree. The main display area displays the configured communication link information.</td></tr>
<tr><td>A device is added to a single link.
 
</td><td>A device is added to multiple links.
  </td></tr>
</table>

Connecting the Drive

1. Right-click the added device name and select "Connection" in the pop-up interface. You can commission the drive only after it is connected.

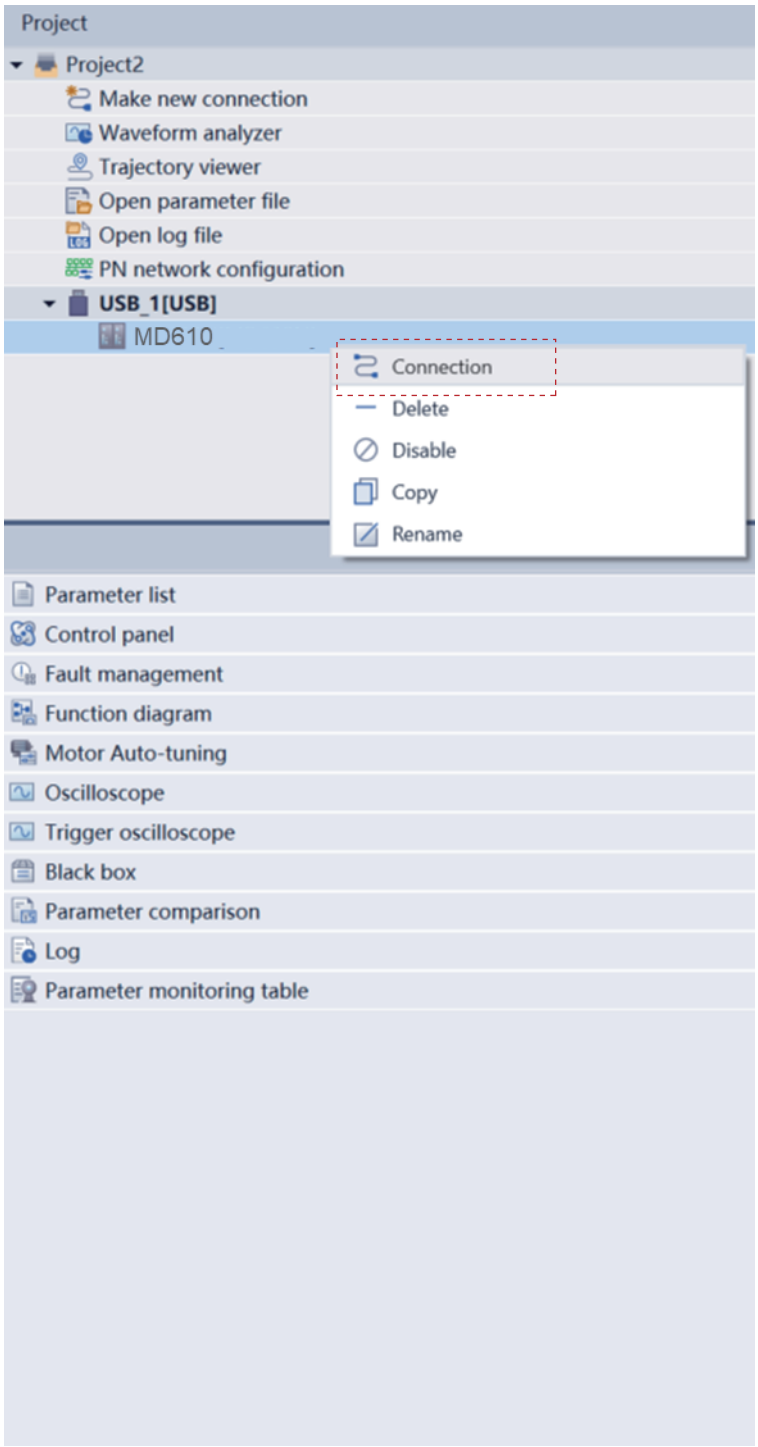
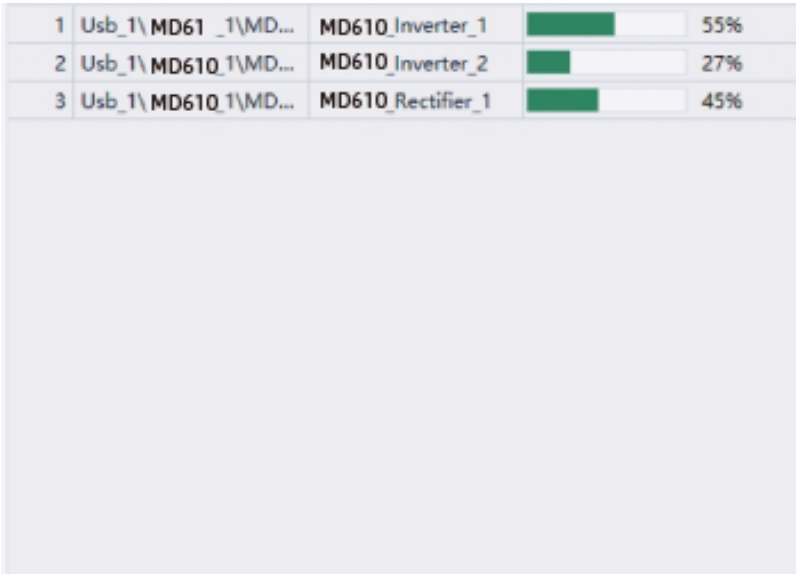
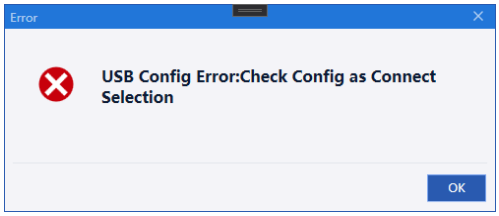


Figure 7-5 Connection to PC through USB interface

2. For devices that support attribute updates, the update is triggered automatically after a successful connection, provided the device meets the update conditions.



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



7.3 MD-BP-M External Operating Panel

7.3.1 Overview

The external MD-BP-M operating panel is designed for commissioning of drives of Inovance. It features numerical display, parameter setting, status monitoring, knob control, jump frequency, and other functions. Its key functions and display are basically consistent with those of the local operating panel. The RJ45 interface on the back of the operating panel is connected to the external operating panel interface (CN2) of the drive. For details, see *"4.7.1 Description of Control Circuit Terminals" on page 98*.

7.3.2 Description

The external MD-BP-M operating panel consists the status indicator, parameter display area, unit display area, key area, and AI pressure adjustment knob, as shown below.

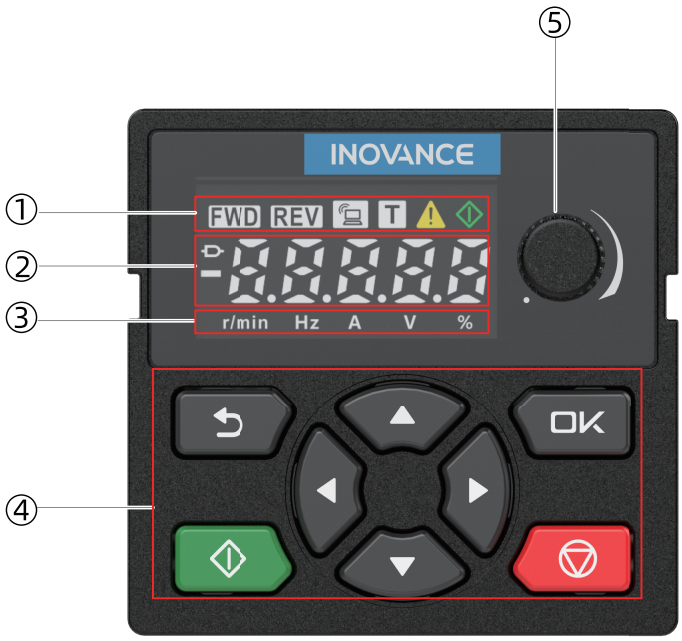


Figure 7-6 Operating panel components

Table 7–8 Operating panel components

No.	Name	Description
①	Status indicator	Displays the operation state of the drive. For details, see *"Table 7-3 Description of status bar" on page 139*.
②	Parameter display	Displays the parameters of the AC drive. For details, see *"7.1.3 Display" on page 140*.
③	Unit display area	Displays the unit of the currently displayed data.
④	Key area	For details, see *"Table 7-4 Description of keys" on page 140*.
⑤	AI voltage adjustment knob	It is used to adjust the running frequency, multi-reference 0 input, and arithmetic module input of the AC drive. For details, see *"7.3.6 AI voltage adjustment knob" on page 161*.

Note

The status bar and keys of the MD-BP-M external operating panel are consistent with those of the local operating panel. For details, see *"Table 7-3 Description of status bar" on page 139* and *"Table 7-4 Description of keys" on page 140*.

7.3.3 Display

The MD-BP-M operating panel display is identical to the local operating panel display. For details, see *"7.1.3 Display" on page 140*.

7.3.4 Parameter View and Setting

The parameter view and setting interface is the same as the local operating panel. For details, refer to *"7.1.4 Parameter View and Setting" on page 141*.

7.3.5 Status monitoring

The status monitoring interface is the same as the local operating panel. For details, refer to *" Status monitoring" on page 142*.

7.3.6 AI voltage adjustment knob

Description

Adjusting the AI voltage adjustment knob changes the voltage input. The MD-BP-M converts this voltage to a digital value and sends it to the drive, where it is processed through the AI curve to produce a proportional output. This can be used to adjust the operating frequency, multi-reference 0 input, arithmetic module input, and other functions of the drive. For detailed AI curve setting methods, see *"10.11.8 Analog Input Terminal (AI)" on page 482*.

Related parameters

Table 7–9 Parameters related to AI voltage adjustment knob

Param.	Name	Default value	Value range
A6-36	MD-BP-M potentiometer gain	1.00	-10.00 to +10.00
A6-37	Potentiometer MD-BP-M offset	0.00 V	-10.00 V to +10.00 V
A6-38	Denoising threshold of potentiometer MD-BP-M	0.1%	0.0% to 100.0%
A6-39	Filter time of potentiometer MD-BP-M	0.10s	0.00s to 100.00s
A6-40	MD-BP-M potentiometer zero-crossing threshold	1.0%	0.0% to 100.0%
A6-41	MD-BP-M potentiometer jump point	0.0%	-100.0% to +100.0%
A6-42	MD-BP-M potentiometer jump amplitude	0.1%	0.0% to 100.0%
A6-43	MD-BP-M potentiometer communication filter time	100 ms	0ms~32767 ms
A6-44	MD-BP-M potentiometer communication filtering count	32	0 to 64
A6-68	MD-BP-M potentiometer input error alarm enable	0	0: Disable 1: Active
A6-69	MD-BP-M potentiometer input protection upper limit	8.00 V	A6-70 to 10.00 V
A6-70	MD-BP-M potentiometer input protection lower limit	2.00 V	0.00 V~A6-69

Param.	Name	Default value	Value range
E2-37	AI polarity selection	0	Ones: AI1 selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Tens: AI2 selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Hundreds: MD-BP-M potentiometer selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Thousands to ten thousands: Reserved

Param.	Name	Default value	Value range
E2-38	AI curve selection	0x0321	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 place: MD-BP-M potentiometer 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) Thousands to ten thousands: Reserved

Param.	Name	Default value	Value range
E2-39	AI lower limit selection	0x0000	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: Selection when MD- BP-M potentiometer value < minimum input value 0: Minimum value 1: 0.0% Thousands to ten thousands: Reserved
E2-81	AI hardware source selection	0	Ones: AI1 source 0: Hardware sampling 1: Forced value Tens: AI2 source 0: Hardware sampling 1: Forced value Hundreds: MD-BP-M potentiometer source 0: Hardware sampling 1: Forced value
E2-84	Forced setpoint of MD-BP-M potentiometer	0.00 V	-10.00 V to +10.00 V
EE-08	Measured voltage 1 of potentiometer MD-BP-M	2.000 V	-10.000 to +10.000
EE-09	Displayed voltage 1 of potentiometer MD-BP-M	2.000 V	-10.000 to +10.000
EE-10	Measured voltage 2 of potentiometer MD-BP-M	8.000 V	-10.000 to +10.000
EE-11	Displayed voltage 2 of potentiometer MD-BP-M	8.000 V	-10.000 to +10.000

Table 7–10 Monitoring parameters related to AI voltage adjustment knob

Param.	Name	Monitoring range	Parameter description
U0-11	Voltage of potentiometer MD-BP-M	-10.570V~+10.570 V	Indicates the value of MD-BP-M potentiometer after linear correction in units of V. Note: The parameter value is the value of U0-23 (MD-BP-M potentiometer pre-calibration voltage) after linear calibration (EE-08, EE-09, EE-10, EE-11). Scaling: N/A Related parameters: EE-08, EE-09, EE-10, EE-11, U0-23
U0-23	Uncalibrated MD-BP-M potentiometer voltage	-10.570V~+10.570 V	Indicates the actual value of MD-BP-M potentiometer input sampling voltage in units of V. Note: The uncalibrated voltage of MD-BP-M potentiometer is the input sampling voltage of the MD-BP-M potentiometer, which will be linearly calibrated by EE-08, EE-09, EE-10, and EE-11. The calibrated value is displayed in U0-11. Scaling: - Related: EE-08, EE-09, EE-10, EE-11, U0-11
U1-07	Curve input value of potentiometer MD-BP-M	-10.570V~+10.570 V	Indicates the input value of MD-BP-M potentiometer curve in units of V during calculation of MD-BP-M potentiometer. Note: When the hundreds (MD-BP-M potentiometer curve selection) of E2-38 (AI curve selection) is set to [Curve 3], the input value of MD-BP-M potentiometer curve 3 (E2-48, E2-49, E2-50, E2-51) is displayed. The per-unit converted according to MD-BP-M potentiometer curve is L2248. Scaling: - Related: E2-38, E2-48, E2-49, E2-50, E2-51, L2248
L0052	MD-BP-M potentiometer input limit violated	0 to 1	Indicates whether the MD-BP-M potentiometer input exceeds the preset MD-BP-M potentiometer protection upper/lower limit. Note: Indicates whether the MD-BP-M potentiometer input voltage (U0-11) exceeds the MD-BP-M potentiometer protection upper/lower limit (A6-69/ A6-70). Scaling: - Related: U0-11, A6-69, A6-70

Param.	Name	Monitoring range	Parameter description
L0056	Level selection for MD-BP-M potentiometer used as DI	0 to 1	Defines the level state when MD-BP-M potentiometer is used as DI. The value 1 indicates DI high level. Note: When the MD-BP-M potentiometer voltage (U0-11) is higher than E2-35, the output switches from low level to high level, and the flag bit is set to 1. When the MD-BP-M potentiometer voltage (U0-11) is lower than E2-36, the output switches from high level to low level, and the flag bit is set to 0. Scaling: - Related: E2-35, E2-36, U0-11
L2248	MD-BP-M potentiometer input value	-800% to +800 %	Indicates the per-unit value of the MD-BP-M potentiometer input after conversion by the MD-BP-M potentiometer curve. Note: When the hundreds place (MD-BP-M potentiometer curve selection) of E2-38 (AI curve selection) is set to "[Curve 3]", the per-unit percentage of MD-BP-M potentiometer voltage (U0-11) converted according to AI curve 3 (E2-48, E2-49, E2-50, E2-51) is displayed. When the input is lower than E2-48, the default output is E2-49. You can also set the output upon MD-BP-M potentiometer input that lower than the minimum input setpoint to 0.0% through the hundreds place of E2-39 (AI lower limit selection). Scaling: Per-unit value Related: E2-38, E2-39, E2-48, E2-49, E2-50, E2-51, U0-11

Application instance

Set F0-29 (Main frequency source) to 10 (MD-BP-M potentiometer), and select the AI voltage adjustment knob as the frequency source. After the AI voltage adjustment knob input is converted to an input ratio through the AI curve, 100% of the input ratio corresponds to C4-06 (Rated motor frequency).

The basic steps for setting the main frequency through the AI voltage adjustment knob are as follows:

1. Set the curve relationship between the AI voltage adjustment knob input and the setting ratio to "0 V to 10 V correspond to 0% to 100%".
   - Set E2-48 (AI curve 3 minimum input) to 0.00 V.
   - Set E2-49 (Percentage corresponding to the minimum input of AI curve 3) to 0.0%.

- Set E2-50 (AI curve 3 maximum input) to 10.00 V.
- Set E2-51 (Percentage corresponding to the maximum input of AI curve 3 to 100.0%

2. Set the filter time for the AI voltage adjustment knob input through A6-39.
3. Set F0-29 (Main frequency source) to 10 (MD-BP-M potentiometer) to select the AI voltage adjustment knob of MD-BP-M as the frequency source.
   After the above steps are completed, when the AI voltage control knob input is 5 V, the drive obtains 50% converted by the AI3 curve. This means the actual set frequency is 25 Hz (50.00 x 50%). When the AI voltage adjustment knob is used, the operating frequency will change according to the AI3 curve conversion.

   For detailed functions, see *"10.3.2.4 Setting Frequency Through AI" on page 305*.

Caution

A6-43 and A6-44 are used to configure the filtering time and number of times for the data sampled by the MD-BP-M potentiometer.

7.4 MD-BP-S External Operating Panel

7.4.1 Overview

MD-BP-S is the commissioning assistant for drive systems of Inovance. It features numerical display, parameter setting, status monitoring, system status prompt, USB relay, and other functions. Designed as an extension of the local operating panel, it is connected to the external operating panel interface CN2 of the drive via the RJ45 port on its back. For details, see *"Table 4-7 Description of Control Circuit Terminals" on page 98*.

7.4.2 Components

The LED operating panel consists of six parts: status indicator, auxiliary display area, main display area, unit display area, menu indicator, key area, and USB interface.

Table 7–11 Operating panel components

No.	Name	Description
①	Status indicator	Displays the operation state of the drive. For details, see *"Table 7-12" on page 168*.
②	Secondary display area	Displays information such as key test results and system status.
③	Primary display area	Displays parameters.
④	Unit display area	Displays the unit of the currently displayed data.
⑤	Menu indicator	Indicates the current menu. Press and hold the back key to switch among menus.
⑥	Key area	For details, see *"Table 7-13" on page 169*.
⑦	USB port	Used to connect to the PC via a Type-C data cable of the operating panel in relay mode. For details, see *"Figure 7-4" on page 152* .

Table 7–12 Description of status bar

Symbol	Name	Function	Description
FWD	FWD	Forward run	Steady on: The set speed or running speed of the drive is in the forward direction.
REV	REV	Reverse run	Steady on: The set speed or running speed of the drive is in the reverse direction.
	Local/remote	Local/remote connection mode	Off: Local (operating panel) control mode Steady on: Terminal control Slow blink (3.3 Hz): Communication control mode Fast blink (0.83 Hz): Custom control mode Double blink: Background control mode
T	Torque control	Torque control mode	Steady on: Torque control mode

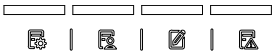
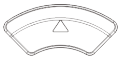
Symbol	Name	Function	Description
	Speed control	speed control mode	Steady on: Speed control mode
	Fault	Fault	Steady ON: faulty
	Operation	Operation state	Steady on: The AC drive is running.
	Stop	Stop state	Steady on: The AC drive is stopped.
	Minus sign	Negative symbol	Steady ON: Indicates that the current parameter value is negative or the direction is reverse.
	Connector	Connector negative symbol	Steady ON: Displays connector parameters.
kW h s r/min Hz A V ℃ %	Unit	Unit display area	Unit of the value in main display area
	Basic menu	Indicator steady on	The primary display area displays the basic menu.
	User-defined	Indicator steady on	The primary display area displays the user-defined parameter menu.
	User-modified parameter	Indicator steady on	The primary display area displays the modified parameter (with the default value changed) menu.
	Fault	Indicator steady on	The main display area displays the fault list.

Table 7–13 Key descriptions

Key	Name	Function
	Enter	Used to enter the setting page or confirm the settings.
	Program/Back key	Used to return to the previous page or undo the operation. Menu switchover Holding down this key enters the multi-function menu. Exit the MD-BP-S menu.
	MD-BP-S menu key	Press and hold this key to enter/exit the MD-BP-S menu.

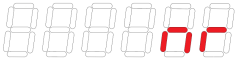
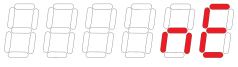
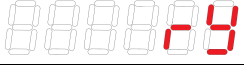
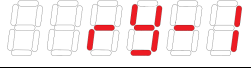
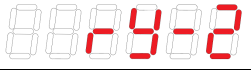
Key	Name	Function
	UP	Used to increase the parameter value you are operating on.
	DOWN	Used to decrease the parameter value you are operating on.
	Shift	Used to switch monitored values in the monitoring page. Used to switch data bits in the parameter page. Used to switch basic menus, user menus, and calibrate menus and fault log menus in multi-function menu page. Used to switch fault log in fault log menu.
	Loc/Rem key	Switch the forced operating panel control state. For details, see "*Loc/Rem Key Operation*" *on page 171*.
	Run	Used for start operations in operating panel control mode.
	Stop key	Used for stop operations in the operation state. Used for reset operations in the fault/alarm state.

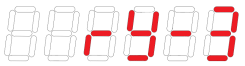
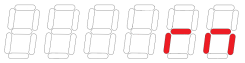
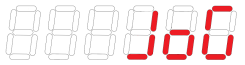
7.4.3 Display

The content in the main display area and the auxiliary display area are independent of each other. The main display area of the MD-BP-S operating panel is identical to that of the drive. For details, refer to *"7.1.3 Display" on page 140*.

The auxiliary display area, consisting of six eight-segment LEDs, displays the following 11 types of system status:

Table 7–14 System status displayed on the auxiliary display area

State	Keypad Display	Definition
reset		Initializing after power-on
nr		Not ready (caused by STO, fault activation, or drive busy state)
nr-2		Not ready (caused by OFF2 activation)
nr-3		Not ready (caused by OFF3 activation)
nE		Waiting for running enable command
ry		Ready (waiting for the running command)
ry-1		The running command is available only after it is deactivated and then reactivated.
ry-2		Jog 1 command is available only after it is deactivated and then reactivated.

State	Keypad Display	Definition
ry-3		Jog 2 command is available only after it is deactivated and then reactivated.
rn		During operation
JOG		Jogging

Note: Except the "Not ready" status (nr, nr-2, nr-3), all other status display conditions are mutually exclusive. If the display conditions for the "Not ready" status are met simultaneously, the display priority is as follows: nr > nr-2 > nr-3.

Related parameters

Param.	Name	Default value	Value range
A1-52	System status information prompt	-	0: None 1: Startup is available only after the startup command is deactivated and activated again. 2: OFF2 command activated 3: OFF3 command activated 4: Fault activated 5: Preparing internal parameters 6: Operation enable deactivated 7: STO activated 8: Startup is available only after the jog 1 command is deactivated and activated again. 9: Startup is available only after the jog 2 command is deactivated and activated again.

7.4.4 Parameter View and Setting

The parameter view and setting interface is the same as the local operating panel. For details, refer to *"7.1.4 Parameter View and Setting" on page 141*.

7.4.5 Status monitoring

The status monitoring interface is the same as the local operating panel. For details, refer to *" Status monitoring" on page 142*.

7.4.6 Loc/Rem Key Operation

Description

By default, the Loc/Rem key on the MD-BP-S operating panel is used to switch the forced operating panel control mode. The key function can be set through A6-00.

Related parameters

Table 7–15 Parameter descriptions of the Loc/Rem key

Param.	Name	Default value	Value range
A6-00	Loc/Rem key function selection	1	0: Inactive 1: Forced operating panel control
A6-67	Loc/Rem key function retention upon power failure	0	Ones: Forced operating panel flag 0: Not save 1: Save Tens to Ten-thousands: Reserved

Application instance

Set A6-00 (Loc/Rem key function selection) to 1 (Forced operating panel control). When the Loc/Rem key function is enabled, the procedure to switch the forced operating panel control mode using the Loc/Rem key is as follows:

1. Click the Loc/Rem key

on the external operating panel to forcibly enable the operating panel control mode and switch the control command source to operating panel.
2. Click the Loc/Rem key

again to disable the operating panel control mode.

Repeat the above steps to switch the forced operating panel control mode.

Note:

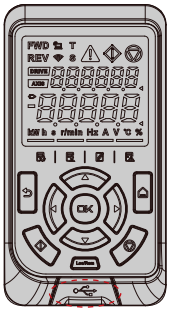
- Pressing and holding the right key on the local operating panel for 1.5 seconds is equivalent to clicking the Loc/Rem key

. If the external operating panel is disconnected, the forced operating panel control status remains the same as before disconnection. To switch the forced operating panel control status in this case, press and hold the right key on the local operating panel for 1.5 seconds.
- If the drive is running, the forced operating panel control mode cannot be switched using the Loc/Rem key.
- If the drive is controlled through the backend software, the forced operating panel control mode cannot be switched using the Loc/Rem key. The priority of the actual active control command source is as follows: backend control > forced operating panel control switched by the Loc/Rem key > forced control by the DI > b1-00/b3-00 (Control channel Main command source of control channel).
- You can set A6-67 (Loc/Rem key function retention at power-off) to set whether the forced operating panel control status is retained at power-off.

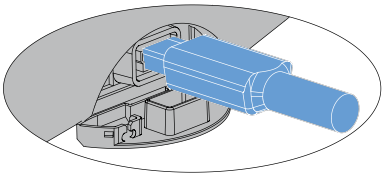
7.4.7 Connecting the SOP-20-880 Used as the Relay to the PC

The Type-C USB interface on the lower front of the MD-BP-S is used to connect to a PC. The length of the connecting cable should not exceed three meters. After connection, the operating panel automatically enters the relay mode.

Step 1. Open the USB port cover.



Step 2. Connect the MDKE10 to the PC by using a cable with the Type-C connector and the ferrite magnetic ring.



Step 3. After the MD-BP-S and the PC are connected, the MD-BP-S automatically enters the USB relay mode. "USB" is displayed in the status display area, which indicates the USB relay mode. You can use the InoDriveStudio to commission the drive.

7.5 SOP-20-MD6 Intelligent External Operating Panel

7.5.1 Overview

The SOP-20-MD6 is a new-generation commissioning assistant for AC drives of Inovance. Featuring a wide power supply range and an LCD display, it is suitable for single-drive and multi-drive systems. The operating panel provides rich functions, such as parameter settings, status monitoring, parameter copy, fault analysis and diagnosis, parameter upload and download, and USB relay/ large capacity storage. The RJ45 interface on the back of the operating panel is connected to the external operating panel (CN2) of the drive. For details, see "Wiring - Control Circuit Terminal Description".

7.5.2 Description

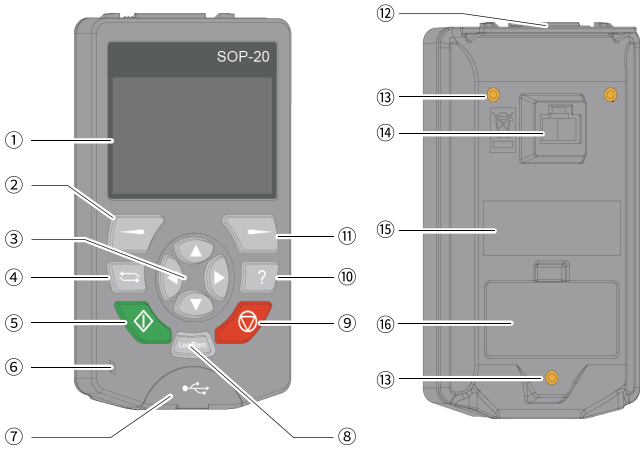


Figure 7-7 Appearance and keys of SOP-20-MD6

Table 7–16 Components of SOP-20-MD6

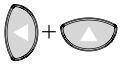
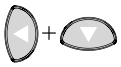
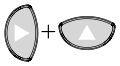
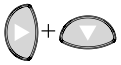
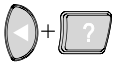
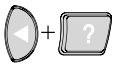
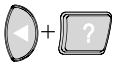
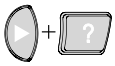
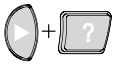
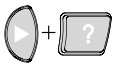
No.	Name
①	Display
②	Left soft key
③	Direction keys
④	Shift key
⑤	Run key
⑥	Status indicator
⑦	USB port
⑧	Loc/Rem key
⑨	Stop/Reset key
⑩	Help key
⑪	Right soft key
⑫	Snap-fit joint
⑬	Fixing screw
⑭	RJ45 port
⑮	Product nameplate
⑯	Battery cover

Table 7–17 Description of keys

Key	Name	Description
	Left soft key	Used for exit or cancellation purpose. The soft key in the lower left corner on the display features different functions in different interfaces. For example, this key on the homepage is used to enter the device selection page.
	Right soft key	Enter or confirm The soft key in the lower right corner on the display features different functions in different interfaces. For example, this key on the homepage is used to enter the menu interface.

Key	Name	Description
	Shift key	Used to quickly enter the device selection page. In interfaces that do not allow operations to be interrupted, the quick device switchover function is inhibited. In this case, the shift key is inactive.
	Help key	Used to open the help page. The help interface varies with the context.
	Run key	Used to start the device in the local control mode.
	Stop/Reset key	Used to stop the device in the local control mode. When the device is in the fault state, use this key to reset the fault.
	Loc/Rem key	Used to switch the control permission of the device. Local: The SOP-20-MD6 controls drive start/stop. Remote: The device start/stop is controlled by the parameters and functions of the device.
	Direction keys	The up and down keys are used to select options in a displayed menu and list, scroll up and down a text page, and adjust a value (such as setting time, entering a password, or changing a parameter value). The left and right keys are used to move the cursor left and right.

Table 7–18 Description of shortcuts

Shortcut	Keys	Available in	Function
Left+Up		Any view	Adjusts the backlight brightness.
Left+Down			
Right+Up		Any view	Adjusts the contrast.
Right+Down			
Left+Help		Parameter list view	Adds the parameter where the cursor is directed at to the shortcut interface.
Left+Help		Shortcut view	Deletes the parameter from the shortcut interface.
Left+Help		Startup view	Deletes the parameter from the startup interface.
Right+Help		Parameter list view	Adds the parameter where the cursor is directed at to the startup interface.
Right+Help		Shortcut view	Deletes all the parameters from the shortcut interface.
Right+Help		Startup view	Clears all parameters in the startup interface.

7.5.3 Keypad Display

SOP-20-MD6 adopts the monocolour LCD with white backlight and a resolution of 240x160 pixels.

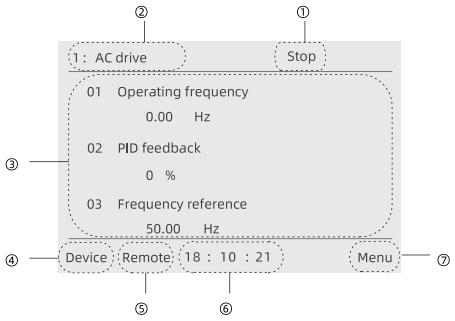


Figure 7-8 Homepage

Table 7–19 Descriptions of the homepage

No.	Display	Description
①	Device status and fault information	Displays information about the operating status of the device, including the state machine, fault, and alarm. When a fault occurs on the device, the fault information and operating status are displayed alternately.
②	Current device information	1: Current device station number Drive: Displays the specific model of the current device.
③	Content	Real-time display of monitored information
④	Device list	Used to display the device list of the current network.
⑤	Local/remote	Local: The device is controlled by SOP-20-MD6. Remote: The device is controlled by I/O or bus (remote control). Blank: This function is unavailable on the equipment.
⑥	SOP-20-MD6 time	Displays the clock time in SOP-20-MD6.
⑦	Menu	Used to access the function menu of current device.

7.5.4 Parameter View and Settings

Parameter view

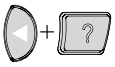
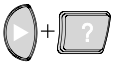
The parameter groups are sorted by name. If a parameter group is selected, all parameters in this group will be displayed. You can view or edit these parameters as needed. Press the Help key to display the help information.

For read-only parameters, when the cursor points at this parameter, the right soft key is invalid, and the "Select" button will not be displayed at the right bottom on the screen.

If "0x" is displayed before the parameter, this parameter value is in hexadecimal system.

Parameter Settings

Table 7–20 Description of parameter setting

Description	Key	Description
Viewing or modifying parameters	Key operations	Go to "Menu > Parameter setting", select the parameter group to be changed, select the parameter to be changed, view or modify the parameter, and click "Back" or "OK".
Adding or deleting "Shortcut" parameters		**Adding a parameter to the shortcut interface** In the parameter setting interface, enter any parameter group, move the cursor to the specific parameter, and press the Left key and Help key at the same time for more than 1.5 seconds to add the parameter to the quick commissioning interface. **Deleting a parameter from the shortcut interface** In the quick commissioning interface, move the cursor to the parameter to be deleted, and press and at the same time for more than 1.5 seconds to delete the parameter from the quick commissioning interface.
Clearing parameters from the shortcut interface		Clearing parameters from the shortcut interface In the quick commissioning interface, press and hold (right key) and (help key) at the same time for more than 1.5s to clear all the parameters in the quick commissioning interface.
Viewing shortcut parameters	Key operations	-

Modifying parameters that used to set values

For example, to set b7-04 (Ramp 1 acceleration time) to 30.00s, do as follows:

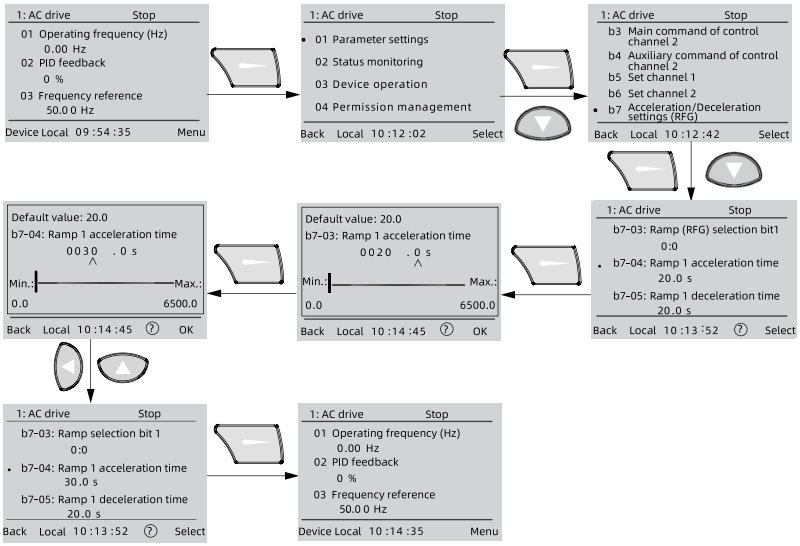


Figure 7-9 Modifying parameters that used to set values

Note

"1: AC drive" in the figure displays the actual mode of the AC drive. “”

After setting the parameter, press to save the setting and exit or press to quit and exit.

Press and at the same time for more than 1.5 seconds to restore the parameter to default value and then press to activate the default value.

7.5.5 Status indicator

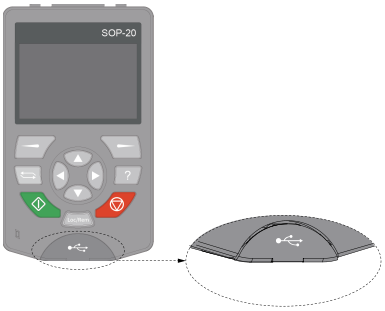
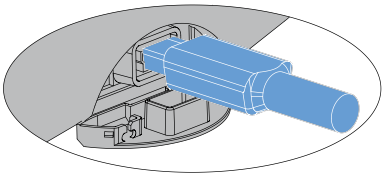
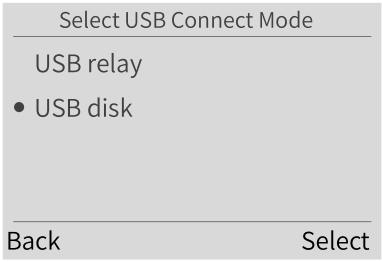
The status indicator on SOP-20-MD6 is used to indicate whether a fault or alarm exists.

Table 7–21 Descriptions of status indicators

Symptom	Demonstration	Meaning
Steady green		The equipment is running properly.
Flashing green		The data is being transferred between the SOP-20-MD6 and PC with USB.
Steady red		Communication between SOP-20-MD6 and the equipment is normal, but the equipment is faulty.
Flashing red		Communication between SOP-20-MD6 and the equipment is interrupted.

7.5.6 Connecting the SOP-20-880 Used as the Relay to the PC

The B-type mini USB terminal on the lower part of SOP-20-MD6 is used to connect to PC. The connection cable cannot exceed 3 m. The communication protocol is USB2.0 between the SOP-20-MD6 and the PC.

1. Open the USB terminal cover.	
2. Insert the USB cable and connect the cable with ferrite core (recommended) to the PC.	
3. After the SOP-20-MD6 is connected to the PC through the USB cable, you will be prompted to choose the USB relay mode or USB mass storage mode. • When "USB relay mode" is selected, the SOP-20-MD6 can be used as a relay to enable communication between the device and the PC. To perform commissioning with InoDriveStudio, select "USB relay mode". • In the "USB mass storage mode", the SOP-20-MD6 can be used as a memory.	

Note

For details on how to use SOP-20-MD6, see SOP-20-MD6 Series Smart Operating Panel User Guide.

7.6 External operating panel disconnection detection

Overview

The external operating panel disconnection detection function aims to improve the safety and reliability of equipment operation. When this function is enabled and the control command source is set to the operating panel, if the external panel disconnects from the drive for longer than the preset time, a fault is triggered. This causes the drive to coast to stop immediately, preventing loss of control or failure to stop.

Application scenario

The function is suitable for industrial automation scenarios where the external operating panel serves as the primary control method for the equipment. For example, in environments such as manufacturing and logistics equipment that require remote control through an external operating panel, if the operator accidentally disconnects the operating panel while the equipment is running, this function can promptly trigger the protection mechanism. This prevents equipment loss of control or malfunction caused by communication interruption.

Function description

When A6-72 (External operating panel disconnection detection) is enabled and the equipment is running under operating panel control, if the external operating panel remains disconnected from the equipment for longer than the time set by A6-74 (External operating panel disconnection detection time), fault E189.2 (External operating panel communication timeout) will be reported. The default fault protection action is coast-to-stop.

You can check whether the disconnection fault is triggered via L0194 (External operating panel disconnection fault) and check the model of the disconnected external operating panel via L1077 (Disconnected external operating panel model).

Related parameters

Parameters related to external operating panel disconnection detection are shown in *"Table 7-22" on page 180*.

Table 7–22 External operating panel disconnection detection

Param.	Name	Default value	Value range	Description
A6-72	External operating panel open circuit detection enable	1	0 to 1	Defines the disconnection detection function of the external operating panel. When this function is enabled and the operating panel disconnects from the drive, a fault is reported. Ones: Standard external operating panel (including MD-BP-M and MD-BP-S) 0: Inactive 1: Active Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved
A6-73	External operating panel open circuit detection time	2.0	0.1 to 6000.0	Defines the external operating panel disconnection detection time.
U3-06	External operating panel model	/	0 to 2	Indicates the model of the external operating panel connected. Note: 1: [Not connected] - No external operating panel is connected currently. 2: [MD-BP-M] - The model of the external operating panel connected is MD-BP-M. 3 [MD-BP-S] - The model of the external operating panel connected is MD-BP-S. Scaling: - Related: -

Param.	Name	Default value	Value range	Description
L0194	External operating panel open circuit fault	/	0 to 1	Note: Indicates whether the external operating panel open circuit fault is activated. Options: 0: Inactive. No external operating panel disconnection fault is reported. 1: Active. - The external operating panel disconnection fault is activated and 189.2 is reported. Related: A6-72, L1077, U3-06 A6-72 is used to enable external operating panel open circuit detection, L1077 is used to display the operating panel model that reports the open circuit fault, and U3-06 is used to display the model of the external operating panel connected currently.
L1077	Model of the external operating panel with open circuit fault	/	0 to 2	Indicates the model of the external operating panel when the drive is disconnected (189.2). Note: 0: No external operating panel disconnection fault. No external operating panel disconnection fault is reported. 1: MD-BP-M. The fault 189.2 (External operating panel disconnection fault) is reported due to MD-BP-M disconnection. 2: MD-BP-S. The fault 189.2 (External operating panel disconnection fault) is reported due to MD-BP-S disconnection. When external operating panel open circuit detection (A6-72) is active, and L0194 (External operating panel open circuit fault) is set to 1 [Active], the model of the external operating panel with open circuit fault is outputted. Scaling: - Related parameters: A6-72, L0194, U3-06

Application example

1. Set b1-00 (Main command source of control channel 1) to 0 (Operating panel) or enable forced operating panel control (see *"Table 7-22" on page 180* in section 7.4.6 Loc/Rem Key Operation). Set A6-72 (External operating panel disconnection detection) to 1 to enable the external operating panel disconnection detection function.
2. When an external operating panel (MD-BP-M or MD-BP-S) is connected, U3-06 (External operating panel model) displays the connected external operating panel model. The value 1 indicates MD-BP-M and 2 indicates MD-BP-S.
3. Start the drive. When the drive is running, disconnect the external operating panel from the drive. After the time set by A6-73 (Disconnection detection time) expires, the drive reports fault E189.2 (External operating panel communication timeout) and coasts to stop. U3-06 (External operating panel model) is set to 0, L0194 (External operating panel disconnection fault) is activated, and L1077 (Disconnected external operating panel model) outputs 1 (MD-BP-M) or 2 (MD-BP-S).

Note If the external operating panel (MD-BP-M or MD-BP-S) is reconnected within the disconnection detection time, E189.2 (External operating panel communication timeout) fault will not be reported.

8 Quick Commissioning and Trial Run

8.1 Commissioning Instructions

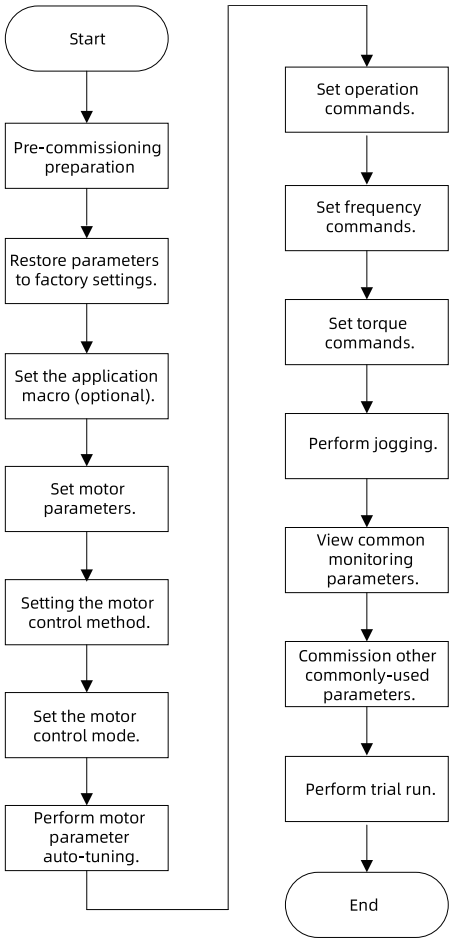


Figure 8-1 Commissioning flowchart

8.2 Parameter Introduction

8.2.1 Function Parameter Groups

Parameters of the AC drive are grouped based on functions and displayed in three levels of menus, as shown below.

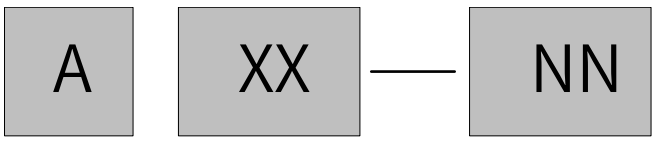


Figure 8-2 Parameter display

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 "-".

Parameters of the level-1 menu are shown in the following table.

Table 8–1 Parameter group

Level-1 group name	Level-1 parameter group description
F	Common parameter
A	System
b	Reference channel
C	Motor parameters
d/y	Motor control
E	Input/Output
H	Protection and auxiliary
n	Communication Configuration
o	Free function block
P	Application function
L	Connector
U	Monitoring Parameters

Parameters in group F are commonly used parameters, which includes all the commonly used parameters in other groups to facilitate commissioning. For example, parameters in group F1 are mapped from parameters in group C (motor parameters). When setting basic motor parameters, you can make quick settings in group F or set them in group C. These two groups are equivalent, with parameter values automatically synchronized.

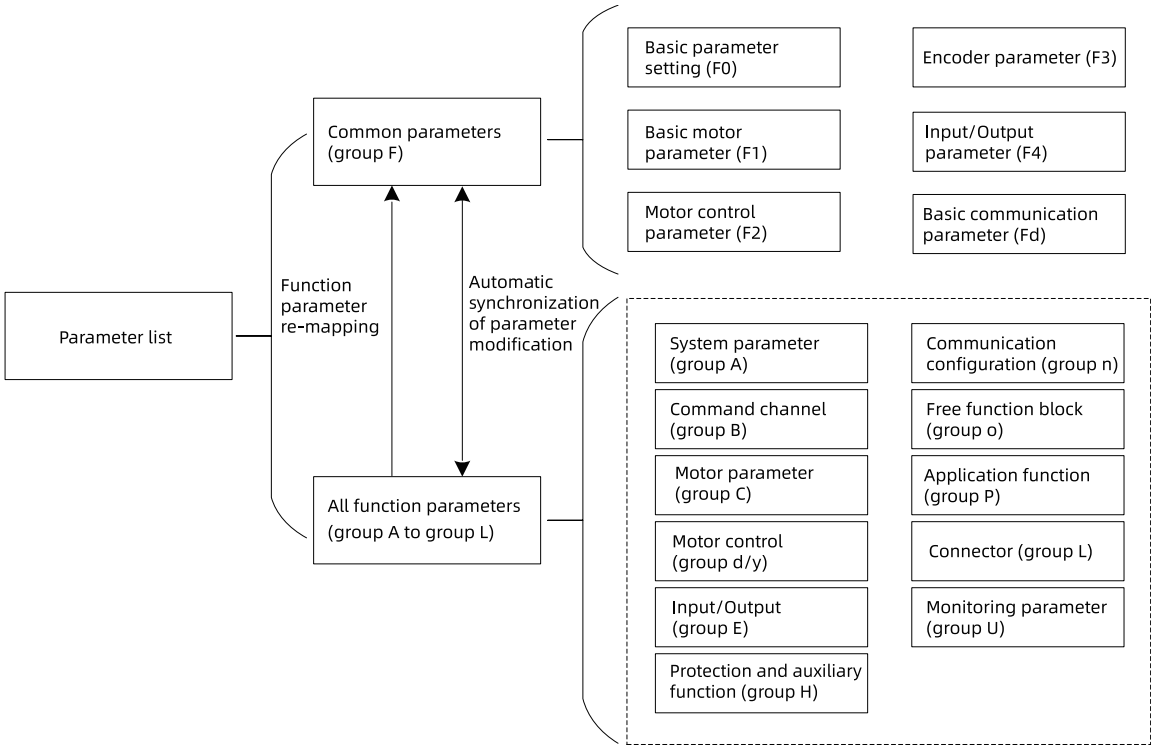


Figure 8-3 Parameter group diagram

8.2.2 Parameter Access Level

This product defines parameters into four levels: standard, extended, expert, and manufacturer. The range of parameters that can be read and written at each level is shown below.

Table 8–2 Access level

Access level	Description	Remarks
1	Standard	Default parameter access level, which allows you to access the basic function parameters of the drive.
2	Extended	Mainly include extended motor function parameters, such as user-defined parameters and frequency detection parameters.
3	Expert	Password-protected parameters, which include complex performance commissioning parameters for the motor.
4	Manufacturer	Password-locked parameters for use by the manufacturer only. This level has the highest authority with access to all parameters.

The default parameter access level is standard. You can switch the parameter access level through A0-11. The parameter access level currently in effect are displayed in A0-10. Standard and extended levels can be switched directly. Expert and manufacturer levels are password-protected, which cannot be switched directly. For details on switchover of parameter access levels, see *"13.2.2 Parameter Access Level" on page 874*.

Table 8-3 Parameter access level switchover

Param.	Name	Display range
A0-10	System parameter access level	0: Standard 1: Extended 2: Expert 3: Manufacturer
A0-11	Parameter access level	0: Standard 1: Extended 2: Expert

Caution

If the expert password status (A0-14) is locked, you cannot switch directly to expert level.

8.3 Commissioning Preparation

8.3.1 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.

8.3.2 Select Motor Parameter Group 1 on 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 of the AC drive cannot be used to set the field-

weakening parameters. Selecting motor parameter group 3 or 4 will result in insufficient motor output. Therefore, only motor parameter group 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.

8.3.3 Identifying Drive and Motor Information

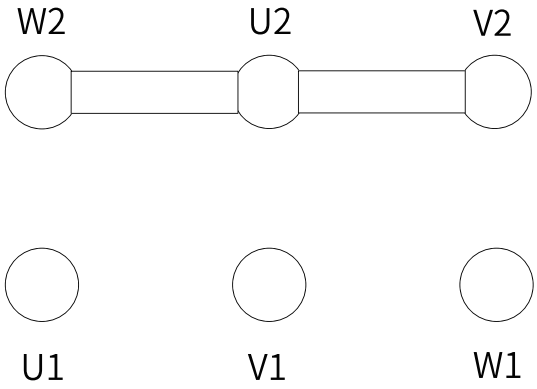
Before starting commissioning, identify the following information.

- Collecting motor data
  Identify the rated power, rated voltage, rated current, rated frequency, rated speed, and motor type on the motor nameplate.

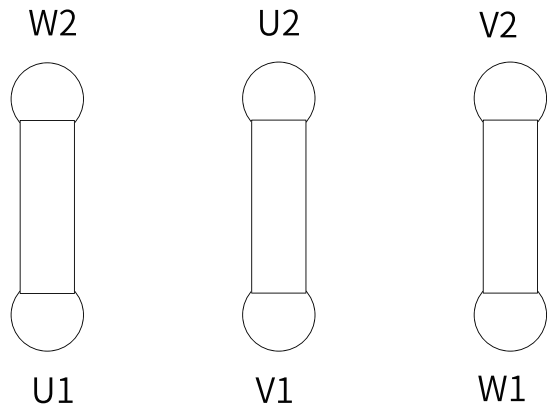
  When performing motor parameter auto-tuning, correctly set the motor nameplate parameters. The nameplate parameter settings differ between asynchronous and synchronous motors. Determine the motor type before setting the parameters by referring to *"8.3.1 Identifying the Motor Type" on page 186*.

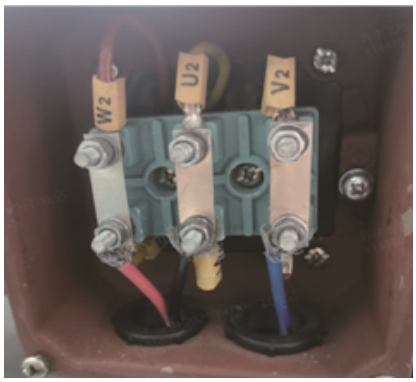
- Collecting the drive data
  Identify the product name, model, power, voltage class, and output current on the drive nameplate, and compare them with motor nameplate parameters to ensure the input/output range and power rating of the drive match those of the motor.

- Identifying motor connection method
  Check whether the motor connection method (Y-type or delta-type) is consistent with the motor nameplate. Incorrect motor connection (confusing Y-type and Δ-type wiring) will result in poor motor output, insufficient load capacity, and excessive output current.



(a) Y connection





(b) Delta connection

Figure 8-4 Motor connection mode

8.3.4 Check the cables connecting the AC drive and the motor

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

Table 8–4 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 cannot be connected to the output side.	☐	☐
4	The drive and motor are grounded properly.	☐	☐
5	The auxiliary circuit power supply is correctly connected.	☐	☐
6	Connect the communication cables properly.	☐	☐
7	Connect external terminals such as I/O terminals properly.	☐	☐

8.3.5 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.

8.3.6 AC Drive Model Check

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

Table 8–5 Parameters to be checked

Parameter code	Name	Description
A2-21	Device Type	1: MD610S (485 standard version + STO)
A3-02	Rated power of the drive	This parameter displays the rated AC drive power.
A3-03	Rated current of the drive	This parameter displays the rated AC drive current.
A3-04	Rated AC drive voltage	This parameter displays the rated AC drive voltage.
A3-05	Maximum AC drive current	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.

8.3.7 Software Version

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 major version	0.00 to 655.35
A2-23	Function major version	0.00 to 655.35
A2-24	Performance sub-version	0.00 to 655.35
A2-25	Function sub-version	0.00 to 655.35

8.4 Factory Setting Restoration

Scenarios for restoring default values

This function is used to restore parameters to default values. This function is recommended in the following scenarios. Note that parameters that already configured will also be reset, so back up critical parameters before restoring default settings.

- The drive is commissioned for the first time.
- Parameters that have been configured are unknown, or some parameters have been modified inadvertently.
- The drive operates improperly due to modification on some parameters during commissioning (record normal parameters before restoring default settings).
- Parameters are in the abnormal state with alarms or faults generated.

- The application macro function of the drive needs to be set, which requires parameters to be restored to default settings first (record parameters that already configured in advance and set these parameters to the configured values again after parameter reset).

Procedure for restoring default settings

1. Parameter backup: Used to back up parameters that already configured to prevent these parameters from being reset to default values.
2. Function trigger: Set A0-00 [Parameter initialization] to restore default settings.
   Different values of A0-00 indicate different functions. See details in related parameters. After default settings are restored, A0-00 is set to 0 again automatically.

   If motor parameters have not been set or motor parameters also need to be reset, it is recommended to set A0-00 [Parameter Initialization] to 3 [Reset default parameters (including motor parameters)].

   If motor parameters have already been set and reset is not needed, it is recommended to set A0-00 [Parameter Initialization] to 1 [Restore default parameters (excluding motor parameters)].
3. Function execution: After step 2, wait until A0-00 [Parameter initialization] is cleared. When A0-00 [Parameter initialization] changes from 1/3/503 to 0, parameters are restored successfully and you can continue commissioning.

Parameters for restoring default settings

Table 8–6 Parameters for restoring default settings

Param.	Name	Default value	Value range	Description
A0-00	Parameter initialization	0: Not applied	0: Not applied 1: Restore default parameters (excluding motor parameters) 2: Clear log information 3: Restore default parameters (including motor parameters) 4: Back up current user parameters 5: Clear fault log 501: Restore backup parameters 503: Restore default parameters (including motor parameters) and clear log information	0: Not applied 1: Restore default parameters (excluding motor parameters) - 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 factory settings. Except the factory parameters and records, all other parameters of the AC drive are restored to factory settings. This differs from mode 1 in that the motor parameters are also restored. 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 default parameters (including motor parameters) and clear log information - 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.

8.5 (Optional) Set up application macros

This product provides multiple sets of predefined application macro parameters. During commissioning, you can select a suitable application macro as a base, and then modify some parameters as required, thereby simplifying the commissioning process. For details, see *"10.12.1 Application Macro Introduction" on page 531*.

8.6 Setting Motor Parameters

8.6.1 Setting Asynchronous Motor Parameters

Related parameters

When an asynchronous motor is used, see the motor nameplate to set the following motor parameters.

Table 8–7 Asynchronous motor parameter setting

Param.	Name	Description	Mandatory
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 (not supported) 4: Synchronous reluctance motor with permanent magnet (not supported)	Yes
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).	Yes
F1-03 (C4-03)	Rated motor voltage	Sets 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	Sets the rated motor frequency, which corresponds to 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 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

Param.	Name	Description	Mandatory
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
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

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%	5.0%	4%	4%	3.5%	3%	2.5%

After motor parameters are set based on the nameplate, if the output current is excessively high during no-load operation in V/f mode, reduce the rated voltage by 10 V to 20 V, and then perform parameter auto-tuning again to get better control performance.

8.6.2 Setting Synchronous Motor and Synchronous Reluctance Motor Parameters

Related parameters

When a synchronous motor is used, set the following motor parameters according to the motor nameplate.

Table 8–8 Setting synchronous motor parameters

Param.	Name	Description	Mandatory
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 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnet (not supported) 4: Synchronous reluctance motor with permanent magnet (not supported)	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	Sets 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 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
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

Param.	Name	Description	Mandatory
F1-12 (C4-12)	Synchro-nous 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 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 nameplate indicates a back EMF RMS value of 120V/ krpm, then the rated back EMF = F1-07 ÷ 1000 × 120V. If the back EMF is unknown, disconnect the motor from the load to perform 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)	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 is that the number of pole pairs equals the number of poles divided by 2.	Optional

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

8.6.3 Set 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 parameters

Table 8–9 Parameter for setting carrier frequency

Param.	Name	Default value	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) is higher than 12 multiplied by 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.

8.7 Setting the Motor Control Method

You can set the motor control mode through F0-01 [Motor control method].

The drive supports V/f and SVC control modes.

Description	Scenario
SVC	Open loop vector control Advantages: The SVC mode features excellent dynamic response and requires less use of encoders, encoder cables, and encoder cards. The fault rate in SVC mode is low during long-term operation. Low Disadvantage: Good control performance can be achieved at low speeds. However, the drive cannot operate near zero speed for a long duration. Recommended scenarios: High-precision and quick dynamic response applications, such as machine tools, centrifuges, wire drawing machines, injection molding machines, and other loads.
V/f	Applicable to applications without strict load control requirements or where one drive is used to drive multiple asynchronous motors, such as fans and pumps.

Related parameters

Param.	Name	Default value	Value range
F0-01 (d0-00)	Motor control method	2	0: SVC 2: V/f

Note

F0-01 is mapped from d0-00, and these two parameters are equivalent.

Precautions

When F1-00 [Motor type] is set to 0 [Regular asynchronous motor], F0-01 [Motor control method] can be set according to the application requirements. When F1-00 [Motor type] is set to 2 [Permanent magnet synchronous motor], the SVC control mode is recommended.

If one drive is used to drive multiple asynchronous motors, SVC or V/f control mode can be used.

Note

If the synchronous motor encounters runaway during startup, tune the magnetic pole position and current parameters according to actual conditions.

Caution: Exercise caution when disabling the magnetic pole position auto-tuning function, as this may cause the drive to control the motor abnormally.

8.8 Setting the Speed or Torque Control Mode

The product supports two motor control modes: speed control and torque control, which is set through F0-02 (Motor control mode).

Related parameters

Param.	Name	Default value	Value range
F0-02 (d0-01)	Motor control mode	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector Note: 3 to 7: DI1 to DI5. The control method depends on the terminal state of the DI. 0 indicates speed control and 1 indicates torque control.

Note

F0-02 marked in the table is mapped from d0-01 in group F. These two parameters have the same function.

Precautions

If F0-01 [Motor control mode] is set to V/f mode, only the speed control mode is supported.

If the torque control mode is applied under normal operating conditions, it is recommended to switch to the speed control mode during motor auto-tuning upon initial commissioning. This is to prevent speed control error caused by inadvertent start. After auto-tuning is done, adjust the operating direction properly and switch to the torque control mode again.

8.9 Motor Parameter Auto-tuning

8.9.1 Auto-Tuning Step

Application scenario

Auto-tuning is used to get the drive and motor parameter values. Unlike servo systems which use preset parameters, the AC drives need to be matched with different motors and require the motor parameter auto-tuning before operation 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.)

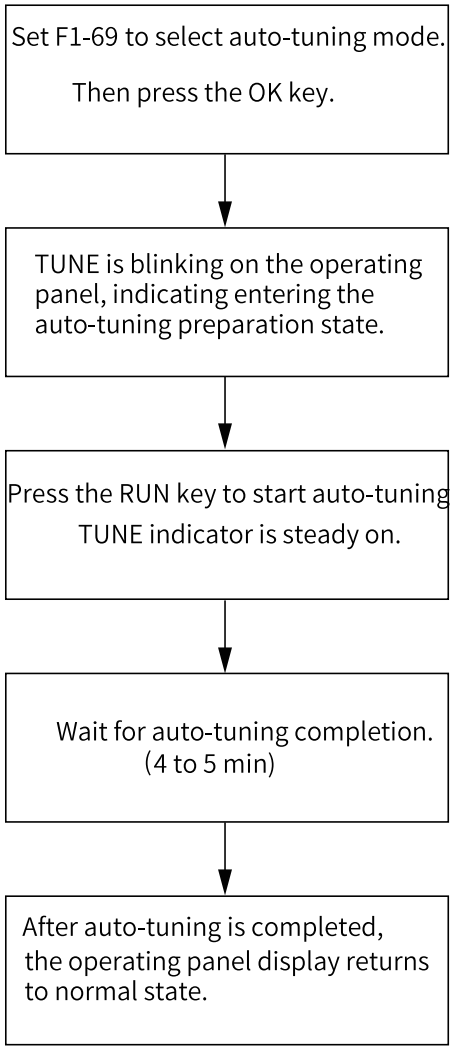
Note

After re-installing and re-wiring the synchronous motor on the field, perform motor parameter auto-tuning to prevent abnormal motor operation.

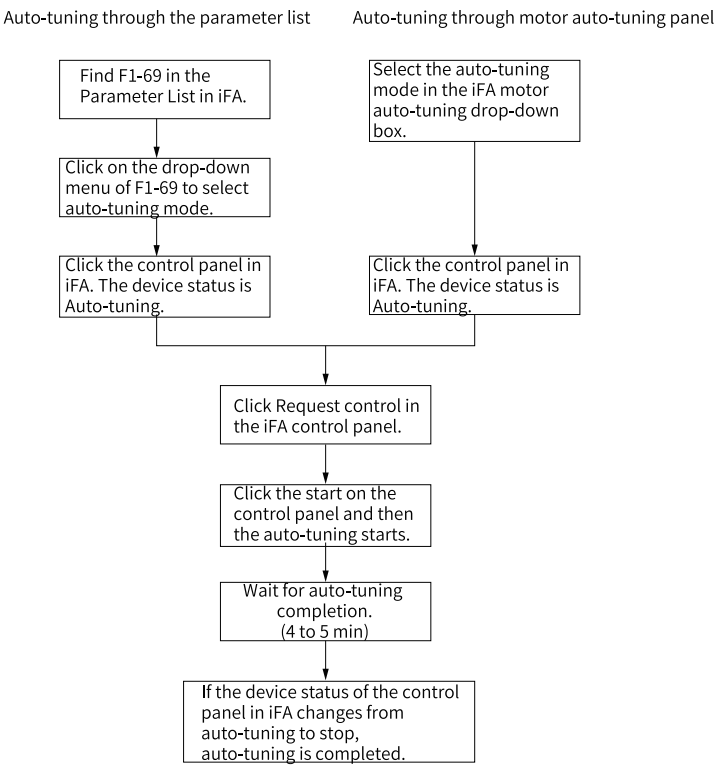
Operation flowchart

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 8–10 Parameters for setting motor parameter auto-tuning

Param.	Name	Default value	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).

8.9.2 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 8-5 Asynchronous motor parameter auto-tuning mode selection" on page 200*.

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.
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].

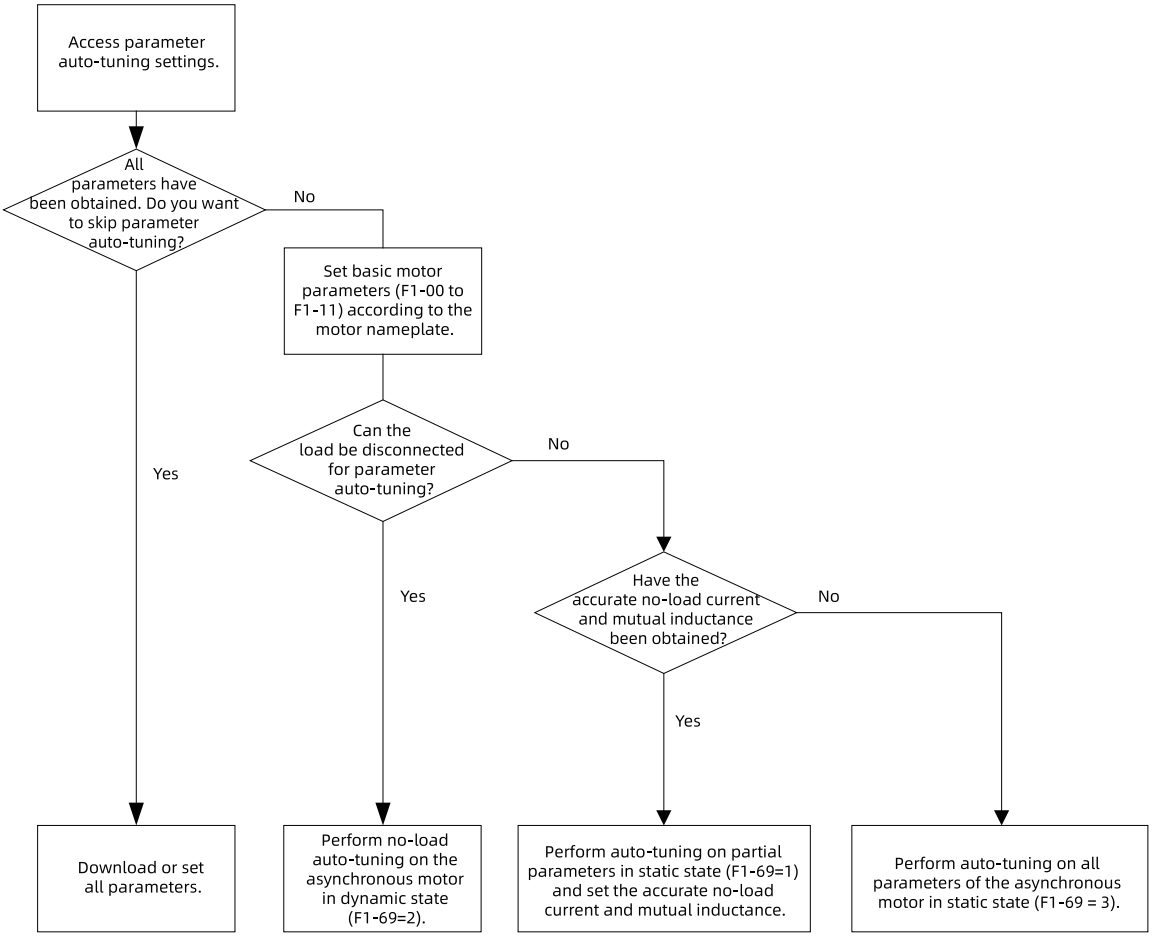


Figure 8-5 Asynchronous motor parameter auto-tuning mode selection

Related parameters

Table 8–11 Auto-tuned parameters for asynchronous motors

Parameter code	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.
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.

8.9.3 Synchronous Motor Parameter Auto-tuning

Mode selection

The parameter auto-tuning process of synchronous motors is shown in *"Figure 8-6 Synchronous motor parameter auto-tuning mode" on page 202*. 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 possible, 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.

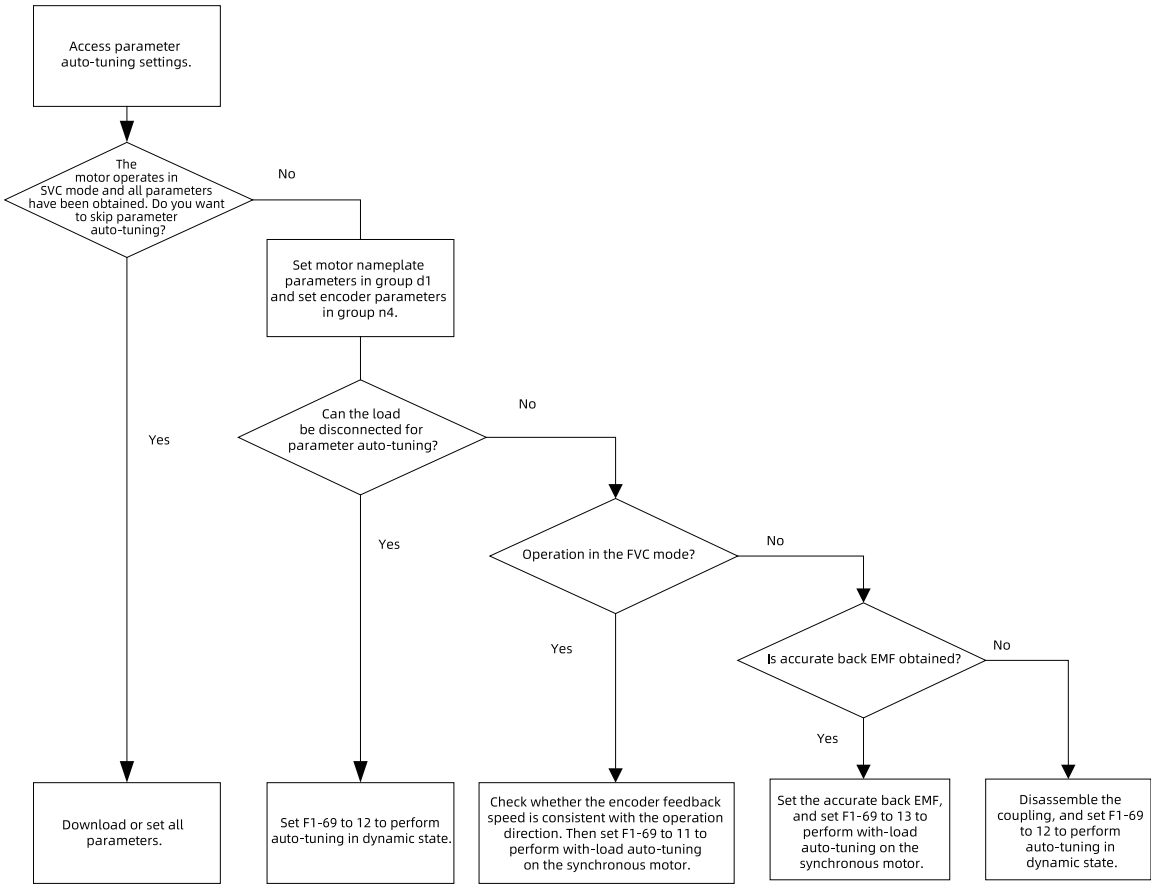


Figure 8-6 Synchronous motor parameter auto-tuning mode

Related parameters

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 8–12 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	Synchronous motor back EMF	-	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 value of back EMF indicated on the nameplate is 120 V/krpm, the rated back EMF = d0-05/1000 x 120 V. The back EMF refers to the effective value of the line voltage. If the back EMF is not known, the motor shaft must be disconnected for 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.

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
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.

8.9.4 Auto-tuning of Synchronous Reluctance Motor

Mode selection

The parameter auto-tuning process of reluctance motors is shown in *"Figure 8-7 Reluctance motor parameter auto-tuning mode" on page 205*. 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 cannot be performed, set F1-69 (Motor parameter auto-tuning selection) to 21 (Parameter auto-tuning of synchronous reluctance motor in static state).
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.

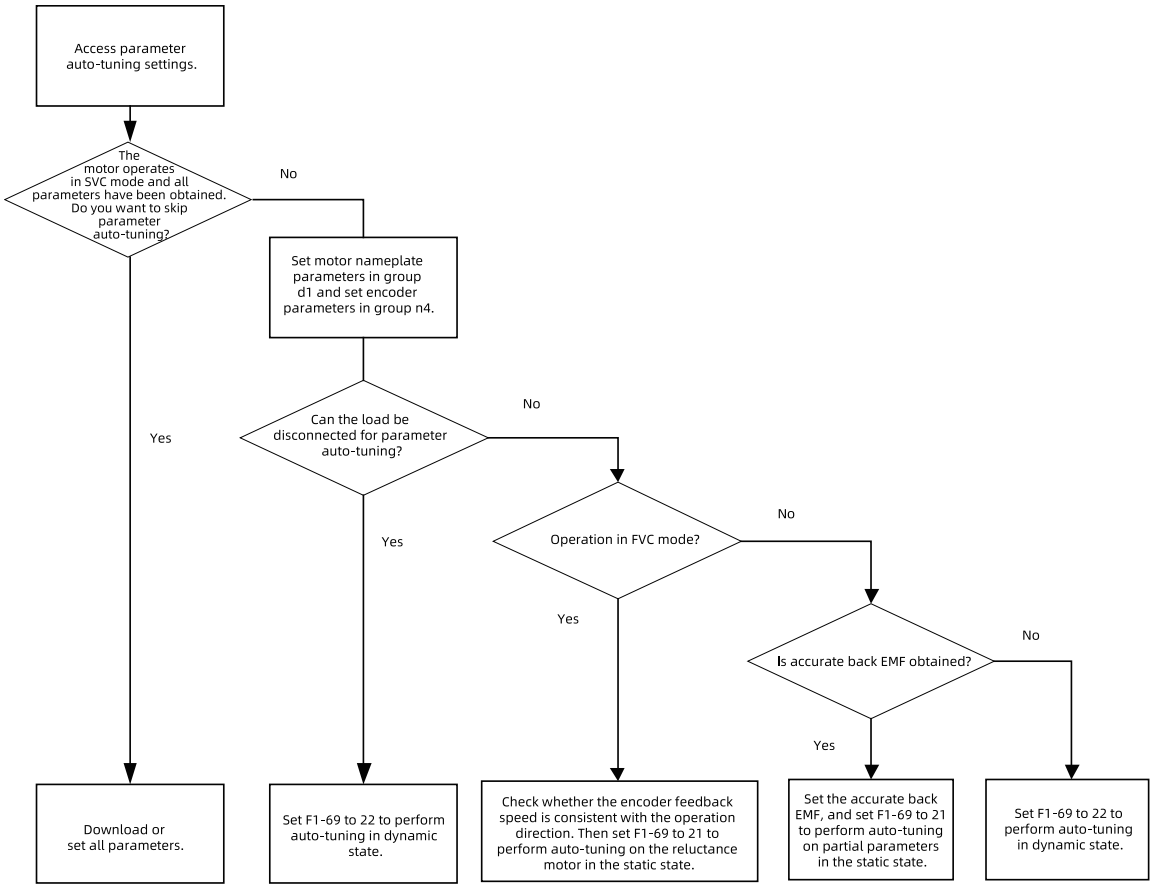


Figure 8-7 Reluctance motor parameter auto-tuning mode

Related parameters

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 8–13 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 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. 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 not known, the motor shaft must be disconnected for 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.

8.10 Operation Command Settings

8.10.1 Selecting control channel

The command source is the source or input mode of operation commands to control the start, stop, forward run, reverse run, jog, and fault reset of the drive. See *"10.2.1 Selecting Control Channel and Operation Command" on page 271* for related parameters.

8.10.2 Operation control through the operating panel

You can start/stop the drive through the built-in operating panel.

Procedure

Set F0-03 [Main command source of control channel 1] to 0 [Operating panel] to set the operating panel as the command source, so that you can start/stop the drive through the operating panel.

- In the stop state, press to set the start command of the drive.
- In the operation state, press to set the stop command of the drive.
- In the fault state, press to set the fault reset command.

8.10.3 Control Operation Through Terminals

You can start/stop the drive through the digital state of the DI terminal.

Procedure

1. Set b1-00 [Main command source of control channel 1] to 1 [Terminal control].
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 transition 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. Defines 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, start/stop and fault reset can be performed on the 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.

See functions and related parameters in *"10.2.4 DI-Based Operation" on page 275*.

8.10.4 Control Operation Through Communication

Start or stop the drive through remote communication.

Procedure

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.
2. When the command 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.
   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].

See functions and related parameters in *"10.2.5 Control Operation Through Communication" on page 287*.

8.10.5 Setting Operation Commands Through User-Defined Channel

The AC drive includes user-defined main command source in control channels 1/2. By default, control channel 1 is active. You can set customized commands through parameter groups b1 and b2.

Procedure

1. Set F0-03 [Main command source of control channel 1] to 3 [Custom] to set the custom channel as the command source.
2. Set b1-01 [Custom ON_OFF1 (start/stop) source] to 3 [DI1].

3. Set E0-00 [DI1 terminal function selection] to 0 [No function].
4. Set b1-02 (Custom OFF2 (Coast to stop) source 1) to 1 (Invalid) and b1-03 (Custom OFF3 (Quick stop) source 1) to 1 (Invalid).
5. After configuring the custom channel parameters and DI1 function, you can start/stop the drive through DI1.
   For example, when DI1 is enabled, the drive starts. When DI1 is disconnected, the drive stops.

See functions and related parameters in *"10.2.6 Setting Operation Commands Through User-Defined Channel" on page 290*.

8.11 Frequency Reference Settings

8.11.1 Select Set Channel

You can change the setting channel through b0-03 (Setting channel selection). See details in *"10.3.1 Setting Channel and Frequency Reference" on page 295*.

8.11.2 Setting Frequency Through Parameter

You can set the frequency directly through parameters.

Procedure

1. Set F0-29 [Main frequency source] = 0 [F0-30].
2. Set F0-30 [Digital reference of main frequency] to the target frequency.
3. When the main frequency is set by parameters, in addition to directly modifying the value of the parameters to set the frequency, you can also set the frequency using the UP/DOWN keys.

After preceding settings are done, you can increase the frequency reference by pressing on the operating panel or decrease the frequency by pressing in real time when the drive is in stop state or is running.

For detailed functions, see *"10.3.2.2 Setting Main Frequency Through Parameter" on page 302*.

8.11.3 Setting frequency through AI

When F0-29 (Main frequency source) is set to 2 (AI1) or 3 (AI2), the AI terminal is selected as the source of the frequency reference. The AI input is converted to the input ratio through the AI curve. 100.0% of the input ratio corresponds to rated motor frequency (C4-06).

Procedure

The basic steps for setting the main frequency through AI are as follows:

1. Set AI1 curve to "0 V to 10 V corresponds to 0% to 100%":

   - Set F4-28 (minimum input of AI curve 1) to 0.00 V.
   - Set F4-29 (Percentage corresponding to minimum input of AI curve 1) to 0.0%.

- Set F4-30 (maximum input of AI curve 1) to 10.00 V.
- Set F4-31 (maximum input of AI curve 1) to 100.0 %.

2. Set AI filter time through F4-21 (AI1 filter time).
3. Set F0-29 (Main frequency source) = 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). In this case, the actual set frequency is 25 Hz (50.00 Hz x 50%). When AI1 input voltage is changed, the running frequency changes according to the AI1 curve.

For detailed functions, see *"10.3.2.4 Setting Frequency Through AI" on page 305*.

8.11.4 Setting frequency through pulse input (HDI)

The AC drive control board provides the high-speed pulse input function (HDI) with up to 20 kHz. DI5 is used as the pulse input terminal. By default, DI5 is used as a common DI terminal.

Procedure

The basic steps for setting the main frequency through HDI are as follows:

1. Set F4-68 (HDI terminal type selection) to 0 (Use as HDI) to configure DI5 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.

For detailed functions, see *"10.3.2.5 Setting Main Frequency Through Pulse" on page 310* .

8.11.5 Setting Frequency Through Multi-reference

Set b5-00 [Main frequency source] to 6 [Multi-reference]. Up to 16 frequency references can be set, which can be selected through b8-03 (Multi-reference selection bit 0) to b8-06 (Multi-reference selection bit 3) or the combinations of input signals from the four DI terminals.

Procedure

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.

For detailed functions, see *"10.3.2.6 Setting the Main Frequency by Multi-reference" on page 312* .

8.11.6 Setting Frequency Through PID

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.

Procedure

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].

See functions and related parameters in *"10.3.2.8 Setting Main Frequency Through PID" on page 326*.

8.11.7 Setting Frequency Through Communication

Set b5-00 [Main reference source] to 9 [Communication] to set communication as the main reference source.

Procedure

The following shows how to set "Communication" as the main frequency source of channel 1.

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 configure the speed reference through 7310H.
3. Send a write command to the drive through the host controller.

When the frequency 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. For details on the communication configuration method and communication address, see *"10.3.2.9 Setting the Main Frequency Through Communication" on page 334*.

8.12 Torque Reference Settings

8.12.1 Select Set Channel

Procedure

Set b0-03 [Setting channel selection] to change the active setting channel.

See details in *"10.4.2 Selecting Torque Reference Source" on page 362*.

8.12.2 Setting Torque Through Parameter

Set the reference value of b5-14 [Digital torque reference] as the active torque source.

Procedure

Set b5-13 [Torque reference source] to 0 [b5-14].

See details in *"10.4.3 Setting Torque Reference Through Parameter" on page 366*.

8.12.3 Setting Torque Through AI

When AI is used as the torque source, the relationship curve between AI and torque setpoint needs to be set.

Procedure

The basic steps for setting the torque via AI are as follows (taking AI1 as an example):

1. Set the relationship between AI1 voltage input and the curve of the set ratio to "0 V to 10 V (or 0 mA to 20 mA) correspond to 0% to 100%".
   - Set F4-28 (minimum input of AI curve 1) to 0.00 V.
   - Set F4-29 (Percentage corresponding to minimum input of AI curve 1) to 0.0%.
   - Set F4-30 (maximum input of AI curve 1) to 10.00 V.
   - Set 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) = 2 (AI1) to select AI1 as the torque source.

After the preceding steps, when AI1 inputs 5 V, the drive obtains 50% from the AI1 curve and the torque setting is 50%. When AI1 input voltage is changed, the active torque changes according to the AI1 curve.

See details in *"10.4.4 Setting Torque Through AI" on page 366*.

8.12.4 Setting Torque Frequency Through Communication

Set the torque through communication.

Procedure

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 reference is set through communication, you need to configure basic communication parameters to enable the drive to communicate with the host controller. The host controller needs to follow the communication address and format specified by the drive to write communication commands to the drive.

For details on the communication configuration method and communication address, see *"10.4.9 Setting Torque Reference Through Communication" on page 386*.

8.13 Jog

8.13.1 Select Set 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 *"10.6.2 Jog Frequency Set Channel" on page 427* for the jog frequency setting channel.

Procedure

Set b0-03 [Setting channel selection] to change the active setting channel.

Related parameters

Table 8–14 Setting channel selection

Param.	Name	Default value	Value range
b0-03	Setting channel selection	0	0: Setting channel 1 1: Setting channel 2 3 to 7: DI1 to DI5 Other: B connector

8.13.2 Set 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 frequency 1] and F0-58 [Source of jog frequency 2].

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

To set the jog frequency source to be digital setting, AI input, HDI pulse setting (MD610S), and multi-reference, set the values of related parameters to corresponding values.

Procedure

1. Set the source of jog frequencies 1 and 2 through F0-56 [Source of jog frequency 1] and F0-58 [Source of jog frequency 2].
2. Set other parameters based on the frequency source selected according to *" Frequency Reference Setting" on page 209*.

Related parameters

Table 8–15 Parameters related to jog frequency

Param.	Name	Default value	Value range
F0-56 (b5-07)	Source of jog frequency 1	0: Set by the parameter (F0-57)	0: F0-57 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector
F0-58 (b5-09)	Source of jog frequency 2	0 [F0-59]	0: F0-59 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector

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

Param.	Name	Default value	Value range
F0-57 (b5-08)	Digital reference of jog frequency 1	2.00 Hz	-50.00 Hz to +50.00 Hz
F0-59 (b5-10)	Digital reference of jog frequency 2	-2.00 Hz	-50.00 Hz to +50.00 Hz

8.13.3 Set Terminal Jog Operation Command

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

Related parameters

Table 8–16 Parameters related to jog

Param.	Name	Default value	Value range
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)
F4-04 (E0-01)	DI2 function	4	
F4-05 (E0-02)	DI3 function	9	
F4-06 (E0-03)	DI4 function	12	
F4-07 (E0-04)	DI5 function	13	
F0-62 (b7-31)	Jogging ramp source	0	Defines the jog ramp source. Options: 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).
F0-63 (b7-32)	Ramp-up time in jog	20	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.
F0-64 (b7-33)	Ramp-down time in jog	20	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.

8.14 General Monitoring Parameter View

You can view the default monitoring parameters in the stop or operational state through the monitoring page on the operating panel, as shown in *" Status monitoring" on page 142*.

Enter U group parameters through the operating panel to view commonly used monitoring parameters.

8.14.1 Basic Monitoring Parameters

Param.	Name	Monitoring range
U0-02	Bus voltage	0.0 V to 6553.5 V
U0-03	Output voltage	0 V to 65535 V
U0-04	Output current	0.00 A to 655.35 A
U0-05	Output power	-3276.8 kW to +3276.7 kW
U0-06	Output torque	-3276.8 to +3276.7
U0-35	Target torque	-200.0% to +200.0%
U0-65	Torque upper limit	-2000.0% to +2000.0%
U2-01	Current control channel	0: Control channel 1 1: Control channel 2
U2-02	Current setting channel	0: Setting channel 1 1: Setting channel 2

8.14.2 Speed Monitoring Parameters

Param.	Name	Monitoring range
U0-00	Operating frequency	0.00 Hz to 600.00 Hz
U0-01	Frequency reference	0.00 Hz to 600.00 Hz
U0-14	Load speed display	0 rpm to 65535 rpm
U0-19	Actual motor frequency	-327.68 Hz to +327.67 Hz
U0-30	Setpoint of main frequency	-327.68 Hz to +327.67 Hz
U0-31	Setpoint of auxiliary frequency	-327.68 Hz to +327.67 Hz
U0-59	Frequency reference (%)	-3276.8 to +3276.7
U0-60	Operating frequency (%)	-3276.8 to +3276.7
U0-69	Actual motor frequency (signed)	-327.68 Hz to +327.67 Hz
U0-70	Actual motor speed (signed)	-32768 rpm to +32767 rpm
U0-75	Actual motor frequency (unsigned)	0.00 to 655.35

8.14.3 Terminal Monitoring Parameters

Param.	Name	Monitoring range
U0-07	DI state	0x0000 to 0xFFFF
U0-08	DO state	0x0000 to 0xFFFF
U0-09	AI1 voltage	-10.570 V to 10.570 V
U0-10	AI2 voltage	-10.570 V to 10.570 V
U0-18	HDI input pulse frequency	0.00 kHz to 20.00 kHz
U0-21	AI1 voltage before correction	-10.570 V to 10.570 V
U0-22	AI2 voltage before correction	-10.570 V to 10.570 V
U1-08	AO output (before correction)	-327.68 to +327.67
U1-10	AO output (after correction)	-327.68 V to 32.767 V
U1-17	Final output actual frequency of HDO	0.00 kHz to 655.35 kHz

8.14.4 Data Received During Communication

Param.	Name	Monitoring range
U0-28	Communication setpoint	-300.00 % to +300.00%
U3-23	Monitoring on speed reference 1 set through communication (0x1000)	-32768 to 32767
U3-16	Speed reference 2 set through communication (0x7310)	0 to 65535
U3-33	Control word 1 set through communication (0x7321)	0x0000 to 0xFFFF
U3-17	Control word 2 set through communication (0x7311)	0x0000 to 0xFFFF

8.14.5 Other Common Monitoring Parameters

Param.	Name	Monitoring range
U0-15	PID setting	0 to 65535
U0-16	PID feedback	0 to 65535
U0-17	PLC phase	0 to 65535
U2-05	Current multi-reference selection	0 to 65535
U2-06	Current multi-speed effective value	-3276.8 to +3276.7
U0-82	Heatsink temperature	-20.0°C to +120°C

8.15 Common Commissioning Parameters

8.15.1 Control Method and Control Mode

Param.	Name	Default value	Monitoring range
F0-01 (d0-00)	Motor control method	2	0: SVC 2: V/f
F0-02 (d0-01)	Motor control mode	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5 to 7: DI3 (Only valid for MD610S) to DI5 (Only valid for MD610S) Other: B connector

8.15.2 Parameters Related to Frequency Settings

Param.	Name	Default value	Value range
F0-25 (A0-70)	Frequency decimal place	2	1: One decimal place 2: Two decimal places
F0-29 (b5-00)	Main frequency source	0	0: F0-30 2: AI1 3: AI2 5: HDI pulse reference (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector
F0-30 (b5-01)	Digital reference of main frequency	50.00 Hz	0.00 to A2-17
F0-31 (b5-02)	Auxiliary frequency source	0	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector

Param.	Name	Default value	Value range
F0-32 (b5-03)	Calculation relationship between main and auxiliary references	0	0: Main frequency + auxiliary frequency 1: X - Y 2: Max. (|X|, |Y|) 3: Min. (|X|, |Y|) 4: Main frequency x Auxiliary frequency 5: Main/auxiliary switchover
F0-33 (b5-04)	Auxiliary frequency source	0	Same as F0-31 (b5-02)
F0-34 (b5-05)	Source of main frequency gain coefficient	0	0: 100% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector

8.15.3 Parameters Related to Multi-reference

Param.	Name	Default value	Value range
F0-38 (b8-08)	Source of multi-reference 0	0	0: F0-39 1: AI1 2: AI2 4: HDI pulse (valid only for MD610S) 5: PID 6: b5-01/b6-01 Others: F connector
F0-39 (b8-09)	Multi-reference 0	0.0	b8-42 and b8-43
F0-40 (b8-10)	Multi-reference 1	0.0	b8-42 and b8-43
F0-41 (b8-11)	Multi-reference 2	0.0	b8-42 and b8-43
F0-42 (b8-12)	Multi-reference 3	0.0	b8-42 and b8-43

8.15.4 Parameters Related to V/f Curve

When F0-01 [Motor control mode] is set to 2 [V/f], V/f-related parameters need to be set. V/f control is divided into V/f curve, which can be linear or multi-point curves, and decoupled V/f mode.

Param.	Name	Default value	Value range
d2-00	V/f curve type	0	0: Linear 1: Multi-point 10: Decoupled V/f 11: V/f semi-separation mode
d2-02	Frequency point 1 of multi-point V/f curve	0.0 Hz	0 to d2-03
d2-03	Frequency point 2 of multi-point V/f curve	0.0 Hz	d2-02 to d2-04
d2-04	Frequency point 3 of multi-point V/f curve	0.0 Hz	d2-03 to 600.0 Hz
d2-08	Voltage point 1 of multi-point V/f curve	0.0	0.0 to 1000.0
d2-09	Voltage point 2 of multi-point V/f curve	0.0	0.0 to 1000.0
d2-10	Voltage point 3 of multi-point V/f curve	0.0	0.0 to 1000.0
d2-47	Voltage upper limit in separated V/f	100.0%	50.0% to 200.0%
d2-48	Voltage source for separated V/f	0	0: d2-49 2: AI1 3: AI2 5: HDI pulse reference (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector
d2-49	Digital setting of voltage in separated V/f	0 V	0 to C4-03
d2-50	Voltage acceleration time of separated V/f	0.0s	0.0s to 1000.0s
d2-51	Voltage acceleration time of separated V/f	0.0s	0.0s to 1000.0s
d2-52	RFG time of the frequency in separated V/f	0	0: Set to 0 forcibly 1: Preset RFG time
d2-53	Stop mode selection of V/f separation	0	0: Frequency and voltage declined to 0 independently 1: Frequency declines to 0 after voltage declines to 0. 2: Coast to stop (newly added)

8.15.5 SVC Parameters

When F0-01 [Motor control mode] is set to 0 [SVC], you need to set SVC-related parameters. The following table shows the related parameters. F2-02 to F2-03 set the control parameters, and F2-04 to F2-12 adjust the effective speed loop parameters according to the actual operating conditions.

Param.	Name	Default value	Value range
F2-02 (d3-02)	Speed loop Kp in SVC mode	5.0	0.0 to 6000.0
F2-03 (d3-03)	Speed loop Ti in SVC mode	0.127s	0.000s to 20.000s
F2-04 (d3-06)	Zero speed switchover frequency	1.0%	0 to d3-09
F2-05 (d3-07)	Zero speed Kp correction coefficient	100.0%	0.0% to 1000.0%
F2-06 (d3-08)	Zero speed Ti correction factor	100.0%	0.0% to 1000.0%
F2-07 (d3-09)	Low speed switchover frequency	10.0%	0.0% to d3-12
F2-08 (d3-10)	Low speed Kp correction factor	100.0%	0.0% to 1000.0%
F2-09 (d3-11)	Low speed Ti correction factor	100.0%	0.0% to 1000.0%
F2-10 (d3-12)	High speed switchover frequency	100.0%	d3-09 to 400.0%
F2-11 (d3-13)	High speed Kp correction factor	100.0%	0.0% to 1000.0%
F2-12 (d3-14)	High speed Ti correction factor	100.0%	0.0% to 1000.0%

8.15.6 Motor Phase Sequence Switchover

Unlike the speed reversal function, the direction of the speed reference is not changed when the motor phase sequence is switched, but the actual operating direction of the motor changes to the opposite direction.

Param.	Name	Default value	Value range
F2-14 (d0-14)	Motor direction selection	0	0: Default direction 1: Opposite direction

8.15.7 Acceleration/deceleration time

Param.	Name	Default value	Value range
F0-45 (b7-00)	Ramp-up/down mode	0	0: Linear 1: S-curve
F0-46 (b7-01)	Ramp-up/down time base	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference
F0-48 (b7-04)	Ramp-up time of ramp 1	20.0s	0.0 to 6500.0
F0-49 (b7-05)	Ramp-down time of ramp 1	20.0s	0.0 to 6500.0
F0-50 (b7-06)	Ramp-up start arc of ramp 1	0.00s	0.00s to 650.00s
F0-51 (b7-07)	Ramp-up end arc of ramp 1	0.00s	0.00s to 650.00s
F0-52 (b7-08)	Ramp-down start arc of ramp 1	0.00s	0.00s to 650.00s
F0-53 (b7-09)	Ramp-down end arc of ramp 1	0.00s	0.00s to 650.00s

8.15.8 Frequency Limits

Param.	Name	Default value	Value range
F2-22 (d1-03)	Digital reference of positive frequency upper limit 1	800.0%	F2-26 to 800.0%
F2-23 (d1-04)	Digital reference of negative frequency upper limit 1	-800.0%	-800.0% to F2-27
F2-24 (d1-05)	Positive frequency upper limit 2 selection	0 [800.0%]	0: 800% 2: AI1 3: AI2 5: HDI pulse reference (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector

Param.	Name	Default value	Value range
F2-25 (d1-06)	Source of negative frequency upper limit 2	1 [Inverted value of d1-05]	0: -800% 1: Opposite to the forward frequency upper limit 2 2: AI1 3: AI2 5: HDI pulse reference (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector
F2-26 (d1-07)	Digital setting of positive frequency lower limit 1	0.0%	0.0% to F2-22
F2-27 (d1-08)	Digital setting of negative frequency lower limit 1	0.0%	F2-23 to 0.0%
F2-30 (d1-09)	Digital reference of torque upper limit 1	150.0%	0.0% to 800.0%
F2-31 (d1-10)	Digital reference of torque lower limit 1	-150.0%	-800.0% to 0.0%
F2-32 (d1-11)	Source of torque upper limit 2	0	Same as F2-24 (d1-05)
F2-33 (d1-12)	Torque lower limit 2 selection	1	Same as F2-25 (d1-06)

8.15.9 Common Protection Parameter

Param.	Name	Default value	Value range
F2-36 (d0-41)	Over-excitation gain (V/f)	90%	0% to 200%
F2-37 (d2-26)	Overcurrent suppression enable	1	0: Disable 1: Active
F2-38 (d2-27)	Overcurrent suppression threshold	200%	80% to 300%
F2-39 (d1-54)	Overvoltage suppression enable	0x0001	bit0: Overvoltage suppression enable in V/f mode 0: Disable 1: Active bit1: Overvoltage suppression enable in vector mode 0: Disable 1: Active

Param.	Name	Default value	Value range
F2-40 (d1-55)	Voltage threshold for overvoltage suppression	770.0 V	600.0 V to A3-57
F2-43 (d1-63)	Response to undervoltage	0	0: Not respond 1: Suppress undervoltage 2: Decelerate to stop
F2-44 (d1-64)	Undervoltage suppression action voltage	430.0 V	A3-55 to 500.0 V

8.15.10 Startup Parameters

Param.	Name	Default value	Value range
F2-15 (d0-02)	Startup mode	10	Ones position: Asynchronous motor startup mode 0: Direct start for asynchronous motor. The drive starts directly for asynchronous motors. This mode applies to scenarios where the motor starts from a standstill state. 1: Flying start for asynchronous motor. In this mode, the drive first determines the motor rotation speed and direction, and then starts at the tracked frequency of the motor. Select this mode when the motor starts during rotation. For other scenarios, select direct start. Tens position: Synchronous motor startup mode 0: Same as the startup mode of the ones position. If the ones position uses direct start, the synchronous motor uses direct start. If the ones position uses flying start, the synchronous motor also uses flying start. 1: Flying start. The synchronous motor uses flying start regardless of the value set in the ones position. Hundreds to ten thousands: Reserved
F2-16 (d0-03)	Speed tracking mode	4	0: Starting from the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented speed tracking
d0-23	Start frequency	0.00 Hz	0.00 to 10.00 Hz
d0-24	Starting frequency hold time	0.0s	0.0s to 1000.0s
d0-25	DC braking time at start	0.0s	0.0 to 100.0
d0-26	DC braking current at start	50%	0% to 800%

8.15.11 Parameters in stop state

Param.	Name	Default value	Value range
d0-04	OFF1 stop mode	0	0: Decelerate to stop 1: Coast to stop 2: Stop with maximum capability
d0-05	OFF2 (coast to stop) mode	0	0: Coast to stop
d0-06	OFF3 (quick stop) mode	0	0: Quick stop 1: Stop with maximum capability
d0-27	Starting frequency of DC braking at stop	0.0 Hz	0.0 Hz to 600.0 Hz
d0-28	Waiting time of DC braking at stop	0.0s	0.0 to 100.0
d0-29	DC braking time at stop	0.0s	0.0 to 100.0
d0-30	DC braking current at stop	50%	0% to 800%

8.15.12 Carrier Frequency Parameters

Param.	Name	Default value	Value range
F2-48 (A5-06)	Overmodulation coefficient	103.0%	0.0% to 110.0%
F2-50 (A5-01)	Carrier frequency reference	4.0 kHz	0.8 kHz to 20.0 kHz

8.15.13 I/O Parameters

Param.	Name	Default value	Value range
F4-00 (b9-00)	Terminal start/stop module A/B selection	0	0: Module A 1: Module B Other: B connector
F4-01 (b9-01)	Mode of terminal start/ stop module A	3	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 start in forward direction, IN2P (rising edge) for start in reverse direction, and IN3 for stop
F4-02 (b9-09)	Mode of terminal start/ stop module B	3	Same as F4-01 (b9-01)

Param.	Name	Default value	Value range
F4-03 (E0-00)	DI1 function selection	1	-
F4-04 (E0-01)	DI2 function	4	
F4-05 (E0-02)	DI3 function selection (for MD610S)	9	
F4-06 (E0-03)	DI4 function selection (for MD610S)	12	
F4-07 (E0-04)	DI5 function selection (for MD610S)	13	
F4-14 (E1-00)	RO output selection	2	-
F4-15 (E1-04)	DO function selection	0	
F4-16 (E1-08)	FMR (HDO) function selection	0	
F4-21 (E2-10)	AI1 filter time	0.10s	0.00s to 10.00s
F4-22 (E2-19)	AI2 filter time	0.10s	0.00s to 10.00s
F4-27 (E2-38)	AI curve selection	0x0021	0x0001 to 0x0055
F4-28 (E2-40)	Minimum input of AI curve 1	0.00 V	-10.00 V to F4-30
F4-29 (E2-41)	Percentage corresponding to the minimum input of AI curve 1	0.0%	-800.0 % to +800.0%
F4-30 (E2-42)	Maximum input of AI curve 1	10.00 V	F4-28 to 10.00 V
F4-31 (E2-43)	Percentage corresponding to the maximum input of AI curve 1	100.0%	-800.0 % to +800.0%
F4-32 (E2-44)	Minimum input of AI curve 2	0.00 V	-10.00 V to F4-34
F4-33 (E2-45)	Percentage corresponding to the minimum input of AI curve 2	0.0%	-800.0 % to +800.0%
F4-34 (E2-46)	Maximum input of AI curve 2	10.00 V	F4-32 to 10.00 V
F4-35 (E2-47)	Percentage corresponding to the maximum input of AI curve 2	100.0%	-800.0 % to +800.0%
F4-36 (E2-48)	Minimum input of AI curve 3	0.00 V	-10.00 V to F4-38
F4-37 (E2-49)	Percentage corresponding to the minimum input of AI curve 3	0.0%	-800.0 % to +800.0%

Param.	Name	Default value	Value range
F4-38 (E2-50)	Maximum input of AI curve 3	10.00 V	F4-36 to 10.00 V
F4-39 (E2-51)	Percentage corresponding to the maximum input of AI curve 3	100.0%	-800.0 % to +800.0%
F4-40 (E2-52)	Minimum input of AI curve 4	0.00 V	-10.00 V to F4-42
F4-41 (E2-53)	Percentage corresponding to the minimum input of AI curve 4	0.0%	-800.0 % to +800.0%
F4-42 (E2-54)	AI curve 4 inflection point 1 input	3.00 V	F4-40 to F4-44
F4-43 (E2-55)	Percentage corresponding to inflection point 1 input of AI curve 4	30.0%	-800.0 % to +800.0%
F4-44 (E2-56)	Inflection point 2 input of AI curve 4	6.00 V	F4-42 to F4-46
F4-45 (E2-57)	Percentage corresponding to inflection point 2 input of AI curve 4	60.0 %	-800.0 % to +800.0%
F4-46 (E2-58)	Maximum input of AI curve 4	10.00 V	F4-44 to 10.00
F4-47 (E2-59)	Percentage corresponding to the maximum input of AI curve 4	100.0%	-800.0 % to +800.0%
F4-48 (E2-60)	AI curve 5 min. input	-10.00 V	-10.00 V to F4-50
F4-49 (E2-61)	Percentage corresponding to the minimum input of AI curve 5	-100.0%	-800.0 % to +800.0%
F4-50 (E2-62)	Inflection point 1 input of AI curve 5	-3.00 V	F4-48 to F4-52
F4-51 (E2-63)	Percentage corresponding to inflection point 1 input of AI curve 5	-30.0%	-800.0 % to +800.0%
F4-52 (E2-64)	Inflection point 2 input of AI curve 5	3.00 V	F4-50 to F4-54
F4-53 (E2-65)	Percentage corresponding to inflection point 2 input of AI curve 5	30.0%	-800.0 % to +800.0%
F4-54 (E2-66)	Maximum input of AI curve 5	10.00 V	F4-52 to 10.00
F4-55 (E2-67)	Percentage corresponding to the maximum input of AI curve 5	100.0%	-800.0 % to +800.0%
F4-59 (E3-00)	AO1 function selection	0	-
F4-60 (E3-05)	Minimum input of AO curve	0.0%	-800.0% to F4-62

Param.	Name	Default value	Value range
F4-61 (E3-06)	Percentage corresponding to the minimum input of AO curve	0.00 V	0.00 V to 10.00 V
F4-62 (E3-07)	Maximum input of AO curve	100.0%	F4-60 to 800.0 %
F4-63 (E3-08)	Percentage corresponding to the maximum input of AO curve	10.00 V	0.00 V to 10.00 V
F4-68 (E4-00)	HDI terminal type selection	1 [Used as DI]	0: Used as HDI 1: Used as DI
F4-69 (E4-01)	HDI input	0 [Disable]	0: Inhibited 1: Active Other: B connector
F4-70 (E4-07)	HDI curve setting	0 [Two-point curve]	Ones position: HDI curve selection 0: Two-point curve 1: Four-point curve Tens to Ten-thousands: Reserved
F4-71 (E4-08)	Minimum input of HDI two-point curve	0.00 kHz	0.00 to F4-73
F4-72 (E4-09)	Percentage corresponding to the minimum input of HDI two-point curve	0.0%	-800.0 % to +800.0%
F4-73 (E4-10)	Maximum input of HDI two-point curve	20.00 kHz	F4-71 to 20.00 kHz
F4-74 (E4-11)	Percentage corresponding to the maximum input of HDI two-point curve	100.0%	-800.0 % to +800.0%
F4-75 (E4-12)	Minimum input of HDI four-point curve	0.00 kHz	0.00 to F4-77
F4-76 (E4-13)	Percentage corresponding to minimum input of four-point HDI curve	-100.0%	-800.0 % to +800.0%
F4-77 (E4-14)	Inflection point 1 input of four-point HDI curve	5.00 kHz	F4-75 to F4-79
F4-78 (E4-15)	Percentage corresponding to inflection point 1 input of four-point HDI curve	-30.0%	-800.0 % to +800.0%
F4-79 (E4-16)	Inflection point 2 input of HDI four-point curve	10.00 kHz	F4-77 to F4-81
F4-80 (E4-17)	Percentage corresponding to inflection point 2 input of HDI four-point curve	30.0%	-800.0 % to +800.0%
F4-81 (E4-18)	Maximum input of HDI four-point curve	20.00 kHz	F4-79 to 20.00
F4-82 (E4-19)	Percentage corresponding to the maximum input of HDI four-point curve	100.0%	-800.0 % to +800.0%

Param.	Name	Default value	Value range
F4-83 (E4-32)	HDI filter time	0.10s	0.00s to 10.00s
F4-88 (E5-00)	FM multi-functional terminal output selection	0 [HDO pulse output (FMP)]	0: HDO pulse output (FMP) 1: Switch output (FMR)
F4-89 (E5-01)	HDO function selection	0 [Operating frequency]	-
F4-90 (E5-03)	Minimum input of HDO curve	0.0	-100.0% to F4-92
F4-91 (E5-04)	Percentage corresponding to minimum input of HDO curve	0.00	0.00 to 100.00
F4-92 (E5-05)	Maximum input of HDO curve	100.0	F4-90 to 100.0 %
F4-93 (E5-06)	Percentage corresponding to the maximum input of HDO curve	100.00	0.00 to 100.00
F4-97 (E5-15)	Maximum frequency of HDO output	50.00 kHz	0.01 to 100.00

8.15.14 Communication Parameters

The following table shows the common communication parameters of MD610S.

Table 8–17 Common communication parameters of MD610S

Param.	Name	Default value	Value range
Fd-00 (n1-02)	Commissioning address (for commissioning software/operating panel)	1	1 to 127
Fd-04 (n2-20)	Modbus communication effectiveness	0	0: Not supported by the current device 1: Active
Fd-05 (n2-00)	Modbus communication 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
Fd-06 (n2-01)	Modbus data format	0	0: 8-N-2 (No check) 1: 8-E-1 (Even parity) 2: 8-O-1 (Odd parity) 3: 8-N-1 (No check)

Param.	Name	Default value	Value range
Fd-07 (n2-02)	Modbus local address	1	1 to 247
Fd-08 (n2-03)	Modbus response delay	2 ms	0 ms to 20 ms
Fd-09 (n2-04)	Modbus communication timeout time	0.0s	0.0s to 6000.0s

8.16 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.

8.17 Quick Copy after Commissioning

This function is used to copy the commissioned parameters to the other drives quickly to achieve batch commissioning.

9 Communications

9.1 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 non-periodic 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.

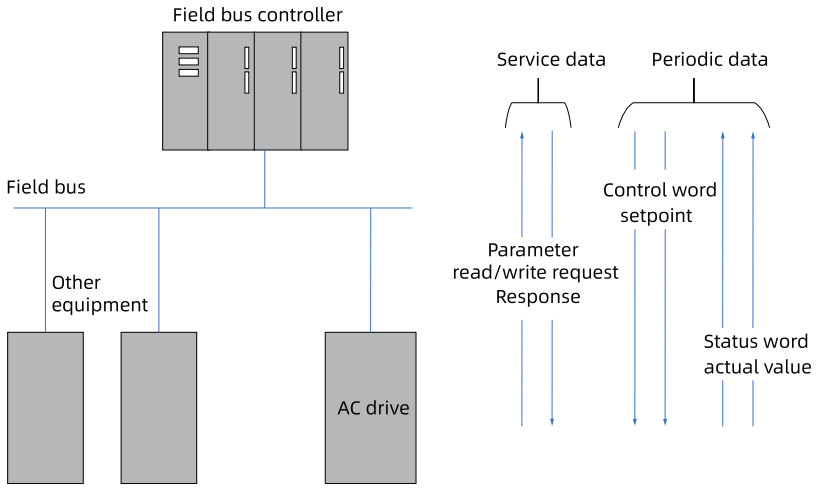


Figure 9-1 Communication system connection diagram

9.2 Communication Protocol

Communication protocols supported are listed in the table below.

Model	Protocol	Hardware
MD610S	Modbus	MD610 RS485 wiring terminal

9.3 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 example, if the bus controller sends a command word to control start/stop of the drive, set the main command source for the active control channel (two control channels available: F0-03/b1-00 as channel 1 and b3-00 as channel 2) to 2 [Communication].

Note 2: For example, if the bus controller sends a frequency reference to control the output frequency of the drive, set the main frequency source (two setting channels available: F0-29/b5-00 as channel 1 and b6-00 as channel 2) to 9 [Communication].

9.4 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.

9.4.1 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.

9.4.1.1 Communication Control Word

In the effective control channel, set the main command source of the 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.
Control word 1 set through communication	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.

9.4.1.2 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 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 (Int16)]	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/Int16/2 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)
4 [Percentage (corresponds to maximum frequency/Int16/2 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.

9.4.1.3 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 MD610S) 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

9.4.1.4 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 MD610S) 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%

9.4.2 Special Communication Address

9.4.2.1 Special Communication Address

This drive provides special communication address that can be read and written. This allows the host controller to write certain values and configure certain functions of the drive through communication. The special communication addresses described in this section are not retentive at power failure.

9.4.2.2 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.
Control word 1 set through communication	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 MD610	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.

9.4.2.3 Communication setpoint

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 setpoint

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 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 (Int16)]	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/Int16/2 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.

9.4.2.4 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 MD610S) 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

9.4.2.5 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 MD610S) 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%

9.4.3 Control Word and Status Word

9.4.3.1 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.

Parameter	Description
Target frequency	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 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

Options of n0-14	Unit	Data format	Number of decimal places	Example of communication value	Actual value
2 [Speed (Int16)]	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/Int16/2 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)
4 [Percentage (corresponds to maximum frequency/Int16/2 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)

9.4.3.2 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.

9.4.4 Mapping Table

Mapping Table

See the following table for commonly used monitoring and setting parameters in communication.

Comm. address (Hexadecimal)	Comm. address (Decimal)	Name	Revision mode	Value range	Unit	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	Error 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 status							
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 DI5 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 status							

Comm. address (Hexadecimal)	Comm. address (Decimal)	Name	Revision mode	Value range	Unit	Type	Param.
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 status 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 frequency	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
0x700A	28682	AI2 voltage	Read-only	-10.57 to +10.57	-	Signed 16-bit	U0-10
Analog output state							
0x7123	28963	Calibrated AO	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)

9.5 Modbus RTU Drive Control

9.5.1 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.

Caution

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.

9.5.2 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
Maximum number of connected slaves	247
Number of request messages that can be received at the same time	1

9.5.3 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.

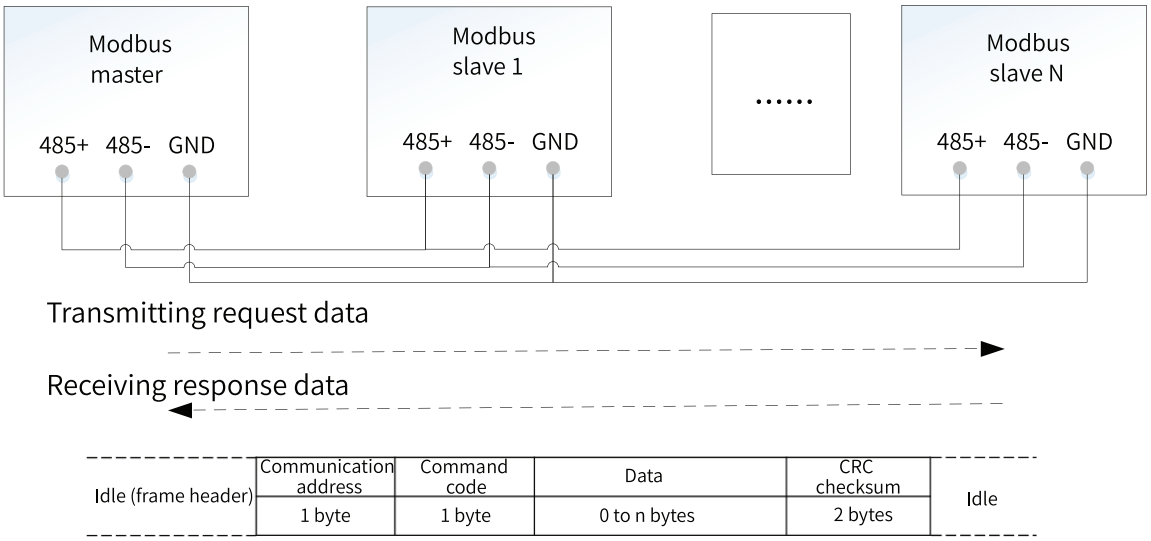
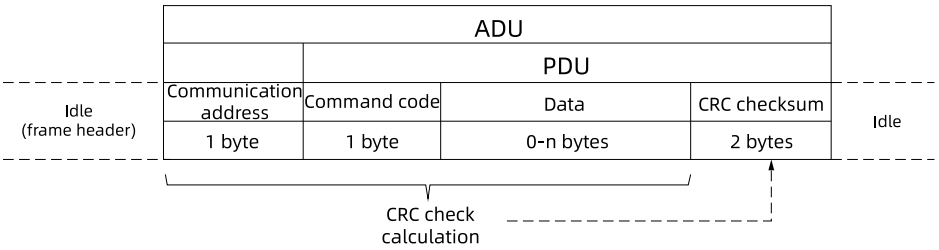


Figure 9-2 Bus-type topology

9.5.4 Message

9.5.4.1 Message Structure

The Modbus RTU protocol communication data message consists of the communication address, command code, data, and CRC. The frame structure is shown in the following figure.



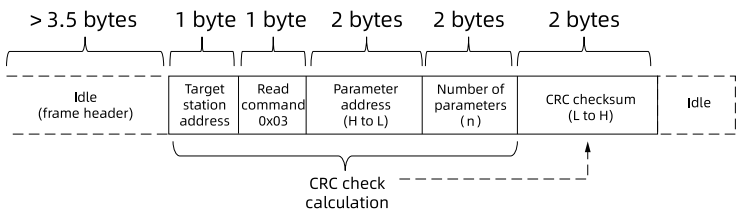
Field	Description
Communication address	It is used to uniquely identify yourself in the network, which is one byte, and can be set by n2-03.
Command Code	The command code specified for Modbus standard communication, which occupies one byte.
Data	The length of the data field is related to commands and specific usage. For example, the 0x06 function code write command can only be used to write one function code, with a fixed length of 4 bytes. The 0x03 read function code command and 0x10 write multiple function code commands can read or write multiple function codes. The length is related to the usage.
CRC checksum	The CRC value is calculated by the standard Modbus CRC16 check algorithm and occupies two bytes.

Instances

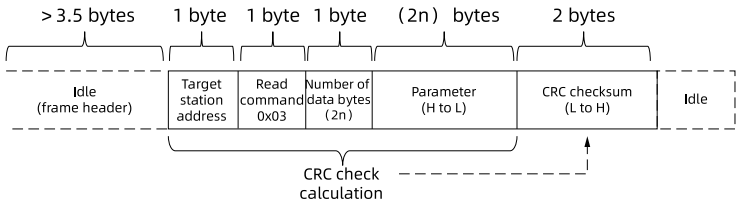
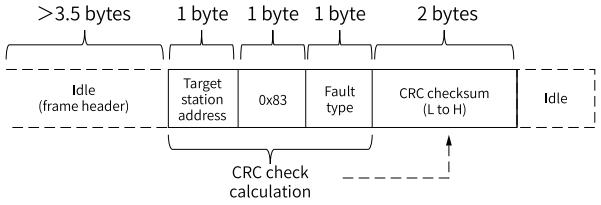
The AC drive supports reading or writing only of word type parameters, and does not support reading or writing of bytes or bits. The read operation command is 0x03, the write operation command is 0x06, and the multi-data write operation command is 0x10.

1. Communication read process

The controller or host controller sends a read request data frame to the AC drive.

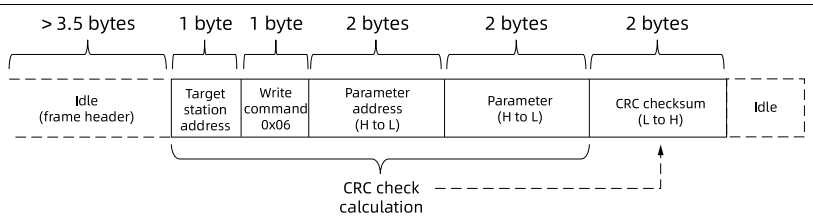
Read parameter request	

The AC drive sends a normal response frame to the read request based on the data processing result of the read request, and an abnormal response frame to the read request when the error occurs.

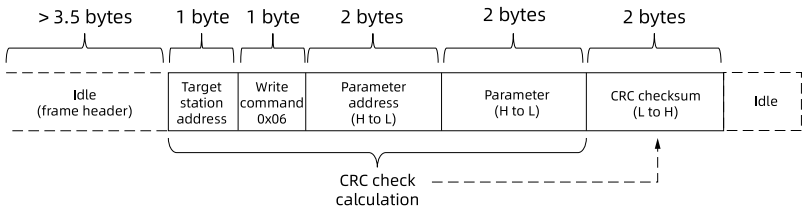
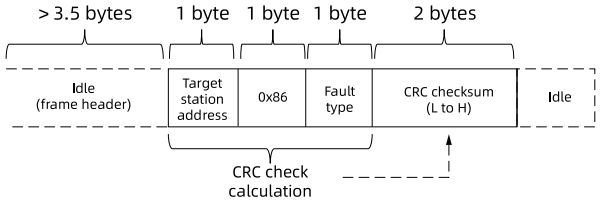
Normal response to read parameter	
Abnormal response to read parameter	

2. Communication write process

The controller or host controller sends a write request data frame to the AC drive.

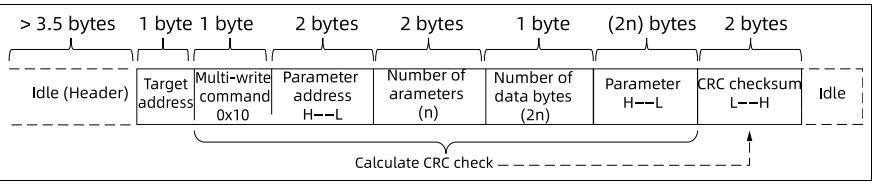
Write parameter request	

The AC drive sends a normal response frame to the write request based on the data processing result of the write request, and an abnormal response frame to the write request when the error occurs.

Normal response to write parameter	
Abnormal response to write parameter	

3. Multi-write process

The controller or host controller sends a multi-write request data frame to the AC drive.

Multi-write parameter request	

The AC drive sends a normal response frame to the multi-write request based on the data processing result of the multi-write request, and an abnormal response frame to the multi-write request when the error occurs.

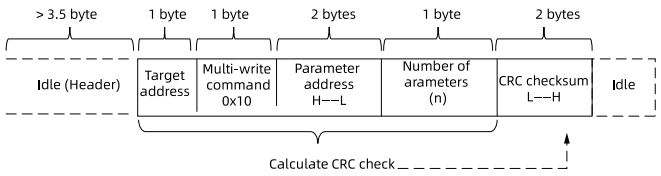
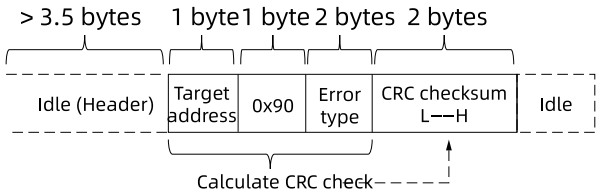
Normal response to multi-write parameter	
Abnormal response to multi-write parameter	

Table 9–1 Field description of data frame structure

Field	Remarks
Frame header	An idle level for a duration greater than or equal to 3.5-byte transmission time
Destination address	Communication address range: 1 to 247; 0: Broadcast address
Command code	03: Read parameter, 06: Write parameter, 10: Multi-write parameter.
Parameter address (H)	The internal parameter address of the AC drive, in hexadecimal format. Low-order bytes follow high-order bytes during transmission.
Parameter address L	
Number of parameters	Indicates the number of parameters read/written in this frame. 1 indicates that one parameter is read. Low-order bytes follow high-order bytes during transmission. Note: The communication write operation (0x06) does not have this field.
Number of data bytes	Data length, which is twice the number of parameters
Parameter H	Read request response data or data to be written (Low-order bytes follow high-order bytes during transmission.)
Parameter L	

Field	Remarks
CRC H	Detection value: CRC16 check value. High-order bytes follow low-order bytes during transmission.
CRC L	
Idle	An idle level for a duration greater than or equal to 3.5-byte transmission time

9.5.4.2 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 250*.

9.5.4.3 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

9.5.4.4 Mapping table (AC drive)

For details, see *"9.4.4 Mapping Table" on page 252*.

9.5.5 Communication Ports

The MD610 standard model (MD610S) 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.

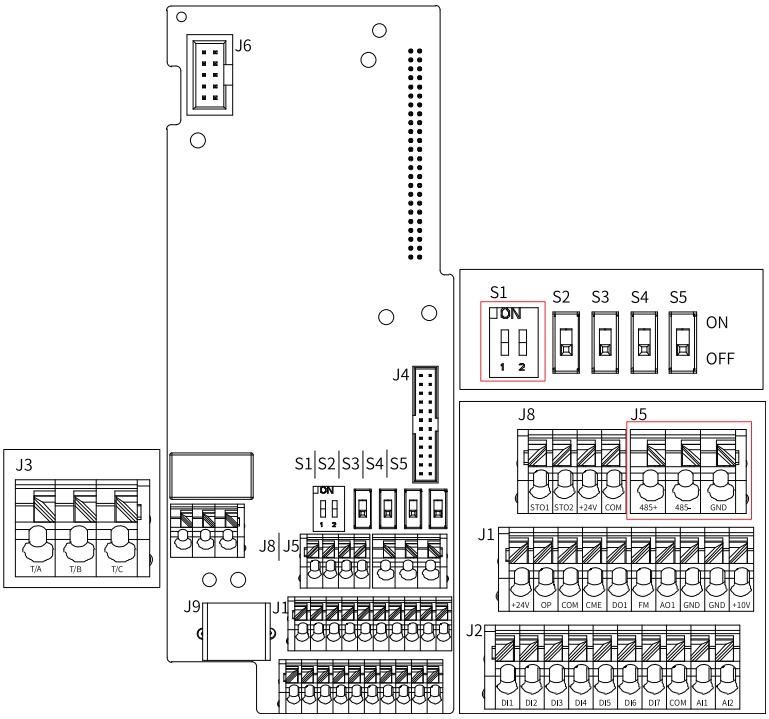


Figure 9-3 Diagram showing the positions of the Modbus communication port and DIP switch

Table 9–2 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 9–3 Description 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.

9.5.6 Connecting 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.

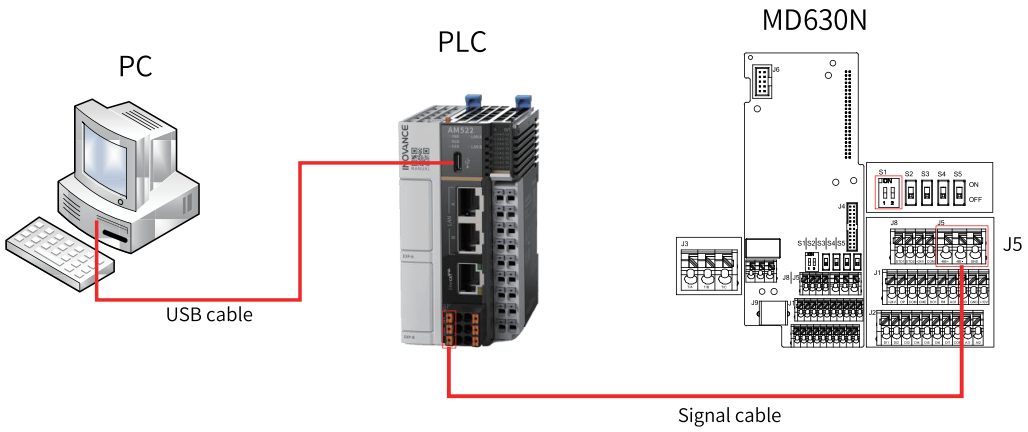


Figure 9-4 Modbus communication wiring

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.

You can install an external termination resistor (Method 1) or set the termination resistor via DIP switch S1 (Method 2) for the master as required.

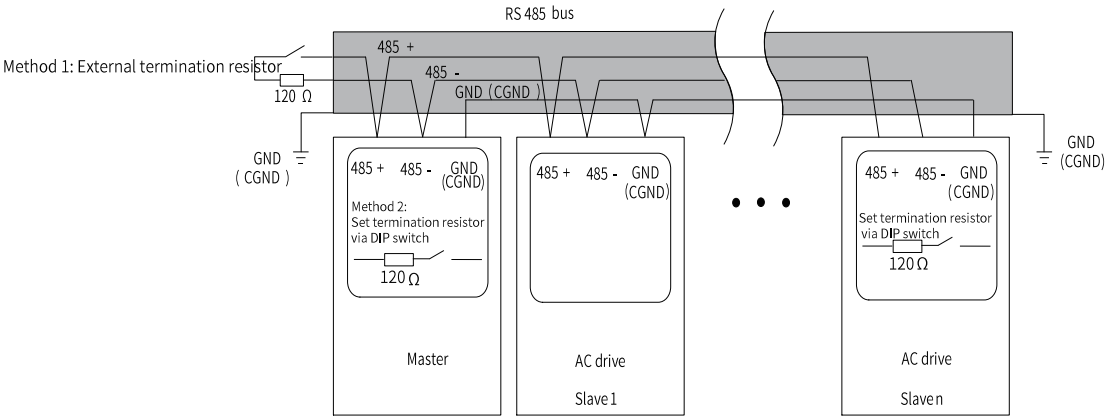


Figure 9-5 Diagram of signal cable connections between master and slave

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.

9.5.7 Configure Communication Between AC Drive and Controller

The MD610 standard model (MD610S) can communicate with master stations that support standard Modbus RTU, such as Inovance PLCs.

1. Connect the master and drive, as shown in *"9.5.6 Connecting AC Drive to Bus System Through RS485 Port" on page 259*.
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 the communication between the master station (controller) and the slave station (AC drive). For details, see *" Configuration for RS485 Communication Between the Drive and H5U" on page 263*.

Ensure that the baud rate and data format of the master are consistent with the settings of the slave. Otherwise, communication errors may occur.

9.5.8 Communication parameters

Param.	Name	Default value	Value range	Change mode	Description
n2-00 (Fd-05)	Modbus communication 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	Change 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 (8-E-1) 2: Odd parity (8-O-1) 3: 8-N-1	Real time	Note that the data format of the host controller must be the same as that of the drive. Otherwise, communication can fail.
n2-02 (Fd-07)	Modbus local address	1	1 to 247	Change 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	Value range	Change mode	Description
n2-03 (Fd-08)	Modbus response delay	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) 0.1 to 600.0	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, it reports E160.1 (Communication fault). This parameter is generally set to an invalid value. This parameter is used to monitor communication status in a system with continuous communication.

9.5.9 Communication Fault Diagnosis

Table 9–4 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.

9.5.10 Communication Configuration Instance

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 that the controller and the AC drive are connected correctly (H5U as Modbus master and MD610S as Modbus slave). Connect the H5U PLC to the 485+, 485-, and GND terminals of the drive. See details in *"9.5.6 Connecting AC Drive to Bus System Through RS485 Port" on page 259*.
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:

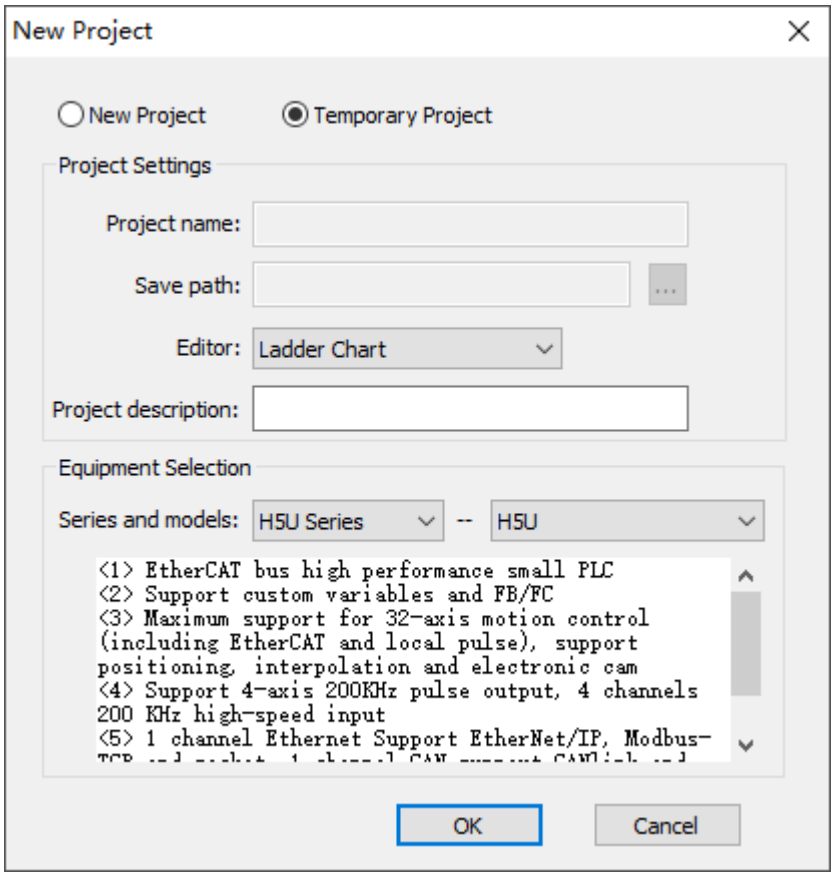
1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed. 0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (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:

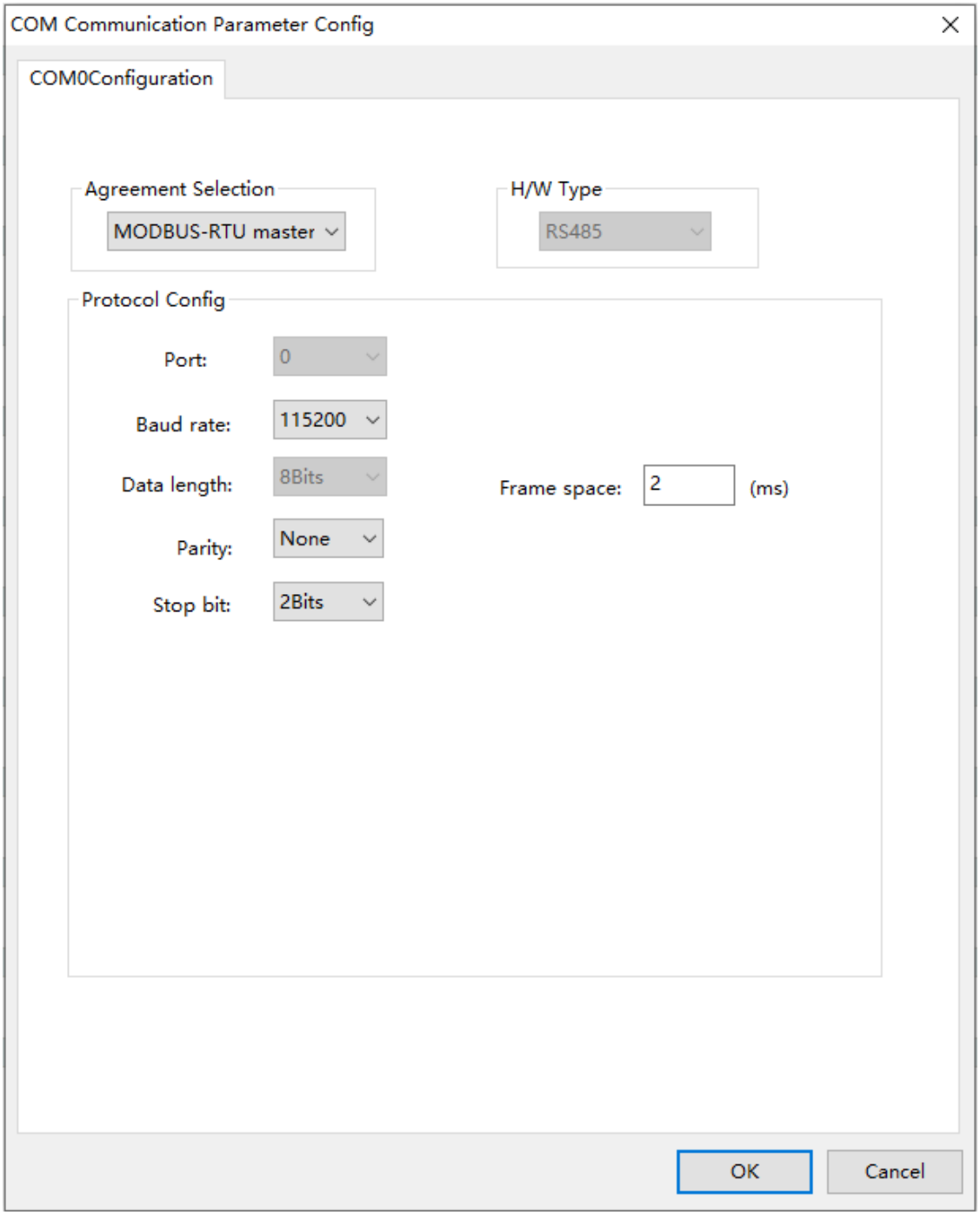
1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. Set n0-14 [7310H Reference selection], and choose one of the following values as needed. 0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 2: Speed (signed 16-bit); 3: Percentage (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.

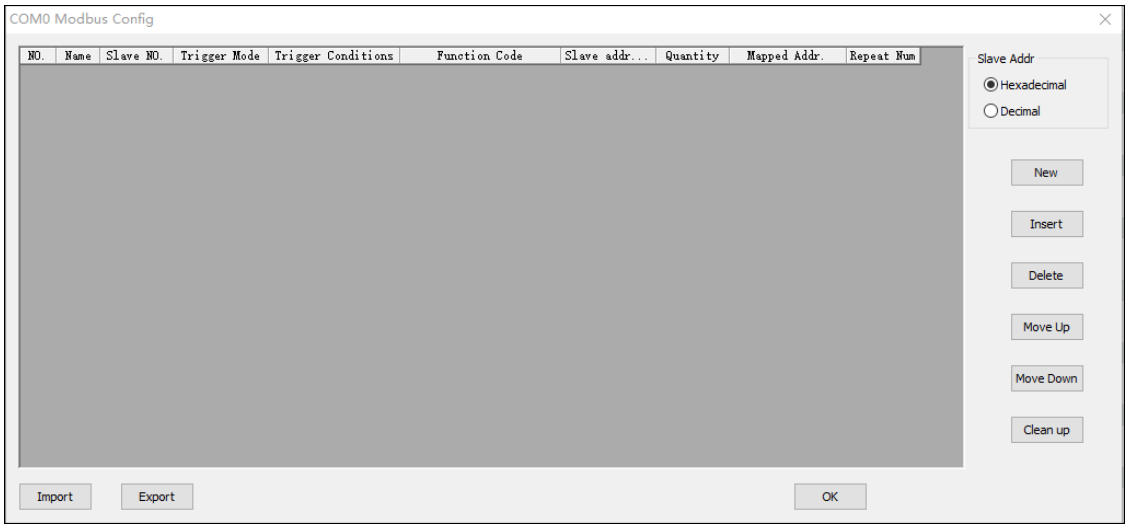
1. Open AutoShop. Click "Create a new project(Ctrl+N)", select "H5U Series" from the "Series and models" drop-down list, and click "OK".



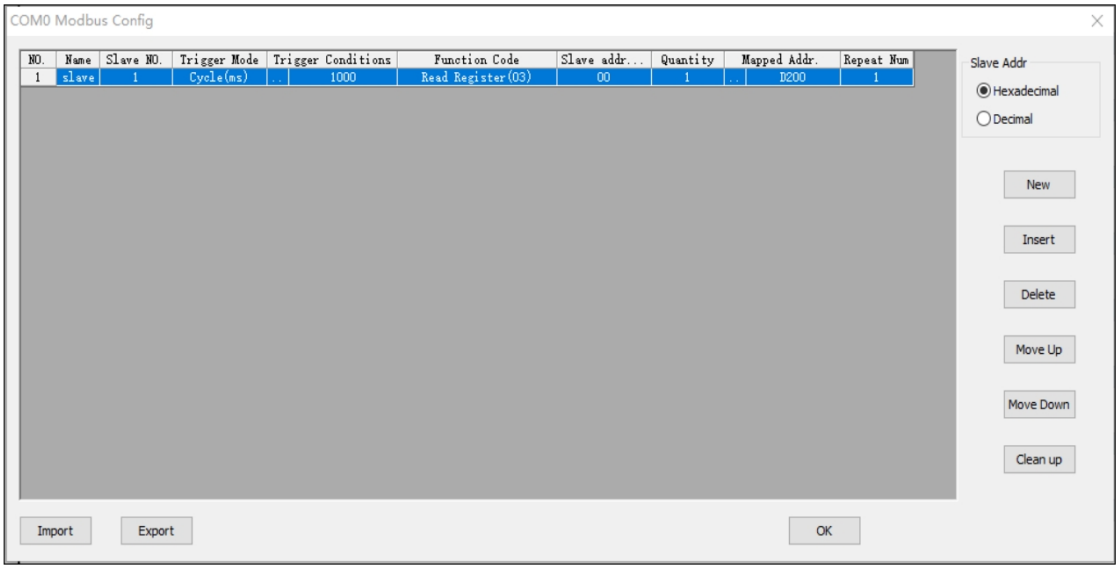
2. Click COM in the left pane to go to the PLC configuration interface, select the protocol and data format, and click "OK". Note: The data format must be consistent with the drive.



3. Click COM0, and 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.

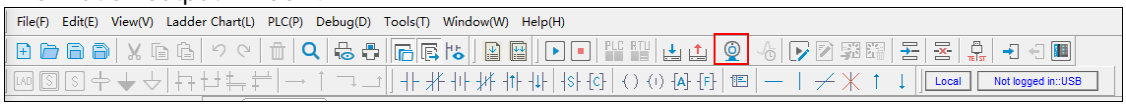
NO.	Name	Slave NO.	Trigger Mode	Trigger Conditions		Function Code	Slave addr...	Quantity		Mapped Addr.	Repeat Num
1	slave	1	Cycle(ms)	..	1000	Write Single Registe...	F027	1	..	D200	1

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.

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		

write value

read value

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.

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	0	
4	D301	16-bit int	Dec	0	
5		16-bit int	Dec		

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.

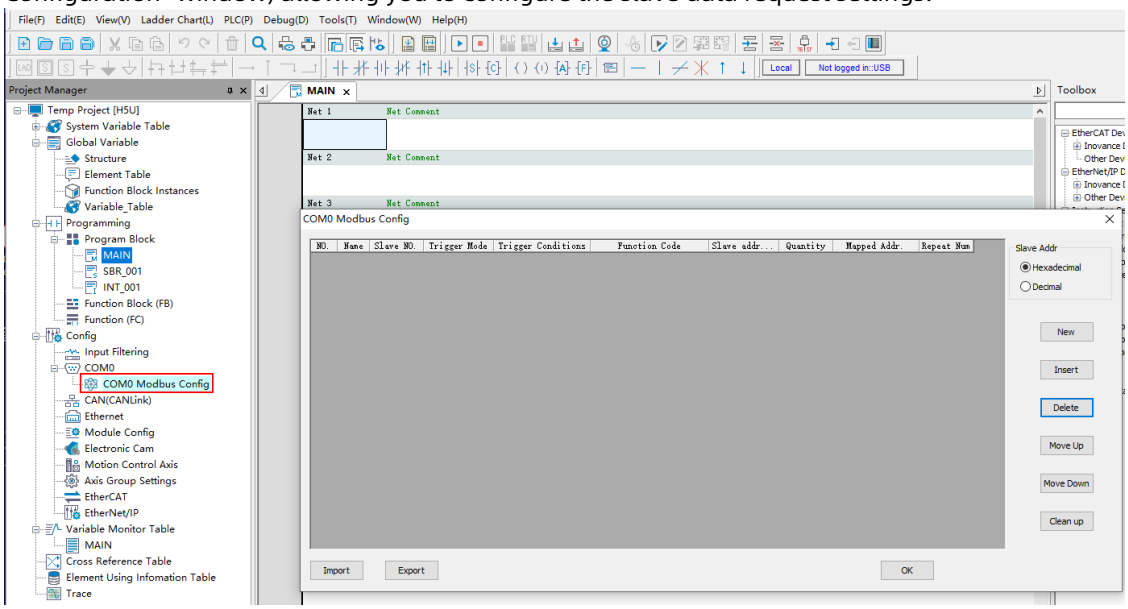
Parameter	Description	Current value	Unit	Factory value	Minimum value	Maximum value	Modify type	Display mode	Postal address
F0-30	Digital setting of main frequency	50.00	Hz	50.00	0.00	100.00[A2-17]	AnyModify	Decimalism	0xF01E
F0-31	Auxiliary frequency source	0 [Invalid]	-	0	0	9	AnyModify	Decimalism	0xF01F
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		

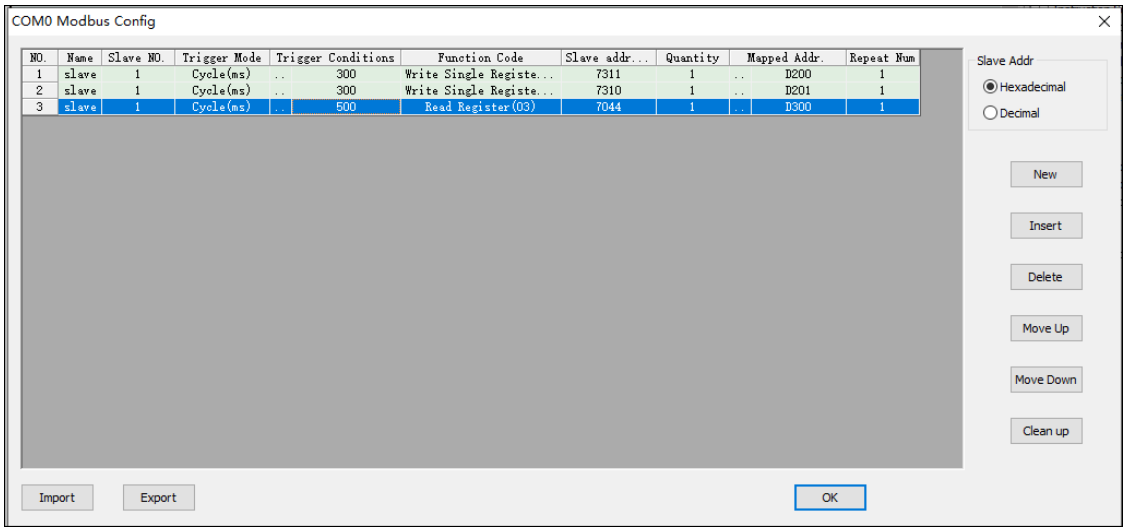
Step 4: Control the AC drive through communication

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.

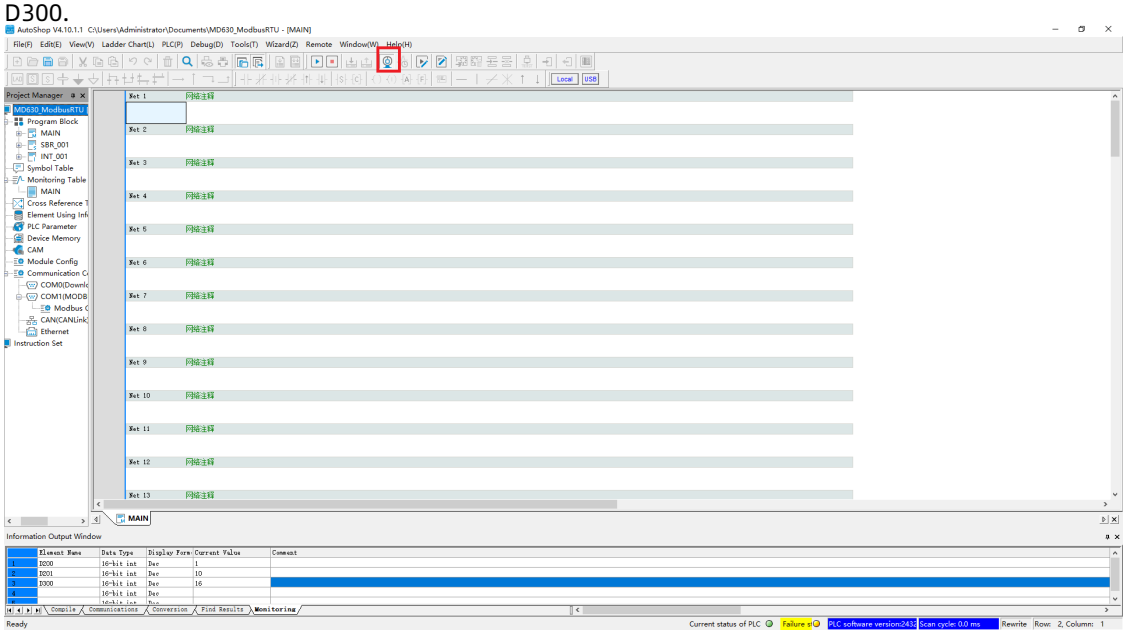


2. Configure the request data.

   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 for control commands 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 for frequency reference 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)

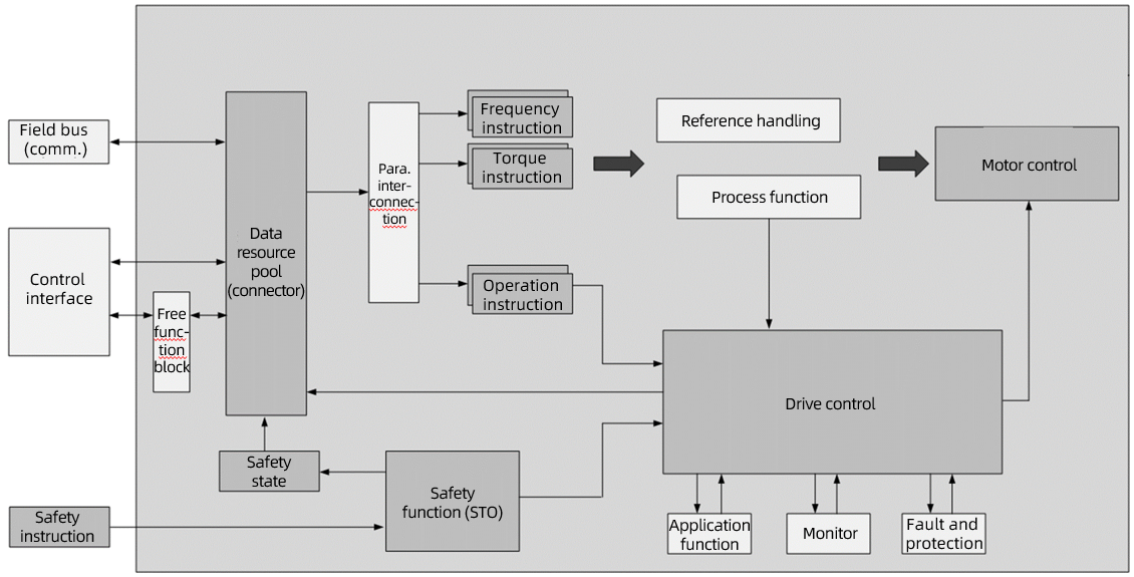
In default settings, when n0-14 [7310H Reference selection] is set to 1 [Frequency (signed 16-bit)], writing 1000 to 7310H sets the main frequency to 10.00 Hz. Writing -1000 sets the main frequency to -10.00 Hz.

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 reached. 0: Not reached; 1: Reached 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.

10 Common Functions

10.1 Functions



10.2 Operation Command

10.2.1 Selecting Control Channel and Operation Command

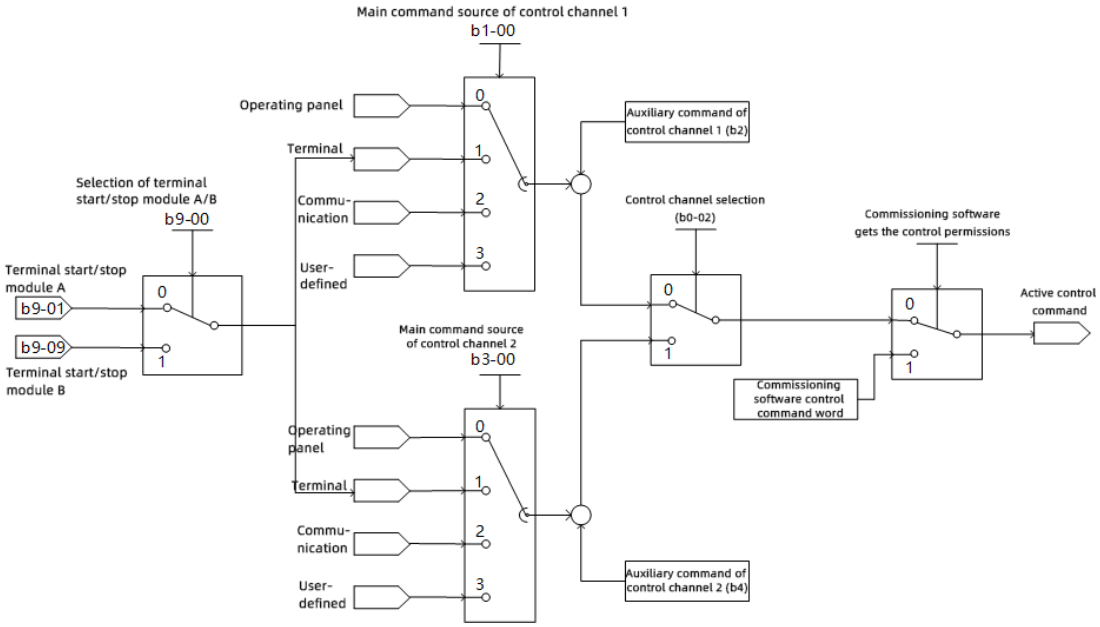


Figure 10-1 Control channel diagram

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). 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

You can set the running command source through b1-00 or F0-03 (Main command source of control channel 1) or b3-00 (Main command source of control channel 2).

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.

Selecting the running command source	Application scenarios	Link
Control operation via operating panel (b1-00 or F0-03 = 0)	Control the drive (such as starting/stopping the drive) through the operating panel.	*"10.2.2 Control Operation Through the Operating Panel" on page 274*
Controlling Operation Through Commissioning Software	Control the drive (such as starting/stopping the drive) through the iFA commissioning software.	*"10.2.3 Controlling Operation Through Commissioning Software" on page 275*
Control operation through DI terminal (b1-00 or F0-03 = 1)	The two terminal start/stop modules are configured with different control modes to control the drive, such as starting or stop the drive, or enabling the drive to run forwardly. You can set b9-00 (Terminal start/stop module A/B selection) to switch between the two modules, thereby switching between different control modes.	*"10.2.4 DI-Based Operation" on page 275*

Selecting the running command source	Application scenarios	Link
Control operation through communication (b1-00 or F0-03 = 2)	When implementing remote control of the drive, set b1-00 (Main command source of control channel 1) to 2 (Communication). In this case, the operation command of the drive can be set through communication to achieve start/stop of the drive.	*"10.2.5 Control Operation Through Communication" on page 287*
Control operation through custom channel (b1-00 or F0-03 = 3)	The drive supports self-defined main command sources besides channel 1 and channel 2. You can start/stop the drive through setting control command signal source directly to achieve complex and flexible configuration.	*"10.2.6 Setting Operation Commands Through User-Defined Channel" on page 290*

Related parameters

Param.	Name	Default value	Value range	Description
b0-02	Control channel selection	0	0: Control channel 1 1: Control channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: 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. Options: 0: Inactive - Channel 1 is selected. 1: Active - Channel 2 is selected. 3 to 7: DI1 to DI5 - 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.

Param.	Name	Default value	Value range	Description
b1-00 (F0-03)	Main command source of control channel 1	0	0: Operating panel 1: Terminal 2: Communica-tion 3: Custom	Used to set the main command source of control channel 1 or 2. Options: 0: Operating panel - The LED operating panel is used as the main command source of control channel 1. You can control the drive by pressing RUN/STOP keys on the operating panel. 1: Terminal - The terminal is used as the main command source of control channel 1. The DI can be assigned with different functions such as start/stop, forward/reverse run, jog, and multi-reference as needed. 2: Communication - Communication (such as Modbus) is used as the main command source of control channel 1. If the drive needs to communicate with the host controller, you can input control commands through remote communication. This mode is suitable for remote control or centralized control on multiple equipment. 3: Custom - Custom control is used as the main command source of control channel 1. In this case, the control commands can be set through b1-01 to b1-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).
b3-00	Main command source of control channel 2	0		

Note: F group is the commonly used parameter group. b1-00 is actually mapped to F0-03. These two parameters are equivalent.

10.2.2 Control Operation Through the Operating Panel

Description

When b1-00 (Main command source of control channel 1) is set to 0 (Operating panel), you can operate the drive, such as starting or stopping it, through the operating panel.

Procedure

The following shows how to set operation commands through the operating panel.

1. Set F0-03 (Main command source of control channel 1) to 0 (Operating panel) and press

to set the operating panel as the main command source.
2. Set F0-30 (Digital reference of main frequency) to 10.00 Hz and press

again. The operating panel displays the frequency reference as 10 Hz.
3. Press to start the drive (with RUN indicator turned on). Then the drive runs at a frequency of 10 Hz.
4. When the drive is running, press to stop the drive. In this case, the RUN indicator turns off.

Related parameters

Param.	Name	Default value	Value range	Description
b1-00 (F0-03)	Main command source of control channel 1	0	0: Operating panel 1: Terminal 2: Communication 3: Custom	Defines the main command source of control channel 1. Options: 0: Operating panel - The LED operating panel is used as the main command source of control channel 1. You can control the drive by pressing RUN/STOP keys on the operating panel. 1: Terminal - The terminal is used as the main command source of control channel 1. The DI can be assigned with different functions such as start/stop, forward/reverse run, jog, and multi-reference as needed. 2: Communication - Communication (such as Modbus) is used as the main command source of control channel 1. If the drive needs to communicate with the host controller, you can input control commands through remote communication. This mode is suitable for remote control or centralized control on multiple equipment. 3: Custom - Custom control is used as the main command source of control channel 1. In this case, the control commands can be set through b1-01 to b1-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).
b5-01 (F0-30)	Digital reference of main frequency	50	0.00 Hz to A2-17	Defines the target frequency. This parameter is activated when digital reference is used as the main frequency source.

Note: b1-00 and b5-01 are mapped to F0-03 and F0-30 in group F. These two sets of parameters are equivalent.

10.2.3 Controlling Operation Through Commissioning Software

For details, see "iFA Commissioning Software" in this user guide.

10.2.4 DI-Based Operation

Description

When b1-00 [Main command source of control channel 1] is set to 1 [Terminal], you can start/stop the drive through the DI terminal.

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.

Generally, these two groups of modules are configured with different control modes, which can be switched through b9-00.

Param.	Name	Default value	Value range	Description
b9-00 (F4-00)	Terminal start/ stop module A/ B selection	0	0: Module A 1: Module B Other: B connector	Select the terminal module based on the setpoint. The value 0 indicates terminal module A, and the value 1 indicates terminal module B. 0: Module A - The terminal start/stop module A is selected. 1: Module B - The terminal start/stop module B is selected. Other: B connector. The source of this parameter value is B connector. You can select B connector through the pop-up window.

Note: b9-00 is mapped to F4-00 in group F. These two sets of parameters are equivalent.

In default state, the terminal start/stop module A is activated by default. Terminal module A is used as an example in this section if no notes are provided.

Operating principles

Set b9-01 [Mode of terminal start/stop module A] or b9-09 [Mode of terminal start/stop module B] to set the control mode of terminal commands. Six terminal command 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.

Param.	Name	Default value	Value range	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	3	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, IN2 for stop 5: IN1P (rising edge) for start, IN2 for stop, and IN3 for direction 6: IN1P (rising edge) for start in forward direction, IN2P (rising edge) for start in reverse direction, and IN3 for stop	Defines the mode of terminal start/stop module A. This parameter is valid for IN1/IN2/IN3 in the terminal function. Options: 0: Disable, which means the mode is invalid, with IN1/IN2/IN3 invalid. 1: IN1 for start In this mode, one DI is connected for setting function IN1 for controlling start/stop of the drive in forward run. 2: IN1 for start and IN2 for direction In this mode, two DIs are connected for setting functions IN1 and IN2. IN1 is used to control start/stop in forward run. IN2 is used to control the operating direction. 3: IN1 for forward start and IN2 for reverse start In this mode, two DIs are connected for setting functions IN1 and IN2. IN1 is used to control start/stop in forward run. IN2 is used to control start/stop in reverse run. The drive stops when both IN1 and IN2 are active. 4: IN1P (rising edge) for start and IN2 for stop In this mode, two DIs are connected for setting functions IN1 and IN2. The rising edge of IN1 is used to control start of forward run. IN2 is used for stop. 5: IN1P (rising edge) for start, IN2 for stop and IN3 for direction In this mode, three DIs are connected for setting functions IN1/IN2/IN3. The rising edge of IN1 is used to control start of forward run. IN2 is used to control stop, and IN3 is used to control the operating direction. 6: IN1P (rising edge) for start in forward direction, IN2P (rising edge) for start in reverse direction, and IN3 for stop In this mode, three DIs are connected for setting functions IN1/IN2/IN3. IN2 is used to control start of reverse run, and IN3 is used for stop.
b9-09 (F4-02)	Mode of terminal start/stop module B	3		

Note: b9-01 and b9-09 are mapped to F4-01 and F4-02 in group F. These two sets of parameters are equivalent.

1. One-wire mode

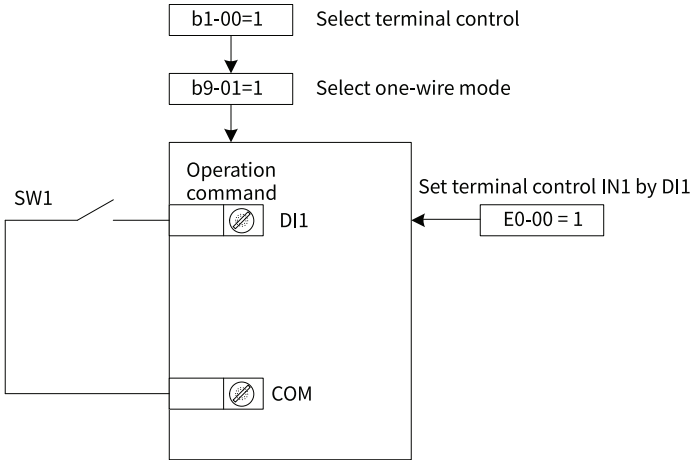
b9-01 [Mode of terminal start/stop module A] = 1 [IN1 for start], with one DI connected for setting function IN1 for operation command control. The following shows how to set parameters for assigning DI1 with operation commands.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	1 [IN1 for start]	In this mode, one DI is connected for setting function IN1 for controlling start/stop of the drive in forward run.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Operation command

Note: b9-01 and E0-00 are mapped to F4-01 and F4-03 in group F. These two sets of parameters are equivalent.

Set E0-00 [DI1 function selection] to 1 [Terminal start/stop module A_IN1] to allow DI1 to control operation commands.

Wiring and parameter setting for one-wire mode is shown in the following figure. When the control switch SW1 closes, the motor runs. When SW1 opens, the motor does not run.



SW1	Operation command
0	Stop
1	Operation

Figure 10-2 Wiring and parameter settings for one-wire mode

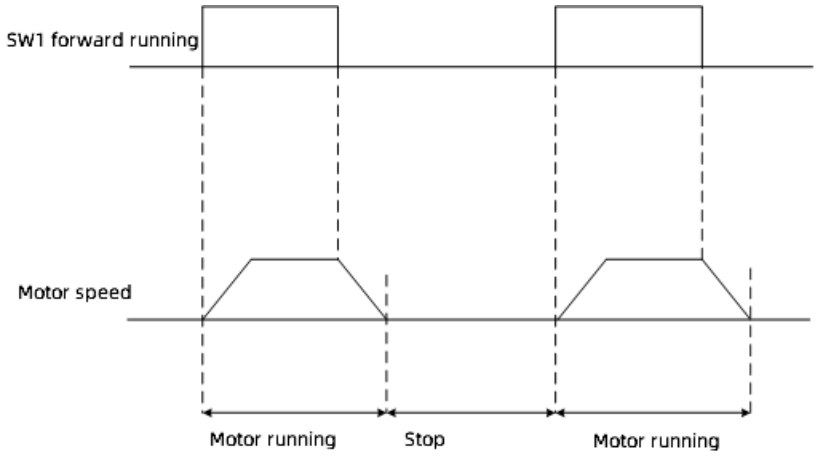


Figure 10-3 One-wire mode sequence

2. Two-wire mode 1

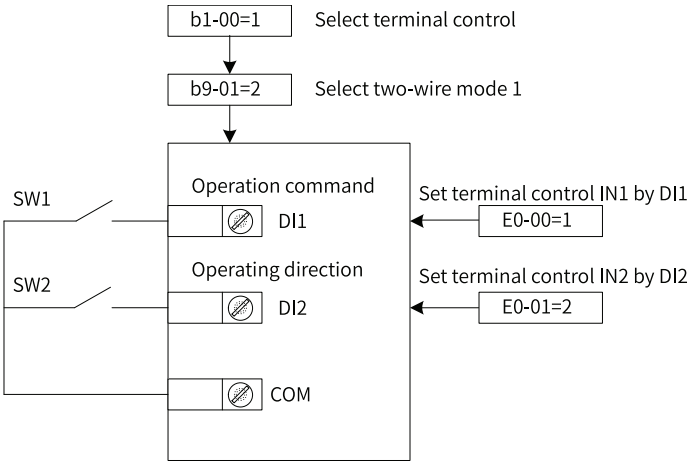
Set b9-01(Terminal start/stop module A mode) to 2 (IN1 for start, IN2 for direction). Connect with two DIs to set functions IN1 and IN2. IN1 is used to control the operation command, and IN2 is used to control the operating direction. The following shows how to set parameters for assigning DI1 with operation commands and DI2 with operating direction.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	2 [IN1 for start, IN2 for direction]	In this mode, two DIs are connected for setting functions IN1 and IN2. IN1 is used to control start/stop in forward run. IN2 is used to control the operating direction.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Operation command
E0-01 (F4-04)	DI2 function	2 [Terminal start/stop module A_IN2]	Operating direction

Note: b9-01, E0-00, and E0-01 are mapped to F4-01, F4-03, and F4-04 in group F. The two sets of parameters are equivalent.

Set E0-00 [DI1 function selection] to 1 [Terminal start/stop module A_IN1] and E0-01 [DI2 function selection] to 2 [Terminal start/stop module A_IN2] to make DI1 control operation commands and DI2 control operating direction.

The following figure shows wiring and parameter setting for two-wire mode 1. When the control switch SW1 closes, the operation is enabled. When SW2 opens, the motor runs forwardly. When SW2 closes, the motor runs reversely. When SW1 opens, the motor does not run regardless of the SW2 state.



SW1	SW2	Operation command
1	0	Forward
1	1	Reverse
0	0	Stop
0	1	Stop

Figure 10-4 Wiring and parameter setting for two-wire mode 1

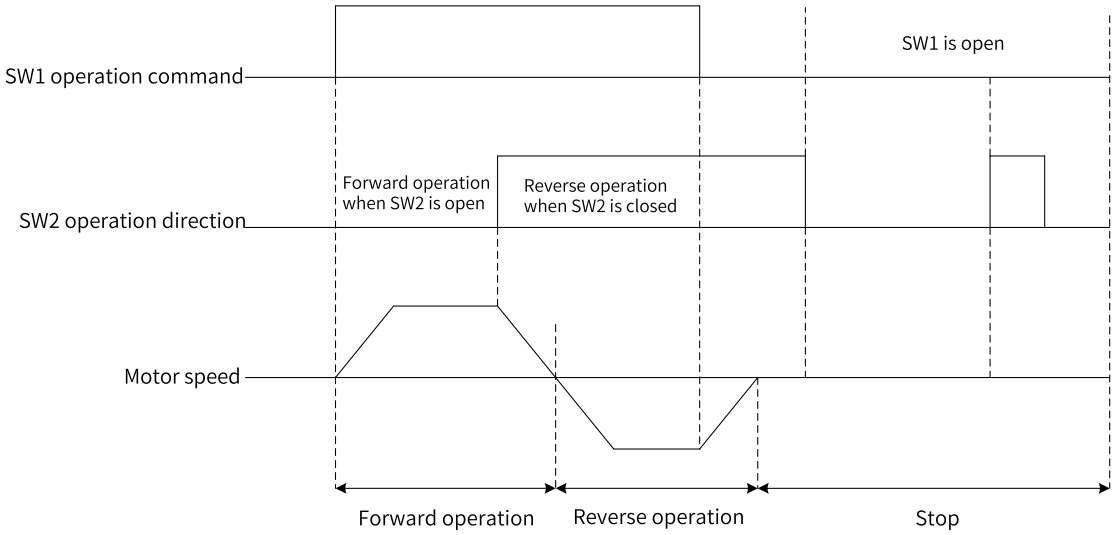


Figure 10-5 Two-wire mode 1 sequence

3. Two-wire mode 2

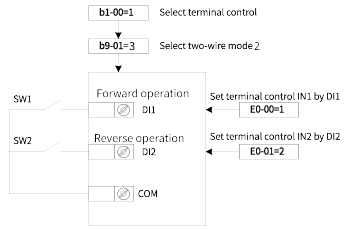
Set b9-01 [Terminal start/stop module A mode] to 3 [IN1 for forward start, IN2 for reverse start] and connect two DIs for setting functions IN1 and IN2. IN1 is used to control the start/stop in forward run. IN2 is used to control start/stop in reverse run. When both IN1 and IN2 are active, the motor stops. The following shows how to set parameters for assigning DI1 with forward run and DI2 with reverse run.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/ stop module A	3 [IN1 for forward start, IN2 for reverse start]	In this mode, two DIs are connected for setting functions IN1 and IN2. IN1 is used to control start/stop in forward run. IN2 is used to control the operating direction.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Forward run
E0-01 (F4-04)	DI2 function	2 [Terminal start/stop module A_IN2]	Reverse run

Note: b9-01, E0-00, and E0-01 are mapped to F4-01, F4-03, and F4-04 in group F. The two sets of parameters are equivalent.

Set E0-00 [DI1 function selection] to 1 [Terminal start/stop module A_IN1] and E0-01 [DI2 function selection] to 2 [Terminal start/stop module A_IN2] to make DI1 control forward run and DI2 control reverse run.

The wiring and parameter setting for two-wire mode 2 are shown in the following figure. In this mode, When SW1 closes, the motor runs forwardly. When SW1 opens, the motor stops. When SW2 closes, the motor rotates reversely. When SW2 opens, the motor stops. When SW1 and SW2 both open or close, the motor stops.



SW1	SW2	Operation command
1	0	Forward
0	1	Reverse
1	1	Stop
0	0	Stop

Figure 10-6 Wiring and parameter setting for two-wire 2

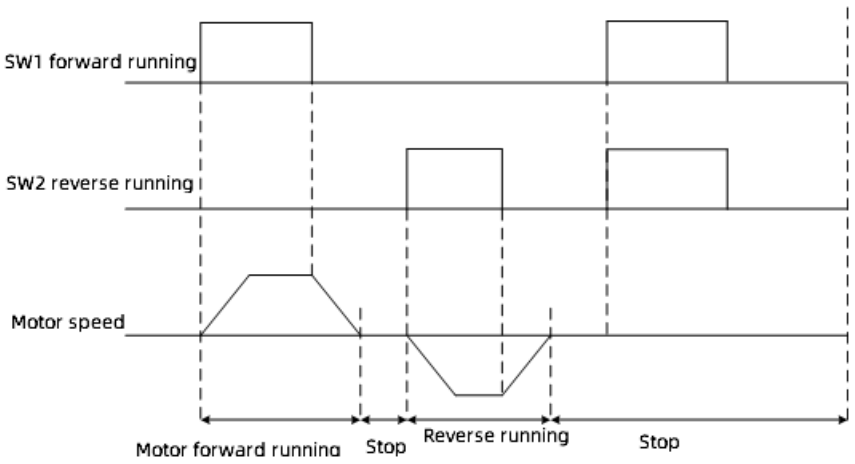


Figure 10-7 Sequence for two-wire mode 2 (in normal conditions)

When the terminal functions are not set correctly, the motor does not run when SW1 closes. When SW1 opens and SW2 closes, the motor does not run. When SW1 and SW2 both open or close, the motor does not run, as shown in the following figure.

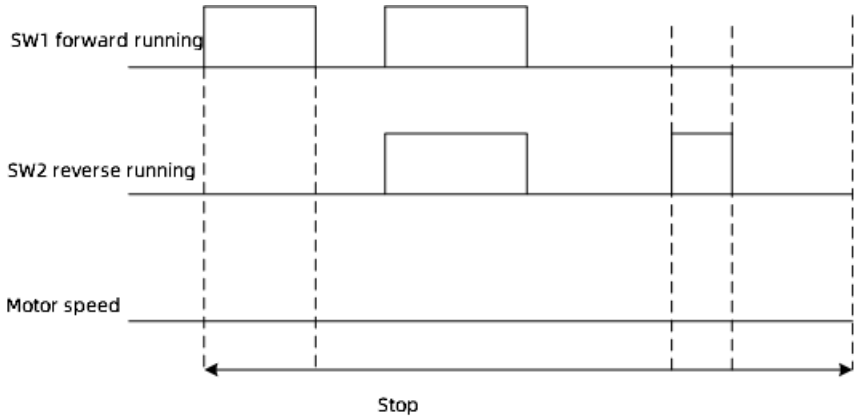


Figure 10-8 Sequence for two-wire mode 2 (in abnormal conditions)

4. Two-wire mode 3

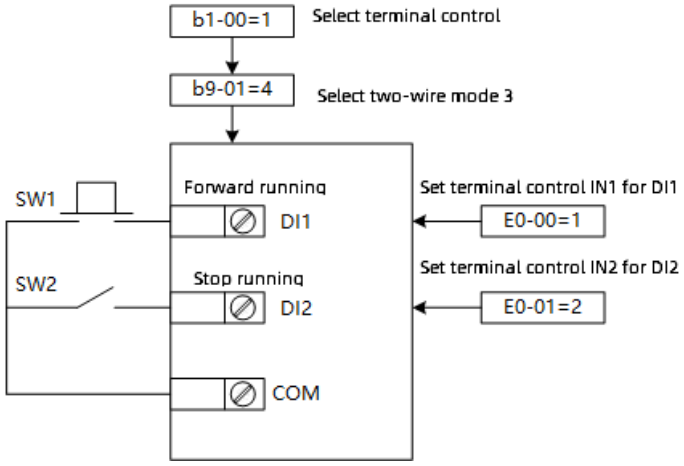
Set b9-01 [Terminal start/stop module A mode] to 4 [IN1P (rising edge) for start, IN2 for stop]. In this mode, two DIs are connected for setting functions IN1 and IN2. The rising edge of IN1 is used for, and IN2 is used for stop. The following shows how to set parameters for assigning DI1 with start and DI2 with stop functions.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	4 [IN1P (rising edge) for start, IN2 for stop]	In this mode, two DIs are connected for setting functions IN1 and IN2. The rising edge of IN1 is used to control forward start, and IN2 is used for stop.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Operation command
E0-01 (F4-04)	DI2 function	2 [Terminal start/stop module A_IN2]	Stop

Note: b9-01, E0-00, and E0-01 are mapped to F4-01, F4-03, and F4-04 in group F. The two sets of parameters are equivalent.

Set E0-00 [DI1 function selection] to 1 [Terminal start/stop module A_IN1] and E0-01 [DI2 function selection] to 2 [Terminal start/stop module A_IN2] to start through DI1 and stop through DI2.

The wiring and parameter setting for two-wire mode 3 are shown in the following figure, in which SW2 is normally closed and SW1 is normally open. When SW1 and SW2 close, the motor runs. When SW2 opens, the motor stops.



SW1	SW2	Operation command
X	0	Stop
0->1	1	Operation

Figure 10-9 Wiring and parameter setting for two-wire mode 3

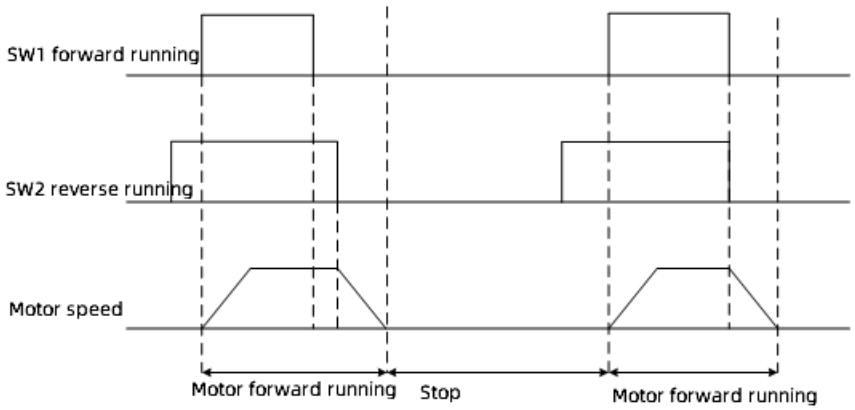


Figure 10-10 Sequence for two-wire mode 3 (in normal conditions)

When the terminal functions are not correctly set, when control switches SW2 and SW1 close, the motor does not execute the start command, as shown below.

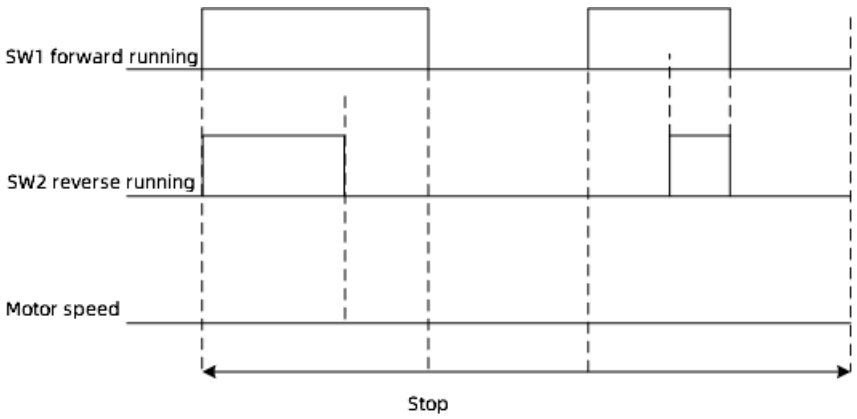


Figure 10-11 Sequence for two-wire mode 3 (in abnormal conditions)

5. Three-wire mode 1

Set b9-01 [Terminal start/stop module A mode] to 5 [IN1P (rising edge) for start, IN2 for stop, and IN3 for direction]. In this mode, three DIs are connected for setting functions IN1/IN2/IN3. The rising edge of IN1 is used to control start of forward run. IN2 is used to control stop. IN3 is used to control the operating direction.

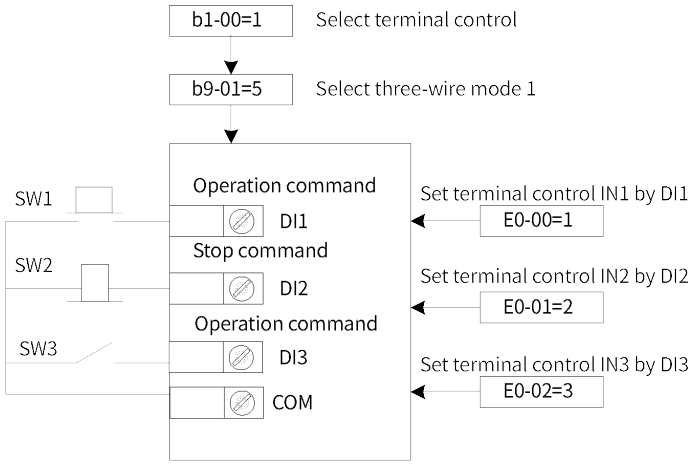
For example, DI1 controls start of forward run, DI2 control the stop function, and DI3 controls the operating direction. The parameters are set as follows.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	5 [IN1P (rising edge) FOR start, IN2 for stop, and IN3 for direction]	In this mode, three DIs are connected for setting functions IN1/IN2/IN3. The rising edge of IN1 is used to control forward start. IN2 is used to control the stop function, and IN3 is used to control the operating direction.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Operation command
E0-01 (F4-04)	DI2 function	2 [Terminal start/stop module A_IN2]	Stop
E0-02	D13 function selection	3 [Terminal start/stop module A_IN3]	Operating direction

Note: b9-01, E0-00, and E0-01 are mapped to F4-01, F4-03, and F4-04 in group F. The two sets of parameters are equivalent.

Set E0-00 (DI1 terminal function selection) to 1 (Terminal A control_IN1), E0-01 (DI2 terminal function selection) to 2 (Terminal A control_IN2), and E0-02 (DI3 terminal function selection) to 3 (Terminal A_IN3) to control forward run through DI1, stop through DI2, and operating direction through DI3.

The wiring and parameter setting for three-wire mode 1 are shown in the following figure, in which SW2 is normally closed and SW1/SW3 are normally open. When SW2 and SW1 close, the drive starts to run. If SW3 opens, the motor rotates in the forward direction. If SW3 closes, the motor rotates in reverse direction. The drive stops immediately at the moment when SW2 opens. SW2 must remain closed during normal startup and operation. Commands from SW1 takes effect immediately as soon as SW1 is closes.



SW1	SW2	SW3	Operation command
X	0	X	Stop
0->1	1	0	Forward
0->1	1	1	Reverse

Figure 10-12 Wiring and parameter setting for three-wire mode 1

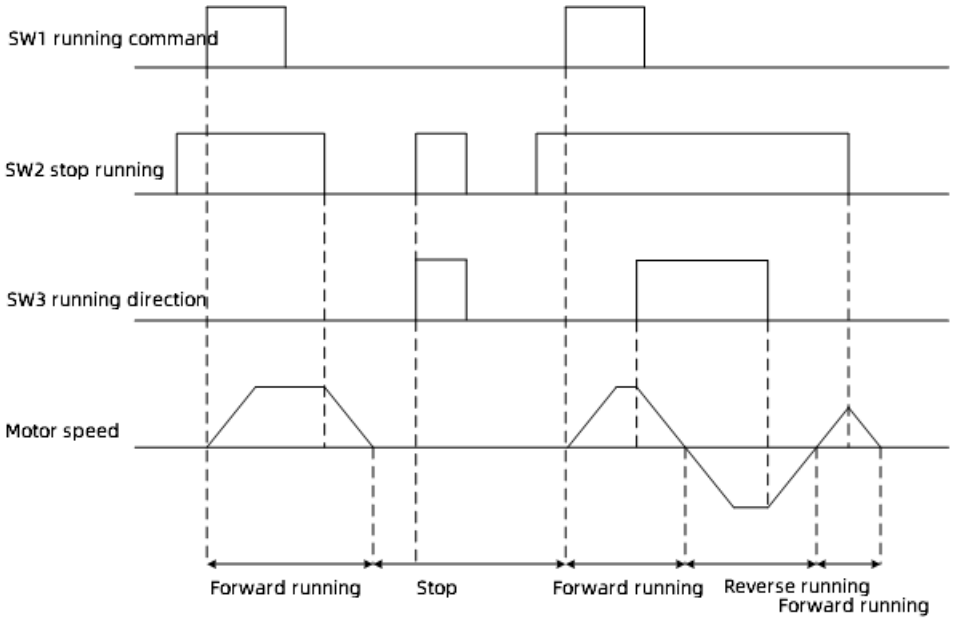


Figure 10-13 Sequence for three-wire mode 1

6. Three-wire mode 2

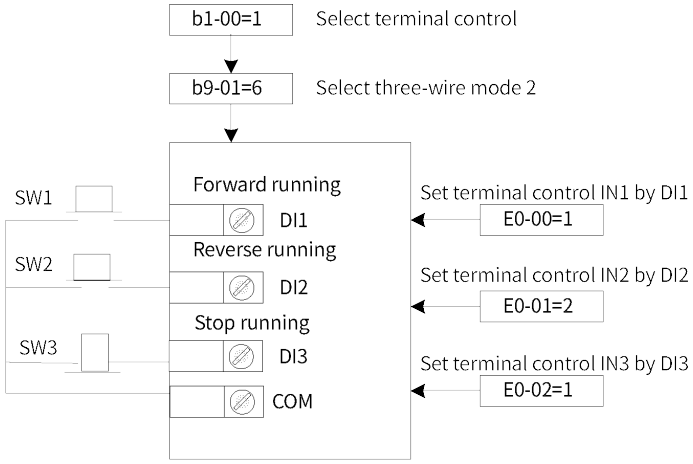
Set b9-01 [Terminal start/stop module A mode] to 6 [IN1P (rising edge) for forward start, IN2 (rising edge) for reverse start, and IN3 for stop]. In this mode, three DIs are connected for setting functions IN1/IN2/IN3. The rising edge of IN1 is used to control start of forward run. The rising edge of IN2 is used to start of reverse run, and IN3 is used for stop. For example, DI1 controls the forward start, DI2 is assigned with reverse start function, and DI3 controls the stop function. The parameters are set as follows.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	6 [IN1P (rising edge) for start, IN2P (rising edge) for reverse start, and IN3 for stop]	In this mode, three DIs are connected for setting functions IN1/IN2/IN3. The rising edge of IN1 is used to control start of forward run, IN2 is used to control start of reverse run, and IN3 is used for stop.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Forward start
E0-01 (F4-04)	DI2 function	2 [Terminal start/stop module A_IN2]	Reverse start
E0-02	D13 function selection	3 [Terminal start/stop module A_IN3]	Stop

Note: b9-01, E0-00, and E0-01 are mapped to F4-01, F4-03, and F4-04 in group F. The two sets of parameters are equivalent.

Set E0-00 (DI1 terminal function selection) to 1 (Terminal A control_IN1), E0-01 (DI2 terminal function selection) to 2 (Terminal A control_IN2), and E0-02 (DI3 terminal function selection) to 3 (Terminal A control_IN3) to control forward run through DI1, reverse run through DI2, and stop through DI3.

The wiring and parameter setting for two-wire mode 2 are shown in the following figure, in which SW3 is normally closed and SW1/SW2 are normally open. If you press SW1 when SW3 closes, the drive runs forwardly. If you press SW2 when SW3 closes, the drive runs reversely. When SW3 opens, the drive stops immediately. SW3 must remain closed during START sequence and during normal RUN operation. Signals from SW1 and SW2 are valid only with SW3 closed.



SW1	SW2	SW3	Operation command
X	X	0	Stop
0->1	X	1	Forward
X	0->1	1	Reverse

Figure 10-14 Wiring and parameter setting for three-wire mode 2

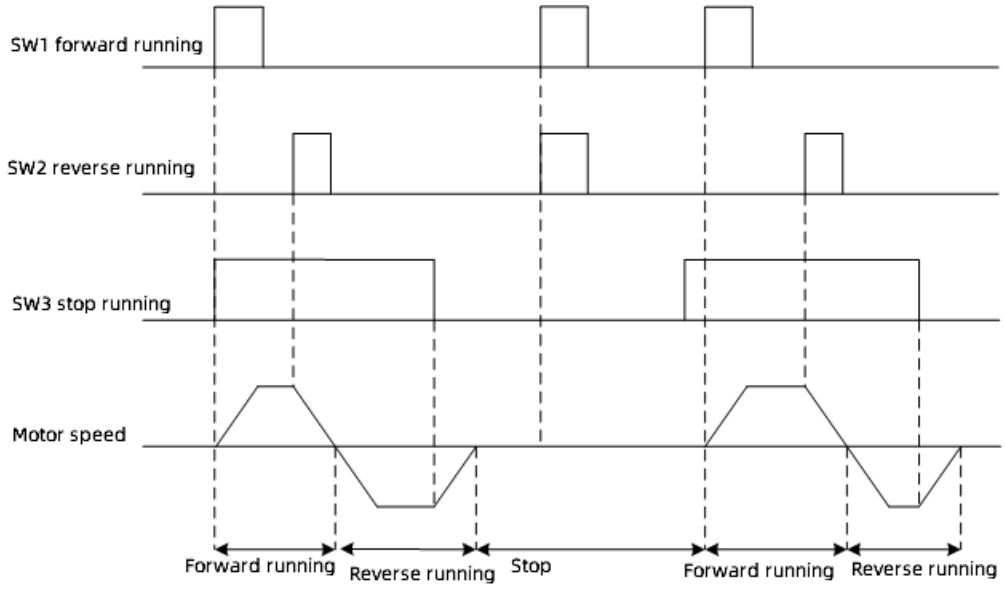


Figure 10-15 Sequence for three-wire mode 2

Application instance

The following shows how to set operation commands through terminals.

- Set b1-00 [Main command source of control channel 1] to 1 [Terminal control].
- Set b9-00 [Terminal start/stop module A/B selection] to 0 [Module A].
- Set b9-01 [Mode of terminal start/stop module A] to 4 [IN1P (rising edge) for start, IN2 for stop].
- Set E0-00 (DI1 function selection) to 1 (Terminal A control_IN1) and E0-01 to 2 (Terminal A control_IN2).

After preceding steps are done, enable DI1 when DI2 is valid. In this case, the drive runs at the set frequency. When DI2 opens, the drive stops immediately.

10.2.5 Control Operation Through Communication

Application scenarios

When implementing remote control of the drive, set b1-00 (Main command source of control channel 1) to 2 (Communication). In this case, the operation command of the drive can be set through communication to achieve start/stop of the drive.

See the table below for communication protocols supported by the drive.

Model	Protocol	Hardware
MD610S	Modbus	MD610S RS485 communication interface (CN3)

Description

The MD610S model supports Modbus communication. You can set related communication parameters in group n2.

Param.	Name	Default value	Value range	Description
n2-00 (Fd-05)	Modbus communication 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	This parameter defines the speed of data transmitted between the host controller and the AC drive. Note: 1. The higher the baud rate, the faster the communication speed. 2. The baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will 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)	This parameter defines the format of Modbus data transmitted between the host controller and the AC drive. Note: Note that the data format of the host controller must be the same as that of the drive. Otherwise, communication can fail.
n2-02 (Fd-07)	Modbus local address	1	1 to 247	Sets the Modbus local address. Note: The local address must be unique and in the range of 1 to 247. This is the prerequisite for point-to-point communication between the drive and the host controller.

Param.	Name	Default value	Value range	Description
n2-03 (Fd-08)	Modbus response delay	2	0 ms to 20 ms (active for Modbus)	This parameter defines the interval from the end of data reception by the AC drive to the start of data transmission to the host controller. Note: If the response delay is shorter than the system processing time, the system processing time prevails. This means that the system processes data and then sends the data to the host controller. If the response delay is longer than the system processing time, the system processes data and waits for the response delay time. After the time elapses, the system sends the data to the host controller.
n2-04 (Fd-09)	Modbus communication timeout time	0	0.0 (inactive) 0.1s~6000.0s	Defines Modbus communication timeout time. 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. This parameter 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 the next communication exceeds the value of n2-04, the system reports a communication fault.

Comm. 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. The following communication addresses are supported by the drive for control commands.

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, write 1 to 7311H to control forward run of the drive.
Control word 1 set through communication	7321H	The value format of 7321H is hexadecimal. The command mapped to each bit is shown below. bit0: ON_OFF1; 0: Stop;1: Run bit1: OFF2; 0: Stop bit2: OFF3; 0: Stop bit3: Running allowed; 1: Enabled bit4: Reset command; 1: Reset bit5: JOG1; 1: Enabled bit6: JOG2; 1: Enabled bit7: Speed inversion; 1: Inverted For example, you can control the start of the drive by writing 0x000F to 7321H.

Application instance

The following takes 7311H as an example to show how to set commands through 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 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.

10.2.6 Setting Operation Commands Through User-Defined Channel

Application scenarios

The AC drive includes user-defined main command source in control channels 1/2. This section takes control channel 1 as an example. By setting b1-00 (Main command source of control channel 1) to 3

(user-defined), you can configure control commands such as start and stop of the AC drive through parameter group b1.

Description

The control commands that can be set in the custom mode are shown below.

- ON_OFF1 (Start/Stop): The value 0 indicates it is inactive and the value 1 indicates it is active. It is generally used together with OFF2 and OFF3 to control the drive. When the OFF2 and OFF3 commands are invalid and no fault exists, the ON_OFF1 command is triggered by the rising edge (0→1). When the stop command is triggered by the falling edge (1→0), the drive stops as defined by d0-04 [OFF1 stop mode].
- OFF2 (Coast to stop): The value 1 indicates it is inactive and the value 0 indicates it is active. It is generally used together with ON_OFF1 and OFF3 to control the drive. 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 in the mode set by d005 (OFF2 stop mode).
- OFF3 (Quick stop): The value 1 indicates it is inactive and the value 0 indicates it is active. It is generally used together with ON_OFF1 and OFF2 to control the drive. 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 in the mode set by d006 (OFF3 stop mode).
- Jog 1 (JOG1): The value 0 indicates it is inactive and the value 1 indicates it is active. When it is active, the drive runs at the frequency set by jog 1.
- Jog 2 (JOG2): The value 0 indicates it is inactive and the value 1 indicates it is active. When it is active, the drive runs at the frequency set by jog 2.
- Speed inversion: The value 0 indicates it is inactive and the value 1 indicates it is active. It controls whether the speed direction of the drive is opposite to the set direction.
- Operation permission: The value 0 indicates it is inactive and the value 1 indicates it is active. It controls whether IGBT of the drive is triggered. After ON_OFF1 is activated, the drive can operate normally only when the operation enable command is set to 1.
- Fault reset: The value 0 indicates it is inactive and the value 1 indicates it is active. When a fault occurs on the drive, the fault reset command is triggered upon the rising edge (0→1).

The default settings for the above custom control commands are as follows.

Custom command	Setpoint
ON_OFF1 (start/stop)	0: The start command is triggered upon the rising edge (0→1).
OFF2 (Coast to stop)	1: The stop command of OFF2 is inactive.
OFF3 (Quick stop)	1: The stop command of OFF3 is inactive.
Jog 1	0: The jog 1 command is inactive.
Jog 2	0: The jog 2 command is inactive.
Speed inversion	0: Speed direction complies to the set direction.
Operation permission	1: The drive is allowed to run.
Fault reset	0: The fault reset command is inactive.

The user-defined start/stop commands in the AC drive include ON_OFF1, OFF2, and OFF3. You can set the values of ON_OFF1, OFF2 and OFF3 to enable the start/stop control of the AC drive. The following table describes the user-defined start/stop commands.

Table 10–1 Description of custom start/stop commands

Operation mode	Command type	Setpoint	Result
Start	Normal Start	ON_OFF1: 0→1	The drive starts normally.
		OFF2: 1	
		OFF3: 1	
Stop	OFF1 stop command	ON_OFF1: 1→0	The drive stops according to the OFF1 setting. The OFF1 stop mode includes decelerate to stop, coast to stop, and stop with maximum capacity.
		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→0	
		OFF3: 1	
	OFF3 stop command	ON_OFF1: 1	The drive stops according to the OFF3 setting. The OFF3 stop mode includes quick stop and stop with maximum capacity.
		OFF2: 1	
		OFF3: 1→0	

Related parameters

Param.	Name	Default value	Value range	Description
b1-00	Main command source of control channel 1	0	0: Operating panel 1: Terminal 2: Communication 3: Custom	Defines the main command source of control channel 1. Options: 0: Operating panel - The main command of control channel 1 is set through the LED operating panel. 1: Terminal - The main command of control channel 1 is set through the terminal. 2: Communication - The main command of control channel 1 is set through communication. 3: Custom - The main command source of control channel 1 is custom control. The control commands can be set by b1-01 to b1-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).
b1-01	Custom ON_OFF1 (start/stop) source	0	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the custom ON_OFF (start/stop) source. Bit signal = 0 indicates this function is inactive. Bit signal = 1 indicates OFF1 start/stop is active. Options: 0: Inactive. This function is inactive. 3 to 7: DI1 to DI5. Whether this function is active depends on the DI terminal state. Other: B connector - Depends on the B connector. You can select the B connector through the pop-up window.

Param.	Name	Default value	Value range	Description
b1-02	User-defined OFF2 (coast to stop) source 1	1	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the custom OFF2 (coast to stop) source 1. Bit signal = 0 indicates OFF2 stop is active. Bit signal = 1 indicates this function is inactive. Options: 0: Active. OFF2 (Coast to stop) is active. 1: Inactive - OFF2 (Coast to stop) is inactive. 3 to 7: DI1 to DI5. Whether this function is active depends on the DI terminal state. Other: B connector - Depends on the B connector. You can select the B connector through the pop-up window. Note:There are three sources for OFF2 (coast to stop) of control channel 1: b1-02, b2-00, and b2-01. If any one of the sources is active, OFF2 (coast to stop) command is active.
b1-03	User-defined OFF3 (quick stop) source 1	1	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the custom OFF3 (quick stop) source 1. Bit signal = 0 indicates OFF3 stop is active. Bit signal = 1 indicates this function is inactive. Options: 0: Active. OFF2 (Coast to stop) is active. 1: Inactive - OFF2 (Coast to stop) is inactive. 3 to 7: DI1 to DI5. Whether this function is active depends on the DI terminal state. Other: B connector - Depends on the B connector. You can select the B connector through the pop-up window. Note: There are three sources of OFF3 (quick stop) of control channel 1: b1-03, b2-02, and b2-03. If any one of the sources is active, OFF3 (quick stop) command is active.
b1-04	User-defined operation permission source	1	0: Operation inhibited 1: Operation allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the custom operation permission source. Bit signal = 0 indicates operation is not allowed. Bit signal = 1 indicates operation is allowed. Options: 0: Operation inhibited 1: Operation allowed 3 to 7: DI1 to DI5. Whether this function is active depends on the DI terminal state. Other: B connector - Depends on other B connectors, which can be selected through the pop-up window.

Param.	Name	Default value	Value range	Description
b1-05	User-defined fault reset command source 1	0	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the custom fault reset source 1. Bit signal = 0 indicates this function is inactive. Bit signal = 1 indicates this function is active. Options: 0: Inactive - Indicates that the reset is inactive. 1: Active - Indicates that the fault reset command is active, and the fault can be reset. 3 to 7: DI1 to DI5. Whether this function is active depends on the DI terminal state. Other: B connector - Depends on the B connector, which can be selected through the pop-up window. Note: There are three sources of user-defined fault reset for control channel 1: b1-05, b2-04, and b2-05. When any of these sources is active, and the user-defined fault reset command is valid.
b1-06	Custom jog 1 command source	0	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the custom jog 1 source. Bit signal = 0 indicates this function is inactive. Bit signal = 1 indicates this function is active. Options: 0: Inactive - Indicates that jog is inactive. 3 to 7: DI1 to DI5. Whether this function is active depends on the DI terminal state. Other: B connector - Depends on other B connectors, which can be selected through the pop-up window.

Param.	Name	Default value	Value range	Description
b1-07	Custom jog 2 source	0	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the custom jog 2 source. Bit signal = 0 indicates this function is inactive. Bit signal = 1 indicates this function is active. Options: 0: Inactive - Indicates that jog is inactive. 3 to 7: DI1 to DI5. Whether this function is active depends on the DI terminal state. Other: B connector - Depends on the B connector, which can be selected through the pop-up window.
b1-08	User-defined speed inversion source	0	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the custom speed inversion source. Bit signal = 0 indicates the speed is not inverted. Bit signal = 1 indicates the speed is inverted. Options: 0: Invalid. Speed inversion is invalid. 1: Active - Speed inversion is active. 3 to 7: DI1 to DI5. Whether this function is active depends on the DI terminal state. Other: B connector - Depends on other B connectors, which can be selected through the pop-up window.

Application instance

1. Set F0-03 [Main command source of control channel 1] to 3 [Custom] to set custom control as the command source.
2. Set b1-01 [Custom ON_OFF1 (start/stop) source] to 3 [DI1].
3. Set E0-00 [DI1 terminal function selection] to 0 [No function].
4. Set b1-02 (Custom OFF2 (Coast to stop) source 1) to 1 (Invalid) and b1-03 (Custom OFF3 (Quick stop) source 1) to 1 (Invalid).

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.

10.3 Frequency Reference

10.3.1 Setting Channel and Frequency Reference

The drive provides two channels for setting the motor frequency reference, which can change the motor operation state. Parameter group b5 corresponds to the setting channel 1, and group b6 corresponds to the setting channel 2.

You can select the active setting channel through b0-03 (Setting channel selection) to set the motor frequency reference, thereby changing the motor running status.

Select different set channels to switch between two different frequency references and dynamically change the frequency reference source.

Channel 1 (b0-03 = 0): Set the main frequency source through b5-00 and the auxiliary frequency source through b5-02.

Channel 2 (b0-03 = 1): Set the main frequency source through b6-00 and auxiliary frequency source through b6-02.

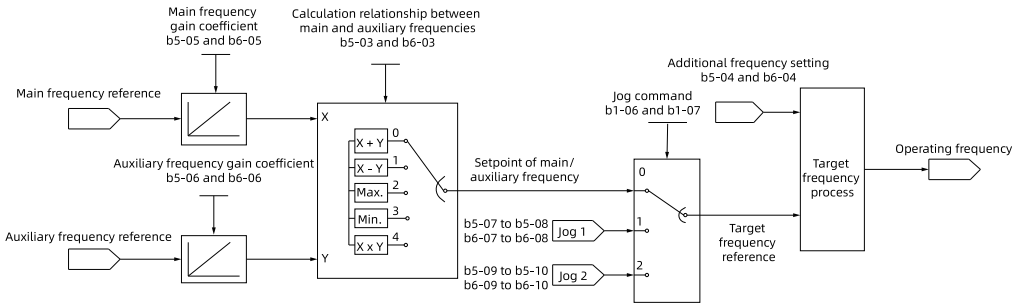


Figure 10-16 Setting channel flowchart

Type	Description	Link
Set the main and auxiliary frequencies.	Main frequency reference x Main frequency setting gain coefficient = Effective main frequency reference. Auxiliary frequency reference x Auxiliary frequency reference gain coefficient = Effective auxiliary frequency reference. After the operation of the valid main frequency reference and valid auxiliary frequency reference, the value serves as the input of the ramp function generator. After the acceleration/deceleration time, the actual frequency reference is generated. Sometimes, a frequency regulation reference that is enabled directly without acceleration/deceleration time is required for the process. The system provides a supplementary frequency reference, which is enabled only during running. It is added to the ramp function generator (RFG) output frequency when it is being enabled.	*"10.3.2.1 Selecting the Main Frequency Reference Source" on page 299* *"10.3.3 Selecting the Auxiliary Frequency Reference Source" on page 337* *"10.3.4 Selecting Source of Main Frequency and Auxiliary Frequency Superposition" on page 342*
Set Jog Frequency	Each channel has two jog frequencies. Jog frequency 1 is valid only when jog command 1 is active. Jog frequency 2 is valid only when jog command 2 is active.	*"10.3.5 Setting Jog Frequency and Additional Frequency" on page 343*
Set the additional frequency.	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.	

Related parameters

Param.	Name	Default value	Value range	Description
b0-03	Setting channel selection	0	0: Setting channel 1 1: Setting channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the active setting channel. The setpoint 0 indicates the setting channel 1. The setpoint 1 indicates the setting channel 2. **Value description:** 0: Inactive - Channel 1 applies. 1: Active - Channel 2 applies. 3 to 9: DI1 to DI5. Whether this function is active depends on the DI terminal state. The setpoint 0 indicates the value is invalid. The setpoint 1 indicates the value is valid. Other: B connector - The selection depends on B connector. You can select B connector through the pop-up window. The setpoint 0 indicates the value is invalid. The setpoint 1 indicates the value is valid. **Note:** 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	Value range	Description
F0-29 (b5-00)	Main frequency source	0: F0-30	0: Parameter setting 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC Continued	Defines the main frequency source. **Value description:** 0: b5-01 or b6-01. The frequency is the value of b5-01 or b6-01 (Digital setting of main frequency). The frequency can be changed by using the ▲ and ▼ keys on the keypad or using the multi-function input terminals as the UP/DOWN keys. When the AC drive is restarted, whether the frequency adjusted through the UP/DOWN keys is saved depends on the setting of [Retain values set by using UP/DOWN keys]. When the DI serves as the UP/DOWN keys, you can clear the value changed by the UP/DOWN keys through the DI. • When the main frequency source is set to 0, the value of this parameter in units of Hz is used as the main frequency reference. • When the main frequency 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]. 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 DI5. 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 frequency references. Continued

Param.	Name	Default value	Value range	Description
b6-00	Main frequency source	0: b6-01	Continued 8: PID 9: Communication 10: MD-BP-M potentiometer Other: F connector	Continued 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 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 main frequency is set through PID. 9: Communication The main frequency is set through communication. The frequency can be set through remote communication. 10: Potentiometer MD-BP-M The main frequency is set through the potentiometer MD-BP-M. **Note:** The addresses for the 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 setpoint is defined by n0-13. When the frequency is written through communication by using address 0x7310, the setpoint is defined by n0-14.

Caution

F0-29 is mapped from b5-00, and these two parameters are equivalent.

10.3.2 Selecting the Set Channel

10.3.2.1 Selecting the Main Frequency Reference Source

Function description

There are multiple main frequency reference sources including digital setting, AI1, AI2, pulse input, multi-reference, simple PLC, PID, communication, and F connector. You can select the source through b5-00 and b6-00.

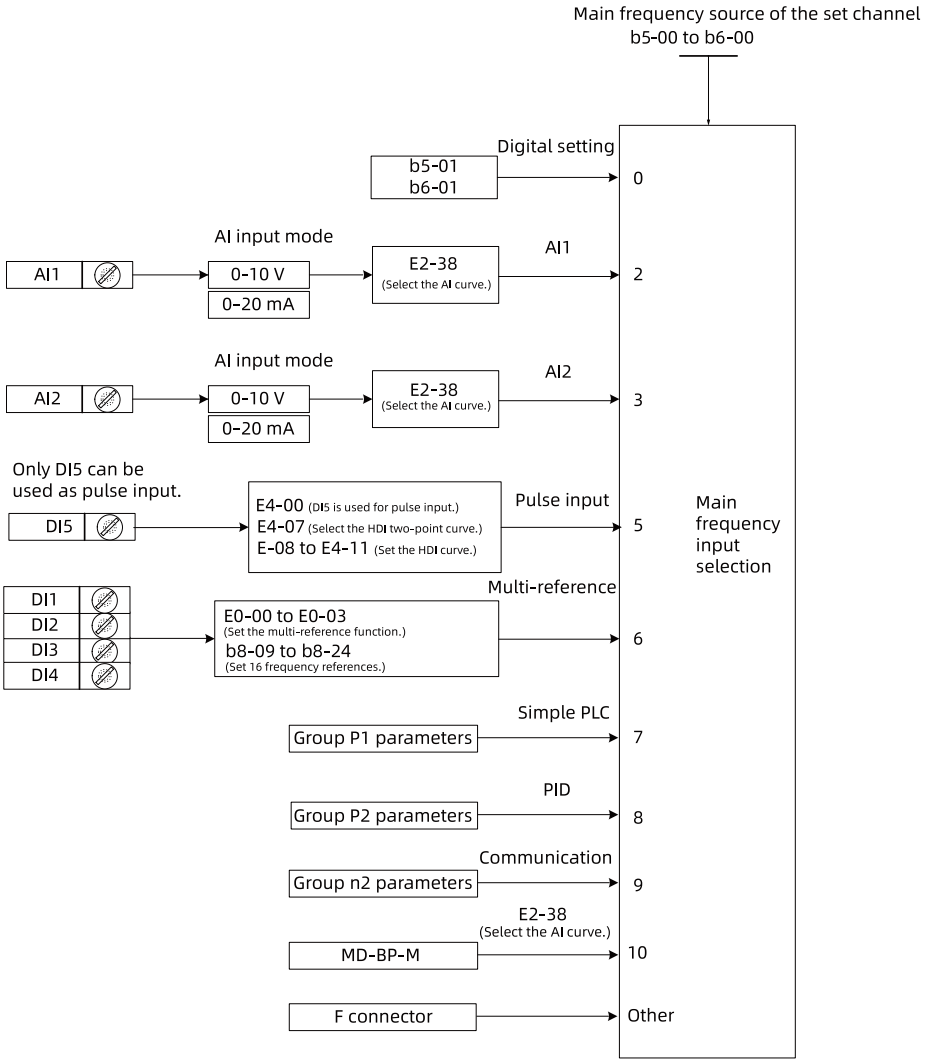


Figure 10-17 Diagram of main frequency source selection

Related parameters

Table 10–2 Parameters for setting main frequency source

Param.	Name	Default value	Value range	Description
b5-00 (F0-29)	Main frequency source	0: b5-01	0: Parameter setting 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC Continued	Defines the main frequency source of the setting channel 1. **Value description:** 0: b5-01 or b6-01. The frequency is the value of b5-01 or b6-01 (Digital setting of main frequency). You can change the frequency reference of the drive by the ▲ and ▼ keys on the operating panel (or the multi-function input terminal serving as the UP/DOWN key). When the drive is powered on again after power failure, whether the frequency adjusted by using UP/DOWN keys or multi-functional input terminal functioning as the UP/DOWN key is saved depends on the value of P0-89 [UP/DOWN retention upon power failure]. When the DI serves as the UP/DOWN keys, you can clear the value changed by the UP/DOWN keys through the DI. 2: AI1. The frequency reference 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 frequency reference is input by the current or voltage signal through AI2. The corresponding frequency value is calculated according to the preset AI curve. 5: HDI pulse. The frequency 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 - In the multi-reference mode, combinations of different DI terminal states correspond to different frequency reference. 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. Continued

Param.	Name	Default value	Value range	Description
b6-00	Main frequency source	0: b6-01	Continued 8: PID 9: Communication 10: MD-BP-M potentiometer Other: F connector	Continued 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. 10: Potentiometer MD-BP-M The main frequency is set through the potentiometer MD-BP-M. Other: F connector After the parameter No. of a floating connector is set, the connector value is read as the frequency. It is used for extension of common sources. **Note:** The addresses for the 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 setpoint is defined by n0-13. When the frequency is written through communication by using address 0x7310, the setpoint is defined by n0-14.

When the main frequency source is set to "0: Digital reference", the value of b5-01 or b6-01 in units of Hz is used as the main frequency reference source.

When the main frequency 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].

10.3.2.2 Setting Main Frequency Through Parameter

Description

When b5-00 (Main frequency source) is set to 0 (b5-01), the main frequency reference of the drive can be input through b5-01 (Digital reference of main frequency) in units of Hz.

Related parameters

Param.	Name	Default value	Value range	Description
F0-30 (b5-01)	Digital reference of main frequency	50.00 Hz	0.00 Hz to A2-17	Defines the target frequency. This parameter is active when the main frequency source is set to a parameter. b5-01 and F0-30 have the same function. b5-01 changes automatically along with F0-30.

Application instance

When F0-30 or b5-01 [Digital reference of main frequency] is set to 30 Hz, the frequency reference of the drive is 30 Hz.

10.3.2.3 Setting the Main Frequency Through Operating Panel

Description

The drive supports the built-in operating panel. You can set the main frequency of the drive by pressing the key on the operating panel.

Related parameters

Param.	Name	Default value	Value range	Description
F0-30 (b5-01)	Digital reference of main frequency	50.00 Hz	0.00 Hz to A2-17	Defines the target frequency. This parameter is active when the main frequency source is set to a parameter. b5-01 and F0-30 have the same function. After F0-30 is modified, b5-01 is automatically synchronized.
P0-87	Base frequency for target frequency adjusted by UP/DOWN key during operation	0	0: Operating frequency 1: Frequency reference	Defines the frequency base adjusted by UP/DOWN key during operation. Options: 0: Operating frequency - When the target frequency is adjusted by UP/DOWN key, it increases or decreases based on the operating frequency. 1: Set frequency - When the target frequency is adjusted by UP/DOWN key, it increases or decreases based on the set frequency.

Param.	Name	Default value	Value range	Description
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 is retentive when the drive stops. Options: 0: Non-retentive - Set b5-01 and b6-01 [Digital reference of main frequency] through the operating panel, then adjust the frequency using the ▲ and ▼ keys on the operating panel or the UP and DOWN terminals. After the drive stops, the adjusted frequency is cleared. 1: Retentive - Set b5-01 and b6-01 [Digital reference of main frequency] through the operating panel, then adjust the frequency using the ▲ and ▼ keys on the operating panel or the UP and 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: Active	Defines whether the frequency corrected by UP/DOWN is retentive upon power failure. Options: 0: Not enabled - Set b5-01 and b6-01 [Digital reference of main frequency] through the operating panel, then adjust the frequency using the ▲ and ▼ keys on the operating panel or the UP and DOWN terminals. The adjusted frequency is cleared upon power-off. 1: Enable - Set b5-01 and b6-01 (Digital reference 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.

Application instance

You can set the frequency by modifying the parameters or modifying the frequency by pressing the UP/DOWN key on the operating panel.

- Modifying frequency reference through operating panel

  1. After switch-on, press to enter the parameter setting interface, and then press , , and to locate b0-03 (Setting channel selection) and set it to 0. Finally, press to confirm the settings.
  2. Locate b5-00 [Main frequency source] and set it to 0 (b5-01).
  3. Locate b5-01 [Digital reference of main frequency] and set it to 20.00. 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.

- Press UP/DOWN key to modify the frequency value.
  Set the main frequency source to a parameter through the operating panel, and set the frequency to 20.00 Hz.

  For example, modify the frequency references quickly when the drive is at a standstill through and or terminals serving as UP and DOWN keys. The following shows how to correct the frequency of 20.00 Hz to 19.99 Hz or 20.01 Hz through the operating panel.

  1. For intuitive display, make the operating panel LED flash, as shown in .
  2. Click . The operating panel flashes, displaying .
  3. On the basis of 19.99 Hz, click twice to make the LED flash.

     To make the frequency reference corrected by the UP/DOWN key to be restored at next power-on, set P0-89 [UP/DOWN retention upon power failure] to "1: Enable".

     During trial run of the drive, modify the frequency reference quickly through and or terminals serving as UP and DOWN keys.

  During acceleration from 0.00 Hz to 20.00 Hz, when the drive reaches 10.00 Hz, you can change the current target frequency through and . The operation procedure is as follows.

  1. Set P0-87 [UP/DOWN base during operation] to "0: Operating frequency" through the operating panel.
  2. For intuitive display, make the operating panel display the current operating frequency.
  3. Run the drive. When the operating frequency reaches 10.00 Hz, press the key once. When the frequency displayed on the operating panel is kept at 10.01 Hz and acceleration is deactivated, click the key once to make the operating panel keep displaying 10.02 Hz.

You can set whether the frequency reference corrected by UP/DOWN during operation is retained at stop through P0-88[UP/DOWN retention at stop]. To retain the frequency, set P0-88 [UP/DOWN retention at stop] to 1 [Retentive] and P0-89 [UP/DOWN retention power failure] to 1 [Retentive].

10.3.2.4 Setting Frequency Through AI

Description

This control board of the AC drive provides two voltage/current type analog input terminals, namely AI1 and AI2. In this case, when b5-00 and b6-00 are set to 2, AI1 is used to set the main frequency; when b5-00 and b6-00 are set to 3, AI2 is used to the main frequency.

As a frequency source, each AI terminal supports five types of AI curves. The AI curve is used to define the relationship between the analog input voltage (or current) and the corresponding setting.

Procedure

Step	Related parameters	Description
(Step 1) AI curve setting method: Set the relationship between the AI voltage input and the set value.	E2-40 to E2-43	Curve 1 setting
	E2-44 to E2-47	Curve 2 setting
	E2-48 to E2-51	Curve 3 setting
	E2-52 to E2-59	Curve 4 setting
	E2-60 to E2-67	Curve 5 setting
	E2-39	AI lower limit selection
	A2-04	When the AI is used as the frequency reference source, the value 100% of the voltage input corresponds to the value of A2-04 (Per-unit frequency base value). **Note:** The base value of the per-unit frequency is the rated frequency of the motor. If the base value of the per-unit frequency is 50.00 Hz and the AI input voltage is 5 V, and the AI curve percentage is 50%, the actual set frequency is 25 Hz (50.00 Hz x 50%).
(Step 2) AI curve selection method: Select the curve for the AI terminal and set the filter time.	E2-38	This parameter is used to select the AI curve. You can select any AI curve for an AI. The default value 0x21 of E2-38 is used. That is, select curve 1 for AI1 and curve 2 for AI2.
	E2-10	AI1 filter time:
(Step 3) AI as frequency source: Select the AI as the frequency source based on terminal characteristics.	b0-03	Set the main frequency source; Set b5-00 to 2 select AI as the main frequency source. Select voltage input or current input for AI1 via the DIP switch S4 on the control board. Select voltage input or current input for AI2 via the DIP switch S2 and S3 on the control board.
	b5-00	

- **Curve setting methods**

  There are five types of AI curves in total. Curves 1, 2, and 3 are two-point curves, while curves 4 and 5 are four-point curves. The related parameters are E2-40 to E2-67.

  Take the setting method for AI curve 1 as an example. The related parameters are E2-40 to E2-43.

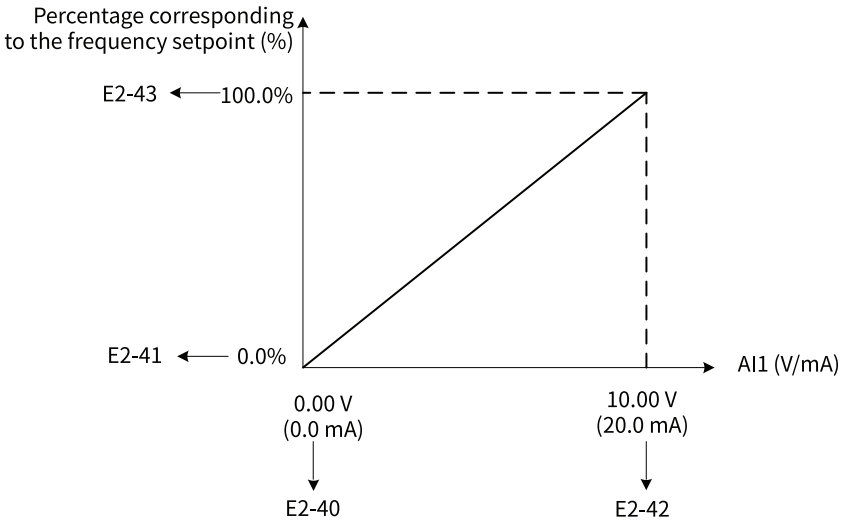


Figure 10-18 Setting AI curve 1

When AI is used as the frequency reference source, the percentage of the voltage/current input is relative to A2-04 (Per-unit frequency base value). When the analog current input is used, 0 mA to 20 mA current corresponds to 0 V to 10 V voltage. For example, if voltage-type AI1 is used as the frequency reference with the input range of 0–10 V, when the input is 5 V, the frequency reference is 50 x (A2-04). If A2-04 is 50 Hz, the frequency reference is 25 Hz.

Curve 2 and curve 3 are set in a similar way as curve 1. The parameters related to curve 2 are E2-44 to E2-47, and the parameters related to curve 3 are E2-48 to E2-51.

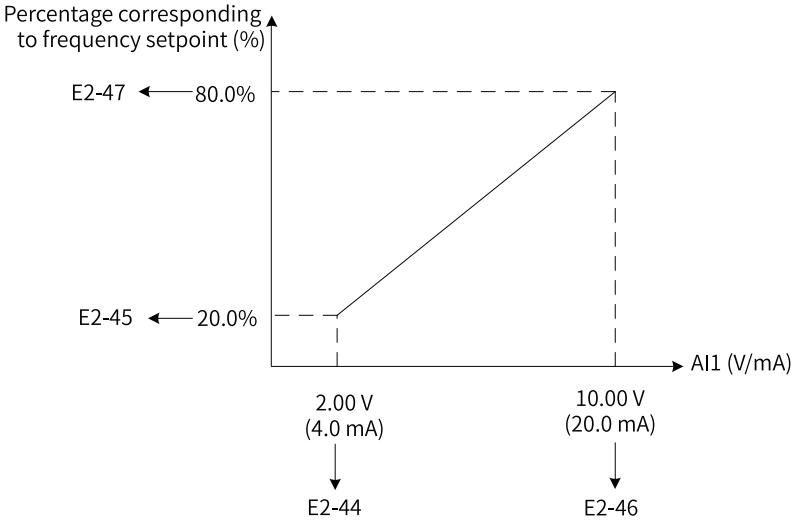


Figure 10-19 Schematic diagram for curve 2 and curve 3

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. The parameters related to curve 4 are E2-52 to E2-59, and the parameters related to curve 5 are E2-60 to E2-67.

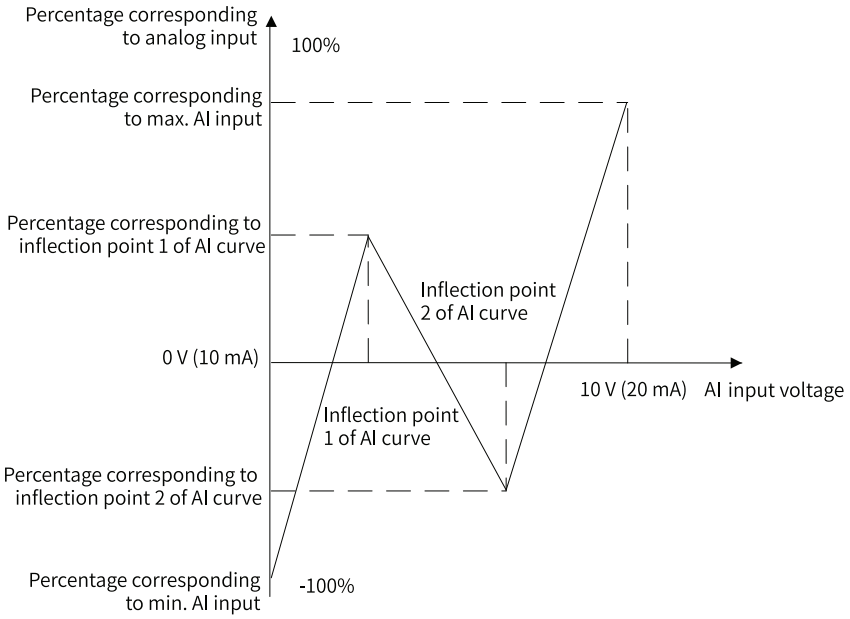


Figure 10-20 Schematic diagram for curve 4 and curve 5

- **Select the AI curve and filtering method for the AI**

  The set curve corresponding to AI1 is selected by the ones place of E2-38, and the set curve corresponding to AI2 is selected by the tens place of E2-38. Each analog input terminal can be assigned any one of the five available curves.

  The AI filter time is set by E2-10. The longer the AI input filter time, the stronger the anti-interference capability, but the slower the adjustment response will be. The shorter the filter time, the quicker the adjustment response, but the weaker the anti-interference capability will be. If the analog signal is prone to interference, increase the filter time to stabilize the detected analog signal. However, increasing the filter time will slow the response speed of analog detection. Set the filter time properly based on actual conditions.

Related parameters

Param.	Name	Default value	Value range	Description
E2-10 (F4-21)	AI1 filter time	0.10s	0.00s to 10.00s	Defines the software filter time of AI1. **Note:** 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.
E2-40 (F4-28)	Minimum input of AI curve 1	0.00 V	-10.00 V to E2-42	Defines the minimum input on the x-axis of the AI curve 1, that is, the minimum analog input voltage (or 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 input, the y-axis represents the percentage to the rated frequency of the motor. 2. There are five types of AI curves. Curves 1 to 3 are two-point curves, which are the minimum input point and the maximum input point. The related parameters are E2-40 to E2-51. Curve 4 and curve 5 are four-point curves, that is, the maximum, minimum, and intermediate two inflection points. The related parameters are E2-52 to E2-67.
E2-41 (F4-29)	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 (F4-30)	Maximum input of AI curve 1	10.00 V	E2-40 to 10.00 V	Defines the maximum input point of x-axis on AI curve 1, namely the maximum analog input voltage (or maximum analog input current). Note: See E2-40 for details.
E2-43 (F4-31)	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.

Application instance

- **AI terminal as main frequency reference source**
  The control board provides two AIs, namely AI1 and AI2. The two AIs support voltage input of 0 V to 10 V or current input of 0 mA to 20 mA. Use the DIP switch S4 on the control board to select voltage input or current input for AI1. Use the DIP switch S2 and S3 to select voltage input or

current input for AI2. The following describes how to set AI1 as the main frequency reference source.

For example, assume that curve 1 is selected for AI1 (the ones place of E2-38 is set to 1) and voltage-type AI1 is used as the main frequency reference source. To make input voltage of 2 V to 10 V be mapped to frequency of 10 Hz to 40 Hz, set as follows.

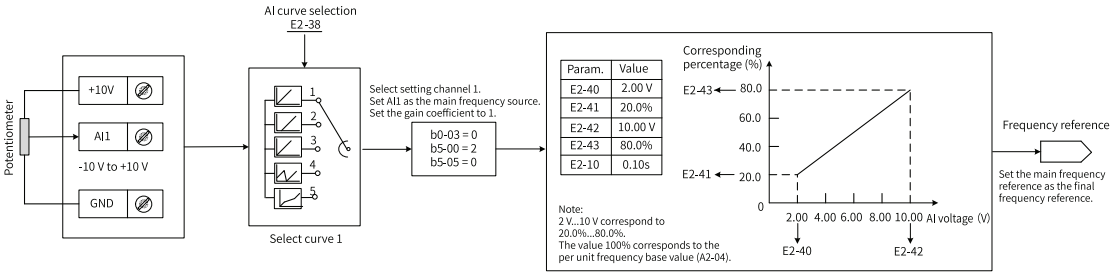


Figure 10-21 Parameter setting for voltage-type AI1 to be used as main frequency reference source

AI1 supports analog voltage input (0 V to 10 V) or analog current input (0 mA to 20 mA).

When AI1 is used for analog current input, input current of 0 mA to 20 mA corresponds to input voltage of 0 V to 10 V. If the input current ranges from 4 mA to 20 mA, current of 4 mA corresponds to voltage of 2 V, and current of 20 mA corresponds to voltage of 10 V.

For example, assume that curve 2 is selected for AI1 (the ones place of E2-38 is set to 2) and current-type AI1 is used as the main frequency reference source. To make input current of 4 mA to 20 mA be mapped to frequency of 0 Hz to 50 Hz, set as follows.

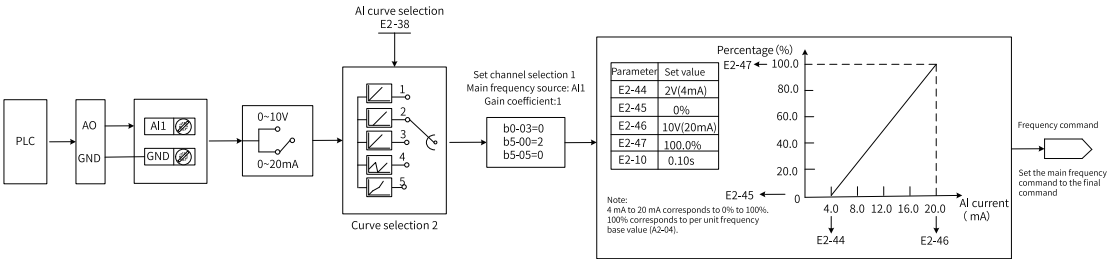


Figure 10-22 Parameter setting for current-type AI1 to be used as main frequency reference source

10.3.2.5 Setting Main Frequency Through Pulse

Application scenarios

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.

Description

Set b5-00 (Main frequency source) to 5 (HDI) to select the input pulse as the main frequency. When the frequency source is HDI pulse input, the pulse reference can only be input from multi-function terminal DI5.

Specifications of pulse reference signal: 15 V to 30 V (voltage) and 0 kHz to 20 kHz (frequency)

You can set the relationship between the percentage and the pulse frequency input from DI5, such as defined by two-point curve and four-point curve. Set the two-point curve through E4-08 to E4-11,

and set the four-point curve through E4-12 to E4-19. For details on setting HDI curves, see *"10.11.6 High-speed digital input (HDI)" on page 470*. This section takes the HDI two-point curve as an example. When pulse input is used as the frequency source, the pulse input 100.0% corresponds to the value of C4-06 (Rated motor frequency).

Related parameters

Param.	Name	Default value	Value range	Description
E4-08 (F4-71)	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: The x-axis of the HDI curve indicates the pulse input frequency, and the y-axis indicates the per-unit percentage corresponding to the pulse input. The meaning is determined by the HDI function selection. For example, if the HDI terminal is selected as the frequency reference, the y-axis represents the percentage to the rated frequency of the motor.
E4-09 (F4-72)	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 2-point curve, that is, the per-unit value in percentage corresponding to the minimum pulse input. Note: See E4-08.
E4-10 (F4-73)	Maximum input of HDI two-point 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. Note: See E4-08.
E4-11 (F4-74)	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: See E4-08.
E4-32 (F4-83)	HDI filter time	0.10	0 to 10.00	The parameter is used to set the HDI software filter time. Note: 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.

Application instance

The basic steps for setting main frequency through HDI pulses are as follows:

1. Set E4-00 (HDI terminal type selection) to 0 (Use as HDI).
2. Select HDI pulse as the source of the main frequency reference of set channel 1 by setting b0-03 to 0 and b5-00 to 5. In this mode, the HDI pulse reference must be obtained from multi-functional input terminal DI5.
3. To 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 E4-10 (Maximum input of HDI two-point curve) to 20 kHz.
   - Set E4-09 (Percentage corresponding to minimum input of HDI two-point curve) to 20.0%.
   - Set E4-11 (Percentage corresponding to maximum input of HDI two-point curve) to 100.0%.

After the preceding steps are completed, when the HDI input is 10 kHz, the main frequency is 50% of the rated motor frequency (C4-06), and the HDI input frequency changes, the running frequency is calculated and changed according to the HDI curve.

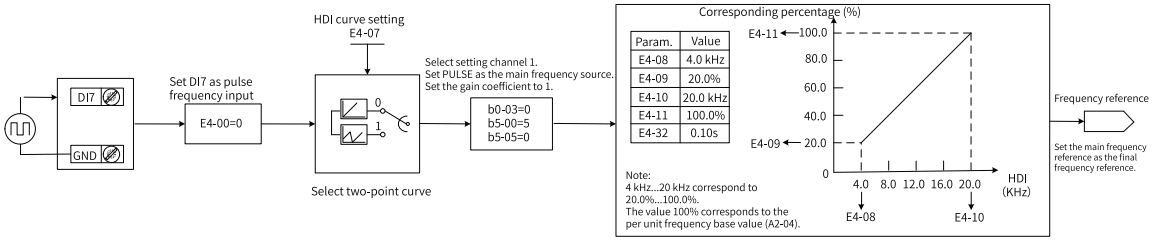


Figure 10-23 Parameters used to set the main frequency through pulse input

10.3.2.6 Setting the Main Frequency by Multi-reference

Application scenarios

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.

Description

Set b5-00 [Main frequency source] to 6 [Multi-reference]. Up to 16 frequency references can be set, which can be selected through b8-03 (Multi-reference selection bit 0) to b8-06 (Multi-reference selection bit 3) or the combinations of input signals from the four DI terminals. You can also set multi-references through fewer than four DIs. In this case, missing digits are populated with 0.

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)

Related parameters

The multi-references are set through parameters in group b8, as listed in the following table.

Table 10–3 Parameters for multi-references

Param.	Name	Default value	Value range	Description
b8-03	Multi-reference selection bit 0	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the source of multi-reference selection bit0. Multi-reference bit1 to bit3 are used together to support 16 multi-references in total. Options: 0: 0 - The value of multi-reference bit0 is 0. 1: 1. The value of multi-reference bit0 is 1. 3 to 7: DI1 to DI5. The value of multi-reference bit0 depends 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. Other: B connector - Depends on the B connector, which can be selected 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. Note: A total of 16 multi-reference 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 bit 1	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Parameter description: Defines the source of multi-reference selection bit1. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit2, and bit3. Options: 0: 0 - The value of multi-reference bit1 is 0. 1: 1 - The value of multi-reference bit1 is 1. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. The setpoint 0 indicates that the multi-reference bit1 is 0. The setpoint 1 indicates that the multi-reference bit1 is 1. Other: B connector - Depending on the B connector The setpoint 0 indicates that the multi-reference bit1 is 0. The setpoint 1 indicates that the multi-reference bit1 is 1.

Param.	Name	Default value	Value range	Description
b8-05	Multi-reference selection bit2	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the source of multi-reference selection bit2. Multi-reference bit0 to bit3 are used together to support 16 multi-references in total. The value description and the note are the same as b8-03.
b8-06	Multi-reference selection bit3	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the source of multi-reference selection bit3. Multi-reference bit0 to bit3 are used together to support 16 multi-references in total. The value description and the note are the same as b8-03.

Param.	Name	Default value	Value range	Description
(b8-08) (F0-38)	Source of multi-reference 0	0	0: F0-39 1: AI1 2: AI2 3: MD-BP-M potentiometer 4: HDI pulse (valid only for MD610S) 5: PID 6: b5-01/b6-01 Others: F connector	Defines the source of multi-reference 0. b5-08 [Source of multi-reference 0] is mapped to F0-38 in group F. The two parameters have the same function. Options: 0: F0-39 - Multi-reference 0 is set by F0-39. 1: AI1. The multi-reference 0 is input by the current or voltage signal through AI1. The multi-reference 0 is calculated according to the preset AI curve. 2: AI2. Multi-reference 0 is input by the current or voltage signal through AI2. The corresponding per-unit value is calculated according to the preset AI curve. 3: MD-BP-M potentiometer The multi-reference 0 is set by the MD-BP-M potentiometer. 4: HDI pulse. The multi-reference 0 is set through the pulse frequency of the DI5. The multi-reference 0 is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 5: PID - Multi-reference 0 is set by PID. 6: b5-01/b6-01 - Multi-reference 0 is set by b5-01/b6-01. The corresponding frequency per-unit value is calculated based on the frequency reference. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the main frequency reference. It is used for extension of common sources. Note: When the value of b8-02 [Multi-reference unit selection] is not 0, the source of multi-reference 0 can only be set to 0 [b8-09], and other setpoints are invalid.

Param.	Name	Default value	Value range	Description
b8-09 (F0-39)	Multi-reference 0	0.00%	b8-42 and b8-43	The source of multi-reference 0 is selected by b8-08, and the other multi-references are set by other parameters. Note: 1. The unit of the multi-reference value is percentage (%). The drive provides four multi-reference terminals (b8-03 to b8-06), which provide 16 states that correspond 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%	b8-42 and b8-43	
b8-11 (F0-41)	Multi-reference 2	0.00%	b8-42 and b8-43	
b8-12 (F0-42)	Multi-reference 3	0.00%	b8-42 and b8-43	
b8-13	Multi-reference 4	0.00%	b8-42 and b8-43	
b8-14	Multi-reference 5	0.00%	b8-42 and b8-43	
b8-15	Multi-reference 6	0.00%	b8-42 and b8-43	
b8-16	Multi-reference 7	0.00%	b8-42 and b8-43	
b8-17	Multi-reference 8	0.00%	b8-42 and b8-43	
b8-18	Multi-reference 9	0.00%	b8-42 and b8-43	
b8-19	Multi-reference 10	0.00%	b8-42 and b8-43	
b8-20	Multi-reference 11	0.00%	b8-42 and b8-43	
b8-21	Multi-reference 12	0.00%	b8-42 and b8-43	
b8-22	Multi-reference 13	0.00%	b8-42 and b8-43	
b8-23	Multi-reference 14	0.00%	b8-42 and b8-43	
b8-24	Multi-reference 15	0.00%	b8-42 and b8-43	

b8-08 to b8-12 are mapped to F0-38 to F0-42 in group F. The two parameter sets are equivalent.

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).

The functions assigned to DI terminals must be different. By default, DI4 is assigned with multi-reference terminal 1.

Table 10–4 Multi-reference input terminal

Param.	Name	Setpoint	Description
E0-00 (F4-03)	DI1 function selection	12	Multi-reference terminal 1
E0-01 (F4-04)	DI2 function	13	Multi-reference terminal 2
E0-02 (F4-05)	DI3 function	14	Multi-reference terminal 3
E0-03 (F4-06)	DI4 function	15	Multi-reference terminal 4

Application instance

In the following figure, DI1, DI2, DI3, and DI4 are used as the multi-reference input terminals, which form a four-bit binary number. The state combinations of these terminals represent different multi-

reference values. When (DI4, DI3, DI2, DI1) = (0, 0, 1, 0), the state combination value is 2, corresponding to the frequency set by b8-11 [Multi-reference value 2]. The target operating frequency is calculated automatically based on b8-11 (Multi-reference 2) x A2-04 (Per-unit base value of frequency). The following figure shows the frequency setting.

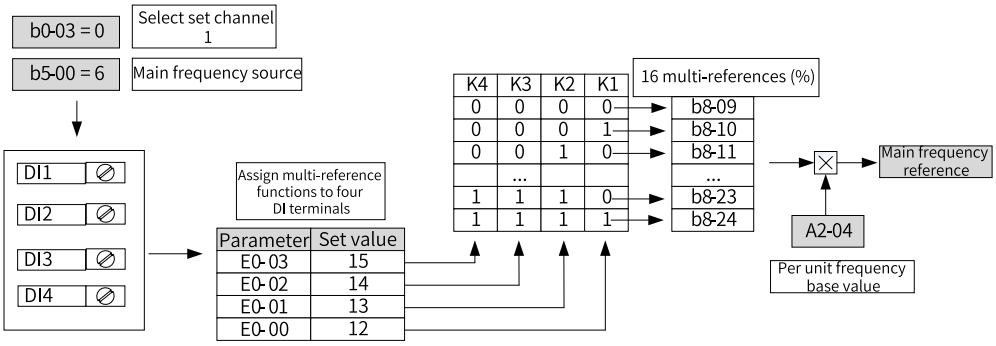


Figure 10-24 Multi-speed mode setting

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

Table 10–5 Description of multi-reference function

K4	K3	K2	K1	Reference	Parameter
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
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

In the preceding section, the multi-reference values are determined by assigning functions to terminals through parameters in group E0. You can also set the multi-reference values through parameters in group b8.

10.3.2.7 Setting Main Frequency Through Simple PLC

Application scenarios

In industrial applications where the AC motor only needs to execute start/stop, timed segment-based speed regulation, and automatic forward/reverse run, you can use the simple PLC to achieve control functions without a PLC.

The simple PLC can directly set the operating speed, direction, and operating time of each phase. It can be used in industrial equipment such as mixture mixing and industrial washing machines. For example, in industrial washing machines, the motor operates cyclically within timed period at different speed and direction.

Function description

Set b5-00 [Main frequency source] to 7 [Simple PLC] to select the PLC as the main frequency source.

Related parameters

Table 10–6 Related parameters

Param.	Name	Default value	Value range	Description
P1-00	Simple PLC module	0	0: Disable 1: Active	Used to enable/disable the simple PLC module. Value description: 0: Disable - The simple PLC module is disabled. The current STEP, current STEP operating time (hours and seconds), and STEP per-unit value of the simple PLC module are cleared. 1: Enable - The simple PLC module is enabled, but whether the calculation and output of the PLC module are normal depends on P1-01.
P1-01	Simple PLC calculation enable source	36978	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the source for enabling simple PLC calculation. Value description: 0: Inactive - The simple PLC calculation function is inactive. 1: Active - The simple PLC calculation function is active. 3 to 7: DI1 to DI5 - Whether simple PLC calculation is enabled depends on the input state of DI1 to DI5. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Other: B connector - Whether the simple PLC calculation function is active depends on the state of the selected B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Note: 1. 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 output per-unit value obtained in the current step. 2. If the simple PLC calculation is disabled, the output current STEP, current STEP operating 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	Value range	Description
P1-02	Simple PLC operation 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 one cycle 3: Output 0 after running for one cycle	Defines the operation mode of the simple PLC. Value description: 0: Keep multi-reference 0 output after running for one cycle - The output of multi-speed reference 0 is maintained after the end of a single cycle of the simple PLC module. 1: Keep final values after running for one cycle - The final value is output after the simple PLC module runs for one cycle. 2: Repeat after running one cycle - The simple PLC module starts running again from the first STEP after completing a cycle. 3: Output 0 after running for one cycle - The PLC STEP per-unit value is output as 0 after the simple PLC module runs for one cycle. Note: 1. If this parameter is set to 0, 1, or 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: Retention upon power failure 0: Non-retentive 1: Retentive Tens: Calculation enable configuration 0: Current STEP retained when calculation deactivated, and recalculated when enabled 1: Current STEP retained when calculation deactivated, and continue when enabled Hundreds to ten thousands: Reserved	Sets the simple PLC function. Value description: Ones: Retention upon power failure 0: Non-retentive upon power failure. The current STEP and the current STEP running time of the simple PLC is not retentive upon power failure. 1: Retentive - The current STEP and current STEP operating time of the simple PLC is saved upon power failure. Tens: Calculation enable configuration 0: If P1-01 is disabled, the current STEP is kept. If P1-01 is enabled, operation starts from STEP0 and the operating time is calculated again. 1: When calculation (P1-01) is disabled, the current STEP is kept. When calculation (P1-01) is enabled, the drive runs from the current STEP and the current operating time continues.

Param.	Name	Default value	Value range	Description
P1-04	Simple PLC status reset	0	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Used to reset the simple PLC status. Value description: 0: Inactive - When the simple PLC state reset is inactive, the simple PLC operates according to the setting. 1: Active - When simple PLC status reset is active, the simple PLC module returns to initial state. The simple PLC outputs the value of multi-speed reference 0 (P1-09) only when the STEP 0 is under execution by simple PLC. 3 to 7: DI1 to DI5. Whether the simple PLC status reset is enabled depends on the input state of DI1 to DI5 terminals. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Others: B connector - Whether the simple PLC state reset function is active depends on the state of the selected B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active.
P1-08	Simple PLC operating time unit	0	0: s (second) 1: h (hour)	Defines the simple PLC operating time unit. Value description: 0: s (second) - The simple PLC operating time is in seconds. 1: h (hour) - The simple PLC operating time is in hours.
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	Operating time of multi-reference 0 set by simple PLC	0	0 to 6553.5s(h) The unit depends on the value of P1-08. If the value is 0, the unit is second. If the value is 1, the unit is hour.	Defines the operating time of multi-reference 0 set by simple PLC, which is the sum of ramp-up/down time and operating time at constant speed and target frequency. Note: It is recommended to set the operating time of multi-reference i in simple PLC to a value higher than the ramp-up/down time.

Param.	Name	De fault value	Value range	Description
P1-11	Ramp-up/down time of multi-reference 0 set by simple PLC	0	0: Ramp-up/down time of ramp 1 (b7-04 [Ramp 1 ramp-up time]/b7-05 [Ramp 1 ramp-down time]) 1: Ramp-up/down time of ramp 2 (b7-10 [Ramp 2 ramp-up time]/b7-11 [Ramp 2 ramp-down time]) 2: Ramp-up/down time of ramp 3 (b7-16 [Ramp 3 ramp-up time]/b7-17 [Ramp 3 ramp-down time]) 3: Ramp-up/down time of ramp 4 (b7-22 [Ramp 4 ramp-up time]/b7-23 [Ramp 4 ramp-down time])	Defines the ramp-up/down time of multi-reference 0 set by simple PLC. Value description: 0: Ramp-up/down time of ramp 1 - The ramp-up/down time of ramp 1 (b7-04/b7-05) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 1: Ramp-up/down time of ramp 2. The ramp-up/down time of ramp 2 (b7-10/b7-11) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 2: Ramp-up/down time of ramp 3 - The ramp-up/down time of ramp 3 (b7-16/b7-17) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 3: Ramp-up/down time of ramp 4- The ramp-up/down time of ramp 4 (b7-22/b7-23) is used as the ramp-up/down 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	Operating time of multi-reference 1 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-14	Ramp-up/down 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
P1-16	Operating time of multi-reference 2 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-17	Ramp-up/down 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	Operating time of multi-reference 3 set by simple PLC	0	Same as P1-10	Same as P1-10

Param.	Name	Default value	Value range	Description
P1-20	Ramp-up/down 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	Operating time of multi-reference 4 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-23	Ramp-up/down 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	Operating time of multi-reference 5 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-26	Ramp-up/down 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	Operating time of multi-reference 6 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-29	Ramp-up/down 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
P1-31	Operating time of multi-reference 7 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-32	Ramp-up/down 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

Param.	Name	De fault value	Value range	Description
P1-34	Operating time of multi-reference 8 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-35	Ramp-up/down 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	Operating time of multi-reference 9 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-38	Ramp-up/down 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	Operating time of multi-reference 10 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-41	Ramp-up/down 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	Operating time of multi-reference 11 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-44	Ramp-up/down time of multi-reference 11 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-45	Multi-reference 12 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-46	Operating time of multi-reference 12 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-47	Ramp-up/down time of multi-reference 12 set by simple PLC	0	Same as P1-11	Same as P1-11

Param.	Name	De fault value	Value range	Description
P1-48	Multi-reference 13 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-49	Operating time of multi-reference 13 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-50	Ramp-up/down 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	Operating time of multi-reference 14 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-53	Ramp-up/down 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	Operating time of multi-reference 15 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-56	Ramp-up/down time of multi-reference 15 set by simple PLC	0	Same as P1-11	Same as P1-11

Application example

The follow shows basic steps to set simple PLC as the main frequency source.

1. Set b0-03 [Setting channel selection] to 0 [Setting channel 1] and b5-00 [Main frequency source] to 7 [Simple PLC] to select simple PLC as the main frequency reference.
2. Set P1-09 [Multi-reference 0 set by simple PLC], P1-12 [Multi-reference 1 set by simple PLC], P1-15 [Multi-reference 2 set by simple PLC], P1-18 [Multi-reference 3 set by simple PLC], P1-21 [Multi-reference 4 set by simple PLC], P1-24 [Multi-reference 5 set by simple PLC], P1-27 [Multi-reference 6 set by simple PLC], P1-30 [Multi-reference 7 set by simple PLC], P1-33 [Multi-reference 8 set by simple PLC], P1-36 [Multi-reference 9 set by simple PLC], P1-39 [Multi-reference 10 set by simple PLC], P1-42 [Multi-reference 11 set by simple PLC], P1-45 [Multi-reference 12 set by simple PLC], P1-48 [Multi-reference 13 set by simple PLC], P1-51 [Multi-reference 14 set by simple PLC], and P1-54 [Multi-reference 15 set by simple PLC]. These 16 multi-reference values correspond to the frequency references of 16 STEPS of simple PLC. 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 STEPS) to define the operating time and ramp-up/down time of STEP 0.

3. Set P1-02 to select the required simple PLC operation mode.
4. Set the ones 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 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 STEP i 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.

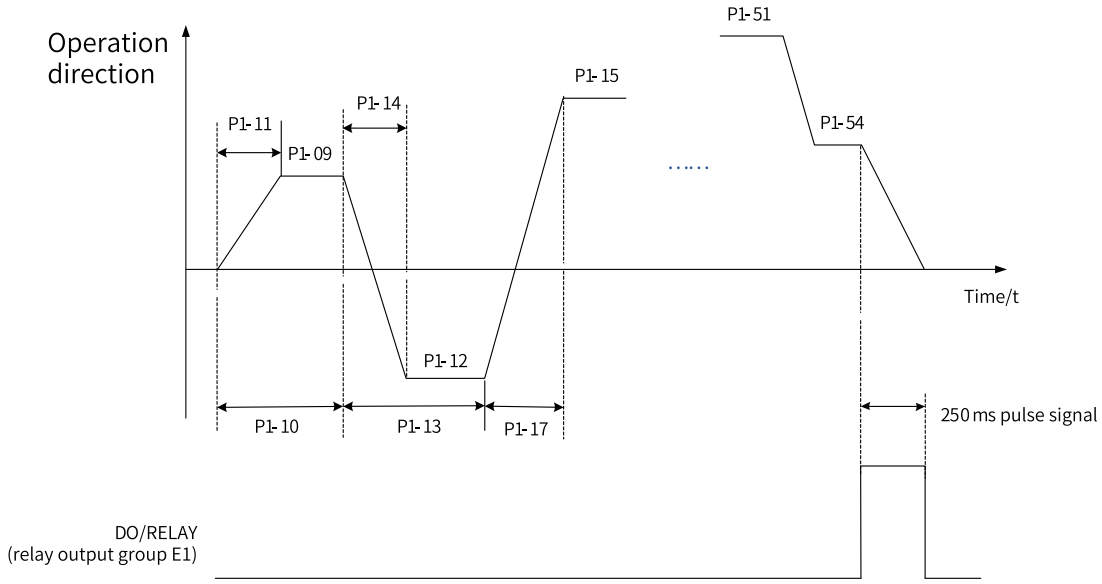


Figure 10-25 Use of simple PLC as the main frequency source

10.3.2.8 Setting Main Frequency Through PID

Application scenarios

Select the PID control output as the operating frequency, which is generally used for process closed-loop control. ,for example, constant pressure closed-loop control and constant tension closed-loop control.

Description

Set b5-00 [Main frequency source] to 8 [PID] to select the PID output as the main frequency.

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 AC drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value

When the PID output is selected as the operating frequency, the PID output 100% corresponds to A2-04 (Per-unit base value of frequency).

PID control adjusts the PID output by modifying the proportional, integral, and derivative parameters. The PID control parameters are defined as follows.

- Proportional gain Kp: Once the deviation between the PID output and the input is generated, the PID adjusts the control output so that the controlled value changes to reduce deviation. The speed of the deviation reduction depends on the proportional coefficient Kp. A higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction.
- Integral time Ti: Determines the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can be.
- Derivative time Td: Determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be.

See detailed PID function description in *"12.6.5 Process PID Control" on page 717*.

Related parameters

Table 10–7 Related parameters

Param.	Name	Default value	Value range	Description
P2-00	PID enable	0	0: Inhibited 1: Active Other: B connector	Defines whether PID is enabled. 0: Inhibited - The process PID is not used for calculation and the output is cleared. 1: Enabled - PID operation is performed based on parameters. Other: B connector - Whether to enable the PID function is determined by a parameter in the bit connector.
P2-01	PID acting direction	0	0: Direct acting 1: Reverse acting Other: B connector	Defines the PID action direction. 0: Direct acting - When the feedback value is lower than the PID reference, the output frequency of the drive increases. 1: Reverse acting - When the feedback value is lower than the PID reference, the output frequency of the drive decreases. Other: B connector - The PID direction is controlled by a parameter in the bit connector. The value 0 represents direct acting and the value 1 represents reverse acting.

Param.	Name	Default value	Value range	Description
P2-02	PID setting source	0	0: PID value reference 1: AI1 2: AI2 3: MD-BP-M potentiometer 4: HDI pulse 5: Multi-reference 6: Simple PLC 8: Communication Others: F connector	Defines the PID reference source. Options: 0: PID value reference - The PID target is the value of P2-03 [PID value reference]. 1: AI1 - The PID reference is set by AI1. 2: AI2 - The PID reference is set by AI2. 3: MD-BP-M potentiometer. The PID target value is set by the MD-BP-M potentiometer. 4: HDI pulse 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: Multi-reference. The PID target value is set by multi-reference. Combinations of different DI terminal states correspond to different frequency references. The four multi-reference terminals can be combined to form 16 states, corresponding to 16 frequencies respectively. 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. Other: F connector - The PID target reference is set by a parameter in the floating-point connector. Note: When this parameter is set to 5 [Multi-reference], b8-08 [Multi-reference 0 setting mode] cannot be set to 5 [PID reference].
P2-03	PID value reference	50.0%	0.0% to 800.0%	Used to set the PID reference value when P2-02 [PID reference source] is set to 0.

Param.	Name	Default value	Value range	Description
P2-04	PID feedback source	0	0: AI1 1: AI2 3: MD-BP-M potentiometer 4: HDI setting 5: Communication reference Others: F connector	Defines the PID feedback channel. Options: 0: AI1. The PID feedback value is set by AI1. 1: AI2. The PID feedback value is set by AI2. 3: MD-BP-M potentiometer. The PID feedback value is set by the MD-BP-M potentiometer of the external operating panel. 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 feedback is set through 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. Note: The deviation reduction speed depends on the proportional coefficient Kp. A higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-15	PID parameter 1 integral time Ti1	2.00	0.01 to 10.00	Defines the integral time Ti of the first parameter set in PID control. Note: It decides the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can 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. Note: The derivative time determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be.
P2-17	Proportional gain Kp2 of PID parameter 2	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	Integral time Ti2 of PID parameter 2	2.00	0.01 to 10.00	Defines the integral time Ti of the second group of parameters in PID control. Additional information: See P2-15.
P2-19	Derivative time Td2 of PID parameter 2	0.000	0.000s to 10.000s	Defines the derivative time Td of the second group of parameters in PID control. Note: See P2-16.

Param.	Name	Default value	Value range	Description
P2-26	Source of maximum PID output	0	0: 100% 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the maximum PID output value, which is the per-unit value in percentage. Options: 0: 100% - The maximum PID output value is 100%. 2: AI1 - The maximum PID output is defined by AI1. 3: AI2 - The maximum PID output is defined by AI2. 5: HDI pulse setting - 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 reference. 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. 10: MD-BP-M potentiometer. The maximum PID output value is set by the MD-BP-M potentiometer. Other: F connector - The maximum PID output value is the value in the selected floating-point connector.

Param.	Name	Default value	Value range	Description
P2-27	Source of minimum PID output	0	0: -100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the minimum PID output value, which is the per-unit value in percentage. Options: 0: -100% - The minimum PID output value is -100%. 2: AI1 - The minimum PID output is defined by AI1. 3: AI2- The minimum PID output is defined by AI2. 5: HDI pulse setting - 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 minimum value of PID output is defined by simple PLC output reference. 8: PID - The minimum value of PID output is the current PID output. 9: Communication - The minimum value of PID output is set through communication. The minimum PID output value can be inputted through remote communication. 10: MD-BP-M potentiometer. The maximum PID output value is set by the MD-BP-M potentiometer. Other: F connector - The minimum PID output value is the value in the selected floating-point connector.

Application instance

The steps for setting PID as the main frequency source are as follows.

1. Set b0-03 [Setting channel selection] to 0 [Setting channel 1] and b5-00 [Frequency source] to 8 [PID] to select PID as the main frequency reference source of setting channel 1.
2. Set P2-00 [General PID enable] to 1 [Enable] to enable PID.
3. Set P2-02 [PID reference source] 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).

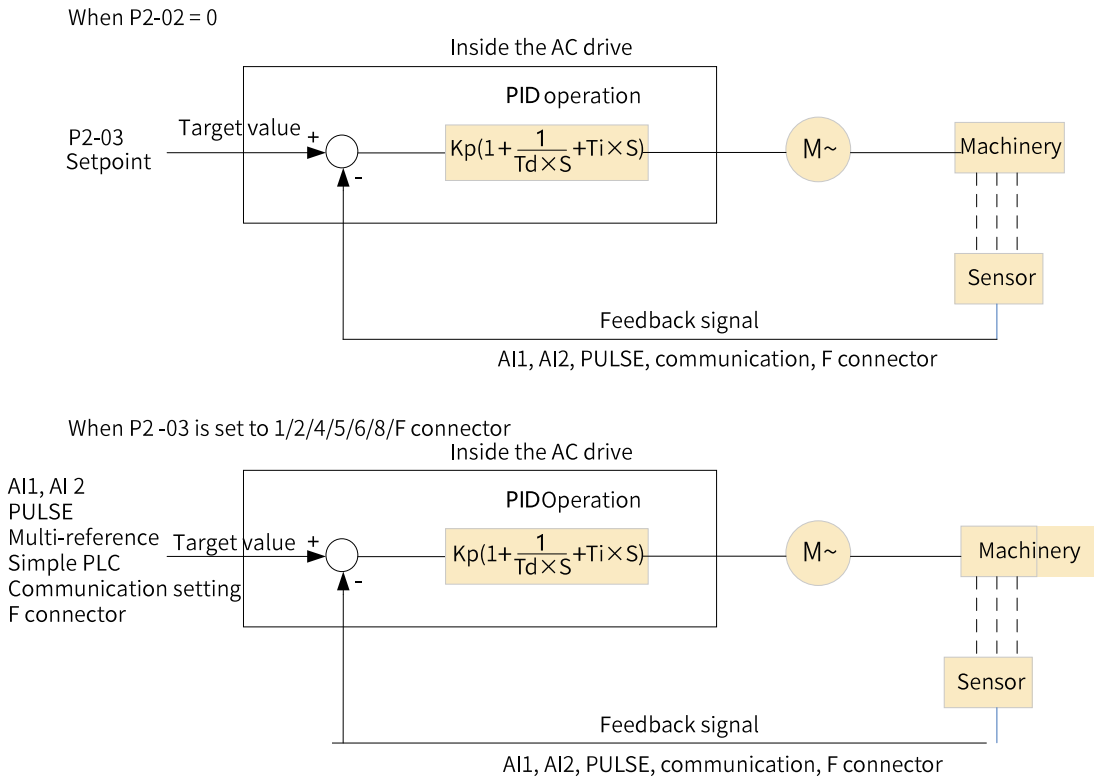


Figure 10-26 Schematic of process PID control

4. Set P2-04 [PID feedback source] to select the PID feedback source.
5. Set P2-01 [PID action direction] 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.
   Then the main frequency of the drive is defined by the PID output value. The PID automatically adjusts the PID output value based on the PID feedback. The main frequency of the drive also changes with the PID output.

   The following figure shows the logic of process PID control parameter configuration.

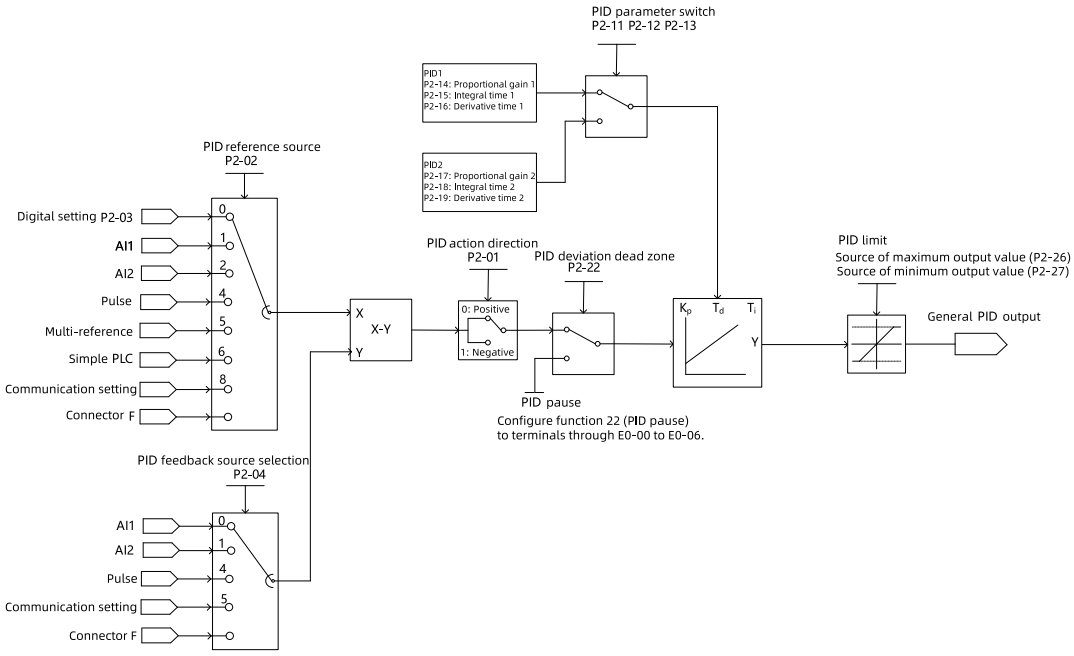


Figure 10-27 Parameter settings for process PID control

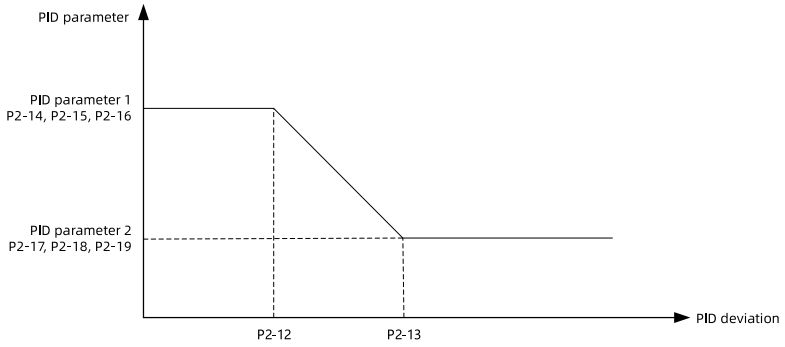


Figure 10-28 PID parameter switchover

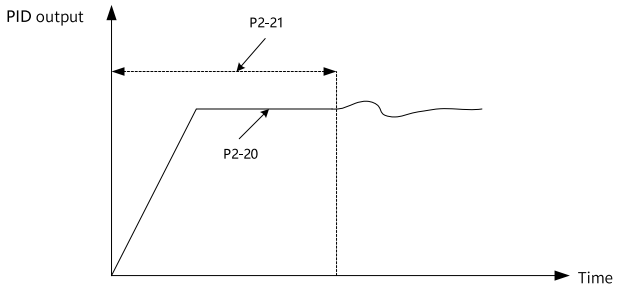


Figure 10-29 PID initial value function

You can set the maximum and minimum values of PID through P2-26 and P2-27.

For example, when the main frequency source is PID and A2-04 [Per-unit frequency base value] is 50 Hz, you can set P2-09 [PID inversion cutoff frequency] to 2 Hz, P2-27 [Minimum output value] to

L2480 [PID inversion cutoff output], and P2-26 to 0 to allow a PID output range of 100.0% to -4.0%. Accordingly, the frequency reference range of the selected channel is 100% to -4%.

10.3.2.9 Setting the Main Frequency Through Communication

Application scenarios

This function applies to applications requiring torque setting through communication, such as applications where wiring conditions cannot be met, where drives are far from the host controller, or where the host controller controls multiple drives simultaneously.

Function description

Set b5-00 [Main reference source] to 9 [Communication] to set communication as the main reference source.

See the table below for communication protocols supported.

Model	Protocol	Hardware
MD610S	Modbus	MD610S RS485 communication interface (CN3)

Related parameters

The MD610S model supports Modbus communication. You can set related communication parameters in group n2.

See communication-related parameters in *"10.2.5 Control Operation Through Communication" on page 287*.

Comm. address

Set the input source parameters such as b5-00 [Main frequency source] to 9 [Communication], and configure the communication-related parameters correctly. After sending a command to the communication address specified by the drive according to the communication protocol, you can set the main frequency of the drive.

The following table lists the communication addresses supported by the AC drive.

Comm. address		Description
Communication reference value 2	7310H	The target frequency can be set through the communication address. The property of values written by this address is defined by n0-14 (7310H reference selection). 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 number of decimal points is the same as A0-70 and unsigned 16-bit value in units of frequency is used. For example, when a decimal value 1000 is written and A0-70 [Number of frequency decimal places] is set to 2 [Two decimal places], the frequency reference is 10.00 Hz. When a decimal value 40000 is written and A0-70 [Number of frequency decimal places] is set to 1 [One decimal place], the frequency reference is 4000.0 Hz. When n0-14 is set to 1, the number of decimal points is the same as A0-70 and signed 16-bit value in units of frequency is used. For example, when a decimal value -1000 is written and A0-70 [Number of frequency decimal places] is set to 2 [Two decimal places], the frequency reference is -10.00 Hz. When a decimal value 20000 is written and A0-70 (Number of frequency decimal places) is set to 1 (One decimal place), the frequency reference is 2000.0 Hz. When n0-14 is set to 2, the signed 16-bit integer in units of speed is used. For example, when a decimal value -1500 is written and the number of pole pairs is 2, the frequency reference is 50.00 Hz. When a 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 written value is a signed 16-bit number with two decimal places in the unit of percentage. When n0-14 is set to 4, the written value is a signed 16-bit number with two decimal places in the unit of percentage.

The data format of the special address 7310H is defined by n0-14 (7310H reference selection), as shown in the following table.

- When the value of n0-14 (7310H reference selection) is set to 0, 1, or 2, the setpoint of 7310H can be used as the frequency source.
- When the value of n0-14 (7310H reference selection) is 3 or 4, the setpoint of 7310H can be used as input sources for torque references, V/f decoupled voltage, and PID references.

Param.	Name	Default value	Value range
n0-14	7310H setting selection	1	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)

For example, when n0-14 (7310H reference selection) is set to 1 (Frequency (signed 16-bit)) and A0-70 (Frequency decimal places) is set to 2 (Two decimal places), writing 2500 to 7310H sets the main frequency to 25.00 Hz. Writing -2500 to 7310H sets the main frequency to -25.00 Hz.

Application example

The following shows how to set "Communication" as the main frequency source of channel 1.

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 define 7310H reference configuration.
3. Send a write command to the drive through the host controller.

The following shows how to set the main frequency through Modbus communication. For example, when setting the frequency to 100.00% (actual transmitted value is 10000) through communication, the transmitted write command is 01 06 10 00 27 10 97 36.

The following table describes the definition of each byte.

Byte	Definition
01H (editable)	AC drive address
06H	Write command
7310H	Frequency reference address
2710H (10000 in decimal)	Target frequency
9736H	CRC

Similarly, to set the frequency reference to -100% (-10000) through communication, send the write command 01 06 73 10 D8 F0 D7 4E. In the command, D8F0 is the lower four bits of the hexadecimal number converted from -10000.

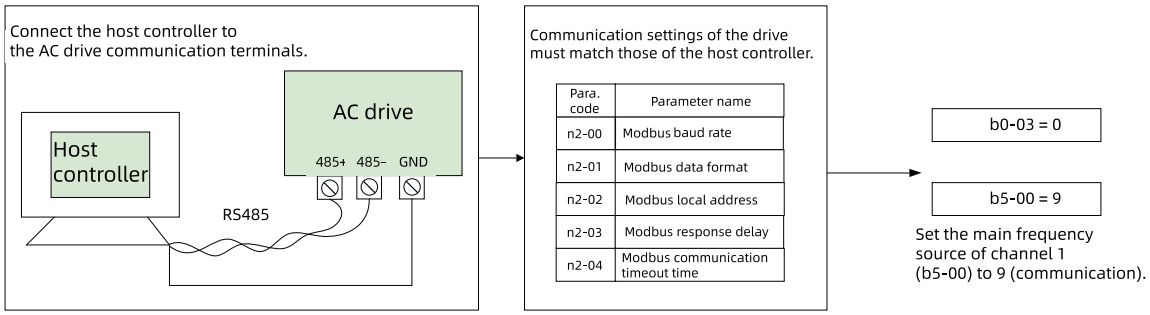


Figure 10-30 Setting main frequency through communication

When n0-14 is set to 1 (7310H reference selection), the range of frequency set through communication is -A2-17 to +A2-17 (Maximum motor frequency). Assume that 0xF448 (-3000) is input to address 0x7310, and the current frequency has 2 decimal places, then the frequency written is -30.00 Hz.

Table 10–8 Relationship between master commands and slave responses

Command from the master		Response from the slave	
ADDR	01H	ADDR	01H
CMD	06H	CMD	06H
High bits of parameter address	73H	High bits of parameter address	73H
Low bits of parameter address	10H	Low bits of parameter address	10H
High bits of data content	F4H	High bits of data content	F4H
Low bits of data content	48H	Low bits of data content	48H
High bits of CRC	97H	High bits of CRC	97H
Low bits of CRC	36H	Low bits of CRC	36H

10.3.2.10 Setting Main Frequency Through MD-BP-M potentiometer

Description

The potentiometer of the MD-BP-M supports the voltage input range of 0 V to 10 V. Set b5-00/b6-00 (Main frequency source) to 10 (MD-BP-M potentiometer) to select the MD-BP-M potentiometer as the main frequency source. For specific parameters, see *"Table 10-2 Parameters for setting main frequency source" on page 301*. The input ratio 100.0% corresponds to C4-06 (Rated motor frequency).

When the MD-BP-M potentiometer is used as the frequency source, five different AI curves can be selected. The AI curve is used to define the relationship between the analog input voltage (or current) and the corresponding setting. For detailed AI curve setting methods, see *"10.11.8 Analog Input Terminal (AI)" on page 482*.

Application instance

For details, see *"7.3.6 AI voltage adjustment knob" on page 161*.

10.3.2.11 Setting the Main Frequency Through F Connector

Application scenarios

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.

Description

Set b5-00 [Main frequency source] to "Other: [F Connector]". You can select any parameter from L22 [Floating-point connector 1] to L33 [Floating-point connector 12] as the frequency source. That is, by setting the parameter number of a floating-point connector, the value of that connector can be read as the main frequency reference. It is used for extension of common sources.

Application instance

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 [Other].
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.

10.3.3 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.

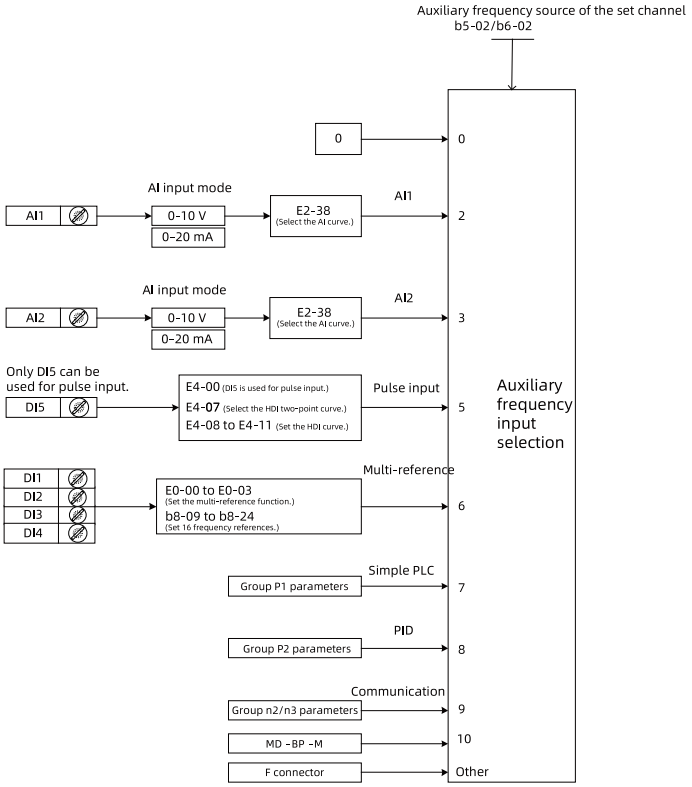


Figure 10-31 Auxiliary frequency reference source selection

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.

Be default, the auxiliary frequency gain factor source is set to "0: 100.0%", that is, the auxiliary frequency gain factor is 100.0%. When the auxiliary frequency gain factor source is set to other options, the frequency is set in percentage. The base value (100%) is determined 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.

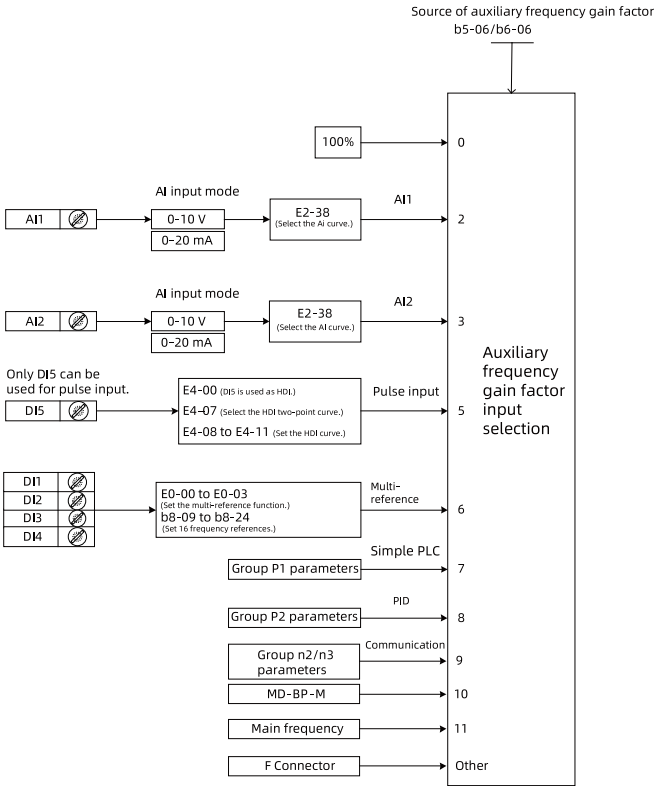


Figure 10-32 Selection of auxiliary frequency gain coefficient source

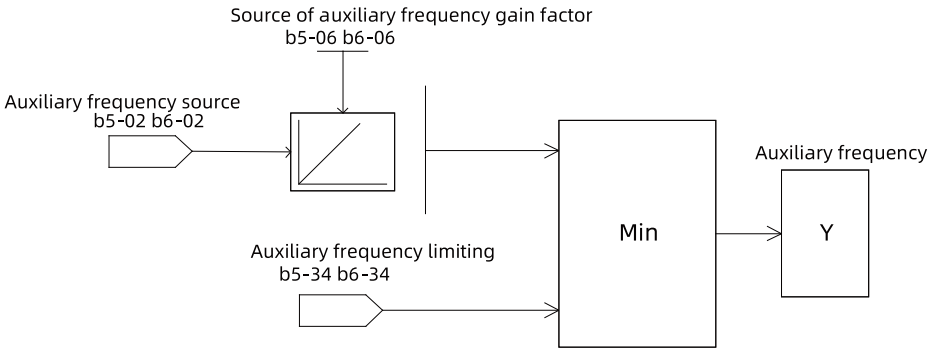


Figure 10-33 Final effective process of auxiliary frequency and auxiliary frequency gain coefficient

Related parameters

Param.	Name	Value range	Default value	**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 - The frequency is set through the pulse frequency of the DI5. 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: MD-BP-M potentiometer - The auxiliary frequency gain coefficient is set through the MD-BP-M potentiometer. Other: 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 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.

Param.	Name	Value range	Default value	**Description**
b5-06 (b6-06) (F0-35)	Auxiliary frequency gain coefficient source	0: [Rated Frequency (100%)] 2: AI1 3: AI2 5: HDI (MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer 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 factor 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 DI5 and calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source for the gain coefficient of the auxiliary frequency, different combinations of DI terminal states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 references. 7: Simple PLC. Simple PLC is a multi-reference 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 gain coefficient of the auxiliary frequency reference is set through PID. 9: Communication. The gain coefficient of the 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: MD-BP-M potentiometer - The auxiliary frequency gain coefficient is set through the MD-BP-M potentiometer. 11: Main frequency. The gain coefficient of the auxiliary frequency reference is set through the main frequency per-unit value. 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.

10.3.4 Selecting Source of Main Frequency and Auxiliary Frequency Superposition

Application scenarios

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

Description

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 (%). The frequency reference is the product of the calculation result and A2-04 [Per-unit frequency base value].

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.
- 5 [Switchover between main frequency and auxiliary frequency]: The main frequency or backup frequency is selected through the DI or switchover source.

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 [Main and auxiliary frequency calculation relationship] is set to 1 [Main frequency - Auxiliary frequency], the frequency reference value is (100% - 30%) x 50.00 = 35.00 Hz.

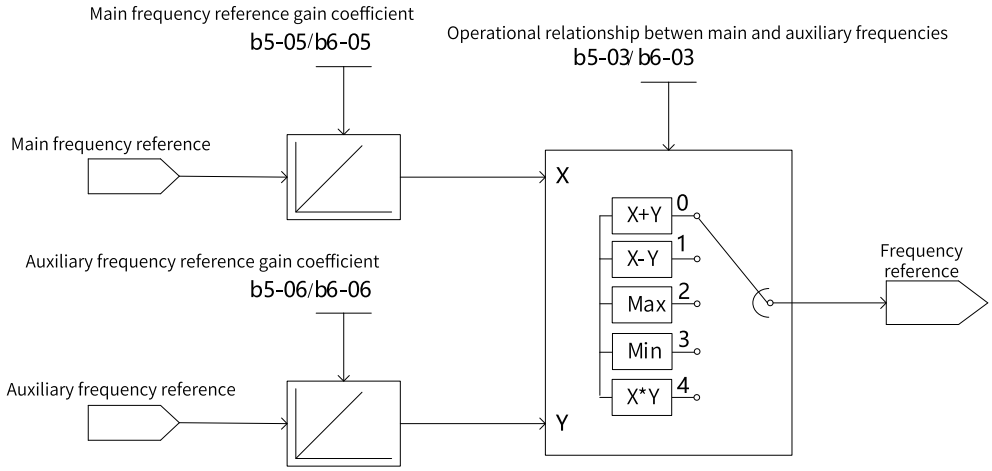


Figure 10-34 Diagram of main and auxiliary frequency reference input

10.3.5 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 frequency 1 is active only when jog command 1 is active, and jog frequency 2 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.

Description

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

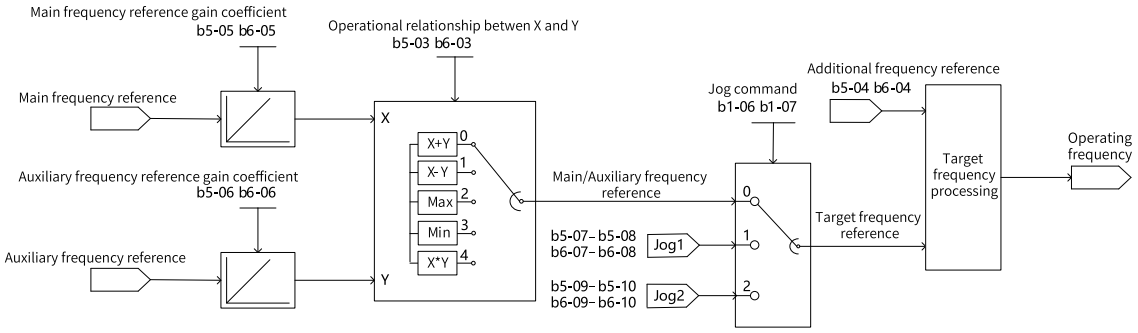


Figure 10-35 Frequency reference channel

Related parameters

Table 10–9 Related parameters

Param.	Name	Default value	Value range	Description
b5-04	Auxiliary frequency source	0	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the additional frequency source of the setting channel 1. Options: 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. The additional frequency is set through the pulse frequency of the DI5. 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 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. Continued

Param.	Name	Default value	Value range	Description
b5-04	Auxiliary frequency source	0	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Continued 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 input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M The auxiliary frequency is set through the potentiometer MD-BP-M. 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	Value range	Description
b5-07 (F0-56)	Source of jog frequency 1	0	0: b5-08 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of jog frequency 1. Options: 0: b5-08 - The jog 1 frequency is set through b5-08. set by the parameter (b508). 2: AI1 - The jog frequency 1 is input through current or voltage signals from AI1 and calculated according to the preset AI curve. 3: AI2 - The jog frequency 1 is input through current or voltage signal from AI2 and calculated according to the preset AI curve. 5: HDI pulse. The jog 1 frequency is set by using the pulse frequency of the DI5 and calculated according to the corresponding mapping curve. 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 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 frequency 1 is set through PID. 9: Communication - The jog frequency 1 is set through communication. In this mode, the jog frequency 1 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 auxiliary frequency is set through the potentiometer MD-BP-M. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. It is used for extension of common sources. b5-07 and F0-56 have the same function. b5-07 changes automatically along with F0-56.
b5-08 (F0-57)	Digital reference of jog frequency 1	2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 1. When b5-07 is set to 0, this parameter is active. b5-08 and F0-57 are the same parameter. After F0-57 is modified, b5-08 is automatically synchronized.

Param.	Name	Default value	Value range	Description
b5-09 (F0-58)	Source of jog frequency 2	0	0: b5-10 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of jog frequency 2. Options: 0: b5-10/b6-10 - The jog frequency 2 is set through b5-10/b6-10. set by the parameter (b510). 2: AI1 - The jog frequency 2 is input through current or voltage signals from AI1 and calculated according to the preset AI curve. 3: AI2 - The jog frequency 2 is input through current or voltage signal from AI2 and calculated according to the preset AI curve. 5: HDI pulse. The jog 2 frequency is set by using the pulse frequency of the DI5 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 states, corresponding to 16 frequencies. 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 frequency 2 is set through PID. 9: Communication - The jog frequency 2 is set through communication. When selecting the source, you can set the jog frequency 2 through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M The auxiliary frequency is set through the potentiometer MD-BP-M. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 2. It is used for extension of common sources. b5-09 and F0-58 have the same function. b5-09 changes automatically along with F0-58.
b5-10 (F0-59)	Digital reference of jog frequency 2	-2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 2. When b5-09 is set to 0, b5-10 is active. b5-10 and F0-59 are the same parameter. After F0-59 is modified, b5-10 is automatically synchronized.

Param.	Name	Default value	Value range	Description
b6-04	Auxiliary frequency source	0	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the additional frequency source. Options: 0: 0 - 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. The additional frequency is set through the pulse frequency of the DI5. 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 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 input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M The auxiliary frequency is set through the potentiometer MD-BP-M. 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 addresses for setting the additional frequency through communication are 0x1000 (dedicated for Modbus) 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	Value range	Description
b6-07	Source of jog frequency 1	0	0: b6-08 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of jog frequency 1. Options: 0: b5-08 - The jog 1 frequency is set through b5-08. set by the parameter (b6-08). 2: AI1 - The jog frequency 1 is input through current or voltage signals from AI1 and calculated according to the preset AI curve. 3: AI2 - The jog frequency 1 is input through current or voltage signal from AI2 and calculated according to the preset AI curve. 5: HDI pulse. The jog 1 frequency is set by using the pulse frequency of the DI5 and calculated according to the corresponding mapping curve. 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 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 frequency 1 is set through PID. 9: Communication - The jog frequency 1 is set through communication. In this mode, the jog frequency 1 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 auxiliary frequency is set through the potentiometer MD-BP-M. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. It is used for extension of common sources.
b6-08	Digital reference of jog frequency 1	2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 1. It is valid when b6-07 is set to 0.

Param.	Name	Default value	Value range	Description
b6-09	Source of jog frequency 2	0	0: b6-10 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of jog frequency 2. Options: 0: b5-10/b6-10 - The jog frequency 2 is set through b5-10/b6-10. set by the parameter (b6-10). 2: AI1 - The jog frequency 1 is input through current or voltage signals from AI1 and calculated according to the preset AI curve. 3: AI2 - The jog frequency 1 is input through current or voltage signal from AI2 and calculated according to the preset AI curve. 5: HDI pulse. The jog 2 frequency is set by using the pulse frequency of the DI5 and calculated according to the corresponding mapping curve. 6: Multi-reference - When multi-reference is used as the source of jog frequency 2, 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 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 frequency 2 is set through PID. 9: Communication - The jog frequency 2 is set through communication. When selecting the source, you can set the jog frequency 2 through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M The auxiliary frequency is set through the potentiometer MD-BP-M. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. It is used for extension of common sources.
b6-10	Digital reference of jog frequency 2	-2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 2. This parameter is active when b6-09 is set to 0.

10.3.6 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.

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

The active 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 reference of positive frequency upper limit 1]. The minimum value of 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 reference of positive frequency lower limit]. The maximum values of the two parameters are the final effective limit of the positive frequency lower limit of the frequency reference. The negative frequency limits are similar.

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].

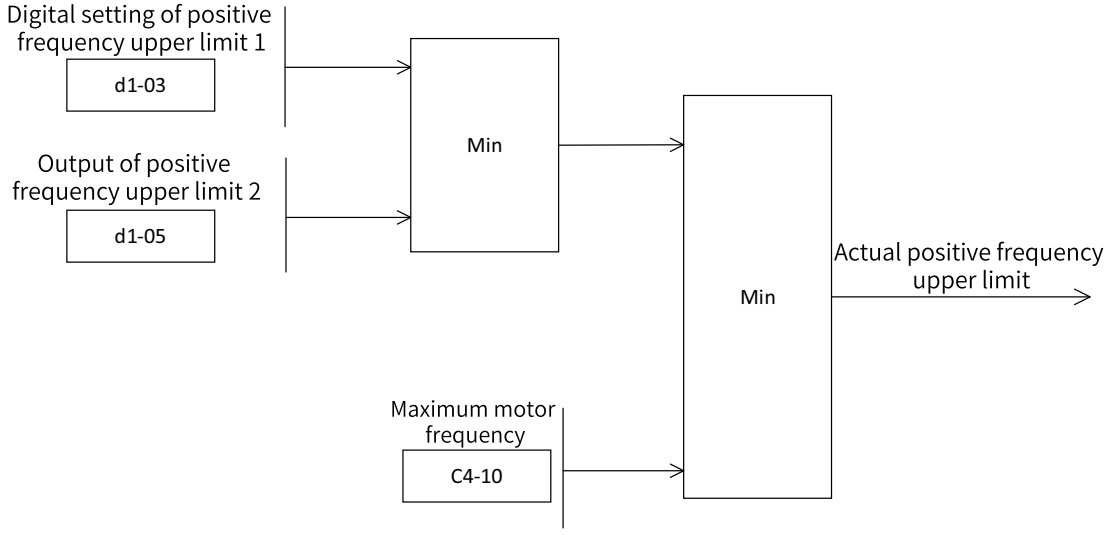


Figure 10-36 Effective positive upper limit

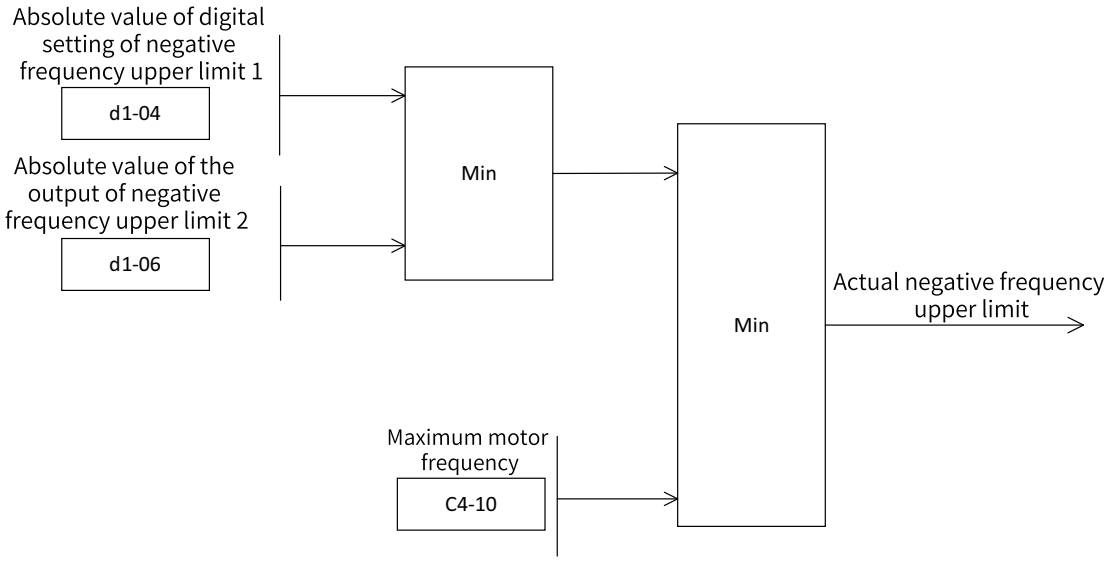


Figure 10-37 Effective positive lower limit

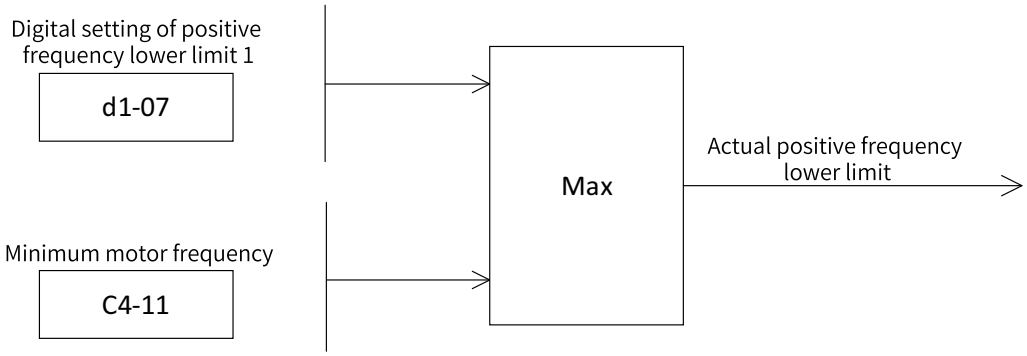


Figure 10-38 Active negative upper limit

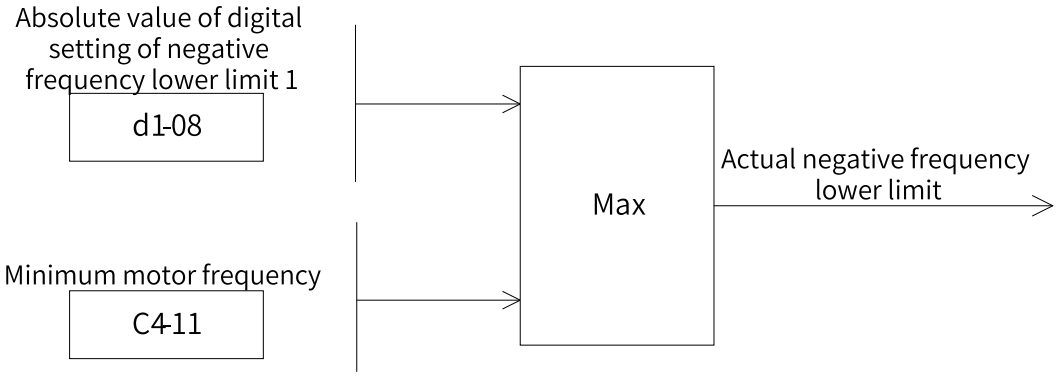


Figure 10-39 Active negative lower limit

Related parameters

Table 10–10 Parameters related to the frequency reference limit

Param.	Name	Default value	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	Value range	Description
d1-05 (F2-24)	Positive frequency upper limit 2	0	0: 800% 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: 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. Options: 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. - The forward frequency upper limit is set through the pulse frequency of the DI5. 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 forward 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 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. 10: MD-BP-M potentiometer. The forward frequency upper limit 2 is set through the MD-BP-M potentiometer. 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	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 setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: 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. Options: 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. - The reverse frequency upper limit is set through the pulse frequency of the DI5. 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 reverse 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-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 reverse frequency upper limit can be input through remote communication. 10: MD-BP-M potentiometer. The forward frequency upper limit 2 is set through the MD-BP-M potentiometer. 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.

Param.	Name	Default value	Value range	Description
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.
d1-08 (F2-27)	Digital reference 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 have the same function. d1-08 changes automatically along with F2-27.

10.3.7 Define Running Mode in Case of a Frequency Below Minimum Limit

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.

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 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.

- 0: Run at frequency lower limit
  If the frequency reference is lower than the lower limit (U6-08 Positive minimum frequency), the drive runs at the frequency defined by "U6-08 Positive minimum frequency". In reverse run, if the frequency reference is lower than the absolute value of the active lower limit (U6-10 Absolute value of negative minimum frequency), the drive runs at "U6-10 negative minimum frequency".
- 1: Stop
  If the frequency reference is lower than the frequency lower limit, the drive stops.
- 2: Run at zero speed
  If the frequency reference is lower than the frequency lower limit, the drive runs at zero speed.
- 3: Coast to stop
  If the frequency reference is lower than the frequency lower limit, the drive coasts to stop.

Related parameters

Table 10–11 Parameters related to setting the action at frequencies lower than the minimum value

Param.	Name	Default value	Value range	Description
P0-11	Operation mode for frequency references lower than the minimum motor frequency	0	0: Run at 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 frequency lower limit. Options: 0: Run at frequency lower limit - During forward run, if the frequency reference is lower than the 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 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 operating frequency is lower than the frequency lower limit, the drive stops. 2: Run at zero speed. If the frequency reference is lower than the frequency lower limit, the drive runs at zero speed. 3: Coast to stop - If the set frequency is below the effective frequency lower limit, the AC drive coasts to stop.

10.3.8 Set Frequency Through Terminal

Application scenarios

During remote control of the drive, you can adjust the operating frequency through the DI terminal instead of communication or analog signal input.

Operating principles

As shown in the following figure, 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). Select the base frequency for terminal adjustment during operation through P0-87 [UP/DOWN base during operation]. When P0-87 is set to the default value 0 [Operating frequency], the target frequency after terminal adjustment is the current operating frequency (adjusted value), which means the operating frequency follows the terminal adjustment signal in real time. When DI1 is active high, the current frequency increases. When DI2 is active high, the current frequency decreases.

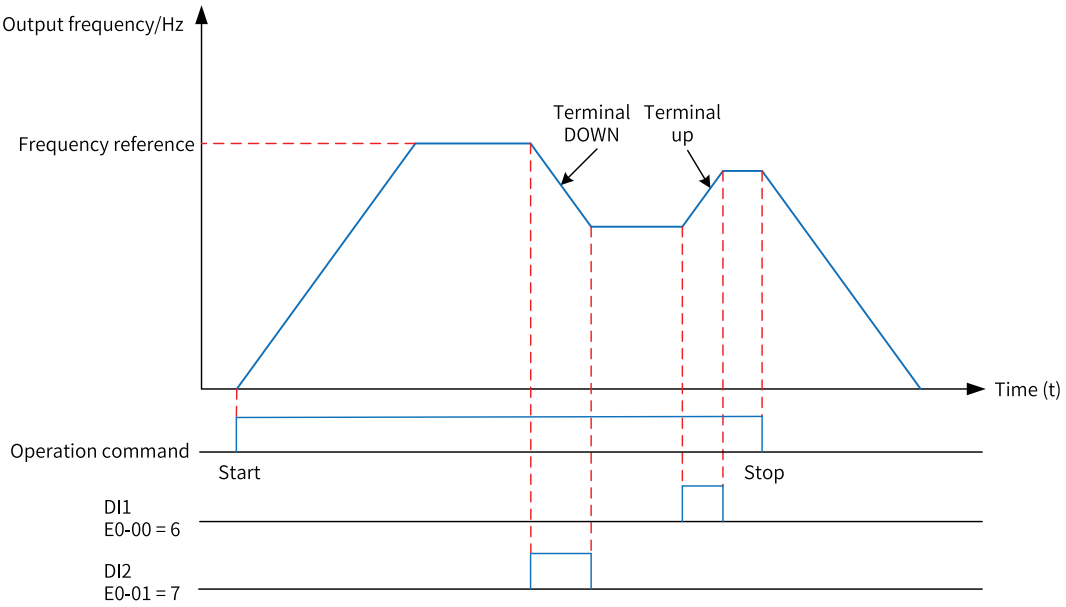


Figure 10-40 Adjusting frequency through terminals

Additionally, the frequency reference adjusted by UP/DOWN terminals can be retained after stop by setting P0-88 [Retention of UP/DOWN adjustment at stop]. To retain the frequency reference at power failure, set P0-88 [UP/DOWN retention selection at stop] to 1 [Retentive] and P0-89 [UP/DOWN retention selection upon power failure] to 1 [Retentive].

Related parameters

Param.	Name	Default value	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 frequency base adjusted by UP/DOWN key during operation. Options: 0: Operating frequency - When the target frequency is adjusted by UP/DOWN key, it increases or decreases based on the operating frequency. 1: Set frequency - When the target frequency is adjusted by UP/DOWN key, it increases or decreases based on the set frequency.
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 is retentive when the drive stops. Options: 0: Non-retentive Parameters b5-01 and b6-01 are set through the operating panel and then adjust the frequency by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is cleared when the AC drive stops. 1: Retentive Parameters b5-01 and b6-01 are set through the operating panel and then adjust the frequency by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is retained when the AC drive stops.
P0-89	Retention of frequency adjusted by UP/DOWN key upon power failure	0	0: Disable 1: Active	Defines whether the frequency adjusted by UP/DOWN is retentive upon power failure. Options: 0: Disable Parameters b5-01 and b6-01 (digital setting of main frequency) are set through the operating panel and then adjusted by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is cleared upon power failure. 1: Enable. Parameters b5-01 and b6-01 (digital setting of main frequency) are set through the operating panel and then adjusted by the ▲ or ▼ keys or terminals functioning as UP or DOWN keys. The frequency adjustment is retained upon power failure.

Application instance

To control operation and frequency of the drive through terminals, do as follows.

1. Set b1-00 [Main command source of control channel 1] to 1 [Terminal control].
2. Set b9-00 [Terminal start/stop module A/B selection] to 0 [Module A].
3. Set b9-01 [Terminal start/stop module A mode] to 1 [IN1 for start].
4. Assign DI1 with the function of terminal control IN1, and assign DI2 and DI3 with frequency adjustment function. Terminal function setpoint and wiring diagram are as follows:

Param.	Name	Setpoint	Description
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	Operation command
E0-01	DI2 function	6 [Frequency UP adjustment]	Used to increase the frequency.
E0-02	DI3 function	7 [Frequency DOWN adjustment]	Used to reduce the frequency.

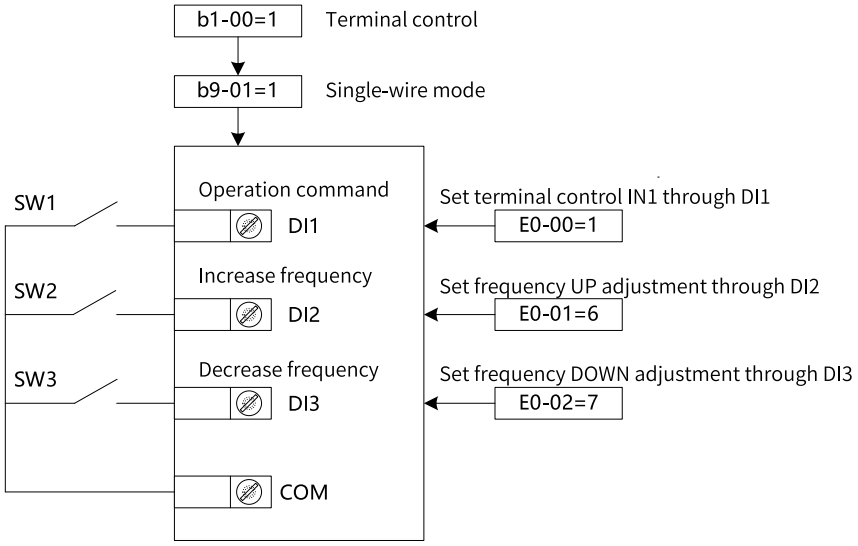


Figure 10-41 Set Frequency Through Terminal

5. Set P0-87 [UP/DOWN base during operation] to 0 [Operating frequency].

After preceding steps are done, the drive starts running when DI1 closes. The operating frequency decreases gradually when DI3 closes. The operating frequency increases gradually when DI2 closes. The command is inactive and the frequency remains unchanged when both DI2 and DI3 close. The frequency will no longer change once it reaches the upper limit or decreases to the lower limit.

10.3.9 Frequency Reference Source Selection

The frequency reference for each setting channel is defined by the main frequency and auxiliary frequency.

Main frequency reference x Main frequency reference gain coefficient = Effective main frequency reference.

Auxiliary frequency reference x Auxiliary frequency reference gain coefficient = Effective auxiliary frequency reference.

After the preceding operations are performed on the effective main and auxiliary frequency references, the operation result is used as the input for the ramp function generator.

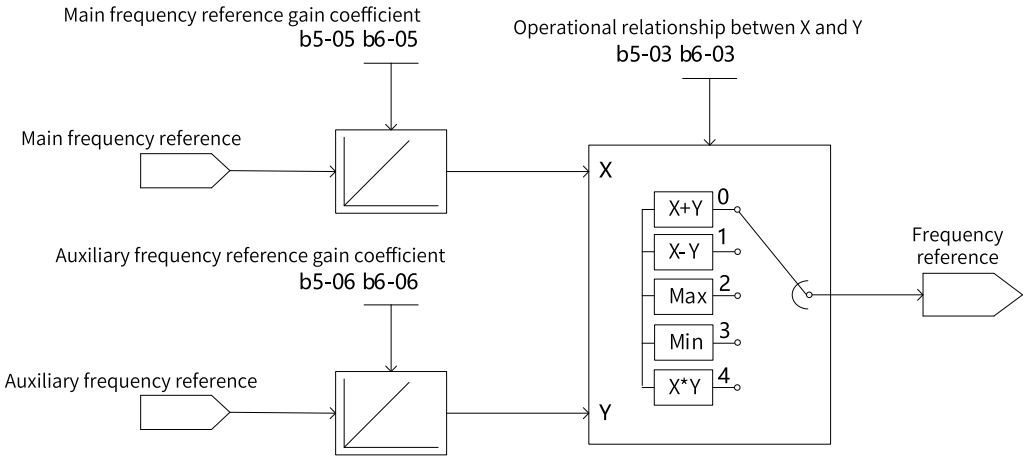


Figure 10-42 Diagram of main and auxiliary frequency reference input

In some cases, frequency regulation needs to be activated directly without being processed with the acceleration/deceleration time. In this case, an additional frequency reference that activated only during operation can be provided, which can be superimposed to the output frequency of the ramp function generator directly.

10.4 Torque Reference

10.4.1 Selecting Torque Reference

Similar to frequency reference setting, the drive provides two channels for setting the torque reference to change the motor operation state. Parameter group b5 corresponds to the setting channel 1, and group b6 corresponds to the setting channel 2.

You can select the active setting channel through b0-03 [Setting channel selection], as shown below. When the setting channel 1 is selected, parameters in group b5 are activated. In this case, the torque reference is set by parameters in group b5. When the setting channel 2 is selected, parameters in group b6 are activated. In this case, the torque reference is defined by parameters in group b6.

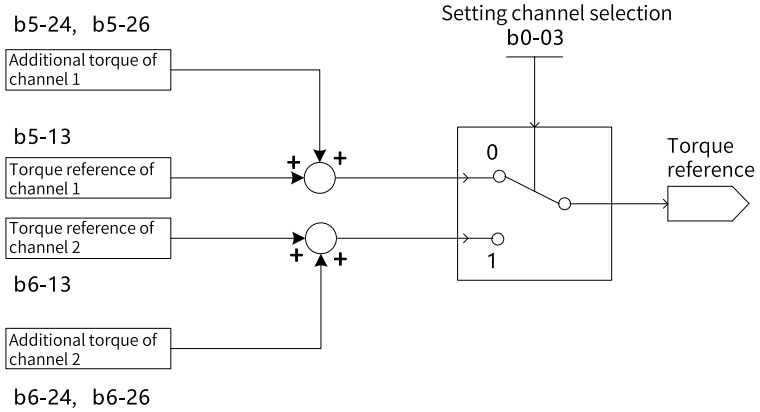


Figure 10-43 Torque reference source

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 *"10.4.11 Setting Supplementary Torque" on page 389*.

10.4.2 Selecting Torque Reference Source

Function description

The setting channel 1 is activated by default. The motor control mode needs to be set to torque control (d0-01 = 1). b5-13 (Torque reference source) allows you to select the torque setting method, such as digital setting, AI, multi-reference, and communication, which is similar to frequency reference source.

The torque reference is set in percentages, whose base value (100%) is defined by A2-06 [Per-unit torque base value].

Related parameters

Table 10–12 Related parameters

Param.	Description	Value range	Default value	Description
b5-13 (b6-13)	Torque reference source	0	0: b5-14 2: AI1 3: AI2 5: HDI pulse reference (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer 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 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 is set through communication. Torque reference is set through remote communication. The drive must be installed with a communication card to for communication with the host controller. This mode is suitable for remote control or centralized control on multiple devices. 10: MD-BP-M potentiometer. The forward frequency upper limit 2 is set through the MD-BP-M potentiometer. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the torque reference. It is used for extension of common sources.

Param.	Description	Value range	Default value	Description
b5-19 (b6-19)	Speed limit source in torque control mode	0	0: b5-20 1: Speed channel	Defines the speed limit source. Value description: 0: b5-20. The speed limit source in torque mode is digital setting. The speed limit set by b5-20 is active. 1: Speed channel - The speed limit is set through the speed channel in torque control mode.
b5-20 (b6-20)	Digital setting of speed limit in torque control mode	100.0%	-800.0 % to +800.0%	Defines the digital reference value of the speed limit, which is active when the "Speed limit source" is set to "0: b5-20".
b5-21 (b6-21)	Speed limit bias mode in torque mode	0	0: Bidirectional bias 1: Uni-directional bias 2: Overspeed control mode	Defines the speed limit bias mode in the torque mode. Value description: 0: Bidirectional bias - The bias is effective for both directions (forward and reverse). 1: Unidirectional bias - The bias is effective only for one direction (opposite to the limit direction). 2: Overspeed control mode - The bias is effective for both directions (forward and reverse), and the absolute values of positive and negative speed limits are equal to the speed limit plus the bias.

Param.	Description	Value range	Default value	Description
b5-22 (b6-22)	Speed limit bias source in torque control mode	0	0: b5-23 2: AI1 3: AI2 5: HDI pulse reference (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the speed limit bias source. Value description: 0: b5-23 - The speed limit bias is set through b5-23. 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. (Valid only for MD610S) 6: Multi-reference - When multi-reference is used as the source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 references. 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 - Select the PID output as the speed limit offset source. 9: Communication. The speed limit bias is set through 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. 10: MD-BP-M potentiometer. The forward frequency upper limit 2 is set through the MD-BP-M potentiometer. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the speed limit bias source. It is used for extension of common sources.
b5-23 (b6-23)	Digital setting of speed limit offset in torque mode	5.0%	0.0% to 800.0%	Defines the speed limit bias as a percentage to the rated speed. This parameter is activated when b5-22 [Speed limit bias source] is set to 0 [b5-23].

10.4.3 Setting Torque Reference Through Parameter

Description

Set b5-13 [Torque reference source] to 0 [Digital reference] to set the value of b5-14 [Digital torque reference] as the active torque source.

Related parameters

Table 10–13 Related parameters

Param.	Name	Default value	Value range
b5-14	Digital setting of torque reference	0	-800.0% to +800.0%

If b5-14 [Digital torque reference] is set to 50.0%, the torque reference is 50.0%.

10.4.4 Setting Torque Through AI

Description

This control board of the AC drive provides two voltage/current type analog input terminals, namely AI1 and AI2.

When b5-13 (Torque reference source) is set to 2 (AI1) or 3 (AI2), the selected AI serves as the frequency source. The AI input is converted to the input ratio through the AI curve. 100.0% of the input ratio corresponds to A2-06 (per-unit torque base value).

Each AI can select one of five different AI curves. AI curves are used to set the relationship between the analog input voltage (or analog input current) and its corresponding set value. For detailed AI curve setting methods, see *"10.11.8 Analog Input Terminal (AI)" on page 482*. This section uses AI curve 1 as an example.

Related parameters

Param.	Name	Default value	Value range	Description
E2-10 (F4-21)	AI1 filter time	0.10s	0.00s to 10.00s	Defines the software filter time of AI1. Note: 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.
E2-40 (F4-28)	Minimum input of AI curve 1	0.00 V	-10.00 V to E2-42	Defines the minimum input on the x-axis of the AI curve 1, that is, the minimum analog input voltage (or 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 input, the y-axis represents the percentage to the rated frequency of the motor. 2. There are five types of AI curves. Curves 1 to 3 are two-point curves, which are the minimum input point and the maximum input point. The related parameters are E2-40 to E2-51. Curve 4 and curve 5 are four-point curves, that is, the maximum, minimum, and intermediate two inflection points. The related parameters are E2-52 to E2-67.
E2-41 (F4-29)	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.

Param.	Name	Default value	Value range	Description
E2-42 (F4-30)	Maximum input of AI curve 1	10.00 V	E2-40 to 10.00 V	Defines the maximum input point of x-axis on AI curve 1, namely the maximum analog input voltage (or maximum analog input current). Note: See E2-40 for details.
E2-43 (F4-31)	Percentage corresponding to the maximum input of AI curve 1	100.0%	-800.0% to +800.0%	Defines the maximum input point of x-axis on AI curve 1, namely the maximum analog input voltage (or maximum analog input current). Note: See E2-40 for details.

Application instance

The basic steps for setting the torque via AI are as follows (taking AI1 as an example):

1. Set the relationship between AI1 voltage input and the curve of the set ratio to "0 V to 10 V (or 0 mA to 20 mA) correspond to 0% to 100%".
   - 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 the AI1 filter time through E2-10.
3. Set b5-13 (Torque reference source) = 2 (AI1) to select AI1 as the torque source.

After the preceding steps, when AI1 inputs 5 V, the drive obtains 50% from the AI1 curve and the torque setting is 50%. When AI1 input voltage is changed, the active torque changes according to the AI1 curve.

10.4.5 Setting Torque Reference Through Pulse

Application scenarios

This setting method applies to scenarios where high-speed digital input terminal is used as the torque source and the pulse frequency determines the input torque.

Description

Set b5-13 (Torque reference source) to 5 to select the HDI input as the torque reference. When the torque source is HDI pulse input, the pulse reference can only be input from multi-function terminal DI5.

The signal specifications set by pulse are 15 V to 30 V (voltage) and 0 kHz to 20 kHz (frequency).

You can set the relationship between the percentage and the pulse frequency input from DI5, such as defined by two-point curve and four-point curve. Set the two-point curve through E4-08 to E4-11, and set the four-point curve through E4-12 to E4-19.

When the pulse input is used as the torque reference, the pulse input 100% corresponds to the torque setpoint.

For details on setting HDI curves, see *"10.11.6 High-speed digital input (HDI)" on page 470*. This section takes the HDI two-point curve as an example.

Related parameters

Param.	Name	Default value	Value range	Description
E4-08 (F4-71)	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 terminal DI5 is used as the source of the main frequency reference, a curve must be defined to map pulse frequencies to frequency references. The frequency references are expressed as percentages of the rated frequency (C4-06). The x-axis of this curve represents the pulse frequencies of DI5, and the y-axis represents the percentages of the rated motor frequency (C4-06). The curve is a two-point linear graph, that is, the minimum input point and maximum input point. E4-08 corresponds to the minimum input point on the x-axis, that is, the minimum pulse input frequency.
E4-09 (F4-72)	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 2-point curve, that is, the per-unit value in percentage corresponding to the minimum pulse input. Note: When the high-speed pulse terminal DI5 is used as the source of the main frequency reference, a curve must be defined to map pulse frequencies to frequency references. The frequency references are expressed as percentages of the rated frequency (C4-06). The x-axis of this curve represents the pulse frequencies of DI5, and the y-axis represents the percentages of the rated motor frequency (C4-06). The curve is a two-point linear graph, that is, the minimum input point and maximum input point. E4-09 corresponds to the y-axis of minimum pulse input, that is, the setpoint corresponding to the minimum pulse input frequency.

Param.	Name	Default value	Value range	Description
E4-10 (F4-73)	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: When the high-speed pulse terminal DI5 is used as the source of the main frequency reference, a curve must be defined to map pulse frequencies to frequency references. The frequency references are expressed as percentages of the rated frequency (C4-06). The x-axis of this curve represents the pulse frequencies of DI5, and the y-axis represents the percentages of the rated motor frequency (C4-06). The curve is a two-point linear graph, that is, the minimum input point and maximum input point. E4-10 corresponds to the x-axis of the maximum pulse input, that is, the maximum pulse input frequency.
E4-11 (F4-74)	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: When the high-speed pulse terminal DI5 is used as the source of the main frequency reference, a curve must be defined to map pulse frequencies to frequency references. The frequency references are expressed as percentages of the rated frequency (C4-06). The x-axis of this curve represents the pulse frequencies of DI5, and the y-axis represents the percentages of the rated motor frequency (C4-06). The curve is a two-point linear graph, that is, the minimum input point and maximum input point. E4-11 corresponds to the y-axis of the maximum pulse input, that is, the set value corresponding to the maximum pulse input frequency.

Application instance

The basic steps for setting torque through HDI pulses are as follows:

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 DI5.
3. To 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.

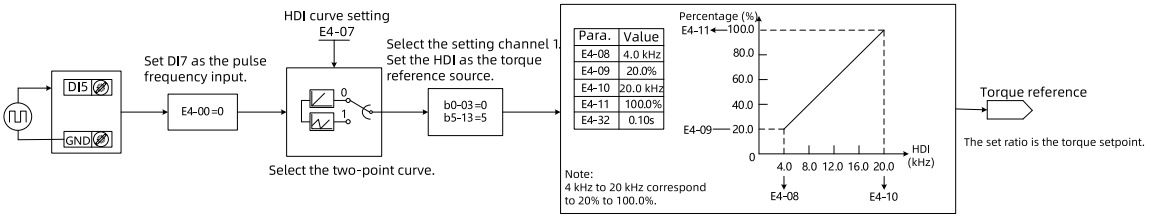


Figure 10-44 Parameter setting when torque reference is set through pulse input

10.4.6 Setting Torque References Through Multi-references

Application scenarios

This method is suitable for applications that only require several torque references instead of continuous adjustment of the drive torque. That is, in scenarios where continuous adjustment of the frequency is not required, the frequency will change with the torque.

Description

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 [Multi-reference selection bit0] to b8-06 [Multi-reference selection bit 3] 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)

Related parameters

The multi-references are set through parameters in group b8, as listed in the following table.

Param.	Name	Default value	Value range	Description
b8-03	Multi-reference selection bit 0	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the source of multi-reference selection bit0. Multi-reference bit1 to bit3 are used together to support 16 multi-references in total. Options: 0: 0 - The value of multi-reference bit0 is 0. 1: 1. The value of multi-reference bit0 is 1. 3 to 7: DI1 to DI5. The value of multi-reference bit0 depends 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. Other: B connector - Depends on the B connector, which can be selected 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. Note: A total of 16 multi-reference 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 bit 1	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the source of multi-reference selection bit1. Multi-reference bit0, bit2, and bit3 are used together to support 16 multi-references in total. The value description and the note are the same as b8-03.
b8-05	Multi-reference selection bit2	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the source of multi-reference selection bit2. Multi-reference bit0 to bit3 are used together to support 16 multi-references in total. The value description and the note are the same as b8-03.

Param.	Name	Default value	Value range	Description
b8-06	Multi-reference selection bit3	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the source of multi-reference selection bit3. Multi-reference bit0 to bit3 are used together to support 16 multi-references in total. The value description and the note are the same as b8-03.
b8-08 (F0-38)	Source of multi-reference 0	0	0: b8-09 1: AI1 2: AI2 3: MD-BP-M potentiometer 4: HDI pulse 5: PID 6: b5-01/b6-01 Others: F connector	Defines the source of multi-reference 0. Options: 0: b8-09 - The value of multi-reference 0 is set by b8-09. 1: AI1. The 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. The 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. 3: MD-BP-M potentiometer The multi-reference 0 is set by the MD-BP-M potentiometer. 4: HDI pulse reference. The multi-reference 0 is set through the pulse frequency of DI5. The corresponding per-unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 5: PID - The value of multi-reference 0 is set by PID. 6: Digital reference of the main frequency (b5-01/b6-01) - The multi-reference 0 is set by the digital reference of the main frequency (b5-01/b6-01), and the corresponding frequency per-unit value is calculated based on the frequency reference. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the main frequency reference. It is used for extension of common sources.

Param.	Name	Default value	Value range	Description
b8-09 (F0-39)	Multi-reference 0	0.00%	b8-42 and b8-43	The source of multi-reference 0 is selected by b8-08, and the other multi-references are set by other parameters. Note: 1. The unit of the multi-reference value is percentage (%). The drive provides four multi-reference terminals (b8-03 to b8-06), which provide 16 states that correspond 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. 3. When the multi-reference is output to a floating-point connector, it can serve as the frequency reference, as well as a torque, voltage, or other reference input. The multi-reference value is a percentage to the rated value.
b8-10 (F0-40)	Multi-reference 1	0.00%	b8-42 and b8-43	
b8-11 (F0-41)	Multi-reference 2	0.00%	b8-42 and b8-43	
b8-12 (F0-42)	Multi-reference 3	0.00%	b8-42 and b8-43	
b8-13	Multi-reference 4	0.00%	b8-42 and b8-43	
b8-14	Multi-reference 5	0.00%	b8-42 and b8-43	
b8-15	Multi-reference 6	0.00%	b8-42 and b8-43	
b8-16	Multi-reference 7	0.00%	b8-42 and b8-43	
b8-17	Multi-reference 8	0.00%	b8-42 and b8-43	
b8-18	Multi-reference 9	0.00%	b8-42 and b8-43	
b8-19	Multi-reference 10	0.00%	b8-42 and b8-43	
b8-20	Multi-reference 11	0.00%	b8-42 and b8-43	
b8-21	Multi-reference 12	0.00%	b8-42 and b8-43	
b8-22	Multi-reference 13	0.00%	b8-42 and b8-43	
b8-23	Multi-reference 14	0.00%	b8-42 and b8-43	
b8-24	Multi-reference 15	0.00%	b8-42 and b8-43	

Note

F0-39 F0-42 are mapped from b8-09 to b8-12. These two sets of parameters are equivalent.

To use multi-reference as the torque reference source, assign functions 12 to 15 to the DI terminals or set b8-03 [Multi-reference selection bit0] to b8-06 [Multi-reference selection bit3].

Table 10–14 Multi-reference input terminal

Param.	Name	Setpoint	Function description
E0-00 (F4-03)	DI1 function selection	12	Multi-reference terminal 1
E0-01 (F4-04)	DI2 function	13	Multi-reference terminal 2
E0-02 (F4-05)	DI3 function	14	Multi-reference terminal 3
E0-03 (F4-06)	DI4 function	15	Multi-reference terminal 4

Note

F4-03 to F4-06 are the mapped from E0-00 to E0-03 in group F, and the two sets of parameters are equivalent.

Application instance

In the following figure, DI1, DI2, DI3, and DI4 are used as the multi-reference input terminals, which form a four-bit binary number. The state combinations of these terminals represent different multi-reference values. When (DI4, DI3, DI2, DI1) = (0, 0, 1, 0), the state combination value is 2, corresponding to the value set by b8-11. The detailed settings are as follows.

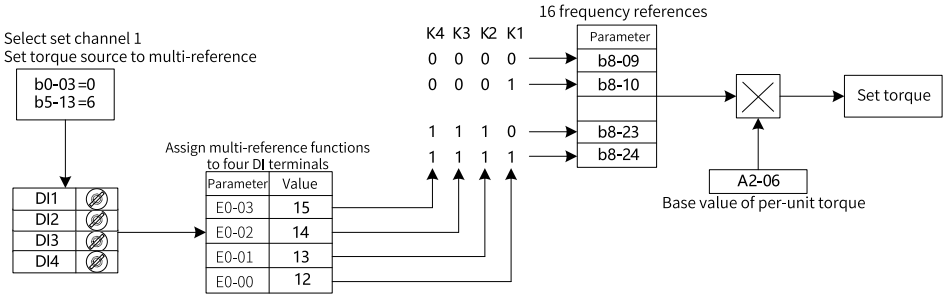


Figure 10-45 Setting torque through multi-reference

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

Table 10–15 Description of multi-reference function

K4	K3	K2	K1	Reference	Parameter
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
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

In the preceding section, the multi-reference values are determined by assigning functions to terminals through parameters in group E0. You can also set the multi-reference values through parameters in group b8.

10.4.7 Setting Torque Through Simple PLC

Application scenarios

In industrial applications where the AC motor only needs to execute start/stop, timed segment-based speed regulation, and automatic forward/reverse run, you can use the simple PLC to achieve control functions without a PLC.

The simple PLC can directly set the operating speed, direction, and operating time of each phase. It can be used in industrial equipment such as mixture mixing and industrial washing machines. For example, in industrial washing machines, the motor operates in forward and reverse cycles at different speeds within the timed period.

Description

Set b5-13 [Torque reference source] to 7 [Simple PLC] to select the setpoint of simple PLC as the torque source.

Related parameters

Table 10–16 Related parameters

Param.	Name	Default value	Value range	Description
P1-00	Simple PLC module	0	0: Disable 1: Active	Used to enable/disable the simple PLC module. Options: 0: Disable - The simple PLC module is disabled. The current STEP, current STEP operating time (hours and seconds), and STEP per-unit value of the simple PLC module are cleared. 1: Enable - The simple PLC module is enabled, but whether the calculation and output of the PLC module are normal depends on P1-01.
P1-01	Simple PLC calculation enable source	36978	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the source for enabling simple PLC calculation. Options: 0: Inactive - The simple PLC calculation function is inactive. 1: Active - The simple PLC calculation function is active. 3 to 7: DI1 to DI5. Whether simple PLC calculation is enabled depends on the input state of DI1 to DI5 terminals. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Other: B connector - Whether the simple PLC calculation function is active depends on the state of the selected B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Note: 1. 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 running time. It also outputs the 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 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	Value range	Description
P1-02	Simple PLC operation 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 one cycle 3: Output 0 after running for one cycle	Defines the operation mode of the simple PLC. Options: 0: Keep multi-reference 0 output after running for one cycle - The output of multi-speed reference 0 is maintained after the end of a single cycle of the simple PLC module. 1: Keep final values after running for one cycle - The final value is output after the simple PLC module runs for one cycle. 2: Repeat after running one cycle - The simple PLC module starts running again from the first STEP after completing a cycle. 3: Output 0 after running for one cycle - The PLC STEP per-unit value is output as 0 after the simple PLC module runs for one cycle. Note: 1. If this parameter is set to 0, 1, or 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: Retention upon power failure 0: Non-retentive 1: Retentive Tens: Calculation enable configuration 0: Current STEP retained when calculation deactivated, and recalculated when enabled 1: Current STEP retained when calculation deactivated, and continue when enabled	Defines the simple PLC function. Options: Ones: Retention upon power failure 0: Non-retentive upon power-off. The current STEP and the current STEP running time of the simple PLC is not retentive upon power failure. 1: Retentive - The current STEP and current STEP operating time of the simple PLC is saved upon power failure. Tens: Calculation enable configuration 0: If P1-01 is disabled, the current STEP is kept. If P1-01 is enabled, operation starts from STEP0 and the operating time is calculated again. 1: When calculation (P1-01) is disabled, the current STEP is kept. When calculation (P1-01) is enabled, the drive runs from the current STEP and the current operating time continues.

Param.	Name	Default value	Value range	Description
P1-04	Simple PLC status reset	0	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Used to reset the simple PLC status. Options: 0: Inactive - When the simple PLC state reset is inactive, the simple PLC operates according to the setting. 1: Active - When simple PLC status reset is active, the simple PLC module returns to initial state. The simple PLC outputs the value of multi-speed reference 0 (P1-09) only when the STEP 0 is under execution by simple PLC. 3 to 7: DI1 to DI5. Whether the simple PLC status reset is enabled depends on the input state of DI1 to DI5 terminals. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Others: B connector - Whether the simple PLC state reset function is active depends on the state of the selected B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active.
P1-08	Simple PLC operating time unit	0	0: s (second) 1: h (hour)	Defines the simple PLC operating time unit. Options: 0: s (second) - The simple PLC operating time is in seconds. 1: h (hour) - The simple PLC operating time is in hours.
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	Operating time of multi-reference 0 set by simple PLC	0	0 to 6553.5s(h)	Defines the operating time of multi-reference 0 set by simple PLC, which is the sum of ramp-up/down time and operating time at constant speed and target frequency. Note: It is recommended to set the operating time of multi-reference i in simple PLC to a value higher than the ramp-up/down time.

Param.	Name	Default value	Value range	Description
P1-11	Ramp-up/down time of multi-reference 0 set by simple PLC	0	0: Ramp-up/down time of ramp 1 (b7-04 [Ramp 1 ramp-up time]/b7-05 [Ramp 1 ramp-down time]) 1: Ramp-up/down time of ramp 2 (b7-10 [Ramp 2 ramp-up time]/b7-11 [Ramp 2 ramp-down time]) 2: Ramp-up/down time of ramp 3 (b7-16 [Ramp 3 ramp-up time]/b7-17 [Ramp 3 ramp-down time]) 3: Ramp-up/down time of ramp 4 (b7-22 [Ramp 4 ramp-up time]/b7-23 [Ramp 4 ramp-down time])	Defines the ramp-up/down time of multi-reference 0 set by simple PLC. Options: 0: Ramp-up/down time of ramp 1 - The ramp-up/down time of ramp 1 (b7-04/b7-05) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 1: Ramp-up/down time of ramp 2 - The ramp-up/down time of ramp 2 (b7-10/b7-11) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 2: Ramp-up/down time of ramp 3 - The ramp-up/down time of ramp 3 (b7-16/b7-17) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 3: Ramp-up/down time of ramp 4. The ramp-up/down time of ramp 4 (b7-22/b7-23) is used as the ramp-up/down 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	Operating time of multi-reference 1 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-14	Ramp-up/down 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
P1-16	Operating time of multi-reference 2 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-17	Ramp-up/down 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	Operating time of multi-reference 3 set by simple PLC	0	Same as P1-10	Same as P1-10

Param.	Name	Default value	Value range	Description
P1-20	Ramp-up/down 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	Operating time of multi-reference 4 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-23	Ramp-up/down 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	Operating time of multi-reference 5 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-26	Ramp-up/down 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	Operating time of multi-reference 6 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-29	Ramp-up/down 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
P1-31	Operating time of multi-reference 7 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-32	Ramp-up/down 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	Operating time of multi-reference 8 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-35	Ramp-up/down 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

Param.	Name	Default value	Value range	Description
P1-37	Operating time of multi-reference 9 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-38	Ramp-up/down 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	Operating time of multi-reference 10 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-41	Ramp-up/down 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	Operating time of multi-reference 11 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-44	Ramp-up/down time of multi-reference 11 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-45	Multi-reference 12 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-46	Operating time of multi-reference 12 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-47	Ramp-up/down 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	Operating time of multi-reference 13 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-50	Ramp-up/down 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	Operating time of multi-reference 14 set by simple PLC	0	Same as P1-10	Same as P1-10

Param.	Name	Default value	Value range	Description
P1-53	Ramp-up/down 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	Operating time of multi-reference 15 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-56	Ramp-up/down time of multi-reference 15 set by simple PLC	0	Same as P1-11	Same as P1-11

Application instance

Steps to set the simple PLC as the torque source are as follows.

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 P1-09 [Multi-reference 0 set by simple PLC], P1-12 [Multi-reference 1 set by simple PLC], P1-15 [Multi-reference 2 set by simple PLC], P1-18 [Multi-reference 3 set by simple PLC], P1-21 [Multi-reference 4 set by simple PLC], P1-24 [Multi-reference 5 set by simple PLC], P1-27 [Multi-reference 6 set by simple PLC], P1-30 [Multi-reference 7 set by simple PLC], P1-33 [Multi-reference 8 set by simple PLC], P1-36 [Multi-reference 9 set by simple PLC], P1-39 [Multi-reference 10 set by simple PLC], P1-42 [Multi-reference 11 set by simple PLC], P1-45 [Multi-reference 12 set by simple PLC], P1-48 [Multi-reference 13 set by simple PLC], P1-51 [Multi-reference 14 set by simple PLC], and P1-54 [Multi-reference 15 set by simple PLC]. These 16 multi-reference values correspond to the frequency references of 16 STEPS of simple PLC. 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 STEPS) to define the operating time and ramp-up/down time of STEP 0.
3. Set P1-02 to select the simple PLC operation mode.
4. Set the ones 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 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 STEP i when the calculation stops.
6. Set P1-00 [Simple PLC module enable] to 1 [Enable] 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, the drive switch to the next STEP, and the torque reference is also switched to the reference of the next STEP.

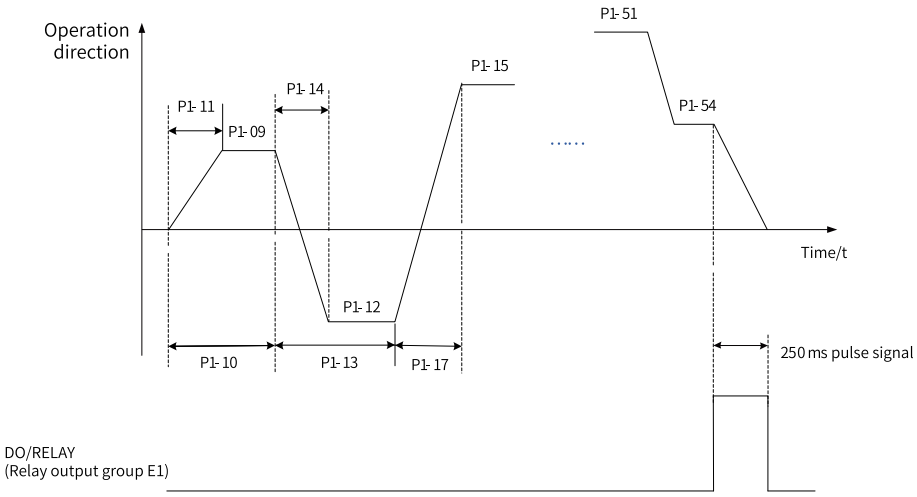


Figure 10-46 Setting torque through simple PLC

10.4.8 Setting Torque Through PID

Application scenarios

The PID control output is used as the operating frequency. The PID control is generally used for field process closed-loop control, such as constant pressure closed-loop control and constant tension closed-loop control.

Description

Set b5-13 [Torque reference source] to 8 [PID] to set the PID output as the torque reference.

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. When the PID output is used as the operating frequency, the PID output value 100% corresponds to A2-06 [Per-unit base value of torque].

PID control adjusts the PID output by modifying the proportional, integral, and derivative parameters. The PID control parameters are defined as follows.

- Proportional gain Kp: Once the deviation between the PID output and the input is generated, the PID adjusts the control output so that the controlled value changes to reduce deviation. The speed of the deviation reduction depends on the proportional coefficient Kp. A higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction.
- Integral time Ti: Determines the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can be.
- Derivative time Td: Determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be.

See detailed PID function description in *"12.6.5 Process PID Control" on page 717*.

See *"10.3.2.8 Setting Main Frequency Through PID" on page 326* for related parameters.

Application instance

The steps for setting PID as the torque source are as follows.

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 [General PID enable] to 1 [Enable] to enable PID.
3. Set P2-02 [PID reference source] 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).

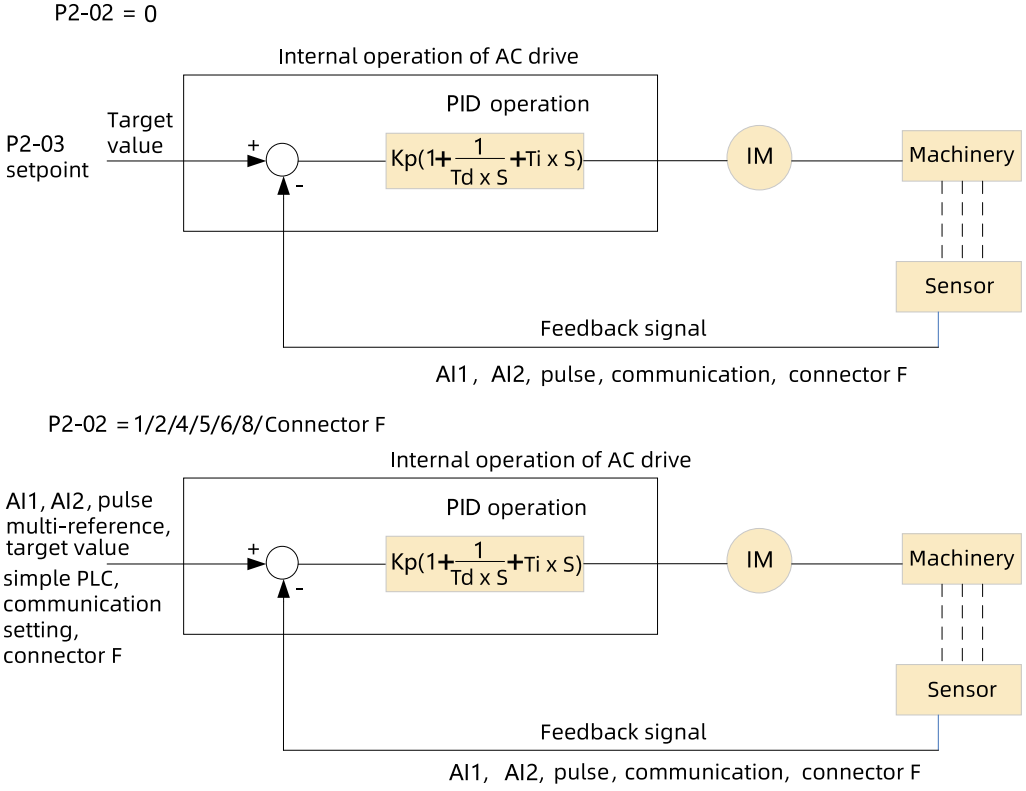


Figure 10-47 Schematic of general PID control

4. Set P2-04 [PID feedback source] to select the PID feedback source.
5. Set P2-01 [PID action direction] 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.

10.4.9 Setting Torque Reference Through Communication

Application scenarios

This function applies to applications requiring torque setting through communication, such as applications where wiring conditions cannot be met, where drives are far from the host controller, or where the host controller controls multiple drives simultaneously.

Description

Set b5-13 [Torque reference source] to 9 to select communication as the torque source.

Communication protocols supported are listed in the table below.

Model	Protocol	Hardware
MD610S	Modbus	MD610S RS485 communication interface (CN3)

Related parameters

The MD610S model supports Modbus communication. You can set related communication parameters in group n2.

See communication-related parameters in *"10.2.5 Control Operation Through Communication" on page 287*.

Comm. address

Set b5-13 [Torque reference source] to 9 to select communication as the torque source.

When the torque reference is set through communication, you need to configure basic communication parameters to enable the drive to communicate with the host controller. The host controller needs to follow the communication address and format specified by the drive to write communication commands to the drive.

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	This parameter specifies how to interpret the target speed written through the 7310H address by communication. Value description 0: Frequency (UInt16). When n0-14 is set to 0, the unit is frequency unit and the value is an unsigned 16-bit 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 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 unit and the value is a signed 16 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 decimal 20000 is written and A0-70 is set to 1, the frequency reference is 2000.0 Hz. 2: Speed (Int16) - When n0-14 is set to 2, the unit is speed unit 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 a 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 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 with two decimal places. The written value is mapped to the maximum frequency. For example, when decimal 1000 is written and the rated frequency is 150.00 Hz, the frequency reference is 15.00 Hz. When a decimal value -10000 is written and the rated frequency is 150.00 Hz, the frequency reference is -150.00 Hz. 4: Percentage (corresponds to the rated frequency/Int16/two decimal places) - When n0-14 is set to 3, the unit is percentage and the value is a signed 16-bit number with two decimal places. The written value is mapped to the rated frequency. For example, when a decimal value 1000 is written and the rated frequency is 50.00 Hz, the frequency reference is 5.00 Hz. When a decimal value -10000 is written and the rated frequency is 50.00 Hz, the frequency reference is -50.00 Hz.

Set n0-14 (7310H reference selection) to 4 (Percentage (corresponds to rated frequency/signed 16-bit/two decimal places)). In this case, writing 1000 to 7310H sets the torque to 10%. The torque reference can be viewed through U6-11.

Application instance

Procedure for setting "Communication" as the torque source:

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 to define 7310H reference configuration.
3. Send a write command to the drive through the host controller.

The following example shows how to set the main frequency through communication, with the Modbus protocol and address 0x7310. For example, when the torque is set to 10.00% (actual

transmitted value is 1000) through communication, the write command sent is 01 06 73 10 03 E8 92 35.

The following table describes the definition of each byte.

Byte	Definition
01H (editable)	AC drive address
06H	Write command
7310H	Torque reference address
03E8H (converted to 1000 in decimal)	Target torque
9235H	CRC

Set n0-14 (7310H reference selection) to 4 (Percentage (corresponds to rated frequency/signed 16-bit/two decimal places)). In this case, writing 1000 to 7310H sets the torque to 10%. The torque reference can be viewed through U6-11.

10.4.10 Setting Torque Reference Through MD-BP-M potentiometer

Description

Set b5-13/b5-16 (Torque reference source) to 10 (MD-BP-M potentiometer) to select the MD-BP-M potentiometer as the torque source. The potentiometer input is converted into an input ratio through the AI curve. 100.0% of the input ratio corresponds to A2-06 (Per-unit torque base value).

When the MD-BP-M potentiometer is used as the torque reference source, five different AI curves can be selected. The AI curve is used to define the relationship between the analog input voltage (or current) and the corresponding setting. For detailed AI curve setting methods, see *"10.11.8 Analog Input Terminal (AI)" on page 482*.

Application instance

1. Set curve of the AI1 voltage adjustment knob input and the setting ratio to "0 V to 10 V correspond to 0% to 100%".
   - Set E2-48 (minimum input of AI curve 3) to 0.00 V.
   - Set E2-49 (Percentage corresponding to minimum input of AI curve 3) to 0.0%.
   - Set E2-50 (maximum input of AI curve 3) to 10.00 V.
   - Set E2-51 (Percentage corresponding to maximum input of AI curve 3) to 100.0%.
2. Set the filtering time for the MD-BP-M potentiometer input using A6-39 (MD-BP-M potentiometer filtering time).
3. Set b5-13 (Torque reference source) to 10 (MD-BP-M potentiometer) to select the MD-BP-M potentiometer as the torque reference source.
   After the preceding steps, when AI voltage adjustment input is 5 V, the AC drive obtains the AI3 curve conversion value of 50%. In this case, the torque setpoint is 50%. When the input voltage of the MD-BP-M potentiometer is changed, the active torque changes according to the AI3 curve.

10.4.11 Setting Supplementary Torque

Application scenarios

The additional torque is used in applications that require the torque regulation to be activated directly.

Description

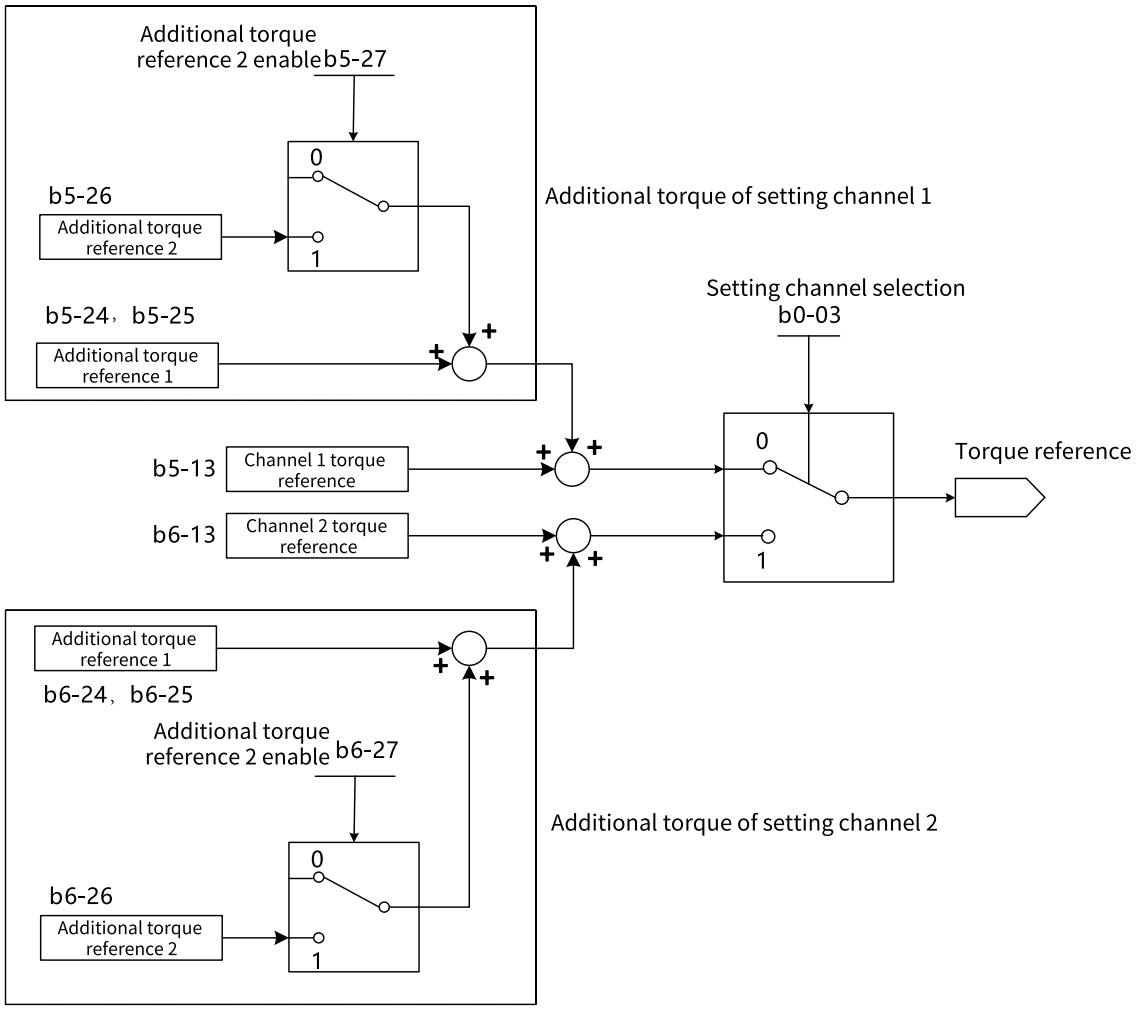


Figure 10-48 Torque reference and additional torque

Related parameters

Table 10–17 Related parameters

Param.	Name	Default value	Value range	Description
b5-24	Source of additional torque reference 1	0	0: b5-25 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of additional torque reference 1. Options: 0: b5-25 - The source of additional torque reference 1 is set through b5-25. 2: AI1 The supplementary 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 supplementary 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 DI5. It is calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the source of supplementary 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 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 additional torque reference 1 is set through PID. 9: Communication - The additional torque reference 1 is set through communication. In this mode, the additional torque reference 1 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: MD-BP-M potentiometer. The additional torque reference 1 is set through the MD-BP-M potentiometer. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the additional torque reference 1. It is used for extension of common sources.
b5-25	Digital reference of additional reference torque 1	0	-400.0% to +400.0%	Defines the digital reference of additional torque reference 1. The value is effective when the source of additional torque reference 1 is set to 0.

Param.	Name	Default value	Value range	Description
b5-26	Source of supplementary torque reference 2	0	0: Inactive 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of additional torque reference 2. Options: 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 DI5. 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 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 additional torque reference 2 is set through PID. 9: Communication - The additional torque reference 2 is set through 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. 10: MD-BP-M potentiometer. The additional torque reference 1 is set through the MD-BP-M potentiometer. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the additional torque reference 2. It is used for extension of common sources.
b5-27	Additional torque reference 2 enable	0	0: Inhibited 1: Active 3: DI1 4: DI2 5: DI3 6: Di4 7: DI5 Other: B connector	Defines whether to enable additional torque reference 2. When the value is 0, additional torque 2 is disabled. When the value is 1, additional torque 2 is enabled. Options: 0: Inhibited - The additional torque reference 2 is disabled. 1: Enabled - The additional torque reference 2 is enabled. 3 to 7: DI1 to DI5. Whether additional torque reference 2 is enabled depends on the terminal state of the DI. Other: B connector - Depends on B connector. You can select B connector through the pop-up window.

Param.	Name	Default value	Value range	Description
b6-24	Source of additional torque reference 1	0	0: b6-25 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of additional torque reference 1. Options: 0: b6-25 - The additional torque reference 1 is set through b6-25. 2: AI1 The supplementary 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 supplementary 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 DI5. It is calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the source of supplementary 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 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 additional torque reference 1 is set through PID. 9: Communication - The additional torque reference 1 is set through communication. In this mode, the additional torque reference 1 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: MD-BP-M potentiometer. The additional torque reference 1 is set through the MD-BP-M potentiometer. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the additional torque reference 1. It is used for extension of common sources.
b6-25	Digital reference of additional reference torque 1	0	-400.0% to +400.0%	Defines the digital reference of additional torque reference 1. The value is effective when the source of additional torque reference 1 is set to 0.

Param.	Name	Default value	Value range	Description
b6-26	Source of supplementary torque reference 2	0	0: Inactive 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of additional torque reference 2. Options: 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 DI5. 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 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 additional torque reference 2 is set through PID. 9: Communication - The additional torque reference 2 is set through communication. In this mode, the supplementary torque is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: MD-BP-M potentiometer. The additional torque reference 1 is set through the MD-BP-M potentiometer. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the additional torque reference 2. It is used for extension of common sources.
b6-27	Additional torque reference 2 enable	0	0: Inhibited 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines whether to enable additional torque reference 2. When the value is 0, additional torque 2 is disabled. When the value is 1, additional torque 2 is enabled. Options: 0: Inhibited - The additional torque reference 2 is disabled. 1: Enabled - The additional torque reference 2 is enabled. 3 to 7: DI1 to DI5. Depends on the terminal state of the DI. Other: B connector - Depends on B connector. You can select B connector through the pop-up window.

10.4.12 Setting Torque Limit

Application scenarios

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

Description

The torque upper limit refers to the maximum torque reference of the motor. The torque lower limit refers to the minimum torque reference of the motor.

The active torque upper limit is the smaller of d1-09 [Digital reference of torque upper limit 1] and d1-11 [Source of torque upper limit 2].

The active torque lower limit is the higher of d1-10 [Digital reference of torque lower limit 1] and d1-12 [Source of torque lower limit 2].

Related parameters

Table 10–18 Related parameters

Param.	Name	Default value	Value range	Description
d1-09 (F2-30)	Digital reference of torque upper limit 1	150.0%	0.0% to 800.0%	Defines the torque upper limit, which is a per-unit value based on the rated torque of the motor. d1-09 [Digital reference of torque upper limit 1] is mapped to F2-30 in group F. These two parameters have the same function. Note: The active positive torque limit is the smaller of d1-09 and d1-11.
d1-10 (F2-31)	Digital reference of torque lower limit 1	-150.0%	-800.0% to 0.0%	Defines the torque lower limit, which is a per-unit value based on the rated torque of the motor. d1-10 [Digital reference of torque lower limit 1] is mapped to F2-31 in group F. These two parameters have the same function. Note: The effective torque lower limit is the higher of d1-10 and d1-12.

Param.	Name	Default value	Value range	Description
d1-11 (F2-32)	Source of torque upper limit 2	0	0: -800% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: 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. Options: 0: -800% - The limit is set 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 forward torque limit is set through the pulse frequency of the DI5. 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. Continued

Param.	Name	Default value	Value range	Description
d1-11 (F2-32)	Source of torque upper limit 2	0	0: -800% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Continued 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/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 limit is set through PID. 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 AC drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value 9: Communication - The limit is set through communication. You can set the torque lower limit through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: MD-BP-M potentiometer. The additional torque reference 1 is set through the MD-BP-M potentiometer. Other: F connector - A parameter number is set for the floating-point connector, and the value of the connector is used as the limit. It is used for extension of common sources. Note: The effective torque upper limit is the smaller of F2-30 and F2-32.

Param.	Name	Default value	Value range	Description
d1-12 (F2-33)	Torque lower limit 2 selection	1	0: -800% 1: Inverted value of d1-11 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: 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. Options: 0: -800% - The limit is set to -800%. 1: Inverted value of d1-11- The inverted value of d1-11 is used as the source. 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 reverse torque limit is set through the pulse frequency of the DI5. 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 reverse torque limits. The four multi-reference terminals can provide 16 states, corresponding to 16 limits. Continued

Param.	Name	Default value	Value range	Description
d1-12 (F2-33)	Torque lower limit 2 selection	1	0: -800% 1: Inverted value of d1-11 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Continued 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/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 limit is set through PID. 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 AC drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value 9: Communication - The limit is set through communication. You can set the torque lower limit through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: MD-BP-M potentiometer. The additional torque reference 1 is set through the MD-BP-M potentiometer. Other: F connector - A parameter number is set for the floating-point connector, and the value of the connector is used as the limit. It is used for extension of common sources. Note: The effective torque lower limit is the smaller of F2-31 and F2-33.

10.5 Start/Stop Mode

10.5.1 Startup Mode

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

Related parameters

Param.	Name	Default value	Value range	Description
d0-02 (F2-15)	Startup mode	0	0: Direct start 1: Flying start	Defines the startup mode of the motor. Options: 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.

10.5.1.1 Flying Start

Application scenarios

If a rotating motor is being started directly, overcurrent may occur due to the inrush current at startup. In this case, you can set d0-02 (Startup mode) to 1 (Flying start) to apply flying start, where the drive detects the motor speed and direction first and then start at the motor frequency tracked.

Flying start is suitable for applications where the motor needs to be started while rotating, typically for driving high-inertia mechanical loads.

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.

Operating principles

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.

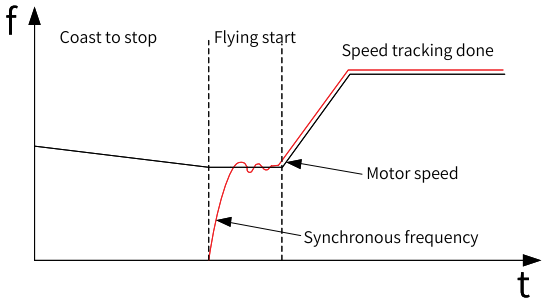


Figure 10-49 Flying start diagram

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

Related parameters

Param.	Name	Default value	Value range	Description
d0-03 (F2-16)	Speed tracking mode	4	0: Starting from the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented speed tracking	Defines the speed tracking mode when the drive starts. Options: 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 power 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.

Precautions

1. In the V/f control mode of the asynchronous motor, four flying start modes can be selected. In the SVC control mode, only magnetic field oriented flying start is available.
2. The flying start methods 0, 1, and 2 take longer time than the other methods but feature lower requirements on motor parameters.
3. No changes are needed for speed tracking method of synchronous motors.

4. After speed tracking start, self-test before startup is not performed.

Application instance

● 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 motor may continue to rotate due to water flow striking the impeller blades.

● 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.

The flying start mode is usually applied to fields including fans, water pumps, air conditioners, and air compressors. You need to enable flying start for a rotating motor. Set d0-02 (Start mode) to 1 (Flying start) and start the drive. Then the drive detects the current motor speed and starts the motor at the current motor speed.

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

Application scenarios

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. This startup mode is applicable to most load applications.

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.

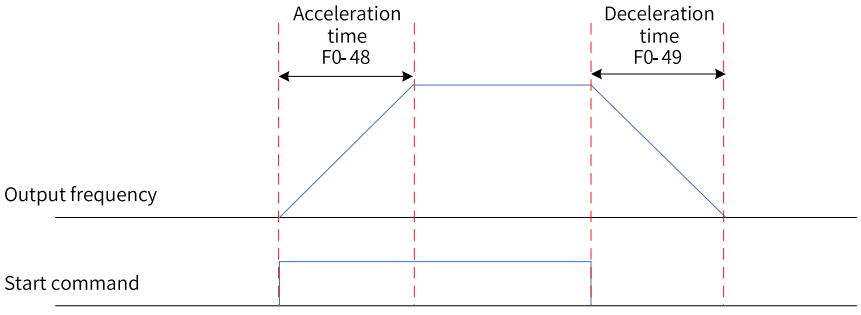


Figure 10-50 Schematic for direct startup

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].

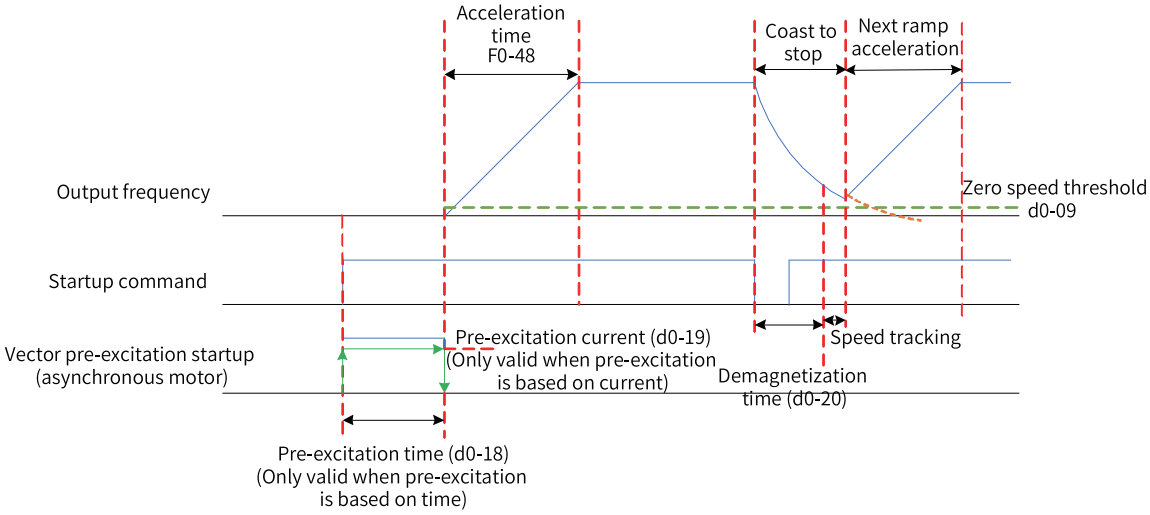


Figure 10-51 Schematic of pre-excitation

Related parameters

Param.	Name	Default value	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. Options: 0: Time-based pre-excitation - 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	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	Demagnetization 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.

Precautions

1. Pre-excitation start is applicable only to asynchronous motors in FVC and SVC 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". In this case, pre-excitation time changes.
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.

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.

10.5.1.3 Synchronous Motor Direct Startup (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.

Operating principles

Direct starting 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 start-up issues such as reverse start-up, oscillation, or out-of-step caused by excessive deviation between the initial wave phase angle and the actual position of the motor's rotor.

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.

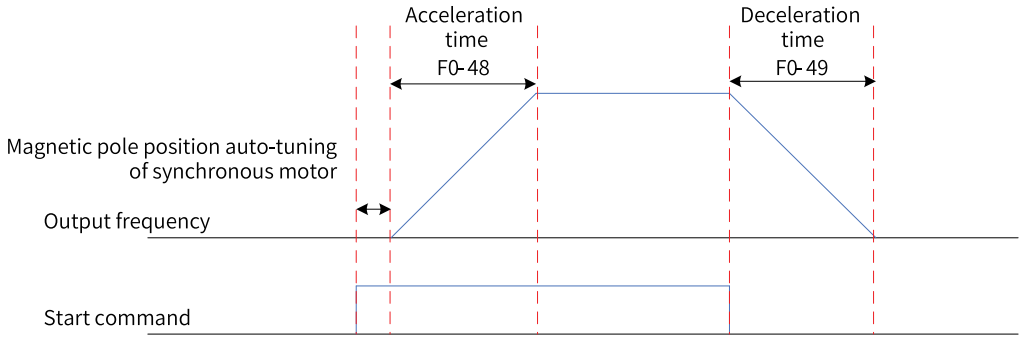


Figure 10-52 Pole position auto-tuning

Related parameters

Param.	Name	Default value	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. Options: 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. Options: 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.

Param.	Name	Default value	Value range	Description
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, 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.

Precautions

1. 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.
2. 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.
3. 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.
4. 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.
5. Magnetic pole position auto-tuning is performed on the synchronous motor every time upon startup in SVC mode.
6. Auto-tuning with voltage pulse lasts about 15 ms.
7. Auto-tuning with high frequency injection lasts about 120 ms.
8. Pre-positioning-based auto-tuning lasts about 2s.

10.5.2 Stop mode

Application scenarios

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

Operating principles

The drive supports three start/stop commands, which include ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).

- ON_OFF1 (Start/Stop): The value 0 indicates it is inactive and the value 1 indicates it is active. It is generally used together with OFF2 and OFF3 to control the drive. When the OFF2 and OFF3 commands are invalid and no fault exists, the ON_OFF1 command is triggered by the rising edge (0→1). When the stop command is triggered by the falling edge (1→0), the drive stops as defined by d0-04 (OFF1 stop mode).
- OFF2 (Coast to stop): The value 1 indicates it is inactive and the value 0 indicates it is active. It is generally used together with ON_OFF1 and OFF3 to control the drive. 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 in the mode set by d005 (OFF2 stop mode).
- OFF3 (Quick stop): The value 1 indicates it is inactive and the value 0 indicates it is active. It is generally used together with ON_OFF1 and OFF2 to control the drive. 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 in the mode set by d006 (OFF3 stop mode).

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

As shown in the preceding table, the stop modes of OFF1 to OFF3 can be set with different commands, as defined below.

- Decelerate to stop
  d0-04 [OFF1 stop mode] is generally set to "decelerate to stop". Once the decelerate-to-stop command is activated, the drive decreases the output frequency to 0 and then stops based on the RFG deceleration time.

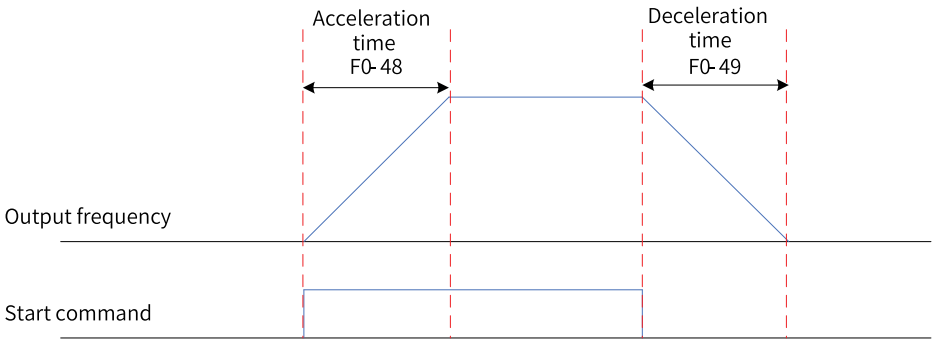


Figure 10-53 Decelerate to stop

- Coast to stop
  d0-05 [OFF2 (coast to stop) mode] is fixed to coast-to-stop. In coast-to-stop, the IGBT output is blocked directly and the motor coasts to stop. For devices with high inertia, the coast-to-stop process lasts for a long time. Coast-to-stop can be triggered upon most of the faults or OFF2 emergency stop.

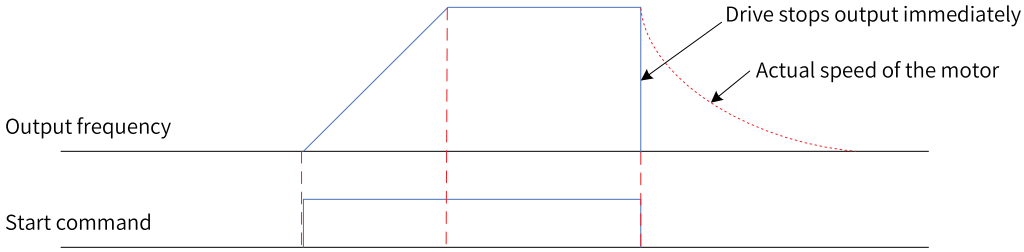


Figure 10-54 Coast to stop

- Stop with 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 (quick stop) mode] is generally set to "quick stop". The quick stop mode is equivalent to the function of emergency stop assigned to a terminal. The deceleration time is determined by b7-34 [Deceleration time in quick stop] to b7-36 [End arc in quick stop].

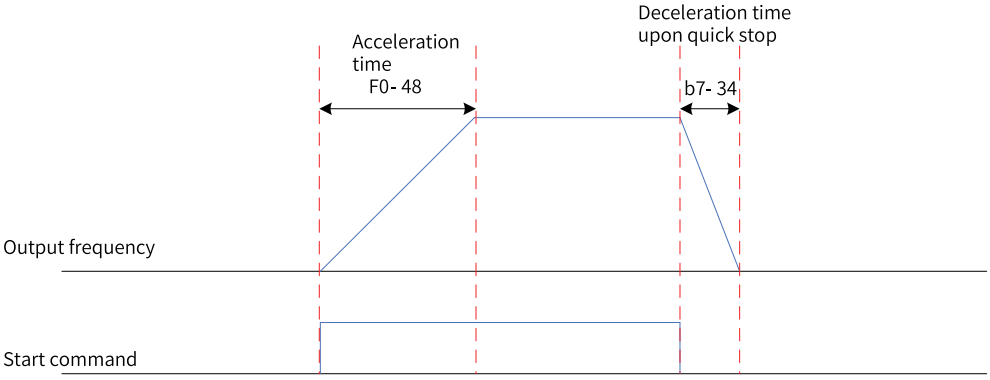


Figure 10-55 Quick stop

If the motor reaches torque or current limit during deceleration, the corresponding deceleration time will be extended.

Related parameters

Param.	Name	Default value	Value range	Description
d0-04 (F2-17)	OFF1 stop mode	0	0: Decelerate to stop 1: Coast to stop 2: Stop with maximum capability	It is used to set the OFF1 stop mode. Options: 0: Decelerate to stop - The stop mode is determined by the active ramp setting. 1: Coast to stop - The drive stops output, which means the power supply of the motor is cut off and the driving system is in the free braking state. 2: Stop with maximum capability - 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) mode	0	0: Coast to stop	Displays the OFF2 stop mode. The default mode is "coast to stop".
d0-06	OFF3 (Quick stop) mode	0	0: Quick stop 1: Stop with maximum capability	Defines the OFF3 (quick stop) mode. Options: 0: Quick stop - It is equivalent to the emergency stop function assigned to a terminal. The deceleration time is defined by b7-34/b7-35/b7-36. 1: Stop with 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.

Param.	Name	Default value	Value range	Description
d0-07	Permissible stop mode during operation	1	0: OFF1 stop mode 1: OFF2 (coast to stop) stop mode 2: OFF3 (quick stop) mode	Defines the stop mode after the operation permission signal is deactivated. It is equivalent to the operation pause or operation enable function that assigned to the terminal. Options: 0: OFF1 mode - The stop mode is defined by d0-04. 1: OFF2 (coast to stop) mode - The stop mode is coast-to-stop. 2: OFF3 (quick stop) mode - The stop mode is defined by d0-06.
d0-08	Stop mode in torque control	1	0: Coast to stop forcibly 1: Switched to speed mode and stop 2: Staying in torque mode until reaching zero speed and then stop	Defines the stop mode in torque control. Options: 0: Coast to stop forcibly - The motor coasts to stop, and the driving system is in the free braking state. 1: Switching to speed mode and stop. The speed mode applies and the motor stops based on the active stop 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.

10.5.3 Start 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.

Operating principles

Set the starting frequency through d0-23 [Starting frequency] and d0-24 [Starting frequency hold time]. When d0-24 is set to 0, the starting frequency is inactive. When d0-24 [Starting frequency hold time] is set to a non-zero value, 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.

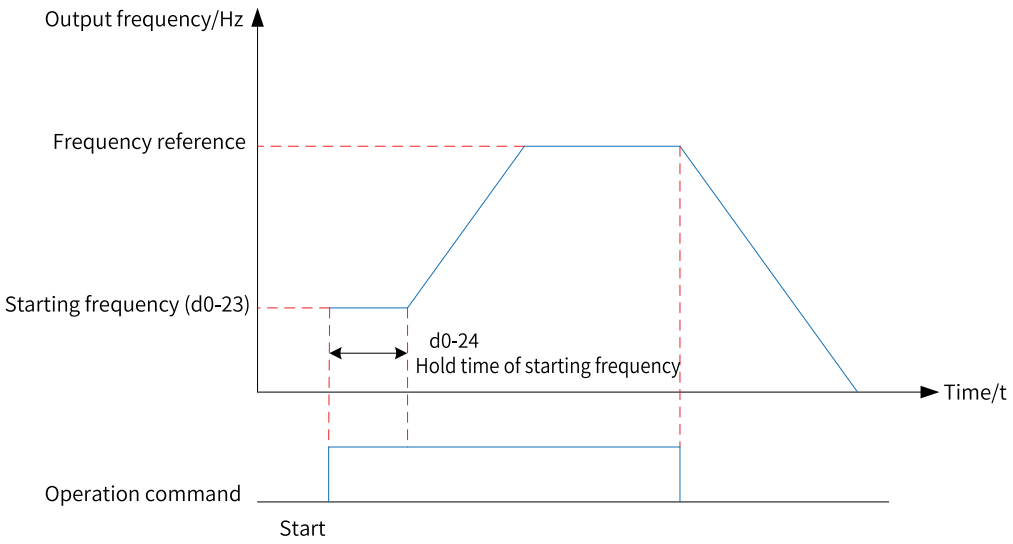


Figure 10-56 Diagram of starting frequency

Related parameters

Param.	Name	Default value	Value range	Description
d0-23	Start 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.

10.5.4 DC Braking

10.5.4.1 DC Braking at Startup

Application scenarios

The setting of DC braking time at startup applies to applications where the motor may rotate at start.

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

Operating principles

The DC braking function supplies a DC current to the motor's stator winding, generating a braking force that brings the motor to a halt. 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].

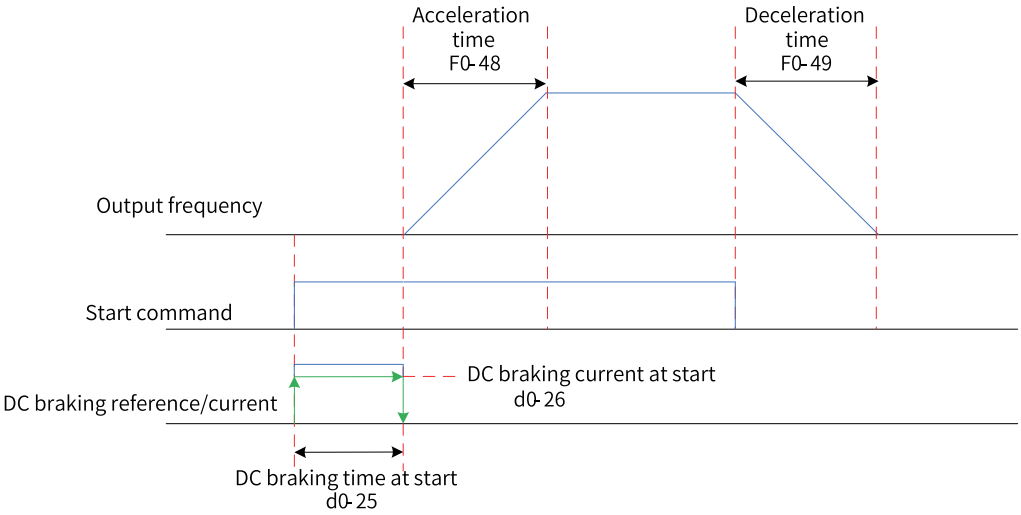


Figure 10-57 Diagram for DC braking at startup

Related parameters

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

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 ensure that the asynchronous motor is at the zero speed but may cause much motor heating.
3. Do not use the DC braking function to replace the brake function of the mechanical device.

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.

Application instance

In scenarios where rapid acceleration is required in V/f control mode, the absence of flux during the initial startup stage causes a significant deviation in the actual motor speed response, resulting in the process failing to meet requirements. 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.

10.5.4.2 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.

Operating principles

The DC braking function supplies a DC current to the motor's stator winding, generating a braking force that brings the motor to a halt.

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.

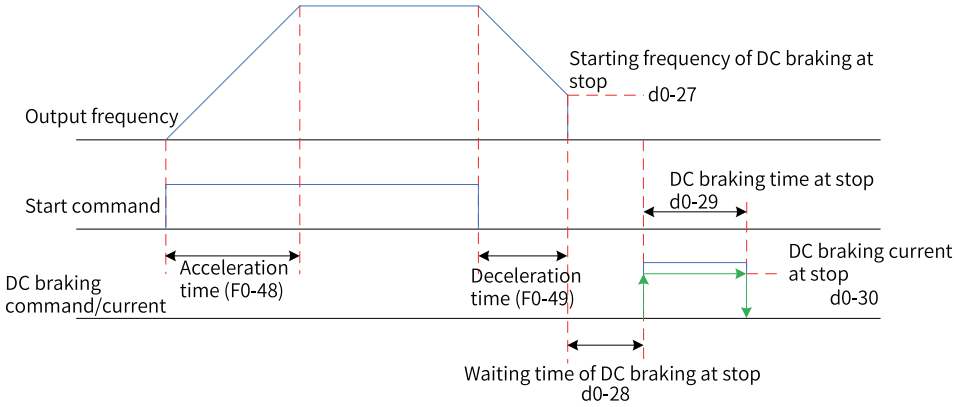


Figure 10-58 DC braking at stop

Related parameters

Param.	Name	Default value	Value range	Description
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: 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. 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.

Param.	Name	Default value	Value range	Description
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.
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.

Precautions

1. The starting frequency for DC braking at stop must not be set too high; otherwise, overcurrent may occur on the AC 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.

10.5.5 AC Drive Automatically Stops

Application scenarios

To make the drive stop automatically after operating for a certain period of time, you can set the timed operation period through P0-13 [Timing function selection] to P0-15 [Timed operation period]. Each time the drive starts, timing starts from 0. When the timed operation period expired, the drive stops automatically.

When the RO or DO is assigned with function "30 [Timed operation arrival]," the corresponding RO or DO outputs an active signal once the operating time of the drive reaches the set time.

Operating 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 period expires, the drive stops automatically. The remaining operating time can be viewed through U0-20 [Remaining time of timed operation].

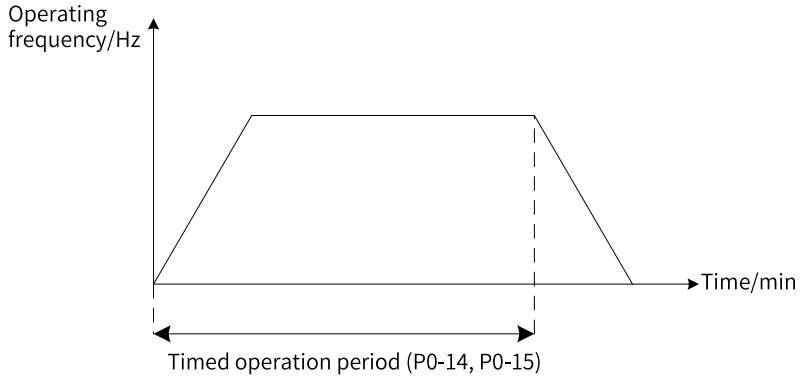


Figure 10-59 Timed operation

Set the timed operation period (min) through P0-14 [Timed operation period source] and P0-15 [Digital reference of timed operation period]. When the timed operation period is set to 0, the timed operation is inactive. Set the source of timed operation period through P0-14.

1. When P0-14 [Timed operation period source] is set to 0 [P0-15], the timed operation period is defined by 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 period source] is set to "Other [F Connector]", the timed operation period = floating-point connector value x P0-15.

When no special requirements are needed, P0-14 [Timed operation period source] is set to 0 [P0-15] by default, and the timed operation period is set through P0-15.

Related parameters

Param.	Name	Default value	Value range	Description
P0-13	Timing function	0	0: Inactive 1: Active	Defines whether the timer of the drive is enabled. Options: 0: Inactive 1: Active - The timer starts upon startup of the drive. When the set timing period expires, the drive stops automatically, with the corresponding multi-function DO outputs ON signal. Note: 1. The timing period is set by P0-14 and P0-15 in units of minute. 2. The drive starts timing from 0 upon start every time, and the remaining timing period can be viewed in U0-20.
P0-14	Timed operation period source	0	0: P0-15 1: AI1 2: AI2 Others: F connector	Defines the source of the timed operation period. Options: 0: P0-15 - The timed operation period is set by P0-15. 1: AI1. The time is set by AI1 input voltage and P0-15. 2: AI2. The time is set by AI2 input voltage and P0-15. Other: F connector - The timed operation period is set by the F connector value and P0-15. Note: 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 reference of timed operation period	0.0 min	0.0 min to 6500.0 min	Defines the local digital value of the timed operation period.
U0-20	Remaining time of timed operation period	-	-	This parameter indicates the remaining time for timing operation in the unit of minute.

10.5.6 Hibernation and Wakeup

Application scenarios

You can set a sleep time within any 24-hour period. During the sleep period, the drive stops and enters the sleep state.

Wake-up is a process that the drive wakes up from the sleep state and starts to run.

Operating principles

To use the sleep and wake-up functions, set the sleep frequency and wake-up frequency. As shown in the following figure, set the sleep function through P0-24 [Sleep frequency] and P0-25 [Sleep delay]. During operation of the drive, when the frequency reference is lower than or equal to the P0-24 [Sleep frequency], the drive enters the sleep state and decelerates to stop after the sleep

delay defined by P0-25 elapses. Set the wake-up function through P0-22 (Wake-up frequency) and P0-23 (Wake-up delay). In the sleep state, when the frequency reference is equal to or greater than P0-22 (Wake-up frequency), the drive wakes up after the delay defined by P0-23 elapses.

Generally, set P0-22 [Wake-up frequency] to a value equal to or higher than P0-24 [Sleep frequency]. The sleep and wake-up functions are invalid if both the wake-up frequency and sleep frequency are set to 0.0 Hz.

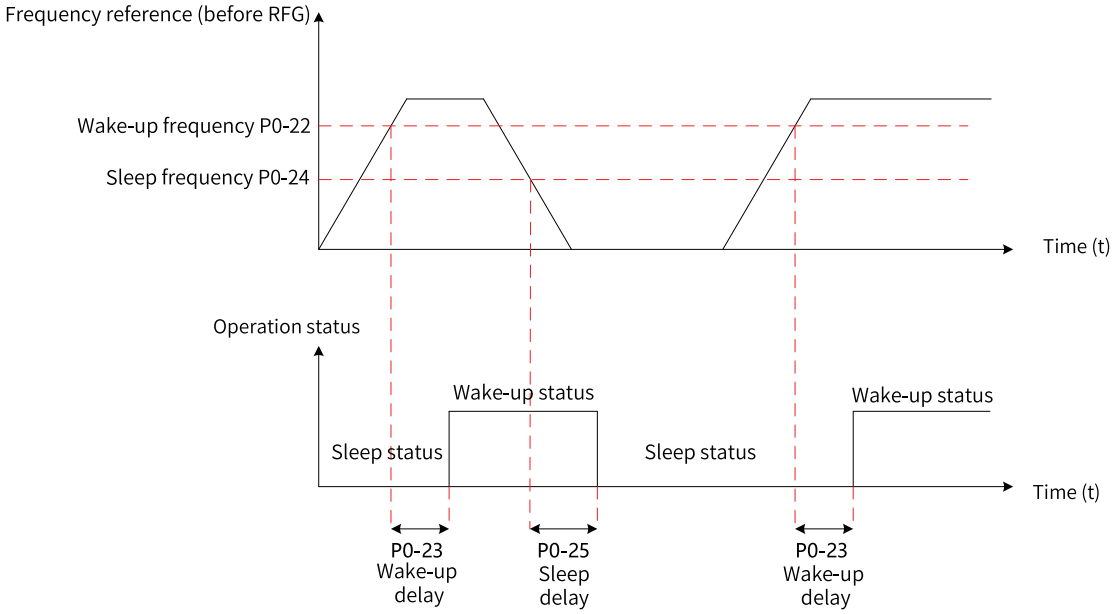


Figure 10-60 Sleep and wake-up function setting

Note:

(1) The upper limit of the sleep frequency can be set to a value equal to the wake-up frequency. Set P0-22 [Wake-up frequency] first and then P0-24 [Sleep 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

Param.	Name	Default value	Value range	Description
P0-22	Wakeup frequency source	0.00 Hz	P0-24 to A2-17	Defines the wake-up frequency of the drive to exit the sleep state. Note: If the drive is in the sleep state and the current operation command is active, when the frequency reference is greater than or equal to P0-22 [Wake-up frequency], the drive starts directly after the delay defined by P0-23 elapses.
P0-23	Wakeup delay	0.0s	0.0s to 6500.0s	Defines the effective time of wake-up delay. Note: If the drive is in the sleep state and the current operation command is active, when the frequency reference is greater than or equal to P0-22 [Wake-up frequency], the drive starts directly after the delay defined by P0-23 elapses.
P0-24	Sleep frequency	0.00 Hz	0.00 Hz to P0-22	Defines the sleep frequency of the drive. During operation of the drive, setting the frequency to a value lower than the sleep frequency triggers the sleep state. Note: During operation of the drive, when the frequency reference is lower than or equal to the P0-24 [Sleep frequency], the drive enters the sleep state and decelerates to stop after the sleep delay defined by P0-25 elapses.
P0-25	Sleep delay	0.0s	0.0s to 6500.0s	Defines the hibernation delay of the AC drive. Note: During operation of the drive, when the frequency reference is lower than or equal to the P0-24 [Sleep frequency], the drive enters the sleep state and decelerates to stop after the sleep delay defined by P0-25 elapses.

10.5.7 Startup Protection

Application scenarios

This function is used to apply protection upon start of the drive to prevent dangers caused by inadvertent motor responses to the operation commands. The startup protection applies to the following conditions.

1. If the operation command is active when the drive is powered on (for example, an input terminal is ON before power-on), the drive does not respond to the command. The drive responds only after the operation command is activated again.
2. If the operation command is active during fault reset, the drive does not respond to the operation command. In this case, the startup protection can be disabled only after the operation command is deactivated. The drive starts to run when the operation command is activated again.

Operating principles

You can activate startup protection through P0-21 [Startup protection selection]. When P0-21 is set to 1, this function is active. If the operation command is inactive upon power-on or fault reset, the drive does not respond to the operation command. In this case, the startup protection can be disabled only after the operation command is deactivated. The drive starts to run when the operation command is activated again.

Related parameters

Param.	Name	Default value	Value range	Description
P0-21	Startup protection	1	0: Disable 1: Enable	Defines whether the startup protection is enabled. Options: 0: Disable 1: Enable Note: 1. When this parameter is set to 1 and the operation command is active upon power-on (for example, the terminal that used to send an operation command is closed before power-on), the drive does not respond to the operation command. The drive responds only after the operation command is activated again. 2. When this parameter is set to 1 and the operation command is active upon fault reset, the drive does not respond to the operation command. The operation command must be deactivated first to disable the operation protection state.

Note: This parameter is inactive during fault reset, and the protection always applies.

10.6 Jog

10.6.1 Jog

Jog

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.

Operating principles

This drive can be set with 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 (Custom jog 1 source), and whether jog 2 command is valid through b1-07 (Custom jog 2 source).

Same as normal operation, the base frequency is set by b7-01 [Ramp-up/down time base]. Set the jog acceleration/deceleration time source through b7-31 [Jog ramp source selection]. When b7-31 is 0, the jog acceleration/deceleration time is the same as the normal acceleration/deceleration time. When b7-31 is 1, the jog acceleration/deceleration time is defined by b7-32 [Jog ramp acceleration time] and b7-33 [Jog ramp deceleration time]. The following figure shows the relationship between the output frequency and acceleration/deceleration time during jogging.

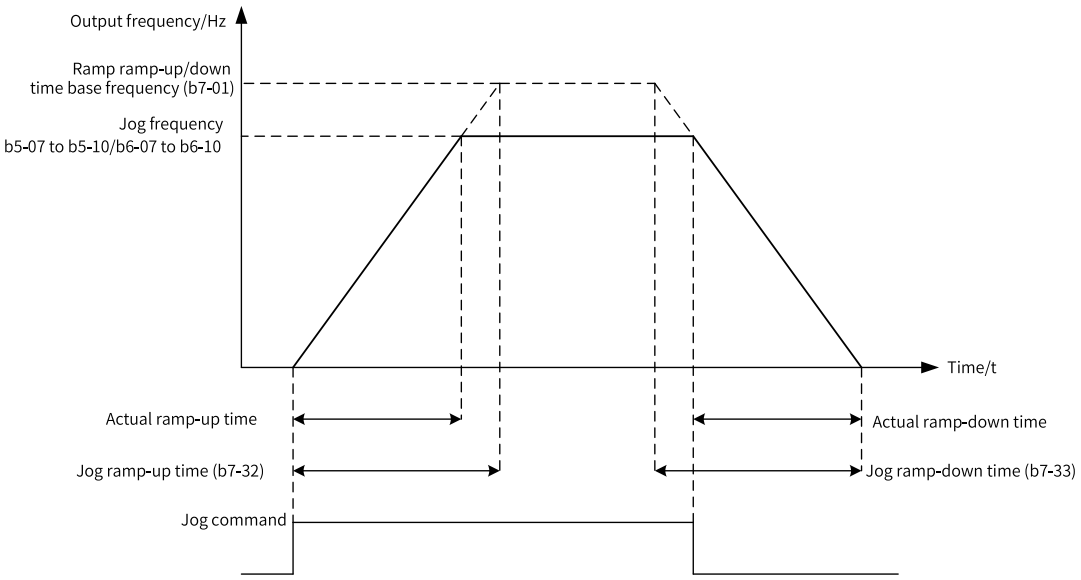


Figure 10-61 Jog

When both jog 1 and jog 2 commands are sent simultaneously, the drive responds to jog 1 command firstly. As shown in the figure below, when both jog 1 and jog 2 commands are input to the drive simultaneously, the drive starts at the jog 1 frequency reference (b5-07 [Jog 1 frequency source selection] and b5-08 [Jog 1 frequency reference]). If the jog 1 command is deactivated, the drive responds to the jog 2 command and starts at the jog 2 frequency reference (b5-09 [Jog 2 frequency source selection] and b5-10 [Jog 2 frequency reference]).

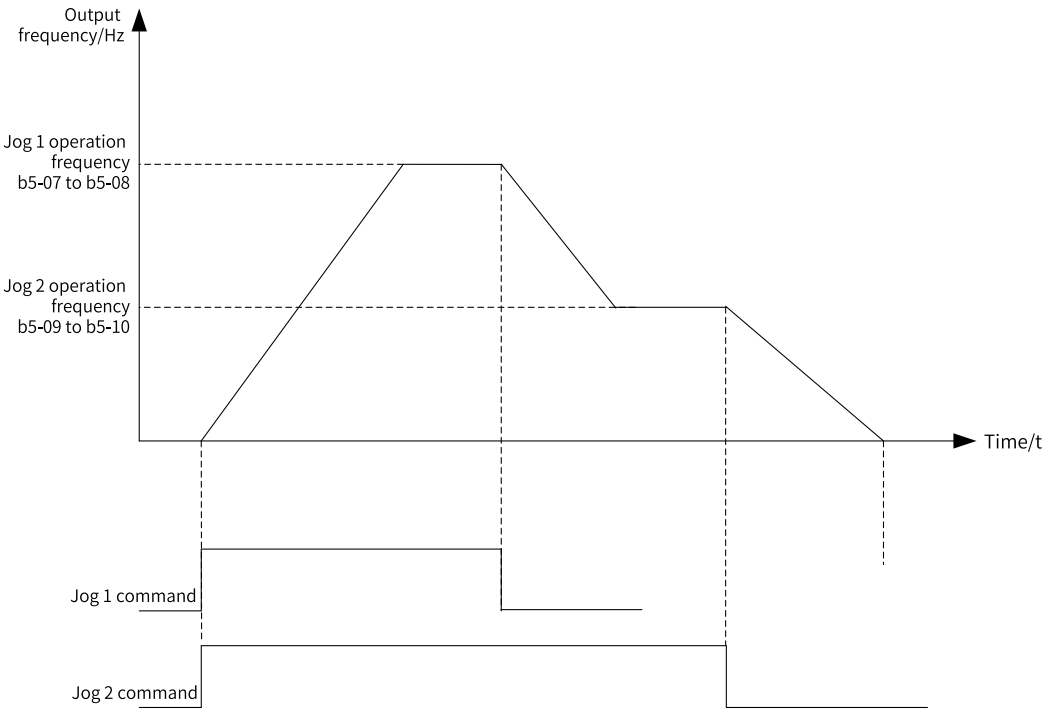


Figure 10-62 Relationship diagram between jog 1 and jog 2 commands

Additionally, the priority between jog and normal operation commands can be set through b1-09 [Jog/ON_OFF1 priority mode selection].

- When b1-09 is set to 0, priority is not differentiated, which means the command that comes first will be responded to first and the command that comes later will not be responded to. As shown in the figure below, the jog 1 command is input to the drive first, and the drive starts at the jog 1 frequency reference (b5-07 [Jog 1 frequency source selection] and b5-08 [Jog 1 frequency reference]). Therefore, when the jog 1 command is active, even if the ON_OFF1 normal operation command is active, the drive does not respond.

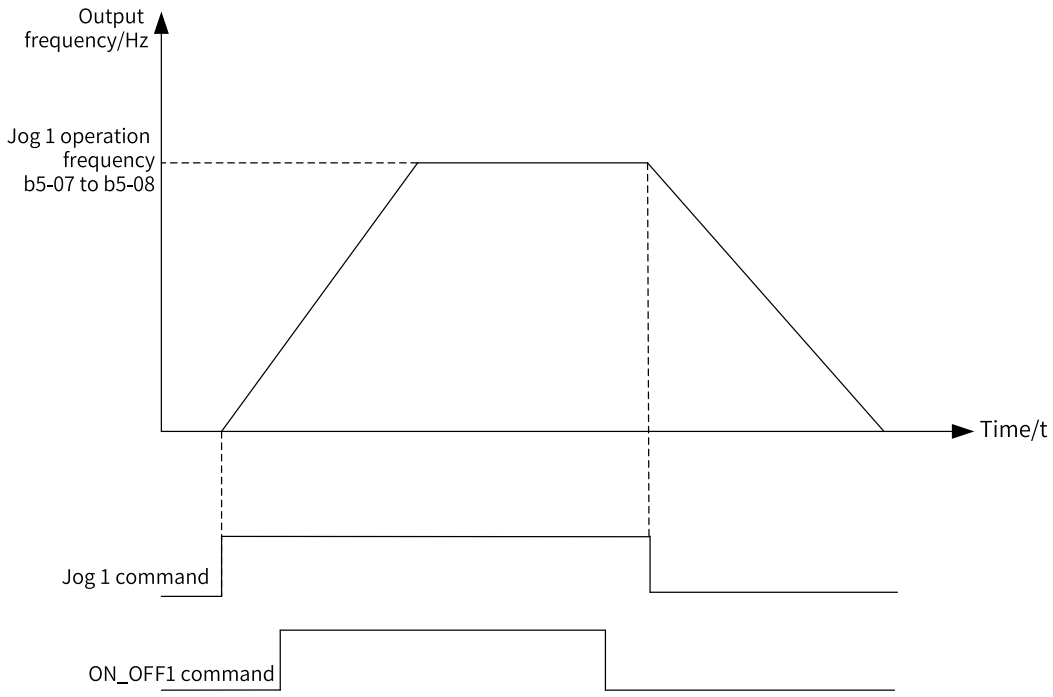


Figure 10-63 Jog command sent first upon non-priority distinction

As shown in the figure below, the ON_OFF1 normal operation command is input to the drive first, and the drive starts at the normal frequency set by ON_OFF1 (b5-00 to b5-06). Therefore, when the ON_OFF1 command is active, even if the jog 1 command is active, the drive does not respond.

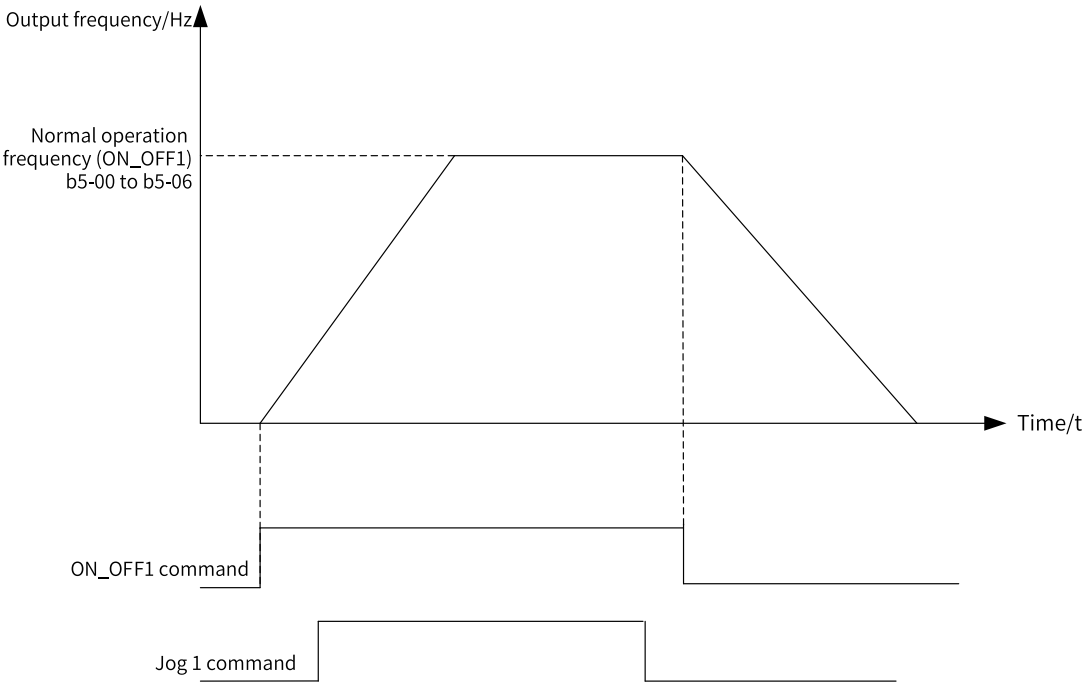


Figure 10-64 ON_OFF1 command sent first upon non-priority distinction

- When b1-09 is set to 1, jog commands are responded to first. 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 defined by b5-07 [Jog 1 frequency source] and b5-08 [Jog 1 frequency reference].

As shown in the figure below, when the ON_OFF1 command is active and the drive is running at the normal frequency reference (b5-00 to b5-06), if the jog 1 command is active, the drive immediately responds and switches to the jog 1 frequency (b5-07 [Jog 1 frequency source selection] and b5-08 [Jog 1 frequency setting]) until the jog 1 command is deactivated.

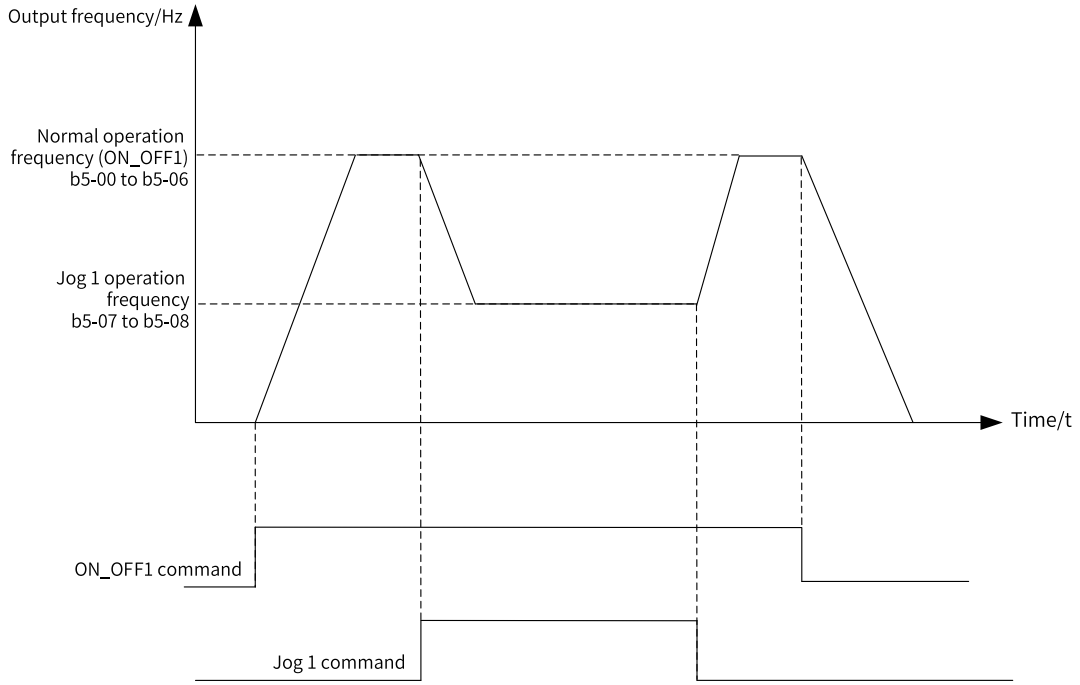


Figure 10-65 Jog command responded to first

- When b1-09 is set to 2, normal operation commands are responded to first. 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 defined by b5-00 to b5-06.

  As shown in the figure, when the jog 1 command is active, the drive runs at the jog 1 frequency reference (b5-07 [Jog 1 frequency source selection] and b5-08 [Jog 1 frequency reference]). If the ON_OFF1 command is active, the drive immediately responds and switches to the normal operation set frequency (b5-00 to b5-06) until the ON_OFF1 command is deactivated.

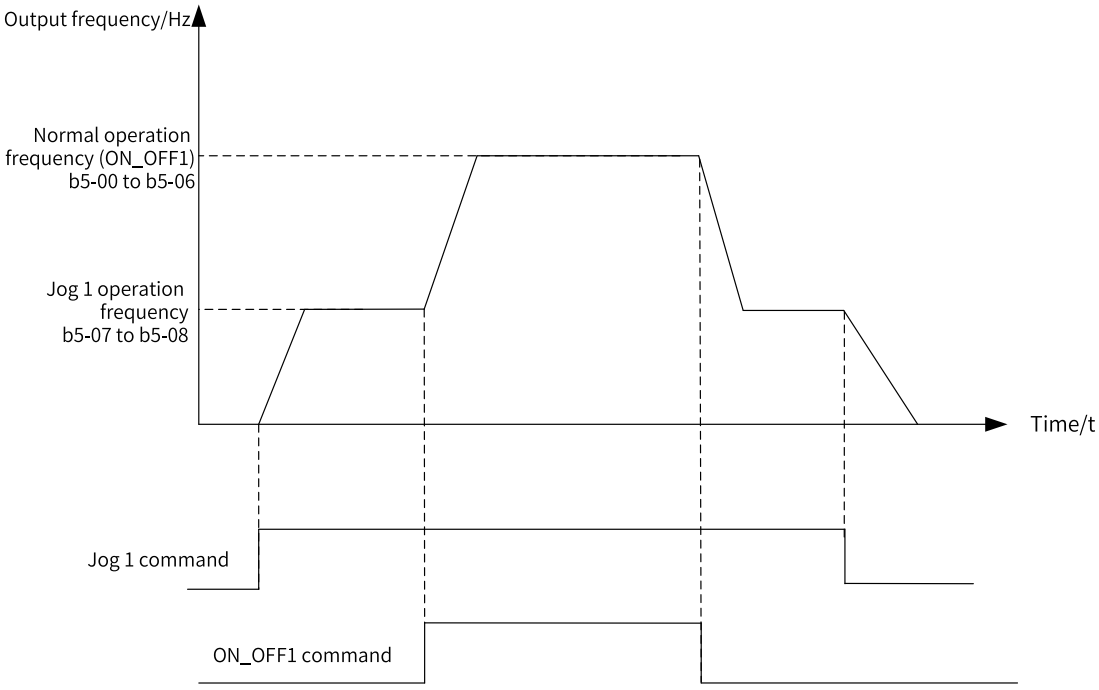


Figure 10-66 Normal operation (ON_OFF1) commands responded to first

Related parameters

Param.	Name	Default value	Value range	Description
b7-01 (F0-46)	Ramp-up/down time base	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	Defines the ramp-up/down time base. Options: 0: Rated frequency - The rated frequency is used as the ramp-up/down time base. 1: Max. frequency - The max. frequency is used as the ramp-up/down time base. 2: 100 Hz - 100 Hz is used as the ramp-up/down time base. 3: Frequency reference - The frequency reference is used as the ramp-up/down time base. Note: This parameter is used to set the ramp-up/down time base frequency. The ramp-up time indicates time required by the drive to accelerate from 0 Hz to the base frequency. The ramp-down time indicates time required by the drive to decelerate from the base frequency to 0 Hz.
b7-31 (F0-62)	Jogging ramp source	0	0: Ramp time in normal operation 1: Ramp time in jog	Defines the jog ramp source. Options: 0: Ramp time of normal operation - The jog ramp time is the same as the ramp-up/down time during normal operation. 1: Ramp time of jog - The ramp time in the jog mode is set separately (b7-32 and b7-33).

Param.	Name	Default value	Value range	Description
b7-32 (F0-63)	Ramp-up time in jog	20.00s	0.00s to 650.00s	Defines the time required for the output frequency to rise from 0 to b7-01 [Base frequency for acceleration/deceleration] in the jog mode. It determines the frequency rise rate in the jog mode.
b7-33 (F0-64)	Ramp-down time in jog	20.00s	0.00s to 650.00s	Defines the time required for the output frequency to decline from b7-01 [Base frequency for acceleration/deceleration] to 0 in the jog mode. It determines the frequency decline rate in the jog mode.
b5-07/b6-07	Source of jog frequency 1	0	0: b5-08 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of jog frequency 1. Options: 0: b5-08 - The jog 1 frequency is defined by b5-08. set by the parameter (b5-08). 2: AI1. The jog 1 frequency is input by the current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2. The jog 1 frequency is input by the current or voltage signal through 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. (Valid only for MD610S) 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 torque ramp-up/down 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. The jog 1 frequency can be input through remote communication. The drive must be installed with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. 10: MD-BP-M potentiometer. The jog frequency 1 is set through the MD-BP-M potentiometer. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. It is used for extension of common sources.
b5-08/b6-08	Jog 1 frequency reference	2.00	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 1. b5-08 is active when b5-07 is set to 0.

Param.	Name	Default value	Value range	Description
b5-09/b6-09	Source of jog frequency 2	0	0: b5-10 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of jog frequency 2. Options: 0: b5-10 - The jog 2 frequency is set through b5-10. It means the source is b5-10. 2: AI1. The jog 2 frequency is input by current or voltage signal through AI1 and calculated according to the preset AI curve. 3: AI2. The jog 2 frequency is input by the current or voltage signal through AI2 and calculated according to the preset AI curve. 5: HDI pulse. The jog 2 frequency is set by the pulse frequency of DI4 and calculated according to the corresponding mapping curve. (Valid only for MD610S) 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 torque ramp-up/down 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. The jog 2 frequency can be input through remote communication. The drive must be installed with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple equipment. 10: MD-BP-M potentiometer. The jog frequency 1 is set through the MD-BP-M potentiometer. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 2. It is used for extension of common sources.
b5-10/b6-10	Jog 2 frequency	-2.00	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 2. b5-10 is active when b5-09 is set to 0.
b1-06/b3-06	Custom JOG1 source	0	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines custom jog (JOG1) source. When the bit signal is 0, this function is inactive. When the bit signal is 1, this function is active. Options: 0: Invalid - Indicates that jog is invalid. 3 to 7: DI1 to DI5. Depends on the terminal state of the DI. Other: B connector - Depends on the B connector. You can select the B connector through the pop-up window.

Param.	Name	Default value	Value range	Description
b1-07/b3-07	Custom JOG2 source	0	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the custom jog 2 source. When the bit signal is 0, this function is inactive. When the bit signal is 1, this function is active. Options: 0: Invalid - Indicates that jog is invalid. 3 to 7: DI1 to DI5. Depends on the terminal state of the DI. Other: B connector - Depends on the B connector. You can select the B connector through the pop-up window.
b1-09/b3-09	Jog/ON_OFF1 priority mode selection	0	0: Priority not differentiated 1: Jog command responded to first 2: ON_OFF1 (start/stop) command responded to first	Defines the priority level of jog and normal operation commands. Options: 0: Non-priority distinction - The drive responds only to the operation command that arrives first. 1: Priority for jog. The jog command can interrupt normal operation. 2: Priority for ON_OFF1 (start/stop) Normal operation commands can interrupt jogging.

10.6.2 Jog Frequency Set Channel

The frequency references for jog 1 and jog 2 can be controlled separately. The jog frequency can be set through two channels, as shown below.

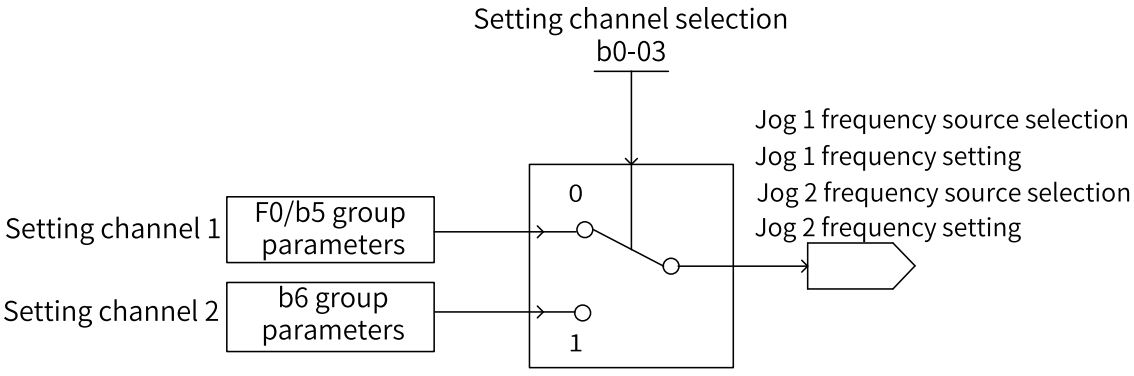


Figure 10-67 Jog frequency source

10.7 Acceleration/Deceleration Time

10.7.1 Acceleration/Deceleration Time Setting

Application scenarios

In scenarios where gradual ramp-up/down is required, set the ramp-up/down time to a high value. In scenarios where quick ramp-up/down is required, set the ramp-up/down time to a low value.

Operating principles

The ramp-up time indicates the time required for the drive to ramp up from 0 Hz to b7-01 [Ramp ramp-up/down time base frequency]. The ramp-down time indicates the time required for the drive to decelerate from b7-01 [Ramp ramp-up/down time base frequency] to 0 Hz. To set the ramp-up/down time properly, set b7-01 (Ramp ramp-up/down time base frequency) first. Then, set the ramp-up/down time. In default settings, the ramp-up/down time is set by b7-04 [Ramp 1 ramp-up Time] and b7-05 [Ramp 1 ramp-down Time].

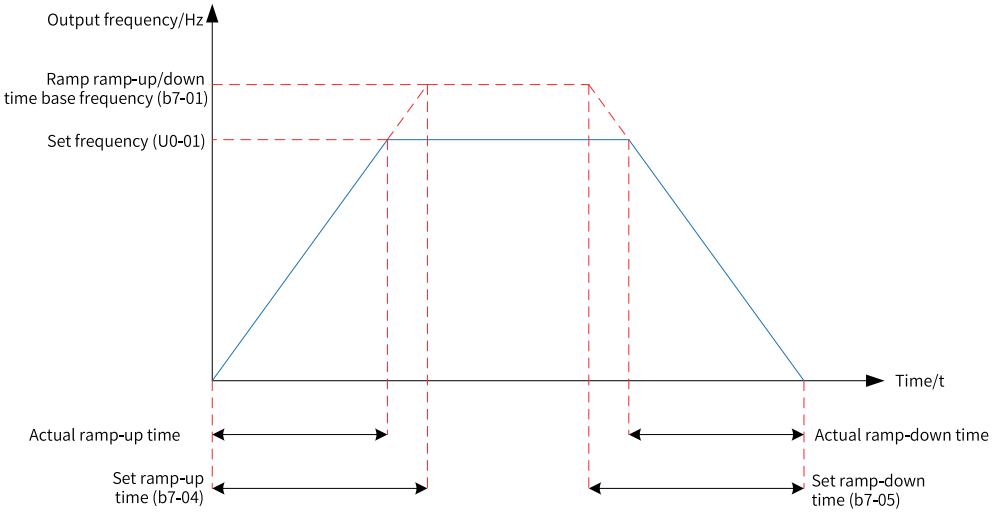


Figure 10-68 Ramp-up/down time base

For example, if the ramp-up/down time base is set to maximum frequency (50 Hz), and b7-04 [Ramp 1 ramp-up time] is set to 10 s, then the ramp-up rate during ramp-up is 50 Hz/10s = 5 Hz/s; if b7-05 [Ramp 1 ramp-down time] is set to 25s, then the ramp-up rate during ramp-down is 50 Hz/25s = 2 Hz/s.

Set the frequency to 25 Hz and start the drive. The drive ramps up to 25 Hz at the speed of 5 Hz/s and then run at the frequency of 25 Hz. The actual ramp-up time is 5s. Stop the AC drive. The drive will decelerate to stop at the speed of 2 Hz/s. The actual deceleration time is 12.5s.

Acceleration/Deceleration time selection

The drive supports up to four sets of ramp-up/down time, which are configured through the following parameters.

1. 1st set: b7-04 (Ramp 1 ramp-up time) and b7-05 (Ramp 1 ramp-down time), time unit: 0.1s
2. 2nd set: b7-10 (Ramp 2 ramp-up time) and b7-11 (Ramp 2 ramp-down time), time unit: 0.1s.
3. 3rd set: b7-16 (Ramp 3 ramp-up time) and b7-17 (Ramp 3 ramp-down time), time unit: 0.01s.
4. 4th set: b7-22 [Ramp 4 ramp-up time] and b7-23 [Ramp 4 ramp-down time], time unit: 0.01s.

You can select the effective ramp-up/down time through b7-02 [Ramp selection bit0] and b7-03 [Ramp selection bit1]. The relationship between parameter setpoints and selection results is as follows.

b7-02 [Ramp selection bit0]	b7-03 [Ramp selection bit1]	Acceleration/Deceleration time selection
0	0	1st set (b7-04 and b7-05)
1	0	2nd set (b7-10 and b7-11)
0	1	3rd set (b7-16 and b7-17)
1	1	4th set (b7-22 and b7-23)

Related parameters

Param.	Name	Default value	Value range	Description
b7-01 (F0-46)	Ramp-up/down time base	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	It is used to set the base frequency of ramp acceleration/ deceleration time. Options: 0: Rated frequency - The rated frequency is used as the ramp-up/down time base. 1: Max. frequency - The max. frequency is used as the ramp-up/down time base. 2: 100 Hz - 100 Hz is used as the ramp-up/down time base. 3: Frequency reference - The frequency reference is used as the ramp-up/down time base. Note: This parameter is used to set the ramp-up/down time base frequency. The ramp-up time indicates time required by the drive to accelerate from 0 Hz to the base frequency. The ramp-down time indicates time required by the drive to decelerate from the base frequency to 0 Hz.
b7-02	Ramp selection bit 0	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines ramp selection bit0. When the bit signal is 0, this function is inactive. When the bit signal is 1, this function is active. The drive supports four sets of ramp-up/down time, which can be switched by combining the states of ramp (RFG) selection bit0 and bit1 in four ways. Options: 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 7: DI1 to DI5. The value of bit0 depends on the terminal state of the DI1 to DI5. Other: B connector - Indicates the value of ramp selection bit0 depends on other B connector, which can be selected through the pop-up window. Note: This parameter is invalid when b7-28 is 1 and b7-29 or b7-30 is not zero.

Param.	Name	Default value	Value range	Description
b7-03	Ramp selection bit1	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines ramp selection bit1. When the bit signal is 0, this function is inactive. When the bit signal is 1, this function is active. The drive supports four sets of ramp-up/down time, which can be switched by combining the states of ramp (RFG) selection bit0 and bit1 in four ways. Options: 0: 0 - Indicates that the value of ramp selection bit1 is 0. 1: 1 - Indicates that the value of ramp selection bit1 is 1. 3 to 7: Same as b7-02 Other: Same as b7-02 Note: Same as b7-02
b7-04 (F0-48)	Ramp-up time of ramp 1	20.0s	0.0 to 6500.0	Defines ramp 1 ramp-up time. Note: It indicates the time required for the output frequency to increase from 0 to the ramp-up/down time base frequency (b7-01). The time is used to set the ramp-up speed. The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter specifies the first set of ramp-up time.
b7-05 (F0-49)	Ramp-down time of ramp 1	20.0s	0.0 to 6500.0	Defines the deceleration time of ramp 1. Note: It indicates the time required for the output frequency to decrease from b7-01 [Ramp-up/down base frequency] to 0. The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter specifies the first set of ramp-down time.
b7-10	Ramp-up time of ramp 2	20.0s	0.0 to 6500.0	Defines the acceleration time of ramp 2. Note: Same as b7-04 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the second set of ramp-up time.
b7-11	Ramp-down time of ramp 2	20.0s	0.0 to 6500.0	Defines the deceleration time of ramp 2. Note: b7-05 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the second set of ramp-down time.

Param.	Name	Default value	Value range	Description
b7-16	Ramp-up time of ramp 3	20.00s	0.00s to 650.00s	Defines the acceleration time of ramp 3. Note: Same as b7-04 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the third set of ramp-up time.
b7-17	Ramp-down time of ramp 3	20.00s	0.00s to 650.00s	Defines the deceleration time of ramp 3. Note: b7-05 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the 3rd set of ramp-down time.
b7-22	Ramp-up time of ramp 4	20.00s	0.00s to 650.00s	Defines the acceleration time of ramp 4. Note: Same as b7-04 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the fourth set of ramp-up time.
b7-23	Ramp-down time of ramp 4	20.00s	0.00s to 650.00s	Defines the deceleration time of ramp 4. Note: b7-05 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the fourth set of ramp-down time.

Note: b7-01, b7-04, and b7-05 are mapped to F0-46, F0-48, and F0-49 in group F. The settings of the two sets of parameters are equivalent.

Application instance

The following shows the setting procedure by taking DI1 and DI2 for ramp-up/down time switchover.

1. Set E0-00 [DI1 terminal function selection] and E0-01 [DI2 terminal function selection] to select DI1 and DI2 as ramp-up/down time switchover terminals.

Param.	Name	Setpoint	Description
E0-00	DI1 function selection	16	Acceleration/Deceleration selection terminal 1
E0-01	DI2 function	17	Acceleration/Deceleration selection terminal 2

2. Set b7-01 [Ramp-up/down time base] to 1 [Maximum frequency].
3. Set the four sets of ramp-up/down time parameters (b7-04 to b7-23) respectively.
4. Select the active ramp-up/down time by switching the DI terminal state.

DI1 state	DI2 state	Acceleration/Deceleration time selection
OFF	OFF	1st set (b7-04 and b7-05)
ON	OFF	2nd set (b7-10 and b7-11)
OFF	ON	3rd set (b7-16 and b7-17)
ON	ON	4th set (b7-22 and b7-23)

10.7.2 Acceleration/Deceleration Mode Setting

Application scenarios

In linear ramp-up/down, the output frequency increases or decreases linearly. This mode applies to most applications.

In S-curve ramp-up/down, 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 operation and quick response in real time.

Operating principles

Set b7-00 [Ramp-up/down mode] to select the frequency change mode during start/stop of the drive.

When b7-00 [Ramp-up/down mode] is set to 0 [Linear ramp-up/down], the output frequency changes linearly according to the set ramp-up/down time.

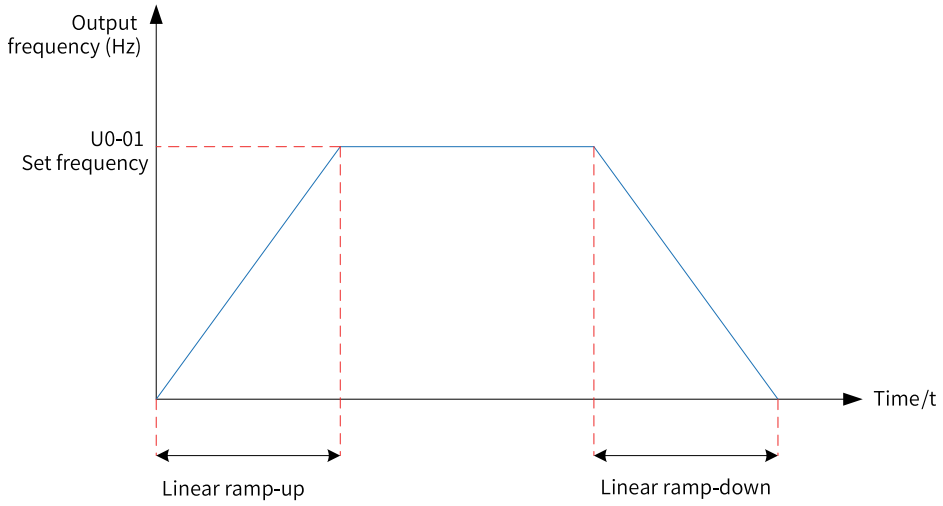


Figure 10-69 Linear acceleration/deceleration

When b7-00 [Ramp-up/down 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 set of ramp-up/down time as an example. Set the S-curve change time through b7-06 [Ramp-up start arc of ramp 1] to b7-09 [Ramp-down end arc of ramp 1].

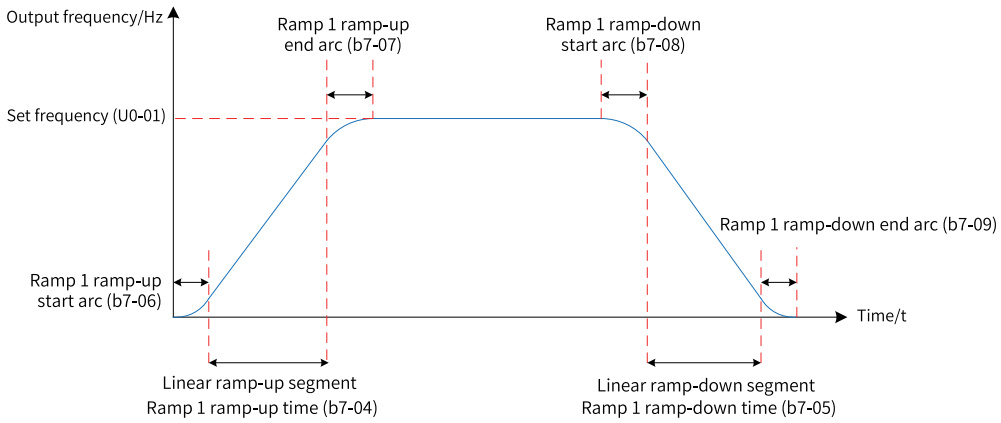


Figure 10-70 S-curve acceleration/deceleration

You can select the arc type through b7-43 (Ramp arc mode). b7-43 = 0 [Non-continuous smoothing]: When the ramp-up/down trend changes, the curve switches to the new target direction immediately. b7-43 = 1 [Continuous smoothing]: When the ramp-up/down trend changes, the curve follows the end arc of current ramp-up/down and then switches to the reference direction.

Related parameters

Param.	Name	Default value	Value range	Description
b7-00 (F0-45)	Ramp-up/down mode	0	0: Linear 1: S-curve	Defines the ramp-up/down mode. Options: 0: Linear - The output frequency increases or decreases linearly. 1: S-curve - In S-curve ramp-up/down, 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 operation and quick response in real time.
b7-06	Ramp-up start arc of ramp 1	0.00s	0.00s to 650.00s	Defines the motion time of the acceleration start arc of ramp 1. Note: The arc time at the start of output frequency ramp-up determines the acceleration of the arc at the start of reference ramp-up. This parameter is the first set of ramp-up start arc. This function is active only in the S-curve ramp-up/down mode (b7-00 = 1). For example, if this parameter is set to 2s and 10s is taken in ramping up to the set frequency, then the arc motion applies in the first 2s and linear motion applies in the last 8s during ramp-up. In addition, the linear motion is executed according to the set linear ramp-up/down time.

Param.	Name	Default value	Value range	Description
b7-07	Ramp-up end arc of ramp 1	0.00s	0.00s to 650.00s	Defines the motion time of the acceleration end arc of ramp 1. Note: The arc time at the end of output frequency ramp-up determines the acceleration of the arc at the end of reference ramp-up. This parameter is the first set of ramp-up end arc. This function is active only in the S-curve ramp-up/down mode (b7-00 = 1). For example, if this parameter is set to 2s and the acceleration time to the set frequency is 10s, the linear motion applies in the first 8s and arc motion applies in the last 2s during acceleration. In addition, the linear motion is performed based on the set linear ramp-up/down time.
b7-08	Ramp-down start arc of ramp 1	0.00s	0.00s to 650.00s	Defines the motion time during increasing deceleration start arc of ramp 1. Note: The arc time at the start of output frequency ramp-down determines the acceleration of the arc at the start of reference ramp-down. This parameter is the first set of ramp-down start arc. This function is active only in the S-curve ramp-up/down mode (b7-00 = 1). For example, if this parameter is set to 2s and 10s is taken in ramping down from the set frequency to 0, then the arc motion applies in the first 2s and linear motion applies in the last 8s during ramp-down. In addition, the linear motion is executed according to the set linear ramp-up/down time.

Param.	Name	Default value	Value range	Description
b7-09	Ramp-down end arc of ramp 1	0.00s	0.00s to 650.00s	Defines the motion time of deceleration end arc of ramp 1. Note: The arc time at the end of output frequency ramp-down determines the acceleration of the arc at the end of reference ramp-down. This parameter is the first set of ramp-down end arc. This function is active only in the S-curve ramp-up/down mode (b7-00 = 1). For example, if this parameter is set to 2s and 10s is taken in ramping down from the set frequency to 0, then the linear motion applies in the first 8s and arc motion applies in the last 2s during ramp-down. In addition, the linear motion is executed according to the set linear ramp-up/down time.
b7-43	Ramp arc mode	0	0: Non-continuous smoothing 1: Continuous smoothing	This parameter sets the ramp arc mode. This means that the arc acceleration changes when the acceleration/deceleration trend changes. Options: 0: Non-continuous smoothing - When the ramp-up/down trend changes, the new target direction applies immediately. 1: Continuous smoothing - When the ramp-up/down trend changes, wait for the current ramp-up/down to be done before the reference direction applies. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

Note:

(1) b7-00, b7-04, and b7-05 are mapped to F0-45, F0-48, and F0-49 in group F. These two sets 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 ramp-up/down time set is selected.

10.7.3 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 operation at a low speed, but the acceleration time is prolonged.

Operating principles

Set b7-42 [Threshold of low-speed range]. When the operating frequency is lower than this threshold, the drive is in the low-speed range. In this case, b7-41 [Acceleration time gain coefficient in low-speed range] takes effect. The acceleration time in the low-speed range is the product of the original acceleration time and the gain coefficient (b7-41). The default value of b7-41 is 100%, which means the acceleration time remains unchanged in the low-speed range. When the output frequency exceeds b7-42 [Threshold of low-speed range], the acceleration time reverts to the original setpoint, and the drive accelerates normally to the set frequency.

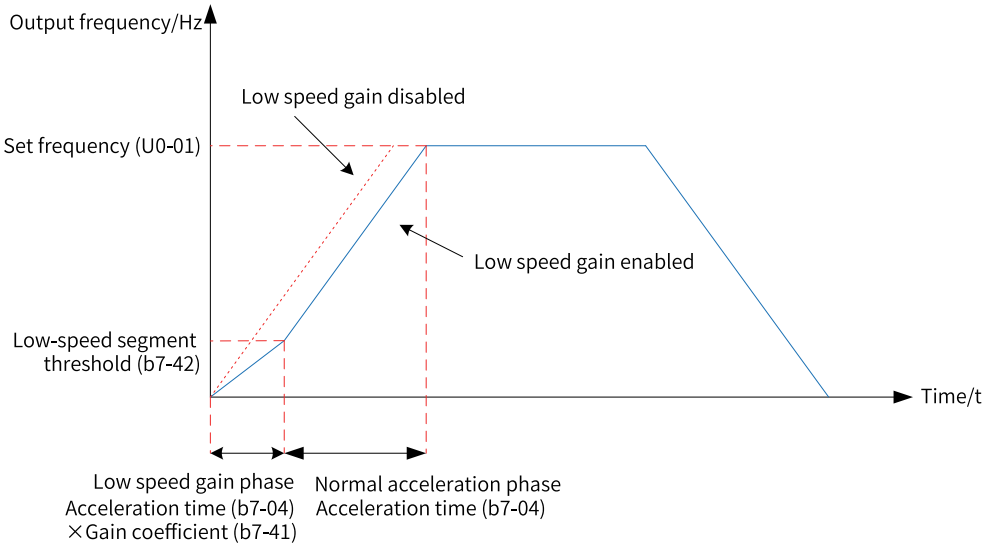


Figure 10-71 Low-speed gain

Related parameters

Param.	Name	Default value	Value range	Description
b7-41	Ramp-up time gain coefficient in low-speed range	100.0%	1.0% to 1000.0%	Defines the ramp-up time gain coefficient in low-speed range. Note: When the output frequency is lower than b7-42 [Threshold of low-speed range], b7-41 takes effect, and the actual acceleration time in the low-speed range is the product of the original acceleration time and b7-41.
b7-42	Threshold of low-speed range	15.00%	0.00% to 100.00%	Defines the threshold of low-speed range. Note: When the output frequency is lower than this threshold, b7-41 [Acceleration time gain coefficient in low-speed range] takes effect.

10.7.4 Automatic switch accel/decel time based on running frequency

Application scenarios

This function is used to select different acceleration/deceleration time based on the operating frequency range during operation of the drive.

Operating principles

You can enable automatic switchover of ramp-up/down time through b7-28 [Ramp 1/2 frequency switchover], and set the frequency threshold for ramp-up/down time switchover through b7-29 [Frequency threshold for ramp-up switchover of ramp 1/2] and b7-30 [Frequency threshold for ramp-down switchover of ramp 1/2].

The diagram for acceleration/deceleration time switchover is shown below.

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.

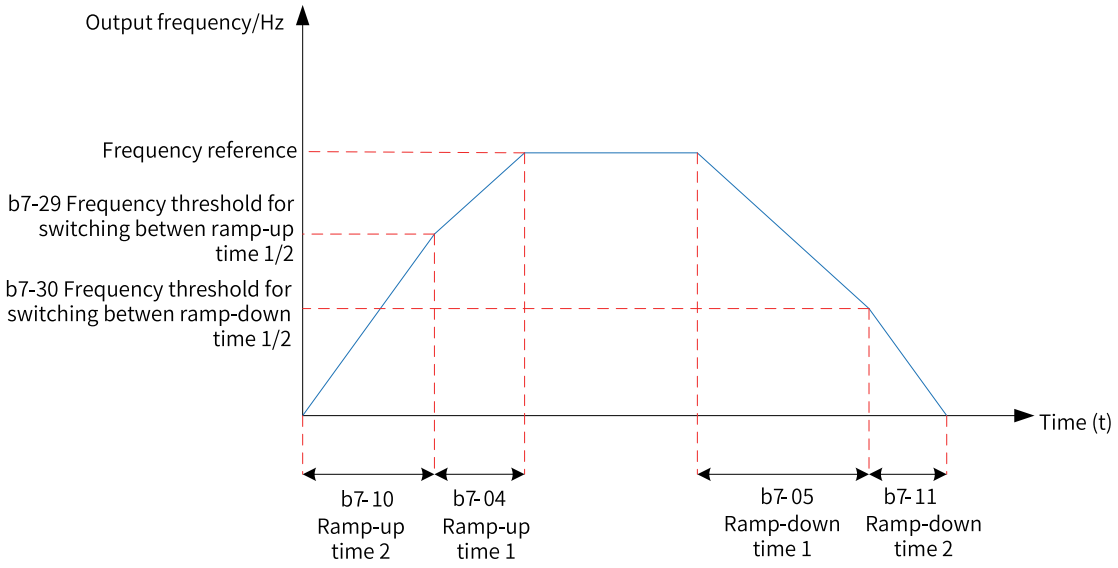


Figure 10-72 Automatic switchover of acceleration/deceleration time

Related parameters

Param.	Name	Default value	Value range	Description
b7-28	Ramps 1/2 frequency switchover	0	0: Inhibited 1: Active	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. Note: This parameter is generally used together with b7-29 and b7-30 to apply different acceleration/deceleration time (acceleration rate) during acceleration/deceleration.
b7-29	Frequency threshold for acceleration time 1/2 switchover	0.0 Hz	0.0 Hz to A2-18	Defines the frequency threshold for ramp 1/2 acceleration switchover. During acceleration, if the output frequency is greater than or equal to this setpoint, the ramp 1 acceleration time is active. Otherwise, the ramp 2 acceleration time is active.
b7-30	Frequency threshold for ramp-down time 1/2 switchover	0.0 Hz	0.0 Hz to A2-18	Defines the frequency threshold for ramp-down switchover of ramp 1/2. During ramp-down, if the output frequency is greater than or equal to the value of this parameter, ramp 1 ramp-down time is active. Otherwise, ramp 2 ramp-down time is active.
b7-04	Ramp-up time of ramp 1	20.0	0.0 to 6500.0	Defines ramp 1 ramp-up time. Note: It indicates the time required for the output frequency to increase from 0 to the ramp-up/down time base frequency (b7-01). The time is used to set the ramp-up speed. The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter specifies the first set of ramp-up time.
b7-05	Ramp-down time of ramp 1	20.0	0.0 to 6500.0	Defines the deceleration time of ramp 1. Note: It indicates the time required for the output frequency to decrease from b7-01 [Acceleration/Deceleration base frequency] to 0. The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter specifies the first set of ramp-down time.

Param.	Name	Default value	Value range	Description
b7-10	Ramp-up time of ramp 2	20.0	0.0 to 6500.0	Defines the acceleration time of ramp 2. Note: Same as b7-04 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the second set of ramp-up time.
b7-11	Ramp-down time of ramp 2	20.0	0.0 to 6500.0	Defines the deceleration time of ramp 2. Note: Same as b7-05 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the second set of ramp-down time.

10.7.5 Ramp tracking enable

Application scenarios

In certain operating conditions, if the load torque is excessive during acceleration, the actual motor speed cannot keep up with the speed output by the ramp function generator (set target speed). In this case, you can enable the ramp tracking function.

Operating principles

The motor cannot decelerate immediately under excessive load torque because the speed output by the ramp function generator deviates greatly from the actual speed. If the ramp function generator tracking function is not enabled, the speed setpoint is n_2 at time t_0, and reduced to n_1 at t_1. In this case, the motor still accelerates to t_2. A deceleration command is sent at t_1. However, it still takes Δt time (t_2 -t 1) before deceleration begins, as shown in *"Figure 10-73 Ramp function generator output speed (ramp tracking function not enabled)" on page 439*.

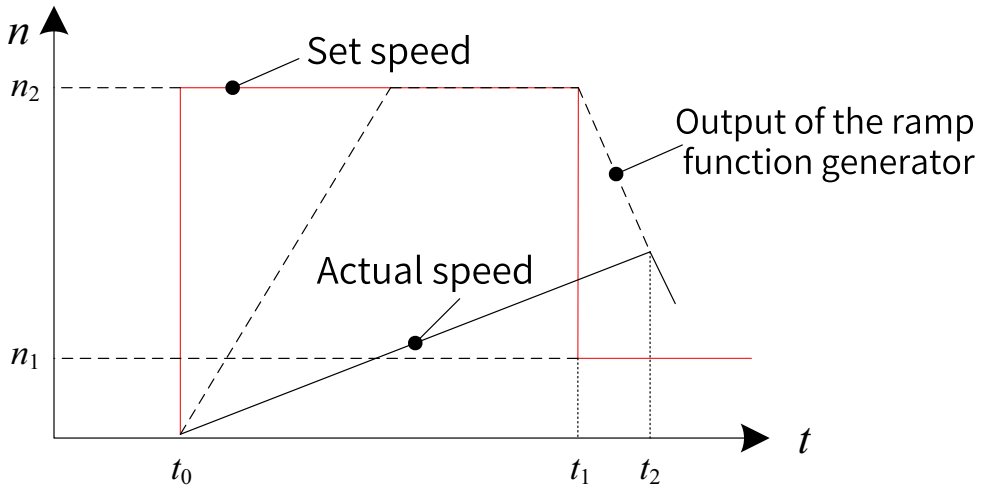


Figure 10-73 Ramp function generator output speed (ramp tracking function not enabled)

As shown by *"Figure 10-74 Ramp function generator output speed (ramp tracking function enabled)" on page 440*, when the tracking function of ramp function generator is enabled, the speed output by the ramp function generator 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 tracking function of ramp function generator is activated when the actual speed is lower than the output speed of the ramp function generator by Δn (Δn can be set according to actual conditions). After which, the output speed of ramp function generator is kept at actual speed + Δn forcibly. If the specified 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 value. The ramp function generator output speed is then forced to be at actual speed + Δn. The tracking state is exited if the condition is not met.

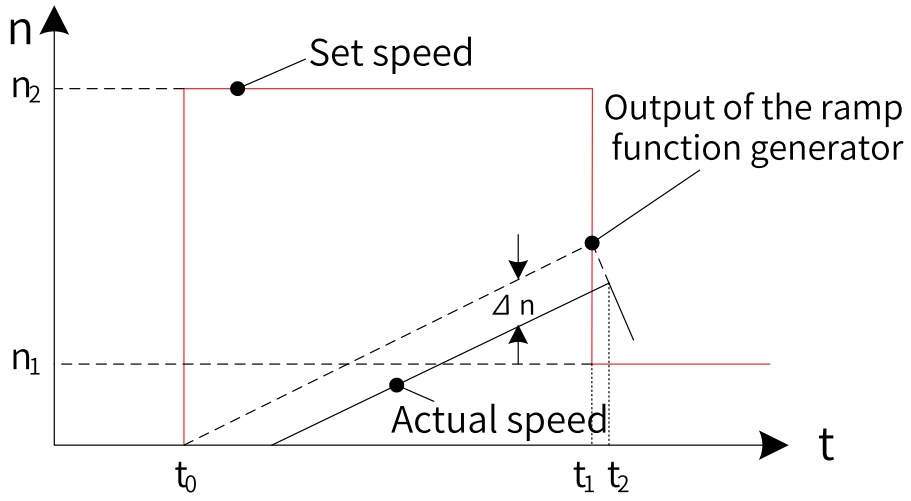


Figure 10-74 Ramp function generator output speed (ramp tracking function enabled)

Related parameters

Param.	Name	Default value	Value range	Description
b7-46	Ramp tracking enable	0	0: Inhibited 1: Active 2: Torque limit reached Other: B connector	Defines whether to enable ramp tracking. 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: Enabled - Ramp tracking enabled 2: Torque limit reached – Whether ramp tracking is enabled depends on whether the current motor torque limit is reached. Other: B connector – Whether ramp tracking is enabled depends on the B connector status.
b7-47	Ramp tracking error	10.0%	0.0% to 100.0%	Defines the ramp tracking error.

10.8 Parameter Group Number

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.

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 defined by b0-00 [Motor parameter set selection 1] and b0-01 [Motor parameter set selection 2]. The active motor parameter set is achieved through binary combination of bits. See details in the following table. Additionally, the active motor parameter set can be viewed through U2-00.

Table 10–19 Example for motor parameter set selected by parameters

Parameter setting			Active motor parameter set
b0-00	b0-01	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

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 active motor parameter set can also be determined using binary bit combination. The following takes DI1 terminal function 41 [Motor selection terminal 1] and DI2 terminal function 76 [Motor selection terminal 2] as an example.

Table 10–20 Selecting motor parameter set through DI terminal

Parameter setting			Active motor parameter set
DI1 status	DI2 status	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

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.

Related parameters

Param.	Name	Default value	Value range	Description
b0-00	Motor parameter set selection 1	0	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines motor parameter set selection 1. Options: 0: Inactive - This function is inactive. 1: Active - This parameter is active. 3 to 7: DI1 to DI5. Depends on the terminal state of DI1 to DI7. 0: Invalid; 1: Valid Other: B connector - Depends on the B connector. You can select B connector through the pop-up window. The value 0 indicates this function is inactive and the value 1 indicates this function is 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. Binary bit combination: When b0-00 is 0 and b0-01 is 0, the combination is 0x0, indicating that motor parameter group 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: DI3 6: DI4 7: DI5 Other: B connector	Defines motor parameter set selection 2. Options: Same as b0-00 Note: Same as b0-00
U2-00	Current motor parameter group	0	-	Displays the effective motor parameter set. Options: 0 to 3: Motor parameter set 1 to motor parameter set 4

10.9 Motor Direction Change

10.9.1 Motor Running Direction Limit

Application scenarios

This function is used to inhibit the motor from running forwardly or reversely, allowing the motor to rotate in one direction only.

Description

You can limit the motor operating direction through d1-01 [Positive speed permission] and d1-02 [Negative speed permission].

- When d1-01 is set to 0 (Invalid), the motor runs at zero frequency when a forward run command is received by the drive.
- When d1-02 is set to 0 (Invalid), the motor runs at zero frequency when a reverse run command is received by the drive.

Related parameters

Table 10–21 Parameters related to reverse frequency inhibition

Param.	Name	Default value	Value range	Description
d1-01	Positive speed permission	1	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines whether the drive allows forward operation. d1-01 [Positive speed] is mapped to F2-20 in group F. These two parameters have the same function. Options: 0: Inhibited - Forward operation is not allowed. 1: Allowed - Forward operation is allowed. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. The value 0 indicates that forward run is inhibited, and the value 1 indicates that forward run is allowed. Other: B connector - Depends on the B connector state. The value 0 indicates that forward run is inhibited, and the value 1 indicates that forward run is allowed. Note: After the DI is assigned with function 78 [Forward run permission], the value of d1-01 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
d1-02	Negative speed selection	1	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines whether the drive allows reverse operation. d1-02 [Negative speed permission] is mapped to F2-21 in group F. These two parameters have the same function. Options: 0: Reverse operation is inhibited. 1: Reverse operation is allowed. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. The value 0 indicates that reverse run is inhibited, and the value 1 indicates that reverse run is allowed. Other: B connector - Depends on the B connector state. The value 0 indicates that reverse run is inhibited, and the value 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).

Note: The drive supports four sets of motor parameters. The parameters related to motor parameter set 2 are d9-01/d9-02, those related to motor parameter set 3 are y1-01/y1-02, and those related to motor parameter set 4 are y9-01/y9-02.

10.9.2 Change Motor Direction Without Changing Motor Wiring

Application scenarios

This function allows you to change the motor direction without altering the motor wiring.

Description

It is equivalent to swapping any two of the motor (U, V, W) cables to reverse the motor rotation direction.

Note: The AC drive supports four groups of motor parameters: d0-14 for motor parameter group 1, d8-14 for motor parameter group 2, y0-14 for motor parameter group 3, and y8-14 for motor parameter group 4.

Related parameters

Table 10–22 Parameters for changing motor direction

Param.	Name	Default value	Value range	Description
F2-14 (d0-14)	Motor direction selection	0	0: Default direction 1: Opposite direction	Defines the motor operating direction.

10.9.3 Dead Zone Time of Forward/Reverse Run Switchover

Application scenarios

When switching between forward and reverse run, the direction can be changed only after a transition period elapses. This transition period is dead zone time of forward/reverse run switchover. Within this period, the output frequency is 0 Hz.

Operating principles

The transition period at 0 Hz output is the dead zone time during switchover between forward run and reverse run, which can be set through P0-26.

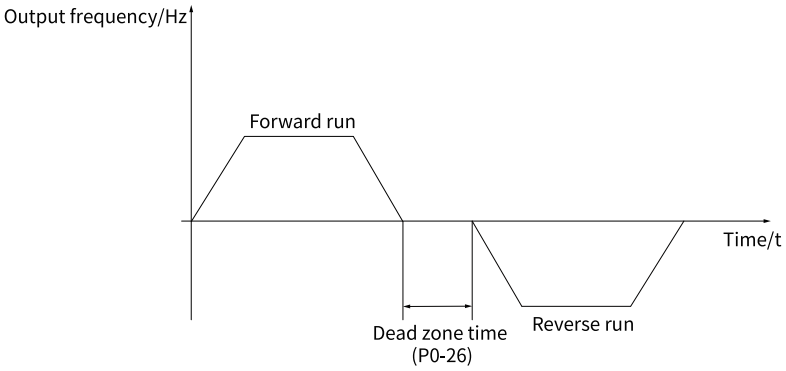


Figure 10-75 Dead zone time of forward/reverse run switchover

Related parameters

Table 10–23 Parameters related to dead zone time of forward/reverse run switchover

Param.	Name	Default value	Value range	Description
P0-26	Dead Zone Time of Forward/Reverse Run Switchover	0.0s	0.0s to 3000.0s	Defines the transition time at 0 Hz output during switchover between forward run and reverse run.

10.10 Speed Control/Torque Control Switchover

Application scenarios

The drive supports two motor control methods: speed control and torque control. This function is suitable for applications requiring control mode switchover.

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 applies to all control methods (V/f and SVC). Most of the applications require the motor speed 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 consists of two parts: torque reference and overspeed control. Torque references include torque instruction, gain calculation, filtering, and acceleration/deceleration time. Overspeed control includes speed limit, filtering and acceleration/deceleration time, and speed offset mode setting.

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 overspeed of the motor, the motor speed must be limited under torque control. When the motor speed exceeds the limit, the speed control mode applies. When the motor speed is recovered to a value below the speed limit, the torque control mode applies.

The two control modes can be switched through d0-01 (Motor parameter set 1), d8-01 (Motor parameter set 2), y0-01 (Motor parameter set 3), and y8-01 (Motor parameter set 4).

Related parameters

Table 10–24 Parameters for speed/torque mode switchover

Param.	Name	Default value	Value range	Description
F0-02 (Motor parameter set 1) d0-01 (Motor parameter set 1) d8-01 (Motor parameter set 2) y0-01 (Motor parameter set 3) y8-01 (Motor parameter set 4)	Motor control mode	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	Defines the motor control target. Options: 0: Speed control - The speed is controlled. 1: Torque control - The torque is controlled. 3 to 7: DI1 to DI5. Depends on the 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). Note: The torque control mode is inactive in V/f mode.

Note: d0-01 is mapped to F0-02. When F0-02 changes, d0-01 changes accordingly.

10.11 Control Interface

10.11.1 Control Terminals

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).

The MD610S is equipped with DI1 to DI5 (DI5 can be used as a normal DI, pulse input terminal, or high-speed digital input terminal HDI), RO (relay output terminal), and FM (can be used as a normal DO or HDO), DO, AI1, AI2, and AO.

The control interfaces of the product are described in the table below.

Table 10–25 List of control interfaces

Name	Product hardware
	MD610S
DI1	Yes
DI2	Yes
DI3	Yes
DI4	Yes
DI5	Yes
RO	Yes
FM	Yes
DO	Yes

Name	Product hardware
	MD610S
AI1	Yes
AI2	Yes
AO	Yes

10.11.2 Digital Input (DI) Terminals

List of functions

Each DI can be assigned any DI terminal function.

The MD610 comes standard with DI1 to DI5. The default functions of the DI1 to DI5 terminals are shown in the table below. DI1 to DI4 support DC or AC signal detection. For specific signal specifications, see *"4.7.1 Description of Control Circuit Terminals" on page 98*. Only DI5 supports high-speed digital input (HDI). However, DI5 is used as a common DI by default. For specific functions, see *"Table 10-26" on page 449*.

Table 10–26 List of DI function assignment

Function	DI terminal				
	DI1	DI2	DI3	DI4	DI5
DI function selection	Yes	Yes	Yes	Yes	Yes
Input filter time 1	Yes	Yes	Yes	Yes	Yes
Input filter time 2	Yes	Yes	Yes	Yes	Yes
Input filter time selection	Yes	Yes	Yes	Yes	Yes
Switch-on delay	Yes	Yes	Yes	Yes	Yes
Switch-off delay	Yes	Yes	Yes	Yes	Yes
Forced enable	Yes	Yes	Yes	Yes	Yes
Forced data	Yes	Yes	Yes	Yes	Yes
Terminal active mode (active level)	Yes	Yes	Yes	Yes	Yes
AC signal detection	Yes	Yes	Yes	Yes	Yes
High-speed digital input	-	-	-	-	-

Function description

DI refers to digital input terminals. Each DI can be assigned one DI function, but DI functions cannot be duplicated. If a DC signal is input, the functional logic of the signal is as shown in *"Figure 10-76" on page 450* .

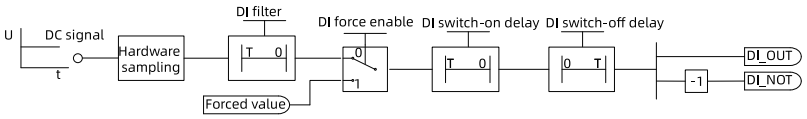


Figure 10-76 DI logic data flow diagram (DC signal)

If an AC signal is input, the functional logic of the signal is as shown in *"Figure 10-77" on page 450* . When AC signals are input, E0-16 (DI input filter time) to E0-18 (DI input filter time selection) are invalid. However, E0-20 (DI1 switch-on delay time) to E0-27 (DI4 switch-off delay time) and E0-56 (Forced DI enable) to E0-58 (DI valid mode selection) are valid for AC signals.

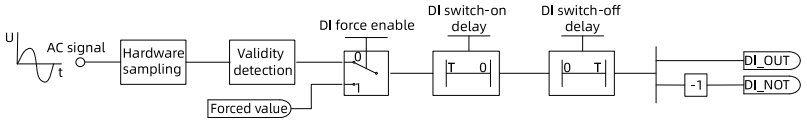


Figure 10-77 DI logic data flow diagram (AC signal)

By default, after DC or AC signals are applied to DI1 to DI4, the AC drive will automatically identify the input signal. This can meet requirements of most scenarios. However, if higher requirements are placed on the input terminal signals, you can set E0-59 (DI detection signal type selection) to 1 (Detect DC signals) or 2 (Detect AC signal to exclude interference from the other signal detection logic. For details, see *"Table 10-27" on page 450*.

Table 10–27 DI selection mode selection

Param.	Name	Default value	Value range	Parameter description
E0-59	DI detection signal type selection	0	0 to 2	Sets the signal detection type for DI1 to DI4 terminals. Options: 0: Detect DC and AC signals. Both DC and AC signals are detected. The terminal is valid if either signal is active. 1: Detect DC signals. The terminal can detect DC signals. 2: Detect AC signals. The terminal can detect AC signals.

DI Function

Table 10–28 DI terminal function parameter list

Param.	Name	Default value	Value range	Parameter description
E0-16	DI input filter time 1	0.01s	0.00s to 1.00s	This parameter defines the filter time 1 for the AC drive to respond to changes in DI terminal status. Note: It is valid only for DC signal detection.
E0-17	DI input filter time 2	0.01s	0.00s to 1.00s	Defines filter time 2 for the drive to respond to changes in DI status. Note: It is valid only for DC signal detection.
E0-18	DI input filter time selection	0	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: DI3 filter time (MD610) 0: Filter time 1 1: Filter time 2 bit3: DI4 filter time (MD610) 0: Filter time 1 1: Filter time 2 bit4: DI5 filter time (MD610) 0: Filter time 1 1: Filter time 2 bit4 to bit15: Reserved	This parameter sets which DI filter time takes effect. Options: bit0 to bit4: They are used to select the filter time for DI1 to DI5. 0: Filter time 1 - The filter time of DI1 to DI5 is defined by E0-16. 1: Filter time 2 - The filter time of DI1 to DI5 is defined by E0-17. Note: It is valid only for DC signal detection.

10.11.3 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 detailed functions, see *"10.11.7 High-speed digital output (HDO)" on page 477*.

Table 10–29 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	-

Function description

The DO/RO function refers to the digital output terminal.

The MD610S 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).

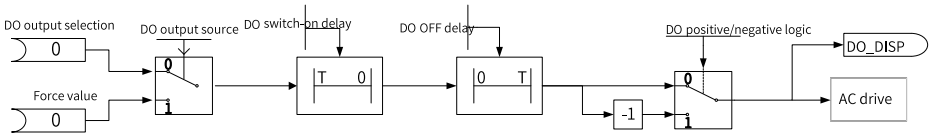


Figure 10-78 DO data flow diagram

DO terminal layout

The MD610S provides three digital output terminals: RO, FMR, and DO.

The RO terminals of the MD610S are arranged on terminal block J3 of the control board, numbered 1 to 3 (TA, TB, TC). The DO and FM (with FMR used as a standard DO) are located on terminal block J1 of the control board, numbered 5 and 6, respectively.

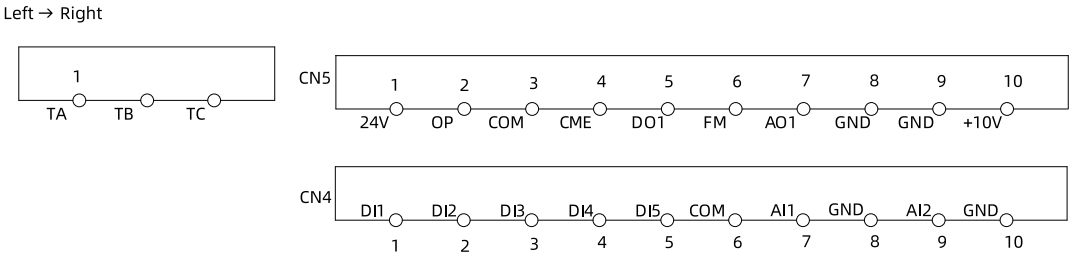


Figure 10-79 (a) Schematic diagram of MD610S terminal layout

The hardware wiring of the terminal is shown as below.

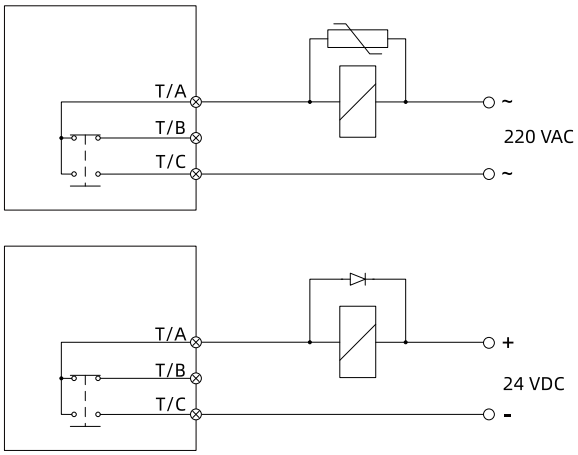


Figure 10-80 Terminal layout

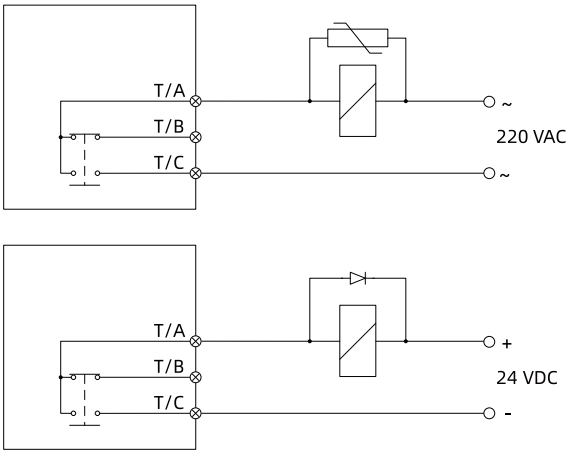


Figure 10-81 (a) Wiring of RO terminal

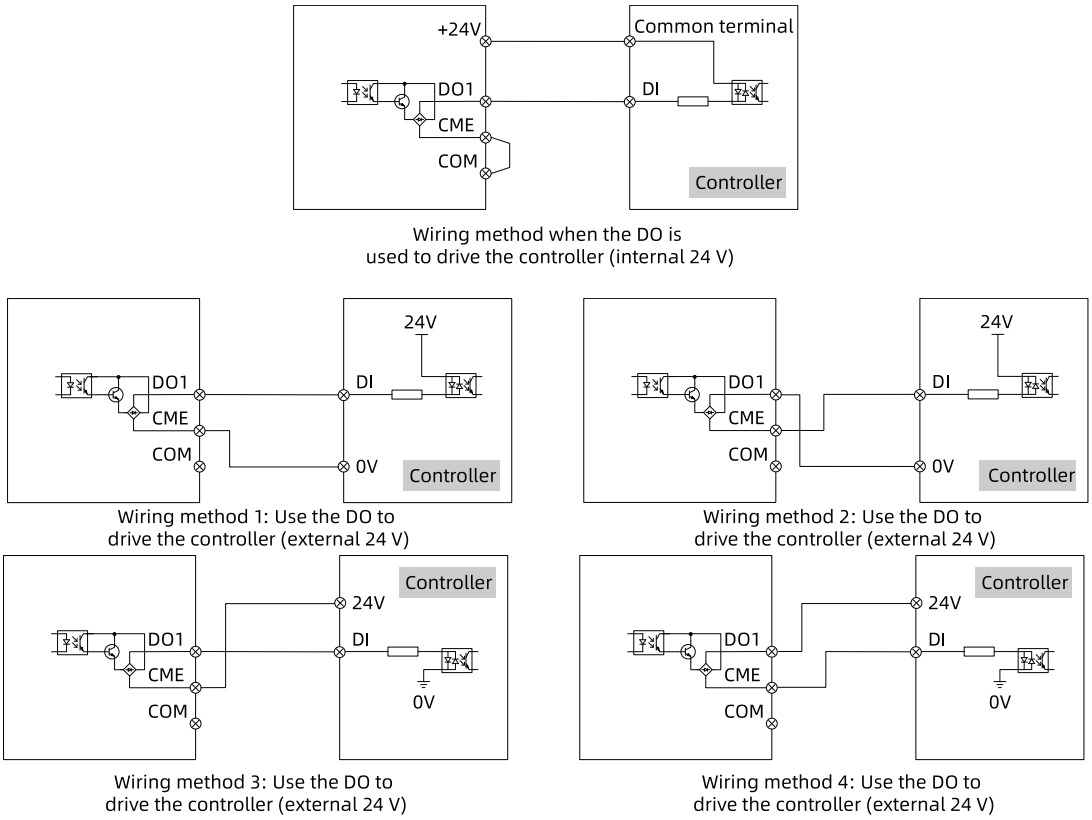


Figure 10-82 (b) Wiring of DO terminal

DO function

1. DO 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. For related parameters, refer to E1-00 to E1-38 in the E1 parameter group. For DO/RO terminal function selection, see parameters E1-00 to E1-04.

Param.	Name	Default value	Value range	Description
E1-00	RO1 function selection	2	0 to 44	See *"Table 10-30 DO terminal functions" on page 454*.
E1-04	DO1 function selection	0		
E1-08	FMR output function selection (for MD610S)	0		

DO/RO terminals can be configured with the following functions.

Table 10–30 DO terminal functions

Setpoint	Function	Description	Related parameters
0	No output	The terminal is not assigned with any function.	-
1	Drive running	When the drive is operating and outputs frequency (can be zero), an active signal is outputted.	-
2	Fault output	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.	-

Setpoint	Function	Description	Related parameters
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
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 and P0-19
13	Swing frequency limited	In wobble 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 and 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 Reach	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 and U0-01 F1-10 F2-22 to F2-25 L3068/L3072

Setpoint	Function	Description	Related parameters
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 and U0-01 F1-10 F2-26/F2-27 L3070/L3074
19	Undervoltage state output	When undervoltage occurs on the drive, an active signal is outputted.	-
20	Communication	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
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 and 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 - 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

Setpoint	Function	Description	Related parameters
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 and 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	Heatsink 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
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 and U0-01 F1-10 F2-26/F2-27 L3070/L3074
38	Abnormality (fault/minor fault/warning)	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 and E2-24

2. Other function setting

Table 10–31 List of DO/RO-related parameters

Param.	Name	Default value	Value range	Description
E1-00	RO1 function selection	2	0 to 44	See *"Table 10-30 DO terminal functions" on page 454*.
E1-04	DO1 function selection	0		
E1-08	FMR (HDO) function selection (MD610S)	0		
E1-16	RO switch-on delay time	0.0s	0.0 to 3600.0	Defines the RO output delay. RO 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.
E1-17	RO switch-on delay time	0.0s	0.0 to 3600.0	
E1-24	DO output switch-on delay time	0.0s	0.0 to 3600.0	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 time	0.0s	0.0 to 3600.0	
E1-32	FMR output switch-on delay (MD610S)	0.0s	0.0 to 3600.0	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 time	0.0s	0.0 to 3600.0	

Param.	Name	Default value	Value range	Description
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 (MD610S) 0: Output function 1: Forced value bit10: VDO1 output source 0: Output function 1: Forced value bit11: VDO2 output source 0: Output function 1: Forced value bit12: VDO3 output source 0: Output function 1: Forced value bit13: VDO4 output source 0: Output function 1: Forced value bit14: VDO5 output source 0: Output function 1: Forced value bit15: VDO6 output source 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	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 (MD610S) 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 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/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 MD610S) 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.

3. Terminal status connector

The following table shows the current status of each DO terminal. The DO terminal state connector has the following functions.

a. 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.
b. 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). Therefore, it can be configured through the drop-down menu of parameters with option "Other: B connector", as shown in *"13.1.1.1 Introduction to Connectors" on page 828*.

Table 10–32 DO terminal status connector

Param.	Name	Default value	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: 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: output Note: It can be used as an option for parameters with "Other: B connector".
L0042 (MD610S)	FMR	0	0 to 1	Bit connector: Displays the final level state of FMR terminal. Value description: 0: No output 1: 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), follow the steps below to enable the DO to output an active signal during drive operation. do as follows: When the DO output source (E1-36) is set to "Output function" (0x0000), follow the steps below to enable the DO to output an active signal during drive operation. 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 inverted. 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 setting" (E1-36 = 0000), that is, whether the DO outputs an active signal 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 MD610S. 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).

10.11.4 Virtual Digital Input (VDI) Terminals

Function List

The following table describes the standard functions of VDI1 to VDI5.

Function	VDI terminal				
	VDI1	VDI2	VDI3	VDI4	VDI5
VDI function selection	Yes	Yes	Yes	Yes	Yes
Whether the VDI source can be set	Yes	Yes	Yes	Yes	Yes
Forced data	Yes	Yes	Yes	Yes	Yes
Terminal active mode (active level)	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 provides five multi-functional DI terminals (VDI1 to VDI5) as standard. Each VDI terminal can be assigned with a specific function like 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.

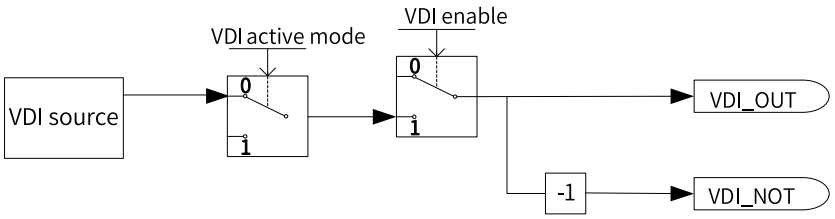


Figure 10-83 VDI data flow diagram

Layout of VDI terminals

VDI is the virtual DI terminal. The VDI source can be the actual physical terminals 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 *"10.11.8 Analog Input Terminal (AI)" on page 482* 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

1. VDI function selection

The VDI terminals can be set through E0-10 to E0-15 as shown below. The optional functions are the same as those of the DI, as shown in *"10.11.2 Digital Input (DI) Terminals" on page 449*.

Param.	Name	Default value	Value range	Description
E0-10	VDI1 function selection	0	0 to 80	See *"10.11.2 Digital Input (DI) Terminals" on page 449*. 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		

2. VDI source

The VDI source can be set through E0-50 to E0-55.

Param.	Description	Default value	Value range
E0-50	VDI1 source	1	1: Forced value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 14: DI4 15: DI5/HDI 22 to 26: VDI2 to VDI6 27 and 28: DI1 and DI2 of the I/O card 1 30 to 31: DI1 and DI2 of the I/O card 2 51: RO1 55: DO1 59: FMR 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO7
E0-51	VDI2 source	1	Same as E0-51

Param.	Description	Default value	Value range
E0-52	VDI3 source	1	Same as E0-51
E0-53	VDI4 source	1	Same as E0-51
E0-54	VDI5 source	1	Same as E0-51
E0-55	VDI6 source	1	Same as E0-51

3. Other function setting

Param.	Name	Default value	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. Options: 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). Options: 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

4. Terminal status connector

The following table shows the current status of each VDI terminal. The main functions of the VDI terminal connector are as follows.

a. Display the status of the VDI terminal. The value 0 indicates that the VDI terminal has no input and the value 1 indicates that the VDI terminal has input.

b. 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 *" Parameter Interconnection" on page 828*.

Table 10–33 VDI terminal status connector

Param.	Name	Default value	Value range	Description
L0012	VDI1	0	0 to 1	Bit connector: Displays the final level state of VDI1. Options: 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. Options: 0: Opened 1: Closed Note: The options can be used for "Other: B connector".
L0014	VDI3	0	0 to 1	Bit connector: Displays the final level state of VDI3. Options: 0: Opened 1: Closed Note: The options can be used for "Other: B connector".
L0015	VDI4	0	0 to 1	Bit connector: Displays the final level state of VDI4. Options: 0: Opened 1: Closed Note: The options can be used for "Other: B connector".
L0016	VDI5	0	0 to 1	Bit connector: Displays the final level state of VDI5. Options: 0: Opened 1: Closed Note: The options can be used for "Other: B connector".
L0017	VDI6	0	0 to 1	Bit connector: Displays the final level state of VDI6. Options: 0: Opened 1: Closed Note: The options can be used for "Other: B connector".

Application instance

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.

10.11.5 Virtual Digital Output Terminals

Function List

The following table describes the standard functions of VDO1 to VDO6.

Table 10–34 List of VDO terminal function assignment

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.

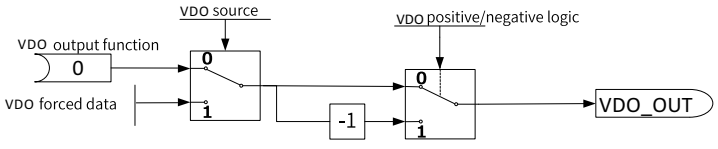


Figure 10-84 VDO data flow diagram

VDO terminal layout

VDI is the virtual DI terminal.

VDO function

1. VDO function selection

   VDO terminals can be set through E1-10 to E1-15. See E1-00 to E1-38 for details. For details on VDO function selection, see E1-10 to E1-15.

Param.	Name	Default value	Value range	Description
E1-10	VDO1 function selection	0	0 to 44	For details, see *"Table 10-30 DO terminal functions" on page 454*.
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

2. Other function setting

Table 10–35 VDO-related parameter list

Param.	Name	Default value	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). Options: 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. Options: 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 inverted, 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.

3. Terminal status connector

The table below shows the current status of each VDO terminal. The VDO terminal status connector is used for the following purpose.

Display 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.

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). Therefore, it can be configured through the drop-down menu of parameters with option "Other: B connector", as shown in *" Parameter Interconnection" on page 828*.

Table 10–36 VDO terminal status connector

Param.	Name	Default value	Value range	Description
L0044	VDO1	0	0 to 1	Bit connector: Displays the final level state of VDO1. Options: 0: No output 1: 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. Options: Same as L0044 Note: Same as L0044
L0046	VDO3	0	0 to 1	Bit connector: Displays the final level state of VDO3. Options: Same as L0044 Note: Same as L0044
L0047	VDO4	0	0 to 1	Bit connector: Displays the final level state of VDO4. Options: Same as L0044 Note: Same as L0044
L0048	VDO5	0	0 to 1	Bit connector: Displays the final level state of VDO5. Options: Same as L0044 Note: Same as L0044
L0049	VDO6	0	0 to 1	Bit connector: Displays the final level state of VDO6. Options: Same as L0044 Note: Same as L0044

Application instance

When the VDO output source (E1-36) is set to 0000 (Output function setting), 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 setting" (E1-36 = 0000).

After preceding steps are done, VDO outputs active level upon fault or inactive level when the fault is cleared.

10.11.6 High-speed digital input (HDI)

Function List

The HDI function refers to the high-speed digital input terminal DI5.

Function	HDI (DI5)
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
De-noising threshold	Yes
Salt-and-pepper noise	Yes

Description

The MD610S is equipped with a high-speed digital input terminal.

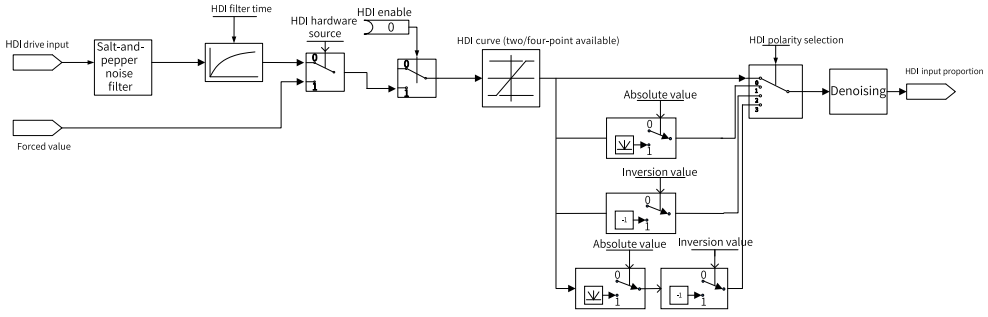


Figure 10-85 HDI data flow diagram

HDI terminal layout

The MD610S provides one high-speed digital input terminal HDI, which is DI5.

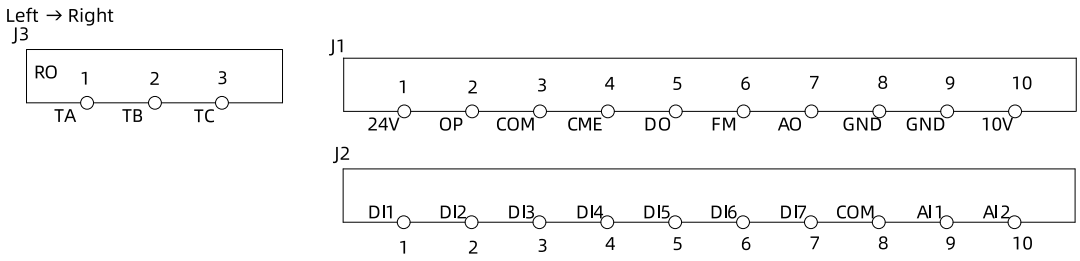
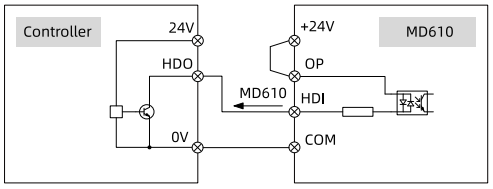
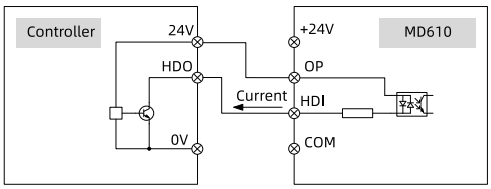


Figure 10-86 Terminal layout

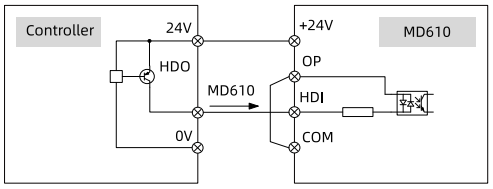
For the hardware wiring of the MD610S high-speed input terminals, see the following method.



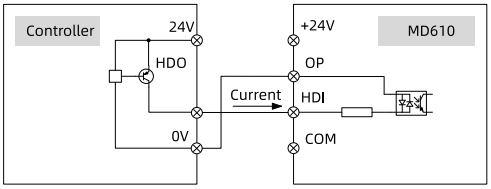
Sink wiring method using the internal 24 V of the AC drive



Sink wiring method using the external 24 V



Source wiring method using the internal 24 V of the AC drive



Source wiring method using the external 24 V

Figure 10-87 Terminal wiring diagram

HDI function

1. DI5 terminal type selection

   DI5 is used as a regular DI by default. If it is used as a high-speed digital input terminal (HDI), you need to modify E4-00 [HDI terminal type selection] to 0 [Used as HDI]. When E4-01 (HDI input enable state) is set to 1 (Enabled), the function of DI5 as a common DI is inactive and the DI5 function is defined by E4-00 to E4-36.

   The following table lists relevant parameters.

Table 10–37 DI5 terminal type selection

Param.	Name	Default value	Value range	Description
E4-00	DI5/HDI terminal type selection	1	0 to 1	Defines the DI function assigned to DI5. Options: 0: Used as HDI. DI5 is used as HDI. 1: Used as DI. DI5 is used as a common DI.
E4-01	HDI input enable state	0	0 to 1	Displays the HDI state. Options: 0: Disable - HDI is disabled. 1: Enable - HDI is enabled. Note: Whether HDI is enabled is determined by E4-00.

2. Other function setting

Table 10–38 List of HDI functions

Param.	Name	Default value	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 DI5 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. Options: 0: Two-point curve - The two-point curve is selected. 1: Four-point curve - The four-point curve is selected.

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 DI5 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 to the rated frequency (C4-06). The x-axis of this curve represents the pulse frequencies of DI5, and the y-axis represents the percentages to the rated 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 DI5 terminal is used as the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages to the rated frequency (C4-06). The x-axis of this curve represents the pulse frequencies of DI5, and the y-axis represents the percentages to the rated 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.
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.
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. Options: 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 per unit percentage of the HDI input after being processed by 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 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 higher than “Extended” .

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 input of current cycle and input of the last cycle is greater than the threshold (250 Hz), then the signal of the last cycle is inputted. After the time defined by E4-36 elapses, the HDI signal of current cycle is inputted. 2. If the absolute value of the difference between this input and the last input is lower than the threshold of 250 Hz, the last HDI signal is input directly.

Application instance

To set the main frequency source to HDI, do as follows:

1. Set DI5 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).

10.11.7 High-speed digital output (HDO)

Function List

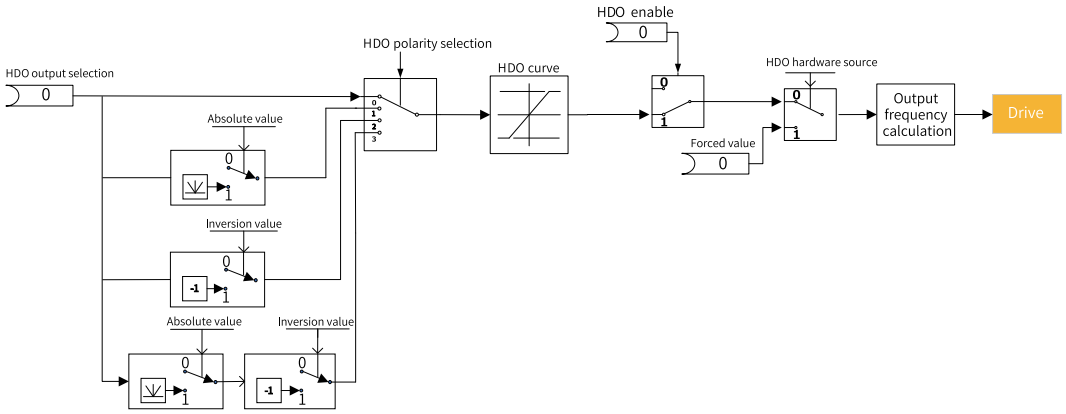
The HDO function is provided by the high-speed digital output terminal FM.

Function	HDO (FM)
Terminal output selection (normal DO/high-speed HDO)	Yes
Output function selection	Yes
Two-point curve	Yes

Function	HDO (FM)
Output polarity selection	Yes
Hardware source selection	Yes
Forced value	Yes
Maximum output frequency setting	Yes

Description

The MD610S is equipped with a high-speed digital input terminal as standard, namely FM.



HDO terminal layout

The MD610S provides a high-speed digital output terminal HDO, namely FM.

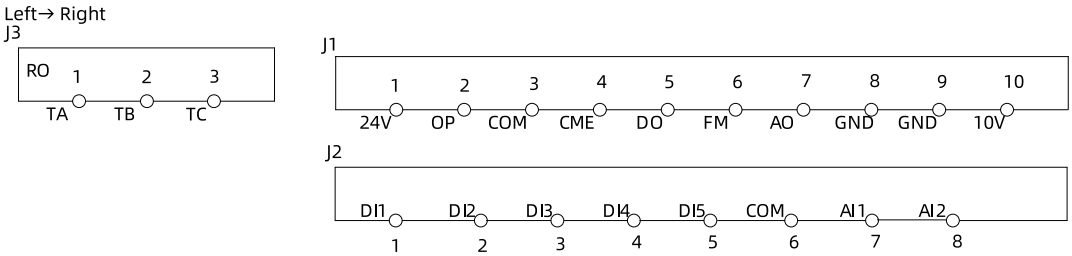
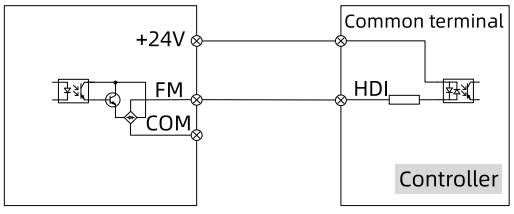


Figure 10-88 Terminal layout

For hardware wiring of the high-speed output terminal of the MD610S, refer to the following method.



Wiring method when the FM is used
to drive the controller HDI (internal 24 V)

Figure 10-89 Terminal wiring diagram

HDO function

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).

Param.	Description	Default value	Value range	Description
E5-00	FM multi-functional terminal output selection	0 (HDO pulse output (FMP))	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). Options: 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.

2. HDO function selection

Table 10–39 HDO function selection parameter

Param.	Description	Default value	Value range	Description
E5-01	HDO function selection	0	0 to 16	See . *"Table 10-40 List of HDO functions" on page 479*

Table 10–40 List of HDO functions

Setpoint	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 control	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).

Setpoint	Function	Description
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).

3. Other function selection

Param.	Description	Default value	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.

Param.	Description	Default value	Value range	Description
E5-11	HDO output polarity selection	0	Ones: HDO selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Tens to Ten-thousands: Reserved	Defines the HDO output polarity. Options: 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: Opposite to normal value - The inverted per-unit percentage of the selected function is used. 3: Opposite to absolute value - The inverted absolute value of the per-unit percentage of the selected function is used.
E5-12	HDO hardware source	0	Ones: HDO selection 0: Output function 1: Force value Tens to Ten-thousands: Reserved	Defines the hardware source of HDO. Options: 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 instance

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 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.

10.11.8 Analog Input Terminal (AI)

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 10–41 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 MD610S provides 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.

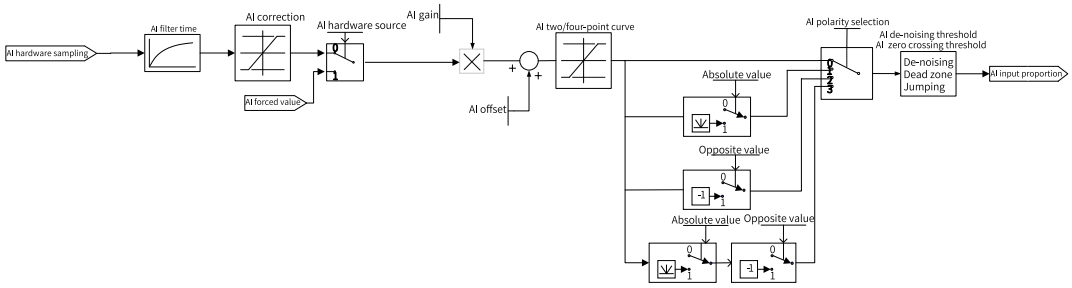


Figure 10-90 AI data flow diagram

AI terminal layout

The MD610S provides two analog input terminals, namely AI1 to AI2. The AI terminal of the MD610S is located at terminal numbers 9 to 10 on the J2 terminal block of the control board.

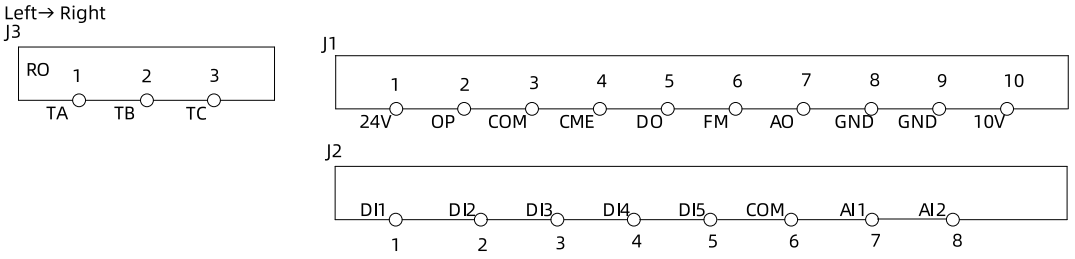


Figure 10-91 Terminal arrangement diagram of the MD610S

The hardware wiring of the AI terminal is shown below.

Switch between the AI1 voltage mode and current mode via the S4 DIP switch on the control board, and the AI2 voltage mode and current mode via the S2 DIP switch. Switch the AI2 temperature mode via the S3 DIP switch.

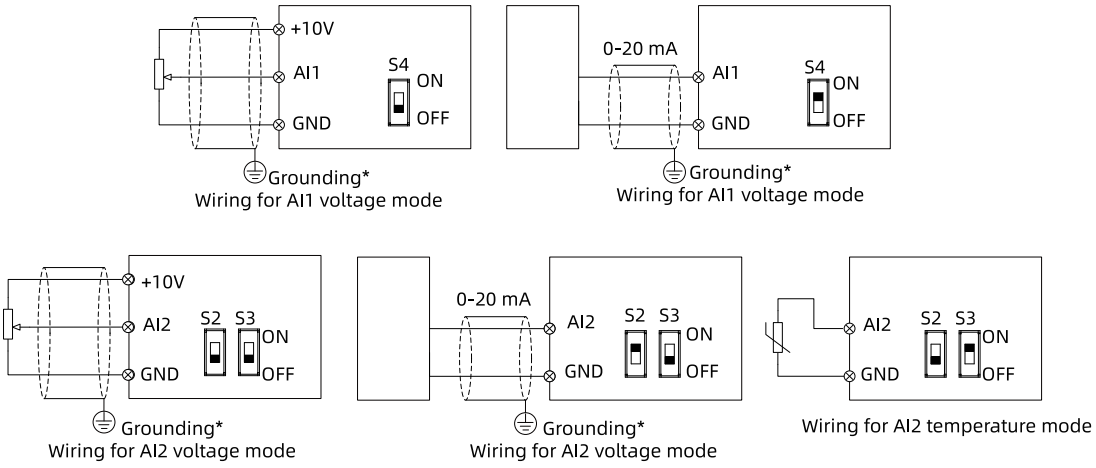


Figure 10-92 AI wiring diagram of the MD610S

Table 10–42 DIP switch of the AI

Assignment			Description
Pin	Set the switch to the up position	Set the switch to the down position	
S4 (MD610S)	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 (MD610S)	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 (MD610S)	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

1. AI correction

AI correction This group of parameters are used to correct the AI to eliminate the effect of AI zero offset and gain. This group of parameters have been corrected by default. If restored to default, these setpoints are restored to the values calibrated by default. Generally, no calibration is needed on site.

Caution

The correction is invalid for AI temperature mode.

Table 10–43 AI correction parameter

Param.	Name	Default value	Value range	Description
EE-00	AI1 measured voltage 1	Factory-calibrated	-10.000 to +10.000	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 to +10.000	Defines the AI1 displayed voltage 1, which is the uncalibrated voltage of AI1 (U0-21). Note: See EE-00.

Param.	Name	Default value	Value range	Description
EE-02	AI1 measured voltage 2	Factory-calibrated	-10.000 to +10.000	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 to +10.000	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 to +10.000	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 to +10.000	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 to +10.000	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 to +10.000	Indicates the AI2 displayed voltage 2, which is the uncalibrated voltage of AI2 (U0-22). Note: See EE-04.

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.

If the reference voltage does not match the sampled voltage, adjust the settings on the site to match the sampled value with the reference value. The following takes AI1 as an example to show how to adjust the settings.

a. Set the AI1 voltage signal (about 2 V).
b. Measure the AI1 voltage and set EE-00 to the measured value.
c. View the value of U0-21 and set EE-01 to the viewed value.
d. Set the AI1 voltage signal (about 8 V).
e. Measure the AI1 voltage and set EE-02 to the measured value.
f. View the value of U0-21 and set EE-03 to the viewed value.
g. When AI2 is corrected, view U0-22 to obtain the actual sampled voltage.

h. For AI1 and AI2, it is recommended to use 2 V and 8 V as the two correction points.

2. AI used as DI

AI1 and AI2 can be used as DI. According to *"Table 10-44 Parameters for AI used as DI" on page 486*, you can judge the AI1 and AI2 input voltage based on the values of E2-35 (High level threshold when AI is used as DI) and E2-36 (Low level threshold when AI is 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 10–44 Parameters for AI used as DI

Param.	Name	Default value	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.

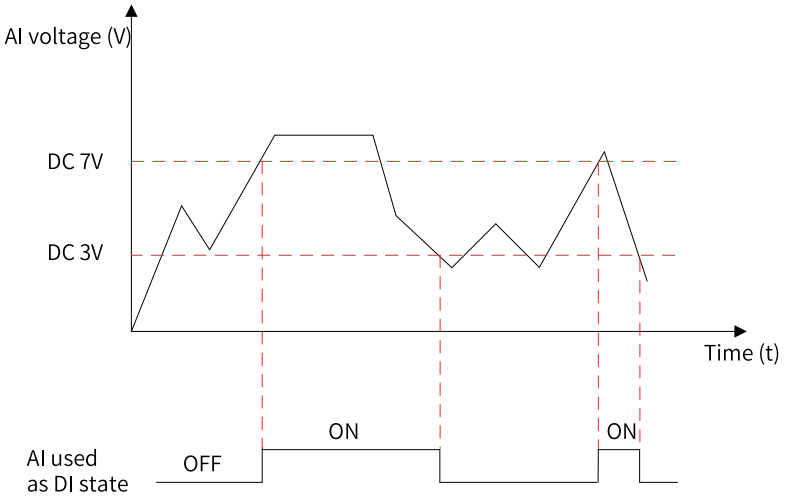


Figure 10-93 Schematic diagram for the AI used as DI

Main application scenario:

a. When used as the DI, the AI acts as the source of VDI1 to VDI6, which can be set by E0-50 to E0-55. For details, see *"10.11.4 Virtual Digital Input (VDI) Terminals" on page 462*.

b. The result of the AI used as DI can be checked through the connector. See the following table for details. The value of the AI used as the DI is either 0 (Low level threshold when AI is used as DI) or 1 (High level threshold when AI is used as DI). Therefore, you can configure in the parameter

drop-down box with "Other: B connector". For details, see *“ Parameter Interconnection” on page 828*.

Table 10–45 Result of the AI used as DI

Param.	Name	Default value	Value range	Description
L0054	Level state of the AI1 that 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".

3. Other function setting

Table 10–46 AI-related parameter list

Param.	Name	Default value	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 together 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 higher than “Extended” .
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 together 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 higher than “Extended” .

Param.	Name	Default value	Value range	Description
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 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 higher than “Extended” .
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 may be easily disturbed, you may increase the AI filter time to enhance the stability of the analog signals.
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.

Param.	Name	Default value	Value range	Description
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).
E2-16	AI2 gain	1.00	- 10.00 to +10.00	Defines the gain multiplier of the AI2 analog sampling voltage. Note: 1. When E2-17 is also used, 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 higher than “Extended” .
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 E2-16 is also used, 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 higher than “Extended” .
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 higher than “Extended” .

Param.	Name	Default value	Value range	Description
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 may be easily disturbed, you may increase the AI filter time to enhance the stability of the analog signals.
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).

Param.	Name	Default value	Value range	Description
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).
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 1: Absolute value 2: Inverted 3: Absolute value inverted Tens: AI2 selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Hundreds to ten thousands: Reserved	Defines the input polarity of AI1 and AI2 (assigned by ones and tens). Options: 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: 1. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".

Param.	Name	Default value	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) 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 to thousands: Reserved	Defines the input/output curve of AI1 and AI2. Options: 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)
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 to 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). Options: 0000H: Corresponding to the minimum input. When the AI input 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	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 input, the y-axis represents the per-unit percentage of the rated motor frequency. 2. There are five types of AI curves. Curves 1 to 3 are two-point curves, which are the minimum input point and the maximum input point. The related parameters are E2-40 to E2-51. Curve 4 and curve 5 are four-point curves, that is, the maximum, minimum, and intermediate two inflection points. The related 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.

Param.	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 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.
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 10.00 V	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 corresponding to the analog input voltage. If the AI input is selected as the frequency source, y axis represents the percentage of the maximum frequency (C4-10). 2. There are five types of AI curves. Curves 1 to 3 are two-point curves, which are the minimum input point and the maximum input point. The related parameters are E2-40 to E2-51. Curve 4 and curve 5 are four-point curves, that is, the maximum, minimum, and intermediate two inflection points. The related 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.

Param.	Name	Default value	Value range	Description
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.
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	AI curve 5 min. input	-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.

Param.	Name	Default value	Value range	Description
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 10.00 V	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.
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). Options: 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 place 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 higher than “Extended” .
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 place 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 higher than “Extended” .

Application instance

- 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	Value range	Description
E2-73	AI2 temperature mode - Motor temperature sensor type	0	0 to 4	Defines the AI2 temperature sensor type. Options: 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 reached	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.

10.11.9 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 drive provides one AO terminal (AO1) by default. The AO terminal can be assigned with any AO terminal function, and can be set with the corresponding curve or gain and deviation parameters.

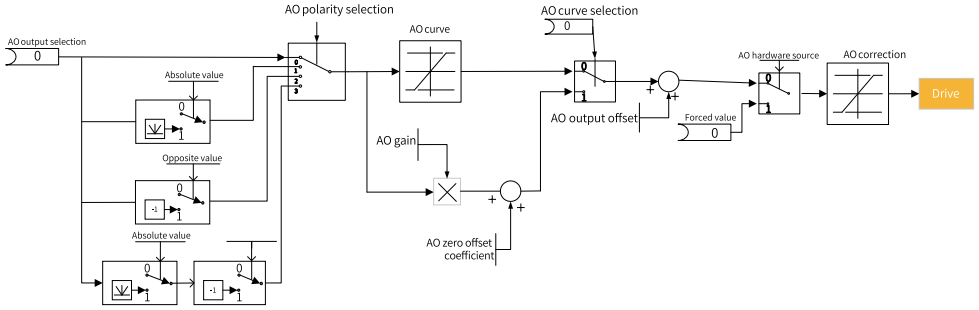


Figure 10-94 AO data flow diagram

AO terminal layout

The MD610S provides one analog output terminal (AO). The AO terminal of the MD610S is located at terminal number 7 on the J1 terminal block of the control board.

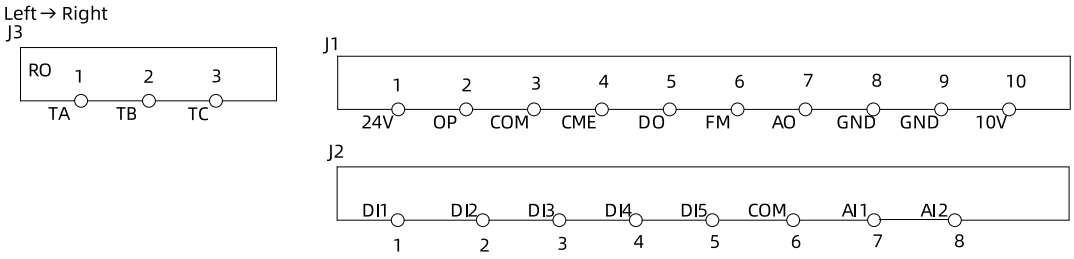


Figure 10-95 Terminal layout

For the hardware wiring of the high-speed input terminals of the MD610S, refer to the following method. Use the S5 DIP switch on the control board to select AO voltage mode or current mode.

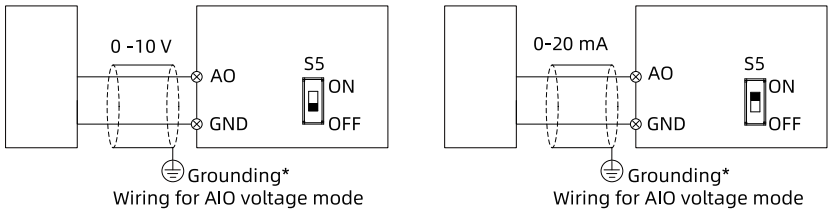


Figure 10-96 Terminal wiring diagram

Table 10–47 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

1. AO1 function selection

The AO terminals are set through the parameter group (E3-00 to E3-27). The AO terminal functions are set by the parameter E3-00. See *"Table 10-48 List of AO functions" on page 500* for details.

Param.	Description	Default value	Value range	Description
E3-00	AO1 function selection	0	0 to 16	*"Table 10-48 List of AO functions" on page 500*

Table 10–48 List of AO functions

Setpoint	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).
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 control	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).

Setpoint	Function	Description
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).

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.

Table 10–49 AO calibration parameters

Param.	Name	Default value	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.

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 AI.

If the required output voltage does not match the actual output voltage, adjust the settings on site to match the sampled value with the reference value. Do as follows:

a. Set the target voltage signal (about 2 V) of the AO terminal.
b. Set EE-12 to 2 V.
c. Measure the voltage of AO terminal and set EE-13 to the measured value.
d. Set the target voltage signal (about 8 V) of the AO terminal.
e. Set EE-14 to 8 V.
f. Measure the voltage of AO terminal and set EE-15 to the measured value.
g. For AO, it is suggested to use 2 V and 8 V as the two correction points.

3. Other function setting

Table 10–50 Related parameters

Param.	Description	Default value	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	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	Percentage corresponding to 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	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	Percentage corresponding to 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	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.
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.
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.
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.

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 10–51 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 control	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 instance

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.

10.11.10 DI Function Settings

10.11.10.1 Running pause (controlled by terminals)

Application scenarios

This function is used to pause the drive without changing the operation command.

Operating 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.

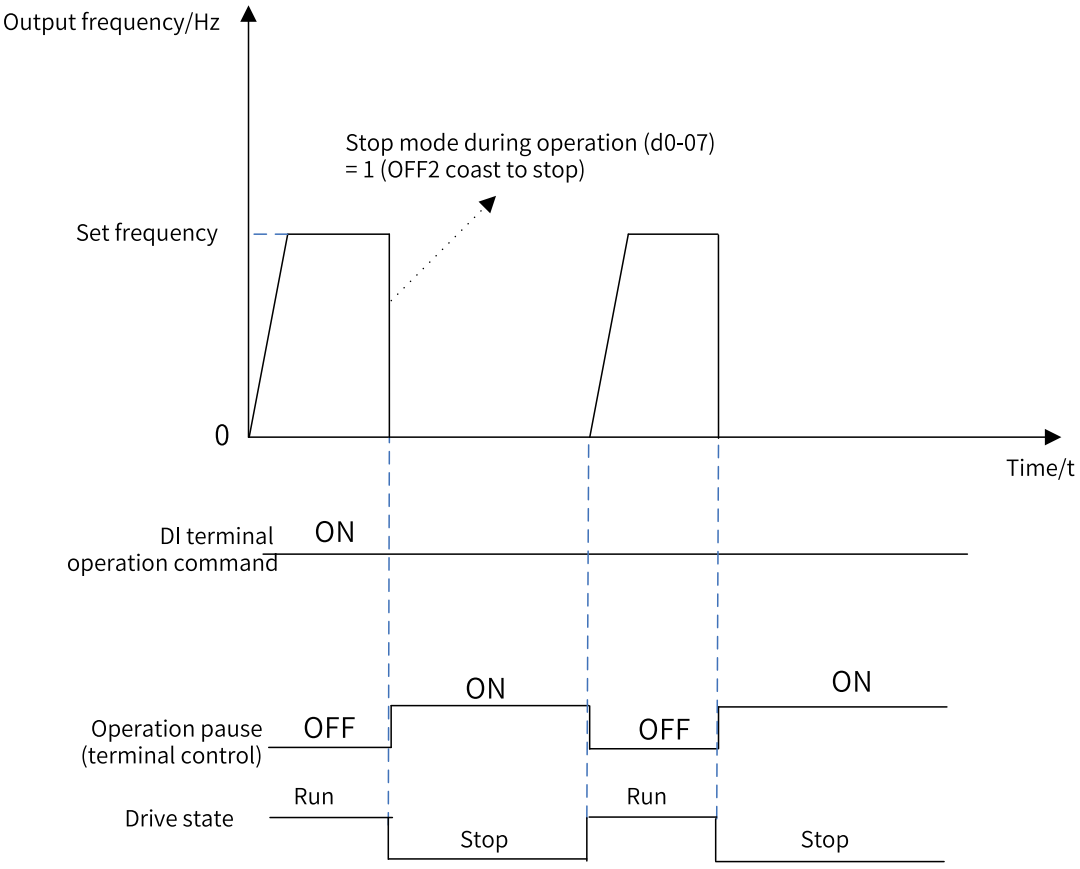


Figure 10-97 Schematic of operation pause (terminal control)

Application instance

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 active 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.

10.11.10.2 Operation enable

Application scenarios

This function is used to protect the drive from inadvertent startup through the operation enable terminal.

Operating 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 valid after stop, the drive starts automatically as long as the operation enable function is active and the corresponding DI terminal is valid.

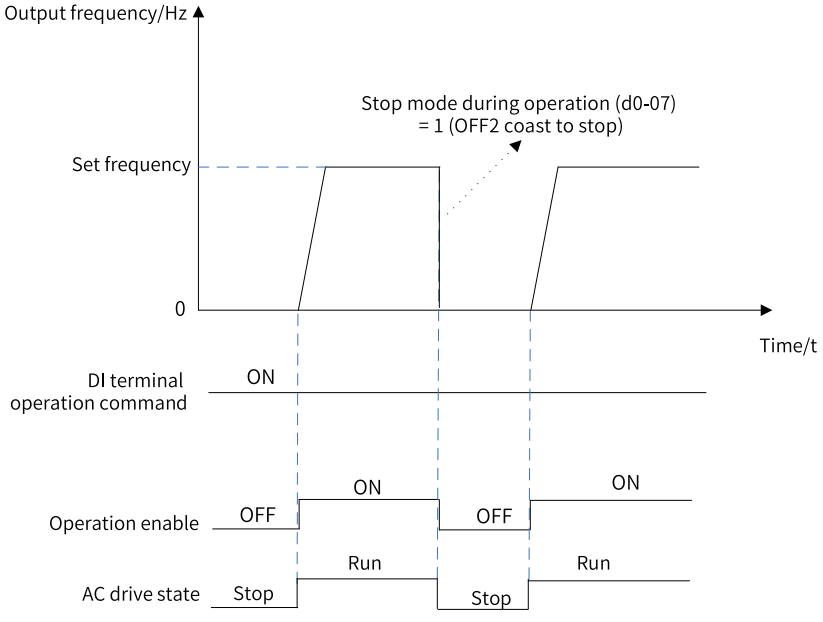


Figure 10-98 Schematic of operation enable (terminal control)

Application instance

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 active 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.

10.11.10.3 Switchover between speed control and torque control

Application scenarios

This function is used to switch the motor control mode of the drive between speed control and torque control.

Operating 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 inhibited" is active, the system control mode is forcibly set to speed control and input to the system.

- When this function is active, the torque control mode will be switched to speed control mode forcibly.
- When this terminal is inactive, the motor control mode is not affected.

If the DI terminal function "29: Torque control inhibited" 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.

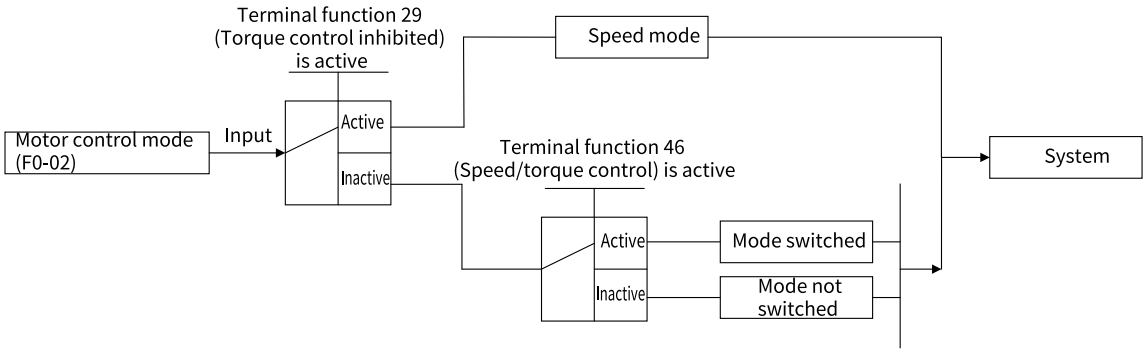


Figure 10-99 Schematic of speed control/torque control switchover

Application example

1. Set F0-02 [Motor control mode] to 1 [Torque control].
2. Set F4-03 [DI1 function selection] to 29 [Torque control inhibited].
3. Set F4-04 [DI2 terminal selection] to 46 [Speed control/Torque control selection].
4. Set E0-58 [DI active 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.

10.11.10.4 Immediate DC braking

Application scenarios

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.

Operating 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.

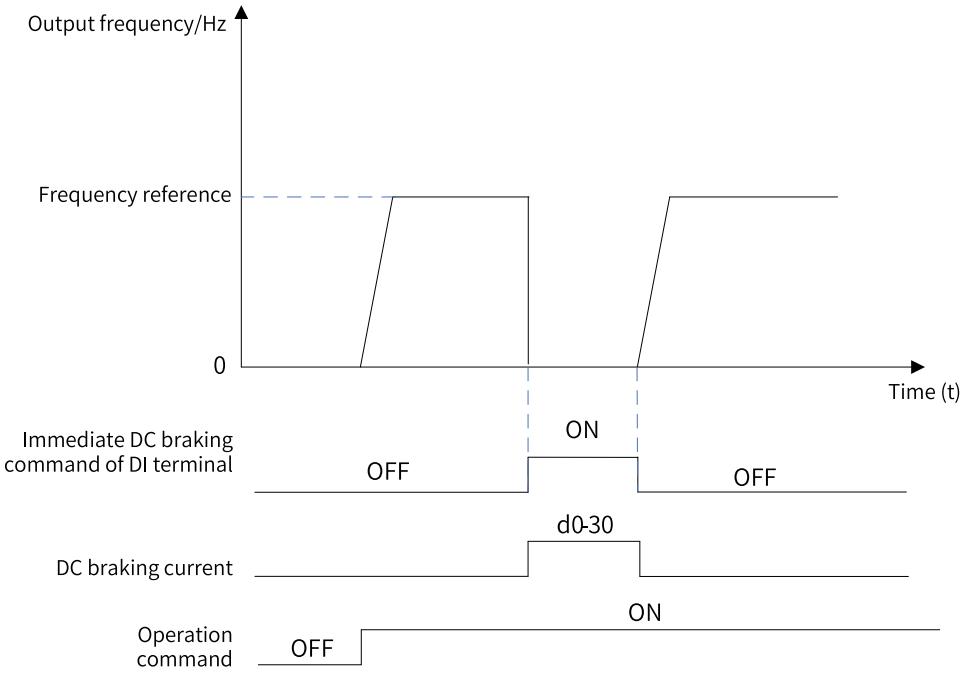


Figure 10-100 Schematic of immediate DC braking

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 active 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.

10.11.10.5 Decelerate to DC braking

Application scenarios

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.

Operating 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.

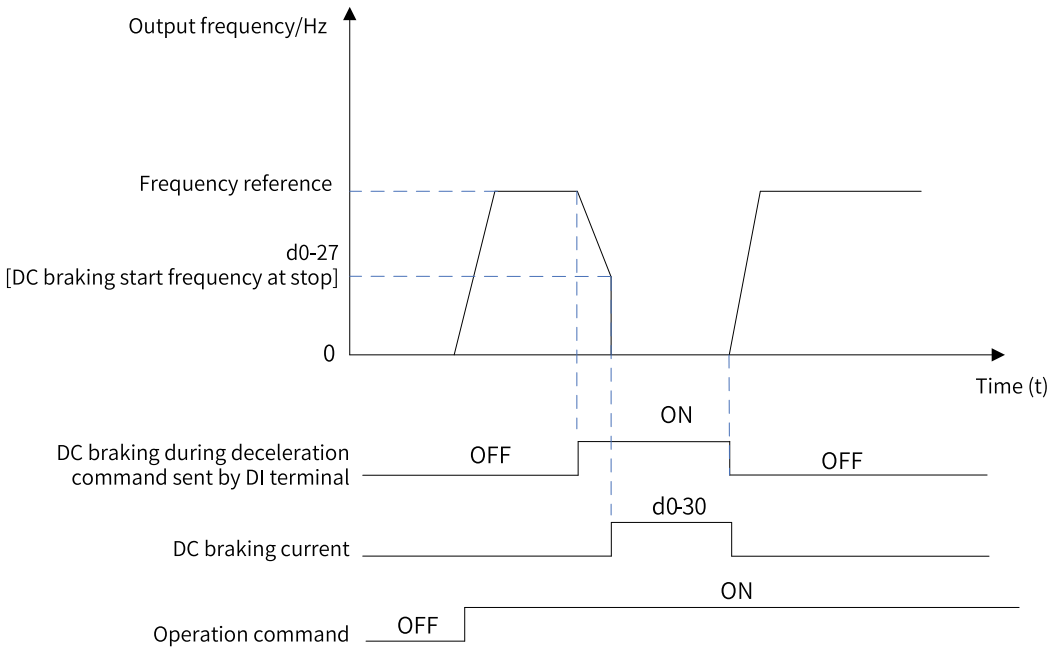


Figure 10-101 Schematic diagram of decelerating to DC braking

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 active 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.

10.11.11 DO Function Settings

10.11.11.1 Motor overload pre-alarm

Application scenarios

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.

Operating 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%.

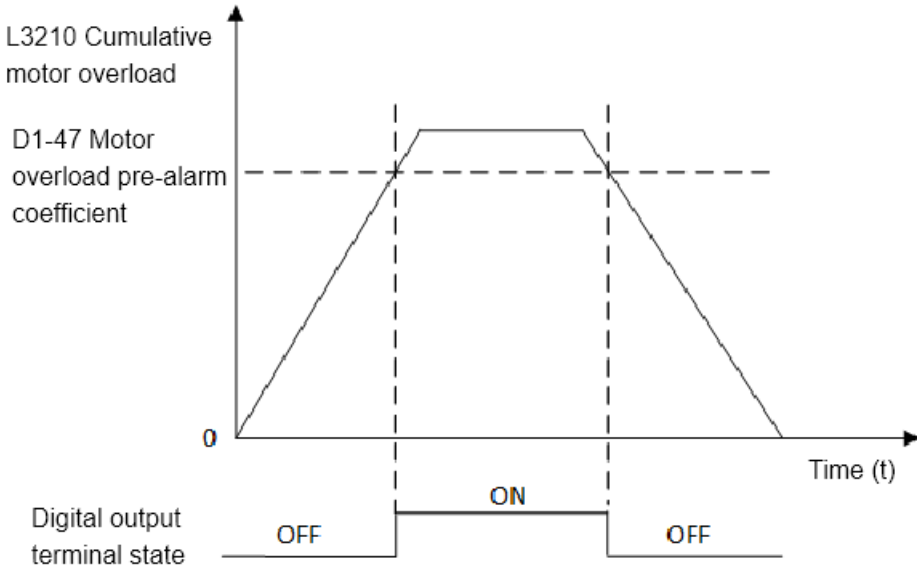


Figure 10-102 Motor overload pre-alarm

The relationship between overload current and fault reporting time is shown in the following figure.

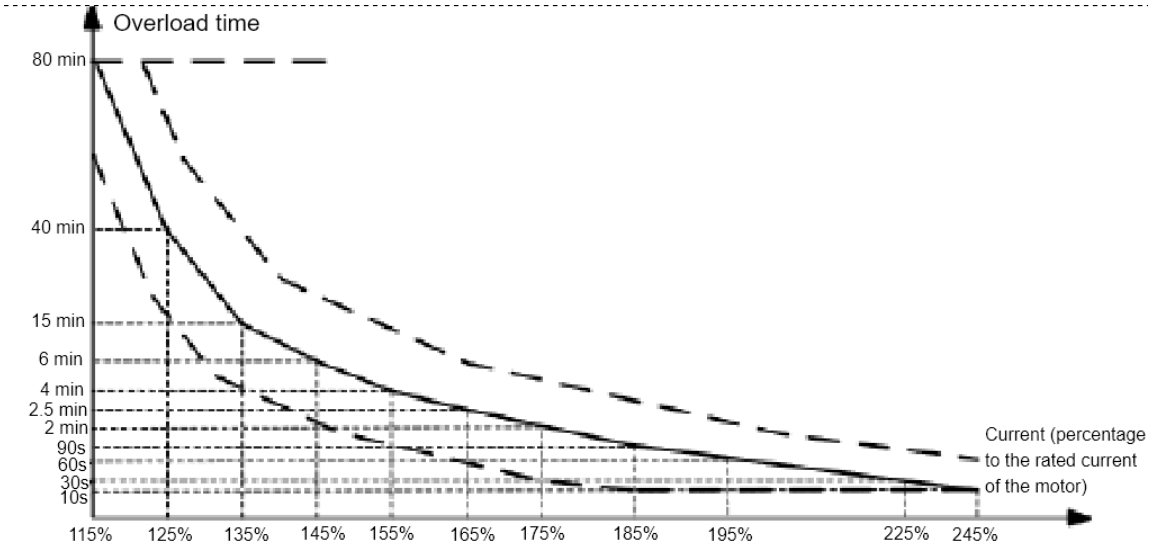


Figure 10-103 Motor overload curve

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.

10.11.11.2 Drive overload pre-alarm

Application scenarios

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.

Operating 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%.

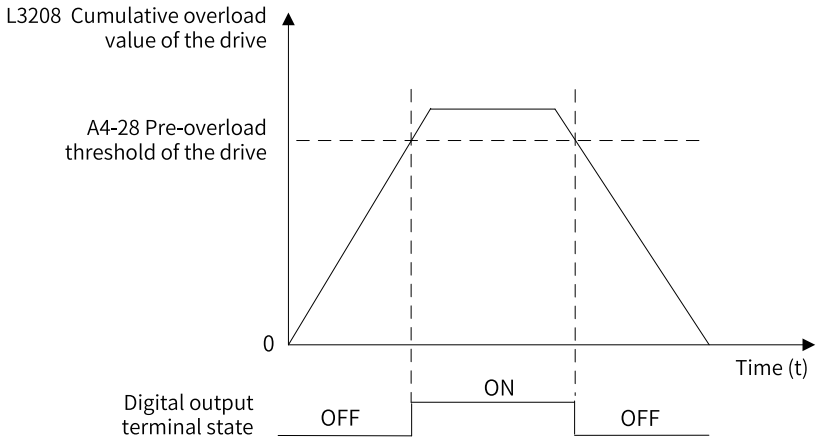


Figure 10-104 Drive overload pre-alarm

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.

10.11.11.3 Torque limited

Application scenarios

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 (SVC) mode. To switch to this 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.

Operating 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.

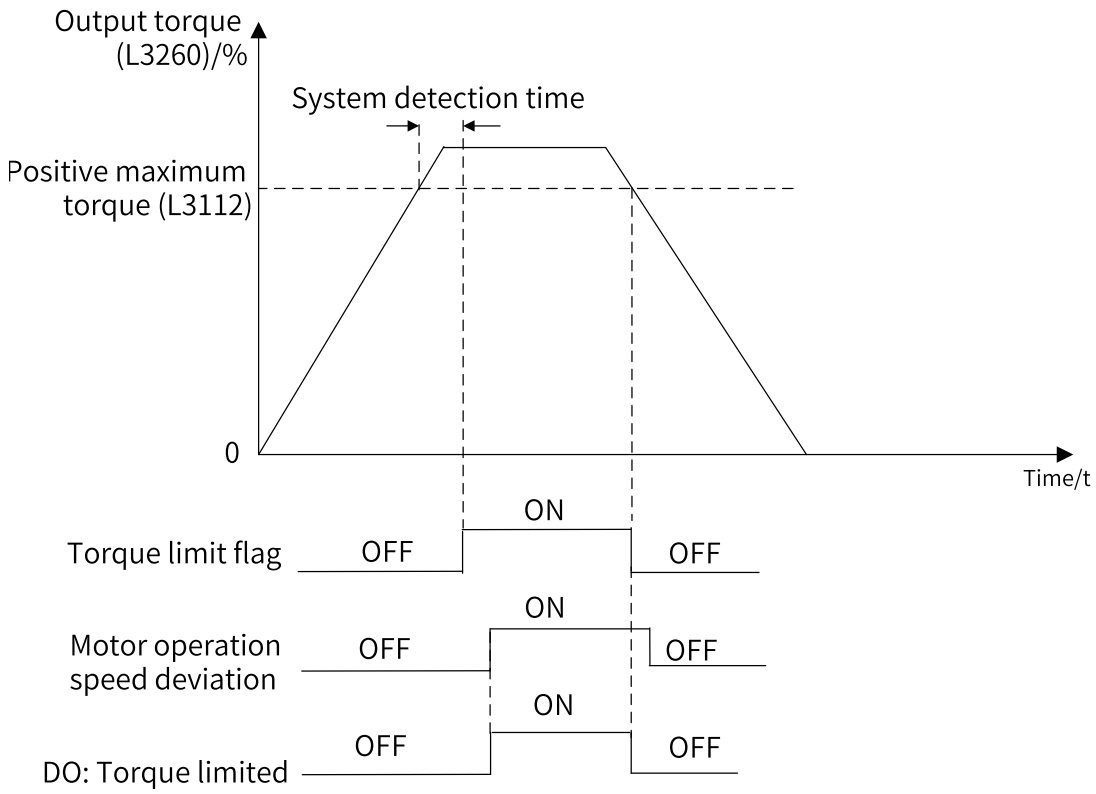


Figure 10-105 Operation principles

Application instance

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.

10.11.11.4 Undervoltage state output

Application scenarios

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.

Operating 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.

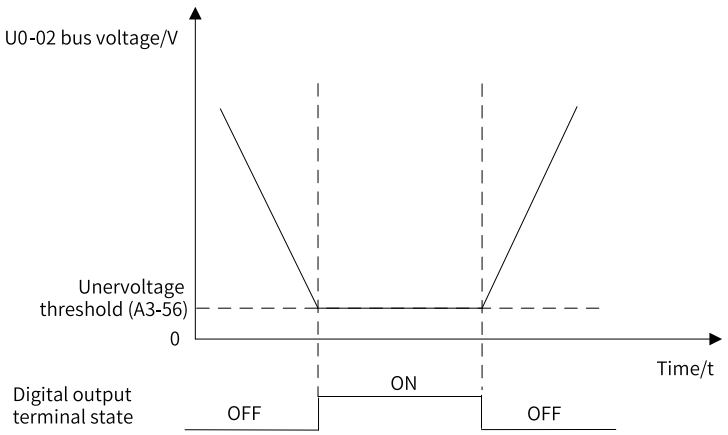


Figure 10-106 Undervoltage state output

Application instance

1. Set E1-00 (RO output function selection) to "19: Undervoltage state output".

With the above configuration, the RO terminal outputs an active signal when the system detects that the drive is in the undervoltage state.

10.11.11.5 Communication control

Application scenarios

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.

Operating principles

For the digital output terminals RO, DO, FMR (for MD610S), and the analog digital output terminals VDO1 to VDO6 of the MD610 AC drive, if the function 20 (communication setting) is selected, the address 0x2001 or 0x7312 is uniformly 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 10–52 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

Name	Bit position at address 0x2001 or 0x7312
VDO3	bit12
VDO4	bit13
VDO5	bit14
VDO6	bit15

Application instance

The following shows the setting of DO output through communication.

1. Set E1-04 [DO output function selection] to 20 [communication setting].
2. According to *"Table 10-52 Bit positions of digital output terminals (communication setting)" on page 515*, the DO corresponds to bit4 of 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.

10.11.11.6 Three phase loss

Application scenarios

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.

Operating principles

When three-phase loss protection is enabled (d1-78 = 1), if the three-phase output current keeps lower than the three-phase loss detection threshold (d1-82) for a period defined by d1-81, E30-1 (Three-phase loss fault) is reported and the DO terminal outputs an active signal.

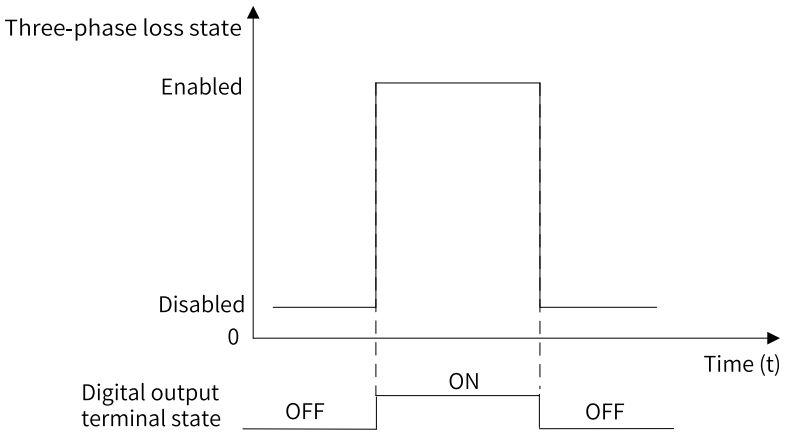


Figure 10-107 Three phase loss

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.

10.11.11.7 AI Input Limit Exceeded

Application scenarios

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 *"10.11.8 Analog Input Terminal (AI)" on page 482*. 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.

Operating 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.

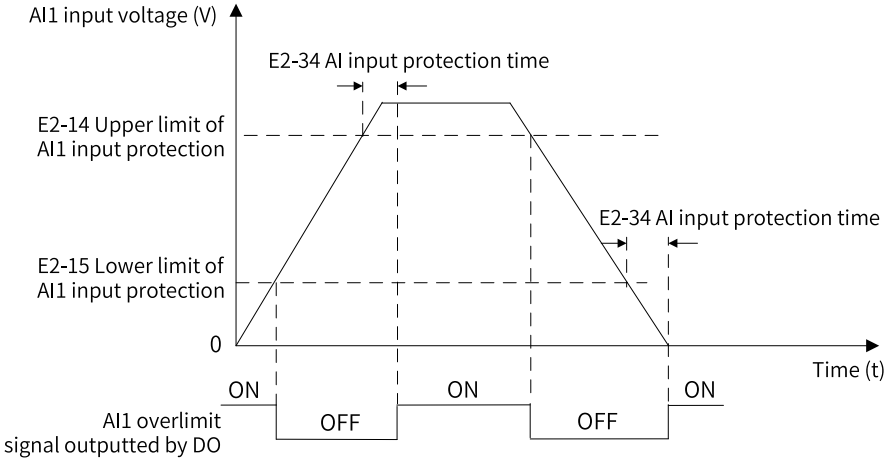


Figure 10-108 AI Input Limit Exceeded

Application instance

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.

10.11.11.8 Heatsink temperature arrival

Application scenarios

This function is used to monitor whether the heatsink temperature of the drive reaches the threshold through the control terminal.

Description

When the system detects that the heatsink temperature of the drive reaches the threshold, the DO assigned with function "35: Drive temperature arrival" outputs an active signal.

Operating principles

As shown in the following figure, when the DO terminal function is set to 35 (Module temperature reach) 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.

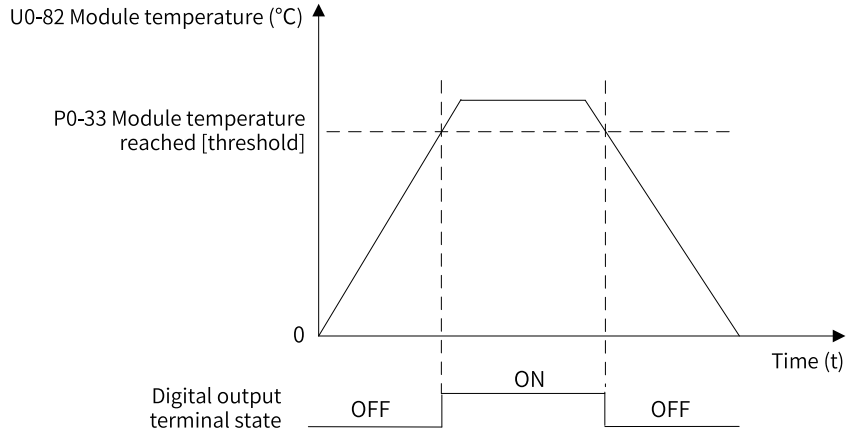


Figure 10-109 Heatsink temperature arrival

Application instance

The following takes the RO assigned with function "35: Heatsink temperature arrival" as an example.

1. Set P0-33 [Heatsink temperature arrival] to 60°C.
2. Set E1-00 [RO output function selection] to "35: Heatsink temperature arrival".
3. With above configuration, the RO outputs an active signal when U0-82 [Heatsink temperature] exceeds 60°C.

10.11.12 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 IO expansion card is compatible with T1 to T5 models of the AC drive. For detailed operation instructions, refer to the "MD-IO-M1 IO Expansion Card User Guide".

10.11.12.1 I/O Expansion Card Digital Input Terminal (DI)

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 in *"10.11.2 Digital Input (DI) Terminals" on page 449*.

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	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. Additional information: 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. Additional information: 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. Additional information: 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. Additional information: The parameter can be used together with the filter time.

Param.	Name	Default value	Value range	Description
EA-05	DI2 switch-off delay	0.0	0.0s to 3600.0s	Defines the delay change time when DI2 is switched off. Additional information: 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.

10.11.12.2 I/O Expansion Card DO

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). The DO function can refer to the DO function of this product (*"10.11.3 Digital Output (DO) Terminal" on page 451*).

As shown in the table below, parameters in group EA are used to set functions for DO and RO.

Param.	Name	Default value	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). Options: 0: Output function. DO and RO outputs depend on the function selection of EA-16 and EA-17. 1: Force value. The DO and RO outputs depend on EA-19.

Param.	Name	Default value	Value range	Description
EA-19	Forced DO/RO data	0x0000	0x0000 to 0xFFFF	Defines the level state of forced values of DO and RO (in bit sequence). Options: 0: Low level. Force DO and RO outputs to low level. 1: High level. Force DO and RO outputs 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). Options: 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. Options: 0: Low level. Set output to forced low level. 1: High level. Set output to forced high level.

10.11.12.3 I/O Expansion Card AI

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. (*"10.11.8 Analog Input Terminal (AI)" on page 482*)

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	DIP 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-conductor/three-conductor)
	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 MD610 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 10–53 Parameters for AI used as DI

Param.	Name	Default value	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 higher than "Extended".
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 higher than "Extended".

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 10–54 Related parameter list

Param.	Name	Default value	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.

Param.	Name	Default value	Value range	Description
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 higher than "Extended".
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 higher than "Extended".
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 greater than E2-14 or lower than E2-15, the DO terminal outputs a valid signal indicating AI1 input out of range. You can also set H1-14 (Fault action protection) to set 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 greater than E2-15 or lower than E2-14, the DO terminal outputs a valid signal indicating AI1 input out of range. You can also set H1-14 (Fault action protection) to set 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 [Nor-mal]	0 to 3	Defines AI1 input polarity. Options: 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. Options: 0000H: Corresponding to the minimum input. When the AI input 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	Value range	Description
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. Options: 0000H: Corresponding to the minimum input. When the AI input 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-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: See 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: See 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: See 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: See 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: See 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: See EA-51.

Param.	Name	Default value	Value range	Description
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: See 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: See 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: See 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: See 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: See 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 to 10 V correspond to 0% to 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 to EA-42, that is, the denoising threshold, filter time, zero-crossing threshold, jump point, and jump amplitude based on the actual conditions.

5. Set the frequency source to "Others" (b5-00 = Others). 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.

10.11.12.4 I/O expansion card AO

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 the AO function, see the description of the AO function (*"10.11.9 Analog Output (AO) Terminals" on page 498*).

The hardware wiring of the AO terminal is shown below.

When AO1 is used for voltage output (0-10 V), set switch S1 to the OFF position. When AO1 is used for current output (0-20 mA), set switch S1 to the ON position. For the position of the DIP switch for AO1 voltage and current modes, see *"10.11.12.3 I/O Expansion Card AI" on page 521*.

The following table lists the AO function parameters.

Param.	Name	Default value	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. The AO curve output value keeps unchanged. 1: Absolute value. The absolute value of the AO curve output value is used. 2: Inverted. The inverted value of the AO curve output value is used. 3: Absolute value inverted. The inverted value of the absolute AO curve output value is used.

Param.	Name	Default value	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. The gain and offset are set by parameters EA-78 and EA-79.
EA-74	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	Percentage corresponding to the 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	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	Percentage corresponding to the 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

Param.	Name	Default value	Value range	Description
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 source is defined by EA-82.
EA-82	AO1 forced value	0.00	0.00 to 10.00	Defines the forced AO value. Additional information: This parameter is valid when EA-81 is set to 1.

10.11.12.5 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. 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. *"10.11.12.3 I/O Expansion Card AI" on page 521*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.

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 motor temperature reach), EA-61 (Motor overtemperature pre-alarm threshold), and EA-60 (Motor overtemperature 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.

Related parameters

Table 10–55 Parameters related to motor temperature

Param.	Name	Default value	Value range	Description
EA-59	AI temperature mode - motor temperature sensor	0	0 to 5	Defines the AI2 temperature sensor type. Value description: 0: As analog input - AI2 is used as normal analog input 1: PT100 - AI2 is used as the input of the PT100 sensor. 2: PT1000 - AI2 is used as the input of the PT1000 sensor. 3: KTY84-130 - AI2 is used as the input of the KTY84-130 sensor. 4: PTC130 - AI2 is used as the input of the PTC130 sensor. 5: PTC130 three-conductor. The temperature sensor type is PTC130. Additional information: Resistance temperature detector (RTD) supports the following temperature sensor types: PT100, PT1000, KTY84-130, single-conductor PTC130, and three-conductor PTC-130, with corresponding temperature values displayed in U1-45.
EA-60	AI temperature mode - motor overtempera-ture protection	130°C	EA-61 to 200	Defines the motor overtemperature protection threshold.
EA-61	AI temperature mode - motor overtempera-ture pre-alarm	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 alarm threshold for motor temperature arrival.

Table 10–56 Temperature display parameter of the I/O expansion card

Param.	Name	Default value	Value range	Description
U1-45	I/O expansion card 1-RTD temperature value	0.0	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°C to 180°C, ±5°C)	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°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°C to 180°C, ±5°C)	Displays the motor temperature (in unit of degree) sampled by the RTD of I/O expansion card 2 used as the temperature sensor.

10.12 Application Macro

10.12.1 Application Macro Introduction

Application macros are multiple pre-set parameter sets. You can select one macro as the basis, modify some parameters based on function requirements, and save the modified parameters as user-defined parameter sets. This can simplify the commissioning process.

Application scenario

Application macros of the AC drive are divided into interface macros, custom macros, and load control optimization macros.

The parameter sets of the interface macros are mainly designed for control interfaces such as DIs, DOs, and AIs. Through standardized I/O configuration or wiring templates, you can complete engineering design or drawing design quickly.

Custom macros are primarily designed to meet customers' customized parameter requirements or product switching compatibility needs.

Load control optimization macros are mainly designed for specific applications (for example, drive controlling fan and pump loads). The drive includes expert tuning parameter sets for motor control. By configuring these expert tuning parameters with one click, you can achieve optimal control quickly.

Description

Eighteen types of interface macros can be selected via F0-11/A0-48 (Interface macro selection). These cover control interface parameter sets such as two-wire start/stop control, three-wire start/stop control, AI as frequency source, control channel 1/2 switching, terminal module A/B, and setting channel 1/2 switching. Each option corresponds to a specific wiring method. After selecting one, the inverter will automatically set certain parameters corresponding to that wiring method.

Three custom macros can be selected via F0-13/A0-50 (Custom macro selection), including power unwinding, mechanical movement, and lathe industry, to meet product switching compatibility needs.

Four types of load control optimization macros are selected via F0-15/A0-52 (Load control optimization macro Selection). These cover various load applications such as fans and pumps, air conditioners and air compressors, rapid start/stop, and high inertia loads. After selecting an application, relevant high-level tuning parameters will be automatically set.

F0-11/A0-48 (Interface macro selection), F0-13/A0-50 (Custom macro selection), and F0-15/A0-52 (Load control optimization macro selection) are trigger-type macro selection parameters. Once the parameter set is correctly written to the drive, it will be automatically cleared. You can view the last successfully written interface macro and industry macro through F0-12/A0-49 (Interface macro active value), F0-14/A0-51 (Custom macro active value), and F0-16/A0-53 (Active value of load control optimization macro).

If you need to clear the parameter set corresponding to the active macro, you can set F0-11/A0-48 (Interface macro selection), F0-13/A0-50 (Custom macro selection), and F0-15/A0-52 (Load control optimization macro selection) to 1. The drive will restore the parameter set to factory settings. Parameters outside the parameter set are unaffected.

After setting the macro, you can adjust the parameters as required. You can also back up the parameters after commissioning using an external operating panel or commissioning software. In the same scenario, you can download the parameters with one click, greatly simplifying the commissioning process.

Related parameters

Table 10–57 Application macro parameters

Param.	Name	Default value	Value range	Description
A0-48	Interface macro selection	0	0 to 200	0: No action 1: Restores the parameters related to the selected interface macro to default settings 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode 103: Analog speed regulation in single-wire mode 104: Four fixed speeds in two-wire mode 2 105: Analog speed regulation in two-wire mode 1 106: Analog speed regulation in two-wire mode 2 107: Analog speed regulation in two-wire mode 3 108: Four fixed speeds in three-wire mode 2 109: Analog speed regulation in three-wire mode 1 110: Analog speed regulation in three-wire mode 2 111: Analog PID controller 112: PID controller with fixed reference value 113: Modbus communication control macro 114: Modbus communication control macro with DI-based start/stop control 115: Multi-channel switchover 1 116: Multi-channel switchover 2 117: Jog control through DI 118: CANopen communication control macro
A0-49	Effective value of the interface macro	0	0 to 65535	Same as A0-49.
A0-50	Custom macro selection	0	0 to 500	0: No action 1: Restores the parameters related to the selected custom macro to default settings 211: Power unwinding 212: Mechanical movement 213: Lathe industry
A0-51	Active value of the custom macro	0	0 to 65535	Same as A0-51.

Param.	Name	Default value	Value range	Description
A0-52	Load control optimization macro selection	0	0 to 700	0: No action 1: Restores the related parameters of the selected load control optimization macro to default settings 601: Fan and pump macro 602: Air compressor and air conditioning macro 603: Quick start and quick stop macro 605: Large inertia load macro
A0-53	Active value of the load control optimization macro	0	0 to 65535	Same as A0-52.

Operation Flowchart

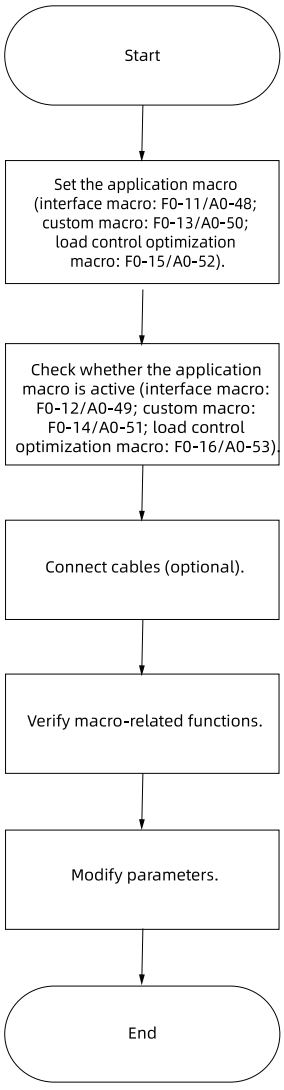


Figure 10-110 Procedure of using application macros

Procedure

To select an interface macro or a custom macro, do as follows:

1. Select a macro through F0-11/A0-48 (Interface macro selection), F0-13/A0-50 (Custom macro selection), or F0-15/A0-52 (Load control optimization macro selection).
2. Check whether the application macro is active. If F0-12/A0-49 (Interface macro active value), F0-14/A0-51 (Custom macro active value), and F0-16/A0-53 (Active value of load control optimization macro) displays the macro number set in the previous step, the parameter set has been successfully written.
3. Whether using an interface macro or a custom macro, wiring is required for DI, DO, AI, and AO. For detailed wiring, refer to *" Control Circuit Connection" on page 98*.
4. 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 drive runs forwardly. When DI1 is open and DI2 is closed, the drive runs reversely. Adjust the input of AI1 to control the set frequency. The RO is used for fault output, the DO for output during operation, and the AO for motor speed output.
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 drive runs forwardly. When DI1 is open and DI2 is closed, the drive runs reversely. Adjust the input of AI1 to control the set frequency. The RO is used for fault output, the DO for output during operation, and the AO for motor speed output.
6. Adjust and modify parameters based on actual application needs.

Precautions

1. The AC drive provides three types of application macros, including interface macros, custom macros, and load control optimization macros. If a macro is set to a new parameter set, the old parameter set is first restored to factory settings and then the new parameter set is written. For example, if A0-48 (Interface macro selection) is set to 104 (Four fixed speeds in two-wire mode) and then changed to 111 (Analog PID), the parameters for option 104 are restored to factory settings before the parameters for option 111 are written.
2. The AC drive provides three types of application macros, including interface macros, custom macros, and load control optimization macros. These three types of macros can be used together or separately. For example, you can set the load control optimization macro and interface macro simultaneously.
3. Parameter writing takes time. Ensure that the power supply of the AC drive is normal.

10.12.2 Interface Macro

10.12.2.1 Interface Macro Overview

Application scenario

The 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
7. For communication control using CANopen, refer to interface macro 118.

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.

Description

The interface macro functions and parameters of the AC drive are all related to the control interface. To use the interface macros, select a macro number in A0-48 (interface macro selection). In this case, the drive A automatically writes a set of parameters to implement the corresponding function, thus simplifying commissioning. For details on interface macro functions, see *"Table 10-58 Interface macro" on page 537*. The written parameters can be queried with the application macro function, as shown in the "Related Application Macro" column of the table below.

Table 10–58 Interface macro

Param.	Name	Optional Macro	Function	Links
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.	"10.12.2.2 Quick Commissioning Macro (A0-48 = 101)" on page 541
		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.	"10.12.2.3 Two Fixed Speeds in Single-wire Mode (A0-48 = 102)" on page 542
		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.	"10.12.2.4 Analog Speed Regulation in Single-wire Mode (A0-48 = 103)" on page 543
		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.	"10.12.2.5 Four Fixed Speeds in Two-wire Mode 2 (A0-48 = 104)" on page 545

Param.	Name	Optional Macro	Function	Links
A0-48	Interface macro selection	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.	*"10.12.2.6 Analog Speed Regulation in Two-wire Mode 1 (A0-48 = 105)" on page 547*
		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.	*"10.12.2.7 Analog Speed Regulation in Two-wire Mode 2 (A0-48 = 106)" on page 548*
		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.	*"10.12.2.8 Analog Speed Regulation in Two-wire Mode 3 (A0-48 = 107)" on page 550*
		108 (Two 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. • The open/closed state of DI5 provides two different fixed frequencies (multi-reference).	*"10.12.2.9 Two Fixed Speeds in Three-wire Mode 2 (A0-48 = 108)" on page 552*

Param.	Name	Optional Macro	Function	Links
A0-48	Interface macro selection	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.	"10.12.2.10 Analog Speed Regulation in Three-wire Mode 1 (A0-48 = 109)" on page 553
		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.	"10.12.2.11 Analog Speed Regulation in Three-wire Mode 2 (A0-48 = 110)" on page 555
		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.	"10.12.2.12 Analog PID Controller (A0-48 = 111)" on page 557
		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.	"10.12.2.13 PID Controller with Fixed Reference Value (A0-48 = 112)" on page 558

Param.	Name	Optional Macro	Function	Links
A0-48	Interface macro selection	113: Modbus communication control macro	Scenario: Start/stop the AC drive and set the frequency through Modbus communication.	"10.12.2.14 Modbus Communication Control Macro (A0-48 = 113)" on page 560
		114 (Modbus communication control macro with DI-based 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.	"10.12.2.15 Modbus Communication Control Macro with DI-based Start/Stop Control (114)" on page 561
		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 and setting channel 1: DI1 active; frequency set by AI1 • Terminal start/stop module B and setting channel 2: DI2 active; frequency set by 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 terminal start/stop module B.	"10.12.2.16 Multi-channel Switchover 1 (A0-48 = 115)" on page 563
A0-48	Interface macro selection	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.	"10.12.2.17 Multi-channel Switchover 2 (A0-48 = 116)" on page 564
		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.	"10.12.2.18 Jog Control Through DI (A0-48 = 117)" on page 566
		118 (CANopen Control)	Scenario: CANopen is used for start/stop control and frequency setting.	"10.12.2.19 CANopen Communication Control Macro (A0-48 = 118)" on page 568

Procedure

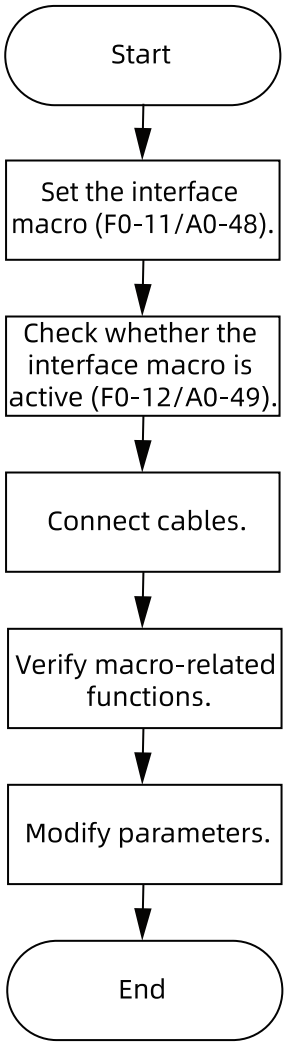


Figure 10-111 Procedure of using application macros

Precautions

If the interface macro parameter set is successfully written, the selected macro number will be displayed by F0-12/A0-49 (effective interface macro value).

10.12.2.2 Quick Commissioning Macro (A0-48 = 101)

Application scenario

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 of the safety function terminal

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 10–59 Parameter set of quick commissioning macro

Parameter code	Definition	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	Setting 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 reference of main frequency	50.00 Hz	5.00 Hz
b7-04	Acceleration time	20.0s	20.0s
b7-05	Deceleration time	20.0s	20.0s
E1-00	RO output selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.3 Two Fixed Speeds in Single-wire Mode (A0-48 = 102)

Application scenario

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 of the safety function terminal

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 Design" on page 64*.

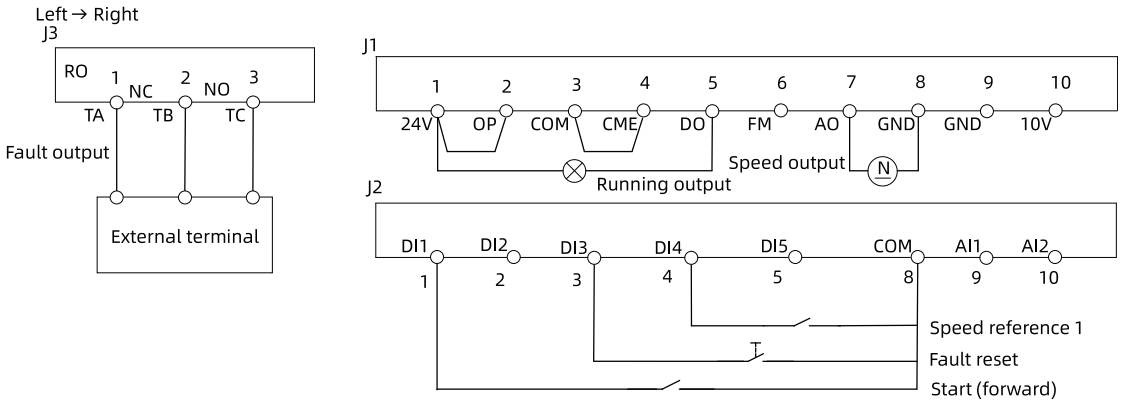


Figure 10-112 Wiring diagram of two fixed speeds in single-wire mode

Function

- 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 10–60 Parameter set of two fixed speeds in single-wire mode

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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	Mode of terminal start/stop module A	3 [IN1 for forward start, IN2 for reverse start]	1 [IN1 start]
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	1 [Terminal start/stop module A_IN1]
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	12: Multi-reference terminal 1
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function
E0-56	Forced DI enable	0x0000: Hardware	0x0000: Hardware
b8-08	Source of multi-reference 0	0 (b8-09)	0 (b8-09)
b8-09	Multi-reference 0	0.0%	25.0%
b8-10	Multi-reference 1	0.0%	50.0%
E1-00	RO output selection	2 (fault output)	2 (fault output)
E1-02	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.4 Analog Speed Regulation in Single-wire Mode (A0-48 = 103)

Application scenario

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 of the safety function terminal

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 Design” on page 64*.

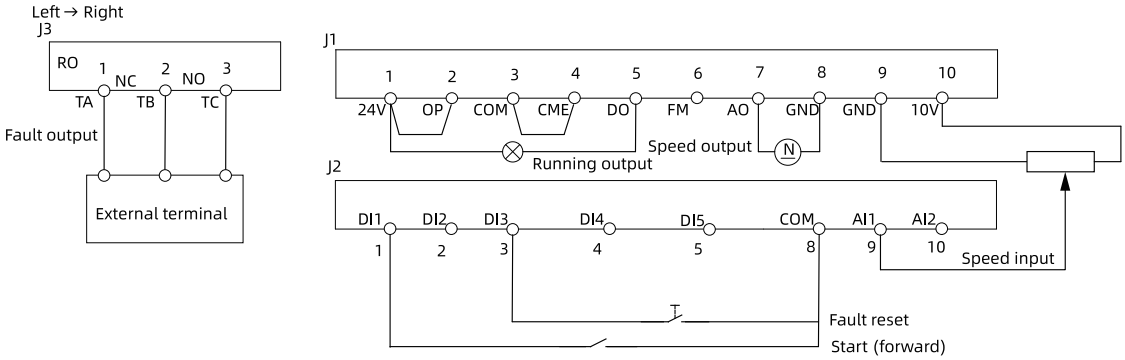


Figure 10-113 Wiring diagram of analog speed regulation in single-wire mode

Function

- 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 10–61 Parameter set of analog speed regulation in single-wire mode

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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	Mode of terminal start/stop module A	3 [IN1 for forward start, IN2 for reverse start]	1 [IN1 start]
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	1 [Terminal start/stop module A_IN1]
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	0: No function

Parameter code	Definition	Default value	Written Value
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function
E0-56	Forced DI enable	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 selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.5 Four Fixed Speeds in Two-wire Mode 2 (A0-48 = 104)

Application scenario

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 of the safety function terminal

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 Design" on page 64*.

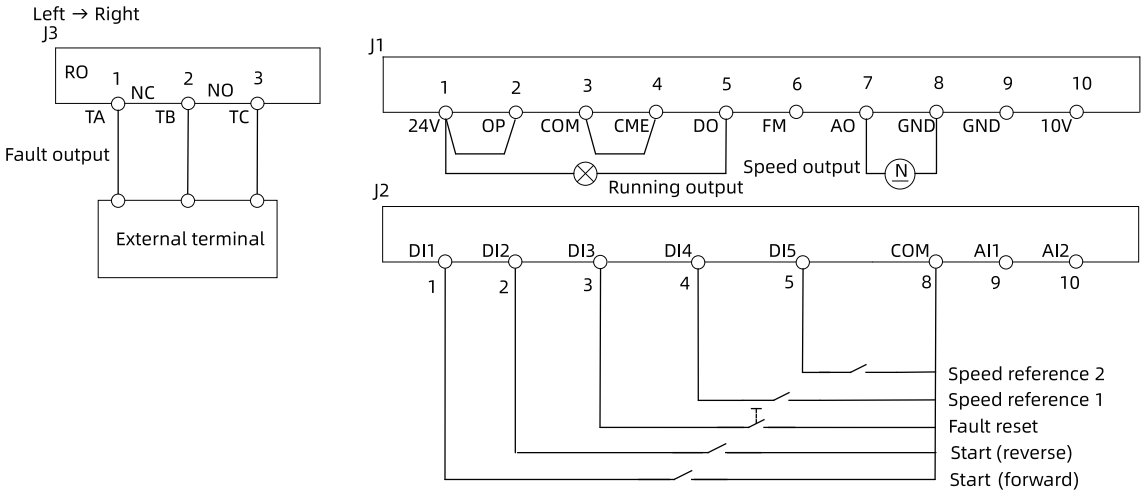


Figure 10-114 Wiring diagram of four fixed speeds in two-wire mode 2

Function

- 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 10–62 Parameter set of four fixed speeds in two-wire mode 2

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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	Mode of 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	4: Terminal start/stop module A (JOG1)	2 [Terminal start/stop module A_IN2]
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	12: Multi-reference terminal 1
E0-04	DI5 function	13 (Multi-reference terminal 2)	13 (Multi-reference terminal 2)
E0-56	Forced DI enable	0x0000: Hardware	0x0000: Hardware
b8-08	Source of multi-reference 0	0 (b8-09)	0 (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 selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.6 Analog Speed Regulation in Two-wire Mode 1 (A0-48 = 105)

Application scenario

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 of the safety function terminal

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 Design” on page 64*.

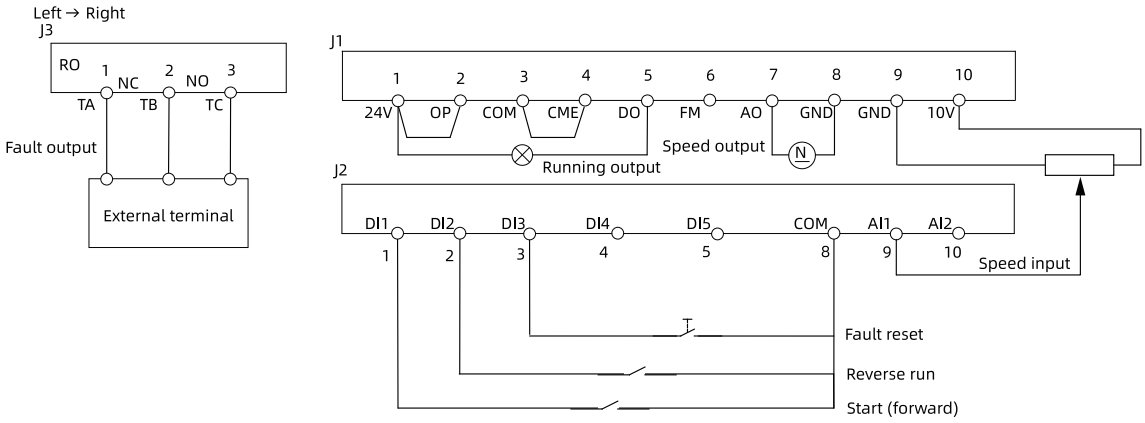


Figure 10-115 Wiring diagram of analog speed regulation in two-wire mode 1

Function

- 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 10–63 Parameter set of analog speed regulation in two-wire mode 1

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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 code	Definition	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	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	4: Terminal start/stop module A (JOG1)	2 [Terminal start/stop module A_IN2]
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function
E0-56	Forced DI enable	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 selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.7 Analog Speed Regulation in Two-wire Mode 2 (A0-48 = 106)

Application scenario

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 of the safety function terminal

Analog speed regulation in two-wire mode 2 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 Design" on page 64*.

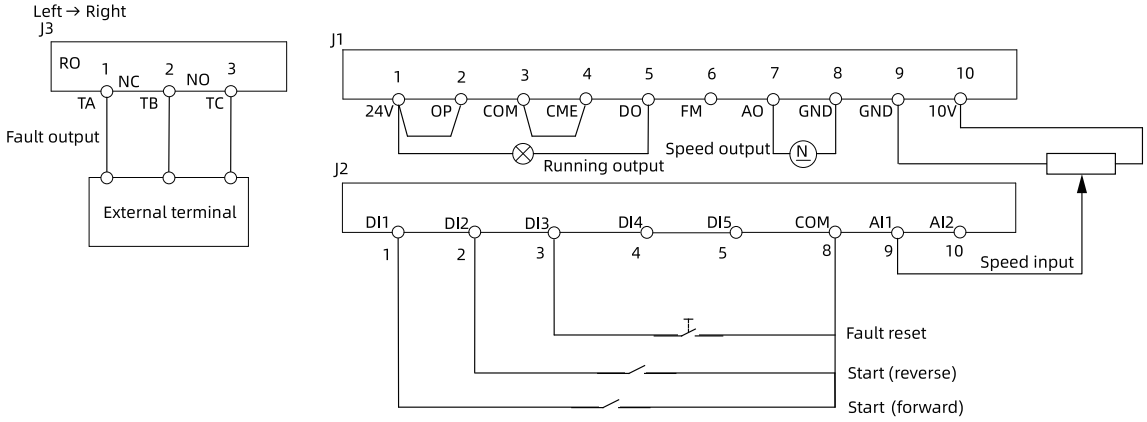


Figure 10-116 Wiring diagram of analog speed regulation in two-wire mode 2

Function

- 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 10–64 Parameter set of analog speed regulation in two-wire mode 2

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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	Mode of 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	4: Terminal start/stop module A (JOG1)	2 [Terminal start/stop module A_IN2]
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function
E0-56	Forced DI enable	0x0000: Hardware	0x0000: Hardware

Parameter code	Definition	Default value	Written Value
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 selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.8 Analog Speed Regulation in Two-wire Mode 3 (A0-48 = 107)

Application scenario

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 of the safety function terminal

Analog speed regulation in two-wire mode 3 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 Design" on page 64*.

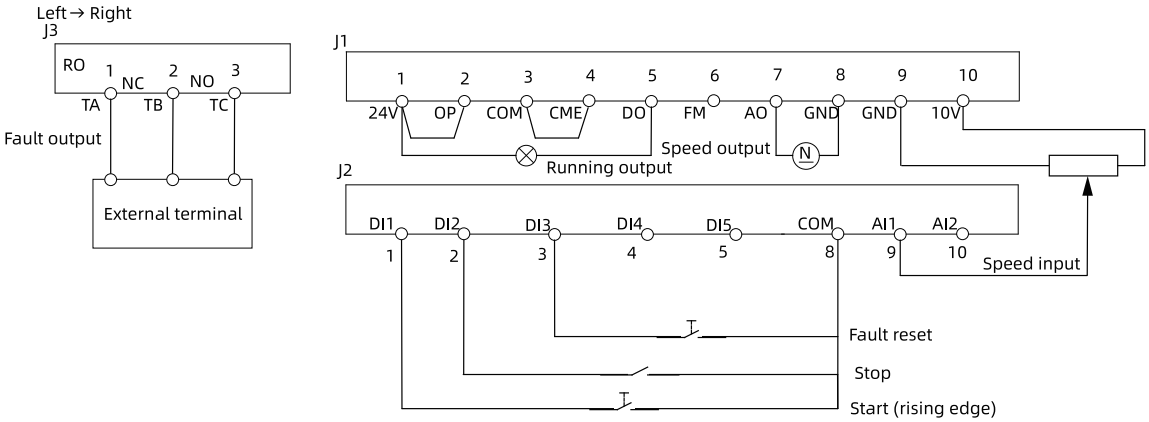


Figure 10-117 Wiring diagram of analog speed regulation in two-wire mode 3

Function

- When DI2 is closed and DI1 transitions from the open state to closed state (by setting to 1 from 0), 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 10–65 Parameter set of analog speed regulation in two-wire mode 3

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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	Mode of terminal start/stop module A	3 [IN1 for forward start, IN2 for reverse start]	4 (IN1P (rising edge) for start and 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	4: Terminal start/stop module A (JOG1)	2 [Terminal start/stop module A_IN2]
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function
E0-56	Forced DI enable	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 selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.9 Two Fixed Speeds in Three-wire Mode 2 (A0-48 = 108)

Application scenario

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 of the safety function terminal

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 drive. See the wiring details in *" Electrical Design" on page 64*.

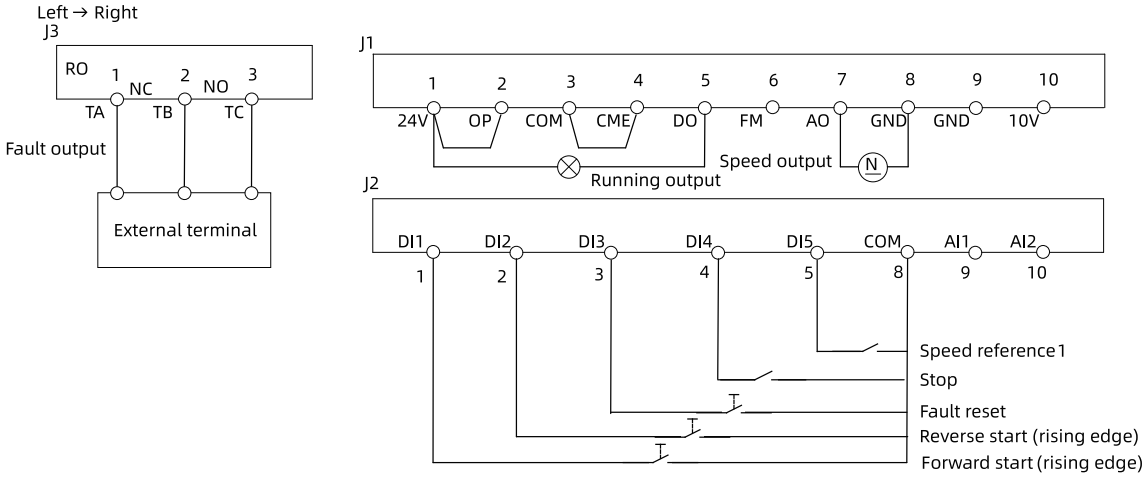


Figure 10-118 Wiring for two fixed speeds in three-wire mode 2

Function

- 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 1, which corresponds to the states of 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 108 (two fixed speeds in three-wire mode 2), the AC drive automatically writes the parameters in the following table.

Table 10–66 Parameter set for two fixed speeds in three-wire mode 2

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting channel selection	0: Set channel 1	0: Set channel 1

Parameter code	Definition	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)	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]	6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	1 [Terminal start/stop module A_IN1]
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	2 [Terminal start/stop module A_IN2]
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	3 [Terminal start/stop module A_IN3]
E0-04	DI5 function	13 (Multi-reference terminal 2)	12: Multi-reference terminal 1
E0-56	Forced DI enable	0x0000: Hardware	0x0000: Hardware
b8-08	Source of multi-reference 0	0 (b8-09)	0 (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 selection	2 (fault output)	2 (fault output)
E1-02	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.10 Analog Speed Regulation in Three-wire Mode 1 (A0-48 = 109)

Application scenario

This macro is mainly used in three-wire mode and in scenarios where analog is used to control speed.

Wiring of the safety function terminal

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 drive. 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 Design" on page 64*.

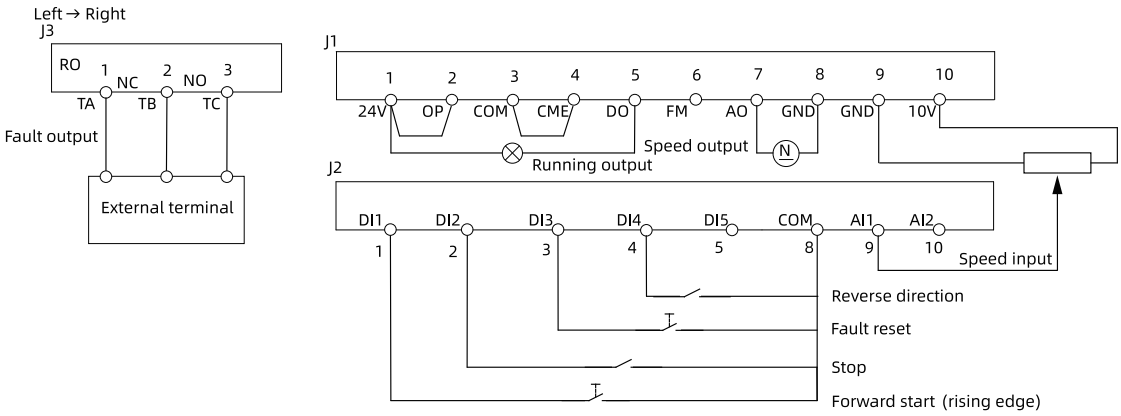


Figure 10-119 Wiring diagram of analog speed regulation in three-wire mode 1

Function

- 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 10–67 Parameter set of analog speed regulation in three-wire mode 1

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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	Mode of terminal start/stop module A	3 [IN1 for forward start, IN2 for reverse start]	5: IN1P (rising edge) start, IN2 stop, IN3 direction
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	1 [Terminal start/stop module A_IN1]
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	2 [Terminal start/stop module A_IN2]
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	3 [Terminal start/stop module A_IN3]
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function

Parameter code	Definition	Default value	Written Value
E0-56	Forced DI enable	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 selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.11 Analog Speed Regulation in Three-wire Mode 2 (A0-48 = 110)

Application scenario

This macro is mainly used in three-wire mode and in scenarios where analog is used to control speed.

Wiring of the safety function terminal

Analog speed regulation in three-wire mode 2 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 Design" on page 64*.

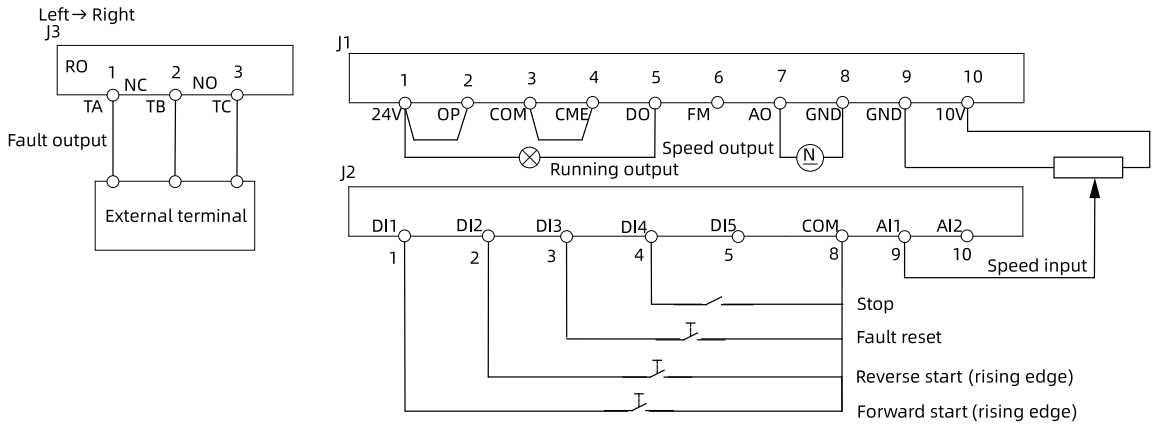


Figure 10-120 Wiring diagram of analog speed regulation in three-wire mode 2

Function

- 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 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 10–68 Parameter set of analog speed regulation in three-wire mode 2

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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	Mode of terminal start/stop module A	3 [IN1 for forward start, IN2 for reverse start]	6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	1 [Terminal start/stop module A_IN1]
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	2 [Terminal start/stop module A_IN2]
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	3 [Terminal start/stop module A_IN3]
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function
E0-56	Forced DI enable	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 selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.12 Analog PID Controller (A0-48 = 111)

Application scenario

This macro is mainly used to start/stop the AC drive through the terminal in single-wire mode and set frequency through PID.

Wiring of the safety function terminal

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 Design" on page 64*.

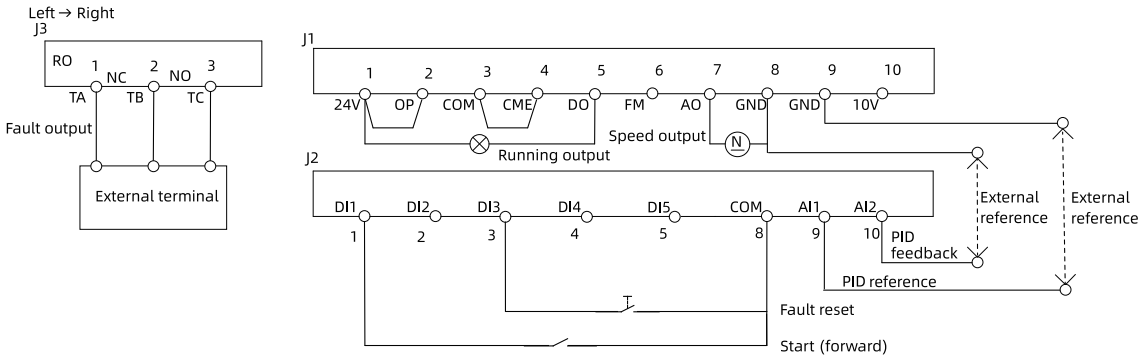


Figure 10-121 Wiring for analog PID controller

Function

- 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 10–69 Parameter set for the analog PID controller

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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)

Parameter code	Definition	Default value	Written Value
b9-01	Mode of terminal start/stop module A	3 [IN1 for forward start, IN2 for reverse start]	1 [IN1 start]
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	1 [Terminal start/stop module A_IN1]
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function
E0-56	Forced DI enable	0x0000: Hardware	0x0000: Hardware
P2-00	PID enable	0 [Disable]	1: Enable
P2-01	PID acting direction	0 (direct acting)	0 (direct acting)
P2-02	PID setting 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 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%
E2-44	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 selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.13 PID Controller with Fixed Reference Value (A0-48 = 112)

Application scenario

This macro is mainly used to start/stop the AC drive through the terminal in single-wire mode and set frequency through PID.

Wiring of the safety function terminal

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 Design" on page 64*.

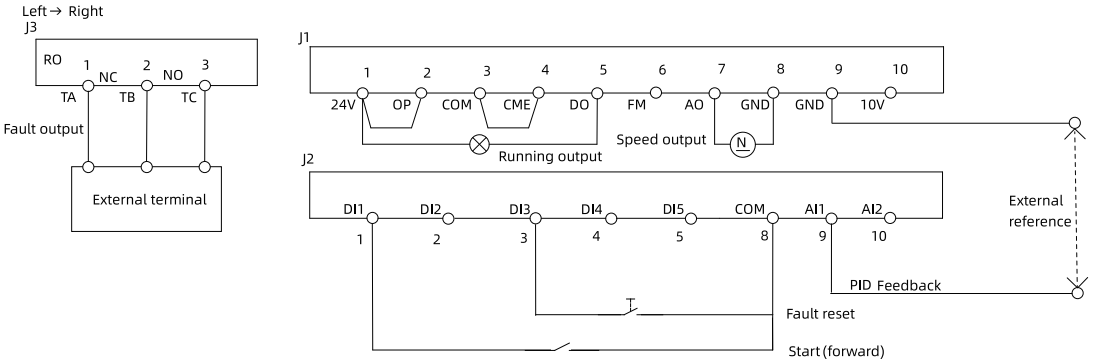


Figure 10-122 Wiring of PID controller with fixed value

Function

- When DI1 is closed, the AC drive starts. When DI1 is open, the AC drive stops.
- The PID setpoint source is the value of P2-03, and the feedback source is AI1.
- 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 value), the AC drive automatically writes the parameters in the following table.

Table 10–70 Parameter set for PID controller with fixed value

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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	Mode of terminal start/stop module A	3 [IN1 for forward start, IN2 for reverse start]	1 [IN1 start]
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	1 [Terminal start/stop module A_IN1]
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function	9: Fault reset	9: Fault reset

Parameter code	Definition	Default value	Written Value
E0-03	DI4 function	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function
E0-56	Forced DI enable	0x0000: Hardware	0x0000: Hardware
P2-00	PID enable	0 [Disable]	1: Enable
P2-01	PID acting direction	0 (direct acting)	0 (direct acting)
P2-02	PID setting source	0 (PID digital setting)	0 (PID digital setting)
P2-03	PID value reference	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 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 selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.14 Modbus Communication Control Macro (A0-48 = 113)

Application scenario

This macro is mainly used for scenarios where Modbus is used for start/stop control and speed reference settings.

Wiring of the safety function terminal

The Modbus communication control macro involves wiring of the 485+ and 485- terminals as shown below. J1, J2, J3, and J5 are terminal block numbers. The relative positions of the interfaces correspond to the actual layout. See the wiring details in *" Electrical Design" on page 64*.

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.

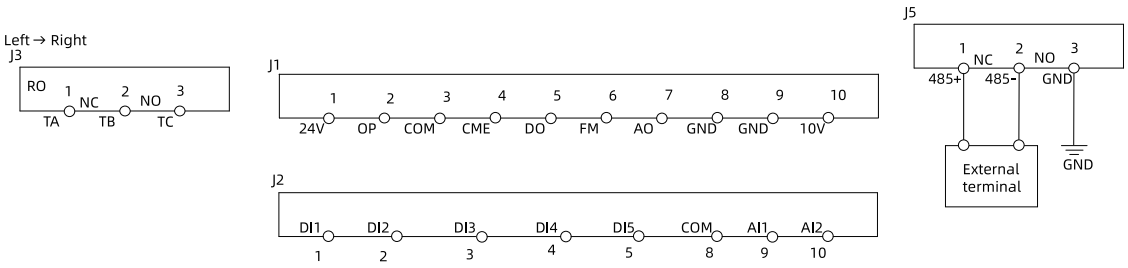


Figure 10-123 Wiring for the Modbus communication control macro

Function

- Modbus is used for start/stop control and speed reference settings.
- Modbus is used to read various status information of the 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 10–71 Parameter set for the Modbus communication control macro

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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 (b5-01)	9 (Communication)
n2-00	Modbus communication 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 (Address 1)	1 (Address 1)

10.12.2.15 Modbus Communication Control Macro with DI-based Start/Stop Control (114)

Application scenario

This macro is mainly for scenarios where the DI is used for start/stop control and the Modbus communication is used for speed control and drive information reading.

Wiring of the safety function terminal

This macro involves wiring for DI1, DI3, RO, DO, AO, 485+, and 485- terminals, as shown below. J1, J2, J3, and J5 are terminal block numbers, and interface positions correspond to the actual layout. See the wiring details in *" Electrical Design" on page 64*.

In this mode, only speed information is transmitted by the communication link, and all other control interfaces require wiring.

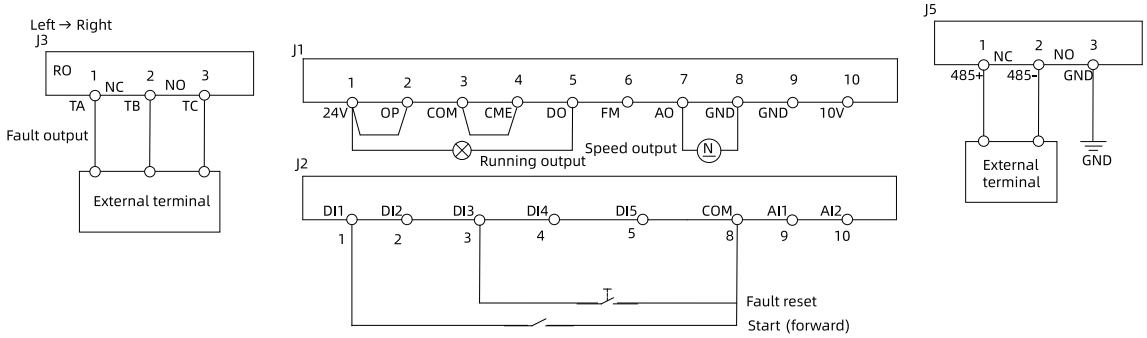


Figure 10-124 Wiring schematic for the Modbus communication control macro with DI-based start/stop control

Function

- When DI1 is closed, the AC drive runs.
- When DI1 is open, the AC drive stops.
- When DI3 is closed, the AC drive resets the fault.
- Modbus is used to control speeds and read various status information of the drive.

Parameters to be written

After setting A0-48 (Interface macro selection) to 114 (Modbus communication control macro with DI-based start/stop control), the drive will automatically write the parameters in the following table.

Table 10–72 Parameter set for the Modbus communication control macro with DI-based start/stop control

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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 (b5-01)	9 (Communication)
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 start]
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	1 [Terminal start/stop module A_IN1]
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	0: No function
E0-02	DI3 function	9 (Fault reset)	9 (Fault reset)
E0-03	DI4 function	12: Multi-reference terminal 1	0: No function
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function
E0-56	Forced DI enable	0x0000: Hardware	0x0000: Hardware
n2-00	Modbus communication 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 (Address 1)	1 (Address 1)

10.12.2.16 Multi-channel Switchover 1 (A0-48 = 115)

Application scenario

The macro is mainly intended for scenarios requiring switching between two terminal start/stop modes and between two setting channels.

Wiring of the safety function terminal

This macro involves the wiring of terminals DI1 to DI5, AI1, AI2, RO, DO, and AO as shown below. J1, J2, and J3 are terminal block numbers. The interface layout corresponds to the actual drive. See the wiring details in *" Electrical Design" on page 64*.

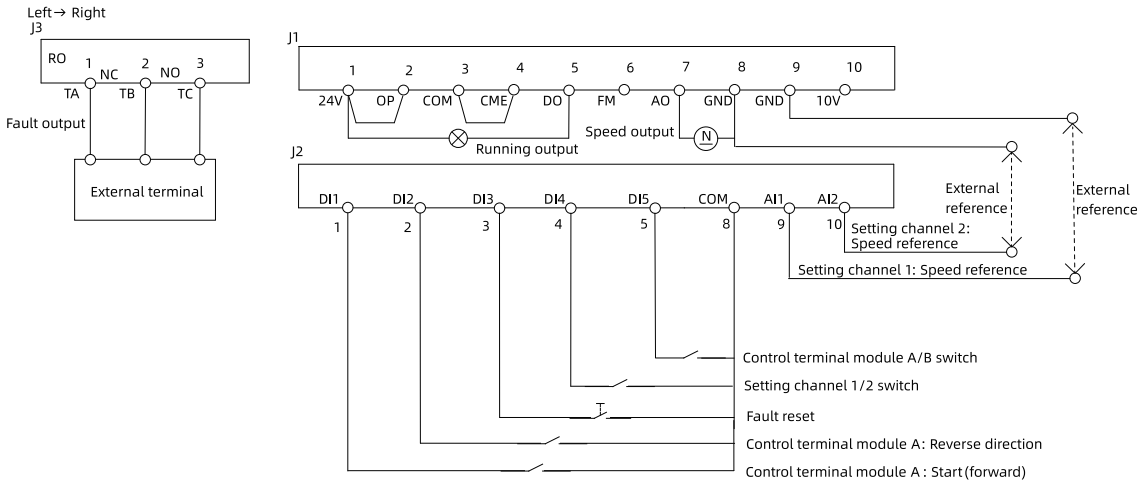


Figure 10-125 Wiring for multi-channel switchover 1

Function

In both mode 1 and mode 2, the main command source for control channel 1 is the DI. In mode 1, the terminal start/stop module A is one-wire, and AI1 is used to set the frequency (speed) of setting channel 1. In mode 2, the terminal start/stop module B is single-wire, and AI2 is used to set the frequency (speed) of setting channel 1.

- When DI4 is open, the set channel 1 is active and AI1 controls the frequency.
- When DI4 is closed, the setting channel 2 is active. AI2 is used to set the frequency.
- When DI5 is open, terminal start/stop module A is active. Therefore, if DI1 is closed, the drive starts.
- When DI5 is closed, terminal start/stop module B is active. Therefore, if DI2 is closed, the drive starts.
- 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 10–73 Parameter set for multi-channel switchover 1

Parameter code	Definition	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 (b5-01)	2: AI1
b6-00	Main frequency source	0 (b5-01)	3 (AI2)
b9-01	Mode of terminal start/stop module A	3 [IN1 for forward start, IN2 for reverse start]	1 [IN1 start]
b9-09	Mode of terminal start/stop module B	3 [IN1 for forward start, IN2 for reverse start]	1 [IN1 start]
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	1 [Terminal start/stop module A_IN1]
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	61 (Terminal start/stop module B_IN1)
E0-02	DI3 function	9 (Fault reset)	9 (Fault reset)
E0-03	DI4 function	12: Multi-reference terminal 1	71 (Setting channel selection)
E0-04	DI5 function	13 (Multi-reference terminal 2)	72 (Terminal start/stop module A/B selection)
E0-56	Forced DI enable	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%
E2-44	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 selection	2 (fault output)	2 (fault output)
E1-02	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.17 Multi-channel Switchover 2 (A0-48 = 116)

Application scenario

Scenarios requiring switching between two control channels and two setting channels.

Wiring of the safety function terminal

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 Design" on page 64*.

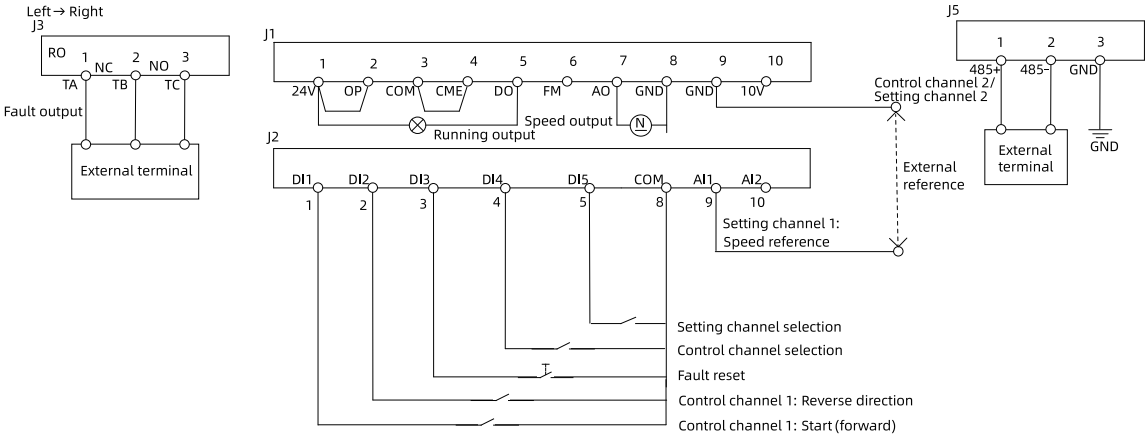


Figure 10-126 Wiring diagram of multi-channel switchover 2

Function

In mode 1, the main command source of control channel 1 is the DI, and the frequency (speed) source of setting channel 1 is AI1. In mode 2, the main command source of control channel 2 is communication, and the frequency (speed) source of setting channel 2 is communication.

- When DI4 is open, control channel 1 is active and DI is used to control start/stop. That is, when DI1 is closed and DI2 is open, the drive starts in the forward direction. When DI1 and DI2 are closed, the drive starts in the reverse direction.
- When DI4 is closed, control channel 2 is active and Modbus communication is used to control start/stop.
- When DI5 is open, setting channel 1 is active and AI1 is used to control the speed.
- When DI5 is closed, setting channel 2 is active and Modbus communication is used to control the speed.
- 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 switch 2), the AC drive automatically writes the parameters in the following table.

Table 10–74 Parameter set of multi-channel switchover 2

Parameter code	Definition	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)

Parameter code	Definition	Default value	Written Value
b5-00	Main frequency source	0 (b5-01)	2: AI1
b6-00	Main frequency source	0 (b5-01)	9 (Communication)
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 reverse direction)
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	1 [Terminal start/stop module A_IN1]
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	2 [Terminal start/stop module A_IN2]
E0-02	DI3 function	9: Fault reset	9: Fault reset
E0-03	DI4 function	12: Multi-reference terminal 1	70 (Control channel selection)
E0-04	DI5 function	13 (Multi-reference terminal 2)	71 (Setting channel selection)
E0-56	Forced DI enable	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 selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)
n2-00	Modbus communication 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 (Address 1)	1 (Address 1)

10.12.2.18 Jog Control Through DI (A0-48 = 117)

Application scenario

The macro is mainly intended for DI-based jog control.

Wiring of the safety function terminal

This macro involves the wiring of terminals DI1, DI2, 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 drive. See the wiring details in *" Electrical Design" on page 64*.

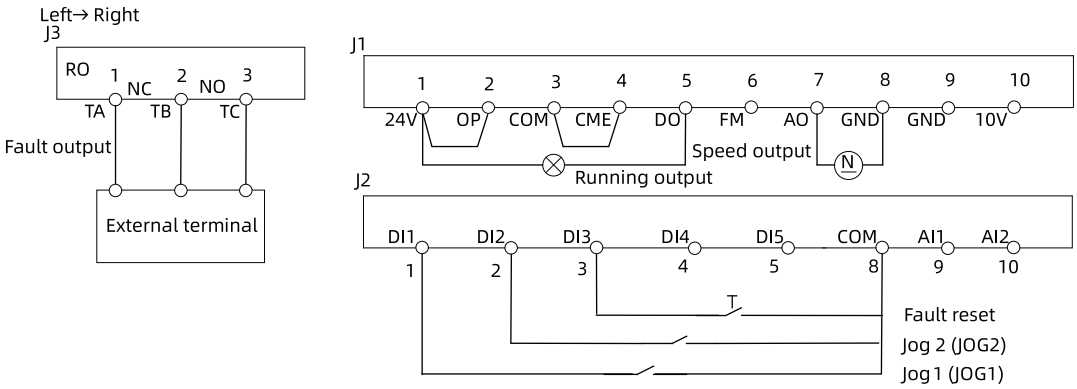


Figure 10-127 Wiring for DI-based jog control

Function

- When the DI1 is closed, the drive runs at jog 1 frequency; when the DI1 is open, the drive stops.
- When the DI2 is closed, the drive runs at jog 2 frequency; when the 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-based jog control), the AC drive automatically writes the parameters in the following table.

Table 10–75 Parameter set for the DI-based jog control macro

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting 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	Jogging frequency 1 source	0 (b5-08)	0 (b5-08)
b5-08	Jog 1 frequency reference	2.00 Hz	2.00 Hz
b5-09	Source of jog frequency 2	0 (b5-10)	0 (b5-10)
b5-10	Jog 2 frequency reference	-2.00 Hz	-2.00 Hz
b7-31	Jogging ramp source	0 (Ramp time of normal running)	1 (Ramp time of jogging)
b7-32	Ramp-up time in jog	20.00s	20.00s
b7-33	Ramp-down time in jog	20.00s	20.00s
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	4: Terminal start/stop module A (JOG1)
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	5 (Terminal start/stop module A (JOG2))
E0-02	DI3 function	9 (Fault reset)	9 (Fault reset)
E0-03	DI4 function	12: Multi-reference terminal 1	0: No function

Parameter code	Definition	Default value	Written Value
E0-04	DI5 function	13 (Multi-reference terminal 2)	0: No function
E0-56	Forced DI enable	0x0000: Hardware	0x0000: Hardware
E1-00	RO output selection	2 (fault output)	2 (fault output)
E1-04	DO function selection	0 (no output)	1: In operation
E3-00 model	AO1 function selection	0 [Operating frequency]	13 (motor speed)

10.12.2.19 CANopen Communication Control Macro (A0-48 = 118)

Application scenario

This macro is mainly suitable for scenarios where CANopen is used for start/stop control and speed settings.

Wiring of the safety function terminal

The CANopen communication control macro involves wiring of the CAN_H and CAN_L terminals as shown below. J1, J2, J3, and J5 are terminal block numbers. The relative positions of the interfaces correspond to the actual layout. See the wiring details in *" Electrical Design" on page 64*.

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.

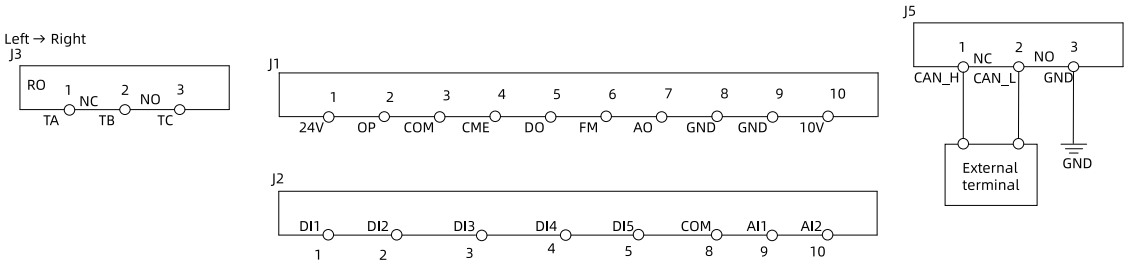


Figure 10-128 Wiring of CANopen communication control macro

Function

- CANopen is used for start/stop control and speed settings.
- CANopen is used to read various status information of the drive.

Parameters to be written

After A0-48 (interface macro selection) is set to 118 (CANopen communication control macro), the AC drive automatically writes the parameters in the following table.

Table 10–76 Parameter set for the CANopen communication control macro

Parameter code	Definition	Default value	Written Value
b0-02	Control channel selection	0: Control channel 1	0: Control channel 1
b0-03	Setting channel selection	0: Set channel 1	0: Set channel 1

Parameter code	Definition	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)	9 (Communication)
n3-01	CAN communication protocol selection	2 (CANlink)	1 (CANopen)
n3-02	CANopen baud rate	5 (500k)	4 (250k)
n3-03	CANopen station number	1 (Address 1)	1 (Address 1)

10.12.3 Custom Macros

10.12.3.1 Introduction to Custom Macros

Application scenario

Three custom macros can be selected through F0-13/A0-50 (Custom macro selection), which meet your customized parameter and product switching compatibility requirements.

Function description

This product provides the custom macro function. After you select a macro number through F0-13/A0-50 (Custom macro selection), the drive automatically writes a set of parameters to implement the corresponding function, thereby simplifying commissioning. For the custom macro function, refer to "Table x Custom macro". You can query the written parameters from the custom macro function, as shown in the "Related link" column in the table below.

Table 10–77 Custom macros

Param.	Name	Optional parameters	Description	Links
A0-50	Custom macro selection	0	No operation	-
		211 (Power unwinding)	Provides a set of power unwinding parameters (compatible with MD310/MD290)	*"10.12.3.2 Power Unwinding (A0-50 = 211)" on page 570*
		212 (Mechanical movement)	Provides a set of mechanical movement parameters (compatible with MD310/MD290)	*"10.12.3.3 Mechanical Movement (A0-50 = 212)" on page 571*
		213 (Lathe industry)	Provides a set of lathe industry parameters (compatible with MD310/MD290)	*"10.12.3.4 Lathe Industry (A0-50 = 213)" on page 572*

Procedure

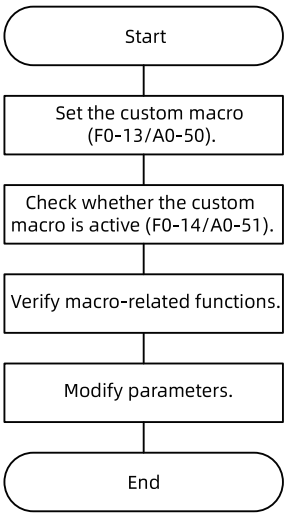


Figure 10-129 Procedure of using application macros

Precautions

If the custom macro parameter set is successfully written, F0-14/A0-51 (Custom macro active value) will display the selected macro number.

10.12.3.2 Power Unwinding (A0-50 = 211)

Application scenario

This macro is primarily intended for power unwinding scenarios where the MD610 is compatible with the MD290/MD310.

Power unwinding wiring

The fan macro involves wiring for DI1 and the 485 terminals as shown below. J1, J2, and J3 are terminal block numbers. The relative positions of the interfaces correspond to the actual layout. For detailed wiring methods, refer to the "Electrical Design" section.

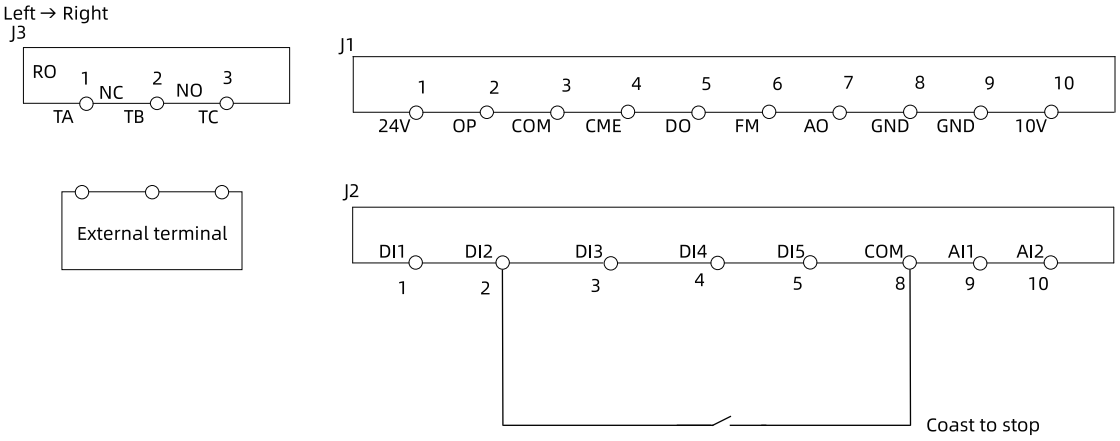


Figure 10-130 Power unwinding wiring

Function

When the DI2 is closed, the drive coasts to stop.

Parameters to be written

After A0-50 (interface macro selection) is set to 211 (power unwinding), the AC drive automatically writes the parameters in the following table.

Table 10–78 Parameter set for the power unwinding macro

Parameter code	Definition	Default value	Written Value
F0-03	Main command source of control channel 1	2 (V/f)	1 (V/f)
F0-29	Main frequency source	0 (Set by the parameter F0-30)	8 (PID)
b7-02	Ramp selection bit 0	0 (0)	0 (0)
b7-03	Ramp selection bit1	0 (0)	0 (0)
b7-04	Ramp-up time of ramp 1	20.0	1.0
b7-05	Ramp-down time of ramp 1	20.0	1.0
E0-01	DI2 function	4: Terminal start/stop module A (JOG1)	8 (Coast to stop)
P2-14	PID parameter 1 proportional gain Kp1	20.0	15.0
P2-15	PID parameter 1 integral gain Ti1	2.00	1.30
P2-16	PID parameter 1 differential gain Td1	0.000	0.000
A5-11	Random PWM depth	0	3
d3-02	Speed loop Kp in SVC mode	5.0	12.0
d3-13	High speed Kp correction factor	100.0	133.0

10.12.3.3 Mechanical Movement (A0-50 = 212)

Application scenario

This macro is mainly targeted at the mechanical movement industry where the MD610 is compatible with the MD290/MD310.

Parameters to be written

After A0-50 (Interface macro selection) is set to 212 (Mechanical movement), the AC drive automatically writes the parameters in the following table.

Table 10–79 Parameter set for the mechanical movement macro

Parameter code	Definition	Default value	Written Value
F0-45	Ramp-up/down mode	0 (Linear acceleration/ deceleration)	1 (S-curve)
d0-27	Starting frequency of DC braking at stop	0.0	0.5
d0-29	DC braking time at stop	0.0	1.0
d0-30	DC braking current at stop	50	50

10.12.3.4 Lathe Industry (A0-50 = 213)

Application scenario

This macro is mainly targeted at the lathe industry where the MD610 is compatible with the MD290/ MD310.

Parameters to be written

After A0-50 (Custom macro selection) is set to 213 (Lathe industry), the drivel automatically writes the parameters in the following table.

Table 10–80 Parameter set for the lathe industry macro

Parameter code	Definition	Default value	Written Value
F0-45	Ramp-up/down mode	0 (Linear acceleration/ deceleration)	1 (S-curve)
F2-48	Overmodulation coefficient	103.0	107.0
A5-11	Random PWM depth	0	3
d0-27	Starting frequency of DC braking at stop	0.0	0.5
d0-29	DC braking time at stop	0.0	1.0
d0-30	DC braking current at stop	50	50
d3-38	Acceleration torque feedforward enable	0 (Disabled)	1: Enable
d3-39	Acceleration torque feedforward coefficient	100.0	80.0

10.12.4 Load Control Optimization Macros

10.12.4.1 Introduction to Load Control Optimization Macros

Application scenario

You can select a load control optimization macro from four types through F0-15/A0-52 (Load control optimization macro selection) as required.

1. If the drive controls fan and pump loads, you can set F0-15/A0-52 to 601 to achieve better control performance.
2. If the drive controls air compressor and air conditioner loads, you can set F0-15/A0-52 to 602 to achieve better control performance.

3. If the drive controls fast start/stop-type loads, you can set F0-15/A0-52 to 603 to achieve better control performance.
4. If the drive controls high-inertia loads, you can set F0-15/A0-52 to 605 to achieve better control performance.

For application scenarios where the drive controls the above-mentioned loads, select a suitable load control optimization macro to achieve better control performance.

Description

This product provides the load control optimization macro function. After F0-15/A0-52 (Load control optimization macro selection) is set, the drive automatically writes a set of parameters to implement the corresponding function, thereby simplifying commissioning. For the load control optimization macro function, refer to "Table x Load control optimization macro". You can query the written parameters from the load control optimization macro function, as shown in the "Related link" column in the table below.

Table 10–81 Load control optimization macro

Param.	Name	Optional parameters	Description	Links
A0-52	Load control optimization macro	0	No operation	-
		601 (Fan and pump)	Provides a set of parameters for fan and pump-type loads to achieve optimized control.	*"10.12.4.2 Fan and Pump Macros (F0-15/A0-52 = 601)" on page 574*
		602 (Air compressor and air conditioner)	Provides a set of parameters for air compressor and air conditioner-type loads to achieve optimized control.	*"10.12.4.3 Air Compressor and Air Conditioner Macros (602)" on page 576*
		603 (Quick start and quick stop)	Provides a set of parameters for fast start/stop-type loads to achieve optimized control.	*"10.12.4.4 Quick Start and Stop Macros (F0-15/A0-52 = 603)" on page 578*
		605 (Large inertia load)	Provides a set of parameters for high-inertia loads to achieve optimized control.	*"10.12.4.5 Large Inertia Load Macros (F0-15/A0-52 = 605)" on page 579*

Procedure

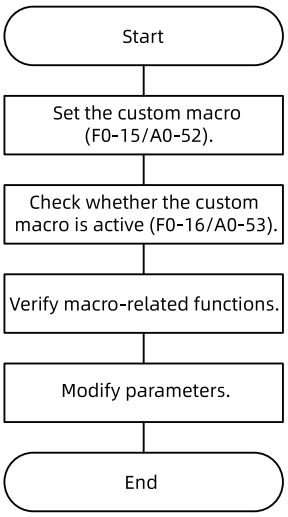


Figure 10-131 Procedure for load custom optimization macro

Precautions

If the parameter set of load custom optimization macro is successfully written, F0-15/A0-16 (Active value of load custom optimization macro) will display the selected macro number.

10.12.4.2 Fan and Pump Macros (F0-15/A0-52 = 601)

Application scenario

This macro primarily targets scenarios where the AC drive controls fan and water pump loads.

- The motor may be started while operating. In this case, enabling the application macro will set the start method to flying start.
- To reduce the fault rate, enable the following functions after enabling fan/water pump application macro.

  1. To prevent overvoltage caused by high inertia during deceleration, enable overvoltage suppression function.
  2. To prevent undervoltage after grid power failure, enable undervoltage suppression function to improve the resistance to power dip.
  3. Enable automatic restart upon fault.

- To improve the voltage output capability, enable overmodulation and increase the overmodulation coefficient.

Parameters to be written

After F0-15/A0-52 (Load control optimization macro selection) is set to 601 (Fan and water pump macro), the drive automatically writes the parameters in the table below.

Table 10–82 Parameter set of fan and water pump macro

Parameter code	Definition	Default value	Written Value	Function
F0-02	Motor control mode	0 (Speed control)	0 (Speed control)	-
F0-50	Ramp 1 acceleration start arc	0.00	0.50	Setting the acceleration start arc can lower down the starting torque. Setting the acceleration end arc can improve speed tracking performance and prevent speed overshoot. Setting the deceleration arc can prevent the motor from rotating reversely at stop or eliminate residual speed after stop.
F0-51	Ramp 1 acceleration end arc	0.00	0.50	
F0-52	Ramp 1 deceleration start arc	0.00	0.50	
F0-53	Ramp 1 deceleration end arc	0.00	0.50	
F1-13	Max. motor current	1000.0	120.0	-
F2-02	Speed loop Kp in SVC mode	5.0	12.0	For large inertia, increasing kp can accelerate torque response; increasing Ti (decreasing Ki) can prevent speed loop oscillation.
F2-03	Speed loop Ti in SVC mode	0.127	2.000	
F2-15	Startup mode	0 (Direct start)	1 (Flying start)	Since fans and water pumps are generally not at a standstill at startup, enabling flying start allows the drive to track the current speed before start.
F2-39	Overvoltage suppression enable	0x0001	0x0003	Enabling overvoltage suppression prevents overvoltage faults caused by excessive inertia during deceleration or speed overshoot.
F2-43	Undervoltage action selection	3 (Undervoltage suppression with limit time)	1 (Undervoltage suppression)	Enabling undervoltage suppression prevents shutdown caused by grid voltage dip, thereby improving resistance to voltage dip.
F2-48	Overmodulation coefficient	105.0	107.0	It can increase the voltage output capacity and slightly reduce current at maximum voltage output. In this case, the current ripple will increase slightly. It can also reduce drive losses during field weakening.
A5-11	Random PWM depth	0	3	It can reduce noise.
b7-02	Ramp selection bit 0	0 (0)	0 (0)	-
b7-03	Ramp selection bit1	0 (0)	0 (0)	-

Parameter code	Definition	Default value	Written Value	Function
d0-85	Low speed handling mode	101	111	Enabling synchronous motor low-speed IF can prevent issues arising from prolonged operation at low speeds, improving low-speed load-bearing capability.
d2-35	Energy-saving control in V/f mode	0 (Invalid)	1 (Valid)	Enabling energy-saving in V/f control mode optimizes output current and reduces current under light loads.
d5-25	Energy-saving control selection of asynchronous motor	0 (Disabled)	1: Enable	Enabling energy-saving in vector control mode optimizes output current and reduces current under light loads.
H3-00	Automatic fault reset selection	1: Enable	1: Enable	Enabling automatic fault reset allows the fault to reset itself within 10 minutes if it occurs fewer than 3 times. This reduces shutdown caused by occasional anomalies and increases operation continuity.
H3-01	Automatic fault reset count	0	3	
H3-02	Interval time of automatic fault reset	1.0	10.0	
H3-04	Time for restoring the number of automatic fault resets	10	10	
H3-28	Restart after automatic fault reset	0 (Disabled)	1: Enable	
H3-29	Restart delay after automatic fault reset	0.5	1.0	
H3-30	Force flying start after automatic fault reset	0 (Disabled)	1 (Enabled)	For large inertia, the speed drops slowly after a fault. Enabling flying start after automatic fault reset can make the motor start normally while operating.

10.12.4.3 Air Compressor and Air Conditioner Macros (602)

Application scenario

This macro is primarily targeted at scenarios where the drive controls air compressors and air conditioners.

- The motor may be started while operating. In this case, enabling the application macro will set the start method to flying start.
- To reduce the fault rate, enable the following functions after enabling air compressor and air conditioner application macro:

  1. To prevent overvoltage caused by high inertia during deceleration, enable overvoltage suppression function.
  2. To prevent undervoltage after grid power failure, enable undervoltage suppression function to improve the resistance to power dip.

3. Enable automatic restart upon fault.

- To improve the voltage output capability, enable overmodulation and increase the overmodulation coefficient.

Parameters to be written

After F0-15/A0-52 (Load control optimization macro selection) is set to 602 (Air compressor and air conditioner macro), the drive automatically writes the parameters in the table below.

Table 10–83 Parameter set for air compressor and air conditioner macro

Parameter	Definition	Default value	Written Value	Modified effect
F0-02	Motor control mode	0 (Speed control)	0 (Speed control)	-
F2-02	Speed loop Kp in SVC mode	5.0	12.0	Increasing kp can accelerate torque response; increasing Ti (decreasing Ki) prevents speed loop oscillation.
F2-03	Speed loop Ti in SVC mode	0.127	2.000	
F2-39	Overvoltage suppression enable	0x0001	0x0003	Enabling overvoltage suppression prevents overvoltage faults caused by excessive inertia during deceleration or speed overshoot.
F2-43	Undervoltage action selection	3 (Undervoltage suppression with limit time)	1 (Undervoltage suppression)	Enabling undervoltage suppression prevents shutdown caused by grid voltage dip, thereby improving resistance to voltage dip.
F2-48	Overmodulation coefficient	103.0	106.0	It can increase the voltage output capacity and slightly reduce current at maximum voltage output. In this case, the current ripple will increase slightly. It can also reduce drive losses during field weakening.
A5-03	DPWM switchover frequency	2000.0	30.0	-
A5-13	Carrier frequency upper limit at low speed (SVC)	2.0	1.5	-
d1-39	Excessive speed deviation protection time	1.0	10.0	Air conditioner and air compressor loads are large. Therefore, if torque output is insufficient and acceleration time is short, the actual speed may fail to follow the set speed. In this case, increasing protection time can prevent false fault reports.
d1-88	Current control error threshold	25.0	0.0	-

Parameter	Definition	Default value	Written Value	Modified effect
d5-01	Field weakening gain of mode 0	50.0	50.0	-
H3-00	Automatic fault reset selection	1: Enable	1: Enable	Enabling automatic fault reset allows the fault to reset itself within 10 minutes if it occurs fewer than 3 times. This reduces shutdown caused by occasional anomalies and increases operation continuity.
H3-01	Automatic fault reset count	0	3	
H3-02	Interval time of automatic fault reset	1.0	10.0	
H3-04	Time for restoring the number of automatic fault resets	10	10	
H3-28	Restart after automatic fault reset	0 (Disabled)	1: Enable	
H3-29	Restart delay after automatic fault reset	0.5	1.0	
H3-30	Force flying start after automatic fault reset	0 (Disabled)	1 (Enabled)	For large inertia, the speed drops slowly after a fault. Enabling flying start after automatic fault reset can make the motor start normally while operating.
P2-09	PID inversion cutoff frequency	2.00	0.00	-

10.12.4.4 Quick Start and Stop Macros (F0-15/A0-52 = 603)

Application scenario

This macro is primarily intended for applications involving loads that require fast start and stop.

- This fast start/stop parameter macro is mainly applied to asynchronous motors in V/f control mode.
- Enabling the deceleration end arc can reduce mechanical vibration during deceleration to stop.
- Reducing the DI filter time can accelerate the response to start/stop commands.

Parameters to be written

After F0-15/A0-52 (Load control optimization macro selection) is set to 603 (Fast start and stop macro), the drive automatically writes the parameters in the table below.

Table 10–84 Parameter set of fast start and stop macro

Parameter code	Definition	Default value	Written Value	Function
F0-01	Motor control mode	2 (V/f)	2 (V/f)	-
F0-53	Ramp 1 deceleration end arc	0.00	0.10	Enabling the deceleration end arc can reduce mechanical vibration and reverse running during deceleration to stop.

Parameter code	Definition	Default value	Written Value	Function
F2-36	Over-excitation gain (V/f)	90	150	-
F2-37	Overcurrent suppression	1: Enable	0 (Disabled)	-
F2-39	Overvoltage suppression enable	0x0001	0x0000	-
E0-16	DI input filter time 1	0.010	0.000	Setting the DI filter time to 0 can accelerate the response to the start command.
E0-18	DI input filter time selection	0x0000	0x0000	

10.12.4.5 Large Inertia Load Macros (F0-15/A0-52 = 605)

Application scenario

This macro aims at scenarios where the drive controls high-inertia loads.

- The motor may be started while operating. In this case, enabling the application macro will set the start method to flying start.
- Setting the ramp arc can prevent low-frequency resonance in high-inertia machinery and speed overshoot after the speed reaches the set value.
- Enabling the overvoltage suppression function can prevent overvoltage faults triggered by large inertia during deceleration and speed overshoot adjustment.
- Enabling acceleration feedforward can improve torque response during the acceleration startup phase and make the feedback speed quickly track the set value.

Parameters to be written

After F0-15/A0-52 (Load control optimization macro selection) to 605 (High-inertia load macro), the drive automatically writes the parameters in the table below.

Table 10–85 Parameter set for high-inertia load macro

Parameter code	Definition	Default value	Written Value	Function
F0-50	Ramp 1 acceleration start arc	0.00	0.50	Setting the acceleration start arc can lower down the starting torque. Setting the acceleration end arc can improve speed tracking performance and prevent speed overshoot. Setting the deceleration arc can prevent the motor from rotating reversely at stop or eliminate residual speed after stop.
F0-51	Ramp 1 acceleration end arc	0.00	0.50	
F0-52	Ramp 1 deceleration start arc	0.00	0.50	
F0-53	Ramp 1 deceleration end arc	0.00	0.50	
F2-03	Speed loop Ti in SVC mode	0.127	2.000	For large inertia, increasing kp can accelerate torque response; increasing Ti (decreasing Ki) can prevent speed loop oscillation.

Parameter code	Definition	Default value	Written Value	Function
F2-15	Startup mode	0 (Direct start)	1 (Flying start)	When a high-inertia load is started, the motor may be coasting from the previous operation rather than being stopped. In this case, enabling flying start allows the drive to track the motor speed before starting it.
F2-39	Overvoltage suppression enable	0x0001	0x0003	Enabling overvoltage suppression prevents overvoltage faults caused by excessive inertia during deceleration or speed overshoot.
A5-11	Random PWM depth	0	3	Noise reduction
d0-39	Overexcitation selection	0 (Inactive)	1 (Active)	During deceleration and generation, enabling over-excitation helps consume generated power, and prevent excessive stop time caused by high-inertia loads and overvoltage suppression.
d0-85	Low speed handling mode	101	111	Enabling synchronous motor low-speed IF can prevent issues arising from prolonged operation at low speeds, improving low-speed load-bearing capability.
d3-38	Acceleration torque feedforward enable	0 (Disabled)	1: Enable	Enabling acceleration feedforward control can improve torque response during the start-up acceleration process to enhance system responsiveness.
d3-39	Acceleration torque feedforward coefficient	100.0	100.0	

11 Motor Control

11.1 Vector Control

Vector control features high dynamic responsiveness and high precision, which can be used to adjust the output torque. Vector control includes speed sensorless vector control (SVC). Different control modes can be selected through d0-00.

Param.	Name	Description	Default value	Range
d0-00	Motor control method	Value description: 0: SVC - Indicates sensorless vector control. This mode features excellent dynamic performance and steady-state accuracy, but it is highly dependent on parameters and requires motor parameter auto-tuning before operation. 2: V/f - Open-loop control with constant voltage-to-frequency ratio. This mode is less dependent on parameters and easy to use, but the dynamic performance of this mode is not as good as the SVC mode.	0	0 and 2

Control mode	Advantage	Disadvantage	Common application scenarios
SVC	The SVC mode features excellent dynamic response and requires less use of encoders, encoder cables, and encoder cards. The fault rate in SVC mode is low 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.	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.
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.

11.1.1 SVC Control

Application scenarios

SVC control can be used in scenarios such as fans, water pumps, air compressors, air conditioners, and crushers.

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
Configuring parameters	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

Motor control mode	SVC	V/f
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	Worse 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

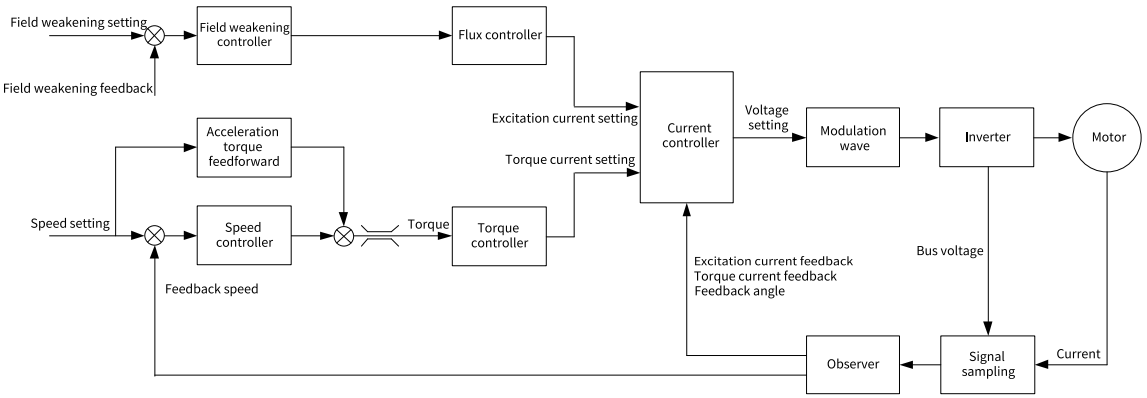


Figure 11-1 Control block diagram of SVC mode

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.

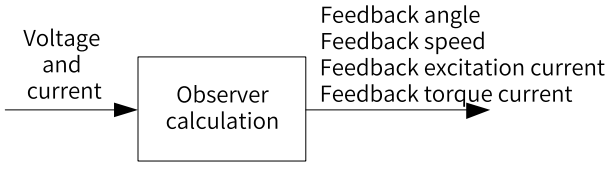


Figure 11-2 Diagram of the observer module

Related parameters

Parameter code	Name	Description	Default value	Range
d0-00	Motor control method	Defines the motor control mode based on the application scenario and motor type. 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. 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 simple and easy to use. The dynamic performance of the V/f control mode is not as good as that of the SVC mode.	0	0 and 2

Application

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.

- 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.

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.

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, prolonged stay at zero speed may result in startup error or even startup failure caused by observer failure.

In this case, you can set the SVC observer model of the asynchronous motor [d6-27] to 2, as shown in the following figure. 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.

The related function code is set in the following table.

Parameter code	Name	Description	Default value	Range
d6-27	Observer model of asynchronous motor in SVC mode	Defines the observer mode of asynchronous motor in SVC mode.	0	0 to 3

For synchronous motors, low-speed open loop IF control can be enabled if long-term operation at low or zero speed is present. 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.

I/F control related parameters:

Parameter code	Name	Description	Default value	Range
d0-85	Low speed handling mode	Used to enable open loop at low speed. In SVC mode, setting the tens of d0-85 to 1 enables open loop control.	101	0 to 121
d0-86	Speed open-loop current	Defines the magnitude of speed open-loop current. Set this parameter to a value higher than 20% of the load.	100%	0% to 800%
d0-87	Speed open-loop switchover frequency	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.	10.0%	0.0% to 100.0%
d0-88	Speed open loop switchover hysteresis frequency	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 speed closed-loop control. The default value is 2.5% of the rated frequency according to the actual required hysteresis band.	2.5%	0.0% to 100.0%

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. The SVC control applies during operation 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.

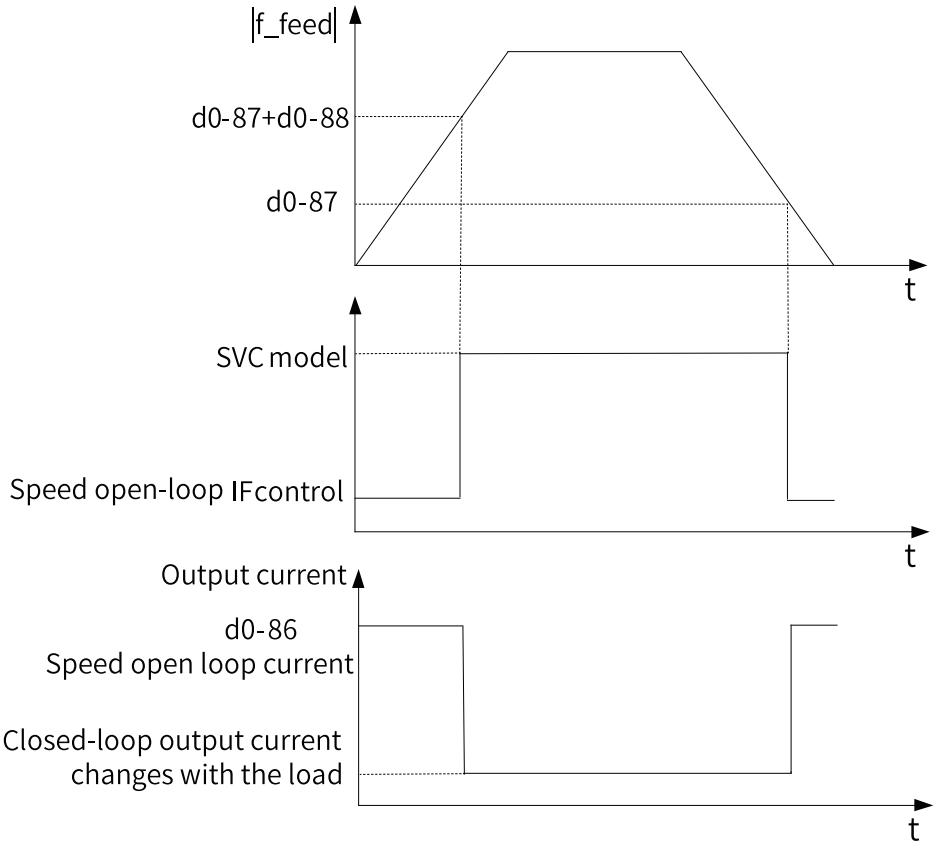


Figure 11-3 Switching between IF control and SVC mode

Application instance

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. Observe that the torque corresponding to the tension, which 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%).

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 problem can be solved in a stable manner.

2. If this is not possible, try changing bit1 of [d0-85] to 1 and reducing the open loop switchover frequency [d0-87] to an acceptable range.

11.1.2 Speed Control

11.1.2.1 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).

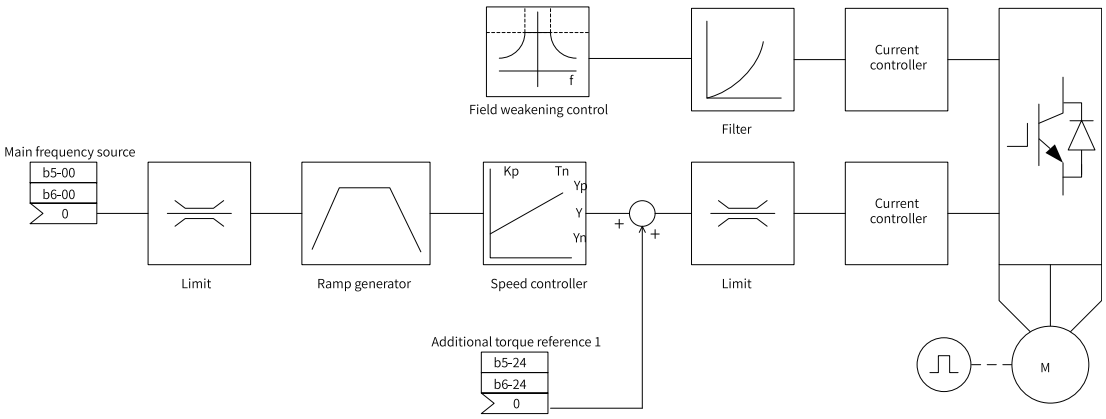


Figure 11-4 Typical block diagram of speed control

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 generate the motor speed reference (L3002).

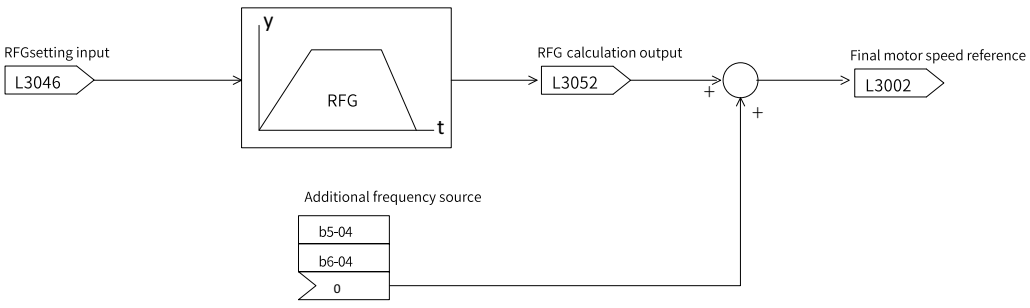


Figure 11-5 Speed reference block diagram

Related parameters

Parameter code	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 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. 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 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 2: V/f

11.1.2.2 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, and sends it to the current controller. The function diagram of the speed controller is as follows.

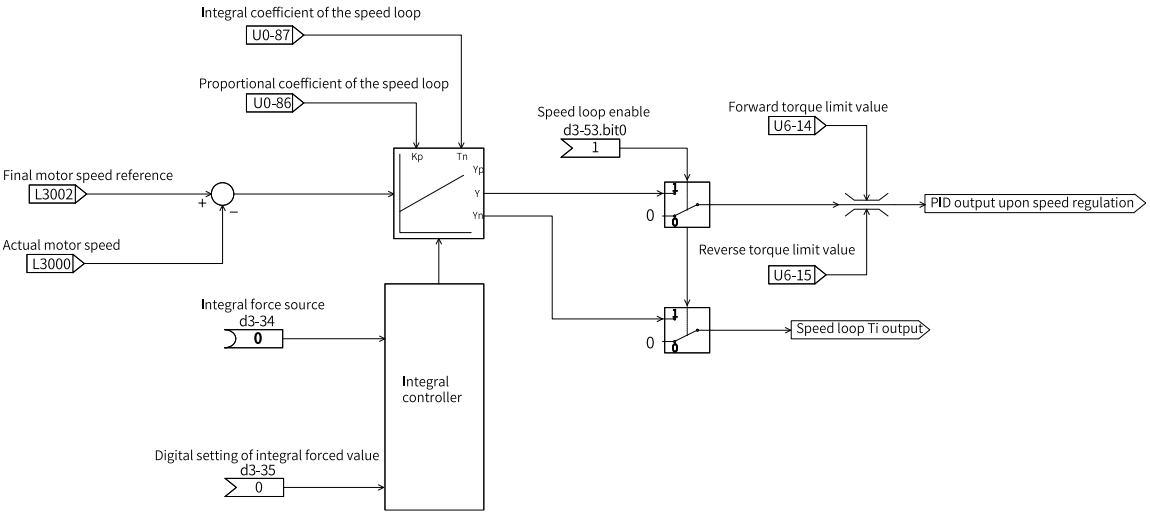


Figure 11-6 Function diagram of the speed controller

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.

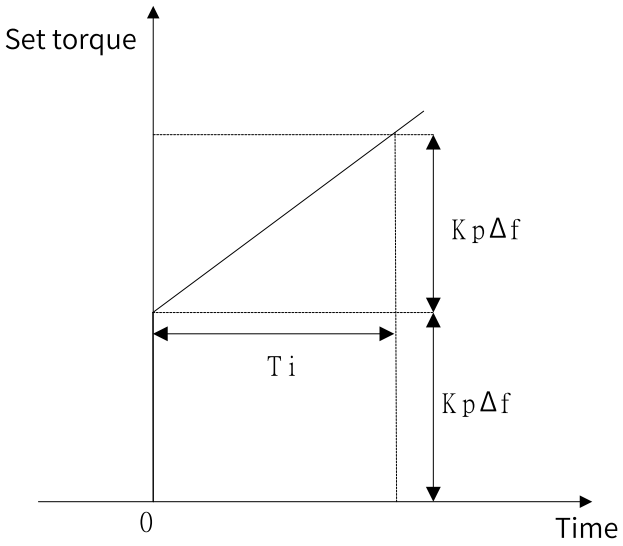


Figure 11-7 Torque reference diagram

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: Controlled 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 parameters

Parameter code	Name	Description	Default value	Range
F2-02/d3-02	Speed loop Kp in SVC mode	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 can be. Note that an excessively high Kp value can easily result in oscillation.	5.0	0.0 to 6000.0
F2-03/d3-03	Speed loop Ti in SVC mode	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 can be. Note that an excessively low Ti value can easily result in oscillation.	0.127s	0.000s to 20.000s
d3-33	Forced integral enable	Defines whether to set the integral value forcibly. Options: 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.	0	0 to 1

Parameter code	Name	Description	Default value	Range
d3-34	Forced integral source	Defines the source of forced integral value. Options: 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 derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the AC drive accordingly, thereby forming 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 equipment. 10: Potentiometer MD-BP-M - The integral force value is set through the potentiometer MD-BP-M. 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.	0	0 to 10
d3-35	Digital reference of forced integral	Defines the forced integral 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.	0.0%	-800.0 % to +800.0%

11.1.2.3 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 adaption and adaptive adaption.

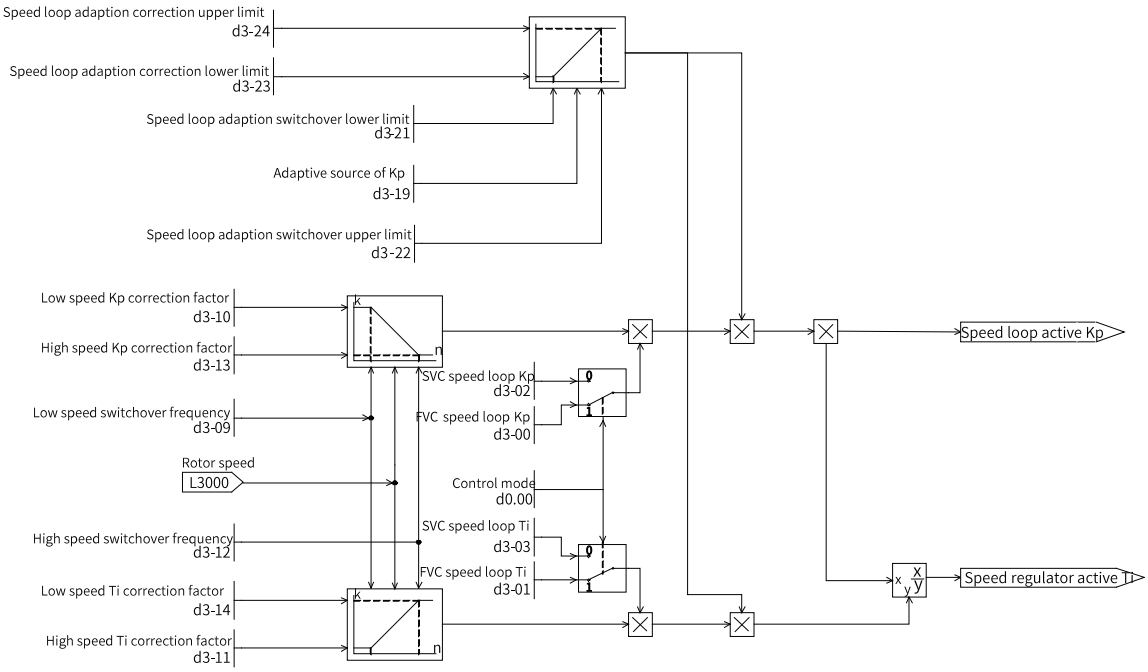
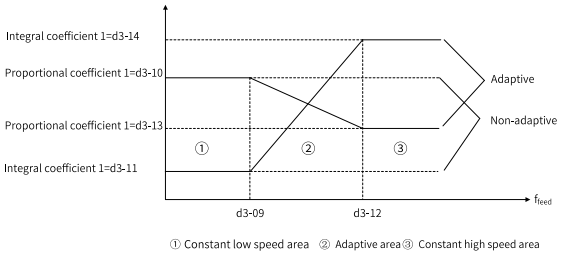
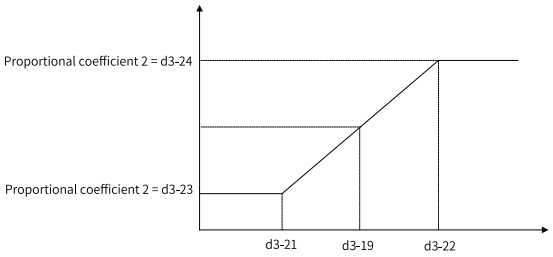


Figure 11-8 Speed Controller Adapter

Rule name	Condition/ Principle	Adjustment rules	Wiring description
Zero speed adap-tation	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 active 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 correction coefficients "d3-07 [Zero speed Kp calibration coefficient] and d3-08 [Zero speed Ti calibration coefficient]."	-

Rule name	Condition/ Principle	Adjustment rules	Wiring description
Low/ High-speed adap-tion	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 active 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 correction 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 active 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 correction 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.	 Figure 11-9 Speed adapter

Rule name	Condition/ Principle	Adjustment rules	Wiring description
Adaptive adaption	The operating principle of speed adapter is the same as that of speed adaptation, but the adjustment reference value range for adaptive adaption 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 11-10 Adaptive adapter The final active 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)

Related parameters

Parameter code	Name	Description	Default value	Range
F2-04/d3-06	Zero speed switchover frequency	Defines the zero speed switchover frequency of the speed loop.	1.0%	0.0% to d3-09
F2-05/d3-07	Zero speed Kp calibration coefficient	Defines the proportional calibration coefficient of the speed loop at zero speed.	100.0%	0.0% to 1000.0%
F2-06/d3-08	Zero speed Ti correction factor	Defines the integral correction factor of the speed loop at zero speed.	100.0%	0.0% to 1000.0%
F2-07/d3-09	Low speed switchover frequency	Defines the low speed switchover frequency of the speed loop.	10.0%	0.0 % to d3-12
F2-08/d3-10	Low speed Kp correction factor	This parameter sets the proportional correction factor of the speed loop at low speed.	100.0%	0.0% to 1000.0%
F2-09/d3-11	Low speed Ti correction factor	Defines the integral correction factor of the speed loop at low speed.	100.0%	0.0% to 1000.0%
F2-10/d3-12	High speed switchover frequency	Defines the high speed switchover frequency of the speed loop.	100.0%	d3-09 to 400.0%
F2-11/d3-13	High speed Kp calibration factor	Defines the proportional calibration coefficient of the speed loop at high speed.	100.0%	0.0% to 1000.0%
F2-12/d3-14	High speed Ti correction factor	Defines the integral correction factor of the speed loop at high speed.	100.0%	0.0% to 1000.0%

Parameter code	Name	Description	Default value	Range
d3-19	Adaptive source of speed loop Kp	Defines the adaptive source of speed loop Kp. Options: 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 derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the AC drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value 9: Communication - The adaptive source is set through communication. The operating frequency 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 equipment. 10: MD-BP-M potentiometer The speed loop Kp self-adaption source is set through the MD-BP-M potentiometer. 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.	0	0 to 10
d3-21	Lower limit of speed loop adaptive switchover	Defines the adaptive switchover lower limit of the speed loop.	40.0 %	0.0% to 1000.0%

Parameter code	Name	Description	Default value	Range
d3-22	Upper limit of speed loop adaptive switchover	Defines the adaptive switchover upper limit of the speed loop.	100.0%	0.0% to 1000.0%
d3-23	Lower limit of speed loop adaptive calibration	Defines the lower limit of speed loop adaptive calibration.	100.0%	0.0% to 1000.0%
d3-24	Upper limit of speed loop adaptive calibration	Defines the adaptive calibration upper limit of the speed loop.	100.0%	0.0% to 1000.0%

Application Cases

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 loop proportional calibration coefficient to 100%. Set F2-08/d3-10 to 100% and F2-09/d3-11 to 100%.
3. Set F2-10/d3-12 (High speed switchover frequency) = 15 Hz.
4. According to the commissioning results, the high-speed speed loop proportional term (F2-11/d3-13) is reduced to 30%, and the integral term (F2-12/d3-14) remains unchanged at 100%.

11.1.2.4 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.

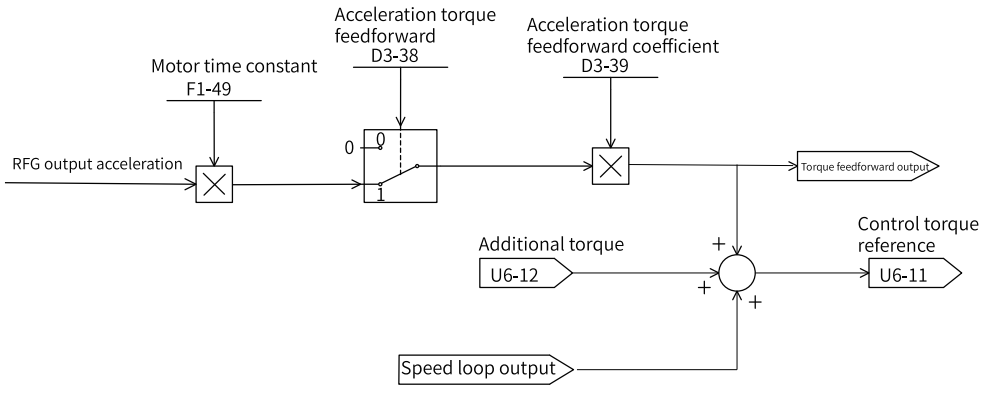


Figure 11-11 Feedforward torque

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.

11.1.2.5 Frequency Ramp Change

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 enabling b5-11 [Frequency ramp transition], 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.

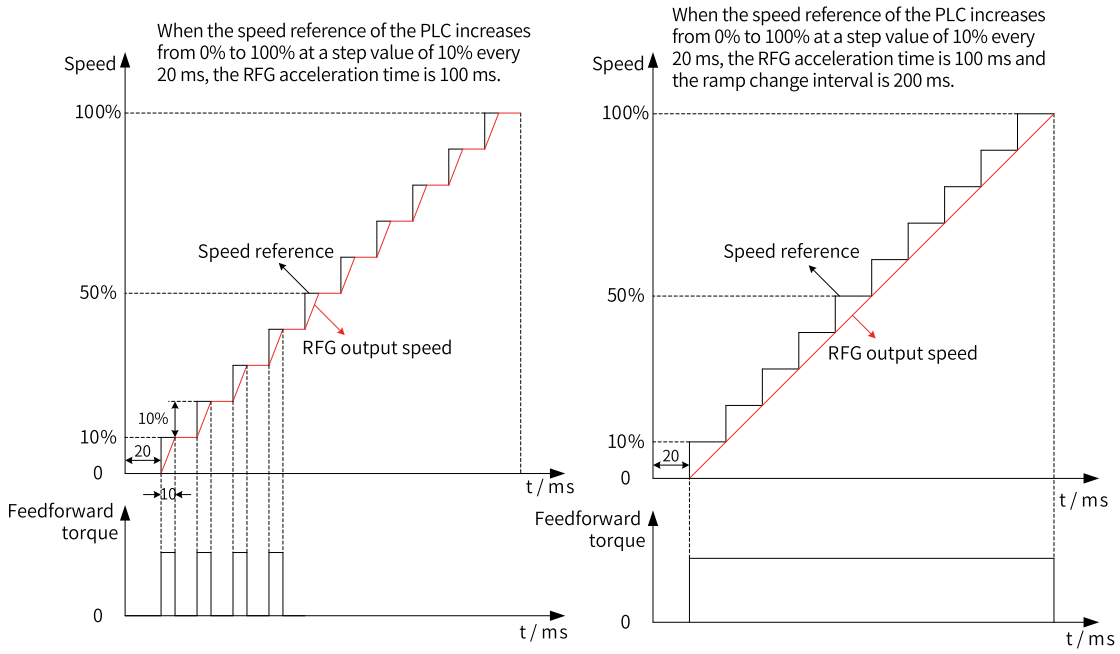


Figure 11-12 Ramp transition diagram

Related parameters

Parameter code	Name	Description	Default value	Range
b5-11	Frequency ramp transition enable	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. Options: 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 6: Depends on the final state of DI4. 0: Inhibited; 1: Enabled 7: Depends on the final state of DI5. 0: Inhibited; 1: Enabled 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.	0	0 to 7
b5-12	Frequency ramp transition interval	Defines the frequency ramp transition interval. Note: The frequency ramp transition interval must be the same as the communication cycle of the speed reference.	50 ms	2 ms to 10000 ms

Application instance

Frequency ramp transition is generally used together with the acceleration torque feedforward function. See the application instance in *"11.1.2.4 Acceleration Torque Feedforward" on page 598*.

11.1.2.6 Speed Control Optimization in Vector Control Mode

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.

1. Speed following performance
   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.

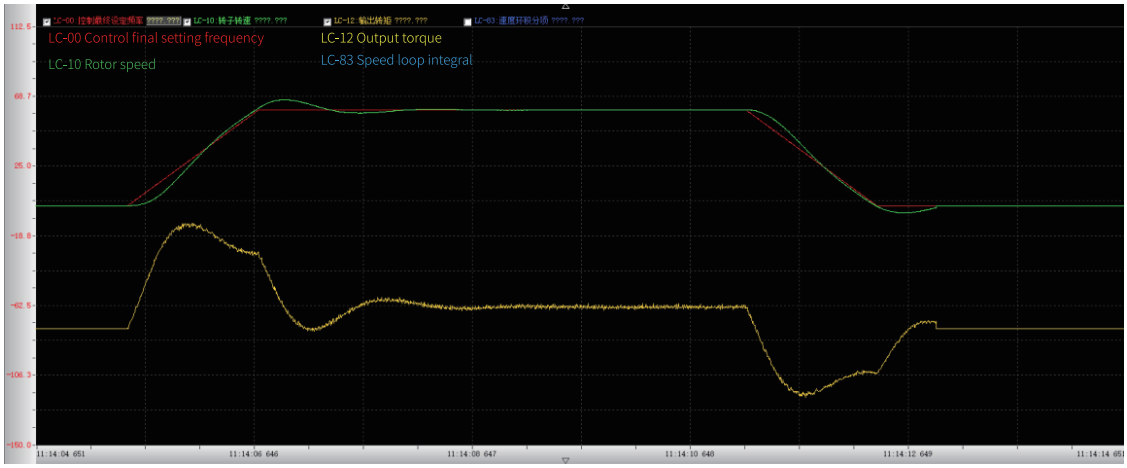


Figure 11-13 Poor speed following performance

2. Load disturbance resistance

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.

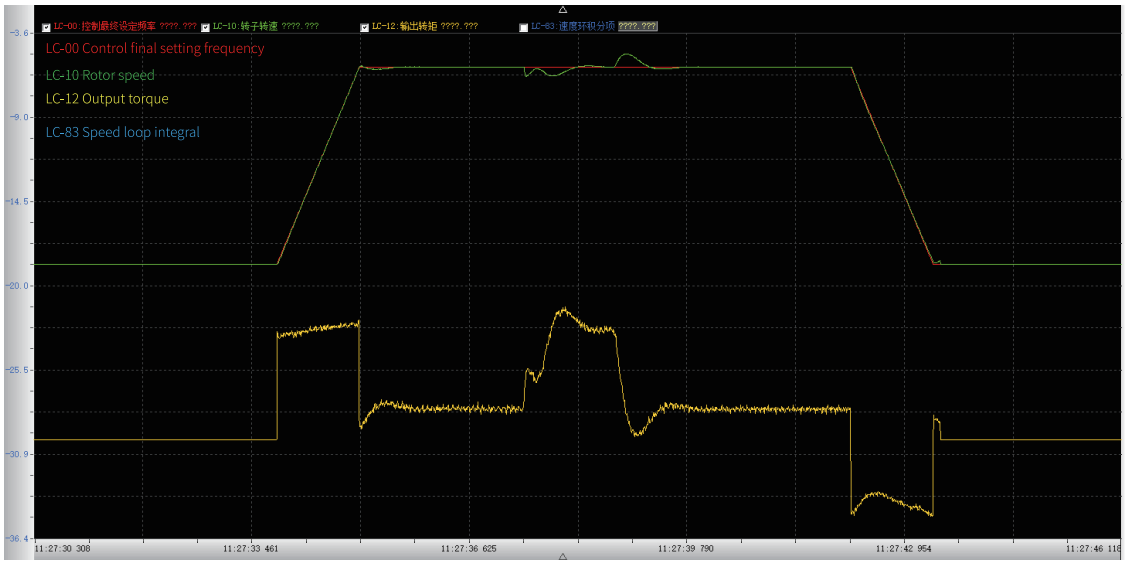


Figure 11-14 Poor load disturbance resistance

Optimizing speed following performance

Application scenario: 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. To optimize speed control, first adjust the speed loop to a low value. For example, set speed loop Kp to 5 (F2-02 = 5) and Ti to 2.0s (F2-03 = 2.0s). Adjusting the acceleration torque feedforward properly can greatly improve the speed following performance.

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.

If dynamic inertia auto-tuning is available, see the commissioning process for acceleration feedforward in the following diagram.

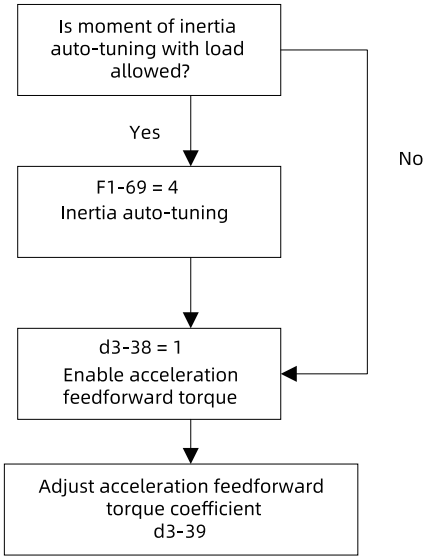


Figure 11-15 Commissioning for acceleration feedforward based on inertia auto-tuning

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).

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.

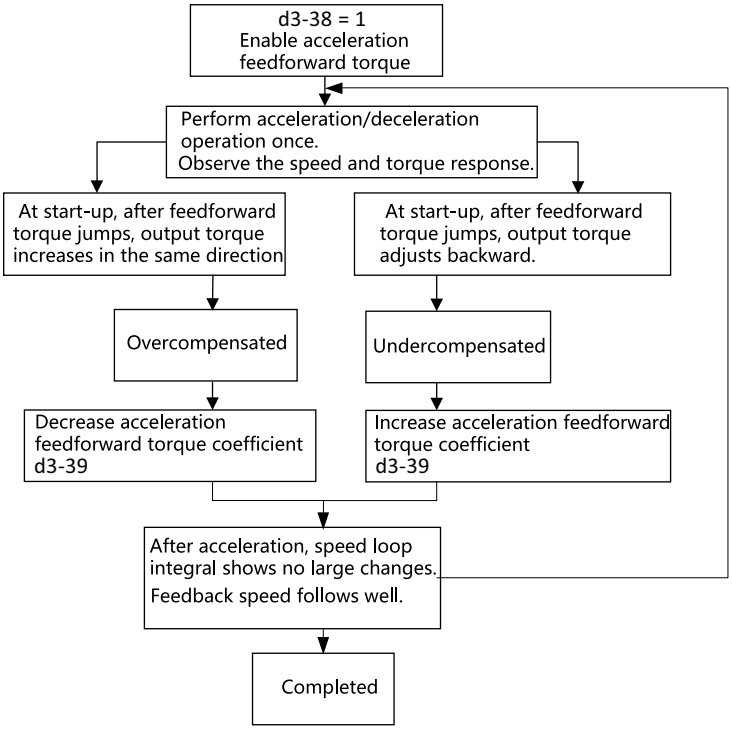


Figure 11-16 Commissioning process for acceleration feedforward without inertia auto-tuning

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.

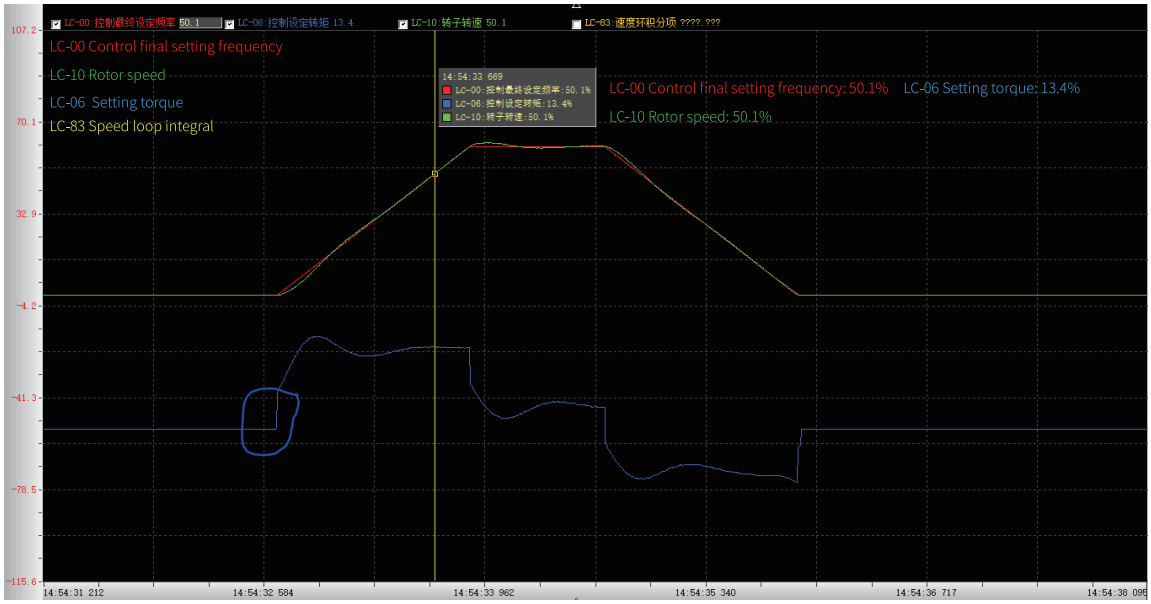


Figure 11-17 Acceleration torque feedforward undercompensation

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 11-18 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

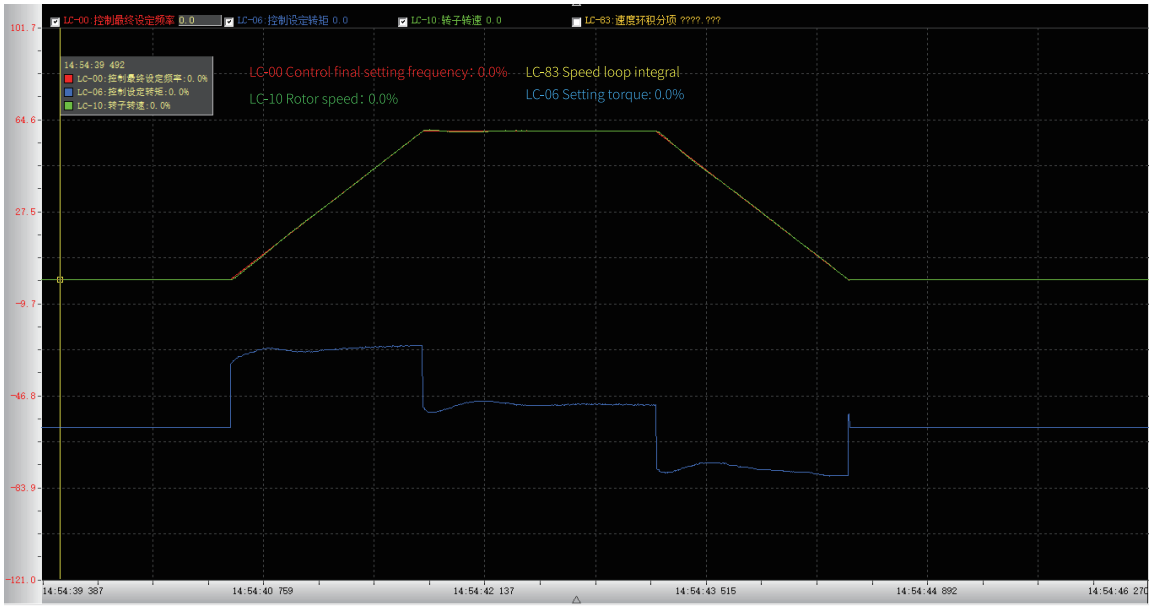


Figure 11-19 Normal effect of acceleration torque feedforward

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.

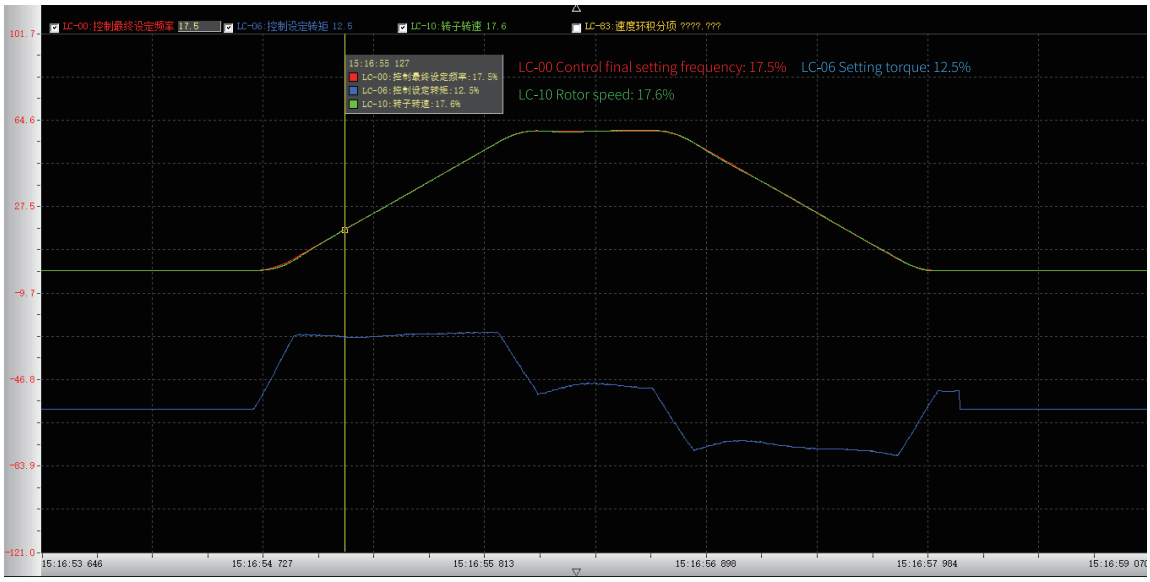


Figure 11-20 Normal effect of acceleration torque feedforward after S-curve enabled

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 *"11.1.2.5 Frequency Ramp Change" on page 601*). 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 scenario: 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.

See the following procedure for PI parameter adjustment.

1. Set speed loop Kp (F2-02 = 3) and Ti (F2-03 = 2.0s) to low values first to prevent operation oscillation caused by high PI parameter values. 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.

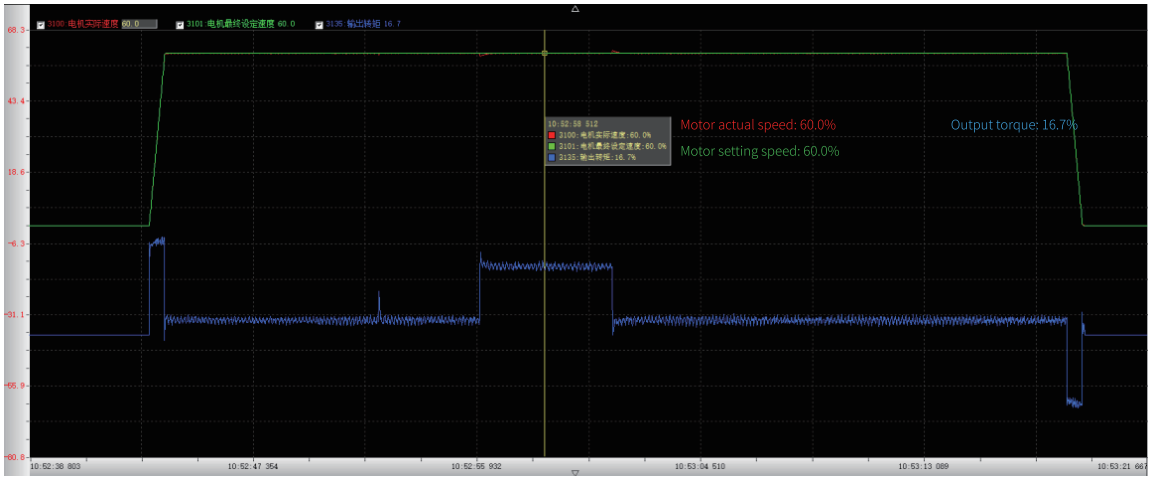


Figure 11-21 Waveform upon sudden loading/unloading after commissioning is done

11.1.3 Torque Control

11.1.3.1 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.

11.1.3.2 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.

Function Applications

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.

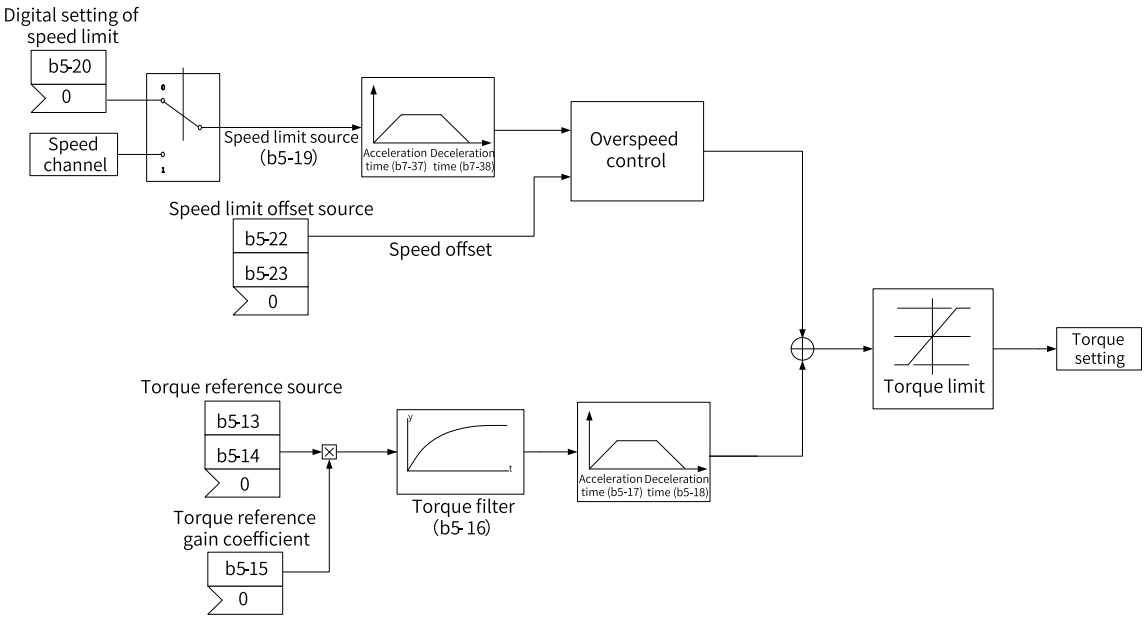


Figure 11-22 Torque control diagram

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 parameters

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 6: DI4 7: DI5 Other: B connector	Defines the motor control target. Options: 0: Speed control - The speed is controlled. 1: Torque control - The torque is controlled. 3 to 7: DI1 to DI5. 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 setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the torque reference source. The default value is 0 [b5-14].
b5-14	Digital setting of 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 coefficient	0	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: 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 can be.
b5-17	Torque ramp-up time	0.000s	0.000 to 60.000	Defines the torque ramp-up time.
b5-18	Torque ramp-down time	0.000s	0.000 to 60.000	Defines the torque ramp-down time.

11.1.3.3 Overspeed Control

Application scenarios

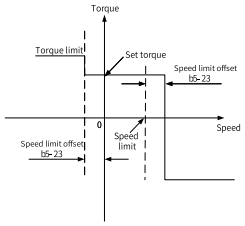
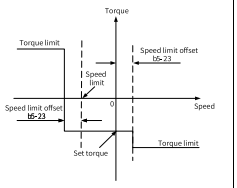
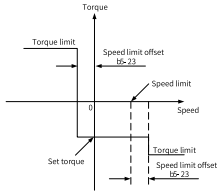
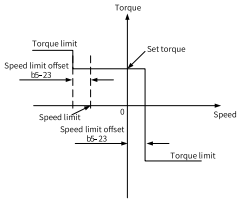
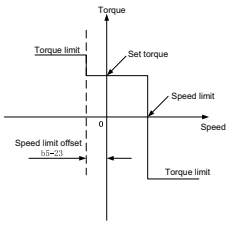
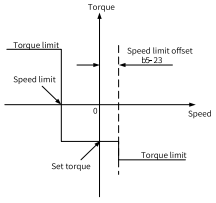
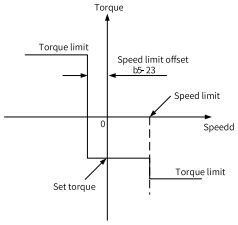
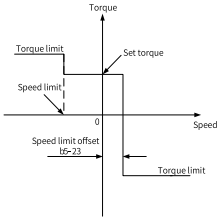
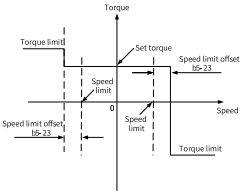
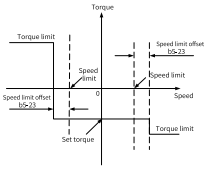
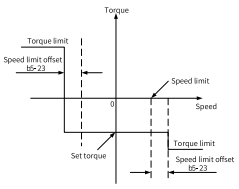
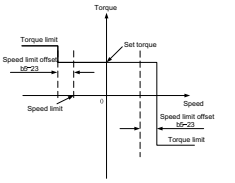
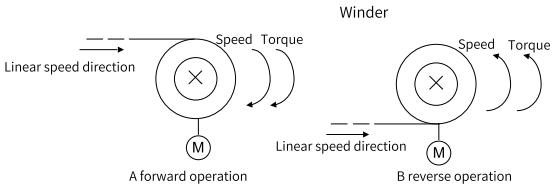
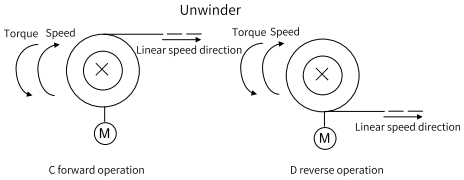
In the torque control mode, if the load torque is lower than the output torque of the motor, the motor speed keeps increasing. Therefore, the motor speed (frequency upper limit) must be limited to prevent accidents such as runaway.

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
Bi-directional speed limit bias (b5-21 = 0)				
Uni-directional speed limit bias (b5-21 = 1)				
Overspeed control mode (b5-21 = 2)				
Application instance				

Related parameters

Param.	Name	Description	Default value	Range
b5-19	Speed limit bias source	Defines the speed limit source. Options: 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. Options: 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: Uni-directional bias 2: Overspeed control mode
b5-22	Speed limit bias source	Defines the speed limit offset source.	0	0: Digital reference 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: 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.

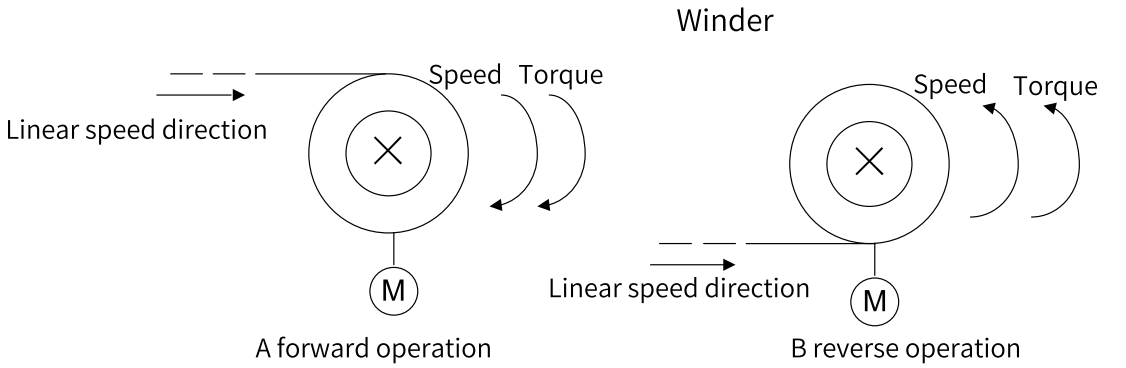


Figure 11-23 Torque control diagram 1 for winder/unwinder

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 setting of 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.

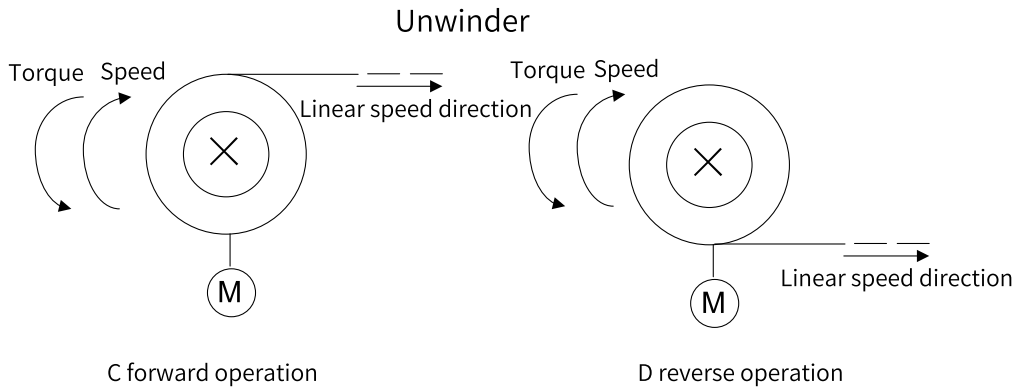


Figure 11-24 Torque control diagram 2 for winder/unwinder

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 setting of 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.

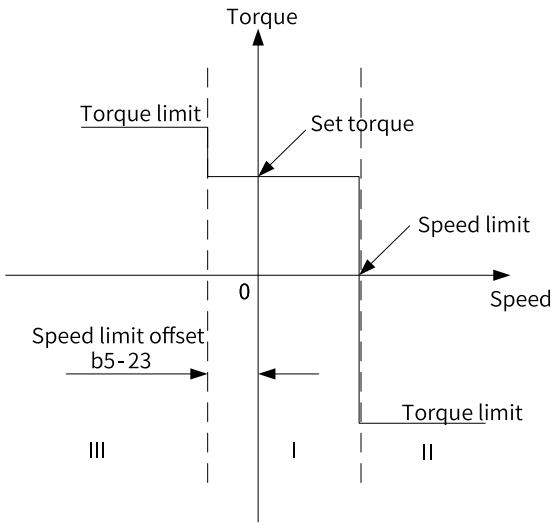


Figure 11-25 (a) Example of unidirectional limit bias in forward motoring overspeed control

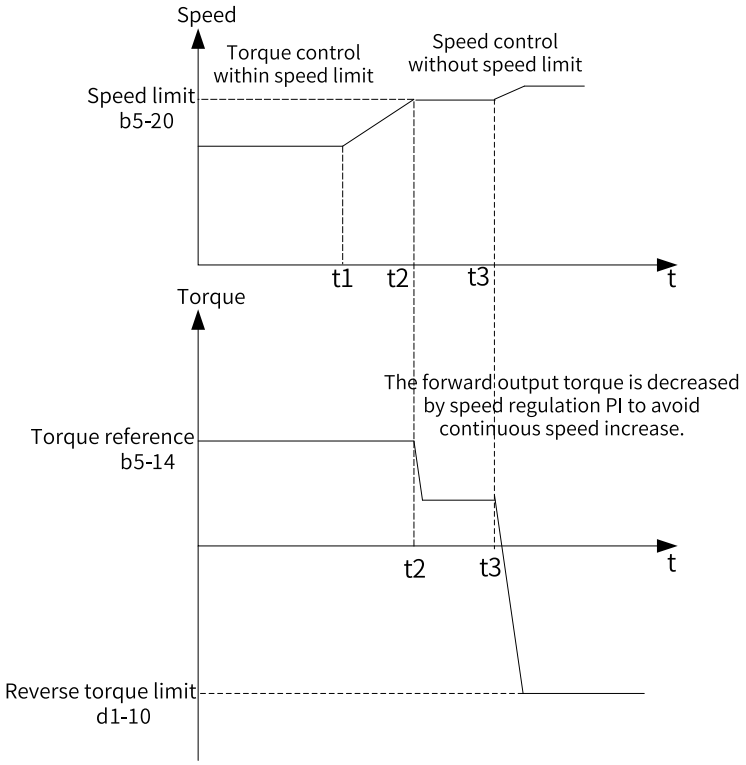


Figure 11-26 (b) Example of unidirectional limit bias in forward motoring dynamic behavior

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.

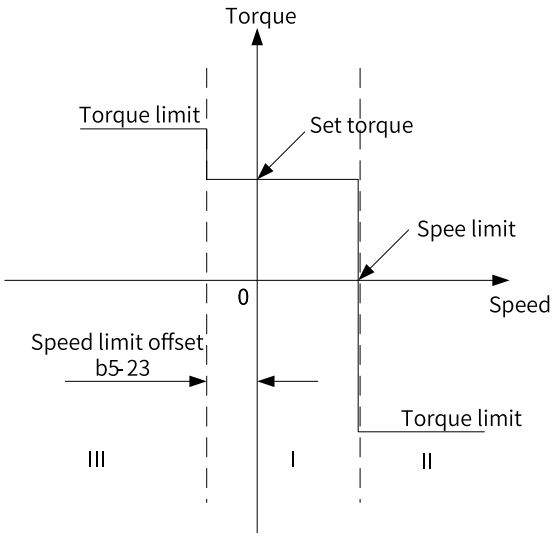


Figure 11-27 (c) Example of unidirectional limit bias in forward motoring overspeed control

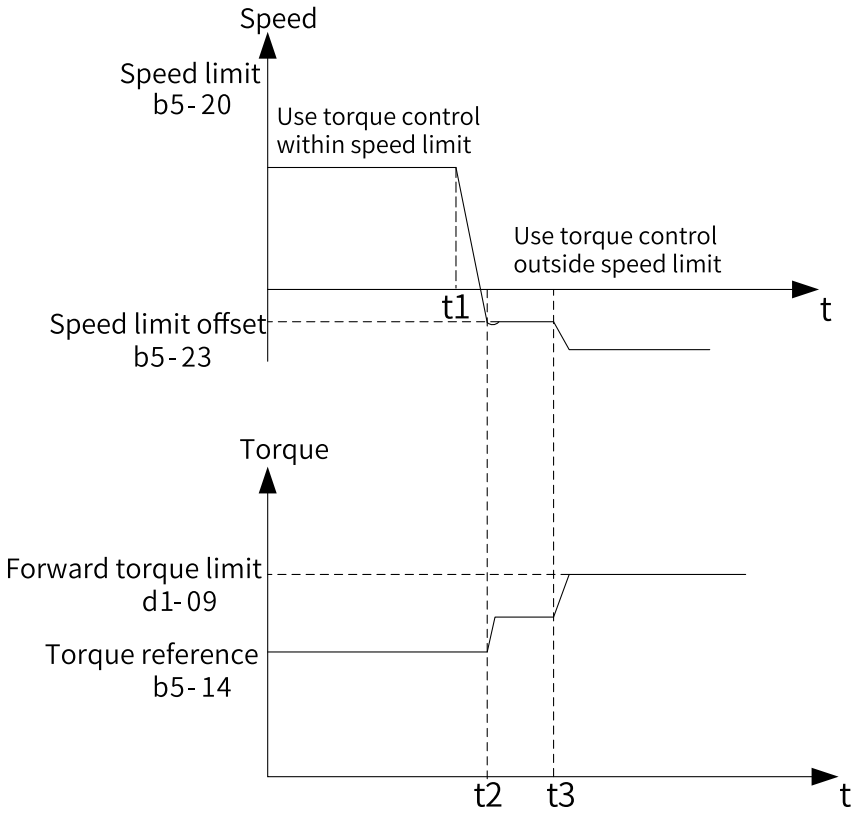


Figure 11-28 (d) Example of unidirectional limit bias in forward motoring dynamic control

11.1.4 Current Limit

Application scenarios

If the operating current of the motor needs to be limited in SVC mode, set the maximum motor current (F1-13) and maximum drive current (A3-05) to keep the normal operating current of the motor does not exceed the smaller of F1-13 and A3-05.

Operating principles

The current regulator automatically controls the current, ensuring that the total current output does not exceed the limit value.

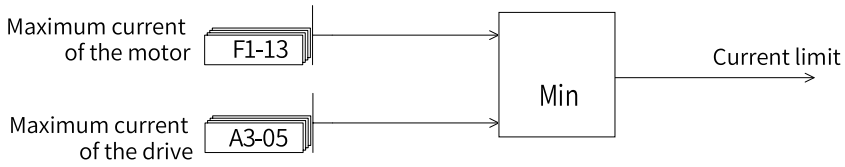


Figure 11-29 Effective current limit diagram

Related parameters

Param.	Name	Description	Default value	Range
F1-13	Max. motor current	Set the maximum value to limit the motor current. The value 100% corresponds to the rated motor current. Note: The current limit is the smaller of F1-13 and A3-05.	1000.0%	0.0% to 1000.0%
A3-05	Maximum AC drive current	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.	150 %	0% to 600 %

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.

11.1.5 Torque Limit

Application scenarios

In some process applications, the motor output torque needs to be limited in the 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.

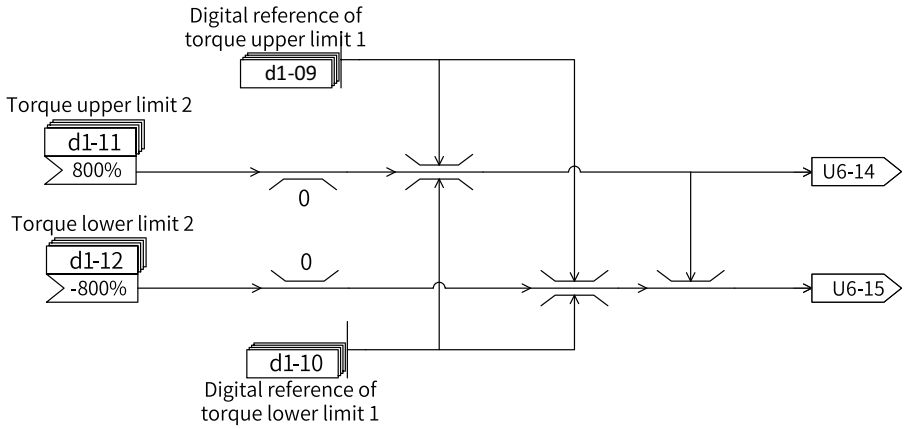


Figure 11-30 Torque limit setting

The following figure shows how the torque limit takes effect.

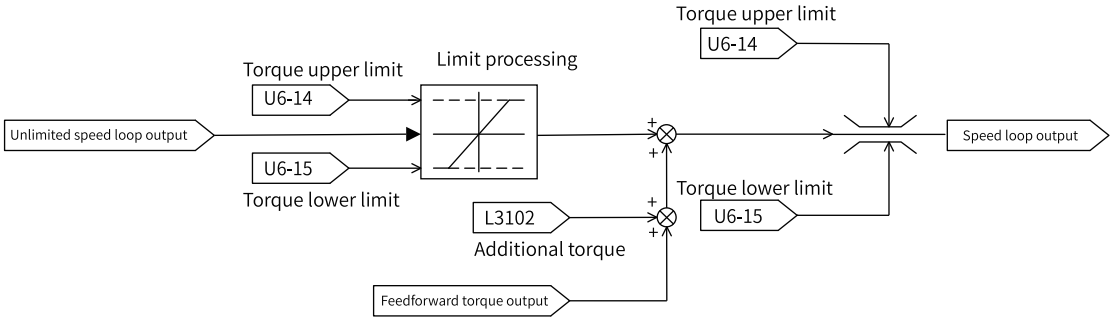


Figure 11-31 Speed loop with output torque limit

Related parameters

Param.	Name	Description	Default value	Range
d1-09	Digital reference of torque upper limit 1	Defines the maximum positive torque output. The value 100% corresponds to the rated torque of the motor. Note: The active positive torque limit is the smaller of d1-09 and d1-11.	150.0%	0.0% to 800.0%
d1-10	Digital reference of torque lower limit 1	Used to limit the maximum negative torque output. The value 100% corresponds to the rated torque of the motor. Note: The active negative torque limit is the smaller of d1-10 and d1-12.	-150.0%	-800.0% to 0.0%

Param.	Name	Description	Default value	Range
d1-11	Source of torque upper limit 2	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. Options: 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 DI5. 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. 10: MD-BP-M potentiometer Other: F connector - The positive torque limit depends on the value of the selected F connector. Note: The active positive torque limit is the smaller of d1-09 and d1-11.	0: 800%	0: 800% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer. The torque lower limit 2 is set through the MD-BP-M potentiometer. Others: F connector

Param.	Name	Description	Default value	Range
d1-12	Torque lower limit 2 selection	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. Options: 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 DI5. 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 and 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 reverse torque limit is set through PID. 9: Communication The reverse torque limit is set through communication. 10: MD-BP-M potentiometer Other: F connector - The negative torque limit depends on the value of the selected F connector. Note: The active negative torque limit is the smaller of d1-10 and d1-12.	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 10: MD-BP-M potentiometer. The torque lower limit 2 is set through the MD-BP-M potentiometer. Others: F connector

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 working condition as an example to illustrate 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 active torque limit is slightly moved down for easy comparison. In actual applications, the torque reference limit coincide with the minimum torque limit.

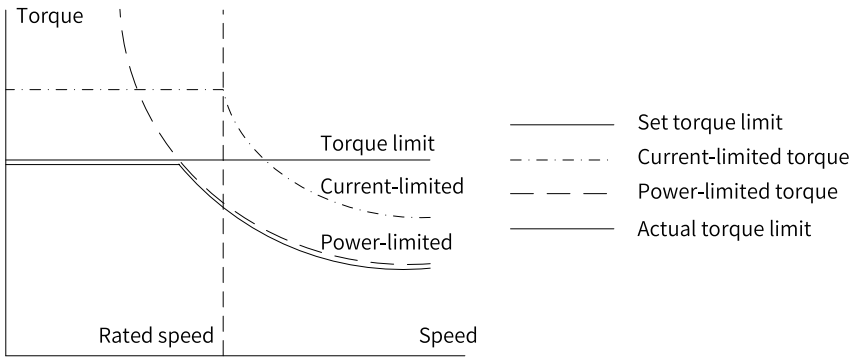


Figure 11-32 Torque limit diagram

11.1.6 Power Limit

Application scenarios

In SVC control, the power limit can restrict the total power output by the motor. It is suitable for process 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.

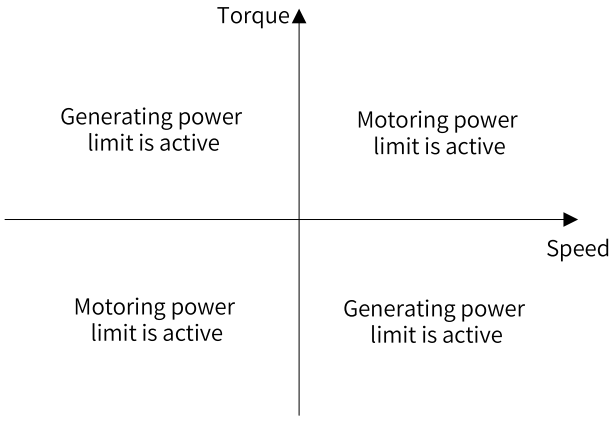


Figure 11-33 Effective range of power limits

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.

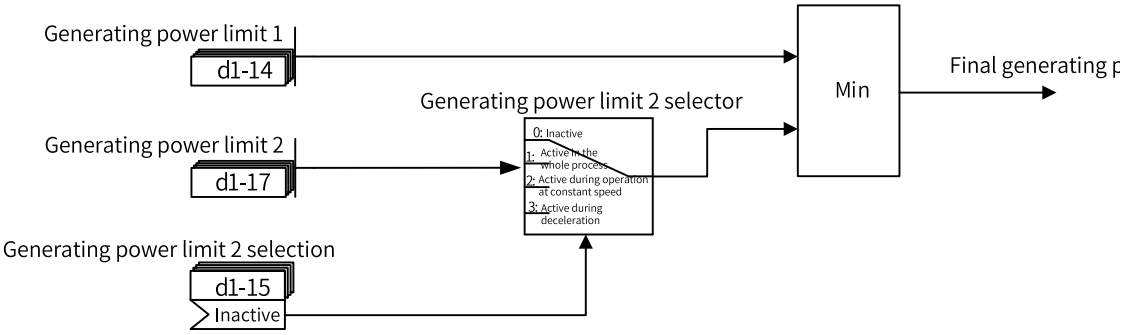


Figure 11-34 Generating power limit diagram

Related parameters

Param.	Name	Description	Default value	Range
d1-13	Motoring power limit	Used to limit the output power of the motor in the motoring state. The value 100% corresponds to the rated power of the motor.	400.0%	0.0% to 1000.0%
d1-14	Generating power limit 1	Limits the output power of the motor in the generating state. The value 100% corresponds to the rated power of the motor.	400.0%	0.0% to 1000.0%
d1-15	Selection of generating power limit 2	Defines whether the motoring power limit 2 is active. Options: 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.	0 [Inactive]	0: Inactive 1: Active in the whole process 2: Active during operation at constant speed 3: Active during deceleration
d1-17	Generating power limit 2	Limits the output power of the motor in the generating state. The value 100% corresponds to the rated power of the motor.	20.0%	0.0% to 800.0%

Precautions

The motor power limit is active only in vector control modes. It is inactive in V/f mode.

11.1.7 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 SVC control mode, you can enable overvoltage suppression to suppress the rise of the DC bus voltage.

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.

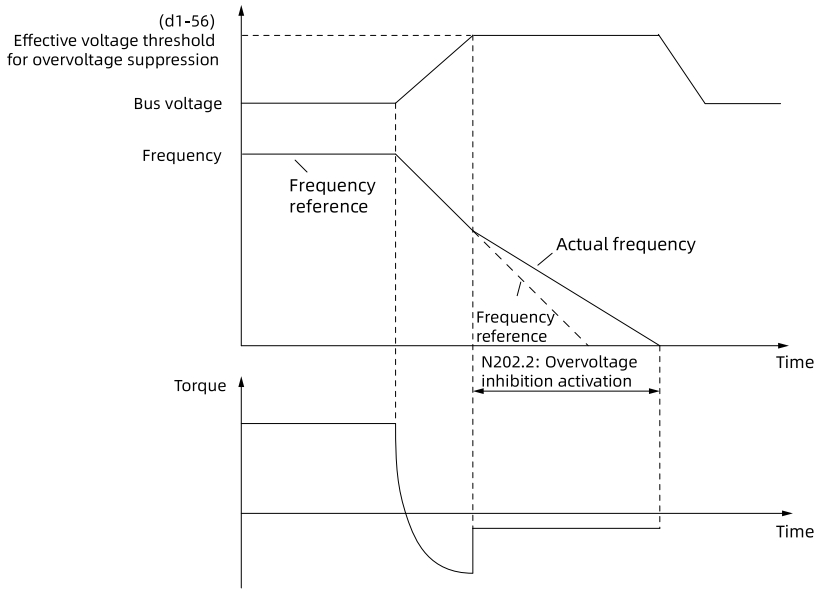


Figure 11-35 Overvoltage suppression control process

Related parameters

Param.	Name	Default value	Value range	Description
d1-52	Overvoltage suppression overspeed detection time	50 ms	0 ms to 10000 ms	If the feedback speed during overvoltage suppression exceeds the feedback speed upon activation of overvoltage suppression plus the value of d1/d9/y1/y9-53, and such state persists for the time defined by d1/d9/y1/y9-52, 193.3 (Vector overvoltage suppression overspeed fault) will be reported.
d1-53	Overvoltage suppression overspeed detection threshold	20%	20 to 100	If the feedback speed during overvoltage suppression exceeds the feedback speed upon activation of overvoltage suppression plus the value of d1/d9/y1/y9-53, and such state persists for the time defined by d1/d9/y1/y9-52, 193.3 (Vector overvoltage suppression overspeed fault) will be reported.
d1-54 (F2-39)	Overvoltage suppression enable	1 [Enable]	bit0: Overvoltage suppression enable in V/f mode • 0: Disable 1: Active bit1: Overvoltage suppression enable in vector mode • 0: Disable • 1: Active	Used to set whether overvoltage suppression is enabled. F2-39 has the same function as d1-54. When F2-39 is changed, d1-54 is updated synchronously.
d1-55 (F2-40)	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. F2-40 has the same function as d1-55. When F2-40 is changed, 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. 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.
d1-57	Overvoltage suppression Kp adjustment	100%	0% to 1000%	Defines the bus voltage threshold for overvoltage suppression. The actual effective value is displayed in d1-56. F2-40 is the same parameter as d1-55. After F2-40 is modified, d1-55 is updated synchronously.
d1-58	Overvoltage suppression Ki adjustment	100%	0% to 1000%	Defines the integral coefficient of the overvoltage suppression control loop. Increasing this setpoint improves the dynamic characteristics of the bus voltage, but may result in output frequency fluctuation. When the output frequency fluctuates greatly, reduce this value properly.

Precautions

- Set d1-55 to a high value upon excessively high grid voltage fluctuation, preventing false triggering of overvoltage control. It is recommended to verify the 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.

Application instance

In applications with short deceleration time and high motor inertia, overvoltage fault may occur during deceleration or 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 overvoltage suppression is enabled, a prompt "N202.2 Overvoltage suppression activated" is displayed, indicating that the system is in overvoltage suppression and that motor speed may deviate from normal operating speed.

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 a grid voltage rise, cause an abnormal increase in DC bus voltage, and the overvoltage suppression function fails to regulate it, the motor speed may continue to increase. The overvoltage suppression overspeed detection function is enabled by default. If the feedback speed exceeds the feedback speed at overvoltage suppression entry plus d1/d9/y1/y9-53 (overvoltage suppression overspeed detection threshold) for a duration longer than d1/d9/y1/y9-52 (overvoltage suppression overspeed detection time), fault 193.3 (vector overvoltage suppression overspeed fault) is triggered.

11.1.8 Undervoltage Suppression (Vector)

Application scenarios

In SVC control, an instantaneous power failure on the power supply or DC bus can lead to undervoltage if not handled promptly, resulting in a 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
1-Undervoltage suppression/3-Undervoltage suppression with limited time d1-63 (Action upon undervoltage) is set to 1 (Undervoltage suppression) or 3 (Undervoltage suppression with limited time)	2-Decelerate to stop
When the bus voltage falls below d1-65 (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 of undervoltage suppression (vector)), undervoltage suppression is enabled.	When the bus voltage falls below d1-65 (Actually effective action voltage of undervoltage suppression), the drive decelerates to stop according 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. When the undervoltage action is set to 3 (Undervoltage suppression with limited time), the previous conditions are met. However, the maximum duration of undervoltage suppression is set to d1-68. If the drive remains in undervoltage suppression for longer than d1-68, it stops immediately and reports fault E193.2 (Undervoltage suppression timeout).	The drive remains in the stop state upon bus voltage recovery until the stop process is done.

The following figures show the overvoltage suppression process.

- If d1-63 is set to 1 (Undervoltage suppression), normal operation resumes after voltage recovery. If, at the moment when undervoltage occurs, 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)), undervoltage suppression is activated. Upon bus voltage recovery, if the operating frequency exceeds d1-72, the motor accelerates to the set speed based on the set acceleration time.
- When d1-63 is set to 2 [Decelerate to stop], the drive decelerates to stop after the voltage is recovered. If the operating frequency is lower than the sum of d1-72 [Minimum frequency of undervoltage suppression (SVC)] and d1-73 [Minimum frequency hysteresis of undervoltage

suppression (SVC)] at the moment when undervoltage occurred, the drive decelerates to stop based on d1-69 [Decelerate-to-stop time upon undervoltage] until the stop operation is done, on matter whether the bus voltage is recovered.

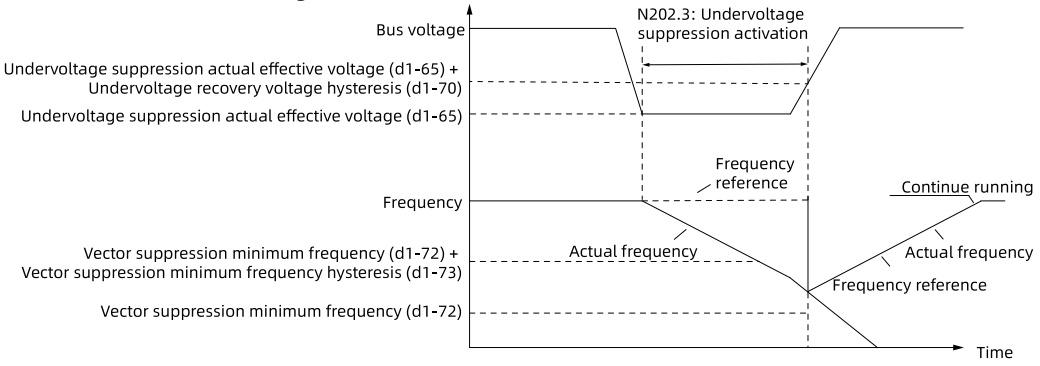


Figure 11-36 Undervoltage suppression applied, normal operation resumes after voltage recovery

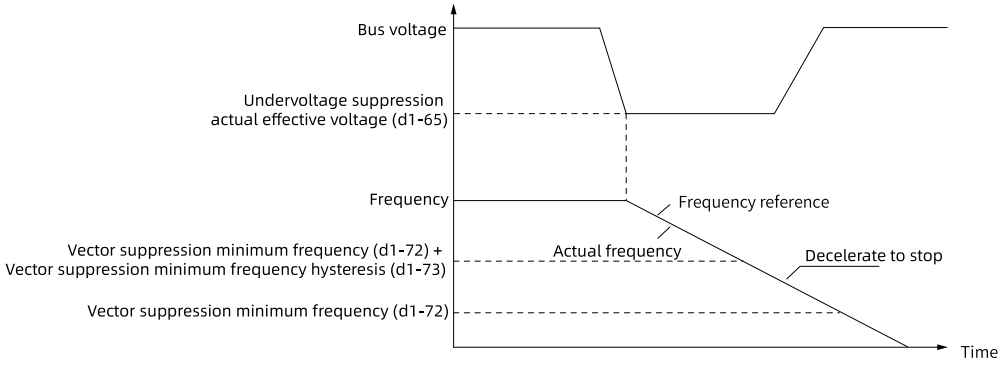


Figure 11-37 Selecting deceleration to stop for undervoltage

- When the following conditions are met, the drive reports an undervoltage suppression limit violation fault: 1. The action upon undervoltage is enabled. 2. At the moment undervoltage occurs, 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)). 3. The bus voltage does not recover when the operating frequency reaches d1-72 (Minimum frequency of undervoltage suppression (vector)).

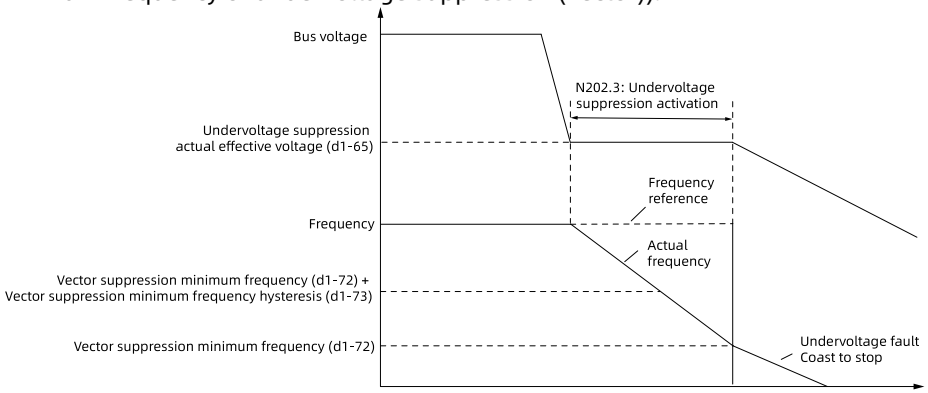


Figure 11-38 When undervoltage is suppressed, running frequency lower than minimum frequency of undervoltage suppression

- 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.

Related parameters

Param.	Name	Description	Default value	Range
d1-63 (F2-43)	Response upon undervoltage	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 drops to the undervoltage suppression threshold, the motor decelerates to stop based on the deceleration time defined by d1-69. If the bus voltage is restored during this period, the motor still stops. 3: Undervoltage suppression with limited time. Through motor deceleration and energy feedback, the drive maintains the DC bus at the undervoltage suppression point, enabling its short-term operation without stopping. Once the operating time exceeds d1/d9/y1/y9-68, the drive stops immediately and reports E193.2 (undervoltage suppression timeout).	3 (Undervoltage suppression with limited time)	0: Not respond 1: Suppress undervoltage 2: Decelerate to stop 3: Undervoltage suppression with limited time
d1-64 (F2-44)	Undervoltage suppression action voltage	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.	430.0 V	A3-55 to 500.0 V
d1-65	Actual effective voltage threshold for undervoltage suppression	Displays the actual effective voltage that triggers undervoltage suppression. This is a read-only variable that cannot be modified.	430.0 V	A3-55 to 500.0 V

Param.	Name	Description	Default value	Range
d1-66	Undervoltage suppression Kp adjustment	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 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].	100%	0% to 1000%
d1-67	Undervoltage suppression Ki adjustment	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].	100%	0% to 1000%
d1-68	Maximum operating time during undervoltage suppression	Defines the maximum operating time during undervoltage suppression. Note: When the following conditions are met, the drive reports E193.2 (undervoltage suppression timeout): 1. d1-63 (undervoltage suppression action) is set to 3 (undervoltage suppression with limited time) or 1 (undervoltage suppression and overvoltage suppression). 2. bit1 (undervoltage suppression operation time limit) of d1-76 (undervoltage suppression command word) is set to "Enabled". 3. The drive remains in undervoltage suppression for longer than d1-68.	1s	0.1s to 600s
d1-69	Time for decelerating to stop during undervoltage	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”.	20s	0s to 300s

Param.	Name	Description	Default value	Range
d1-70	Recovery voltage hysteresis upon undervoltage	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.	30 V	1 V to 100 V
d1-72	Minimum frequency of undervoltage suppression (vector)	Defines the minimum frequency of undervoltage suppression in SVC mode. Note: The drive is allowed to enter undervoltage suppression state 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), the drive reports E193.1 (Undervoltage suppression limit arrival).	3.00 Hz	0.00 Hz to 10.00 Hz
d1-73	Minimum frequency hysteresis for undervoltage suppression (SVC)	Defines the minimum frequency hysteresis for undervoltage suppression in SVC mode. Note: The drive is allowed to enter undervoltage suppression state 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), the drive reports E193.1 (Undervoltage suppression limit arrival).	3.00 Hz	0.00 Hz to 10.00 Hz
d1-74	Undervoltage suppression overspeed detection time	If the feedback speed during undervoltage suppression exceeds the feedback speed upon activation of undervoltage suppression plus the value of d1/d9/y1/y9-75, and such state persists for the time defined by d1/d9/y1/y9-74, E193.4 (Vector overvoltage suppression overspeed fault) can be reported.	50 ms	0 ms to 10000 ms
d1-75	Undervoltage suppression overspeed detection threshold	If the feedback speed during undervoltage suppression exceeds the feedback speed upon activation of undervoltage suppression plus the value of d1/d9/y1/y9-75, and such state persists for the time defined by d1/d9/y1/y9-74, E193.4 (Vector overvoltage suppression overspeed fault) can be reported.	20%	20% to 100%

Precautions

Set E9.05 for undervoltage control to a relatively small value to prevent incorrect trigger in the case of large grid voltage fluctuations. It is recommended that the trigger voltage be verified 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. If the bus voltage recovers before the speed drops to the minimum frequency, normal operation can resume.

If you need to keep the drive running after the DC bus voltage drops, resume operation of the drive once the bus voltage recovers, and limit the abnormal operation time, set d1-63 to "3: Undervoltage suppression with limited time". In this case, if the speed has not dropped to the minimum frequency and the undervoltage suppression action time has not exceeded d1-68 (Maximum operation time of undervoltage suppression), normal operation can resume after the DC bus voltage recovers. Note that if undervoltage suppression operation time exceeds the time limit, the drive immediately stops and reports E193.2 (undervoltage suppression timeout).

If you need to perform a normal stop after a DC bus abnormality and wait for manual restart, set d1-63 to "2: Decelerate to stop". In this case, the drive decelerates to stop immediately upon voltage abnormality. Adjust d1-69 (Deceleration-to-stop time for undervoltage) appropriately to ensure that the generating torque maintains the DC bus voltage above the undervoltage threshold during the deceleration-to-stop process.

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 undervoltage suppression is enabled, a prompt "N202.3 Undervoltage suppression activated" is displayed, indicating that the system is in undervoltage suppression and that motor speed may deviate from normal operating speed.

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 applications, a DC bus voltage drop triggers undervoltage suppression. In this case, abnormal load may cause the motor speed to keep rising. The undervoltage suppression overspeed detection function is enabled by default. If the feedback speed exceeds the feedback speed at undervoltage suppression entry plus d1/d9/y1/y9-75 (undervoltage suppression overspeed detection threshold) for a duration longer than d1/d9/y1/y9-74 (undervoltage suppression overspeed detection time), fault 193.4 (vector undervoltage suppression overspeed fault) is triggered.

11.1.9 Flux Control

11.1.9.1 Asynchronous Motor Field Weakening Control

Application scenarios

In SVC control mode, field weakening is triggered either when the asynchronous motor requires a speed increase beyond the maximum voltage output capacity, or when the bus voltage is too low to maintain the current 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.

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.

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.

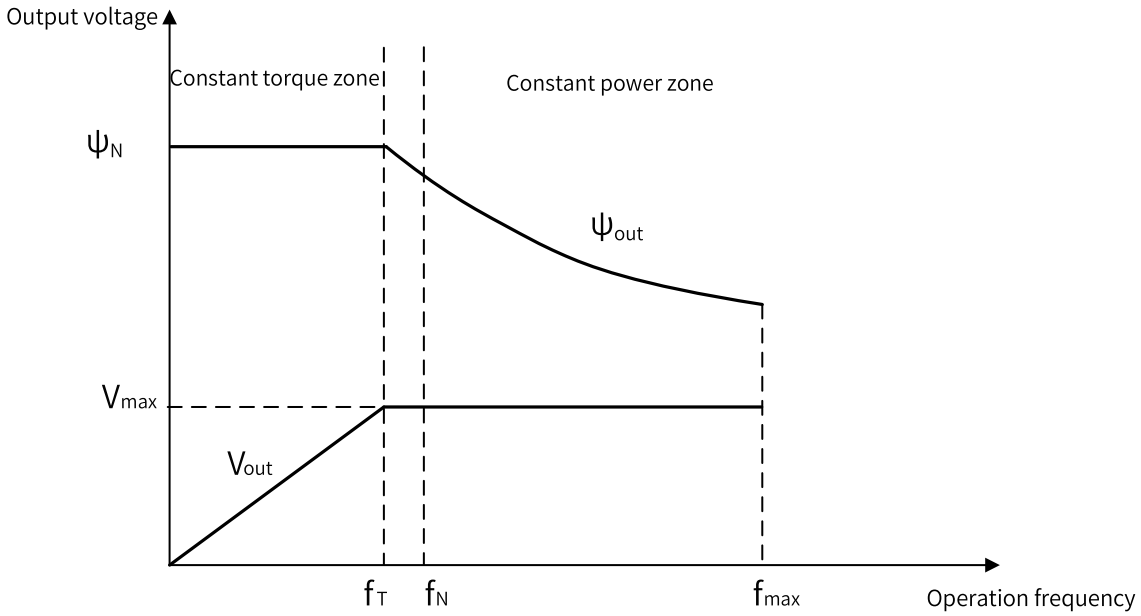


Figure 11-39 Flux frequency characteristics of the motor under voltage constraints

The following figure shows the process for obtaining the final flux reference in the field weakening phase after the maximum output voltage is obtained.

Rated flux of the motor x Rated flux tuning factor = Actual applied flux of motor

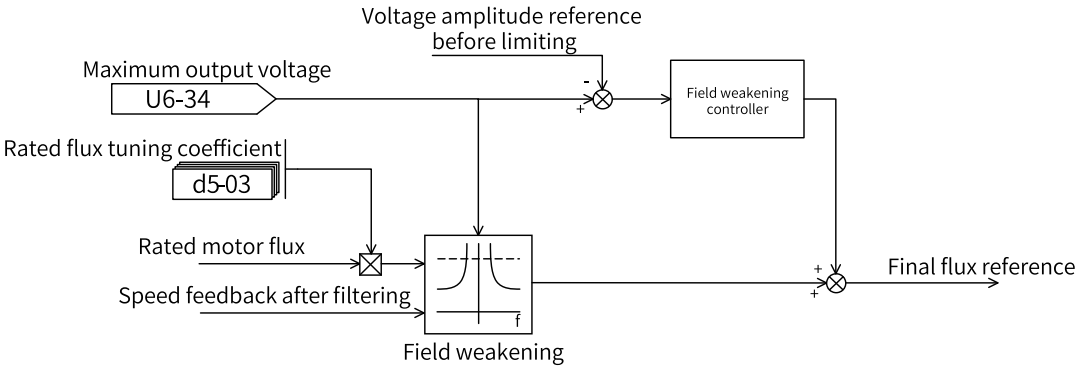


Figure 11-40 Calculation process for final flux reference

Related parameters

Param.	Name	Description	Default value	Range
d5-00	Voltage margin for field-weakening through adjustment method	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.	3.0%	0.1% to 50.0%
d5-03	Rated flux tuning factor	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.	100.0%	50.0% to 200.0%

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.

11.1.9.2 Synchronous Motor Field Weakening Control

Application scenarios

In SVC control mode, field weakening is triggered either when the synchronous motor requires a speed increase beyond the maximum voltage output capacity, or when the bus voltage is too low to maintain the current 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 parameters

Param.	Name	Description	Default value	Range
d5-00	Voltage margin for field-weakening	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.	3.0%	0.1% to 50.0%
d5-17	Demagnetization current limit	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.	300%	0% to 500%

11.1.10 Energy-Saving Control (Vector)

Application scenarios

In applications requiring high energy conservation, you can enable energy-saving control in 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.

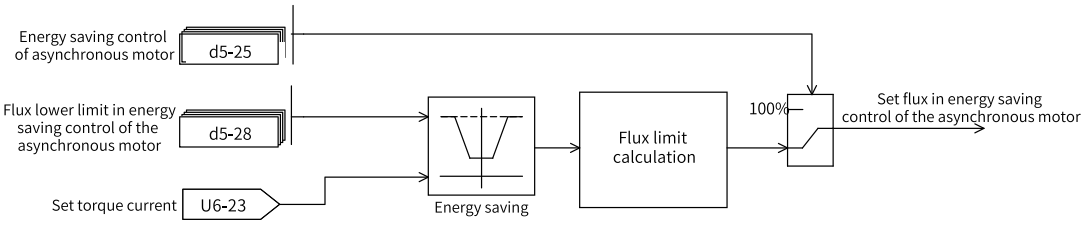


Figure 11-41 Energy-saving control

Related parameters

Param.	Name	Description	Default value	Range
d5-25	Energy-saving control selection of asynchronous motor	Defines whether to enable energy-saving control for the asynchronous motor in the vector control mode. Options: 0: Disable - Energy saving is disabled. 1: Enable - Energy saving is enabled. Note: After energy-saving control is enabled, the current in no-load or low-load mode can be reduced.	0 [Disable]	0: Disable 1: Active
d5-28	Flux lower limit in energy-saving control of asynchronous motor	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.	50.0%	10.0 % to 100.0%

Precautions

The function is applicable to stable load conditions. For frequent sudden load addition and sudden unloading, it is not recommended to enable the function.

11.1.11 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.

11.1.12 Current Loop

Application scenarios

In the SVC control mode, the current loop acts as the regulator of the inner loop, which serves to make 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

The PID output of the speed loop is the input of the current loop. The output current of the drive is the 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.

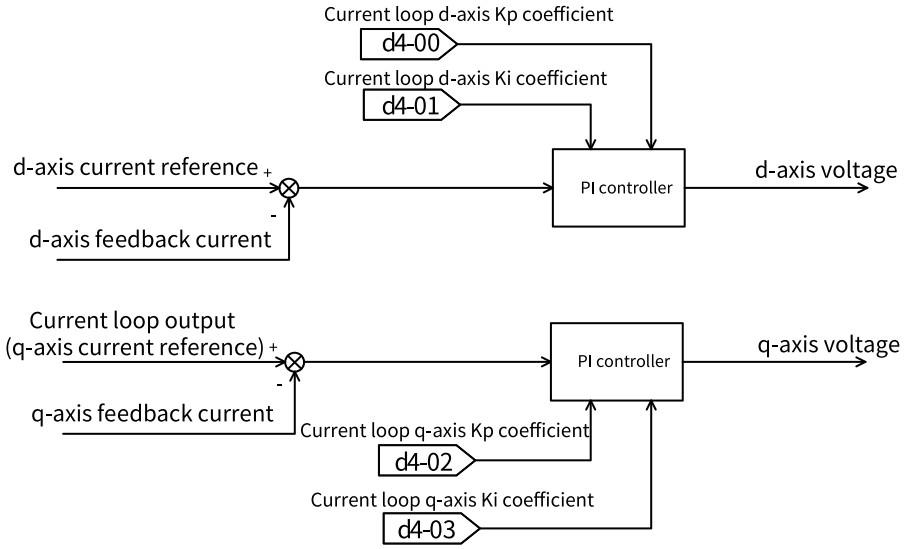


Figure 11-42 Current loop diagram

Adaptive PI parameters for current loop is 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].

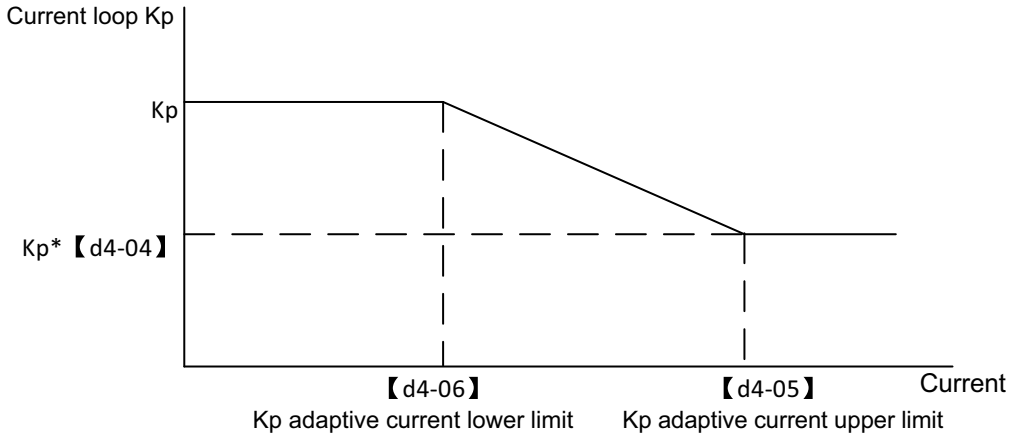


Figure 11-43 Adaptive Kp of current loop

Related parameters

Param.	Name	Description	Default value	Range
d4-00	Current loop d-axis Kp coefficient	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.	100%	1% to 1000%
d4-01	Current loop d-axis Ki coefficient	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.	100%	1% to 1000%
d4-02	Current loop q-axis Kp adjustment	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.	100%	1% to 1000%
d4-03	Current loop q-axis Ki adjustment	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.	100%	1% to 1000%
d4-04	Kp adaptive upper limit coefficient of current loop	Defines the Kp adaptive upper limit coefficient of current loop.	50%	1% to 100%

Param.	Name	Description	Default value	Range
d4-05	Kp adaptive current upper limit of current loop	Defines the adaptive current upper limit of current loop.	200%	d4-06 to 300%
d4-06	Kp adaptive current lower limit of current loop	Defines the adaptive current lower limit of current loop.	100%	10% to d4-05

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.

11.1.13 Droop control

Application scenarios

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.

Note

In vertical load lifting scenarios, the droop control function is not allowed.

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 speed regulation range is usually not greater than the rated slip of the motor.
- 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.

Operating 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.

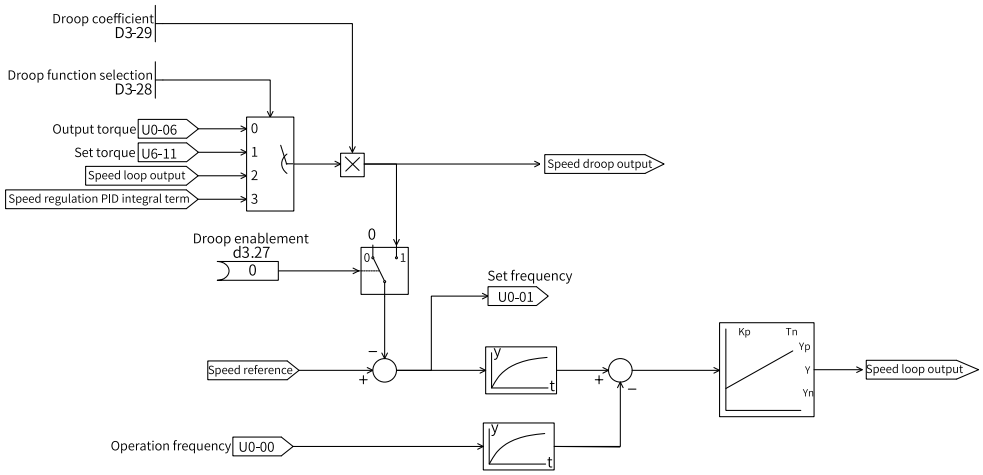


Figure 11-44 Block diagram of droop control

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.

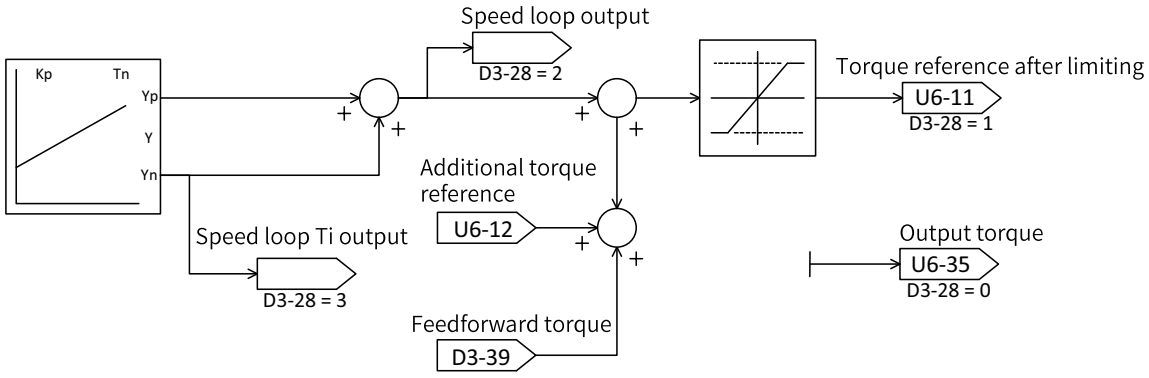


Figure 11-45 Four different droop sources

Application Cases

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	Value range	Description
d3-27	Droop function	0	0: Disable 1: Active	Enables/disables the droop function in speed control. 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 0: Output torque 1: Torque reference 2: Speed loop output 3: Integral component of speed regulator	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	Defines 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.

11.1.14 Asynchronous Motor in V/f Control

11.1.14.1 Function List

Function type	Name	Description	Links
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.	*"11.1.14.3 V/f Curve Selection" on page 645*
	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.	*"11.1.14.4 Overvoltage Suppression in V/f" on page 648*
	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.	*"11.1.14.5 Undervoltage Suppression in V/f Mode" on page 650*
	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.	*"11.1.14.6 Overcurrent Suppression in V/f Mode" on page 653*
	Oscillation suppression in V/f mode	During motor operation, mechanical resonance causes system oscillation. Enable oscillation suppression for a better control effect.	*"11.1.14.7 Oscillation Suppression in V/f Mode" on page 655*
	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.	*"11.1.14.8 V/f Torque Boost" on page 656*
	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.	*"11.1.14.9 Slip Compensation in V/f Mode" on page 658*
	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.	*"11.1.14.10 Energy-saving Control in V/f Mode" on page 659*
	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.	*"11.1.14.11 Droop Control in V/f Mode" on page 659*
	Over-excitation	Used to accelerate the motor deceleration process.	*"11.1.14.12 Over-excitation" on page 661*

11.1.14.2 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.

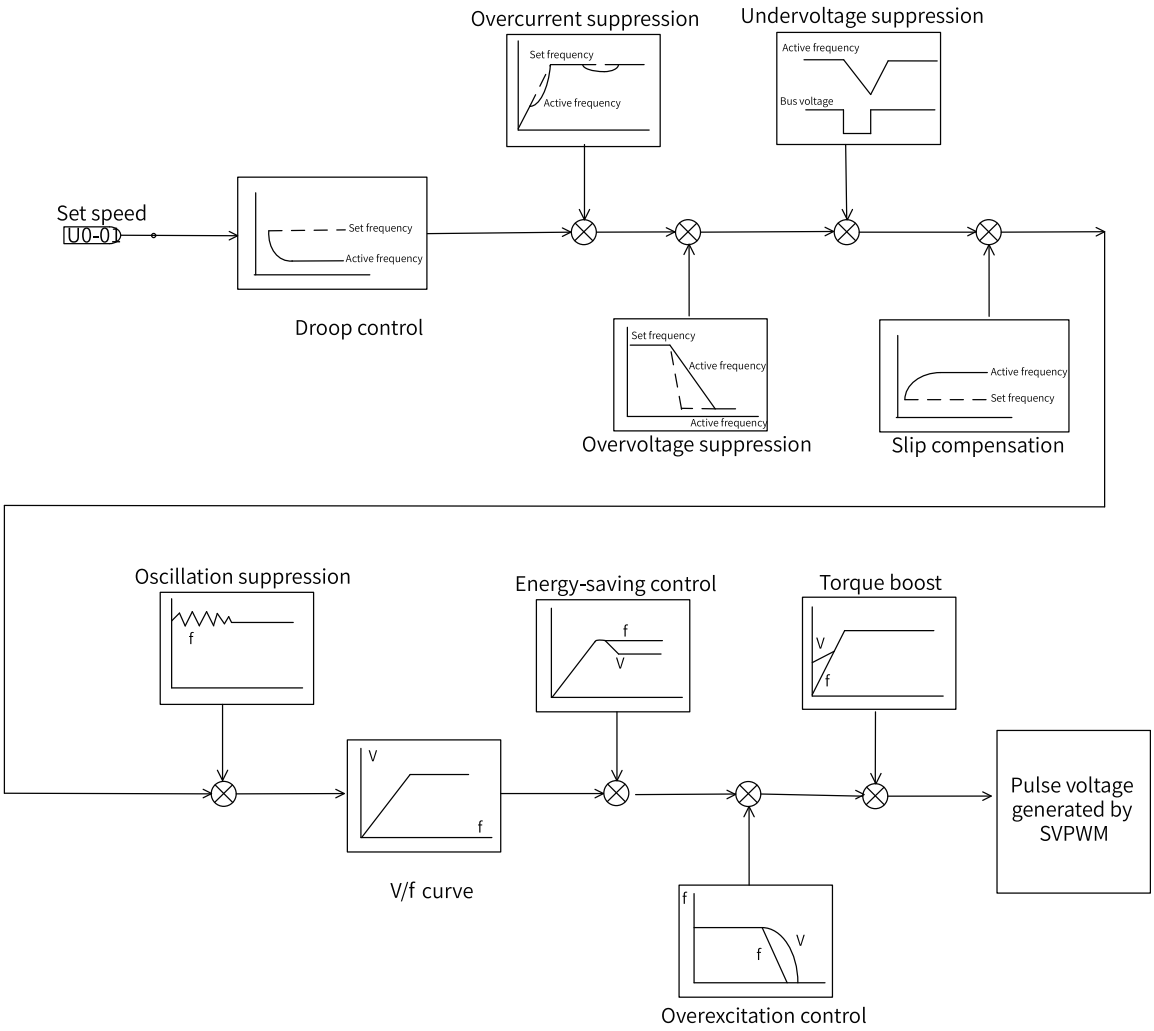


Figure 11-46 Schematic diagram of V/f control mode

11.1.14.3 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.
4. V/f semi-separation It is applicable to induction heating and inverter power supply control. In this mode, the output voltage of the AC drive is proportional to the output frequency. You can set the relationship between the output voltage and the output frequency.

Operating principles

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 semi-separation 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 as follows: V/f = 2 x X x (rated motor voltage)/(rated motor frequency)

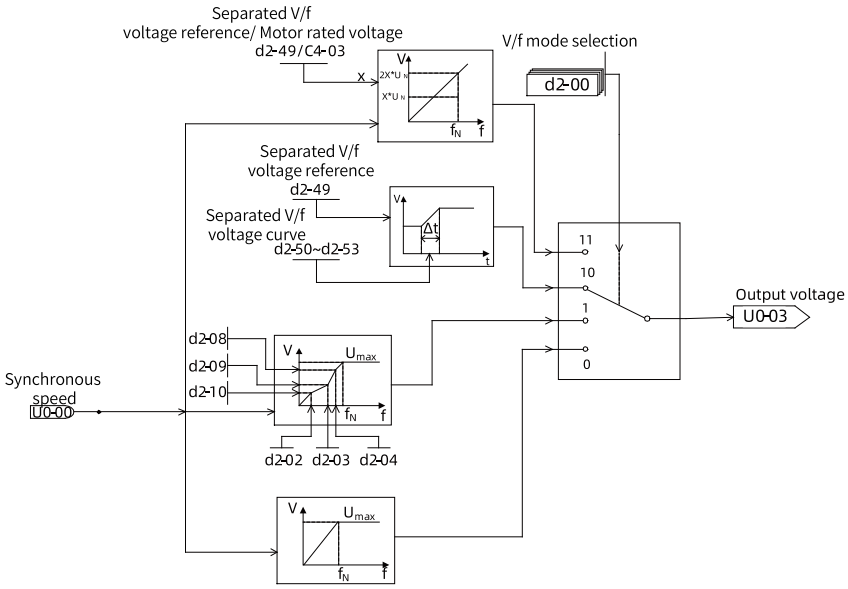


Figure 11-47 Operating principle of V/f curve

Note: f_N indicates the set frequency, and U_{max} indicates the maximum output voltage.

Precautions

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	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 semi-separation
d2-01	Multi-point curve source	0	0	Defines 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	Voltage point 1 of multi-point V/f curve	0.0	0.0 V to 1000.0 V	Defines voltage point 1 of a multi-point V/f curve.

Param.	Name	Default value	Value range	Description
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 in separated V/f	100.0%	50.0% to 200.0%	Defines the voltage upper limit of decoupled V/f. This parameter is a percentage to the rated voltage of the motor.
d2-48	Voltage source for separated V/f	0	0: d2-49 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Other: F connector	Defines the target voltage reference source in decoupled V/f mode. 0: d2-49 - The decoupled voltage is defined by d2-49. 2: AI1. The voltage source is input by current or voltage signal through AI1 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. For details, see the multi-reference module. 7: Simple PLC - The V/f decoupled voltage is set by simple PLC. For details, see the function description of simple PLC. 8: PID - The V/f decoupled voltage is set through PID. For details, see the PID function description. 9: Communication - The V/f decoupled voltage is set through communication. The frequency can be set through remote communication. This mode is suitable for remote control or centralized control on multiple equipment. 10: MD-BP-M potentiometer. The voltage source in the V/f separation mode is the MD-BP-M potentiometer. Other: F connector - Read the connector value through setting the parameter No. of a floating-point connector. The value being read is used as the V/f decoupled voltage in speed control mode. 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 separated V/f	0 V	0 to C4-03	Defines the digital setpoint of the voltage in separated V/f. This parameter is valid when d2-48 [V/f decoupled voltage source] is set to 0.
d2-50	Voltage acceleration time of separated V/f	0.0s	0.0s to 1000.0s	Defines the time required for the output voltage to rise from 0 to the rated motor voltage.

Param.	Name	Default value	Value range	Description
d2-51	Voltage acceleration time of separated V/f	0.0s	0.0s to 1000.0s	This parameter defines the time required for the output voltage to fall from the rated motor voltage to 0.
d2-52	RFG time of the frequency in separated V/f	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 selection of V/f separation	0	0 to 2	Defines the stop mode selection of separated V/f. 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.

11.1.14.4 Overvoltage Suppression in V/f

Application scenarios

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.

Operating 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.

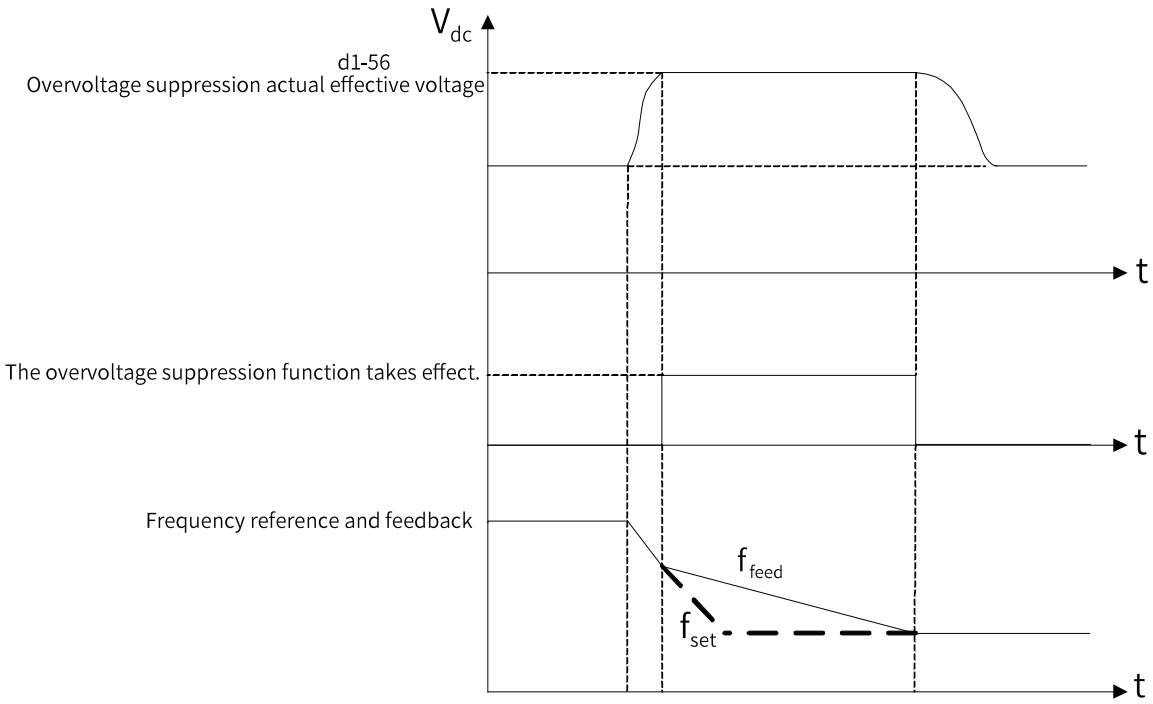


Figure 11-48 Operating principle of overvoltage suppression in V/f mode

Note: f_{feed} indicates feedback frequency and f_{set} indicates frequency reference.

Related parameters

Param.	Name	Default value	Value range	Description
F2-39/d1-54	Overvoltage suppression enable	1	0 to 1	Used to set 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	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 setpoint improves the dynamic characteristics of the bus voltage, but may result in output frequency fluctuation. When the output frequency fluctuates greatly, reduce this value properly. 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 setpoint improves the dynamic characteristics of the bus voltage, but may result in output frequency fluctuation. When the output frequency fluctuates greatly, reduce this value properly. The actual Ki gain is calculated through loop calculation, which is the product of Ki and d1-58 (Overvoltage suppression Ki adjustment).

Precaution

- 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.

11.1.14.5 Undervoltage Suppression in V/f Mode

Application scenarios

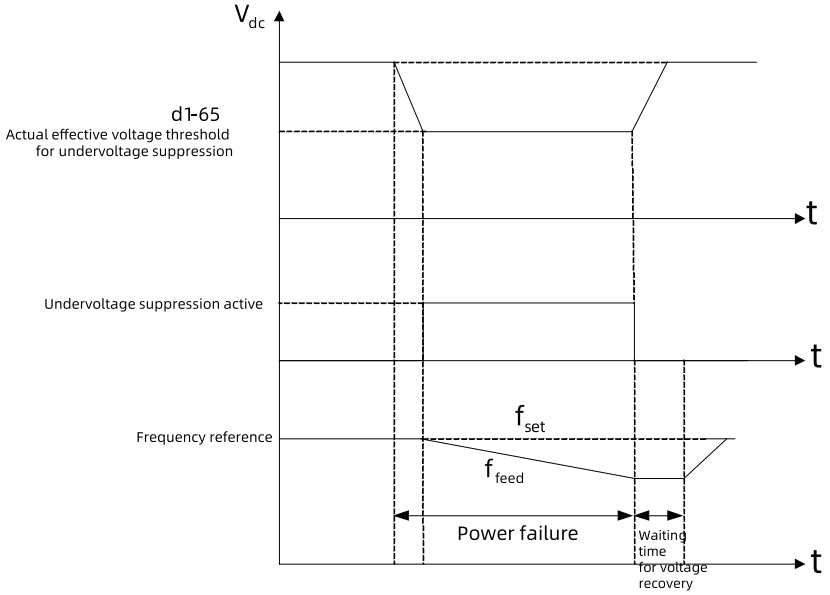
This function is mainly applicable to unstable power grid, preventing system stop due to undervoltage caused by transient voltage dip. It can also be used to prevent coast-to-stop of the

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].

11.1.14.6 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.

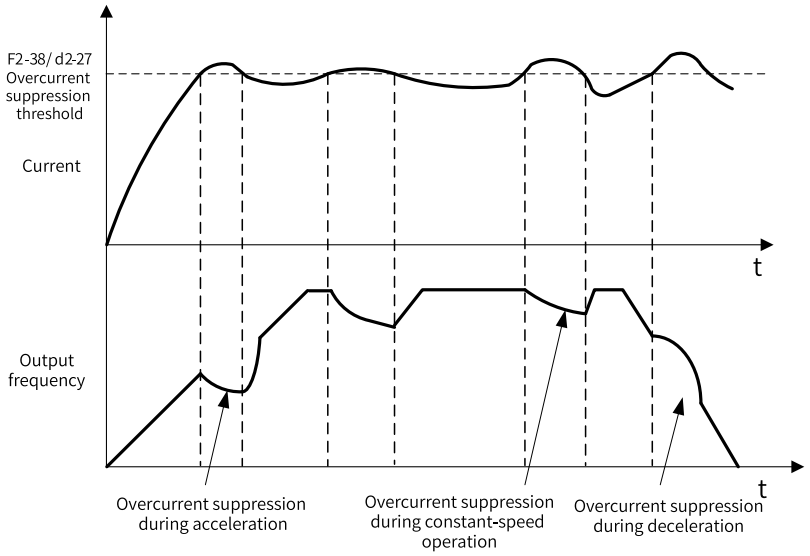


Figure 11-49 Schematic diagram of the overcurrent suppression control function

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.

11.1.14.7 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.

11.1.14.8 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.

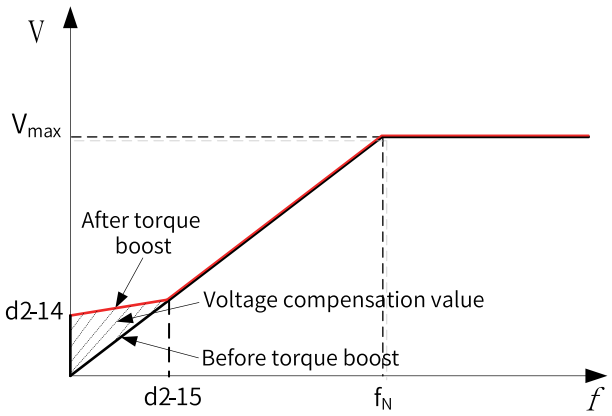


Figure 11-50 Schematic diagram of torque boost in V/f mode

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.

11.1.14.9 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].

11.1.14.10 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.

11.1.14.11 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.

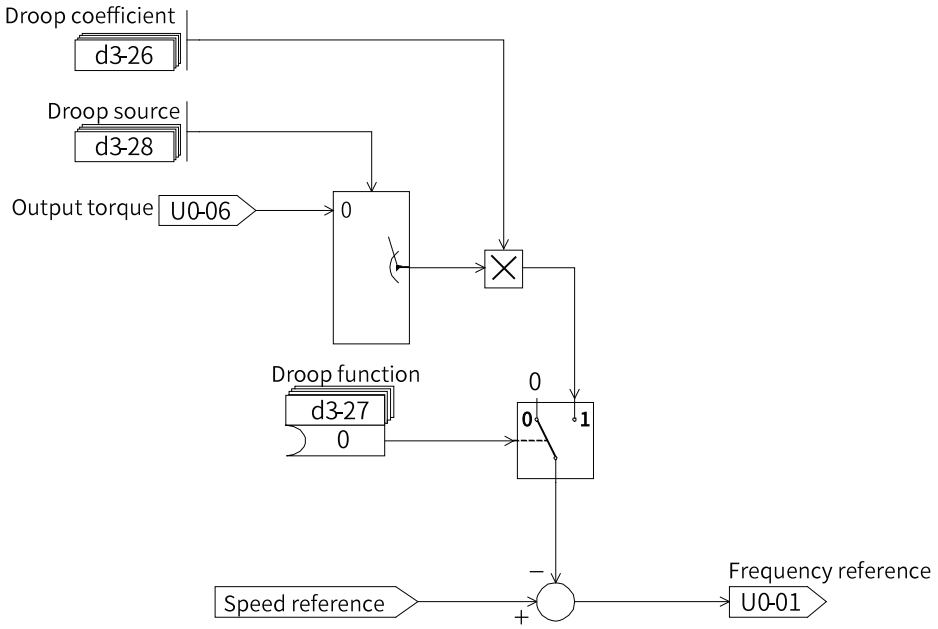


Figure 11-51 Schematic diagram of droop control in V/f mode

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.

11.1.14.12 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.

11.1.15 Basic Control

11.1.15.1 Function List

Function type	Name	Description	Links
Basic control	Random PWM	After enabling random PWM, the actual effective carrier frequency will randomly vary around the set frequency, improving sound quality and reducing electromagnetic noise.	*"11.1.15.2 Random PWM" on page 664*
	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.	*"11.1.15.3 Overmodulation" on page 664*
	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 fed back to the bus, preventing overvoltage faults.	*"11.1.15.4 Braking Resistor Control" on page 665*
	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.	*"11.1.15.5 Parameter Calculation" on page 667*
	Automatic Check	Used to check the potential errors of the drive automatically. The self-test covers IGBT shoot-through, ground short circuit, and output phase loss.	*"11.1.15.6 Self-test" on page 668*
	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.	*"11.1.15.7 Active short circuit control" on page 671*
	Carrier Frequency and Pulse Generation	You can set different carrier frequencies according to actual operating conditions and further define various carrier frequency limits.	*"11.1.15.8 Carrier Frequency and Pulse Generation" on page 673*

11.1.15.2 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.

11.1.15.3 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.

11.1.15.4 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 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.

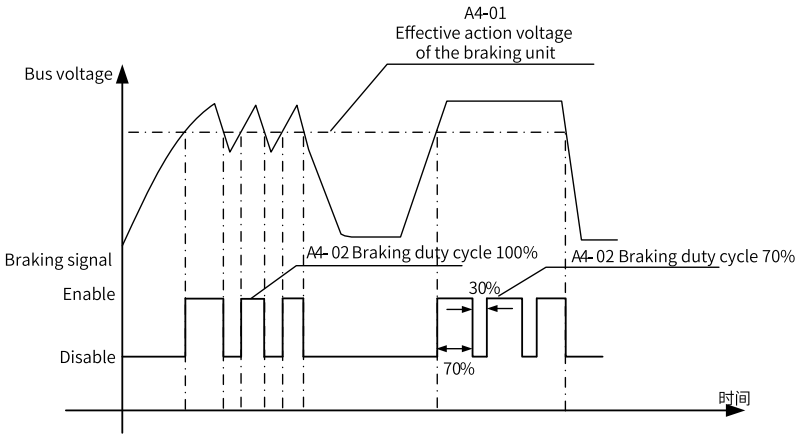


Figure 11-52 Braking resistor control schematic

Related parameters

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.

Parameter code	Name	Description	Default value	Range
A4-00	Braking unit activation voltage	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.	760.0 V	600.0 V to 820.0 V
A4-01	Effective activation voltage of the braking unit	Displays the actual effective activation voltage of the braking unit, which is set through A4-00.	760.0 V	600.0 V to 820.0 V
A4-02	Braking duty cycle	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	100%	0.0% to 100.0%

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 *"16.6.5 Braking Resistor" on page 1554*.
- 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.

11.1.15.5 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

11.1.15.6 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.

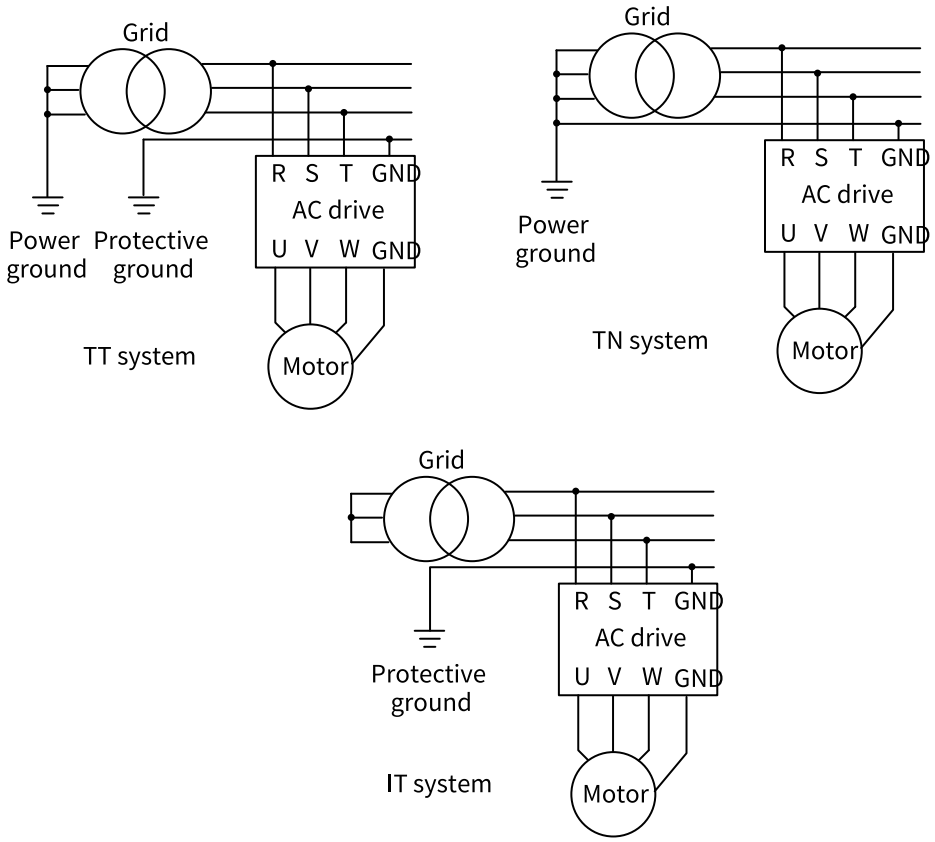


Figure 11-53 Connection for self-test under different power grid types

Related parameters

Table 11–1 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 11–2 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 11–3 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.

11.1.15.7 Active short circuit control

Application scenarios

The shorting motor stator is a type of braking control applicable to synchronous motors. It is also known as active short circuit (ASC). 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, the greater the braking torque can be generated in active short circuit control.

The schematic diagram of the ASC is as follows.

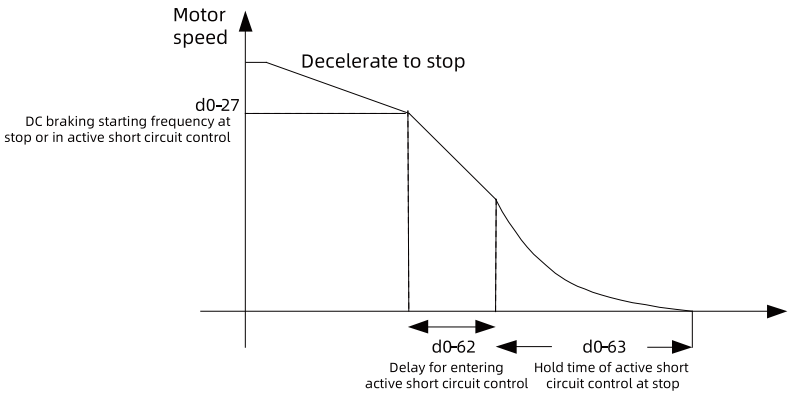


Figure 11-54 ASC schematic

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, 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.
d0-61	Star connection	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 time for entering star connection	0.0 ms	0.0 ms to 5000.0 ms	Star connection starts after this delay time elapses upon stop.
d0-63	Hold time of star connection 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.

11.1.15.8 Carrier Frequency and Pulse Generation

Application scenarios

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.

Operating 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.

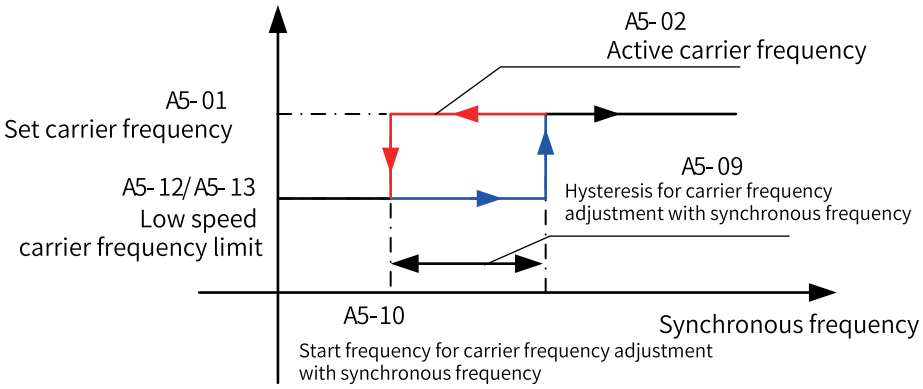


Figure 11-55 Schematic for carrier frequency adjustment with synchronous frequency

Related parameters

Param.	Name	Default value	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	Carrier frequency reference	4.0 kHz	0.8 kHz to 20.0 kHz	Defines the carrier frequency of the 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 setpoint, the lower the motor noise and the lower the current ripple. However, an excessively high carrier frequency can derate the drive, resulting in frequent overload faults. 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 effective carrier frequency of the drive. Note: The actual effective carrier frequency of the drive is also affected by the synchronous frequency and random PWM.

Param.	Name	Default value	Value range	Description
A5-09	Hysteresis for adjusting carrier frequency with synchronous frequency	3.0 Hz	0.0 Hz to 100.0 Hz	Defines 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	Defines the starting 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	Defines 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	Influence
Carrier frequency	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.

But note that 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.

12 Advanced Functions

12.1 Frequency Detection

12.1.1 Function List

Function type	Name	Function 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.	*"12.1.2 Frequency Detection (FDT)" on page 679*
	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.	*"12.1.3 Frequency Arrival Detection Window" on page 681*
	Frequency arrival detection value	This function is used to detect the operating frequency of the drive, within a certain range of any frequency.	*"12.1.4 Detection Value for Frequency Arrival" on page 682*
	Frequency Upper Limit Reach	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.	*"12.1.5 Frequency upper limit reached" on page 683*
	Frequency Lower Limit Reach	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.	*"12.1.6 Frequency Lower Limit Reached" on page 688*
	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.	*"12.1.7 Target Speed Arrival" on page 689*
	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.	*"12.1.8 Speed Comparison Arrival" on page 691*
	Jump Frequency	The frequency jump function enables the AC drive to avoid mechanical resonance point of load.	*"12.1.9 Jump Frequency" on page 693*

12.1.2 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.

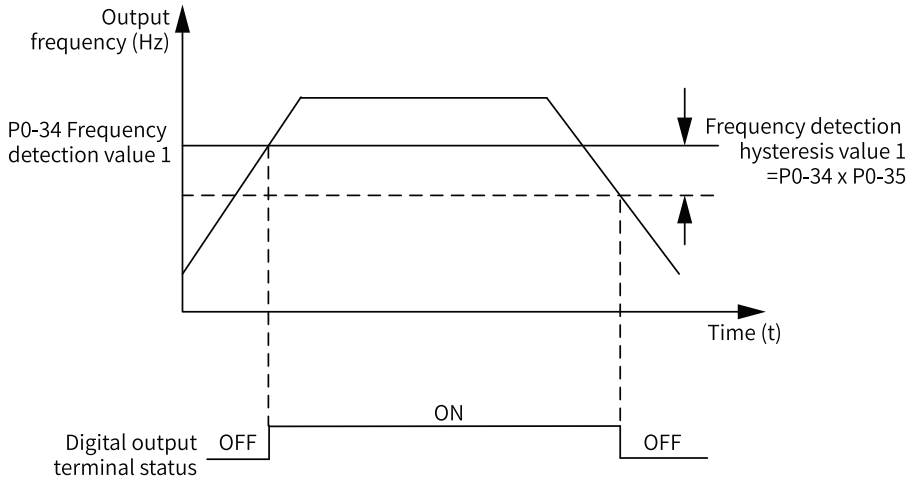


Figure 12-1 Parameters related to frequency detection

Related parameters

Table 12–1 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.

12.1.3 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.

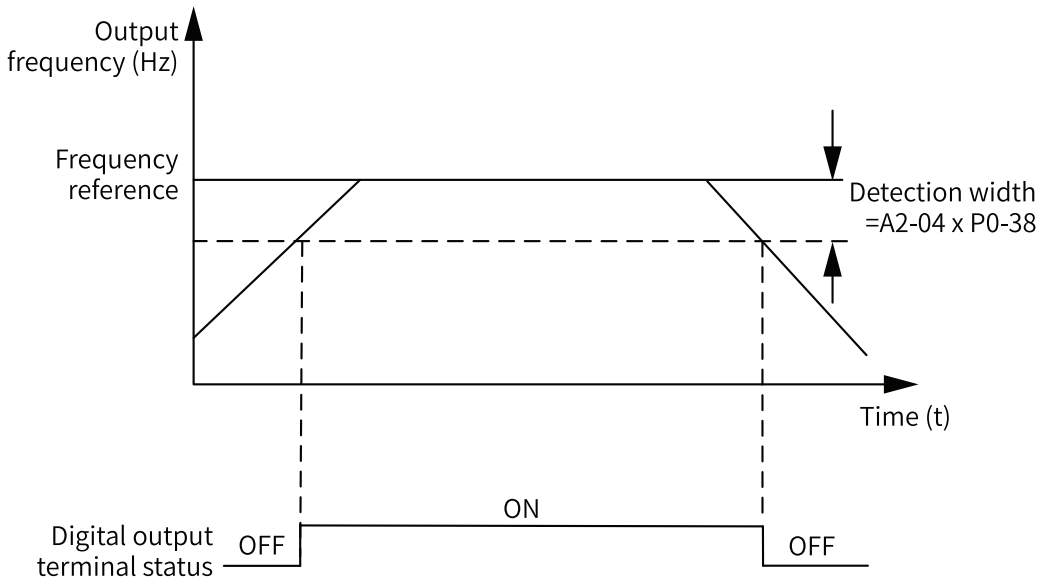


Figure 12-2 Detection amplitude sequence

Related parameters

Table 12–2 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.

12.1.4 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.

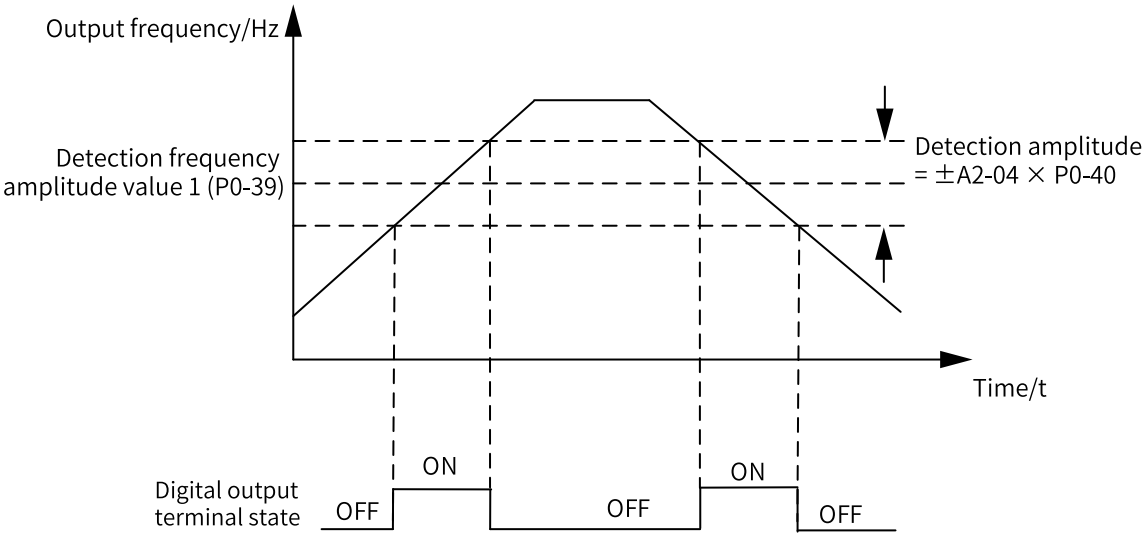


Figure 12-3 Frequency arrival

Related parameters

Table 12–3 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.

12.1.5 Frequency upper limit reached

Description

This function is used to detect whether the operating frequency of the drive reaches the upper limit frequency 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 active 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 active 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 active frequency upper limit, the DO terminal outputs an active signal. The upper limit frequency arrival function is shown in the figure below.

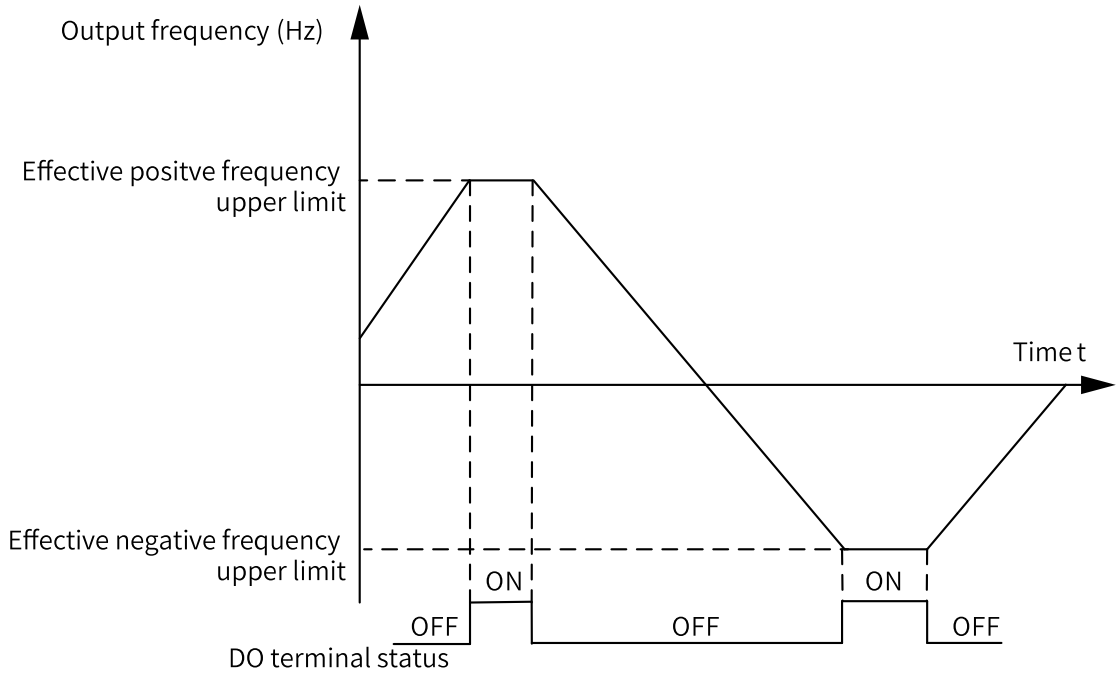


Figure 12-4 Diagram of frequency upper limit arrival

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 parameters

Table 12–4 Parameters related to frequency upper limit arrival

Param.	Name	Default value	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	Value range	Description
d1-05	Positive frequency upper limit 2 selection	0	0: 800% 2: AI1 3: AI2 5: HDI pulse setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the highest operating frequency in the forward direction, which is expressed as a percentage to the motor rated frequency. Options: 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 MD610S) 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. 10: MD-BP-M potentiometer. The forward frequency upper limit 2 is set through the MD-BP-M potentiometer. Other: F connector - The positive frequency upper limit depends on the value of the selected F connector. Note: The positive frequency upper limit is the minimum value among C4-10, d1-03, and d1-05.

Param.	Name	Default value	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 setting (active only for MD610S) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: 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. Options: 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 MD610S) 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 reverse frequency upper limit can be input through remote communication. 10: MD-BP-M potentiometer. The forward frequency upper limit 2 is set through the MD-BP-M potentiometer. 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.

12.1.6 Frequency Lower Limit Reached

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 lower 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 *"10.3.6 Frequency Reference Limits" on page 350*.

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.

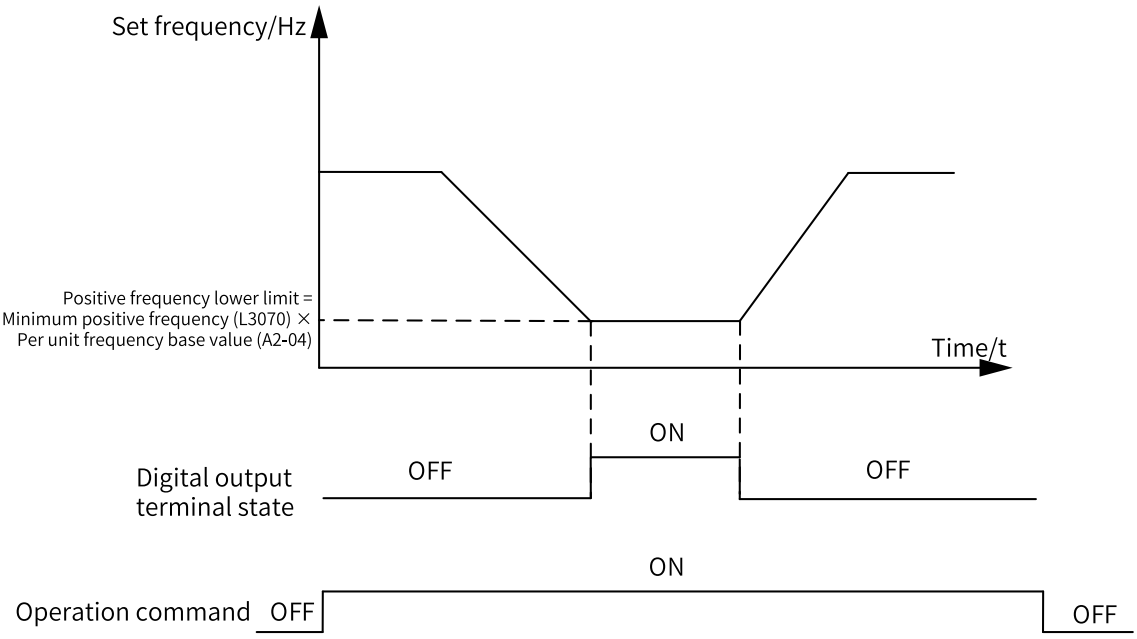


Figure 12-5 18: Frequency lower limit arrival (no output at stop)

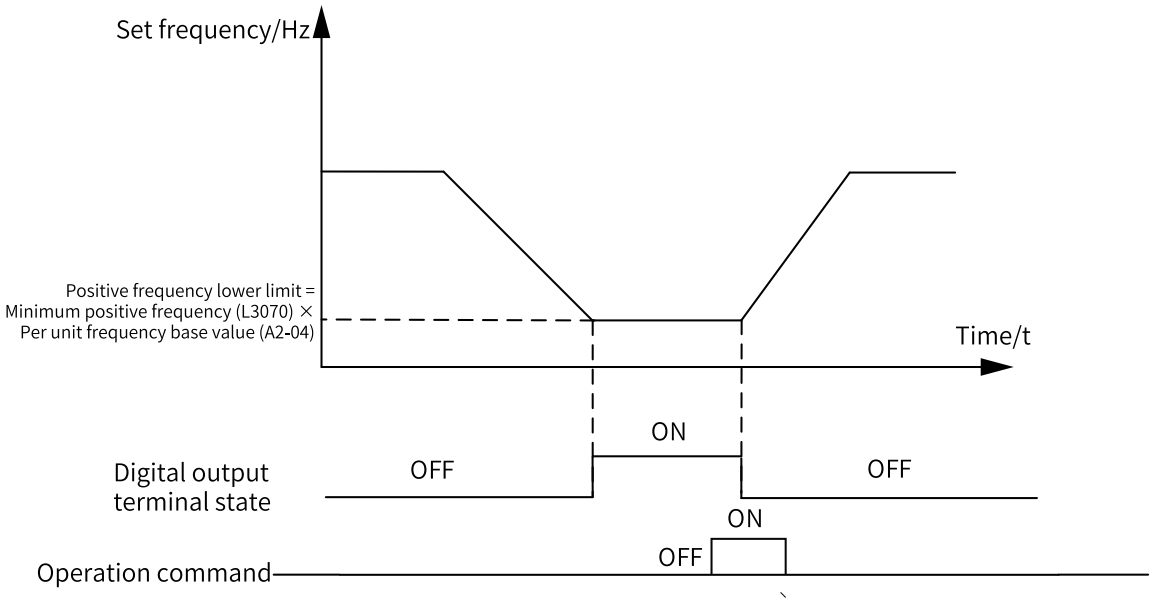


Figure 12-6 37: Frequency lower limit arrival (output even at stop)

Related parameters

Table 12–5 Parameters related to frequency lower limit arrival

Param.	Name	Default value	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 unit of 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.

12.1.7 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.

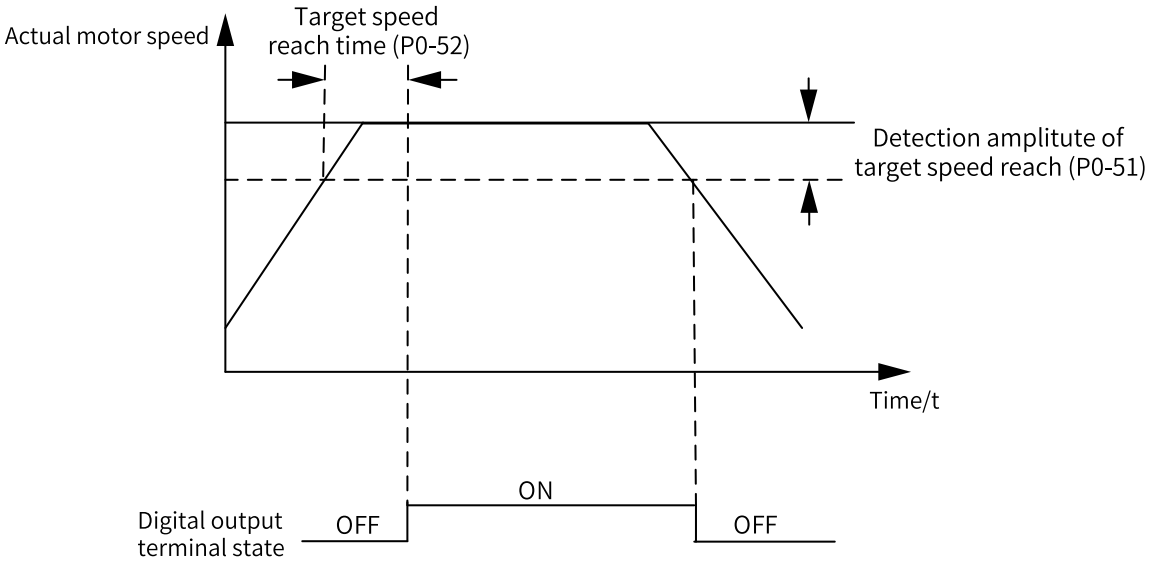


Figure 12-7 Target speed arrival

Related parameters

Table 12–6 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.

12.1.8 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 compari-son 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 compari-son 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.

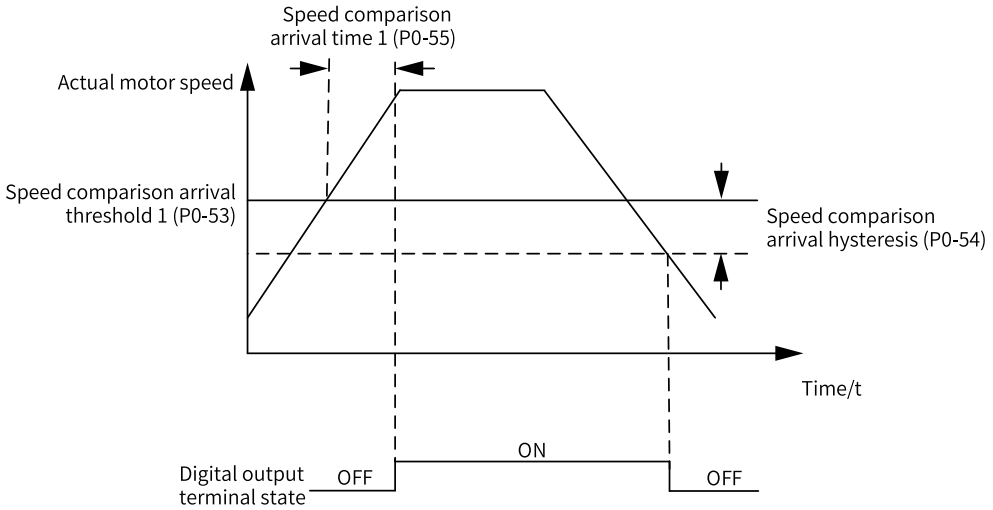


Figure 12-8 Speed arrival

Related parameters

Table 12–7 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.

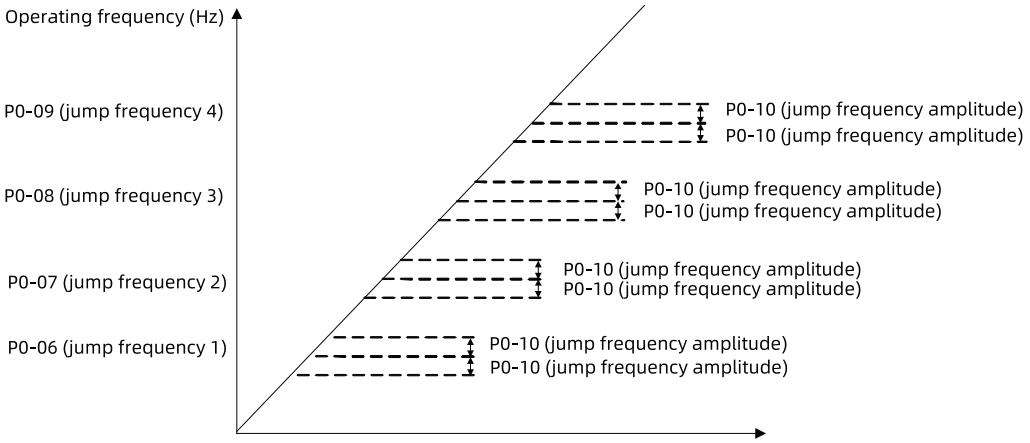
12.1.9 Jump Frequency

Function description

The frequency jump function enables the AC drive to avoid mechanical resonance point of load.

Operating principles

The AC drive supports four jump frequencies. If the four frequencies are set to 0, the frequency jump function is disabled. Set whether the jump frequency is active during acceleration/deceleration by P0-05 (Jump frequency during acceleration/deceleration). If 0 (Disable) is selected, the jump frequency will not be skipped during acceleration and deceleration.

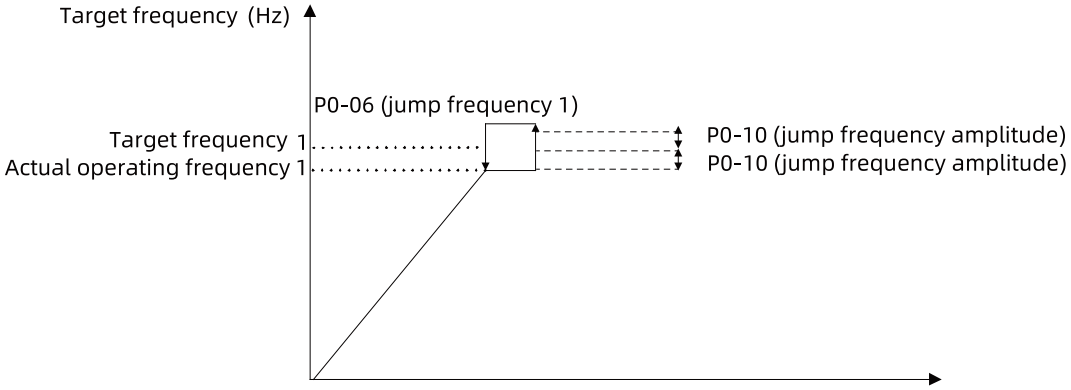


When the target frequency is within the range of the jump frequency, the AC drive will jump the target frequency to the set jump frequency boundary "jump frequency ± P0-10 [Jump frequency amplitude]."

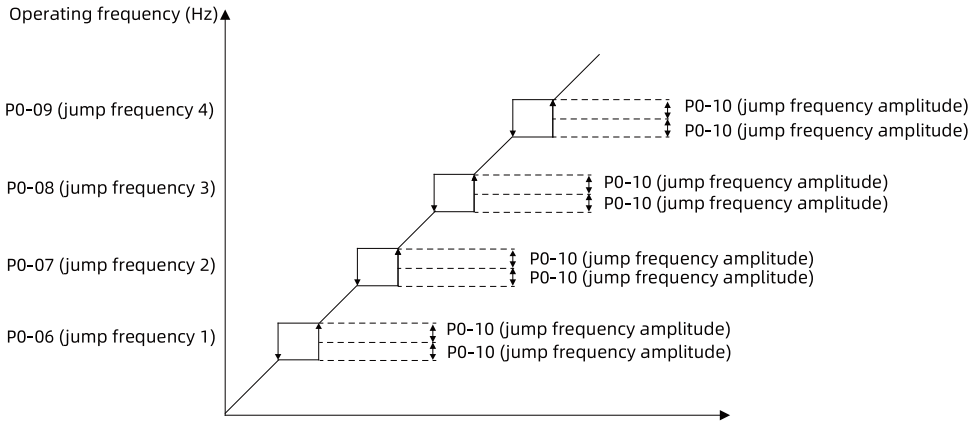
When the target frequency is within the range of jump frequency - P0-10 (Jump frequency amplitude), the target frequency jumps to the lower boundary of the jump frequency.

When the target frequency is within the range of jump frequency + P0-10 (Frequency jump amplitude), the target frequency jumps to the upper boundary of the jump frequency.

When P0-05 (Jump frequency enable during acceleration and deceleration) is set to 0 (Disable), the jump frequency function is shown in the following figure 2. Take jump frequency 1 as an example. If the target frequency is within the jump frequency range, the jump operation is executed. The target frequency can only be at the jump frequency boundary.



When P0-05 (Jump frequency enable during acceleration and deceleration) is set to 1 (Enable), the jump frequency function is shown in the following figure 3. The jump operation is executed when the target frequency reaches the jump frequency during acceleration/deceleration.



Application example

Here, taking jump frequency 1 as an example:

1. Set P0-05 (Jump frequency enable during acceleration/deceleration) to 0, indicating that the jump operation is not applied during acceleration/deceleration.
2. Set P0-10 (Frequency jump amplitude) and P0-06 (Frequency jump 1).

Related parameters

Table 12–8 Frequency Jump Parameters

Param.	Name	Default value	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. Option description 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.

Param.	Name	Default value	Value range	Description
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.
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).

12.2 Current Detection

12.2.1 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].

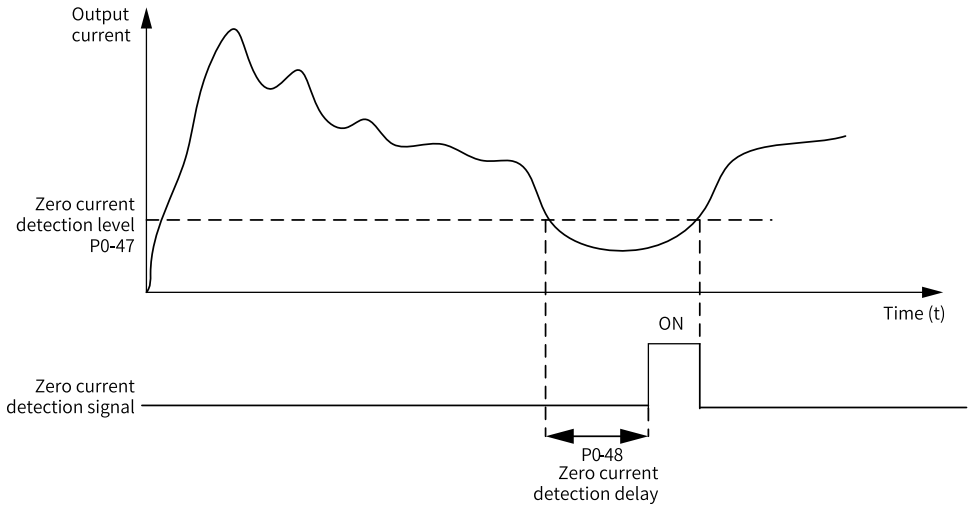


Figure 12-9 Zero current detection

Related parameters

Table 12–9 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.

12.2.2 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].

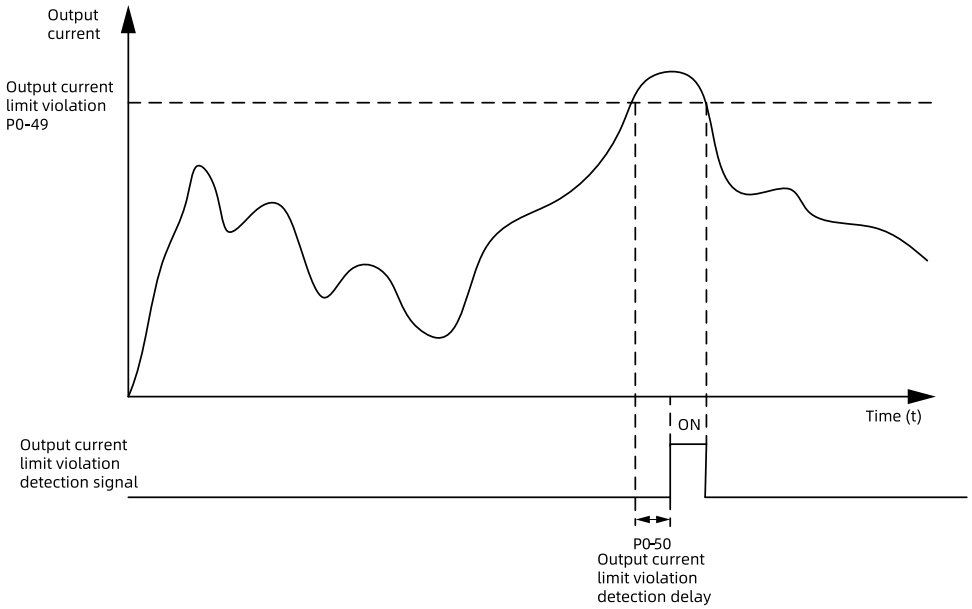


Figure 12-10 Output current limit violation detection

Related parameters

Table 12–10 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.

12.2.3 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].

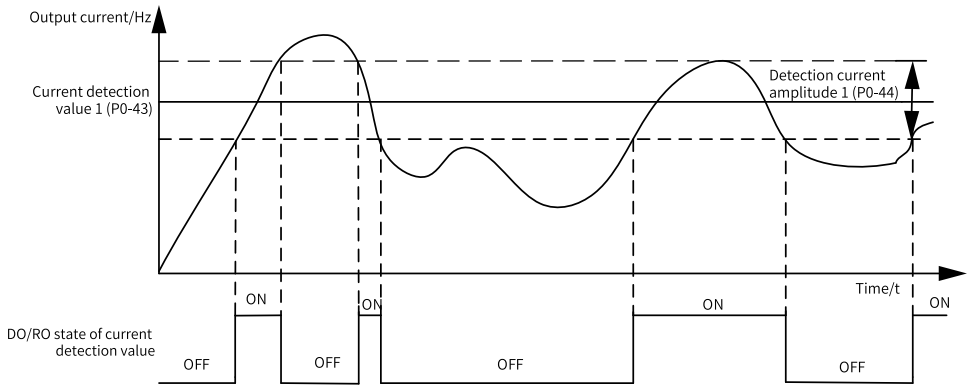


Figure 12-11 Sequence for current arrival

Related parameters

Table 12–11 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.

12.3 Fan Control

Application scenarios

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.

Operating 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).

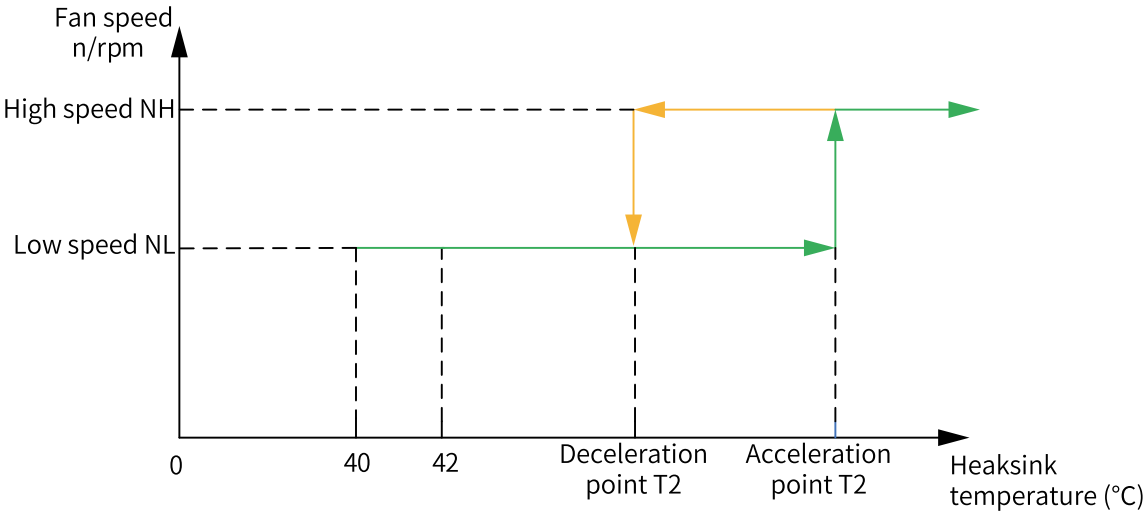


Figure 12-12 Fan speed curve

Related parameters

Table 12–12 Parameters related to fan control

Param.	Name	Default value	Value range	Description
A4-11	General 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 higher than 42℃ and stops when the heatsink temperature 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 higher than 42℃ and stops when the heatsink temperature 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) When this parameter is set to 3, the fan keeps operating in the non-undervoltage state. 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	1,500 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	1,500 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 to 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	Value range	Description
A4-15	Reverse operating time of the fan during forward/reverse operation	60s	60s to 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 to 65535	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.

12.4 Setting Time Arrival

12.4.1 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.

12.4.2 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.

12.4.3 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.

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 is set to 0, the current running time reach function is inactive and the DO (RO) 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.

12.5 Load monitoring

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.

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 the "Parameter Interconnection" section.

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].

For details on related parameters, see *" Related parameters" on page 709*.

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.

Scenarios requiring linkage to overload pre-alarm

1. Cause identifying of abnormal fluctuations. Scenario: The monitoring interface displays periodic load fluctuations (e.g., ±15% oscillation) without triggering an alarm.
   - Immediately check if the level 1 pre-alarm threshold set in *"10.11.11.1 Motor overload pre-alarm" on page 510* is too high.
   - If the fluctuation is accompanied by an abnormal rise in temperature, refer to the level 2 protection threshold calibration method in the overload pre-alarm.
2. Energy efficiency optimization conflict. Scenario: After implementing frequency energy-saving strategies, the system frequently enters a low-load state (< 30%).
   - Prevent response delays during sudden load applications by referring to "Short-term Overload Tolerance Configuration" in *"10.11.11.1 Motor overload pre-alarm" on page 510*.
   - Calibrate the current sampling synchronization rate of both modules synchronously (error should be <2%).
3. Predictive maintenance alarm. Scenario: Load trend analysis indicates a bearing wear risk level at least 3 (5 levels in total).
   - Enable the dynamic threshold adjustment function in *"10.11.11.1 Motor overload pre-alarm" on page 510* to allow the overload rate to decrease from 110% to 105%.
   - Do not disable the hardwired emergency stop circuit for overload protection before maintenance is completed.

Note

Configurations of two modules must be checked when the following conditions occur:

- Load monitoring shows improved efficiency, but the number of overload alarms increases.
- Gaps appear in the load monitoring data after overload protection activation.
- The difference of the same parameter displayed by two modules remains greater than 3%.

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).

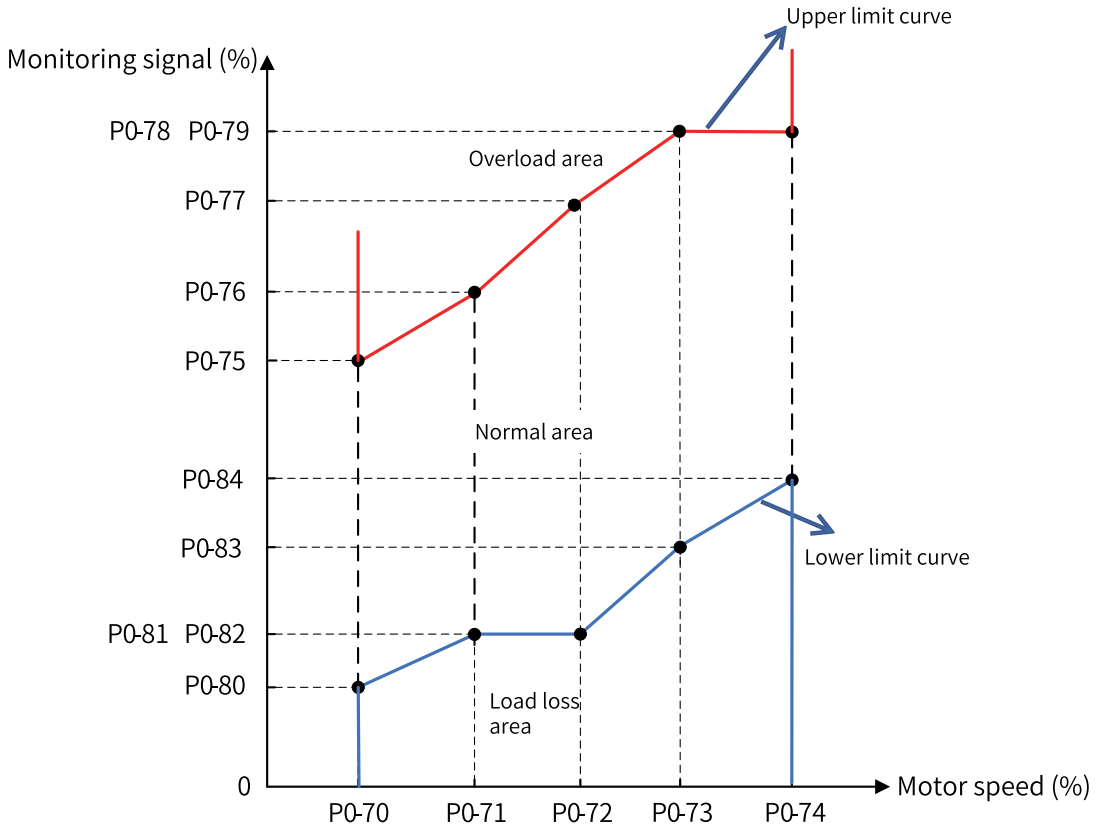


Figure 12-13 Schematic of load monitoring signal

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.

- If the monitored signal sampled by the system exceeds the upper boundary point, overload occurs.
- If the monitored signal sampled by the system exceeds the lower boundary point, load loss occurs.
- If the monitored signal sampled by the system is between the upper and lower boundary points, the load is normal.

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.

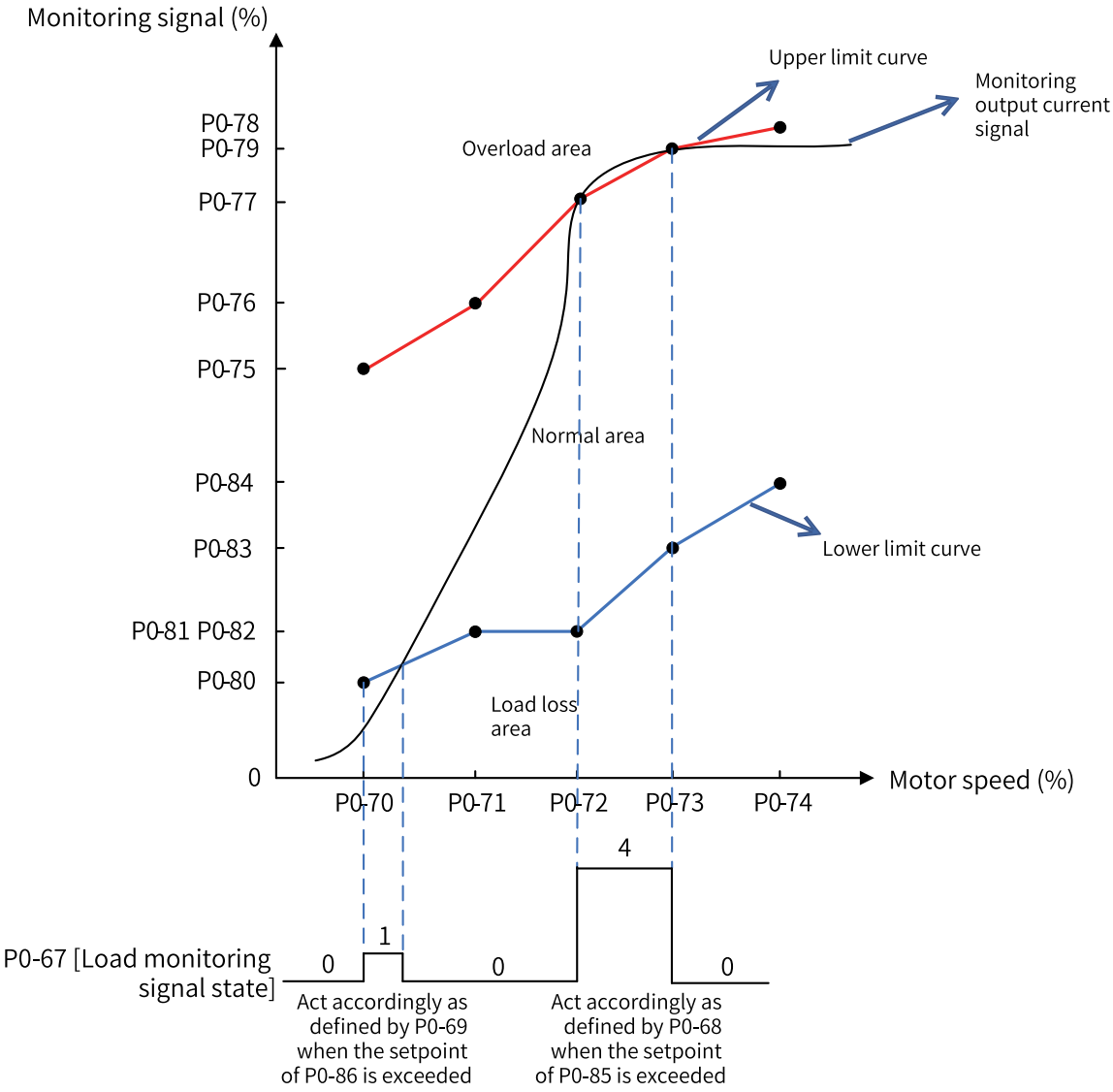


Figure 12-14 Monitoring example

Related parameters

Param.	Name	Default value	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 Others: 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. Options: 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. Options: 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	20.0s	0.0 to 6553.5	Defines the response delay from overload detection to triggering P0-68.
P0-86	Allowable load loss time	20.0s	0.0 to 6553.5	Defines the response delay from load loss detection to triggering P0-69.
P0-68	Overload response 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	Value range	Description
P0-69	Load loss response 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%–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%–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%–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%–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%–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	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.

12.6 Process Functions

12.6.1 Function List

Function type	Name	Function description	Links
Process functions	Wobble Function	Wobble control means that the drive output frequency changes around the center frequency set by the wobble frequency setting method.	*"12.6.4 Wobble Function" on page 715*
	Process PID Control	As a general process control method, PID process control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and derivative calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the drive output frequency.	*"12.6.5 Process PID Control" on page 717*
	Simple PLC Function	Simple PLCs are typically applied in scenarios that require multi-reference control.	*"12.6.6 Simple PLC Function" on page 729*
	Motorized potentiometer	The motorized potentiometer function is applicable to industries such as logistics and ceramics that require flexible speed control.	*"12.6.7 Motorized potentiometer" on page 734*
	Brake control	The motor and the device being driven are kept at zero speed through the mechanical brake when the drive unit is not running. When brake control is enabled, set relevant parameters based on the actual working conditions of equipment and load for effective control by the brake logic to achieve operation safety.	*" Brake Control" on page 740*
	Tension control	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.	*" Tension control" on page 750*

12.6.2 Fixed Length Control Function

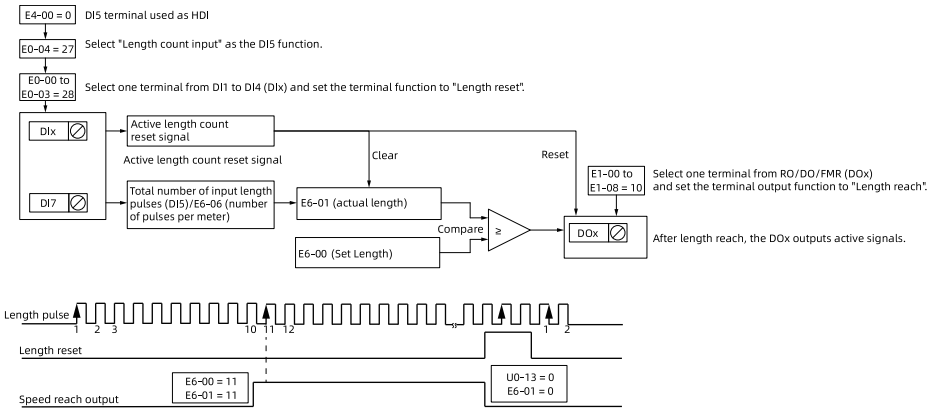
Application scenarios

Use this function when you need to convert input pulses to length units and define a travel distance.

Function description

The MD610 features the fixed-length control function. It is recommended to use the high-speed pulse input terminal, that is, DI5, for collecting length pulses. As shown in the figure below, set E4-00 (HDI terminal type selection) to 0 (Use as HDI), and set E0-04 (DI5 function selection) to 27 (Length counting input). Therefore, the fixed-length control function is enabled. Subsequently, set E6-03 (Pulses per Meter) to convert input pulse signals into meters. The drive detects the input signal from

DI5, converts it to distance, and displays it in E6-01 (Actual length). Then the drive compares E6-01 (Actual length) with E6-00 (Set length). When E6-01 (Actual length) exceeds E6-00 (Set Length), the DO output can generate a signal indicating length reach. If the function of another DI is set to selection 28 (Length reset), the current length information is continuously cleared while the signal on that terminal is active.



Related parameters

Param.	Name	Default value	Value range	Description
E6-03	Set length	1000	0 - 65535	Defines the length value to be controlled in fixed length control mode.
E6-04	Actual length	-	-	The actual length is a monitored value. The actual length (high-speed pulse input terminal as an example) equals number of pulses sampled by DI5/number of pulses per meter (E6-02).
E6-05	Number of pulses per meter	100.0	0.1 to 6553.5	Defines the number of pulses outputted when the actual length is 1 m. Note: If the length pulse is sampled by DI5, set the DI5 function to length count input (E0-04 = 27).
U0-13	Length value	-	-	Indicates the length value in the fixed length function.

Application instance

1. Set DI5 to "Used as HDI" (E4-00 = 0).
2. Set the DI5 terminal function to 27 "Length counting input" (E0-04=27).
3. Set the DI4 terminal function to 28 "Length reset" (E0-03=28).
4. Set the DO1 terminal function to 10 "Length reach" (E1-04=10).
5. Set the fixed length to 2000 m (E6-00=2000).
6. Set the number of pulses per meter to 100 (E6-02=100).

After the above settings, if more than 2000 x 100 pulses are input to DI5, DO1 will output a valid signal to notify the host computer that the specified length has been reached. If a valid signal is input to DI4, the current length information will be cleared, and the valid output signal from DO1 will be terminated.

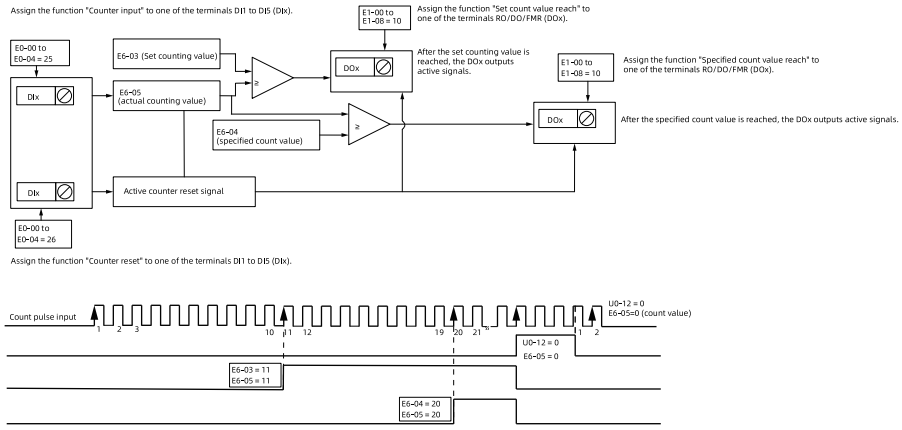
12.6.3 Counting Function

Application scenarios

This function is used in scenarios where the number of ON/OFF operations of the general-purpose DI or the number of pulses of the high-speed DI needs to be counted.

Description

The MD610 features a counting function, which can be implemented via general-purpose DIs (DI1–DI4) or high-speed terminal (DI5). To enable the counting function, set the DI function to 25 (Counter input). If the DI1 to DI4 function is set to 25 (Counter input), the count value increases by 1 each time the terminal transitions from open to close. If E4-00 (HDI terminal type selection) for DI5 is set to 0 (Use as HDI), and E0-04 (DI5 function selection) is set to 27 (Length count input), the system counts the number of pulses as the count value. When the count value reaches the set count value (E6-03) and the DO function is set to 8 (Set count value reach), an ON signal indicating "Set count value reach" is output. When the count value reaches the specified count value (E6-04) and the DO function is set to 9 (Specified count value reach), an ON signal indicating "Specified count value reach" is output. If the function of another DI is set to 26 (Counter reset), the current count information is continuously cleared while the signal on that terminal is active.



Related parameters

Param.	Name	Default value	Value range	Description
E6-03	Set count value	1000	0 to 65535	Defines the value for the set terminal count arrival. Note: When the count value reaches E6-03, the DO terminal assigned with the function of "Set count value reach" outputs an active signal.
E6-04	Specified count value	1000	0 to 65535	Defines the value for the specified terminal count value arrival. Note: When the count value reaches E6-04, the DO terminal assigned with the function of "Specified count value reach" outputs an active signal.
E6-05	Actual count	-	-	The actual count value is a monitored value, which is retentive upon power failure.
U0-12	Count value	-	-	Indicates the length value in the fixed length function.

Application instance

1. Set DI5 to "Used as HDI" (E4-00 = 0).
2. Set the DI5 function to 25 "Counter input" (E0-04=25).
3. Set the DI4 function to 26 "Count reset" (E0-03=26).
4. Set the RO function to 8 "Set count value reach" (E1-00=8).
5. Set the DO function to 9 "Specified count value reached" (E1-04=9).
6. Set the set count value to 1000 (E6-03=1000).
7. Set the specified count value to 2000 (E6-04=2000).

After the above settings, if more than 1000 pulses are input to DI5, the RO will output an active signal to notify the host computer that the set count value has been reached. If more than 2000 pulses are input to DI5, the DO will output an active signal to notify the host computer that the specified count value has been reached. If an active signal is input to DI4, the current length information will be cleared, and the active signal from DO1 will be terminated.

12.6.4 Wobble Function

Application scenarios

The wobble control function is applicable to textile and chemical fiber industries, which involve traverse motion during production. In these cases, cyclic changing frequency is preferred rather than constant frequency. In these applications, adopts the wobble control function s through P0-95 and P0-97 to meet the requirements of these production scenarios.

Set parameters related to oscillation frequency

Param.	Name
P0-95	Oscillation frequency amplitude
P0-96	Oscillation frequency amplitude
P0-97	Oscillation frequency cycle
P0-98	Triangle wave rising time coefficient

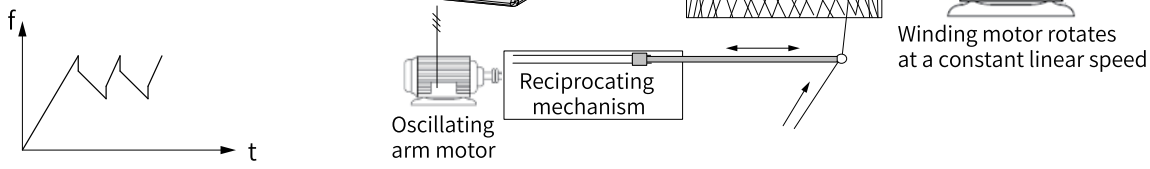


Figure 12-15 Application scenario of the wobble function

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.

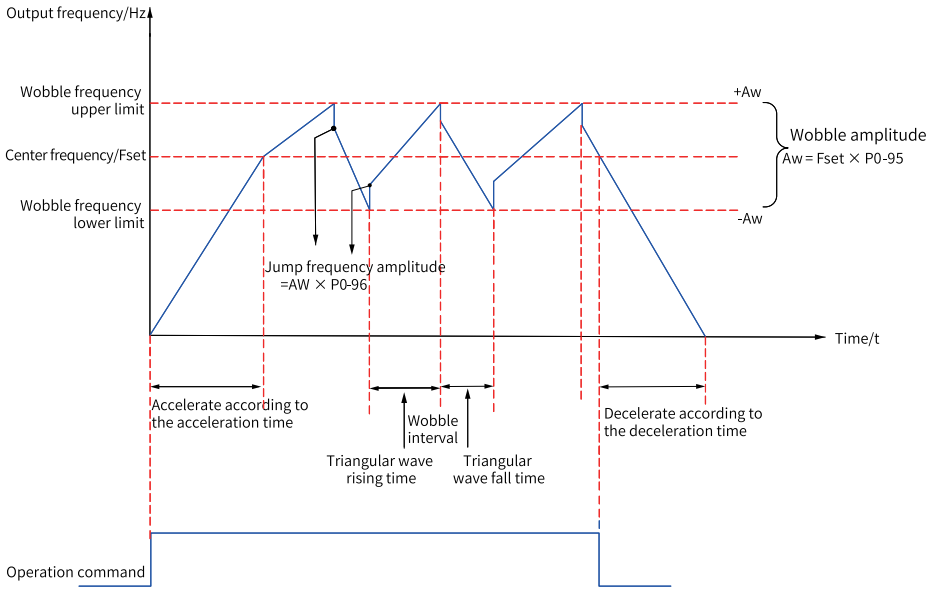


Figure 12-16 Working principle of the wobble function

- **Wobble frequency calculation**
  When P0-94 is set to 0 (relative to the center frequency), wobble frequency (AW) = b5-00/b6-00 (main frequency source) x P0-95 (wobble amplitude).

  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 operation, jump frequency = wobble frequency (AW) x P0-96 (wobble 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 = P0-97 (wobble cycle) - triangular wave rise time

  (Wobble cycle = triangular wave rise time + triangular wave fall time)

Application instance

1. Set P0-94 to 0 to enable the wobble control relative to the center frequency.
2. Set b5-00 (Main frequency source) to 0 (Set by b5-01) and set 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 frequency will be 3 Hz (30 Hz x 10%). The AC drive will then swing 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. This means that the time required to complete a cycle (from the center frequency and back to the center frequency) is 10s.

6. Set P0-98 (triangular wave rise time coefficient) to 50%, that is, the triangular wave rise time is 5s (10s x 50%). This means the time to rise from the lower limit to the upper limit of the wobble frequency is 5s. The triangular wave fall time is 5s (10s - 5s). This means the time to fall from the upper limit to the lower limit of the wobble frequency is 5s.

Related parameters

Param.	Function	Default	Value range	Description
P0-94	Wobble 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 frequency 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 frequency is fixed.
P0-95	Wobble amplitude	0.0%	0.0% to 100.0%	Defines the wobble amplitude, which is the percentage to the wobble base frequency. Note: 1. When P0-95 is set to 0.0%, the wobble function is disabled. 2. When P0-95 is not 0.0% and P0-94 is set to 0, the wobble frequency is the product of the target frequency and P0-95. If P0-94 is set to 1, the wobble frequency is the product of the maximum frequency and 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. Note: The jump frequency is the product of the wobble frequency and 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	Triangular wave rising time coefficient	50.0%	0.1% to 100.0%	Defines the percentage of the triangular wave rise time to the wobble cycle. Note: Triangular wave fall time = wobble cycle - triangular wave rise time; triangular wave rise time = wobble cycle x P0-98

12.6.5 Process PID Control

Application scenarios

The PID-controlled output is used as the operating frequency. The 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, PID process control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and derivative calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the drive output frequency.

Parameter	Description	Commissioning introduction
Proportional gain Kp	This parameter determines the strength of the proportional adjustment of the PID regulator, namely, the P output. When the deviation occurs between the PID output and the input, the PID adjusts the output to change the controlled value and minimize the deviation. The speed of the deviation reduction depends on the proportional coefficient Kp.	Increasing Kp accelerates deviation correction, but may cause oscillation, particularly in scenarios with large hysteresis. 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 adjusts the output reference to the maximum limit. For example, the PID regulator adjusts the frequency to the maximum frequency.)
Integral time Ti	This parameter determines the strength of the integral adjustment of the PID regulator, namely, the I output.	The shorter the integral time, the greater the regulation intensity can be. (When the deviation between PID feedback and PID reference is 100.0%, the integral regulator continuously adjusts the output over time until it reaches the maximum limit. For example, the PID regulator adjusts the frequency to the maximum frequency.)
Derivative time Td	This parameter determines the strength of the deviation change rate adjustment of the PID regulator, namely, the D output.	The longer the derivative time is, the greater the regulation intensity can be. (Derivative time indicates that when the feedback changes 100.0% within the time, the derivative regulator adjusts the value to the maximum limit. For example, the PID regulator adjusts the frequency to the maximum frequency.)

Application example

1. **Enable PID:** Set P2-00 (Process PID enable) to 1 to enable the process PID function.
2. **Set the PID reference source:** Set P2-02 to select the target PID reference source. If P2-02 [PID reference source] is set to 0, you need to set P2-03 [PID value reference]. The value 100% of this parameter corresponds to the maximum value of PID feedback.

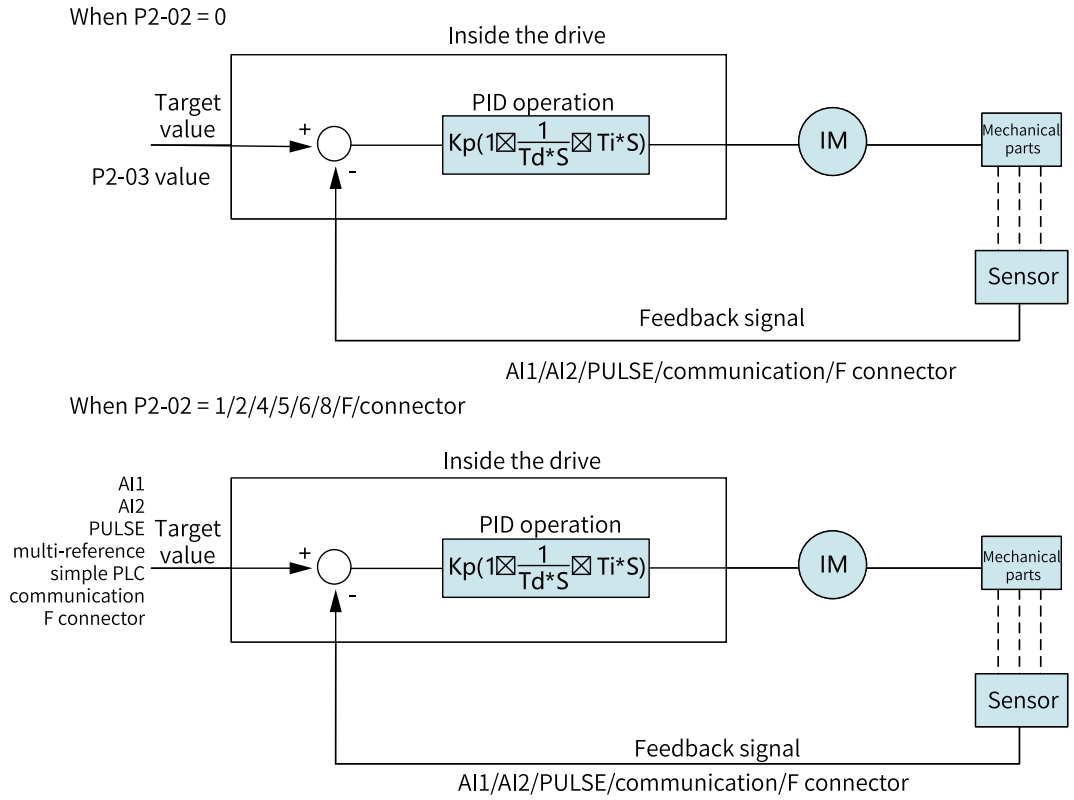


Figure 12-17 Schematic of PID process control

3. **Set the PID feedback source:** Set P2-04 to select the PID feedback source.
4. **Set the PID action direction:** Set P2-01 to select the PID action direction.
5. **Set the frequency source to PID:** Set F0-29 to 8 to select the main frequency source as PID.

After the above parameter settings, the set frequency of the drive dynamically changes with the setpoint and feedback of the PID regulator. The overall PID functional logic block diagram is shown below. You can configure other options as required.

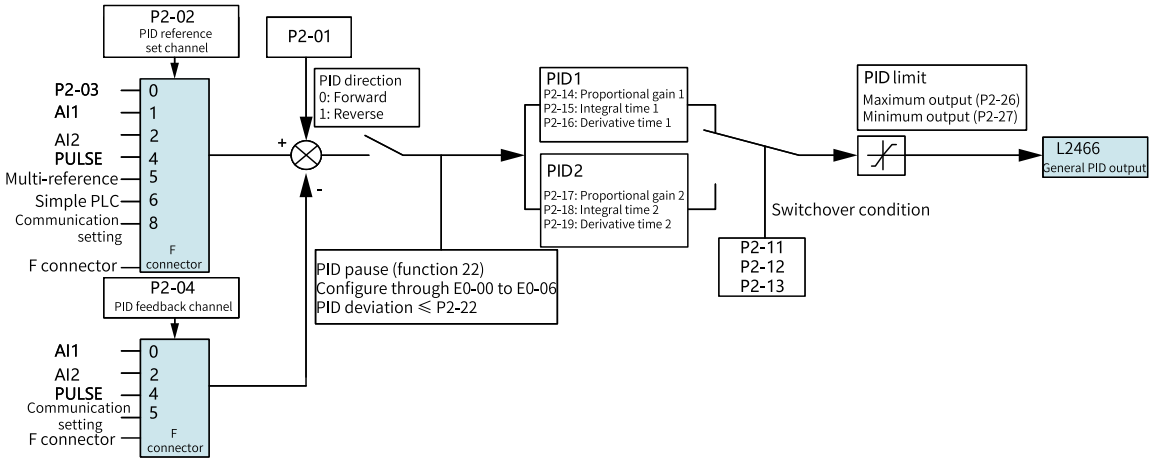


Figure 12-18 Parameter setting for process PID control

PID regulation guide

Symptom	Adjustment strategy
Slow response	Increase Kp.
Fast oscillation	Decrease Kp.
Large overshoot and slow fluctuation	Increase Ti.
Large steady-state error and slow recovery during load fluctuation	Increase Kp or decrease Ti.
Continuous system oscillation	Set the derivative time Td properly to stabilize the system. Note that if the derivative time Td is too long, interference and vibration may be caused.

Related parameters

Param.	Parameter	Default value	Value range	Description
P2-00	PID enable	0	0: Disable	The process PID is not used for calculation and the PID output is cleared.
			1: Enable	The PID function is enabled. The PID output is calculated based on the set parameter.
			Other: B connector	Select a parameter in the bit connector to control operation of the PID function.
P2-01	PID acting direction	0	0: Direct acting	If the feedback signal is smaller than the PID reference, the drive output frequency increases.
			1: Reverse	If the feedback signal is smaller than the PID reference, the drive output frequency decreases.
			Other: 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.	Parameter	Default value	Value range	Description
P2-02	PID setting source	0	0: PID value reference	Used to select the PID reference setting channel. The PID reference source 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 is set by AI2 input.
			3: MD-BP-M potentiometer	The PID target reference channel is the MD-BP-M potentiometer.
			4: HDI reference (active only for MD610S)	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, different combinations of DI states correspond to different frequency references. The four multi-reference terminals can be combined to form 16 states, corresponding to 16 frequencies respectively. 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	The PID reference is set through remote communication.
			Others: F connector	The parameter in the floating-point connector is used as the PID reference value.
P2-03	PID value 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.
P2-04	PID feedback source	0	0: AI1	The PID feedback reference channel is AI1.
			1: AI2	The PID feedback is set by AI2 input.
			3: MD-BP-M potentiometer	The PID feedback reference channel is the external operating panel MD-BP-M potentiometer.
			4: HDI reference (active only for MD610S)	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	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	Dimensionless unit that only used to display the PID reference and feedback range 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.

Param.	Parameter	Default value	Value range	Description
P2-06	PID reference change time	0.00s	0.00s to 650.00s	Indicates the time required for PID setting to change from 0.0% to 100.0%.
P2-07	PID feedback filter time	0.00s	0.00s to 60.00s	Defines the filter time of PID feedback. The filter helps to reduce interference on the feedback but degrades the response 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	Used to filter the PID output frequency, smoothing the AC drive output frequency. However, the filter time slows down the response of the process closed-loop system. 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 significant system vibration.
P2-09	PID inversion cutoff frequency	2.00 Hz	0.00 Hz to A2-07	When the frequency source is only the PID, the PID inversion 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 being processed by "main frequency + PID". This parameter is inactive when P2-09 is set to 0. Note: When using this function, you need to select connector L2480 (General PID inversion cutoff frequency) as the minimum output source of PID.

Param.	Parameter	Default value	Value range	Description
P2-11	PID parameter switchover condition	0	0: No switchover, default PID parameter 1	Used for switchover between two groups of PID parameters. PID parameters are not switched. The first group of PID parameters are used, namely P2-14 to P2-16.
			1: Switched by DI	Assign the DI with function 43 (PID parameter switchover). When this terminal is disabled, parameter group 1 (P2-14 to P2-16) is used. When this terminal is enabled, parameter group 2 (P2-17 to P2-19) is used.
			2: Switched automatically based on deviation	When the absolute value of the deviation between PID feedback and PID reference is lower 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 (PID parameter switchover deviation 1) and P2-13 (PID parameter switchover deviation 2), the PID parameters are the linearly interpolated value of the two groups of PID parameter values, as shown in *"Figure 12-19 PID parameter switchover" on page 729*.
			3: Switched automatically based on operating frequency	In this mode, when the operating frequency of the 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 12-19 PID parameter switchover" on page 729*.
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 higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-15	PID parameter 1 integral time Ti1	2.00s	0.01 to 10.00	Indicates the integral time Ti in PID control. It decides the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can be.
P2-16	PID parameter 1 differential time Td1	0.000s	0.000s to 10.000s	Defines the derivative time Td in PID control. The derivative time determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be.

Param.	Parameter	Default value	Value range	Description
P2-17	Proportional gain Kp2 of PID parameter 2	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 higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-18	Integral time Ti2 of PID parameter 2	2.00s	0.01 to 10.00	Indicates the integral time Ti in PID control. It decides the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can be.
P2-19	Derivative time Td2 of PID parameter 2	0.000s	0.000s to 10.000s	Defines the derivative time Td in PID control. The derivative time determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be.
P2-20	PID initial value	0.0%	0.0% to 800.0%	When the 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 hold time.
P2-21	PID initial value hold time	0.00s	0.00s to 650.00s	When the 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 hold 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%	In PID control, the derivative may easily cause system oscillation. Therefore, the PID derivative action is restricted to a small range.

Param.	Parameter	Default value	Value range	Description
P2-26	Source of maximum PID output	0	0: 100.0 %	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 output value of PID is limited by this parameter. When this parameter is set to 0, 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 is set by AI2 input.
			5: Pulse reference	The maximum output value of PID is set through DI. The maximum output value of PID 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.
			8: PID	The maximum value of PID output is the current PID output.
			9: Communication	The maximum output value of PID is set through communication. The maximum value of PID output can be inputted through remote communication.
			10: MD-BP-M potentiometer	The maximum PID output value is set by the potentiometer of the external operating panel MD-BP-M.
			Others: F connector	The parameter in the floating-point connector is used as the maximum PID output.

Param.	Parameter	Default value	Value range	Description
P2-27	Source of minimum PID output	0	0: -100.0 %	Used to select the source of minimum PID output value. 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 output value of PID is limited by this parameter. When this parameter is set to 0, the default minimum PID output value is -100.0%.
			2: AI1	The minimum PID output is set through AI1.
			3: AI2	The minimum PID output value is set by AI2.
			5: Pulse reference	The minimum value of PID output is set through DI. The minimum output value of PID 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 minimum output value of PID output is defined by simple PLC output.
			8: PID	The minimum output value of PID output is the current PID output.
			9: Communication	The minimum output value of PID is set through communication. The minimum value of PID output can be inputted through remote communication.
			10: MD-BP-M potentiometer	The minimum PID output value is set by the potentiometer of the external operating panel MD-BP-M.
			Others: F connector	The parameter in the floating-point connector is used as the minimum PID output.

Param.	Parameter	Default value	Value range	Description
P2-28	Forced value of PID output	0	0: 0.0 %	Used to select the source of forced value 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 set by AI2.
			5: Pulse reference	The forced value of the PID output is the pulse frequency reference of the DI terminal.
			6: Multi-reference	The forced output value of PID is the multi-reference output value.
			7: Simple PLC	The forced value of PID output is defined by simple PLC output.
			8: PID	The PID output value is the current PID output.
			9: Communication	The PID output value is set through communication.
			10: MD-BP-M potentiometer	The forced value of PID output is set by the potentiometer of the external operating panel MD-BP-M.
			Others: F connector	The parameter in the floating-point connector is used as the forced PID output value.
P2-29	Forced assignment of PID output enable	0	0: Inactive	The forced output value assignment is invalid, and the PID calculation is performed normally.
			1: Active	The PID stops calculation and performs forced value assignment. The PID output is the forced value, that is, the value set by P2-28.
			Other: B connector	Select the parameter in the bit connector to set whether to enable forced value assignment. 0: Inactive 1: Active
P2-30	Upper limit for PID feedback loss detection	100.0%	P2-31 to 800.0 %	Defines the upper limit of PID feedback loss detection, which is used to determine whether PID feedback is lost. When the PID feedback keeps exceeding this parameter for a period longer than P2-32 [PID feedback loss detection time], the 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	Defines the lower limit of PID feedback loss detection, which is used to determine whether PID feedback is lost. When the PID feedback keeps lower than this parameter for a period longer than P2-32 [PID feedback loss detection time], the drive reports E31.1. When this parameter is set to 0, PID feedback loss detection is disabled.
P2-32	PID feedback loss detection time	0.0s	0.0–20.0s	Defines the duration for detecting PID feedback signal loss.

Param.	Parameter	Default value	Value range	Description
P2-33	Selection of PID operation at stop selection	0	0: No	Used to determine whether to continue the PID operation when the drive stops. Generally, the PID operation stops when the drive stops. When the drive stops, the PID function is not calculated and the PID output is cleared.
			1: Yes	When the drive stops, the PID function is still calculated. The PID output changes based on PID feedback and PID reference.
			Other: B connector	Select the parameter in the bit connector to set whether to enable operation at stop. 0: No 1: Yes
P2-34	PID integral property	10	Ones: Integral pause/ separation 0: Inactive 1: Active	When integral pause/separation is invalid, the integral remains invalid no matter 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 (F4-00 = 22), the PID integral operation stops. In this case, only proportional and derivative operations take effect.
			Tens: Whether to stop integral operation when the output reaches the limit 0: Continue integral operation 1: Stop integral operation	When the PID operation output reaches the maximum or minimum value, you can select whether to stop the integral operation. If "Stop integral operation" is selected, the PID integral operation stops, which may help reduce the PID overshoot. If "Continue integral operation" is selected, the PID integral operation continues, which may result in PID overshoot.
P2-35	Saturation integral processing mode selection	0	0: Default mode 1: Integral separation	Defines the PID saturation integral processing mode. Options: 0: Default mode - When PID output exceeds upper limit or falls below lower limit, integral term = PID output upper limit (lower limit) - proportional term output - derivative term output. 1: Integral separation - When PID output exceeds upper limit or falls below lower limit, integral term does not change. Note: P2-35 is valid only when the tens place of P2-34 (PID integral attribute) is set to "1: Stop integral operation".
P2-36	PID operation during jogging	0	0: Inhibited 1: Allowed	Defines whether PID operation is allowed during jog. Options: 0: Inhibited - PID operation disabled during jogging 1: Allowed - PID operation allowed during jogging

Param.	Parameter	Default value	Value range	Description
P2-37	PID execution interval	1	0 to 20	Defines the PID execution interval. The higher the setpoint, the longer the calculation cycle. The lower the setpoint, the shorter the calculation cycle.
P2-38	Active mode for PID ramp reference	-	0: Activated when PID enabled 1: Activated when PID operation starts Other: B connector	0: Activated when PID enabled When the PID function is enabled, the PID ramp reference is valid and the PID reference value is calculated based on the PID reference time. 1: Activated when PID operation starts When PID operation starts, the PID ramp reference is valid and the PID reference value is calculated based on the PID reference time. Other: B connector Select the parameters in the bit connector to select the active mode of PID ramp reference.

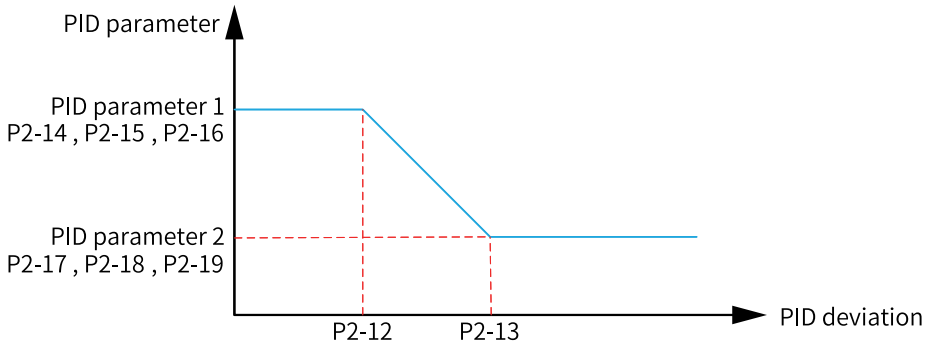


Figure 12-19 PID parameter switchover

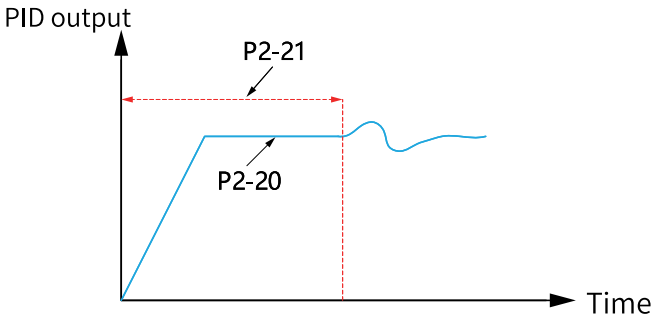


Figure 12-20 PID output function

12.6.6 Simple PLC Function

Application scenarios

Simple PLCs are generally used in scenarios where multiple speeds are required. When an individual frequency cannot meet the application needs, and the execution time and frequency cannot be accurately controlled by the operating panel or other frequency sources, you can enable the simple

PLC function to control different operating frequencies at different moments, as well as the operating time of different frequencies.

You need to set the frequency and running time through the P1-00 to P1-56. See *"Table 12-13" on page 731*.

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.

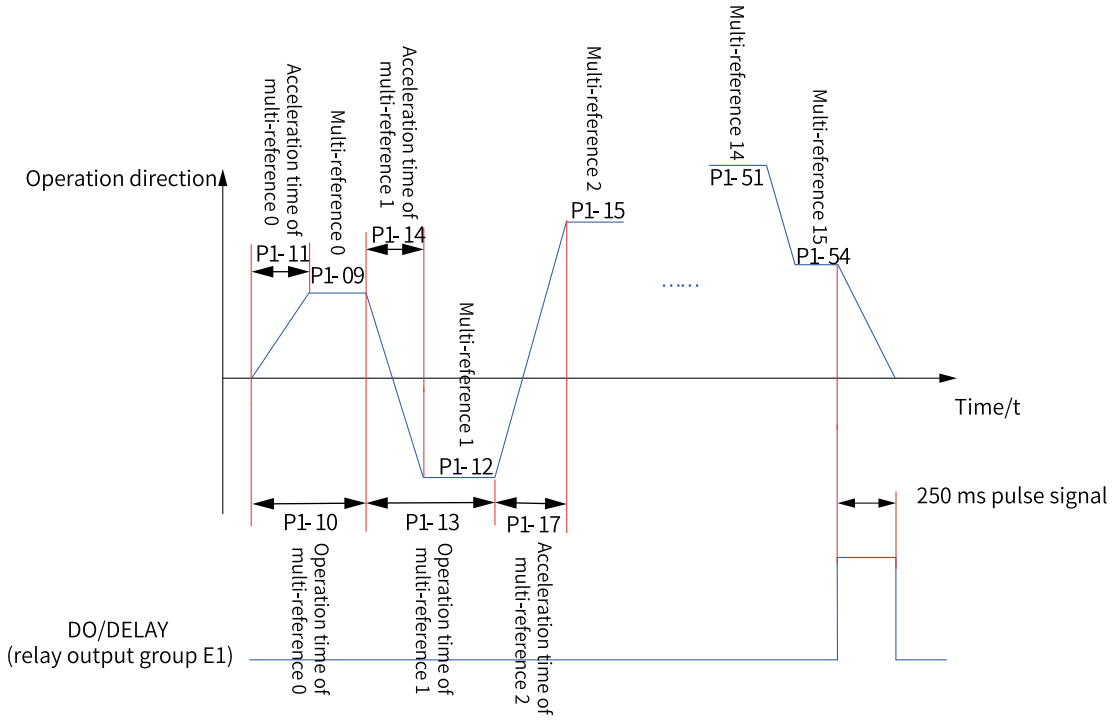


Figure 12-21 Operation diagram of the simple PLC

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.

Related parameters

Table 12–13 Parameter list of P1-00 to P1-56

Param.	Function	Default value	Value range	Description
P1-00	Simple PLC module	0: Disable	0: Disable 1: Active	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 operating 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 enable source	L0114 Motor operation flag	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: 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 operating 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.	Function	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 one cycle 3: Output 0 after running for one cycle	Defines the operation 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	Sets 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
P1-04	Simple PLC status reset	0: Inactive	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: 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.

Param.	Function	Default value	Value range	Description
P1-05	Current STEP of the simple PLC	0	This parameter displays the current STEP of the simple PLC.	Displays the current step number and speed of the simple PLC.
P1-06	Current STEP operating time (in hours) of the simple PLC	0	This parameter displays the current STEP running time in hours of the simple PLC.	This parameter displays the current STEP running time in hours of the simple PLC.
P1-07	Current STEP running time in seconds of the simple PLC	0	This parameter displays the current STEP running time in seconds of the simple PLC.	This parameter displays the current STEP running time in seconds of the simple PLC.
P1-08	Simple PLC operating time unit	0: s (second)	0: s (second); 1: h (hour)	Defines the simple PLC operating time unit.
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	0.0 to 6553.5	Defines the operating time of multi-reference 0 set by simple PLC, which is the sum of ramp-up/down time and operating time at constant speed and target frequency.
P1-11	Ramp-up/down 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 ramp-up/down time of multi-reference 0 set by simple PLC.
…	…	…	…	…
P1-54	Multi-reference 15 set by simple PLC	0.0%	-800.0 % to +800.0%	Defines the target frequency of multi-reference 15 of the simple PLC, which is a percentage to the rated motor frequency.

Param.	Function	Default value	Value range	Description
P1-55	Operating time of multi-reference 15 set by simple PLC	0.0s	0.0 to 6553.5	Defines the operation time of multi-reference 15 set by simple PLC, which is the sum of acceleration or deceleration time and operation time at constant speed and target frequency.
P1-56	Ramp-up/down 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.

12.6.7 Motorized potentiometer

Application 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.

Operating 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.

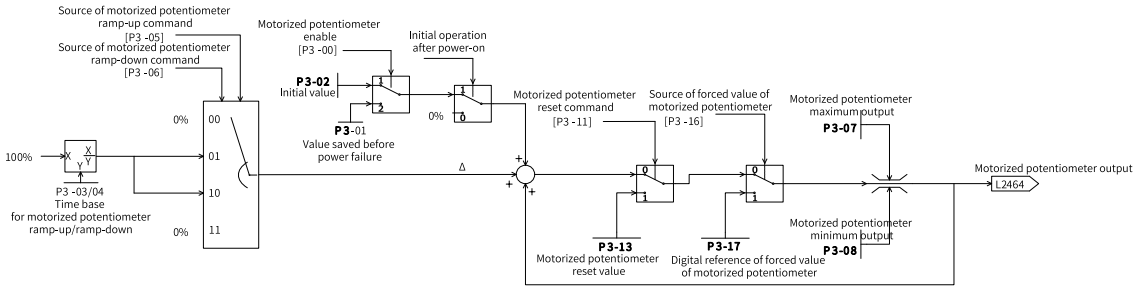


Figure 12-22 Schematic of motorized potentiometer function

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 "Other [F connector]".
3. Set P3-03 [Ramp-up time base of motorized potentiometer] to 10s and P3-04 [Ramp-down time base of motorized potentiometer] to 10s.
4. Set P3-05 [Ramp-up command source of motorized potentiometer] to 3 [DI1] and P3-06 [Ramp-down 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 output of the potentiometer increases from 0% to 10% per second until P3-03 [Ramp-up time base of motorized potentiometer] is 10s where 100% rated frequency is outputted. On the contrary, when DI1 is invalid and DI2 is valid, the output of the potentiometer decreases from 100% to 10% per second until P3-04 [Ramp-down time base of motorized potentiometer] is 10s where the 0% rated frequency is outputted.

Related parameters

Param.	Name	Default value	Value range	Description
P3-00	Motorized potentiometer enable selection	0	0: Disable 1: Enable 3: DI1 4: DI2 5 to 7: DI3 to DI5 Other: B connector	Defines whether the motorized potentiometer function is enabled. Options: 0: Inhibited - The motorized potentiometer is not enabled. 1: Enable - The motorized potentiometer is enabled. 3 to 7: DI1 to DI5. Whether the motorized potentiometer is enabled depends on the terminal state of the DI. 0: Inhibited; 1: Enabled Others: B connector - Whether the motorized potentiometer is enabled depends on the B connector state (0: Inhibited; 1: Enabled)
P3-01	Retention of motorized potentiometer upon power failure	0	0: Disable 1: Active	Defines whether the motorized potentiometer is retentive at power failure. Options: 0: Disable - Non-retentive upon power failure 1: Enable - Retentive upon power failure Note: When this parameter is set to 1, if the motorized potentiometer is enabled before power failure, then the output value of the motorized potentiometer upon next power-on is the value outputted the moment before power failure occurs. When memory retention is disabled, the output value of the motorized potentiometer at next 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.
P3-03	Increasing time base of motorized potentiometer	20.00s	0.00s to 655.35s	Defines the increase rate of the motorized potentiometer, which is the time taken to increase from 0% to 100%.
P3-04	Decreasing time base of motorized potentiometer	20.00s	0.00s to 655.35s	Defines the decrease rate of the motorized potentiometer, which is the time taken to decrease from 100% to 0%.

Param.	Name	Default value	Value range	Description
P3-05	Source of motorized potentiometer increasing command	0	Same as P3-00	Defines the motorized potentiometer ramp-up command is valid. Options: 0: Invalid - The ramp-up command is invalid. 1: Valid - The ramp-up command is valid. 3 to 7: Whether the increase command is valid depends on the terminal state of the DI1 to DI5. 0: Invalid; 1: Valid Other: B connector - Depends on the state of B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Note: 1. After the ramp-up command is active, the value is increased according to the rate defined by P3-03. 2. If the ramp-up command and ramp-down command are set simultaneously, both commands are invalid and the current output remains unchanged.
P3-06	Source of motorized potentiometer decreasing command	0	Same as P3-00	Defines whether the motorized potentiometer ramp-down command is valid. Options: 0: Invalid - The ramp-down command is invalid. 1: Valid - The ramp-down command is valid. 3 to 7: Whether the decrease command is valid depends on the terminal state of the DI1 to DI5. 0: Invalid; 1: Valid Other: B connector - Depends on the state of B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Note: 1. After the ramp-down command is activated, the value is decreased according to the rate defined by P3-04. 2. If the ramp-up command and ramp-down 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.
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.

Param.	Name	Default value	Value range	Description
P3-09	Source 1 of motorized potentiometer pause command	0	Same as P3-00	Defines whether the motorized potentiometer pause command 1 is valid. Options: 0: Invalid - The pause command is invalid. 1: Valid - The pause command is valid. 3 to 7: Whether the pause command is valid depends on the terminal state of the DI1 to DI5. 0: Invalid; 1: Valid Other: B connector - Depends on the state of B connector. 0: Invalid; 1: Valid Note: 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	Same as P3-00	Defines whether the motorized potentiometer pause command 2 is valid. The function description is the same as P3-09.
P3-11	Source 1 of motorized potentiometer reset command	0	Same as P3-00	Defines whether motorized potentiometer reset command 1 is valid. Options: 0: Invalid - The reset command is invalid. 1: Valid - The reset command is valid. 3 to 7: Whether the reset command is valid depends on the terminal state of the DI1 to DI5. 0: Invalid; 1: Valid Others: B connector - Whether the reset command is valid depends on the state of B connector. 0: Invalid; 1: Valid Note: 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	Same as P3-00	Defines whether motorized potentiometer reset command 2 is valid. The function description is the same as P3-11.

Param.	Name	Default value	Value range	Description
P3-13	Source of motorized potentiometer reset value	0	0: Digital reference 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of motorized potentiometer reset value. Options: 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). 10: MD-BP-M potentiometer. The value is the per-unit value of the MD-BP-M potentiometer after curve processing. Others: F connector. - Value of the selected connector
P3-14	Reset value digital setting of motorized potentiometer	0.0%	-600.0 % to +600.0%	Defines the digital reference of the reset value of motorized potentiometer. Note: 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	Same as P3-00	Defines whether the forced command of the motorized potentiometer is valid. Options: 0: Invalid - The forced command is invalid. 1: Valid - The forced command is valid. 3 to 7: DI1 to DI5. Whether the forced command is valid depends on the terminal state of the DI. 0: Invalid; 1: Valid Other: B connector - Depends on the state of B connector. 0: Invalid; 1: Valid Note: When the forced command (P3-15) is 1, the output value of the motorized potentiometer is set to the values defined by P3-16 and P3-17.
P3-16	Forced value source of motorized potentiometer	0	0: Digital reference 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	Defines the source of the forced value after the forced command of the motorized potentiometer is activated. Options: 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). 10: MD-BP-M potentiometer. The value is set through the MD-BP-M potentiometer. Others: F connector. - Value of the selected connector

Param.	Name	Default value	Value range	Description
P3-17	Digital reference of motorized potentiometer forced value	0.0%	-600.0 % to +600.0%	Defines the digital reference of motorized potentiometer reset value. Note: When P3-16 is set to 0, the forced value of motorized potentiometer reset value is the setpoint of P3-17.
P3-38	High-order bits of motorized potentiometer storage	0	0 to 65535	Defines the high bits (those higher than 65535) of the motorized potentiometer saved by P3-38 at next power-on after the memory retention function (P3-01) is enabled.
P3-39	Low-order bits of motorized potentiometer storage	0	0 to 65535	Defines the low bits (those lower than 65535) of the motorized potentiometer saved by P3-39 at next power-on after the memory retention function (P3-01) is enabled.

12.6.8 Brake Control

12.6.8.1 Description

Application scenarios

The motor and the device being driven are kept at zero speed through the mechanical brake when the drive unit is not running. When brake control is enabled, set relevant parameters based on the actual working conditions of equipment and load for effective control by the brake logic to achieve operation safety.

Description

When brake control is enabled, the brake function module outputs the L0700 brake command after internal processing logic. After E1-00 is set to L0700 (Brake command output), the RO1 relay of the drive can be used to control the external mechanical brake mechanism. The brake function is set via P4-00, which is divided into two cases: brake without detection information and brake with detection information. The details are as follows:

1. Set P4-00 to 2 (brake with detection information). The brake will detect the brake feedback status set by P4-04. After the brake release time (P4-02) expires, the drive expects the brake release signal within the brake feedback fault delay time (P4-05). If the signal is not received, the drive reports a brake release failure. After the brake close time (P4-03) expires, the drive expects the brake close signal within the brake feedback fault delay time (P4-05). If the signal is not received, the drive reports a brake close failure. When the brake feedback signal is high level, the brake is closed; when the brake feedback signal is low level, the brake is released.

2. Set P4-00 to 1 (Brake without detection information). The brake is controlled only by the set release and close time, and no longer detects the actual status. Specify P4-25, P4-26, and P4-27 to set the brake release conditions. For example, you can set the condition that the brake can be

released only when the output torque is greater than a specified value (to ensure that the gravity load does not slip at brake release). Note that the system speed loop neither works or generates torque output before the brake is released. Therefore, when the source of the brake release comparison value is set in P4-25 and when the comparison value source is the output torque, you also need to set the starting torque in P4-09 to meet the conditions for brake release.

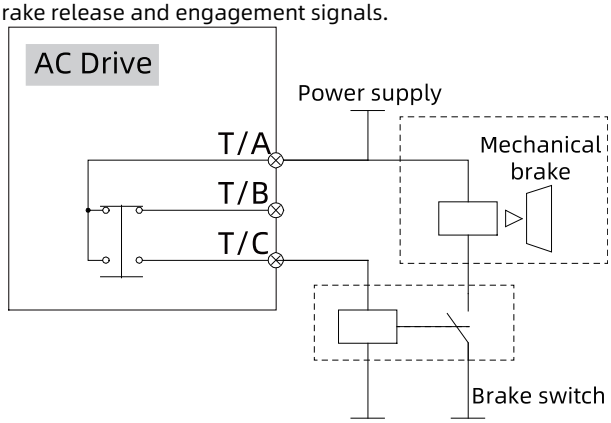
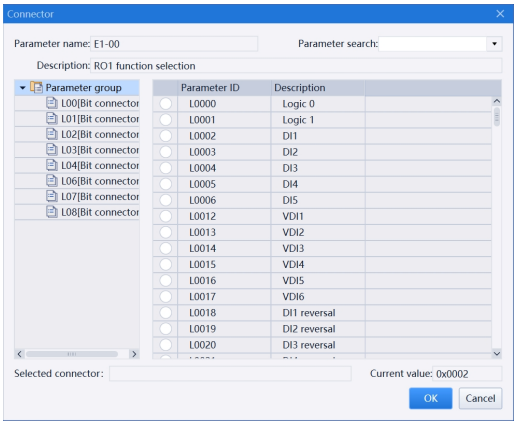
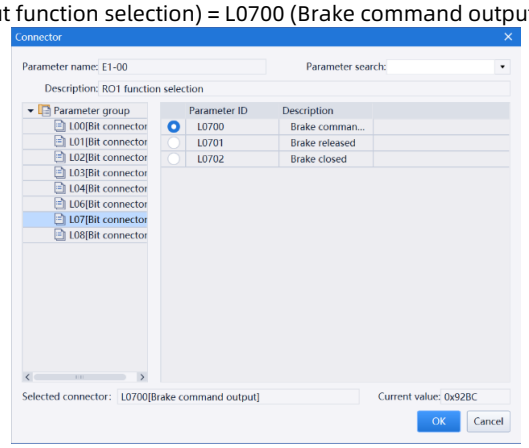
Note

During the trial run, check that the brake operation is normal. If the operation is abnormal, adjust the relevant brake parameters according to actual conditions.

12.6.8.2 Brake Control Implementation Steps

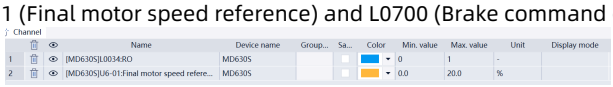
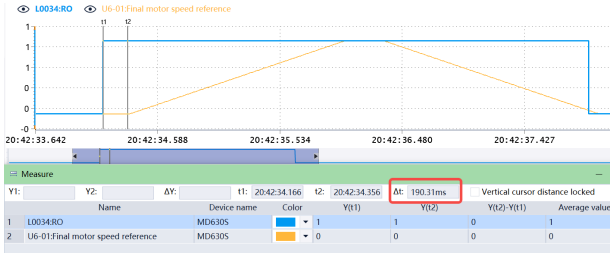
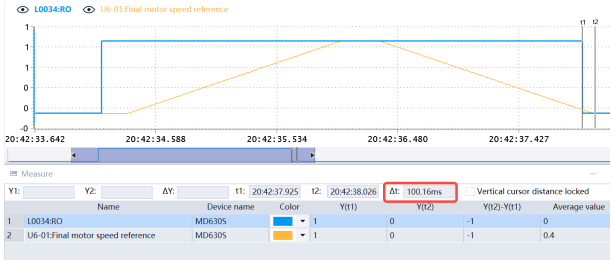
Note

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 *"7.2.1 Downloading and Installing Software" on page 147*.

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 to other (B connector). In the displayed connector dialog box, select L0001 (Logic 1). Check whether the motor brake is released to determine whether the motor brake is wired correctly.  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.

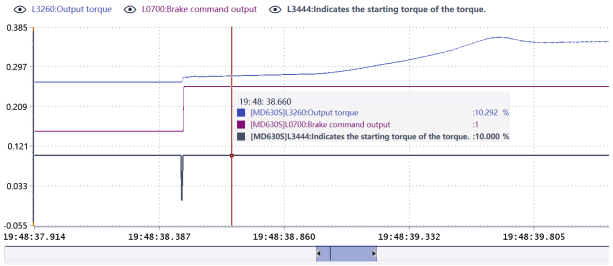
<table>
<tr><th>Task steps</th><th>Description</th></tr>
<tr><td>Step 3: Complete motor parameter auto-tuning</td><td>According to the motor nameplate or motor design values, input the rated motor parameters into F1-00~F1-11.
For detailed information on motor parameter auto-tuning, please refer to "8.9.1 Auto-Tuning Step" on page 197.
<table>
<tr><th>Motor status</th><th>Auto-tuning mode</th><th>Description</th></tr>
<tr><td>Motor no load (Recommended)</td><td>Dynamic parameter auto-tuning</td><td>It is recommended to perform dynamic auto-tuning before installing the load on 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, and under safe conditions, you can choose one of the following methods:
• 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>if the motor is already connected to a load, only static motor parameter auto-tuning can be performed.</td></tr>
</table></td></tr>
</table>

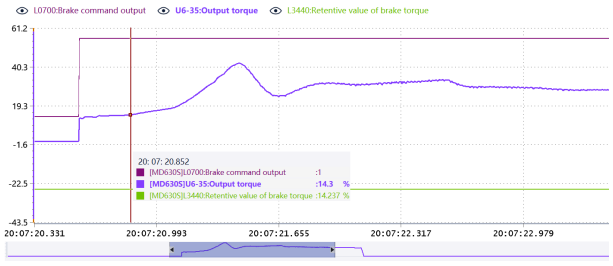
<table>
<tr><th>Task steps</th><th>Description</th></tr>
<tr><td>Step 4: Set the brake release action time and brake apply action time</td><td>
You can set the brake release and apply time to the default value of 200ms under normal conditions. If the brake has been in use for a long time or the brake 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 200ms. 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: Under SVC control, do not set an excessively long brake apply action time in order to meet requirements; otherwise it may cause prolonged zero-speed holding time and lead to instability.
</td></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 releasing the brake to prevent the motor from running away. The following are several common application scenarios requiring starting speed or torque.

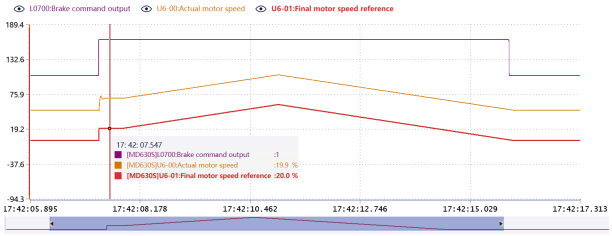
• Require starting torque to prevent the motor from running away: applicable for SVC or FVC control in scenarios with stable load.

Set the parameters as follows:
<table>
<tr><th>Parameter</th><th>Function</th><th>Parameter value</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>
</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>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 slipping 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 748</td></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>Parameter</th><th>Function</th><th>Parameter value</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>This torque value is used as the retentive torque during initial start, which can be set based on 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 selection</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 749
 
</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 runaway: applicable for V/f control, in scenarios with stable load.
<table>
<tr><th>Parameter</th><th>Function</th><th>Parameter value</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 reference of startup speed</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></td></tr>
<tr><td>Step 5: Set starting torque and starting speed</td><td>Set P4-13 (Starting speed source) and P4-14 (Digital setting of starting speed). During brake release, the motor final speed reference will be forced to the value of P4-14, instead of accelerating from zero speed. This allows the motor to quickly build torque and prevent the load from running away. 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 slipping 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 748.</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, only one of which 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>Parameter</th><th>Function</th><th>Parameter value</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>Parameter</th><th>Function</th><th>Description</th></tr>
<tr><td>P4-40</td><td>Braking self-test enable</td><td>You can control whether to enable the automatic rest through the connector. When this parameter is set to 1, the detection action is executed before completion of excitation and brake release.</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 brake test</td><td>Defines the torque direction, which can be modified through the connector. The output is generated and the brake is tested based on positive torque by default.</td></tr>
<tr><td>P4-44</td><td>Slip speed threshold of brake 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 brake test</td></tr>
</table></td></tr>
</table>

12.6.8.3 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 disabling delay

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 d0-16 shutdown delay time can maintain excitation for a longer period after the brake is closed, thus eliminating the need for excitation during the next brake release. The d0-16 shutdown delay time needs to be greater than the brake apply action time. If d0-16 value is set to be less than the brake apply action time, it will not be possible to maintain excitation after the brake is applied.

Parameter	Name	Description
d0-16	Shut-down delay time	PWM output can be inhibited 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 can be blocked only after the time specified by P4-03 elapses after the brake close signal is output (L0700 = 0).

Starting torque restriction

In some lifting load scenarios, the brake can be released only when the load torque is greater than the threshold for safety 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, then set P4-25 = L3260, P4-26 = the required comparison threshold, and set

P4-27 to a delay time. When the absolute value of P4-25 is greater than P4-26 and the duration exceeds the value indicated byP4-27, the AC drive enters the brake release state.

12.6.8.4 Troubleshooting for Common Problems

Frequently Asked Questions	Solution
Runaway after brake releasing	The starting torque or starting speed is not set properly. Follow the brake commissioning guide to correctly set the brake parameters. For details, see *"12.6.8.2 Brake Control Implementation Steps" on page 741*.
	Speed loop response is enhanced in SVC mode. Before releasing the brake, the speed loop is not active. During startup, the speed loop response is slow, leading to runaway. You can appropriately enhance the speed loop response. In SVC mode, increase D3-02 (SVC speed loop Kpp) properly.
	If the tarting 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.
Runaway occurs upon brake apply.	The brake apply time is too short. If torque is removed before the mechanical brake is fully applied, severe brake wear or short brake apply time can lead to a runaway. You can slowly increase P4-03 (Brake apply time) to extend the time of output current of the drive.
Overshoot during brake release	The set brake release time is too short. If the brake release time is set too short, severe brake wear may occur. Outputting torque before the brake is fully released may can an overshoot during brake release.
Long startup time causes poor device following performance	Long startup time may be caused by the set value of the brake release action time being larger than the actual value. Refer to step 4 in the brake commissioning guide to shorten the brake release time gradually.
	Shorten P4-27 [Brake apply delay time].
	When the motor type is asynchronous, in a continuous operation condition, you can use the excitation delay turn-off function to shorten the motor excitation time, thus improving the startup time. For details, see *"10.5.1.2 Direct Start of Asynchronous Motor (Pre-excitation Start)" on page 401*
The brake does not apply or the apply time is too long at motor zero speed.	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 *"12.6.8.2 Brake Control Implementation Steps" on page 741*.

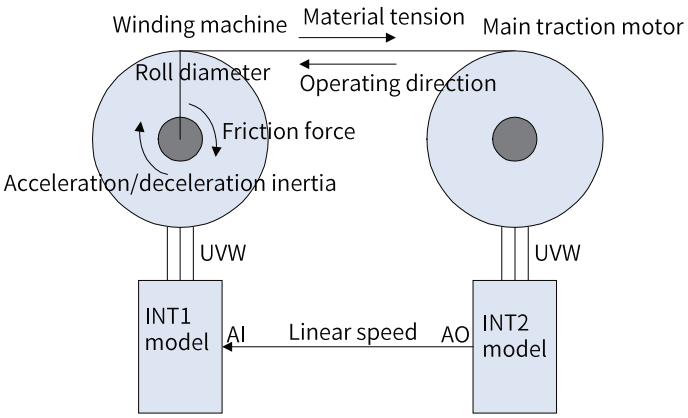
12.6.9 Tension Control

12.6.9.1 Examples of Typical Applications

Select the proper tension control and winding modes as required, and set the running direction correctly to ensure tension control.

12.6.9.1.1 Tension Open-Loop Torque Control

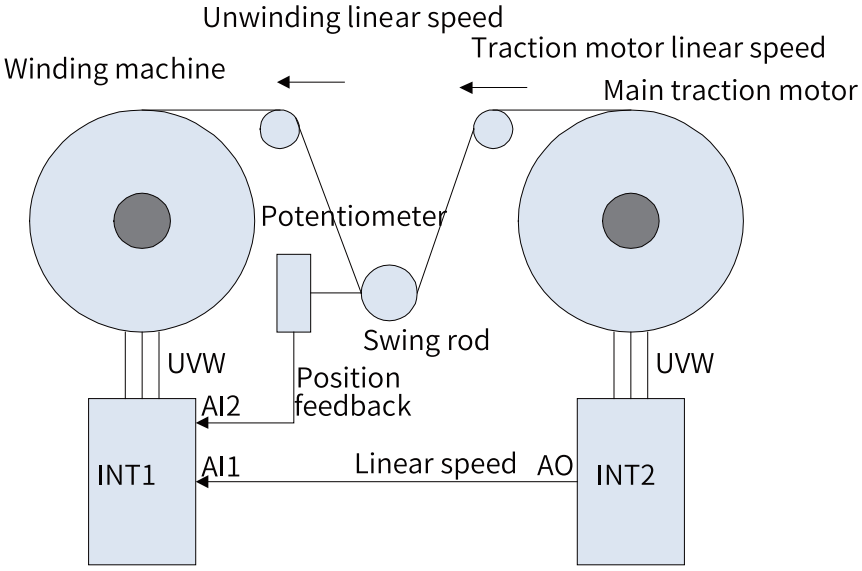
In this mode, no swing rod (floating roller) or tension sensor is required. Tension accuracy is slightly low. This control mode is applicable to scenarios where tension accuracy is not critical.



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.

12.6.9.1.2 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.

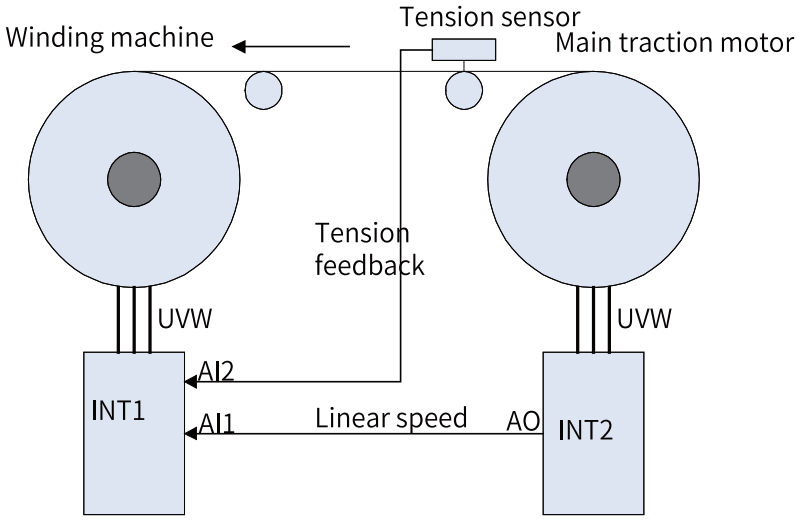


As shown in the preceding figure, when the winding machine works in closed-loop speed control mode, two AI signal channels receive potentiometer signals of the swing rod and linear speed signals of the main traction motor, respectively. The roll diameter is calculated based on linear speed control. The 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.

12.6.9.1.3 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.

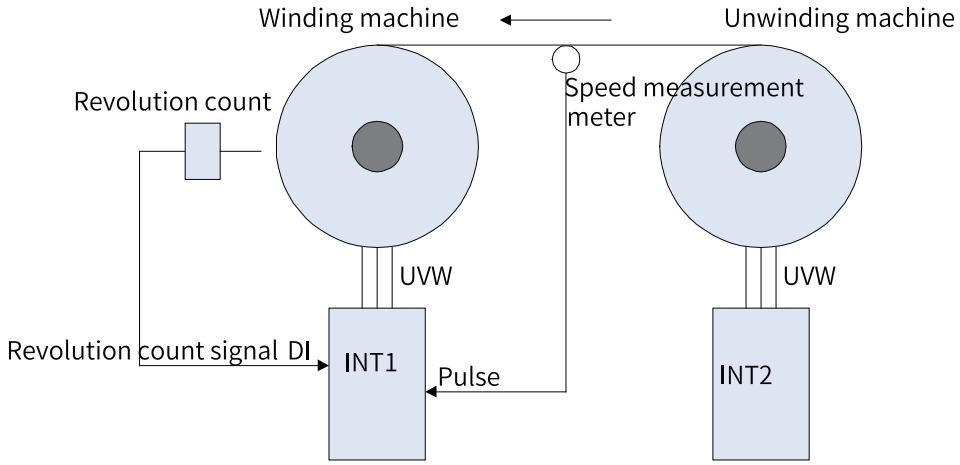


In the preceding figure, when the winding machine works in closed-loop torque control mode, two AI signal channels receive tension sensor signals and main traction motor linear speed signals, respectively. When tension is controlled in the "open-loop tension reference plus tension sensor regulation" 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.

12.6.9.1.4 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.

Note: The above typical application solutions illustrate the applicable scenarios for the four tension control modes. When basic conditions are met, flexible handling can be applied according to actual circumstances.

12.6.9.1.5 Application Restrictions

The preceding section describes four typical tension control applications, which are determined by roll diameter, linear speed, and control feedback.

Table 12–14 Required conditions for tension control modes

Control Mode	Roll diameter[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

Note:

1: If the roll diameter is calculated based on linear speed (PD-09 = 0), the linear speed is required.

2: Inertia compensation and friction compensation are associated with linear speed, so the linear speed is required in applications.

12.6.9.2 Function

12.6.9.2.1 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.

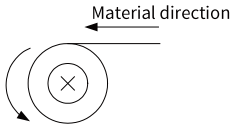
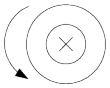
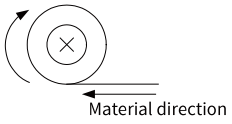
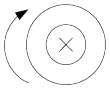
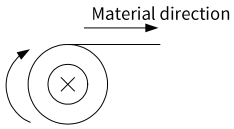
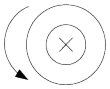
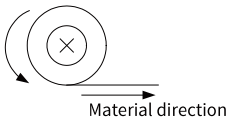
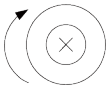
Parameter code	Name	Default value	Value range	Description
PD-00	Tension control mode	0	0: Inactive 1: Open-loop torque control mode 2: Closed-loop speed control mode 3: Closed-loop torque control mode 4: Constant linear speed control mode	Used to select the tension control mode. 0: Inactive Used for direction judgment and parameter auto-tuning. 1: Open-loop torque control mode Tension/Position detection and feedback are not required. The drive controls the torque output to adjust the tension on the material in the torque control mode. 2: Closed-loop speed control mode 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 control mode can be SVC or V/f control mode. 3: Closed-loop torque control mode Tension detection and feedback are required. Based on the set torque in the open-loop torque control mode, the drive controls the output torque to obtain the required tension by applying the PID closed-loop operation. 4: Constant linear speed control mode In the speed mode, the drive adjusts its operating frequency according to the change of the roll diameter to ensure that the drive runs at a constant linear speed. The control mode can be SVC or V/f control mode.

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 code	Name	Default value	Value range	Description
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. To switch between winding and unwinding, modify PD-01 directly, or change the state of the winding/unwinding switching terminal without modifying PD-01 (otherwise, misfunction may occur).

12.6.9.2.2 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.

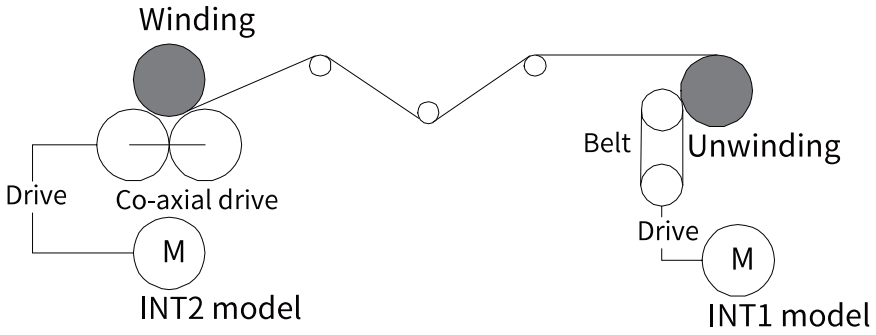


Figure 12-23 Surface winding/unwinding

Roll diameter calculation method

Table 12–15 Parameters for roll diameter calculation method

Parameter code	Name	Default value	Value range	Description
PD-09	Winding diameter calculation method	0	0: Calculated based on linear speed 1: Calculated based on accumulative thickness 2: AI1 3: AI2 4: AI3 5: Pulse input (DI5) 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 roll diameter can be obtained through channels 2 to 6 to meet the situation that the roll diameter is directly measured by sensors or the roll diameter operation is performed outside the AC drive. When using the preceding channels, the maximum roll diameter (PD-10) should be set correctly according to the per-unit relationship. If AI1 is used as the roll diameter channel, the roll diameter corresponding to 100.0% of AI1 input will be the maximum roll diameter (PD-10). 7: PD-16 When the roll diameter channel is set to 7, the roll diameter is set directly by PD-16, which can be used as an additional communication address or used when the roll diameter is manually set during commissioning.

Initial reel diameter

Table 12–16 Relationship between the initial winding 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 roll replacement, running faults, or other reasons, the roll diameter often changes. To ensure accurate roll diameter during startup of the system, roll diameter must be reset by enabling the function roll diameter reset of the active DI.

Table 12–17 Parameters related to the initial roll diameter

Parameter code	Name	Default value	Value range	Description
PD-10	Maximum roll diameter	500.0 mm	PD-11 to 6000.0 mm	Defines the actual full reel diameter.
PD-11	Empty winding diameter	100.0 mm	0.1 to PD-10 (mm)	Defines the actual full reel diameter.
PD-12	Initial roll diameter source	0	0: PD-13 to PD-15 1: AI1 2: AI2 3: AI3 4: Communication (1000H)	0: By default, the source of the initial roll diameter is set by PD-10 or PD-11 depending on the winding mode. 1 to 4: The initial roll diameter can be obtained through channels 1 to 4. When using the preceding channels, the maximum roll diameter (PD-10) should be set correctly according to the per-unit relationship.
PD-13	Initial roll diameter 1	100.0 mm	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 mm	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 mm	PD-11 to PD-10 (mm)	For details about initial roll diameters 1 to 3, see PD-12.
PD-16	Current reel diameter	100.0 mm	PD-11 to PD-10 (mm)	This parameter shows the current roll diameter in real time. Modifying this parameter can change 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: Inhibited 1: Allowed	This parameter can be used to enable roll diameter reset during operation.

Roll diameter calculation based on linear speed

Table 12–18 Parameters for roll diameter calculation based on linear speed (they affect roll diameter calculation only when PD-09 is set to 0)

Parameter code	Name	Default value	Value range	Description
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 roll diameter (PD-09 = 0), the larger the parameter is, the larger the calculated roll 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 is active only when PD-09 is set to 0. When the linear speed is lower than the value of this parameter, the current roll diameter is maintained. When the linear speed is higher than the value of this parameter, the roll diameter is calculated. This parameter can be used to solve the problems that the running frequency is low or the roll diameter calculation is incorrect during acceleration.
PD-18	Roll diameter filter time	5.00s	0.00s to 10.00s	This parameter is active only when PD-09 is set to 0. You can set this parameter to filter the result of roll diameter operation and suppress the jitter of roll diameter. The higher the setpoint, the smoother the roll diameter operation, and the longer the roll diameter change delay. Rule: When the roll diameter changes linearly, the time that the calculated roll diameter lags behind the actual roll diameter is basically equal to the parameter value.
PD-19	Roll diameter change rate	0	0: Unlimited. 0.1 mm/s to 1000.0 mm/s	This parameter is active 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 roll diameter change, affecting the real-time roll 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 is active 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 roll diameter calculation result will be caused.

Roll diameter calculation based on thickness accumulation

Table 12–19 Parameters for roll diameter calculation based on cumulative thickness (affecting roll diameter calculation only when **PD-09** is set to 1)

Parameter code	Name	Default value	Value range	Description
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	Defines the number of revolutions for each layer of winded materials. Set this parameter to 1 in cable/strip applications.
PD-37	Material thickness reference source	0	0: Digital reference 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: When PD-37 is set to 0, set DI1 to DI terminal function 62 and DI2 to DI terminal function 63. 1 to 3: The initial roll 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 material thickness, see PD-37.

Table 12–20 Material Thickness

DI2	DI1	Initial roll diameter source
0	0	Depending on PD-38
0	1	Depending on PD-39
1	0	Depending on PD-40
1	1	Depending on PD-41

12.6.9.2.3 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 12–21 Related parameters

Parameter code	Function	Default value	Value range	Description
PD-04	Linear speed input source	0	0: PD-05 1: AI1 2: AI2 3: AI3 4: Reserved 5: Communication (1000H)	0: 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 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. The value can be used as an additional communication address for the linear speed 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. (Note that it differs from the maximum linear speed required by production.) When the linear speed is used to calculate the roll diameter (PD-09 = 0), the larger the parameter is, the larger the calculated roll 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: Reserved 5: Communication (1000H)	B0-41 is used to select the target linear speed source in the constant linear speed control mode. 0: PD-45 (The setpoint is non-retentive upon power failure.) 1 to 5: If the constant 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 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. The value can be used as an additional communication address for the constant linear speed set through communication.

12.6.9.2.4 Tension setting

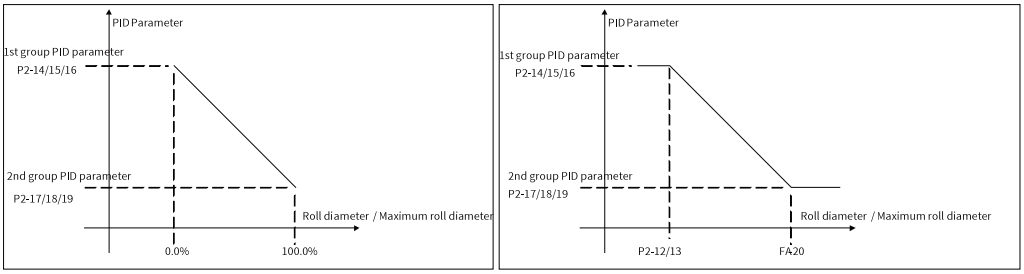
In the open-loop torque control mode (PD-00 = 1) or closed-loop torque control mode (PD-00 = 3), tension control is implemented by controlling the output torque. Therefore, set the target tension based on material characteristics and production requirements.

Parameter code	Name	Default value	Value range	Description
PE-00	Tension reference source	0	0: PE-01 1: AI1 2: AI2 3: AI3 4: Reserved 5: Communication (1000H)	0: Set by 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	0.000s to PE-02N	For digital setting of the tension, see channel 0 of PE-00.
PE-02	Maximum tension	500 N	0 N to 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.

12.6.9.2.5 PID Closed-Loop Adjustment

In the closed-loop speed control mode (PD-00 = 2) and closed-loop torque control mode (PD-00 = 3), PID closed-loop adjustment based on the open-loop reference is important to ensure control accuracy. Therefore, the parameters for PID closed-loop adjustment must be set properly. In the closed-loop speed control mode and closed-loop torque control mode, set closed-loop control parameters in group FA, such as PID reference source, PID feedback source, PID direction, and PID proportional, and PID integral based on actual conditions. For descriptions of these parameters, see section of group FA. The following section only introduces settings which are different from common PID 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 12-24 Automatic adjustment based on roll diameter

Parameter code	Component	Default value	Value range	Description
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 P2-12/13 and FA-20, the PID parameters change linearly.

12.6.9.2.6 Winding Speed Limits and Unwinding Reverse Tightening

This function is valid only in torque mode (PD-00 = 1 or 3).

No.	Scenario	Description
1	Winding scenarios where the winding speed is not limited (subject to the frequency upper limit).	When PD-32 is set to 0, the speed limit is set to the frequency upper limit.
2	Winding scenarios where the winding speed is limited	When PD-32 is set to 1, the speed limit is calculated by adding an offset frequency to the product of the synchronous frequency (operating frequency at which the winding machine matches the current line speed) and the proportional gain. The formula is as follows: winding frequency upper limit = linear speed synchronous frequency x (1 + PD-30) + PD-31.
3	Unwinding scenarios where revers tightening is disabled	PD-02 = 0
4	Unwinding scenarios where revers tightening is enabled	Reverse tightening at fixed linear speed can be enabled through PD-02.

Parameter code	Component	Default value	Value range	Description
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 Hz to 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, the unwinding axis does not generate output and the material is not tightened upon zero speed of the material. If this parameter is set to 0.1 m/min to 500.0 m/min, the unwinding axis 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.

12.6.9.2.7 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 code	Component	Default value	Value range	Description
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 Hz to 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 adjustment value to the open-loop control torque reference in the closed-loop torque control mode (PD-00 is set to 3).

12.6.9.2.8 Tension Torque Compensation

This function is applicable only to the torque control mode. Set parameters in this section properly to optimize the tension control effect, improve the tension stability, and increase the system response speed.

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).

12.6.9.2.8.1 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.

Parameter code	Component	Default value	Value range	Description
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 roll 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.
PE-17	Friction force compensation curve	0	0: Running frequency 1: Linear speed 2: Multi-friction compensation curve 1 3: Multi-friction compensation curve 2	Four 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 converted 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. See parameters PE-18 to PE-23 for details. 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-friction compensation torque 2	0.0%	0.0% to 50.0%	-
PE-20	Multi-friction compensation torque 3	0.0%	0.0% to 50.0%	-

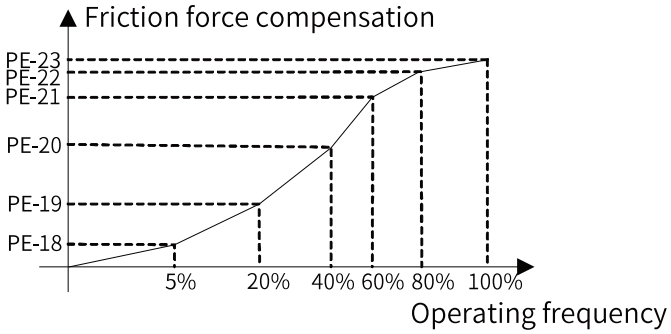
Parameter code	Component	Default value	Value range	Description
PE-21	Multi-friction compensation torque 4	0.0%	0.0% to 50.0%	-
PE-22	Multi-friction compensation torque 5	0.0%	0.0% to 50.0%	-
PE-23	Multi-friction compensation torque 6	0.0%	0.0% to 50.0%	-
PE-24	Multi-segment friction compensation inflection point 1	0.00 Hz	0.00 Hz to maximum frequency	-
PE-25	Multi-friction compensation inflection point 2	0.00 Hz	0.00 Hz to maximum frequency	-
PE-26	Multi-friction compensation inflection point 3	0.00 Hz	0.00 Hz to maximum frequency	-
PE-27	Multi-friction compensation inflection point 4	0.00 Hz	0.00 Hz to maximum frequency	-
PE-28	Multi-friction compensation inflection point 5	0.00 Hz	0.00 Hz to maximum frequency	-
PE-29	Multi-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.

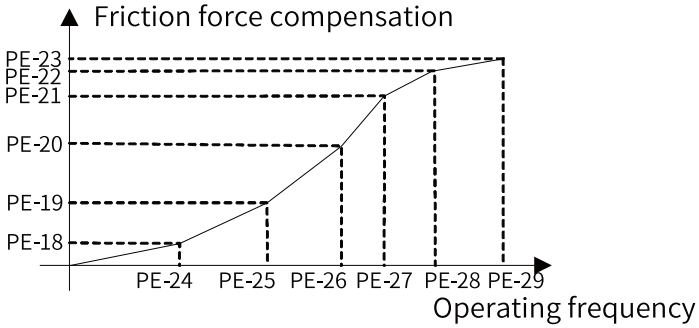
When PE-17 is set to 2, parameters PE-18 to PE-23 take effect. When PE-17 is set to 3, PE-18 to PE-29 take effect.

The change curves of friction compensation values are as shown in the following figures. You can set B1-18 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.



12.6.9.2.8.2 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 code	Component	Default value	Value range	Description
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 setting should 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 boost at the threshold.

The preceding three parameters can be used together for static compensation, as shown below.

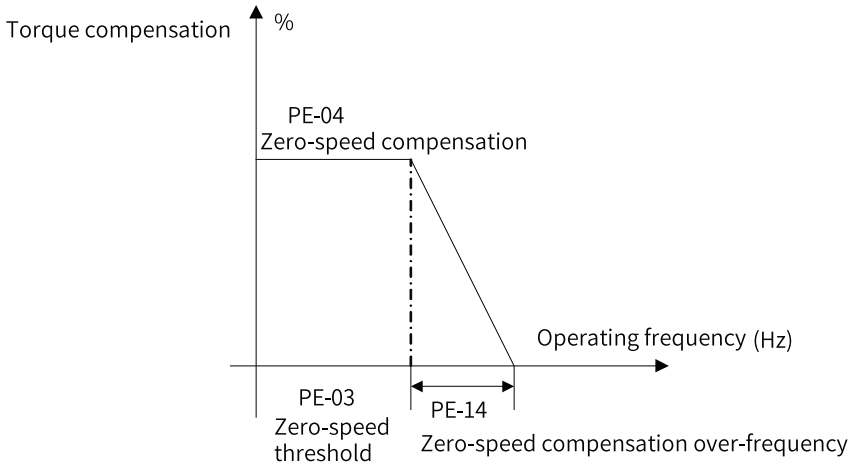


Figure 12-25 Static friction compensation function

12.6.9.2.8.3 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.

In any of the following cases, consider inertia compensation:

- 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 relationship 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.

Note: Accurate linear speed is required for inertia compensation.

Parameter code	Component	Default value	Value range	Description
PE-08	Mechanical inertia compensation coefficient	0 N·m²	0-65535 N·m²	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: $GD_M^2=\frac{\pi g}{8i^2}\gamma b\left(D^4-D_0^4\right)$ Where, g is the gravitational acceleration (9.8 m/s²), γ is the density of machine materials, b is the length of the mechanical reel, D and D_0 are the outer diameter and inner diameter (0 for a solid reel) of the mechanical reel respectively, 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/m³	0-65535 kg/m³	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 mm to 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. Take the winding acceleration as an example. If the material tension is small, PE-09 can be increased to strengthen the compensation effect; otherwise, the parameter can be reduced. It works the same for deceleration. This set of parameters can provide some convenience for commissioning.
PE-10	Correction of deceleration inertia compensation	100.0%	0.0% to 200.0%	

12.6.9.2.8.4 Terminal tension rise

In some scenarios, customized torque boost is required.

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.

Parameter code	Component	Default value	Value range	Description
PE-33	Terminal tension rise ratio	50.0%	0.0% to 500.0%	-
PE-34	Terminal torque boost cancellation time	0.0s	0.0s to 50.0s	-

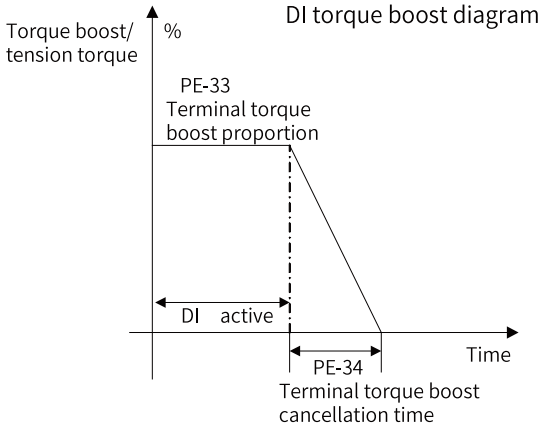


Figure 12-26 DI torque boost function

12.6.9.2.8.5 Torque direction control parameters

Parameter code	Component	Default value	Value range	Description
PE-15	Open-loop torque reverse allowance	0	0: Reverse torque inhibited 1: Reverse torque allowed	This parameter takes effect only when PD-00 is set to 1 or 3. After the friction and inertia compensation is 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.

12.6.9.2.9 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. The parameters are valid only in the winding mode (PD-01 = 0).

Param.	Name	Default value	Value range	Parameter description
PF-00	Taper curve selection	0	0: Curve taper 1: Multi-linear taper	Used to set the generation mode of the taper curve. 0: The specific taper curve is generated according to the taper setting and taper compensation correction value (PF-03). See the description of PF-03 for details. 1: For details of the multi-segment linear taper, see descriptions of PF-08 to PF-19.
PF-01	Tension taper source	0	0: PF-02 1: AI1 2: AI2 4: Communication (1000H)	0: Set by PF-02 1 to 2: Defined by analog channels 1 to 2. 4: Set through the communication address 1000H.
PF-02	Taper digital setting	0.0%	0.0% to 100.0 %	See channel 0 of PF-01.
PF-03	Correction value of tension taper compensa-tion	0 mm	0-10000 mm	Used to set the correction value of taper compensation. The curve taper is implemented together with the taper setting. The taper value can be determined according to the following formula, which is one of several typical implementation methods adopted by the current software: $F=F_0 \times [1 - K \times (1 - (D_0 + D_1)/(D + D_1))]$ Where, F is the tension after taper is set; F_0 is the tension before taper is set, which is set by PF-00; K is the taper value, which is set by PF-01; D_0 is the reel diameter set by D1-09; D is the current roll diameter set by D1-16; D_1 is the correction coefficient of taper compensation.
PF-05	Maximum external taper source	0	0: PF-06 1: AI1 2: AI2 4: Communication (1000H)	In some cases, the material tension is determined by the external actuator. The external taper output function can be used to control the external executive parts to achieve the purpose of 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 output value when the roll is empty. Its value setting channel is determined by this parameter. 0: Set by PF-06 1 to 2: Defined by analog channels 1 to 2. 4: Communication setting (1000H)
PF-06	External taper setting	100.0%	0.0% to 100.0 %	See channel 0 of PF-05 for digital setting of the maximum external taper.
PF-08	Minimum winding diameter taper	100.0%	0.0% to 100.0 %	Taper corresponding to the minimum winding diameter
PF-09	Linear taper switchover point 1	150.0 mm	PD-11 to PF-11	Winding diameter 1 set by multi-point linear taper curve

Param.	Name	Default value	Value range	Parameter description
PF-10	Taper of switchover point 1	100.0%	0.0% to 100.0 %	Taper 1 set by multi-point linear taper curve
PF-11	Linear taper switchover point 2	200.0 mm	PF-09 to PF-13	Roll diameter 2 set by multi-point linear taper curve
PF-12	Taper of switchover point 2	90.0%	0.0% to 100.0 %	Taper 2 set by multi-point linear taper curve
PF-13	Linear taper switchover point 3	250.0 mm	PF-11 to PF-15	Roll diameter 3 set by multi-point linear taper curve
PF-14	Taper of switchover point 3	80.0%	0.0% to 100.0 %	Taper 3 set by multi-point linear taper curve
PF-15	Linear taper switchover point 4	300.0 mm	PF-13 to PF-17	Roll diameter 4 set by multi-point linear taper curve
PF-16	Taper of switchover point 4	70.0%	0.0% to 100.0 %	Taper 4 set by multi-point linear taper curve
PF-17	Linear taper switchover point 5	400.0 mm	PF-15 to PD-10	Roll diameter 5 set by multi-point linear taper curve
PF-18	Taper of switchover point 5	50.0%	0.0% to 100.0 %	Taper 5 set by multi-point linear taper curve
PF-19	Maximum winding diameter taper	30.0%	0.0% to 100.0 %	Taper corresponding to maximum winding diameter

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.

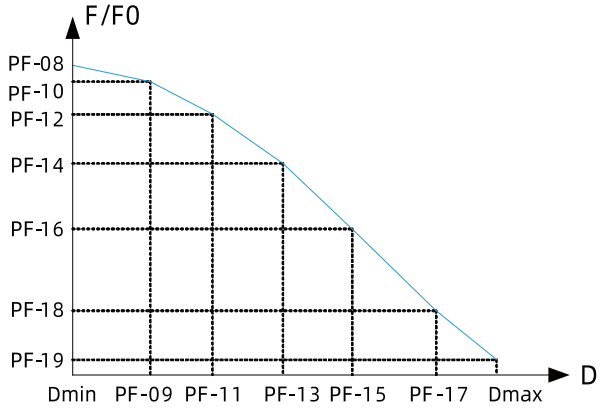


Figure 12-27 Multi-point linear taper curve

12.6.9.2.10 Pre-drive

The pre-charge 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, use the DI function (pre-charge) and set parameters in this group properly.

Accurate linear speed and roll diameter are required for this function.

Parameter code	Component	Default value	Value range	Description
PD-22	Pre-drive speed gain	0.0%	-100.0% to 200.0%	During pre-driving, 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 tension control open-loop torque (only for mode 1 and mode 3).
PD-24	Pre-drive torque correction	0.0%	-100.0% to 100.0%	This function is activated when PD-23 is set to 1, and is used to correct the tension control torque in the pre-charge mode. To prevent slow pre-charge acceleration due to a small torque limit when PD-23 is set to 1, set a lower torque limit in pre-charge mode.
PD-26	Pre-drive acceleration time	20.0s	0.0s to 6000.0s	PD-26, PD-27, and PD-28 are used to set the time as a group, corresponding to the acceleration and deceleration time when the roll diameter is the minimum. 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-charge mode	0.0%	0.0% to 100.0 %	

Parameter code	Component	Default value	Value range	Description
PD-29	Pre-charge roll diameter calculation function	0	0: Inhibited 1: Allowed	This parameter is valid only when PD-09 is set to 1. When the roll diameter is calculated by thickness accumulation, the roll diameter increases/decreases with the number of revolutions of the reel. At this time, this parameter can be set to a valid value to avoid the cumulative error caused by the failure of roll diameter calculation during pre-driving. You can set this parameter as required.

12.6.9.2.11 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 code	Name	Default value	Value range	Description
PD-44	Constant linear speed source selection	0	0: PD-45 1: AI1 2: AI2 4: Reserved 5: Communication (1000H)	0: Digital setting of D1-45 and non-retentive upon power failure 1 to 2: AI channel 4: Defined by 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.

12.6.9.2.12 Optimization for Control Mode

12.6.9.2.12.6 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.

Param.	Name	Default value	Value range	Description
PE-30	Tension establishment	0	0: Off 1: Enable	In closed-loop control mode, when PE-30 is set to 0, the pre-speed tension set-up function is disabled. When PE-30 is set to 1, the pre-speed tension set-up function is enabled.
PE-31	Tension establishment dead zone	2.0%	0.0% to 100.0 %	The PID operation stops when the pre-speed tension set-up 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 . 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.

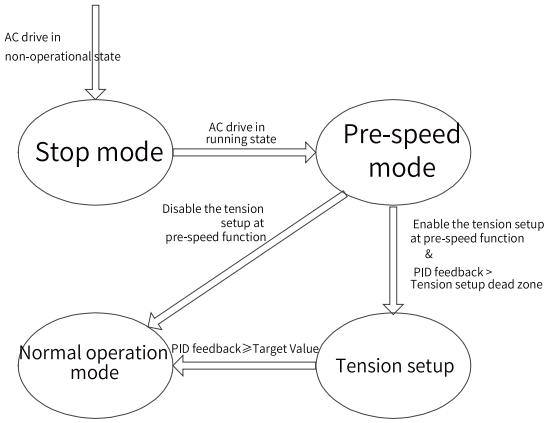


Figure 12-28 Diagram of tension setup at zero speed

12.6.9.2.12.7 Closed-loop Tension Torque Mode

You can set the tension in closed-loop torque control mode by using PID alone or main torque + PID.

Parameter code	Component	Default value	Value range	Description
PD-33	Closed-loop tension torque mode selection	0	0: Torque is calculated by pure PID 1: Torque is calculated by main frequency + 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.

In main frequency + PID mode, accurately configure the tension corresponding to 100.0% of PID feedback value, and set parameter PE-02.

12.6.9.2.13 Related I/O Functions

12.6.9.2.13.8 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.

You can set the DI function through PF-30 to PF-42, virtual DIs, or communication. The general terminal functions of the drive are not described here.

DI function: Thickness accumulation

When the roll diameter is calculated based on cumulative thickness, set this function for the DI to input revolution count signals from the terminal.

DI function: 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.

DI function: 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.

DI function: 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.

DI function: Winding/unwinding switchover

Winding/unwinding switchover is performed without modifying the parameter, greatly facilitating the operation. For details of use, see PD-01.

DI function: Roll diameter calculation stopped

When the terminal is activated, the roll diameter calculation is disabled.

DI function: 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).

DI function: Terminal tension rise

When the DI is activated, the tension torque is increased by a certain ratio. After the DI is deactivated, the increase value will be decreased gradually based on time. For details, see parameter descriptions of PE-33 and PE-34.

DI function: 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/PD-39/PD-40/PD-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 roll diameter. When these two terminals are active, PD-41 is selected as the material thickness.

DI function: Passive unwinding (cable reel application)

The drive does not support this function.

Emergency stop - Tension torque compensation enable

In tension mode, when PE-54 is enabled, the PI switches to the emergency stop PI parameter (PE-51 to PE-53).

12.6.9.2.13.9 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).

12.6.9.2.14 Monitoring

The following table lists monitoring parameters, which can be monitored through an operating panel or in the background in real time.

Parameter code	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	This parameter represents 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.

Parameter code	Parameter name	Unit	Description
U7-08	Tension control state machine	1	Defines the state of the tension process, where: The value 0 indicates a non-tension control state, during which the tension process is invalid; The value 10 indicates the open-loop torque control state; Values 20 to 23 indicate the closed-loop tension speed control state, where the value 20 represents the shutdown branch state, the value 21 represents the pre-speed branch state, the value 22 represents the tension setup branch state, and the value 23 represents the normal operation branch state; Values 30 to 33 indicate the closed-loop tension torque control state, where the value 30 indicates the shutdown branch state, the value 31 indicates the pre-speed branch state, the value 32 indicates the tension buildup branch state; and the value 33 indicates the normal operation branch state; The value 40 indicates the constant linear speed control mode; The value 50 indicates the 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.

Parameter code	Parameter name	Unit	Description
U7-18	Dynamic friction torque	0.1%	This parameter represents the frictional torque caused by the dynamic frictional force during operation.
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%	The actual effective maximum torque is determined by comparing the maximum torque calculated for vertical cable drums with the maximum torque set by PD-52.
U7-24	Torque lower limit in vertical cable drum application (actual value)	0.1%	The actual effective minimum torque is determined by comparing the calculated minimum torque for vertical cable drums with the minimum torque set by PD-53.
U7-25	Closed-loop tension (speed/torque) PID output	0.1%	Defines the PID calculation output value (namely, the sum of proportional, integral, and derivative output) 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.

12.7 Fire Mode

12.7.1 Fire Mode

Application scenarios

In emergency situations such as fires, the drive can enter the 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. In the fire mode, the drive supports bypass operation, allowing the motor to be connected directly to the power grid for operation. You can set the logic conditions of the fire mode through parameters in group J6.

Note

When operating in the fire mode, the drive is in an extreme abnormal operating environment, which may lead to product damage. Damage incurred under such conditions may void the product warranty.

Description

You can set the state of the fire mode through J6-02 (Fire mode enable).

- When J6-02 is set to 1 (Enabled), the fire mode will be activated based on the input signal set by J6-03 (Fire mode activation source). Once the fire mode is activated, the drive will operate under abnormal extreme conditions, which may affect the product warranty policy.
- When J6-02 is set to 2 (Fire mode test), you can test the fire mode. In this case, the drive will still enter the fire mode based on the input signal set by J6-03. However, the difference between option 1 or option 2 is that the test mode is used only for one-time test. During the test process, the input signal set by J6-03 will no longer take effect. In addition, if J6-02 is set to 2 (Test mode) at power-on, the system automatically forces it to 0 (Disabled).
  The test mode is only used for verifying the fire mode function. The use of this mode will be recorded and identified by the system, but will not affect the warranty of the drive.

If the test mode is selected during formal operation, the fire mode may fail to be activated in emergency situations.

Related parameters

Param.	Name	Default value	Range	Description
J6-02	Fire mode enable	0	0: Disabled 1: Enabled 2: Fire mode test	Used to enable the fire mode. **Options:** 0: Disable 1: Active 2. Fire mode test: The test is used for testing the fire mode function only. Otherwise, the drive may record it as an actual fire accident, which can affect warranty. Note: Do not use this mode during normal operation. Otherwise, the fire mode cannot be activated.
J6-03	Operating source in fire mode	0	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 Other: B connector	After the fire mode is enabled, it is activated when the source is valid, and deactivated when the source becomes invalid.

12.7.2 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

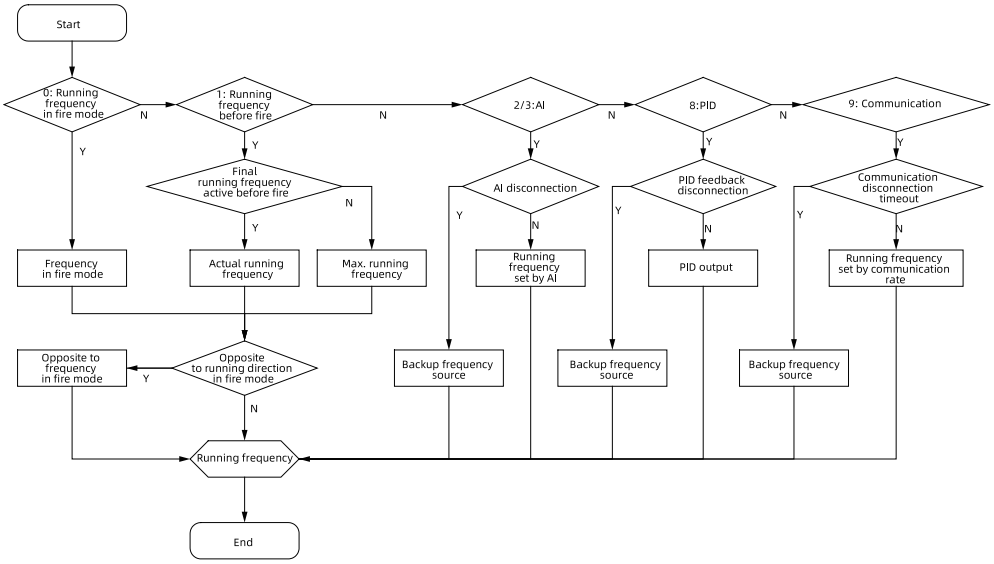


Figure 12-29 Main frequency source flowchart

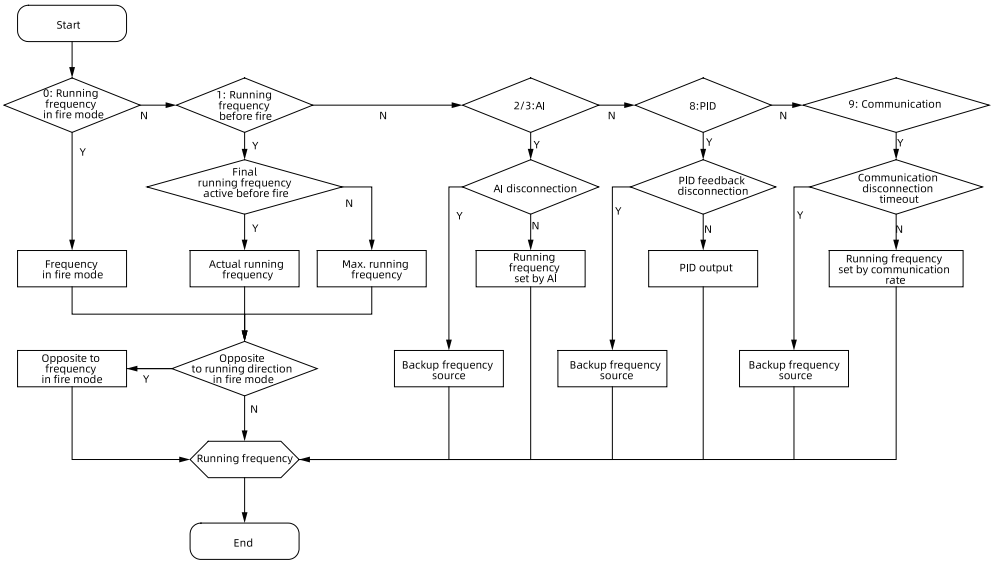


Figure 12-30 Backup frequency source flowchart

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.

12.7.3 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).

<table>
<tr><th colspan="2">Fault level</th><th>Response</th><th>Reset logic</th></tr>
<tr><td colspan="2">Negligible faults</td><td>The drive continues operating.</td><td>No need for fault reset</td></tr>
<tr><td colspan="2">Resettable faults</td><td>The drive stops immediately.</td><td>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.</td></tr>
<tr><td colspan="2">Non-operational faults</td><td>The drive stops forcibly.</td><td>-</td></tr>
<tr><td rowspan="2">Pending reset faults</td><td>Type 1</td><td rowspan="2">The drive stops immediately.</td><td rowspan="2">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.</td></tr>
<tr><td>Type 2</td></tr>
</table>

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.

12.7.4 Bypass

Application scenarios

The bypass function allows the motor to switch to the mains frequency 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.

Description

The bypass function of MD610 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 a fault persists or the preset fault reset attempts are exhausted. After a delay set by J6-28 (Fire bypass delay), the drive outputs a bypass signal to the L0802 (fire mode bypass flag) connector. You can also 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	Description
J6-27	Enable bypass function in fire mode	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 (valid only for MD610S) 6: DI4 (valid only for MD610S) 7: DI5 (valid only for MD610S) 8: DI6 (valid only for MD610S) 9: DI7 (valid only for MD610S) Other: B connector	Used to enable the bypass function in fire mode. When the drive malfunctions and cannot operate normally in fire mode, you can switch to operation at mains frequency 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 an error occurs in fire mode, the DO/RO outputs bypass signals, allowing the motor to switch to operation at mains frequency through external electrical circuit. 3 to 9: DI1 to DI7 - Indicates that whether this function is active depends on the state of the DI. Other: B connector **Note:** You can control the bypass switch by selecting "L0802" in "Other: B Connector" of the DO/RO terminal.
J6-28	Fire bypass delay	5.0	0.0 to 300.0	Defines the bypass delay in fire mode. When the drive fails to run due to an error, a bypass signal is output after the delay defined by this parameter elapses.

12.8 Free Function Module

12.8.1 Introduction To the Free Function Module

In complex engineering applications, this drive can associate multiple status signals and control signals together through the free function module to meet engineering control requirements. The application functions include logic operation, arithmetic function, word-to-bit conversion, data conversion, switch function, control function, multi-point curve, and constant setting modules. You can set related parameters as needed to achieve simple logic operation.

Function type	Name	Description	Links
Free function module	Word-to-Bit Module	This module can be used to enable mutual conversion between 16-bit data and 16 bits.	*"12.8.2.1 Introduction To Word-to-bit Module" on page 789*
	Data Conversion Module	This module enables conversion between different types of data (such as 16-bit word data and 32-bit double-word data).	*"12.8.3.1 Introduction To Data Conversion Module" on page 794*
	Logic Operation Module	This module is used to perform simple logic operations, such as AND, OR, and XOR.	*"12.8.4.1 Introduction To Logic Operation Module" on page 798*
	Arithmetic Operation Module	This module can be used to perform simple arithmetic operations on numerical values, such as addition, subtraction, multiplication, division, comparison, and absolute value.	*"12.8.5.1 Introduction To Arithmetic Operation Module" on page 803*
	Switch Selection Module	The module controls the output to be equal to input 1 or input 2 through module input selection signal. When the input selection signal is 0, the output equals input 1. When the input selection signal is 1, the output equals input 2.	*"12.8.6.1 Introduction To Switch Selection Module" on page 808*
	Control Function Module	This module can be used to process input signals to eliminate signal errors.	*"12.8.7.1 Introduction To Control Function Module" on page 816*
	Multi-point Curve Module (A to B)	The multi-point curve module can define up to ten curve points to define the input-output relationship in segments. After setting the multi-point curve, set the module input value, and the corresponding output value will be calculated based on the curve relationship.	*"12.8.8 Multi-point Curve Module (A to B)" on page 823*
	Constant value module	The output value of the constant value module is always equal to the input value.	*"12.8.9 Constant Value Module" on page 826*

12.8.2 Word-to-Bit Module

12.8.2.1 Introduction To Word-to-bit Module

Function description

This module can be used to enable mutual conversion between 16-bit data and 16 bits.

Applicable scenario

User-defined status words are generally generated through the word-to-bit module for view by the user, and the user-defined control words can also be parsed through the word-to-bit module to meet control requirements.

12.8.2.2 Word-To-Bit Module (A To H)

Function description

The word-to-bit module is used to convert a 16-bit data into 16 individual bits (bit0 to bit15).

Operating principles

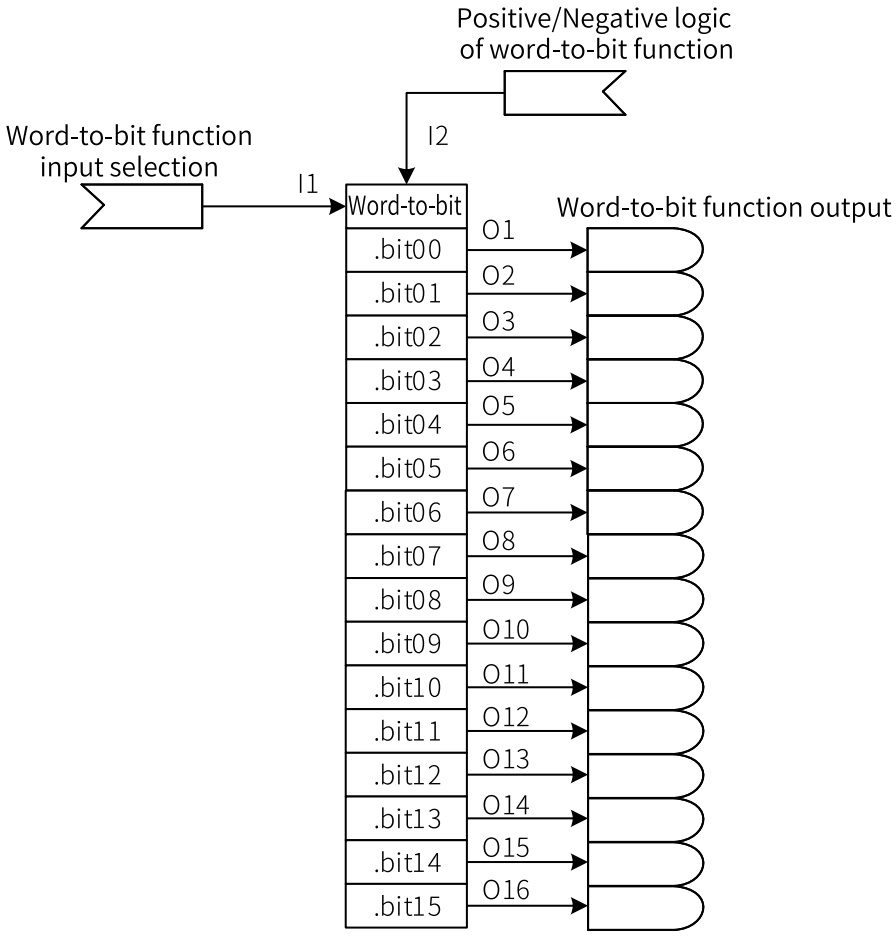


Figure 12-31 Diagram of the word-to-bit module

When the word-to-bit function module receives a 16-bit word at input I1, the outputs O1 to O16 correspond to bit0 to bit15 of input I1.

When the input I is a 32-bit double-word, the outputs O1 to O16 correspond to the high 16 bits (bit0 to bit15) of the input I1.

The input I2 of the word-to-bit function module is used to set the logic during conversion. When bit0 to bit15 of input I2 are 1, the outputs O1 to O16 that correspond to input I1 are inverted.

Connection parameters

This drive provides four word-to-bit modules (A to D). The corresponding inputs and outputs of each module are as follows.

Source of parameter value for input I1: Word connector and double-word connector.

Source of parameter value for input I2: Unsigned number.

Location for saving outputs O1 to O16: Bit connector.

Parameters for inputs and outputs of each word-to-bit module are shown in the table below.

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 (bit0)	L0304	L0320	L0336	L0352
	O2 (bit1)	L0305	L0321	L0337	L0353
	O3 (bit2)	L0306	L0322	L0338	L0354
	O4 (bit3)	L0307	L0323	L0339	L0355
	O5 (bit4)	L0308	L0324	L0340	L0356
	O6 (bit5)	L0309	L0325	L0341	L0357
	O7 (bit6)	L0310	L0326	L0342	L0358
	O8 (bit7)	L0311	L0327	L0343	L0359
	O9 (bit8)	L0312	L0328	L0344	L0360
	O10 (bit9)	L0313	L0329	L0345	L0361
	O11 (bit10)	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

Application instance

The received user-defined control word can be converted to bit data through the word-to-bit module, allowing reading of the control commands sent by the user. For example, the command word for control channel 1 can be converted to bit data through word-to-bit module A.

Control word bit	Definition	Description
bit0	ON_OFF1 (start/stop)	The drive starts upon 0->1 and stops at 0.
bit1	OFF2 (coast to stop) stop	The value 1 indicates coast-to-stop is active.
bit2	OFF3 (quick stop) stop	The value 1 indicates quick stop is active.
bit3	Operation permission	The value 1 indicates operation permission is active.

Control word bit	Definition	Description
bit4	Reset command	The fault reset function is active upon 0->1.
bit5	JOG1 (Jog 1)	The value 1 indicates the jog 1 command is active.
bit6	2JOG2	The value 1 indicates the jog 2 command is active.
bit7	Speed inversion	The value 1 indicates the speed is inverted.
bit8 to bit15	Reserved	-

Parameters need to be set are described in the following table.

Param.	Description	Setpoint	Description
o3-00	Input of word-to-bit function A	L1044 [User-defined command word of control channel 1]	The input of word-to-bit module A is the user-defined control word.
o3-04	Direct logic and inverted logic of word-to-bit function A	0x0000	The output bits of word-to-bit function A are kept to their original values.

In this case, the validity of the coast-to-stop command can be queried through L0305 [bit1 of word-to-bit module A output], and the validity of the fault reset command can be queried through L0308 [bit4 of word-to-bit module A output].

12.8.2.3 Bit-to-Word Module (A to D)

Function description

The bit-to-word module is used to combine 16 bits (bit0 to bit15) into a 16-bit data.

Operating principles

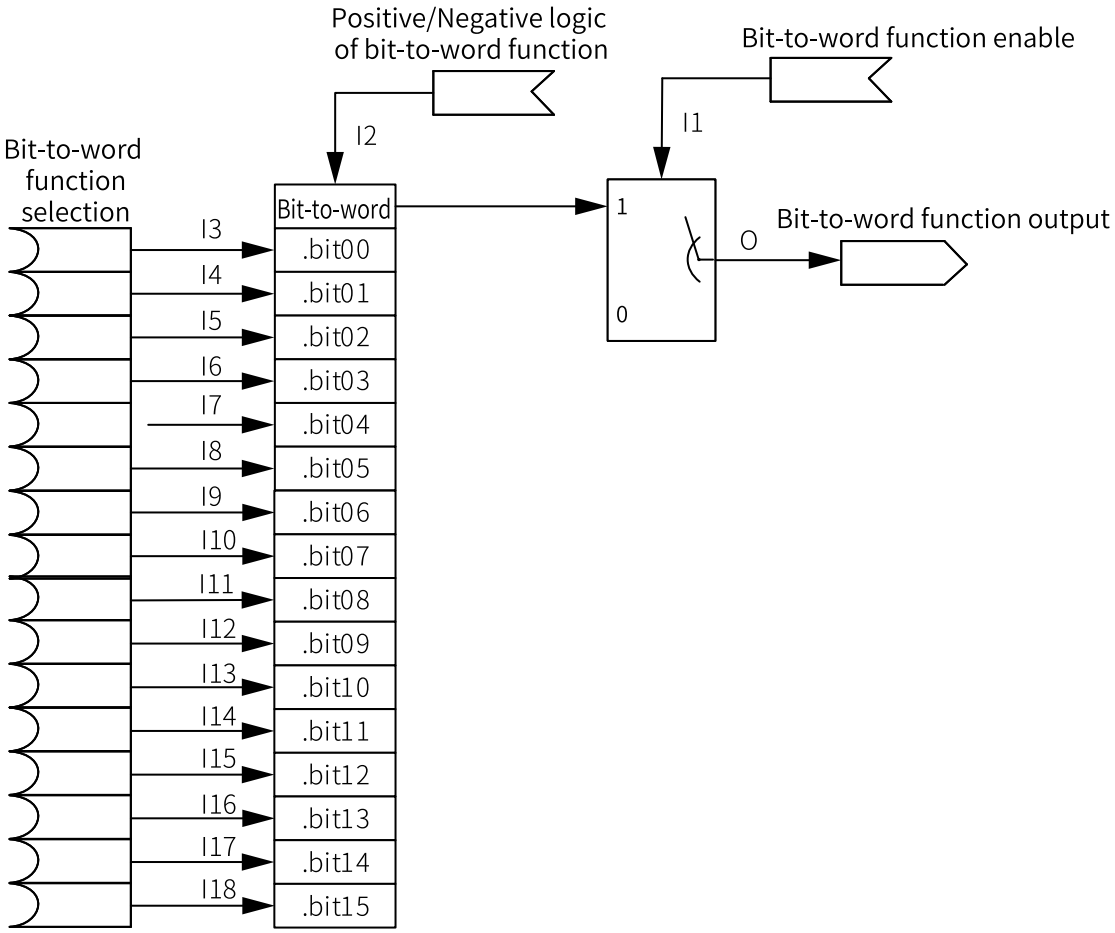


Figure 12-32 Diagram of the bit-to-word module

The inputs I3 to I18 of the bit-to-word module represent bit00 to bit15 of a hexadecimal number, forming a 16-bit word data to be output to O.

The input I1 of the bit-to-word module is the enable control bit, When I1 is 1, the module function is valid. When I1 is 0, the output O is 0.

The input I2 of the bit-to-word module is used to set the positive/negative logic during conversion. When bit0 to bit15 of input I2 are 1, the corresponding bit0 to bit15 of output O are inverted.

Connection parameters

The drive provides four groups of bit-to-word modules (A to D), with the following corresponding inputs and outputs for each module.

Source of parameter value for input I1: Binary number.

Source of parameter value for input I2: Unsigned number.

Source of parameter value for inputs I3 to I18: 0, 1, DI input, and bit connector.

Location for saving output O: Word connector.

Parameters for inputs and outputs of each bit-to-word module are as 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 (bit0)	o3-10	o3-28	o3-46	o3-64
	I4 (bit1)	o3-11	o3-29	o3-47	o3-65
	I5 (bit2)	o3-12	o3-30	o3-48	o3-66
	I6 (bit3)	o3-13	o3-31	o3-49	o3-67
	I7 (bit4)	o3-14	o3-32	o3-50	o3-68
	I8 (bit5)	o3-15	o3-33	o3-51	o3-69
	I9 (bit6)	o3-16	o3-34	o3-52	o3-70
	I10 (bit7)	o3-17	o3-35	o3-53	o3-71
	I11 (bit8)	o3-18	o3-36	o3-54	o3-72
	I12 (bit9)	o3-19	o3-37	o3-55	o3-73
	I13 (bit10)	o3-20	o3-38	o3-56	o3-74
	I14 (bit11)	o3-21	o3-39	o3-57	o3-75
	I15 (bit12)	o3-22	o3-40	o3-58	o3-76
	I16 (bit13)	o3-23	o3-41	o3-59	o3-77
	I17 (bit14)	o3-24	o3-42	o3-60	o3-78
	I18 (bit15)	o3-25	o3-43	o3-61	o3-79
Output	O	L1208	L1209	L1210	L1211

Application instance

The bit-to-word module can be used to user-defined control words sent to the user to meet control requirements. For example, the status word can be defined through the bit-to-word module A as follows.

Param.	Name	Setpoint	Description
o3-08	Bit-to-word module A	1 [Enable]	Bit-to-word module A enable
o3-09	Direct logic and inverted logic of bit-to-word module A	0x0000	All bits of bit-to-word module A are in direct logic.
o3-10	bit0 selection of bit-to-word module A	L0100 [Ready for power-on]	The value 1 indicates "Ready for power-on".
o3-11	bit1 selection of bit-to-word module A	L0102 [Running]	The value 1 indicates the drive is running.
o3-12	bit2 selection of bit-to-word module A	L0103 [Fault active]	The value 1 indicates the fault is activated.
o3-13	bit3 selection of bit-to-word module A	L0106 [Startup lockout]	The value 1 indicates the startup is locked out, and operation is not allowed.
o3-14	bit4 selection of bit-to-word module A	L0118 [Current control channel]	The value 0 indicates channel 1 is active, and the value 1 indicates channel 2 is active.
o3-15	bit5 selection of bit-to-word module A	L0119 [Current setting channel]	The value 0 indicates channel 1 is active, and the value 1 indicates channel 2 is active.
L1208	Output of bit-to-word module A	-	Output value of the word-to-bit module A

In this case, the output value of the bit-to-word module A (L1208) can be sent to the user, enabling user-defined status word transmission.

12.8.3 Data Conversion Module

12.8.3.1 Introduction To Data Conversion Module

Function description

This module is used to enable conversion between different types of data (such as 16-bit word data and 32-bit double-word data).

Applicable scenario

This module can be used to convert data to the expected data type for easy query and data processing.

12.8.3.2 Word-To-DWord Module (A To D)

Function description

The word-to-double-word module combines two 16-bit word data into a 32-bit data, then divides it by a user-defined 32-bit base value to obtain the converted 32-bit double-word data.

Operating principles

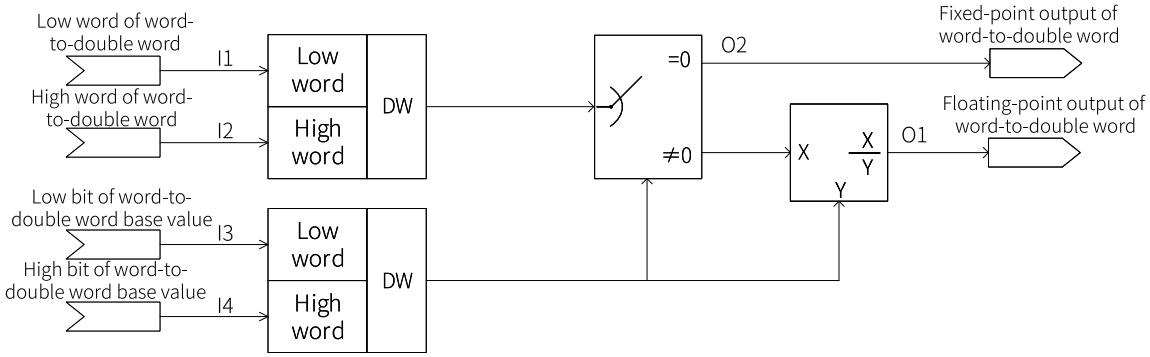


Figure 12-33 Diagram of the word-to-double-word module

The conversion formula for the input and output of the word-to-double-word 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 composed of I3 as the low 16 bits and I4 as the high 16 bits is non-zero, the output value equals the double word (with input I1 as low 16 bits and I2 as high 16 bits) divided by the base value, which is then output to O1.

(2) When the base value composed of I3 as the low 16 bits and I4 as the high 16 bits is zero, the output value equals the double word (with input I1 as low 16 bits and I2 as high 16 bit), which is output to O2 directly without being divided by the base value.

Connection parameters

This drive provides four word-to-double-word modules (A to D), with the corresponding inputs and outputs as follows.

Source of parameter value for input I1, I2: Word connector and double-word connector.

Source of parameter value for input I3, I4: 16-bit unsigned number.

Location for saving output O1: Floating-point connector.

Location for saving output O2: Double-word connector.

Parameters corresponding to the inputs and outputs of each word-to-double-word module are shown in the table below.

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 input I2 of the word-to-double-word module is set to option 0 [Module disabled], the word-to-double-word module is inactive, and the output is 0. When input I2 of the word-to-double-word module is set to "Other [K connector]", the module operates normally.

12.8.3.3 DWord-To-Word Module (A To D)

Function description

The double-word-to-word module divides the 32-bit double-word input data by a user-defined 32-bit base value, resulting in a converted 16-bit data.

Operating principles

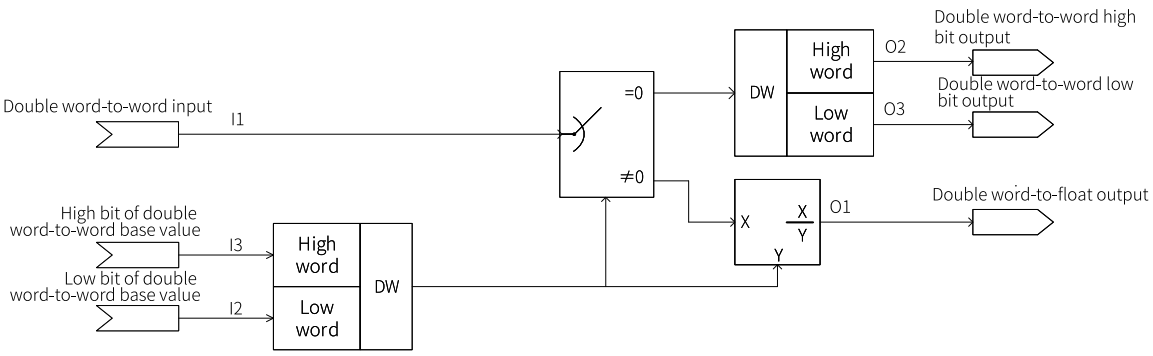


Figure 12-34 Diagram of the double-word-to-word module

The conversion formula for the input and output of the double-word-to-word 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 composed of I2 as the low 16 bits and I3 as the high 16 bits is non-zero, the output value equals the input I1 divided by the base value, which is then output to O1.

(2) When the base value composed of I2 as the low 16 bits and I3 as the high 16 bits is zero, the output O2 is the high 16 bits of input I1, and output O3 is the low 16 bits of input I1.

Connection parameters

The drive provides four sets of double-word-to-word modules (A to D), with the corresponding inputs and outputs as follows.

Source of parameter value for input I1: word connector and double-word connector.

Source of parameter value for inputs I2 and I3: 16-bit unsigned number.

Location for saving output O1: Floating-point connector.

Location for saving outputs O2 and O3: Word connector.

Parameters corresponding to the inputs and outputs of each of the double-word-to-word module are shown below.

Double-word-to-word	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

12.8.3.4 Floating-Point Connector-to-Monitoring Parameter Module (A to H)

Description

The floating-point-connector-to-monitoring parameter module converts the floating-point connector data inputted to monitoring parameters to be displayed in group U.

Operating principles

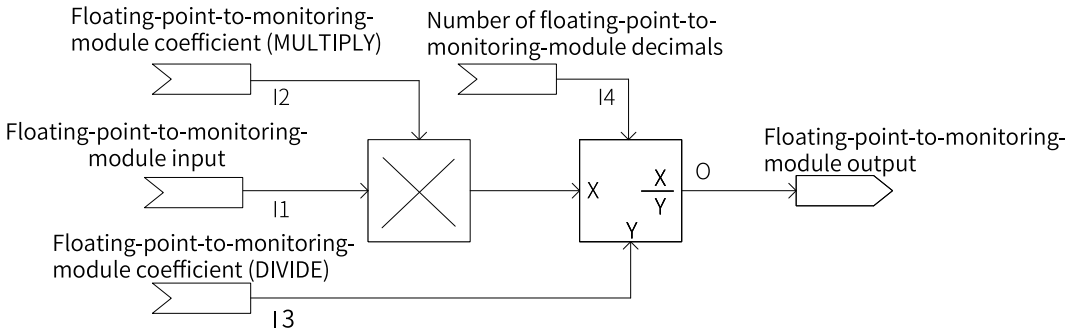


Figure 12-35 Schematic of floating-point-connector-to-monitor parameter

Input I1 of the floating-point-connector-to-monitor parameter module is the original value. Input I2 is the multiplication 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 for output value O, which can be set to 0 to 3 decimal places. The meanings of different decimal places are as follows.

(1) In the case of zero decimal places, the converted monitor parameter display value is the floating-point connector value x 100.

(2) In the case of one decimal place, the converted monitor parameter display value is the floating-point connector value x 100 x 10.

(3) In the case of two decimal places, the converted monitor parameter display value is the floating-point connector value x 100 x 100.

(4) In the case of three decimal places, the converted monitor parameter display value is the floating-point connector value x 100 x 1000.

For example, if the floating-point connector value is 40.0%, I2 and I3 are set to 1, and I4 is set to 1 decimal place, then the converted monitor parameter is 40.0% x 100 x 10 = 400.

Connection parameters

The drive provides eight groups of floating-point connector-to-monitoring parameter modules (A to H). Inputs and outputs of each module are shown as below.

Source of input I1 parameter value: Floating-point connector

Source of input I2 and I3 parameter values: 16-bit unsigned number (I3 ≠ 0)

Source of input I4 parameter value: 0, 1, 2, or 3 decimal places

Storage location of output O: monitor parameter in group U3

Parameters corresponding to the inputs and outputs of each of the double-word-to-word module are shown below.

Floating-point-to-monitoring	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

Application instance

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. Parameters need to be set are described in the following table.

Param.	Name	Setpoint	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 connector-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 connector-to-monitoring parameter module A coefficient (divide)	1	Sets the division coefficient to 1 during conversion
U3-90	Floating-point connector-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.

12.8.4 Logic Operation Module

12.8.4.1 Introduction To Logic Operation Module

Function description

This module is used to perform simple logic operations, such as AND, OR, and XOR.

Applicable scenario

This module can be used to perform simple logic processing on DI signals and other data, enabling combined control of a single module using multiple signal sources.

12.8.4.2 AND/OR Module (A to H)

Description

The logic AND or OR function of this module can be selected through the function selection parameter. This module can be used to perform logic processing on up to two inputs. When the logic AND function is selected, the output is 1 only when all inputs are 1. Otherwise, the output is 0. When the OR function is selected, the output is 0 only when all inputs are 0. Otherwise, the output is 1.

Operating principles

The logic AND and OR modules A to D support four input values, while the logic AND and OR modules E to H support three input values. The following takes modules A to D an example to introduce the logic AND and logic OR functions.

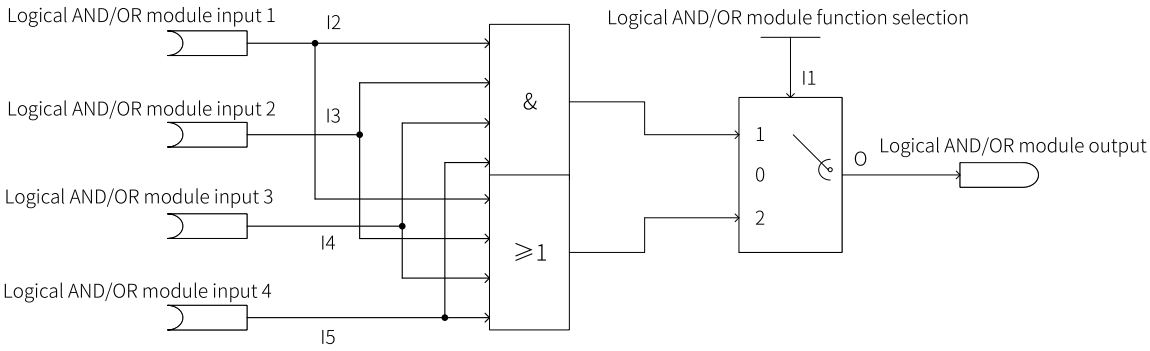


Figure 12-36 Logic AND/OR module

When the logic AND/OR function selection input I1 is 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. The output is 1 only when inputs I2, I3, I4, and I5 are all 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 the logic AND/OR function selection input I1 is 2, the logic OR is active, and the output O = I2 & I3 & I4 & I5. The output is 0 only when inputs I2, I3, I4, and I5 are all 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 parameters

The drive supports eight sets of AND/OR modules (A to H).The inputs and outputs corresponding to each module are as follows.

Source of input I1 parameter value: 0 [Disabled], 1 [Logic AND], and 2 [Logic OR].

Source of input I2, I3, I4, I5 parameter values: 0, 1, DI input, and bit connector.

Location for saving output O: Bit connector.

Parameters corresponding to the inputs and outputs of each AND/OR module are shown in the table below.

Logic AND and logic OR	Input					Output
	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

12.8.4.3 Logic NOT Module (A To H)

Function description

This module can be used to implement the logic NOT function, with the output value inverted to the input value.

Operating principles

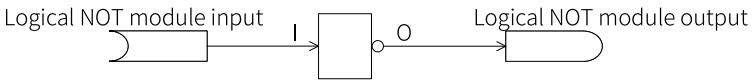


Figure 12-37 Diagram of the logic NOT module

When the input I option of the logic NOT module is set to 0 [Disable], the module is disabled, and the output is 0.

When the input I of the logic NOT module is set to any other option, the output O is inverted to the input.

Input	Output
I	O
0	1
1	0

Connection parameters

The drive provides 8 sets of logic NOT modules (A to H), with the corresponding inputs and outputs for each module as follows.

Source of input I parameter value: 0 [Disable], DI input, and bit connector.

Location for saving output O: Bit connector.

Parameters for the inputs and outputs of each logic NOT module are shown in the table below.

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

12.8.4.4 Logic XOR/XNOR Module (A To D)

Function description

The logic XOR or XNOR function of this module can be selected through the function selection parameter. This module can be used to perform logical processing on up to two inputs. When the logic XOR function is selected, the output is 1 only when the input 1 and input 2 are different. Otherwise, the output is 0. When the logic XNOR function is selected, the output is 1 only when the input 1 and input 2 are the same. Otherwise, the output is 0.

Operating principles

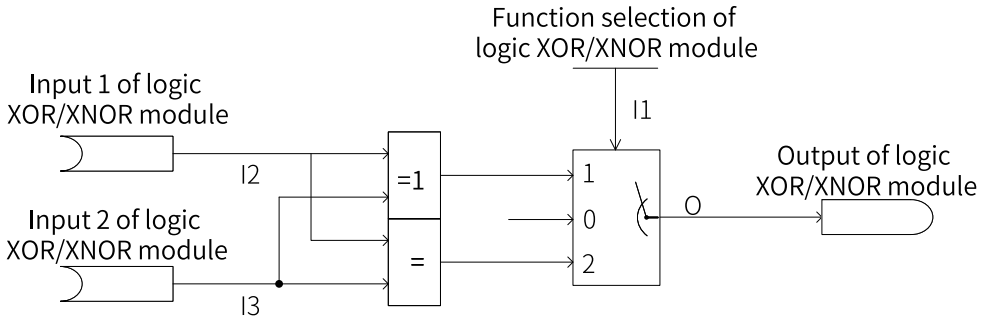


Figure 12-38 Diagram of the logic XOR/XNOR module

When the function selection input I1 of the logic XOR/XNOR module is 0, the module is inactive, and the output O is 0.

When the function selection input I1 of the logic XOR/XNOR module is 1, the logic XOR function is active. If the input I2 and input I3 are the same, the output O is 0. If the input I2 and input 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 the function selection input I1 of the logic XOR/XNOR module is 2, the logic XNOR function is active. If the input I2 and input I3 are the same, the output O is 1. If the input I2 and input 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 parameters

This product contains 8 sets of logic XOR and XNOR modules (A to H). The corresponding inputs and outputs for each module are as follows:

Source of parameter value for Input I1: 0 [Disable], 1 [XOR], and 2 [XNOR].

Source of parameter values for Input I2 and I3: 0, 1, DI input, and bit connector.

Location for saving output O: Bit connector.

Parameters corresponding to the inputs and outputs of each logic XOR/XNOR module are shown in the table below.

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

12.8.5 Arithmetic Operation Module

12.8.5.1 Introduction To Arithmetic Operation Module

Function description

This module can be used to perform simple arithmetic operations on numerical values, such as addition, subtraction, multiplication, division, comparison, and absolute value.

Applicable scenario

This module can be used to process input values through operations to obtain values that meet user requirements.

12.8.5.2 Absolute Value Module (A to H)

Description

The absolute value module is used to perform absolute value processing on the input value and output the result. The output equals the absolute value of the input.

Operating principles

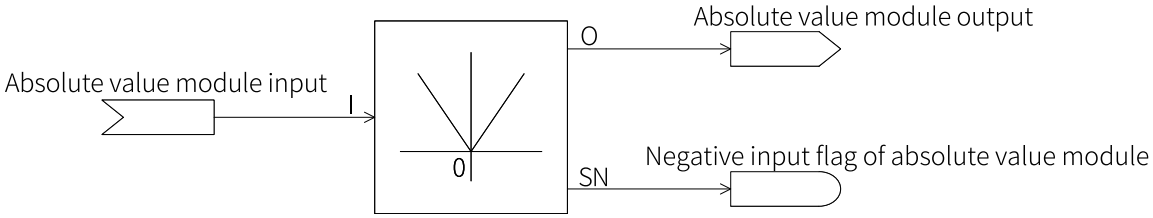


Figure 12-39 Schematic of the absolute value module

The calculation formula for the absolute value module is 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 set to 0 [Module disabled], the module is inactive and the output is 0.

(2) When the absolute value module input I is not 0 [Module disabled], the output O equals the absolute value of input I. When input I is negative, the input flag SN is 1; otherwise, it is 0.

Connection parameters

The drive supports eight groups of absolute value modules (A to H). The inputs and outputs corresponding to 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.

Location for saving output O: Floating-point connector.

Storage location of output SN: Bit connector

The parameters corresponding to the input and output of the absolute value module are as follows.

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

12.8.5.3 Addition and Subtraction Module (A to H)

Description

The addition/subtraction module is used to perform addition and subtraction operations on input values and output the result. The addition/subtraction module has four inputs. The output = Input 1 + Input 2 + Input 3 - Input 4.

Operating principles

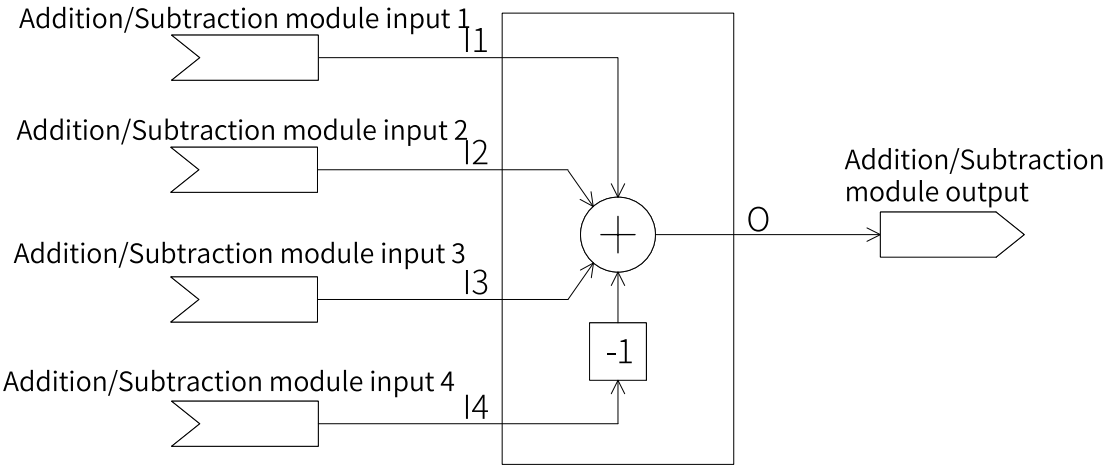


Figure 12-40 Schematic of the addition/subtraction module

The calculation formula for the addition/subtraction module is as follows:

O = I1 + I2 + I3 - I4

(1) When input I1 of the addition/subtraction module is set to 0 [Disabled], the module is inactive and the output is 0.

(2) When input I1 of the addition/subtraction module is set to any other value, the output O equals I1 + I2 + I3 - I4.

Connection parameters

The drive supports eight addition/subtraction modules (A to H). The inputs and outputs corresponding to 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.

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the addition/subtraction module are as follows.

Addition/ 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

12.8.5.4 Multiplication and Division Module (A to H)

Description

The multiplication/division module is used to perform multiplication and division operations on the input values and output the result. The multiplication/division module has three inputs. The output value = Input 1 x Input 2/Input 3.

Operating principles

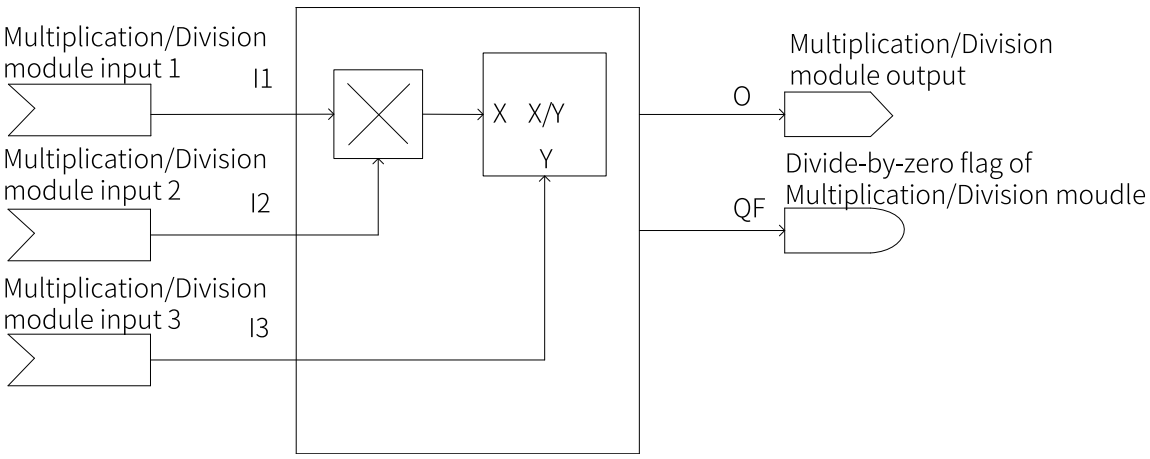


Figure 12-41 Schematic of the multiplication/division module

The calculation formula for the multiplication/division module is 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 input I1 of the multiplication/division module is set to 0 [Disable], the module is inactive and the output is 0.

(2) When input I3 of the multiplication/division module is set to 0 [Value 1], the output O equals the product of I1 and I2.

(3) When input I3 of the multiplication/division module is set to any other option, if the value of input I3 is 0, the output O is 0 and the divide-by-zero flag bit QF is 1. If the value of input I3 is not 0, the output O = I1 x I2/I3 and the divide-by-zero flag bit QF is 0.

Connection parameters

The drive supports eight multiplication/division modules (A to H). The inputs and outputs corresponding to 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.

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the multiplication/division module are as follows.

Multiplication/ 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

12.8.5.5 Comparison Module (A to H)

Description

The comparison mode of the input can be set by selecting the comparison module function parameter. Three modes can be set: Input 1 > Input 2, Input 1 = Input 2, or Input 1 < Input 2. The comparison module compares input 1 and input 2 according to the set mode. When the comparison condition is met, the output is 1; otherwise, the output is 0.

Operating principles

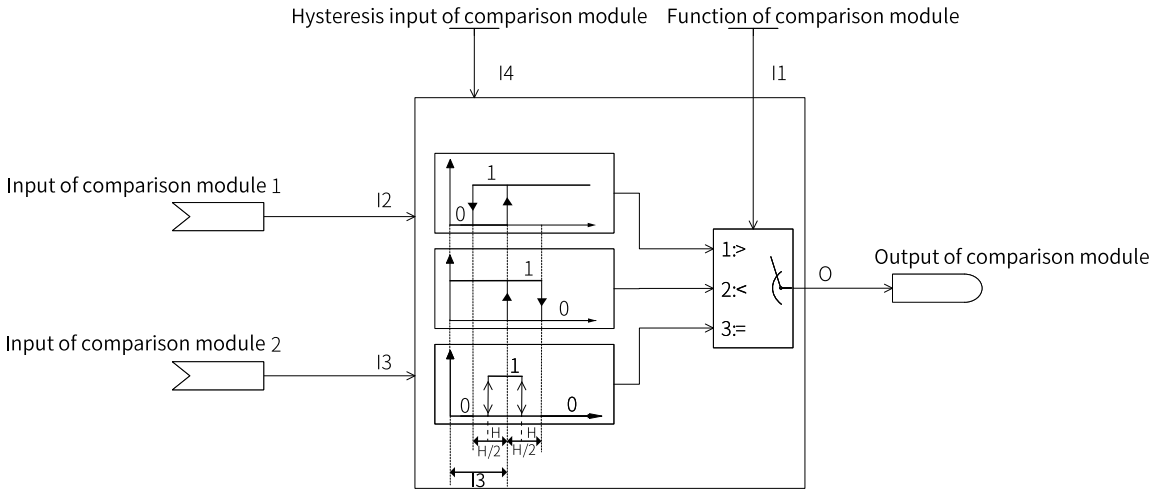


Figure 12-42 Schematic of the comparison module

(1) When comparison module function selection I1 is set to 0 [Module disabled], the module is inactive and the output is 0.

(2) When comparison module function selection I1 is set to 1 [input 1 > input 2], the output O keeps at low level before I2 increases from 0 to I3 in the forward direction. 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 at high level. If I2 decreases but keeps higher than I3 - I4, the output O keeps at high level. Only when I2 is lower than I3 - I4, the output O changes from high level to low level.

(3) When comparison module function selection I1 is set to 2 [input 1 < input 2], the output O keeps at high level before I2 increases from 0 to I3 + I4 in the forward direction. 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 at low level. If I2 decreases but keeps higher than I3, the output O keeps at low level. Only when I2 is lower than I3, the output O changes from low level to high level.

(4) When comparison module function selection I1 is set to 3 [input 1 = input 2], high level is outputted if I2 is within the range of I3 - I4/2 to I3 + I4/2. Otherwise, low level is outputted.

Connection parameters

The drive supports eight groups of comparison modules (A to H). The inputs and outputs corresponding to each module are as follows.

Source of parameter value for Input I1: 0 [Module disabled], 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.

Source of parameter value for input I4: Floating-point number with two decimal places

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the comparison module are as follows.

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

12.8.6 Switch Selection Module

12.8.6.1 Introduction To Switch Selection Module

Function description

The module controls the output to be equal to input 1 or input 2 through module input selection signal. When the input selection signal is 0, the output equals input 1. When the input selection signal is 1, the output equals input 2.

Applicable scenario

This module can be used to change the parameter setpoint when the control condition changes.

12.8.6.2 Binary Selector Module (A To H)

Function description

The binary selector module has two binary number inputs, and the output equals either input 1 or input 2 based on the input selection. When the input selection signal is 0, the output equals input 1. When the input selection signal is 1, the output equals input 2.

Operating principles

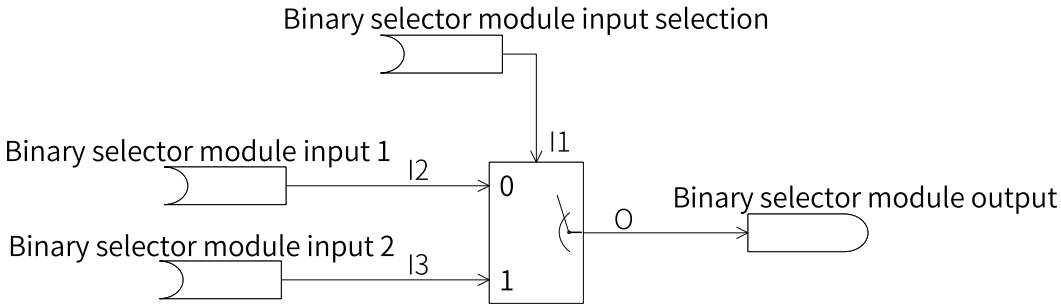


Figure 12-43 Diagram of the binary selector

When the binary selector module input I1 is set to 0 [Inactive], the module is inactive and the output is 0.

When the binary selector module input I1 is set to any other option, if the I1 input value is 0, the output O equals the module input I2. If the I1 input value is 1, the output O equals the module input I3.

Connection parameters

The input and output of the binary selector module (A to H) are as follows.

Source of parameter value for input I1: 0 [Inactive], DI input, and bit connector

Source of parameter values for input I2 and I3: logic 0, logic 1, DI input, and bit connector.

Location for saving output O: Bit connector.

Parameters corresponding to the input and output of the binary selector module are as follows.

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	Value range	Description
L1234	Input state of binary selector module	-	-	Displays the input state of the binary selector module. bit0 to bit7 represent the selection results of binary selector modules A to H, respectively. When the bit value is 0, input 1 is selected. When the bit value is 1, input 2 is selected.

12.8.6.3 Digital Selector Module (A to H)

Description

The digital selector module has two floating-point inputs, and the output equals input 1 or input 2 based on the input selection. When the input selection signal is 0, the output equals input 1. When the input selection signal is 1, the output equals input 2.

Operating principles

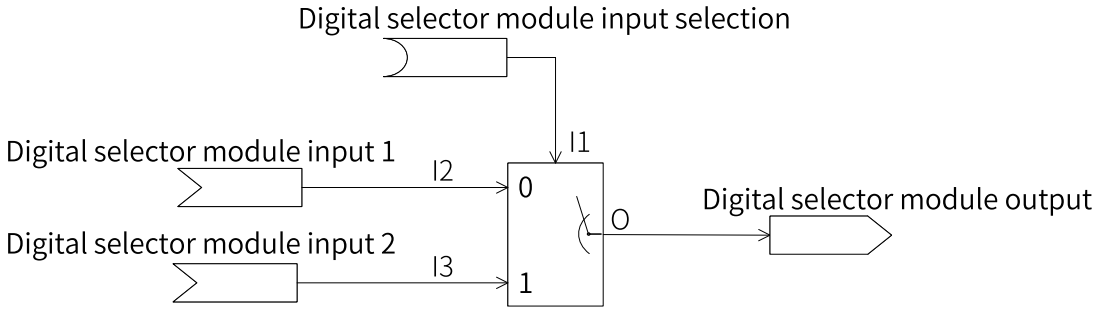


Figure 12-44 Schematic of the digital selector module

When input I1 of the digital selector module is set to 0 [Invalid], the module is inactive, and the output is 0.

When input I1 of the digital selector module is set to any other option, if the input I1 value is 0, the output O equals module input I2; if the input I1 value is 1, the output O equals module input I3.

Connection parameters

The inputs and outputs corresponding to the digital selector module (A to H) are as follows.

Source of parameter value for input I1: 0 [Inactive], DI input, and bit connector

Parameter source of input I2 and I3: 0, AI1, AI2, HDI, Multi-reference, simple PLC, PID, communication, and floating-point connector.

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the digital selector module are shown below.

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.

Param.	Name	Default value	Value range	Description
L1235	Input state of digital selector module	-	-	Displays the input selection state for digital selector module. bit0 to bit7 represent the selection results of digital selector modules A to H respectively. When the bit value is 0, input 1 is selected. When the bit value is 1, input 2 is selected.

12.8.6.4 Arithmetic Operation Module

12.8.6.4.1 Introduction To Arithmetic Operation Module

Function description

This module can be used to perform simple arithmetic operations on numerical values, such as addition, subtraction, multiplication, division, comparison, and absolute value.

Applicable scenario

This module can be used to process input values through operations to obtain values that meet user requirements.

12.8.6.4.2 Absolute Value Module (A to H)

Description

The absolute value module is used to perform absolute value processing on the input value and output the result. The output equals the absolute value of the input.

Operating principles

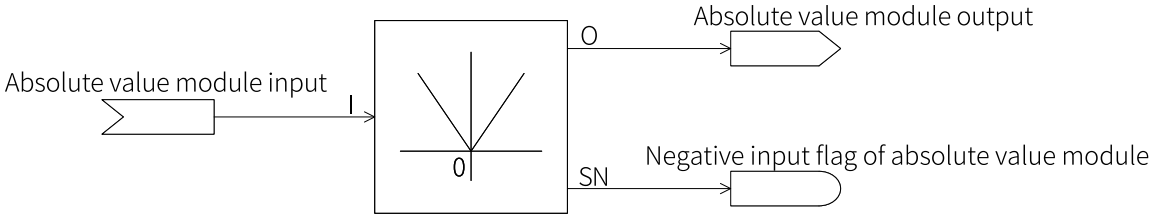


Figure 12-45 Schematic of the absolute value module

The calculation formula for the absolute value module is 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 set to 0 [Module disabled], the module is inactive and the output is 0.

(2) When the absolute value module input I is not 0 [Module disabled], the output O equals the absolute value of input I. When input I is negative, the input flag SN is 1; otherwise, it is 0.

Connection parameters

The drive supports eight groups of absolute value modules (A to H). The inputs and outputs corresponding to 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.

Location for saving output O: Floating-point connector.

Storage location of output SN: Bit connector

The parameters corresponding to the input and output of the absolute value module are as follows.

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

12.8.6.4.3 Addition and Subtraction Module (A to H)

Description

The addition/subtraction module is used to perform addition and subtraction operations on input values and output the result. The addition/subtraction module has four inputs. The output = Input 1 + Input 2 + Input 3 - Input 4.

Operating principles

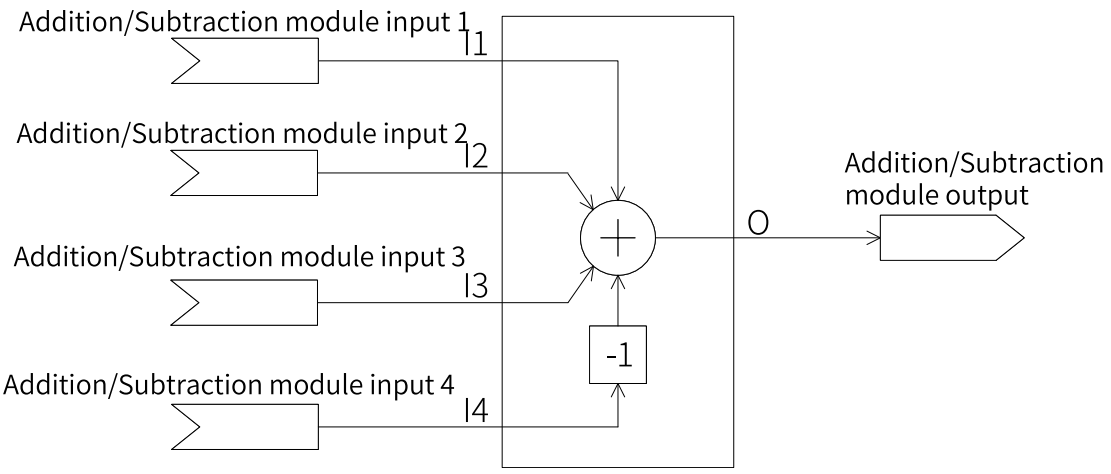


Figure 12-46 Schematic of the addition/subtraction module

The calculation formula for the addition/subtraction module is as follows:

O = I1 + I2 + I3 - I4

(1) When input I1 of the addition/subtraction module is set to 0 [Disabled], the module is inactive and the output is 0.

(2) When input I1 of the addition/subtraction module is set to any other value, the output O equals I1 + I2 + I3 - I4.

Connection parameters

The drive supports eight addition/subtraction modules (A to H). The inputs and outputs corresponding to 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.

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the addition/subtraction module are as follows.

Addition/ 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

12.8.6.4.4 Multiplication and Division Module (A to H)

Description

The multiplication/division module is used to perform multiplication and division operations on the input values and output the result. The multiplication/division module has three inputs. The output value = Input 1 x Input 2/Input 3.

Operating principles

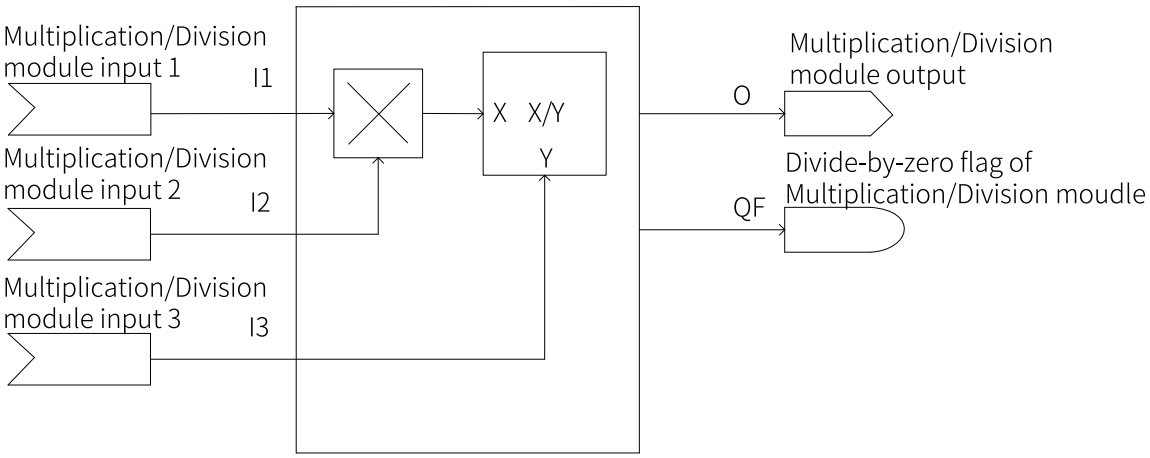


Figure 12-47 Schematic of the multiplication/division module

The calculation formula for the multiplication/division module is 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 input I1 of the multiplication/division module is set to 0 [Disable], the module is inactive and the output is 0.

(2) When input I3 of the multiplication/division module is set to 0 [Value 1], the output O equals the product of I1 and I2.

(3) When input I3 of the multiplication/division module is set to any other option, if the value of input I3 is 0, the output O is 0 and the divide-by-zero flag bit QF is 1. If the value of input I3 is not 0, the output O = I1 x I2/I3 and the divide-by-zero flag bit QF is 0.

Connection parameters

The drive supports eight multiplication/division modules (A to H). The inputs and outputs corresponding to 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.

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the multiplication/division module are as follows.

Multiplication/ 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

12.8.6.4.5 Comparison Module (A to H)

Description

The comparison mode of the input can be set by selecting the comparison module function parameter. Three modes can be set: Input 1 > Input 2, Input 1 = Input 2, or Input 1 < Input 2. The comparison module compares input 1 and input 2 according to the set mode. When the comparison condition is met, the output is 1; otherwise, the output is 0.

Operating principles

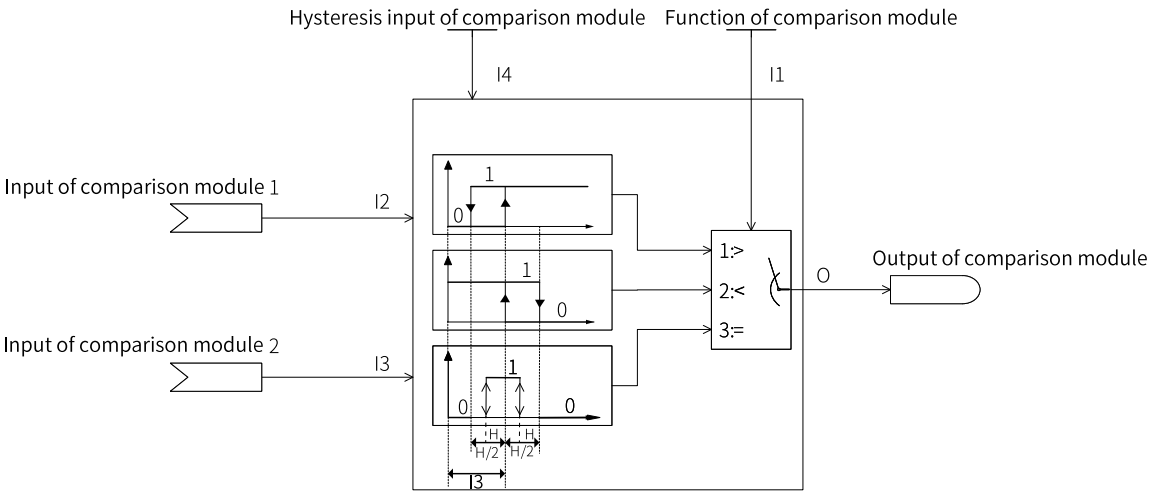


Figure 12-48 Schematic of the comparison module

(1) When comparison module function selection I1 is set to 0 [Module disabled], the module is inactive and the output is 0.

(2) When comparison module function selection I1 is set to 1 [input 1 > input 2], the output O keeps at low level before I2 increases from 0 to I3 in the forward direction. 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 at high level. If I2 decreases but keeps higher than I3 - I4, the output O keeps at high level. Only when I2 is lower than I3 - I4, the output O changes from high level to low level.

(3) When comparison module function selection I1 is set to 2 [input 1 < input 2], the output O keeps at high level before I2 increases from 0 to I3 + I4 in the forward direction. 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 at low level. If I2 decreases but keeps higher than I3, the output O keeps at low level. Only when I2 is lower than I3, the output O changes from low level to high level.

(4) When comparison module function selection l1 is set to 3 [input 1 = input 2], high level is outputted if I2 is within the range of I3 - I4/2 to I3 + I4/2. Otherwise, low level is outputted.

Connection parameters

The drive supports eight groups of comparison modules (A to H). The inputs and outputs corresponding to each module are as follows.

Source of parameter value for Input I1: 0 [Module disabled], 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.

Source of parameter value for input I4: Floating-point number with two decimal places

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the comparison module are as follows.

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

12.8.7 Control Function Module

12.8.7.1 Introduction To Control Function Module

Function description

This module can be used to process input signals to eliminate signal errors.

Applicable scenario

This module is generally used to filter and limit signals such as level and frequency, which eliminates signal errors.

12.8.7.2 Filter Module (A to D)

Description

The filter module is used to filter the input signal to generate the output value, effectively eliminating signal errors. The filtering time can also be set. The longer the filtering time, the better the effect, but an excessively long filtering time also causes the output signal to lag behind the input signal.

Operating principles

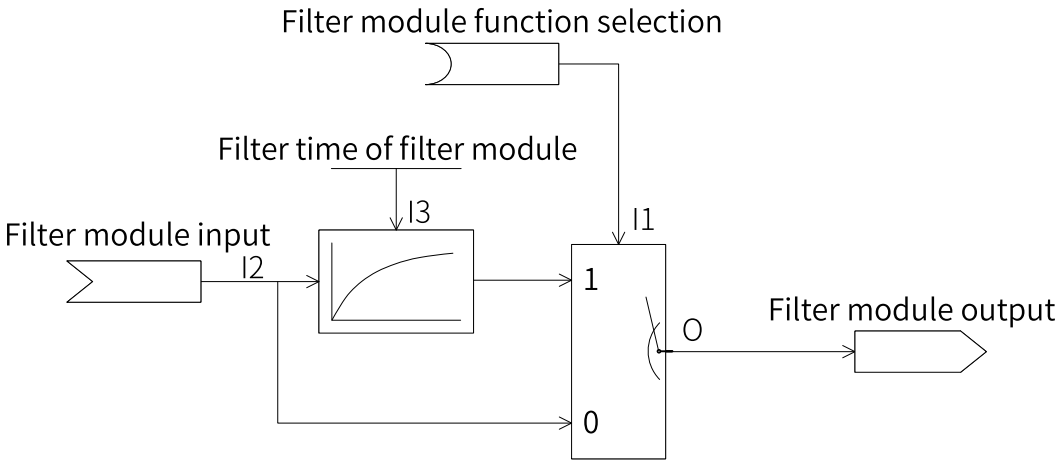


Figure 12-49 Schematic diagram of the filter module

Connection parameters

The input and output corresponding to the filter module (A to D) are as follows:

Source of parameter value for input I1: 0 [Invalid], 1 [Valid], DI input, bit connector.

Parameter source of input I2: 0, AI1, AI2, HDI, multi-reference, simple PLC, PID, communication, and floating-point connector.

Source of parameter value for input I3: Floating-point number with three decimal places

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the filter module are as follows.

Filter module	Input			Output
	I1	I2	I3	O
A	ob-00	ob-01	ob-02	L2440
B	ob-03	Fb-03	ob-05	L2442
C	ob-06	ob-07	ob-08	L2444
D	ob-09	ob-10	ob-11	L2446

12.8.7.3 Level-To-Pulse Module (A To D)

Function description

The level-to-pulse module is used for mutual conversion between level signals and pulse signals. When the module function selection is set to 1, the level signal is converted to pulse signal. When the module function selection is set to 2, the pulse signal is converted to level signal.

Operating principles

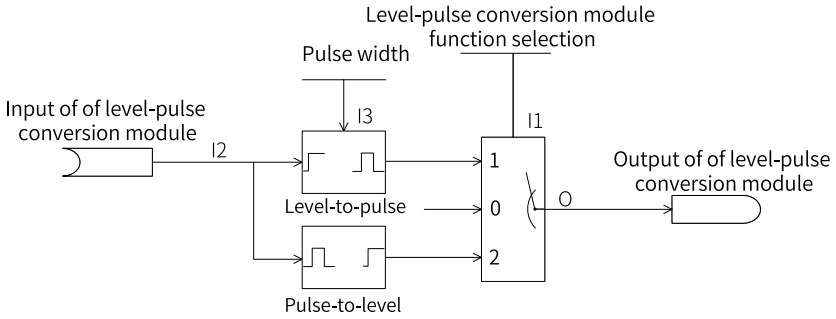
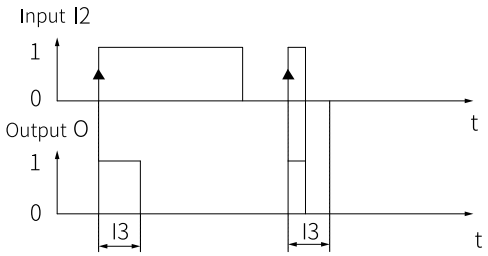


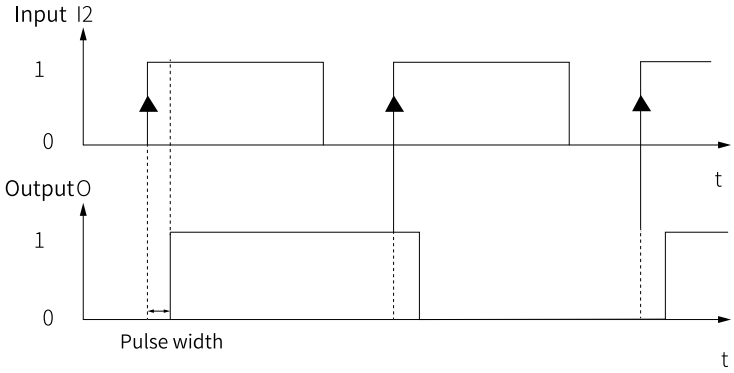
Figure 12-50 Schematic of the level-to-pulse module

(1) When the level-to-pulse module function selection I1 is set to 0 [Disable], the module is inactive and the output is 0.

(2) When the level-to-pulse module function selection I1 is set to 1 [Level-to-pulse], the level signal can be converted to pulse signal, and the output O is set to high level within one pulse duration I3 at the rising edge of input I2. If the input I2 is 0, the output is set 0 immediately no matter whether the pulse duration I3 is reached.



(3) When the level-to-pulse module function selection I1 is set to 2 [Pulse-to-level], the pulse signal can be converted to level signal. In this case, the output is set to high level after the first rising edge of input I2 persists for a duration equal to pulse width I3, and the output is set to low level after the second rising edge of input I2 persists for a duration equal to pulse width I3. Thereafter, the output is set to high level at every odd-numbered rising edge and set to low level at every even-numbered rising edge.



Connection parameters

The input and output of the level-to-pulse module (A to D) are as follows.

Input I1 parameter value source: 0 [Disable], 1 [Level-to-pulse], and 2 [Pulse-to-level].

Input I2 parameter value source: 0, 1, DI input, and bit connector.

Input I3 parameter value source: Floating-point number with two decimal places

Location for saving output O: Bit connector.

Parameters corresponding to the inputs and outputs of the level-to-pulse module are as follows.

Level-to-pulse 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

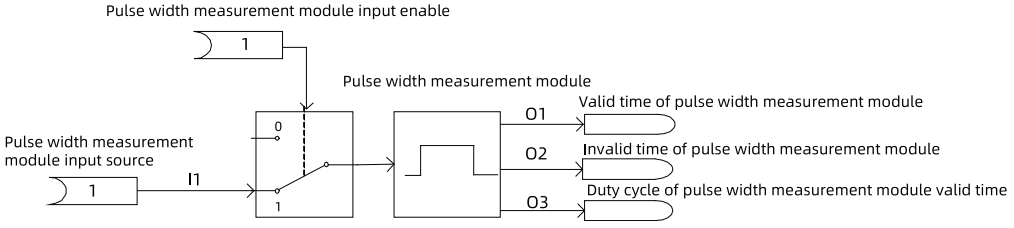
12.8.7.4 Pulse Width Measurement Module (A to D)

Description

The pulse width measurement module can summarize the application scenario changing with the DI edge and implement the timing function for the open and close time of the DI.

Operating principles

The pulse width measurement module involves two functions: the input enable function and the input source. The input enable function is used to determine whether to enable the pulse width measurement function, and the input source is used to select the DI or other objects to be measured.



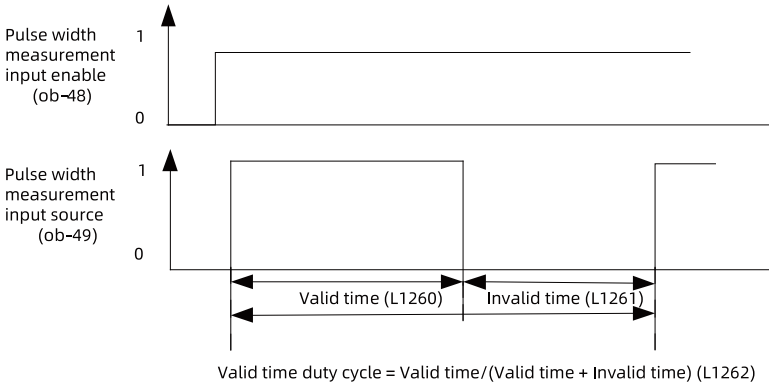
Note

The high level of the input source corresponds to the valid time, and the low level of the input source corresponds to the invalid time.

Input enable of pulse width measurement module	Detailed description
0 (Disabled)	The module is inactive. The effective time, time, and effective time duty cycle of the pulse measurement module are all output as 0.
1: Enable	The module is active. When the input source is constantly high, the module is inactive.
DI terminal	When the DI input value is 0, the module is inactive; when the DI input value is 1, the module is active.
Other: B connector	

Application instance

Take pulse width measurement module A as an example.



Scenario when the input enable of the pulse measurement module is 1 (Enabled):

When the input source of the pulse measurement module is high level, the duration of the high level is the effective time of the pulse measurement module.

When the input source of the pulse measurement module is low level, the duration of the low level is the ineffective time of the pulse measurement module.

Effective time duty cycle of the pulse measurement module = Effective time of pulse measurement module/(Effective time of pulse measurement module + Ineffective time of pulse measurement module).

Connection parameters

The input and output corresponding to the pulse measurement module (A to D) are as follows:

Source of parameter value for input I1: 0 (Disabled), 1 (Enabled), DI input, word connector.

Storage location for outputting effective time O1: Word connector.

Storage location for outputting effective time O2: Word connector.

Storage location for outputting effective time duty cycle O3: Word connector.

The parameters for the input and output of the pulse width measurement module are as follows.

Pulse width measurement module	Input	Output		
	I	O1	O2	O3
A	ob-49	L1260	L1261	L1262
B	ob-51	L1263	L1264	L1265
C	ob-53	L1266	L1267	L1268
D	ob-55	L1269	L1270	L1271

12.8.7.5 Limit Module (A to D)

Description

The limiting module is used to limit the numerical value of the input signal, and both upper and lower limits can be set. 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.

Operating principles

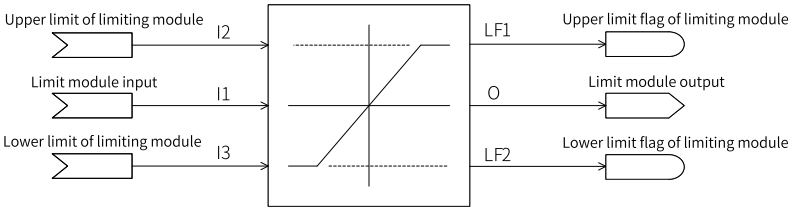


Figure 12-51 Limiting module diagram

(1) When the input I1 of the limiting module is set to 0 [Disabled], the module is inactive and the output is 0.

(2) When the input I1 is greater than the upper limit I2, the output O equals the value of I2, and the upper limit flag LF1 is set to 1.

(3) When the input I1 is lower than the lower limit I3, the output O equals the value of I3, and the lower limit flag LF2 is set to 1.

(4) When the input I1 is within the upper and lower limit range, the output O equals the input value I1.

Connection parameters

The input and output of the limiting module (A to D) 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: 0 (upper limit invalid), AI1, AI2, HDI, multi-reference, simple PLC, PID, communication, and floating-point connector.

Parameter source of input I3: 0 (lower limit invalid), AI1, AI2, HDI, multi-reference, simple PLC, PID, communication, and floating-point connector.

Location for saving output O: Floating-point connector.

Storage location for outputs LF1 and LF2: Bit connector

Parameters corresponding to the inputs and outputs of the limiting module are as follows.

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

12.8.7.6 Logic Delay Module (A To H)

Function description

The logic delay module is used to process input signals with a delay. After the ON delay time is set, when the input signal changes from 0 to 1, the output signal will be delayed. After the OFF delay time is set, the output signal will be delayed when the input signal changes from 1 to 0.

Operating principles

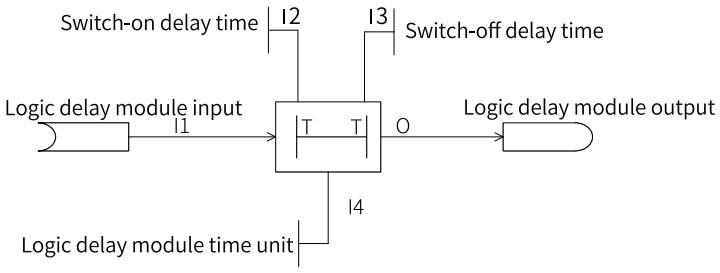
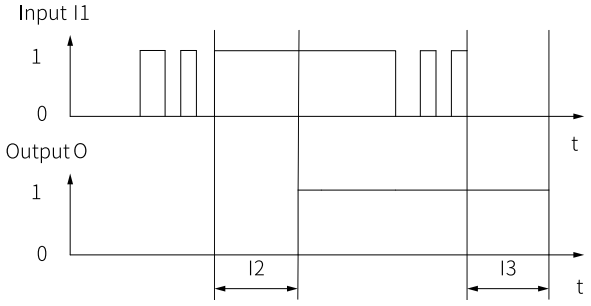


Figure 12-52 Diagram of the logic delay module

When the input I1 of the logic delay module is set to 0 [Disable], the module is inactive and the output is 0.

When the input I1 of the logic delay module is set to any other input, the output O is applied with the ON delay when the input I1 changes from low level to high level. The delay time depends on the ON delay time set by I2 and the time unit selected by I4. The output O is also applied with a OFF delay when the input I1 changes from high level to low level. The delay time depends on the OFF delay time set by I3 and the time unit selected by I4.

During the delay period, pulse signals shorter than the set delay time will be filtered out, as shown in the figure below.



Connection parameters

The inputs and outputs corresponding to the logic delay modules (A to H) are as follows.

Source of parameter value for input I1: 0 [Disable], DI input, and bit connector.

Source of parameter values for inputs I2 and I3: Unsigned number.

Source of parameter value for input I4: 0 [No delay], 1 [10 ms], 2 [100 ms], 3 [1s], 4 [10s], 5 [1 min], and 6 [2 min].

Location for saving output O: Bit connector.

Parameters corresponding to the inputs and outputs of the logic delay module are as follows.

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

12.8.8 Multi-point Curve Module (A to B)

Description

The multi-point curve module can define up to ten curve points to define the input-output relationship in segments. After setting the multi-point curve, set the module input value, and the corresponding output value will be calculated based on the curve relationship.

Applicable scenario

When the variation relationship between input and output is relatively complex, the multi-point curve can be used to achieve the corresponding variation between input and output.

Operating principles

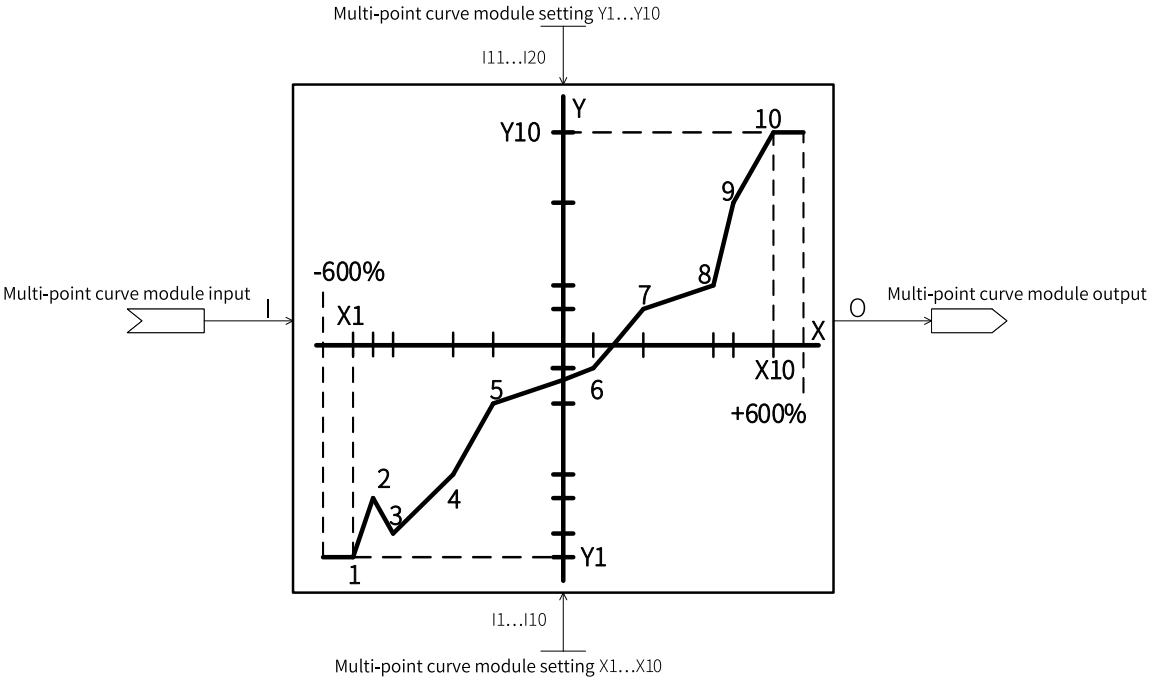


Figure 12-53 Multi-point curve diagram

The coordinate is valid only when X1 ≤ X2 ≤⋯≤ X10 on the x-coordinate of the multi-point curve 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 x-coordinate of the multi-point curve does not meet X1 ≤ X2 ≤⋯≤ X10, U6-74 [Multi-point curve setting error flag] is set to 1, the curve setting is incorrect.

Connection parameters

The input-output relationship of the multi-point curve (A to B) is as follows.

Parameter value source for input I: 0 [Disable] and floating-point connector.

Parameter value source for coordinate setpoints X1 to X10 and Y1 to Y10: Floating-point number with one decimal place.

Location for saving output O: Floating-point connector.

The parameters for the input-output relationship of the multi-point curve module are as follows in the table.

Multi-point curve module		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

Application instance

If frequency adjustment based on AI input is required but the relationship is complex and cannot be met by AI curve, you can set through the multi-point curve module. For example, the AI input and frequency reference satisfy the following relationship.

(1) When AI input is 0, the frequency reference is 10%.

(2) When AI input is 30%, the frequency reference is 25%.

(3) When AI input is 50%, the frequency reference is 60%.

(4) When AI input is 70%, the frequency reference is 85%.

(5) When AI input is 100%, the frequency reference is 100%.

In this case, the multi-point curve parameters can be set as follows to establish the relationship between AI and frequency. Then set F0-29 [Main frequency source] to L2448 [Multi-point curve A output] to modify the frequency reference through the multi-point curve.

Param.	Name	Setpoint	Description
o2-00	Input of multi-point curve module A	L2244 [AI1 input value]	The multi-point curve input is set to AI1.
o2-01	Configuration X1 of multi-point curve module A	0.0%	Defines the x-coordinate of the first point of the multi-point curve.

Param.	Name	Setpoint	Description
o2-02	Setpoint X2 of multi-point curve module A	30.0%	Defines the x-coordinate of the second point of the multi-point curve.
o2-03	Setpoint X3 of multi-point curve module A	50.0%	Defines the x-coordinate of the third point of the multi-point curve.
o2-04	Setpoint X4 of multi-point curve module A	70.0%	Defines the x-coordinate of the fourth point of the multi-point curve.
o2-05	Setpoint X5 of multi-point curve module A	100.0%	Defines the x-coordinate of the fifth point of the multi-point curve.
o2-11	Setpoint Y1 of multi-point curve module A	10.0%	Defines the y-coordinate of the first point of the multi-point curve.
o2-12	Setpoint Y2 of multi-point curve module A	25.0%	Defines the y-coordinate of the second point of the multi-point curve.
o2-13	Setpoint Y3 of multi-point curve module A	60.0 %	Defines the y-coordinate of the third point of the multi-point curve.
o2-14	Setpoint Y4 of multi-point curve module A	85.0 %	Defines the y-coordinate of the fourth point of the multi-point curve.
o2-15	Setpoint Y5 of multi-point curve module A	100.0%	Defines the y-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 multi-point curve module output is 25.000%, and the frequency reference is 25%.

When AI1 input is 40.0%, this value falls between X2 and X3 on the x-coordinate of the multi-point curve. The multi-point curve output is then calculated based on the linear relationship between the second and third points. The output is 42.5%, which is calculated based on (Y3 - Y2)/(X3 - X2) x (40.0% - X2) + Y2. This means the frequency reference is 42.5%.

12.8.9 Constant Value Module

Description

The output value of the constant value module is always equal to the input value.

Applicable scenario

When the input source needs to be set to a fixed value, use the constant value module to set the value, and then select the output of the constant value module as the input source.

Operating principles

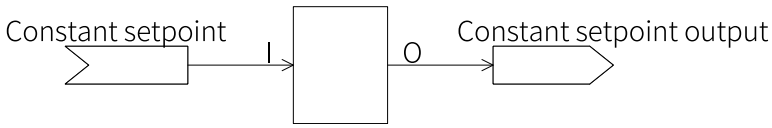


Figure 12-54 Diagram of the constant value module

The output O of the constant value module equals the setpoint I. Constant value setpoints are divided into the following two types.

(1) Floating-point number with 1 decimal place, with a setting range of -3000.0% to +3000.0%

(2) Signed integer, with a setting range of -32768 to +32767

Connection parameters

The drive provides 16 groups of constant value modules, with the following input and output corresponding to each module:

Source of input I parameter value: Floating-point number or signed integer

Location for saving output O: word connector or floating-point connector

The parameters corresponding to the input and output of the constant value module are as follows.

Constant Value 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
Word 1	o1-08	L1200
Word 2	o1-09	L1201
Word 3	o1-10	L1202
Word 4	o1-11	L1203
Word 5	o1-12	L1204
Word 6	o1-13	L1205
Word 7	o1-14	L1206
Word 8	o1-15	L1207

13 Other Functions

13.1 Parameter Interconnection

13.1.1 Connectors

13.1.1.1 Introduction to Connectors

Description

Connectors refers to parameters in group L, which are divided into bit connectors (B connector), word connector system (K connector), and floating-point connectors (F connector).

Word connector system contain 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. To distinguish between the two types of word connectors, this guide describes as word connectors (single-word connectors) and double-word connectors.

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.

13.1.1.2 Bit Connector (Connector B)

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).

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 parameters

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 disconnected 1: DI2 closed	Displays the final level state of DI2.
L0004	DI3	0: DI3 disconnected 1: DI3 closed	Displays the final level state of DI3.
L0005	DI4	0: DI4 disconnected 1: DI4 closed	Displays the final level state of DI4.
L0006	DI5	0: DI5 disconnected 1: DI5 closed	Displays the final level state of DI5.
L0012	VDI1	0: VDI1 disconnected 1: VDI1 closed	Displays the final level state of VDI1.
L0013	VDI2	0: VDI2 disconnected 1: VDI2 closed	Displays the final level state of VDI2.
L0014	VDI3	0: VDI3 disconnected 1: VDI3 closed	Displays the final level state of VDI3.
L0015	VDI4	0: VDI4 disconnected 1: VDI4 closed	Displays the final level state of VDI4.
L0016	VDI5	0: VDI5 disconnected 1: VDI5 closed	Displays the final level state of VDI5.
L0017	VDI6	0: VDI6 disconnected 1: VDI6 closed	Displays the final level state of VDI6.
L0018	DI1 inverted	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	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 MD610S).
L0021	DI4 inversion	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 MD610S).

Group L00			
Param.	Name	Display range	Description
L0022	DI5 inversion	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 MD610S).
L0028	Opposite to VDI1	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.
L0029	Opposite to VDI2	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	Opposite to VDI3	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	Opposite to VDI4	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	Opposite to VDI5	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	Opposite to VDI6	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	Read-only	0: No output is generated from RO. 1: RO generates output.	This parameter 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	0: FMR does not generate output. 1: FMR generates output.	Displays the final output state of FMR (valid only for MD610S).
L0044	VDO1	0: No output is generated from VDO1. 1: VDO1 generates output.	This parameter displays the final output state of VDO1.
L0045	VDO2	0: No output is generated from VDO2. 1: VDO2 generates output.	Displays the final output state of VDO2.
L0046	VDO3	0: No output is generated from VDO3. 1: VDO3 generates output.	Displays the final output state of VDO3.

Group L00			
Param.	Name	Display range	Description
L0047	VDO4	0: No output is generated from VDO4. 1: VDO4 generates output.	Displays the final output state of VDO4.
L0048	VDO5	0: No output is generated from VDO5. 1: VDO5 generates output.	Displays the final output state of VDO5.
L0049	VDO6	0: No output is generated from VDO6. 1: VDO6 generates output.	Displays the final output state of VDO6.
L0050	AI1 input limit violation	0: Not exceeded 1: Active	This parameter displays whether the AI1 input voltage exceeds the AI limit range.
L0051	AI2 input limit violation	0: Not exceeded 1: Active	This parameter displays whether the AI2 input voltage exceeds the AI limit range.
L0053	HDI input disconnection (active only for MD610S)	0: Inactive 1: Active	This parameter indicates 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	This parameter indicates the level status when AI1 is used as the DI.
L0055	Level state of the AI2 used as DI	0: Low level 1: High level	This parameter indicates the level status when AI2 is used as the DI.
L0057	AI2 temperature mode - Motor temperature reached	0: Temperature not reached 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: No overtemperature fault 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: No overtemperature pre-alarm 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: Invalid 1: Valid	Displays whether the drive is ready for switch-on.
L0101	Ready to run	0: Invalid 1: Valid	Displays whether the drive is ready to run.

Group L01			
Param.	Name	Display range	Description
L0102	Operation state	0: Invalid 1: Valid	Displays whether the drive is operating.
L0103	Fault activation	0: Invalid 1: Valid	Displays whether the drive is faulty.
L0104	OFF2 (coast to stop) flag	0: Valid 1: Invalid	Displays the current state of the OFF2 (coast to stop) command.
L0105	OFF3 (quick stop) flag	0: Valid 1: Invalid	Displays the current state of the OFF3 (quick stop) command.
L0107	Alarm/Minor fault activation	0: Invalid 1: Valid	Displays whether the drive encounters an alarm or a minor fault.
L0110	Target Speed Arrival	0: Speed not reached 1: Speed reached	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: No output 1: Error outputted	Displays whether the drive reports faults, minor faults, or alarms.
L0133	Error output (excluding undervoltage fault)	0: No output 1: Error outputted	Defines whether the drive reports faults, minor faults, or alarms (excluding undervoltage faults).

Group L01			
Param.	Name	Display range	Description
L0134	Fault output	0: Relay invalid upon fault and automatic fault reset 1: Relay valid 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: Invalid 1: Valid	Displays whether the drive is in the normal operation state.
L0137	Jog	0: Invalid 1: Valid	Displays whether the drive is in the jog state.
L0138	Decelerate-to-stop state	0: Inactive 1: Valid	Displays whether the drive is in the decelerate-to-stop state.
L0139	Quick stop	0: Inactive 1: Valid	Displays whether the drive is in the quick-stop state.
L0140	Stop-at-maximum-capability state	0: Inactive 1: Valid	Displays whether the drive is in the stop-at-maximum-capability state.
L0156	Reverse run	0: Inactive 1: Valid	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: Not reached 1: Reached	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: Not reached 1: Reached	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: Not reached 1: Reached	Displays whether the current operating time reaches the timed operation time (P0-14 and P0-15).
L0247	Current Operating Time Arrival	0: Not reached 1: Reached	Displays whether the current operation time reaches the set time (P0-20).
L0258	Current 1 arrival	0: Not reached 1: Reached	Displays whether the output current reaches the range of current detection level 1.
L0259	Current 2 arrival	0: Not reached 1: Reached	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.

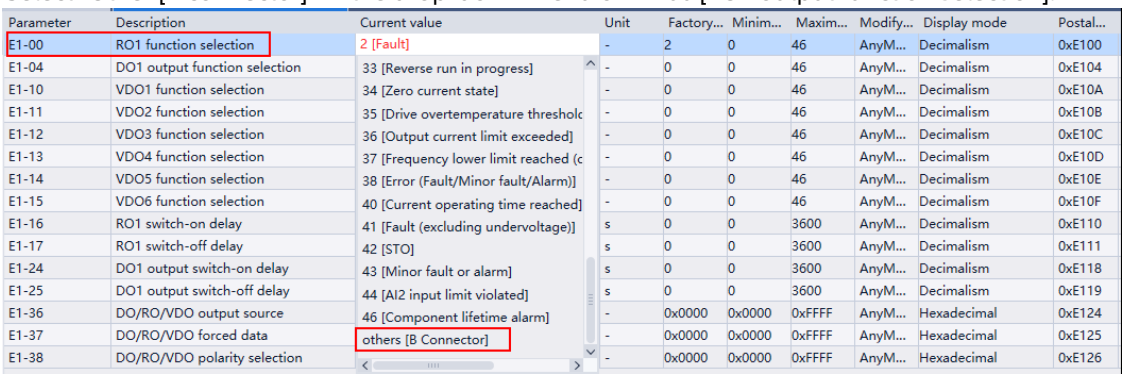
Group L02			
Param.	Name	Display range	Description
L0262	Frequency level detection 1	0: Inactive 1: Active	Displays whether the operating frequency reaches the frequency level detection 1 (FDT1) range.
L0263	Frequency level detection 2	0: Inactive 1: Active	Displays whether the operating frequency reaches the frequency level detection 2 (FDT2) range.
L0264	Frequency arrival	0: Not reached 1: Reached	Displays whether the operating frequency reaches the target frequency.
L0265	Frequency arrival 1	0: Not reached 1: Reached	Displays whether the running frequency reaches detection frequency 1.
L0266	Frequency arrival 2	0: Not reached 1: Reached	Displays whether the running frequency reaches detection frequency 2.
L0267	Frequency upper limit reached	0: Not reached 1: Reached	Displays whether the operating frequency reaches the upper limit. Note: The 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: Not reached 1: Reached	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 invalid in the stop state. Note: The 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.

Group L02			
Param.	Name	Display range	Description
L0269	Frequency lower limit arrival (output generated even at stop)	0: Not reached 1: Reached	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 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: Not reached 1: Reached	Displays whether the motor operating speed reaches the range of speed comparison 1.
L0271	Speed comparison arrival 2	0: Not reached 1: Reached	Displays whether the motor operating speed reaches the range of speed comparison 2.

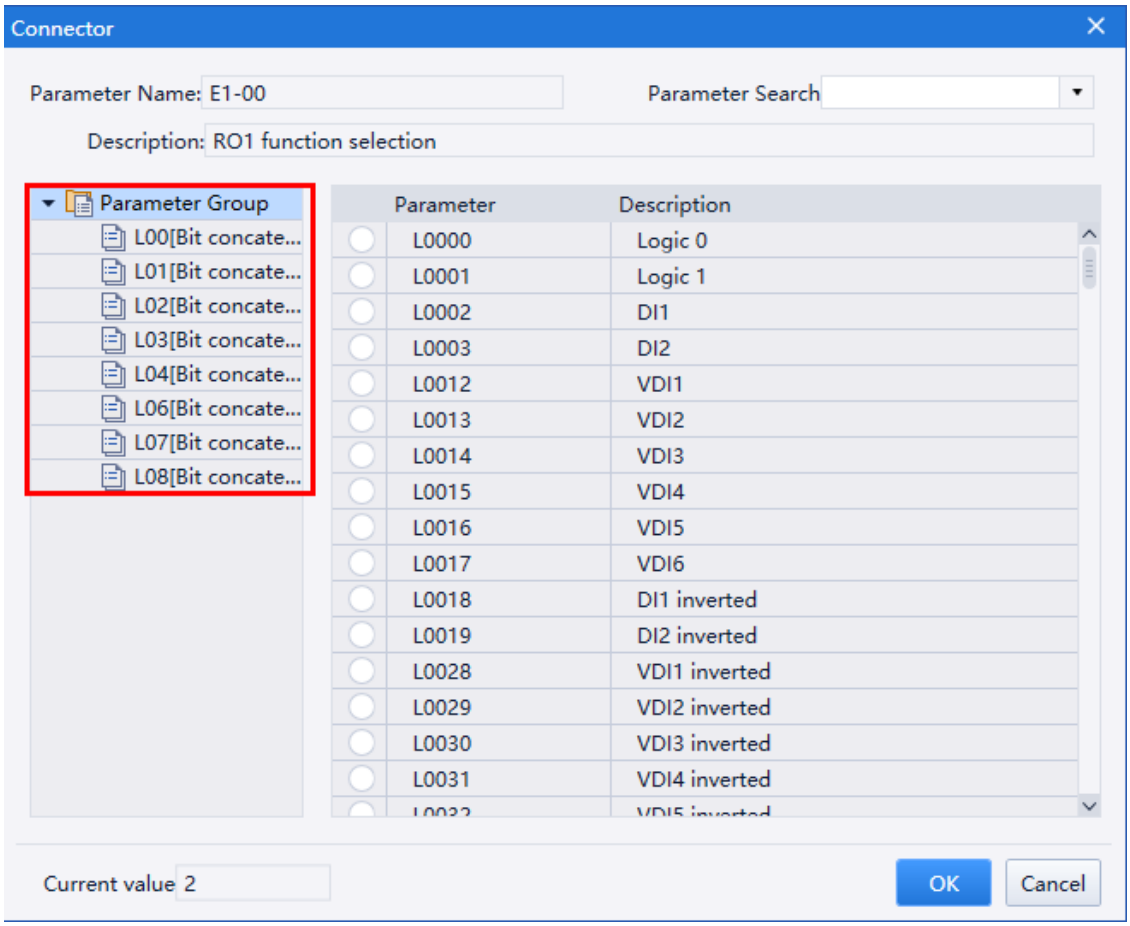
Application instance

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.

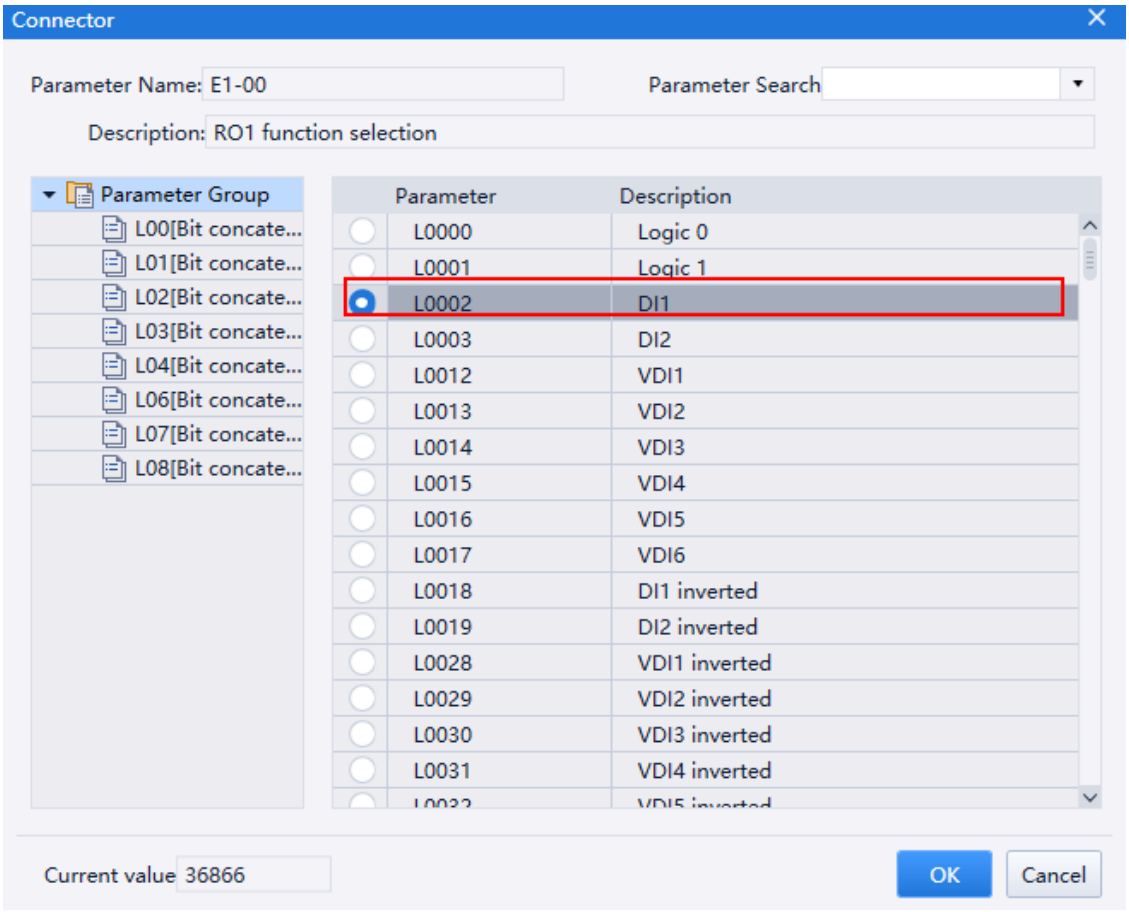
1. Select "Other [B connector]" in the drop-down menu of E1-00 [RO1 output function selection].



2. After clicking "Other [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.

13.1.1.3 Word Connector (Connector K)

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 DI5 and VDI1 to VDI6 through L1065.

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 *"12.8.1 Introduction To the Free Function Module" on page 788* 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 parameters

Group L10			
Param.	Name	Display range	Description
L1000	Current state of the system state machine	0: Initializing 1: Switch-on inhibited 2: Switch-on allowed 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 for 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 (To be 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 P0-59. If the value of P0-59 is 1, then bit 15 value is 1; when the word P0-59 is 0, then bit 15 value is 0.

Group L10			
Param.	Name	Display range	Description
Same as above	Same as above	(Continued) bit12: Forward 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 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 (To be 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 operating 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: Custom 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 invalid 1: Relay valid bit8: IGBT pulsing state 0: Stop 1: Valid bit9: System command direction 0: Forward run 1: Reverse (To be 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 active control channel of the drive. bit1: Setting channel selection - Displays the active 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 - 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. Bit 9: System command direction – Displays the system command direction. bit10: IGBT pulsing state with delay - Displays the IGBT pulsing state with delay. Bit 11: 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) bit10: IGBT pulsing state with delay 0: Stop 1: Valid 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 (invalid at stop) 0: Inactive 1: Active bit1: Operating at zero speed (valid at stop) 0: Inactive 1: Active bit2: Frequency level detection 1 0: Inactive 1: Active bit3: Frequency level detection 2 0: Inactive 1: Active Bit 4: AI1/AI2 0: Inactive 1: Active bit5: Simple PLC cycle state 0: Not completed 1: Completed bit6: Reference value set through communication 0: Inactive 1: Active bit7: Reserved (To be 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 (invalid 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. Bit 2: 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 PO-35. Bit 3: 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: Reference value set through communication - 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 PO-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 AC 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. (To be 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 reach 0: Inactive 1: Active bit10: Zero current state 0: Inactive 1: Active bit11: Output current limit exceeded 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: Initializing 1: Sampling preparation 2: Undervoltage 3: Ready bit2: Hardware information status 0: Not ready 1: Ready bit3: Operation state 0: Stop 1: Valid bit4: Output blocked 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 - Indicates the power-on initialization state of the drive. Bit 2: Hardware information status - Displays whether the hardware power-on self-test passed without exception. Bit 3: Running/stop status - 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: Valid bit1: OFF2 (coast to stop) state 0: Stop 1: Valid bit2: OFF3 (quick stop) stop 0: Stop 1: Valid bit3: Running permitted 0: Disable 1: Active Bit 4: Reset command 0: Not reset 1: Reset bit5: Jog 1 0: Inactive 1: Active Bit 6: Jog 2 0: Inactive 1: Active Bit 7: Speed inversion 0: no inverse 1: Inverse	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 custom command word of control channel 1. bit4: Reset command - Displays the reset command status of the custom command word of control channel 1. bit5: Jog 1 - Displays the jog 1 state of the custom command word of control channel 1. bit6: Jog 2 - Displays the jog 2 state of the custom command word of control channel 1. bit7: Speed inversion - Displays the speed inversion state of the custom command word of control channel 1.

Group L10			
Param.	Name	Display range	Description
L1045	Custom command word of control channel 2	Same as L1044	Displays the real-time operating status of custom 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 custom command word of control channel 2. bit4: Reset command - Displays the reset command status of the custom command word of control channel 2. bit5: Jog 2 - Displays the jog 1 state of the custom command word of control channel 2. bit6: Jog 2 - Displays the jog 2 state of the custom command word of control channel 2. bit7: Speed inversion - Displays the speed inversion state of the custom 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: Valid bit1: OFF2 (coast to stop) state 3 0: Stop 1: Valid bit2: OFF3 (quick stop) stop 2 0: Stop 1: Valid bit3: OFF3 (quick stop) state 3 0: Disable 1: Active Bit 4: Reset command 2 0: Not reset 1: Reset Bit 5: Reset command 3 0: Not reset 1: Reset Bit 6: RFG disabled 0: Active 1: Inactive Bit 7: RFG paused 0: Active 1: Inactive Bit 8: RFG mandatory 0: Active 1: Inactive	Displays the real-time operating status of the auxiliary command word control channel 1. You can view the drive 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. Bit 0: 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. Bit 4: 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 control channel 2. You can view the drive 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: Bit 0 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 outputs an active signal. When both 24 V inputs are disconnected, the DO outputs an active signal. In this case, this bit is set to 1. bit3 indicates the STO status flag bit. When both 24 V inputs are disconnected, this bit is set to 1.

Group L10			
Param.	Name	Display range	Description
L1051	LED control word	bit0: Start command 0: Inactive 1: Active Bit 1: Stop 0: Inactive 1: Active Bit 2: Jog 1 0: Inactive 1: Active Bit 3: Local control 0: Inactive 1: Active Bit 4: Reset 0: Inactive 1: Active Bit 5: Jog 2 0: Inactive 1: Active Bit 6: Direction switching 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: Valid 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 1: RFG output set to 0 forcibly bit5: RFG paused 0: Normal 1: RFG pause bit6: RFG input forced to 0 0: Normal 1: RFG input set to 0 forcibly bit7: Fault reset 0: Inactive 1: Active Bit 8: Jog 1 0: Inactive 1: Active Bit 9: Jog 2 0: Inactive 1: Active bit10: Remote control (reserved) 0: Inactive 1: Active bit11: Speed inversion 0: Inversion disabled 1: Inversion (To be continued)	This parameter indicates 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) bit12: Start signal 0: Inactive 1: Active Bit13: Internal start command 0: Inactive 1: Active	Same as above
L1055	Control word set through communication	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Valid bit1: OFF2 (coast to stop) state 0: Stop 1: Valid bit2: OFF3 (quick stop) stop 0: Stop 1: Valid bit3: Running permitted 0: Disable 1: Active Bit 4: Reset command 0: Not reset 1: Reset bit5: Jog 1 0: Inactive 1: Active Bit 6: Jog 2 0: Inactive 1: Active Bit 7: Speed inversion 0: no inverse 1: Inverse	This parameter indicates 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 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 Bit 1: Reverse operation (Rev) 0: Inactive 1: Active Bit 2: Running permitted (Enable) 0: Inactive 1: Active Bit 3: Reset command (Reset) 0: Inactive 1: Active Bit 4: Jog 1 (JOG1) 0: Inactive 1: Active Bit 5: Jog 2 (JOG2) 0: Inactive 1: Active Bit 6: Reserved (Rsvd1) 0: Inactive 1: Active bit7: Terminal input (In1) 0: Inactive 1: Active bit8: Terminal input (In2) 0: Inactive 1: Active bit9: Terminal 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.
L1060	Active external command source	0: Operating panel 1: Terminal 2: Communication 3: Custom	Displays the effective external command source.

Group L10			
Param.	Name	Display range	Description
L1065	DI state	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2 to bit4: States of DI3 to DI5 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 status 0: Low level 1: High level bit8: FMR 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.

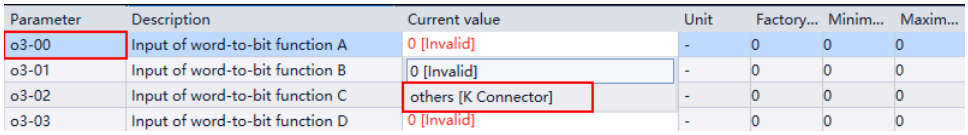
Group L11			
Param.	Name	Display range	Description
L1100	Base value of speed per unit value	0 rpm to 65535 rpm	Displays the base value of speed per-unit value. Speed per-unit value = Actual speed/Base value
L1101	Base value of frequency per-unit value	0.0 Hz to 6553.5 Hz	Displays the base value of current frequency per-unit value. Frequency per-unit value = Actual frequency/Base value
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

Group L11			
Param.	Name	Display range	Description
L1105	Base value of torque per unit value	0.00-655.35N·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

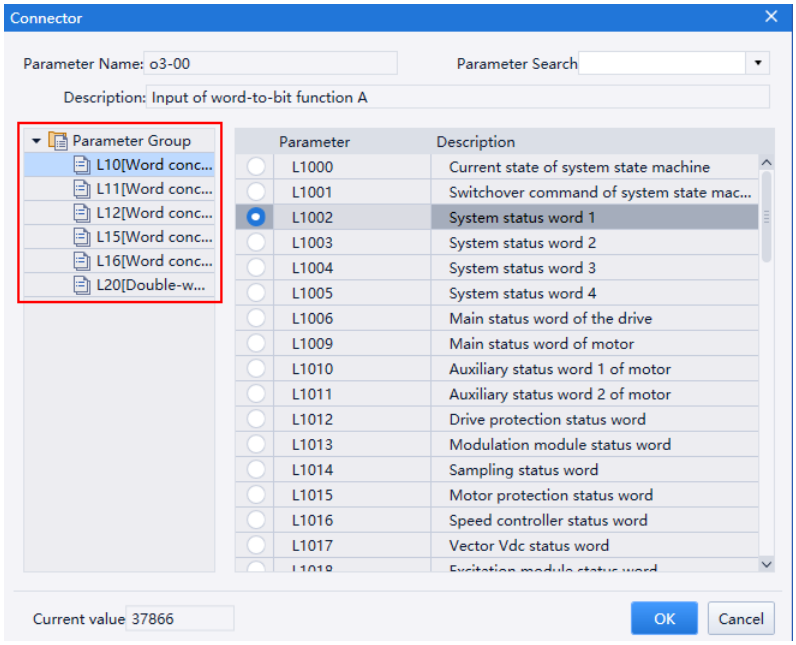
Application example

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.

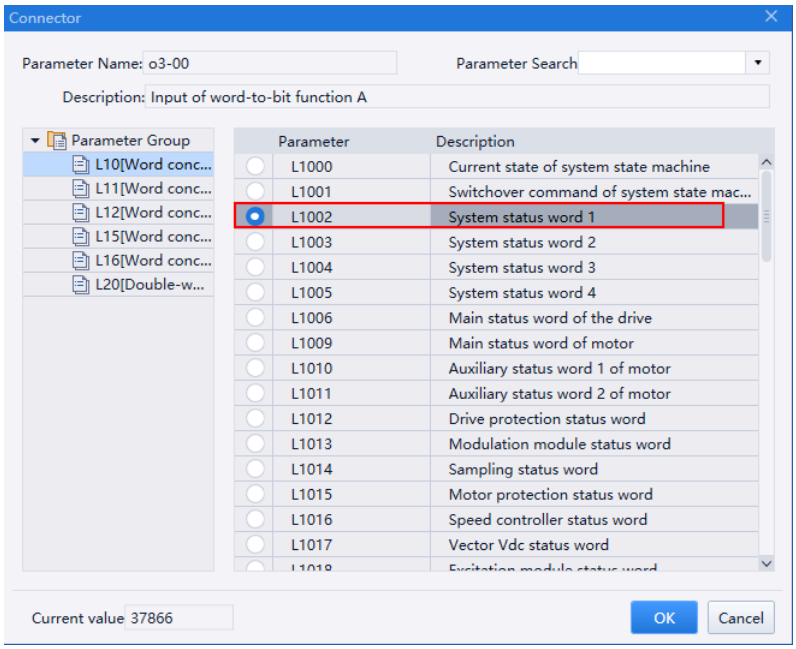
1. Select "Other [K connector]" in the drop-down menu of o3-00 [Input of word-to-bit function A].



2. After clicking "Other [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.

13.1.1.4 Double Word Connector (Connector K)

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 A output of the word-to-double-word module. 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. When 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).

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.

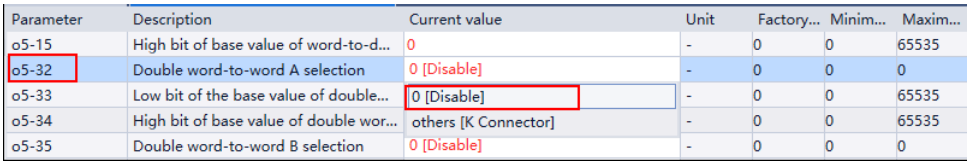
Related parameters

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.

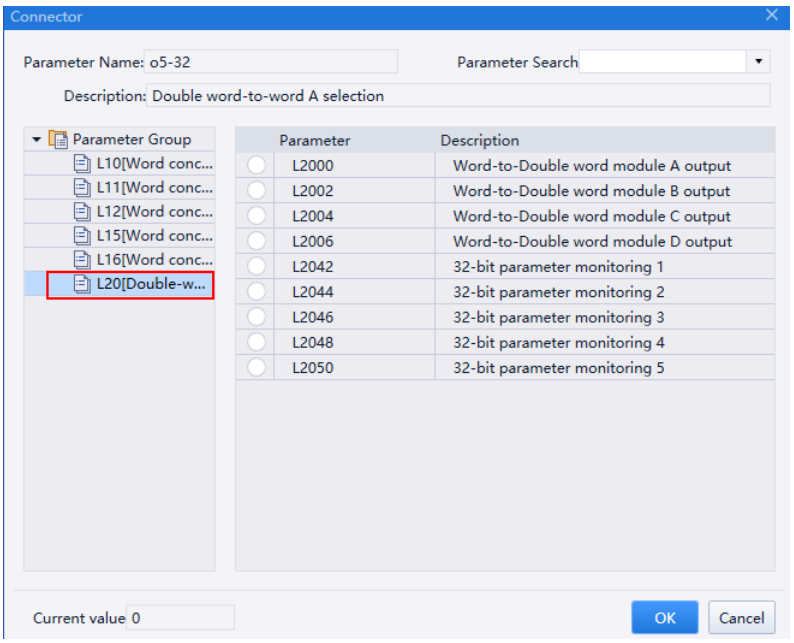
Application instance

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.

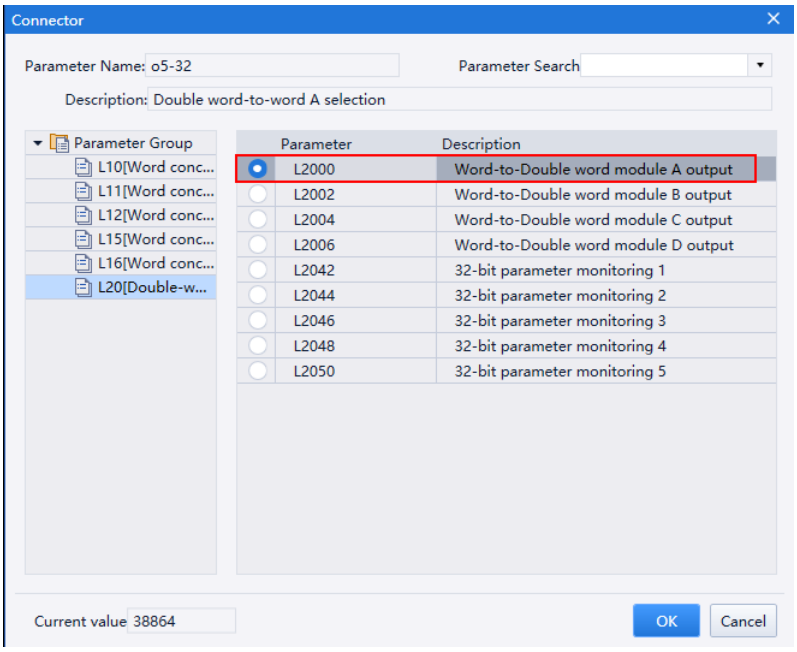
1. Select "Other [K connector]" in the drop-down menu of o5-32 [Selection of double-word-to-word module A].



2. After clicking "Other [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.

13.1.1.5 Floating-Point Connector (Connector F)

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".

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.

Related parameters

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 (MD610S)	-800.0% to +800.0 %	Displays the percentage of the AO value written through communication.
L2258	Current value based on max. 1000A per-unit	-800.0% to +800.0 %	Displays the per-unit current value based on 1000 A at maximum.
L2260	Voltage value based on max. 1000V per-unit	-800.0% to +800.0 %	Displays the per unit voltage value based on 1000 V at maximum.
L2262	Absolute output of AO output torque (MD610S)	-800.0% to +800.0 %	Displays the absolute output of AO output torque.
L2264	Actual value of AO output torque (MD610S)	-800.0% to +800.0 %	Displays the AO output torque range.

Group L23			
Param.	Name	Display range	Description
L2318	Output corresponding to the selected multi-reference value	-800.0% to +800.0 %	This parameter indicates 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	Output corresponding to multi-reference 2	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 2.
L2326	Output corresponding to multi-reference 3	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 3.
L2328	Output corresponding to multi-reference 4	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 4.
L2330	Output corresponding to multi-reference 5	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 5.
L2332	Output corresponding to multi-reference 6	-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	Output corresponding to multi-reference 8	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 8.

Group L23			
Param.	Name	Display range	Description
L2338	Output corresponding to multi-reference 9	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 9.
L2340	Output corresponding to multi-reference 10	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 10.
L2342	Output corresponding to multi-reference 11	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 11.
L2344	Output corresponding to multi-reference 12	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 12.
L2346	Output corresponding to multi-reference 13	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 13.
L2348	Output corresponding to multi-reference 14	-800.0% to +800.0 %	Displays the output corresponding to multi-reference 14.
L2350	Output corresponding to multi-reference 15	-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 %	This parameter indicates the total output of the general PID.
L2468	General PID error	-800.0% to +800.0 %	This parameter indicates the error input of the general PID.
L2470	General PID reference	-800.0% to +800.0 %	This parameter indicates 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 %	This parameter indicates 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.

Group L24			
Param.	Name	Display range	Description
L2478	General PID derivative output	-800.0% to +800.0 %	Displays the derivative term output of the general PID.
L2480	General PID inversion cutoff output	-800.0% to +800.0 %	Displays the maximum output upon PID inversion cutoff.
L2482	Value after simple PLC step per-unit	-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: In the SVC mode, this parameter specifies the motor observed speed; in the V/f mode, this parameter specifies the synchronous frequency before slip compensation.
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 frequency 1	-800.0% to +800.0 %	Defines jog frequency 1 of the effective setting channel, which is obtained based on settings of the jog frequency 1 source and jog frequency 1 reference.
L3018	Jog 2 frequency	-800.0% to +800.0 %	Defines jog frequency 2 of the effective setting channel, which is obtained based on settings of the jog frequency 2 source and jog frequency 2 reference.
L3046	RFG setting 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 speed ramping up	-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 forward 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 reverse frequency	-800.0% to +800.0 %	Displays the effective minimum negative frequency.

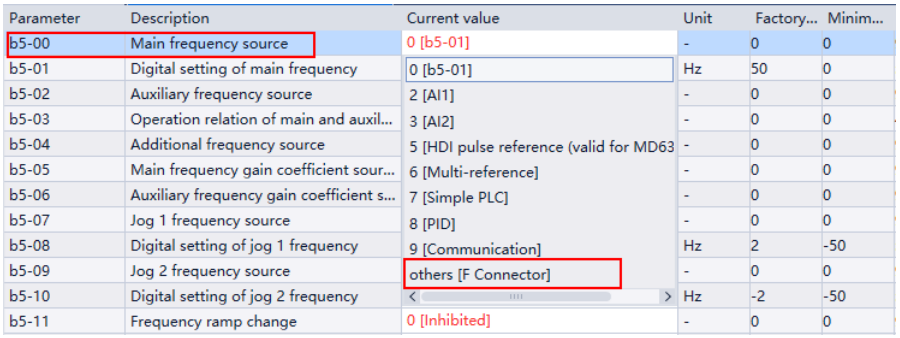
Group L31			
Param.	Name	Display range	Description
L3100	Torque reference	-800.0% to +800.0 %	Displays the torque reference. Note: The torque reference is obtained after the torque is multiplied by the torque gain factor and processed with the maximum and minimum torque limits.
L3112	Maximum positive 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 upon V/f separation	-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	V/f separation voltage output	-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	Drive overload cumulative 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	Motor overload cumulative 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	Drive bus voltage	-800.0% to +800.0 %	Displays the bus voltage of the drive.

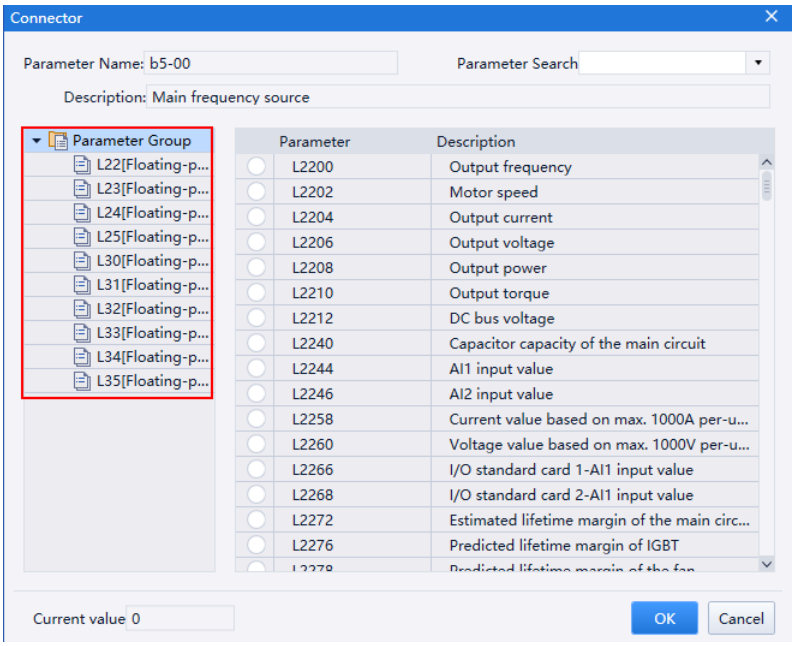
Application instance

Take b5-00 [Main frequency source] as an example to describe how to select the floating-point connector (F connector) as the parameter input.

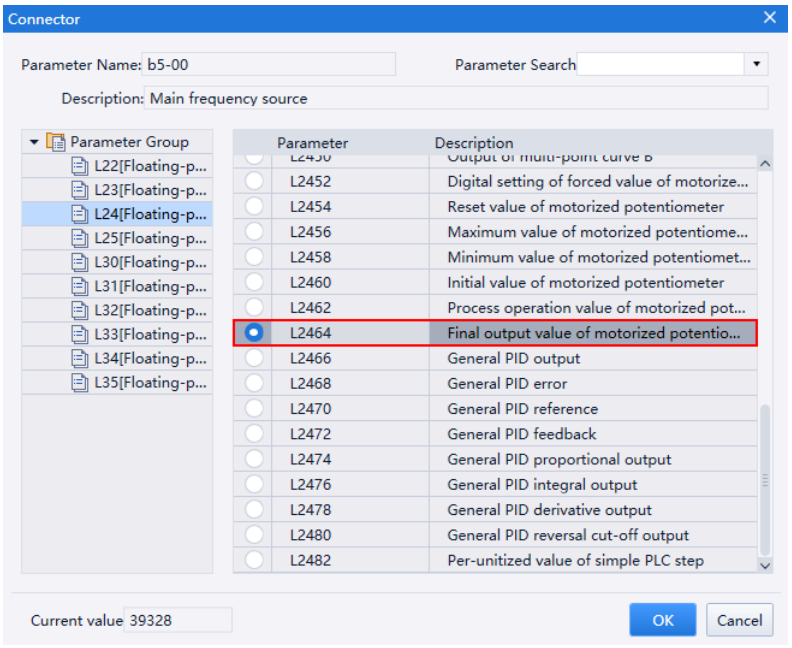
1. Select "Others [F connector]" from the drop-down menu of b5-00 [Main frequency source].



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.

13.1.2 Introduction to 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.

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]".

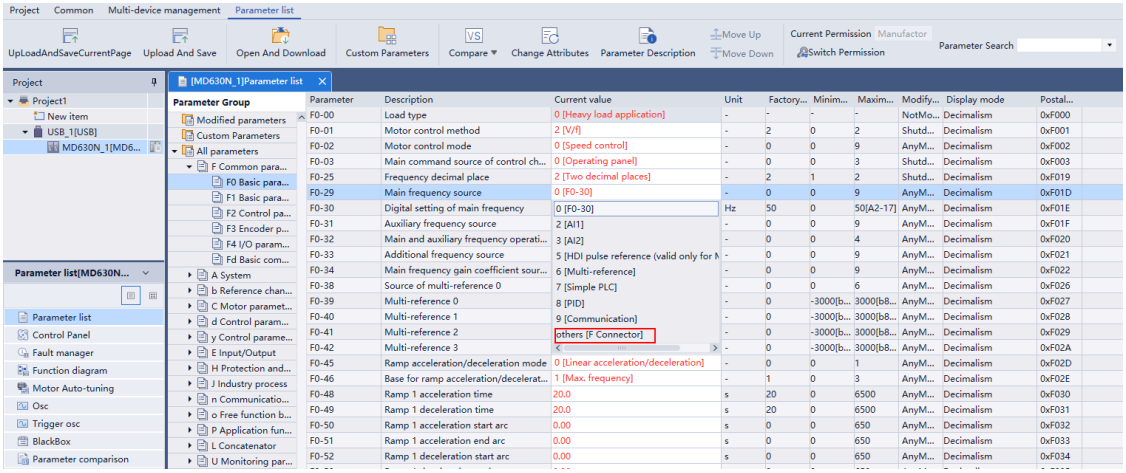


Figure 13-1 Setting the parameter value source

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.

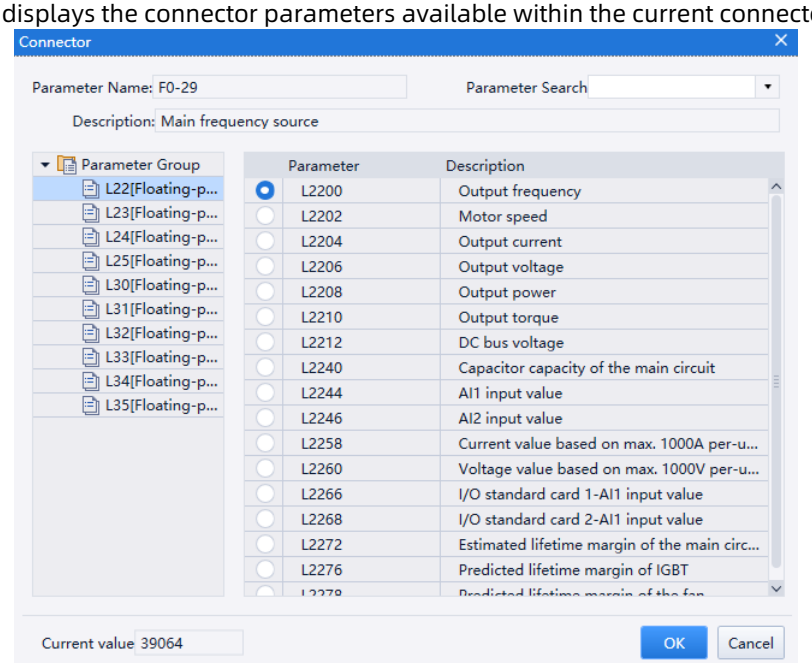


Figure 13-2 Connector selection window

3. Select the connector value to be set. As shown in the figure below, L2352 [Constant setpoint 1 (per-unit)] has been selected.

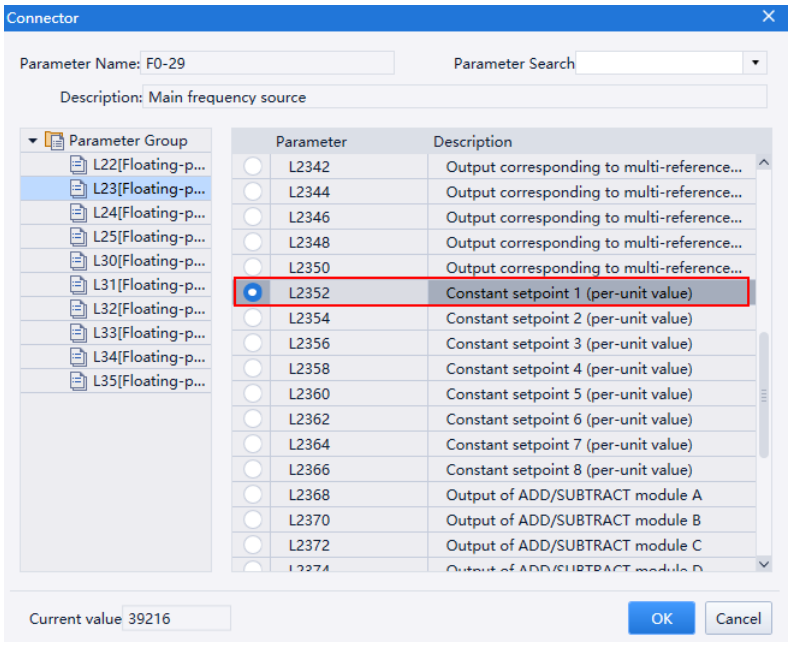


Figure 13-3 Selecting the floating-point connector

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 13-4 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.

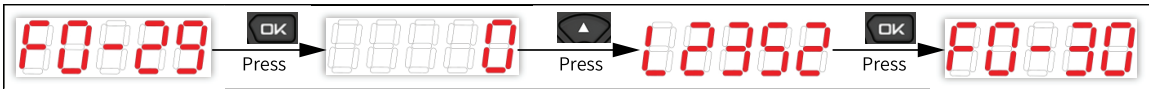


Figure 13-5 Setting the connector parameter through the operating panel

13.2 Parameter Access Level

13.2.1 Introduction to Parameter Access Level

Application scenario

The drive provides different levels of parameter access permissions. The number of accessible parameters varies by access level. The higher the level, the more parameters can be accessed. Users can switch to the appropriate access level as needed to operate and maintain the equipment.

The standard access level is set by default, which displays basic function parameters, excluding parameters for extended functions. To access parameters for extended functions, you can change the current system parameter access level to extended level.

The standard access level includes commonly used parameters of the drive, which can meet the basic function commissioning requirements. For complex and extended function commissioning scenarios, you can the current system parameter access level to extended level.

Description

The access levels are divided into standard, extended, expert, and manufacturer, with each level assigned with access to different parameters. These levels correspond to numbers 0 to 3 in sequence, where a higher number indicates a higher level and more accessible parameters.

High access levels include low access levels, with lower-level parameters being subset of higher-level parameters.

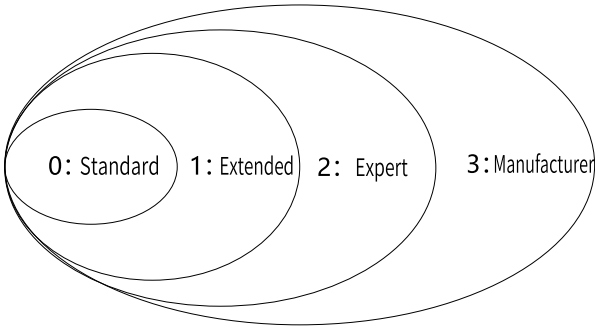


Figure 13-6 Relationship of parameter access levels from low to high

See the table below for descriptions and applicable scopes of different parameter access levels:

Table 13–1 Description of parameter access level

Access level	Description	Description	Applicable scenario
0	Standard	Covers most commonly used functions of the drive. The standard level is recommended when advanced application functions or complex process needs are not needed.	Default parameter access level, which mainly includes commonly used parameters of the drive to meet the basic function commissioning requirements of the drive.
1	Extended	Besides the standard drive functions, advanced application features and complex processes are added, such as user-defined parameters, VDI, VDO, wobble frequency, and free function blocks. If these functions are required, the extended access level is recommended.	Added with extended function parameters to the standard parameters to meet specific functional requirements.
2	Expert	Added with more complex motor performance tuning parameters to the extended parameters.	Access to the expert level is password-protected. Expert level is added with complex motor performance tuning parameters to the extended parameters, which is intended only for professional commissioning personnel.
3	Manufacturer	Password-protected for use by Inovance only.	Allows access to all parameters, which is intended only for after-sales maintenance personnel of Inovance.

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 value	Value range	Description
A0-10	System parameter access level	0	0: Standard 1: Extended 2: Expert 3: Manufacturer	Displays the parameter access level of current system. Options: 0: Standard (Default) - Only standard-level parameters are accessible. Parameters of other levels cannot be accessed. Most commonly-used parameters are available at the standard level to meet the needs of most commissioning scenarios. 1: Extended - Parameters at the extended level and standard level can be accessed. Extended-level parameters are related to specific functional requirements or process needs. 2: Expert - Parameters at the expert level, extended level, and expert level can be accessed. The expert level is password-protected and intended for professional commissioning personnel only. 3: Manufacturer - All parameters can be accessed. The manufacturer level is password-protected and intended for use by Inovance only.
A0-11	Parameter access level	0	0: Standard 1: Extended 2: Expert	Defines the system parameter level. Options: 0: Standard - The standard level can be accessed. 1: Expansion - The extended level can be accessed. 2: Expert - The expert level can be accessed. Note: If the expert password (A0-14) is locked, you cannot switch to expert level directly.

Param.	Name	Default value	Value range	Description
A0-14	Expert password status display	0	0: Expert password invalid (expert password is not set) 1: Expert password locked (expert password is activated and locked) 2: Expert password unlocked (expert password is activated and unlocked)	Displays the current expert password status. Options: 0: Expert password invalid (expert password is 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: Expert password locked (expert password is activated and locked) - The expert password is set, and the expert-level parameters are locked. You need to enter the correct expert password to switch to the expert level through A0-11. 2: Expert password unlocked (expert password is activated and unlocked) - 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, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
A0-15	Expert password input	-	-	Used to input the expert password. Note: If the data entered through A0-15 is consistent with that defined by A0-16, you can unlock the expert-level parameters. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
A0-16	Expert password setting	-	0 to 65535	Defines 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 the password entered is incorrect, you cannot enter the expert level. This parameter is an expert parameter, which can be displayed only when the parameter access level (A0-10) is "Expert" or higher.

13.2.2 Parameter Access Level

The parameter access level of the drive is set to "Standard level" by default. During use, you may switch to other parameter access levels as needed. The current parameter access level of the drive is displayed in A0-10 [Current system parameter access level].

The method for switching parameter access levels is shown in the figure below.

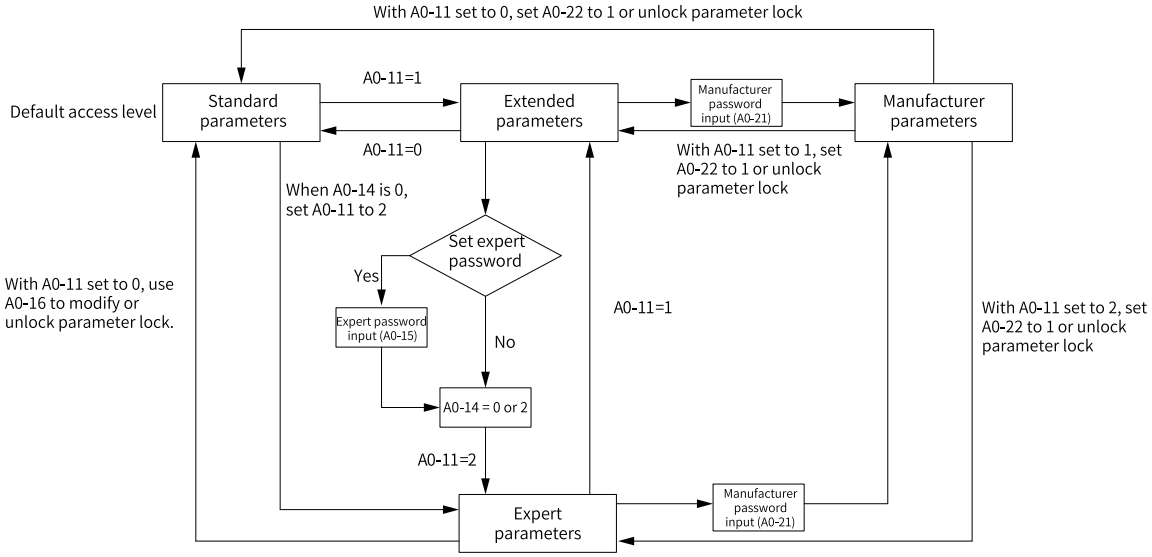


Figure 13-7 Parameter access level switchover

The following rules apply when switching parameter access levels:

1. You can switch between standard parameters and extended parameters through A0-11 [Parameter access level setting] directly.
   When A0-11 [Parameter access level setting] is set to 0 [Standard], the parameter access level is "Standard".

   When A0-11 [Parameter access level setting] is set to 1 [Extended], the parameter access level is "Extended".

2. Expert parameters
   When A0-14 [Expert password status display] is set to 0 [Expert password invalid] or 2 [Expert password unlocked], you can set A0-11 [Parameter access level setting] to 2 [Expert] to switch to expert parameters directly. At this point, the standard, extended, and expert parameters can be switched freely.

   When A0-14 [Expert password status display] is set to 1 [Expert password locked], set A0-11 [Parameter access level setting] to 1 [Extended] to switch to extended parameters first, then enter the set expert password to A0-15 [Expert password input]. After unlocking, A0-14 [Expert password status display] is set to 2 [Expert password unlocked]. At this point, you can switch to expert parameters by setting A0-11 [Parameter access level setting] to 2 [Expert].

3. There are three methods to exit expert parameters:
   Method 1: Modify 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 default expert password is 0. After you enter the expert parameter level after the set expert password is active, wait for one hour to allow the expert password unlock hold time elapses, at which point the expert level is exited automatically.

Switching from standard parameters to extended parameters

1. Check that A0-10 [Current system parameter access level] is set to 0 [Standard] in the default state.
2. Change the value of A0-11 [Parameter access level setting] to 1 [Extended].
3. Check that A0-10 [Current system parameter access level] is set to 1 [Extended], indicating that the system has switched from standard parameters to extended parameters.

Switching from standard parameters to expert parameters

- If A0-14 [Expert password status display] is set to 0 [Expert password invalid] or 2 [Expert password unlocked],
  You can set A0-11 [Parameter access level setting] to 2 [Expert] to switch to expert parameters directly.
- If A0-14 [Expert password status display] is set to 1 [Expert password locked],
  1. You can set A0-11 [Parameter access level setting] to 1 [Extended] to switch to extended parameters first.
  2. Enter the set expert password in A0-15 [Expert password input]. After unlocking, A0-14 [Expert password status display] is set to 2 [Expert password unlocked].
  3. Set A0-11 [Parameter access level setting] to 2 [Expert] to switch from standard parameters to expert parameters.

13.3 Parameter Protection

13.3.1 Parameter Lock

13.3.1.1 Introduction To Parameter Lock

Application scenario

This product provides the parameter lock function, which can be used to lock all drive parameters after commissioning is done. In the locked state, no parameters can be viewed, copied, or downloaded, which means you can only view the monitoring parameters in the monitoring page of the operating panel and the user-defined parameter group in the user menu.

After commissioning is done on site, you can lock parameters to prevent parameters from be viewed by unauthorized personnel.

Description

The parameter lock function is disabled by default. If you need to enable the parameter lock function, it is recommended to activate it only after all commissioning work is done to avoid frequent unlock during commissioning.

The mapped parameters in the user-defined parameter group are not locked by the parameter lock, so the parameter lock function can be used together with the user-defined parameter group, which means the user-defined parameter group can be used as an interface parameter group that

contains monitoring parameters or non-critical commissioning parameters for simple monitoring and commissioning in the parameter lock state.

You can enable the parameter lock function through A0-31 [Parameter lock setting]. After the parameter lock password is set, a password is required for accessing parameters, preventing parameters from being viewed by unauthorized personnel.

The procedure for using the parameter lock is as follows.

- By default, the parameter lock password is inactive, and all users can access the parameters. After the parameter lock password is set through A0-31 [Parameter lock setting], the parameter menu of the drive is locked immediately.
- After the parameter menu is locked, it can only be unlocked by entering the correct password. After unlocking, A0-30 [Parameter lock status] displays the value 2 [Parameter lock unlocked], and parameters can be modified normally. After the parameter menu remains unlocked for a duration equal to the time set in A0-32 [Hold time of unlock state], the parameter menu is locked again automatically.
- After setting the parameter lock password and unlocking, in addition to waiting for the unlock hold time to expire, you can also set A0-33 [Lock parameter lock immediately] to 1 [Lock] to activate the parameter lock function.
- When A0-30 [Parameter lock status] is set to 0 [Parameter lock inactive], the settings on A0-33 [Lock parameter lock immediately] and A0-32 [Hold time of unlock state] are inactive, and a lock on the parameter menu will not be triggered.

Related parameters

Param.	Name	Default value	Value range	Description
A0-30	Parameter Lock Status	0	0: Inactive (parameter lock not set) 1: Locked (parameter lock setting activated, and locked) 2: Unlocked (parameter lock setting activated, and unlocked)	Displays the parameter lock status. Options: 0: Inactive (parameter lock not set) - A0-31 [Parameter lock setting] is set to 0, which means the parameter lock is inactive. 1: Locked (parameter lock setting activated, and locked) - Parameter lock is set through A0-31 [Parameter lock setting], and the parameter lock is in the locked state. You need to enter the correct parameter lock to unlock it. 2: Unlocked (parameter lock setting activated, and unlocked) - Parameter lock is set through A0-31 [Parameter lock setting]. You need to enter the correct parameter lock to lock it. Note: 1 .If A0-31 [Parameter lock setting] is set to a non-zero value, the parameter lock is active. 2 .When the parameter lock is in the locked state, you need to enter a correct password to access the parameter list normally.
A0-31	Parameter lock setting	-	0 to 65535	Used to set the parameter lock. The setpoint 0 indicates the parameter lock is inactive, and the setpoint 1 indicates the parameter lock is active. Note: 1 .If A0-31 [Parameter lock setting] is set to a non-zero value, the parameter lock is active. 2 .When the parameter lock is in the locked state, you need to enter a correct password to access the parameter list normally.

Param.	Name	Default value	Value range	Description
A0-32	Hold time of unlock state	3600	60s to 65535s	Defines the duration for unlock state of the parameter lock. The timing starts when a correct password is entered and ends when the hold time elapses, at which point the parameter lock is locked automatically. Note: 1 .This parameter is active when the parameter lock is active (A0-31 is not 0). 2 .The parameter lock is automatically locked after the unlock time exceeds the hold time. In this case, you need to enter the correct parameter lock again to unlock the parameter.
A0-33	Lock parameter lock immediately	0	0: Not applied 1: Lock	Defines whether to lock the parameter lock manually. Options: 0: Not apply - This function is inactive. 1: Lock - The parameter lock is locked. Note: 1 .This parameter is active when the parameter lock is active (A0-31 is not 0). 2 .When this parameter is set to 1, the parameter lock is locked immediately before the time defined by A0-32 elapses. You need to enter the correct parameter lock to unlock it. 3 .This parameter is set to 0 automatically after the parameter lock is locked.

Precautions

Keep the password properly for enabling the parameter lock function. An incorrect password prevents you from accessing parameters locked.

13.3.1.2 Setting Parameter Lock Password

It is recommended to set the parameter lock password after parameters are commissioned properly. This is to prevent frequent unlock of the parameter lock during commissioning.

The procedure for setting parameter lock is as follows.

1. Check that the drive commissioning is done.
2. Check that A0-30 [Parameter lock status] is set to 0 [Parameter lock deactivated (parameter lock not set)].
3. Record the password to be set, and enter it to A0-31 [Parameter lock setting].

After preceding settings are done, the parameter lock is activated. After the parameter lock is activated, a password prompt appears when you try to access parameters. Namely:

For the operating panel, you need to enter the password when access parameters in the base mode or -C– (User-changed) mode under the QUICK menu. For the iFA software, you need to enter the password when enter the parameter list.

13.3.1.3 Accessing User-Defined Parameter Group with Parameter Locked

User-defined parameters (AE-00 to AE-31) and drive fault information are not affected by the parameter lock, which means even with a set parameter lock, you can still access user-defined parameters (AE-00 to AE-31) and drive fault information.

The parameter lock is generally used together with user-defined parameters during operation.

Prerequisites

The drive has done commissioning and ready to enter the operation state.

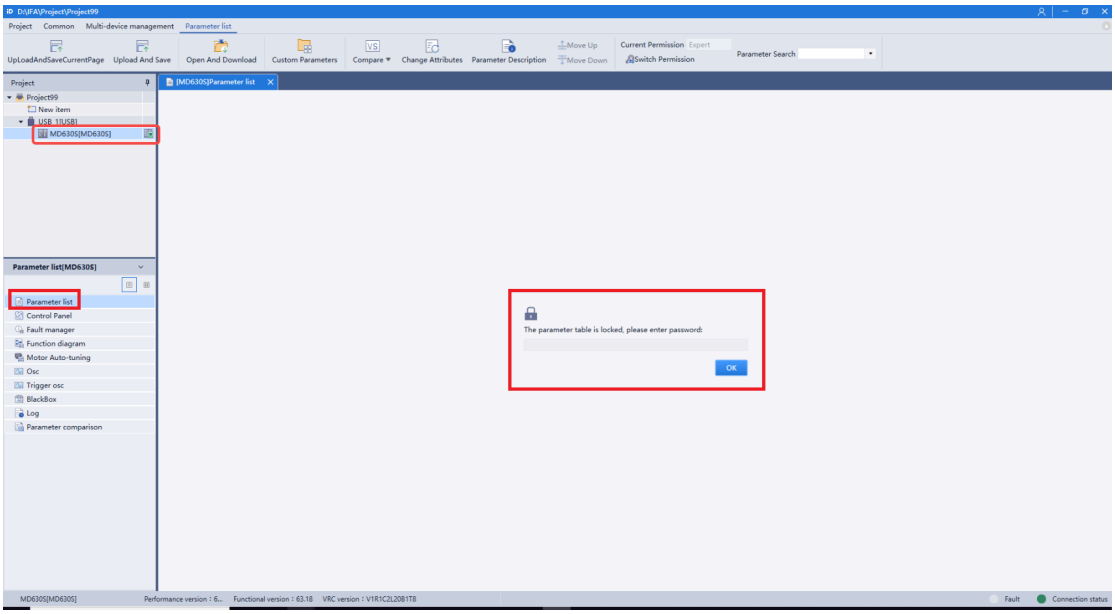
Procedure

1. Establish a mapping relationship between common parameters and user-defined parameters (AE-00 to AE-31).
   Open parameters in group AE, enter uF0.30 to AE-00 [User parameter 0], uF0.48 to AE-01 [User parameter 1], uF0.49 to AE-02 [User parameter 2], uF0.49 to AE-03 [User parameter 3], uU0.26 to AE-04 [User parameter 4], and uU0.61 to AE-05 [User parameter 5]. In this way, F0-30 [Digital reference of main frequency], F0-48 [Ramp-up time of ramp 1], F0-49 [Ramp-down time of ramp 1], U0-26 [Current operating time], and U0-61 [Drive status 1] to parameters in group AE. See section "User-Defined Parameter Groups" for details.
2. Check that A0-30 [Parameter lock status] is set to 0 [Parameter lock deactivated (parameter lock not set)].
3. Adjust A0-32 [Hold time of unlock state].
4. Enter the password to A0-31 [Parameter lock setting]. After entering the password, the parameters are locked and cannot be accessed normally (except for parameters in user-defined parameter groups).
5. Switch the operating panel to the user mode under the QUICK menu. Under the parameter lock condition, F0-30 [Digital reference of main frequency], F0-48 [Ramp-up time of ramp 1], F0-49 [Ramp-down time of ramp 1], U0-26 [Current operating time], and U0-61 [Drive status 1] can be accessed through the user-defined parameter group.

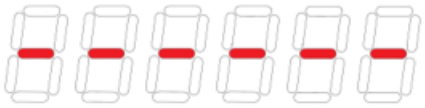
13.3.1.4 Unlocking Parameter Lock

Parameters cannot be accessed when the parameter lock is locked. Do as follows to unlock parameters.

- For iFA debugging software, click the "Parameter list" option, enter the set parameter lock password in the dialog box, and click "OK" to unlock.



- For the operating panel, switch to the base mode or -C- (User-changed) mode under the QUICK menu, enter the parameter lock password in the displayed "----", and click OK to unlock.



13.3.1.5 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.

13.3.1.6 Deactivating Parameter Lock

1. Set A0-31 [Parameter lock setting] to 0 in the unlock state.
2. The parameter lock function is deactivated when you set A0-30 [Parameter lock state] to 0 [Parameter lock inactive (parameter lock not set)].
   After the parameter lock is deactivated, access to parameters is not limited by the parameter lock.

13.3.1.7 Re-lock

Application scenarios

- The drive needs to be commissioned again (the user-defined parameter group cannot meet the commissioning requirements).
- The drive parameters need to be copied in batches.

Procedure

1. Check that the commissioning/copy operations are done.
2. Set A0-33 [Immediately lock parameter lock] to 1 [Lock] to immediately lock the parameter lock.

After preceding settings are done, the parameter lock is activated. After the parameter lock is activated, a password prompt appears when you try to access parameters. Namely:

For the operating panel, you need to enter the password when access parameters in the base mode or -C– (User-changed) mode under the QUICK menu. For the iFA software, you need to enter the password when enter the parameter list.

13.3.1.8 Non-lockable Functions

After the parameter lock is locked, the following functions are not affected.

For the operation panel:

1. The monitoring page is not affected.
2. All keys on the operating panel are not affected.
3. The user mode under the QUICK menu is not affected.
4. The Err menu is not affected.

For the iFA commissioning software:

1. The oscilloscope function is not affected.
2. The control panel function is not affected.
3. The fault management function is not affected.
4. The function of the function diagram is not affected.

13.3.2 Parameter Write Protection

Application scenarios

This function is used to prevent commissioning parameters from being modified inadvertently. After the write protection is enabled, all the drive parameters cannot be modified except those permitted for modification by the software.

Description

Set the parameter write protection function through A0-44 [Parameter write protection enable]. When A0-44 [Parameter write protection enable] is set to 1 [Enable], the protection is activated. In this case, all the drive parameters cannot be modified except those permitted for modification by the software.

The following parameters can still be modified after parameter write protection is enabled.

Param.	Name	Description
A0-44	Parameter write protection	Used to set the parameter write protection function.
A0-11	Parameter access level	Defines the system parameter level. Options: 0: Standard - The standard level can be accessed. 1: Expansion - The extended level can be accessed. 2: Expert - The expert level can be accessed. Note: If the expert password (A0-14) is locked, you cannot switch to expert level directly.
A0-15	Expert password input	Used to input the expert password. Note: If the data entered through A0-15 is consistent with that defined by A0-16, you can unlock the expert-level parameters.
A0-21	Manufacturer password input	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.	Name	Description
A0-22	Exit manufacturer level immediately	Defines whether to exit the manufacturer level immediately. Options: 0: Not apply - This function is inactive. 1: Exit - The drive exits manufacturer level and switches to the level set by A0-11. Note: Automatic clear is performed after the manufacturer level is exited.
A0-33	Lock parameter lock immediately	Defines whether to lock the parameter lock manually. Options: 0: Not apply - This function is inactive. 1: Lock - The parameter lock is locked. Note: 1. This parameter is active when the parameter lock is active (A0-31 is not 0). 2. When this parameter is set to 1, the parameter lock is locked immediately before the time defined by A0-32 elapses. You need to enter the correct parameter lock to unlock it. 3. This parameter is set to 0 automatically after the parameter lock is locked.

Unlike the parameter lock function, after enabling parameter write protection, you can still view the parameter menu and modify the parameter access level to check the drive parameter information.

Related parameters

Param.	Name	Default value	Value range	Description
A0-44	Parameter write protection	0	0: Disable 1: Active	Defines whether the write protection of the drive parameters is enabled. After the parameter write protection is enabled, the drive parameters cannot be changed. 0: Disable - The parameter write protection is disabled. 1: Enable - Parameter-write protection is enabled. The drive parameters cannot be changed. Note: A0-11, A0-15, A0-33, and A3-00 are not controlled by A0-44.

13.4 Parameter Restoration to Default Values

You can restore designated parameters to default values through A0-00 [Parameter initialization]. After the operation is done, A0-00 [Parameter initialization] will be automatically reset to 0 [Not applied].

13.4.1 Restoring Parameters to Default Values (Excluding Motor Parameters)

Application scenario

This function applies when motor parameters have been set, or when the motor parameters do not need to be reset for parameter initialization.

Description

Set A0-00 [Parameter initialization] to 1 [Restoring default parameters (excluding motor parameters)] to restore the drive parameters (excluding motor parameters) to default values.

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.

13.4.2 Restoring Parameters to Default Values (Including Motor Parameters)

Application scenario

This function applies when motor parameters have not been set, or when the motor parameters need to be reset for parameter initialization.

Description

Set A0-00 [Parameter initialization] to 3 [Restoring default parameters (including motor parameters)] to restore the drive parameters (including motor parameters) to default values.

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.

13.4.3 Backing Up Current User Parameters

Application scenario

This function is used to back up the set parameters to the local drive.

Description

Set A0-00 [Parameter initialization] to 4 [Back up current user parameters] to back up the parameters with default values changed by the user.

Note

Same as A0-39 (User backup) when it is set to 400.

13.4.4 Restoring Backup Parameters

Application scenario

This function is used to restore backup parameters in the drive.

Description

Set A0-00 [Parameter initialization] to 501 [Restoring backup parameters] to restore parameters backed up by setting A0-00 to 4.

Note

Same as A0-38 (Backup parameter restore) when it is set to 500.

13.4.5 Clearing Log Information

Description

Set A0-00 [Parameter initialization] to 2 [Clear log information] to clear the log 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.

13.4.6 Clear fault information

Description

Set A0-00 [Parameter Initialization] to 5 [Clear fault information] to clear the historical fault log parameters saved in groups H6 to Hb.

13.4.7 Restoring Parameters to Default Values (Including Motor Parameters) and Clearing Log Information

Application scenario

This function applies when motor parameters have not been set, or when the motor parameters need to be reset, and log parameters need to be cleared for parameter initialization.

Description

Set A0-00 [Parameter initialization] to 503 [Restoring default parameters (including motor parameters) and clear log information] to restore the drive parameters (including motor parameters) to default values and clear the log information.

Note

The parameters related to the model are restored to the default values of the model instead of the factory values.

13.5 User-defined Parameter Group

13.5.1 User-defined Parameter Group

Application scenario

You can group commonly used parameters scattered in different parameter groups into a single user-defined parameter group for easy access and commissioning.

Description

Parameters (AE-00 to AE-31) in group AE are user-defined, consisting of a continuous set of parameters with consecutive communication addresses. You can set common parameters as user-defined parameters, with a maximum of 32 user-defined parameters allowed. You only need to enter the common parameter address to the user-defined parameter group. Accessing and modifying the mapped parameters in the user-defined parameter group is equivalent to accessing and modifying the common parameters in different parameter groups.

As shown below, scattered common parameters are consolidated into the user-defined parameter group for easy management.

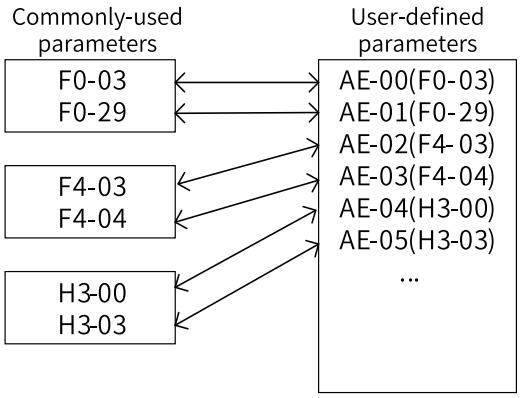


Figure 13-8 Mapping relationship between common parameters and user-defined parameter group

Related parameters

Param.	Name	Default value	Value range	Description
A0-72	Customized parameter display	111	Ones: 0: Hide user mode 1: Show user mode Tens: 0: Hide calibration mode 1: Show calibration mode Hundreds position: 0: Mask error menu 1: Show error menu	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.
AE-00	User parameter 0	F0-00	0x0000 to 0xFFFF	Defines user-defined parameters. AE-00 to AE-31 support setting of up to 32 user-defined parameters. Note: This group of parameters are user-defined. You can select required parameters from all parameters and summarize them into group AE for ease of viewing and modification. You can switch to the -USER menu by holding the Back key down.
AE-01	User parameter 1	Same as AE-00	Same as AE-00	Same as AE-00
AE-02	User parameter 2	Same as AE-00	Same as AE-00	Same as AE-00
AE-03	User parameter 3	Same as AE-00	Same as AE-00	Same as AE-00

Param.	Name	Default value	Value range	Description
AE-04	User 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	Value range	Description
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

13.5.2 Address Mapping

As shown in the following table, the parameter address for group AE is 0x2F00 to 0x2F1F. This address is used to establish mapping relationship. You can write the parameter address to this address directly to establish the mapping relationship. 0xAE00 to 0xAE1F are user parameter access addresses. After mapping relationship is established, these addresses are used to access common parameters. Reading from or writing to these addresses is equivalent to reading from or writing to the mapped parameters.

Table 13–2 Parameter address relationship in group AE

Param.	Function	Parameter address (establishing mapping relationship)	User parameter access address
AE-00	User parameter 0	0x2F00	0xAE00
AE-01	User parameter 1	0x2F01	0xAE01
AE-02	User parameter 2	0x2F02	0xAE02
AE-03	User parameter 3	0x2F03	0xAE03
AE-04	User 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

Param.	Function	Parameter address (establishing mapping relationship)	User parameter access address
AE-19	User-defined parameter 19	0x2F13	0xAE13
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

13.5.3 Mapping Relationship Establishment

Enter the address of common parameters to parameters in group AE (AE-00 to AE-31) to set the mapping relationship. The default value of AE-00 to AE-31 is 0xF000, indicating no parameter is mapped.

The mapping relationship can be established through the operating panel, iFA commissioning software, or communication.

You can enter the parameter address to be mapped to parameters AE-00...AE-31 through the operating panel/iFA software or through communication to establish the mapping relationship.

After the mapping relationship is established, scattered common parameters can be grouped into a single user-defined parameter group, which are directly displayed in the user menu. Additionally, reading and writing addresses 0xAE00 to 0xAE1F via communication is equivalent to reading and writing the addresses of common parameters.

Application instance 1: Configuring the mapping relationship between common parameters and user-defined parameter group through the operating panel

Establish the mapping relationship between AE-00 [User parameter 0] and F0-03 [Main command source of control channel 1] through the operating panel.

1. On the operating panel, locate the secondary menu for parameters in group AE. See details in section *"6.1 Operating Panel"*.
2. After locating AE-00, press OK to enter AE-00 mapping configuration, where the default display is uF0.00.
3. Press ▲ again to adjust the mapped parameter. Press ▲ three times consecutively to adjust it to uF0.03.
4. Press OK to complete mapping. In this case, the operating panel displays AE-01.

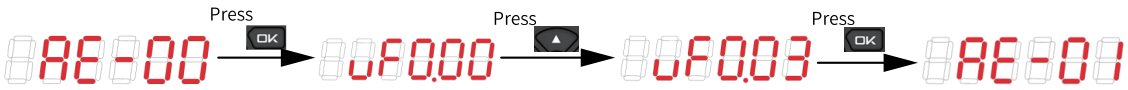
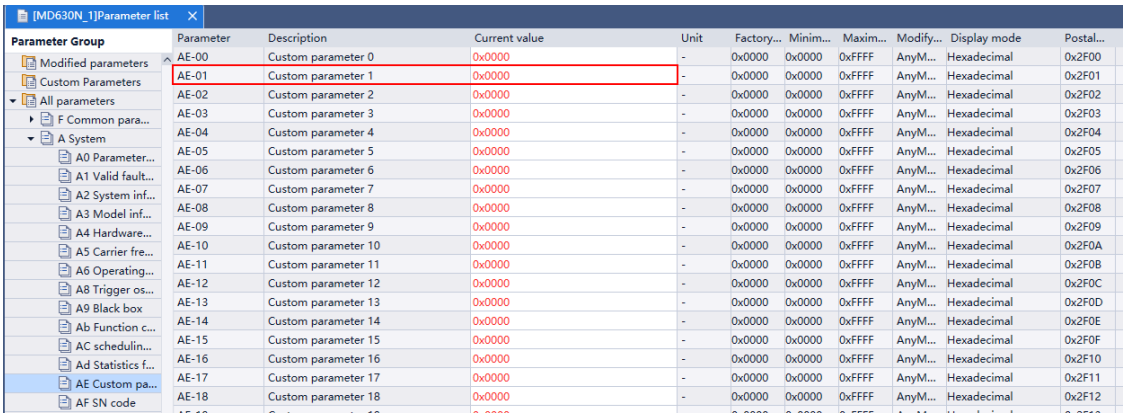


Figure 13-9 Configuring mapping relationship through the operating panel

Application instance 2: Configuring the mapping relationship between common parameters and user-defined parameter group through iFA software

Establish the mapping relationship between AE-01 [User parameter 1] and F0-29 [Main frequency source] through the iFA software.

1. In the iFA software, locate AE-01 in group AE, as shown in the figure below.



Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...	Modify...	Display mode	Postal...
AE-00	Custom parameter 0	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F00
AE-01	Custom parameter 1	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F01
AE-02	Custom parameter 2	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F02
AE-03	Custom parameter 3	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F03
AE-04	Custom parameter 4	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F04
AE-05	Custom parameter 5	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F05
AE-06	Custom parameter 6	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F06
AE-07	Custom parameter 7	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F07
AE-08	Custom parameter 8	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F08
AE-09	Custom parameter 9	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F09
AE-10	Custom parameter 10	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F0A
AE-11	Custom parameter 11	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F0B
AE-12	Custom parameter 12	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F0C
AE-13	Custom parameter 13	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F0D
AE-14	Custom parameter 14	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F0E
AE-15	Custom parameter 15	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F0F
AE-16	Custom parameter 16	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F10
AE-17	Custom parameter 17	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F11
AE-18	Custom parameter 18	0x0000	-	0x0000	0x0000	0xFFFF	AnyM...	Hexadecimal	0x2F12

2. Enter 0xF01D to AE-01 and press Enter to complete mapping configuration, as shown in the figure below.

Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...
AE-00	Custom parameter 0	0x0000	-	0x0000	0x0000	0xFFFF
AE-01	Custom parameter 1	0xF01D	-	0x0000	0x0000	0xFFFF
AE-02	Custom parameter 2	0x0000	-	0x0000	0x0000	0xFFFF
AE-03	Custom parameter 3	0x0000	-	0x0000	0x0000	0xFFFF

Figure 13-10 Configuring mapping relationship through iFA software

Application instance 3: Configuring the mapping relationship between common parameters and user-defined parameter group through communication

Establish the mapping relationship between AE-02 [User parameter 2] and F4-03 [DI1 terminal function selection] through communication.

1. Write 0xF403 (F4-03 parameter address) to address 0x2F02 (AE-02 parameter address) to establish the mapping relationship.

2. Read the value at address 0xAE02 (user parameter access address of AE-02), and the value of F4-03 is returned.
3. Write 2 to address 0xAE02 (user parameter access address of AE-02), and the value 2 is written to F4-03.

Precautions

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 [Main command source of control channel 1]. On the commissioning software, the value of AE-00 corresponds to the communication address 0xF003 of F0-03 [Main command source of control channel 1].

13.5.4 QUICK Menu

The QUICK Menu on the operating panel includes four modes: Base (base) mode, User Custom (user) mode, User Changed (-C-) mode, and Fault (-Err-) mode.

- Base (base) mode: Displays all parameters such as F0, F1..., A0...
- User Custom (user) mode: Displays parameters mapped in group AE (namely common parameters). For example, mapped parameters such as F0-03, F0-29, and F4-03 are displayed in the user (User Custom) mode. In this mode, you can view and modify the values of the mapped parameters.
- User Changed (-C-) mode: Displays parameters that have been changed, which are parameters with values different from default ones.
- Fault (-Err-) mode: Displays current fault information of the drive.

The following figure shows switchover among these four modes.

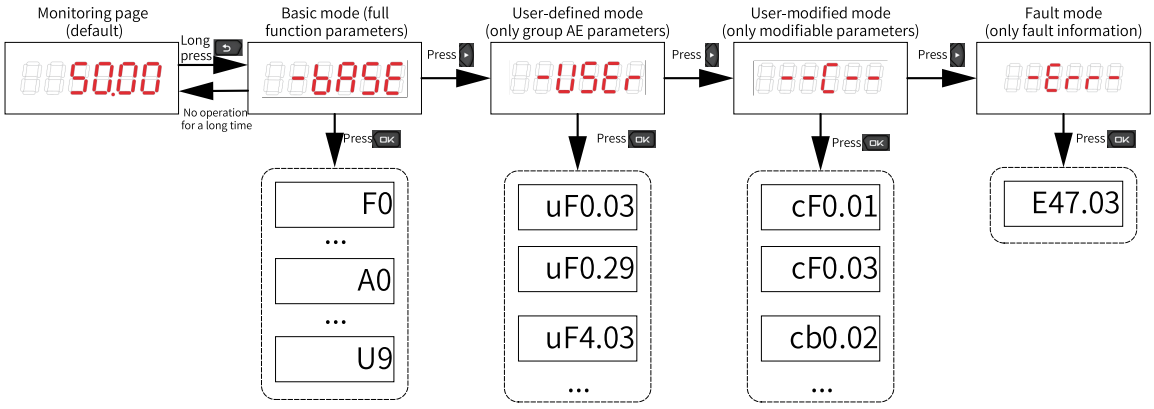


Figure 13-11 QUICK menu mode switchover

Application example: Modifying mapped parameters in user mode

You can view and set the values of the mapped parameters through the user mode in the QUICK menu of the operating panel. As shown in the following figure, you can enter user mode from the default monitoring screen, then access and set the mapped parameters in user mode.

Prerequisites

The mapping relationship from AE-00 to F0-03 and from AE-01 to F0-29 has been established.

Procedure

1. On the default monitoring page, hold down to enter the QUICK menu.
2. After entering the QUICK menu, the default mode is base mode. Press to select user mode.
3. When the operating panel displays "-user", press to enter user mode, where the first mapped parameter in group AE is displayed, which is uF0.03 (F0-03).
4. Keep pressing to select the second mapped parameter in group AE, which is uF0.29 (F0-29).
5. When "uF0.29" is displayed, press to access the current value of F0-29 (such as the value 3).
6. Keep pressing to modify the value of F0-29 (such as the value 2).
7. Press to save the value of F0-29.

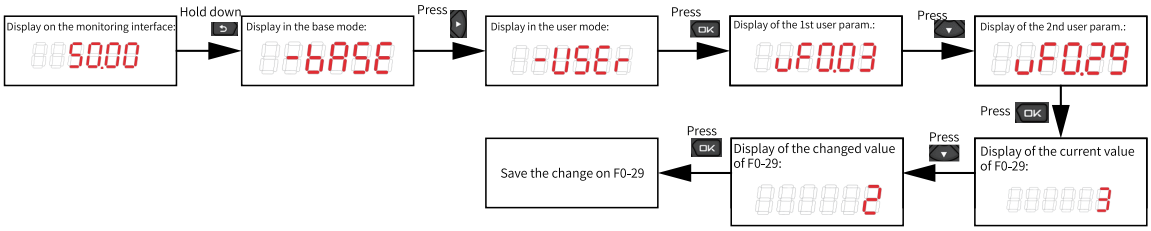


Figure 13-12 Example for entering user mode

The default value of AE-00 to AE-31 is 0xF000 (displayed as uF0.00 on the operating panel). In this case, only F0-00 is displayed in user mode.

13.6 Black Box

The drive supports 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 scenario

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.

Description

The black box supports automatic triggering of fault and user-defined triggering, either of which will trigger the black box recording. The AC drive stores logged data in its flash memory, holding up to 20 of the most recent data sets. Each set contains 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.

Param.	Name	Default value	Value range	Description
A9-66	Black box trigger mode		0: Triggered upon any fault 1: Triggered upon designated fault 2: Triggered based on user-defined conditions 3: Triggered upon any fault or based on user-defined conditions 4: User-defined or triggered upon designated fault	Defines the trigger mode of the black box. Options: 0: Triggered upon any fault. The black box is triggered once when any fault that cause stop (fault protection actions 0 to 3) occurs. 1: Triggered upon designated fault. The black box is triggered when the fault (fault protection actions 0 to 3, namely faults that cause stop) defined by A9-67 occurs. 2. User-defined. The black box is triggered when the custom condition configured by A9-69 is met. 3: User-defined or triggered upon any fault. The black box is triggered when either any fault or the custom condition defined by A9-69 is met. 4. User-defined or triggered upon designated fault. The black box is triggered when either the specified fault or the custom condition defined by A9-69 is met.
A9-67	Specified fault	0.0	6553.5	This parameter is used together with A9-66. When A9-66 is set to "1: Triggered by specified fault", the black box is triggered upon the fault set by A9-67 (fault protection action 0 to 3, that is, fault that causes stop).

Param.	Name	Default value	Value range	Description
A9-69	User-defined trigger condition mode	0	0: User-defined condition A 1: User-defined condition B 2: User-defined condition A && User-defined condition B 3: Custom condition A ‖ Custom condition B	Defines the custom condition for triggering the black box. Options: 0: Custom condition A. The black box is triggered once when custom condition A is met. 1: Custom condition B. The black box is triggered once when custom condition B is met. 2: Custom condition A && Custom condition B - The black box is triggered once when both the conditions A and B are met. 3: Custom condition A ‖ Custom condition B - The black box is triggered once when the custom condition A or B is met.
A9-70	Configuration mode of user-defined trigger condition A	0	0: Internal variable comparison 1: Bit connector comparison 2: Word connector compare 3: Floating-point connector comparison 4: State machine comparison	Defines the configuration mode of custom trigger condition A. Options: 0: Internal variable comparison. Set A9-71, A9-72, and A9-73 to use the internal variable comparison as the triggering condition for custom A. 1: Bit connector comparison. Set A9-74 and A9-75 to use bit connector comparison as the triggering condition for custom A. 2: Word connector comparison. Set A9-76, A9-77, and A9-78 to use word connector comparison as the triggering condition for custom A. 3: Float-point connector comparison. Set A9-79, A9-80, and A9-81 to use float connector comparison as the triggering condition for custom A. 4. State machine comparison. Set A9-82 and A9-83 to use state machine comparison as the triggering condition for custom A. Note: This parameter is used to select an active comparison mode among A9-71 to A9-83 for triggering condition A.

Param.	Name	Default value	Value range	Description
A9-71	Internal variable compare mode of trigger condition A	0	0: Greater than (>) 1: Equal to (=) 2: Lower than (<) 3: Greater than or equal to (≥) 4: Lower than or equal to (≤)	Defines the internal variable comparison mode of triggering condition A. Options: 0: Greater than (>). Triggered when A9-72 is greater than A9-73. 1: Equal (=). Triggered when A9-72 is equal to A9-73. 2: Lower than (<). Triggered when A9-72 is smaller than A9-73. 3: Greater than or equal to (>=). Triggered when A9-72 is greater than or equal to A9-73. 4: Lower than or equal to (<=). Triggered when A9-72 is smaller than or equal to A9-73.

Param.	Name	Default value	Value range	Description
A9-72	Internal variable compare source of trigger condition A	1	0: Unconditionally triggered 1: Fault triggered 2: Saved during operation 11: Drive main status word 12: Drive auxiliary status word 13: Motor main status word 14: Motor auxiliary status word 15: Current state of the system state machine 16: Switchover command of system state machine 17: Parameter auto-tuning self-check pre-state 18: Motor object auxiliary status word 2 19: Final frequency reference control 20: Final voltage reference control 21: Non-limited output voltage 22: Voltage phase angle 23: Torque reference control 24: Final flux reference control 25: Set excitation current 26: Set torque current 27: Rotor speed 28: Reserved 29: Output torque 30: Flux amplitude 31: Flux angle 32: Synchronization frequency (To be continued)	Defines the internal variable comparison source of triggering condition A. Options: 0: Unconditionally triggered. When A9-08 is set to 0, the black box can be triggered once in any condition. After being triggered once, the black box is disabled (cyclic mode inactive). 1: Fault triggered. The black box is triggered once when the comparison between current fault code and the fault code set in A9-73 meets the condition defined by A9-71. 2. Saved during operation. The black box is triggered when the drive is in the operation state. 11 to 79: Internal variable. The black box is triggered once when the comparison between the internal variable and the setting of A9-73 meets the condition defined by A9-71.

Param.	Name	Default value	Value range	Description
A9-72	Internal variable compare source of trigger condition A	1	(continued) 33: Synchronous rotational angle 34: Output voltage amplitude 35: Output current amplitude 36: Actual excitation current of the motor 37: Motor actual torque current 38: PWMU 39: PWMV 40: PWMW 41: IU 42: IV 43: IW 44: Udc 45: System status word 1 46: System status word 2 47: Operating frequency 48: Frequency reference 49: Output torque 50: Output power 51: Output voltage 52: Output current 53: Bus voltage 54: Feedback speed 55: Reserved 56: Reserved 57: Monitoring variable 0 58: Monitoring variable 1 59: Original frequency reference 60: Frequency reference after ramp change (To be continued)	Defines the internal variable comparison source of triggering condition A. Options: 0: Unconditionally triggered. When A9-08 is set to 0, the black box can be triggered once in any condition. After being triggered once, the black box is disabled (cyclic mode inactive). 1: Fault triggered. The black box is triggered once when the comparison between current fault code and the fault code set in A9-73 meets the condition defined by A9-71. 2. Saved during operation. The black box is triggered when the drive is in the operation state. 11 to 79: Internal variable. The black box is triggered once when the comparison between the internal variable and the setting of A9-73 meets the condition defined by A9-71.

Param.	Name	Default value	Value range	Description
A9-72	Internal variable compare source of trigger condition A	1	(continued) 61: Torque reference 62: RFG calculation input 63: RFG output 64: RFG output superposed with additional frequency 65: RFG acceleration rate 66: RFG status word display 67: RFG command word display 68: Command word of command channel 69: Last sampling cycle command 70: Reserved 71: System status word C 72: System status word D 73: Final output DI state 74: Final output DO status 77: Current operating time-0.1 min	Same as above
A9-73	Internal variable compare value of trigger condition A	0	-32768 to 32767	Defines the internal variable comparison value of the triggering condition A. Note: The internal variable comparison is processed by multiplying the source value of the internal variable by the corresponding source internal coefficient. Then the value is converted to S16 and compared with the setpoint.

Param.	Name	Default value	Value range	Description
A9-74	Bit connector compare mode of trigger condition A	0	0: Rising edge (0->1) 1: Falling edge (1->0) 2: Edge-triggered (0->1 or 1->0) 3: Equal to logic 1 (= 1) 4: Equal to logical 0 (=0)	Defines the bit connector comparison mode of triggering condition A. Options: 0: Rising edge (0->1). The black box is triggered once when a rising edge change signal is generated by the bit connector selected by A9-75. 1: Falling edge (1->0). The black box is triggered once when a falling edge change signal is generated by the bit connector selected by A9-75. 2: Edge detection (0->1 or 1->0). The black box is triggered once when a rising/falling edge change signal is generated by the bit connector selected by A9-75. 3: Equal to logic 1 (=1). The black box is triggered when the bit connector selected by A9-75 is equal to 1. 4: Equal to logic 0 (=0). The black box is triggered when the bit connector selected by A9-75 is equal to 0.
A9-75	Bit connector compare source of trigger condition A	0	0: Inactive Other: B connector	Defines the bit connector comparison source of triggering condition A, which is selected from the bit connector.
A9-76	Bit connector compare mode of trigger condition A	0	0: Greater than (>) 1: Equal to (=) 2: Lower than (<) 3: Greater than or equal to (≥) 4: Lower than or equal to (≤)	Defines the bit connector comparison mode of triggering condition A. Options: 0: Greater than (>). Triggered when A9-77 is higher than A9-78. 1: Equal (=). Triggered when A9-77 is equal to A9-78. 2: Lower than (<). Triggered when A9-77 is lower than A9-78. 3: Greater than or equal to (>=). Triggered when A9-77 is higher than or equal to A9-78. 4: Lower than or equal to (<=). Triggered when A9-77 is lower than or equal to A9-78.
A9-77	Word connector compare source of trigger condition A	0	0: Invalid; Other: K connector	Defines the word connector comparison source of triggering condition A, which is selected from the word connector.

Param.	Name	Default value	Value range	Description
A9-78	Word connector compare value of trigger condition A	0	0: Invalid; Other: K connector	Defines the word connector comparison value of triggering condition A.
A9-79	Floating-point connector compare mode of trigger condition A	0	0: Greater than (>) 1: Equal to (=) 2: Lower than (<) 3: Greater than or equal to (≥) 4: Lower than or equal to (≤)	Defines the float connector comparison mode for triggering condition A. Options: 0: Greater than (>). Triggered when A9-80 is higher than A9-81. 1: Equal (=). Triggered when A9-80 is equal to A9-81. 2: Lower than (<). Triggered when A9-80 is lower than A9-81. 3: Greater than or equal (>=). Triggered when A9-80 is higher than or equal to A9-81. 4: Lower than or equal to (<=). Triggered when A9-80 is lower than or equal to A9-81.
A9-80	Floating-point connector compare source of trigger condition A	0	0: Invalid; Other: F connector	Defines the float connector comparison source of triggering condition A, which is selected from the float connector.
A9-81	Floating-point connector compare value of trigger condition A	0	0: Invalid; Other: F connector	Defines the float connector comparison value of triggering condition A.

Param.	Name	Default value	Value range	Description
A9-82	State machine compare mode of trigger condition A	0	0: Greater than (>) 1: Equal to (=) 2: Lower than (<) 3: Greater than or equal to (≥) 4: Lower than or equal to (≤)	Defines the state machine comparison mode of triggering condition A. Options: 0: Greater than (>). Triggered when current system state machine is greater than A9-83. 1: Equal (=). Triggered when current system state machine is equal to A9-83. 2: Lower than (<). Triggered when current system state machine is lower than A9-83. 3: Greater than or equal to (>=). Triggered when current system state machine is greater than or equal to A9-83. 4: Lower than or equal to (<=). Triggered when current system state machine is lower than or equal to A9-83.
A9-83	Trigger condition A state machine compare value	0	0: Initializing 1: Switch-on inhibited 2: Switch-on allowed 3: Operation permission 4: Start 5: Run 6: Stop 7: Active 8: Auto-tuning	Defines the state machine comparison value of triggering condition A.

Instructions for use

Note that the black box function must be used with the iFA debugging software. After opening the iFA project interface, double-click "Black box" to access the main black box operation interface, as shown in the figure below. The black box function interface displays the data reading view.

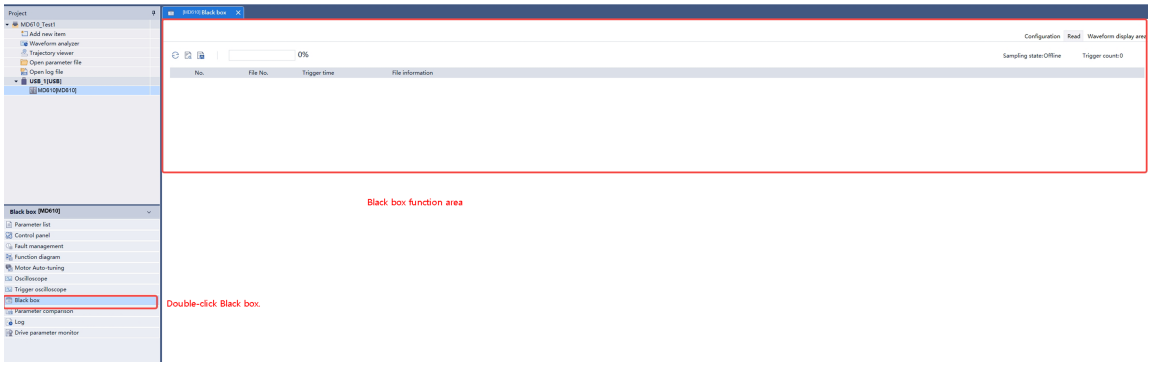


Figure 13-13 Black box interface

You can click "Configuration", "Read", and "Waveform display area" in the upper right corner of the black box interface to switch among different functions. By default, the "Read" tab is displayed. The configuration interface of the black box is shown in the figure below. The configuration results on this interface are the same as those for A9-00 to A9-97. The waveform display area records the data waveforms configured by the black box, which facilitates data analysis.

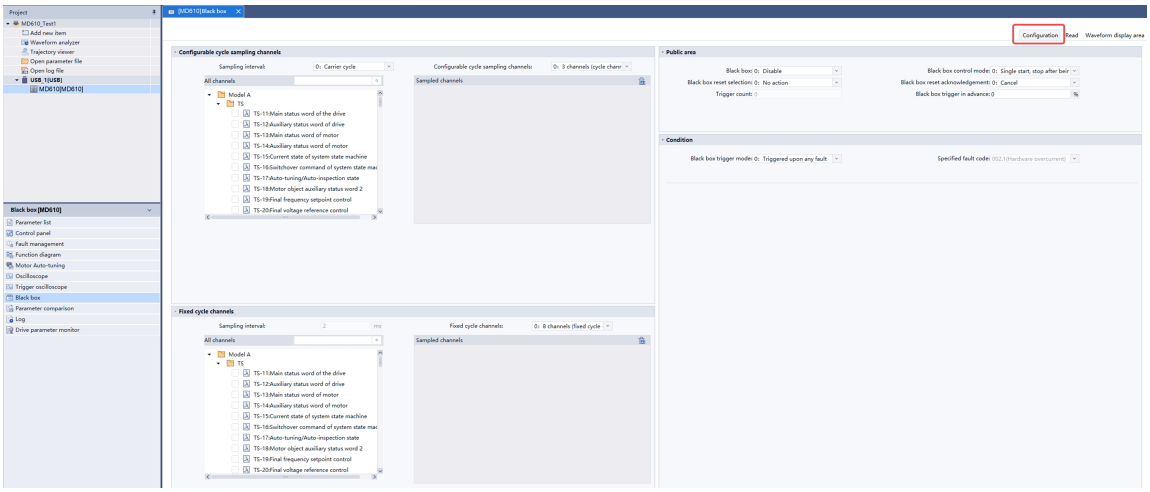


Figure 13-14 Black box configuration interface

In the upper left corner of the black box interface, you can click "Refresh directory", "Read file," and "Save file", as shown in the figure below.

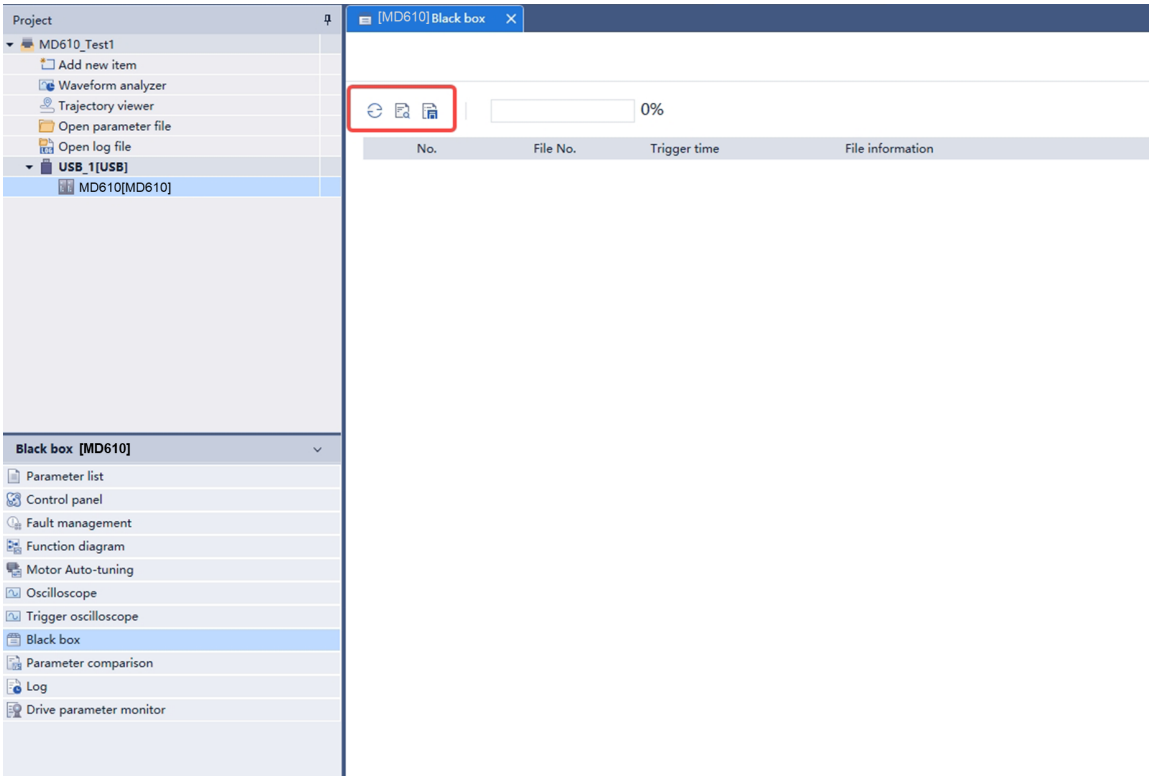


Figure 13-15 Black box data management buttons

"Refresh directory" is used to refresh black box data files. If the black box has recorded data, clicking "Refresh directory" will display all black box data entries, as shown in the figure below. There are a

total of 5 data files in the figure. In the upper right side of the black box area, you can view the black box state (Waiting for triggering in the figure) and the trigger event counts. In the black box area, you can view "No.", "Trigger time", and "File information." Among them, "No." indicates the order of data files arranged by trigger time. File No. 1 contains the most recent black box trigger event, with subsequent files in chronological order. "Trigger time" records the cumulative power-on time when the trigger event occurs. "File information" indicates the trigger condition of the data file. You do not need to pay attention to the "File No." column.

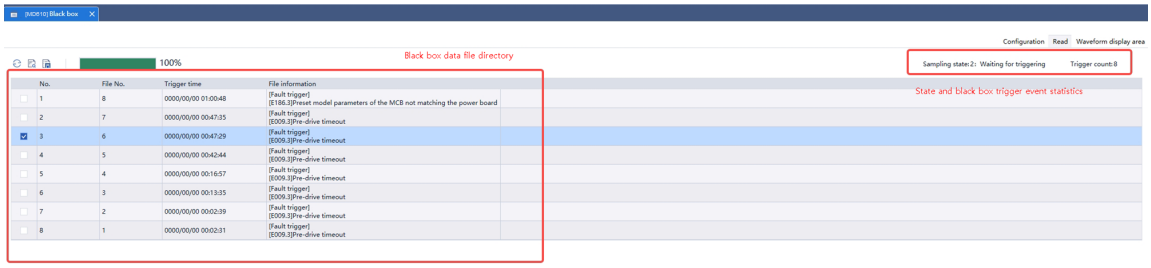


Figure 13-16 Refresh list of black box data

You can click "Read file" to read the selected black box data file. As shown in the figure below, after you select a data file and click "Read file", the iFA software automatically reads the black box data file and displays a progress bar. Once the progress bar reaches 100%, the reading is complete. In this case, the interface will automatically switch to the waveform display area to show data of all channels.

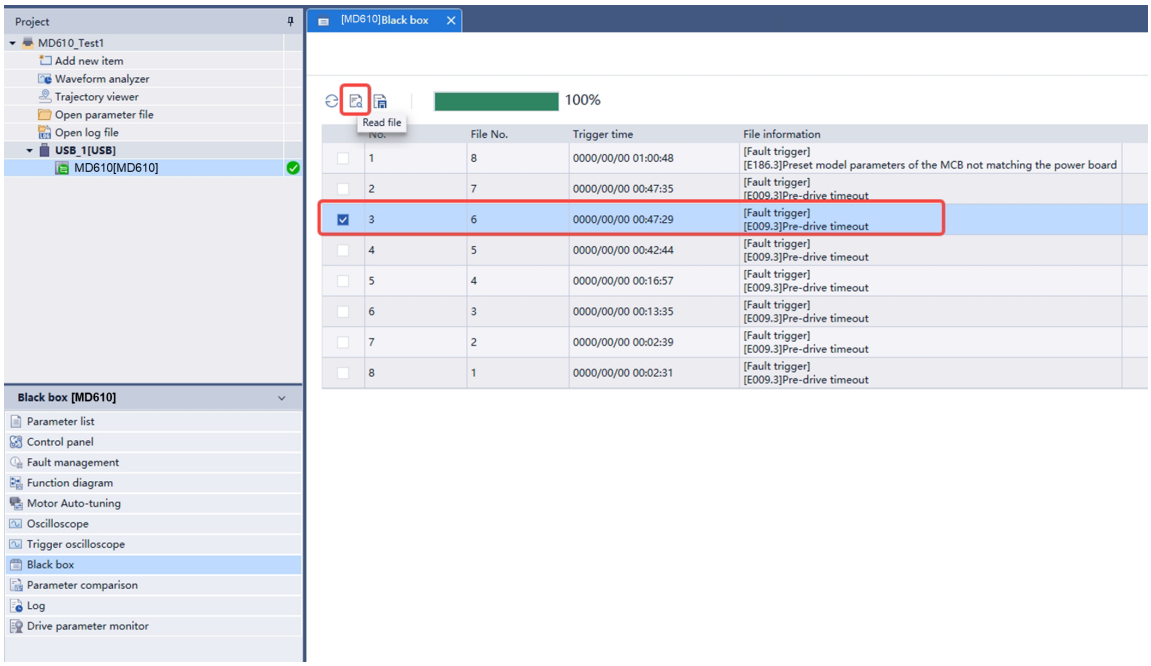


Figure 13-17 Reading data from black box

As shown in the figure below, the interface displays data of configurable-period channels A9-17 to A9-22 and fixed-period channels A9-34 to A9-49. You can also click "Waveform display area" in the upper right corner to directly enter it, and then click "Read file" to return to the data reading interface. The five buttons under the waveform allows you to view the data file information.

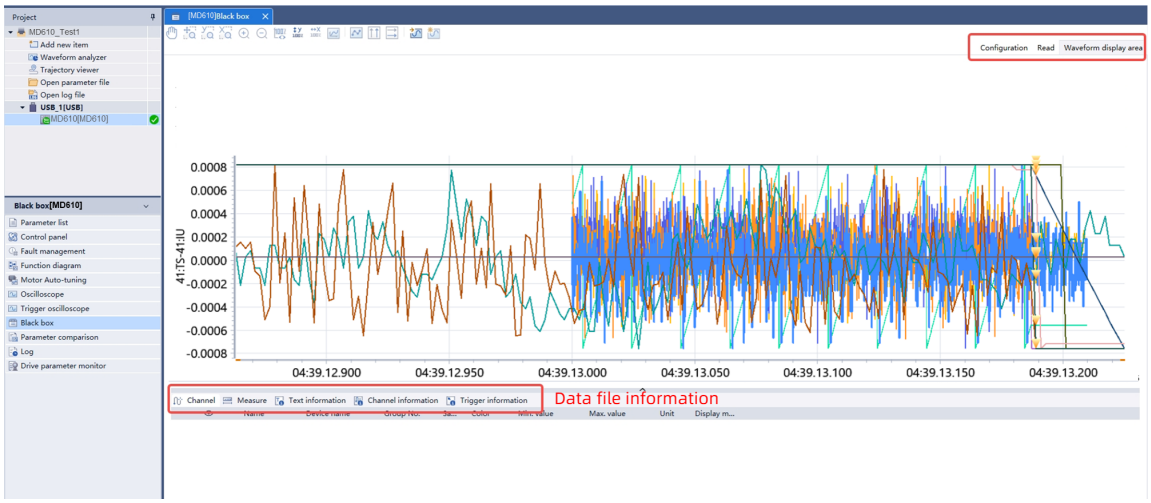


Figure 13-18 Black box data file

Clicking "Save file" saves the data file to the host controller. As shown in the figure below, select a data file and click the "Save file" button. If the data file has not been saved, the software will first read the data file and then prompt the user to select a location on the local disk for saving. After successful saving, a pop-up message will appear indicating that "File saved successfully".

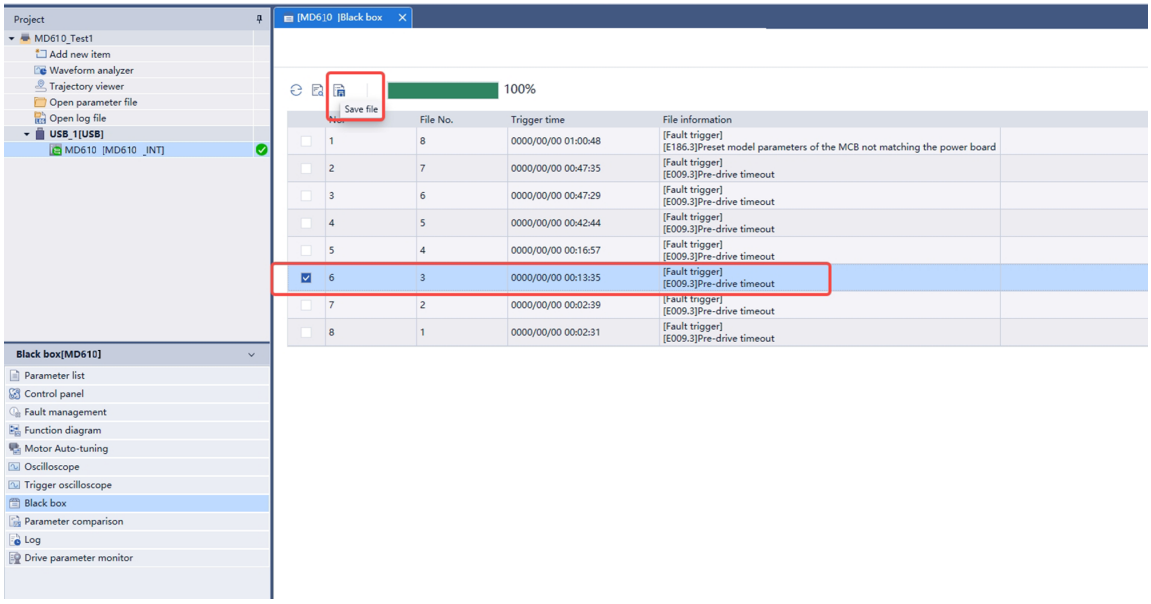


Figure 13-19 Saving data file

As shown in the figure below, you can also save the data file to the local disk using the "Export data" button in the waveform display area. Clicking "Import data" imports locally saved data files into the iFA and display the data waveforms in the waveform display area.

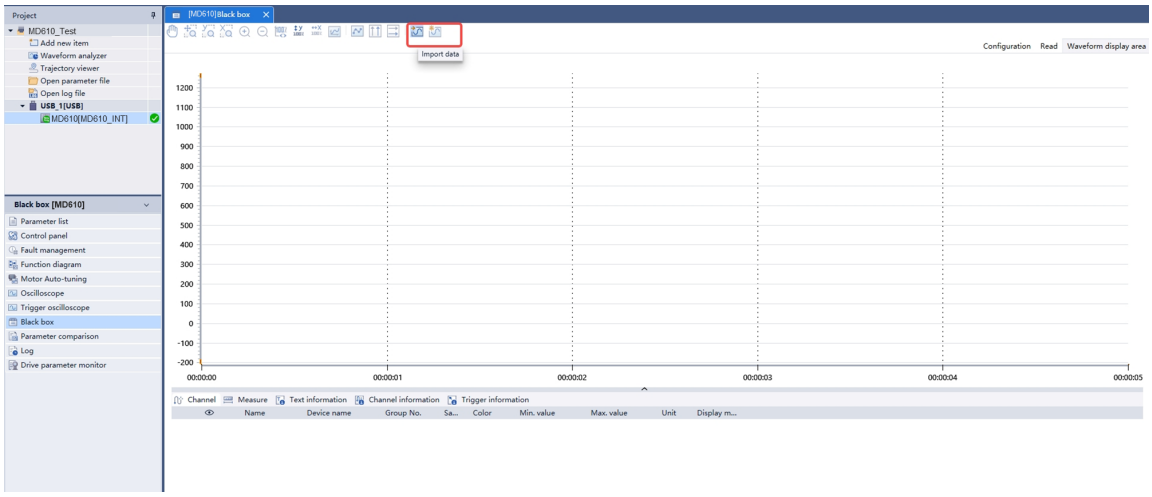


Figure 13-20 Waveform data import and export

Black box record clearing

You can clear the data recorded by the black box. Before clearing data, you must ensure that important data has been stored locally; otherwise, the data will be lost permanently. Set the black box reset function through A9-06 (Black box reset function selection) and A9-07 (Black box reset confirmation). To prevent accidentally clearing of black box data files, you must set A9-06 to 1 and then A9-07 to 1. Only then will the drive clear the black box data record, as shown in the table below.

Param.	Name	Default value	Value range	Description
A9-06	Black box reset function selection	0	0: No action 1: Clear black box records 2: Restore black box configuration parameters	Sets the black box reset function. Options: 1: Clear all black box records. Clear the record information stored in the black box and the black box data records stored in Flash. 2: Restore the black box configuration parameters. Clear all the black box module configuration parameters. Note: This function must be used together with A9-07 [Black box reset acknowledgment].
A9-07	Black box reset confirmation	0	0: Cancel 1: OK	Defines whether the black box is reset. Options: 0: Cancel. Do not reset. 1: OK. Perform the reset operation according to the selection of A9-06. Note: After this parameter is set to 1, the black box data automatically is reset to zero.

After the black box data is cleared, the black box does not have any data file. At this time, after you click "Refresh directory" in the black box interface, a prompt indicating "Reading failed" is displayed, as shown in the figure below.

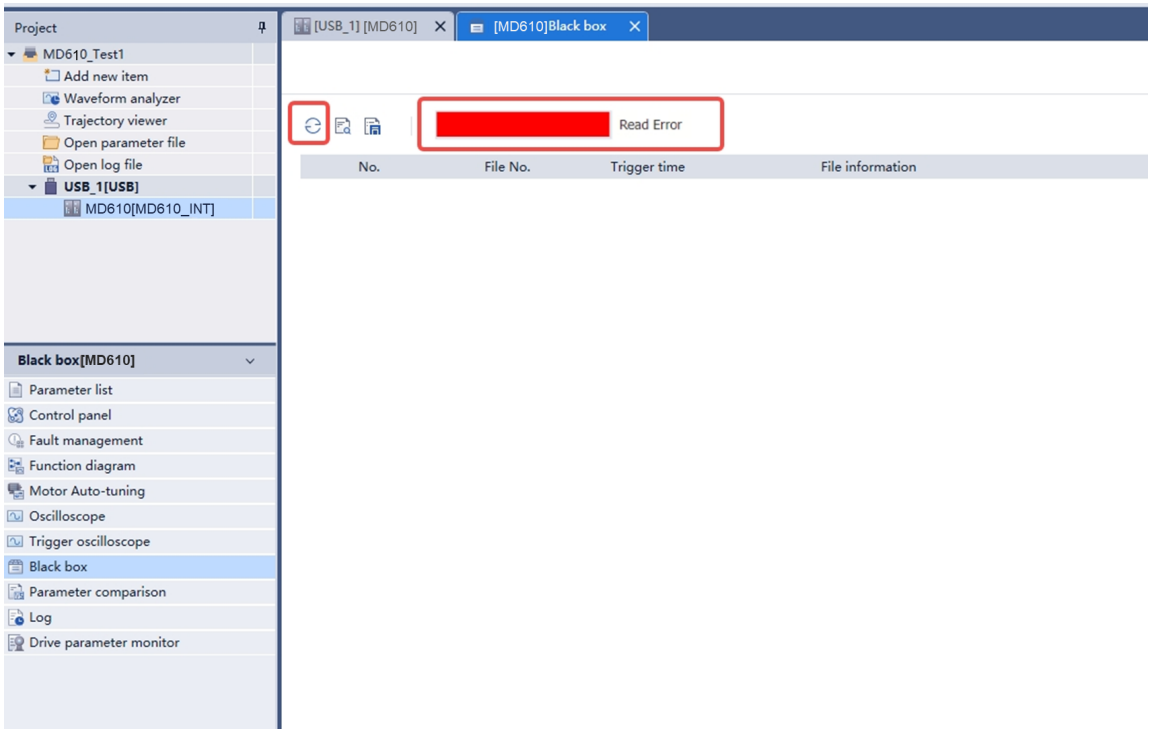


Figure 13-21 Black box having no data file

13.7 Clearing Records

13.7.1 Clearing Fault Information

Application scenarios

Parameter groups H6 to Hb of the drive is used to save fault log. After the current fault of the drive is rectified and reset, the fault log can be cleared through this function.

Description

Set A0-00 [Parameter initialization] to 5 [Clear fault information], then execute parameter initialization to clear the fault log saved in parameter groups H6 to Hb.

Alternatively, set A0-00 [Parameter initialization] to 2 [Clear records] to clear fault log, but other logs such as cumulative operating time, cumulative power-on time, and cumulative power consumption will also be cleared together. Therefore, it is not recommended to clear the fault log by setting A0-00 to 2.

Related parameters

Param.	Name	Default value	Value range	Description
A0-00	Parameter initializa-tion	0	0: Not applied 1: Restore default parameters (excluding motor parameters) 2: Clear log information 3: Restore default parameters (including motor parameters) 4: Back up current user parameters 5: Clear fault log 501: Restore backup parameters 503: Restore default parameters (including motor parameters) and clear log information	0: No action 1: Most of the function parameters are restored to default values, except manufacturer parameters, motor parameters, and log information. 2: Clear the fault log, cumulative operating time, cumulative power-on time, and cumulative power consumption. 3: Most of the function parameters are restored to default values, except manufacturer parameters and log information. 4: The current parameter setpoints are backed up, which functions in the same way as the setpoint 400 of A0-39. 5: Clear the fault log information in groups H6 to Hb. 501: Parameters backed up by setting A0-00 to 4 are restored, which functions in the same way as the setpoint 500 of A0-38. 503: Most of the 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. Note: After the operation is completed, this parameter is automatically restored to 0.

13.7.2 Clearing Log Information

Application scenarios

Records such as the cumulative operating time and cumulative power consumption will not be automatically reset after the drive is restarted. You can clear the log through this function.

Description

Set A0-00 [Parameter initialization] to 2 [Clear log information], then execute parameter initialization to clear information including fault log, cumulative operating time, cumulative power-on time, and cumulative power consumption.

Related parameters

Param.	Name	Default value	Value range	Description
A0-00	Parameter initialization	0	0: Not applied 1: Restore default parameters (excluding motor parameters) 2: Clear log information 3: Restore default parameters (including motor parameters) 4: Back up current user parameters 5: Clear fault log 501: Restore backup parameters 503: Restore default parameters (including motor parameters) and clear log information	0: No action 1: Most of the function parameters are restored to default values, except manufacturer parameters, motor parameters, and log information. 2: Clear the fault log, cumulative operating time, cumulative power-on time, and cumulative power consumption. 3: Most of the function parameters are restored to default values, except manufacturer parameters and log information. 4: The current parameter setpoints are backed up, which functions in the same way as the setpoint 400 of A0-39. 5: Clear the fault log information in groups H6 to Hb. 501: Parameters backed up by setting A0-00 to 4 are restored, which functions in the same way as the setpoint 500 of A0-38. 503: Most of the 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. Note: After the operation is completed, this parameter is automatically restored to 0.

13.8 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 *" Commissioning Tool List" on page 138*. For details on the QUICK menu, see *"13.5.1 User-defined Parameter Group" on page 887*.

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.

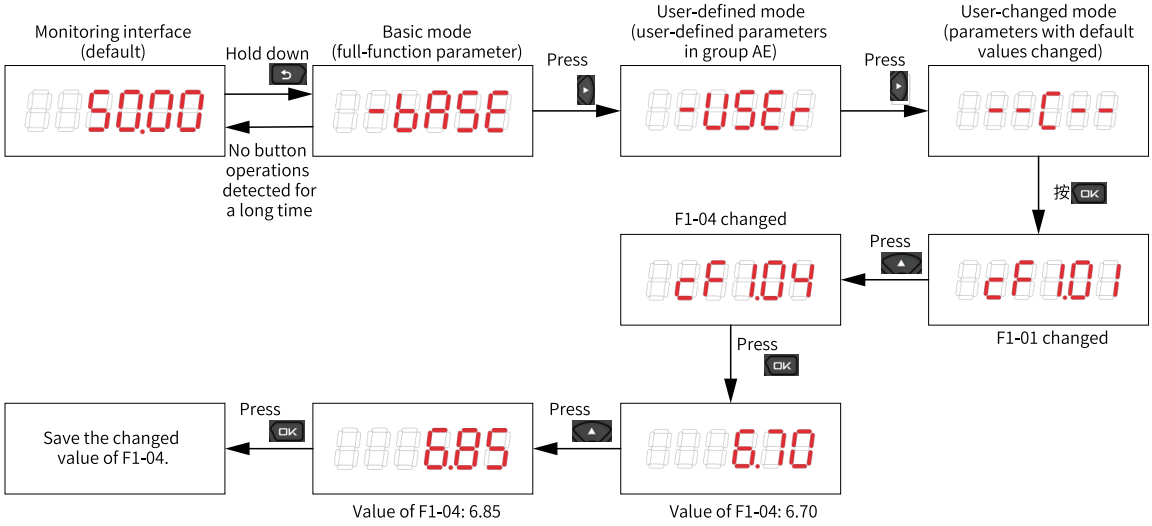


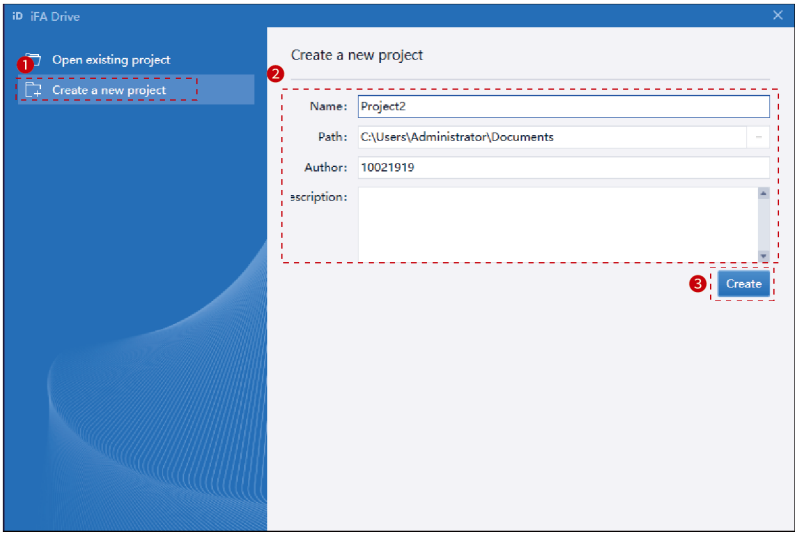
Figure 13-22 Accessing the list through operating panel

Application instance 2: Accessing the list of modified parameters through iFA commissioning software

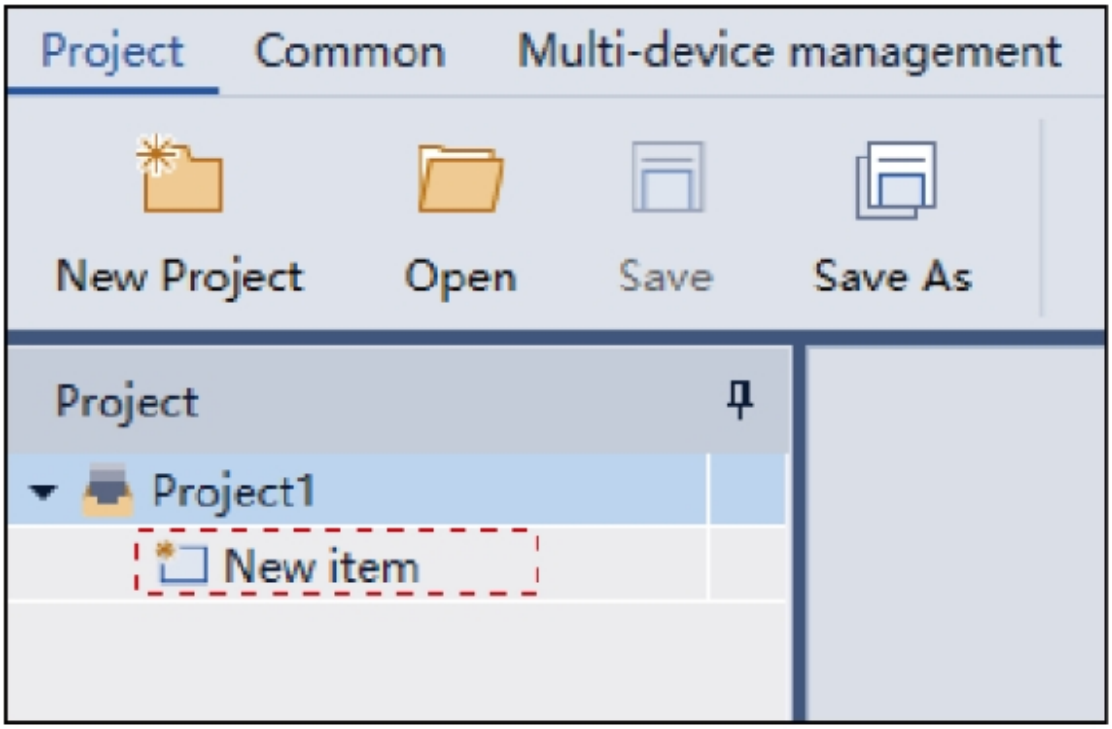
The iFA commissioning software can also synchronize and display the modified parameters of the drive. For detailed information on the iFA commissioning software functions, see *"7.2.2 Quick Commissioning Guide" on page 151*.

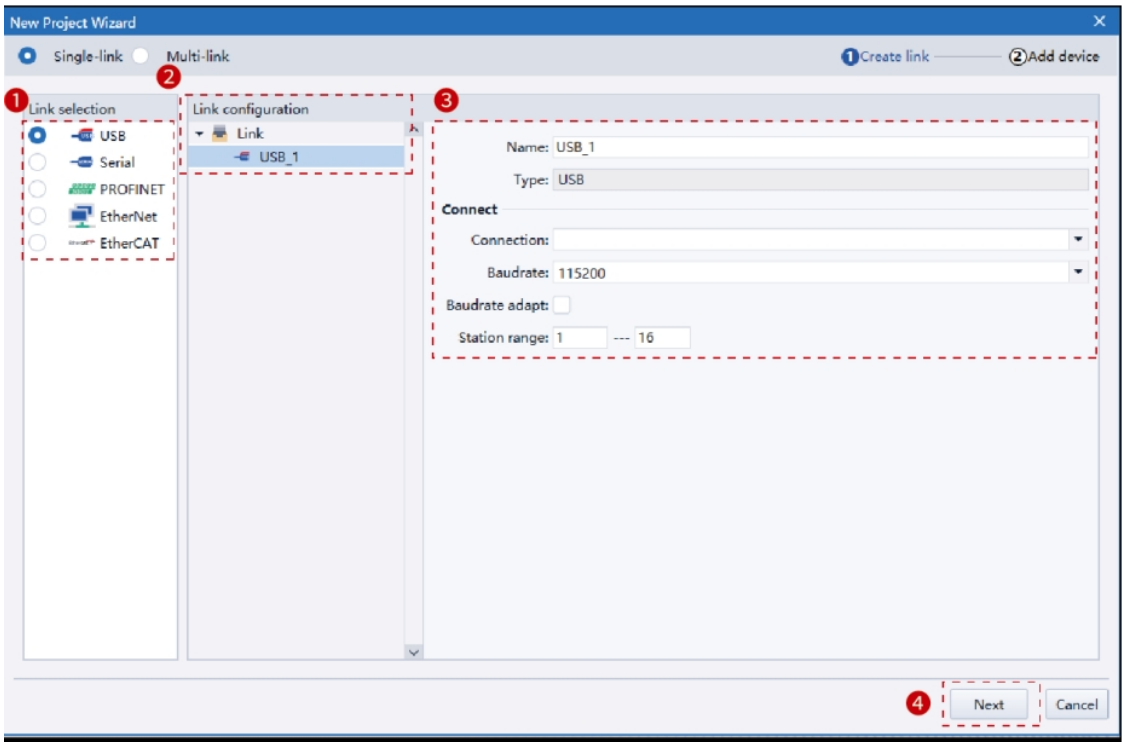
The basic steps to access the list of modified parameters through iFA commissioning software are as follows:

1. Open the iFA commissioning software, enter the project information, and click "Create" to create a new project.

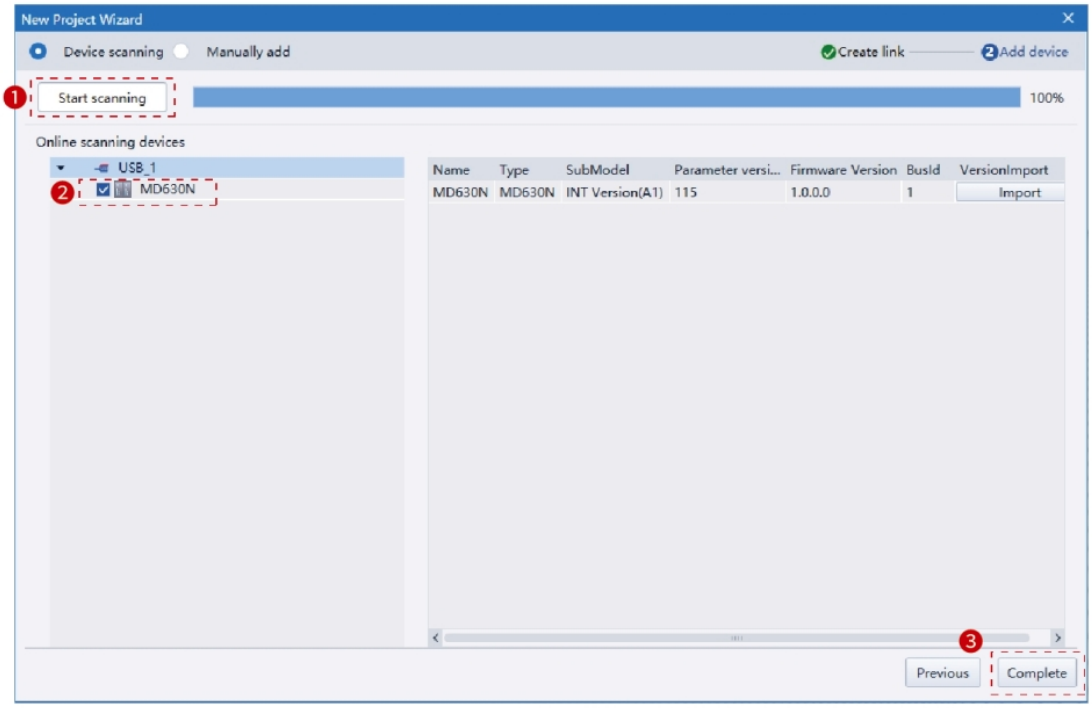


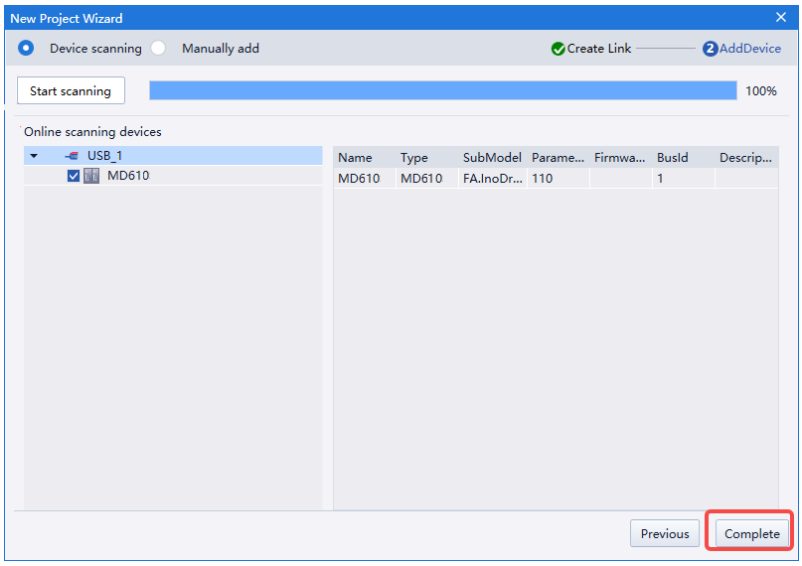
2. After entering the main page, click on the left side to add new items. In the wizard page displayed, enter information such as baud rate and station number, then click "Next".



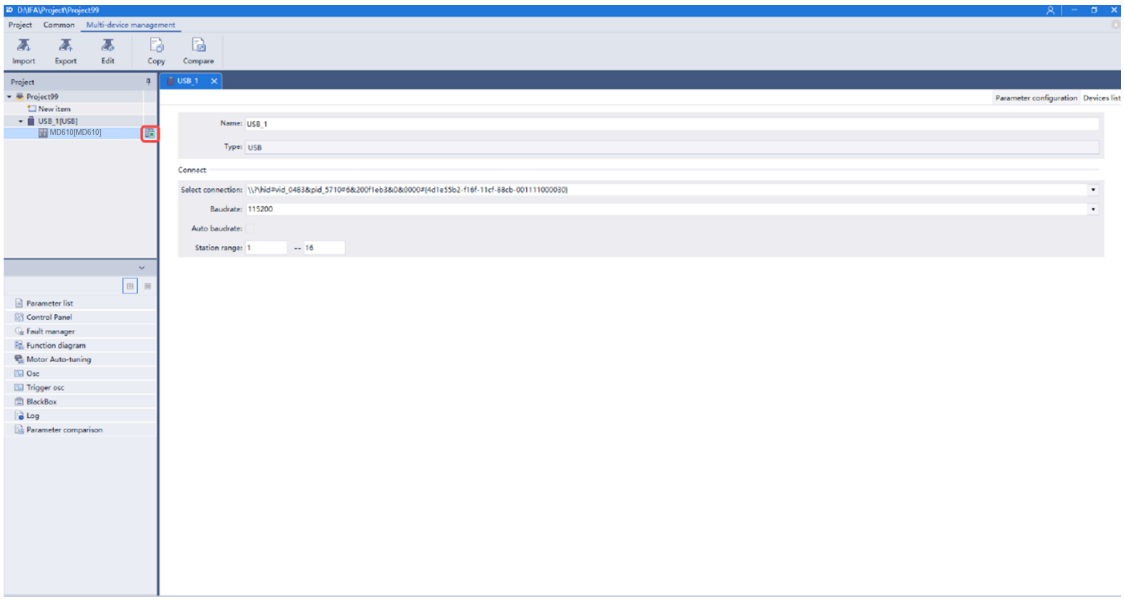


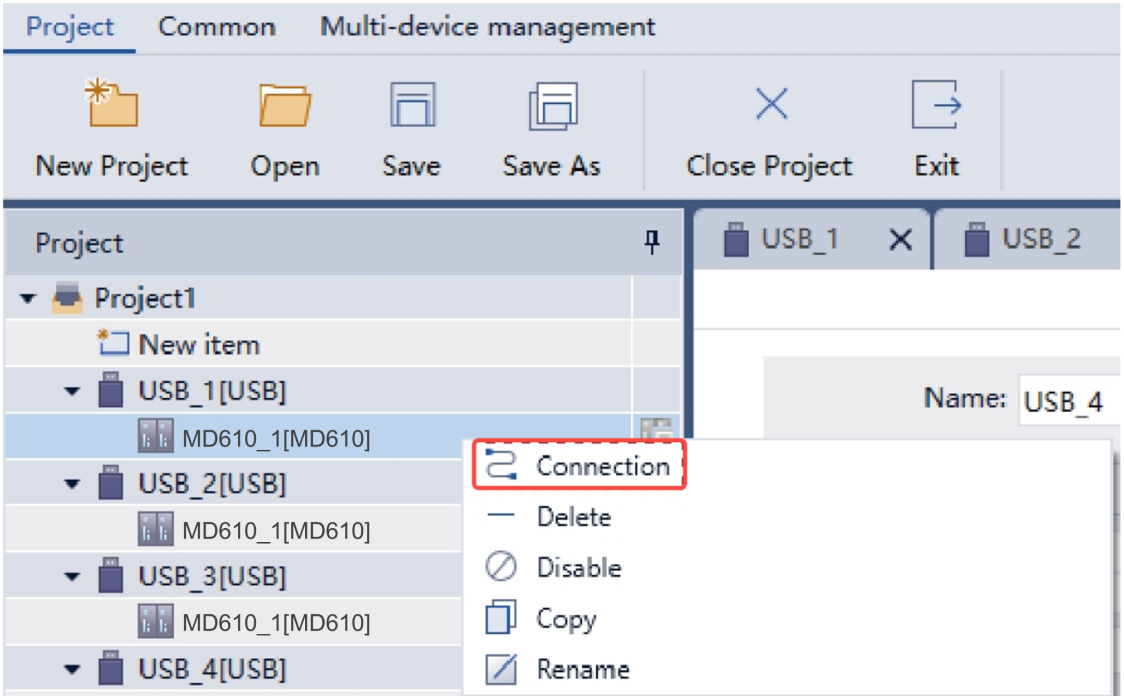
3. First, click "Start scanning" on the new page to scan for devices. After the connected device information is displayed, click "Done" to return to the main page.

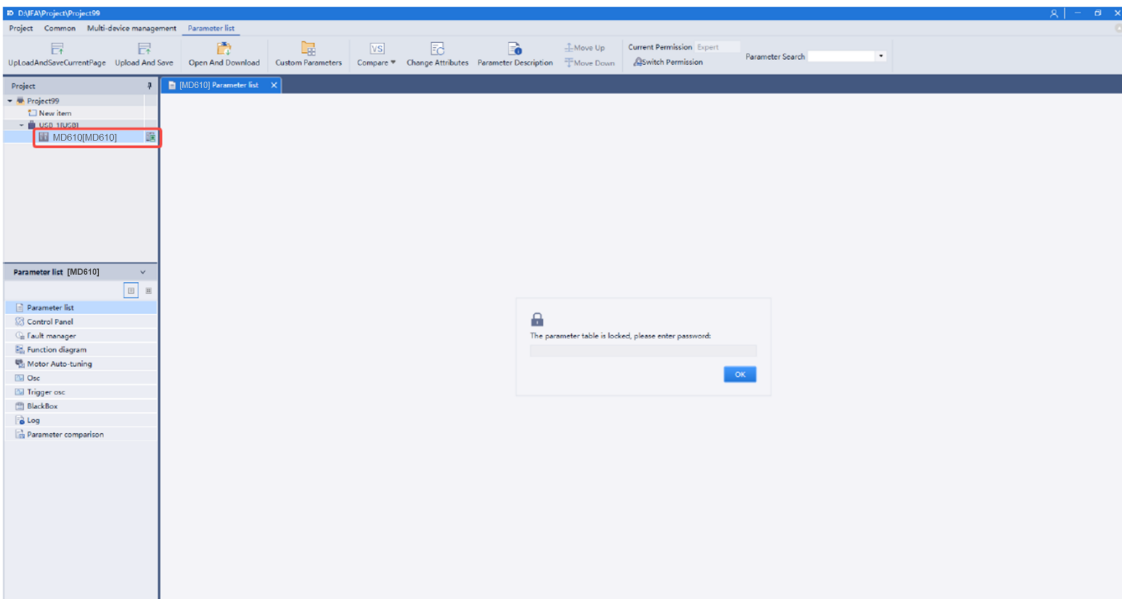




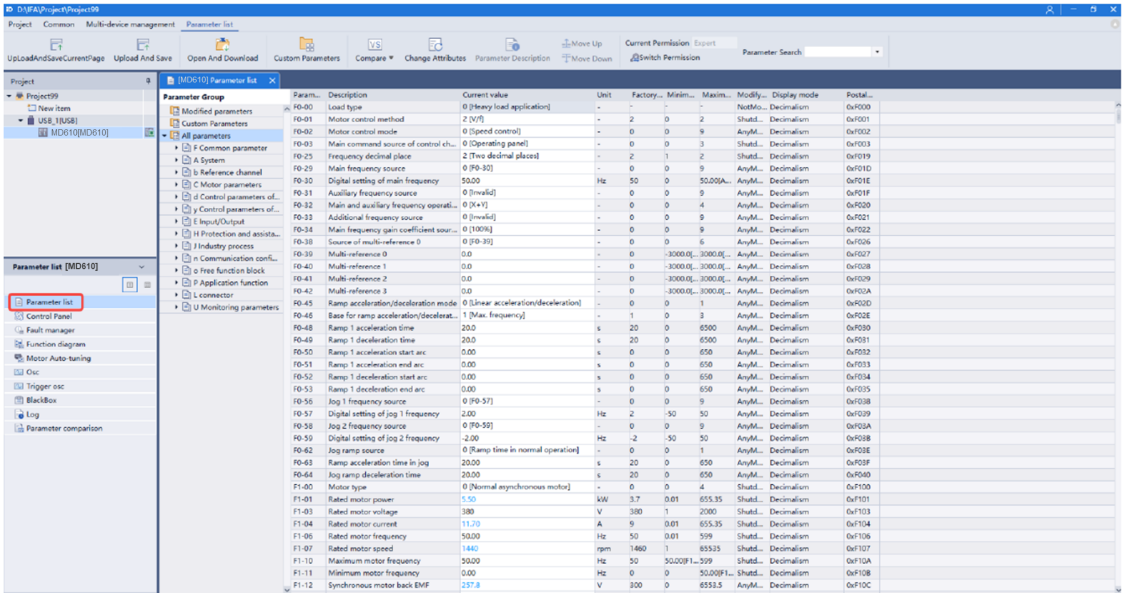
4. Right-click on the device name on the left side of the main page, which is MD610S her, and select "Connect device" in the pop-up menu. A green mark displayed besides the device name indicates this device has been connected successfully.



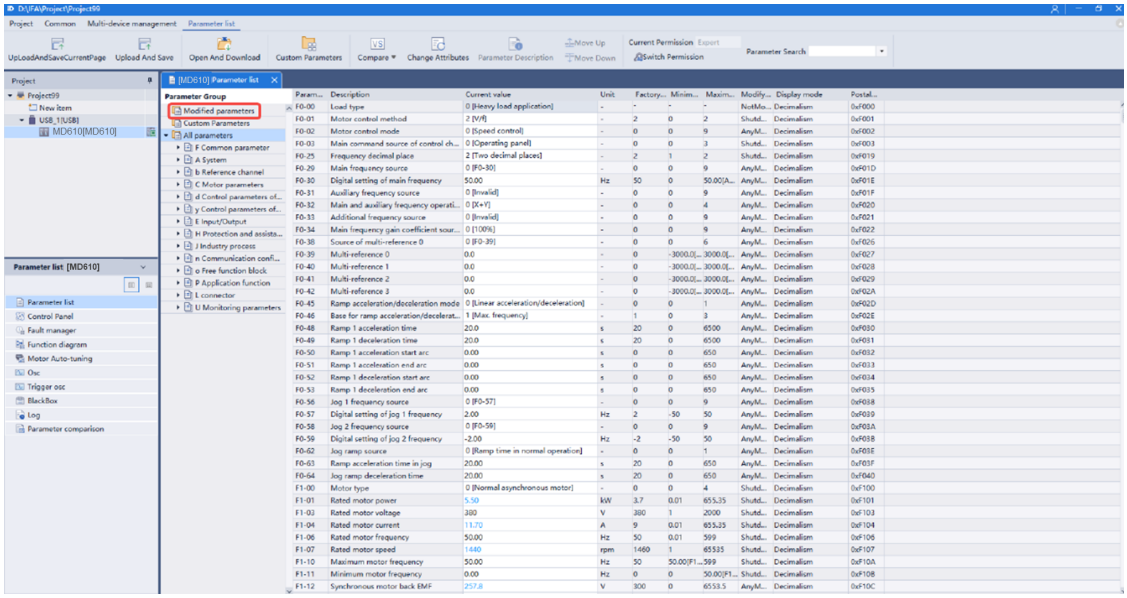


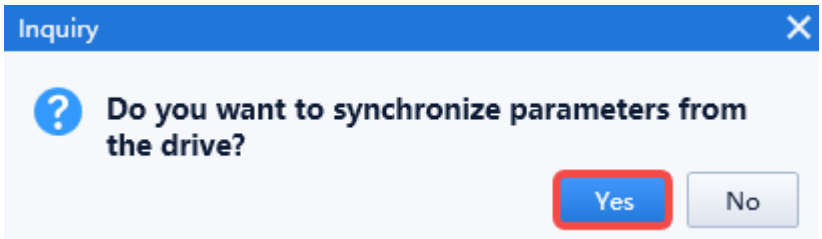


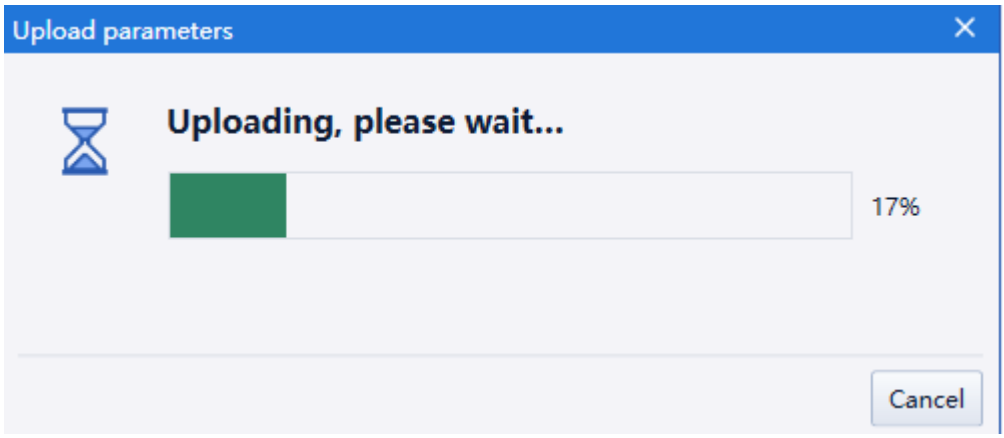
5. Next, click the parameter list on the left side to display parameters of the drive. Parameter groups are displayed on the right side.



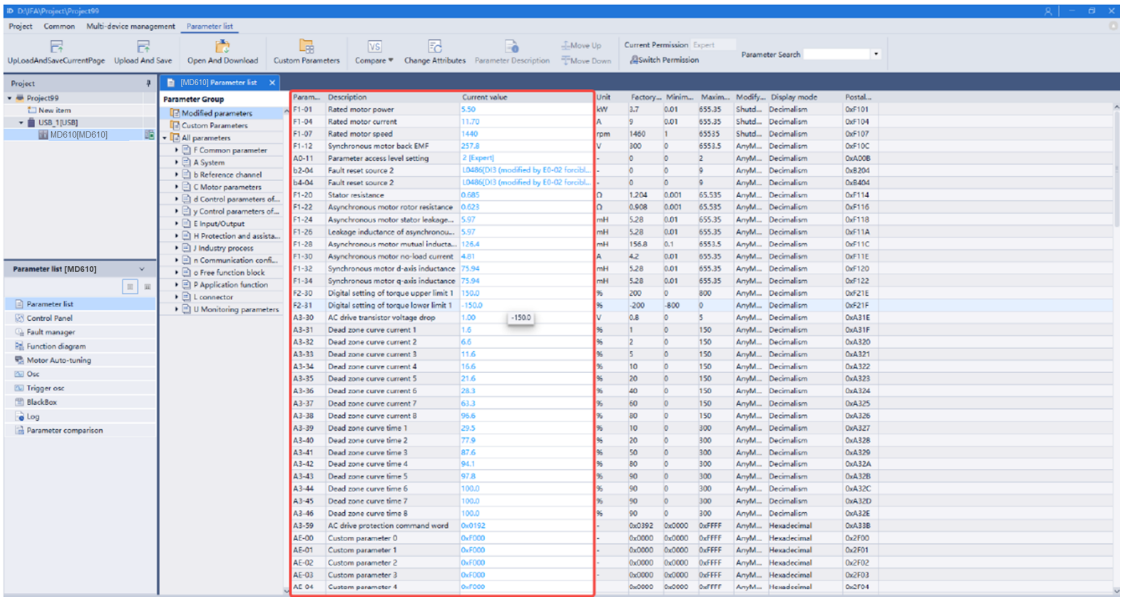
6. Click the modified parameters at the top of the parameter groups on the right side of the page. In the pop-up menu, click "Yes." Then the message "Uploading, please wait" is displayed, indicating that the modified parameters are being synchronized.







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.



14 Faults and Protection

14.1 Startup Protection

Application scenarios

Set P0-21 [Startup protection selection] to 1 [Enable] to enable the startup protection of the drive, preventing risks caused by motor responses.

Startup protection can be used in the following scenarios.

If the operation command is active when the drive is powered on (for example, an input terminal is ON before power-on), the drive does not respond to the command. The drive responds only after the operation command is activated again.

Related parameters

Table 14–1 Parameters related to startup protection

Param.	Name	Default value	Value range	Description
P0-21	Startup protection	1	0: Disable 1: Enable	Defines whether the startup protection is enabled. Value description: 0: Disable Startup protection is not enabled. 1: Enable Startup protection is enabled. Note: When this parameter is set to 1, the drive does not respond to the operation command even if the operation command is active upon power-on (for example, an input terminal is ON before power-on). The drive responds only after the operation command is activated again. In addition, when this parameter is set to 1, the drive does not respond to the operation command even if the operation command is active upon fault reset. To exit the protection state, deactivate the operation command first.

14.2 Fault Reset and Restart

14.2.1 Fault Reset Mode

The AC drive supports two fault reset modes, namely automatic reset and manual reset.

After the fault is rectified, you can reset the fault through on the operating panel or configuring DI function, or reset the fault manually through communication, as shown in *"14.2.2 Manual fault reset" on page 920*.

Automatic reset requires configuration of related parameters in Group H3 to be activated. See details in *"14.2.3 Automatic Fault Reset" on page 921*.

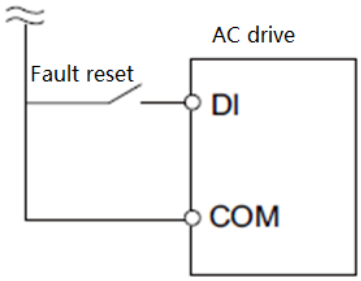
14.2.2 Manual fault reset

When a fault occurs on the drive, rectify the fault and reset the fault manually.

The fault can be reset manually through the following four ways.

Method 1: Reset the fault through the DI terminal.

Assign a DI (any DI function selection) with function "9: Fault reset".

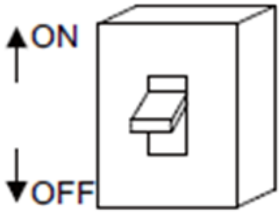


Method 2: Reset the fault through the operating panel.

Press on the operating panel to reset the fault.

Method 3: Restart the drive to reset the fault.

Disconnect the main circuit power supply. Wait until the fault code disappears, and then switch on the power supply again.



Method 4: Reset the fault through communication.

When b1-00 (Command source) is set to 2 (Communication), writing "16" (bit4 of fault reset command) to communication address 7321H through the host controller can reset the fault after the fault is cleared.

14.2.3 Automatic Fault Reset

Application scenarios

After a fault occurs, the fault is reset automatically when the fault cause is rectified. In this case, no further action is required.

Operating principles

The automatic fault reset function of the drive is deactivated by default. The default value of H3-01 [Automatic fault reset count] is 0. To enable automatic fault reset, you need to configure related parameters. The diagram for using this function is shown below.

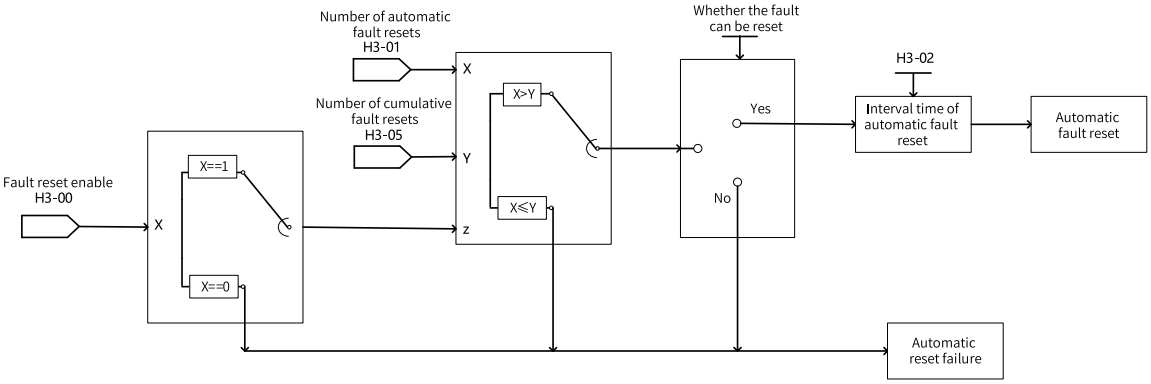


Figure 14-1 Automatic fault reset

As shown in the preceding figure, parameters to be set are as follows.

(1) Set H3-00 [Automatic fault reset enable] to 1 [Enable].

(2) Set H3-01 [Automatic fault reset count].

(3) Set H3-02 [Automatic fault reset interval time], which is the waiting time between fault occurrence and automatic fault reset.

When a fault occurs, make sure that H3-00 [Fault reset enable] is enabled and H3-01 [Automatic fault reset count] is higher than H3-05 [Cumulative fault reset count]. In this case, the drive resets the fault upon every interval time defined by H3-02 until the fault cause is rectified.

Note that unless the fault can be quickly located and eliminated, it is not recommended to set H3-02 [Automatic fault reset interval time] to an excessively low value. This is because the drive resets the

fault at configured interval time after the fault occurs. If the fault does not reach the reset condition, H3-05 [Cumulative fault reset count] increments by one. If the interval time is excessively short and the fault reset conditions are not met within a long term, the permissible number of automatic fault resets may be exhausted, which means the value of H3-05 [Cumulative fault reset count] exceeds the value of H3-01 [Automatic fault reset count].

Additionally, when the permissible number of fault resets is exhausted, you can restore the reset count by H3-04 [Waiting time for restoring automatic fault reset count] and H3-06 [Action upon fault reset count exhausted].

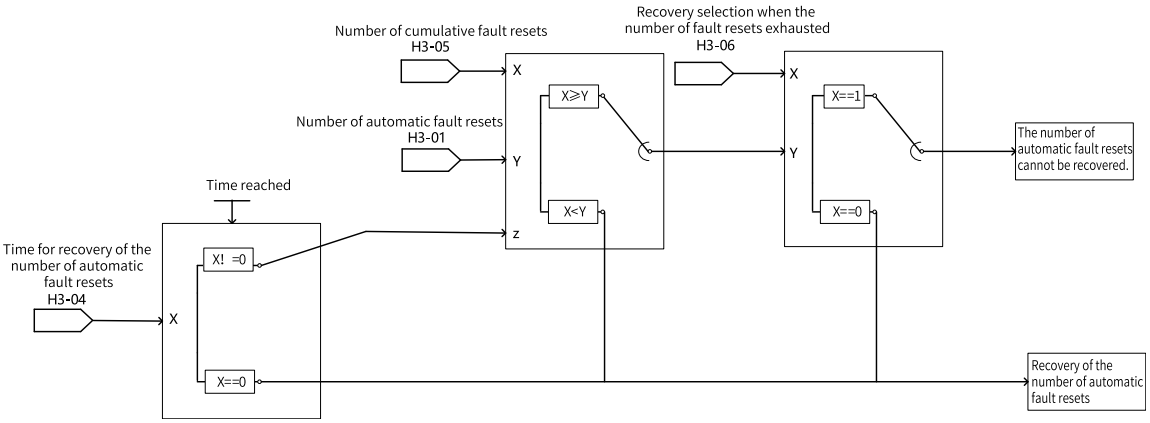


Figure 14-2 Time for restoring automatic fault reset count

As shown in the preceding figure, if H3-04 [Waiting time for restoring automatic fault reset count] is not set, H3-01 [Automatic fault reset count] can be restored continuously. If H3-04 is set, the fault reset count can be restored when H3-05 [Cumulative fault reset count] is lower than H3-01 [Automatic fault reset count].

When H3-05 [Cumulative fault reset count] is higher than H3-01 [Automatic fault reset count], whether H3-01 can be restored depends on the setting of H3-06 [Action upon fault reset count exhausted]. When H3-06 is set to 1 [Not restore automatic reset count], the reset count cannot be restored, which means the automatic fault reset count is exhausted. When H3-06 is set to 0 [Restore automatic fault reset count], the automatic fault reset count is restored.

Meanwhile, you can set ten sets of fault codes that inhibit automatic reset through H3-13 [Fault code 1 that inhibits automatic reset] to H3-22 [Fault code 10 that inhibits automatic reset].

Related parameters

Table 14–2 Parameters related to automatic fault reset

Param.	Name	Default value	Value range	Description
H3-00	Automatic fault reset selection	1	0: Disable 1: Enable	Defines 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	Defines the number of automatic fault resets. Note: If the number of reset times exceeds the value of this parameter, the drive stays in the fault state.

Param.	Name	Default value	Value range	Description
H3-02	Interval time of automatic fault reset	1.0s	0.1s to 600.0s	Defines the interval time between automatic fault resets. Note: This parameter defines the time between fault occurrence and automatic reset.
H3-03	Automatic reset disabled upon manual reset	1	0: Automatic reset deactivated 1: Automatic reset continued	Defines whether automatic reset can be terminated by manual reset during automatic reset. If the fault is terminated, the drive no longer resets the fault automatically. Value description: 0: Automatic reset deactivated - Automatic reset is terminated upon manual reset. 1: Automatic reset continued - Automatic reset continues after manual reset.
H3-04	Waiting time for restoring the number of automatic fault resets	10 min	0 min to 6000 min	Defines the waiting time for restoring the number of automatic fault resets. Note: When it is set to a non-zero value, the automatic fault reset count is restored after the time defined by H3-04 elapses. When it is set to 0, the automatic fault reset count can be restored continuously.
H3-05	Cumulative number of fault resets	0	-	Displays the cumulative number of fault resets, which cannot be modified. This parameter is cleared automatically when the number of manual resets and automatic resets are reached.
H3-06	Action when automatic fault reset count exhausted	0	0: Restore automatic fault reset count 1: Not restore automatic fault reset count	Defines whether to restore the automatic fault reset count after the fault reset count is exhausted. Value description: 0: Restore automatic fault reset count - When the automatic fault reset count is exhausted and waiting time for restoring the number of automatic fault resets elapses, the automatic fault reset count can be restored automatically. 1: Not restore automatic fault reset count - The automatic fault reset count will not be restored automatically when expired.
H3-07	Fault flag output selection	0	0: Not output during automatic fault reset 1: Output during automatic fault reset	Defines whether the fault flag is output during automatic reset, which is used to determine whether connector L0134 [Fault output] is 1 during fault reset. Value description: 0: Not output during automatic fault reset - The fault flag is not output during automatic reset. 1: Output during automatic fault reset - The fault flag is output during automatic reset.

Param.	Name	Default value	Value range	Description
H3-13	Fault code 1 that inhibits automatic reset	0.0	0.0 to 255.9	To set fault code 1 that inhibits automatic reset, enter the fault code and subcode, such as 187.1. Note: Enter the code and subcode of the fault, such as 187.1. In this case, the power unit EEPROM junction temperature parameter storage error (E187.1) cannot be reset automatically.
H3-14	Fault code 2 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-15	Fault code 3 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-16	Fault code 4 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-17	Fault code 5 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-18	Fault code 6 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-19	Fault code 7 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-20	Fault code 8 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-21	Fault code 9 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-22	Fault code 10 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13

14.2.4 Restart After Automatic Fault Reset

Application scenarios

When this function is enabled, the drive is restarted automatically after waiting time for restart upon fault reset elapses.

Note

When automatic fault reset and automatic restart are enabled, ensure that unexpected equipment operation will not cause personal injury or mechanical damage. This function is strictly prohibited for vertical lifting applications; otherwise, heavy loads may fall out of control.

Operating principles

During restart, if the drive receives a stop/manual reset command, it will stop and not restart. You can set black/whitelist for faults that allow/inhibit restart after automatic reset. Up to six fault codes can be set for the black/whitelist.

When H3-31 [Faults allowing restart after automatic reset] is set to 0 [Whitelist], H3-34 [Specified fault code 1] to H3-39 [Specified fault code 6] can be set to define six sets of fault codes that allow restart. When H3-31 is set to 1 [Black list], only the parameters defined by H3-34 to H3-39 do not allow restart. The following figure shows the detailed process.

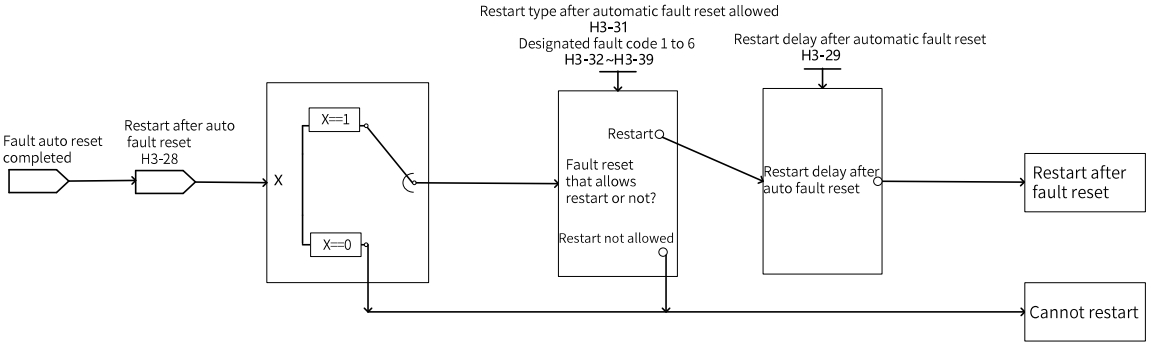


Figure 14-3 Restart after automatic fault reset

For example, set H3-00 [Automatic fault reset enable] to 1 [Enable], H3-01 [Automatic fault reset count] to 10, H3-02 [Automatic fault reset interval time] to 5s, H3-28 [Restart after automatic fault] to 1 [Enabled], and H3-29 [Restart delay after automatic fault reset] to 5s.

Generate a fault during operation of the drive on purpose, and set H2-00 [External fault 1 (NO) source] to 1 [Active]. In this case, the drive reports E015.1. Then set H2-00 to 0 to rectify the fault cause. After the fault is reset automatically, the drive starts automatically after a delay of 5s.

Related parameters

Table 14–3 Parameters related to restart after automatic fault reset

Param.	Name	Default value	Value range	Description
H3-28	Restart after automatic fault reset	0	0: Disable 1: Active	Defines whether the drive restarts after automatic fault reset. Value description: 0: Disable - Restart is not performed after automatic fault reset. 1: Enable - Restart is performed after automatic fault reset.
H3-29	Restart delay after automatic fault reset	0.5s	0.0s to 600.0s	Defines the waiting time from automatic fault reset to automatic restart.
H3-30	Flying start applied forcibly after automatic fault reset	0	0: Flying start is not applied forcibly after automatic fault reset. 1: Flying start is applied forcibly after automatic fault reset.	Defines whether to enable flying start after automatic restart upon fault reset. Flying start prevents the motor from being restarted when the speed is not reduced to 0 upon fault, avoiding overcurrent fault caused by inrush current upon start. Value description: 0: Flying start is not applied forcibly after automatic fault reset. 1: Flying start is applied forcibly after automatic fault reset.
H3-31	Faults allowing restart upon automatic reset	1	0: White list 1: Black list	Defines the faults that allow restart after automatic reset. Value description: 0: Whitelist - Only the six sets of parameters contained in the whitelist allow restart upon automatic reset. 1: Blacklist - Only the six sets of parameters contained in the blacklist do not allow restart upon automatic reset.
H3-34	Specified fault code 1	0.0	0.0 to 255.9	To set fault code 1, which allows restart after automatic fault reset, enter the fault code and subcode, such as 187.1. Note: Enter the code and subcode of the fault, such as 187.1. In this case, when power unit EEPROM junction temperature parameter storage error (E187.1) occurs, whether the drive restarts after reset is determined by the blacklist/whitelist in H3-31.
H3-35	Designated fault code 2	0.0	0.0 to 255.9	Defines the fault code 2 that allows restart after automatic reset.
H3-36	Designated fault code 3	0.0	0.0 to 255.9	Defines the fault code 3 that allows restart after automatic reset.
H3-37	Designated fault code 4	0.0	0.0 to 255.9	Defines the fault code 4 that allows restart after automatic reset.

Param.	Name	De fault value	Value range	Description
H3-38	Designated fault code 5	0.0	0.0 to 255.9	Defines the fault code 5 that allows restart after automatic reset.
H3-39	Designated fault code 6	0.0	0.0 to 255.9	Defines the fault code 6 that allows restart after automatic reset.

14.3 Protective Action Against Fault

14.3.1 Set Protection Actions upon Faults

Application scenarios

The fault action indicates the corresponding action taken by the drive after a fault occurs. You can set the fault action according to actual requirements to keep the drive in the corresponding state after the fault occurs.

Function description

11 types of actions can be set to the faults based on degree of severity from high to low: coast-to-stop > stop at maximum capacity > quick stop > decelerate-to-stop > limited operation (operating at limited speed, power, current, and torque) > alarm > prompt > ignore.

When "Ignore" is selected as the protective action against fault, no prompt will be displayed when a fault occurs. Select this option only when necessary.

You can set different fault actions to make the drive active accordingly when a fault occurs, as shown in the following table.

Table 14–4 Descriptions of actions to faults

Fault operation	Description	Related parameters
Coast to stop	After a fault occurs, the output stops and the load coasts to stop based on inertia.	-
Stop with maximum capability	The drive stops the load as quick as possible with maximum output capability upon fault.	The ramp-down time for this stop mode is fixed to 50 ms.
Quick stop	After a fault occurs, the drive stops according to the set quick stop time.	b7-34 [Ramp-down time for quick stop]
Decelerate to stop	After a fault occurs, the drive stops according to the set ramp-down time.	(Take the first set of ramp-up/down time as an example): b7-04 [Ramp 1 ramp-up time] b7-05 [Ramp 1 ramp-down time]
Operating at limited speed	After the fault occurs, the drive continues to run according to the operating mode set by H1-60.	H1-60 [Operating at limited speed] H1-61 [Operating at designated safe operating frequency] H1-62 [Maximum positive frequency limit] H1-63 [Maximum negative frequency limit]

Fault operation	Description	Related parameters
Run with power restriction	After the fault occurs, the drive continues to run, but the power cannot exceed 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 the fault occurs, the drive continues to run, but the maximum output current cannot exceed the current limit defined by H1-68.	H1-68 [Maximum current limit]
Operating at limited torque	After the fault occurs, the drive continues to run, but the maximum output torque cannot exceed the torque limit defined by H1-66 and H1-67.	H1-66 [Maximum positive torque limit] 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.	-

Multiple operation modes and parameters involved are during operation at limited speed. When a fault occurs and the fault action is set to "operating at limited speed", the drive continues to run in the mode defined by H1-60 [Operating at limited speed]. The following six options are available for H1-60.

0: Operating at limited frequency In this mode, the drive continues to run after a fault occurs, but the speed is limited by H1-62 [Maximum positive frequency limit] and H1-63 [Maximum negative frequency limit]. 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: Operating at the operating frequency upon fault In this mode, after a fault occurs, the drive continues to run according to the running frequency upon fault.

2: Operating at the designated safe frequency In this mode, after a fault occurs, the drive continues to run according to H1-61 [Designated safe operating frequency]. H1-61 indicate the frequency reference in percentages. The base value (100%) is determined by A2-04 [Per unit frequency base value].

3: Operating at the set frequency In this mode, the drive continues to run at the set frequency after a fault occurs.

4: Operating at the frequency upper limit in the current direction In this mode, the drive runs at the frequency upper limit in the current direction after a fault occurs.

5: Operating at the frequency lower 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 DO terminal configuration can be used. When a fault occurs, the output terminal outputs an active signal.

For example, you can set E1-04 [DO function selection] is to option 2 [Fault output], option 38 [Error output (fault/minor fault/alarm)], option 41 [Fault output (except undervoltage)], or option 43 [Output upon minor fault or alarm].

2: Fault - When the 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: Error (Fault/minor fault/alarm): When the drive encounters an error (fault/minor fault/alarm), the terminal outputs an active signal.

41: Fault (excluding undervoltage) - When the drive encounters an error (fault/minor fault/alarm) other than undervoltage, the terminal outputs an active signal.

43: Minor fault or alarm - When the drive encounters an error (minor fault/alarm), the terminal outputs an active signal.

You can select the protection actions by referring to the fault action range set for main fault codes in H1-00 to H1-18. For detail, see *"14.3.2 Set Protection Actions upon Faults" on page 930*.

When the fault level is "Prompt", the output terminal cannot be configured as the fault output signal.

Related parameters

Table 14–5 Parameters related to operation modes

Param.	Name	Default value	Value range	Parameter description
H1-60	Operation at limited speed	1	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	Defines the operation mode at limited speed when a minor fault occurs. Value description: 0: Operating at limited frequency - The maximum operating frequency is limited by H1-62 and H1-63. 1: Operating at the operating frequency upon fault - The operating frequency upon fault is used for operation. 2: Operating at the designated safe frequency - The drive operates at the frequency specified by H1-61 in limited operation. 3: Operating at the frequency reference - The drive operates at the set frequency in limited operation. 4: Operating at the frequency upper limit in the current direction - The drive operates at the frequency upper limit in the current direction in limited operation. 5: Operating at the frequency lower limit in the current direction - The drive operates frequency lower limit in the current direction in limited operation.
H1-61	Specified safety frequency	0.0%	0.0% to 800.0%	Defines the designated safe operating frequency in limited operation. Note: If H1-60 (Operating at limited speed) is set to 2, the drive operates at the frequency defined by H1-61 upon a minor fault.

Param.	Name	Default value	Value range	Parameter description
H1-62	Maximum positive frequency limit	100.0%	0.0% to 800.0%	Defines the maximum positive frequency in limited operation. Note: If H1-60 (Operating at limited speed) is set to 0, the drive operates at the permissible maximum positive frequency upon a minor fault.
H1-63	Maximum negative frequency limit	100.0%	0.0% to 800.0%	Defines the maximum negative frequency in limited operation. Note: If H1-60 (Operating at limited speed) is set to 0, the drive operates at the permissible maximum negative frequency upon a minor fault.
H1-64	Maximum motoring power limit	50.0%	0.0% to 400.0%	Defines the maximum motoring power outputted by the drive in limited operation. Note: Defines the maximum motoring power upon a minor fault.
H1-65	Maximum regenerative power limit	50.0%	0.0% to 400.0%	Defines the maximum regenerative power in limited operation. Note: Defines the maximum regenerative power upon a minor fault.
H1-66	Maximum positive torque limit	50.0%	0.0% to 400.0%	Defines the maximum positive torque in limited operation. Note: Defines the maximum positive torque upon a minor fault.
H1-67	Maximum negative torque limit	50.0%	0.0% to 400.0%	Defines the maximum negative torque under limited operation mode. Note: Defines the maximum negative torque upon a minor fault.
H1-68	Maximum current limit	50.0%	0.0% to 400.0%	Defines the maximum current under limited operation mode. Note: Defines the maximum operating current upon a minor fault.

14.3.2 Set Protection Actions upon Faults

Application scenarios

The action for fault codes applies to all the subcodes under this fault code.

Description

The AC drive supports action settings for 76 fault codes through H1-00 (Fault protection action selection 0) to H1-18 (Fault protection action selection 18). The action for a fault code can be set through the tens, hundreds, and thousands of each parameter. As shown in the following table, the ones, tens, hundreds, and thousands of H1-00 are used to set the actions for overcurrent, overvoltage, pre-charging fault, and undervoltage faults respectively.

Table 14–6 Parameter setting for fault protection action

Param.	Fault name	Fault subcode		
H1-00	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

Note that not all the fault code can be set with 11 actions. Only fault actions provided in the parameter can be set. Take the ones of H1-00 as an example, the only option for overcurrent fault (E002) is coast-to-stop, which means no other actions can be set.

When the action for the fault code is set, all the subcodes under this master code take the same fault action. You can modify individual fault actions as needed. See details in *"14.3.3 Modify Single Fault Action" on page 970*.

For example, if the thousands of H1-03 [Protective action selection 3 upon fault] is set to 3, the protective action for E186 (Power EEPROM fault) is decelerate-to-stop, then decelerate-to-stop applies to all the subcodes under E186, such as E186.1 (Model parameter read/write failure), E186.2 (Power unit parameter error), and E186.3 (Preset model parameters of the main control board inconsistent with the power board).

Related parameters

Table 14–7 Parameters for setting actions for fault codes

Param.	Name	Default value	Value range	Description
H1-00	Protective action selection 0 upon fault	0	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	The ones, tens, hundreds, and thousands of this parameter are used to set protective actions upon different faults. Options: Ones: Overcurrent (E002) 0: Coast to stop - When the drive encounters overcurrent, the operating panel displays E002 and the motor coasts to stop. Tens: Overvoltage (E005) 0: Coast to stop - When the drive encounters overvoltage, the operating panel displays E005 and the motor coasts to stop. Hundreds: Pre-charge fault (E008) 0: Coast to stop - When the drive encounters a pre-charge fault, the operating panel displays E008 and the motor coasts to stop. Thousands: Undervoltage (E009) 0: Coast to stop - When the drive encounters undervoltage for some reason, the operating panel displays E009 and the motor coasts to stop. Note: Protective actions for overcurrent, overvoltage, pre-charge fault, and undervoltage set by this parameter cannot be changed. When these faults occur, the drive stops output and the motor coasts to stop.

Param.	Name	Default value	Value range	Description
H1-01	Protective action selection 1 upon fault	0	Ones: Drive overload (E010) 0: Coast to stop Ones: Motor overload (E011) 0: Coast to stop Hundreds position: 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: Ignore Thousands position: Output phase loss (E013) 0: Coast to stop	Defines protective actions for different faults. Options: Ones: Drive overload (E010) 0: Coast to stop - When the drive encounters overload due to certain reasons, the operating panel displays E010 and the motor coasts to stop. Ones: Motor overload (E011) 0: Coast to stop - When the drive encounters motor overload, the operating panel displays E011 and the motor coasts to stop. Hundreds position: Input phase loss (E012) 0: Coast to stop - When the drive encounters phase loss on the input side, the operating panel displays E012 and the motor coasts to stop. 1: Stop at maximum capability - When the drive encounters phase loss on the input side, the operating panel displays E012 and the motor stops at the maximum capability. 2: Quick stop - When the drive encounters phase loss on the input side, the operating panel displays E012 and the motor stops quickly. 3: Decelerate to stop - When the drive encounters phase loss on the input side, the operating panel displays E012 and the motor decelerates to stop. 9: Operating at limited speed - When the drive encounters phase loss on the input side, the operating panel displays L012 and the drive operates with the speed limited to a certain range. 000AH: Run at limited power - When the drive encounters phase loss on the input side due to certain reasons, the operating panel displays L012 and the drive runs with the power limited to a certain range. 000BH: Run at limited current - When the drive encounters phase loss on the input side due to certain reasons, the operating panel displays L012 and the drive runs with the current limited to a certain range. (Continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) 000CH: Operating at limited torque. When the drive encounters phase loss on the input side, the operating panel displays L012 and the drive operates with the torque limited to a certain range. 13: Alarm - When the drive encounters phase loss on the input side, the operating panel displays A012 and the drive operates normally. 14: Prompt - When the drive encounters phase loss on the input side, the operating panel displays N012 and the drive operates normally. 15: Ignore - When the drive encounters phase loss on the input side, the operating panel does not display any fault and the drive operates normally. Thousands position: Output phase loss (E013) 0: Coast to stop - When the drive encounters output phase loss, the operating panel displays E013 and the motor coasts to stop. Note: In protective action selection 1, actions for drive overload, motor overload, and output phase loss cannot be changed. When these faults occur, the drive stops output and the motor coasts to stop. If an input phase loss fault occurs, you can change the protective action to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-02	Protective action selection 2 upon fault	0	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: Ignore Hundreds: Reserved 0: Coast to stop Thousands: Current sampling error (E018) 0: Coast to stop	The ones, tens, and thousands of this parameter are used to set protection actions upon different faults. Options: Ones: Module overtemperature (E014) 0: Coast to stop - When the drive encounters the module overtemperature fault, the operating panel displays E014 and the motor coasts to stop. Tens: External fault (E015) 0: Coast to stop - When the drive encounters an external fault, the operating panel displays E015 and the motor coasts to stop. 1: Stop at maximum capability - When the drive encounters an external fault, the operating panel displays E015 and the motor stops at the maximum capability. 2: Quick stop - When the drive encounters an external fault, the operating panel displays E015 and the motor stops quickly. 3: Decelerate to stop - When the drive encounters an external fault, the operating panel displays E015 and the motor decelerates to stop. 9: Operating at limited speed - When the drive encounters an external fault, the operating panel displays L015 and the drive operates with the speed limited to a certain range. 10: Run at limited power - When the drive encounters an external fault due to certain reasons, the operating panel displays L015 and the drive runs with the power limited to a certain range. Continued

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	Continued 11: Run at limited current - When the drive encounters an external fault due to certain reasons, the operating panel displays L015 and the drive runs with the current limited to a certain range. 12: Operating at limited torque - When the drive encounters an external fault, the operating panel displays L015 and the drive operates with the torque limited to a certain range. 13: Alarm - When the drive encounters an external fault, the operating panel displays A015 and the drive operates normally. 14: Prompt - When the drive encounters an external fault, the operating panel displays N015 and the drive operates normally. 15: Ignore - When the drive encounters an external fault, the operating panel does not display any fault and the drive operates normally. Thousands: Current sampling error (E018) 0: Coast to stop - When the drive encounters a current sampling fault, the operating panel displays E018 and the motor coasts to stop. Note: In protective action selection 2, actions for drive overtemperature and current sampling error cannot be changed. When these faults occur, the drive stops output and the motor coasts to stop. If an external fault occurs, you can change the protective action to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
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 position: 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	Same as H1-00

Param.	Name	Default value	Value range	Description
H1-04	Protective action selection 4 upon fault	0	Ones: Output ground fault (E023) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Cumulative operating time arrival (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: Ignore Thousands: Custom 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: Ignore	The ones, tens, and thousands of this parameter are used to set protection actions upon different faults. Options: Ones: Output ground fault (E023) 0000H: Coast to stop - When the drive encounters an output ground fault, the operating panel displays E023 and the motor coasts to stop. Hundreds: Cumulative operating time arrival (E026) 0000H: Coast to stop - When the drive encounters a cumulative operating time arrival fault, the operating panel displays E026 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters a cumulative operating time arrival fault, the operating panel displays E026 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a cumulative operating time arrival fault, the operating panel displays E026 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a cumulative operating time arrival fault, the operating panel displays E026 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters a cumulative operating time arrival fault, the operating panel displays L026 and the drive operates with the speed limited to a certain range. 000AH: Run at limited power - When the drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L026 and the drive runs with the power limited to a certain range. 000BH: Run at limited current - When the drive encounters a cumulative operating time reach fault due to certain reasons, the operating panel displays L026 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters a cumulative operating time arrival fault, the operating panel displays L026 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters a cumulative operating time arrival fault, the operating panel displays A026 and the drive operates normally. (Continued)

Param.	Name	Default value	Value range	Description
H1-04	Protective action selection 4 upon fault	0	Ones: Output ground fault (E023) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Cumulative operating time arrival (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: Ignore Thousands: Custom 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: Ignore	(Continued) 000EH: Prompt - When the drive encounters a cumulative operating time arrival, the operating panel displays N026 and the drive operates normally. 000FH: Ignore - When the drive encounters a cumulative operating time arrival fault, the operating panel does not display any fault and the drive operates normally. Thousands: Custom fault (E027) 0000H: Coast to stop - When the drive encounters a custom fault, the operating panel displays E027 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters a custom fault, the operating panel displays E027 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a custom fault, the operating panel displays E027 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a custom fault, the operating panel displays E027 and the motor decelerates to stop. 000FH: Ignore - When the drive encounters a custom fault, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 4, action for output ground fault cannot be changed. When this fault occurs, the drive stops output and the motor coasts to stop. If an operating time arrival fault or custom fault occurs, you can change the protective action to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-05	Fault protection action selection 5	0xDD	Ones: Custom 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: Ignore Tens: Cumulative power-on time arrival (E029) 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 (Continued)	The ones, tens, and thousands of this parameter indicate actions for different fault. Options: Ones: Custom alarm (E028) 0000H: Coast to stop - When the drive encounters a custom alarm, the operating panel displays E028 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters a custom alarm, the operating panel displays E028 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a custom alarm, the operating panel displays E028 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a custom alarm, the operating panel displays E028 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters a custom fault, the operating panel displays L028 and the drive operates with the speed limited to a certain range. 000AH: Run at limited power - When the drive encounters a custom fault due to certain reasons, the operating panel displays L028 and the drive runs with the power limited to a certain range. 000BH: Run at limited current - When the drive encounters a custom fault due to certain reasons, the operating panel displays L028 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters a custom fault, the operating panel displays L028 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters a custom fault, the operating panel displays A028 and the drive operates normally. 000EH: Prompt - When the drive encounters a custom fault, the operating panel displays N028 and the drive operates normally. 000FH: Ignore - When the drive encounters a custom alarm, the operating panel does not display any fault and the drive operates normally. (Continued)

Param.	Name	Default value	Value range	Description
H1-05	Fault protection action selection 5	0xDD	(Continued) Hundreds: Three-phase loss (E030) 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 Thousands: PID feedback loss fault (E031) 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	(Continued) Tens: Cumulative power-on time arrival (E029) 0000H: Coast to stop - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays E029 and the motor decelerates to stop. 0001H: Stop at maximum capability - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays E029 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays E029 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays E029 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays L029 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L029 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters a cumulative power-on time reach fault due to certain reasons, the operating panel displays L029 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays L029 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays A029 and the drive operates normally. 000EH: Prompt - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays N029 and the drive operates normally. 000FH: Ignore - When the drive encounters a cumulative power-on time arrival fault, the operating panel does not display any fault and the drive operates normally. (Continued)

Param.	Name	Default value	Value range	Description
H1-05	Fault protection action selection 5	0xDD	Hundreds: Three-phase loss (E030) 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 Thousands: PID feedback loss fault (E031) 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	(Continued) Hundreds: Three-phase loss (E030) 0000H: Coast to stop - When the drive encounters three-phase loss, the operating panel displays E030 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters three-phase loss, the operating panel displays E030 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters three-phase loss, the operating panel displays E030 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters three-phase loss, the operating panel displays E030 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters three-phase loss, the operating panel displays L030 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters three-phase loss due to certain reasons, the operating panel displays L030 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters three-phase loss due to certain reasons, the operating panel displays L030 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters three-phase loss, the operating panel displays L030 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters three-phase loss, the operating panel displays A030 and the drive operates normally. 000EH: Prompt - When the drive encounters three-phase loss, the operating panel displays N030 and the drive operates normally. 000FH: Ignore - When the drive encounters three-phase loss, the operating panel does not display any fault and the drive operates normally.

Param.	Name	Default value	Value range	Description
H1-05	Fault protection action selection 5	0xDD	Hundreds: Three-phase loss (E030) 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 Thousands: PID feedback loss fault (E031) 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	(Continued) Thousands: PID feedback loss fault (E031) 0000H: Coast to stop - When the drive encounters the PID feedback loss fault, the operating panel displays E031 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the PID feedback loss fault, the operating panel displays E031 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the PID feedback loss fault, the operating panel displays E031 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the PID feedback loss fault, the operating panel displays E031 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the PID feedback loss fault, the operating panel displays L031 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters the PID feedback loss fault due to certain reasons, the operating panel displays L031 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters the PID feedback loss fault due to certain reasons, the operating panel displays L031 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the PID feedback loss fault, the operating panel displays L031 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the PID feedback loss fault, the operating panel displays A031 and the drive operates normally. 000EH: Prompt - When the drive encounters the PID feedback loss fault, the operating panel displays N031 and the drive operates normally. 000FH: Ignore - When the drive encounters the PID feedback loss fault, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 5 upon fault, actions for the custom alarm, cumulative power-on time arrival, three-phase loss, and PID feedback loss can be changed to enable the drive to act accordingly.

Param.	Name	Default value	Value range	Description
H1-06	Protection action selection 6 upon fault	0x0D0D	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: Ignore Tens: Reserved 0: Coast to stop (Continued)	The ones, tens, and thousands of this parameter are used to set protection actions upon different faults. Options: Ones: Parameter reset error (E032) 0000H: Coast to stop - When the drive encounters a parameter reset fault, the operating panel displays E032 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters a parameter reset fault, the operating panel displays E032 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a parameter reset fault, the operating panel displays E032 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a parameter reset fault, the operating panel displays E032 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters a parameter reset fault, the operating panel displays L032 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters a parameter reset fault due to certain reasons, the operating panel displays L032 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters a parameter reset fault due to certain reasons, the operating panel displays L032 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters a parameter reset fault, the operating panel displays L032 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters a parameter reset fault, the operating panel displays A032 and the drive operates normally. 000EH: Prompt - When the drive encounters a parameter reset fault, the operating panel displays N032 and the drive operates normally. 000FH: Ignore - When the drive encounters a parameter reset fault, the operating panel does not display any fault and the drive operates normally. Tens: Reserved (Continued)

Param.	Name	Default value	Value range	Description
H1-06	Protection action selection 6 upon fault	0x0D0D	(Continued) Hundreds: Excessive speed deviation (E042) 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 (Continued)	(Continued) Hundreds position: Excessive speed deviation (E042) 0000H: Coast to stop - When the drive encounters excessive speed deviation, the operating panel displays E042 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters excessive speed deviation, the operating panel displays E042 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters excessive speed deviation, the operating panel displays E042 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters excessive speed deviation, the operating panel displays E042 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters excessive speed deviation, the operating panel displays L042 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters excessive speed deviation due to certain reasons, the operating panel displays L042 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the AC drive encounters excessive speed deviation due to certain reasons, the operating panel displays L042 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters excessive speed deviation, the operating panel displays L042 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters excessive speed deviation, the operating panel displays A042 and the drive operates normally. 000EH: Prompt - When the drive encounters a parameter reset fault, the operating panel displays N032 and the drive operates normally. 000FH: Ignore - When the drive encounters a parameter reset fault, the operating panel does not display any fault and the drive operates normally. (Continued)

Param.	Name	Default value	Value range	Description
H1-06	Protection action selection 6 upon fault	0x0D0D	(Continued) Thousands: Motor speed overlimit (E043) 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	(Continued) Thousands position: Motor speed error (E043) 0000H: Coast to stop - When the drive encounters motor overspeed, the operating panel displays E043 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters motor overspeed, the operating panel displays E043 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters motor overspeed, the operating panel displays E043 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters motor overspeed, the operating panel displays E043 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters motor overspeed, the operating panel displays L043 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters a motor speed fault due to certain reasons, the operating panel displays L043 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters a motor speed fault due to certain reasons, the operating panel displays L043 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters motor overspeed, the operating panel displays L043 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters motor overspeed, the operating panel displays A043 and the drive operates normally. 000EH: Prompt - When the drive encounters motor overspeed, the operating panel displays N043 and the drive operates normally. 000FH: Ignore - When the drive encounters motor overspeed, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 6 upon fault, actions for fault reset error, excessive speed deviation, and motor speed error can be changed to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-07	Protective action selection 7 upon fault	0	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Magnetic pole position auto-tuning error (E051) 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Options: Thousands: Magnetic pole position auto-tuning error (E051) 0000H: Coast to stop - When the drive encounters the magnetic pole position auto-tuning fault, the operating panel displays E051 and the motor coasts to stop. Note: In protective action selection 7 upon fault, the action for magnetic pole position auto-tuning fault cannot be changed. When this fault occurs, the drive stops output and the motor coasts to stop.
H1-08	Protective action selection 8 upon fault	0	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 indicate protective actions for different faults. Options: Tens: Self-test fault 1 (E056) 0000H: Coast to stop - When the drive encounters self-test fault 1, the operating panel displays E056 and the motor coasts to stop. Hundreds: Self-test fault 2 (E057) 0000H: Coast to stop - When the drive encounters self-test fault 2, the operating panel displays E057 and the motor coasts to stop. Thousands: Self-test fault 3 (E058) 0000H: Coast to stop - When the drive encounters self-test fault 3, the operating panel displays E058 and the motor coasts to stop. Note: In protective action selection 8 upon fault, actions for self-test faults 1, 2, and 3 cannot be changed. When these faults occur, the drive stops output and the motor coasts to stop.

Param.	Name	Default value	Value range	Description
H1-09	Protective action selection 9 upon fault	0	Ones: Self-test 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: 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 indicate protective actions for different faults. Options: Ones: Self-test fault 4 (E059) 0000H: Coast to stop - When the drive encounters self-test fault 4, the operating panel displays E059 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters self-test fault 4, the operating panel displays E059 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters self-test fault 4, the operating panel displays E059 and the motor stops quickly. 0003H: Quick stop - When the drive encounters self-test fault 4, the operating panel displays E059 and the motor stops quickly. 0009H: Operating at limited speed - When the drive encounters self-test fault 4, the operating panel displays L059 and the drive operates 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: Operating at limited torque - When the drive encounters self-test fault 4, the operating panel displays L059 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters self-test fault 4, the operating panel displays A059 and the drive operates normally. 000EH: Prompt - When the drive encounters self-test fault 4, the operating panel displays N059 and the drive operates normally. 000FH: Ignore - When the drive encounters self-test fault 4, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 9 upon fault, the action for self-test fault 4 cannot be changed. When this fault occurs, the drive stops output and the motor coasts to stop.

Param.	Name	Default value	Value range	Description
H1-10	Protective action selection 10 upon fault	0	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: 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 indicate protective actions for different faults. Options: Ones position: Fan fault (E080) 0000H: Coast to stop When the drive encounters a fan fault, the operating panel displays E080 and the motor coasts to stop. 0001H: Stop at maximum capability When the drive encounters a fan fault, the operating panel displays E080 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a fan fault, the operating panel displays E080 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a fan fault, the operating panel displays E080 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters a fan fault, the operating panel displays L080 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - 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 limited current - 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: Operating at limited torque - When the drive encounters a fan fault, the operating panel displays L080 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters a fan fault, the operating panel displays A080 and the drive operates normally. 000EH: Prompt - When the drive encounters a fan fault, the operating panel displays N080 and the drive operates normally. 000FH: Ignore - When the drive encounters a fan fault, the operating panel does not display any fault and the drive operates normally. Note: In the protective action selection 10 upon fault, the action for fan fault can be changed to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-11	Protection action selection 11 upon fault	0xF00	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds position: 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: Ignore Thousands: Motor control error 1 (E093) 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	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Options: Hundreds position: Sequence fault (E085) 0000H: Coast to stop - When the drive encounters the time sequence fault, the operating panel displays E085 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the time sequence fault, the operating panel displays E085 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the time sequence fault, the operating panel displays E085 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the time sequence fault, the operating panel displays E085 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the time sequence fault, the operating panel displays L085 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - 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 limited current - 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: Operating at limited torque - When the drive encounters the brake fault, the operating panel displays L085 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the time sequence fault, the operating panel displays A085 and the drive operates normally. 000EH: Prompt - When the drive encounters the time sequence fault, the operating panel displays N085 and the drive operates normally. 000FH: Ignore - When the drive encounters the time sequence fault, the operating panel does not display any fault and the drive operates normally. (Continued)

Param.	Name	Default value	Value range	Description
H1-11	Protection action selection 11 upon fault	0xF00	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds position: 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: Ignore Thousands: Motor control error 1 (E093) 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	(Continued) Thousands: Motor control error 1 (E093) 0000H: Coast to stop - When the drive encounters motor control error 1, the operating panel displays E093 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters motor control error 1, the operating panel displays E093 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters motor control error 1, the operating panel displays E093 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters motor control error 1, the operating panel displays E093 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters motor control error 1, the operating panel displays L093 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters motor control exception 1 due to certain reasons, the operating panel displays L093 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters motor control exception 1 due to certain reasons, the operating panel displays L093 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters motor control error 1, the operating panel displays L093 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters motor control error 1, the operating panel displays A093 and the drive operates normally. 000EH: Prompt - When the drive encounters motor control error 1, the operating panel displays N093 and the drive operates normally. 000FH: Ignore - When the drive encounters motor control error 1, the operating panel does not display any fault the drive operates normally. Note: In protective action selection 11 upon fault, actions for the sequence fault and motor control error 1 can be changed to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-12	Protective action selection 12 upon fault	0xDDDD	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: Ignore (Continued)	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Options: Ones position: Motor control error 2 (E094) 0000H: Coast to stop - When the drive encounters motor control error 2, the operating panel displays E094 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters motor control error 2, the operating panel displays E094 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters motor control error 2, the operating panel displays E094 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters motor control error 2, the operating panel displays E094 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters motor control error 2, the operating panel displays L094 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters motor control exception 2 due to certain reasons, the operating panel displays L094 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters motor control exception 2 due to certain reasons, the operating panel displays L094 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters motor control error 2, the operating panel displays L094 and the drive operates with the torque limited to a certain range. (Continued)

Param.	Name	Default value	Value range	Description
H1-12	Protective action selection 12 upon fault	0xDDDD	(Continued) Tens: AC drive pre-overload (E110) 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 (Continued)	(Continued) 000DH: Alarm - When the drive encounters motor control error 2, the operating panel displays A094 and the drive operates normally. 000EH: Prompt - When the drive encounters motor control error 2, the operating panel displays N094 and the drive operates normally. 000FH: Ignore - When the drive encounters motor control error 2, the operating panel does not display any fault and the drive operates normally. Tens position: AC drive pre-overload (E110) 0000H: Coast to stop - When the drive encounters the drive pre-overload fault, the operating panel displays E110 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the drive pre-overload fault, the operating panel displays E110 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the drive pre-overload fault, the operating panel displays E110 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the drive pre-overload fault, the operating panel displays E110 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the drive pre-overload fault, the operating panel displays L110 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters the drive pre-overload fault due to certain reasons, the operating panel displays L110 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters the drive pre-overload fault due to certain reasons, the operating panel displays L110 and the drive runs with the current limited to a certain range. (Continued)

Param.	Name	Default value	Value range	Description
H1-12	Protective action selection 12 upon fault	0xDDDD	(Continued) Hundreds: Motor pre-overload (E111) 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 (Continued)	(Continued) 000CH: Operating at limited torque - When the drive encounters the drive pre-overload fault, the operating panel displays L110 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the drive pre-overload fault, the operating panel displays A110 and the drive operates normally. 000EH: Prompt - When the drive encounters the drive pre-overload fault, the operating panel displays N110 and the drive operates normally. 000FH: Ignore - When the drive encounters the drive pre-overload fault, the operating panel does not display any fault and the drive operates normally. Hundreds: Motor pre-overload (E111) 0000H: Coast to stop - When the drive encounters the motor pre-overload fault, the operating panel displays E111 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the motor pre-overload fault, the operating panel displays E111 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the motor pre-overload fault, the operating panel displays E111 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the motor pre-overload fault, the operating panel displays E111 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the motor pre-overload fault, the operating panel displays L111 and the drive operates with the speed limited to a certain range. (Continued)

Param.	Name	Default value	Value range	Description
H1-12	Protective action selection 12 upon fault	0xDDDD	(Continued) Thousands position: Module pre-overheat (E114) 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	(Continued) 000AH: Run with limited power - When the drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays L111 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters the motor pre-overload fault due to certain reasons, the operating panel displays L111 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the motor pre-overload fault, the operating panel displays L111 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the motor pre-overload fault, the operating panel displays A111 and the drive operates normally. 000EH: Prompt - When the drive encounters the motor pre-overload fault, the operating panel displays N111 and the drive operates normally. 000FH: Ignore - When the drive encounters the motor pre-overload fault, the operating panel does not display any fault and the drive operates normally. (Continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Thousands position: Module pre-overheat (E114) 0000H: Coast to stop - When the drive encounters the module pre-overtemperature fault, the operating panel displays E114 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the module pre-overtemperature fault, the operating panel displays E114 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the module pre-overtemperature fault, the operating panel displays E114 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the module pre-overtemperature fault, the operating panel displays E114 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the module pre-overtemperature fault, the operating panel displays L114 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters the module pre-overtemperature fault due to certain reasons, the operating panel displays L114 and the drive runs with the power limited to a certain range. 000BH: Run with module current limited. When the drive encounters the module pre-overtemperature fault, the operating panel displays L114 and the drive operates with the current limited to a certain range. (Continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) 000CH: Operating at limited torque - When the drive encounters the module pre-overtemperature fault, the operating panel displays L114 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the module pre-overtemperature fault, the operating panel displays A114 and the drive operates normally. 000EH: Prompt - When the drive encounters the module pre-overtemperature fault, the operating panel displays N114 and the drive operates normally. 000FH: Ignore - When the drive encounters the module pre-overtemperature fault, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 12 upon fault, actions for motor control error 2, drive pre-overload, motor pre-overload, and module pre-overtemperature can be changed to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-14	Protective action selection 14 upon fault	0xF	Ones: AI/HDI disconnection (Err154) 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: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands position: Automatic fault reset failure (E159) 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Options: Ones: AI/HDI disconnection (Err154) 0000H: Coast to stop - When the 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 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 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 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 limited speed - When the drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the drive runs with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the drive runs with the power limited to a certain range. Continued

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	Continued 000BH: Run with limited current - When the drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the drive runs with the current limited to a certain range. 000CH: Run with limited torque - When the drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays L154 and the drive runs with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays A154 and the drive operates normally. 000EH: Prompt - When the drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel displays N154 and the drive operates normally. 000FH: Ignore - When the drive encounters the AI/HDI disconnection fault due to certain reasons, the operating panel does not display any fault and the drive operates normally. Thousands: Automatic fault reset failure (E159) 0000H: Coast to stop - When the drive encounters an automatic fault reset failure, the operating panel displays E159 and the motor coasts to stop. Note: 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	Value range	Description
H1-15	Protective action selection 15 upon fault	0x0333	Ones: Modbus communication timeout fault (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: 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 indicate protective actions for different faults. Options: Ones: Modbus communication timeout (E160) 0000H: Coast to stop - When the drive encounters the Modbus communication timeout fault, the operating panel displays E160 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the Modbus communication timeout fault, the operating panel displays E160 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the Modbus communication timeout fault, the operating panel displays E160 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the Modbus communication timeout fault, the operating panel displays E160 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the Modbus communication timeout fault, the operating panel displays L160 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the Modbus communication timeout fault, the operating panel displays L160 and the drive operates with the power limited to a certain range. Continued

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	Continued 000BH: Run with limited current - When the drive encounters the Modbus communication timeout fault due to certain reasons, the operating panel displays L160 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the Modbus communication timeout fault, the operating panel displays L160 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the Modbus communication timeout fault, the operating panel displays A160 and the drive operates normally. 000EH: Prompt - When the drive encounters the Modbus communication timeout fault, the operating panel displays N160 and the drive operates normally. 000FH: Ignore - When the drive encounters the Modbus communication timeout fault, the operating panel does not display any fault and the drive operates normally. Tens: Reserved 0000H: Coast to stop Hundreds: Reserved 0000H: Coast to stop Thousands: Reserved 0000H: Coast to stop Note: When an action is selected for a fault, the drive acts accordingly.

Param.	Name	Default value	Value range	Description
H1-16	Protective action selection 16 upon fault	0	Ones: EtherNet/IP fault (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: Ignore Tens position: PROFINET fault (E166) 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 (Continued)	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Options: Ones: EtherNet/IP fault (E165) 0000H: Coast to stop - When the drive encounters the EtherNet/IP fault, the operating panel displays E165 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the EtherNet/IP fault, the operating panel displays E165 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the EtherNet/IP fault, the operating panel displays E165 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the EtherNet/IP fault, the operating panel displays E165 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the EtherNet/IP fault, the operating panel displays L165 and the drive operates with the speed limited to a certain range. 000AH: Run at limited power - When the drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays L165 and the drive runs with the power limited to a certain range. 000BH: Run at limited current - When the drive encounters the EtherNet/IP fault due to certain reasons, the operating panel displays L165 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the EtherNet/IP fault, the operating panel displays L165 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the EtherNet/IP fault, the operating panel displays A165 and the drive operates normally. 000EH: Prompt - When the drive encounters the EtherNet/IP fault, the operating panel displays N165 and the drive operates normally. 000FH: Ignore - When the drive encounters the EtherNet/IP fault, the operating panel does not display any fault and the drive operates normally. (Continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	(Continued) Hundreds: EtherCAT fault 1 (E167) 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 Thousands: EtherCAT fault (E168) 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	(Continued) Tens position: PROFINET fault (E166) 0000H: Coast to stop - When the drive encounters the PROFINET fault, the operating panel displays E166 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the PROFINET fault, the operating panel displays E166 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the PROFINET fault, the operating panel displays E166 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the PROFINET fault, the operating panel displays E166 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the PROFINET fault, the operating panel displays L166 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters the PROFINET fault due to certain reasons, the operating panel displays L166 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters the PROFINET fault due to certain reasons, the operating panel displays L166 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the PROFINET fault, the operating panel displays L166 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the PROFINET fault, the operating panel displays A166 and the drive operates normally. 000EH: Prompt - When the drive encounters the PROFINET fault, the operating panel displays N166 and the drive operates normally. 000FH: Ignore - When the drive encounters the PROFINET fault, the operating panel does not display any fault and the drive operates normally. (Continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Hundreds: EtherCAT fault 1 (E167) 0000H: Coast to stop - When the drive encounters the 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 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 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 drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays E167 and the motor decelerates to stop. 0009H: Run at limited speed - When the 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 at limited power - When the drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the drive runs with the power limited to a certain range. 000BH: Run at limited current - When the drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the drive runs with the current limited to a certain range. 000CH: Run at limited torque - When the drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays L167 and the drive runs with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays A167 and the drive operates normally. 000EH: Prompt - When the drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel displays N167 and the drive operates normally. 000FH: Ignore - When the drive encounters the EtherCAT fault 1 due to certain reasons, the operating panel does not display any fault and the drive operates normally. (Continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Thousands: EtherCAT fault 2 (E168) 0000H: Coast to stop - When the drive encounters the 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 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 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 drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays E168 and the motor decelerates to stop. 0009H: Run at limited speed - When the 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 at limited power - When the drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the drive runs with the power limited to a certain range. (Continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) 000BH: Run at limited current - When the drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the drive runs with the current limited to a certain range. 000CH: Run at limited torque - When the drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays L168 and the drive runs with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays A168 and the drive operates normally. 000EH: Prompt - When the drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel displays N168 and the drive operates normally. 000FH: Ignore - When the drive encounters the EtherCAT fault 2 due to certain reasons, the operating panel does not display any fault and the drive operates normally. Note: Protective actions for EtherNet/IP, PROFINET, EtherCAT fault 1, and EtherCAT fault 2 can be changed to enable the drive to act accordingly.

Param.	Name	Default value	Value range	Description
H1-17	Protective action selection 17 upon fault	0	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: Ignore Tens: Junction temperature fault (E191) 0: Coast to stop Hundreds: flying start fault (E192) 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 (Continued)	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Options: Ones: Inobus protocol fault (E170) 0000H: Coast to stop - When the 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 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 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 drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays E170 and the motor decelerates to stop. 0009H: Run at limited speed - When the drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the drive runs with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the drive runs with the power limited to a certain range. 000BH: Run with limited current - When the drive encounters the Inobus protocol fault due to certain reasons, the operating panel displays L170 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the Inobus protocol fault, the operating panel displays L170 and the drive operates with the torque limited to a certain range. (Continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	(Continued) Thousands: Overvoltage/ Undervoltage suppression fault (E193) 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	(Continued) 000DH: Alarm - When the drive encounters the Inobus protocol fault, the operating panel displays A170 and the drive operates normally. 000EH: Prompt - When the drive encounters the Inobus protocol fault, the operating panel displays N170 and the drive operates normally. 000FH: Ignore - When the drive encounters the Inobus protocol fault, the operating panel does not display any fault and the drive operates normally. Hundreds: Speed tracking fault (E192) 0000H: Coast to stop - When the drive encounters the flying start fault, the operating panel displays E192 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the flying start fault, the operating panel displays E192 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the flying start fault, the operating panel displays E192 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the flying start fault, the operating panel displays E192 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the flying start fault, the operating panel displays L192 and the drive operates with the speed limited to a certain range. 000AH: Run with limited power - When the drive encounters the flying start fault due to certain reasons, the operating panel displays L192 and the drive runs with the power limited to a certain range. (Continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) 000BH: Run with limited current - When the drive encounters the PROFINET fault due to certain reasons, the operating panel displays L192 and the drive runs with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the flying start fault, the operating panel displays L192 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the flying start fault, the operating panel displays A192 and the drive operates normally. 000EH: Prompt - When the drive encounters the flying start fault, the operating panel displays N192 and the drive operates normally. 000FH: Ignore - When the drive encounters the flying start fault, the operating panel does not display any fault and the drive operates normally. Thousands: Overvoltage/Undervoltage suppression fault (E193) 0000H: Coast to stop - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel displays E193 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel displays E193 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel displays E193 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel displays E193 and the motor decelerates to stop. (Continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) 0009H: Operating at limited speed - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel displays L193 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel displays L193 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel displays L193 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel displays L193 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel displays A193 and the drive operates normally. 000EH: Prompt - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel displays N193 and the drive operates normally. 000FH: Ignore - When the drive encounters an overvoltage/undervoltage suppression fault, the operating panel does not display any fault and the drive operates normally. Note: When an action is selected for a fault, the drive acts accordingly.

14.3.3 Modify Single Fault Action

Application scenarios

This function applies when you need to set the action for an individual subcode. It applies to scenarios where the actions for the fault code and subcode must be different.

Description

You can set the action for an individual fault through H1-30 [First group of fault code setting] to H1-49 [Tenth group of fault level setting].

H1-30 and H1-31 are used together to set the action for the first fault. H1-30 is used to enter the fault number to be set, and H1-31 is used to select the fault action type to be set. By analogy, there are 20 parameters, that is, the actions for 10 faults can be set separately.

For example, when you set H1-30 to 186.1 and H1-31 to 0x0002 [Quick stop], the action for E186.1 [Model parameter read/write failure] is quick stop.

Table 14–8 Modifying an individual fault action

Parameter	Fault name	Setpoint
H1-30	Setting of error codes in group 1	186.1
H1-31	1st set of fault level	0x0002 [Quick stop]

Note that the action range for an individual fault must be within that of its fault code. Actions outside the range of the fault code cannot be set.

For example, if the thousands (Power unit EEPROM fault (E186)) of H1-03 [Fault protection action selection 3] can only be set to 0 [Coast to stop], 1 [Stop at maximum capability], 2 [Quick stop], 3 [Decelerate to stop], and F [Ignore], then only one of these five options can be selected as the action for a subcode under E186.

Related parameters

Table 14–9 Parameters for modifying the action for an individual fault

Parameter	Name	Default value	Value range	Description
H1-30	Setting of error codes in group 1	0.0	0.0 to 255.9	Defines the 1st group of fault codes whose fault level needs to be edited. Note: Enter the 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 parameter storage error) is not displayed, but the drive can operate normally.
H1-31	1st set of fault level	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: Operating at limited speed 000AH: Operating at limited power 000BH: Operating at limited current 000CH: Operating at limited torque 000DH: Alarm 000EH: Prompt 000FH: Ignore	Used to set the level of the first group of fault codes. Value description: 0000H: Coast to stop - When a fault occurs, the drive displays E and the motor coasts to stop. 0001H: Stop at maximum capability - When a fault occurs, the drive displays E and the motor stops at its maximum capacity. 0002H: Quick stop - When a fault occurs, the drive displays E and the motor performs quick stop. 0003H: Decelerate to stop - When a fault occurs, the drive displays E and the motor decelerates to stop. 0009H: Operating at limited speed - The drive displays L and continues operating at limited speed. 000AH: Operating at limited power - The drive displays L and continues operating at limited power. 000BH: Operating at limited current - The drive displays L and continues operating at limited current. 000CH: Operating at limited torque - The drive displays L and continues operating at limited torque. 000DH: Alarm - The drive displays alarm A, which does not affect operation. 000EH: Prompt - The drive displays prompt N, which does not affect operation. 000FH: Ignore - This fault is masked by the drive. Note: After fault codes are set, this parameter represents the action against the active fault. The fault level is set through a white list, which lists the allowable fault levels.
H1-32	Setting of error codes in group 2	0.0	0.0 to 255.9	Same as H1-30.
H1-33	2nd set of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-34	Setting of 3rd group of fault codes	0.0	0.0 to 255.9	Same as H1-30.

Parameter	Name	Default value	Value range	Description
H1-35	3rd set of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-36	Setting of the 4th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-37	4th set of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-38	Setting of 5th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-39	5th set of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-40	Setting of error codes in group 6	0.0	0.0 to 255.9	Same as H1-30.
H1-41	6th set of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-42	Setting of the 7th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-43	7th set of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-44	Setting of error codes in group 8	0.0	0.0 to 255.9	Same as H1-30.
H1-45	8th set of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-46	Setting of the 9th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-47	9th set of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-48	Setting of error codes in group 10	0.0	0.0 to 255.9	Same as H1-30.
H1-49	10th set of fault level	0x000F	Same as H1-31.	Same as H1-31.

14.4 Customized Faults and Alarms

Application scenarios

The drive supports custom faults and alarms. You can select the B connector as the condition for triggering faults and alarms, defining custom faults and alarms through parameter interconnection. For details, see *" Parameter Interconnection" on page 828*.

Operating 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.

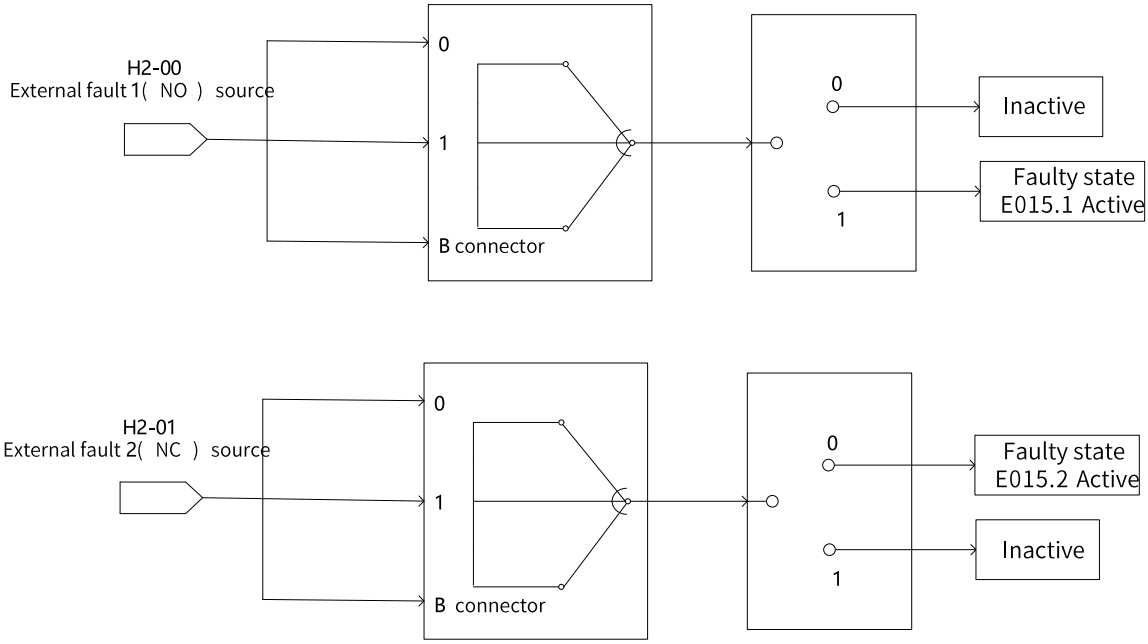


Figure 14-4 External fault diagram

Note that the DI terminal can also be used as the source for triggering these faults. Assign function 11 [External fault NO input] and function 33 [External fault NC input] to the DIs. 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.

Up to 8 sets of custom faults and alarms are available. You can set the source for triggering the 8 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 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. Then, 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 14–10 Parameters related to custom faults and alarms

Param.	Name	Default value	Value range	Description
H2-00	External fault 1 (NO) source	0	0: Inactive 1: Active Other: B connector	Defines the source of external fault 1 (NO). Options: 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: Inactive 1: Active Other: B connector	Defines the source of external fault 2 (NC). Options: 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	Value range	Description
H2-02	Source of user-defined fault 1	0	0: Inactive 1: Active Other: B connector	Defines the source of custom fault 1. Options: 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: Inactive 1: Active Other: B connector	Defines the source of custom fault 2. Options: 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: Inactive 1: Active Other: B connector	Defines the source of custom fault 3. Options: 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	Value range	Description
H2-05	Source of user-defined fault 4	0	0: Inactive 1: Active Other: B connector	Defines the source of custom fault 4. Options: 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: Inactive 1: Active Other: B connector	Defines the source of custom fault 5. Options: 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: Inactive 1: Active Other: B connector	Defines the source of custom fault 6. Options: 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: Inactive 1: Active Other: B connector	Defines the source of custom fault 7. Options: 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	Value range	Description
H2-09	Source of user-defined fault 8	0	0: Inactive 1: Active Other: B connector	Defines the source of custom fault 8. Options: 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: Inactive 1: Active Other: B connector	Defines the source of custom alarm 1. Options: 0: Inactive - The custom alarm 1 is inactive, and the drive does not report the fault. 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. A028.1 is reported when it is active.
H2-11	Source of user-defined alarm 2	0	0: Inactive 1: Active Other: B connector	Defines the source of custom alarm 2. Options: 0: Inactive - The custom alarm 2 is inactive, and the drive does not report the fault. 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. A028.2 is reported when it is active.
H2-12	Source of user-defined alarm 3	0	0: Inactive 1: Active Other: B connector	Defines the source of custom alarm 3. Options: 0: Inactive - The custom alarm 3 is inactive, and the drive does not report the fault. 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. A028.3 is reported when it is active.

Param.	Name	Default value	Value range	Description
H2-13	Source of user-defined alarm 4	0	0: Inactive 1: Active Other: B connector	Defines the source of custom alarm 4. Options: 0: Inactive - The custom alarm 4 is inactive, and the drive does not report the fault. 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. A028.4 is reported when it is active.
H2-14	Source of user-defined alarm 5	0	0: Inactive 1: Active Other: B connector	Defines the source of custom alarm 5. Options: 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. A028.5 is reported when it is active.
H2-15	Source of user-defined alarm 6	0	0: Inactive 1: Active Other: B connector	Defines the source of custom alarm 6. Options: 0: Inactive - The custom alarm 6 is inactive, and the drive does not report the fault. 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. A028.6 is reported when it is active.

Param.	Name	Default value	Value range	Description
H2-16	Source of user-defined alarm 7	0	0: Inactive 1: Active Other: B connector	Defines the source of custom alarm 7. Options: 0: Inactive - The custom alarm 7 is inactive, and the drive does not report the fault. 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. A028.7 is reported when it is active.
H2-17	Source of user-defined alarm 8	0	0: Inactive 1: Active Other: B connector	Defines the source of custom alarm 8. Options: 0: Inactive - The custom alarm 8 is inactive, and the drive does not report the fault. 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. A028.8 is reported when it is active.

15 Common Fault Handling

15.1 Troubleshooting of Common Faults

Table 15–1 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 technical support.
		The pre-charge resistor of the drive is damaged.	-	Contact 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 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 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 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 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 this user guide for how to re-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 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 15–2 Solutions to common faults (performance)

No.	Fault symptom		Possible cause	Verification method	Solution
1	The input side is abnormal.	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. **Notes:** 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.
1	The input side is abnormal.	The three-phase current on the grid side is unbalanced.	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	The input side is abnormal.	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	The output side is abnormal.	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 oscilloscope 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. **Notes:** 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	Faults occurred 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	Faults occurred 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 the motor parameters are confirmed to be correct but the output current is still high, the rated motor voltage can be decreased. 6 .Use the same current clamp for output current measurement and sampling.

No.	Fault symptom		Possible cause	Verification method	Solution
3	Faults occurred 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 under heavy 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	Faults occurred 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. Droop control is recommended to be set to the rated slip percentage of the motor. For details, see "Droop Control in V/f Mode" in this user 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 and reverse, 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 incorrect motor connection (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 low-speed synchronous motor 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 the motor parameters are confirmed to be correct but the output current is still high, the rated motor voltage can be decreased. 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 machines is too 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.
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.

No.	Fault symptom		Possible cause	Verification method	Solution
4	SVC control errors	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.
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 rotary auto-tuning. If such an auto-tuning cannot be performed, 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).

No.	Fault symptom		Possible cause	Verification method	Solution
4	SVC control errors	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 accelera tion 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 drive creeps at 0 speed in SVC mode and occasionally report issues due to high current.	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 faults occur.	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 faults occur.	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 faults occur.	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 .To check for mechanical noise, run the motor at a high speed and then perform a coast-to-stop. Check whether the noise persists. 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.

No.	Fault symptom		Possible cause	Verification method	Solution
5	Motor faults occur.	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 technical support.
		Motor tempera ture 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 drive 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 ratio 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 faults occur.	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: Perform 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.

15.2 List of Fault Codes

The drive enters the fault state when certain limits are reached. The error types of the drive are divided into four types, which are fault (E) > minor fault (L) > Alarm (A) > Prompt (N), ranking from high to low based on the severity level. See the following table for details.

Table 15–3 Correspondence between fault types and fault levels

Fault type	Fault level
Fault (E)	Coast to stop
	Stop with maximum capability
	Quick stop
	Decelerate to stop
Minor fault (L)	Operating at limited speed
	Run with power restriction
	Run with current restriction
	Operating at limited torque
Alarm (A)	Warning
Prompt (N)	Prompt
	Ignore

See *MD610 Series General-Purpose AC Drive Parameter Guide* for detailed parameter description.

Note

After troubleshooting, reset the fault to exit the drive from the fault state.

Fault code	Fault name	Fault level range	Default fault level	Resettable
E002.1	Hardware overcurrent	0: Coast to stop	0: Coast to stop	Supported
E002.2	Software overcurrent	0: Coast to stop	0: Coast to stop	Supported
E002.3	Phase W overcurrent	0: Coast to stop	0: Coast to stop	Supported
E002.4	Hardware VCE fault	0: Coast to stop	0: Coast to stop	Supported
E005.1	Bus overvoltage	0: Coast to stop	0: Coast to stop	Supported
E008.1	Contactor tripped frequently	0: Coast to stop	0: Coast to stop	Supported
E009.1	Bus undervoltage	0: Coast to stop	0: Coast to stop	Supported
E009.3	Pre-drive timeout	0: Coast to stop	0: Coast to stop	Supported
E010.1	Drive overload	0: Coast to stop	0: Coast to stop	Supported
E010.2	PCB overload	0: Coast to stop	0: Coast to stop	Supported
E011.1	Motor overload	0: Coast to stop	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
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: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Supported
E013.1	Phase U loss	0: Coast to stop	0: Coast to stop	Supported
E013.2	V phase loss	0: Coast to stop	0: Coast to stop	Supported
E013.3	W phase loss	0: Coast to stop	0: Coast to stop	Supported
E014.1	Drive overtemperature	0: Coast to stop	0: Coast to stop	Supported
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: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E015.2/ A015.2/ L015.2/ N015.2	External fault 2	Same as E015.1/ A015.1/ L015.1/ N015.1	0: Coast to stop	Supported
E018.1	Current detection circuit fault.	0: Coast to stop	0: Coast to stop	Supported
E019.1	Motor auto-tuning timeout	0: Coast to stop	0: Coast to stop	Supported
E019.2	Motor auto-tuning interrupted	0: Coast to stop	0: Coast to stop	Supported
E019.4	Back EMF auto-tuning error	0: Coast to stop	0: Coast to stop	Supported
E019.5	Incorrect motor type	0: Coast to stop	0: Coast to stop	Supported
E019.6	Current sampling phase gain deviation auto-tuning error	0: Coast to stop	0: Coast to stop	Supported
E019.7	Auto-tuned no-load current exceeds the limit	0: Coast to stop	0: Coast to stop	Supported
E021.1	Uninterrupted operation on the EEPROM timeout	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Supported
E021.2	EEPROM read fault	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Supported
E021.3	EEPROM write error	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Supported
E021.4	Number of write/read operations of the EEPROM exceeds the limit within 1s	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Supported
E021.5	EEPROM internal buffer exceeds the limit	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Supported
E023.1	Output ground fault of the drive	0: Coast to stop	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E026.1/ A026.1/ L026.1/ N026.1	Operation time reached	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Supported
E027.1/ A027.1/ L027.1/ N027.1	User-defined fault 1	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E027.2/ A027.2/ L027.2/ N027.2	User-defined fault 2	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E027.3/ A027.3/ L027.3/ N027.3	User-defined fault 3	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E027.4/ A027.4/ L027.4/ N027.4	User-defined fault 4	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E027.5/ A027.5/ L027.5/ N027.5	User-defined fault 5	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E027.6/ A027.6/ L027.6/ N027.6	User-defined fault 6	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E027.7/ A027.7/ L027.7/ N027.7	User-defined fault 7	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E027.8/ A027.8/ L027.8/ N027.8	User-defined fault 8	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E028.1/ A028.1/ L028.1/ N028.1	User-defined alarm 1	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E028.2/ A028.2/ L028.2/ N028.2	User-defined alarm 2	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E028.3/ A028.3/ L028.3/ N028.3	User-defined alarm 3	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E028.4/ A028.4/ L028.4/ N028.4	User-defined alarm 4	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E028.5/ A028.5/ L028.5/ N028.5	User-defined alarm 5	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E028.6/ A028.6/ L028.6/ N028.6	User-defined alarm 6	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E028.7/ A028.7/ L028.7/ N028.7	User-defined alarm 7	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E028.8/ A028.8/ L028.8/ N028.8	User-defined alarm 8	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E029.1/ A029.1/ L029.1/ N029.1	Cumulative power-on time reached	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E030.1/ A030.1/ L030.1/ N030.1	Phase loss occurs on the three output phases.	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E031.1 / A031.1 / L031.1 / N031.1	PID feedback is lost.	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E032.1/ A032.1 / L032.1 / N032.1	Parameter reset is abnormal.	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E032.2/ A032.2/ L032.2/ N032.2	Parameter backup is abnormal.	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E032.4/ A032.4/ L032.4/ N032.4	Parameter setting error	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E032.6/ A032.6/ L032.6/ N032.6	Power-on parameter checksum error	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E032.7/ A032.7/ L032.7/ N032.7	Parameter backup invalid	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E032.8 / A032.8 / L032.8 / N032.8	Parameter initialization errors occur upon power-on.	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	No
E032.9 / A032.9 / L032.9 / N032.9	Property change error	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	No
E040.1	Pulse-by-pulse current limiting fault	0: Coast to stop	0: Coast to stop	Supported
E042.1/ A042.1 / L042.1 / N042.1	Excessive speed deviation	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E042.2 / A042.2 / L042.2 / N042.2	Actual speed opposite to the set speed	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E043.1/ A043.1 / L043.1 / N043.1	Motor overspeed	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E043.2 / A043.2 / L043.2 / N043.2	Asynchronous motor (SVC) stall	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E045.1 / A045.1 / L045.1 / N045.1	Motor overheat	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E045.2/ A045.2 / L045.2 / N045.2	Motor pre-overtemperature	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E046.1	Load monitoring overload fault	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
A046.2	Load monitoring overload alarm	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
E046.3	Load monitoring load loss fault	Same as E026.1/ A026.1/ L026.1/ N026.1	0: Coast to stop	Supported
A046.4	Load monitoring load loss alarm	Same as E026.1/ A026.1/ L026.1/ N026.1	13: Alarm	Supported
E047.1	STO1 disconnection	0: Coast to stop	0: Coast to stop	Supported
E047.2	STO2 disconnected	0: Coast to stop	0: Coast to stop	Supported
E047.3	STO circuit power supply error	0: Coast to stop	0: Coast to stop	Supported
E047.4	STO input subsystem fault	0: Coast to stop	0: Coast to stop	Supported
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	Supported
E047.8	STO RAM check error	0: Coast to stop	0: Coast to stop	Supported
E047.9	STO check configuration failure	0: Coast to stop	0: Coast to stop	Supported
E051.1	Magnetic pole position auto-tuning error	0: Coast to stop	0: Coast to stop	Supported
E056.1	Self-test interrupted	0: Coast to stop	0: Coast to stop	Supported
E056.2	Short circuit when only upper-arm IGBT of phase U activated	0: Coast to stop	0: Coast to stop	Supported
E056.3	Short circuit when only lower-arm IGBT of phase U activated	0: Coast to stop	0: Coast to stop	Supported
E056.4	Short circuit when only upper-arm IGBT of phase V activated	0: Coast to stop	0: Coast to stop	Supported
E056.5	Short circuit when only lower-arm IGBT of phase V activated	0: Coast to stop	0: Coast to stop	Supported
E056.9	Output phase loss during self-test	0: Coast to stop	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E057.1	Failed to turn on upper-arm IGBT of phase U or lower-arm IGBT of phase V	0: Coast to stop	0: Coast to stop	Supported
E057.2	Lower IGBT of phase U or upper IGBT of phase V cannot turn on	0: Coast to stop	0: Coast to stop	Supported
E057.3	Upper IGBT of phase V or lower IGBT of phase W cannot turn on	0: Coast to stop	0: Coast to stop	Supported
E057.4	Lower IGBT of phase V or upper IGBT of phase W cannot turn on	0: Coast to stop	0: Coast to stop	Supported
E057.5	Upper IGBT of phase W or lower IGBT of phase U cannot turn on	0: Coast to stop	0: Coast to stop	Supported
E057.6	Lower IGBT of phase W or upper IGBT of phase U cannot turn on	0: Coast to stop	0: Coast to stop	Supported
E057.7	UV output short circuit	0: Coast to stop	0: Coast to stop	Supported
E057.8	V/W output short circuit	0: Coast to stop	0: Coast to stop	Supported
E057.9	WU output short circuit	0: Coast to stop	0: Coast to stop	Supported
E058.1	Phase U current sensor installed reversely	0: Coast to stop	0: Coast to stop	Supported
E058.2	Phase V current sensor installed reversely	0: Coast to stop	0: Coast to stop	Supported
E058.3	Phase W current sensor installed reversely.	0: Coast to stop	0: Coast to stop	Supported
E058.4	Misalignment of phase U and phase V current sensors	0: Coast to stop	0: Coast to stop	Supported
E058.5	Misalignment of phase V and phase W current sensors	0: Coast to stop	0: Coast to stop	Supported
E058.6	Misalignment of phase W and phase U current sensors	0: Coast to stop	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	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: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore	0: Coast to stop	Supported
E059.2 / A059.2 / L059.2 / N059.2	Phase V/W unbalance	Same as E059.1/ A059.1 / L059.1 / N059.1	0: Coast to stop	Supported
E059.3 / A059.3 / L059.3 / N059.3	The WU phases are unbalanced.	Same as E059.1/ A059.1 / L059.1 / N059.1	0: Coast to stop	Supported
E060.1	Capacitor leakage occurs.	0: Coast to stop	0: Coast to stop	No
E080.1 / A080.1 / L080.1 / N080.1	Fan speed feedback error	Same as E059.1/ A059.1 / L059.1 / N059.1	15: Ignore	Supported
E080.2 / A080.2 / L080.2 / N080.2	The fan initialization fails.	Same as E059.1/ A059.1 / L059.1 / N059.1	0: Coast to stop	Supported
E080.3 / A080.3/ L080.3 / N080.3	PWM fan stall	Same as E059.1/ A059.1 / L059.1 / N059.1	0: Coast to stop	Supported
E084.1	Brake release failure	0: Coast to stop	0: Coast to stop	Supported
E084.2	Brake apply failure	0: Coast to stop	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E084.3	Brake torque verification failure	0: Coast to stop	0: Coast to stop	Supported
E084.4	Brake speed verification failure	0: Coast to stop	0: Coast to stop	Supported
E084.6	Brake release is not allowed during parameter auto-tuning.	0: Coast to stop	0: Coast to stop	Supported
E085.1 / A085.1 / L085.1 / N085.1	Sequence fault 1	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore	15: Ignore	Supported
E085.2 / A085.2 / L085.2 / N085.2	Sequence fault 2	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported
E085.3 / A085.3 / L085.3 / N085.3	Sequence fault 3	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported
E085.4 / A085.4 / L085.4 / N085.4	Sequence fault 4	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported
E085.5 / A085.5 / L085.5 / N085.5	Sequence fault 5	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E085.6 / A085.6 / L085.6 / N085.6	Sequence fault 6	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported
E093.1 / A093.1 / L093.1 / N093.1	Motor stall fault	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E093.2 / A093.2 / L093.2 / N093.2	Motor step loss fault	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E093.3 / A093.3 / L093.3 / N093.3	Current control error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E094.1 / A094.1 / L094.1 / N094.1	The calculated number of pole pairs does not match the setpoint.	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E094.2 / A094.2 / L094.2 / N094.2	The rated power, voltage, and current of the motor do not match.	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E094.3 / A094.3 / L094.3 / N094.3	No-load current parameter range error	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E094.4 / A094.4 / L094.4 / N094.4	Mutual inductance and no-load current inconsistent with the rated voltage	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E094.5 / A094.5 / L094.5 / N094.5	Rotor resistance parameter range error	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E094.8 / A094.8 / L094.8 / N094.8	The motor parameter is set incorrectly.	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E110.1 / A110.1 / L110.1 / N110.1	Drive pre-overload	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E110.2	PCB pre-overload	0: Coast to stop	0: Coast to stop	Supported
E111.1 / A111.1 / L111.1 / N111.1	Motor pre-overload	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E114.1 / A114.1 / L114.1 / N114.1	Drive pre-overtemperature	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E132.3	Parameter error upon power-off	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E151.1 / A151.1 / L151.1 / N151.1	Cable drum vertical application parameter setting error	Same as E085.1/ A085.1 / L085.1 / N085.1	3: Decelerate to stop	Supported
E153.1 / A153.1 / L153.1 / N153.1	Material run-out fault	Same as E085.1/ A085.1 / L085.1 / N085.1	3: Decelerate to stop	Supported
E154.1 / A154.1 / L154.1 / N154.1	HDI disconnected	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported
E154.3 / A154.3 / L154.3 / N154.3	AI1 abnormal	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E154.4 / A154.4 / L154.4 / N154.4	AI2 input error	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported
E154.6 / A154.6 / L154.6 / N154.6	MD-BP-M potentiometer input abnormality	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported
E154.8 / A154.8 / L154.8 / N154.8	I/O expansion card 1-AI input abnormality	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported
E154.9 / A154.9 / L154.9 / N154.9	I/O expansion card 2-AI input abnormality	Same as E085.1/ A085.1 / L085.1 / N085.1	15: Ignore	Supported
E155.1 / A155.1 / L155.1 / N155.1	I/O expansion card 1 communication timeout	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E155.2 / A155.2 / L155.2 / N155.2	Communication timeout error of I/O expansion card 2	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E159.1	Automatic fault reset failure	0: Coast to stop	0: Coast to stop	Supported
E160.1/ A160.1 / L160.1 / N160.1	Modbus-RTU communication timeout	Same as E085.1/ A085.1 / L085.1 / N085.1	3: Decelerate to stop	Supported
E161.1/ A161.1 / L161.1 / N161.1	The CANopen heartbeat message times out.	Same as E085.1/ A085.1 / L085.1 / N085.1	3: Decelerate to stop	Supported
E161.2/ A161.2 / L161.2 / N161.2	CANopen PDO length error	Same as E085.1/ A085.1 / L085.1 / N085.1	3: Decelerate to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E161.4 / A161.4 / L161.4 / N161.4	CANopen status switchover error	Same as E085.1/ A085.1 / L085.1 / N085.1	3: Decelerate to stop	Supported
E162.1/ A162.1 / L162.1 / N162.1	CANlink heartbeat timeout	Same as E085.1/ A085.1 / L085.1 / N085.1	3: Decelerate to stop	Supported
E162.2/ A162.2 / L162.2 / N162.2	CANlink station number conflict	Same as E085.1/ A085.1 / L085.1 / N085.1	3: Decelerate to stop	Supported
E165.1 / A165.1 / L165.1 / N165.1	EtherNet/IP Ethernet communication timeout	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E165.2 / A165.2 / L165.2 / N165.2	An Ethernet/IP hardware error occurs.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E165.3 / A165.3 / L165.3 / N165.3	The MAC address is not programmed for Ethernet/IP.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E165.4 / A165.4 / L165.4 / N165.4	Ethernet/IP IP conflict	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E166.1 / A166.1 / L166.1 / N166.1	PROFINET communication times out.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E166.2 / A166.2 / L166.2 / N166.2	The MAC address is not programmed to PROFINET.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E166.3 / A166.3 / L166.3 / N166.3	PROFINET mapping address error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E167.1 / A167.1 / L167.1 / N167.1	EtherCAT Sync loss	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E167.2 / A167.2 / L167.2 / N167.2	EtherCAT link loss	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E167.3 / A167.3 / L167.3 / N167.3	EtherCAT read-only memory loading error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E167.4 / A167.4 / L167.4 / N167.4	EtherCAT initialization error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E167.6 / A167.6 / L167.6 / N167.6	Distributed clock not enabled in EtherCAT	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E167.7 / A167.7 / L167.7 / N167.7	The number or length of EtherCAT PDO mapping exceeds the limit.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E167.8 / A167.8 / L167.8 / N167.8	EtherCAT process data reception timeout	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E167.9 / A167.9 / L167.9 / N167.9	EtherCAT ESC port 0 reception error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E168.1 / A168.1 / L168.1 / N168.1	EtherCAT ESC port transfer and EPU processing error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E168.2 / A168.2 / L168.2 / N168.2	EtherCAT MailBox setting error protection	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E168.3 / A168.3 / L168.3 / N168.3	EtherCAT SM2 setting error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E168.4 / A168.4 / L168.4 / N168.4	EtherCAT SM3 setting error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E168.5 / A168.5 / L168.5 / N168.5	PDO watchdog setting error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E168.6 / A168.6 / L168.6 / N168.6	EtherCAT does not have sync signal	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E168.7 / A168.7 / L168.7 / N168.7	EtherCAT Phy initialization configuration error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E168.8 / A168.8 / L168.8 / N168.8	The pulse length of the synchronous data signal configured in the EtherCAT read-only memory is abnormal.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E170.1 / A170.1 / L170.1 / N170.1	Internal communication is being disturbed or the module operation stops.	Same as E085.1/ A085.1 / L085.1 / N085.1	3: Decelerate to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E170.2 / A170.2 / L170.2 / N170.2	The internal communication synchronization frame on the MCB side is lost.	Same as E085.1/ A085.1 / L085.1 / N085.1	3: Decelerate to stop	Supported
A176.1	The external 24 V power supply of the control board is abnormal.	13: Alarm	13: Alarm	Supported
E177.1	Model hardware identification error	0: Coast to stop	0: Coast to stop	No
E177.2	The hardware type of the model does not match 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 E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E179.3 / A179.3 / L179.3 / N179.3	IGBT lifetime alarm	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E179.4 / A179.4 / L179.4 / N179.4	Cooling fan service life alarm	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
E186.1	Model parameter read-write failure	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E186.2	Parameter unit parameter error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E186.3	The preset model parameters of the MCB do not match the power board.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E186.5	Model parameter error	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
E187.2 / A187.2 / L187.2 / N187.2	The check on power unit junction temperature parameter fails.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E187.3 / A187.3 / L187.3 / N187.3	The junction temperature parameter in the EEPROM of the power unit fails to be read or written.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E187.4 / A187.4 / L187.4 / N187.4	The attempt to read EEPROM junction temperature parameter of the power unit times out upon power-on.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E187.6 / A187.6 / L187.6 / N187.6	The power unit EEPROM junction temperature parameter model does not match the set control board model.	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
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 E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
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 E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E189.1 / A189.1 / L189.1 / N189.1	IDS communication timeout	Same as E085.1/ A085.1 / L085.1 / N085.1	0: Coast to stop	Supported
E190.1	Application macro parameter write error	13: Alarm	13: Alarm	Supported
E191.1	IGBT over-temperature	0: Coast to stop	0: Coast to stop	Supported
E192.1	Speed tracking timeout	0: Coast to stop	0: Coast to stop	Supported
E193.1	Undervoltage suppression reaches the speed upper limit.	0: Coast to stop	0: Coast to stop	Supported
E193.2	Undervoltage suppression timeout	0: Coast to stop	0: Coast to stop	Supported
E193.3	Overvoltage suppression in vector control	0: Coast to stop	0: Coast to stop	Supported
E193.4	Undervoltage suppression overspeed in vector control	0: Coast to stop	0: Coast to stop	Supported

Fault code	Fault name	Fault level range	Default fault level	Resettable
N194.1	STO1 and STO2 disconnected	14: Prompt	14: Prompt	Supported
E195.1	Parameter download interrupted unexpectedly	0: Coast to stop	0: Coast to stop	Supported
A196.1	External flash data read/write fault of black box	Same as E085.1/ A085.1 / L085.1 / N085.1	13: Alarm	Supported
A197.1	Fire mode activated	13: Alarm 14: Prompt 15: Ignore	13: Alarm	Supported

Parameter List

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F0-00	0xF000	Load type	0: High-load application 1: Light-load application	0	-	Read-only
F0-01	0xF001	Motor control method	0: SVC 2: V/f	2	-	At stop
F0-02	0xF002	Motor control mode	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F0-11	0xF00B	Interface macro selection	0: No action 1: Restores the parameters related to the selected interface macro to default settings 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode 103: Analog speed regulation in single-wire mode 104: Four fixed speeds in two-wire mode 2 105: Analog speed regulation in two-wire mode 1 106: Analog speed regulation in two-wire mode 2 107: Analog speed regulation in two-wire mode 3 108: Two fixed speeds in three-wire mode 2 109: Analog speed regulation in three-wire mode 1 110: Analog speed regulation in three-wire mode 2 111: Analog PID controller 112: PID controller with fixed reference value 113: Modbus communication control macro 114: Modbus communication control macro with DI-based start/stop control 115: Multi-channel switchover 1 116: Multi-channel switchover 2 117: Jog control through DI 118: CANopen communication control macro	0	-	At stop

Param.	Comm. address	Name	Range	Default value	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 103: Analog speed regulation in single-wire mode 104: Four fixed speeds in two-wire mode 2 105: Analog speed regulation in two-wire mode 1 106: Analog speed regulation in two-wire mode 2 107: Analog speed regulation in two-wire mode 3 108: Two fixed speeds in three-wire mode 2 109: Analog speed regulation in three-wire mode 1 110: Analog speed regulation in three-wire mode 2 111: Analog PID controller 112: PID controller with fixed reference value 113: Modbus communication control macro 114: Modbus communication control macro with DI-based start/stop control 115: Multi-channel switchover 1 116: Multi-channel switchover 2 117: Jog control through DI 118: CANopen communication control macro	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F0-13	0xF00D	Custom macro selection	0: Not applied 1: Restores the parameters related to the selected custom macro to default settings 211: Power unwinding (compatible with MD290/ MD310) 212: Mechanical movement (compatible with MD290/ MD310) 213: Lathe industry (compatible with MD290/ MD310)	0	-	At stop
F0-14	0xF00E	Active value of the custom macro	0: Not applied 211: Power unwinding (compatible with MD290/ MD310) 212: Mechanical movement (compatible with MD290/ MD310) 213: Lathe industry (compatible with MD290/ MD310)	0	-	Read-only
F0-15	0xF00F	Load control optimization macro	0: Not applied 1: Restores the related parameters of the selected load control optimization macro to default settings 601: Fan and pump macro 602: Air compressor and air conditioning macro 603: Quick start and quick stop 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 pump macro 602: Air compressor and air conditioning macro 603: Quick start and quick stop macro 605: Large inertia load macro	0	-	Read-only
F0-25	0xF019	Decimal places of frequency reference	1: One decimal place 2: Two decimal places	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F0-29	0xF01D	Main frequency source	0: F0-30 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
F0-30	0xF01E	Digital reference of main frequency	0.00 Hz to A2-17	50.00	Hz	Real time
F0-31	0xF01F	Auxiliary frequency source	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
F0-32	0xF020	Calculation relationship between main and auxiliary references	0: Main + Auxiliary 1: Main frequency - auxiliary frequency 2: Max. (main frequency, auxiliary frequency) 3: Min (X, Y) 4: X × Y 5: Main/auxiliary frequency switchover	0	-	Real time
F0-33	0xF021	Additional frequency source	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
F0-34	0xF022	Source of main frequency gain coefficient	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F0-38	0xF026	Multi-reference 0 setting mode	0: F0-39 1: AI1 2: AI2 3: MD-BP-M potentiometer 4: HDI pulse 5: PID 6: b5-01/b6-01 Others: F connector	0	-	Real time
F0-39	0xF027	Multi-reference 0	b8-42 to b8-43	0.0	-	Real time
F0-40	0xF028	Multi-reference 1	b8-42 to b8-43	0.0	-	Real time
F0-41	0xF029	Multi-reference 2	b8-42 to b8-43	0.0	-	Real time
F0-42	0xF02A	Multi-reference 3	b8-42 to b8-43	0.0	-	Real time
F0-45	0xF02D	Ramp-up/ down mode	0: Linear 1: S-curve	0	-	Real time
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	0.00s to 650.00s	0.00	s	Real time
F0-51	0xF033	Ramp-up end arc of ramp 1	0.00s to 650.00s	0.00	s	Real time
F0-52	0xF034	Ramp-down start arc of ramp 1	0.00s to 650.00s	0.00	s	Real time
F0-53	0xF035	Ramp-down end arc of ramp 1	0.00s to 650.00s	0.00	s	Real time
F0-56	0xF038	Source of jog frequency 1	0: F0-57 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
F0-57	0xF039	Digital reference of jog 1 frequency	-50.00 Hz to +50.00 Hz	2.00	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F0-58	0xF03A	Source of jog frequency 2	0: F0-59 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
F0-59	0xF03B	Digital reference of jog 2 frequency	-50.00 Hz to +50.00 Hz	-2.00	Hz	Real time
F0-62	0xF03E	Jog ramp source	0: Ramp time of normal operation 1: Ramp time in jog	0	-	Real time
F0-63	0xF03F	Ramp-up time in jog	0.00s to 650.00s	20.00	s	Real time
F0-64	0xF040	Ramp-down time in jog	0.00s to 650.00s	20.00	s	Real time
F1-00	0xF100	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnetic (not supported) 4: Synchronous reluctance motor with permanent magnetic (not supported)	0	-	At stop
F1-01	0xF101	Rated motor power	0.01 kW to 655.35 kW	3.70	kW	At stop
F1-03	0xF103	Rated motor voltage	1 V to 2000 V	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 Hz to 599.00 Hz	50.00	Hz	At stop
F1-07	0xF107	Rated motor speed	1 rpm to 65535 rpm	1460	rpm	At stop
F1-10	0xF10A	Maximum motor frequency	F1-06 to 599.00 Hz	50.00	Hz	At stop
F1-11	0xF10B	Minimum motor frequency	0.00 Hz~F1-10	0.00	Hz	At stop
F1-12	0xF10C	Synchronous motor back EMF	0.0 V to 6553.5 V	300.0	V	Real time
F1-13	0xF10D	Maximum motor current	0.0% to 1000.0%	1000.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	-	Read-only
F1-20	0xF114	Stator resistance	0.001 Ω to 65.535 Ω	1.204	Ω	Real time
F1-22	0xF116	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω	0.908	Ω	Real time
F1-24	0xF118	Leakage inductance of asynchronous motor stator	0.01 mH to 655.35 mH	5.28	mH	Real time
F1-26	0xF11A	Leakage inductance of asynchronous motor rotor	0.01 mH to 655.35 mH	5.28	mH	Real time
F1-28	0xF11C	Asynchronous motor mutual inductance	0.1 mH to 6553.5 mH	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 mH to 655.35 mH	5.28	mH	Real time
F1-34	0xF122	q-axis inductance of synchronous motor	0.01 mH to 655.35 mH	5.28	mH	Real time
F1-48	0xF130	Inertia ratio	0.0% to 6553.5%	120.0	%	At stop
F1-49	0xF131	Electrome-chanical time constant	0.01s to 655.35s	1.00	s	Read-only
F1-55	0xF137	Motor brake control	0: Inhibited 1: Enable	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F1-69	0xF145	Motor parameter auto-tuning mode	0: Not applied 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 11: With-load auto-tuning of permanent magnet motor (excluding back EMF) 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static partial auto-tuning of permanent magnet motor 14: UV gain deviation auto-tuning 15: Reserved 21: Static tuning of synchronous reluctance motor 22: Auto-tuning of synchronous reluctance motor in dynamic state	0	-	At stop
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	0.000s to 20.000s	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 calibration coefficient	0.0% to 1000.0%	100.0	%	Real time
F2-06	0xF206	Zero speed Ti calibration factor	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 calibration factor	0.0% to 1000.0%	100.0	%	Real time
F2-09	0xF209	Low speed Ti calibration factor	0.0% to 1000.0%	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F2-10	0xF20A	High speed switchover frequency	d3-09 to 400.0%	100.0	%	Real time
F2-11	0xF20B	High speed Kp calibration factor	0.0% to 1000.0%	100.0	%	Real time
F2-12	0xF20C	High speed Ti calibration factor	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 position: Synchronous motor startup mode 0: Same as the startup mode of the ones position 1: Flying start Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	10	-	At stop
F2-16	0xF210	Flying start mode	0: 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: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
F2-21	0xF215	Negative speed selection	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
F2-22	0xF216	Digital reference of positive frequency upper limit 1	F2-26 to 800.0 %	800.0	%	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F2-23	0xF217	Digital reference of negative 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	1	-	Real time
F2-26	0xF21A	Digital reference of positive frequency lower limit 1	0.0 % to F2-22	0.0	%	At stop
F2-27	0xF21B	Digital reference of negative frequency lower limit 1	F2-23 to 0.0 %	0.0	%	At stop
F2-30	0xF21E	Digital reference of torque upper limit 1	0.0% to 800.0%	200.0	%	Real time
F2-31	0xF21F	Digital reference of torque lower limit 1	-800.0% to 0.0%	-200.0	%	Real time
F2-32	0xF220	Source of torque upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F2-33	0xF221	Source of torque lower limit 2	0: -800 % 1: Opposite to torque upper limit 2 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	1	-	Real time
F2-36	0xF224	Over-excitation gain (V/f)	0% to 200%	90	%	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 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector mode 0: Disable 1: Enable bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0003	-	Real time
F2-40	0xF228	Voltage threshold for overvoltage suppression	600.0 V to A3-57	770.0	V	Real time
F2-43	0xF22B	Response to undervoltage	0: Not act 1: Suppress undervoltage 2: Decelerate to stop 3: Undervoltage suppression with time limit setting	3	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F2-44	0xF22C	Voltage threshold for undervoltage suppression	A3-55 to 500.0 V	430.0	V	Real time
F2-48	0xF230	Overmodula-tion coefficient	0.0 % to 110.0%	105.0	%	Real time
F2-50	0xF232	Set carrier frequency	0.8 kHz to 20.0 kHz	4.0	kHz	Real time
F2-51	0xF233	Effective carrier frequency	0.8 kHz to 20.0 kHz	4.0	kHz	Read-only
F4-00	0xF400	Terminal start/ stop module A/B selection	0: Module A 1: Module B Other: 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 start in forward direction, IN2P (rising edge) for start in reverse direction, 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 start in forward direction, IN2P (rising edge) for start in reverse direction, and IN3 for stop	3	-	At stop

Param.	Comm. address	Name	Range	Default value	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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable Continued	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-03	0xF403	DI1 function selection	Continued 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-04	0xF404	DI2 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause	4	-	At stop

Continued

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-04	0xF404	DI2 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	4	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-05	0xF405	DI3 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause	9	-	At stop

Continued

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-05	0xF405	DI3 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	9	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-06	0xF406	DI4 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause	12	-	At stop

Continued

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-06	0xF406	DI4 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	12	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-07	0xF407	DI5 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 Continued	13	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-07	0xF407	DI5 function selection	Continued 38: PID integral pause 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	13	-	At stop

Param.	Comm. address	Name	Range	Default value	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 arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) 24: Cumulative power-on time arrival 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival Continued	2	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-14	0xF40E	RO1 function selection	Continued 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	2	-	Real time
F4-15	0xF40F	DO1 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop)	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-15	0xF40F	DO1 function selection	24: Cumulative power-on time arrival 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-16	0xF410	FMR (HDO) function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-16	0xF410	FMR (HDO) function selection	Continued 24: Cumulative power-on time arrival 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time
F4-21	0xF415	AI1 filter time	0.00s to 10.00s	0.10	s	Real time
F4-22	0xF416	AI2 filter time	0.00s to 10.00s	0.10	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 place: MD-BP-M potentiometer 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) Thousands: Reserved	0x0321	-	Real time
F4-28	0xF41C	Minimum input of AI curve 1	-10.00 V 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 V	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 V to F4-34	0.00	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 V	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 V 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
F4-38	0xF426	Maximum input of AI curve 3	F4-36 to 10.00 V	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 V 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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-46	0xF42E	Maximum input of AI curve 4	F4-44 to 10.00 V	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 V 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
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 V	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 rotational 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	Minimum input of AO curve	-800.0% to F4-62	0.0	%	Real time
F4-61	0xF43D	Percentage corresponding to the minimum input of AO curve	0.00 V to 10.00 V	0.00	V	Real time
F4-62	0xF43E	Maximum input of AO curve	F4-60 to 800.0 %	100.0	%	Real time
F4-63	0xF43F	Percentage corresponding to the maximum input of AO curve	0.00 V to 10.00 V	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: Inhibited 1: Enable Other: B connector	0	-	Read-only
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 kHz to F4-73	0.00	kHz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 kHz	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 kHz~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 kHz	20.00	kHz	Real time

Param.	Comm. address	Name	Range	Default value	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	0.00s to 10.00s	0.10	s	Real time
F4-88	0xF458	FM multi-functional terminal output selection	0: HDO pulse output (FMP) 1: Switch 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 rotational 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 kHz to 100.00 kHz	50.00	kHz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Fd-00	0xFD00	Commissioning address (used by commissioning software/ operating panel)	1 to 127	1	-	At stop
Fd-04	0xFD04	Modbus communication effectiveness	0: Not supported by the current device 1: Active	0	-	Read-only
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 ms to 20 ms	2	ms	Real time
Fd-09	0xFD09	Modbus communication timeout time	0.0s to 6000.0s	0.0	s	Real time
Fd-13	0xFD0D	CAN communication	0: Not supported by the current device 1: Active	0	-	Read-only
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
Fd-16	0xFD10	CANopen station number	1 to 127	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Fd-20	0xFD14	CANlink 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
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	-	Read-only
Fd-29	0xFD1D	Maximum number of errors received through CAN	0 to 65535	0	-	Read-only
Fd-30	0xFD1E	Maximum number of errors transmitted through CAN	0 to 65535	0	-	Read-only
Fd-31	0xFD1F	Number of CAN bus disconnections per unit time	0 to 65535	0	-	Read-only
Fd-32	0xFD20	CAN communica-tion disconnection coefficient	1 to 15	3	-	At stop
A0-00	0xA000	Parameter initialization	0: Not applied 1: Restore default parameters (excluding motor parameters) 2: Clear log information 3: Restore default parameters (including motor parameters) 4: Back up current user parameters 5: Clear fault log 501: Restore backup parameters 503: Restore default parameters (including motor parameters) and clear log information	0	-	At stop
A0-10	0xA00A	System parameter access level	0: Standard 1: Extended 2: Expert 3: Factory	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A0-11	0xA00B	Parameter access level	0: Standard 1: Extended 2: Expert	0	-	Real time
A0-14	0xA00E	Expert password status display	0: Expert password invalid (expert password not set) 1: Expert password locked (set expert password activated and locked) 2: Expert password unlocked (set expert password activated and unlocked)	0	-	Read-only
A0-15	0xA00F	Expert password input	0 to 65535	0	-	Real time
A0-20	0xA014	Displays the status of the factory password.	1: Manufacturer password locked 2: Factory password unlock	0	-	Read-only
A0-21	0xA015	Manufacturer password input	0 to 65535	0	-	Real time
A0-22	0xA016	Exit manufacturer level immediately	0: Not applied 1: Exit	0	-	Real time
A0-30	0xA01E	Parameter Lock Status	0: Inactive (parameter lock not set) 1: Locked (parameter lock setting activated, and locked) 2: Unlocked (parameter lock setting activated, and unlocked)	0	-	Read-only
A0-31	0xA01F	Parameter lock setting	0 to 65535	0	-	Real time
A0-32	0xA020	Hold time of unlock state	60s to 65535s	3600	s	Real time
A0-33	0xA021	Lock parameter lock immediately	0: Not applied 1: Lock	0	-	Real time
A0-37	0xA025	Backed-up parameter clear	0: Not applied 500: Clear all user parameters that backed up	0	-	At stop
A0-38	0xA026	Recovery of backup parameters	0: Not applied 501: Restore user backup parameters	0	-	At stop
A0-39	0xA027	User backup	0: Not applied 400: User parameter backup	0	-	At stop
A0-44	0xA02C	Parameter write protection	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A0-47	0xA02F	Parameter group display on operating panel	bit0: Group F 0: Mask 1: Display bit1: Group A 0: Mask 1: Display bit2: Group b 0: Mask 1: Display bit3: Group C 0: Mask 1: Display bit4: Group d 0: Mask 1: Display bit5: Group y 0: Mask 1: Display bit6: Group E 0: Mask 1: Display bit7: Group H 0: Mask 1: Display bit8: Reserved 0: Mask 1: Display bit9: Group n 0: Mask 1: Display bit10: Group o 0: Mask 1: Display bit11: Group P 0: Mask 1: Display bit12: Group L 0: Mask 1: Display bit13: Group U 0: Mask 1: Display bit14: Reserved bit15: Reserved	0xFFFF	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A0-48	0xA030	Interface macro selection	0: Not applied 1: Restores the parameters related to the selected interface macro to default settings 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode 103: Analog speed regulation in single-wire mode 104: Four fixed speeds in two-wire mode 2 105: Analog speed regulation in two-wire mode 1 106: Analog speed regulation in two-wire mode 2 107: Analog speed regulation in two-wire mode 3 108: Two fixed speeds in three-wire mode 2 109: Analog speed regulation in three-wire mode 1 110: Analog speed regulation in three-wire mode 2 111: Analog PID controller 112: PID controller with fixed reference value 113: Modbus communication control macro 114: Modbus communication control macro with DI-based start/stop control 115: Multi-channel switchover 1 116: Multi-channel switchover 2 117: Jog control through DI 118: CANopen communication control macro	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A0-49	0xA031	Active value of the interface macro	0: No action 101: Quick commissioning macro 102: Two fixed speeds in single-wire mode 103: Analog speed regulation in single-wire mode 104: Four fixed speeds in two-wire mode 2 105: Analog speed regulation in two-wire mode 1 106: Analog speed regulation in two-wire mode 2 107: Analog speed regulation in two-wire mode 3 108: Two fixed speeds in three-wire mode 2 109: Analog speed regulation in three-wire mode 1 110: Analog speed regulation in three-wire mode 2 111: Analog PID controller 112: PID controller with fixed reference value 113: Modbus communication control macro 114: Modbus communication control macro with DI-based start/stop control 115: Multi-channel switchover 1 116: Multi-channel switchover 2 117: Jog control through DI 118: CANopen communication control macro	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A0-50	0xA032	Custom macro selection	0: Not applied 1: Restores the parameters related to the selected custom macro to default settings 211: Power unwinding (compatible with MD290/ MD310) 212: Mechanical movement (compatible with MD290/ MD310) 213: Lathe industry (compatible with MD290/ MD310)	0	-	At stop
A0-51	0xA033	Active value of the custom macro	0: No action 211: Power unwinding (compatible with MD290/ MD310) 212: Mechanical movement (compatible with MD290/ MD310) 213: Lathe industry (compatible with MD290/ MD310)	0	-	Read-only
A0-52	0xA034	Load control optimization macro	0: Not applied 1: Restores the related parameters of the selected load control optimization macro to default settings 601: Fan and pump macro 602: Air compressor and air conditioning macro 603: Quick start and quick stop macro 605: Large inertia load macro	0	-	At stop
A0-53	0xA035	Active value of the load control optimization macro	0: No action 601: Fan and pump macro 602: Air compressor and air conditioning macro 603: Quick start and quick stop macro 605: Large inertia load macro	0	-	Read-only
A0-70	0xA046	Decimal places of frequency reference	1: One decimal place 2: Two decimal places	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A0-71	0xA047	Number of decimal places for load speed display (group U0)	Ones: Number of decimal places of U0-14/U0-24 0: Zero decimal places 1: One decimal place 2: Two decimal places Tens: Number of decimal places of U0-19/U0-29 1: One decimal place 2: Two decimal places Hundreds: Number of decimal places of U0-30/U0-31 0: Zero decimal places 1: One decimal place 2: Two decimal places Thousands: Number of decimal places of U0-69 1: One decimal place 2: Two decimal places Ten-thousands: Reserved	2220	-	Real time
A0-72	0xA048	Customized parameter display	Ones: User mode selection 0: Mask user mode 1: Show user mode Tens: Calibration mode selection 0: Mask calibration mode 1: Show calibration mode Hundreds: Error menu selection 0: Mask error menu 1: Show error menu Thousands: Reserved Ten-thousands: Reserved	111	-	Real time
A1-00	0xA100	Active fault 1	0.0 to 6553.5	0.0	-	Read-only
A1-02	0xA102	Active fault 2	0.0 to 6553.5	0.0	-	Read-only
A1-04	0xA104	Active fault 3	0.0 to 6553.5	0.0	-	Read-only
A1-06	0xA106	Active fault 4	0.0 to 6553.5	0.0	-	Read-only
A1-08	0xA108	Active fault 5	0.0 to 6553.5	0.0	-	Read-only
A1-10	0xA10A	Active fault 6	0.0 to 6553.5	0.0	-	Read-only
A1-12	0xA10C	Active minor fault 1	0.0 to 6553.5	0.0	-	Read-only
A1-14	0xA10E	Active minor fault 2	0.0 to 6553.5	0.0	-	Read-only
A1-16	0xA110	Active minor fault 3	0.0 to 6553.5	0.0	-	Read-only
A1-18	0xA112	Active minor fault 4	0.0 to 6553.5	0.0	-	Read-only
A1-20	0xA114	Active minor fault 5	0.0 to 6553.5	0.0	-	Read-only
A1-22	0xA116	Active minor fault 6	0.0 to 6553.5	0.0	-	Read-only
A1-24	0xA118	Active alarm 1	0.0 to 6553.5	0.0	-	Read-only
A1-26	0xA11A	Active alarm 2	0.0 to 6553.5	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A1-28	0xA11C	Active alarm 3	0.0 to 6553.5	0.0	-	Read-only
A1-30	0xA11E	Active alarm 4	0.0 to 6553.5	0.0	-	Read-only
A1-32	0xA120	Active alarm 5	0.0 to 6553.5	0.0	-	Read-only
A1-34	0xA122	Active alarm 6	0.0 to 6553.5	0.0	-	Read-only
A1-36	0xA124	Active prompt 1	0.0 to 6553.5	0.0	-	Read-only
A1-38	0xA126	Active prompt 2	0.0 to 6553.5	0.0	-	Read-only
A1-40	0xA128	Active prompt 3	0.0 to 6553.5	0.0	-	Read-only
A1-42	0xA12A	Active prompt 4	0.0 to 6553.5	0.0	-	Read-only
A1-44	0xA12C	Active prompt 5	0.0 to 6553.5	0.0	-	Read-only
A1-46	0xA12E	Active prompt 6	0.0 to 6553.5	0.0	-	Read-only
A1-52	0xA134	System status information prompt	0: None 1: Startup is available only after the startup command is deactivated and activated again. 2: OFF2 command activated 3: OFF3 command activated 4: Fault activated 5: Preparing internal parameters 6: Operation enable deactivated 7: STO activated 8: Startup is available only after the jog 1 command is deactivated and activated again. 9: Startup is available only after the jog 2 command is deactivated and activated again.	0	-	Read-only
A2-00	0xA200	Base value of per-unit voltage	0.0 V to 6553.5 V	0.0	V	Read-only
A2-01	0xA201	Base value of per-unit current	0.0 to 6553.5	0.0	A	Read-only
A2-02	0xA202	Base value of per-unit speed	0 to 65535	0	rpm	Read-only
A2-04	0xA204	Per-unit frequency base value	0.0 to 6553.5	0.0	Hz	Read-only
A2-05	0xA205	Per-unit power base value	0.00 kW to 655.35 kW	0.00	kW	Read-only
A2-06	0xA206	Per-unit torque base value	0.00 N·m to 655.35 N·m	0.00	N·m	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A2-09	0xA209	Per-unit DC voltage base value	0 to 65535	0	V	Read-only
A2-16	0xA210	Maximum output frequency of the system	0.0 to 6553.5	599.0	Hz	Read-only
A2-17	0xA211	Effective value of the maximum motor frequency	0.00 Hz to 655.35 Hz	50.00	Hz	Read-only
A2-18	0xA212	Maximum effective frequency of the motor (fixed decimal place)	0.0 to 6553.5	50.0	Hz	Read-only
A2-20	0xA214	Product code	0: Reserved 610: MD610	0	-	Read-only
A2-21	0xA215	Device type	0: MD610 (485 version) 1: MD610 (485 version + STO) 2: Reserved 3: Reserved 4: Reserved 5: MD610 (CAN version) 6: MD610 (CAN version + STO)	0	-	Read-only
A2-22	0xA216	Performance major version	0.00 to 655.35	0.00	-	Read-only
A2-23	0xA217	Function major version	0.00 to 655.35	0.00	-	Read-only
A2-24	0xA218	Performance sub-version	0.00 to 655.35	0.00	-	Read-only
A2-25	0xA219	Function sub-version	0.00 to 655.35	0.00	-	Read-only
A2-62	0xA23E	Type of expansion card 1	0 to 65535	0	-	Read-only
A2-63	0xA23F	Version of expansion card 1	0.00 to 655.35	0.00	-	Read-only
A2-64	0xA240	Type of expansion card 2	0 to 65535	0	-	Read-only
A2-65	0xA241	Version of expansion card 2	0.00 to 655.35	0.00	-	Read-only
A2-78	0xA24E	Per-unit current base value (32-bit)	0.00 to 655.35	0.00	A	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A2-80	0xA250	Per-unit speed base value of (32-bit)	0.0 to 6553.5	0.0	rpm	Read-only
A2-82	0xA252	Per-unit frequency base value (32-bit)	0.00 Hz to 655.35 Hz	0.00	Hz	Read-only
A2-84	0xA254	Per-unit power base value (32-bit)	0.00 kW to 655.35 kW	0.00	kW	Read-only
A2-86	0xA256	Per-unit torque base value (32-bit)	0.00 N·m to 655.35 N·m	0.00	N·m	Read-only
A2-90	0xA25A	VRC version parameter 1	0.00 to 65535.00	0.00	-	Read-only
A2-91	0xA25B	VRC version parameter 2	0.00 to 65535.00	0.00	-	Read-only
A2-92	0xA25C	VRC version parameter 3	0.00 to 65535.00	0.00	-	Read-only
A2-93	0xA25D	VRC version parameter 4	0.00 to 65535.00	0.00	-	Read-only
A3-01	0xA301	Load type	0: High-load application 1: Light-load application	0	-	At stop
A3-02	0xA302	Rated power of the drive	0.00 kW to 655.35 kW	0.40	kW	Read-only
A3-03	0xA303	Rated current of the drive	0.0 to 6553.5	9.5	A	Read-only
A3-04	0xA304	Rated voltage of the drive	0 to 65535	380	V	Read-only
A3-05	0xA305	Maximum current of the drive	0 to 600	150	%	Real time
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 V to 5.00V	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A3-39	0xA327	Dead zone curve time 1	0.0% to 300.0%	10.0	%	Real time
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 °C to 65535°C	0	°C	Read-only
A3-52	0xA334	Module pre-overtemperature margin	0.0 °C to 60.0°C	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 V to 440.0 V	350.0	V	Real time
A3-56	0xA338	Valid undervoltage threshold	300.0 V to 440.0 V	350.0	V	Read-only
A3-57	0xA339	Overvoltage threshold	650.0 V to 820.0 V	820.0	V	Real time
A3-58	0xA33A	Valid overvoltage threshold	650.0 V to 820.0 V	820.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A3-59	0xA33B	Protection command word of the drive	bit0: Reserved 0: Disable 1: Enable bit1: Defines whether to enable input phase loss detection (software). 0: Disable 1: Enable bit2: Defines whether to disable derating at low frequencies 0: Enable 1: Enable. Derating at low frequencies is disabled. bit3: Defines whether to report overvoltage at stop. 0: Yes 1: No bit4: Defines whether to enable zero drift 0: Disable 1: Enable. E18.01 (Current sampling error) is reported when zero drift error is detected. bit5: Defines whether to enable bus voltage acquisition analysis 0: Disable 1: Enable bit6: Defines whether to enable software overcurrent 0: Disable 1: Enable. When the phase current exceeds the threshold, the custom software overcurrent fault E02.02 is reported. Continued	0x0392	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A3-59	0xA33B	Protection command word of the drive	Continued bit7: Defines whether to enable CBC 0: Disable 1: Enable. The pulse-by-pulse current limit function is enabled. bit8: Reserved bit9: Defines whether to enable Junction temperature protection 0: Disable 1: Enable bit10: Defines whether to enable capacitor leakage 0: Disable 1: Enable bit11: Reserved bit12: Reserved bit13: Reserved bit14: Defines whether to enable random PWM parameter detection 0: Disable 1: Enable bit15: Reserved	0x0392	-	Real time
A3-67	0xA343	Automatic reset of undervoltage fault	0: Enable 1: Disable	0	-	Real time
A4-00	0xA400	Braking unit activation voltage	600.0 V to 820.0 V	750.0	V	At stop
A4-01	0xA401	Effective activation voltage of the braking unit	600.0 V to 820.0 V	760.0	V	Read-only
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
A4-28	0xA41C	Oscillation suppression parameter 1	0 to 300	100	-	At stop
A4-29	0xA41D	Oscillation suppression parameter 2	30 to 100	45	-	At stop
A4-30	0xA41E	Oscillation suppression parameter 3	5 to 100	50	-	At stop
A4-31	0xA41F	Oscillation suppression parameter 4	0.0 to 10.0	5.0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A5-00	0xA500	Maximum carrier frequency	0.0 kHz to 24.0 kHz	16.0	kHz	Read-only
A5-01	0xA501	Set carrier frequency	0.8 kHz to 20.0 kHz	4.0	kHz	Real time
A5-02	0xA502	Effective carrier frequency	0.8 kHz to 20.0 kHz	4.0	kHz	Read-only
A5-03	0xA503	DPWM up transfer frequency	5.0 Hz to 6000.0Hz	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 Hz to 6000.0Hz	2000.0	Hz	Real time
A5-06	0xA506	Overmodula-tion coefficient	0.0 % to 110.0%	105.0	%	Real time
A5-09	0xA509	Hysteresis for adjusting carrier frequency with synchronous frequency	0.0 Hz to 100.0 Hz	3.0	Hz	Real time
A5-10	0xA50A	Starting frequency for adjusting carrier frequency with synchronous frequency	0.0 Hz to 600.0 Hz	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 (VF)	0.8 kHz to 20.0 kHz	4.0	kHz	Real time
A5-13	0xA50D	Carrier frequency upper limit at low speed (SVC)	0.8 kHz to 20.0 kHz	2.0	kHz	Real time
A6-00	0xA600	Loc/Rem key function selection	0: Inactive 1: Forced operating panel control	1	-	At stop

Param.	Comm. address	Name	Range	Default value	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-03	0xA603	Parameter 1 displayed on LED operating panel during operation	bit0: Operating frequency (Hz) 0: Not displayed 1: Display bit1: Frequency reference (Hz) 0: Not displayed 1: Display bit2: Bus voltage (V) 0: Not displayed 1: Display bit3: Output voltage (V) 0: Not displayed 1: Display bit4: Output current (A) 0: Not displayed 1: Display bit5: Output power (kW) 0: Not displayed 1: Display bit6: Output torque (%) 0: Not displayed 1: Display bit7: DI input status 0: Not displayed 1: Display bit8: DO output status 0: Not displayed 1: Display Bit 9: AI1 voltage (V) 0: Not displayed 1: Display Bit 10: AI2 voltage (V) 0: Not displayed 1: Display bit11: MD-BP-M potentiometer voltage (V) 0: Not displayed 1: Display bit12: Reserved bit13: Reserved bit14: Load speed 0: Not displayed 1: Display bit15: PID reference 0: Not displayed 1: Display	0x001F	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-04	0xA604	Parameter 2 displayed on LED operating panel during operation	bit0: PID feedback 0: Not displayed 1: Display bit1: PLC stage 0: Not displayed 1: Display Bit 2: HDI pulse input frequency (kHz) 0: Not displayed 1: Display bit3: Operating frequency 2 (Hz) 0: Not displayed 1: Display bit4: Remaining operating time 0: Not displayed 1: Display Bit 5: AI1 voltage before correction (V) 0: Not displayed 1: Display bit6: Free mapping 0 0: Not displayed 1: Display bit7: Free mapping 1 0: Not displayed 1: Display bit8: Motor speed 0: Not displayed 1: Display bit9: Current power-on time (min) 0: Not displayed 1: Display bit10: Current operating time (min) 0: Not displayed 1: Display bit11: Reserved bit12: Reference set through communication 0: Not displayed 1: Display bit13: Reserved bit14: Main frequency X 0: Not displayed 1: Display bit15: Auxiliary frequency Y 0: Not displayed 1: Display	0x0000	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-05	0xA605	Parameter displayed on LED operating panel at stop	bit0: Frequency reference (Hz) 0: Not displayed 1: Display bit1: Bus voltage (V) 0: Not displayed 1: Display bit2: DI input status 0: Not displayed 1: Display bit3: DO output status 0: Not displayed 1: Display Bit 4: AI1 voltage (V) 0: Not displayed 1: Display Bit 5: AI2 voltage (V) 0: Not displayed 1: Display Bit 6: Voltage of potentiometer MD-BP-M (V) 0: Not displayed 1: Display bit7: Reserved bit8: Reserved bit9: PLC stage 0: Not displayed 1: Display bit10: Reserved bit11: PID reference 0: Not displayed 1: Display bit12: HDI input pulse frequency (kHz) (valid only for MD610S) 0: Not displayed 1: Display bit13: Reserved bit14: Free mapping 0 0: Not displayed 1: Display bit15: Free mapping 1 0: Not displayed 1: Display	0x0033	-	Real time
A6-07	0xA607	Address displayed by free mapping 0	0: Invalid address Others: K connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	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 places 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places Hundreds: Enable 0: Disable 1: Enable Thousands: Reserved	0x0000	-	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	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 places 1: One decimal place 2: Two decimal places 3: Three decimal places 4: Four decimal places Hundreds: Enable 0: Disable 1: Enable Thousands: Reserved	0x0000	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-16	0xA610	LED operating panel direction display	Ones: Whether to display the stop direction 0: Not displayed 1: Display 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	Update cycle of LED display	0 to 300	0	ms	Real time
A6-18	0xA612	LED error pop-up time	1s to 60s	10	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-28	0xA61C	Save parameter displayed on the LED operating panel during operation	0: Running frequency (Hz) 1: Set frequency (Hz) 2: Bus voltage (V) 3: Output voltage (V) 4: Output current (A) 5: Output power (kW) 6: Output torque (%) 7: DI input state 8: DO output state 9: AI1 voltage (V) 10: AI2 voltage (V) 11: Voltage of MD-BP-M potentiometer (V) 12: Reserved 13: Reserved 14: Load speed 15: PID setting 16: PID Feedback 17: PLC stage 18: HDI pulse input frequency (kHz) 19: Running frequency 2 (Hz) 20: Remaining running time 21: AI voltage before correction 22: Free mapping 0 23: Free mapping 1 24: Motor speed 25: Current power-on time (hour) 26: Current running time (minute) 27: Reserved 28: Communication 29: Reserved 30: Main frequency X display 31: Auxiliary frequency Y display	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-29	0xA61D	Save parameter displayed on the LED operating panel at stop	0: Set frequency (Hz) 1: Bus voltage (V) 2: DI input state 3: DO output state 4: AI1 voltage (V) 5: AI2 voltage (V) 6: Voltage of MD-BP-M potentiometer (V) 7: Reserved 8: Reserved 9: PLC stage 10: Reserved 11: PID setting 12: HDI pulse input frequency (kHz) 13: Reserved 14: Free mapping 0 15: Free mapping 1	0	-	Read-only
A6-34	0xA622	SOP-20 communica-tion control timeout period	0.00s to 655.35s	0.50	s	Real time
A6-35	0xA623	Commission-ing software communica-tion control timeout period	0.1s to 130.0s	3.0	s	Real time
A6-40	0xA628	MD-BP-M potentiometer zero-crossing threshold	0.0% to 100.0%	1.0	%	Real time
A6-45	0xA62D	Commission-ing software control activation	0: Inhibited 1: Allowed	1	-	At stop
A6-67	0xA643	Loc/Rem key function retention upon power failure	Ones: Forced operating panel flag 0: Not save 1: Save Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	0	-	Real time
A6-71	0xA647	MD-IP-S control	0: Inhibited 1: Allowed Other: B connector	1	-	Real time
A6-72	0xA648	MD-IP-S disconnection detection	0: Inactive 1: Active	1	-	Real time
A6-73	0xA649	MD-IP-S disconnection detection time	0.5 to 600.0	3.0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Ab-94	0xAB5E	Motor frequency/ speed filter time	0 ms to 10000 ms	128	ms	Real time
Ab-95	0xAB5F	Output voltage filter time	0 ms to 10000 ms	256	ms	Real time
Ab-96	0xAB60	Output current filter time	0 ms to 10000 ms	128	ms	Real time
Ab-97	0xAB61	Output power filter time	0 ms to 10000 ms	128	ms	Real time
Ab-98	0xAB62	Output torque filter time	0 ms to 10000 ms	128	ms	Real time
Ab-99	0xAB63	DC bus voltage filter time	0 ms to 10000 ms	128	ms	Real time
Ad-00	0xAD00	Cumulative operating time - hours	0 to 65535	0	h	Read-only
Ad-01	0xAD01	Cumulative operating time - seconds	0s to 3599s	0	s	Read-only
Ad-02	0xAD02	Cumulative power-on time - hours	0 to 65535	0	h	Read-only
Ad-03	0xAD03	Cumulative power-on time - seconds	0s to 3599s	0	s	Read-only
Ad-04	0xAD04	Cumulative power consumption	0 kWh to 65535 kWh	0	kWh	Read-only
Ad-05	0xAD05	Auxiliary calculation 1 of cumulative power consumption	0 to 65535	0	-	Read-only
Ad-06	0xAD06	Auxiliary calculation 2 of cumulative power consumption	0 to 65535	0	-	Read-only
Ad-07	0xAD07	Cumulative power consumption k	0.0 kWh to 6553.5 kWh	0.0	kWh	Read-only
Ad-08	0xAD08	Cumulative power consumption M	0 MWh to 65535 MWh	0	MWh	Read-only
Ad-09	0xAD09	Cumulative energy auxiliary calculation 1	0 to 65535	0	-	Read-only
Ad-10	0xAD0A	Cumulative energy auxiliary calculation 2	0 to 65535	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Ad-11	0xAD0B	Cumulative energy saving (kWh)	0.0 kWh to 999.9 kWh	0.0	kWh	Read-only
Ad-12	0xAD0C	Cumulative energy saving (MWh)	0 MWh to 999 MWh	0	MWh	Read-only
Ad-13	0xAD0D	Cumulative energy saving (GWh)	0 GWh to 65535 GWh	0	GWh	Read-only
Ad-14	0xAD0E	Cumulative cost saving	0.0 to 999.9	0.0	-	Read-only
Ad-15	0xAD0F	Cumulative cost saving (K)	0 to 65535	0	-	Read-only
Ad-16	0xAD10	Cumulative CO2 reduction (T)	0.0 to 999.9	0.0	-	Read-only
Ad-17	0xAD11	Cumulative CO2 reduction (KT)	0 to 65535	0	-	Read-only
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
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 kW to 6553.5 kW	0.0	kW	At stop
Ad-24	0xAD18	Reset of cumulative energy calculation	0: Not applied 1: Reset	0	-	At stop
AE-00	0x2F00	User parameter 0	0x0 to 0xFFFF	0x0	-	Real time
AE-01	0x2F01	User parameter 1	0x0 to 0xFFFF	0x0	-	Real time
AE-02	0x2F02	User parameter 2	0x0 to 0xFFFF	0x0	-	Real time
AE-03	0x2F03	User parameter 3	0x0 to 0xFFFF	0x0	-	Real time
AE-04	0x2F04	User 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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
AF-00	0xAF00	SN code serial number 1	0x0 to 0xFFFF	0x0	-	Read-only
AF-01	0xAF01	SN code serial number 2	0x0 to 0xFFFF	0x0	-	Read-only
AF-02	0xAF02	SN code serial number 3	0x0 to 0xFFFF	0x0	-	Read-only
AF-03	0xAF03	SN code serial number 4	0x0 to 0xFFFF	0x0	-	Read-only
AF-04	0xAF04	SN code serial number 5	0x0 to 0xFFFF	0x0	-	Read-only
AF-05	0xAF05	SN code serial number 6	0x0 to 0xFFFF	0x0	-	Read-only
AF-06	0xAF06	SN code serial number 7	0x0 to 0xFFFF	0x0	-	Read-only
AF-07	0xAF07	SN code serial number 8	0x0 to 0xFFFF	0x0	-	Read-only
AF-08	0xAF08	SN code serial number 9	0x0 to 0xFFFF	0x0	-	Read-only
AF-09	0xAF09	SN code serial number 10	0x0 to 0xFFFF	0x0	-	Read-only
AF-10	0xAF0A	SN code serial number 11	0x0 to 0xFFFF	0x0	-	Read-only
AF-11	0xAF0B	SN code serial number 12	0x0 to 0xFFFF	0x0	-	Read-only
AF-12	0xAF0C	SN code serial number 13	0x0 to 0xFFFF	0x0	-	Read-only
AF-13	0xAF0D	SN code serial number 14	0x0 to 0xFFFF	0x0	-	Read-only
AF-14	0xAF0E	SN code serial number 15	0x0 to 0xFFFF	0x0	-	Read-only
AF-15	0xAF0F	SN code serial number 16	0x0 to 0xFFFF	0x0	-	Read-only
AF-16	0xAF10	SN code serial number 17	0x0 to 0xFFFF	0x0	-	Read-only
AF-17	0xAF11	SN code serial number 18	0x0 to 0xFFFF	0x0	-	Read-only
AF-18	0xAF12	SN code serial number 19	0x0 to 0xFFFF	0x0	-	Read-only
AF-19	0xAF13	SN code serial number 20	0x0 to 0xFFFF	0x0	-	Read-only
AF-20	0xAF14	SN code serial number 21	0x0 to 0xFFFF	0x0	-	Read-only
AF-21	0xAF15	SN code serial number 22	0x0 to 0xFFFF	0x0	-	Read-only
AF-22	0xAF16	SN code serial number 23	0x0 to 0xFFFF	0x0	-	Read-only
AF-23	0xAF17	SN code serial number 24	0x0 to 0xFFFF	0x0	-	Read-only
AF-24	0xAF18	SN code serial number 25	0x0 to 0xFFFF	0x0	-	Read-only
AF-25	0xAF19	SN code serial number 26	0x0 to 0xFFFF	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
AF-26	0xAF1A	SN code serial number 27	0x0 to 0xFFFF	0x0	-	Read-only
AF-27	0xAF1B	SN code serial number 28	0x0 to 0xFFFF	0x0	-	Read-only
AF-28	0xAF1C	SN code serial number 29	0x0 to 0xFFFF	0x0	-	Read-only
AF-29	0xAF1D	SN code serial number 30	0x0 to 0xFFFF	0x0	-	Read-only
AF-30	0xAF1E	SN code serial number 31	0x0 to 0xFFFF	0x0	-	Read-only
AF-31	0xAF1F	SN code serial number 32	0x0 to 0xFFFF	0x0	-	Read-only
AF-32	0xAF20	SN code serial number 33	0x0 to 0xFFFF	0x0	-	Read-only
AF-33	0xAF21	SN code serial number 34	0x0 to 0xFFFF	0x0	-	Read-only
AF-34	0xAF22	SN code serial number 35	0x0 to 0xFFFF	0x0	-	Read-only
AF-35	0xAF23	SN code serial number 36	0x0 to 0xFFFF	0x0	-	Read-only
AF-36	0xAF24	SN code serial number 37	0x0 to 0xFFFF	0x0	-	Read-only
AF-37	0xAF25	SN code serial number 38	0x0 to 0xFFFF	0x0	-	Read-only
AF-38	0xAF26	SN code serial number 39	0x0 to 0xFFFF	0x0	-	Read-only
AF-39	0xAF27	SN code serial number 40	0x0 to 0xFFFF	0x0	-	Read-only
AF-40	0xAF28	SN code serial number 41	0x0 to 0xFFFF	0x0	-	Read-only
AF-41	0xAF29	SN code serial number 42	0x0 to 0xFFFF	0x0	-	Read-only
AF-42	0xAF2A	SN code serial number 43	0x0 to 0xFFFF	0x0	-	Read-only
AF-43	0xAF2B	SN code serial number 44	0x0 to 0xFFFF	0x0	-	Read-only
AF-44	0xAF2C	SN code serial number 45	0x0 to 0xFFFF	0x0	-	Read-only
AF-45	0xAF2D	SN code serial number 46	0x0 to 0xFFFF	0x0	-	Read-only
AF-46	0xAF2E	SN code serial number 47	0x0 to 0xFFFF	0x0	-	Read-only
AF-47	0xAF2F	SN code serial number 48	0x0 to 0xFFFF	0x0	-	Read-only
AF-48	0xAF30	SN code serial number 49	0x0 to 0xFFFF	0x0	-	Read-only
AF-49	0xAF31	SN code serial number 50	0x0 to 0xFFFF	0x0	-	Read-only
AF-50	0xAF32	SN code serial number 51	0x0 to 0xFFFF	0x0	-	Read-only
AF-51	0xAF33	SN code serial number 52	0x0 to 0xFFFF	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
AF-52	0xAF34	SN code serial number 53	0x0 to 0xFFFF	0x0	-	Read-only
AF-53	0xAF35	SN code serial number 54	0x0 to 0xFFFF	0x0	-	Read-only
AF-54	0xAF36	SN code serial number 55	0x0 to 0xFFFF	0x0	-	Read-only
AF-55	0xAF37	SN code serial number 56	0x0 to 0xFFFF	0x0	-	Read-only
AF-56	0xAF38	SN code serial number 57	0x0 to 0xFFFF	0x0	-	Read-only
AF-57	0xAF39	SN code serial number 58	0x0 to 0xFFFF	0x0	-	Read-only
AF-58	0xAF3A	SN code serial number 59	0x0 to 0xFFFF	0x0	-	Read-only
AF-59	0xAF3B	SN code serial number 60	0x0 to 0xFFFF	0x0	-	Read-only
AF-60	0xAF3C	SN code serial number 61	0x0 to 0xFFFF	0x0	-	Read-only
AF-61	0xAF3D	SN code serial number 62	0x0 to 0xFFFF	0x0	-	Read-only
AF-62	0xAF3E	SN code serial number 63	0x0 to 0xFFFF	0x0	-	Read-only
AF-63	0xAF3F	SN code serial number 64	0x0 to 0xFFFF	0x0	-	Read-only
b0-00	0xB000	Motor parameter group selection 1	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
b0-01	0xB001	Motor parameter group selection 2	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
b0-02	0xB002	Control channel selection	0: Control channel 1 1: Control channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b0-03	0xB003	Setting channel selection	0: Setting channel 1 1: Setting channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
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	Custom ON_ OFF1 (start/ stop) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: 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 6: DI4 7: DI5 Other: B connector	1	-	Real time
b1-03	0xB103	User-defined OFF3 (quick stop) source 1	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b1-04	0xB104	Custom operation permission source	0: Operation inhibited 1: Operation allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b1-05	0xB105	User-defined fault reset command source 1	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b1-06	0xB106	Custom jog (JOG1) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b1-07	0xB107	Custom jog (JOG2) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b1-08	0xB108	Custom speed inversion source	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b1-09	0xB109	JOG/ON_OFF1 priority mode selection	0: Priority not differentiated 1: Jog command responded to first 2: ON_OFF1 (start/stop) command responded to first	0	-	Real time
b2-00	0xB200	OFF2 (coast to stop) source 2	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b2-01	0xB201	OFF2 (coast to stop) source 3	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b2-02	0xB202	OFF3 (quick stop) source 2	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b2-03	0xB203	OFF3 (quick stop) source 3	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b2-04	0xB204	Fault reset source 2	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b2-05	0xB205	Fault reset source 3	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b2-06	0xB206	Ramp inhibition command source	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b2-07	0xB207	Ramp pause command source	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b2-08	0xB208	Source of setting ramp reference to 0	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b3-00	0xB300	Main command source of control channel 2	0: Operating panel 1: Terminal 2: Communication 3: Custom	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b3-01	0xB301	Custom ON_ OFF1 (start/ stop) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: 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 6: DI4 7: DI5 Other: B connector	1	-	Real time
b3-03	0xB303	User-defined OFF3 (quick stop) source 1	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b3-04	0xB304	Custom operation permission source	0: Operation inhibited 1: Operation allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b3-05	0xB305	User-defined fault reset command source 1	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b3-06	0xB306	Custom jog (JOG1) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b3-07	0xB307	Custom jog (JOG2) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b3-08	0xB308	Custom speed inversion source	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b3-09	0xB309	JOG/ON_OFF1 priority mode selection	0: Priority not differentiated 1: Jog command responded to first 2: ON_OFF1 (start/stop) command responded to first	0	-	Real time
b4-00	0xB400	OFF2 (coast to stop) source 2	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b4-01	0xB401	OFF2 (coast to stop) source 3	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b4-02	0xB402	OFF3 (quick stop) source 2	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b4-03	0xB403	OFF3 (quick stop) source 3	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b4-04	0xB404	Fault reset source 2	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b4-05	0xB405	Fault reset source 3	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b4-06	0xB406	Ramp inhibition command source	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b4-07	0xB407	Ramp pause command source	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b4-08	0xB408	Source of setting ramp reference to 0	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
b5-00	0xB500	Main frequency source	0: b5-01 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b5-01	0xB501	Digital reference of main frequency	0.00 Hz to A2-17	50.00	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b5-02	0xB502	Auxiliary frequency source	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b5-03	0xB503	Calculation relationship between main and auxiliary references	0: Main + Auxiliary 1: Main frequency - auxiliary frequency 2: Max. (main frequency, auxiliary frequency) 3: Min (X, Y) 4: X × Y 5: Main/auxiliary frequency switchover	0	-	Real time
b5-04	0xB504	Additional frequency source	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b5-05	0xB505	Source of main frequency gain coefficient	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b5-06	0xB506	Source of auxiliary frequency gain factor	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b5-07	0xB507	Source of jog frequency 1	0: b5-08 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b5-08	0xB508	Digital reference of jog 1 frequency	-50.00 Hz to +50.00 Hz	2.00	Hz	Real time
b5-09	0xB509	Source of jog frequency 2	0: b5-10 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b5-10	0xB50A	Digital reference of jog 2 frequency	-50.00 Hz to +50.00 Hz	-2.00	Hz	Real time
b5-11	0xB50B	Frequency ramp transition enable	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b5-12	0xB50C	Frequency ramp transition interval	2 ms to 10000 ms	50	ms	Real time
b5-13	0xB50D	Torque reference source	0: b5-14 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b5-14	0xB50E	Digital torque reference	-800.0 to +800.0	0.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b5-15	0xB50F	Torque reference gain coefficient	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b5-16	0xB510	Torque filter time	0 ms to 10000 ms	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 reference of speed limit in torque mode	-800.0 to +800.0	100.0	%	Real time
b5-21	0xB515	Speed limit offset mode in torque mode	0: Bidirectional bias 1: Uni-directional bias 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b5-23	0xB517	Digital reference of speed limit bias 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b5-27	0xB51B	Additional torque reference 2 enable	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b5-40	0xB528	Main/auxiliary frequency switchover source	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b6-00	0xB600	Main frequency source	0: b6-01 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b6-01	0xB601	Digital reference of main frequency	0.00 Hz to A2-17	50.00	Hz	Real time
b6-02	0xB602	Auxiliary frequency source	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b6-03	0xB603	Calculation relationship between main and auxiliary references	0: Main + Auxiliary 1: Main frequency - auxiliary frequency 2: Max. (main frequency, auxiliary frequency) 3: Min (X, Y) 4: X × Y 5: Main/auxiliary frequency switchover	0	-	Real time
b6-04	0xB604	Additional frequency source	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b6-05	0xB605	Source of main frequency gain coefficient	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b6-06	0xB606	Source of auxiliary frequency gain factor	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b6-07	0xB607	Source of jog frequency 1	0: b6-08 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b6-08	0xB608	Digital reference of jog 1 frequency	-50.00 Hz to +50.00 Hz	2.00	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b6-09	0xB609	Source of jog frequency 2	0: b6-10 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b6-10	0xB60A	Digital reference of jog 2 frequency	-50.00 Hz to +50.00 Hz	-2.00	Hz	Real time
b6-11	0xB60B	Frequency ramp transition enable	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b6-12	0xB60C	Frequency ramp transition interval	2 ms to 10000 ms	50	ms	Real time
b6-13	0xB60D	Torque reference source	0: b6-14 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b6-14	0xB60E	Digital torque reference	-800.0 to +800.0	0.0	%	Real time
b6-15	0xB60F	Torque reference gain coefficient	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b6-16	0xB610	Torque filter time	0 ms to 10000 ms	0	ms	Real time
b6-17	0xB611	Torque acceleration time	0.000 to 60.000	0.000	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 reference of speed limit in torque mode	-800.0 to +800.0	100.0	%	Real time
b6-21	0xB615	Speed limit offset mode in torque mode	0: Bidirectional bias 1: Uni-directional bias 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b6-23	0xB617	Digital reference of speed limit bias 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer 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	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b6-27	0xB61B	Additional torque reference 2 enable	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b6-40	0xB628	Main/auxiliary frequency switchover source	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
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 6: DI4 7: DI5 Other: B connector	0	-	Real time
b7-03	0xB703	Ramp selection bit1	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	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	0.00s to 650.00s	0.00	s	Real time
b7-07	0xB707	Ramp-up end arc of ramp 1	0.00s to 650.00s	0.00	s	Real time
b7-08	0xB708	Ramp-down start arc of ramp 1	0.00s to 650.00s	0.00	s	Real time
b7-09	0xB709	Ramp-down end arc of ramp 1	0.00s to 650.00s	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.	Comm. address	Name	Range	Default value	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	0.00s to 650.00s	0.00	s	Real time
b7-13	0xB70D	Ramp-up end arc of ramp 2	0.00s to 650.00s	0.00	s	Real time
b7-14	0xB70E	Ramp-down start arc of ramp 2	0.00s to 650.00s	0.00	s	Real time
b7-15	0xB70F	Ramp-down end arc of ramp 2	0.00s to 650.00s	0.00	s	Real time
b7-16	0xB710	Ramp-up time of ramp 3	0.00s to 650.00s	20.00	s	Real time
b7-17	0xB711	Ramp-down time of ramp 3	0.00s to 650.00s	20.00	s	Real time
b7-18	0xB712	Ramp-up start arc of ramp 3	0.00s to 650.00s	0.00	s	Real time
b7-19	0xB713	Ramp-up end arc of ramp 3	0.00s to 650.00s	0.00	s	Real time
b7-20	0xB714	Ramp-down start arc of ramp 3	0.00s to 650.00s	0.00	s	Real time
b7-21	0xB715	Ramp-down end arc of ramp 3	0.00s to 650.00s	0.00	s	Real time
b7-22	0xB716	Ramp-up time of ramp 4	0.00s to 650.00s	20.00	s	Real time
b7-23	0xB717	Ramp-down time of ramp 4	0.00s to 650.00s	20.00	s	Real time
b7-24	0xB718	Ramp-up start arc of ramp 4	0.00s to 650.00s	0.00	s	Real time
b7-25	0xB719	Ramp-up end arc of ramp 4	0.00s to 650.00s	0.00	s	Real time
b7-26	0xB71A	Ramp-down start arc of ramp 4	0.00s to 650.00s	0.00	s	Real time
b7-27	0xB71B	Ramp-down end arc of ramp 4	0.00s to 650.00s	0.00	s	Real time
b7-28	0xB71C	Ramps 1/2 frequency switchover	0: Inhibited 1: Enable	0	-	Real time
b7-29	0xB71D	Acceleration switchover frequency threshold of ramp 1/2	0.0 Hz to A2-18	0.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b7-30	0xB71E	Deceleration switchover frequency threshold of ramp 1/2	0.0 Hz to A2-18	0.0	Hz	Real time
b7-31	0xB71F	Jog ramp source	0: Ramp time of normal operation 1: Ramp time in jog	0	-	Real time
b7-32	0xB720	Ramp-up time in jog	0.00s to 650.00s	20.00	s	Real time
b7-33	0xB721	Ramp-down time in jog	0.00s to 650.00s	20.00	s	Real time
b7-34	0xB722	Ramp-down time for quick stop	0.00s to 650.00s	1.00	s	Real time
b7-35	0xB723	Start arc of quick stop	0.00s to 650.00s	0.00	s	Real time
b7-36	0xB724	End arc of quick stop	0.00s to 650.00s	0.00	s	Real time
b7-37	0xB725	Frequency ramp-up time in torque control	0.00s to 650.00s	0.00	s	Real time
b7-38	0xB726	Frequency deceleration time in torque control	0.00s to 650.00s	0.00	s	Real time
b7-39	0xB727	Ramp-up time gain factor	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b7-40	0xB728	Gain factor of ramp-up time	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	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 threshold	0.00 % to 100.00%	15.00	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b7-43	0xB72B	Ramp arc mode	0: Discontinuous smoothing 1: Continuous smoothing	0	-	Real time
b7-44	0xB72C	Forcible enable of ramp output	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b7-45	0xB72D	Ramp output forced value	0: 100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
b7-46	0xB72E	Ramp tracking enable	0: Inhibited 1: Enable 2: Torque limit reached Other: B connector	0	-	Real time
b7-47	0xB72F	Ramp tracking error	0.0% to 100.0%	10.0	%	Real time
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	-	Read-only
b8-01	0xB801	Active multi-reference output	-3000.0 % to +3000.0%	0.0	%	Read-only
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b8-03	0xB803	Multi-reference selection bit0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b8-04	0xB804	Multi-reference selection bit1	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b8-05	0xB805	Multi-reference selection bit2	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b8-06	0xB806	Multi-reference selection bit3	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
b8-08	0xB808	Multi-reference 0 setting mode	0: b8-09 1: AI1 2: AI2 3: MD-BP-M potentiometer 4: HDI pulse 5: PID 6: Digital reference of main frequency (b5-01/b6-01) Others: F connector	0	-	Real time
b8-09	0xB809	Multi-reference 0	b8-42 to b8-43	0.0	-	Real time
b8-10	0xB80A	Multi-reference 1	b8-42 to b8-43	0.0	-	Real time
b8-11	0xB80B	Multi-reference 2	b8-42 to b8-43	0.0	-	Real time
b8-12	0xB80C	Multi-reference 3	b8-42 to b8-43	0.0	-	Real time
b8-13	0xB80D	Multi-reference 4	b8-42 to b8-43	0.0	-	Real time
b8-14	0xB80E	Multi-reference 5	b8-42 to b8-43	0.0	-	Real time
b8-15	0xB80F	Multi-reference 6	b8-42 to b8-43	0.0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b8-16	0xB810	Multi-reference 7	b8-42 to b8-43	0.0	-	Real time
b8-17	0xB811	Multi-reference 8	b8-42 to b8-43	0.0	-	Real time
b8-18	0xB812	Multi-reference 9	b8-42 to b8-43	0.0	-	Real time
b8-19	0xB813	Multi-reference 10	b8-42 to b8-43	0.0	-	Real time
b8-20	0xB814	Multi-reference 11	b8-42 to b8-43	0.0	-	Real time
b8-21	0xB815	Multi-reference 12	b8-42 to b8-43	0.0	-	Real time
b8-22	0xB816	Multi-reference 13	b8-42 to b8-43	0.0	-	Real time
b8-23	0xB817	Multi-reference 14	b8-42 to b8-43	0.0	-	Real time
b8-24	0xB818	Multi-reference 15	b8-42 to b8-43	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
b9-00	0xB900	Terminal start/ stop module A/B selection	0: Module A 1: Module B Other: 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 start in forward direction, IN2P (rising edge) for start in reverse direction, and IN3 for stop	3	-	At stop
b9-02	0xB902	Terminal start/ stop module A_IN1	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b9-03	0xB903	Terminal start/ stop module A_IN2	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
b9-04	0xB904	Terminal start/ stop module A_IN3	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
b9-05	0xB905	Operation permission source of terminal start/ stop module A	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	At stop
b9-06	0xB906	Fault reset source of terminal start/ stop module A	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
b9-07	0xB907	JOG1 source of terminal start/ stop module A	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
b9-08	0xB908	JOG2 source of terminal start/ stop module A	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop

Param.	Comm. address	Name	Range	Default value	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 start in forward direction, IN2P (rising edge) for start in reverse direction, and IN3 for stop	3	-	At stop
b9-10	0xB90A	Terminal start/ stop module B_IN1	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
b9-11	0xB90B	Terminal start/ stop module B_IN2	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
b9-12	0xB90C	Terminal start/ stop module B_IN3	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
b9-13	0xB90D	Operation permission source of terminal start/ stop module B	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	At stop
b9-14	0xB90E	Fault reset source of terminal start/ stop module B	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b9-15	0xB90F	JOG1 source of terminal start/ stop module B	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
b9-16	0xB910	JOG2 source of terminal start/ stop module B	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
C2-00	0xC200	Motor parameter auto-tuning mode	0: Not applied 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 (excluding back EMF) 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static partial auto-tuning of permanent magnet motor 14: UV gain deviation auto-tuning 15: Reserved 21: Auto-tuning of synchronous reluctance motor in static state 22: Auto-tuning of synchronous reluctance motor in dynamic state	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C2-03	0xC203	Self-test configuration before startup	bit0: Self-test on IGBT short circuit upon start 0: Disable 1: Enable bit1: Self-test on ground short circuit upon start 0: Disable 1: Enable bit2: Self-test on phase loss upon start 0: Disable 1: Enable bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	At stop
C2-04	0xC204	Manual self-test	0: No command 1: Static self-test preparation	0	-	At stop
C2-06	0xC206	Self-test configuration upon power-on	bit0: IGBT short circuit upon power-on 0: Disable 1: Enable bit1: Ground short circuit upon power-on 0: Disable 1: Enable bit2: Self-test on phase loss upon power-on 0: Disable 1: Enable bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0002	-	At stop
C2-07	0xC207	Direction selection	0: Default direction 1: Opposite direction	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C2-17	0xC211	Auto-tuning acceleration time	0.0s to 600.0s	20.0	s	At stop
C2-18	0xC212	Auto-tuning deceleration time	0.0s to 600.0s	20.0	s	At stop
C2-19	0xC213	Parameter Calculation	0: Inactive 1: Motor nameplate parameter calculation	0	-	At stop
C2-20	0xC214	Nameplate parameter calculation acknowledg-ment	0: Inactive 1: Active	0	-	At stop
C2-21	0xC215	TB calculation of synchronous motor	0: Inactive 1: Active	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
C4-00	0xC400	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnetic (not supported) 4: Synchronous reluctance motor with permanent magnetic (not supported)	0	-	At stop
C4-01	0xC401	Rated motor power	0.01 kW to 655.35 kW	3.70	kW	At stop
C4-03	0xC403	Rated motor voltage	1 V to 2000 V	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 Hz to 599.00 Hz	50.00	Hz	At stop
C4-07	0xC407	Rated motor speed	1 rpm to 65535 rpm	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 Hz	50.00	Hz	At stop
C4-11	0xC40B	Minimum motor frequency	0.00 Hz to C4-10	0.00	Hz	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C4-12	0xC40C	Synchronous motor back EMF	0.0 V to 6553.5 V	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	-	Read-only
C4-20	0xC414	Stator resistance	0.001 Ω to 65.535 Ω	1.204	Ω	Real time
C4-22	0xC416	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω	0.908	Ω	Real time
C4-24	0xC418	Leakage inductance of asynchronous motor stator	0.01 mH to 655.35 mH	5.28	mH	Real time
C4-26	0xC41A	Leakage inductance of asynchronous motor rotor	0.01 mH to 655.35 mH	5.28	mH	Real time
C4-28	0xC41C	Asynchronous motor mutual inductance	0.1 mH to 6553.5 mH	156.8	mH	Real time
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 mH to 655.35 mH	5.28	mH	Real time
C4-34	0xC422	q-axis inductance of synchronous motor	0.01 mH to 655.35 mH	5.28	mH	Real time
C4-62	0xC43E	Inertia ratio	0.0% to 6553.5%	120.0	%	At stop
C4-63	0xC43F	Electrome-chanical time constant	0.01s to 655.35s	1.00	s	Read-only
C4-64	0xC440	System rotation inertia	0.01 kg·m² to 655.35 kg·m²	1.00	kg·m²	Read-only
C4-70	0xC446	Motor brake control	0: Inhibited 1: Enable	1	-	At stop
C5-02	0xC502	Current coefficient 1 of mutual inductance curve	5.0% to 100.0%	50.0	%	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 N·m to +320.00 N·m	0.00	N·m	At stop
C5-21	0xC515	Torque point 2 of friction curve	-320.00 N·m to +320.00 N·m	0.00	N·m	At stop
C5-22	0xC516	Torque point 3 of friction curve	-320.00 N·m to +320.00 N·m	0.00	N·m	At stop
C5-23	0xC517	Torque point 4 of friction curve	-320.00 N·m to +320.00 N·m	0.00	N·m	At stop
C5-24	0xC518	Torque point 5 of friction curve	-320.00 N·m to +320.00 N·m	0.00	N·m	At stop
C5-25	0xC519	Torque point 6 of friction curve	-320.00 N·m to +320.00 N·m	0.00	N·m	At stop
C5-26	0xC51A	Torque point 7 of friction curve	-320.00 N·m to +320.00 N·m	0.00	N·m	At stop
C5-27	0xC51B	Torque point 8 of friction curve	-320.00 N·m to +320.00 N·m	0.00	N·m	At stop
C5-28	0xC51C	Torque point 9 of friction curve	-320.00 N·m to +320.00 N·m	0.00	N·m	At stop
C5-29	0xC51D	Torque point 10 of friction curve	-320.00 N·m to +320.00 N·m	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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.	Comm. address	Name	Range	Default value	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
C7-00	0xC700	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnetic (not supported) 4: Synchronous reluctance motor with permanent magnetic (not supported)	0	-	At stop
C7-01	0xC701	Rated motor power	0.01 kW to 655.35 kW	3.70	kW	At stop
C7-03	0xC703	Rated motor voltage	1 V to 2000 V	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 Hz to 599.00 Hz	50.00	Hz	At stop
C7-07	0xC707	Rated motor speed	1 rpm to 65535 rpm	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 Hz	50.00	Hz	At stop
C7-11	0xC70B	Minimum motor frequency	0.00 Hz to C7-10	0.00	Hz	At stop
C7-12	0xC70C	Synchronous motor back EMF	0.0 V to 6553.5 V	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
C7-15	0xC70F	Number of effective motor pole pairs	0 to 128	0	-	Read-only
C7-20	0xC714	Stator resistance	0.001 Ω to 65.535 Ω	1.204	Ω	Real time
C7-22	0xC716	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω	0.908	Ω	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C7-24	0xC718	Leakage inductance of asynchronous motor stator	0.01 mH to 655.35 mH	5.28	mH	Real time
C7-26	0xC71A	Leakage inductance of asynchronous motor rotor	0.01 mH to 655.35 mH	5.28	mH	Real time
C7-28	0xC71C	Asynchronous motor mutual inductance	0.1 mH to 6553.5 mH	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 mH to 655.35 mH	5.28	mH	Real time
C7-34	0xC722	q-axis inductance of synchronous motor	0.01 mH to 655.35 mH	5.28	mH	Real time
C7-62	0xC73E	Inertia ratio	0.0% to 6553.5%	120.0	%	At stop
C7-63	0xC73F	Electrome-chanical time constant	0.01s to 655.35s	1.00	s	Read-only
C7-64	0xC740	System rotation inertia	0.01 kg·m² to 655.35 kg·m²	1.00	kg·m²	Read-only
C7-70	0xC746	Motor brake control	0: Inhibited 1: Enable	1	-	At stop
CA-00	0xCA00	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnetic (not supported) 4: Synchronous reluctance motor with permanent magnetic (not supported)	0	-	At stop
CA-01	0xCA01	Rated motor power	0.01 kW to 655.35 kW	3.70	kW	At stop
CA-03	0xCA03	Rated motor voltage	1 V to 2000 V	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 Hz to 599.00 Hz	50.00	Hz	At stop
CA-07	0xCA07	Rated motor speed	1 rpm to 65535 rpm	1460	rpm	At stop
CA-09	0xCA09	Power factor of the motor	0.600 to 1.000	0.860	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
CA-10	0xCA0A	Maximum motor frequency	CA-06 to 599.00 Hz	50.00	Hz	At stop
CA-11	0xCA0B	Minimum motor frequency	0.00 Hz to CA-10	0.00	Hz	At stop
CA-12	0xCA0C	Synchronous motor back EMF	0.0 V to 6553.5 V	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	-	Read-only
CA-20	0xCA14	Stator resistance	0.001 Ω to 65.535 Ω	1.204	Ω	Real time
CA-22	0xCA16	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω	0.908	Ω	Real time
CA-24	0xCA18	Leakage inductance of asynchronous motor stator	0.01 mH to 655.35 mH	5.28	mH	Real time
CA-26	0xCA1A	Leakage inductance of asynchronous motor rotor	0.01 mH to 655.35 mH	5.28	mH	Real time
CA-28	0xCA1C	Asynchronous motor mutual inductance	0.1 mH to 6553.5 mH	156.8	mH	Real time
CA-30	0xCA1E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real time
CA-32	0xCA20	d-axis inductance of synchronous motor	0.01 mH to 655.35 mH	5.28	mH	Real time
CA-34	0xCA22	q-axis inductance of synchronous motor	0.01 mH to 655.35 mH	5.28	mH	Real time
CA-62	0xCA3E	Inertia ratio	0.0% to 6553.5%	120.0	%	At stop
CA-63	0xCA3F	Electrome-chanical time constant	0.01s to 655.35s	1.00	s	Read-only
CA-64	0xCA40	System rotation inertia	0.01 kg·m² to 655.35 kg·m²	1.00	kg·m²	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
CA-70	0xCA46	Motor brake control	0: Inhibited 1: Enable	1	-	At stop
Cd-00	0xCD00	Motor type	0: Common asynchronous motor 2: Permanent magnet synchronous motor 3: Synchronous reluctance motor without permanent magnetic (not supported) 4: Synchronous reluctance motor with permanent magnetic (not supported)	0	-	At stop
Cd-01	0xCD01	Rated motor power	0.01 kW to 655.35 kW	3.70	kW	At stop
Cd-03	0xCD03	Rated motor voltage	1 V to 2000 V	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 Hz to 599.00 Hz	50.00	Hz	At stop
Cd-07	0xCD07	Rated motor speed	1 rpm to 65535 rpm	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 Hz	50.00	Hz	At stop
Cd-11	0xCD0B	Minimum motor frequency	0.00 Hz to Cd-10	0.00	Hz	At stop
Cd-12	0xCD0C	Synchronous motor back EMF	0.0 V to 6553.5 V	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
Cd-15	0xCD0F	Number of effective motor pole pairs	0 to 128	0	-	Read-only
Cd-20	0xCD14	Stator resistance	0.001 Ω to 65.535 Ω	1.204	Ω	Real time
Cd-22	0xCD16	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω	0.908	Ω	Real time
Cd-24	0xCD18	Leakage inductance of asynchronous motor stator	0.01 mH to 655.35 mH	5.28	mH	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Cd-26	0xCD1A	Leakage inductance of asynchronous motor rotor	0.01 mH to 655.35 mH	5.28	mH	Real time
Cd-28	0xCD1C	Asynchronous motor mutual inductance	0.1 mH to 6553.5 mH	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 mH to 655.35 mH	5.28	mH	Real time
Cd-34	0xCD22	q-axis inductance of synchronous motor	0.01 mH to 655.35 mH	5.28	mH	Real time
Cd-62	0xCD3E	Inertia ratio	0.0% to 6553.5%	120.0	%	At stop
Cd-63	0xCD3F	Electrome-chanical time constant	0.01s to 655.35s	1.00	s	Read-only
Cd-64	0xCD40	System rotation inertia	0.01 kg·m² to 655.35 kg·m²	1.00	kg·m²	Read-only
Cd-70	0xCD46	Motor brake control	0: Inhibited 1: Enable	1	-	At stop
d0-00	0xD000	Control mode	0: SVC 2: V/f	2	-	At stop
d0-01	0xD001	Motor control mode	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
d0-02	0xD002	Startup mode	Ones: Asynchronous motor startup mode 0: Direct start 1: Flying start Tens position: Synchronous motor startup mode 0: Same as the startup mode of the ones position 1: Flying start Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	10	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d0-03	0xD003	Flying start mode	0: 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) mode	0: Coast to stop	0	-	Read-only
d0-06	0xD006	OFF3 (quick stop) mode	0: Quick stop 1: Stop with maximum capability	0	-	Real time
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: Switched to speed 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)	0.00s to 10.00s	0.10	s	At stop
d0-11	0xD00B	Zero speed threshold for stop at synchronous frequency	0.00% to 200.00%	1.00	%	Real time
d0-12	0xD00C	Zero speed judgment time of synchronous frequency	0.00s to 655.35s	2.00	s	At stop
d0-13	0xD00D	Start/Stop frequency follow-up	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
d0-14	0xD00E	Motor direction selection	0: Default direction 1: Opposite direction	0	-	At stop
d0-16	0xD010	Stop delay time	0.00s to 655.35s	0.00	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 ms to 30000 ms	1000	ms	Real time
d0-19	0xD013	Pre-excitation current	1 % to 800%	100	%	Real time
d0-20	0xD014	Demagnetiza-tion time	0.00s to 5.00s	0.50	s	Real time
d0-23	0xD017	Starting frequency	0.00 Hz to 10.00 Hz	0.00	Hz	Real time
d0-24	0xD018	Starting frequency hold time	0.0s to 1000.0s	0.0	s	At stop
d0-25	0xD019	DC braking time at start	0.0s to 100.0s	0.0	s	At stop
d0-26	0xD01A	DC braking current at start	0% to 800%	50	%	At stop
d0-27	0xD01B	Starting frequency of DC braking at stop	0.0 Hz to 600.0 Hz	0.0	Hz	Real time
d0-28	0xD01C	Waiting time of DC braking at stop	0.0s to 100.0s	0.0	s	Real time
d0-29	0xD01D	DC braking time at stop	0.0s to 100.0s	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	Overexcitation selection (vector)	0: Inactive 1: Active	0	-	Real time
d0-40	0xD028	Overexcitation current (vector)	0% to 800%	100	%	Real time
d0-41	0xD029	Over-excitation gain (V/f)	0% to 200%	90	%	Real time
d0-61	0xD03D	Active short circuit control	0: Disable 1: Enable Other: B connector	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d0-62	0xD03E	Delay for entering active short circuit control	0.0 ms to 5000.0 ms	0.0	ms	At stop
d0-63	0xD03F	Hold time of active short circuit control at stop	0.1s to 3600.0s	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: 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: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Auto-tuning mode of high-frequency injection polarity 0: Method 0 1: Method 1 bit8: High-frequency injection search method 0: Disable 1: Enable bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	At stop
d0-75	0xD04B	Initial position detection current of synchronous motor	50% to 180%	80	%	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d0-76	0xD04C	Initial position compensation angle	0.0 to 359.9	0.0	°	At stop
d0-85	0xD055	Low-speed processing method	Ones: Synchronous motor in V/f mode 0: Disable 1: Speed open-loop Tens: Synchronous motor in SVC mode 0: Disable 1: Speed open-loop standard mode 2: Speed open-loop advanced mode Hundreds place: Reluctance motor SVC 0: Disable 1: Speed open-loop standard mode 2: Speed open-loop advanced mode 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	0.00s to 5.00s	0.50	s	Real time
d1-00	0xD100	Maximum motor current	0.0% to 1000.0%	1000.0	%	Real time
d1-01	0xD101	Positive speed permission	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-02	0xD102	Negative speed selection	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
d1-03	0xD103	Digital reference of positive frequency upper limit 1	d1-07 to 800.0%	800.0	%	At stop
d1-04	0xD104	Digital reference of negative 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	1	-	Real time
d1-07	0xD107	Digital reference of positive frequency lower limit 1	0.0 % to d1-03	0.0	%	At stop
d1-08	0xD108	Digital reference of negative frequency lower limit 1	d1-04 to 0.0%	0.0	%	At stop
d1-09	0xD109	Digital reference of torque upper limit 1	0.0% to 800.0%	200.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-10	0xD10A	Digital reference of torque lower limit 1	-800.0% to 0.0%	-200.0	%	Real time
d1-11	0xD10B	Source of torque upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer 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: Inactive 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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-33	0xD121	Motor protection	bit0: Reserved bit1: Current control error detection 0: Disable 1: Enable bit2: Motor step loss error detection 0: Disable 1: Enable bit3: Reserved bit4: Demagnetization protection for permanent magnet synchronous motor 0: Disable 1: Enable bit5: Runaway protection 0: Disable 1: Enable bit6: Speed reversal protection 0: Disable 1: Enable bit7: Reserved bit8: Motor parameter error check 0: Disable 1: Enable bit9: Single phase output loss detection 0: Disable 1: Enable bit10: Demagnetization protection of reluctance motor with field strengthening 0: Disable 1: Enable bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0687	-	Real time
d1-35	0xD123	Overspeed protection	0: Disable 1: Enable	1	-	Real time
d1-36	0xD124	Overspeed protection time	0.0s to 60.0s	0.5	s	Real time
d1-37	0xD125	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real time
d1-38	0xD126	Excessive speed deviation	0: Disable 1: Enable	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-39	0xD127	Excessive speed deviation protection time	0.0s to 60.0s	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	0.00s to 5.00s	0.50	s	Real time
d1-45	0xD12D	Motor overload protection	0: Disable 1: Enable	1	-	Real time
d1-46	0xD12E	Motor overload protection coefficient	20% to 1000%	100	%	Real time
d1-47	0xD12F	Motor overload pre-alarm 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
d1-52	0xD134	Overvoltage suppression overspeed detection time	0 ms to 10000 ms	50	ms	Real time
d1-53	0xD135	Overvoltage suppression overspeed detection threshold	0% to 100%	20	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-54	0xD136	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector mode 0: Disable 1: Enable bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0003	-	Real time
d1-55	0xD137	Voltage threshold for overvoltage suppression	600.0 V to A3-57	770.0	V	Real time
d1-56	0xD138	Effective voltage threshold for overvoltage suppression	600.0 V to A3-57	740.0	V	Read-only
d1-57	0xD139	Overvoltage suppression Kp adjustment	0% to 1000%	100	%	Real time
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 3: Undervoltage suppression with time limit setting	3	-	Real time
d1-64	0xD140	Voltage threshold for undervoltage suppression	A3-55 to 500.0 V	430.0	V	Real time
d1-65	0xD141	Actual effective voltage threshold for undervoltage suppression	A3-55 to 500.0 V	430.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0.1s to 600.0s	1.0	s	Real time
d1-69	0xD145	Time for decelerating to stop upon undervoltage	0.0s to 300.0s	20.0	s	Real time
d1-70	0xD146	Voltage hysteresis for undervoltage recovery	1 V to 100 V	30	V	Real time
d1-71	0xD147	Waiting time for recovering from undervoltage (V/f)	0.0s to 100.0s	0.5	s	At stop
d1-72	0xD148	Minimum frequency of undervoltage suppression (vector)	0.00 Hz to 10.00 Hz	3.00	Hz	Real time
d1-73	0xD149	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 Hz to 10.00 Hz	3.00	Hz	Real time
d1-74	0xD14A	Undervoltage suppression overspeed detection time	0 ms to 10000 ms	50	ms	Real time
d1-75	0xD14B	Undervoltage suppression overspeed detection threshold	0% to 100%	20	%	Real time
d1-77	0xD14D	Stall detection	0: Disable 1: Enable	0	-	Real time
d1-78	0xD14E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real time
d1-79	0xD14F	Stall fault detection time	0.0s to 65.0s	2.0	s	Real time
d1-80	0xD150	Stall fault detection frequency	0.0% to 600.0%	6.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-81	0xD151	Detection time for three-phase output loss	0.0s to 5.0s	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	0.0s to 10.0s	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	0.00s to 1.00s	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	Single phase loss detection time	0.05s to 650.00s	0.20	s	Real time
d1-91	0xD15B	Runaway protection time for asynchronous motor in SVC	0.05s to 0.50s	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
d2-00	0xD200	V/f curve type	0: V/f line 1: Multi-point 10: Decoupled V/f 11: V/f semi-separation mode	0	-	At stop
d2-01	0xD201	Multi-point curve selection	0: Three-point curve	0	-	Real time
d2-02	0xD202	Frequency point 1 of multi-point V/f curve	0.0 Hz 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 Hz	0.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 point 2 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
d2-10	0xD20A	Voltage point 3 of 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 400.0%	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 ms to 1000 ms	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 Hz to 50.0 Hz	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d2-30	0xD21E	Frequency for activating field weakening for overcurrent suppression	60% to 500%	100	%	Real time
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: Inactive 1: Active	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d2-48	0xD230	Voltage source in V/f decoupled mode	0: d2-49 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
d2-49	0xD231	Digital reference of V/f decoupled voltage	0 V to C4-03	0	V	Real time
d2-50	0xD232	Voltage ramp-up time in decoupled V/f	0.0s to 1000.0s	0.0	s	Real time
d2-51	0xD233	Voltage ramp-down time in decoupled V/f	0.0s to 1000.0s	0.0	s	Real time
d2-52	0xD234	RFG time of the frequency in V/f decoupled mode	0: Set to 0 forcibly 1: Preset RFG time	0	-	At stop
d2-53	0xD235	Stop mode in V/f decoupled mode	0: Frequency and voltage reduced to 0 independently 1: Frequency reduced after voltage reduced 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 V/f - MTPA coefficient	0% to 1000%	0	%	Real time
d2-62	0xD23E	Synchronous motor oscillation suppression gain factor 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 linear V/f curve 1: Fixed reactive current of 30% 2: MTPA control	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0.000s to 20.000s	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 calibration coefficient	0.0% to 1000.0%	100.0	%	Real time
d3-08	0xD308	Zero speed Ti calibration 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
d3-10	0xD30A	Low speed Kp calibration factor	0.0% to 1000.0%	100.0	%	Real time
d3-11	0xD30B	Low speed Ti calibration 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 calibration factor	0.0% to 1000.0%	100.0	%	Real time
d3-14	0xD30E	High speed Ti calibration factor	0.0% to 1000.0%	100.0	%	Real time
d3-19	0xD313	Adaptive source of speed loop Kp	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	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 calibration	0.0% to 1000.0%	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d3-24	0xD318	Upper limit of speed loop adaptive calibration	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 loop 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: Inactive 1: Enable Other: B connector	0	-	Real time
d3-34	0xD322	Forced integral source	0: d3-35 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
d3-35	0xD323	Digital reference of forced integral	-800.0 to +800.0	0.0	%	Real time
d3-38	0xD326	Acceleration torque feedforward enable	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 Hz to 10.00 Hz	0.00	Hz	At stop
d3-46	0xD32E	Filter time of frequency reference	0.0 ms to 100.0 ms	0.0	ms	At stop
d3-47	0xD32F	Filter time of feedback frequency	0.0 ms to 100.0 ms	0.0	ms	At stop
d3-48	0xD330	Low-pass filter time of torque current reference	0.0 ms to 100.0 ms	0.0	ms	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d3-55	0xD337	Anti-load disturbance	0: Disable 1: Enable	0	-	Real time
d3-57	0xD339	Anti-load disturbance bandwidth	0.01 Hz to 300.00 Hz	1.00	Hz	Real time
d3-58	0xD33A	Anti-load disturbance coefficient	0.0% to 1000.0%	100.0	%	Real time
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
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
d5-17	0xD511	Demagnetiza-tion current limit	0% to 500%	300	%	Real time
d5-25	0xD519	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	-	Real time
d8-00	0xD800	Control mode	0: SVC 2: V/f	2	-	At stop
d8-01	0xD801	Motor control mode	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
d8-02	0xD802	Startup mode	Ones: Asynchronous motor startup mode 0: Direct start 1: Flying start Tens position: Synchronous motor startup mode 0: Same as the startup mode of the ones position 1: Flying start Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	10	-	At stop
d8-03	0xD803	Flying start mode	0: From the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented flying start	4	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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) mode	0: Coast to stop	0	-	Read-only
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
d8-08	0xD808	Stop mode in torque control mode	0: Coast to stop forcibly 1: Switched to speed 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)	0.00s to 10.00s	0.10	s	At stop
d8-11	0xD80B	Zero speed threshold for stop at synchronous frequency	0.00% to 200.00%	1.00	%	Real time
d8-12	0xD80C	Zero speed judgment time of synchronous frequency	0.00s to 655.35s	2.00	s	At stop
d8-13	0xD80D	Start/Stop frequency follow-up	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
d8-14	0xD80E	Motor direction selection	0: Default direction 1: Opposite direction	0	-	At stop
d8-16	0xD810	Stop delay time	0.00s to 655.35s	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 ms to 30000 ms	1000	ms	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d8-19	0xD813	Pre-excitation current	1 % to 800%	100	%	Real time
d8-20	0xD814	Demagnetiza-tion time	0.00s to 5.00s	0.50	s	Real time
d8-23	0xD817	Starting frequency	0.00 Hz to 10.00 Hz	0.00	Hz	Real time
d8-24	0xD818	Starting frequency hold time	0.0s to 1000.0s	0.0	s	At stop
d8-25	0xD819	DC braking time at start	0.0s to 100.0s	0.0	s	At stop
d8-26	0xD81A	DC braking current at start	0% to 800%	50	%	At stop
d8-27	0xD81B	Starting frequency of DC braking at stop	0.0 Hz to 600.0 Hz	0.0	Hz	Real time
d8-28	0xD81C	Waiting time of DC braking at stop	0.0s to 100.0s	0.0	s	Real time
d8-29	0xD81D	DC braking time at stop	0.0s to 100.0s	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	Overexcitation selection (vector)	0: Inactive 1: Active	0	-	Real time
d8-40	0xD828	Overexcitation current (vector)	0% to 800%	100	%	Real time
d8-41	0xD829	Over-excitation gain (V/f)	0% to 200%	90	%	Real time
d8-61	0xD83D	Active short circuit control	0: Disable 1: Enable Other: B connector	0	-	At stop
d8-62	0xD83E	Delay for entering active short circuit control	0.0 ms to 5000.0 ms	0.0	ms	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d8-63	0xD83F	Hold time of active short circuit control at stop	0.1s to 3600.0s	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: 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: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Auto-tuning mode of high-frequency injection polarity 0: Method 0 1: Method 1 bit8: High-frequency injection search method 0: Disable 1: Enable bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved 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.	Comm. address	Name	Range	Default value	Unit	Change mode
d8-85	0xD855	Low-speed processing method	Ones: Synchronous motor in V/f mode 0: Disable 1: Speed open-loop Tens: Synchronous motor in SVC mode 0: Disable 1: Speed open-loop standard mode 2: Speed open-loop advanced mode Hundreds place: Reluctance motor SVC 0: Disable 1: Speed open-loop standard mode 2: Speed open-loop advanced mode 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	0.00s to 5.00s	0.50	s	Real time
d9-00	0xD900	Maximum motor current	0.0% to 1000.0%	1000.0	%	Real time
d9-01	0xD901	Positive speed permission	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
d9-02	0xD902	Negative speed selection	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-03	0xD903	Digital reference of positive frequency upper limit 1	d9-07 to 800.0%	800.0	%	At stop
d9-04	0xD904	Digital reference of negative 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	1	-	Real time
d9-07	0xD907	Digital reference of positive frequency lower limit 1	0.0 % to d9-03	0.0	%	At stop
d9-08	0xD908	Digital reference of negative frequency lower limit 1	d9-04 to 0.0%	0.0	%	At stop
d9-09	0xD909	Digital reference of torque upper limit 1	0.0% to 800.0%	200.0	%	Real time
d9-10	0xD90A	Digital reference of torque lower limit 1	-800.0% to 0.0%	-200.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-11	0xD90B	Source of torque upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	1	-	Real time
d9-13	0xD90D	Motoring power limit 1	0.0% to 1000.0%	400.0	%	Real time
d9-14	0xD90E	Generating power limit 1	0.0% to 1000.0%	400.0	%	Real time
d9-15	0xD90F	Generating power limit 2	0: Inactive 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 2	0.0% to 800.0%	20.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-33	0xD921	Motor protection	bit0: Reserved bit1: Current control error detection 0: Disable 1: Enable bit2: Motor step loss error detection 0: Disable 1: Enable bit3: Reserved bit4: Demagnetization protection for permanent magnet synchronous motor 0: Disable 1: Enable bit5: Runaway protection 0: Disable 1: Enable bit6: Speed reversal protection 0: Disable 1: Enable bit7: Reserved bit8: Motor parameter error check 0: Disable 1: Enable bit9: Single phase output loss detection 0: Disable 1: Enable bit10: Demagnetization protection of reluctance motor with field strengthening 0: Disable 1: Enable bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0687	-	Real time
d9-35	0xD923	Overspeed protection	0: Disable 1: Enable	1	-	Real time
d9-36	0xD924	Overspeed protection time	0.0s to 60.0s	0.5	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-39	0xD927	Excessive speed deviation protection time	0.0s to 60.0s	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	0.00s to 5.00s	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 pre-alarm 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
d9-52	0xD934	Overvoltage suppression overspeed detection time	0 ms to 10000 ms	50	ms	Real time
d9-53	0xD935	Overvoltage suppression overspeed detection threshold	0% to 100%	20	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-54	0xD936	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector mode 0: Disable 1: Enable bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0003	-	Real time
d9-55	0xD937	Voltage threshold for overvoltage suppression	600.0 V to A3-57	770.0	V	Real time
d9-56	0xD938	Effective voltage threshold for overvoltage suppression	600.0 V~A4-38	740.0	V	Read-only
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
d9-63	0xD93F	Response to undervoltage	0: Not act 1: Suppress undervoltage 2: Decelerate to stop 3: Undervoltage suppression with time limit setting	3	-	Real time
d9-64	0xD940	Voltage threshold for undervoltage suppression	A3-55 to 500.0 V	430.0	V	Real time
d9-65	0xD941	Actual effective voltage threshold for undervoltage suppression	A4-35 to 500.0 V	430.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0.1s to 600.0s	1.0	s	Real time
d9-69	0xD945	Time for decelerating to stop upon undervoltage	0.0s to 300.0s	20.0	s	Real time
d9-70	0xD946	Voltage hysteresis for undervoltage recovery	1 V to 100 V	30	V	Real time
d9-71	0xD947	Waiting time for recovering from undervoltage (V/f)	0.0s to 100.0s	0.5	s	At stop
d9-72	0xD948	Minimum frequency for undervoltage suppression (SVC)	0.00 Hz to 10.00 Hz	3.00	Hz	Real time
d9-73	0xD949	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 Hz to 10.00 Hz	3.00	Hz	Real time
d9-74	0xD94A	Undervoltage suppression overspeed detection time	0 ms to 10000 ms	50	ms	Real time
d9-75	0xD94B	Undervoltage suppression overspeed detection threshold	0% to 100%	20	%	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	0.0s to 65.0s	2.0	s	Real time
d9-80	0xD950	Stall fault detection frequency	0.0% to 600.0%	6.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-81	0xD951	Detection time for three-phase output loss	0.0s to 5.0s	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	0.0s to 10.0s	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	0.00s to 1.00s	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	Single phase loss detection time	0.05s to 650.00s	0.20	s	Real time
d9-91	0xD95B	Runaway protection time for asynchronous motor in SVC	0.05s to 0.50s	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
dA-00	0xDA00	V/f curve type	0: V/f line 1: Multi-point 10: Decoupled V/f 11: V/f semi-separation mode	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 Hz to dA-03	0.0	Hz	Real time
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 Hz	0.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 point 2 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
dA-10	0xDA0A	Voltage point 3 of 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 400.0%	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 ms to 1000 ms	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 Hz to 50.0 Hz	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
dA-30	0xDA1E	Frequency for activating field weakening for overcurrent suppression	60% to 500%	100	%	Real time
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: Inactive 1: Active	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
dA-48	0xDA30	Voltage source in V/f decoupled mode	0: d2-49 2: AI1 3: AI2 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
dA-49	0xDA31	Digital reference of V/f decoupled voltage	0 V to C7-03	0	V	Real time
dA-50	0xDA32	Voltage ramp-up time in decoupled V/f	0.0s to 1000.0s	0.0	s	Real time
dA-51	0xDA33	Voltage ramp-down time in decoupled V/f	0.0s to 1000.0s	0.0	s	Real time
dA-52	0xDA34	RFG time of the frequency in V/f decoupled mode	0: Set to 0 forcibly 1: Preset RFG time	0	-	At stop
dA-53	0xDA35	Stop mode in V/f decoupled mode	0: Frequency and voltage reduced to 0 independently 1: Frequency reduced after voltage reduced 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 V/f - MTPA coefficient	0% to 1000%	0	%	Real time
dA-62	0xDA3E	Synchronous motor oscillation suppression gain factor 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 linear V/f curve 1: Fixed reactive current of 30% 2: MTPA control	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0.000s to 20.000s	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 calibration coefficient	0.0% to 1000.0%	100.0	%	Real time
db-08	0xDB08	Zero speed Ti calibration factor	0.0% to 1000.0%	100.0	%	Real time
db-09	0xDB09	Low speed switchover frequency	0.0% to db-12	10.0	%	Real time
db-10	0xDB0A	Low speed Kp calibration factor	0.0% to 1000.0%	100.0	%	Real time
db-11	0xDB0B	Low speed Ti calibration 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 calibration factor	0.0% to 1000.0%	100.0	%	Real time
db-14	0xDB0E	High speed Ti calibration factor	0.0% to 1000.0%	100.0	%	Real time
db-19	0xDB13	Adaptive source of speed loop Kp	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	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 calibration	0.0% to 1000.0%	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
db-24	0xDB18	Upper limit of speed loop adaptive calibration	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 loop 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: Inactive 1: Enable Other: B connector	0	-	Real time
db-34	0xDB22	Forced integral source	0: db-35 2: AI1 3: AI2 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real time
db-35	0xDB23	Digital reference of forced integral	-800.0 to +800.0	0.0	%	Real time
db-38	0xDB26	Acceleration torque feedforward enable	0: Disable 1: Enable	0	-	Real time
db-39	0xDB27	Acceleration torque feedforward coefficient	0.0%~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 Hz to 10.00 Hz	0.00	Hz	At stop
db-46	0xDB2E	Filter time of frequency reference	0.0 ms to 100.0 ms	0.0	ms	At stop
db-47	0xDB2F	Filter time of feedback frequency	0.0 ms to 100.0 ms	0.0	ms	At stop
db-48	0xDB30	Current filter time of torque reference	0.0 ms to 100.0 ms	0.0	ms	At stop
db-55	0xDB37	Anti-load disturbance	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
db-57	0xDB39	Load observer bandwidth	0.01 Hz to 300.00 Hz	1.00	Hz	Real time
db-58	0xDB3A	Load observation coefficient	0.0% to 1000.0%	100.0	%	Real time
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
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
dd-17	0xDD11	Demagnetiza-tion current limit	0% to 500%	300	%	Real time
dd-25	0xDD19	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	-	Real time
y0-00	0x4000	Control mode	0: SVC 2: V/f	2	-	At stop
y0-01	0x4001	Motor control mode	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
y0-02	0x4002	Startup mode	Ones: Asynchronous motor startup mode 0: Direct start 1: Flying start Tens position: Synchronous motor startup mode 0: Same as the startup mode of the ones position 1: Flying start Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	10	-	At stop
y0-03	0x4003	Flying start mode	0: From the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented flying start	4	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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) mode	0: Coast to stop	0	-	Read-only
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
y0-08	0x4008	Stop mode in torque control mode	0: Coast to stop forcibly 1: Switched to speed 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)	0.00s to 10.00s	0.10	s	At stop
y0-11	0x400B	Zero speed threshold for stop at synchronous frequency	0.00% to 200.00%	1.00	%	Real time
y0-12	0x400C	Zero speed judgment time of synchronous frequency	0.00s to 655.35s	2.00	s	At stop
y0-13	0x400D	Start/Stop frequency follow-up	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
y0-14	0x400E	Motor direction selection	0: Default direction 1: Opposite direction	0	-	At stop
y0-16	0x4010	Stop delay time	0.00s to 655.35s	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 ms to 30000 ms	1000	ms	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y0-19	0x4013	Pre-excitation current	1 % to 800%	100	%	Real time
y0-20	0x4014	Demagnetiza-tion time	0.00s to 5.00s	0.50	s	Real time
y0-23	0x4017	Starting frequency	0.00 Hz to 10.00 Hz	0.00	Hz	Real time
y0-24	0x4018	Starting frequency hold time	0.0s to 1000.0s	0.0	s	At stop
y0-25	0x4019	DC braking time at start	0.0s to 100.0s	0.0	s	At stop
y0-26	0x401A	DC braking current at start	0% to 800%	50	%	At stop
y0-27	0x401B	Starting frequency of DC braking at stop	0.0 Hz to 600.0 Hz	0.0	Hz	Real time
y0-28	0x401C	Waiting time of DC braking at stop	0.0s to 100.0s	0.0	s	Real time
y0-29	0x401D	DC braking time at stop	0.0s to 100.0s	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	Overexcitation selection (vector)	0: Inactive 1: Active	0	-	Real time
y0-40	0x4028	Overexcitation current (vector)	0% to 800%	100	%	Real time
y0-41	0x4029	Over-excitation gain (V/f)	0% to 200%	90	%	Real time
y0-61	0x403D	Active short circuit control	0: Disable 1: Enable Other: B connector	0	-	At stop
y0-62	0x403E	Delay for entering active short circuit control	0.0 ms to 5000.0 ms	0.0	ms	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y0-63	0x403F	Hold time of active short circuit control at stop	0.1s to 3600.0s	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: 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: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Auto-tuning mode of high-frequency injection polarity 0: Method 0 1: Method 1 bit8: High-frequency injection search method 0: Disable 1: Enable bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved 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.	Comm. address	Name	Range	Default value	Unit	Change mode
y0-85	0x4055	Low-speed processing method	Ones: Synchronous motor in V/f mode 0: Disable 1: Speed open-loop Tens: Synchronous motor in SVC mode 0: Disable 1: Speed open-loop standard mode 2: Speed open-loop advanced mode Hundreds place: Reluctance motor SVC 0: Disable 1: Speed open-loop standard mode 2: Speed open-loop advanced mode 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	0.00s to 5.00s	0.50	s	Real time
y1-00	0x4100	Maximum motor current	0.0% to 1000.0%	1000.0	%	Real time
y1-01	0x4101	Positive speed permission	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
y1-02	0x4102	Negative speed selection	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-03	0x4103	Digital reference of positive frequency upper limit 1	y1-07 to 800.0%	800.0	%	At stop
y1-04	0x4104	Digital reference of negative 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	1	-	Real time
y1-07	0x4107	Digital reference of positive frequency lower limit 1	0.0 % to y1-03	0.0	%	At stop
y1-08	0x4108	Digital reference of negative frequency lower limit 1	y1-04 to 0.0%	0.0	%	At stop
y1-09	0x4109	Digital reference of torque upper limit 1	0.0% to 800.0%	200.0	%	Real time
y1-10	0x410A	Digital reference of torque lower limit 1	-800.0% to 0.0%	-200.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-11	0x410B	Source of torque upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	1	-	Real time
y1-13	0x410D	Motoring power limit 1	0.0% to 1000.0%	400.0	%	Real time
y1-14	0x410E	Generating power limit 1	0.0% to 1000.0%	400.0	%	Real time
y1-15	0x410F	Generating power limit 2	0: Inactive 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 2	0.0% to 800.0%	20.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-33	0x4121	Motor protection	bit0: Reserved bit1: Current control error detection 0: Disable 1: Enable bit2: Motor step loss error detection 0: Disable 1: Enable bit3: Reserved bit4: Demagnetization protection for permanent magnet synchronous motor 0: Disable 1: Enable bit5: Runaway protection 0: Disable 1: Enable bit6: Speed reversal protection 0: Disable 1: Enable bit7: Reserved bit8: Motor parameter error check 0: Disable 1: Enable bit9: Single phase output loss detection 0: Disable 1: Enable bit10: Demagnetization protection of reluctance motor with field strengthening 0: Disable 1: Enable bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0687	-	Real time
y1-35	0x4123	Overspeed protection	0: Disable 1: Enable	1	-	Real time
y1-36	0x4124	Overspeed protection time	0.0s to 60.0s	0.5	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-39	0x4127	Excessive speed deviation protection time	0.0s to 60.0s	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	0.00s to 5.00s	0.50	s	Real time
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 pre-alarm 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
y1-52	0x4134	Overvoltage suppression overspeed detection time	0 ms to 10000 ms	50	ms	Real time
y1-53	0x4135	Overvoltage suppression overspeed detection threshold	0% to 100%	20	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-54	0x4136	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector mode 0: Disable 1: Enable bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0003	-	Real time
y1-55	0x4137	Voltage threshold for overvoltage suppression	600.0 V to A3-57	770.0	V	Real time
y1-56	0x4138	Effective voltage threshold for overvoltage suppression	600.0 V~A4-38	740.0	V	Read-only
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 3: Undervoltage suppression with time limit setting	3	-	Real time
y1-64	0x4140	Voltage threshold for undervoltage suppression	A3-55 to 500.0 V	430.0	V	Real time
y1-65	0x4141	Actual effective voltage threshold for undervoltage suppression	A4-35 to 500.0 V	430.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-66	0x4142	Undervoltage suppression Kp adjustment	0% to 1000%	100	%	Real time
y1-67	0x4143	Undervoltage suppression Ki adjustment	0% to 1000%	100	%	Real time
y1-68	0x4144	Maximum operating time during undervoltage suppression	0.1s to 600.0s	1.0	s	Real time
y1-69	0x4145	Time for decelerating to stop upon undervoltage	0.0s to 300.0s	20.0	s	Real time
y1-70	0x4146	Voltage hysteresis for undervoltage recovery	1 V to 100 V	30	V	Real time
y1-71	0x4147	Waiting time for recovering from undervoltage (V/f)	0.0s to 100.0s	0.5	s	At stop
y1-72	0x4148	Minimum frequency for undervoltage suppression (SVC)	0.00 Hz to 10.00 Hz	3.00	Hz	Real time
y1-73	0x4149	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 Hz to 10.00 Hz	3.00	Hz	Real time
y1-74	0x414A	Undervoltage suppression overspeed detection time	0 ms to 10000 ms	50	ms	Real time
y1-75	0x414B	Undervoltage suppression overspeed detection threshold	0% to 100%	20	%	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	0.0s to 65.0s	2.0	s	Real time
y1-80	0x4150	Stall fault detection frequency	0.0% to 600.0%	6.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-81	0x4151	Detection time for three-phase output loss	0.0s to 5.0s	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	0.0s to 10.0s	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	0.00s to 1.00s	0.05	s	Real time
y1-88	0x4158	Detection threshold for current control fault	0.0% to 200.0%	25.0	%	Real time
y1-89	0x4159	Single phase loss detection time	0.05s to 650.00s	0.20	s	Real time
y1-91	0x415B	Runaway protection time for asynchronous motor in SVC	0.05s to 0.50s	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
y2-00	0x4200	V/f curve type	0: V/f line 1: Multi-point 10: Decoupled V/f 11: V/f semi-separation mode	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 Hz 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 Hz	0.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 point 2 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
y2-10	0x420A	Voltage point 3 of 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
y2-15	0x420F	Cutoff frequency of torque boost	0.0% to 400.0%	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 ms to 1000 ms	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 Hz to 50.0 Hz	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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: Inactive 1: Active	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
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y2-48	0x4230	Voltage source in V/f decoupled mode	0: d2-49 2: AI1 3: AI2 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
y2-49	0x4231	Digital reference of V/f decoupled voltage	0 V~CA-03	0	V	Real time
y2-50	0x4232	Voltage ramp-up time in decoupled V/f	0.0s to 1000.0s	0.0	s	Real time
y2-51	0x4233	Voltage ramp-down time in decoupled V/f	0.0s to 1000.0s	0.0	s	Real time
y2-52	0x4234	RFG time of the frequency in V/f decoupled mode	0: Set to 0 forcibly 1: Preset RFG time	0	-	At stop
y2-53	0x4235	Stop mode in V/f decoupled mode	0: Frequency and voltage reduced to 0 independently 1: Frequency reduced after voltage reduced 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 V/f - MTPA coefficient	0% to 1000%	0	%	Real time
y2-62	0x423E	Synchronous motor oscillation suppression gain factor in V/f mode	0% to 500%	100	%	Real time
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 linear V/f curve 1: Fixed reactive current of 30% 2: MTPA control	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0.000s to 20.000s	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 calibration coefficient	0.0% to 1000.0%	100.0	%	Real time
y3-08	0x4308	Zero speed Ti calibration 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 calibration factor	0.0% to 1000.0%	100.0	%	Real time
y3-11	0x430B	Low speed Ti calibration 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 calibration factor	0.0% to 1000.0%	100.0	%	Real time
y3-14	0x430E	High speed Ti calibration factor	0.0% to 1000.0%	100.0	%	Real time
y3-19	0x4313	Adaptive source of speed loop Kp	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	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 calibration	0.0% to 1000.0%	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y3-24	0x4318	Upper limit of speed loop adaptive calibration	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 loop 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: Inactive 1: Enable Other: B connector	0	-	Real time
y3-34	0x4322	Forced integral source	0: y3-35 2: AI1 3: AI2 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real time
y3-35	0x4323	Digital reference of forced integral	-800.0 to +800.0	0.0	%	Real time
y3-38	0x4326	Acceleration torque feedforward enable	0: Disable 1: Enable	0	-	Real time
y3-39	0x4327	Acceleration torque feedforward coefficient	0.0%~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 Hz to 10.00 Hz	0.00	Hz	At stop
y3-46	0x432E	Filter time of frequency reference	0.0 ms to 100.0 ms	0.0	ms	At stop
y3-47	0x432F	Filter time of feedback frequency	0.0 ms to 100.0 ms	0.0	ms	At stop
y3-48	0x4330	Current filter time of torque reference	0.0 ms to 100.0 ms	0.0	ms	At stop
y3-55	0x4337	Anti-load disturbance	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y3-57	0x4339	Load observer bandwidth	0.01 Hz to 300.00 Hz	1.00	Hz	Real time
y3-58	0x433A	Load observation coefficient	0.0% to 1000.0%	100.0	%	Real time
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
y5-17	0x4511	Demagnetiza-tion current limit	0% to 500%	300	%	Real time
y5-25	0x4519	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	-	Real time
y8-00	0x4800	Control mode	0: SVC 2: V/f	2	-	At stop
y8-01	0x4801	Motor control mode	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
y8-02	0x4802	Startup mode	Ones: Asynchronous motor startup mode 0: Direct start 1: Flying start Tens position: Synchronous motor startup mode 0: Same as the startup mode of the ones position 1: Flying start Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	10	-	At stop
y8-03	0x4803	Flying start mode	0: From the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented flying start	4	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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) mode	0: Coast to stop	0	-	Read-only
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: Switched to speed 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)	0.00s to 10.00s	0.10	s	At stop
y8-11	0x480B	Zero speed threshold for stop at synchronous frequency	0.00% to 200.00%	1.00	%	Real time
y8-12	0x480C	Zero speed judgment time of synchronous frequency	0.00s to 655.35s	2.00	s	At stop
y8-13	0x480D	Start/Stop frequency follow-up	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
y8-14	0x480E	Motor direction selection	0: Default direction 1: Opposite direction	0	-	At stop
y8-16	0x4810	Stop delay time	0.00s to 655.35s	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 ms to 30000 ms	1000	ms	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y8-19	0x4813	Pre-excitation current	1 % to 800%	100	%	Real time
y8-20	0x4814	Demagnetiza-tion time	0.00s to 5.00s	0.50	s	Real time
y8-23	0x4817	Starting frequency	0.00 Hz to 10.00 Hz	0.00	Hz	Real time
y8-24	0x4818	Starting frequency hold time	0.0s to 1000.0s	0.0	s	At stop
y8-25	0x4819	DC braking time at start	0.0s to 100.0s	0.0	s	At stop
y8-26	0x481A	DC braking current at start	0% to 800%	50	%	At stop
y8-27	0x481B	Starting frequency of DC braking at stop	0.0 Hz to 600.0 Hz	0.0	Hz	Real time
y8-28	0x481C	Waiting time of DC braking at stop	0.0s to 100.0s	0.0	s	Real time
y8-29	0x481D	DC braking time at stop	0.0s to 100.0s	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
y8-35	0x4823	Current limit during constant current	50.0% to 800.0%	100.0	%	Real time
y8-39	0x4827	Overexcitation selection (vector)	0: Inactive 1: Active	0	-	Real time
y8-40	0x4828	Overexcitation current (vector)	0% to 800%	100	%	Real time
y8-41	0x4829	Over-excitation gain (V/f)	0% to 200%	90	%	Real time
y8-61	0x483D	Active short circuit control	0: Disable 1: Enable Other: B connector	0	-	At stop
y8-62	0x483E	Delay for entering active short circuit control	0.0 ms to 5000.0 ms	0.0	ms	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y8-63	0x483F	Hold time of active short circuit control at stop	0.1s to 3600.0s	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: 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: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Auto-tuning mode of high-frequency injection polarity 0: Method 0 1: Method 1 bit8: High-frequency injection search method 0: Disable 1: Enable bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved 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.	Comm. address	Name	Range	Default value	Unit	Change mode
y8-85	0x4855	Low-speed processing method	Ones: Synchronous motor in V/f mode 0: Disable 1: Speed open-loop Tens: Synchronous motor in SVC mode 0: Disable 1: Speed open-loop standard mode 2: Speed open-loop advanced mode Hundreds place: Reluctance motor SVC 0: Disable 1: Speed open-loop standard mode 2: Speed open-loop advanced mode 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	0.00s to 5.00s	0.50	s	Real time
y9-00	0x4900	Maximum motor current	0.0% to 1000.0%	1000.0	%	Real time
y9-01	0x4901	Positive speed permission	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
y9-02	0x4902	Negative speed selection	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-03	0x4903	Digital reference of positive frequency upper limit 1	y9-07 to 800.0%	800.0	%	At stop
y9-04	0x4904	Digital reference of negative frequency upper limit 1	-800.0 % to 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	1	-	Real time
y9-07	0x4907	Digital reference of positive frequency lower limit 1	0.0 % to y9-03	0.0	%	At stop
y9-08	0x4908	Digital reference of negative frequency lower limit 1	y9-04 to 0.0%	0.0	%	At stop
y9-09	0x4909	Digital reference of torque upper limit 1	0.0% to 800.0%	200.0	%	Real time
y9-10	0x490A	Digital reference of torque lower limit 1	-800.0% to 0.0%	-200.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-11	0x490B	Source of torque upper limit 2	0: 800% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	1	-	Real time
y9-13	0x490D	Motoring power limit 1	0.0% to 1000.0%	400.0	%	Real time
y9-14	0x490E	Generating power limit 1	0.0% to 1000.0%	400.0	%	Real time
y9-15	0x490F	Generating power limit 2	0: Inactive 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 2	0.0% to 800.0%	20.0	%	Real time

Param.	Comm. address	Name	Range	Default value	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 0: Disable 1: Enable bit3: Reserved bit4: Demagnetization protection for permanent magnet synchronous motor 0: Disable 1: Enable bit5: Runaway protection 0: Disable 1: Enable bit6: Speed reversal protection 0: Disable 1: Enable bit7: Reserved bit8: Motor parameter error check 0: Disable 1: Enable bit9: Single phase output loss detection 0: Disable 1: Enable bit10: Demagnetization protection of reluctance motor with field strengthening 0: Disable 1: Enable bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0687	-	Real time
y9-35	0x4923	Overspeed protection	0: Disable 1: Enable	1	-	Real time
y9-36	0x4924	Overspeed protection time	0.0s to 60.0s	0.5	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-39	0x4927	Excessive speed deviation protection time	0.0s to 60.0s	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	0.00s to 5.00s	0.50	s	Real time
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 pre-alarm 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
y9-52	0x4934	Overvoltage suppression overspeed detection time	0 ms to 10000 ms	50	ms	Real time
y9-53	0x4935	Overvoltage suppression overspeed detection threshold	0% to 100%	20	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-54	0x4936	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector mode 0: Disable 1: Enable bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0003	-	Real time
y9-55	0x4937	Voltage threshold for overvoltage suppression	600.0 V to A3-57	770.0	V	Real time
y9-56	0x4938	Effective voltage threshold for overvoltage suppression	600.0 V~A4-38	740.0	V	Read-only
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 3: Undervoltage suppression with time limit setting	3	-	Real time
y9-64	0x4940	Voltage threshold for undervoltage suppression	A3-55 to 500.0 V	430.0	V	Real time
y9-65	0x4941	Actual effective voltage threshold for undervoltage suppression	A4-35 to 500.0 V	430.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-66	0x4942	Undervoltage suppression Kp adjustment	0% to 1000%	100	%	Real time
y9-67	0x4943	Undervoltage suppression Ki adjustment	0% to 1000%	100	%	Real time
y9-68	0x4944	Maximum operating time during undervoltage suppression	0.1s to 600.0s	1.0	s	Real time
y9-69	0x4945	Time for decelerating to stop upon undervoltage	0.0s to 300.0s	20.0	s	Real time
y9-70	0x4946	Voltage hysteresis for undervoltage recovery	1 V to 100 V	30	V	Real time
y9-71	0x4947	Waiting time for recovering from undervoltage (V/f)	0.0s to 100.0s	0.5	s	At stop
y9-72	0x4948	Minimum frequency for undervoltage suppression (SVC)	0.00 Hz to 10.00 Hz	3.00	Hz	Real time
y9-73	0x4949	Minimum frequency hysteresis for undervoltage suppression (SVC)	0.00 Hz to 10.00 Hz	3.00	Hz	Real time
y9-74	0x494A	Undervoltage suppression overspeed detection time	0 ms to 10000 ms	50	ms	Real time
y9-75	0x494B	Undervoltage suppression overspeed detection threshold	0% to 100%	20	%	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	0.0s to 65.0s	2.0	s	Real time
y9-80	0x4950	Stall fault detection frequency	0.0% to 600.0%	6.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-81	0x4951	Detection time for three-phase output loss	0.0s to 5.0s	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	0.0s to 10.0s	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	0.00s to 1.00s	0.05	s	Real time
y9-88	0x4958	Detection threshold for current control fault	0.0% to 200.0%	25.0	%	Real time
y9-89	0x4959	Single phase loss detection time	0.05s to 650.00s	0.20	s	Real time
y9-91	0x495B	Runaway protection time for asynchronous motor in SVC	0.05s to 0.50s	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
yA-00	0x4A00	V/f curve type	0: V/f line 1: Multi-point 10: Decoupled V/f 11: V/f semi-separation mode	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 Hz 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 Hz	0.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 point 2 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
yA-10	0x4A0A	Voltage point 3 of 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 400.0%	100.0	%	Real time
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 ms to 1000 ms	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 Hz to 50.0 Hz	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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
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: Inactive 1: Active	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
yA-48	0x4A30	Voltage source in V/f decoupled mode	0: d2-49 2: AI1 3: AI2 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
yA-49	0x4A31	Digital reference of V/f decoupled voltage	0 V to Cd-03	0	V	Real time
yA-50	0x4A32	Voltage ramp-up time in decoupled V/f	0.0s to 1000.0s	0.0	s	Real time
yA-51	0x4A33	Voltage ramp-down time in decoupled V/f	0.0s to 1000.0s	0.0	s	Real time
yA-52	0x4A34	RFG time of the frequency in V/f decoupled mode	0: Set to 0 forcibly 1: Preset RFG time	0	-	At stop
yA-53	0x4A35	Stop mode in V/f decoupled mode	0: Frequency and voltage reduced to 0 independently 1: Frequency reduced after voltage reduced 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 V/f - MTPA coefficient	0% to 1000%	0	%	Real time
yA-62	0x4A3E	Synchronous motor oscillation suppression gain factor 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 linear V/f curve 1: Fixed reactive current of 30% 2: MTPA control	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0.000s to 20.000s	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 calibration coefficient	0.0% to 1000.0%	100.0	%	Real time
yb-08	0x4B08	Zero speed Ti calibration factor	0.0% to 1000.0%	100.0	%	Real time
yb-09	0x4B09	Low speed switchover frequency	0.0% to yb-12	10.0	%	Real time
yb-10	0x4B0A	Low speed Kp calibration factor	0.0% to 1000.0%	100.0	%	Real time
yb-11	0x4B0B	Low speed Ti calibration 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 calibration factor	0.0% to 1000.0%	100.0	%	Real time
yb-14	0x4B0E	High speed Ti calibration factor	0.0% to 1000.0%	100.0	%	Real time
yb-19	0x4B13	Adaptive source of speed loop Kp	0: Inactive 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	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 calibration	0.0% to 1000.0%	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
yb-24	0x4B18	Upper limit of speed loop adaptive calibration	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 loop 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: Inactive 1: Enable Other: B connector	0	-	Real time
yb-34	0x4B22	Forced integral source	0: yb-35 2: AI1 3: AI2 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	0	-	Real time
yb-35	0x4B23	Digital reference of forced integral	-800.0 to +800.0	0.0	%	Real time
yb-38	0x4B26	Acceleration torque feedforward enable	0: Disable 1: Enable	0	-	Real time
yb-39	0x4B27	Acceleration torque feedforward coefficient	0.0%~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 Hz to 10.00 Hz	0.00	Hz	At stop
yb-46	0x4B2E	Filter time of frequency reference	0.0 ms to 100.0 ms	0.0	ms	At stop
yb-47	0x4B2F	Filter time of feedback frequency	0.0 ms to 100.0 ms	0.0	ms	At stop
yb-48	0x4B30	Current filter time of torque reference	0.0 ms to 100.0 ms	0.0	ms	At stop
yb-55	0x4B37	Anti-load disturbance	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
yb-57	0x4B39	Load observer bandwidth	0.01 Hz to 300.00 Hz	1.00	Hz	Real time
yb-58	0x4B3A	Load observation coefficient	0.0% to 1000.0%	100.0	%	Real time
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
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
yd-17	0x4D11	Demagnetiza-tion current limit	0% to 500%	300	%	Real time
yd-25	0x4D19	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 Continued	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-00	0xE000	DI1 function selection	Continued 38: PID integral pause 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-01	0xE001	DI2 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause Continued	4	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-01	0xE001	DI2 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	4	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-02	0xE002	DI3 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause Continued	9	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-02	0xE002	DI3 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	9	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-03	0xE003	DI4 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause	12	-	At stop

Continued

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-03	0xE003	DI4 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	12	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-04	0xE004	DI5 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause Continued	13	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-04	0xE004	DI5 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	13	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-10	0xE00A	VDI1 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause Continued	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-10	0xE00A	VDI1 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-11	0xE00B	VDI2 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause Continued	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-11	0xE00B	VDI2 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-12	0xE00C	VDI3 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause Continued	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-12	0xE00C	VDI3 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-13	0xE00D	VDI4 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause	0	-	At stop

Continued

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-13	0xE00D	VDI4 function selection	Continued 39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-14	0xE00E	VDI5 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-14	0xE00E	VDI5 function selection	39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-15	0xE00F	VDI6 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: Jog 2 (JOG2) of terminal start/stop module A 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 (controlled by terminals) 11: External fault NO input 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Acceleration/ Deceleration selection terminal 1 17: Acceleration/ Deceleration selection terminal 2 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 25: Counter input 26: Counter reset 27: Length count input 28: Length reset 29: Torque control inhibited 32: Immediate DC braking 33: External fault NC input 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 38: PID integral pause	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-15	0xE00F	VDI6 function selection	39: Main/auxiliary frequency switchover 41: Motor selection terminal 1 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/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: Jog 2(JOG2) of terminal start/stop module B 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: Operation enable (all modes) 78: Forward run permission 79: Reverse run permission 80: RFG input set to zero	0	-	At stop
E0-16	0xE010	DI input filter time 1	0.000s to 1.000s	0.010	s	Real time
E0-17	0xE011	DI input filter time 2	0.000s to 1.000s	0.010	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-18	0xE012	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: DI3 filter time 0: Filter time 1 1: Filter time 2 bit3: DI4 filter time 0: Filter time 1 1: Filter time 2 bit4: DI5 filter time 0: Filter time 1 1: Filter time 2 bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Real time
E0-19	0xE013	Step value of frequency adjusted by terminal functioning as UP/DOWN keys	0.001–65.535 Hz/s	1.000	Hz/s	Real time
E0-20	0xE014	DI1 switch-on delay	0.0s to 3600.0s	0.0	s	At stop
E0-21	0xE015	DI1 switch-off delay	0.0s to 3600.0s	0.0	s	At stop
E0-22	0xE016	DI2 switch-on delay	0.0s to 3600.0s	0.0	s	At stop
E0-23	0xE017	DI2 switch-off delay	0.0s to 3600.0s	0.0	s	At stop
E0-24	0xE018	DI3 switch-on delay	0.0s to 3600.0s	0.0	s	At stop
E0-25	0xE019	DI3 switch-off delay	0.0s to 3600.0s	0.0	s	At stop
E0-26	0xE01A	DI4 switch-on delay	0.0s to 3600.0s	0.0	s	At stop
E0-27	0xE01B	DI4 switch-off delay	0.0s to 3600.0s	0.0	s	At stop
E0-28	0xE01C	DI5 switch-on delay	0.0s to 3600.0s	0.0	s	At stop
E0-29	0xE01D	DI5 switch-off delay	0.0s to 3600.0s	0.0	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-50	0xE032	VDI1 source	1: Force value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 14: DI4 15: DI5/HDI 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 27: IO card 1 - DI1 28: IO card 1 - DI2 30: IO card 2 - DI1 31: IO card 2 - DI2 51: RO1 55: DO1 59: FMR 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO6	1	-	At stop
E0-51	0xE033	VDI2 source	1: Force value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 14: DI4 15: DI5/HDI 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 27: IO card 1 - DI1 28: IO card 1 - DI2 30: IO card 2 - DI1 31: IO card 2 - DI2 51: RO1 55: DO1 59: FMR 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO7	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-52	0xE034	VDI3 source	1: Force value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 14: DI4 15: DI5/HDI 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 27: IO card 1 - DI1 28: IO card 1 - DI2 30: IO card 2 - DI1 31: IO card 2 - DI2 51: RO1 55: DO1 59: FMR 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO8	1	-	At stop
E0-53	0xE035	VDI4 source	1: Force value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 14: DI4 15: DI5/HDI 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 27: IO card 1 - DI1 28: IO card 1 - DI2 30: IO card 2 - DI1 31: IO card 2 - DI2 51: RO1 55: DO1 59: FMR 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO9	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-54	0xE036	VDI5 source	1: Force value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 14: DI4 15: DI5/HDI 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 27: IO card 1 - DI1 28: IO card 1 - DI2 30: IO card 2 - DI1 31: IO card 2 - DI2 51: RO1 55: DO1 59: FMR 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO10	1	-	At stop
E0-55	0xE037	VDI6 source	1: Force value 4: AI1 5: AI2 11: DI1 12: DI2 13: DI3 14: DI4 15: DI5/HDI 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 27: IO card 1 - DI1 28: IO card 1 - DI2 30: IO card 2 - DI1 31: IO card 2 - DI2 51: RO1 55: DO1 59: FMR 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO11	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-56	0xE038	Set DI value to forced value	bit0: DI1 0: Hardware 1: Force value bit1: DI2 0: Hardware 1: Force value bit2: DI3 0: Hardware 1: Force value bit3: DI4 0: Hardware 1: Force value bit4: DI5 0: Hardware 1: Force value bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-57	0xE039	Force DI data	bit0: DI1 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 0: Low level 1: High level bit3: DI4 setting 0: Low level 1: High level bit4: DI5 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDI1 setting 0: Low level 1: High level bit11: VDI2 setting 0: Low level 1: High level bit12: VDI3 setting 0: Low level 1: High level bit13: VDI4 setting 0: Low level 1: High level bit14: VDI5 setting 0: Low level 1: High level bit15: VDI6 setting 0: Low level 1: High level	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-58	0xE03A	DI active mode selection	bit0: DI1 active mode 0: Active high 1: Active low bit1: DI2 active mode 0: Active high 1: Active low bit2: DI3 active mode 0: Active high 1: Active low bit3: DI4 active mode 0: Active high 1: Active low bit4: DI5 active mode 0: Active high 1: Active low bit5: Reserved 0: Active high 1: Active low bit6: Reserved 0: Active high 1: Active low bit7: Reserved 0: Active high 1: Active low bit8: Reserved 0: Active high 1: Active low bit9: Reserved 0: Active high 1: Active low bit10: VDI1 active mode 0: Active high 1: Active low bit11: VDI2 active mode 0: Active high 1: Active low bit12: VDI3 active mode 0: Active high 1: Active low bit13: VDI4 active mode 0: Active high 1: Active low bit14: VDI5 active mode 0: Active high 1: Active low bit15: VDI6 active mode 0: Active high 1: Active low	0x0	-	Real time
E0-59	0xE03B	DI detection signal type selection	0: DC and AC detection 1: DC detection 2: AC detection	0	-	Real time

Param.	Comm. address	Name	Range	Default value	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 arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) 24: Cumulative power-on time arrival Continued	2	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-00	0xE100	RO1 function selection	Continued 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	2	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-04	0xE104	DO1 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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) Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-04	0xE104	DO1 function selection	Continued 23: Zero-speed running 2 (output generated at stop) 24: Cumulative power-on time arrival 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-08	0xE108	FMR (HDO) function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-08	0xE108	FMR (HDO) function selection	Continued 24: Cumulative power-on time arrival 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-10	0xE10A	VDO1 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-10	0xE10A	VDO1 function selection	Continued 24: Cumulative power-on time arrival 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-11	0xE10B	VDO2 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) 24: Cumulative power-on time arrival Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-11	0xE10B	VDO2 function selection	Continued 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-12	0xE10C	VDO3 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) 24: Cumulative power-on time arrival Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-12	0xE10C	VDO3 function selection	Continued 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-13	0xE10D	VDO4 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-13	0xE10D	VDO4 function selection	Continued 24: Cumulative power-on time arrival 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-14	0xE10E	VDO5 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-14	0xE10E	VDO5 function selection	Continued 24: Cumulative power-on time arrival 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-15	0xE10F	VDO6 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) 24: Cumulative power-on time arrival Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-15	0xE10F	VDO6 function selection	Continued 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time
E1-16	0xE110	RO1 switch-on delay	0.0s to 3600.0s	0.0	s	Real time
E1-17	0xE111	RO1 switch-off delay	0.0s to 3600.0s	0.0	s	Real time
E1-24	0xE118	DO1 output switch-on delay	0.0s to 3600.0s	0.0	s	Real time
E1-25	0xE119	DO1 output switch-off delay	0.0s to 3600.0s	0.0	s	Real time
E1-32	0xE120	FMR switch-on delay	0.0s to 3600.0s	0.0	s	Real time
E1-33	0xE121	FMR switch-off delay	0.0s to 3600.0s	0.0	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 0: Output function 1: Forced value bit9: Reserved bit10: VDO1 output source 0: Output function 1: Forced value bit11: VDO2 output source 0: Output function 1: Forced value bit12: VDO3 output source 0: Output function 1: Forced value bit13: VDO4 output source 0: Output function 1: Forced value bit14: VDO5 output source 0: Output function 1: Forced value bit15: VDO6 output source 0: Output function 1: Forced value	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-37	0xE125	Force value of DO/RO/VDO	bit0: RO setting 0: Low level 1: High level bit1: Reserved bit2: Reserved bit3: Reserved bit4: DO setting 0: Low level 1: High level bit5: Reserved bit6: Reserved bit7: Reserved bit8: FMR output source 0: Low level 1: High level bit9: Reserved bit10: VDO1 setting 0: Low level 1: High level bit11: VDO2 setting 0: Low level 1: High level bit12: VDO3 setting 0: Low level 1: High level bit13: VDO4 setting 0: Low level 1: High level bit14: VDO5 setting 0: Low level 1: High level bit15: VDO6 setting 0: Low level 1: High level	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-38	0xE126	DO/RO/VDO terminal polarity selection	bit0: RO 0: Positive logic 1: Negative logic bit1: Reserved bit2: Reserved bit3: Reserved bit4: DO 0: Positive logic 1: Negative logic bit5: Reserved bit6: Reserved bit7: Reserved bit8: FMR output source 0: Positive logic 1: Negative logic bit9: Reserved bit10: VDO1 0: Positive logic 1: Negative logic bit11: VDO2 0: Positive logic 1: Negative logic bit12: VDO3 0: Positive logic 1: Negative logic bit13: VDO4 0: Positive logic 1: Negative logic bit14: VDO5 0: Positive logic 1: Negative logic bit15: VDO6 0: Positive logic 1: Negative logic	0x0	-	Real time
E2-07	0xE207	AI1 gain	-10.00 to +10.00	1.00	-	Real time
E2-08	0xE208	AI1 offset	-10.00 V to 10.00 V	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	0.00s to 10.00s	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 V	8.00	V	Real time
E2-15	0xE20F	Lower limit of AI1 input protection	0.00 V 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 V to 10.00 V	0.00	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E2-18	0xE212	AI2 denoising threshold	0.0% to 100.0%	0.0	%	Real time
E2-19	0xE213	AI2 filter time	0.00s to 10.00s	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 V	8.00	V	Real time
E2-24	0xE218	Lower limit of AI2 input protection	0.00 V~E2-23	2.00	V	Real time
E2-34	0xE222	AI input protection time	0.00s to 1.00s	0.01	s	Real time
E2-35	0xE223	High level threshold when AI is used as DI	5.5 V to 9.0 V	7.0	V	Real time
E2-36	0xE224	Low level threshold when AI is used as DI	1.0 V to 4.5 V	3.0	V	Real time
E2-37	0xE225	Inversion calculation of AI curve absolute value	Ones: AI1 selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Tens: AI2 selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Hundreds: MD-BP-M potentiometer selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Thousands: Reserved Ten-thousands: Reserved	0	-	Real time

Param.	Comm. address	Name	Range	Default value	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 place: MD-BP-M potentiometer 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) Thousands: Reserved	0x321	-	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: Selection when MD- BP-M potentiometer value < minimum input value 0: Minimum value 1: 0.0% Thousands: Reserved	0x0	-	Real time
E2-40	0xE228	Minimum input of AI curve 1	-10.00 V~E2-42	0.00	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 V	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 V~E2-46	0.00	V	Real time
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 V	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 V~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 V	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 V~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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 V	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
E2-60	0xE23C	Minimum input of AI curve 5	-10.00 V~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 V	10.00	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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°C to 100°C	75	°C	Real time
E2-75	0xE24B	AI2 temperature mode - Motor overtempera-ture pre-alarm threshold	0°C to E2-76	110	°C	Real time
E2-76	0xE24C	AI2 temperature mode - Motor overtempera-ture protection threshold	E2-75 to 200 °C	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: MD-BP-M potentiometer source 0: Hardware sampling 1: Forced value Thousands: Reserved Ten-thousands: Reserved	0	-	At stop
E2-82	0xE252	AI1 forced value	-10.00 V to 10.00 V	0.00	V	Real time
E2-83	0xE253	AI2 forced value	-10.00 V to 10.00 V	0.00	V	Real time
E2-84	0xE254	Setpoint of MD-BP-M potentiometer	-10.00 V to 10.00 V	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E2-97	0xE261	Bus voltage threshold for AI hardware sampling upon power-off	40.0%~70.0 %	60.0	%	Real time
E2-98	0xE262	AI hardware sampling state	0: Normal sampling 1: Stop sampling	0	-	Read-only
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 rotational 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 place: AO selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	0	-	Real time
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	Minimum input of AO curve	-800.00% to E3-07	0.0	%	Real time
E3-06	0xE306	Percentage corresponding to the minimum input of AO curve	0.00 V to 10.00 V	0.00	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E3-07	0xE307	Maximum input of AO curve	E3-05 to 800.0%	100.0	%	Real time
E3-08	0xE308	Percentage corresponding to the maximum input of AO curve	0.00 V to 10.00 V	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 V to 10.00 V	0.00	V	Real time
E3-26	0xE31A	AO hardware source	Ones place: 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 V to 10.00 V	0.00	V	Real time
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: Inhibited 1: Enable Other: B connector	0	-	Read-only
E4-02	0xE402	HDI hardware source	0: Hardware sampling 1: Forced value	0	-	Real time
E4-03	0xE403	HDI forced value	0.00 kHz to 20.00 kHz	1.00	kHz	Real time
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 kHz 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 kHz	20.00	kHz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 kHz~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 kHz	20.00	kHz	Real time
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	0.00s to 10.00s	0.10	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E4-33	0xE421	Inversion calculation of HDI curve absolute value	Ones: HDI 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted 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
E5-00	0xE500	FM multi-functional terminal output selection	0: HDO pulse output (FMP) 1: Switch 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 rotational 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 %~E5-05	0.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 place: HDO selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	0	-	Real time
E5-12	0xE50C	HDO hardware source	Ones place: HDO selection 0: Output function 1: Force 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 kHz to 100.00 kHz	50.00	kHz	Real time
E6-00	0xE600	Set length	0–65535 m	1000	m	Real time
E6-01	0xE601	Actual length	0–65535 m	0	m	Read-only
E6-02	0xE602	Number of pulses per meter	0.1 to 6553.5	100.0	-	Real time
E6-03	0xE603	Set count value	0 to 65535	1000	-	Real time
E6-04	0xE604	Specified count value	0 to 65535	1000	-	Real time
E6-05	0xE605	Actual count	0 to 65535	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
EA-00	0xEA00	Set DI value to forced value	bit0: DI1 0: Hardware 1: Force value bit1: DI2 0: Hardware 1: Force value bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	At stop
EA-01	0xEA01	Force DI data	bit0: DI1 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Real time
EA-02	0xEA02	DI1 switch-on delay	0.0s to 3600.0s	0.0	s	At stop
EA-03	0xEA03	DI1 switch-off delay	0.0s to 3600.0s	0.0	s	At stop
EA-04	0xEA04	DI2 switch-on delay	0.0s to 3600.0s	0.0	s	At stop
EA-05	0xEA05	DI2 switch-off delay	0.0s to 3600.0s	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
EA-09	0xEA09	DI input filter time 1	0.000s to 1.000s	0.010	s	Real time
EA-10	0xEA0A	DI input filter time 2	0.000s to 1.000s	0.010	s	Real time
EA-16	0xEA10	DO1 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) 24: Cumulative power-on time arrival Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
EA-16	0xEA10	DO1 function selection	Continued 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
EA-17	0xEA11	RO1 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) 24: Cumulative power-on time arrival 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
EA-17	0xEA11	RO1 function selection	Continued 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time
EA-18	0xEA12	DO/RO output source	bit0: RO output source 0: Output function 1: Forced value bit1: RO output source 0: Output function 1: Forced value bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
EA-19	0xEA13	Forced DO/RO data	bit0: DO reference 0: Low level 1: High level bit1: RO 0: Low level 1: High level bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved 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: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Real time
EA-21	0xEA15	DO1 switch-on delay	0.0s to 3600.0s	0.0	s	Real time
EA-22	0xEA16	DO1 switch-off delay	0.0s to 3600.0s	0.0	s	Real time
EA-23	0xEA17	RO1 switch-on delay	0.0s to 3600.0s	0.0	s	Real time
EA-24	0xEA18	RO1 switch-off delay	0.0s to 3600.0s	0.0	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
EA-25	0xEA19	Forced output state of DO/RO upon communica-tion disconnection	bit0: DO disconnection forced output 0: Low level 1: High level bit1: RO disconnection forced output 0: Low level 1: High level bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved 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 V to 10.00 V	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 V to 10.00 V	0.00	V	Real time
EA-38	0xEA26	AI1 denoising threshold	0.0% to 100.0%	0.0	%	Real time
EA-39	0xEA27	AI1 filter time	0.00s to 10.00s	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 V	8.00	V	Real time
EA-44	0xEA2C	Lower limit of AI1 input protection	0.00 V~EA-43	2.00	V	Real time
EA-45	0xEA2D	AI input protection time	0.00s to 1.00s	0.01	s	Real time
EA-46	0xEA2E	High level threshold when AI is used as DI	5.5 V to 9.0 V	7.0	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
EA-47	0xEA2F	Low level threshold when AI is used as DI	1.0 V to 4.5 V	3.0	V	Real time
EA-48	0xEA30	AI polarity selection	Ones: AI1 selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted 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 V~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
EA-53	0xEA35	Maximum input of AI curve 1	EA-51 to 10.00 V	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 V~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 V	10.00	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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: Inactive 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 °C	130	°C	Real time
EA-61	0xEA3D	RTD over-temperature pre-alarm threshold	0 °C~EA-60	110	°C	Real time
EA-62	0xEA3E	RTD temperature threshold	0°C to 100°C	75	°C	Real time
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 (Address: 0x7323) 13: Motor rotational 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 place: AO selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 %~EA-76	0.0	%	Real time
EA-75	0xEA4B	Percentage corresponding to the minimum input of AO curve	0.00 V to 10.00 V	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 V to 10.00 V	10.00	V	Real time
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 V to 10.00 V	0.00	V	Real time
EA-81	0xEA51	AO hardware source	Ones place: 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 V to 10.00 V	0.00	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Eb-00	0xEB00	Set DI value to forced value	bit0: DI1 0: Hardware 1: Force value bit1: DI2 0: Hardware 1: Force value bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	At stop
Eb-01	0xEB01	Force DI data	bit0: DI1 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Real time
Eb-02	0xEB02	DI1 switch-on delay	0.0s to 3600.0s	0.0	s	At stop
Eb-03	0xEB03	DI1 switch-off delay	0.0s to 3600.0s	0.0	s	At stop
Eb-04	0xEB04	DI2 switch-on delay	0.0s to 3600.0s	0.0	s	At stop
Eb-05	0xEB05	DI2 switch-off delay	0.0s to 3600.0s	0.0	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Real time
Eb-09	0xEB09	DI input filter time 1	0.000s to 1.000s	0.010	s	Real time
Eb-10	0xEB0A	DI input filter time 2	0.000s to 1.000s	0.010	s	Real time

Param.	Comm. address	Name	Range	Default value	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 arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) 24: Cumulative power-on time arrival Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Eb-16	0xEB10	DO1 function selection	Continued 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Eb-17	0xEB11	RO1 function selection	0: No output 1: AC drive in operation 2: Fault 3: Frequency-level detection FDT1 4: Frequency arrival 5: Zero-speed running (no output at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8: Set count value arrival 9: Specified count value arrival 10: Length arrival 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 generated at stop) Continued	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Eb-17	0xEB11	RO1 function selection	Continued 24: Cumulative power-on time arrival 25: Frequency level detection (FDT2) 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current limit exceeded 37: Frequency lower limit reached (having 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: Reserved Other: B connector	0	-	Real time
Eb-18	0xEB12	DO/RO output source	bit0: RO output source 0: Output function 1: Forced value bit1: RO output source 0: Output function 1: Forced value bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Eb-19	0xEB13	Forced DO/RO data	bit0: DO reference 0: Low level 1: High level bit1: RO 0: Low level 1: High level bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved 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: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Real time
Eb-21	0xEB15	DO1 switch-on delay	0.0s to 3600.0s	0.0	s	Real time
Eb-22	0xEB16	DO1 switch-off delay	0.0s to 3600.0s	0.0	s	Real time
Eb-23	0xEB17	RO1 switch-on delay	0.0s to 3600.0s	0.0	s	Real time
Eb-24	0xEB18	RO1 switch-off delay	0.0s to 3600.0s	0.0	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Eb-25	0xEB19	Forced output state of DO/RO upon communica-tion disconnection	bit0: DO disconnection forced output 0: Low level 1: High level bit1: RO disconnection forced output 0: Low level 1: High level bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved 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 V to 10.00 V	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 V to 10.00 V	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	0.00s to 10.00s	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 V	8.00	V	Real time
Eb-44	0xEB2C	Lower limit of AI1 input protection	0.00 V to Eb-43	2.00	V	Real time
Eb-45	0xEB2D	AI input protection time	0.00s to 1.00s	0.01	s	Real time
Eb-46	0xEB2E	High level threshold when AI is used as DI	5.5 V to 9.0 V	7.0	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Eb-47	0xEB2F	Low level threshold when AI is used as DI	1.0 V to 4.5 V	3.0	V	Real time
Eb-48	0xEB30	AI polarity selection	Ones: AI1 selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	0	-	Real time
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 V 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 V	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 V 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 V	10.00	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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: Inactive 1: PT100 2: PT1000 3: KTY84-130 4: PTC130 (Single-conductor) 5: PTC130 (three-conductor)	0	-	Real time
Eb-60	0xEB3C	RTD over-temperature protection threshold	Eb-61 to 200°C	130	°C	Real time
Eb-61	0xEB3D	RTD over-temperature pre-alarm threshold	0°C to Eb-60	110	°C	Real time
Eb-62	0xEB3E	RTD temperature threshold	0°C to 100°C	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 (Address: 0x7324) 13: Motor rotational 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 place: AO selection 0: Normal 1: Absolute value 2: Inverted 3: Absolute value inverted Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten-thousands: Reserved	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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
Eb-74	0xEB4A	Minimum input of AO curve	-800.0% to Eb-76	0.0	%	Real time
Eb-75	0xEB4B	Percentage corresponding to the minimum input of AO curve	0.00 V to 10.00 V	0.00	V	Real time
Eb-76	0xEB4C	Maximum input of AO curve	Eb-74 to 800.0%	100.0	%	Real time
Eb-77	0xEB4D	Percentage corresponding to the maximum input of AO curve	0.00 V to 10.00 V	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 V to 10.00 V	0.00	V	Real time
Eb-81	0xEB51	AO hardware source	Ones place: 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 V to 10.00 V	0.00	V	Real time
EE-00	0xEE00	AI1 measured voltage 1	-10.000 V to +10.000 V	2.000	V	At stop
EE-01	0xEE01	AI1 displayed voltage 1	-10.000 V to +10.000 V	2.000	V	At stop
EE-02	0xEE02	AI1 measured voltage 2	-10.000 V to +10.000 V	8.000	V	At stop
EE-03	0xEE03	AI1 displayed voltage 2	-10.000 V to +10.000 V	8.000	V	At stop
EE-04	0xEE04	AI2 measured voltage 1	-10.000 V to +10.000 V	2.000	V	At stop
EE-05	0xEE05	AI2 displayed voltage 1	-10.000 V to +10.000 V	2.000	V	At stop
EE-06	0xEE06	AI2 measured voltage 2	-10.000 V to +10.000 V	8.000	V	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
EE-07	0xEE07	AI2 displayed voltage 2	-10.000 V to +10.000 V	8.000	V	At stop
EE-08	0xEE08	Measured voltage 1 of potentiometer MD-BP-M	-10.000 V to +10.000 V	2.000	V	At stop
EE-09	0xEE09	Displayed voltage 1 of potentiometer MD-BP-M	-10.000 V to +10.000 V	2.000	V	At stop
EE-10	0xEE0A	Measured voltage 2 of potentiometer MD-BP-M	-10.000 V to +10.000 V	8.000	V	At stop
EE-11	0xEE0B	Displayed voltage 2 of potentiometer MD-BP-M	-10.000 V to +10.000 V	8.000	V	At stop
EE-12	0xEE0C	AO1 target voltage 1	-10.000 V to +10.000 V	2.000	V	At stop
EE-13	0xEE0D	AO1 measured voltage 1	-10.000 V to +10.000 V	2.000	V	At stop
EE-14	0xEE0E	AO1 target voltage 2	-10.000 V to +10.000 V	8.000	V	At stop
EE-15	0xEE0F	AO1 measured voltage 2	-10.000 V to +10.000 V	8.000	V	At stop
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	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-01	0x8101	Protective action selection 1 upon fault	Ones: Drive overload (E010) 0: Coast to stop Ones: Motor overload (E011) 0: Coast to stop Hundreds position: 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 position: Output phase loss (E013) 0: Coast to stop	0x0	-	Real time
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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.	Comm. address	Name	Range	Default value	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.	Comm. address	Name	Range	Default value	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) 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 Continued	0x00DD	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-05	0x8105	Protective action selection 5 upon fault	Continued Hundreds: Three phase loss (E030) 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: PID feedback loss fault (E031) 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	0x00DD	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-06	0x8106	Protection action selection 6 upon fault	Ones: Parameter reset fault (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) 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 position: Motor speed error (E043) 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	0x0D0D	-	Real time

Param.	Comm. address	Name	Range	Default value	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 auto-tuning of magnetic pole position (E051) 0: Coast to stop	0x0	-	Read-only
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	-	Read-only
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.	Comm. address	Name	Range	Default value	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-11	0x810B	Protection action selection 11 upon fault	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Time 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) 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	0x0F00	-	Real time

Param.	Comm. address	Name	Range	Default value	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) 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 Continued	0xDDDD	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-12	0x810C	Protective action selection 12 upon fault	Continued Hundreds position: Motor pre-overload (E111) 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 position: Module pre-overheat (E114) 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	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-14	0x810E	Protective action selection 14 upon fault	Ones: AI/HDI disconnection (Err154) 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 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: Automatic fault reset failure (E159) 0: Coast to stop	0x00DF	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-15	0x810F	Protective action selection 15 upon fault	Ones: Modbus communication timeout fault (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: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x0333	-	Real time
H1-16	0x8110	Protective action selection 16 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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-17	0x8111	Protective action selection 17 upon fault	Ones: Inobus protocol fault (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: Speed tracking fault (E192) 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: Undervoltage suppression limit arrival (E193) 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.	Comm. address	Name	Range	Default value	Unit	Change mode
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) 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: Parameter fault in power loss area of the power unit EEPROM (Err188) 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: Junction temperature fault (E191) 0: Coast to stop	0x000D	-	Real time

Param.	Comm. address	Name	Range	Default value	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 to 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: 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: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-32	0x8120	Setting of the 2nd group of fault codes	0.0 to 255.9	0.0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-33	0x8121	Setting of the 2nd group of fault level	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: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-34	0x8122	Setting of 3rd group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-35	0x8123	Setting of the 3rd group of fault level	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: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-36	0x8124	Setting of the 4th group of fault codes	0.0 to 255.9	0.0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-37	0x8125	Setting of the 4th group of fault level	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: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-38	0x8126	Setting of 5th group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-39	0x8127	Setting of the 5th group of fault level	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: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-40	0x8128	Setting of the 6th group of fault codes	0.0 to 255.9	0.0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-41	0x8129	Setting of the 6th group of fault level	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: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-42	0x812A	Setting of the 7th group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-43	0x812B	Setting of the 7th group of fault level	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: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-44	0x812C	Setting of the 8th group of fault codes	0.0 to 255.9	0.0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-45	0x812D	Setting of the 8th group of fault level	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: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-46	0x812E	Setting of the 9th group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-47	0x812F	Setting of the 9th group of fault level	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: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-48	0x8130	Setting of the 10th group of fault codes	0.0 to 255.9	0.0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-49	0x8131	Setting of the 10th group of fault level	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: Alarm 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-60	0x813C	Operation 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	Specified safety 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
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H2-00	0x8200	External fault 1 (NO) source	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-01	0x8201	External fault 2 (NC) source	0: Inactive 1: Active Other: B connector	1	-	Real time
H2-02	0x8202	Source of user-defined fault 1	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-03	0x8203	Source of user-defined fault 2	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-04	0x8204	Source of user-defined fault 3	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-05	0x8205	Source of user-defined fault 4	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-06	0x8206	Source of user-defined fault 5	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-07	0x8207	Source of user-defined fault 6	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-08	0x8208	Source of user-defined fault 7	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-09	0x8209	Source of user-defined fault 8	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-10	0x820A	Source of user-defined alarm 1	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-11	0x820B	Source of user-defined alarm 2	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-12	0x820C	Source of user-defined alarm 3	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-13	0x820D	Source of user-defined alarm 4	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-14	0x820E	Source of user-defined alarm 5	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-15	0x820F	Source of user-defined alarm 6	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-16	0x8210	Source of user-defined alarm 7	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-17	0x8211	Source of user-defined alarm 8	0: Inactive 1: Active Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H3-00	0x8300	Automatic fault reset selection	0: Disable 1: Enable	1	-	Real time
H3-01	0x8301	Number of automatic fault resets	0 to 100	0	-	Real time
H3-02	0x8302	Time interval of automatic fault reset	0.1s to 600.0s	1.0	s	Real time
H3-03	0x8303	Automatic reset disabled upon manual reset	0: Automatic reset canceled 1: Automatic reset continued	1	-	Real time
H3-04	0x8304	Time interval for resetting the fault reset count	0 to 6000	10	min.	Real time
H3-05	0x8305	Cumulative number of fault resets	0 to 65535	0	-	Read-only
H3-06	0x8306	Action when automatic fault reset count exhausted	0: Restore the number of automatic fault resets 1: The number of automatic fault resets is not restored.	0	-	Real time
H3-07	0x8307	Fault flag output selection	0: No output during automatic fault reset 1: Output during automatic fault reset	0	-	Real time
H3-13	0x830D	Fault code 1 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-14	0x830E	Fault code 2 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-15	0x830F	Fault code 3 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-16	0x8310	Fault code 4 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-17	0x8311	Fault code 5 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-18	0x8312	Fault code 6 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H3-19	0x8313	Fault code 7 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-20	0x8314	Fault code 8 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-21	0x8315	Fault code 9 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-22	0x8316	Fault code 10 that inhibits automatic reset	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 after automatic fault reset	0.0s to 600.0s	0.5	s	Real time
H3-30	0x831E	Flying start applied forcibly after automatic fault reset	0: Flying start is not applied forcibly after automatic fault reset. 1: Flying start is applied forcibly after automatic fault reset.	0	-	Real time
H3-31	0x831F	Faults allowing restart upon automatic reset	0: White list 1: Black list	1	-	Real time
H3-34	0x8322	Specified 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
H6-00	0x8600	Fault code 1 in fault log 1	0.0 to 6553.5	0.0	-	Read-only
H6-06	0x8606	Fault code 2 in fault log 1	0.0 to 6553.5	0.0	-	Read-only
H6-12	0x860C	Fault code 3 in fault log 1	0.0 to 6553.5	0.0	-	Read-only
H6-18	0x8612	Fault code 4 in fault log 1	0.0 to 6553.5	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-24	0x8618	Fault code 5 in fault log 1	0.0 to 6553.5	0.0	-	Read-only
H6-30	0x861E	Fault code 6 in fault log 1	0.0 to 6553.5	0.0	-	Read-only
H6-36	0x8624	Frequency upon fault log 1	0.0 to 6553.5	0.0	Hz	Read-only
H6-37	0x8625	Current upon fault log 1	0.00 to 655.35	0.00	A	Read-only
H6-38	0x8626	Bus voltage upon fault log 1	0.0 V to 6553.5 V	0.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-39	0x8627	Input terminal status upon the latest fault	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 status 0: Low level 1: High level bit3: DI4 status 0: Low level 1: High level bit4: DI5 status 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-40	0x8628	Output terminal status upon the latest fault	bit0: RO state 0: Low level 1: High level bit1: FMR status 0: Low level 1: High level bit2: DO status 0: Low level 1: High level bit3: Reserved 0: Low level 1: High level bit4: Reserved 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 status 0: Low level 1: High level bit11: VDO2 status 0: Low level 1: High level bit12: VDO3 status 0: Low level 1: High level bit13: VDO4 status 0: Low level 1: High level bit14: VDO5 status 0: Low level 1: High level bit15: VDO6 status 0: Low level 1: High level	0x0	-	Read-only
H6-41	0x8629	Drive state upon fault log 1	0 to 65535	0	-	Read-only
H6-42	0x862A	Power-on time upon fault log 1	0 min. to 65535 min.	0	min.	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-43	0x862B	Operating time upon fault log 1	0.0 min. to 6553.5 min.	0.0	min.	Read-only
H6-44	0x862C	Status word 1 upon fault log 1	bit0: Ready for 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: Inactive 1: Active bit10: Target speed reach 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active 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	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-45	0x862D	Status word 2 upon the latest fault	bit0: Self-test 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: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jogging 0: Inactive 1: Active bit11: Jogging 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: Custom state 1 0: Inactive 1: Active	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-46	0x862E	Command word upon the latest fault	bit0: ON_OFF1 (start/stop) 0: Stop 1: Run 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 1: RFG output set to 0 forcibly bit5: RFG paused 0: Normal 1: RFG pause bit6: RFG input forced to 0 0: Normal 1: RFG input set to 0 forcibly 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: Inversion disabled 1: Inversion bit12: Start signal 0: Inactive 1: Active Bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-47	0x862F	RFG status word upon the latest fault	bit0 to bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 to bit3: Acceleration/ Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 to bit9: Acceleration/ Deceleration state of previous cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 to bit11: Arc state of previous cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read-only
H7-00	0x8700	Fault code 1 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Read-only
H7-06	0x8706	Fault code 2 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Read-only
H7-12	0x870C	Fault code 3 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Read-only
H7-18	0x8712	Fault code 4 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Read-only
H7-24	0x8718	Fault code 5 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Read-only
H7-30	0x871E	Fault code 6 of the 2nd latest fault	0.0 to 6553.5	0.0	-	Read-only
H7-36	0x8724	Frequency upon fault log 2	0.0 to 6553.5	0.0	Hz	Read-only
H7-37	0x8725	Current upon fault log 2	0.00 to 655.35	0.00	A	Read-only
H7-38	0x8726	Bus voltage upon fault log 2	0.0 V to 6553.5 V	0.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-39	0x8727	Input terminal status upon the 2nd latest fault	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 status 0: Low level 1: High level bit3: DI4 status 0: Low level 1: High level bit4: DI5 status 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-40	0x8728	Output terminal status upon the 2nd latest fault	bit0: RO state 0: Low level 1: High level bit1: FMR status 0: Low level 1: High level bit2: DO status 0: Low level 1: High level bit3: Reserved 0: Low level 1: High level bit4: Reserved 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 status 0: Low level 1: High level bit11: VDO2 status 0: Low level 1: High level bit12: VDO3 status 0: Low level 1: High level bit13: VDO4 status 0: Low level 1: High level bit14: VDO5 status 0: Low level 1: High level bit15: VDO6 status 0: Low level 1: High level	0x0	-	Read-only
H7-41	0x8729	Drive state upon fault log 2	0 to 65535	0	-	Read-only
H7-42	0x872A	Power-on time upon fault log 2	0 min. to 65535 min.	0	min.	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-43	0x872B	Operating time upon fault log 2	0.0 min. to 6553.5 min.	0.0	min.	Read-only
H7-44	0x872C	Status word 1 upon the 2nd latest fault	bit0: Ready for 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: Inactive 1: Active bit10: Target speed reach 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active 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	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-45	0x872D	Status word 2 upon the 2nd latest fault	bit0: Self-test 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: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jogging 0: Inactive 1: Active bit11: Jogging 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: Custom state 1 0: Inactive 1: Active	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-46	0x872E	Command word upon the 2nd latest fault	bit0: ON_OFF1 (start/stop) 0: Stop 1: Run 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 1: RFG output set to 0 forcibly bit5: RFG paused 0: Normal 1: RFG pause bit6: RFG input forced to 0 0: Normal 1: RFG input set to 0 forcibly 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: Inversion disabled 1: Inversion bit12: Start signal 0: Inactive 1: Active Bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-47	0x872F	RFG status word upon the 2nd latest fault	bit0 to bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 to bit3: Acceleration/ Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 to bit9: Acceleration/ Deceleration state of previous cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 to bit11: Arc state of previous cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read-only
H8-00	0x8800	Fault code 1 in fault log 3	0.0 to 6553.5	0.0	-	Read-only
H8-06	0x8806	Fault code 2 in fault log 3	0.0 to 6553.5	0.0	-	Read-only
H8-12	0x880C	Fault code 3 in fault log 3	0.0 to 6553.5	0.0	-	Read-only
H8-18	0x8812	Fault code 4 in fault log 3	0.0 to 6553.5	0.0	-	Read-only
H8-24	0x8818	Fault code 5 in fault log 3	0.0 to 6553.5	0.0	-	Read-only
H8-30	0x881E	Fault code 6 in fault log 3	0.0 to 6553.5	0.0	-	Read-only
H8-36	0x8824	Frequency upon fault log 3	0.0 to 6553.5	0.0	Hz	Read-only
H8-37	0x8825	Current upon fault log 3	0.00 to 655.35	0.00	A	Read-only
H8-38	0x8826	Bus voltage upon fault log 3	0.0 V to 6553.5 V	0.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-39	0x8827	Input terminal status upon the 3rd latest fault	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 status 0: Low level 1: High level bit3: DI4 status 0: Low level 1: High level bit4: DI5 status 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-40	0x8828	Output terminal status upon the 3rd latest fault	bit0: RO state 0: Low level 1: High level bit1: FMR status 0: Low level 1: High level bit2: DO status 0: Low level 1: High level bit3: Reserved 0: Low level 1: High level bit4: Reserved 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 status 0: Low level 1: High level bit11: VDO2 status 0: Low level 1: High level bit12: VDO3 status 0: Low level 1: High level bit13: VDO4 status 0: Low level 1: High level bit14: VDO5 status 0: Low level 1: High level bit15: VDO6 status 0: Low level 1: High level	0x0	-	Read-only
H8-41	0x8829	Drive state upon fault log 3	0 to 65535	0	-	Read-only
H8-42	0x882A	Power-on time upon fault log 3	0 min. to 65535 min.	0	min.	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-43	0x882B	Operating time upon fault log 3	0.0 min. to 6553.5 min.	0.0	min.	Read-only
H8-44	0x882C	Status word 1 upon the 3rd latest fault	bit0: Ready for 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: Inactive 1: Active bit10: Target speed reach 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active 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	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-45	0x882D	Status word 2 upon fault log 3	bit0: Self-test 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: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jogging 0: Inactive 1: Active bit11: Jogging 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: Custom state 1 0: Inactive 1: Active	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-46	0x882E	Command word upon the third latest fault	bit0: ON_OFF1 (start/stop) 0: Stop 1: Run 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 1: RFG output set to 0 forcibly bit5: RFG paused 0: Normal 1: RFG pause bit6: RFG input forced to 0 0: Normal 1: RFG input set to 0 forcibly 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: Inversion disabled 1: Inversion bit12: Start signal 0: Inactive 1: Active Bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-47	0x882F	RFG status word upon the third latest fault	bit0 to bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 to bit3: Acceleration/ Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 to bit9: Acceleration/ Deceleration state of previous cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 to bit11: Arc state of previous cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read-only
H9-00	0x8900	Fault code 1 in fault log 4	0.0 to 6553.5	0.0	-	Read-only
H9-06	0x8906	Fault code 2 in fault log 4	0.0 to 6553.5	0.0	-	Read-only
H9-12	0x890C	Fault code 3 in fault log 4	0.0 to 6553.5	0.0	-	Read-only
H9-18	0x8912	Fault code 4 in fault log 4	0.0 to 6553.5	0.0	-	Read-only
H9-24	0x8918	Fault code 5 in fault log 4	0.0 to 6553.5	0.0	-	Read-only
H9-30	0x891E	Fault code 6 in fault log 4	0.0 to 6553.5	0.0	-	Read-only
H9-36	0x8924	Frequency upon fault log 4	0.0 to 6553.5	0.0	Hz	Read-only
H9-37	0x8925	Current upon fault log 4	0.00 to 655.35	0.00	A	Read-only
H9-38	0x8926	Bus voltage upon fault log 4	0.0 V to 6553.5 V	0.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-39	0x8927	Input terminal status upon the 4th latest fault	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 status 0: Low level 1: High level bit3: DI4 status 0: Low level 1: High level bit4: DI5 status 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-40	0x8928	Output terminal status upon the fourth latest fault	bit0: RO state 0: Low level 1: High level bit1: FMR status 0: Low level 1: High level bit2: DO status 0: Low level 1: High level bit3: Reserved 0: Low level 1: High level bit4: Reserved 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 status 0: Low level 1: High level bit11: VDO2 status 0: Low level 1: High level bit12: VDO3 status 0: Low level 1: High level bit13: VDO4 status 0: Low level 1: High level bit14: VDO5 status 0: Low level 1: High level bit15: VDO6 status 0: Low level 1: High level	0x0	-	Read-only
H9-41	0x8929	Drive state upon the fourth latest fault	0 to 65535	0	-	Read-only
H9-42	0x892A	Power-on time upon fault log 4	0 min. to 65535 min.	0	min.	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-43	0x892B	Operating time upon fault log 4	0.0 min. to 6553.5 min.	0.0	min.	Read-only
H9-44	0x892C	Status word 1 upon the fourth latest fault	bit0: Ready for 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: Inactive 1: Active bit10: Target speed reach 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active 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	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-45	0x892D	Status word 2 upon fault log 4	bit0: Self-test 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: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jogging 0: Inactive 1: Active bit11: Jogging 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: Custom state 1 0: Inactive 1: Active	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-46	0x892E	Command word upon the fourth latest fault	bit0: ON_OFF1 (start/stop) 0: Stop 1: Run 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 1: RFG output set to 0 forcibly bit5: RFG paused 0: Normal 1: RFG pause bit6: RFG input forced to 0 0: Normal 1: RFG input set to 0 forcibly 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: Inversion disabled 1: Inversion bit12: Start signal 0: Inactive 1: Active Bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-47	0x892F	RFG status word upon the fourth latest fault	bit0 to bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 to bit3: Acceleration/ Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 to bit9: Acceleration/ Deceleration state of previous cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 to bit11: Arc state of previous cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read-only
HA-00	0x8A00	Fault code 1 in fault log 5	0.0 to 6553.5	0.0	-	Read-only
HA-06	0x8A06	Fault code 2 in fault log 5	0.0 to 6553.5	0.0	-	Read-only
HA-12	0x8A0C	Fault code 3 in fault log 5	0.0 to 6553.5	0.0	-	Read-only
HA-18	0x8A12	Fault code 4 in fault log 5	0.0 to 6553.5	0.0	-	Read-only
HA-24	0x8A18	Fault code 5 in fault log 5	0.0 to 6553.5	0.0	-	Read-only
HA-30	0x8A1E	Fault code 6 in fault log 5	0.0 to 6553.5	0.0	-	Read-only
HA-36	0x8A24	Frequency upon fault log 5	0.0 to 6553.5	0.0	Hz	Read-only
HA-37	0x8A25	Current upon fault log 5	0.00 to 655.35	0.00	A	Read-only
HA-38	0x8A26	Bus voltage upon fault log 5	0.0 V to 6553.5 V	0.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-39	0x8A27	Input terminal status upon the 5th latest fault	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 status 0: Low level 1: High level bit3: DI4 status 0: Low level 1: High level bit4: DI5 status 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-40	0x8A28	Output terminal status upon the fifth latest fault	bit0: RO state 0: Low level 1: High level bit1: FMR status 0: Low level 1: High level bit2: DO status 0: Low level 1: High level bit3: Reserved 0: Low level 1: High level bit4: Reserved 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 status 0: Low level 1: High level bit11: VDO2 status 0: Low level 1: High level bit12: VDO3 status 0: Low level 1: High level bit13: VDO4 status 0: Low level 1: High level bit14: VDO5 status 0: Low level 1: High level bit15: VDO6 status 0: Low level 1: High level	0x0	-	Read-only
HA-41	0x8A29	Drive state upon fault log 5	0 to 65535	0	-	Read-only
HA-42	0x8A2A	Power-on time upon fault log 5	0 min. to 65535 min.	0	min.	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-43	0x8A2B	Operating time upon fault log 5	0.0 min. to 6553.5 min.	0.0	min.	Read-only
HA-44	0x8A2C	Status word 1 upon the fifth latest fault	bit0: Ready for 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: Inactive 1: Active bit10: Target speed reach 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active 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	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-45	0x8A2D	Status word 2 upon fault log 5	bit0: Self-test 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: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jogging 0: Inactive 1: Active bit11: Jogging 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: Custom state 1 0: Inactive 1: Active	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-46	0x8A2E	Command word upon the fifth latest fault	bit0: ON_OFF1 (start/stop) 0: Stop 1: Run 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 1: RFG output set to 0 forcibly bit5: RFG paused 0: Normal 1: RFG pause bit6: RFG input forced to 0 0: Normal 1: RFG input set to 0 forcibly 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: Inversion disabled 1: Inversion bit12: Start signal 0: Inactive 1: Active Bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-47	0x8A2F	RFG status word upon the fifth latest fault	bit0 to bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 to bit3: Acceleration/ Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 to bit9: Acceleration/ Deceleration state of previous cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 to bit11: Arc state of previous cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read-only
Hb-00	0x8B00	Fault code 1 in fault log 6	0.0 to 6553.5	0.0	-	Read-only
Hb-06	0x8B06	Fault code 2 in fault log 6	0.0 to 6553.5	0.0	-	Read-only
Hb-12	0x8B0C	Fault code 3 in fault log 6	0.0 to 6553.5	0.0	-	Read-only
Hb-18	0x8B12	Fault code 4 in fault log 6	0.0 to 6553.5	0.0	-	Read-only
Hb-24	0x8B18	Fault code 5 in fault log 6	0.0 to 6553.5	0.0	-	Read-only
Hb-30	0x8B1E	Fault code 6 in fault log 6	0.0 to 6553.5	0.0	-	Read-only
Hb-36	0x8B24	Frequency upon fault log 6	0.0 to 6553.5	0.0	Hz	Read-only
Hb-37	0x8B25	Current upon fault log 6	0.00 to 655.35	0.00	A	Read-only
Hb-38	0x8B26	Bus voltage upon fault log 6	0.0 V to 6553.5 V	0.0	V	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-39	0x8B27	Input terminal status upon the sixth latest fault	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 status 0: Low level 1: High level bit3: DI4 status 0: Low level 1: High level bit4: DI5 status 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-40	0x8B28	Output terminal status upon the 6th latest fault	bit0: RO state 0: Low level 1: High level bit1: FMR status 0: Low level 1: High level bit2: DO status 0: Low level 1: High level bit3: Reserved 0: Low level 1: High level bit4: Reserved 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 status 0: Low level 1: High level bit11: VDO2 status 0: Low level 1: High level bit12: VDO3 status 0: Low level 1: High level bit13: VDO4 status 0: Low level 1: High level bit14: VDO5 status 0: Low level 1: High level bit15: VDO6 status 0: Low level 1: High level	0x0	-	Read-only
Hb-41	0x8B29	Drive state upon fault log 6	0 to 65535	0	-	Read-only
Hb-42	0x8B2A	Power-on time upon fault log 6	0 min. to 65535 min.	0	min.	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-43	0x8B2B	Operating time upon fault log 6	0.0 min. to 6553.5 min.	0.0	min.	Read-only
Hb-44	0x8B2C	Status word 1 upon the 6th latest fault	bit0: Ready for 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: Inactive 1: Active bit10: Target speed reach 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active 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	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-45	0x8B2D	Status word 2 upon fault log 6	bit0: Self-test 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: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jogging 0: Inactive 1: Active bit11: Jogging 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: Custom state 1 0: Inactive 1: Active	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-46	0x8B2E	Command word upon the sixth latest fault	bit0: ON_OFF1 (start/stop) 0: Stop 1: Run 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 1: RFG output set to 0 forcibly bit5: RFG paused 0: Normal 1: RFG pause bit6: RFG input forced to 0 0: Normal 1: RFG input set to 0 forcibly 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: Inversion disabled 1: Inversion bit12: Start signal 0: Inactive 1: Active Bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-47	0x8B2F	RFG status word upon the sixth latest fault	bit0 to bit1: Acceleration/ deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 to bit3: Acceleration/ Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 to bit9: Acceleration/ Deceleration state of previous cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 to bit11: Arc state of previous cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read-only
J6-00	0x3600	Fire mode password	0 to 65535	0	-	Real time
J6-01	0x3601	Status of the fire function	0: Fire mode locked 1: Fire mode function unlocked	0	-	Read-only
J6-02	0x3602	Fire mode enable	0: Disable 1: Enable 2: Fire mode test	0	-	Real time
J6-03	0x3603	Operating source in fire mode	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: 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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
J6-11	0x360B	Fire mode frequency source	0: Digital frequency reference in fire mode 1: Frequency filtered value before fire mode applied 2: AI1 3: AI2 8: PID 9: Communication	0	-	At stop
J6-12	0x360C	Fire mode backup frequency source	0: Digital frequency reference in fire mode 1: Filtered frequency value before fire mode applied 2: Maximum operating frequency	0	-	At stop
J6-13	0x360D	Frequency set by digital setting	0.00 Hz to A2-17	50.00	Hz	Real time
J6-16	0x3610	Final operating frequency filter time before fire mode applied	0.0 to 300.0	1.0	-	Real time
J6-17	0x3611	Time for determining effective operating frequency before the fire	0.0s to 6000.0s	30.0	s	Real time
J6-20	0x3614	Automatic fault reset count in fire mode	0 to 100	80	-	Real time
J6-21	0x3615	Delay for automatic fault reset in fire mode	0.0s to 300.0s	1.0	s	Real time
J6-22	0x3616	Waiting time for fault waiting to be reset 1	0s~J6-23	10	s	Real time
J6-23	0x3617	Fault waiting time 2 in fire mode	J6-22~3600s	30	s	Real time
J6-27	0x361B	Enable bypass function in fire mode	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
J6-28	0x361C	Fire bypass delay	0.0s to 300.0s	5.0	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
J6-31	0x361F	Cumulative number of fire accidents	0 to 65535	0	-	Read-only
J6-33	0x3621	Cumulative bypass events upon fire accidents	0 to 65535	0	-	Read-only
n0-11	0x200B	Communication status	0 to 65535	0	-	Read-only
n0-12	0x200C	Compatible with the old communication address	0: Incompatible 1: Compatible	1	-	At stop
n0-13	0x200D	1000 H speed setting selection	0: Percentage (corresponds to rated frequency/1 decimal place) 1:Percentage (corresponds to rated frequency/2 decimal places) 2: Percentage (corresponds to maximum frequency/2 decimal places)	2	-	At stop
n0-14	0x200E	7310H speed setpoint selection	0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to maximum frequency/ signed 16-bit/2 decimal places) 4: Percentage (corresponds to rated frequency/signed 16-bit/2 decimal places)	1	-	At stop
n0-15	0x200F	Save parameters written through communication (group AE)	0: Inactive 1: Active	0	-	Real time
n0-16	0x2010	Automatic reset of communication fault	0: Inactive 1: Active	1	-	Real time
n0-17	0x2011	Current resolution (U0-04) read through communication	0: 0.01 A 1: 0.1 A	0	-	Real time
n0-56	0x2038	Process data address mapping clear	0: Not applied 1: Clear	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
n1-00	0x2100	Commissioning on the baud rate	9: 115200 bps 12: 500 kbps 16: 1 Mbps	9	-	At stop
n1-02	0x2102	Commissioning address	1 to 127	1	-	At stop
n2-00	0x2200	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
n2-01	0x2201	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
n2-02	0x2202	Modbus local address	1 to 247	1	-	At stop
n2-03	0x2203	Modbus response delay time	0 ms to 20 ms	2	ms	Real time
n2-04	0x2204	Modbus communication timeout time	0.0s to 6000.0s	0.0	s	Real time
n2-20	0x2214	Modbus communication effectiveness	0: Not supported by the current device 1: Active	0	-	Read-only
n3-00	0x2300	CAN communication	0: Not supported by the current device 1: Active	0	-	Read-only
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	-	At stop
n3-03	0x2303	CANopen station number	1 to 127	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
n3-06	0x2306	CANlink 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
n3-07	0x2307	CANlink station number	1 to 63	1	-	At stop
n3-09	0x2309	Number of CAN frames received per unit time	0 to 65535	0	-	Read-only
n3-10	0x230A	Maximum number of errors received through CAN	0 to 65535	0	-	Read-only
n3-11	0x230B	Maximum number of errors transmitted through CAN	0 to 65535	0	-	Read-only
n3-12	0x230C	Number of CAN bus disconnections per unit time	0 to 65535	0	-	Read-only
n3-14	0x230E	CAN communica-tion disconnection coefficient	1 to 15	3	-	At stop
n3-25	0x2319	CANopen mode	0: Default mode 1: Expert mode	0	-	At stop
n3-26	0x231A	CANopen disable time	0 to 65535	0	-	At stop
n3-27	0x231B	CANopen event time	0 to 65535	0	-	At stop
n3-32	0x2320	CANopen NMT length error count	0 to 65535	0	-	Read-only
n3-33	0x2321	CANopen NMT command error count	0 to 65535	0	-	Read-only
n3-34	0x2322	CANopen heartbeat frame length error count	0 to 65535	0	-	Read-only
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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
nE-56	0x2E38	TPDO4-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	Number of valid RPDOs	0x0 to 0xFFFF	0x0	-	Read-only
nE-67	0x2E43	Number of valid TPDOs	0x0 to 0xFFFF	0x0	-	Read-only
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.	Comm. address	Name	Range	Default value	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
o2-00	0x5200	Input of multi-point curve module A	0: Module disabled Others: 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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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
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: Module disabled Others: 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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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.	Comm. address	Name	Range	Default value	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
o3-00	0x5300	Input of word-to-bit function A	0: Inactive Others: K connector	0	-	Real time
o3-01	0x5301	Input of word-to-bit function B	0: Inactive Others: K connector	0	-	Real time
o3-02	0x5302	Input of word-to-bit function C	0: Inactive Others: K connector	0	-	Real time
o3-03	0x5303	Input of word-to-bit function D	0: Inactive Others: K connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-04	0x5304	Direct logic and inverted logic of word-to-bit function A	bit0: bit0 0: no inverse 1: Inverted bit1: bit1 0: no inverse 1: Inverted bit2: bit2 0: no inverse 1: Inverted bit3: bit3 0: no inverse 1: Inverted bit4: bit4 0: no inverse 1: Inverted bit5: bit5 0: no inverse 1: Inverted bit6: bit6 0: no inverse 1: Inverted bit7: bit7 0: no inverse 1: Inverted bit8: bit8 0: no inverse 1: Inverted bit9: bit9 0: no inverse 1: Inverted bit10: bit10 0: no inverse 1: Inverted bit11: bit11 0: no inverse 1: Inverted bit12: bit12 0: no inverse 1: Inverted bit13: bit13 0: no inverse 1: Inverted bit14: bit14 0: no inverse 1: Inverted bit15: bit15 0: no inverse 1: Inverted	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-05	0x5305	Positive and negative logic of word-to-bit function B	bit0: bit0 0: no inverse 1: Inverted bit1: bit1 0: no inverse 1: Inverted bit2: bit2 0: no inverse 1: Inverted bit3: bit3 0: no inverse 1: Inverted bit4: bit4 0: no inverse 1: Inverted bit5: bit5 0: no inverse 1: Inverted bit6: bit6 0: no inverse 1: Inverted bit7: bit7 0: no inverse 1: Inverted bit8: bit8 0: no inverse 1: Inverted bit9: bit9 0: no inverse 1: Inverted bit10: bit10 0: no inverse 1: Inverted bit11: bit11 0: no inverse 1: Inverted bit12: bit12 0: no inverse 1: Inverted bit13: bit13 0: no inverse 1: Inverted bit14: bit14 0: no inverse 1: Inverted bit15: bit15 0: no inverse 1: Inverted	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-06	0x5306	Positive and negative logic of word-to-bit function C	bit0: bit0 0: no inverse 1: Inverted bit1: bit1 0: no inverse 1: Inverted bit2: bit2 0: no inverse 1: Inverted bit3: bit3 0: no inverse 1: Inverted bit4: bit4 0: no inverse 1: Inverted bit5: bit5 0: no inverse 1: Inverted bit6: bit6 0: no inverse 1: Inverted bit7: bit7 0: no inverse 1: Inverted bit8: bit8 0: no inverse 1: Inverted bit9: bit9 0: no inverse 1: Inverted bit10: bit10 0: no inverse 1: Inverted bit11: bit11 0: no inverse 1: Inverted bit12: bit12 0: no inverse 1: Inverted bit13: bit13 0: no inverse 1: Inverted bit14: bit14 0: no inverse 1: Inverted bit15: bit15 0: no inverse 1: Inverted	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-07	0x5307	Positive and negative logic of word-to-bit function D	bit0: bit0 0: no inverse 1: Inverted bit1: bit1 0: no inverse 1: Inverted bit2: bit2 0: no inverse 1: Inverted bit3: bit3 0: no inverse 1: Inverted bit4: bit4 0: no inverse 1: Inverted bit5: bit5 0: no inverse 1: Inverted bit6: bit6 0: no inverse 1: Inverted bit7: bit7 0: no inverse 1: Inverted bit8: bit8 0: no inverse 1: Inverted bit9: bit9 0: no inverse 1: Inverted bit10: bit10 0: no inverse 1: Inverted bit11: bit11 0: no inverse 1: Inverted bit12: bit12 0: no inverse 1: Inverted bit13: bit13 0: no inverse 1: Inverted bit14: bit14 0: no inverse 1: Inverted bit15: bit15 0: no inverse 1: Inverted	0x0	-	Real time
o3-08	0x5308	Bit-to-word module A	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-09	0x5309	Direct logic and inverted logic of bit-to-word module A	bit0: bit0 0: no inverse 1: Inverted bit1: bit1 0: no inverse 1: Inverted bit2: bit2 0: no inverse 1: Inverted bit3: bit3 0: no inverse 1: Inverted bit4: bit4 0: no inverse 1: Inverted bit5: bit5 0: no inverse 1: Inverted bit6: bit6 0: no inverse 1: Inverted bit7: bit7 0: no inverse 1: Inverted bit8: bit8 0: no inverse 1: Inverted bit9: bit9 0: no inverse 1: Inverted bit10: bit10 0: no inverse 1: Inverted bit11: bit11 0: no inverse 1: Inverted bit12: bit12 0: no inverse 1: Inverted bit13: bit13 0: no inverse 1: Inverted bit14: bit14 0: no inverse 1: Inverted bit15: bit15 0: no inverse 1: Inverted	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-10	0x530A	Bit 00 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-11	0x530B	Bit 01 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-12	0x530C	Bit 02 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-13	0x530D	Bit 03 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-14	0x530E	Bit 04 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-15	0x530F	Bit 05 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-16	0x5310	Bit 06 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-17	0x5311	Bit 07 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-18	0x5312	Bit 08 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-19	0x5313	Bit 09 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-20	0x5314	Bit 10 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-21	0x5315	Bit 11 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-22	0x5316	Bit 12 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-23	0x5317	Bit 13 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-24	0x5318	Bit 14 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-25	0x5319	Bit 15 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-26	0x531A	Bit-to-word module B enable	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-27	0x531B	Positive and negative logic selection for bit-to-word module B	bit0: bit0 0: no inverse 1: Inverted bit1: bit1 0: no inverse 1: Inverted bit2: bit2 0: no inverse 1: Inverted bit3: bit3 0: no inverse 1: Inverted bit4: bit4 0: no inverse 1: Inverted bit5: bit5 0: no inverse 1: Inverted bit6: bit6 0: no inverse 1: Inverted bit7: bit7 0: no inverse 1: Inverted bit8: bit8 0: no inverse 1: Inverted bit9: bit9 0: no inverse 1: Inverted bit10: bit10 0: no inverse 1: Inverted bit11: bit11 0: no inverse 1: Inverted bit12: bit12 0: no inverse 1: Inverted bit13: bit13 0: no inverse 1: Inverted bit14: bit14 0: no inverse 1: Inverted bit15: bit15 0: no inverse 1: Inverted	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-28	0x531C	Bit 00 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-29	0x531D	Bit 01 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-30	0x531E	Bit 02 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-31	0x531F	Bit 03 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-32	0x5320	Bit 04 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-33	0x5321	Bit 05 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-34	0x5322	Bit 06 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-35	0x5323	Bit 07 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-36	0x5324	Bit 08 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-37	0x5325	Bit 09 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-38	0x5326	Bit 10 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-39	0x5327	Bit 11 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-40	0x5328	Bit 12 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-41	0x5329	Bit 13 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-42	0x532A	Bit 14 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-43	0x532B	Bit 15 selection of bit-to-word module B	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-44	0x532C	Bit-to-word module C enable	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-45	0x532D	Positive and negative logic selection for bit-to-word module C	bit0: bit0 0: no inverse 1: Inverted bit1: bit1 0: no inverse 1: Inverted bit2: bit2 0: no inverse 1: Inverted bit3: bit3 0: no inverse 1: Inverted bit4: bit4 0: no inverse 1: Inverted bit5: bit5 0: no inverse 1: Inverted bit6: bit6 0: no inverse 1: Inverted bit7: bit7 0: no inverse 1: Inverted bit8: bit8 0: no inverse 1: Inverted bit9: bit9 0: no inverse 1: Inverted bit10: bit10 0: no inverse 1: Inverted bit11: bit11 0: no inverse 1: Inverted bit12: bit12 0: no inverse 1: Inverted bit13: bit13 0: no inverse 1: Inverted bit14: bit14 0: no inverse 1: Inverted bit15: bit15 0: no inverse 1: Inverted	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-46	0x532E	Bit 00 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-47	0x532F	Bit 01 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-48	0x5330	Bit 02 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-49	0x5331	Bit 03 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-50	0x5332	Bit 04 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-51	0x5333	Bit 05 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-52	0x5334	Bit 06 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-53	0x5335	Bit 07 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-54	0x5336	Bit 08 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-55	0x5337	Bit 09 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-56	0x5338	Bit 10 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-57	0x5339	Bit 11 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-58	0x533A	Bit 12 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-59	0x533B	Bit 13 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-60	0x533C	Bit 14 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-61	0x533D	Bit 15 selection of bit-to-word module C	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-62	0x533E	Bit-to-word module D enable	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-63	0x533F	Positive and negative logic selection for bit-to-word module D	bit0: bit0 0: no inverse 1: Inverted bit1: bit1 0: no inverse 1: Inverted bit2: bit2 0: no inverse 1: Inverted bit3: bit3 0: no inverse 1: Inverted bit4: bit4 0: no inverse 1: Inverted bit5: bit5 0: no inverse 1: Inverted bit6: bit6 0: no inverse 1: Inverted bit7: bit7 0: no inverse 1: Inverted bit8: bit8 0: no inverse 1: Inverted bit9: bit9 0: no inverse 1: Inverted bit10: bit10 0: no inverse 1: Inverted bit11: bit11 0: no inverse 1: Inverted bit12: bit12 0: no inverse 1: Inverted bit13: bit13 0: no inverse 1: Inverted bit14: bit14 0: no inverse 1: Inverted bit15: bit15 0: no inverse 1: Inverted	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-64	0x5340	Bit 00 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-65	0x5341	Bit 01 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-66	0x5342	Bit 02 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-67	0x5343	Bit 03 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-68	0x5344	Bit 04 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-69	0x5345	Bit 05 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-70	0x5346	Bit 06 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-71	0x5347	Bit 07 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-72	0x5348	Bit 08 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-73	0x5349	Bit 09 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-74	0x534A	Bit 10 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-75	0x534B	Bit 11 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-76	0x534C	Bit 12 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-77	0x534D	Bit 13 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-78	0x534E	Bit 14 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o3-79	0x534F	Bit 15 selection of bit-to-word module D	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
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: Module disabled Others: K connector	0	-	Real time
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	0: 0 Others: K connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-05	0x5505	High word of word-to-double word module B	0: Module disabled Others: K connector	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	0: 0 Others: K connector	0	-	Real time
o5-09	0x5509	High word of word-to-double word module C	0: Module disabled Others: K connector	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	0: 0 Others: K connector	0	-	Real time
o5-13	0x550D	High word of word-to-double word module D	0: Module disabled Others: K connector	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	0: Module disabled Others: K connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0: Module disabled Others: K connector	0	-	Real time
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	0: Module disabled Others: K connector	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	0: Module disabled Others: K connector	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: Module disabled Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-61	0x553D	Number of decimal places of floating-point connector-to-monitoring parameter module A	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three 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 connector-to-monitoring parameter module A coefficient (divide)	1 to 65535	1	-	Real time
o5-64	0x5540	Floating-point connector-to-monitoring parameter module B input	0: Module disabled Others: F connector	0	-	Real time
o5-65	0x5541	Number of decimal places for floating-point connector-to-monitoring parameter module B	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three decimal places	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 connector-to-monitoring parameter module C input	0: Module disabled Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-69	0x5545	Number of decimal places for floating-point connector-to-monitoring parameter module C	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three decimal places	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 connector-to-monitoring parameter module D input	0: Module disabled Others: F connector	0	-	Real time
o5-73	0x5549	Number of decimal places for floating-point connector-to-monitoring parameter module D	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three decimal places	0	-	Real time
o5-74	0x554A	Floating-point connector-to-monitoring parameter module D coefficient (multiply)	0 to 65535	1	-	Real time
o5-75	0x554B	Floating-point connector-to-monitoring parameter module D coefficient (divide)	1 to 65535	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-76	0x554C	Floating-point connector-to-monitoring parameter module E input	0: Module disabled Others: F connector	0	-	Real time
o5-77	0x554D	Number of decimal places for floating-point connector-to-monitoring parameter module E	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three decimal places	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 connector-to-monitoring parameter module F input	0: Module disabled Others: F connector	0	-	Real time
o5-81	0x5551	Number of decimal places for floating-point connector-to-monitoring parameter module F	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three decimal places	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-84	0x5554	Floating-point connector-to-monitoring parameter module G input	0: Module disabled Others: F connector	0	-	Real time
o5-85	0x5555	Number of decimal places for floating-point connector-to-monitoring parameter module G	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three decimal places	0	-	Real time
o5-86	0x5556	Floating-point connector-to-monitoring parameter module G 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 connector-to-monitoring parameter module H input	0: Module disabled Others: F connector	0	-	Real time
o5-89	0x5559	Number of decimal places for floating-point connector-to-monitoring parameter module H	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three decimal places	0	-	Real time
o5-90	0x555A	Floating-point connector-to-monitoring parameter module H coefficient (multiply)	0 to 65535	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-91	0x555B	Floating-point concatenator-to-monitoring parameter module H coefficient (divide)	1 to 65535	1	-	Real time
o6-00	0x5600	Function of logic AND/OR module A	0: Disable 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 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-02	0x5602	Input 2 of logic AND/OR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-03	0x5603	Input 3 of logic AND/OR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-04	0x5604	Input 4 of logic AND/OR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-05	0x5605	Function of logic AND/OR module B	0: Disable 1: AND 2: OR	0	-	Real time
o6-06	0x5606	Input 1 of logic AND/OR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o6-07	0x5607	Input 2 of logic AND/OR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-08	0x5608	Input 3 of logic AND/OR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-09	0x5609	Input 4 of logic AND/OR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-10	0x560A	Function of logic AND/OR module C	0: Disable 1: AND 2: OR	0	-	Real time
o6-11	0x560B	Input 1 of logic AND/OR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-12	0x560C	Input 2 of logic AND/OR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-13	0x560D	Input 3 of logic AND/OR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o6-14	0x560E	Input 4 of logic AND/OR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-15	0x560F	Function of logic AND/OR module D	0: Disable 1: AND 2: OR	0	-	Real time
o6-16	0x5610	Input 1 of logic AND/OR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-17	0x5611	Input 2 of logic AND/OR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-18	0x5612	Input 3 of logic AND/OR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-19	0x5613	Input 4 of logic AND/OR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-20	0x5614	Function of logic AND/OR module E	0: Disable 1: AND 2: OR	0	-	Real time
o6-21	0x5615	Input 1 of logic AND/OR module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o6-22	0x5616	Input 2 of logic AND/OR module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-23	0x5617	Input 3 of logic AND/OR module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-24	0x5618	Logic AND/OR module F function selection	0: Disable 1: AND 2: OR	0	-	Real time
o6-25	0x5619	Logic AND/OR module F input 1	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-26	0x561A	Logic AND/OR module F input 2	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-27	0x561B	Logic AND/OR module F input 3	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-28	0x561C	Logic AND/OR module G function selection	0: Disable 1: AND 2: OR	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o6-29	0x561D	Logic AND/OR module G input 1	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-30	0x561E	Logic AND/OR module G input 2	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-31	0x561F	Logic AND/OR module G input 3	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-32	0x5620	Logic AND/OR module H function selection	0: Disable 1: AND 2: OR	0	-	Real time
o6-33	0x5621	Logic AND/OR module H input 1	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-34	0x5622	Logic AND/OR module H input 2	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-35	0x5623	Logic AND/OR module H input 3	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o6-80	0x5650	Input of logic NOT module A	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-81	0x5651	Input of logic NOT module B	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-82	0x5652	Input of logic NOT module C	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-83	0x5653	Input of logic NOT module D	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-84	0x5654	Input of logic NOT module E	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-85	0x5655	Input of logic NOT module F	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o6-86	0x5656	Input of logic NOT module G	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o6-87	0x5657	Input of logic NOT module H	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
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 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-02	0x5702	Input 2 of logic XOR/XNOR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-03	0x5703	Function selection for logic XOR/ XNOR module B	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-04	0x5704	Input 1 of logic XOR/XNOR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-05	0x5705	Input 2 of logic XOR/XNOR module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-06	0x5706	Function selection for logic XOR/ XNOR module C	0: Disable 1: XOR 2: XNOR	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o7-07	0x5707	Input 1 of logic XOR/XNOR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-08	0x5708	Input 2 of logic XOR/XNOR module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-09	0x5709	Function of logic XOR/ XNOR module D	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-10	0x570A	Input 1 of logic XOR/XNOR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-11	0x570B	Input 2 of logic XOR/XNOR module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-12	0x570C	Function selection for logic XOR/ XNOR module E	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-13	0x570D	Input 1 of logic XOR/XNOR module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o7-14	0x570E	Input 2 of logic XOR/XNOR module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-15	0x570F	Function selection for logic XOR/ XNOR module F	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-16	0x5710	Input 1 of logic XOR/XNOR module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-17	0x5711	Input 2 of logic XOR/XNOR module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-18	0x5712	Function selection for logic XOR/ XNOR module G	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-19	0x5713	Input 1 of logic XOR/XNOR module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-20	0x5714	Input 2 of logic XOR/XNOR module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-21	0x5715	Function selection for logic XOR/ XNOR module H	0: Disable 1: XOR 2: XNOR	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o7-22	0x5716	Input 1 of logic XOR/XNOR module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o7-23	0x5717	Input 2 of logic XOR/XNOR module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
o8-00	0x5800	Input 1 of ADD/ SUBTRACT module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-01	0x5801	Input 2 of addition/ subtraction module A (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-02	0x5802	Input 3 of addition/ subtraction module A (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-03	0x5803	Input 4 of ADD/ SUBTRACT module A (SUBTRACT)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-04	0x5804	ADD/ SUBTRACT module B input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-05	0x5805	Input 2 of addition/ subtraction module B (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-06	0x5806	Input 3 of addition/ subtraction module B (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-07	0x5807	Input 4 of ADD/ SUBTRACT module B (SUBTRACT)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-08	0x5808	ADD/ SUBTRACT module C input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-09	0x5809	Input 2 of addition/ subtraction module C (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-10	0x580A	Input 3 of addition/ subtraction module C (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-11	0x580B	Input 4 of addition/ subtraction module C (subtraction)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-12	0x580C	ADD/ SUBTRACT module D input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-13	0x580D	Input 2 of addition/ subtraction module D (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-14	0x580E	Input 3 of addition/ subtraction module D (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-15	0x580F	Input 4 of ADD/ SUBTRACT module D (SUBTRACT)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-16	0x5810	ADD/ SUBTRACT module E input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-17	0x5811	ADD/ SUBTRACT module E input 2 (ADD)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-18	0x5812	Input 3 of addition/ subtraction module E (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-19	0x5813	ADD/ SUBTRACT module E input 4 (SUBTRACT)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-20	0x5814	ADD/ SUBTRACT module F input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-21	0x5815	ADD/ SUBTRACT module F input 2 (ADD)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-22	0x5816	Input 3 of addition/ subtraction module F (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-23	0x5817	ADD/ SUBTRACT module F input 4 (SUBTRACT)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-24	0x5818	ADD/ SUBTRACT module G input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-25	0x5819	ADD/ SUBTRACT module G input 2 (ADD)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-26	0x581A	Input 3 of addition/ subtraction module G (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-27	0x581B	ADD/ SUBTRACT module G input 4 (SUBTRACT)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-28	0x581C	ADD/ SUBTRACT module H input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-29	0x581D	ADD/ SUBTRACT module H input 2 (ADD)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-30	0x581E	Input 3 of addition/ subtraction module H (addition)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-31	0x581F	ADD/ SUBTRACT module H input 4 (SUBTRACT)	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-48	0x5830	MULTIPLY/ DIVIDE module A input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-49	0x5831	Input 2 of MULTIPLY/ DIVIDE module A (MULTIPLY)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-50	0x5832	Input 3 of multiplication/ division module A (multiplica-tion)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-51	0x5833	Input 1 of multiplication/ division module B	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-52	0x5834	Input 2 of multiplication/ division module B (multiplica-tion)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-53	0x5835	Input 3 of multiplication/ division module B (division)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-54	0x5836	MULTIPLY/ DIVIDE module C input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-55	0x5837	Input 2 of multiplication/ division module C (multiplica-tion)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-56	0x5838	Input 3 of MULTIPLY/ DIVIDE module C (DIVIDE)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-57	0x5839	MULTIPLY/ DIVIDE module D input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-58	0x583A	Input 2 of multiplication/ division module D (multiplica-tion)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-59	0x583B	Input 3 of MULTIPLY/ DIVIDE module D (DIVIDE)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-60	0x583C	MULTIPLY/ DIVIDE module E input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-61	0x583D	MULTIPLY/ DIVIDE module E input 2 (MULTIPLY)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-62	0x583E	MULTIPLY/ DIVIDE module E input 3 (DIVIDE)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-63	0x583F	MULTIPLY/ DIVIDE module F input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-64	0x5840	MULTIPLY/ DIVIDE module F input 2 (MULTIPLY)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-65	0x5841	MULTIPLY/ DIVIDE module F input 3 (DIVIDE)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-66	0x5842	MULTIPLY/ DIVIDE module G input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-67	0x5843	MULTIPLY/ DIVIDE module G input 2 (MULTIPLY)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-68	0x5844	MULTIPLY/ DIVIDE module G input 3 (DIVIDE)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-69	0x5845	MULTIPLY/ DIVIDE module H input 1	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-70	0x5846	MULTIPLY/ DIVIDE module H input 2 (MULTIPLY)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o8-71	0x5847	MULTIPLY/ DIVIDE module H input 3 (DIVIDE)	0: 1 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-00	0x5900	Input of absolute value module A	0: Module disabled 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-01	0x5901	Input of absolute value module B	0: Module disabled 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o9-02	0x5902	Input of absolute value module C	0: Module disabled 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-03	0x5903	Input of absolute value module D	0: Module disabled 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-04	0x5904	Absolute value module E input	0: Module disabled 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-05	0x5905	Absolute value module F input	0: Module disabled 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-06	0x5906	Absolute value module G input	0: Module disabled 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o9-07	0x5907	Absolute value module H input	0: Module disabled 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-16	0x5910	Function of compare module A	0: Module disabled 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	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-18	0x5912	Input 2 of comparison module A	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	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	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-21	0x5915	Input 1 of comparison module B	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o9-22	0x5916	Input 2 of comparison module B	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	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	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-25	0x5919	Input 1 of comparison module C	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-26	0x591A	Input 2 of comparison module C	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	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	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o9-29	0x591D	Input 1 of comparison module D	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-30	0x591E	Input 2 of comparison module D	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	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	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-33	0x5921	Input 1 of comparison module E	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-34	0x5922	Input 2 of comparison module E	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-35	0x5923	Hysteresis input of comparison module E	0.00 % to 655.35%	0.00	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o9-36	0x5924	Function selection for comparison module F	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-37	0x5925	Comparison module F input 1	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-38	0x5926	Comparison module F input 2	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	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	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-41	0x5929	Comparison module G input 1	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-42	0x592A	Comparison module G input 2	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-45	0x592D	Comparison module H input 1	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-46	0x592E	Comparison module H input 2	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
o9-47	0x592F	Hysteresis input of comparison module H	0.00 % to 655.35%	0.00	%	Real time
oA-00	0x5A00	Input selection for binary selector module A	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: 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 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-02	0x5A02	Input 2 of binary selector module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oA-03	0x5A03	Input selection for binary switch module B	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-04	0x5A04	Input 1 of binary switch module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-05	0x5A05	Input 2 of binary multiplexer module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-06	0x5A06	Input selection for binary switch module C	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-07	0x5A07	Input 1 of binary switch module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-08	0x5A08	Input 2 of binary switch module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-09	0x5A09	Input selection for binary switch module D	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oA-10	0x5A0A	Input 1 of binary switch module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-11	0x5A0B	Input 2 of binary switch module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-12	0x5A0C	Input selection for binary switch module E	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-13	0x5A0D	Input 1 of binary switch module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-14	0x5A0E	Input 2 of binary switch module E	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-15	0x5A0F	Input selection for binary switch module F	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-16	0x5A10	Input 1 of binary switch module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oA-17	0x5A11	Input 2 of binary switch module F	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-18	0x5A12	Input selection for binary switch module G	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-19	0x5A13	Input 1 of binary switch module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-20	0x5A14	Input 2 of binary switch module G	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-21	0x5A15	Input selection for binary switch module H	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-22	0x5A16	Input 1 of binary switch module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-23	0x5A17	Input 2 of binary switch module H	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oA-24	0x5A18	Input selection for numeric switch module A	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-25	0x5A19	Input 1 of digital selector module A	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-26	0x5A1A	Input 2 of digital selector module A	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-27	0x5A1B	Input selection for numeric switch module B	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-28	0x5A1C	Input 1 of numeric switch module B	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-29	0x5A1D	Input 2 of numeric switch module B	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oA-30	0x5A1E	Input selection for numeric switch module C	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-31	0x5A1F	Input 1 of numeric switch module C	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-32	0x5A20	Input 2 of numeric switch module C	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-33	0x5A21	Input selection for numeric switch module D	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-34	0x5A22	Input 1 of numeric switch module D	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-35	0x5A23	Input 2 of numeric switch module D	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oA-36	0x5A24	Input selection for numeric switch module E	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-37	0x5A25	Input 1 of numeric switch module E	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-38	0x5A26	Input 2 of numeric switch module E	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-39	0x5A27	Input selection for numeric switch module F	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-40	0x5A28	Input 1 of numeric switch module F	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-41	0x5A29	Input 2 of numeric switch module F	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oA-42	0x5A2A	Input selection for numeric switch module G	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-43	0x5A2B	Input 1 of numeric switch module G	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-44	0x5A2C	Input 2 of numeric switch module G	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-45	0x5A2D	Input selection for numeric switch module H	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oA-46	0x5A2E	Input 1 of numeric switch module H	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oA-47	0x5A2F	Input 2 of numeric switch module H	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
ob-00	0x5B00	Function selection for filter module A	0: Filter function disabled 1: Filter function enabled 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
ob-01	0x5B01	Input of filter module A	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
ob-02	0x5B02	Filter time of filter module A	0.000s to 30.000s	0.000	s	Real time
ob-03	0x5B03	Function selection for filter module B	0: Filter function disabled 1: Filter function enabled 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
Fb-03	0x5B04	Input of filter module B	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
ob-05	0x5B05	Filter time of filter module B	0.000s to 30.000s	0.000	s	Real time
ob-06	0x5B06	Function selection for filter module C	0: Filter function disabled 1: Filter function enabled 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
ob-07	0x5B07	Input of filter module C	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
ob-08	0x5B08	Filter time of filter module C	0.000s to 30.000s	0.000	s	Real time
ob-09	0x5B09	Function selection for filter module D	0: Filter function disabled 1: Filter function enabled 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
ob-10	0x5B0A	Input of filter module D	0: 0 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
ob-11	0x5B0B	Filter time of filter module D	0.000s to 30.000s	0.000	s	Real time
ob-24	0x5B18	Function of level-to-pulse module A	0: Module disabled 1: Level to pulse 2: Pulse to level	0	-	Real time
ob-25	0x5B19	Input of level-pulse conversion module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
ob-26	0x5B1A	Pulse width of level-to-pulse conversion module A	0.00s to 655.35s	0.00	s	Real time
ob-27	0x5B1B	Function of level-to-pulse module B	0: Module disabled 1: Level to pulse 2: Pulse to level	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
ob-28	0x5B1C	Input of level-pulse conversion module B	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
ob-29	0x5B1D	Pulse width of level-to-pulse conversion module B	0.00s to 655.35s	0.00	s	Real time
ob-30	0x5B1E	Function of level-to-pulse module C	0: Module disabled 1: Level to pulse 2: Pulse to level	0	-	Real time
ob-31	0x5B1F	Input of level-pulse conversion module C	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
ob-32	0x5B20	Pulse width of level-to-pulse conversion module C	0.00s to 655.35s	0.00	s	Real time
ob-33	0x5B21	Function of level-to-pulse module D	0: Module disabled 1: Level to pulse 2: Pulse to level	0	-	Real time
ob-34	0x5B22	Input of level-pulse conversion module D	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
ob-35	0x5B23	Pulse width of level-to-pulse conversion module D	0.00s to 655.35s	0.00	s	Real time
oC-00	0x5C00	Input of limiting module A	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oC-01	0x5C01	Upper limit of limiter module A	0: Upper limit invalid 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oC-02	0x5C02	Lower limit of limiter module A	0: Lower limit invalid 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oC-03	0x5C03	Input of limiter module B	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oC-04	0x5C04	Upper limit of limiter module B	0: Upper limit invalid 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oC-05	0x5C05	Lower limit of limiter module B	0: Lower limit invalid 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oC-06	0x5C06	Input of limiter module C	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oC-07	0x5C07	Upper limit of limiter module C	0: Upper limit invalid 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oC-08	0x5C08	Lower limit of limiter module C	0: Lower limit invalid 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oC-09	0x5C09	Input of limiter module D	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oC-10	0x5C0A	Upper limit of limiter module D	0: Upper limit invalid 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oC-11	0x5C0B	Lower limit of limiter module D	0: Lower limit invalid 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
oC-28	0x5C1C	Input of logic delay module A	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oC-29	0x5C1D	Switch-on delay time of logic delay module A	0 to 65535	0	-	Real time
oC-30	0x5C1E	Switch-off delay time of logic delay module A	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: 1 min. 6: 2 min.	1	-	Real time
oC-32	0x5C20	Input of logic delay module B	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oC-33	0x5C21	Switch-on delay of logic delay module B	0 to 65535	0	-	Real time
oC-34	0x5C22	Switch-off delay of logic delay module B	0 to 65535	0	-	Real time
oC-35	0x5C23	Delay time unit of logic delay module B	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min. 6: 2 min.	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oC-36	0x5C24	Input of logic delay module C	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oC-37	0x5C25	Switch-on delay of logic delay module C	0 to 65535	0	-	Real time
oC-38	0x5C26	Switch-off delay of logic delay module C	0 to 65535	0	-	Real time
oC-39	0x5C27	Delay time unit of logic delay module C	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min. 6: 2 min.	1	-	Real time
oC-40	0x5C28	Input of logic delay module D	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oC-41	0x5C29	Switch-on delay time of logic delay module D	0 to 65535	0	-	Real time
oC-42	0x5C2A	Switch-off delay of logic delay module D	0 to 65535	0	-	Real time
oC-43	0x5C2B	Delay time unit of logic delay module D	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min. 6: 2 min.	1	-	Real time
oC-44	0x5C2C	Logic delay module E input	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oC-45	0x5C2D	Switch-on delay time of logic delay module E	0 to 65535	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oC-46	0x5C2E	Switch-off delay time of logic delay module E	0 to 65535	0	-	Real time
oC-47	0x5C2F	Delay time unit of logic delay module E	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min. 6: 2 min.	1	-	Real time
oC-48	0x5C30	Logic delay module F input	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oC-49	0x5C31	Switch-on delay time of logic delay module F	0 to 65535	0	-	Real time
oC-50	0x5C32	Switch-off delay time of logic delay module F	0 to 65535	0	-	Real time
oC-51	0x5C33	Delay time unit of logic delay module F	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min. 6: 2 min.	1	-	Real time
oC-52	0x5C34	Logic delay module G input	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oC-53	0x5C35	Switch-on delay time of logic delay module G	0 to 65535	0	-	Real time
oC-54	0x5C36	Switch-off delay time of logic delay module G	0 to 65535	0	-	Real time
oC-55	0x5C37	Delay time unit of logic delay module G	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min. 6: 2 min.	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oC-56	0x5C38	Logic delay module H input	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
oC-57	0x5C39	Switch-on delay time of logic delay module H	0 to 65535	0	-	Real time
oC-58	0x5C3A	Switch-off delay time of logic delay module H	0 to 65535	0	-	Real time
oC-59	0x5C3B	Delay time unit of logic delay module H	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min. 6: 2 min.	1	-	Real time
P0-06	0x6006	Jump frequency 1	0.0 Hz to 800.0Hz	0.0	Hz	Real time
P0-07	0x6007	Jump frequency 2	0.0 Hz to 800.0Hz	0.0	Hz	Real time
P0-08	0x6008	Jump frequency 3	0.0 Hz to 800.0Hz	0.0	Hz	Real time
P0-09	0x6009	Jump frequency 4	0.0 Hz to 800.0Hz	0.0	Hz	Real time
P0-10	0x600A	Jump frequency amplitude	0.0 Hz to 800.0Hz	0.0	Hz	Real time
P0-11	0x600B	Operation mode when set frequency < frequency lower limit	0: Run at frequency lower limit 1: Stop 2: Run at zero speed 3: Coast to stop	0	-	Real time
P0-13	0x600D	Timing function	0: Inactive 1: Active	0	-	At stop
P0-14	0x600E	Timed operation period source	0: P0-15 1: AI1 2: AI2 Others: F connector	0	-	At stop
P0-15	0x600F	Digital reference of timed operation period	0.0 min to 6500.0 min	0.0	min.	At stop
P0-16	0x6010	Power-on time threshold in hours	0 to 65535	0	h	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P0-17	0x6011	Power-on time threshold in seconds	0s to 3599s	0	s	Real time
P0-18	0x6012	Set operating time threshold in hours	0 to 65535	0	h	Real time
P0-19	0x6013	Set operating time threshold in seconds	0s to 3599s	0	s	Real time
P0-20	0x6014	Current operating time threshold	0.0 min to 6500.0 min	0.0	min.	At stop
P0-21	0x6015	Startup protection	0: Disable 1: Enable	1	-	Real time
P0-22	0x6016	Wakeup frequency	P0-24 to A2-17	0.00	Hz	Real time
P0-23	0x6017	Wakeup delay	0.0 to 6500.0	0.0	s	Real time
P0-24	0x6018	Sleep frequency	0.00 Hz~P0-22	0.00	Hz	Real time
P0-25	0x6019	Sleep delay	0.0 to 6500.0	0.0	s	Real time
P0-26	0x601A	Dead zone time of forward/ reverse run switchover	0.0s to 3000.0s	0.0	s	Real time
P0-29	0x601D	Automatic reset of STO status	0: Manual reset 1: Automatic reset	1	-	Real time
P0-30	0x601E	Detection time for inconsistent STO status	0.020s to 1.000s	0.050	s	Real time
P0-33	0x6021	Drive temperature threshold	0°C to 100°C	75	°C	Real time
P0-34	0x6022	Frequency detection value (FDT1)	0.00 Hz 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 Hz 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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P0-38	0x6026	Frequency arrival detection window	0.0% to 100.0%	0.0	%	Real time
P0-39	0x6027	Frequency arrival detection value 1	0.00 Hz to A2-17	50.00	Hz	Real time
P0-40	0x6028	Frequency arrival detection amplitude 1	0.1 % to 100.0%	0.1	%	Real time
P0-41	0x6029	Frequency arrival detection value 2	0.00 Hz to A2-17	50.00	Hz	Real time
P0-42	0x602A	Frequency arrival detection amplitude 2	0.1 % to 100.0%	0.1	%	Real time
P0-43	0x602B	Current arrival 1	0.0% to 300.0%	100.0	%	Real time
P0-44	0x602C	Window of current arrival 1	0.0% to 300.0%	0.0	%	Real time
P0-45	0x602D	Current arrival 2	0.0% to 300.0%	100.0	%	Real time
P0-46	0x602E	Window of current arrival 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	0.01s to 600.00s	0.10	s	Real time
P0-49	0x6031	Output current threshold limit	0.0% to 300.0%	200.0	%	Real time
P0-50	0x6032	Delay time for output current limit violation detection	0.00s to 600.00s	0.00	s	Real time
P0-51	0x6033	Target speed arrival detection window	0.0% to 600.0%	3.0	%	Real time
P0-52	0x6034	Target speed arrival time	0.00s to 100.00s	3.00	s	Real time
P0-53	0x6035	Speed comparison arrival threshold 1	0.0% to 600.0%	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0.00s to 100.00s	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	0.00s to 100.00s	3.00	s	Real time
P0-59	0x603B	bit15 of system status word 1	0: Inactive 1: 1 Other: B connector	0	-	Real time
P0-60	0x603C	bit15 of system status word 2	0: Inactive 1: 1 Other: B connector	0	-	Real time
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	-	Read-only
P0-68	0x6044	Overload response in load monitoring state	0: No alarm/No fault 1: Alarm 2: Fault 3: Alarm/fault	0	-	Real time
P0-69	0x6045	Load loss response in load monitoring state	0: No alarm/No fault 1: Alarm 2: Fault 3: Alarm/fault	0	-	Real time
P0-70	0x6046	X-coordinate point 1 in load monitoring state	0.0% to 600.0%	0.0	%	Real time
P0-71	0x6047	X-coordinate point 2 in load monitoring state	0.0% to 600.0%	0.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P0-72	0x6048	X-coordinate point 3 in load monitoring state	0.0% to 600.0%	0.0	%	Real time
P0-73	0x6049	X-coordinate point 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
P0-84	0x6054	Lower limit 5 on load monitoring curve	0.0% to 400.0%	0.0	%	Real time
P0-85	0x6055	Allowable overload time	0.0s to 6553.5s	20.0	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P0-86	0x6056	Allowable load loss time	0.0s to 6553.5s	20.0	s	Real time
P0-87	0x6057	Base value for UP/DOWN key during running	0: Operating frequency 1: Frequency reference	0	-	Real time
P0-88	0x6058	Retention selection for UP/DOWN key upon stop	0: Non-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 switchover	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	Swing frequency setting mode	0: Relative to the central frequency 1: Relative to the maximum frequency	0	-	Real time
P0-95	0x605F	Swing frequency amplitude	0.0% to 100.0%	0.0	%	Real time
P0-96	0x6060	Jump frequency amplitude	0.0 to 50.0	0.0	%	Real time
P0-97	0x6061	Swing frequency cycle	0.1s to 3000.0s	10.0	s	Real time
P0-98	0x6062	Triangular wave rising time of wobble frequency	0.1 % to 100.0%	50.0	%	Real time
P1-00	0x6100	Simple PLC module	0: Disable 1: Enable	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-01	0x6101	Simple PLC calculation enable source	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	36978	-	At stop
P1-02	0x6102	Simple PLC operation 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 upon power failure 0: Non-retentive 1: Retentive Tens: Calculation enable configuration 0: Current STEP retained when calculation deactivated, 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	Simple PLC status reset	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	At stop
P1-05	0x6105	Current STEP of the simple PLC	0 to 65535	0	-	Read-only
P1-06	0x6106	Current STEP operating time (in hours) of the simple PLC	0 to 65535	0	-	Read-only
P1-07	0x6107	Current STEP operating time (in seconds) of the simple PLC	0.0 to 3599.9	0.0	-	Read-only
P1-08	0x6108	Simple PLC operating time unit	0: s (second) 1: h (hour)	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-09	0x6109	Multi-reference 0 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-10	0x610A	Operating time of multi-reference 0 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-11	0x610B	Ramp-up/ down time of multi-reference 0 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (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	Operating time of multi-reference 1 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-14	0x610E	Ramp-up/ down time of multi-reference 1 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	Ramp-up/ down time of multi-reference 2 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	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	Operating time of multi-reference 3 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-20	0x6114	Ramp-up/ down time of multi-reference 3 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	0	-	Real time

Param.	Comm. address	Name	Range	Default value	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	Operating time of multi-reference 4 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-23	0x6117	Ramp-up/ down time of multi-reference 4 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	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	Operating time of multi-reference 5 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-26	0x611A	Ramp-up/ down time of multi-reference 5 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-27	0x611B	Multi-reference 6 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-28	0x611C	Operating time of multi-reference 6 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-29	0x611D	Ramp-up/ down time of multi-reference 6 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	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	Operating time of multi-reference 7 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-32	0x6120	Ramp-up/ down time of multi-reference 7 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-33	0x6121	Multi-reference 8 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-34	0x6122	Operating time of multi-reference 8 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-35	0x6123	Ramp-up/ down time of multi-reference 8 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	0	-	Real time
P1-36	0x6124	Multi-reference 9 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-37	0x6125	Operating time of multi-reference 9 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-38	0x6126	Ramp-up/ down time of multi-reference 9 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-39	0x6127	Multi-reference 10 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-40	0x6128	Operating time of multi-reference 10 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-41	0x6129	Acceleration/ deceleration time of simple PLC reference 10	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	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	Operating time of multi-reference 11 set by simple PLC	0.0 to 6553.5	0.0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-44	0x612C	Acceleration/ deceleration time of simple PLC reference 11	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	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	Operating time of multi-reference 12 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-47	0x612F	Acceleration/ deceleration time of simple PLC reference 12	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	0	-	Real time
P1-48	0x6130	Multi-reference 13 set by simple PLC	-800.0 to +800.0	0.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-49	0x6131	Operating time of multi-reference 13 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-50	0x6132	Acceleration/ deceleration time of simple PLC reference 13	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	0	-	Real time
P1-51	0x6133	Multi-reference 14 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-52	0x6134	Operating time of multi-reference 14 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-53	0x6135	Acceleration/ deceleration time of simple PLC reference 14	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-54	0x6136	Multi-reference 15 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-55	0x6137	Operating time of multi-reference 15 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-56	0x6138	Ramp-up/ down time of multi-reference 15 set by simple PLC	0: Ramp 1 acceleration/ deceleration time (b7-04 [Ramp 1 acceleration time]/ b7-05 [Ramp 1 deceleration time]) 1: Ramp 2 acceleration/ deceleration time (b7-10 [Ramp 2 Acceleration Time]/ b7-11 [Ramp 2 Deceleration Time]) 2: Ramp 3 acceleration/ deceleration time (b7-16 [Ramp 3 Acceleration Time]/ b7-17 [Ramp 3 Deceleration Time]) 3: Ramp 4 acceleration/ deceleration time (b7-22 [Ramp 4 Acceleration Time]/ b7-23 [Ramp 4 Deceleration Time])	0	-	Real time
P2-00	0x6200	PID enable	0: Inhibited 1: Enable Other: B connector	0	-	Real time
P2-01	0x6201	PID acting direction	0: Direct acting 1: Reverse Other: B connector	0	-	Real time
P2-02	0x6202	PID setting source	0: PID value reference 1: AI1 2: AI2 3: MD-BP-M potentiometer 4: HDI pulse 5: Multi-reference 6: Simple PLC 8: Communication 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 3: MD-BP-M potentiometer 4: HDI setting 5: Communication Others: F connector	0	-	Real time
P2-05	0x6205	PID reference feedback range	0 to 65535	1000	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P2-06	0x6206	PID reference change time	0.00s to 650.00s	0.00	s	Real time
P2-07	0x6207	PID feedback filter time	0.00s to 60.00s	0.00	s	Real time
P2-08	0x6208	PID output filter time	0.00s to 60.00s	0.00	s	Real time
P2-09	0x6209	PID inversion cutoff frequency	0.00 Hz to A2-17	2.00	Hz	Real time
P2-11	0x620B	PID parameter switchover condition	0: No switchover, default PID parameter 1 1: Switched by DI 2: Switched automatically based on deviation 3: Switched automatically based on operating frequency 4: Automatic adjustment mode 1 based on roll diameter (active only when closed-loop speed mode and closed-loop torque mode for tension process are enabled) 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	PID parameter 1 differential time Td1	0.000s to 10.000s	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	0.000s to 10.000s	0.000	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P2-20	0x6214	PID initial value	0.0% to 800.0%	0.0	%	Real time
P2-21	0x6215	PID initial value hold time	0.00s to 650.00s	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 derivative 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 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
P2-27	0x621B	Source of minimum PID output	0: -100% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
P2-28	0x621C	Forced value of PID output	0: 0% 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
P2-29	0x621D	Forced assignment of PID output enable	0: Inactive 1: Valid Other: 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	PID feedback loss detection time	0.0-20.0s	0.0	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P2-33	0x6221	Selection of PID operation at stop selection	0: No 1: Yes Other: B connector	0	-	Real time
P2-34	0x6222	PID integral property	Ones: Integral pause/ separation 0: Inactive 1: Active Tens: 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 operation during jogging	0: Inhibited 1: Allowed Other: B connector	0	-	Real time
P2-37	0x6225	PID execution interval	0 to 20	1	-	At stop
P2-38	0x6226	Active mode for PID ramp reference	0: Activated when PID enabled 1: Activated when PID operation starts Other: B connector	0	-	At stop
P3-00	0x6300	Motorized potentiometer enable selection	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
P3-01	0x6301	Retention of motorized potentiometer upon power failure	0: Disable 1: Enable	0	-	Real time
P3-02	0x6302	Initial value of motorized potentiometer	-600.0 % to 600.0%	0.0	%	Real time
P3-03	0x6303	Time increase base of motorized potentiometer	0.00s to 655.35s	20.00	s	Real time
P3-04	0x6304	Time decrease base of motorized potentiometer	0.00s to 655.35s	20.00	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P3-05	0x6305	Source of motorized potentiometer increasing command	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
P3-06	0x6306	Source of motorized potentiometer decreasing command	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
P3-07	0x6307	Maximum value of motorized potentiometer output	P3-08 to 600.0 %	600.0	%	Real time
P3-08	0x6308	Minimum value of motorized potentiometer output	-600.0 % to P3-07	-600.0	%	Real time
P3-09	0x6309	Source 1 of motorized potentiometer pause command	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
P3-10	0x630A	Source 2 of motorized potentiometer pause command	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (active only for MD610S) Other: B connector	0	-	Real time
P3-11	0x630B	Source 1 of motorized potentiometer reset command	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (active only for MD610S) Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P3-12	0x630C	Source 2 of motorized potentiometer reset command	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (active only for MD610S) Other: B connector	0	-	Real time
P3-13	0x630D	Source of motorized potentiometer reset value	0: Digital reference 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
P3-14	0x630E	Reset value digital setting of the motorized potentiometer	-600.0 % to 600.0%	0.0	%	Real time
P3-15	0x630F	Source of motorized potentiometer forced command	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
P3-16	0x6310	Forced value source of motorized potentiometer	0: Digital reference 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
P3-17	0x6311	Digital reference of motorized potentiometer forced value	-600.0 % to 600.0%	0.0	%	Real time
P4-00	0x6400	Brake function selection	0: Disable brake 1: Enable brake without detection information 2: Enable brake with detection information	0	-	At stop
P4-02	0x6402	Brake release actuation time	0.00s to 30.00s	0.20	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P4-03	0x6403	Brake apply actuation time	0.00s to 30.00s	0.20	s	Real time
P4-04	0x6404	Brake feedback source	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
P4-05	0x6405	Brake feedback fault delay	0.00s to 30.00s	2.00	s	Real time
P4-07	0x6407	Brake auxiliary function selection	bit0: Braking with detection - completion judgment of releasing/applying 0: Action time + Detection signal 1: Signal detection only bit1: Brake with detection - Detection signal fault judgment 0: Full-time judgment 1: No detection when already released/applied bit2: Start speed logic selection 0: Active when the brake is releasing 1: Active the moment when the brake is released bit3: Braking release enable during auto-tuning 0: Brake release inhibited 1: Brake release allowed bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P4-08	0x6408	Starting torque source in the vector control mode	0: Disable 1: Retentive torque 2: Digital reference of starting torque 3: Defined by digital reference of starting torque and motor operating direction Others: F connector	0	-	Real time
P4-09	0x6409	Digital reference of starting torque	-200.0% to +200.0%	0.0	%	Real time
P4-10	0x640A	Retentive starting torque gain factor	0.0% to 300.0%	100.0	%	Real time
P4-11	0x640B	Starting torque increment time	0.00s to 5.00s	0.04	s	Real time
P4-13	0x640D	Starting speed source	0: Disable 1: Digital reference of starting speed 2: Defined by digital reference of starting speed and motor operating direction	0	-	Real time
P4-14	0x640E	Digital setting of start speed	-30.0% to +30.0%	0.0	%	Real time
P4-17	0x6411	Forced brake close command source	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	0	-	Real time
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	0.00s to 300.00s	0.10	s	Real time
P4-20	0x6414	Speed monitoring threshold for brake apply	0.0% to 100.0%	0.0	%	Real time
P4-21	0x6415	Speed monitoring time for brake apply	0.00s to 60.00s	5.00	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P4-24	0x6418	Brake release permission source	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 Other: B connector	1	-	Real time
P4-25	0x6419	Compare value source of brake release	0: Disable 2: AI1 3: AI2 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: MD-BP-M potentiometer Others: F connector	0	-	Real time
P4-26	0x641A	Comparison threshold for brake release	0.0% to 300.0%	0.0	%	Real time
P4-27	0x641B	Brake release delay	0.00s to 30.00s	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	0.00s to 10.00s	0.20	s	Real time
P4-40	0x6428	Braking self-test enable	0: Inhibited 1: Enable Other: B connector	0	-	Real time
P4-41	0x6429	Brake test duration	0.20s~30.00s	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: Reversed Other: B connector	0	-	Real time
P4-44	0x642C	Slip speed threshold of braking test	0.00%~30.00 %	0.10	%	Real time
P4-45	0x642D	Slip speed duration in braking test	0.000s to 10.000s	0.004	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Pd-00	0x6D00	Tension control mode	0: Inactive 1: Open-loop torque control mode 2: Closed-loop speed control mode 3: Closed-loop torque control mode 4: Constant linear speed control mode	0	-	At stop
Pd-01	0x6D01	Winding mode	0: Winding 1: Unwinding	0	-	Real time
Pd-02	0x6D02	Unwinding reverse tightening selection	0.0 m/min to 500.0 m/min	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: PD-05 1: AI1 2: AI2 4: Reserved 5: Communication (1000H)	0	-	At stop
Pd-05	0x6D05	Digital setting of linear speed input	0.0 m/min to PD-06	0.0	m/min	Real time
Pd-06	0x6D06	Maximum linear speed	0.0 m/min to 6500.0 m/min	1000.0	m/min	Real time
Pd-07	0x6D07	Minimum linear speed for winding diameter calculation	0.0 m/min to PD-06	20.0	m/min	Real time
Pd-08	0x6D08	Reel diameter not calculated in jogging	0: Disable 1: Enable	0	-	At stop
Pd-09	0x6D09	Winding diameter calculation method	0: Calculated based on linear speed 1: Calculated based on accumulative thickness 2: AI1 3: AI2 5: Reserved 6: Communication 7: PD-16	0	-	At stop
Pd-10	0x6D0A	Maximum roll diameter	PD-11 to 6000.0 mm	500.0	mm	Real time
Pd-11	0x6D0B	Empty winding diameter	0.1 mm~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	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 reel diameter	PD-11 to PD-10	100.0	mm	Real time
Pd-17	0x6D11	Winding diameter not reset upon stop	0: Disable 1: Enable	0	-	Real time
Pd-18	0x6D12	Roll diameter filter time	0.00s to 10.00s	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 inhibited during winding, and increase inhibited during unwinding	0	-	Real time
Pd-21	0x6D15	Roll diameter reset during running	0 to 1	0	-	Real time
Pd-22	0x6D16	Pre-drive speed gain	-100.0%~200.0 %	0.0	%	Real time
Pd-23	0x6D17	Pre-drive torque limit source	0: d1-09 to d1-12 1: Torque in tension control mode	1	-	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	0.0s to 6000.0s	20.0	s	Real time
Pd-27	0x6D1B	Pre-drive deceleration time	0.0s to 6000.0s	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	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 Hz to 100.00 Hz	5.00	Hz	Real time
Pd-32	0x6D20	Tension frequency limit	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Pd-33	0x6D21	Closed-loop tension torque mode selection	0: Torque is calculated by pure PID 1: Torque is calculated by main frequency + PID	0	-	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 reference source	0: Digital reference 1: AI1 2: AI2	0	-	At stop
Pd-38	0x6D26	Material thickness 0	0.01–100.00 mm	0.01	mm	Real time
Pd-39	0x6D27	Material thickness 1	0.01–100.00 mm	0.01	mm	Real time
Pd-40	0x6D28	Material thickness 2	0.01–100.00 mm	0.01	mm	Real time
Pd-41	0x6D29	Material thickness 3	0.01–100.00 mm	0.01	mm	Real time
Pd-42	0x6D2A	Maximum thickness	0.01–100.00 mm	1.00	mm	Real time
Pd-44	0x6D2C	Constant linear speed source selection	0: PD-45 1: AI1 2: AI2 4: Reserved 5: Communication (1000H)	0	-	At stop
Pd-45	0x6D2D	Digital setting of constant linear speed input	0.0 m/min to PD-06	0.0	m/min	Real time
Pd-46	0x6D2E	Tension control speed limit offset	0.00 Hz to A2-17	0.00	Hz	Real time
Pd-47	0x6D2F	Tension control torque mode	0: Bidirectional bias 1: Uni-directional bias	1	-	At stop
Pd-48	0x6D30	Cable drum application mode	0: Horizontal cable drum application 1: Vertical cable drum application	0	-	At stop
Pd-49	0x6D31	Pulse counting mode	0: Calculated according to winding/unwinding mode 1: Calculated according to motor running direction	0	-	At stop
Pd-50	0x6D32	Unwinding compensation	0.0% to 100.0%	0.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Pd-51	0x6D33	Minimum tension reference for vertical cable drum applications	0 N~PE-02	500	N	Real time
Pd-52	0x6D34	Maximum torque reference for vertical cable drum applications	PD-53 to 200.0 %	0.0	%	Real time
Pd-53	0x6D35	Minimum torque reference for vertical cable drum applications	0.0 %~PD-52	0.0	%	Real time
Pd-54	0x6D36	Automatic material run-out detection	0: Disable 1: Enable	0	-	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
PE-00	0x6E00	Tension reference source	0: PE-01 1: AI1 2: AI2 4: Reserved 5: Communication (1000H)	0	-	At stop
PE-01	0x6E01	Tension digital setting	0 N~PE-02	50	N	Real time
PE-02	0x6E02	Maximum tension	0 N to 65000 N	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
PE-06	0x6E06	Frequency deceleration time in torque 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 N·m² to 65535 N·m²	0	N·m²	Real time
PE-09	0x6E09	Correction of acceleration inertia compensation	0.0% to 200.0%	100.0	%	Real time
PE-10	0x6E0A	Correction of deceleration inertia compensation	0.0% to 200.0%	100.0	%	Real time
PE-11	0x6E0B	Material density	0 kg/m³ to 65535 kg/m³	0	kg/m³	Real time
PE-12	0x6E0C	Material width	0mm~65535 mm	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 Hz to 20.00 Hz	2.00	Hz	Real time
PE-15	0x6E0F	Open-loop torque reverse allowance	0: Reverse torque inhibited 1: Reverse torque allowed	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 force compensation curve 1 3: Multi-friction compensation curve 2	0	-	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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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 Hz to A2-17	0.00	Hz	Real time
PE-25	0x6E19	Multi-friction force compensation inflection point 2	0.00 Hz to A2-17	0.00	Hz	Real time
PE-26	0x6E1A	Multi-friction force compensation inflection point 3	0.00 Hz to A2-17	0.00	Hz	Real time
PE-27	0x6E1B	Multi-friction force compensation inflection point 4	0.00 Hz to A2-17	0.00	Hz	Real time
PE-28	0x6E1C	Multi-friction force compensation inflection point 5	0.00 Hz to A2-17	0.00	Hz	Real time
PE-29	0x6E1D	Multi-friction force compensation inflection point 6	0.00 Hz to A2-17	0.00	Hz	Real time
PE-30	0x6E1E	Tension establishment	0: Disable 1: On	0	-	At stop
PE-31	0x6E1F	Tension establishment dead zone	0.0% to 100.0%	2.0	%	Real time
PE-32	0x6E20	Tension establishment frequency	0.00 Hz to A2-17	0.10	Hz	Real time
PE-33	0x6E21	Terminal torque boost proportion	0.0% to 500.0%	50.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
PE-34	0x6E22	Terminal torque boost cancellation time	0.0–50.0s	0.0	s	Real time
PE-35	0x6E23	Reel diameter auto-tuning coefficient	0%~60000 %	100	%	Real time
PE-36	0x6E24	Initial winding diameter auto-tuning	0: Disable 1: On	0	-	At stop
PE-37	0x6E25	Rod length	1mm~65535 mm	300	mm	At stop
PE-38	0x6E26	Rod angle	0.1°~360.0 °	40.0	°	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	0.0s to 60.0s	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
PE-46	0x6E2E	Derivative time Td1 for tension setup	0.000s to 10.000s	0.000	s	Real time
PE-47	0x6E2F	Linear speed zero-crossing judgment	0.0 to 100.0	0.0	-	Real time
PE-48	0x6E30	Minimum frequency of tension setup (under maximum reel diameter)	0.00 Hz to A2-17	0.10	Hz	Real time
PE-49	0x6E31	Torque compensation effective time	0.00s to 650.00s	2.00	s	Real time
PE-50	0x6E32	Minimum torque compensation gain	0.0% to 6000.0%	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	0.000s to 10.000s	0.000	s	Real time
PE-54	0x6E36	PI function selection for emergency stop	0 to 1	0	-	Real time
PF-00	0x6F00	Taper curve	0: Curve taper 1: Multi-linear taper	0	-	At stop
PF-01	0x6F01	Tension taper source	0: PF-02 1: AI1 2: AI2 4: Communication (1000H)	0	-	At stop
PF-02	0x6F02	Taper digital setting	0.0% to 100.0%	0.0	%	Real time
PF-03	0x6F03	Correction value of tension taper compensation	0 mm to 10000 mm	0	mm	Real time
PF-05	0x6F05	Setting channel of external taper AO	0: PF-06 1: AI1 2: AI2 4: Communication (1000H)	0	-	At stop
PF-06	0x6F06	External taper setting	0.0% to 100.0%	100.0	%	Real time
PF-08	0x6F08	Minimum winding diameter taper	0.0% to 100.0%	100.0	%	Real time
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

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
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	Maximum winding diameter taper	0.0 to 100.0	30.0	-	Real time
PF-30	0x6F1E	Reel diameter calculated based on the number of pulses	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
PF-31	0x6F1F	Roll diameter reset	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
PF-32	0x6F20	Initial reel diameter source selection terminal 1	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
PF-33	0x6F21	Initial reel diameter source selection terminal 2	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
PF-34	0x6F22	Pre-drive	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
PF-35	0x6F23	Winding/ Unwinding switchover	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
PF-36	0x6F24	Roll diameter calculation stopped	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
PF-37	0x6F25	Exiting from tension mode	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
PF-38	0x6F26	Terminal tension rise	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
PF-39	0x6F27	Material thickness selection terminal 1	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
PF-40	0x6F28	Material thickness selection terminal 2	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
PF-41	0x6F29	Passive unwinding (cable drum application)	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
PF-42	0x6F2A	Emergency stop - Tension torque compensation enable	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5	0	-	Real time
L0000	0x9000	Logic 0	0 to 1	0	-	Read-only
L0001	0x9001	Logic 1	0 to 1	0	-	Read-only
L0002	0x9002	DI1	0 to 1	0	-	Read-only
L0003	0x9003	DI2	0 to 1	0	-	Read-only
L0004	0x9004	DI3	0 to 1	0	-	Read-only
L0005	0x9005	DI4	0 to 1	0	-	Read-only
L0006	0x9006	DI5	0 to 1	0	-	Read-only
L0012	0x900C	VDI1	0 to 1	0	-	Read-only
L0013	0x900D	VDI2	0 to 1	0	-	Read-only
L0014	0x900E	VDI3	0 to 1	0	-	Read-only
L0015	0x900F	VDI4	0 to 1	0	-	Read-only
L0016	0x9010	VDI5	0 to 1	0	-	Read-only
L0017	0x9011	VDI6	0 to 1	0	-	Read-only
L0018	0x9012	DI1 inversion	0 to 1	0	-	Read-only
L0019	0x9013	DI2 inversion	0 to 1	0	-	Read-only
L0020	0x9014	DI3 inversion	0 to 1	0	-	Read-only
L0021	0x9015	DI4 inversion	0 to 1	0	-	Read-only
L0022	0x9016	DI5 inversion	0 to 1	0	-	Read-only
L0028	0x901C	Opposite to VDI1	0 to 1	0	-	Read-only
L0029	0x901D	Opposite to VDI2	0 to 1	0	-	Read-only
L0030	0x901E	Opposite to VDI3	0 to 1	0	-	Read-only
L0031	0x901F	Opposite to VDI4	0 to 1	0	-	Read-only
L0032	0x9020	Opposite to VDI5	0 to 1	0	-	Read-only
L0033	0x9021	Opposite to VDI6	0 to 1	0	-	Read-only
L0034	0x9022	RO	0 to 1	0	-	Read-only
L0038	0x9026	DO	0 to 1	0	-	Read-only
L0042	0x902A	FMR	0 to 1	0	-	Read-only
L0044	0x902C	VDO1	0 to 1	0	-	Read-only
L0045	0x902D	VDO2	0 to 1	0	-	Read-only
L0046	0x902E	VDO3	0 to 1	0	-	Read-only
L0047	0x902F	VDO4	0 to 1	0	-	Read-only
L0048	0x9030	VDO5	0 to 1	0	-	Read-only
L0049	0x9031	VDO6	0 to 1	0	-	Read-only
L0050	0x9032	AI1 input limit exceeded	0: Not exceeded 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0051	0x9033	AI2 input limit violated	0: Not exceeded 1: Active	0	-	Read-only
L0052	0x9034	MD-BP-M potentiometer input limit violated	0: Not exceeded 1: Active	0	-	Read-only
L0053	0x9035	HDI input disconnection	0: Inactive 1: Active	0	-	Read-only
L0054	0x9036	AI1 used as DI level	0: Low level 1: High level	0	-	Read-only
L0055	0x9037	Level state of the AI2 used as DI	0: Low level 1: High level	0	-	Read-only
L0056	0x9038	Level selection for MD-BP-M potentiometer used as DI	0: Low level 1: High level	0	-	Read-only
L0057	0x9039	AI2 temperature mode - Motor temperature arrival	0: Temperature not reached 1: Temperature reached	0	-	Read-only
L0058	0x903A	AI2 temperature mode - Motor overtempera-ture fault	0: No overtemperature fault 1: Valid	0	-	Read-only
L0059	0x903B	AI2 temperature mode - Motor overtempera-ture pre-alarm	0: No overtemperature pre-alarm 1: Valid	0	-	Read-only
L0100	0x9064	Ready to switch on	0: Invalid 1: Valid	0	-	Read-only
L0101	0x9065	Ready to run	0: Invalid 1: Valid	0	-	Read-only
L0102	0x9066	During operation	0: Invalid 1: Run	0	-	Read-only
L0103	0x9067	Fault activation	0: Invalid 1: Valid	0	-	Read-only
L0104	0x9068	OFF2 (coast to stop) flag	0: Valid 1: Invalid	0	-	Read-only
L0105	0x9069	OFF3 (quick stop) flag	0: Valid 1: Invalid	0	-	Read-only
L0106	0x906A	Startup lockout	0: Switch-on not blocked 1: Switch-on blocked	0	-	Read-only
L0107	0x906B	Alarm/Minor fault activated	0: Invalid 1: Valid	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0108	0x906C	Actual speed following the speed reference	0: There is deviation between the actual speed and the speed reference. 1: The deviation between the actual speed and the speed reference is within the allowable range.	0	-	Read-only
L0109	0x906D	Local/remote	0: Local 1: Remote	0	-	Read-only
L0110	0x906E	Target speed arrival	0: Speed not reached 1: Speed reached	0	-	Read-only
L0111	0x906F	Torque limit arrival	0: Inactive 1: Active	0	-	Read-only
L0112	0x9070	Positive speed	0: Inactive 1: Active	0	-	Read-only
L0113	0x9071	Negative speed	0: Inactive 1: Active	0	-	Read-only
L0114	0x9072	Motor operation flag	0: Stop 1: Running (pulsing)	0	-	Read-only
L0116	0x9074	Low bit of current motor parameter group	0: Logic 0 1: Logic 1	0	-	Read-only
L0117	0x9075	High bit of current motor parameter group	0: Logic 0 1: Logic 1	0	-	Read-only
L0118	0x9076	Active control channel	0: Control channel 1 1: Control channel 2	0	-	Read-only
L0119	0x9077	Active reference channel	0: Setting channel 1 1: Setting channel 2	0	-	Read-only
L0120	0x9078	Active terminal start/stop module	0: Terminal start/stop module A 1: Terminal start/stop module B	0	-	Read-only
L0121	0x9079	Terminal control state	0: Inactive 1: Active	0	-	Read-only
L0122	0x907A	Torque control selection	0: Inactive 1: Active	0	-	Read-only
L0123	0x907B	Speed control selection	0: Inactive 1: Active	0	-	Read-only
L0124	0x907C	Position control selection	0: Inactive 1: Active	0	-	Read-only
L0125	0x907D	V/f decoupled mode	0: Inactive 1: Active	0	-	Read-only
L0126	0x907E	RFG function selection	0: Disable 1: Enable	0	-	Read-only
L0127	0x907F	RFG module operation	0: Stop 1: Run	0	-	Read-only
L0132	0x9084	Error output	0: No output 1: Error outputted	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0133	0x9085	Error output (undervoltage fault excluded)	0: No output 1: Error outputted	0	-	Read-only
L0134	0x9086	Fault output	0: The relay is inactive upon fault and automatic fault reset. 1: The relay is active upon fault and automatic fault reset.	0	-	Read-only
L0135	0x9087	Stop upon fault	0: Inactive 1: Active	0	-	Read-only
L0136	0x9088	Normal running	0: Invalid 1: Valid	0	-	Read-only
L0137	0x9089	Jog	0: Invalid 1: Valid	0	-	Read-only
L0138	0x908A	Decelerate-to-stop state	0: Inactive 1: Valid	0	-	Read-only
L0141	0x908D	Self-test state	0: Inactive 1: Valid	0	-	Read-only
L0142	0x908E	Auto-tuning state	0: Inactive 1: Valid	0	-	Read-only
L0152	0x9098	Operating at zero speed (invalid at stop)	0: Inactive 1: Active	0	-	Read-only
L0153	0x9099	Operating-at-zero-speed (valid at stop) state	0: Inactive 1: Active	0	-	Read-only
L0156	0x909C	Reverse run	0: Inactive 1: Valid	0	-	Read-only
L0157	0x909D	Wobble frequency limited	0: Not limited 1: Limited	0	-	Read-only
L0158	0x909E	Torque limit state	0: Not limited 1: Limited	0	-	Read-only
L0159	0x909F	Forward motor speed	0: Negative direction 1: Positive direction	0	-	Read-only
L0160	0x90A0	Reverse motor speed	0: Positive direction 1: Negative direction	0	-	Read-only
L0161	0x90A1	Forced RFG on starting frequency	0: Disabled 1: Enabled	0	-	Read-only
L0162	0x90A2	Stop at frequencies lower than lower limit/ starting frequency	0: Inactive 1: Active	0	-	Read-only
L0163	0x90A3	Coast to stop at frequencies lower than lower limit	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0164	0x90A4	Power dip ride-through deceleration and clear	0: Inactive 1: Active	0	-	Read-only
L0165	0x90A5	Decelerate to stop upon power dip ride-through	0: Inactive 1: Active	0	-	Read-only
L0172	0x90AC	Internal USB mode	0: Inactive 1: Active	0	-	Read-only
L0174	0x90AE	Bus voltage state	0: Abnormal 1: Normal	0	-	Read-only
L0175	0x90AF	Excessive speed deviation	0: Inactive 1: Excessive motor speed deviation	0	-	Read-only
L0176	0x90B0	Motor overspeed	0: Inactive 1: Motor overspeed	0	-	Read-only
L0177	0x90B1	Overcurrent Fault	0: Inactive 1: Active	0	-	Read-only
L0178	0x90B2	Bus overvoltage	0: Inactive 1: Active	0	-	Read-only
L0179	0x90B3	Bus undervoltage	0: Inactive 1: Active	0	-	Read-only
L0180	0x90B4	Motor pre-overload	0: Inactive 1: Active	0	-	Read-only
L0181	0x90B5	Motor overload fault	0: Inactive 1: Active	0	-	Read-only
L0182	0x90B6	AC drive pre-overload	0: Inactive 1: Active	0	-	Read-only
L0183	0x90B7	AC drive overload	0: Inactive 1: Active	0	-	Read-only
L0185	0x90B9	Motor overtempera-ture fault	0: Inactive 1: Active	0	-	Read-only
L0186	0x90BA	Drive pre-overtempera-ture	0: Inactive 1: Drive pre-overtemperature activated	0	-	Read-only
L0187	0x90BB	Drive overtempera-ture	0: Inactive 1: Drive overtemperature activated	0	-	Read-only
L0188	0x90BC	Input phase loss fault	0: Inactive 1: Active	0	-	Read-only
L0189	0x90BD	Output phase loss fault	0: Inactive 1: Active	0	-	Read-only
L0190	0x90BE	Motor stall fault	0: Inactive 1: Active	0	-	Read-only
L0192	0x90C0	Motor disconnected	0: Inactive 1: Active	0	-	Read-only
L0195	0x90C3	External fault 1	0: Inactive 1: Active	0	-	Read-only
L0196	0x90C4	External fault 2	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0197	0x90C5	User-defined fault 1	0: Inactive 1: Active	0	-	Read-only
L0198	0x90C6	User-defined fault 2	0: Inactive 1: Active	0	-	Read-only
L0200	0x90C8	STO output	0: Inactive 1: Active	0	-	Read-only
L0244	0x90F4	Power-on time arrival	0: Not reached 1: Reached	0	-	Read-only
L0245	0x90F5	Operating time arrival	0: Not reached 1: Reached	0	-	Read-only
L0246	0x90F6	Timed operation arrival	0: Not reached 1: Reached	0	-	Read-only
L0247	0x90F7	Current Operating Time Arrival	0: Not reached 1: Reached	0	-	Read-only
L0250	0x90FA	Sleep from wake-up activated	0: Inactive 1: Active	0	-	Read-only
L0251	0x90FB	Individual stop of simple PLC	0: Inactive 1: Active	0	-	Read-only
L0252	0x90FC	Individual operation of simple PLC	0: Not completed 1: Cycle completed	0	-	Read-only
L0253	0x90FD	Cyclic operation of simple PLC	0: Not completed 1: Cycle completed	0	-	Read-only
L0258	0x9102	Current 1 arrival	0: Not reached 1: Reached	0	-	Read-only
L0259	0x9103	Current 2 arrival	0: Not reached 1: Reached	0	-	Read-only
L0260	0x9104	Zero current state	0: Inactive 1: Active	0	-	Read-only
L0261	0x9105	Output Current Limit Violation	0: Inactive 1: Active	0	-	Read-only
L0262	0x9106	Frequency-level detection FDT1 output	0: Inactive 1: Active	0	-	Read-only
L0263	0x9107	Frequency level detection FDT2 output	0: Inactive 1: Active	0	-	Read-only
L0264	0x9108	Frequency arrival	0: Not reached 1: Reached	0	-	Read-only
L0265	0x9109	Frequency arrival 1	0: Not reached 1: Reached	0	-	Read-only
L0266	0x910A	Frequency arrival 2	0: Not reached 1: Reached	0	-	Read-only
L0267	0x910B	Frequency upper limit arrival	0: Not reached 1: Reached	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0268	0x910C	Frequency lower limit arrival (no output at stop)	0: Not reached 1: Reached	0	-	Read-only
L0269	0x910D	Frequency lower limit arrival (output generated even at stop)	0: Not reached 1: Reached	0	-	Read-only
L0270	0x910E	Speed comparison arrival 1	0: Not reached 1: Reached	0	-	Read-only
L0271	0x910F	Speed comparison arrival 2	0: Not reached 1: Reached	0	-	Read-only
L0272	0x9110	Designed counting value reached	0: Not reached 1: Reached	0	-	Read-only
L0273	0x9111	Specified count value arrival	0: Not reached 1: Reached	0	-	Read-only
L0274	0x9112	Length comparison value arrival	0: Not reached 1: Reached	0	-	Read-only
L0279	0x9117	Heatsink temperature arrival	0: Not reached 1: Reached	0	-	Read-only
L0304	0x9130	Word-to-bit module A output Bit00	0: Inactive 1: Active	0	-	Read-only
L0305	0x9131	bit1 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0306	0x9132	bit2 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0307	0x9133	bit3 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0308	0x9134	bit4 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0309	0x9135	bit5 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0310	0x9136	bit6 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0311	0x9137	bit7 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0312	0x9138	bit8 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0313	0x9139	bit9 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0314	0x913A	bit10 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0315	0x913B	bit11 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0316	0x913C	bit12 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0317	0x913D	bit13 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0318	0x913E	bit14 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0319	0x913F	bit15 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read-only
L0320	0x9140	bit0 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0321	0x9141	bit1 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0322	0x9142	bit2 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0323	0x9143	bit3 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0324	0x9144	bit4 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0325	0x9145	bit5 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0326	0x9146	bit6 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0327	0x9147	bit7 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0328	0x9148	bit8 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0329	0x9149	bit9 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0330	0x914A	bit10 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0331	0x914B	bit11 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0332	0x914C	bit12 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0333	0x914D	bit13 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0334	0x914E	bit14 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0335	0x914F	bit15 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read-only
L0336	0x9150	bit0 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0337	0x9151	bit1 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0338	0x9152	bit2 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0339	0x9153	bit3 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0340	0x9154	bit4 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0341	0x9155	bit5 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0342	0x9156	bit6 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0343	0x9157	bit7 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0344	0x9158	bit8 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0345	0x9159	bit9 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0346	0x915A	bit10 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0347	0x915B	bit11 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0348	0x915C	bit12 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0349	0x915D	bit13 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0350	0x915E	bit14 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0351	0x915F	bit15 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read-only
L0352	0x9160	Word-to-bit module D output Bit00	0: Inactive 1: Active	0	-	Read-only
L0353	0x9161	bit1 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0354	0x9162	bit2 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0355	0x9163	bit3 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0356	0x9164	bit4 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0357	0x9165	bit5 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0358	0x9166	bit6 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0359	0x9167	bit7 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0360	0x9168	bit8 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0361	0x9169	bit9 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0362	0x916A	bit10 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0363	0x916B	bit11 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0364	0x916C	bit12 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0365	0x916D	bit13 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0366	0x916E	bit14 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0367	0x916F	bit15 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read-only
L0368	0x9170	Output of binary switch module A	0: Inactive 1: Active	0	-	Read-only
L0369	0x9171	Output of binary switch module B	0: Inactive 1: Active	0	-	Read-only
L0370	0x9172	Output of binary switch module C	0: Inactive 1: Active	0	-	Read-only
L0371	0x9173	Output of binary switch module D	0: Inactive 1: Active	0	-	Read-only
L0372	0x9174	Output of binary switch module E	0: Inactive 1: Active	0	-	Read-only
L0373	0x9175	Output of binary switch module F	0: Inactive 1: Active	0	-	Read-only
L0374	0x9176	Output of binary switch module G	0: Inactive 1: Active	0	-	Read-only
L0375	0x9177	Output of binary switch module H	0: Inactive 1: Active	0	-	Read-only
L0376	0x9178	Output of logic AND/OR module A	0: Inactive 1: Active	0	-	Read-only
L0377	0x9179	Output of logic AND/OR module B	0: Inactive 1: Active	0	-	Read-only
L0378	0x917A	Output of logic AND/OR module C	0: Inactive 1: Active	0	-	Read-only
L0379	0x917B	Output of logic AND/OR module D	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0380	0x917C	Output of logic AND/OR module E	0: Inactive 1: Active	0	-	Read-only
L0381	0x917D	Output of logic AND/OR module F	0: Inactive 1: Active	0	-	Read-only
L0382	0x917E	Output of logic AND/OR module G	0: Inactive 1: Active	0	-	Read-only
L0383	0x917F	Output of logic AND/OR module H	0: Inactive 1: Active	0	-	Read-only
L0384	0x9180	Logic NOT module A output	0: Inactive 1: Active	0	-	Read-only
L0385	0x9181	Logic NOT module B output	0: Inactive 1: Active	0	-	Read-only
L0386	0x9182	Output of logic NOT module C	0: Inactive 1: Active	0	-	Read-only
L0387	0x9183	Output of logic NOT module D	0: Inactive 1: Active	0	-	Read-only
L0388	0x9184	Output of logic NOT module E	0: Inactive 1: Active	0	-	Read-only
L0389	0x9185	Output of logic NOT module F	0: Inactive 1: Active	0	-	Read-only
L0390	0x9186	Output of logic NOT module G	0: Inactive 1: Active	0	-	Read-only
L0391	0x9187	Output of logic NOT module H	0: Inactive 1: Active	0	-	Read-only
L0392	0x9188	Output of logic XOR/XNOR module A	0: Inactive 1: Active	0	-	Read-only
L0393	0x9189	Output of logic XOR/XNOR module B	0: Inactive 1: Active	0	-	Read-only
L0394	0x918A	Output of logic XOR/XNOR module C	0: Inactive 1: Active	0	-	Read-only
L0395	0x918B	Output of logic XOR/XNOR module D	0: Inactive 1: Active	0	-	Read-only
L0396	0x918C	Output of logic XOR/XNOR module E	0: Inactive 1: Active	0	-	Read-only
L0397	0x918D	Output of logic XOR/XNOR module F	0: Inactive 1: Active	0	-	Read-only
L0398	0x918E	Output of logic XOR/XNOR module G	0: Inactive 1: Active	0	-	Read-only
L0399	0x918F	Output of logic XOR/XNOR module H	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0400	0x9190	Output of comparison module A	0: Inactive 1: Active	0	-	Read-only
L0401	0x9191	Output of comparison module B	0: Inactive 1: Active	0	-	Read-only
L0402	0x9192	Output of comparison module C	0: Inactive 1: Active	0	-	Read-only
L0403	0x9193	Output of comparison module D	0: Inactive 1: Active	0	-	Read-only
L0404	0x9194	Output of comparison module E	0: Inactive 1: Active	0	-	Read-only
L0405	0x9195	Comparison module F output	0: Inactive 1: Active	0	-	Read-only
L0406	0x9196	Output of comparison module G	0: Inactive 1: Active	0	-	Read-only
L0407	0x9197	Output of comparison module H	0: Inactive 1: Active	0	-	Read-only
L0408	0x9198	Output of level-to-pulse conversion module A	0: Inactive 1: Active	0	-	Read-only
L0409	0x9199	Output of level-to-pulse conversion module B	0: Inactive 1: Active	0	-	Read-only
L0410	0x919A	Output of level-to-pulse conversion module C	0: Inactive 1: Active	0	-	Read-only
L0411	0x919B	Output of level-to-pulse conversion module D	0: Inactive 1: Active	0	-	Read-only
L0412	0x919C	Divisor being 0 flag of multiplication and division module A	0: Non-zero value 1: 0	0	-	Read-only
L0413	0x919D	Divisor being 0 flag of multiplication and division module B	0: Non-zero value 1: 0	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0414	0x919E	Divisor being 0 flag of multiplication and division module C	0: Non-zero value 1: 0	0	-	Read-only
L0415	0x919F	Divisor being 0 flag of multiplication and division module D	0: Non-zero value 1: 0	0	-	Read-only
L0416	0x91A0	Divisor being 0 flag of multiplier and divider block E	0: Non-zero value 1: 0	0	-	Read-only
L0417	0x91A1	Divisor being 0 flag of multiplier and divider block F	0: Non-zero value 1: 0	0	-	Read-only
L0418	0x91A2	Divisor being 0 flag of multiplier and divider block G	0: Non-zero value 1: 0	0	-	Read-only
L0419	0x91A3	Divisor being 0 flag of multiplier and divider block H	0: Non-zero value 1: 0	0	-	Read-only
L0420	0x91A4	Input of absolute value module A	0: Non-negative value 1: Negative value	0	-	Read-only
L0421	0x91A5	Input of absolute value module B	0: Non-negative value 1: Negative value	0	-	Read-only
L0422	0x91A6	Input of absolute value module C	0: Non-negative value 1: Negative value	0	-	Read-only
L0423	0x91A7	Input of absolute value module D	0: Non-negative value 1: Negative value	0	-	Read-only
L0424	0x91A8	Input of absolute value module E	0: Non-negative value 1: Negative value	0	-	Read-only
L0425	0x91A9	Input of absolute value module F	0: Non-negative value 1: Negative value	0	-	Read-only
L0426	0x91AA	Input of absolute value module G	0: Non-negative value 1: Negative value	0	-	Read-only
L0427	0x91AB	Input of absolute value module H	0: Non-negative value 1: Negative value	0	-	Read-only
L0428	0x91AC	Lower limit flag of limiter module A	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0429	0x91AD	Upper limit flag of limiter module A	0: Inactive 1: Active	0	-	Read-only
L0430	0x91AE	Lower limit flag of limiter module B	0: Inactive 1: Active	0	-	Read-only
L0431	0x91AF	Upper limit flag of limiter module B	0: Inactive 1: Active	0	-	Read-only
L0432	0x91B0	Lower limit flag of limiter module C	0: Inactive 1: Active	0	-	Read-only
L0433	0x91B1	Upper limit flag of limiter module C	0: Inactive 1: Active	0	-	Read-only
L0434	0x91B2	Lower limit flag of limiter module D	0: Inactive 1: Active	0	-	Read-only
L0435	0x91B3	Upper limit flag of limiter module D	0: Inactive 1: Active	0	-	Read-only
L0456	0x91C8	Output of logic delay module A	0: Inactive 1: Active	0	-	Read-only
L0457	0x91C9	Output of logical delay module B	0: Inactive 1: Active	0	-	Read-only
L0458	0x91CA	Output of logical delay module C	0: Inactive 1: Active	0	-	Read-only
L0459	0x91CB	Output of logical delay module D	0: Inactive 1: Active	0	-	Read-only
L0460	0x91CC	Output of logical delay module E	0: Inactive 1: Active	0	-	Read-only
L0461	0x91CD	Output of logical delay module F	0: Inactive 1: Active	0	-	Read-only
L0462	0x91CE	Output of logical delay module G	0: Inactive 1: Active	0	-	Read-only
L0463	0x91CF	Output of logic delay module H	0: Inactive 1: Active	0	-	Read-only
L0484	0x91E4	DI1 (modified by E0-00 forcibly)	0 to 1	0	-	Read-only
L0485	0x91E5	DI2 (modified by E0-01 forcibly)	0 to 1	0	-	Read-only
L0486	0x91E6	DI3 (modified by E0-02 forcibly)	0 to 1	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0487	0x91E7	DI4 (modified by E0-03 forcibly)	0 to 1	0	-	Read-only
L0488	0x91E8	DI5 (modified by E0-04 forcibly)	0 to 1	0	-	Read-only
L0494	0x91EE	VDI1 (modified by E0-10 forcibly)	0 to 1	0	-	Read-only
L0495	0x91EF	VDI2 (modified by E0-11 forcibly)	0 to 1	0	-	Read-only
L0496	0x91F0	VDI3 (modified by E0-12 forcibly)	0 to 1	0	-	Read-only
L0497	0x91F1	VDI4 (modified by E0-13 forcibly)	0 to 1	0	-	Read-only
L0498	0x91F2	VDI5 (modified by E0-14 forcibly)	0 to 1	0	-	Read-only
L0499	0x91F3	VDI6 (modified by E0-15 forcibly)	0 to 1	0	-	Read-only
L0600	0x9258	I/O expansion card 1-DI1	0 to 1	0	-	Read-only
L0601	0x9259	I/O expansion card 1-DI2	0 to 1	0	-	Read-only
L0603	0x925B	I/O expansion card 1-DI1 inverted	0 to 1	0	-	Read-only
L0604	0x925C	I/O expansion card 1-DI2 inverted	0 to 1	0	-	Read-only
L0606	0x925E	I/O expansion card 1-DO	0 to 1	0	-	Read-only
L0607	0x925F	I/O expansion card 1-RO	0 to 1	0	-	Read-only
L0608	0x9260	I/O expansion card 1-Motor temperature reached	0: Temperature not reached 1: Temperature reached	0	-	Read-only
L0609	0x9261	I/O expansion card 1-Motor overtempera-ture	0: No overtemperature fault 1: Valid	0	-	Read-only
L0610	0x9262	I/O expansion card 1-Motor overtempera-ture alarm	0: No overtemperature pre-alarm 1: Valid	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L0611	0x9263	I/O expansion card 1-AI1 input limit violated	0: Not exceeded 1: Active	0	-	Read-only
L0612	0x9264	I/O expansion card 1-AI1 used as the DI level	0: Low level 1: High level	0	-	Read-only
L0616	0x9268	I/O expansion card 2-DI1	0 to 1	0	-	Read-only
L0617	0x9269	I/O expansion card 2-DI2	0 to 1	0	-	Read-only
L0619	0x926B	I/O expansion card 2-DI1 inverted	0 to 1	0	-	Read-only
L0620	0x926C	I/O expansion card 2-DI2 inverted	0 to 1	0	-	Read-only
L0622	0x926E	I/O expansion card 2-DO	0 to 1	0	-	Read-only
L0623	0x926F	I/O expansion card 2-RO	0 to 1	0	-	Read-only
L0624	0x9270	I/O expansion card 2-Motor temperature reached	0: Temperature not reached 1: Temperature reached	0	-	Read-only
L0625	0x9271	I/O expansion card 2-Motor overtempera-ture	0: No overtemperature fault 1: Valid	0	-	Read-only
L0626	0x9272	I/O expansion card 2 - Motor overtempera-ture alarm	0: No overtemperature pre-alarm 1: Valid	0	-	Read-only
L0627	0x9273	I/O expansion card 2-AI1 input limit violated	0: Not exceeded 1: Active	0	-	Read-only
L0628	0x9274	I/O expansion card 2-AI1 used as the DI level	0: Low level 1: High level	0	-	Read-only
L0700	0x92BC	Brake command output	0: Brake close 1: Brake open	0	-	Read-only
L0701	0x92BD	Brake released	0 to 1	0	-	Read-only
L0702	0x92BE	Brake applied	0 to 1	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1000	0x93E8	Current state of system status machine	0: Initializing 1: Switch-on inhibited 2: Switch-on allowed 3: Operation permission 4: Start 5: Run 6: Stop 7: Self-test 8: Auto-tuning	0	-	Read-only
L1001	0x93E9	Switchover command of system status 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	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1002	0x93EA	System state word 1	bit0: Ready for 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 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	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1003	0x93EB	System status word 2	bit0: Self-test 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 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: Custom state 1 0: Inactive 1: Active	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	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: 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 invalid 1: Relay valid bit8: IGBT pulsing state 0: Stop 1: Run bit9: System command direction 0: Forward run 1: Reverse bit10: IGBT pulsing state with delay 0: Stop 1: Run 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	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1005	0x93ED	System status word 4	bit0: Operating at zero speed (invalid at stop) 0: Inactive 1: Active bit1: Operating at zero speed (valid at stop) 0: Inactive 1: Active bit2: Frequency level detection 1 0: Inactive 1: Active bit3: Frequency level detection 2 0: Inactive 1: Active Bit 4: AI1/AI2 0: Inactive 1: Active bit5: Simple PLC cycle state 0: Not completed 1: Completed bit6: Reference value set through communication 0: Inactive 1: Active bit7: Reserved bit8: Current 1 reach 0: Inactive 1: Active bit9: Current 2 reach 0: Inactive 1: Active bit10: Zero current state 0: Inactive 1: Active bit11: Output current limit exceeded 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	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1006	0x93EE	Main status word of drive	bit0 and bit1: Operation status 0: Initializing 1: Sampling preparation 2: Undervoltage 3: Ready bit2: Hardware information status 0: Not ready 1: Ready bit3: Operation state 0: Stop 1: Run bit4: Output blocked forcibly at fault 0: Inactive 1: Active bit5: Bus undervoltage state 0: Inactive 1: Active bit6 to bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1012	0x93F4	Drive protection status word	bit0: Pulse-by-pulse current limit protection 0: Inactive 1: Active bit1: Pulse-by-pulse current limit inhibition 0: Inactive 1: Active bit2: Input phase loss detected 0: Inactive 1: Active bit3: Output phase loss detected 0: Inactive 1: Active bit4: Pre-charge resistor error detected 0: Inactive 1: Active bit5: Drive overload 0: Inactive 1: Active bit6: Drive pre-overload 0: Inactive 1: Active bit7: Bus overvoltage 0: Inactive 1: Active bit8: Bus undervoltage 0: Inactive 1: Active bit9: Output overcurrent 0: Inactive 1: Active bit10: Drive overtemperature 0: Inactive 1: Active bit11: Drive pre-overtemperature 0: Inactive 1: Active bit12: Leakage current protection 0: Inactive 1: Active bit13: Current control error 0: Inactive 1: Active bit14: Software overcurrent 0: Inactive 1: Active bit15: Ground fault (reserved) 0: Inactive 1: Active	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1015	0x93F7	Motor protection status word	bit0: Motor in overload state 0: Inactive 1: Active bit1: Motor in pre-overload state 0: Inactive 1: Active bit2: Three-phase loss state (reserved) 0: Inactive 1: Active bit3: Motor overheating (reserved) 0: Inactive 1: Active bit4: PG detection fault (reserved) 0: Inactive 1: Active bit5: Current control error 0: Inactive 1: Active bit6: Motor stall 0: Inactive 1: Active bit7: Motor open circuit, two-phase or three-phase loss 0: Inactive 1: Active bit8: Excessive motor constant-current load (reserved) 0: Inactive 1: Active bit9: SVC operation step loss due to motor flux error 0: Inactive 1: Active Continued	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1015	0x93F7	Motor protection status word	Continued bit10: Speed measurement fluctuation error (reserved) 0: Inactive 1: Active bit11: Motor parameter setting error (reserved) 0: Inactive 1: Active bit12: HSVM sampling card open circuit, phase error (reserved) 0: Inactive 1: Active bit13: Synchronous motor overcurrent (reserved) 0: Inactive 1: Active bit14: Synchronous output voltage error (reserved) 0: Inactive 1: Active bit15: Reserved	0x0	-	Read-only
L1017	0x93F9	Vector Vdc status word	bit0: Undervoltage suppression 0: Inactive 1: Active bit1: Overvoltage suppression 0: Inactive 1: Active bit2: Entering low frequency lower limit in undervoltage suppression 0: Inactive 1: Active bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	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 maximum 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 maximum torque limit 2 bit6: Positive speed limit 0: Inactive 1: Active bit7: Reverse speed limit 0: Inactive 1: Active bit8: External forced torque limit 0: Inactive 1: Active bit9: Torque cancellation 0: Inactive 1: Active bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only
L1030	0x9406	Active control mode	0: Speed control 1: Torque control 2: Position control (reserved)	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1044	0x9414	Custom command word of control channel 1	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 0: Stop 1: Run bit2: OFF3 (quick stop) stop 0: Stop 1: Run bit3: Running permitted 0: Disable 1: Enable Bit 4: Reset command 0: Not reset 1: Reset Bit 5: Jog 1 0: Inactive 1: Active Bit 6: Jog 2 0: Inactive 1: Active Bit 7: Speed inversion 0: no inverse 1: Inverted bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1045	0x9415	Custom command word of control channel 2	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 0: Stop 1: Run bit2: OFF3 (quick stop) stop 0: Stop 1: Run bit3: Running permitted 0: Disable 1: Enable Bit 4: Reset command 0: Not reset 1: Reset Bit 5: Jog 1 0: Inactive 1: Active Bit 6: Jog 2 0: Inactive 1: Active Bit 7: Speed inversion 0: no inverse 1: Inverted bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1046	0x9416	Auxiliary command word of control channel 1	bit0: OFF2 (coast to stop) stop 2 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 3 0: Stop 1: Run bit2: OFF3 (quick stop) stop 2 0: Stop 1: Run bit3: OFF3 (quick stop) state 3 0: Disable 1: Enable Bit 4: Reset command 2 0: Not reset 1: Reset Bit 5: Reset command 3 0: Not reset 1: Reset Bit 6: RFG disabled 0: Active 1: Inactive Bit 7: RFG paused 0: Active 1: Inactive Bit 8: RFG mandatory 0: Active 1: Inactive bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1047	0x9417	Auxiliary command word of control channel 2	bit0: OFF2 (coast to stop) stop 2 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 3 0: Stop 1: Run bit2: OFF3 (quick stop) stop 2 0: Stop 1: Run bit3: OFF3 (quick stop) state 3 0: Disable 1: Enable Bit 4: Reset command 2 0: Not reset 1: Reset Bit 5: Reset command 3 0: Not reset 1: Reset Bit 6: RFG disabled 0: Active 1: Inactive Bit 7: RFG paused 0: Active 1: Inactive Bit 8: RFG mandatory 0: Active 1: Inactive bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only
L1050	0x941A	STO output status word	0x0 to 0xFFFF	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1051	0x941B	LED control word	bit0: Start command 0: Inactive 1: Active Bit 1: Stop 0: Inactive 1: Active Bit 2: Jog 1 0: Inactive 1: Active Bit 3: Local control 0: Inactive 1: Active Bit 4: Reset 0: Inactive 1: Active Bit 5: Jog 2 0: Inactive 1: Active Bit 6: Direction switching 0: Inactive 1: Active bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1052	0x941C	IDS control word	bit0: Start command 0: Inactive 1: Active bit:1: Stop command 0: Inactive 1: Active bit2: Jog 1 0: Inactive 1: Active bit3: Jog 2 0: Inactive 1: Active bit4: Reset 0: Inactive 1: Active bit5: Forward direction 0: Inactive 1: Active bit6: Reverse direction 0: Inactive 1: Active bit7: Auto-tuning 0: Inactive 1: Active bit8: Self-test 0: Inactive 1: Active bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1053	0x941D	SOP control word	bit0: Start command 0: Inactive 1: Active Bit 1: Stop 0: Inactive 1: Active Bit 2: Jog 1 0: Inactive 1: Active bit3: Jog 2 0: Inactive 1: Active Bit 4: Reset 0: Inactive 1: Active bit5: Forward direction 0: Inactive 1: Active bit6: Reverse direction 0: Inactive 1: Active bit7: Auto-tuning 0: Inactive 1: Active bit8: Self-test 0: Inactive 1: Active bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1054	0x941E	Command channel control word	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Run 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 1: RFG output set to 0 forcibly bit5: RFG paused 0: Normal 1: RFG pause bit6: RFG input forced to 0 0: Normal 1: RFG input set to 0 forcibly bit7: Fault reset 0: Inactive 1: Active Bit 8: Jog 1 0: Inactive 1: Active Bit 9: Jog 2 0: Inactive 1: Active bit10: Remote control (reserved) 0: Inactive 1: Active bit11: Speed inversion 0: Inversion disabled 1: Inversion bit12: Start signal 0: Inactive 1: Active Bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1055	0x941F	Control word set through communica-tion	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 0: Stop 1: Run bit2: OFF3 (quick stop) stop 0: Stop 1: Run bit3: Running permitted 0: Disable 1: Enable Bit 4: Reset command 0: Not reset 1: Reset Bit 5: Jog 1 0: Inactive 1: Active Bit 6: Jog 2 0: Inactive 1: Active Bit 7: Speed inversion 0: no inverse 1: Inverted bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only
L1056	0x9420	Software tool control flag	0: Not controlled 1: Controlled	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1057	0x9421	Terminal module control word	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 0: Stop 1: Run bit2: OFF3 (quick stop) stop 0: Stop 1: Run bit3: Running permitted 0: Disable 1: Enable Bit 4: Reset command 0: Not reset 1: Reset Bit 5: Jog 1 0: Inactive 1: Active Bit 6: Jog 2 0: Inactive 1: Active Bit 7: Speed inversion 0: no inverse 1: Inverted bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1058	0x9422	Terminal module A input state	bit0: ON_OFF1 (start/stop) stop 0: Inactive 1: Active Bit 1: Reverse operation (Rev) 0: Inactive 1: Active Bit 2: Running permitted (Enable) 0: Inactive 1: Active Bit 3: Reset command (Reset) 0: Inactive 1: Active Bit 4: Jog 1 (JOG1) 0: Inactive 1: Active Bit 5: Jog 2 (JOG2) 0: Inactive 1: Active Bit 6: Reserved (Rsvd1) 0: Inactive 1: Active bit7: Terminal input (In1) 0: Inactive 1: Active bit8: Terminal input (In2) 0: Inactive 1: Active bit9: Terminal input (In3) 0: Inactive 1: Active bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1059	0x9423	Terminal module B input state	bit0: ON_OFF1 (start/stop) stop 0: Inactive 1: Active Bit 1: Reverse operation (Rev) 0: Inactive 1: Active Bit 2: Running permitted (Enable) 0: Inactive 1: Active Bit 3: Reset command (Reset) 0: Inactive 1: Active Bit 4: Jog 1Jog1 0: Inactive 1: Active Bit 5: Jog 2 (JOG2) 0: Inactive 1: Active Bit 6: Reserved (Rsvd1) 0: Inactive 1: Active bit7: Terminal input (In1) 0: Inactive 1: Active bit8: Terminal input (In2) 0: Inactive 1: Active bit9: Terminal input (In3) 0: Inactive 1: Active bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only
L1060	0x9424	Active external command source	0: Operating panel 1: Terminal 2: Communication 3: Custom	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1062	0x9426	RFG status word	bit0 to bit1: Acceleration/ Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 to bit3: Acceleration/ Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8 to bit9: Acceleration/ Deceleration state of previous cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 to bit11: Arc state of previous cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1063	0x9427	RFG command word	bit0: Calculation 0: Inhibited 1: Enabled bit1: Forced output 0: Inhibited 1: Enabled bit2: Calculation pause 0: Inhibited 1: Enabled bit3: Bypass 0: Inhibited 1: Enabled bit4: Reserved bit5: Arc type 0: Continuous arc 1: Non-continuous arc bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1064	0x9428	DI physical terminal status word	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 status 0: Low level 1: High level bit3: DI4 status 0: Low level 1: High level bit4: DI5 status 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1065	0x9429	DI state	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 status 0: Low level 1: High level bit3: DI4 status 0: Low level 1: High level bit4: DI5 status 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1068	0x942C	Highest sub-index supported	bit0: RO state 0: Low level 1: High level bit1: Reserved bit2: Reserved bit3: Reserved bit4: DO status 0: Low level 1: High level bit5: Reserved bit6: Reserved bit7: Reserved bit8: FMR status 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 status 0: Low level 1: High level bit11: VDO2 status 0: Low level 1: High level bit12: VDO3 status 0: Low level 1: High level bit13: VDO4 status 0: Low level 1: High level bit14: VDO5 status 0: Low level 1: High level bit15: VDO6 status 0: Low level 1: High level	0x0	-	Read-only
L1100	0x944C	Base value of speed per unit value	0 to 65535	0	rpm	Read-only
L1101	0x944D	Base value of frequency per-unit value	0.0 to 6553.5	0.0	Hz	Read-only
L1102	0x944E	Base value of voltage per-unit value	0.0 V to 6553.5 V	0.0	V	Read-only
L1103	0x944F	Base value of current per unit value	0.0 to 6553.5	0.0	A	Read-only
L1104	0x9450	Base value of power per-unit value	0.00 kW to 655.35 kW	0.00	kW	Read-only
L1105	0x9451	Base value of torque per unit value	0.00 N·m to 655.35 N·m	0.00	N·m	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1106	0x9452	Base value of DC bus voltage per-unit value	0 to 65535	0	V	Read-only
L1200	0x94B0	Constant setpoint 1 (word)	-32768 to 32767	0	-	Read-only
L1201	0x94B1	Constant setpoint 2 (word)	-32768 to 32767	0	-	Read-only
L1202	0x94B2	Constant setpoint 3 (word)	-32768 to 32767	0	-	Read-only
L1203	0x94B3	Constant setpoint 4 (word)	-32768 to 32767	0	-	Read-only
L1204	0x94B4	Constant setpoint 5 (word)	-32768 to 32767	0	-	Read-only
L1205	0x94B5	Constant setpoint 6 (word)	-32768 to 32767	0	-	Read-only
L1206	0x94B6	Constant setpoint 7 (word)	-32768 to 32767	0	-	Read-only
L1207	0x94B7	Constant setpoint 8 (word)	-32768 to 32767	0	-	Read-only
L1208	0x94B8	Output of bit-to-word module A	0x0 to 0xFFFF	0x0	-	Read-only
L1209	0x94B9	Output of bit-to-word module B	0x0 to 0xFFFF	0x0	-	Read-only
L1210	0x94BA	Output of bit-to-word module C	0x0 to 0xFFFF	0x0	-	Read-only
L1211	0x94BB	Output of bit-to-word module D	0x0 to 0xFFFF	0x0	-	Read-only
L1212	0x94BC	High word of double-word-to-word module A output	0 to 65535	0	-	Read-only
L1213	0x94BD	Low word of double-word-to-word module A output	0 to 65535	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1214	0x94BE	High word of double-word-to-word module B output	0 to 65535	0	-	Read-only
L1215	0x94BF	Low word of double-word-to-word module B output	0 to 65535	0	-	Read-only
L1216	0x94C0	High word of double-word-to-word module C output	0 to 65535	0	-	Read-only
L1217	0x94C1	Low word of double-word-to-word module C output	0 to 65535	0	-	Read-only
L1218	0x94C2	High word of double-word-to-word module D output	0 to 65535	0	-	Read-only
L1219	0x94C3	Low word of double-word-to-word module D output	0 to 65535	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1234	0x94D2	Input selection state of binary selector module	bit0: Module A 0: Input 1 1: Input 2 bit1: Module B 0: Input 1 1: Input 2 bit2: Module C 0: Input 1 1: Input 2 bit3: Module D 0: Input 1 1: Input 2 bit4: Module E 0: Input 1 1: Input 2 bit5: Module F 0: Input 1 1: Input 2 bit6: Module G 0: Input 1 1: Input 2 bit7: Module H 0: Input 1 1: Input 2 bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L1235	0x94D3	Input selection state for digital selector module	bit0: Module A 0: Input 1 1: Input 2 bit1: Module B 0: Input 1 1: Input 2 bit2: Module C 0: Input 1 1: Input 2 bit3: Module D 0: Input 1 1: Input 2 bit4: Module E 0: Input 1 1: Input 2 bit5: Module F 0: Input 1 1: Input 2 bit6: Module G 0: Input 1 1: Input 2 bit7: Module H 0: Input 1 1: Input 2 bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only
L1500	0x95DC	Tension process control mode	0 to 65535	0	-	Read-only
L1501	0x95DD	Tension process operation mode	0 to 65535	0	-	Read-only
L1502	0x95DE	Initial reel diameter	0.0 to 6553.5	0.0	mm	Read-only
L1503	0x95DF	Taper setting	0.0% to 6553.5%	0.0	%	Read-only
L1504	0x95E0	Constant linear speed	0.0 m/min to 6553.5 m/min	0.0	m/min	Read-only
L1505	0x95E1	Tension process mask	0 to 65535	0	-	Read-only
L2000	0x97D0	Output of word-to-double-word module A	0x0~0xFFFFFFFF	0x0	-	Read-only
L2002	0x97D2	Output of word-to-double-word module B	0x0~0xFFFFFFFF	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L2004	0x97D4	Output of word-to-double-word module C	0x0~0xFFFFFFFF	0x0	-	Read-only
L2006	0x97D6	Output of word-to-double-word module D	0x0~0xFFFFFFFF	0x0	-	Read-only
L2200	0x9898	Output frequency	-8 to 8	0.0	-	Read-only
L2202	0x989A	Motor speed	-8 to 8	0.0	-	Read-only
L2204	0x989C	Output current	-8 to 8	0.0	-	Read-only
L2206	0x989E	Output voltage	-8 to 8	0.0	-	Read-only
L2208	0x98A0	Output power	-8 to 8	0.0	-	Read-only
L2210	0x98A2	Output torque	-8 to 8	0.0	-	Read-only
L2244	0x98C4	AI1 input value	-8 to 8	0.0	-	Read-only
L2246	0x98C6	AI2 input value	-8 to 8	0.0	-	Read-only
L2248	0x98C8	MD-BP-M potentiometer input value	-8 to 8	0.0	-	Read-only
L2250	0x98CA	HDI input value	-8 to 8	0.0	-	Read-only
L2252	0x98CC	AO value percentage written through communica-tion	-8 to 8	0.0	%	Read-only
L2258	0x98D2	Current value based on max. 1000A per-unit	-8 to 8	0.0	-	Read-only
L2260	0x98D4	Voltage value based on max. 1000V per-unit	-8 to 8	0.0	-	Read-only
L2262	0x98D6	AO output torque absolute output	-8 to 8	0.0	-	Read-only
L2264	0x98D8	AO output torque -200.0% to +200.0%	-8 to 8	0.0	-	Read-only
L2266	0x98DA	I/O standard card 1-AI1 input value	-8 to 8	0.0	-	Read-only
L2268	0x98DC	I/O standard card 2-AI1 input value	-8 to 8	0.0	-	Read-only
L2300	0x98FC	Fixed value 0%	-8 to 8	0.0	-	Read-only
L2302	0x98FE	Fixed value 100%	-8 to 8	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L2304	0x9900	Fixed value 200%	-8 to 8	0.0	-	Read-only
L2306	0x9902	Fixed value 400%	-8 to 8	0.0	-	Read-only
L2308	0x9904	Fixed value 600%	-8 to 8	0.0	-	Read-only
L2310	0x9906	Fixed value -100%	-8 to 8	0.0	-	Read-only
L2312	0x9908	Fixed value -200%	-8 to 8	0.0	-	Read-only
L2314	0x990A	Fixed value -400%	-8 to 8	0.0	-	Read-only
L2316	0x990C	Fixed value -600%	-8 to 8	0.0	-	Read-only
L2318	0x990E	Output corresponding to the selected multi-reference value	-8 to 8	0.0	-	Read-only
L2320	0x9910	Output corresponding to multi-reference 0	-8 to 8	0.0	-	Read-only
L2322	0x9912	Multi-reference 1 output	-8 to 8	0.0	-	Read-only
L2324	0x9914	Output corresponding to multi-reference 2	-8 to 8	0.0	-	Read-only
L2326	0x9916	Output corresponding to multi-reference 3	-8 to 8	0.0	-	Read-only
L2328	0x9918	Output corresponding to multi-reference 4	-8 to 8	0.0	-	Read-only
L2330	0x991A	Output corresponding to multi-reference 5	-8 to 8	0.0	-	Read-only
L2332	0x991C	Output corresponding to multi-reference 6	-8 to 8	0.0	-	Read-only
L2334	0x991E	Multi-reference 7 output	-8 to 8	0.0	-	Read-only
L2336	0x9920	Output corresponding to multi-reference 8	-8 to 8	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L2338	0x9922	Output corresponding to multi-reference 9	-8 to 8	0.0	-	Read-only
L2340	0x9924	Output corresponding to multi-reference 10	-8 to 8	0.0	-	Read-only
L2342	0x9926	Output corresponding to multi-reference 11	-8 to 8	0.0	-	Read-only
L2344	0x9928	Output corresponding to multi-reference 12	-8 to 8	0.0	-	Read-only
L2346	0x992A	Output corresponding to multi-reference 13	-8 to 8	0.0	-	Read-only
L2348	0x992C	Output corresponding to multi-reference 14	-8 to 8	0.0	-	Read-only
L2350	0x992E	Output corresponding to multi-reference 15	-8 to 8	0.0	-	Read-only
L2352	0x9930	Constant setpoint 1 (per-unit value)	-8 to 8	0.0	-	Read-only
L2354	0x9932	Constant setpoint 2 (per-unit value)	-8 to 8	0.0	-	Read-only
L2356	0x9934	Constant setpoint 3 (per-unit value)	-8 to 8	0.0	-	Read-only
L2358	0x9936	Constant setpoint 4 (per-unit value)	-8 to 8	0.0	-	Read-only
L2360	0x9938	Constant setpoint 5 (per-unit value)	-8 to 8	0.0	-	Read-only
L2362	0x993A	Constant setpoint 6 (per-unit value)	-8 to 8	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L2364	0x993C	Constant setpoint 7 (per-unit value)	-8 to 8	0.0	-	Read-only
L2366	0x993E	Constant setpoint 8 (per-unit value)	-8 to 8	0.0	-	Read-only
L2368	0x9940	Output of addition/ subtraction module A	-8 to 8	0.0	-	Read-only
L2370	0x9942	Output of addition/ subtraction module B	-8 to 8	0.0	-	Read-only
L2372	0x9944	Output of addition/ subtraction module C	-8 to 8	0.0	-	Read-only
L2374	0x9946	Output of addition/ subtraction module D	-8 to 8	0.0	-	Read-only
L2376	0x9948	Output of addition/ subtraction module E	-8 to 8	0.0	-	Read-only
L2378	0x994A	Output of addition/ subtraction module F	-8 to 8	0.0	-	Read-only
L2380	0x994C	Output of addition/ subtraction module G	-8 to 8	0.0	-	Read-only
L2382	0x994E	Output of addition/ subtraction module H	-8 to 8	0.0	-	Read-only
L2384	0x9950	Output of multiplication and division module A	-8 to 8	0.0	-	Read-only
L2386	0x9952	Output of multiplication and division module B	-8 to 8	0.0	-	Read-only
L2388	0x9954	Output of multiplication and division module C	-8 to 8	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L2390	0x9956	Output of multiplication and division module D	-8 to 8	0.0	-	Read-only
L2392	0x9958	Output of MULTIPLY/ DIVIDE module E	-8 to 8	0.0	-	Read-only
L2394	0x995A	Output of MULTIPLY/ DIVIDE module F	-8 to 8	0.0	-	Read-only
L2396	0x995C	Output of MULTIPLY/ DIVIDE module G	-8 to 8	0.0	-	Read-only
L2398	0x995E	Output of MULTIPLY/ DIVIDE module H	-8 to 8	0.0	-	Read-only
L2400	0x9960	Output of absolute value module A	-8 to 8	0.0	-	Read-only
L2402	0x9962	Output of absolute module B	-8 to 8	0.0	-	Read-only
L2404	0x9964	Output of absolute module C	-8 to 8	0.0	-	Read-only
L2406	0x9966	Output of absolute module D	-8 to 8	0.0	-	Read-only
L2408	0x9968	Output of absolute module E	-8 to 8	0.0	-	Read-only
L2410	0x996A	Output of absolute module F	-8 to 8	0.0	-	Read-only
L2412	0x996C	Output of absolute module G	-8 to 8	0.0	-	Read-only
L2414	0x996E	Output of absolute module H	-8 to 8	0.0	-	Read-only
L2416	0x9970	Output of digital selector A	-8 to 8	0.0	-	Read-only
L2418	0x9972	Output of digital selector B	-8 to 8	0.0	-	Read-only
L2420	0x9974	Output of digital selector C	-8 to 8	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L2422	0x9976	Output of digital selector D	-8 to 8	0.0	-	Read-only
L2424	0x9978	Output of digital selector E	-8 to 8	0.0	-	Read-only
L2426	0x997A	Output of digital selector F	-8 to 8	0.0	-	Read-only
L2428	0x997C	Output of digital selector G	-8 to 8	0.0	-	Read-only
L2430	0x997E	Output of digital selector H	-8 to 8	0.0	-	Read-only
L2432	0x9980	Output of limit module A	-8 to 8	0.0	-	Read-only
L2434	0x9982	Output of limit module B	-8 to 8	0.0	-	Read-only
L2436	0x9984	Output of limit module C	-8 to 8	0.0	-	Read-only
L2438	0x9986	Output of limit module D	-8 to 8	0.0	-	Read-only
L2440	0x9988	Output of filter module A	-8 to 8	0.0	-	Read-only
L2442	0x998A	Output of filter module B	-8 to 8	0.0	-	Read-only
L2444	0x998C	Output of filter module C	-8 to 8	0.0	-	Read-only
L2446	0x998E	Output of filter module D	-8 to 8	0.0	-	Read-only
L2448	0x9990	Output of multi-point curve A	-8 to 8	0.0	-	Read-only
L2450	0x9992	Output of multi-point curve B	-8 to 8	0.0	-	Read-only
L2452	0x9994	Forced value of motorized potentiometer	-8 to 8	0.0	-	Read-only
L2454	0x9996	Reset value of motorized potentiometer	-8 to 8	0.0	-	Read-only
L2456	0x9998	Maximum value of motorized potentiometer	-8 to 8	0.0	-	Read-only
L2458	0x999A	Minimum value of motorized potentiometer	-8 to 8	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L2460	0x999C	Initial value of motorized potentiometer	-8 to 8	0.0	-	Read-only
L2462	0x999E	Process operation value of motorized potentiometer	-8 to 8	0.0	-	Read-only
L2464	0x99A0	Final output value of motorized potentiometer	-8 to 8	0.0	-	Read-only
L2466	0x99A2	General PID output	-8 to 8	0.0	-	Read-only
L2468	0x99A4	General PID error	-8 to 8	0.0	-	Read-only
L2470	0x99A6	General PID reference	-8 to 8	0.0	-	Read-only
L2472	0x99A8	General PID feedback	-8 to 8	0.0	-	Read-only
L2474	0x99AA	General PID proportional output	-8 to 8	0.0	-	Read-only
L2476	0x99AC	General PID integral output	-8 to 8	0.0	-	Read-only
L2478	0x99AE	General PID derivative output	-8 to 8	0.0	-	Read-only
L2480	0x99B0	General PID inversion cutoff output	-8 to 8	0.0	-	Read-only
L2482	0x99B2	Value after simple PLC step per-unit	-8 to 8	0.0	-	Read-only
L2500	0x99C4	Floating output of word-to-double word module A	-8 to 8	0.00	-	Read-only
L2502	0x99C6	Floating output of word-to-double word module B	-8 to 8	0.00	-	Read-only
L2504	0x99C8	Floating output of word-to-double word module C	-8 to 8	0.00	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L2506	0x99CA	Floating output of word-to-double word module D	-8 to 8	0.00	-	Read-only
L2508	0x99CC	Floating output of double word-to-word module A	-8 to 8	0.00	-	Read-only
L2510	0x99CE	Floating output of double word-to-word module B	-8 to 8	0.00	-	Read-only
L2512	0x99D0	Floating output of double word-to-word module C	-8 to 8	0.00	-	Read-only
L2514	0x99D2	Floating output of double word-to-word module D	-8 to 8	0.00	-	Read-only
L2696	0x9A88	Percentage of current length to target length	-3276.8 to +3276.7	0.0	-	Read-only
L2698	0x9A8A	Percentage of current count value to target count value	-3276.8 to +3276.7	0.0	-	Read-only
L3000	0x9BB8	Actual motor speed	-8 to 8	0.0	-	Read-only
L3002	0x9BBA	Final motor speed reference	-8 to 8	0.0	-	Read-only
L3006	0x9BBE	Target frequency	-8 to 8	0.0	-	Read-only
L3008	0x9BC0	Operating frequency	-8 to 8	0.0	-	Read-only
L3010	0x9BC2	Target frequency of the channel	-8 to 8	0.0	-	Read-only
L3012	0x9BC4	Channel additional frequency	-8 to 8	0.0	-	Read-only
L3014	0x9BC6	Additional frequency reference	-8 to 8	0.0	-	Read-only
L3016	0x9BC8	Jog 1 frequency	-8 to 8	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L3018	0x9BCA	Jog 2 frequency	-8 to 8	0.0	-	Read-only
L3026	0x9BD2	Main frequency reference after gain processing	-8 to 8	0.0	-	Read-only
L3028	0x9BD4	Auxiliary frequency reference after gain processing	-8 to 8	0.0	-	Read-only
L3030	0x9BD6	Frequency reference after direction inversion	-8 to 8	0.0	-	Read-only
L3032	0x9BD8	Frequency reference after speed limit	-8 to 8	0.0	-	Read-only
L3034	0x9BDA	Frequency reference after offset set by UP/DOWN key	-8 to 8	0.0	-	Read-only
L3036	0x9BDC	Frequency reference after direction limit	-8 to 8	0.0	-	Read-only
L3038	0x9BDE	Frequency reference after limit	-8 to 8	0.0	-	Read-only
L3040	0x9BE0	Frequency reference after frequency jump	-8 to 8	0.0	-	Read-only
L3042	0x9BE2	Frequency reference after ramp change	-8 to 8	0.0	-	Read-only
L3046	0x9BE6	RFG setting input	-8 to 8	0.0	-	Read-only
L3048	0x9BE8	RFG calculation input	-8 to 8	0.0	-	Read-only
L3050	0x9BEA	Actual RFG target	-8 to 8	0.0	-	Read-only
L3052	0x9BEC	RFG calculation output	-8 to 8	0.0	-	Read-only
L3054	0x9BEE	RFG speed ramping up	-8 to 8	0.0	-	Read-only
L3056	0x9BF0	RFG forced value of starting frequency function	-8 to 8	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L3058	0x9BF2	Offset amount of UP/DOWN key for channel 1	-8 to 8	0.0	-	Read-only
L3060	0x9BF4	Upper limit of frequency adjusted by UP/DOWN key	-8 to 8	0.0	-	Read-only
L3062	0x9BF6	UP/DOWN lower limit	-8 to 8	0.0	-	Read-only
L3064	0x9BF8	Speed reference set through communica-tion	-8 to 8	0.0	-	Read-only
L3066	0x9BFA	Communica-tion setting	-8 to 8	0.0	-	Read-only
L3068	0x9BFC	Maximum positive frequency	-8 to 8	0.0	-	Read-only
L3070	0x9BFE	Minimum forward frequency	-8 to 8	0.0	-	Read-only
L3072	0x9C00	Maximum negative frequency	-8 to 8	0.0	-	Read-only
L3074	0x9C02	Minimum reverse frequency	-8 to 8	0.0	-	Read-only
L3076	0x9C04	Positive frequency limit with additional frequency applied	-8 to 8	0.0	-	Read-only
L3078	0x9C06	Negative frequency limit with additional frequency applied	-8 to 8	0.0	-	Read-only
L3080	0x9C08	Offset amount of UP/DOWN key for channel 2	0 to 6553.5	0.0	-	Read-only
L3100	0x9C1C	Torque reference	-8 to 8	0.0	-	Read-only
L3102	0x9C1E	Supplementary torque	-8 to 8	0.0	-	Read-only
L3104	0x9C20	Torque setpoint after filtering	-8 to 8	0.0	-	Read-only
L3106	0x9C22	Target torque reference	-8 to 8	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L3108	0x9C24	Speed limit in torque control mode	-8 to 8	0.0	-	Read-only
L3110	0x9C26	Frequency offset in torque control mode	-8 to 8	0.0	-	Read-only
L3112	0x9C28	Maximum positive torque	-8 to 8	0.0	-	Read-only
L3114	0x9C2A	Maximum negative torque	-8 to 8	0.0	-	Read-only
L3120	0x9C30	Target voltage in V/f decoupled mode	-8 to 8	0.0	-	Read-only
L3122	0x9C32	Voltage output in V/f decoupled mode	-8 to 8	0.0	-	Read-only
L3144	0x9C48	D-axis output voltage	-8 to 8	0.0	-	Read-only
L3146	0x9C4A	Q-axis output voltage	-8 to 8	0.0	-	Read-only
L3206	0x9C86	Drive PCB overload accumulated value	-8 to 8	0.0	-	Read-only
L3208	0x9C88	Drive overload cumulative value	-8 to 8	0.0	-	Read-only
L3210	0x9C8A	Cumulative motor overload value	-8 to 8	0.0	-	Read-only
L3212	0x9C8C	Synchronous frequency	-8 to 8	0.0	-	Read-only
L3214	0x9C8E	Synchronous rotating angle	-8 to 8	0.0	-	Read-only
L3216	0x9C90	Control torque reference	-8 to 8	0.0	-	Read-only
L3218	0x9C92	Flux reference control	-8 to 8	0.0	-	Read-only
L3220	0x9C94	Excitation current reference	-8 to 8	0.0	-	Read-only
L3222	0x9C96	Torque current reference	-8 to 8	0.0	-	Read-only
L3224	0x9C98	Actual excitation current	-8 to 8	0.0	-	Read-only
L3226	0x9C9A	Actual torque current	-8 to 8	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L3228	0x9C9C	Phase U current (instantaneous value)	-8 to 8	0.0	-	Read-only
L3230	0x9C9E	Phase V current (instantaneous value)	-8 to 8	0.0	-	Read-only
L3232	0x9CA0	Phase W current (instantaneous value)	-8 to 8	0.0	-	Read-only
L3234	0x9CA2	Output current amplitude	-8 to 8	0.0	-	Read-only
L3238	0x9CA6	Output voltage amplitude	-8 to 8	0.0	-	Read-only
L3240	0x9CA8	Output voltage phase	-8 to 8	0.0	-	Read-only
L3248	0x9CB0	Drive bus voltage	0.0 V to 6553.5 V	0.0	V	Read-only
L3288	0x9CD8	Capacitor core temperature	0.00 to 655.35	0.00	-	Read-only
L3290	0x9CDA	Effective value of capacitor current	0.00 to 655.35	0.00	-	Read-only
L3292	0x9CDC	U-phase loss	0.00 to 655.35	0.00	-	Read-only
L3294	0x9CDE	V-phase loss	0.00 to 655.35	0.00	-	Read-only
L3296	0x9CE0	W-phase loss	0.00 to 655.35	0.00	-	Read-only
L3298	0x9CE2	Rec average loss	0.00 to 655.35	0.00	-	Read-only
L3354	0x9D1A	Speed loop active Kp	0 to 6553.5	0.0	-	Read-only
L3356	0x9D1C	Speed loop active Ti	0 to 6553.5	0.0	-	Read-only
L3358	0x9D1E	Speed loop output	0 to 6553.5	0.0	-	Read-only
L3360	0x9D20	Speed loop Kp output	0 to 6553.5	0.0	-	Read-only
L3362	0x9D22	Speed loop Ti output	0 to 6553.5	0.0	-	Read-only
L3364	0x9D24	Forward torque limit	0 to 6553.5	0.0	-	Read-only
L3366	0x9D26	Reverse torque limit value	0 to 6553.5	0.0	-	Read-only
L3368	0x9D28	Forward torque\current limit	0 to 6553.5	0.0	-	Read-only
L3370	0x9D2A	Reverse torque \current limit	0 to 6553.5	0.0	-	Read-only
L3372	0x9D2C	Unlimited speed loop output	0 to 6553.5	0.0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L3374	0x9D2E	Torque feedforward output	0 to 6553.5	0.0	-	Read-only
L3376	0x9D30	Torque of load observer	0 to 6553.5	0.0	-	Read-only
L3378	0x9D32	Total additional torque	0 to 6553.5	0.0	-	Read-only
L3400	0x9D48	Tension process target speed	-3276.8 to +3276.7	0.0	%	Read-only
L3402	0x9D4A	Tension process target torque	-3276.8 to +3276.7	0.0	%	Read-only
L3404	0x9D4C	Tension process speed limit	-3276.8 to +3276.7	0.0	%	Read-only
L3406	0x9D4E	Tension process speed limit offset	-3276.8 to +3276.7	0.0	%	Read-only
L3408	0x9D50	Tension process torque limit	-3276.8 to +3276.7	0.0	%	Read-only
L3410	0x9D52	Taper AO output	-3276.8 to +3276.7	0.0	%	Read-only
L3412	0x9D54	Roll diameter AO output	-3276.8 to +3276.7	0.0	%	Read-only
L3414	0x9D56	Tension AO output	-3276.8 to +3276.7	0.0	%	Read-only
L3440	0x9D70	Retentive value of brake torque	-8 to 8	0.00	-	Read-only
L3442	0x9D72	Indicates the starting speed of the brake.	-8 to 8	0.00	-	Read-only
L3444	0x9D74	Indicates the starting torque of the torque.	-8 to 8	0.00	-	Read-only
U0-00	0x7000	Operating frequency	0.00 Hz to 600.00 Hz	0.00	Hz	Read-only
U0-01	0x7001	Frequency reference	0.00 Hz to 600.00 Hz	0.00	Hz	Read-only
U0-02	0x7002	Bus voltage	0.0 V to 6553.5 V	0.0	V	Read-only
U0-03	0x7003	Output voltage	0 to 65535	0	V	Read-only
U0-04	0x7004	Output current	0.00 to 655.35	0.00	A	Read-only
U0-05	0x7005	Output power	-3276.8 kW to +3276.7 kW	0.0	kW	Read-only
U0-06	0x7006	Output torque	-3276.8 to +3276.7	0.0	%	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U0-07	0x7007	DI state	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 status 0: Low level 1: High level bit3: DI4 status 0: Low level 1: High level bit4: DI5 status 0: Low level 1: High level bit5: Reserved 0: Low level 1: High level bit6: Reserved 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U0-08	0x7008	DO state	bit0: RO state 0: Low level 1: High level bit1: Reserved bit2: Reserved bit3: Reserved bit4: DO status 0: Low level 1: High level bit5: Reserved bit6: Reserved bit7: Reserved bit8: FMR status 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 status 0: Low level 1: High level bit11: VDO2 status 0: Low level 1: High level bit12: VDO3 status 0: Low level 1: High level bit13: VDO4 status 0: Low level 1: High level bit14: VDO5 status 0: Low level 1: High level bit15: VDO6 status 0: Low level 1: High level	0x0	-	Read-only
U0-09	0x7009	AI1 voltage	-10.570 V to 10.570 V	0.000	V	Read-only
U0-10	0x700A	AI2 voltage	-10.570 V to 10.570 V	0.000	V	Read-only
U0-11	0x700B	Voltage of potentiometer MD-BP-M	-10.570 V to 10.570 V	0.000	V	Read-only
U0-12	0x700C	Count value	0 to 65535	0	-	Read-only
U0-13	0x700D	Length value	0 to 65535	0	-	Read-only
U0-14	0x700E	Load speed display	0 to 65535	0	rpm	Read-only
U0-15	0x700F	PID setting	-32768 to 32767	0	-	Read-only
U0-16	0x7010	PID feedback	-32768 to 32767	0	-	Read-only
U0-17	0x7011	PLC phase	0 to 65535	0	-	Read-only
U0-18	0x7012	HDI input pulse frequency	0.00 kHz to 20.00 kHz	0.00	kHz	Read-only
U0-19	0x7013	Actual motor frequency	-327.67 Hz to 327.67 Hz	0.00	Hz	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U0-20	0x7014	Remaining time for timing operation	0.0 min. to 6553.5 min.	0.0	min.	Read-only
U0-21	0x7015	Uncalibrated AI1 voltage	-10.570 V to 10.570 V	0.000	V	Read-only
U0-22	0x7016	AI2 voltage before correction	-10.570 V to 10.570 V	0.000	V	Read-only
U0-23	0x7017	Uncalibrated MD-BP-M potentiometer voltage	-10.570 V to 10.570 V	0.000	V	Read-only
U0-24	0x7018	Actual motor speed	0 to 65535	0	rpm	Read-only
U0-25	0x7019	Current power-on time	0 min. to 65535 min.	0	min.	Read-only
U0-26	0x701A	Current running time	0.0 min. to 6553.5 min.	0.0	min.	Read-only
U0-28	0x701C	Communica-tion setpoint	-300.00 % to 300.00%	0.00	%	Read-only
U0-30	0x701E	Setpoint of main frequency	-327.68 Hz to +327.67 Hz	0.00	Hz	Read-only
U0-31	0x701F	Setpoint of auxiliary frequency	-327.68 Hz to +327.67 Hz	0.00	Hz	Read-only
U0-35	0x7023	Target torque	-200.0% to +200.0%	0.0	%	Read-only
U0-37	0x7025	Power factor angle	-3276.8° to 3276.7°	0.0	°	Read-only
U0-39	0x7027	Target voltage in V/f decoupled mode	0 to 65535	0	V	Read-only
U0-40	0x7028	Output voltage in V/f decoupled mode	0 to 65535	0	V	Read-only
U0-45	0x702D	Fault code	0.0 to 6553.5	0.0	-	Read-only
U0-46	0x702E	Minor fault code	0.0 to 6553.5	0.0	-	Read-only
U0-47	0x702F	Alarm code	0.0 to 6553.5	0.0	-	Read-only
U0-48	0x7030	Prompt code	0.0 to 6553.5	0.0	-	Read-only
U0-49	0x7031	Set fan speed	0 to 65535	0	rpm	Read-only
U0-50	0x7032	Real-time speed of the fan	-32768 rpm to +32767 rpm	0	rpm	Read-only
U0-51	0x7033	Channel 1 simple UP/ DOWN key output	-327.68 Hz to +327.67 Hz	0.00	Hz	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U0-52	0x7034	Internal temperature of the fan chip	0 to 65535	0	-	Read-only
U0-59	0x703B	Frequency reference (percentage)	-3276.8 to +3276.7	0.0	%	Read-only
U0-60	0x703C	Operating frequency (percentage)	-3276.8 to +3276.7	0.0	%	Read-only
U0-61	0x703D	AC drive status 1	1: Forward run 2: Reverse run 3: Stop 4: Auto-tuning 5: Faulty	0	-	Read-only
U0-62	0x703E	Channel 2 simple UP/ DOWN key output	-327.68 Hz to +327.67 Hz	0.00	Hz	Read-only
U0-65	0x7041	Torque upper limit	-2000.0% to +2000.0%	0.0	%	Read-only
U0-68	0x7044	Drive state 2	bit0: Running status 0: Stop 1: Run bit1: Running direction 0: Forward run 1: Reverse bit2: Fault state 0: Invalid 1: Valid bit3: Frequency reach 0: Not reached 1: Reached bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8 to bit15: Fault code	0x0	-	Read-only
U0-69	0x7045	Actual motor frequency (signed)	-327.67 Hz to 327.67 Hz	0.00	Hz	Read-only
U0-70	0x7046	Actual motor speed (signed)	-32768 rpm to +32767 rpm	0	rpm	Read-only
U0-71	0x7047	Output current (one decimal place)	0.0 to 6553.5	0.0	A	Read-only
U0-75	0x704B	Actual motor frequency (unsigned)	0.00 Hz to 655.35 Hz	0.00	Hz	Read-only
U0-76	0x704C	Low bits of cumulative power consumption	0.0 kWh to 6553.5 kWh	0.0	kWh	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U0-77	0x704D	High bits of cumulative power consumption	0 kWh to 65535 kWh	0	kWh	Read-only
U0-82	0x7052	Heatsink temperature	-20.0 °C to 120.0°C	0.0	°C	Read-only
U0-83	0x7053	Ambient temperature	-20.0 °C to 120.0°C	0.0	°C	Read-only
U0-84	0x7054	Load type	0: High-load application 1: Light-load application	0	-	Read-only
U0-85	0x7055	Auto-tuning and self-test procedure	0 to 65535	0	-	Read-only
U0-86	0x7056	Proportional coefficient of the speed loop	0.00 to 655.35	0.00	-	Read-only
U0-87	0x7057	Integral coefficient of the speed loop	0.00 to 655.35	0.00	-	Read-only
U0-90	0x705A	AI2 temperature mode - motor temperature value	-50 °C to +300°C	0	°C	Read-only
U0-97	0x7061	Effective value of Phase-U current	0.00 % to 655.35%	0.00	%	Read-only
U0-98	0x7062	Effective value of Phase-V current	0.00 % to 655.35%	0.00	%	Read-only
U0-99	0x7063	Effective value of phase W current	0.00 % to 655.35%	0.00	%	Read-only
U1-05	0x7105	AI1 curve input value	-327.68 to +327.67	0.00	V	Read-only
U1-06	0x7106	Input value of AI2 curve	-327.68 to +327.67	0.00	V	Read-only
U1-07	0x7107	Curve input value of potentiometer MD-BP-M	-327.68 to +327.67	0.00	V	Read-only
U1-08	0x7108	AO output	-327.68 to +327.67	0.00	V	Read-only
U1-10	0x710A	AO output (original value)	-327.680V~32.767 V	0.000	V	Read-only
U1-12	0x710C	AO current mode	-327.68 mA to 327.67 mA	0.00	mA	Read-only
U1-14	0x710E	Frequency per-unit value after HDO selects the display source	-327.68 % to 327.67%	0.00	%	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U1-15	0x710F	Frequency per-unit value before HDO curve correction	-327.68 % to 327.67%	0.00	%	Read-only
U1-16	0x7110	Final output frequency per-unit value of HDO	-327.68 % to 327.67%	0.00	%	Read-only
U1-17	0x7111	Final output actual frequency of HDO	0.00 kHz to 655.35 kHz	0.00	kHz	Read-only
U1-41	0x7129	I/O expansion card 1-AI1 input	-32.767 V to +32.767 V	0.000	V	Read-only
U1-42	0x712A	I/O expansion card 1-AI1 curve input value	-327.67 to +327.67	0.00	V	Read-only
U1-43	0x712B	I/O expansion card 1-AO output	-327.67 to +327.67	0.00	V	Read-only
U1-45	0x712D	I/O expansion card 1-RTD temperature value	-50.0℃~300.0 ℃	0.0	℃	Read-only
U1-51	0x7133	I/O expansion card 1 - AI1 input	-32.767 V to +32.767 V	0.000	V	Read-only
U1-52	0x7134	I/O expansion card 2-AI1 curve input value	-327.67 to +327.67	0.00	V	Read-only
U1-53	0x7135	I/O expansion card 2-AO output	-327.67 to +327.67	0.00	V	Read-only
U1-55	0x7137	I/O expansion card 2-RTD temperature value	-50.0℃~300.0 ℃	0.0	℃	Read-only
U2-00	0x7200	Current motor parameter group	0: Motor parameter set 1 1: Motor parameter set 2 2: Motor parameter set 3 3: Motor parameter group 4	0	-	Read-only
U2-01	0x7201	Active control channel	0: Control channel 1 1: Control channel 2	0	-	Read-only
U2-02	0x7202	Current setting channel	0: Reference channel 1 1: Reference channel 2	0	-	Read-only
U2-03	0x7203	Active stop mode	0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U2-05	0x7205	Current multi-reference selection	0 to 65535	0	-	Read-only
U2-06	0x7206	Current multi-reference effective value	-3276.8 to +3276.7	0.0	%	Read-only
U2-07	0x7207	Current running mode	0: Normal operation 1: Valid	0	-	Read-only
U2-08	0x7208	Current jog source	0: Jog source 1 1: Jog source 2	0	-	Read-only
U2-09	0x7209	Current control mode	0: Speed control mode 1: Torque control mode 2: Position control mode (reserved)	0	-	Read-only
U2-10	0x720A	Active carrier frequency	0 Hz to 65535 Hz	0	Hz	Read-only
U2-11	0x720B	Local/remote	0: Remote 1: Local	0	-	Read-only
U2-18	0x7212	Jump frequency flag bit	0 to 65535	0	-	Read-only
U2-19	0x7213	Self-test/Auto-tuning pre-state	0: Inactive 1: Wait for auto-tuning 2: Wait for self-test 3: Forced DC braking	0	-	Read-only
U2-20	0x7214	Self-test/Auto-tuning request	0 to 65535	0	-	Read-only
U2-21	0x7215	Self-test/Auto-tuning completion	0 to 65535	0	-	Read-only
U2-22	0x7216	Self-test upon power-on/ Auto-tuning of current item	0 to 65535	0	-	Read-only
U2-23	0x7217	Decelerate to stop/DC braking	0 to 65535	0	-	Read-only
U2-24	0x7218	Immediate DC braking of DI	0: Inactive 1: Immediate DC braking 2: Decelerate to DC braking	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U2-25	0x7219	Fault and limit level	bit0: Coast to stop 0: Inactive 1: Active bit1: Stop at maximum capability 0: Inactive 1: Active bit2: Quick stop 0: Inactive 1: Active bit3: Decelerate to stop 0: Inactive 1: Active bit4: Reserved 0: Inactive 1: Active bit5: Reserved 0: Inactive 1: Active bit6: Reserved 0: Inactive 1: Active bit7: Reserved 0: Inactive 1: Active bit8: Reserved 0: Inactive 1: Active bit9: Limit operation 0: Inactive 1: Active bit10: Alarm 0: Inactive 1: Active bit11: Prompt 0: Inactive 1: Active bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only
U2-26	0x721A	View of reset/ restart procedure upon fault	0 to 65535	0	-	Read-only
U2-27	0x721B	Automatic reset command flag for communica-tion fault	0: Inactive 1: Active	0	-	Read-only
U2-35	0x7223	Undervoltage fault flag bit	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U2-36	0x7224	Fault restart clear command	0 to 65535	0	-	Read-only
U2-37	0x7225	Frequency offset mode in torque control	0 to 65535	0	-	Read-only
U2-38	0x7226	Separated V/f RFG clear command	0: Inactive 1: Active	0	-	Read-only
U2-39	0x7227	V/f separation	0: Inactive 1: Active	0	-	Read-only
U2-40	0x7228	Stop frequency control for separated V/f	0: Inactive 1: Active	0	-	Read-only
U2-41	0x7229	RFG performance enabled forcibly	0: Inactive 1: Active	0	-	Read-only
U2-42	0x722A	RFG acceleration/ deceleration state	0 to 65535	0	-	Read-only
U2-43	0x722B	RFG arc state	0 to 65535	0	-	Read-only
U2-44	0x722C	Active RFG selection	0: Ramp 1 1: Ramp 2 2: Ramp 3 3: Ramp 4	0	-	Read-only
U2-45	0x722D	State of current additional torque 2	bit0: Setting channel 1 0: Inactive 1: Active bit1: Setting channel 2 0: Inactive 1: Active bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only
U2-49	0x7231	Remaining time of timed operation	0.0 min. to 6553.5 min.	0.0	min.	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U2-50	0x7232	Flag for decimal place changing with power parameter	0.0 to 6553.5	0.0	-	Read-only
U2-51	0x7233	Wobble frequency acceleration/ deceleration timeout flag	0 to 65535	0	-	Read-only
U2-55	0x7237	Parameter record information 0	0 to 65535	0	-	Read-only
U3-00	0x7300	LCD command word	0x0 to 0xFFFF	0x0	-	Read-only
U3-02	0x7302	IDS command word	0x0 to 0xFFFF	0x0	-	Read-only
U3-03	0x7303	Command used by commissioning software to obtain control permission	0 to 65535	0	-	Read-only
U3-07	0x7307	LED control word	0x0 to 0xFFFF	0x0	-	Read-only
U3-08	0x7308	Control word of the commissioning software	0x0 to 0xFFFF	0x0	-	Read-only
U3-09	0x7309	SOP control word	0x0 to 0xFFFF	0x0	-	Read-only
U3-11	0x730B	LED command clear flag	0 to 65535	0	-	Read-only
U3-12	0x730C	Clear SOP command	0 to 65535	0	-	Read-only
U3-13	0x730D	IDS command clear flag	0 to 65535	0	-	Read-only
U3-14	0x730E	Automatic reset command flag for communica-tion fault	0 to 65535	0	-	Read-only
U3-16	0x7310	Speed reference 2 set through communica-tion (0x7310)	0 to 65535	0	-	Read-only
U3-17	0x7311	Control word 2 set through communica-tion (0x7311)	0x0 to 0xFFFF	0x0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U3-18	0x7312	DO state setting (DO function source: communication)	0 to 65535	0	-	Read-only
U3-19	0x7313	AO1 output (AO1 function setting source: communication)	0 to 65535	0	-	Read-only
U3-21	0x7315	HDO output reference (HDO function option: communication)	0 to 65535	0	-	Read-only
U3-23	0x7317	Monitoring of speed reference 1 set through communication (0x1000)	-32768 to 32767	0	-	Read-only
U3-24	0x7318	0x1000H decimal place set through communication	0 to 65535	0	-	Read-only
U3-28	0x731C	Communication status word	0x0 to 0xFFFF	0x0	-	Read-only
U3-29	0x731D	Communication error reset enable	0 to 65535	0	-	Read-only
U3-33	0x7321	Communication setting control word 1 (0x7321)	0x0 to 0xFFFF	0x0	-	Read-only
U3-34	0x7322	DO state setting of I/O expansion card (DO function option: Communication)	0 to 65535	0	-	Read-only
U3-35	0x7323	AO1 output reference of expansion card 1 (AO1 function option: Communication)	0 to 65535	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U3-36	0x7324	AO1 output reference of expansion card 2 (AO1 function option: Communica-tion)	0 to 65535	0	-	Read-only
U3-37	0x7325	Software tool control flag	0 to 65535	0	-	Read-only
U3-38	0x7326	Command channel command (last cycle)	0 to 65535	0	-	Read-only
U3-41	0x7329	Communica-tion command clear flag	0 to 65535	0	-	Read-only
U3-50	0x7332	Read fault code	0 to 65535	0	-	Read-only
U3-51	0x7333	Read fault sub-code	0 to 65535	0	-	Read-only
U3-52	0x7334	Read minor fault code	0 to 65535	0	-	Read-only
U3-53	0x7335	Read minor fault sub-code	0 to 65535	0	-	Read-only
U3-54	0x7336	Read alarm code	0 to 65535	0	-	Read-only
U3-55	0x7337	Read alarm sub-code	0 to 65535	0	-	Read-only
U3-56	0x7338	Read prompt code	0 to 65535	0	-	Read-only
U3-57	0x7339	Read prompt sub-code	0 to 65535	0	-	Read-only
U3-90	0x735A	Floating-point connector-to-monitoring parameter module A output	-32768 to 32767	0	-	Read-only
U3-91	0x735B	Floating-point connector-to-monitoring parameter module B output	-32768 to 32767	0	-	Read-only
U3-92	0x735C	Floating-point connector-to-monitoring parameter module C output	-32768 to 32767	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U3-93	0x735D	Floating-point connector-to-monitoring parameter module D output	-32768 to 32767	0	-	Read-only
U3-94	0x735E	Floating-point connector-to-monitoring parameter module E output	-32768 to 32767	0	-	Read-only
U3-95	0x735F	Floating-point connector-to-monitoring parameter module F output	-32768 to 32767	0	-	Read-only
U3-96	0x7360	Floating-point connector-to-monitoring parameter module G output	-32768 to 32767	0	-	Read-only
U3-97	0x7361	Floating-point connector-to-monitoring parameter module H output	-32768 to 32767	0	-	Read-only
U6-62	0x763E	STO fault exception flag	0 to 65535	0	-	Read-only
U6-63	0x763F	STO initialization flag	0 to 1	0	-	Read-only
U6-64	0x7640	STO status monitoring word	0 to 65535	0	-	Read-only
U6-65	0x7641	STO model	0 to 65535	0	-	Read-only
U6-66	0x7642	STO_1.2 V_AD sampling value	0 to 65535	0	-	Read-only
U6-67	0x7643	STO_5 V_AD sampling value	0 to 65535	0	-	Read-only
U6-70	0x7646	Power-off time display	0 to 65535	0	-	Read-only
U6-71	0x7647	Address mapping enabling state	0: Inactive 1: Active	0	-	Read-only
U6-72	0x7648	User load curve enable	0: Inactive 1: Active	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U6-73	0x7649	User load curve setting error flag	0 to 65535	0	-	Read-only
U6-74	0x764A	Multi-point curve setup error flag	bit0: Multi-point curve A 0: No error 1: Error occurred bit1: Multi-point curve B 0: No error 1: Error occurred bit2: Reserved bit3: Reserved bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read-only
U6-76	0x764C	Power-on Initialization completion flag	0 to 65535	0	-	Read-only
U6-77	0x764D	Model-related parameter update flag	0 to 65535	0	-	Read-only
U6-84	0x7654	Prompt for parameter setting error	0 to 65535	0	-	Read-only
U6-85	0x7655	Macro parameter backup error	0 to 65535	0	-	Read-only
U6-86	0x7656	Flag of invalid restoration for backup parameter	0 to 65535	0	-	Read-only
U8-00	0x7800	Current state of brake control	0: Initializing 1: Inhibited 2: Applying 3: Applied 4: Wait for release 5: Releasing 6: Released 7: Wait for applying 8: Brake test	0	-	Read-only
U8-01	0x7801	Brake module control word	0 to 65535	0	-	Read-only
U8-02	0x7802	Brake module status word	0 to 65535	0	-	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U8-03	0x7803	Status word for brake release not done	0 to 65535	0	-	Read-only
U8-04	0x7804	Status word for brake apply not done	0 to 65535	0	-	Read-only
U8-05	0x7805	Starting frequency state of brake module	0 to 65535	0	-	Read-only
U8-06	0x7806	Starting torque state of brake module	0 to 65535	0	-	Read-only
U8-07	0x7807	Brake feedback state during auto-tuning	0 to 65535	0	-	Read-only
U9-00	0x7900	Linear speed	0.0 m/min to 6553.5 m/min	0.0	m/min	Read-only
U9-01	0x7901	Current reel diameter	0.0 to 6553.5	0.0	mm	Read-only
U9-02	0x7902	Linear speed synchroniza-tion frequency	-327.68 Hz to +327.67 Hz	0.00	Hz	Read-only
U9-03	0x7903	Closed loop speed output	-327.68 Hz to +327.67 Hz	0.00	Hz	Read-only
U9-04	0x7904	Tension reference (before taper)	0N~65535 N	0	N	Read-only
U9-05	0x7905	Tension reference (after taper)	0N~65535 N	0	N	Read-only
U9-06	0x7906	Torque reference	-3276.8 to +3276.7	0.0	%	Read-only
U9-07	0x7907	Closed loop torque output	-3276.8 to +3276.7	0.0	%	Read-only
U9-08	0x7908	Tension control state machine	0 to 65535	0	-	Read-only
U9-09	0x7909	Closed loop tension (speed/ torque) PID setting display	-3276.8 to +3276.7	0.0	%	Read-only
U9-10	0x790A	Closed loop tension (speed/ torque) PID feedback display	-3276.8 to +3276.7	0.0	%	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U9-11	0x790B	Closed loop tension (speed/ torque) PID proportional output	-3276.8 to +3276.7	0.0	%	Read-only
U9-12	0x790C	Closed loop tension (speed/ torque) PID integral output	-3276.8 to +3276.7	0.0	%	Read-only
U9-13	0x790D	Closed loop tension (speed/ torque) PID derivative output	-3276.8 to +3276.7	0.0	%	Read-only
U9-14	0x790E	Tension process execution time	0 to 65535	0	-	Read-only
U9-15	0x790F	Winding mode	0 to 65535	0	-	Read-only
U9-16	0x7910	Tension torque setpoint	-3276.8 to +3276.7	0.0	%	Read-only
U9-17	0x7911	Static friction torque	-3276.8 to +3276.7	0.0	%	Read-only
U9-18	0x7912	Dynamic friction torque	-3276.8 to +3276.7	0.0	%	Read-only
U9-19	0x7913	Inertia torque	-3276.8 to +3276.7	0.0	%	Read-only
U9-20	0x7914	Terminal lift torque	-3276.8 to +3276.7	0.0	%	Read-only
U9-21	0x7915	Torque upper limit in vertical cable drum application (calculated value)	-3276.8 to +3276.7	0.0	%	Read-only
U9-22	0x7916	Torque lower limit in vertical cable drum application (calculated value)	-3276.8 to +3276.7	0.0	%	Read-only
U9-23	0x7917	Torque upper limit in vertical cable drum application (actual value)	-3276.8 to +3276.7	0.0	%	Read-only
U9-24	0x7918	Torque lower limit in vertical cable drum application (actual value)	-3276.8 to +3276.7	0.0	%	Read-only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U9-25	0x7919	Closed loop tension (speed/ torque) PID output	-3276.8 to +3276.7	0.0	%	Read-only
U9-26	0x791A	Linear acceleration	-32768 to 32767	0	-	Read-only

16 Technical Data

16.1 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 16–1 Electrical specifications for T1 to T2 models (three-phase 380 V to 480 V)

Item		Specification					
Model: MD610S-4Txxxxx-INT		1R5 (BS)	2R1 (BS)	3R8 (BS)	5R1 (BS)	7R2 (BS)	9R0 (BS)
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: MD610S-4Txxxxx-INT		1R5 (BS)	2R1 (BS)	3R8 (BS)	5R1 (BS)	7R2 (BS)	9R0 (BS)
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)					
	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	Air cooling	Air cooling	Air cooling	Air cooling
Overvoltage category	OVC III						
Short-circuit rated value	5 kA						
Pollution degree	PD2						
IP rating	IP20 (Except for power supply distribution wiring and capacitor vent)						
Protection class	Class I						
IEC61800-9-2 energy efficiency class	IE2						

Note

G-type: Heavy-duty models supporting 150% overload (1.5x rated load).

P-type: Light-duty models supporting 110% overload (1.1x rated load).

Table 16–2 Electrical specifications for T3 to T5 models (three-phase 380 V to 480 V)

Item		Specification					
Model: MD610S-4Txxxxx-INT		013 (BS)	017 (BS)	025 (BS)	032 (BS)	037 (BS)	045 (BS)
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
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)					
	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					

Item		Specification					
Model: MD610S-4Txxxxx-INT		013 (BS)	017 (BS)	025 (BS)	032 (BS)	037 (BS)	045 (BS)
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	Air cooling	Air cooling	Air cooling	Air cooling	Air cooling	Air cooling
	Exhaust airflow (CFM)	31	31	55.7	57.5	91.8	85
Overvoltage category	OVC III						
Short-circuit rated value	5 kA						
IP rating	IP20 (Except for power supply distribution wiring and capacitor vent)						
Protection class	Class I						
IEC61800-9-2 energy efficiency class	IE2						

Note

G-type: Heavy-duty models supporting 150% overload (1.5x rated load).

P-type: Light-duty models supporting 110% overload (1.1x rated load).

Table 16–3 Electrical specifications for T6 to T8 models (three-phase 380 V to 480 V)

Item		Specification					
Model: MD610S-4Txxxxx-INT		060 (BS)	075 (BS)	091 (BS)	112 (BS)	150 (BS)	176 (BS)
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: MD610S-4Txxxxx-INT		060 (BS)	075 (BS)	091 (BS)	112 (BS)	150 (BS)	176 (BS)
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%; allowed voltage 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	81.9	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)					
	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	Air cooling	Air cooling	Air cooling	Air cooling	Air cooling	Air cooling
	Exhaust airflow (CFM)	130	130	150	150	167	190
Overvoltage category	OVC III						

Item		Specification					
Model: MD610S-4Txxxxx-INT		060 (BS)	075 (BS)	091 (BS)	112 (BS)	150 (BS)	176 (BS)
Short-circuit rated value	5 kA						
IP rating	IP20 (Except for power supply distribution wiring and capacitor vent)						
Protection class	Class I						
IEC61800-9-2 energy efficiency class	IE2						

Note

G-type: Heavy-duty models supporting 150% overload (1.5x rated load).

P-type: Light-duty models supporting 110% overload (1.1x rated load).

16.2 General Specifications

Item			Technical specifications
Motor control performance	Applicable motor type		Asynchronous induction motors (IM), permanent magnet synchronous motors (PMSM), and synchronous reluctance motors (SynRM)
	Control method		Sensorless vector control (SVC), 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 self-adaption of speed loop parameters, load observer, overvoltage suppression, undervoltage suppression (voltage dip suppression), over-excitation fast deceleration, automatic voltage adjustment, 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
		Field weakening ratio	6 x field weakening
	PMSM and synchronous reluctance motor SVC	Functions available	Speed tracking, electronic star connection, fast deceleration upon over-excitation, MTPA maximum torque-to-current ratio control, inertia auto-tuning and acceleration feedforward, droop control, adaptive speed loop parameter programming, 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 specifications
Basic functions	Resolution of input frequency		Digital setting: 0.01 Hz Analog setting: maximum frequency x 0.025%
	Operation	Operation command	Independent dual channel and dual channel, which can be switched freely Provides different start/stop sources (terminal, operating panel, communication, custom, connector). Provides standard control word.
		Frequency reference	Independent dual channel and dual channel, which can be switched freely Provides various sources (communication, operating panel, analog, connector, and so on). 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 rectify command discontinuity caused by communication intervals, ensuring smooth operation.
	Output limit		Supports torque limit, power limit, current limit, torque limit, speed limit, and jump frequency.

Item			Technical specifications
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°C to 200°C, ±8°C) • PT1000 (-25°C to 200°C, ±8°C) • KTY84-130 (-40°C to 260°C, ±8°C) • PTC (20°C to 180°C, guaranteed accuracy ±15°C within a range of 110°C to 150°C)
		Analog output	One AO (that is, AO1): 0 V to 10 V or 0 mA to 20 mA; calibration accuracy: 100 mV; resolution: 12-bit; calibration accuracy: 0.5%
		Digital input	DI4 to DI1 • Supporting photocoupler isolation and bipolar input • Input impedance: 6 kΩ • Input voltage: 15 VDC to 56 VDC; 20 VAC to 54 VAC • Compatible with 24 VDC, 36 VDC, 48 VDC, 36 VAC, and 48 VAC • Input current: 1.5 mA to 10 mA DI5: High-speed pulse input terminal; maximum input frequency: 20 kHz; operating voltage range: 15-30 V; invalid voltage: < 5V; valid voltage: > 15 V; input impedance 1.15 kΩ.
		Digital output	Relay output: two contacts, 3 A/250 VAC, 3 A/30 VDC, with normally open and normally closed functions supported: 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
	External 24 V power supply input		Not configured
	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	Keys on the operating panel can be locked partially or all keys can be locked. In addition, functions with limited availability range can be assigned to some keys. This can prevent accidental operation.
	Commissioning software tool		The commissioning software (iFA Drive) supports uploading and downloading of drive parameters, oscilloscope functions, and fault diagnosis. You can monitor internal status of the drive through the oscilloscope. 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 non-frequent function parameters Expert: Parameters for experts, which can be set with a password

Item			Technical specifications
Advanced functions	Applicability and usability	Application macro	Interface macros: pre-defined with interface schemes for start/stop, speed references, and so on, which can be configured 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 parameter set	You can recombine and generate new parameter sets. 1. Used to view or set parameters quickly. 2. Used for quick access to single command through communication.
		Auxiliary functions	Timed period arrival, operating time arrival, forward/reverse run dead zone time, frequency reference arrival, current reference arrival, and load speed conversion
		Configurable startup protection	Startup protection modes for different command sources can be configured flexibly.
		Automatic carrier frequency adjustment	Used 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 amplitude, PID feedback reference filtering, dead zone, integral saturation, forced PID, and PID feedback loss detection
		Free function module	Supports custom needs through different free function blocks. Supports arithmetic operations, logic operations, control functions, time control, switch selection functions, multi-point curves, data conversion, and other function blocks
		Simple PLC	Supports 16 operational instructions. Supports custom acceleration/deceleration time, speed, and operating time. Supports custom cycle mode. Supports value retention upon power failure. Supports pause and reset.
		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 4 jump frequency points.
		Motorized potentiometer	Indicates the virtual potentiometer output achieved through the software.
	Industry process	Swing frequency control	In wobble 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.
	Energy efficiency	Energy conservation statistics	The energy conservation statistics function converts energy savings into quantifiable metrics (kWh, CO_2 emissions, monetary equivalents) for visual evaluation. These values can be read by the host controller directly.
		Sleep and wake-up	Used to switch the drive to the sleep or standby mode when continuous operation is not needed, and restart the drive when necessary to save energy.
	STO		STO safety level: SIL3 (IEC 61508), PL e, Cat.3 (EN ISO 13849) Terminal specification: Dual-loop input for STO1 and STO2, 24 VDC (±15%)

Item		Technical specifications
Communication	Three-in-one industrial Ethernet bus	Modbus (Modbus RTU) communication
	Communication command word	Single-word control mode Bit control mode Free mode
	Action upon communication interrupt	Actions upon communication interrupt include "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	Supports custom faults, alarms, and prompts.
	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 actual operating conditions. When the corresponding range is exceeded, you can define faults and alarms as needed.
	Automatic Fault Reset	The fault can be reset automatically. If the number of automatic resets is exhausted, the fault cannot be reset. The fault whitelist and blacklist can be configured as needed.
	Automatic restart upon fault	After a fault occurs, automatic fault reset and restart are supported. When the number of automatic resets is exhausted, the fault can no longer be reset. The fault whitelist and blacklist can be configured freely.
	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.
	Automatic Check	Supports self-test on the drive and motor, IGBT shoot-through, current sensor sampling error, ground fault, phase loss, and phase-to-phase short circuit.
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 additional 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

Item	Technical specifications
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, 500 M (carrier frequency reduced by 2 kHz) • 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.

16.3 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

16.4 Overload Capacity of AC Drive

Definition of overload capacity:

Overload capacity refers to the ability to temporarily output more than 100% of its rated load. The overload capacity is generally defined based on the 1-minute rating, which is categorized into high overload and low overload.

- High overload: Within every 5-minute operating cycle, the drive is allowed to operate at 150% of the high overload rated output current for 1 min, and at 100% of the high overload rated output current for 4 min.
- Low overload: Within every 5-minute operating cycle, the drive is allowed to operate at 110% of the low overload rated output current for 1 min, and at 100% of the low overload rated output current for 4 min.

Typical load cycle of the drive

Typical applications of high overload mainly include the following.

- Cranes, elevators, lifts, and other lifting-type loads
- Machine tools, stamping press, and other metal processing applications
- Other applications involving high overload ratios, such as startup with high load

These three types of applications typically involve sudden loading and unloading or shock loads, occasionally resulting in output current to rise far above the rated current. High overload models meet the following cyclic overload operating conditions.

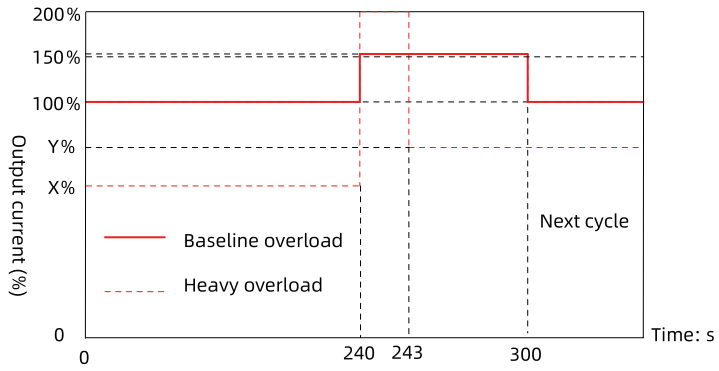


Figure 16-1 Cyclic overload diagram (high load)

Typical applications of low overload mainly include the following.

- Fans, pumps, air conditioning refrigeration, HVAC, and air compressors, and other fluid machinery applications
- Applications that occasionally involve low overload ratios

In these applications, the load is generally stable, and sudden load changes rarely occur. Low overload models meet the following cyclic overload operating conditions.

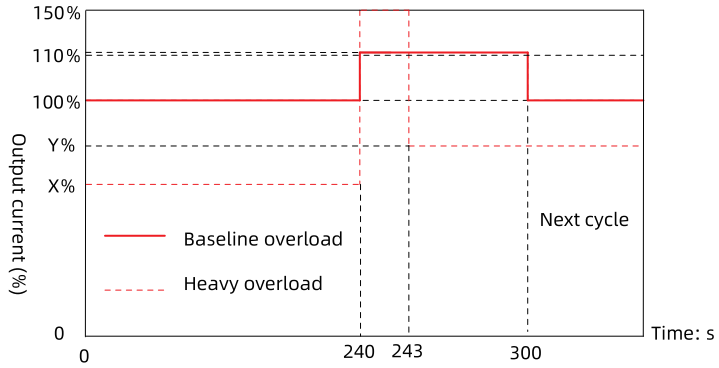


Figure 16-2 Cyclic overload diagram (low load)

16.5 Derating

When the drive operates above its rated conditions (ambient temperature, altitude, and carrier frequency), derating of the drive is required, which means the output current of the drive must be reduced. Otherwise, the drive may be damaged.

16.5.1 Carrier Frequency-based Derating

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.

See the following table for derating based on the carrier frequency.

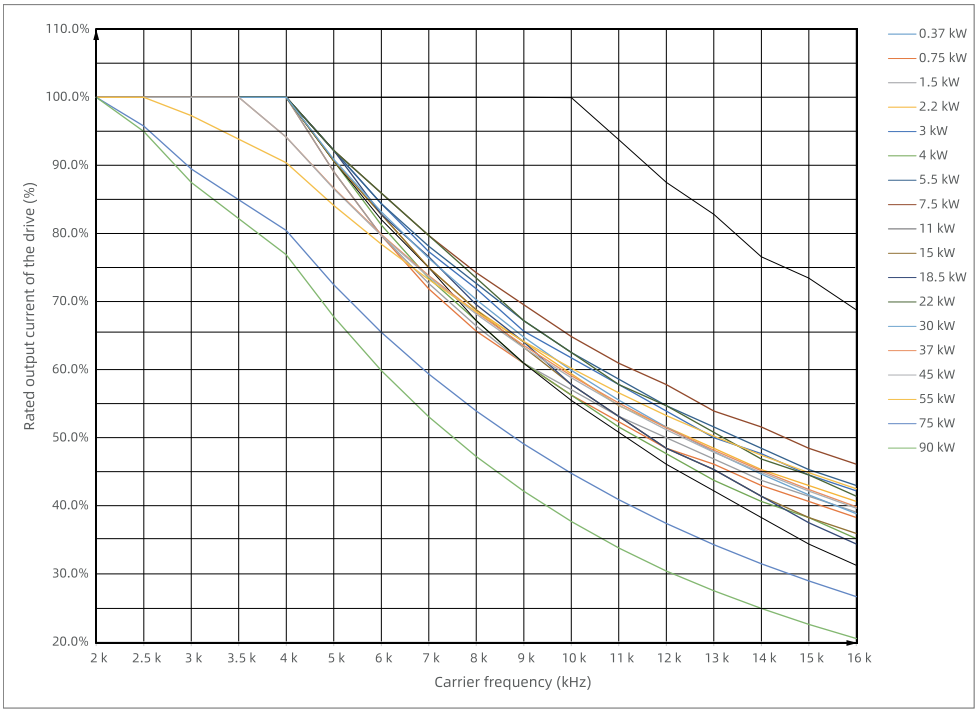


Figure 16-3 Curve for derating based on carrier frequency at low load

Structure	**Rated output (kW)**	Rated output current (A)	Carrier Frequency-based Derating												
			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%	100.0 %	100.0 %	100.0 %	93.8%	87.5%	82.8%	76.6%	73.4%	68.8%
	0.75	2.1	100.0%	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%	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%	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%	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%	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%	90.6%	83.6%	77.3%	71.9%	66.4%	61.7%	57.8%	54.7%	50.8%	47.7%	45.3%	43.0%
	7.5	17	100.0%	92.2%	84.4%	78.1%	73.4%	68.0%	64.1%	59.4%	56.3%	53.1%	50.0%	46.9%	44.5%
T4	11	25	100.0%	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%	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%	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%	92.2%	85.9%	79.7%	73.4%	67.2%	62.5%	57.8%	54.7%	50.8%	46.9%	44.5%	41.4%

Structure	Rated output (kW)	Rated output current (A)	Carrier Frequency-based Derating												
			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
T6	30	60	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	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	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	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	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	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%

16.5.2 Environment-based Derating

Current derating based on ambient temperature

The ambient temperature range of the drive is -20°C to +60°C. When the ambient temperature exceeds 50°C, derate 2.5% for every additional 1°C. The curve for derating based on ambient temperature is shown in the figure below.

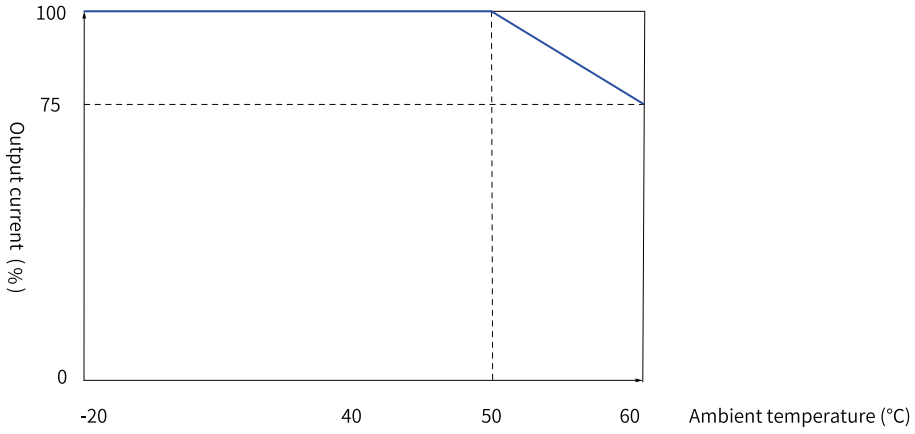


Figure 16-4 Curve for derating based on ambient temperature

Current derating based on installation altitude

Derating is not required for installation altitudes below 1000 m. For altitudes above 1000 m, derating 1% for every additional 100 m, up to a maximum of 3000 m. The curve for derating based on installation altitude is shown in the figure below.

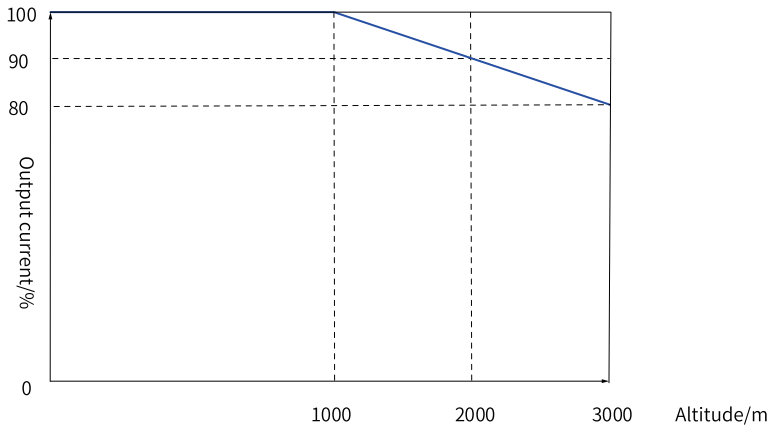


Figure 16-5 Altitude-based derating curve

Current derating based on installation clearance

- In cases where drives are installed with clearance reserved according to *"4.5.2.1 Clearance Requirements" on page 77*, no derating is required for temperature below 50°C.
- In cases where drives are installed without any clearance, a derating of 2.5% per degree is required for ambient temperatures exceeding 40°C (up to a maximum of 60°C). No derating is required for ambient temperature below 40°C. Clearance-based derating curve is shown below.

Figure 16-6 Clearance-based derating curve

16.6 Accessory Specifications

16.6.1 Option List

Table 16–4 Option List

Category	Name	Model	Ordering Number	Applicable Model	Function
Braking Resistor	Braking Resistor	See *"16.6.5 Braking Resistor" on page 1554* 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 *"16.6.6 Cable" on page 1561* 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 *"16.6.6 Cable" on page 1561* 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.
	Terminal	For the recommended cable lug selection, see "Terminal" in *"16.6.6 Cable" on page 1561*.		Full series compatible	Connect cables properly to allow safe and reliable current transmission.
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.

Category	Name	Model	Ordering Number	Applicable Model	Function
Mounting Accessories	Options for Guide Rail Installation	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 Protection 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 the list of peripheral electrical devices, see *"4.1 AC Drive and Peripherals" on page 64*.

16.6.2 Circuit Breaker And Fuse

The following table lists the recommended models for circuit breakers and fuses.

Table 16–5 Selection of circuit breaker and fuse (Heavy-overload G-type)

Structure	Model	Rated input current (A) (G)	In compliance with CE certification			
			Non-semiconductor fuse current (A)	Fuse model (Bussmann)	Circuit breaker current (A)	Circuit breaker model (CHINT)
T1	MD610S-4T1R5(BS)-INT	1.7	4	FWC-6A10F+CHM1DU	3	B1H3D3
	MD610S-4T2R1(BS)-INT	2.4	6	FWC-6A10F+CHM1DU	7	B1H3D7
	MD610S-4T3R8(BS)-INT	4.6	10	FWC-12A10F+CHM1DU	15	M1MS15E3
T2	MD610S-4T5R1(BS)-INT	6.3	15	FWC-16A10F+CHM1DU	15	M1MS15E3
	MD610S-4T7R2(BS)-INT	8.9	16	FWC-16A10F+CHM1DU	15	M1MS15E3
	MD610S-4T9R0(BS)-INT	11.4	25	FWC-32A10F+CHM1DU	30	M1MS30E3
T3	MD610S-4T013(BS)-INT	16.8	40	FWC-40A14F+CH141DU	35	M1MS30E3
	MD610S-4T017(BS)-INT	22	50	FWP-63A22F+CH221DU	50	M1MS50E3
T4	MD610S-4T025(BS)-INT	32.4	63	FWP-63A22F+CH221DU	70	M1MS70E3
	MD610S-4T032(BS)-INT	41.6	80	FWP-80A22F+CH221DU	70	M1MS70E3
T5	MD610S-4T037(BS)-INT	48.7	100	FWP-100A22F+CH221DU	80	M1MS100E3
	MD610S-4T045(BS)-INT	58.5	125	170M1318	100	M1MS100E3
T6	MD610S-4T060(BS)-INT	56.3	80	FWP-80B	100	M1MS100T3
	MD610S-4T075(BS)-INT	70.4	90	FWP-90B	100	M1MS100T3
T7	MD610S-4T091(BS)-INT	86.3	110	FWP-110B	150	M1MS150T3
	MD610S-4T112(BS)-INT	107.6	150	FWP-150A	150	M1MS150T3
T8	MD610S-4T150(BS)-INT	141.6	175	FWP-175A	250	M2MS250T3
	MD610S-4T176(BS)-INT	168.4	225	FWP-225A	250	M2MS250T3

Note

The recommended values in the preceding table are based on the following conditions.
1. The ambient temperature of the device is 40℃ and there is no forced air cooling method.

- The altitude is 2000 m.
- A single product is installed.
- The conductor or copper busbar carrying current density is 1.3 A/mm².

2. If the conditions vary, select the model according to actual conditions.

Table 16–6 Selection of circuit breaker and fuse (Light-overload P-type)

Structure	Model	Rated input current (A) (P)	In compliance with CE certification			
			Non-semiconductor fuse current (A)	Fuse model (Bussmann)	Circuit breaker current (A)	Circuit breaker model (CHINT)
T1	MD610S-4T1R5(BS)-INT	2.4	4	FWC-6A10F+CHM1DU	3	B1H3D3
	MD610S-4T2R1(BS)-INT	4.6	6	FWC-6A10F+CHM1DU	7	B1H3D7
	MD610S-4T3R8(BS)-INT	6.4	10	FWC-12A10F+CHM1DU	15	M1MS15E3
T2	MD610S-4T5R1(BS)-INT	9	15	FWC-16A10F+CHM1DU	15	M1MS15E3
	MD610S-4T7R2(BS)-INT	11.4	16	FWC-16A10F+CHM1DU	15	M1MS15E3
	MD610S-4T9R0(BS)-INT	17	25	FWC-32A10F+CHM1DU	30	M1MS30E3
T3	MD610S-4T013(BS)-INT	22.7	40	FWC-40A14F+CH141DU	35	M1MS30E3
	MD610S-4T017(BS)-INT	33.4	50	FWP-50A22F+CH221DU	50	M1MS50E3
T4	MD610S-4T025(BS)-INT	42.1	70	FWP-70A22F+CH221DU	70	M1MS70E3
	MD610S-4T032(BS)-INT	49.1	80	FWP-80A22F+CH221DU	70	M1MS70E3
T5	MD610S-4T037(BS)-INT	60.1	100	FWP-100A22F+CH221DU	80	M1MS100E3
	MD610S-4T045(BS)-INT	71.6	125	170M1318	100	M1MS100E3
T6	MD610S-4T060(BS)-INT	68.8	90	FWP-90B	100	M1MS100T3
	MD610S-4T075(BS)-INT	84.7	110	FWP-110B	150	M1MS150T3

Structure	Model	Rated input current (A) (P)	In compliance with CE certification			
			Non-semiconductor fuse current (A)	Fuse model (Bussmann)	Circuit breaker current (A)	Circuit breaker model (CHINT)
T7	MD610S-4T091(BS)-INT	104.2	150	FWP-150A	150	M1MS150T3
	MD610S-4T112(BS)-INT	139.9	175	FWP-175A	250	M2MS250T3
T8	MD610S-4T150(BS)-INT	165.4	225	FWP-225A	250	M2MS250T3
	MD610S-4T176(BS)-INT	197.6	250	FWP-250A	250	M2MS250T3

Note

The recommended values in the preceding table are based on the following conditions.
1. The ambient temperature of the device is 40℃ and there is no forced air cooling method.

- The altitude is 2000 m.
- A single product is installed.
- The conductor or copper busbar carrying current density is 1.3 A/mm².

2. If the conditions vary, select the model according to actual conditions.

16.6.3 AC input reactor

See the following table for applicable scenarios of different reactor types.

Table 16–7 Reactor

Type	Instructions for use
Input reactor	Used to suppress the harmonics and surge current at the AC ports; recommended for customers with requirements on low harmonics and surge current suppression.
Output reactor	Used to suppress output waveform oscillation when the UVW output cables 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.

An AC input reactor is optional and mainly used to reduce harmonic waves 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.

ACL ① - 0002 ② - EISC ③ - 9561A ④

Figure 16-7 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: Code of Inovance for Eagtop A: Ranking under the same current **Inductance** EM16: 0.16 mH D: Version NC: Temperature control switch

Table 16–8 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)	Ordering No.	Loss (W)
T1	MD610S-4T1R5(BS)-INT	0.37	1.7	ACL-0002-EISC-9561A	10.5	11070911	5.9
	MD610S-4T2R1(BS)-INT	0.75	2.4	ACL-0003-EISC-9561A	7.2	11070912	9.9
	MD610S-4T3R8(BS)-INT	1.5	4.6	ACL-0005-EISC-9561A	4.4	11070914	12.6
T2	MD610S-4T5R1(BS)-INT	2.2	6.3	ACL-0007-EISC-9561A	3.1	11070915	14.7
	MD610S-4T7R2(BS)-INT	3.0	8.9	ACL-0009-EISC-9561A	2.5	11070916	15.9
	MD610S-4T9R0(BS)-INT	4.0	11.4	ACL-0013-EISC-9561A	1.7	11070917	19
T3	MD610S-4T013(BS)-INT	5.5	16.8	ACL-0017-EISHL-9561A	1.3	11070918	30.4
	MD610S-4T017(BS)-INT	7.5	22.0	ACL-0025-EISHL-9561A	0.89	11070919	43.6
T4	MD610S-4T025(BS)-INT	11	32.4	ACL-0037-EISHL-9561A	0.6	11070921	55.3
	MD610S-4T032(BS)-INT	15	41.6	ACL-0045-EISHL-9561A	0.49	11070922	58.8
T5	MD610S-4T037(BS)-INT	18.5	48.7	ACL-0060-EISHL-9561A	0.37	11070923	80
	MD610S-4T045(BS)-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)	Ordering No.	Loss (W)
T6	MD610S-4T060(BS)-INT	30	56.3	ACL-0060-EISHL-9561A	0.37	11070923	80
	MD610S-4T075(BS)-INT	37	70.4	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
T7	MD610S-4T91(BS)-INT	45	86.3	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
	MD610S-4T112(BS)-INT	55	107.6	ACL-0120-EISCL-EM12DNC	0.12	11070935	122
T8	MD610S-4T150(BS)-INT	75	141.6	ACL-0150-EISCL-E95UDNC	0.091	11070936	191
	MD610S-4T176(BS)-INT	90	168.4	ACL-0200-EISCL-E70UDNC	0.07	11070937	212

Table 16–9 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)	Ordering No.	Loss (W)
T1	MD610S-4T1R5(BS)-INT	0.37	2.4	ACL-0003-EISC-9561A	7.2	11070912	9.9
	MD610S-4T2R1(BS)-INT	0.75	4.6	ACL-0005-EISC-9561A	4.4	11070914	12.6
	MD610S-4T3R8(BS)-INT	1.5	6.4	ACL-0007-EISC-9561A	3.1	11070915	14.7
T2	MD610S-4T5R1(BS)-INT	2.2	9	ACL-0009-EISC-9561A	2.5	11070916	15.9
	MD610S-4T7R2(BS)-INT	3.0	11.4	ACL-0013-EISC-9561A	1.7	11070917	19
	MD610S-4T9R0(BS)-INT	4	17	ACL-0017-EISC-9561A	1.3	11070918	30.4
T3	MD610S-4T013(BS)-INT	5.5	22.7	ACL-0025-EISC-9561A	0.89	11070919	43.6
	MD610S-4T017(BS)-INT	7.5	33.4	ACL-0037-EISC-9561A	0.6	11070921	55.3
T4	MD610S-4T025(BS)-INT	11	42.1	ACL-0045-EISC-9561A	0.49	11070922	58.8
	MD610S-4T032(BS)-INT	15	49.1	ACL-0060-EISC-9561A	0.37	11070923	80
T5	MD610S-4T037(BS)-INT	18.5	60.1	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
	MD610S-4T045(BS)-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)	Ordering No.	Loss (W)
T6	MD610S-4T060(BS)-INT	30	68.8	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
	MD610S-4T075(BS)-INT	37	84.7	ACL-0090-EISCL-EM16DNC	0.16	11070934	81
T7	MD610S-4T91(BS)-INT	45	104.2	ACL-0120-EISCL-EM12DNC	0.12	11070935	122
	MD610S-4T112(BS)-INT	55	139.9	ACL-0150-EISCL-E95UDNC	0.091	11070936	191
T8	MD610S-4T150(BS)-INT	75	165.4	ACL-0200-EISCL-E70UDNC	0.07	11070937	212
	MD610S-4T176(BS)-INT	90	197.6	ACL-0200-EISCL-E70UDNC	0.07	11070937	212

Dimensions

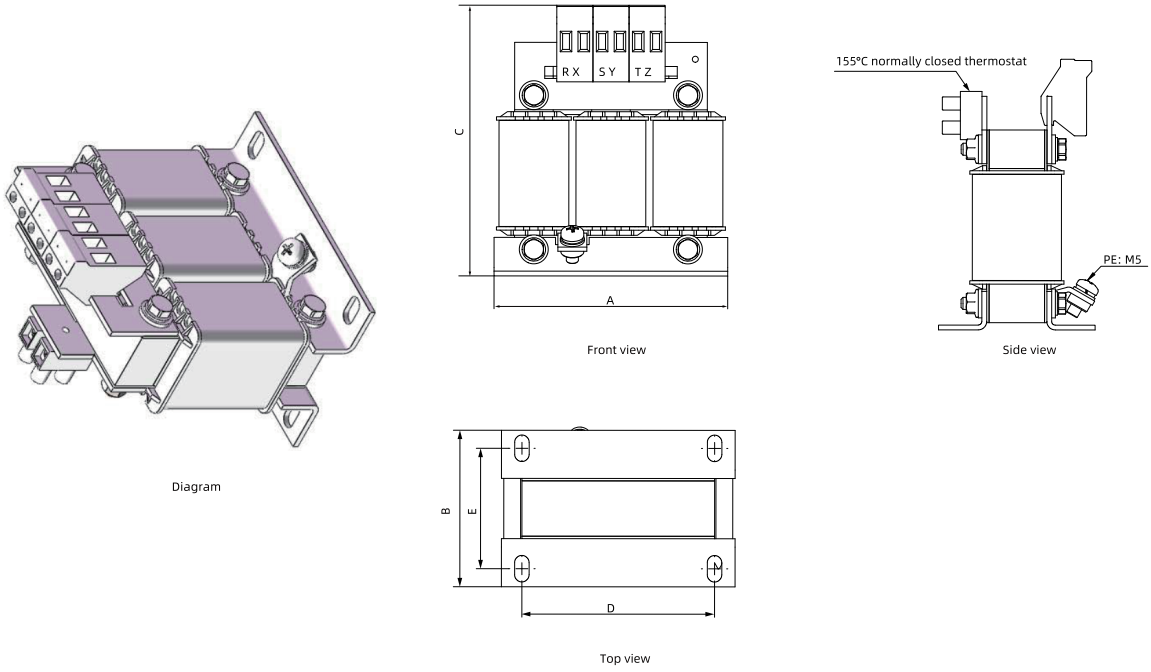


Figure 16-8 Dimensions of AC input reactors (2 A to 13 A, unit: mm)

Table 16–10 Dimensions of 2 A to 13 A AC input reactors

Model	Overall dimensions (mm)	Drilling dimensions (mm)	Installing the screws	Torque (kgf·cm)
	Width A x Depth B x Height C	Width D x Depth E		
ACL-0002-EISC-9561A	100 x 65 (± 2) x 120	80 (±2) x 50 (±2)	M5	28
ACL-0003-EISC-9561A				
ACL-0005-EISC-9561A	115 x 85 (± 2) x 130	90 (±2) x 65 (±2)	M5	28
ACL-0007-EISC-9561A				
ACL-0009-EISC-9561A	135 x 90 (± 2) x 140	100 (±2) x 70 (±2)	M5	28
ACL-0013-EISC-9561A				

Note

Dimensions of B, D, and E in the table may have a tolerance of ±2.

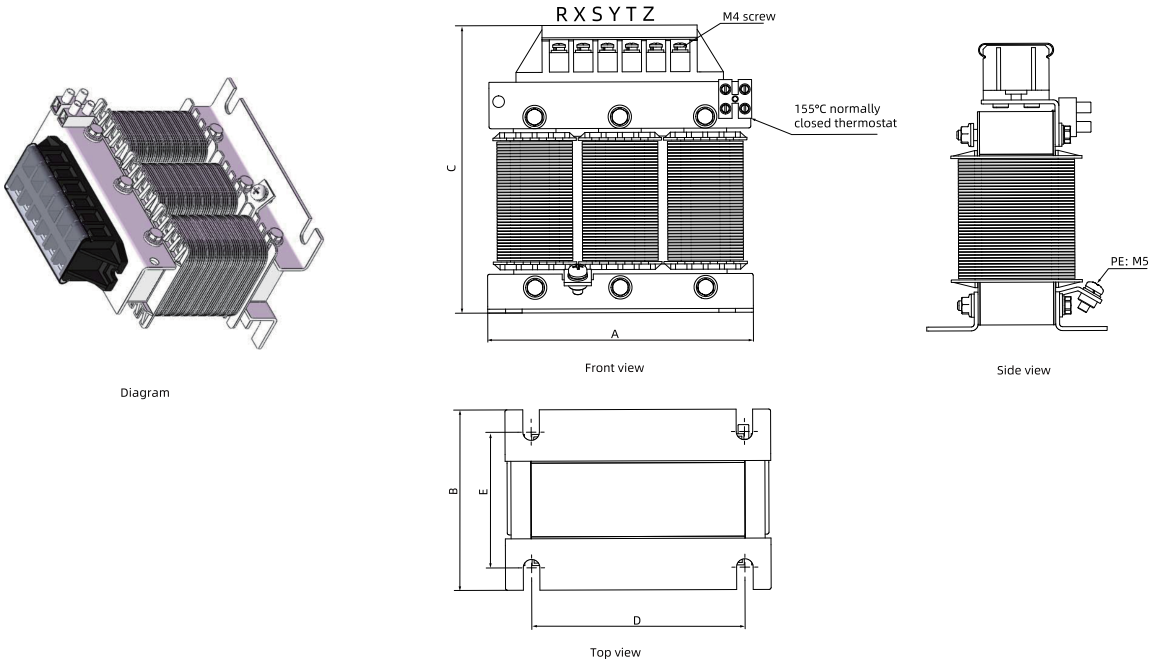


Figure 16-9 Dimensions of AC input reactors (17 A to 60 A, unit: mm)

Table 16–11 Dimensions of 17 A to 60 A AC input reactors

Model	Overall dimensions (mm)	Mounting hole dimensions (mm)	Installing the screws	Torque (kgf·cm)
	Width A x Depth B x Height C	Width D x Depth E		
ACL-0017-EISC-9561A	140 x 93 (± 2) x 160	110 (±2) x 70 (±2)	M6	48
ACL-0025-EISC-9561A	140 x 98 (± 2) x 160	110 (±2) x 75 (±2)	M6	48
ACL-0037-EISC-9561A	160 x 113 (± 2) x 180	120 (±2) x 90 (±2)	M6	48
ACL-0045-EISC-9561A	160 x 128 (± 2) x 180	120 (±2) x 105 (±2)	M6	48
ACL-0060-EISC-9561A				

Note

Dimensions of B, D, and E in the table may have a tolerance of ±2.

Dimensions

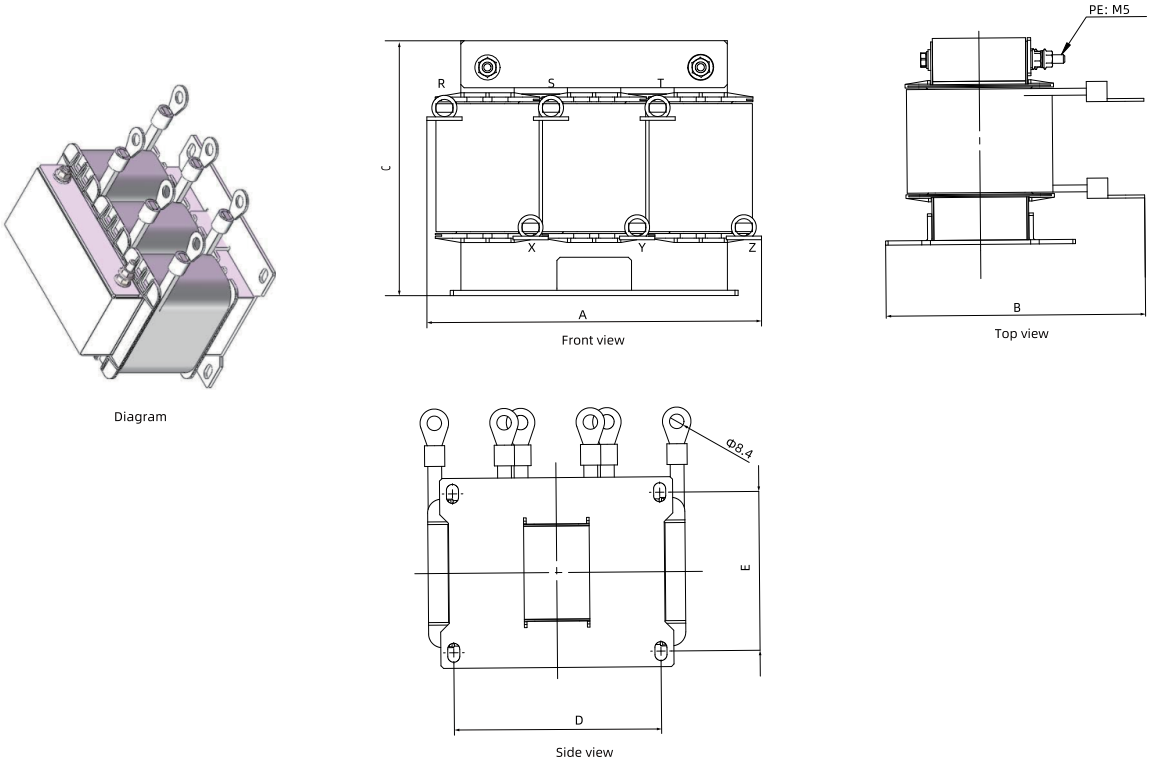


Figure 16-10 Dimensions of AC input reactors (90 A, unit: mm)

Table 16–12 Dimensions of 90 A AC input reactor

Model	Overall dimensions (mm)	Mounting hole dimensions (mm)	Installing the screws	Torque (kgf·cm)
	Width A x Depth B x Height C	Width D x Depth E		
ACL-0090-EISCL-EM16D	165 x 150 (±10) x 130	120 (±2) x 92 (±2)	M6	48

Note

- Dimensions of B in the table may have a tolerance of ±10.
- Dimensions of D and E in the table may have a tolerance of ±2.

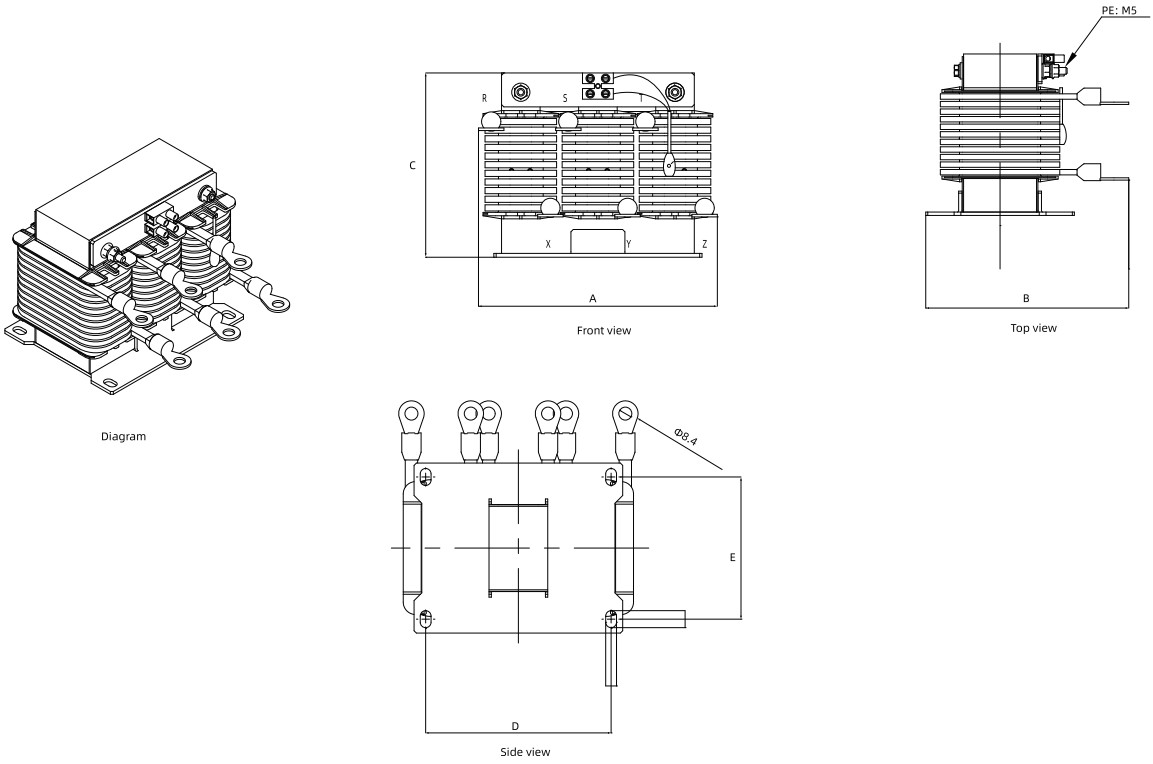


Figure 16-11 Dimensions of AC input reactors (90 A to 200 A, unit: mm)

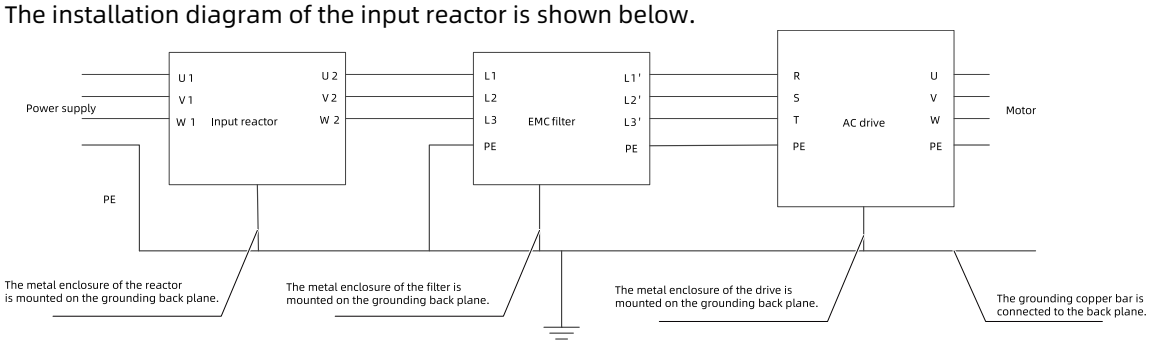
Table 16–13 Dimensions of AC input reactors (90 A to 200 A)

Model	Overall dimensions (mm)	Mounting hole dimensions (mm)	Installing the screws	Torque (kgf·cm)
	Width A x Depth B x Height C	Width D x Depth E		
ACL-0090-EISCL-EM16DNC	165 x 150 (±10) x 130	120 (±2) x 92 (±2)	M8	102.0
ACL-0120-EISCL-EM12DNC	165 x 150 (±10) x 130	120 (±2) x 92 (±2)	M8	102.0
ACL-0150-EISCL-E95UDNC	190 x 160 (± 10) x 150	120 (±2) x 92 (±2)	M8	102.0
ACL-0200-EISCL-E70UDNC	225 x 160 (± 10) x 170	120 (±2) x 92 (±2)	M8	102.0

Note

Dimensions of B, D, and E in the table may have a tolerance of ±2.

The installation diagram of the input reactor is shown below.



16.6.4 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

Models and dimensions of the recommended AC output reactors are as follows.

OCL - 0005 - EISC - E1M4DNC

① ② ③ ④

Figure 16-12 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 16–14 Selection of AC output reactors (Three-phase 380 V to 480 V) (high-overload G-type model)

Structure	Model	Motor Capacity (kW)	Rated current (A)	Reactor model	Reactor inductance (mH)	Ordering No.	Power consumption (W)
T1	MD610S-4T1R5(BS)-INT	0.37	1.5	OCL-0005-EISC-E1M4DNC	1.4	11070950	10
	MD610S-4T2R1(BS)-INT	0.75	2.1				
	MD610S-4T3R8(BS)-INT	1.5	3.8				
T2	MD610S-4T5R1(BS)-INT	2.2	5.1	OCL-0007-EISC-E1M0DNC	1.0	11070951	11
	MD610S-4T7R2(BS)-INT	3.0	7.2	OCL-0010-EISC-EM70DNC	0.7	11070952	14
	MD610S-4T9R0(BS)-INT	4.0	9				
T3	MD610S-4T013(BS)-INT	5.5	13	OCL-0015-EISCL-EM47DNC	0.47	11070953	20
	MD610S-4T017(BS)-INT	7.5	17	OCL-0020-EISCL-EM35DNC	0.35	11070954	25
T4	MD610S-4T025(BS)-INT	11	25	OCL-0030-EISCL-EM23DNC	0.23	11070955	35
	MD610S-4T032(BS)-INT	15	32	OCL-0040-EISCL-EM18DNC	0.18	11070956	45
T5	MD610S-4T037(BS)-INT	18.5	37	OCL-0040-EISCL-EM18DNC	0.18	11070956	45
	MD610S-4T045(BS)-INT	22	45	OCL-0050-EISCL-EM14DNC	0.14	11070957	36
T6	MD610S-4T060(BS)-INT	30	60	OCL-0060-EI SCL-EM14D	0.12	11070958	42
	MD610S-4T075(BS)-INT	37	75	OCL-0080-EISCL-E87UDNC	0.087	11070959	47
T7	MD610S-4T91(BS)-INT	45	91	OCL-0090-EISCL-E78UDNC	0.078	11070960	55
	MD610S-4T112(BS)-INT	55	112	OCL-0120-EISCL-E58UDNC	0.058	11070961	70
T8	MD610S-4T150(BS)-INT	75	150	OCL-0150-EISCL-E47UDNC	0.047	11070962	125
	MD610S-4T176(BS)-INT	90	176	OCL-0200-EISCL-E35UDNC	0.035	11070963	140

Table 16–15 Selection of AC output reactors (Three-phase 380 V to 480 V) (low-overload P-type model)

Structure	Model	Motor Capacity (kW)	Rated current (A)	Reactor model	Reactor inductance (mH)	Ordering No.	Power consumption (W)
T1	MD610S-4T1R5(BS)-INT	0.37	2.1	OCL-0005-EISC-E1M4DNC	1.4	11070950	10
	MD610S-4T2R1(BS)-INT	0.75	3.8				
	MD610S-4T3R8(BS)-INT	1.5	5.1	OCL-0007-EISC-E1M0DNC	1.0	11070951	11
T2	MD610S-4T5R1(BS)-INT	2.2	7.2	OCL-0010-EISC-EM70DNC	0.7	11070952	14
	MD610S-4T7R2(BS)-INT	3.0	9				
	MD610S-4T9R0(BS)-INT	4	13	OCL-0015-EISCL-EM47DNC	0.47	11070953	20
T3	MD610S-4T013(BS)-INT	5.5	17	OCL-0020-EISCL-EM35DNC	0.35	11070954	25
	MD610S-4T017(BS)-INT	7.5	25	OCL-0030-EISCL-EM23DNC	0.23	11070955	35
T4	MD610S-4T025(BS)-INT	11	32	OCL-0040-EISCL-EM18DNC	0.18	11070956	45
	MD610S-4T032(BS)-INT	15	37				
T5	MD610S-4T037(BS)-INT	18.5	45	OCL-0050-EISCL-EM14D	0.14	11070957	36
	MD610S-4T045(BS)-INT	22	60	OCL-0060-EISCL-EM14D	0.12	11070958	42
T6	MD610S-4T060(BS)-INT	30	75	OCL-0080-EISCL-E87UDNC	0.087	11070959	47
	MD610S-4T075(BS)-INT	37	91	OCL-0090-EISCL-E78UDNC	0.078	11070960	55
T7	MD610S-4T91(BS)-INT	45	112	OCL-0120-EISCL-E58UDNC	0.058	11070961	70
	MD610S-4T112(BS)-INT	55	150	OCL-0150-EISCL-E47UDNC	0.047	11070962	125
T8	MD610S-4T150(BS)-INT	75	176	OCL-0200-EISCL-E35UDNC	0.035	11070963	140
	MD610S-4T176(BS)-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

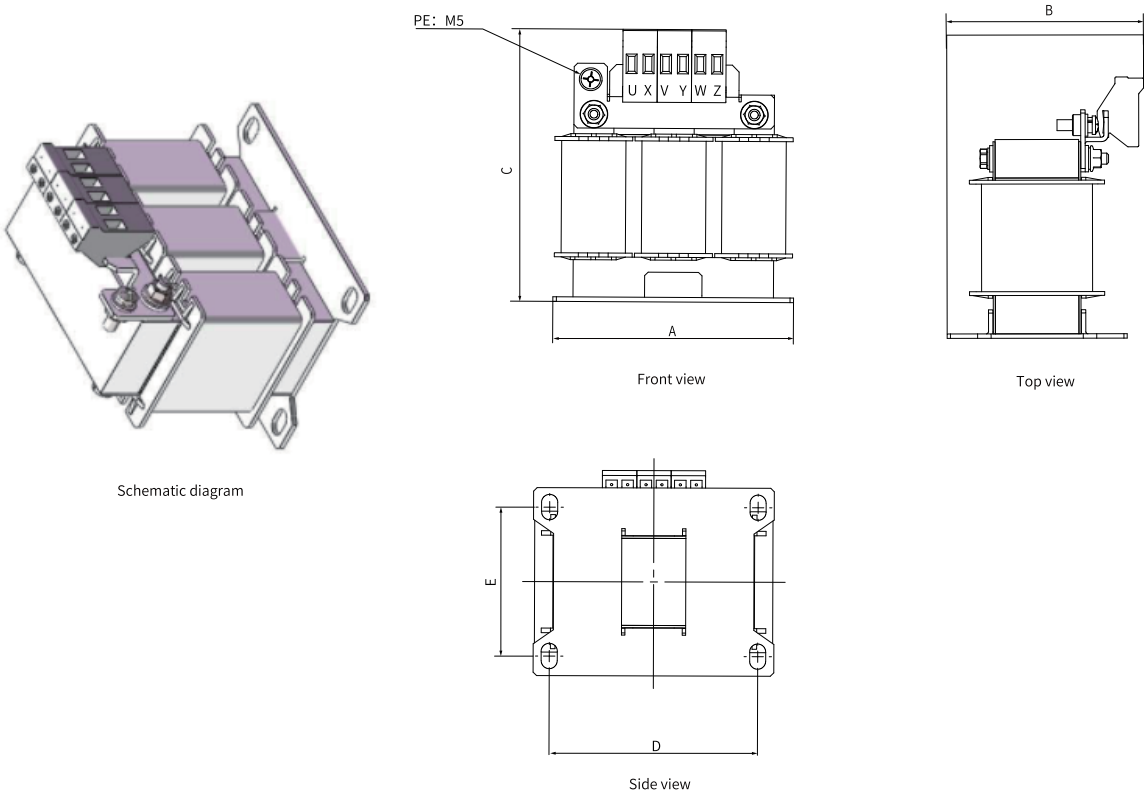


Figure 16-13 Dimensions of AC output reactors (5 A to 10 A)

Table 16–16 Physical dimensions of 5-10 A AC output reactor

Model	Overall dimensions (mm)	Drilling dimensions (mm)	Installing the screws	Torque (kgf·cm)
	Width A x Depth B x Height C	D x E		
OCL-0005-EISC-E1M4D	110 x 95 x 125	91 (±2) x 65 (±2)	M6	48
OCL-0007-EISC-E1M0D				
OCL-0010-EISC-EM70D				

Note

The general dimensions of D and E in the table are 91 mm and 65 mm, respectively, with a possible tolerance of ±2.

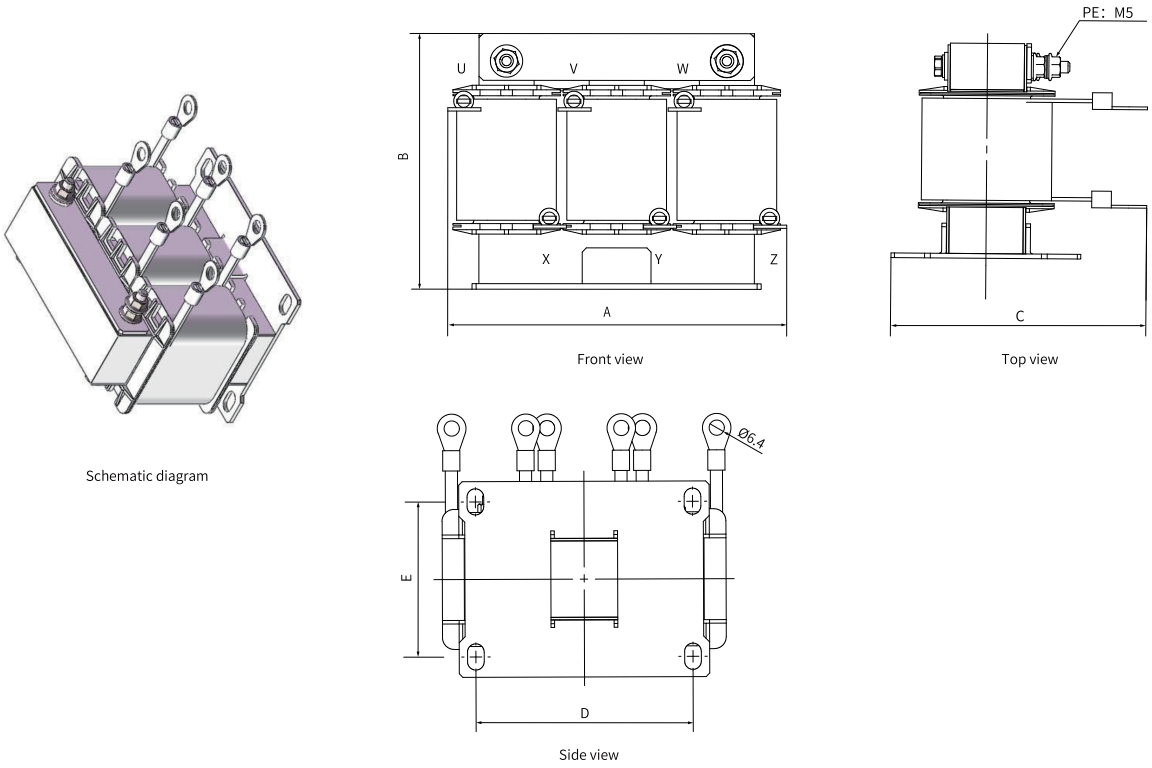


Figure 16-14 Dimensions drawing of AC output reactor (15 A to 60 A)

Table 16–17 Dimensions of AC output reactor (15 A to 60 A)

Model	Overall dimensions (mm)	Mounting hole dimensions (mm)	Installing the screws	Torque (kgf·cm)
	Width A x Depth B x Height C	Width D x Depth E		
OCL-0015-EISCL-EM47D	130 x 110 (±10) x 100	91 (±2) x 65 (±2)	M6	48
OCL-0020-EISCL-EM35D				
OCL-0030-EISCL-EM23D	130 x 120 (± 10) x 100	91 (±2) x 72 (±2)	M6	48
OCL-0040-EISCL-EM18D				
OCL-0050-EISCL-EM14D	140 x 120 (± 10) x 120	91 (±2) x 72 (±2)	M6	48
OCL-0060-EISCL-EM12D				

Note

- Dimensions of B in the table may have a tolerance of ±10.
- Dimensions of D and E in the table may have a tolerance of ±2.

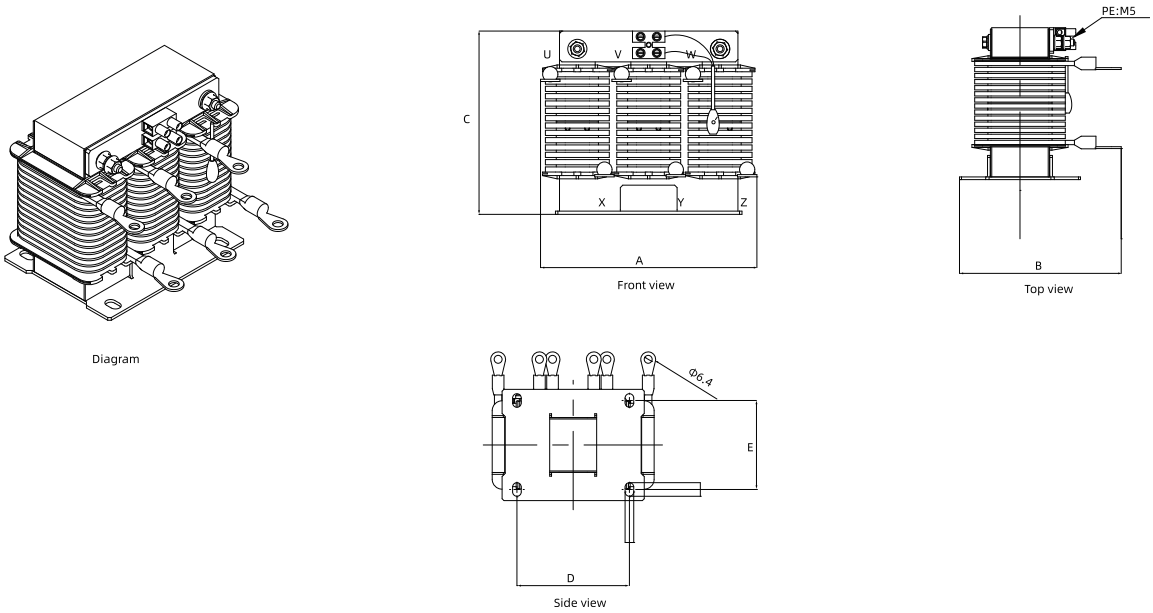


Figure 16-15 Dimensions drawing of AC output reactor (80 A to 200 A)

Table 16–18 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

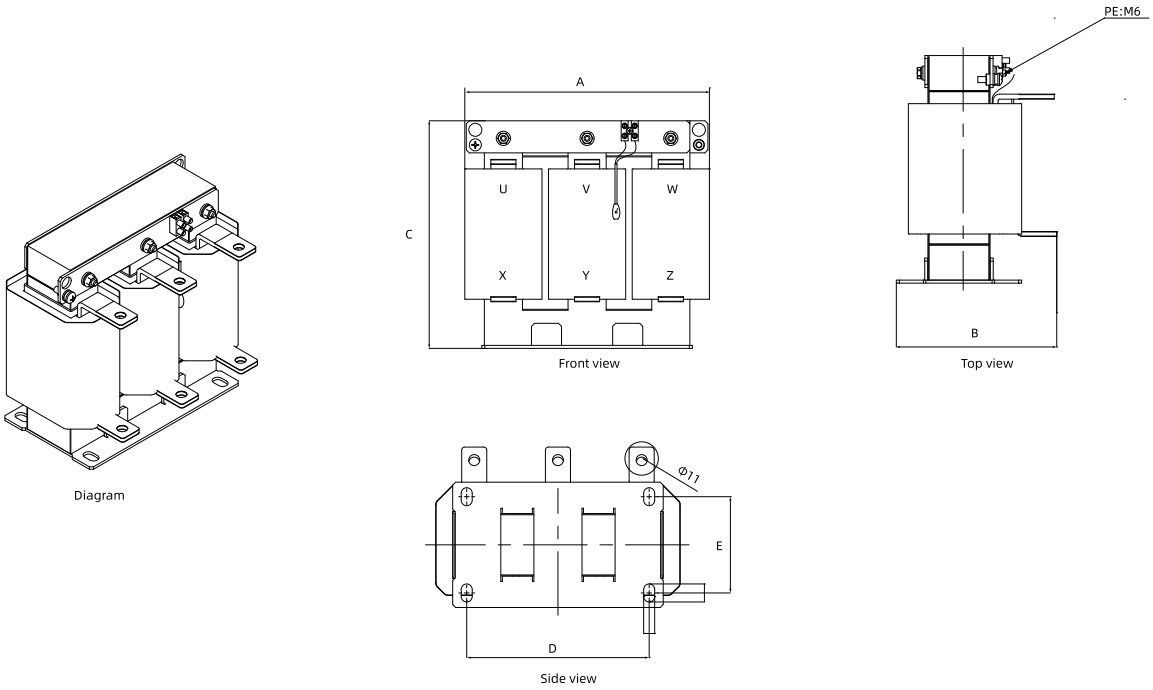
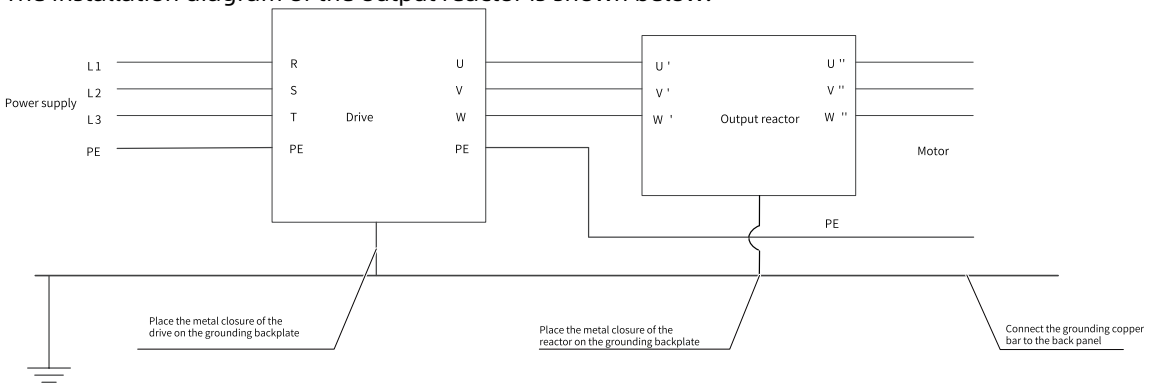


Figure 16-16 Dimensions drawing of AC output reactor (250 A)

Table 16–19 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.



16.6.5 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:

$$P_{N_BR} = \frac{P_{BR} \times ED\%}{\alpha}$$

$$ED\% = \frac{T_{on}}{T_{on} + T_{off}} \times 100\%$$

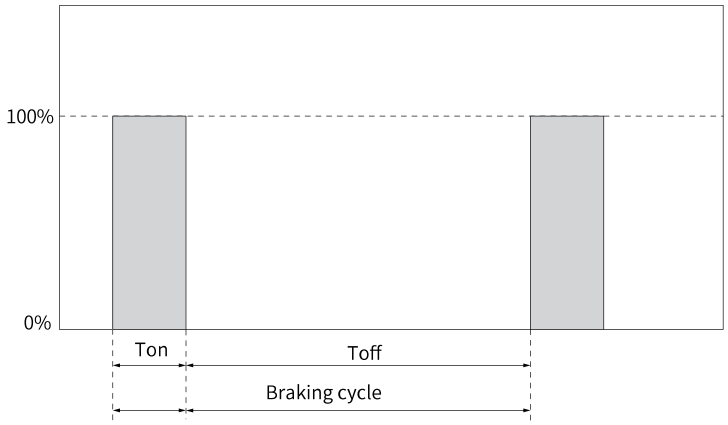


Figure 16-17 Braking cycle

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	General application
ED%	20% to 30%	20% to 30%	50% to 60%	5.0%	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 16–20 Selection of braking resistor (three-phase 380 V to 480 V)

Structure	AC 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	MD610S-4T1R5BS-INT	0.37	Built-in as standard	1560	60	RXLG-50W-1560RJ-XZ1000-OE-B	1560	50	1	250
	MD610S-4T2R1BS-INT	0.75	Built-in as standard	770	110	RXLG-100W-770RJ-XZ1000-OE-B	770	100	1	250
	MD610S-4T3R8BS-INT	1.5	Built-in as standard	380	230	RXLG-200W-380RJ-XZ1000-OE-B	380	200	1	104
T2	MD610S-4T5R1BS-INT	2.2	Built-in as standard	260	330	RXLG-300W-260RJ-XZ1000-OE-B	260	300	1	104
	MD610S-4T7R2BS-INT	3	Built-in as standard	190	450	RXLG-400W-190RJ-XZ1000-OE-B	190	400	1	104
	MD610S-4T9R0BS-INT	4	Built-in as standard	140	600	RXLG-600W-140RJ-XZ1000-OE-B	140	600	1	124
T3	MD610S-4T013BS-INT	5.5	Built-in as standard	100	830	RXLG-800W-100RJ-XZ1000-OE-B	100	800	1	42
	MD610S-4T017BS-INT	7.5	Built-in as standard	77	1130	RXLG-1000W-76RJ-XZ1000-OT-B	76	1000	1	33
T4	MD610S-4T025BS-INT	11	Built-in as standard	52	1660	RXLG-1500W-52RJ-XZ1000-OT-B	52	1500	1	47
	MD610S-4T032BS-INT	15	Built-in as standard	38	2260	RXLG-1000W-76RJ-XZ1000-OT-B	76	1000	2	22

Structure	AC 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	MD610S-4T037BS-INT	18.5	Built-in as standard	31	2790	RXLG-1500W-62RJ-XZ1000-OT-B	62	1500	2	26
	MD610S-4T045BS-INT	22	Built-in as standard	26	3310	RXLG-1500W-52RJ-XZ1000-OT-B	52	1500	2	26
T6	MD610S-4T060BS-INT	30	Built-in as standard	19.2	4500	RXLG-1500W-56RJ-XZ1000-OE-B	56	1500	3	12.2
	MD610S-4T075BS-INT	37	Built-in as standard	15.6	5550	RXLG-1500W-62RJ-XZ1000-OT-B	62	1500	4	11.9
T7	MD610S-4T91BS-INT	45	Built-in as standard	12.8	6750	RXLG-1500W-62RJ-XZ1000-OT-B	62	1500	5	10.7
	MD610S-4T112BS-INT	55	Built-in as standard	10.5	8300	RXLG-1500W-70RJ-XZ1000-OT-B	70	1500	6	10.4
T8	MD610S-4T150BS-INT	75	Built-in as standard	7.7	11300	RXLG-1500W-62RJ-XZ1000-OT-B	62	1500	8	7
	MD610S-4T176BS-INT	90	Built-in as standard	6.4	13500	RXLG-1500W-56RJ-XZ1000-OE-B	56	1500	9	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.

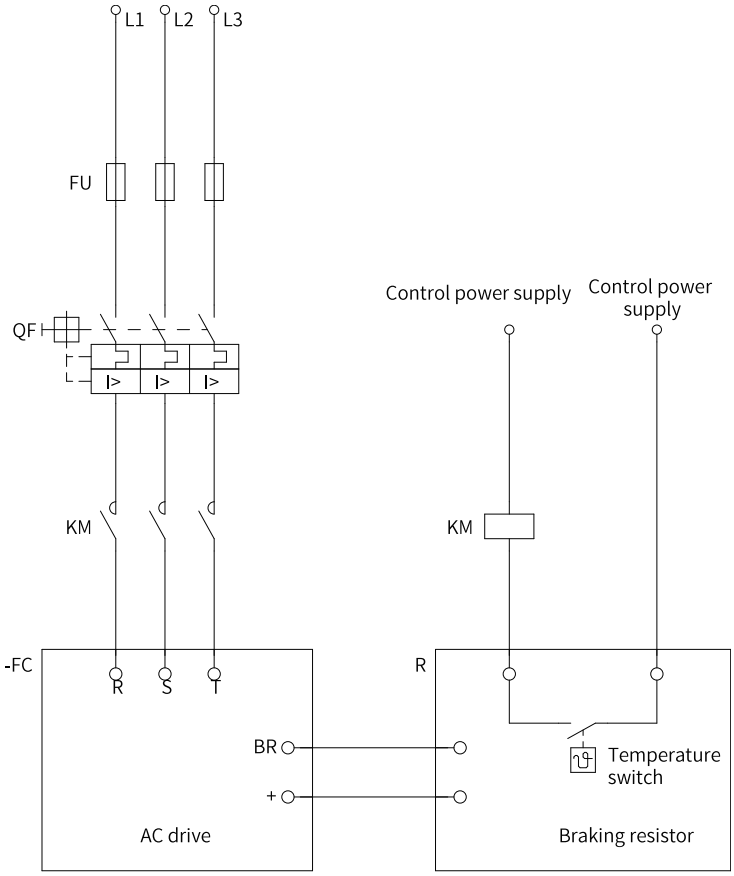


Figure 16-18 Braking resistor overtemperature protection

Note

- FU: Fuse
- KM: Contactor
- QF: Circuit breaker

16.6.6 Cable

Power cable selection

Observe national or regional regulations when selecting power cables. 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. Shielded cables are classified into the three-conductor cables and four-conductor cables, as shown in the following figure. If a three-

conductor cable is used but its shield cannot provide sufficient conductivity, add an independent PE cable. Alternatively, use a four-conductor cable containing a PE conductor. The shield of the shielded cable consists of coaxial cooper braids to suppress radio frequency interference. The braided density of the cooper braid should be greater than 90% to enhance the shielding efficiency and conductivity.

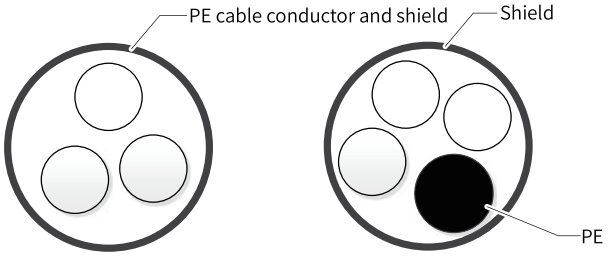


Figure 16-19 Recommended power cable types

The recommended terminal manufacturers are TG-JT and TO series from KST.

Power cables

Table 16–21 Input/Output/Grounding terminal cable specifications (P-type model)

Structure	Model	Input/Output Terminal		Grounding terminal		Allowable cable length	Cable OD (mm)	Screw specification	Tightening torque (N·m)
		IEC (mm^2)		IEC (mm^2)					
		Recommended Cable Type	Recommended terminal specifications	Recommended Cable Type	Recommended terminal specifications				
T1	MD610S-4T1R5(BS)-INT	3x2.5	E2510	2.5	E2510	Customized	9.2± 0.2	M3.5	1.0
	MD610S-4T2R1(BS)-INT	3x2.5	E2510	2.5	E2510	Customized	9.2± 0.2	M3.5	1.0
	MD610S-4T3R8(BS)-INT	3x2.5	E2510	2.5	E2510	Customized	9.2± 0.2	M3.5	1.0
T2	MD610S-4T5R1(BS)-INT	3x2.5	E2510	2.5	E2510	Customized	9.2± 0.2	M3.5	1.0
	MD610S-4T7R2(BS)-INT	3x2.5	E2510	2.5	E2510	Customized	9.2± 0.2	M3.5	1.0
	MD610S-4T9R0(BS)-INT	3 × 6	E6010	6	E6010	Customized	13.5±0.3	M3.5	1.0
T3	MD610S-4T013(BS)-INT	3 × 6	E6010	6	E6010	Customized	13.5±0.3	M4	1.2
	MD610S-4T017(BS)-INT	3 × 10	E10-10	10	E10-10	Customized	18.6±0.4	M4	1.2
T4	MD610S-4T025(BS)-INT	3 × 10	RNB14-5	10	RNB14-5	Customized	22.6±0.4	M5	2.0
	MD610S-4T032(BS)-INT	3 × 10	RNB14-5	10	RNB14-5	Customized	22.6±0.4	M5	2.0

Structure	Model	Input/Output Terminal		Grounding terminal		Allowable cable length	Cable OD (mm)	Screw specification	Tightening torque (N·m)
		IEC (mm²)		IEC (mm²)					
		Recommended Cable Type	Recommended terminal specifications	Recommended Cable Type	Recommended terminal specifications				
T5	MD610S-4T037(BS)-INT	3 × 16	RNBS22-6	16	RNBS22-6	Customized	26.0± 0.6	M6	2.5
	MD610S-4T045(BS)-INT	3 × 16	RNBS22-6	16	RNBS22-6	Customized	26.0± 0.6	M6	2.5
T6	MD610S-4T060(BS)-INT	3 x 25	RNBS22-6	16	RNBL14-6	Customized	23± 0.7	M6	2.5
	MD610S-4T075(BS)-INT	3 x 35	RNB38-6	16	RNBL14-6	Customized	26.5± 0.7	M6	2.5
T7	MD610S-4T091(BS)-INT	3 x 50	RNB60-8	25	RNB22-8	Customized	30± 0.7	M8	13
	MD610S-4T112(BS)-INT	3x70	RNB70-8	35	RNBL38-8	Customized	34.7± 1	M8	13
T8	MD610S-4T150(BS)-INT	3x95	SC95-10	50	RNB60-10	Customized	38.7± 1	M10	20
	MD610S-4T176(BS)-INT	3 x 120	SC120-10	70	RNB70-10	Customized	42.5± 1	M10	20

Table 16–22 Input/Output/Grounding terminal cable specifications (G-type model)

Structure	Model	Input/Output Terminal		Grounding terminal		Allowable cable length	Cable OD (mm)	Screw specification	Tightening torque (N·m)
		IEC (mm²)		IEC (mm²)					
		Recommended Cable Type	Recommended terminal specifications	Recommended Cable Type	Recommended terminal specifications				
T1	MD610S-4T1R5(BS)-INT	3x2.5	E2510	2.5	E2510	Customized	9.2± 0.2	M3.5	1.0
	MD610S-4T2R1(BS)-INT	3x2.5	E2510	2.5	E2510	Customized	9.2± 0.2	M3.5	1.0
	MD610S-4T3R8(BS)-INT	3x2.5	E2510	2.5	E2510	Customized	9.2± 0.2	M3.5	1.0
T2	MD610S-4T5R1(BS)-INT	3x2.5	E2510	2.5	E2510	Customized	9.2± 0.2	M3.5	1.0
	MD610S-4T7R2(BS)-INT	3x2.5	E2510	2.5	E2510	Customized	9.2± 0.2	M3.5	1.0
	MD610S-4T9R0(BS)-INT	3 × 6	E6010	6	E6010	Customized	13.5±0.3	M3.5	1.0

Structure	Model	Input/Output Terminal		Grounding terminal		Allowable cable length	Cable OD (mm)	Screw specification	Tightening torque (N·m)
		IEC (mm²)		IEC (mm²)					
		Recommended Cable Type	Recommended terminal specifications	Recommended Cable Type	Recommended terminal specifications				
T3	MD610S-4T013(BS)-INT	3 × 6	E6010	6	E6010	Customized	13.5±0.3	M4	1.2
	MD610S-4T017(BS)-INT	3 × 10	E10-10	10	E10-10	Customized	18.6±0.4	M4	1.2
T4	MD610S-4T025(BS)-INT	3 × 10	RNB14-5	10	RNB14-5	Customized	22.6±0.4	M5	2.0
	MD610S-4T032(BS)-INT	3 × 10	RNB14-5	10	RNB14-5	Customized	22.6±0.4	M5	2.0
T5	MD610S-4T037(BS)-INT	3 × 16	RNBS22-6	16	RNBS22-6	Customized	26.0± 0.6	M6	2.5
	MD610S-4T045(BS)-INT	3 × 16	RNBS22-6	16	RNBS22-6	Customized	26.0± 0.6	M6	2.5
T6	MD610S-4T060(BS)-INT	3 x 16	RNBL14-6	16	RNBL14-6	Customized	23± 0.7	M6	2.5
	MD610S-4T075(BS)-INT	3 x 25	RNBS22-6	16	RNBL14-6	Customized	23± 0.7	M6	2.5
T7	MD610S-4T091(BS)-INT	3 x 35	RNBL38-8	16	RNB14-8	Customized	26.5± 0.7	M8	13
	MD610S-4T112(BS)-INT	3 x 50	RNB60-8	25	RNB22-8	Customized	30± 0.7	M8	13
T8	MD610S-4T150(BS)-INT	3x70	RNB70-10	35	RNBS38-10	Customized	34.7± 1	M10	20
	MD610S-4T176(BS)-INT	3x95	SC95-10	50	RNB60-10	Customized	38.7± 1	M10	20

Table 16–23 Specifications of braking terminal cables

Structure	Model	Braking terminal				Screw specification	Tightening torque (N·m)
		IEC (mm²)		Allowable cable length	OD (mm)		
		Recommended Cable Type	Recommended cable lug specifications				
T1	MD610S-4T1R5(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M3.5	1.0
	MD610S-4T2R1(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M3.5	1.0
	MD610S-4T3R8(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M3.5	1.0
T2	MD610S-4T5R1(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M3.5	1.0
	MD610S-4T7R2(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M3.5	1.0
	MD610S-4T9R0(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M3.5	1.0

Structure	Model	Braking terminal				Screw specification	Tightening torque (N·m)
		IEC (mm²)		Allowable cable length	OD (mm)		
		Recommended Cable Type	Recommended cable lug specifications				
T3	MD610S-4T013(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M4	1.2
	MD610S-4T017(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M4	1.2
T4	MD610S-4T025(BS)-INT	2 x 4	RNB5.5-5	Customized	8.5± 0.2	M6	2.0
	MD610S-4T032(BS)-INT	2 x 4	RNB5.5-5	Customized	8.5± 0.2	M5	2.0
T5	MD610S-4T037(BS)-INT	2 x 4	RNB5.5-6	Customized	8.5± 0.2	M6	2.5
	MD610S-4T045(BS)-INT	2 x 4	RNB5.5-6	Customized	8.5± 0.2	M6	2.5
T6	MD610S-4T060(BS)-INT	2 x 6	RNB5.5-6	Customized	14.5± 0.4	M6	2.5
	MD610S-4T075(BS)-INT	2 x 10	RNBL8-6	Customized	14.5± 0.4	M6	2.5
T7	MD610S-4T091(BS)-INT	2 x 16	RNB14-8	Customized	18.5± 0.4	M8	13
	MD610S-4T112(BS)-INT	2 x 16	RNB14-8	Customized	18.5± 0.4	M8	13
T8	MD610S-4T150(BS)-INT	2 x 25	RNB22-10	Customized	24.3± 0.5	M10	20
	MD610S-4T176(BS)-INT	2 x 35	RNBL38-10	Customized	24.3± 0.5	M10	20

Table 16–24 Cable Specifications for Bus Terminals

Structure	Model	Bus terminal				Screw specification	Tightening torque (N·m)
		IEC (mm²)		Allowable cable length	OD (mm)		
		Recommended Cable Type	Recommended cable lug specifications				
T1	MD610S-4T1R5(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M3.5	1.0
	MD610S-4T2R1(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M3.5	1.0
	MD610S-4T3R8(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M3.5	1.0
T2	MD610S-4T5R1(BS)-INT	2 x 2.5	E2510	Customized	8.1± 0.2	M3.5	1.0
	MD610S-4T7R2(BS)-INT	2 x 4	E4009	Customized	8.5± 0.2	M3.5	1.0
	MD610S-4T9R0(BS)-INT	2 x 6	E6010	Customized	11.7± 0.3	M3.5	1.0
T3	MD610S-4T013(BS)-INT	2 x 10	E10-10	Customized	15.4± 0.3	M4	1.2
	MD610S-4T017(BS)-INT	2 x 10	E10-10	Customized	15.4± 0.3	M4	1.2
T4	MD610S-4T025(BS)-INT	2 x 16	RNBS22-5	Customized	22.3± 0.3	M5	2.0
	MD610S-4T032(BS)-INT	2 x 16	RNBS22-5	Customized	22.3± 0.3	M5	2.0
T5	MD610S-4T037(BS)-INT	2 x 25	RNB38-6	Customized	26.3± 0.3	M6	2.5
	MD610S-4T045(BS)-INT	2 x 25	RNB38-6	Customized	26.3± 0.3	M6	2.5
T6	MD610S-4T060(BS)-INT	2 x 16	RNBL14-6	Customized	23± 0.7	M6	2.5
	MD610S-4T075(BS)-INT	2 x 25	RNBS22-6	Customized	23± 0.7	M6	2.5
T7	MD610S-4T091(BS)-INT	2 x 35	RNBL38-8	Customized	26.5± 0.7	M8	13
	MD610S-4T112(BS)-INT	2 x 50	RNB60-8	Customized	30± 0.7	M8	13

Structure	Model	Bus terminal				Screw specification	Tightening torque (N·m)
		IEC (mm^2)		Allowable cable length	OD (mm)		
		Recommended Cable Type	Recommended cable lug specifications				
T8	MD610S-4T150(BS)-INT	2 x 70	RNB70-10	Customized	34.7± 1	M10	20
	MD610S-4T176(BS)-INT	2 x 95	SC95-10	Customized	38.7± 1	M10	20

Note

- Observe national or regional regulations during selection. The preceding table is based on the following:
  - PVC insulation and copper conductor
  - Ambient temperature of 40°C and cable surface temperature of 75°C (Remark: When the ambient temperature exceeds 40°C, contact Inovance.)
  - Cable layout type E is adopted (see IEC60204-1).
- If the conditions are different, you need to select the model according to actual conditions.
- For bare OT terminals, the end of the terminal is protected by a heat shrink tube.

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.

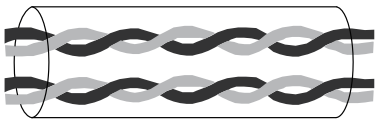


Figure 16-20 Diagram of shielded twisted pairs

Table 16–25 Control signal terminal specifications

Structure	Control signal terminal			
	Recommended Cable Type	Allowable cable length	OD (mm)	Recommended terminal specifications
T1 to T8	22	Customized	Customized	E0508

Table 16–26 Relay signal terminal specifications

Structure	Control signal terminal			
	Recommended Cable Type	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

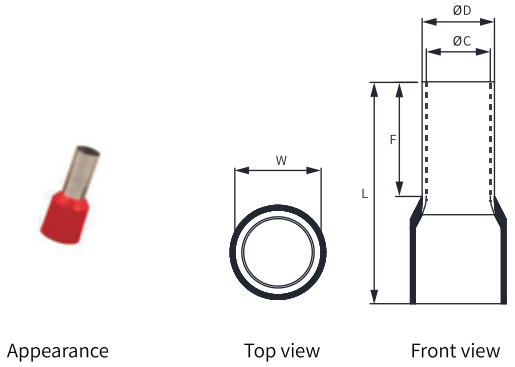


Figure 16-21 Appearance and dimensions of pre-insulated crimping ferrule (TG-JT type)

Table 16–27 Specifications and dimensions of pre-insulated crimping ferrule (TG-JT type)

Cross-sectional area	Model	Dimension (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
14AWG 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	Dimension (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
8AWG 10 mm^2	E10-12	12.0	22.5	7.7	5.05	4.7	(1) Milk white (2) Brown	OPT AN-16WF

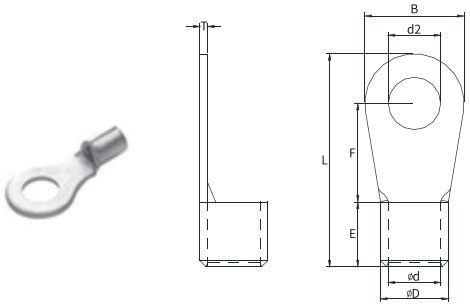


Figure 16-22 Appearance and dimensions of the bare ring lug (TO Type)

Table 16–28 Specifications and dimensions of the bare ring lug (TO Type)

Cross-sectional area	Model	Dimension (mm)								Crimping tool
		d2	B	F	L	E	D	d	T	
6AWG 14 mm^2	RNB14-5	5.3	12.0	13.5	29.5	10.5	9.0	6.0	1.4	OPT TP-150D
4AWG 22 mm^2	RNBS22-6	6.4	12.0	14.5	32.5	12.0	11.5	8.0	1.7	OPT TP-150D
2AWG 38 mm^2	RNB38-6	6.4	15.5	18.5	40.0	14.0	13.5	9.5	1.8	OPT TP-150D
12AWG 4 mm^2	RNB5.5-5	5.3	9.5	8.0	20.0	7.0	5.5	3.5	1.0	IZUMI 5N18
12AWG 4 mm^2	RNB5.5-6	6.4	12.2	105	23.5	7.0	5.5	3.5	1.0	IZUMI 5N18
4AWG 22 mm^2	RNBS22-5	5.3	12.0	14.5	32.5	12.0	11.5	8.0	1.7	OPT TP-150D

16.6.7 Expansion Card

16.6.7.1 Outline dimensions

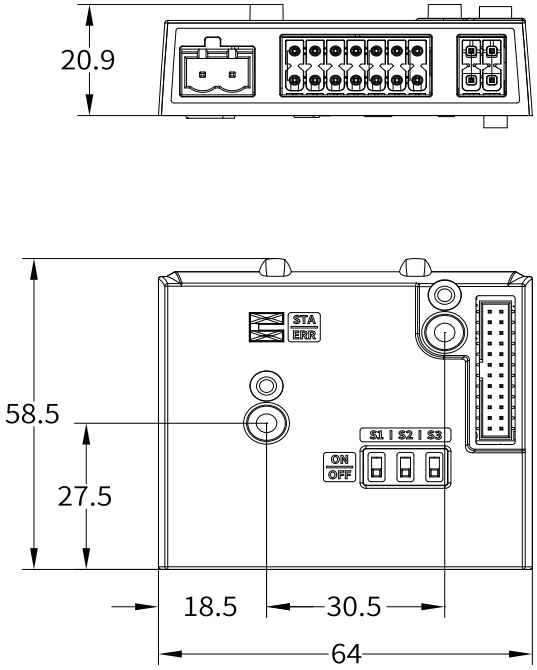


Figure 16-23 Dimensions of IO expansion card MD-IO-M1 (unit: mm)

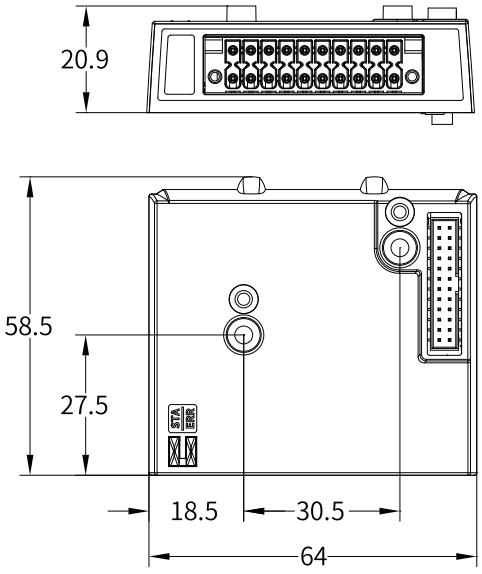


Figure 16-24 Dimensions of PG expansion cards (MD-PG-AU1, MD-PG-S1, MD-PG-R1) (unit: mm)

16.6.7.2 Description of IO Expansion Card Interface

16.6.7.2.1 Terminal descriptions

Terminal layout

The I/O expansion card terminal layout is shown in the figure below.

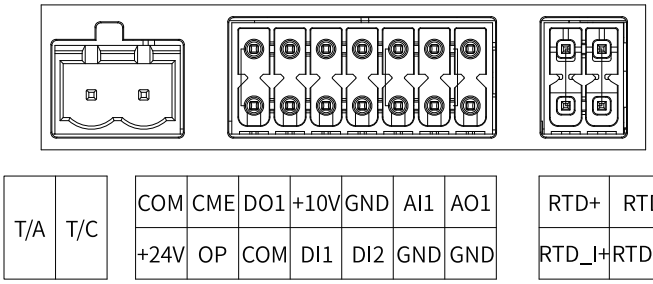


Figure 16-25 Terminal layout

Terminal descriptions

Type	Mark	Name	Function
Power	+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 [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	AO1-GND	AO1	The output signal type is selected through the 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	DO1-CME	DO1	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	AI1-GND	Analog input 1	The input signal type is selected through 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

Type	Mark	Name	Function
Digital input	DI1-COM	Digital input 1	Photocoupler 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	DI2	
Temper-ature sensor input	RTD_I+	RTD excitation port +	Select the temperature sensor type by sliding S3: • S3 = OFF: PT100/PT1000/KTY84-130 • S3 = ON: PTC130 single-conductor/three-conductor Operation 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°C to 180°C, ±5°C)
	RTD+	RTD acquisition port+	
	RTD_I-	RTD excitation port -	
	RTD-	RTD acquisition port-	
Relay output	T/A-T/C	Normally open terminal	Supports long-life requirements in 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.

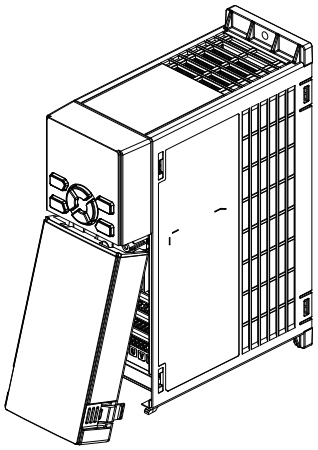
Slide switch description

Name		DIP switch function	
S1	Modes of operation	ON	Current Output
		OFF	voltage output
S2	AI mode selection	ON	Current input
		OFF	Voltage input
S3	Temperature sensor selection	ON	PTC130 (single-conductor/ three-conductor)
		OFF	PT100/PT1000/KTY84-130

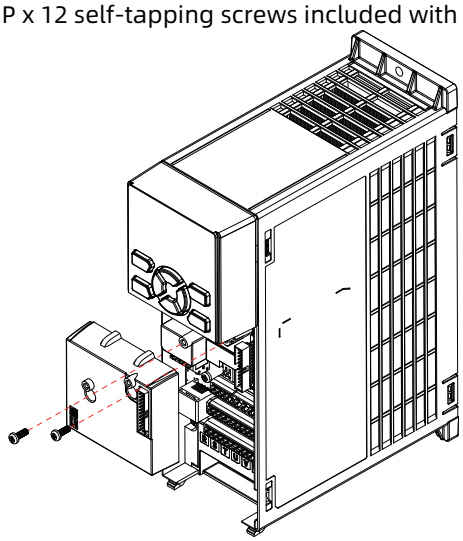
16.6.7.3 Installation

The expansion card is embedded in the MD610 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 P x 12 self-tapping screws included with the product.



17 Appendix

17.1 Certification and Standard Compliance

Table 17–1 List of applicable standards

Applicable standard	Applicable scenario
IEC/EN 61800-5-1	Adjustable Speed Electrical Drive Systems - Part 5-1: Safety Requirements - Electrical, Thermal, and Energy
IEC/EN 61800-3	Adjustable Speed Electrical Power Drive Systems - Part 3: EMC Requirements and Specific Test Methods
IEC/EN 61508	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems
EN/ISO 13849-2	Safety of Machinery - Safety-related Parts of Control Systems - Part 2: Validation
IEC/EN 63000	Technical Documentation for the Assessment of Electrical and Electronic Products with Respect to the Restriction of Hazardous Substances

The drive complies with the following directives and standards. Actual certification is subject to the information on the product nameplate.

Mark	Directive	Standard	Note
CE	2014/35/EU	IEC/EN 61800-5-1	The drive complies with the EU Low Voltage Directive 2014/35/EU.
	2014/30/EU	IEC/EN 61800-3	The drive complies with the EU Electromagnetic Compatibility Directive 2014/30/EU.
	2011/65/EU	IEC/EN 63000	The drive complies with the EU Restriction of Hazardous Substances Directive 2011/65/EU.
SGS TÜV SAAR FUNKTIONALE SICHERHEIT GEPRÜFT FUNCTIONAL SAFETY APPROVED	-	IEC/EN 61508	The drive complies with functional safety-related standards.
	-	EN/ISO 13849-2	

Certificate download

To download the relevant certificate, visit the following website:

https://www.inovance.com/portal/serviceSupport/download

17.1.1 CE certification

17.1.1.1 Precautions for Compliance with EU Standards

Figure 17-1 CE mark

- The CE mark indicates compliance with the Low Voltage Directive (LVD), Electromagnetic Compatibility (EMC), and Restriction of Hazardous Substances (RoHS) directives for commercial trades (production, import, and sales) in EU.
- The CE mark is mandatory for engaging in commercial business (production, importation, and distribution) in EU.
- The drive complies with LVD, EMC, and RoHS directives and carries the CE mark.
- Machines and devices integrated with this drive must also comply with CE requirements for distribution in EU.
- The integrator who integrates this drive into other products and attaches CE mark to the final assembly has the responsibility of ensuring compliance with CE certification.

17.1.1.2 Requirements for Compliance with EMC Directive

- This drive, which is applicable to the First environment and Second environment, complies with EMC Directive 2014/30/EU and standard EN IEC 61800-3.

If the product is used in the first environment, it may generate radio interference. In addition to CE compliance requirements, measures should be taken to prevent interference when necessary.

- As required by EMC Directive and standard, install an EMC filter on the input side and use shielded cables on the output side. Ensure the filter is grounded properly and the shield of the output cable is grounded 360 degrees.

The manufacturer of the system with the product installed must ensure that the system meets the requirements of the European EMC Directive, and ensure that the system meets the requirements of the standard EN IEC 61800-3 according to the application environment of the system.

EMC specifications

The drive complies with EN IEC 61800-3. The maximum length of the motor cable allowed by the conducted and radiated emission is shown in the following table.

Table 17–2 Maximum Cable Length Allowed by Conducted and Radiated Emission

Power grid	Structure	Max. motor cable length allowed by conducted emission				Max. motor cable length allowed by radiated emission			
		C2		C3 Class		C2		C3 Class	
		Built-in filter	External EMC filter	Built-in filter	External EMC filter	Built-in filter	External EMC filter	Built-in filter	External EMC filter
Three-phase 380 V to 480 V	T1	-	10 m	10 m	-	-	10 m	10 m	-
	T2	-	10 m	10 m	-	-	10 m	10 m	-
	T3	-	10 m	10 m	-	-	10 m	10 m	-
	T4	-	10 m	10 m	-	-	10 m	10 m	-
	T5	-	10 m	10 m	-	-	10 m	10 m	-
	T6	-	10 m	10 m	-	-	10 m	10 m	-
	T7	-	10 m	10 m	-	-	10 m	10 m	-
	T8	-	10 m	10 m	-	-	10 m	10 m	-

Introduction to EMC standards

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 the following requirements:

- The electromagnetic interference generated by the device or system during normal operation must be within a certain limit.
- The device or system must have sufficient immunity to the electromagnetic interference in the environment.

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

Devices are divided into the following four categories based on the intended environment.

- Category C1: Power drive systems with the rated voltage less than 1000 V, intended for use in the first environment.
- Category C2: Power drive systems with the rated voltage lower than 1000 V, which is neither a plug-in device nor a movable device and is intended to be installed and commissioned only by professionals when used in the first environment.
- Category C3: Power drive systems with the rated voltage lower than 1000 V, which is intended for use in the second environment and not intended for use in the first environment
- Category C4: Power drive systems with the rated voltage equal to or higher than 1000 V or rated current equal to or higher than 400 A, or intended for use in complex systems in the second environment

17.1.1.3 Requirements for Compliance with LVD

The product has been tested in accordance with EN61800-5-1 and complies with the Low Voltage Directive. Observe the following requirements to enable machines and devices integrated with this drive to comply with the LVD.

Installation location

Install the product in a place with overvoltage category III and pollution degree 1 or 2 as specified by IEC 60664-1.

Installation environment

For requirements on installation environments, see *"3.2.1 Environment Requirements" on page 43*.

Installation protection requirements

- The drive serves as a part of a final system. Install the drive as the system component in a fireproof cabinet that provides effective electrical and mechanical protection, and install it in accordance with local laws and regulations and relevant IEC standards.
- Drives (IP20) intended to be installed inside the cabinet must be installed in a structure that prevents intrusion of unwanted objects from the top and the front.

Wiring requirements for main circuit terminals

For details on main circuit terminal wiring, see *" Main Circuit Connection" on page 87*.

Requirements for protective devices

To comply with EN 61800-5-1 standards, install a fuse/circuit breaker on the input side of the drive to prevent accidents caused by short circuit in the internal circuit. Use a fuse that matches the maximum input current of the AC drive. For selection of fuses, see *"16.6.2 Circuit Breaker And Fuse" on page 1538*.

17.1.2 STO Certification

EU directives and standards

Machinery Directive 2006/42/EC (Safety Functions) Standard IEC 61800-5-2

17.1.3 KC Certification

Figure 17-2 KC mark

Drives with the KC mark on the nameplate comply with electromagnetic compatibility standards of South Korea.

이 기기는 업무용(A 급) 전자파적합기기로서 판매자 또는사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

For sellers or other users, please bear in mind that this device is an A-grade electromagnetic wave device.
This device is intended to be used in areas other than at home.

17.2 Solutions to Common EMC Issues

17.2.1 Solutions to Common EMC Issues

The drive draws power from the grid in a pulsating, intermittent manner, which causes the drive to emit significant harmonic currents. When high grid quality is required, take corrective measures shown in *"17.2.2 Harmonic Suppression Measures" on page 1577*.

The drive can generate strong interference. Electromagnetic noise interference such as coupling interference and common ground impedance may occur among cables in the drive system in the case of improper wiring inside the cabinet, improper grounding, or improper system configuration, resulting in function failure or performance degradation of the system, such as malfunction of the residual current device, I/O signal bouncing, high-speed pulse I/O count error, and communication interruption. When the drive disturbs or is disturbed by other devices, take the measures shown in *"17.2.3 Residual Current Device Misoperation" on page 1578*, *"17.2.4.2 Common I/O Signal Interference" on page 1580*, and *"17.2.5 RS485 Communication Interference" on page 1581*.

17.2.2 Harmonic Suppression Measures

The drive draws power from the grid in a pulsating, intermittent manner, and this pulsating current, together with the impedance along the power grid, creates a pulsating voltage drop that superimposed to the grid voltage, causing voltage distortion.

Harmonics generated by the drive can lead to power loss and interference, as shown below.

- Increase in the overall RMS value of input current (up to 50%)
- Voltage distortion in the power supply (voltage harmonics)
- Reduction in power factor
- Overload, noise, vibration of transformers, cables, and other electrical components...
- Interference with sensitive equipment nearby
- Resonance, which causes local parallel and series resonance in the power grid, thus amplifying harmonics

Therefore, harmonic suppression is required in the following cases:

- Compliance with relevant standards
- High requirements for on-site power grid quality

- Requirements for equipment power factor

No.	Requirements	Description
1	Compliant with requirements in IEC 61800-3/IEC 61000-3-12 Class A or Table 4	Suppression measures: Install an input reactor on the input side. Refer to *" " on page* for details.
2	High harmonic requirements, such as IEEE519, GB/T14549, or custom requirements with harmonics below 10%	Passive harmonic filters are recommended.

17.2.3 Residual Current Device Misoperation

To prevent the residual current device (RCD) from malfunctioning, select a suitable type of RCD. During the operation of the drive, high-frequency leakage currents caused by IGBT can affect the RCD. Therefore, select an RCD with a tripping current equal to or higher than 100 mA for each 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.

When the RCD trips or current leakage occurs, see the following table for recommended solutions.

Table 17–3 Measures against current leakage

Symptom	Possible cause	Solution
The RCD trips at the moment of power-on.	The anti-interference performance of the RCD is weak.	1 .It is recommended to use Siemens or Schneider RCDs. 2 .Use an RCD with a higher tripping current. 3 .Move the unbalanced load to the upstream side of the RCD. 4 .Disconnect the EMC screw or the grounding terminal of the external EMC filter to reduce the ground capacitance of the input end.
	The tripping current of the RCD is excessively low.	
	An unbalanced load is connected to the downstream side of the RCD.	
	An excessive ground capacitance exists in the upstream side of the drive.	
The RCD trips during operation.	The anti-interference performance of the RCD is weak.	1 .It is recommended to use Siemens or Schneider RCDs. 2 .For a single drive, check that the EMC screw is securely tightened, as shown below. 3 .For multiple drives, disconnect the EMC selective grounding screw, as shown below. 4 .Install a simple filter on the input side of the drive and wind LN and RST cables around the ferrite ring, as shown below. 5 .Replace with an RCD with a high rated tripping current. 6 .Reduce the carrier frequency without compromising the performance. 7 .Use shorter motor cables.
	The tripping current of the RCD is excessively low.	
	An unbalanced load is connected to the downstream side of the RCD.	
	The distributed capacitance to ground of the motor cable and motor is excessively high.	

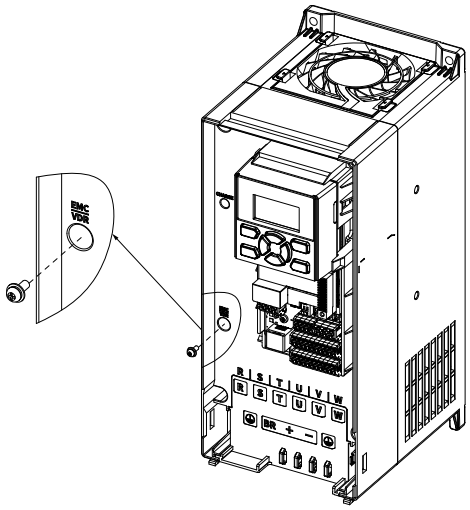


Figure 17-3 Disconnect the EMC selective grounding screw.

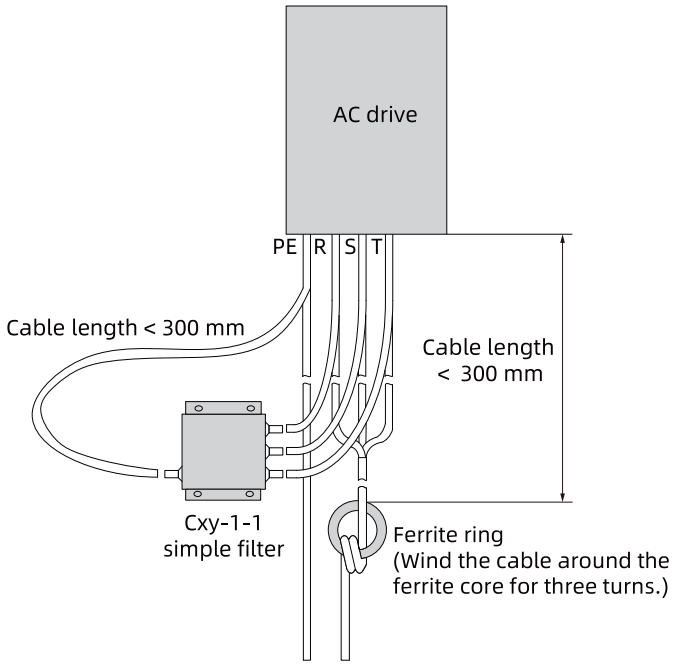


Figure 17-4 Installing simple filter and ferrite ring on the input side

17.2.4 I/O Signal Interference

17.2.4.1 High-Speed Pulse Interference

See the following table for how to rectify high-speed pulse interference.

No.	Procedure
1	Use shielded twisted pair cables with both ends grounded (see *" Control Circuit Connection" on page 98*).
2	Connect the motor enclosure to the PE terminal of the drive.
3	Connect the PE terminal of the drive to the PE of the power grid.
4	Add an equipotential bonding grounding cable between the host controller and drive (see *"4.5.3 Cabinet Design that Meets EMC Requirements" on page 85*).
5	Separate signal cables from power cables with a distance of at least 30 cm.

No.	Procedure
6	Install ferrite ring to the signal lines, or wind the signal cable around the ferrite ring by 2 to 4 turns (see the magnetic ring installation method diagram).
7	Wind U/V/W cables around the ferrite ring by 2 to 4 turns (see the ferrite ring installation diagram).
8	Use shielded power cables and ground the shield properly.

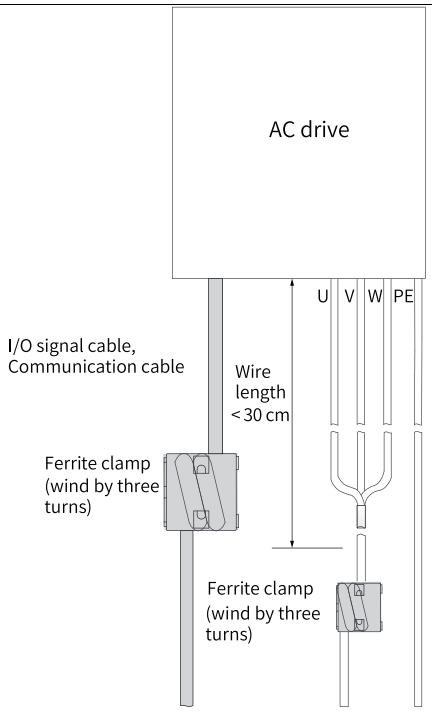


Figure 17-5 Installing the ferrite ring

17.2.4.2 Common I/O Signal Interference

Rectify regular I/O signal interference based on the following table.

No.	Procedure
1	Use shielded cables as the I/O signal cables and connect the shield to the PE terminal (as shown in *" Control Circuit Connection" on page 98*).
2	Connect the PE of the motor to the PE terminal of the drive, and connect the PE terminal of the drive to the PE terminal of the power grid.
3	Add an equipotential bonding grounding cable between the host controller and drive (see *"4.5.3 Cabinet Design that Meets EMC Requirements" on page 85*).
4	Wind U/V/W cables around a ferrite core by two to four turns. For details, see ferrite core installation diagram in *"4.5.3 Cabinet Design that Meets EMC Requirements" on page 85* .
5	Increase capacitance filtering for low-speed DI terminals. The recommended maximum value is 0.1 μF (see details in the diagram for I/O signal cables with capacitance filtering increase).
6	Increase capacitor filtering between AI and GND. The recommended maximum value is 0.22 μF. See details in the diagram for I/O signal cables with capacitor filtering increase.
7	Add the ferrite clamp to the signal cable or wind the signal cable around the ferrite core for one or two turns (see ferrite core installation diagram in *"17.2.4.1 High-Speed Pulse Interference" on page 1579*).
8	Use shielded power cables and ground the shield properly.

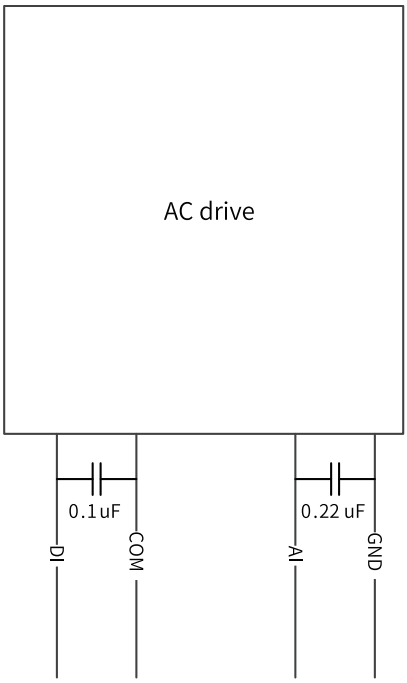


Figure 17-6 I/O signal cables with capacitance filtering increased

17.2.5 RS485 Communication Interference

Rectify regular RS485 communication interference based on the following table.

No.	Procedure
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	Add an equipotential bonding grounding cable between nodes during multi-node communication. See *"4.5.3 Cabinet Design that Meets EMC Requirements" on page 85* for details.
6	Add ferrite clamps at both ends of the communication cable, or wind the cable around a ferrite core for one to two turns. For details, see ferrite core installation diagram in *"17.2.4.1 High-Speed Pulse Interference" on page 1579*.
7	Wind U/V/W cables around a ferrite core by two to four turns. For details, see ferrite core installation diagram in *"17.2.4.1 High-Speed Pulse Interference" on page 1579*.
8	Use shielded power cables and ground the shield properly.

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.

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