INOVANCE

FORWARD, ALWAYS PROGRESSING

SV680-INT Series Servo Drive

Quick Installation and Commissioning

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

Data code PS00015536A02

Preface

Introduction

The SV680-INT series servo drive is a high-end servo drive designed based on global-leading standards and high-end application needs. It is featured with high speed, high precision, high performance, and tuning-free function. Compliant with CE, UL, KC, EAC, UKCA and TUV certification requirements and top international quality standards, it is specially suitable for high-end applications.

Its power ranges from 0.05 kW to 7.5 kW. It supports Modbus, CANopen and EtherCAT communication protocols and carries necessary communication interfaces to work with the host controller for implementing a networked operation of multiple servo drives. The servo drive supports adaptive stiffness level setting, inertia auto-tuning, and vibration suppression for easy use. The drive, together with an MS1 series high-response servo motor (with ultra-low, low or medium inertia) equipped with a 23- or 26-bit single-turn/multi-turn absolute encoder, any third party servo motor, linear motor or DDR motor, serves to deliver a quiet and stable operation and accurate process control through features like fully closed-loop, internal process segment and gantry synchronization.

The drive also comes with features like safe torque off, dynamic braking, and brake output (external relay not needed) as standard and supports extension of seven kinds of functional safety and bus functional safety FSoE (the PINT version further offers 24V backup power) for continuous safe production. The drive aims to achieve quick and accurate position control, speed control, and torque control through high-performance solutions for automation equipment in such industries as electronic manufacturing, lithium batteries, manipulators, packaging, and machine tools.

This manual describes the model number, installation, terminals and quick commissioning and operation of the drive.

Note

The speed of a servo motor and DDR motor is in RPM and DDL motor is in mm/s. RPM is used throughout the manual. Unless otherwise specified, an RPM value is equivalent to the mm/s one.

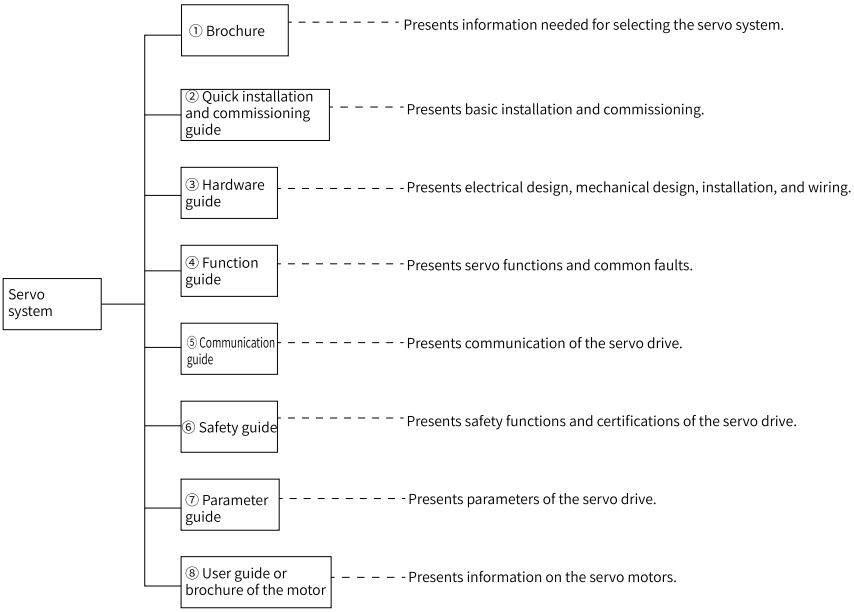
Abbreviation

The following abbreviations will be used herein to refer to the corresponding servo drives.

Abbreviation	Servo drive
[P]	SV680P*****-****
[N]	SV680N*****-****

More documents

The documents related to the drive are shown in the following figure and table.



No.	Name	Data Code	Description
①	SV680-INT series flagship servo drive	19120347	Provides instructions on product selection, including the list of supporting components, technical data on the drive, and the selection guide of cables.
②	SV680-INT Series Servo Drive Installation and Commissioning Quick Guide	PS00015536	Describes the model number, installation, terminals and quick commissioning and operation of the drive.
③	SV680-INT Series Servo Drive Hardware Guide	PS00015494	Describes technical data, installation, terminals, required certificates and standards and solutions to common EMC problems of the drive.
④	SV680-INT Series Servo Drive Function Guide	PS00015554	Introduces the functions and faults of the drive, including function overview, adjustment, basic servo functions and fault handling.
⑤	SV680-INT Series Servo Drive Communication Guide	PS00015535	Introduces the communication of the drive, including configuration of Modbus, CANopen, and EtherCAT communication.
⑥	SV680P-INT Series Servo Drive Safety Guide	PS00009740	Describes the safety function and related certifications and standards, wiring, commissioning process, troubleshooting and parameters of the drive.
	SV680N-INT Series Servo Drive Safety Guide	PS00009768	
⑦	SV680-INT Series Servo Drive Parameter Guide	PS00015555	Introduces the parameters of the drive, including a parameter list and description of parameters.

No.	Name	Data Code	Description
⑧	MS1-R Series Servo Motor Selection Guide	PS00004605	Introduces the product information, general specifications, motor selection, cable selection, and required certificates and standards of the servo motor.
	MS1-R Series Servo Motor Installation Guide	PS00005407	Describes installation of the motor, including an installation flowchart, unpacking and transportation, mechanical installation, and electrical installation.
	Direct drive motor module platform and drive	19120011	Introduces the product information, general specifications, motor selection, cable selection, and required standards of the motor.

Revision History

Date	Version	Description
2024-05	A02	Minor corrections.
2024-03	A01	Minor corrections.
2024-02	A00	First release

Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version in the following way:

- Visit *http://www.inovance.com*, go to Support > Download, search by keyword, and then download the PDF file.
- Scan the QR code on the product with your mobile phone.
- Scan the QR code below to install the app, where you can search for and download manuals.

Warranty

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is not caused by improper operation of the user. You will be charged for any repair work after the warranty period expires.

Within the warranty period,maintenance fee will be charged for the following damage:

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or abnormal voltage

- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

The maintenance fee is charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see the Product Warranty Card.

Table of Contents

Fundamental Safety Instructions

Safety Precautions

- This chapter presents essential safety instructions for a proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to comply with the safety precautions may result in death, serious injury, or equipment damage.
- "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
- Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions

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

Fundamental Safety Instructions

- Drawings in the guide are sometimes shown without covers or protective guards. Remember to 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.
- Users must take mechanical precautions to protect personal safety and wear protective equipment, such as anti-smashing shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking

- Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking.
- Do not install the equipment if you find water seepage or missing or damaged components upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.

- 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 injuries 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-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 equipment components such as the front cover and terminal blocks 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.

CAUTION

- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.

Installation

DANGER

- The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed.

WARNING

- Read through the guide and safety instructions 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 will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an 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 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 equipments with strong electromagnetic interference, such as a transformer, install a shielding equipment for the equipment to prevent malfunction.
- Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply will result in a 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 the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.
- 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

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Before wiring, cut off all the power supplies of the equipment. and wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply will result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply will result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply can result in electric shock.

- Do not connect the input power supply to the output end of the equipment. Failure to comply can result in equipment damage or even a fire.
- When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.
- Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in a fire.
- After wiring is done, 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 an electric shock or equipment damage.

- Follow the proper 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 of the product.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

Power-on

- Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or a fire.
- After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply will result in an electric shock.

- Perform a trial run after wiring and parameter setting 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.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injuries.

Operation

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

- Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

Maintenance

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment with power ON. Failure to comply will result in an electric shock.
- Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- In case of a permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply will result in an electric shock.

- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

Repair

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not repair the equipment with power ON. Failure to comply will result in an 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 the repair request according to the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injuries or equipment damage.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.

Disposal

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

Additional Precautions

Precautions for the dynamic brake

- Dynamic braking can only be used for emergency stop in case of failure and sudden power failure. Do not trigger failure or power failure frequently.
- Ensure that the dynamic braking function has an operation interval of more than 5 minutes at high speed, otherwise the internal dynamic braking circuit may be damaged.

- Dynamic braking is commonly used 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 regenerative state and short-circuit current passes through the dynamic brake. If this situation continues, the drive, and even the motor, may be burned.

Safety label

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. The following table describes the meaning of the safety labels.

Safety label	Description
	• Never fail to connect the protective earth (PE) terminal. Read through the guide and follow the safety instructions before use. • Do not touch terminals within 15 minutes after disconnecting the power supply to prevent the risk of electric shock. • Do not touch the heatsink with power ON to prevent the risk of burn.

1 Model and Nameplate

Description of the Model

SV680 N S 2R8 I - GINT
① ② ③ ④ ⑤ ⑥

①**Product series** SV680: SV680 general-purpose servo drive	④**Rated output current**		⑤**Model configuration** I: Standard type S: Functional safety type
②**Product type** N: EtherCAT P: Pulse + CANopen	S: 200 V	1R6: 1.6 A 2R8: 2.8 A 5R5: 5.5 A 7R6: 7.6 A 012: 12.0 A 018: 18.0 A 022: 22.0 A 027: 27.0 A	⑥**Model configuration** GINT: General (global version) PINT: Backup power supply (global version)
③**Voltage class** S: 200 V T: 400 V	T: 400 V	3R5: 3.5 A 5R4: 5.4 A 8R4: 8.4 A 012: 12.0 A 017: 17.0 A 021: 21.0 A 026: 26.0 A	

Nameplate

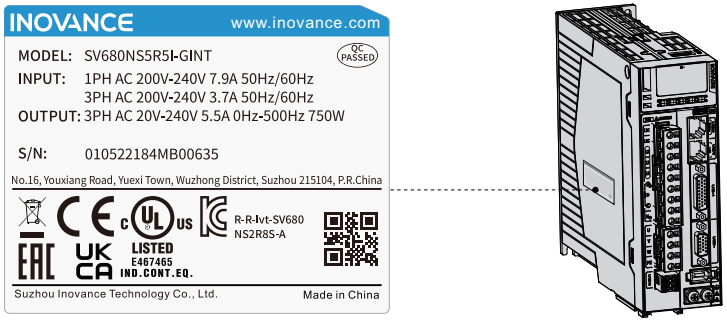


Figure 1-1 Nameplate

Encryption of the production serial number

01050202 4 P 7 00001
① ② ③ ④ ⑤

① **Internal code** Equipment material code	③ **Year** 9: 2009 A: 2010 ... P: 2022 ... Note: I/L/O/Q is not used.	⑤ **Lot number** 00001: 1st in current month 00002: 2nd in current month 00003: 3rd in current month ... Range: 00001 to 99999
② **Manufacturer code** 4: Suzhou Inovance	④ **Month** 1: January 2: February ... A: October B: November C: December	

Example: The S/N 010502024P700001 indicates the drive is manufactured in July, 2022.

2 Unpacking and Handling

Check the following items upon unpacking.

Item	Description
Check whether the delivered product is consistent with your order.	Check whether the servo drive model and specifications comply with your order. See the dimensions of the packing box in *"Table 2–1 " on page 16*. The deliverables include the product, cushion, carton box, and screw bag, as shown in *"Figure 2–1 " on page 17* .
Check whether the product is intact.	Check whether the product delivered is in good condition. If there is any missing or damage, contact Inovance or your supplier immediately.

Table 2–1 Dimensions of the outer packing box

Size	Model SV680P-INT series servo drive	Outer Width (mm)	Outer Height (mm)	Outer Depth (mm)	Weight (kg)
A	S1R6, S2R8	250.0	110.0	200.0	1.13
C	S5R5, S7R6, T3R5, T5R4	235.0	125.0	215.0	1.5
D	S012, T8R4, T012	235.0	150.0	225.0	2.0
E	S018, S022, S027, T017, T021, T026	320.0	170.0	280.0	3.9

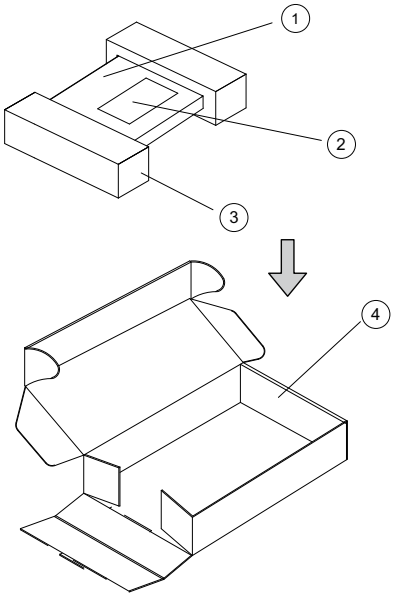


Figure 2-1 Contents inside the packing box

No.	Name
①	Product
②	Terminal accessory package
③	Cushion
④	Carton box

3 Preparations

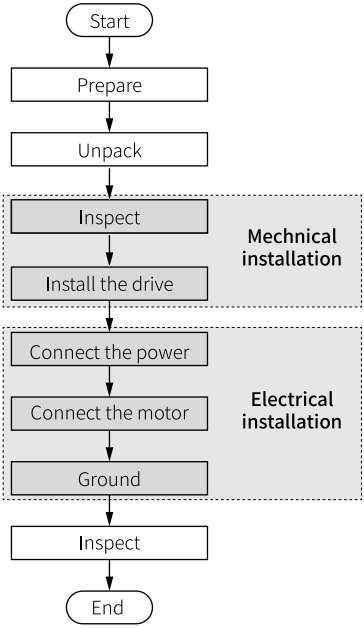


Figure 3-1 Installation flow chart

Note

The illustration presents the recommended installation procedure. You can adjust the procedure as appropriate.

3.1 Installation Environment Requirements

Table 3–1 Environment requirements

Item	Requirement
Installation location	Indoors
Grid overvoltage	Overvoltage Class III (OVC III).

Item	Requirement
Altitude	The maximum altitude is 2000 m. • For altitudes not higher than 1000 m, derating is not required. • Derating is required for altitudes above 1000 m (derate 1% for every additional 100 m). • For altitudes above 2000 m, contact Inovance.
Temperature	• Mounting/Operating temperature: 0°C to +55°C For temperatures between 0°C to 45°C, derating is not required. For temperatures above 45°C, derate 2% for every additional 1°C. • Storage/Transportation temperature: -40°C to +70°C. • To improve the reliability of the machine, use the servo drive in environments without dramatic temperature change. • When installing the servo drive into an enclosed environment such as a control cabinet, use a cooling fan or air conditioner to keep the temperature of the inlet air below 45°C. Failure to comply will result in overheat or fire. • Install the drive on the surface of an incombustible object and leave sufficient surrounding space for heat dissipation. • Take measures to prevent the servo drive from being frozen.
Environment humidity	Below 90% RH (no condensation)
Storage humidity	Below 90% RH (no condensation)
Vibration resistance	Operation: • 5 Hz–8.4 Hz: 3.5 mm displacement • 8.4 Hz–200 Hz: 1g Product package: • 5 Hz–100 Hz：$0.01g^2/Hz$ • 200 Hz: $0.001g^2/Hz$ • Grms = 1.14 g
Impact resistance	Below $19.6m/s^2$
IP rating	IP20 Note: excluding terminals (IP00)
Environment	Pollution Degree 2 and below Install the servo drive in a place that meets the following requirements: • Free from direct sunlight, dust, corrosive gas, explosive and inflammable gas, oil mist, vapor, water drop, and salty element • Insusceptible to vibration (away from equipment that may generate strong vibration, such as a punch press) • Free from unwanted objects such as metal powder, oil, and water inside the servo drive • Free from radioactive substances, combustible materials, harmful gases and liquids, and salt corrosion • Away from combustible materials such as wood • Do not use the equipment in vacuum.

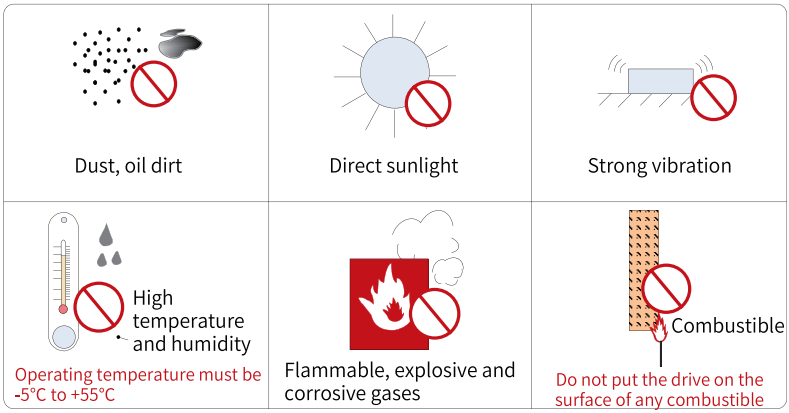


Figure 3-2 Environment requirements

3.2 Installation Clearance

Servo drives in different specifications require different installation clearances. It is recommended to reserve a clearance of at least 10 mm (0.39 in.) at both sides and a clearance of at least 80 mm (3.15 in.) above and below the drive for heat dissipation.

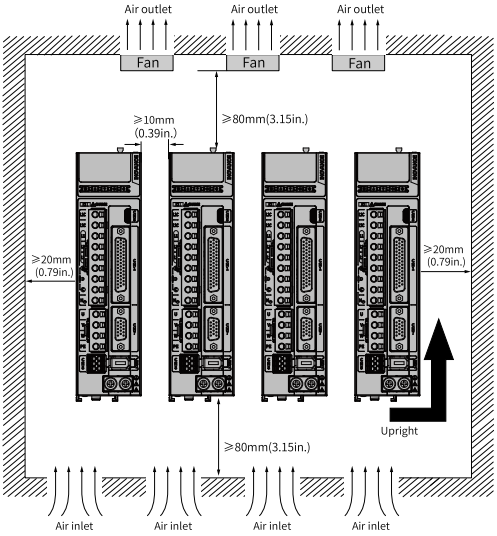


Figure 3-3 Clearance for side-by-side installation

Servo drives in size A support compact installation, in which a clearance of at least 1 mm (0.04 in.) must be reserved between every two drives. When adopting compact installation, derate the load rate to 75%.

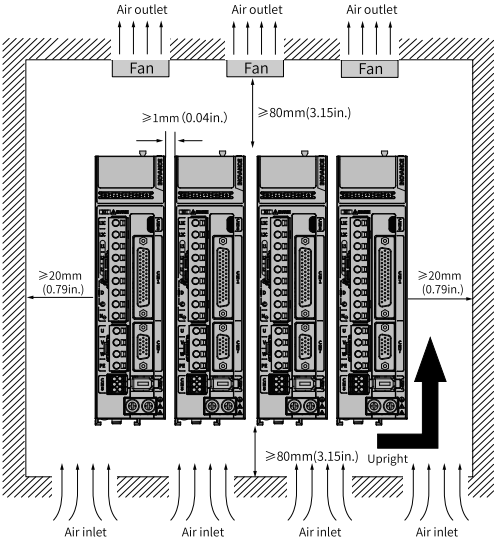


Figure 3-4 Clearance for compact installation

Servo drives in sizes C and D support zero-clearance installation without derating.

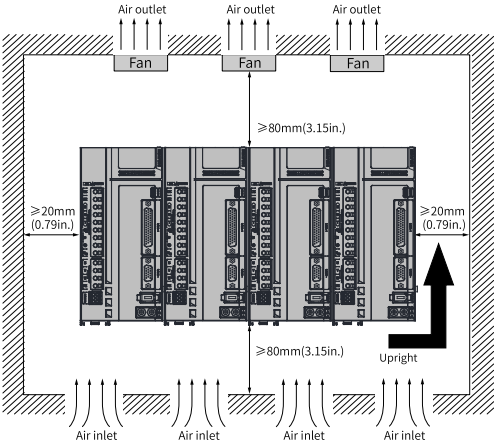


Figure 3-5 Zero-clearance installation

3.3 Cable Preparation

There are many cables connecting to the drive, including the power supply cable, power cable, encoder cable, control cable and communication cable. For detailed cable specifications, see the hardware guide.

If you have special requirements on the cables, contact Inovance.

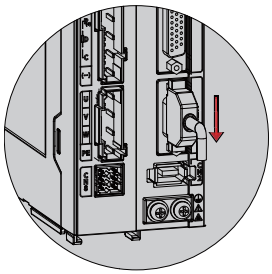
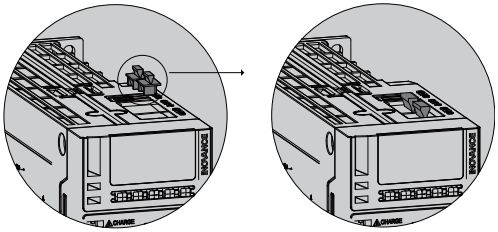
4 Installation and Wiring

4.1 Mechanical Installation

4.1.1 Safety Cautions

Table 4–1 Installation precautions

Item	Description
Method	• Install the servo drive vertically and upward to facilitate heat dissipation. For installation of multiple servo drives inside the cabinet, install them side by side. For dual-row installation, install an air guide plate. • Make sure that the servo drive is installed vertically to the wall. Cool the servo drive down with natural convection or a cooling fan. Secure the servo drive to the mounting surface through two to four mounting holes (the number of mounting holes depends on the capacity of the servo drive). • Install the servo drive vertically to the wall, with its front (actual mounting surface) facing the operator. • The mounting bracket (if needed) must be made of incombustible materials.
Cooling	As shown in *"3.2 Installation Clearance" on page 20*, reserve sufficient space around the servo drive to ensure good heat dissipation through the cooling fan or natural convection. Take the heat dissipated by other devices inside the cabinet into consideration. Install a cooling fan to the upper part of the servo drive to avoid local excessive temperature rise and keep an even temperature inside the control cabinet.
Grounding	Ground the grounding terminal properly. Failure to comply may result in electric shock or malfunction due to interference.

Item	Description
Cable routing requirements	As shown in the figure below, route the servo drive cables downwards to prevent liquid from flowing into the servo drive along the cables.  Route the cable in the direction of the arrow
Dust-proof cover (included in the standard configuration)	Insert the dust-proof cover into the communication port (CN3/CN4) not in use. This is to prevent unwanted objects, such as solids or liquids, from falling into the servo drive and resulting in faults. Each servo drive is delivered with two dust-proof covers inserted into the communication ports by default. You can place an order for more dust-proof covers as needed (model: NEX-02-N2B; manufacturer: PINGOOD).  **NOTE:** • Dust-proof cover: Prevents unwanted objects, such as solids or liquids, from falling into the servo drive and resulting in faults. • Dust-proof covers are delivered along with the servo drive. Keep the dust-proof covers in a proper place.

4.1.2 Pre-Inspection

Table 4–2 Inspection Checklist

No.	Item	Yes
1	The delivered product is consistent with your order.	☐
2	No deformation or cracks are present on the casing.	☐
3	All screws are in position and tightened.	☐
4	The signal terminal is free from fracture, foreign objects and bent pins.	☐

4.1.3 Mounting the Drive

The servo drive supports backplate mounting only.

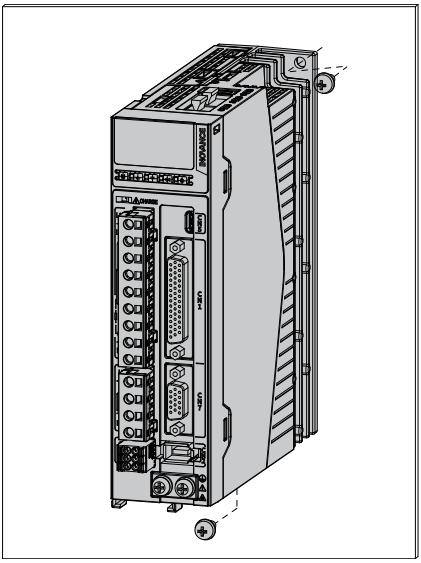


Figure 4-1 Backplate mounting

Note

- Servo drives in sizes A and C are secured by two screws, with one screw on the top and the other one at the bottom.
- Servo drives in size D are secured by three screws, with two screws on the top and another one at the bottom.
- Servo drives in size E are secured by four screws, with two screws on the top and the other two at the bottom.

4.1.4 Post-Inspection

Table 4–3 Inspection Checklist

No.	Description	Checked
1	Terminal screws are tightened to the specified torque and marked.	☐
2	The servo drive and the external regenerative resistor are placed on incombustible objects.	☐
3	There are no unwanted objects (such as cable terminals and metal chippings) that may cause short circuit of the signal cable and power cable inside or outside the servo drive.	☐
4	The servo motor is installed properly. The motor shaft is connected to the machine securely.	☐
5	The servo motor and the connected machine are in good condition and ready to run.	☐
6	The connector of the main circuit cable is crimped and installed firmly.	☐

4.2 Electrical Installation

4.2.1 Safety Precautions

- Observe the following requirements during wiring of the power supply and main circuit:
  - When the main circuit terminal is a connector, remove the connector from the servo drive before wiring.
  - Insert one cable into one cable terminal of the connector. Do not insert multiple cables into one cable terminal.
  - When inserting cables, take enough care to prevent the cable conductor burrs from being short circuited to the neighboring cable.
  - Insulate the connecting part of the power supply terminals to prevent electric shock.
  - Do not connect a 200V servo drive to a 400V power supply directly.
  - Install safety devices such as a circuit breaker to prevent short circuit in external circuits. Failure to comply may result in a fire.
  - Cut off the main circuit power supply and switch off the S-ON signal after an alarm signal is detected.
- Do not put heavy objects onto cables or pull cables with excessive force. Failure to comply may result in cable damage, leading to an electric shock.

- Use a power supply filter to reduce the electromagnetic interference on electronic devices surrounding the servo drive.

4.2.2 Wiring with the Motor

- See the wiring diagram below.

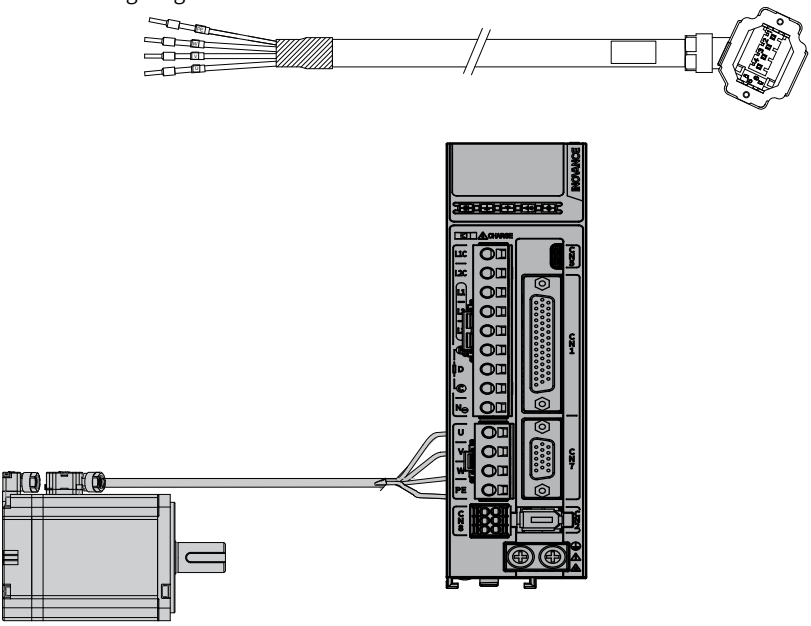


Figure 4-2 Wiring between the servo drive and terminal-type motor

- See the wiring diagram below.

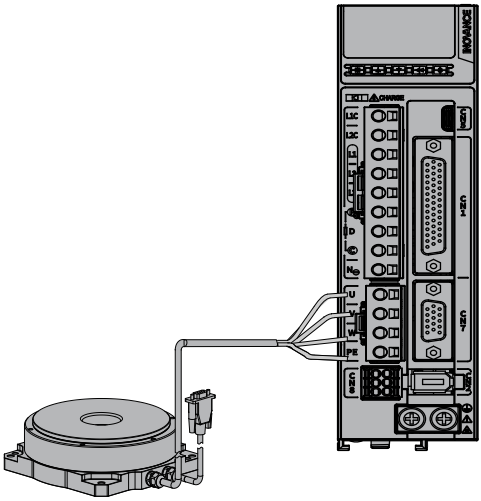


Figure 4-3 Wiring between the servo drive and DDR motor

- See the wiring diagram below.

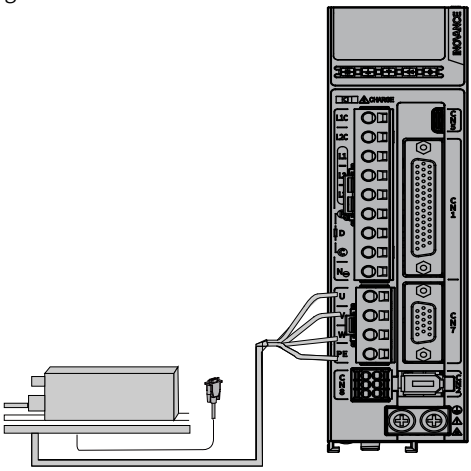


Figure 4-4 Wiring between the servo drive and DDL motor

Caution

To avoid flying start, ensure that the phase sequence is correct.

4.2.3 Wiring of the Power Supply

Single-phase 200V Models

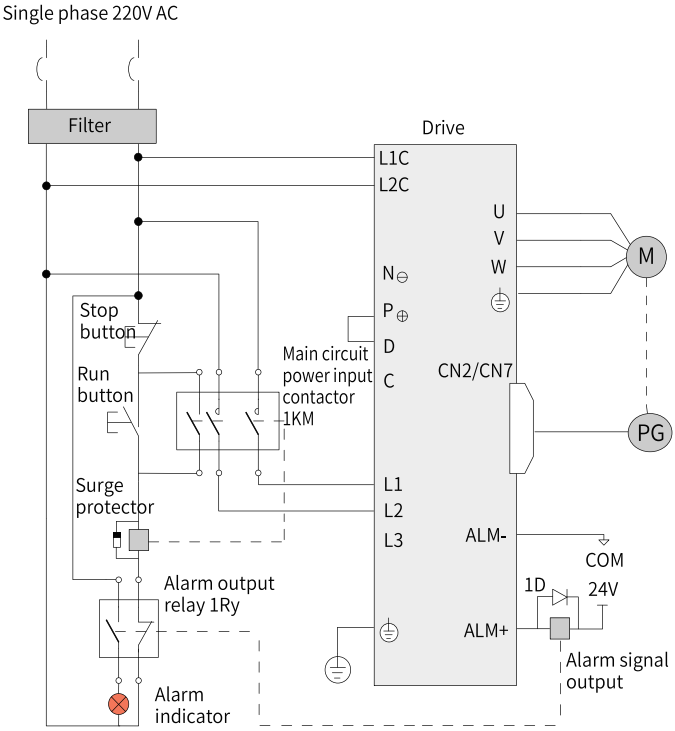


Figure 4-5 Main circuit wiring

Note

- 1KM: Electromagnetic contactor; 1Ry: Relay; 1D: Flywheel diode
- DO is set as alarm output (ALM+/-). When the servo drive alarms, the power supply will be cut off automatically. S1R6 and S2R8 are not configured with built-in regenerative resistors, if the regenerative resistor is needed, connect an external regenerative resistor between P⊕ and C.
- CN2 is used as the encoder terminal when an Inovance rotary servo motor is connected. CN7 is used when a direct drive or purchased motor is connected.

Three-phase 200V Models

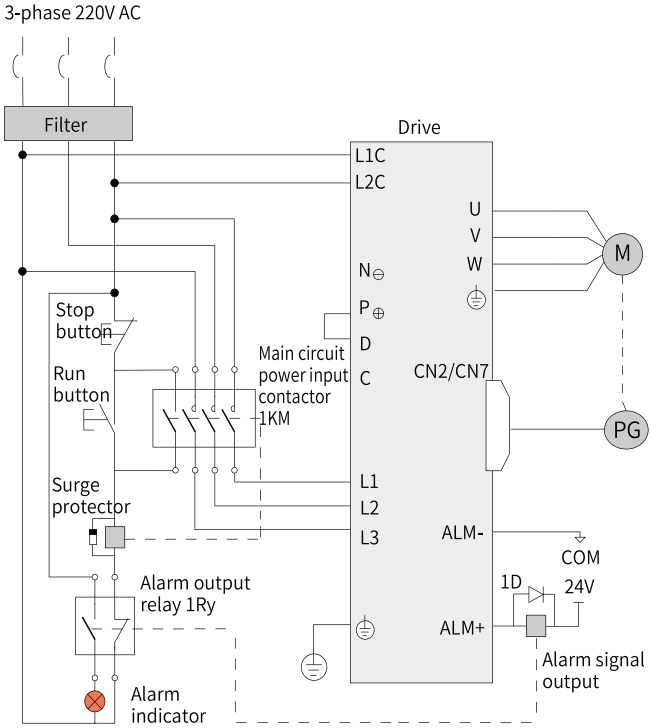


Figure 4-6 Main circuit wiring

Note

- 1KM: Electromagnetic contactor; 1Ry: Relay; 1D: Flywheel diode
- The DO is set as alarm output (ALM+/-). When the servo drive alarms, the power supply is cut off automatically and the alarm indicator lights up.
- CN2 is used as the encoder terminal when an Inovance rotary servo motor is connected. CN7 is used when a direct drive or purchased motor is connected.

Three-phase 400V Models

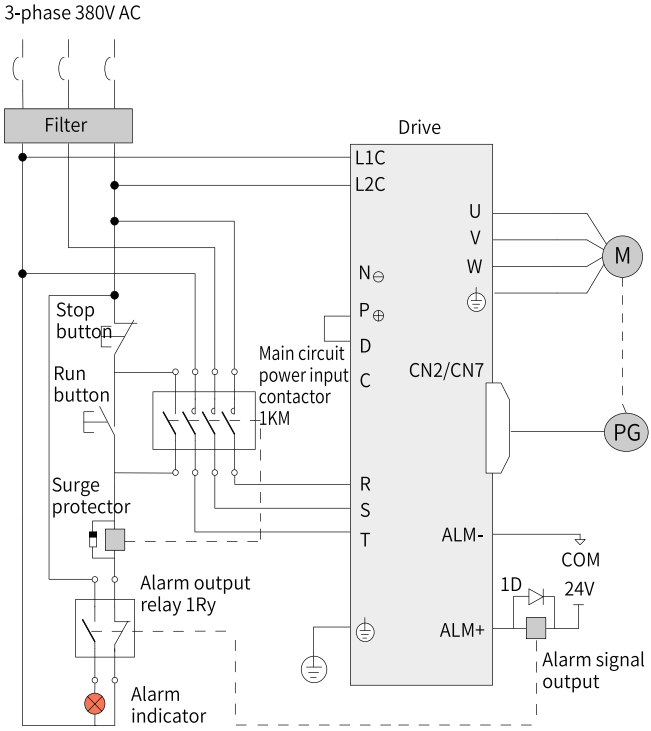


Figure 4-7 Main circuit wiring

Note

- 1KM: Electromagnetic contactor; 1Ry: Relay; 1D: Flywheel diode
- The DO is set as alarm output (ALM+/-). When the servo drive alarms, the power supply is cut off automatically and the alarm indicator lights up.
- CN2 is used as the encoder terminal when an Inovance rotary servo motor is connected. CN7 is used when a direct drive or purchased motor is connected.

4.2.4 Post-Inspection

Table 4–4 Inspection Checklist

No.	Description	Checked
1	The power input terminals (L1C, L2C, L1, L2, L3, R, S, T) of the servo drive are connected properly.	☐
2	P⊕, D, C and N⊖ are connected correctly.	☐
3	The main circuit cables (U, V, W) of the motor are connected to the U/V/W terminals of the drive correctly.	☐
4	No short circuit exists in the power input terminals (L1, L2, L3, R, S, T) or main circuit output terminals (U, V, W) of the servo drive.	☐
5	The stress suffered by the cable is within the specified range.	☐
6	The servo drive and servo motor are grounded properly.	☐
7	All the wiring terminals are insulated properly.	☐

5 Commissioning Tool

5.1 Operating Panel

5.1.1 Components

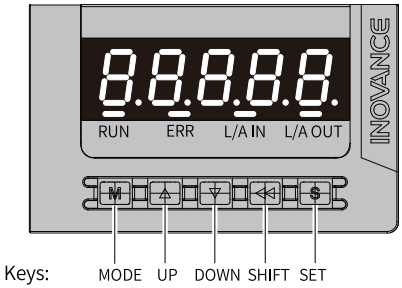


Figure 5-1 Appearance of the keypad

The keypad of the SV680-INT series servo drive consists of a 5-digit, 8-segment LED screen, 5 keys and 4 status indicators. The keypad is used for value display, parameter setting, user password setting and general function execution.

Keys

The following table takes parameter setting as an example to describe the general functions of the keys.

Table 5–1 Descriptions of keys

Name	Appearance	Description
MODE		Switches among different modes. Returns to the previous menu.
UP		Increases the value of the blinking digit for the LED.
DOWN		Decreases the value of the blinking digit for the LED.

Name	Appearance	Description
SHIFT		Shifts the blinking digit for the LED. You can view the high digits of the number consisting of more than 5 digits.
SET		Switches to the lower-level menu. Executes commands such as saving parameter setpoints.

Indicators

Note

The description of Indicators is only available for model N.

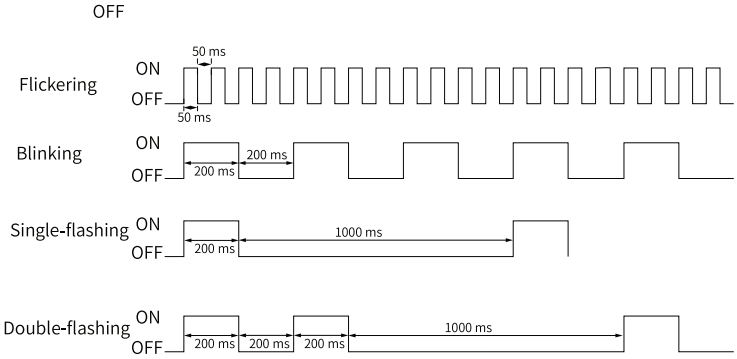


Figure 5-2 Description of indicator status

Table 5–2 Description of indicator status

Indicator	Status	Status indication
RUN	OFF	INIT state
	Flashing (ON for 200 ms/OFF for 200 ms)	Pre-operational
	Single flashing (ON for 200 ms/OFF for 1000 ms)	Safe-operational
	ON	Operational state
ERR	OFF	No network error
	Flashing (ON for 200 ms/OFF for 200 ms)	Communication setting error
	Single flashing (ON for 200 ms/OFF for 1000 ms)	Sync event error
	Double flashing (ON for 200 ms, OFF for 200 ms, ON for 200 ms, and OFF for 1000 ms)	Watchdog timeout
L/A IN indicator[1] L/A OUT indicator	OFF	Link is not established.
	Flickering (ON for 50 ms/OFF for 50 ms)	Link is established. A data transceiving signal is present.
	ON	Link is established. No data transceiving signal is present.

Note

- [1]: L/A IN and L/A OUT indicate the LINK state and action state of the physical layer of each port.
- The ERR indicator lights up red and the other three indicators light up green.

5.1.2 Keypad Display

The keypad can display the running status, parameter, faults, and monitored information during running of the servo drive.

- Status display: Displays the current servo drive status, such as servo ready or servo running.
- Parameter display: Displays parameters and their setpoints
- Fault display: Displays faults and alarms occurred on the servo drive.
- Monitored information display: Displays values of monitoring parameters

Mapping relation between the keypad display and the operation object of the host controller

The mapping relation between the parameter displayed on the keypad (in decimal) and the object dictionary operated by the host controller (in hexadecimal, "Index" and "Sub-index") is as follows.

Object dictionary index = 0x2000 + Parameter group number

Object dictionary sub-index = Hexadecimal value of offset in parameter group + 1. For example:

Keypad Display	Object Dictionary Operated by the Host Controller
H02.15	2002.10h

Note

The following section only describes the display and parameter settings on the keypad side (in decimal), which are different from those displayed in the software tool (in hexadecimal). Make necessary value conversions during use.

Display mode switchover

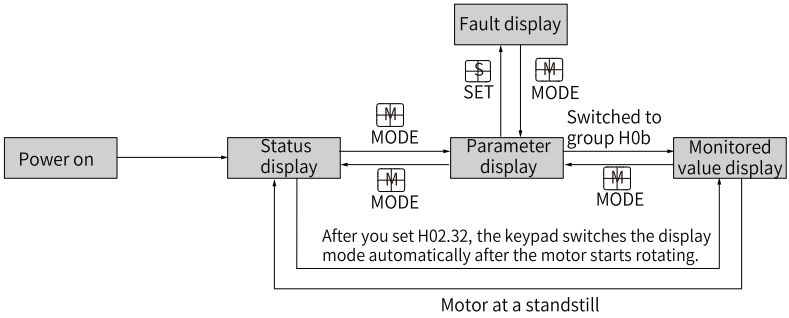


Figure 5-3 Switchover among different display modes

- The keypad enters the status display mode immediately upon power-on.
- Press **MODE** to switch among different display modes based on the conditions shown in *"Figure 5–3 " on page 36* .
- In the status display mode, set H02.32 to select the parameter to be monitored. When the motor rotates, the keypad automatically switches to monitored information display. After the motor stops, the keypad automatically returns to status display.
- In the parameter display mode, after you select the parameter to be monitored in group H0b, the keypad switches to monitored information display.

- Once a fault occurs, the keypad switches to fault display immediately, with all the five LEDs blinking. Press **SET** to stop the LEDs from blinking, and then press **MODE** to switch to parameter display.

Status display of SV680P-INT

Display	Name	Applicable Scenario	Description
	Reset Servo drive initializing	Upon power-on	The servo drive is in the initialization or reset status. After initialization or reset is done, the servo drive automatically switches to other status.
	Nrd.x Servo not ready	The servo drive is initialized, but is not ready.	Meaning of "x" For specific reasons and troubleshooting methods, see *"Table 5–3 Cause and troubleshooting of display "x"" on page 38*. • 1: Control power (L1C, L2C) undervoltage • 2: Main circuit power input error • 3: Bus power supply undervoltage • 4: Pre-charge resistor not bypassed • 5: Encoder initialization not done • 6: Short circuit to ground detection not done
	Rdy Ready	Servo drive ready	The servo drive is ready to run and waits for the enabling signal from the host controller.
	Run Servo running	Servo ON (S-ON) signal activated (S-ON signal switched on)	The servo drive is running.
	JOG Jog	The servo drive is jogging.	See *"6.7 Jog" on page 93* for details.

Table 5–3 Cause and troubleshooting of display "x"

X	Cause	Troubleshooting
1	The control voltage H0b.57 is lower than the undervoltage threshold H01.78 (220 VAC input threshold: 190 VDC; 400 VAC input threshold: 380 VDC).	1. Measure if the L1C and L2C inputs meet the input specifications. 2. If yes, read H0b.57. If H0b. 57 is close to 0, the hardware circuit may be damaged.
2	L1 to L3 inputs are abnormal.	1. Use a multimeter to check whether there is voltage input in L1–L3. 2. Use an oscilloscope to test L1–L3 inputs for phase loss.
3	The bus voltage H0b.26 is lower than the undervoltage threshold H01.42 (220 VAC input threshold: about 200 VDC; 400 VAC input threshold: about 380 VDC).	1. Check if L1-L3 inputs meet the input specifications. 2. If yes, and H0b.26 is close to 0, the hardware circuit may be damaged.
4	The pre-charge resistor is not bypassed.	Check whether the bus voltage (H0b.26) is within the normal range (220 VAC input: 235 VDC to 378 VDC; 400 VAC input: 478 VDC to 751 VDC).
5	The encoder initialization is not done.	Contact the manufacturer technical support engineers.
6	Short circuit to ground detection is not done.	Check whether the value of H0b.57 is normal.

Status display of SV680N-INT

Display	Name	Applicable Scenario	Description
	81nr.x Servo not ready	The initialization is done, but the servo drive is not ready.	Meaning of "x" For specific reasons and troubleshooting methods, see *"Table 5–3 Cause and troubleshooting of display "x"" on page 38*. • 1: Control power (L1C, L2C) undervoltage • 2: Main circuit power input error • 3: Bus power supply undervoltage • 4: Pre-charge resistor not bypassed • 5: Encoder initialization not done • 6: Short circuit to ground detection not done • 7: Other causes
	-88rn Servo running (Run)	The S-ON signal is active.	The servo drive is running.
	-88ry Servo ready (Ready)	The servo drive is ready to run.	The servo drive is ready to run and waits for the enabling signal from the host controller.
	1-A: Control modes	-	It displays the present operation mode of the servo drive in hexadecimal digits. 1: Profile position control 3: Profile velocity mode 4: Profile torque mode 6: Homing mode 8: Cyclic synchronous position mode 9: Cyclic synchronous velocity mode A: Cyclic synchronous torque mode

Display	Name	Applicable Scenario	Description
	1-8: Communication status	-	It displays the status of the slave EtherCAT state machine in characters. 1: Initialization 2: Pre-operational 4: Safe-operational 8: Running
	- CN3 connection indication	CN3 (EtherCAT output) is connected successfully	OFF: No communication connection is detected in the physical layer. Solid ON: Communication connection is detected in the physical layer.
	- CN4 connection indication	CN4 (EtherCAT input) is connected successfully	

Parameter display

Parameters of the SV680-INT are divided into 14 groups based on their functions. A parameter can be located quickly based on its parameter group. For details, see *SV680-INT Series Servo Drive Parameter Guide*.

- Display of parameter groups

Display	Name	Description
HXX.YY	Parameter group	XX: Parameter group number (decimal) YY: Offset within the parameter group (hexadecimal)

For example, H02.00 is displayed as follows:

Display	Name	Description
	H02.00	02: Parameter group No. 00: Offset within the parameter group

- Display of negative numbers and numbers with different lengths
  - Signed number with 4 digits and below or unsigned number with 5 digits and below

    Such numbers are displayed on one interface (five digits). For signed numbers, the highest bit "-" represents the negative symbol.

    For example, -9999 is displayed as follows:

For example, "65535" is displayed as follows:

- Signed number with more than 4 digits or unsigned number with more than 5 digits
  Such numbers are displayed from low-order bits to high-order bits on several interfaces (5 digits per interface) in the format of current interface + values on current interface. Hold down **SHIFT** for more than 2s to switch to the next interface.

  For example, -1073741824 is displayed as follows:

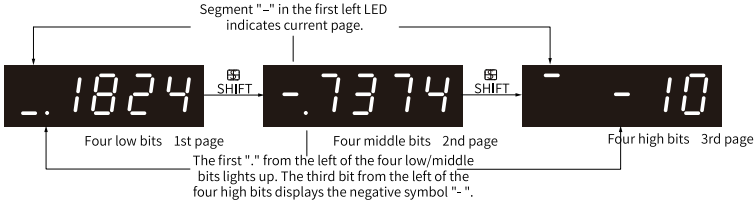


Figure 5-4 Display of –1073741824

For example, "1073741824" is displayed as follows:

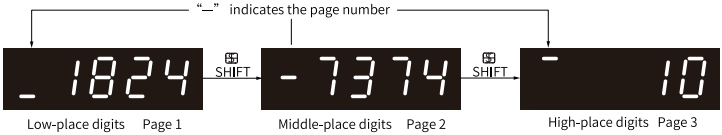


Figure 5-5 Display of 1073741824

- Display of the decimal point
  The dot "." indicates the decimal point, which does not blink.

Display	Name	Description
	Decimal point	100.0

- Display of parameter setting status

Display	Name	Applicable Scenario	Description
	Done Parameter setting completed	The parameter has been set.	The parameter has been set and saved to the servo drive (Done). The servo drive can proceed with other operations.
	F.InIt Restore to default settings	Parameter initialization is in progress (H02.31 = 1).	The servo drive is restoring parameters to default settings (Function Code Initialize). After parameter initialization is done, switch on the control power supply again.
	Error Wrong password	The user password (H02.30) is activated but the password entered is wrong.	An incorrect password is entered. You need to enter the password again.
	TunE	The auto-tuning with one key function is enabled.	The function of auto-tuning with one key is in progress.
	FAIL	The auto-tuning with one key function is enabled.	The function of auto-tuning with one key fails.
	AdJ_	Phase sequence auto-tuning and resistor inductance auto-tuning are used.	The drive is in the auto-tuning process.

Fault display

- The keypad can display present or previous fault and alarm codes. For analysis and solutions to the faults and alarms, see the troubleshooting section in *SV680-INT Series Servo Drive Function Guide*.
- When a fault or alarm occurs, the keypad displays the corresponding fault or error code immediately. When multiple faults or errors occur, the keypad displays the fault or error code of the highest fault level.
- Set in H0b.33 the number of history faults that can be viewed. View H0b.34 to check the selected fault or alarm codes.
- You can clear the latest 10 faults or alarms saved in the servo drive by setting H02.31 to 2.

For example, "E941.0" is displayed as follows:

Display	Name	Description
	E941.0 Present alarm code	E: The servo drive encounters a fault or an alarm. 941.0: Alarm code

Monitored information display

- Group H0b: The parameters in this group are used to monitor the running status of the servo drive.
- Set H02.32 (default keypad display) properly. After the motor operates normally, the keypad switches from status display to parameter display. The parameter group number is H0b and the offset within the group is the setpoint of H02.32.
- For example, if H02.32 is set to 00 and the motor speed is not 0 RPM, the keypad displays the value of H0b.00.

The following table describes the H0b.00.

Parameter Code	Parameter Name	Unit	Description	Example
H0b.00	Actual motor speed	(mm/s)/ RPM	Indicates the actual motor speed after round-off, which is accurate to 1 (mm/s)/ RPM.	Display of 3000 (mm/s)/RPM:  Display of -3000 (mm/s)/RPM: 

Note

For details of parameter group H0b, see *"7.1 Display of Monitoring Parameters" on page 146*.

5.1.3 Parameter Settings

Example of parameter setting

You can set parameters through the keypad. For details on parameters, see *SV680-INT Series Servo Drive Parameter Guide*. The following figure shows how to switch from position control mode to speed control mode by using the keypad after power-on.

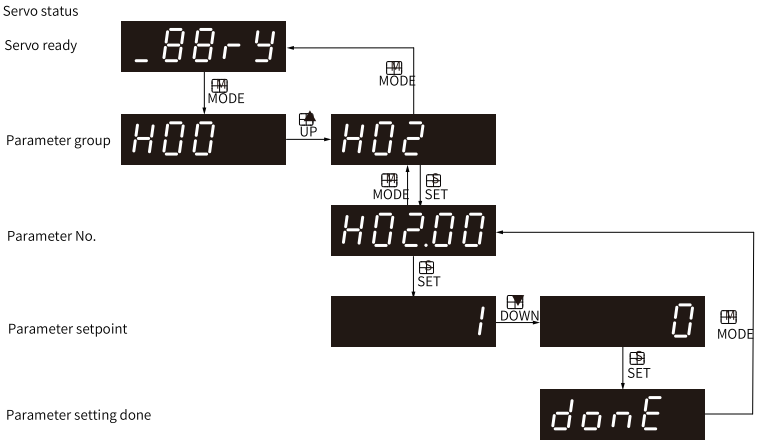


Figure 5-6 Example of parameter settings

- MODE: Used to switch the keypad display mode and return to the previous interface.
- UP/DOWN: Used to increase or decrease the value of the blinking bit.
- SHIFT: Used to shift the blinking bit.
- SET: Used to save the present setpoint or switch to the next interface.

After parameter setting is done, that is, "donE" is displayed on the keypad, press **MODE** to return to the parameter group interface (interface of "H02.00").

Forced DI/DO signals

Digital signals include digital input signals (DI signal) and digital output signals (DO signal). You can configure the DI and DO functions and terminal logic to parameters in group H03 and H04 via keypad or host controller communication. Then, the host controller can control functions of the servo drive via DI signals and the servo drive can output DO signals to the host controller.

The servo drive also provides forced DI/DO functions. The forced DIs can be used to test the DI functions of the servo drive, and the forced DOs can be used to check the DO signal connection between the host controller and the servo drive.

Forced DI signal input

After this function is enabled, all DI signal levels are controlled by the forced DI setting (H0d.18), independent of external DI signal status.

1. Procedure:

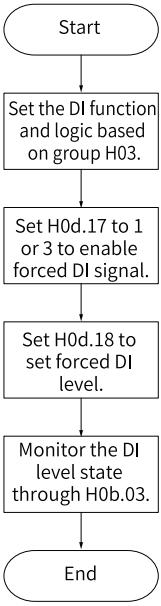


Figure 5-7 Procedure for setting forced DI function

H0d.18 is used to set the forced DI level. The keypad displays the value in hexadecimal. After the hexadecimal value is converted to a binary value, the value "1" indicates high level and "0" indicates low level.

Note

- The DI logic is defined by parameters in group H03.
- H0b.03 is used to monitor the DI level status. The keypad displays the level, and the value of H0b.03 (Monitored DI signal) read in the software tool is a hexadecimal.

Related parameters

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H0d.17	200d-12h	Forced DI/DO function switch	Bit 0: Forced DI function switch 0: Disabled 1: Enabled Bit 1: Forced DO function switch 0: Disabled 1: Enabled	0	-	Real time

2. **SV680P-INT as an example**:

To activate the DI function allocated to DI1 and deactivate DI functions allocated to DI2 to DI5, set as follows: All the DIs are active low. "1" indicates high level and "0" indicates low level.

To activate the DI function allocated to DI1, DI6, and DI7 and deactivate the DI function allocated to DI2 to DI5 and DI8, set as follows: All the DIs are active low. "1" indicates high level and "0" indicates low level.

The corresponding binary value and hexadecimal value are "10011110" and "9E" respectively. Therefore, set H0d.18 to "9E" through the keypad.

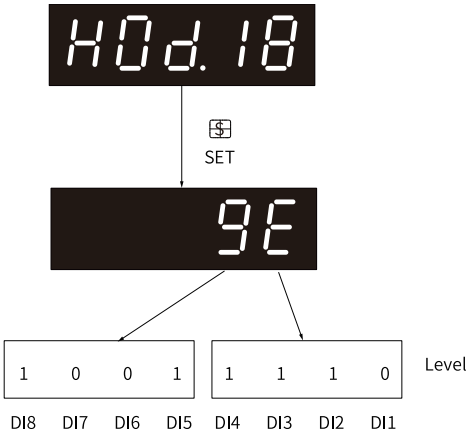


Figure 5-8 Setpoints of H0d.18

Note

- If the DI function is normal, the displayed value of H0b.03 is always the same as that of H0d.18.
- In this case, DI1, DI6, and DI7 are displayed as low level, and DI2...DI5 and DI8 are displayed as high level. The value of H0b.03 read in the software tool is 158 (decimal).

Monitor the DI level states via H0b.03. Display on the keypad:

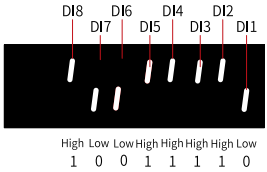


Figure 5-9 DI level states corresponding to bits of H0b.03

Note

Upper LED segments ON: high level (indicated by "1") Lower LED segments ON: low level (indicated by "0")

3. Exiting the forced DI function

   The forced DI function is not retentive upon power-off. After power-on again or after you set H0d.17 to 0, normal DI functions are restored.

Forced DO function

After this function is enabled, all DO signal levels are controlled by the forced DO setting (H0d.19), independent of internal DO signal status.

1. Procedure

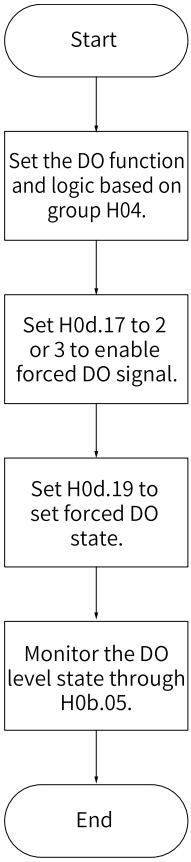


Figure 5-10 Procedure for setting forced DO function

H0d.19 is used to set whether the forced DO function is active. The keypad displays the value in hexadecimal. After the hexadecimal value is converted to a binary value, the value 1 indicates that the forced DO function is active and 0 indicates that the forced DO function is inactive.

Parameters in group H04 are used to set the DO logic. H0b.05 is used to monitor the DO level status. The keypad displays the level, and the value of H0b.05 read in the software tool is decimal.

2. SV680P-INT as an example:
   To deactivate the DO function allocated to DO1 and activate the DO function allocated to DO2 and DO5, set as follows:

   As the value "1" indicates the DO function is active and "0" indicates the DO function is inactive, the binary value is "11110", which corresponds to the hexadecimal value "1E". Therefore, set H0d.19 to 1E through the keypad.

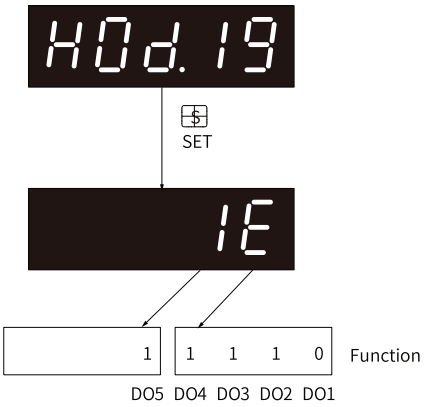


Figure 5-11 Setpoints of H0d.19

Monitor the DO level status through H0b.05.

If the logic of all the five DOs is "active low", the DO1 is high level and DO2 to DO5 are low level. The corresponding binary number is "00001". In this case, the value of H0b.05 read by the software tool is 1 (decimal). Display on the keypad:

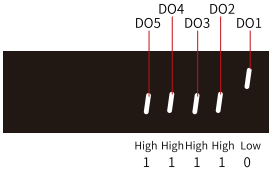


Figure 5-12 Display of H0b.05 when all DOs are active low

If the logic of all the five DOs are "active high", the DO1 is low level and DO2 to DO5 are high level. The corresponding binary number is "11110". In this case, the value of H0b.05 read by the software tool is 30 (decimal). Display on the keypad:

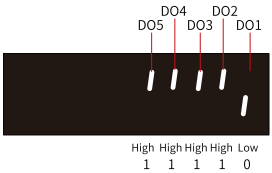


Figure 5-13 Display of H0b.05 when all DOs are active high

3. Exiting the forced DO function
   The forced DO function is not retentive upon power-off. After power-on again or after you set H0d.17 to 0, normal DO functions are restored.

Bus-controlled forced DO function[1]

Note

[1] Bus-controlled forced DO signal output is only available for SV680N-INT series.

Allocate function 31 to the corresponding DO. After this function is enabled, all DO signal levels are controlled by 60FE.01h (Physical output) and are unrelated to the internal DO signal status.

1. Procedure

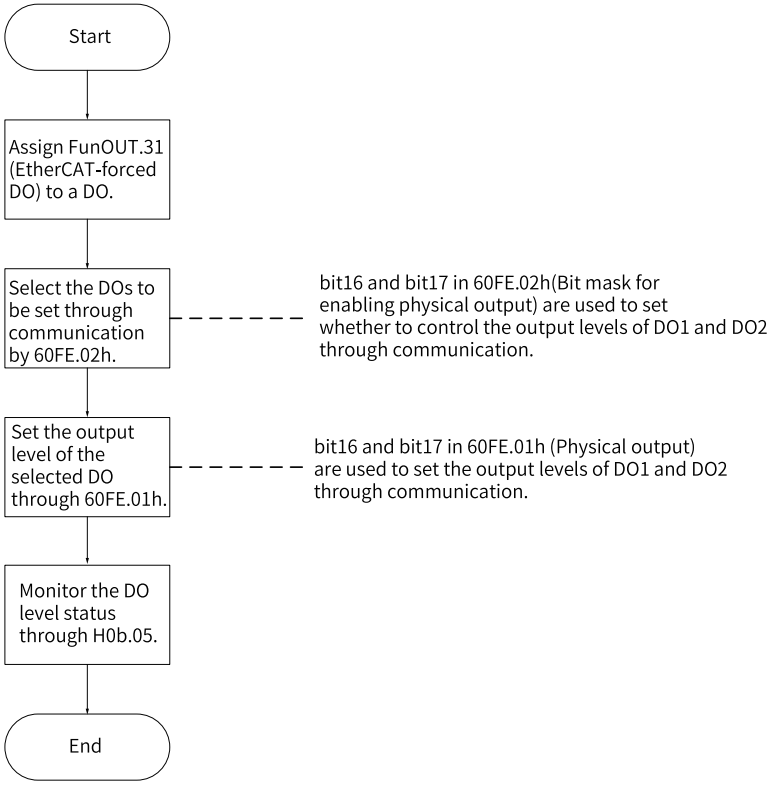


Figure 5-14 Procedure for setting forced DO function in bus control mode

60FEh (Digital output) can be used to forcibly set the DO level through the bus, regardless of the internal DO status of the drive.

Bit	Related DO	60FE.02h	60FE.01h
16	DO1	1: DO1 forced output enabled	DO1 forced output (0: OFF; 1: ON)
17	DO2	1: DO2 forced output enabled	DO2 forced output (0: OFF; 1: ON)

When bit 16 to bit 17 of 60FE.02h and 60FE.01h are set to 1, the forced DO function is ON.

H0b.05 is used to monitor the DO level status. The keypad displays the level, and the value of H0b.05 read by the software tool is hexadecimal.

Example: To make the output levels of DO1 to DO2 be forcibly set by the bus, in which DO1 outputs low level and DO2 outputs high level, set as follows:

Set 60FE.02h to 0x00030000, and 60FE.01h to 0x00020000. Monitor the DO level status through H0b.05. The keypad displays as follows.

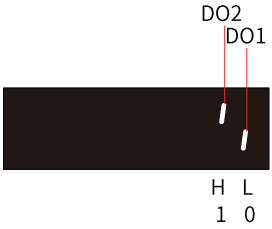


Figure 5-15 Display of H0b.05 when DO signals are controlled by the bus

2. Disconnection logic

Table 5–4 Setting of H04.23 for forced control on the DO disconnected by EtherCAT communication

Bit 0	Bit 1	Description
0	0	The status of DO1 and DO2 is unchanged after they are offline.
1	0	DO1 does not output after it is offline, and the status of DO2 is unchanged after it is offline.
0	1	DO2 does not output after it is offline, and the status of DO1 is unchanged after it is offline.
1	1	DO1 and DO2 do not output after they are offline.

User password

After the user password (H02.30) is activated, only authorized operators can set parameters. Other operators can only view parameters.

- Setting the user password
  The following figure shows how to set the user password to "00001".

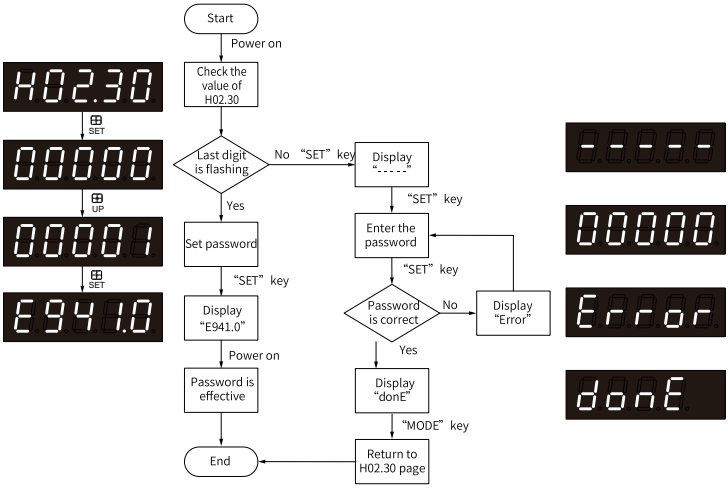


Figure 5-16 Procedure for setting the user password

To change the user password, enter the current password first to authorize the access to parameter settings. Enter H02.30 again, and then set a new password according to the method described in the preceding figure.

Note

If the last bit does not blink, the access to parameters is password protected. If the last bit blinks, password is not needed or the password entered is correct.

- Disabling the user password
  Enter the existing user password, and set H02.30 to "00000". The user password is disabled.

5.2 Commissioning Software

5.2.1 Overview

InoDriverShop is a new commissioning software tool for Inovance servo drives. Except the old 620 series products, it is the commissioning tool for all new and future products.

5.2.2 Installation

1. Software

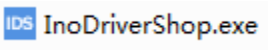
   a. Visit the official website of Inovance as shown below.

http://www.inovance.com

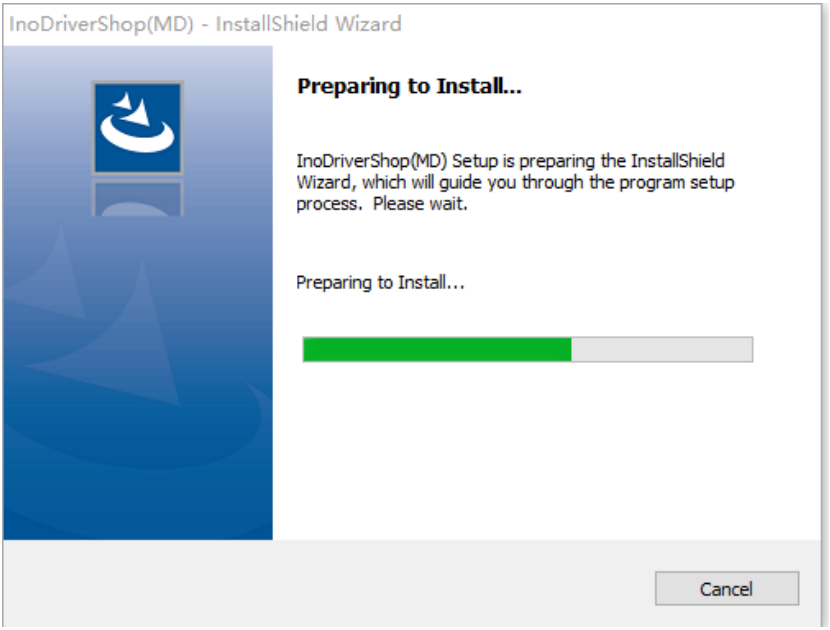
b. Choose Support → Download, and then type in the keyword InoDriverShop and click Search.

c. Click Download.

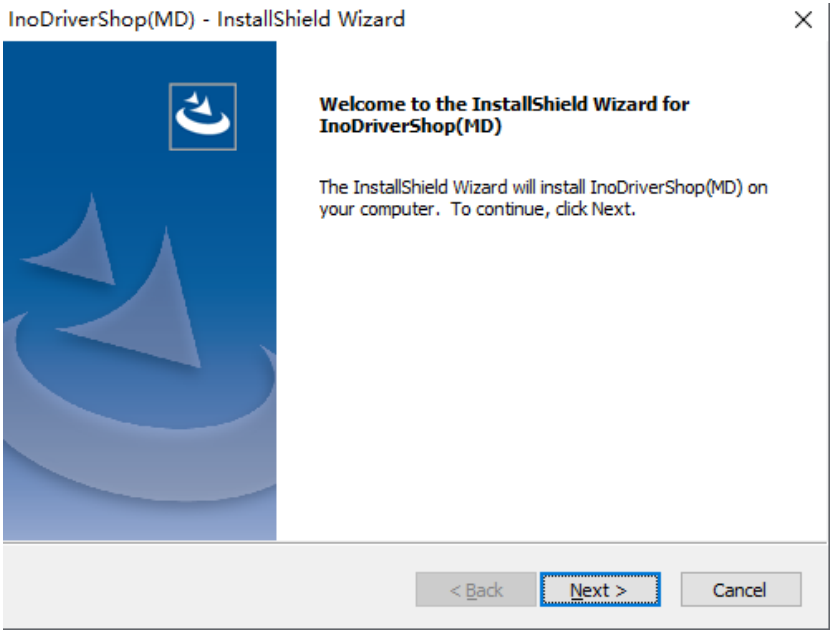
2. Unzip the package downloaded.

3. Click 

to start installing InoDriverShop.

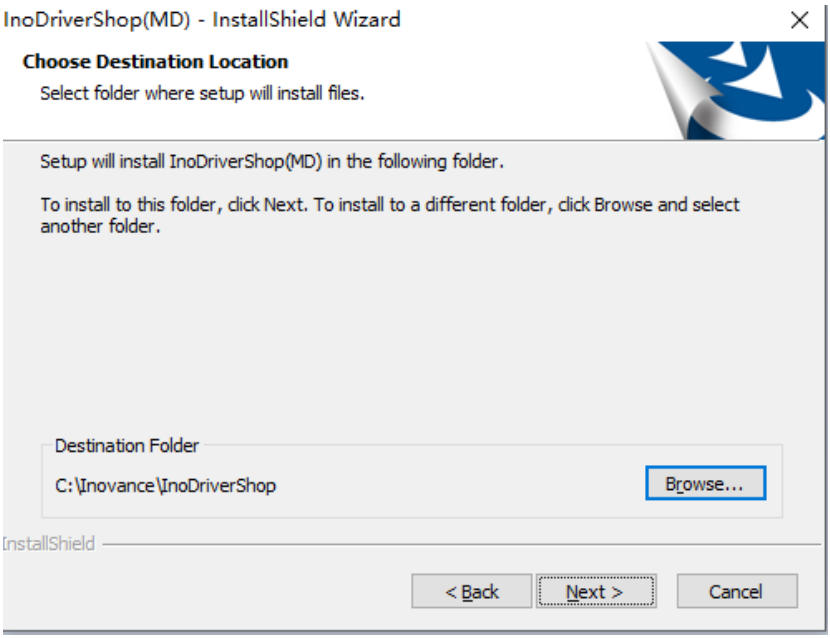


4. Click Next.

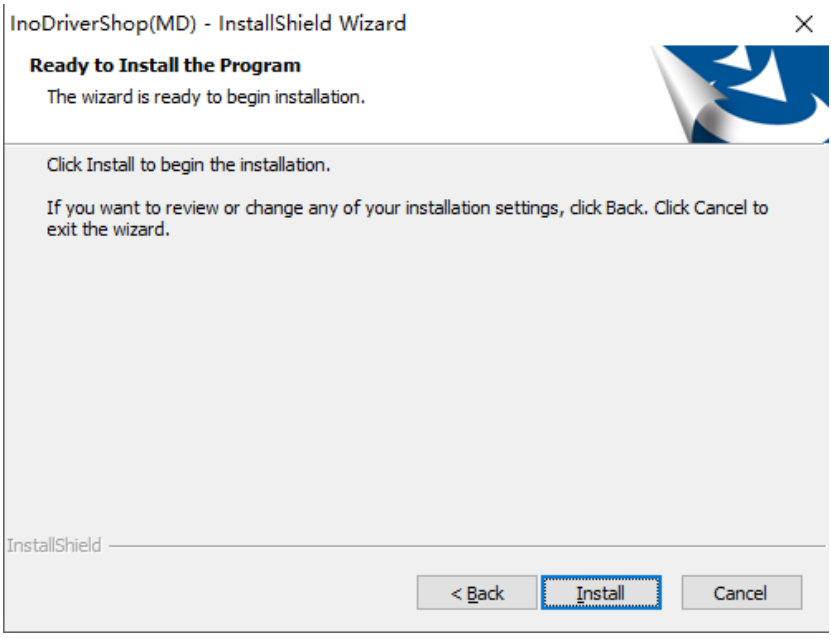


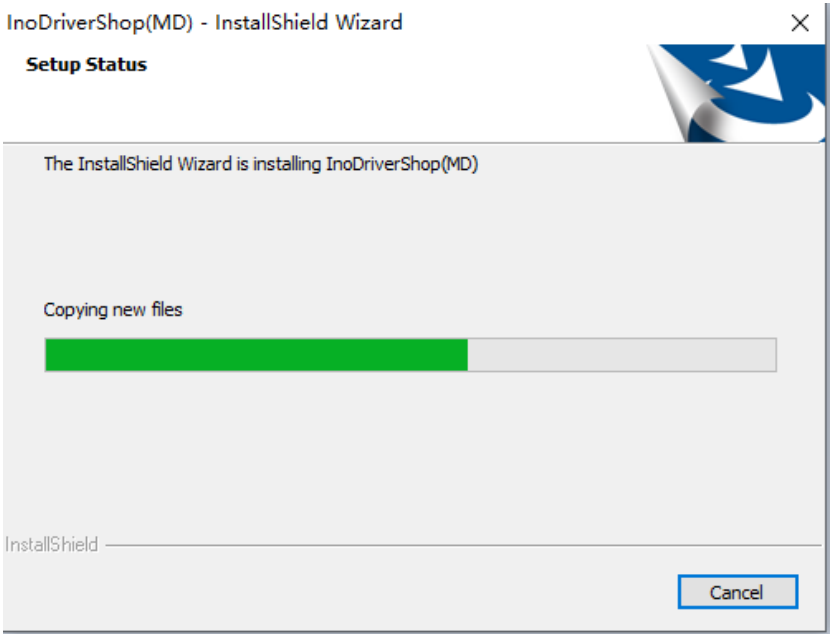
5. You can select the directory for installation as needed through the Browse button. The default directory for installation is "C:\Program Files\Inovance\InoDriverShop". In online upgrade, InoDriverShop will be upgraded directly in the original directory.

   After selecting the directory for installation, click Next.

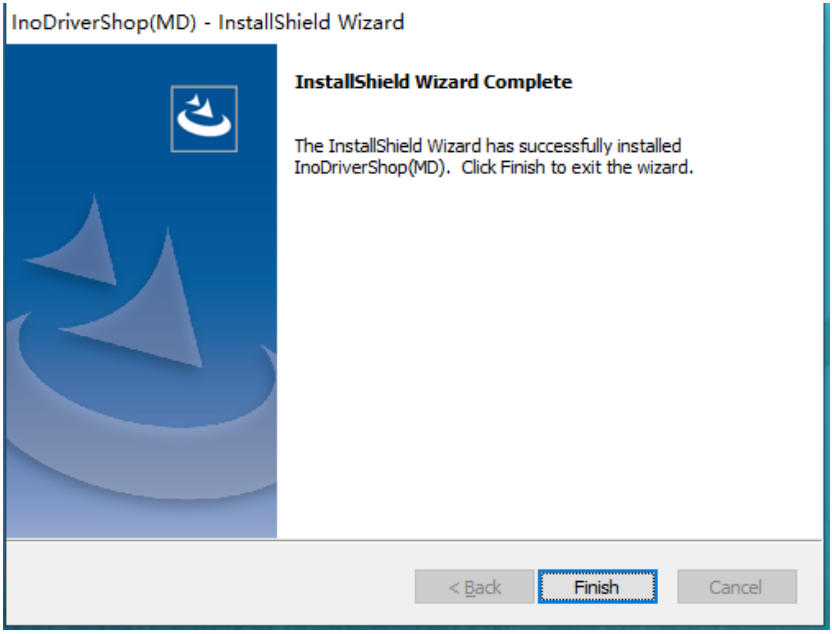


6. Click Install to start installation.





7. After installation is done, click Finish.



8. A shortcut icon for InoDriverShop will be generated automatically on the desktop.

5.2.3 Connection

Take the SV680P-INT as an example:

1. Start InoDriverShop.

   - Double-click  to start the InoDriverShop.
   - If there is no shortcut for InoDriverShop on your desktop, click Start and search for InoDriverShop.

2. Create a project.

   a. Click ① shown in the following figure to create a project.

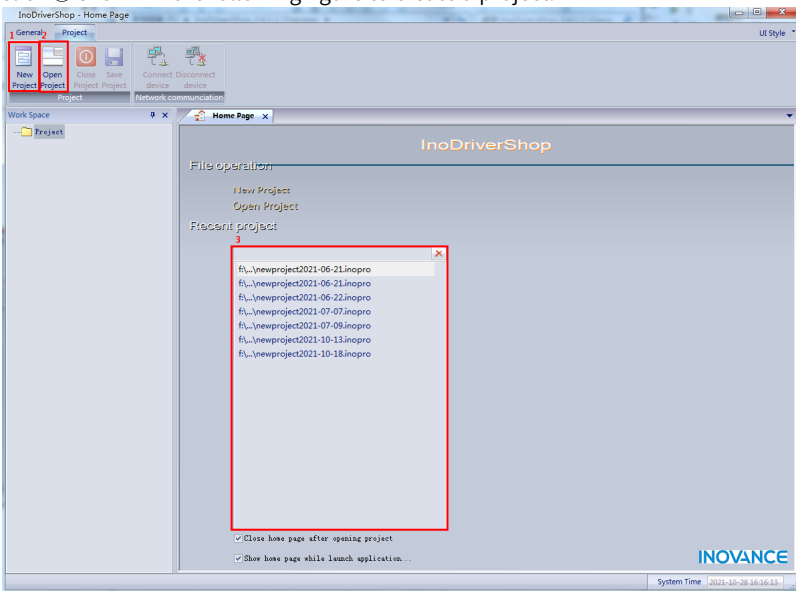


Figure 5-17 Start interface

Note

You can click 2 or 3 shown in the preceding figure to open the project saved before.

   b. Open the Project Guide interface.

Click Online or Offline in area ①. Next, click the product series in area ②. Finally, load default communication parameters in area ③ based on the product series selected.

Figure 5-18 Project Guide interface

c. Click Next page to create a project.

- Creating a project for online device brings you to the following interface. The device is scanned automatically. Select the device to be commissioned and click Finish.

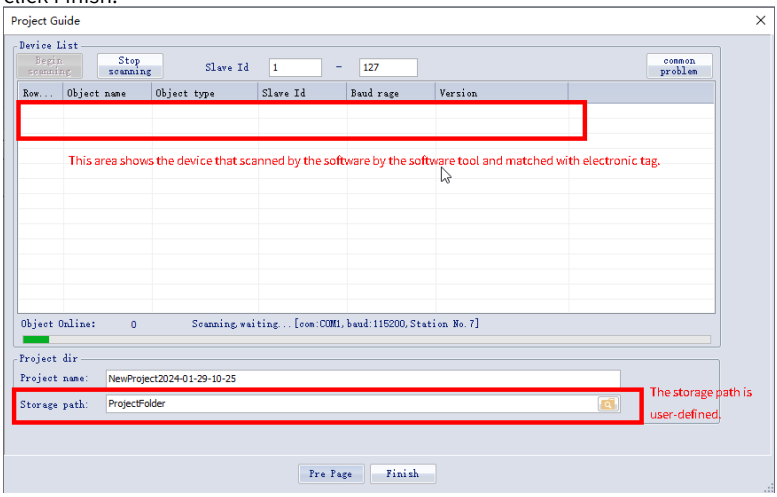


Figure 5-19 Scan interface

- Creating a project for offline device brings you to the following interface. You can select the Slave ID, Object Type, and Software Version as needed and add different standards or customized devices. You can also designate the directory for storage or create multiple offline devices.

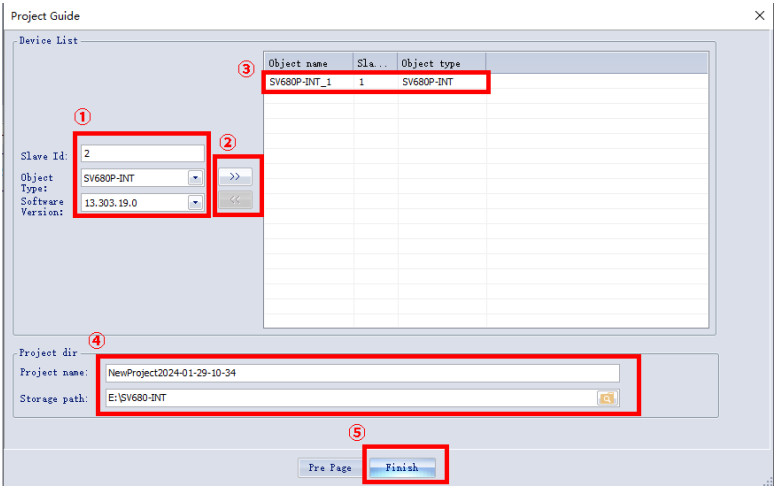


Figure 5-20 Project Guide interface for offline device

Note

① Station No., ④ Project name, and the storage directory can be changed as needed.

d. The project has been created.

3. The main interface is shown as follows.

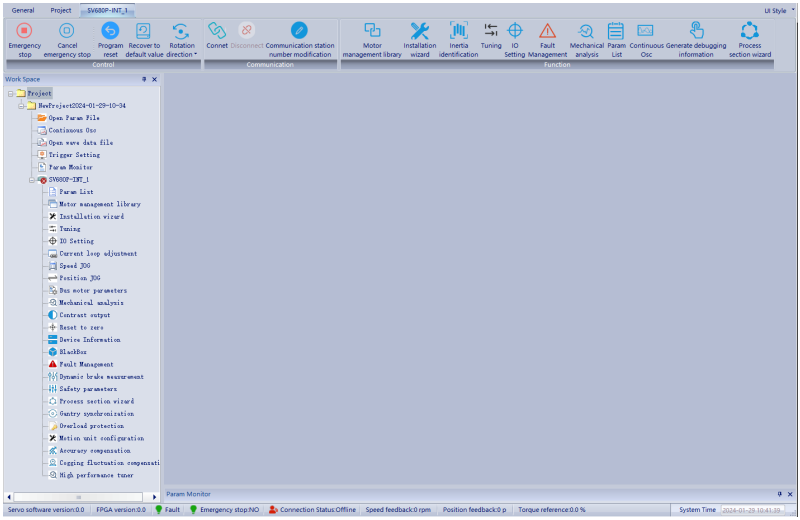


Figure 5-21 Main interface

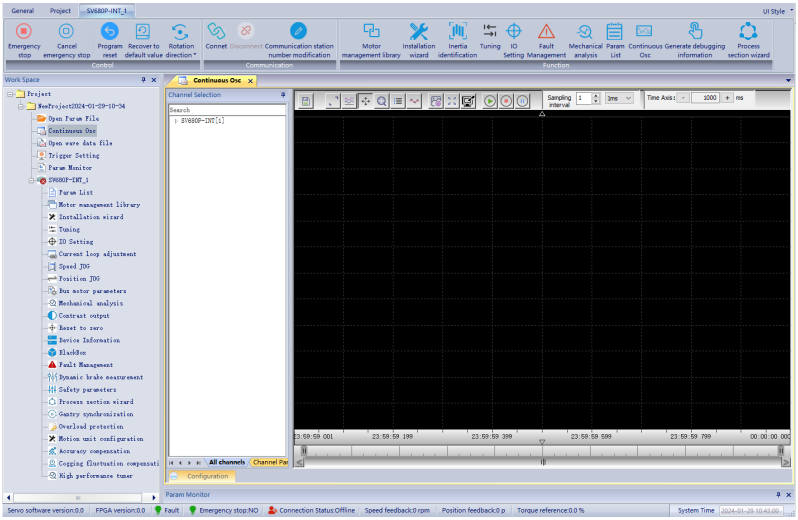
Note

When you create a new online or offline project, the parameter attribute will be automatically updated to match the motor when you make a connection for the first time. If the type of the motor changes later, the parameter attribute will automatically update.

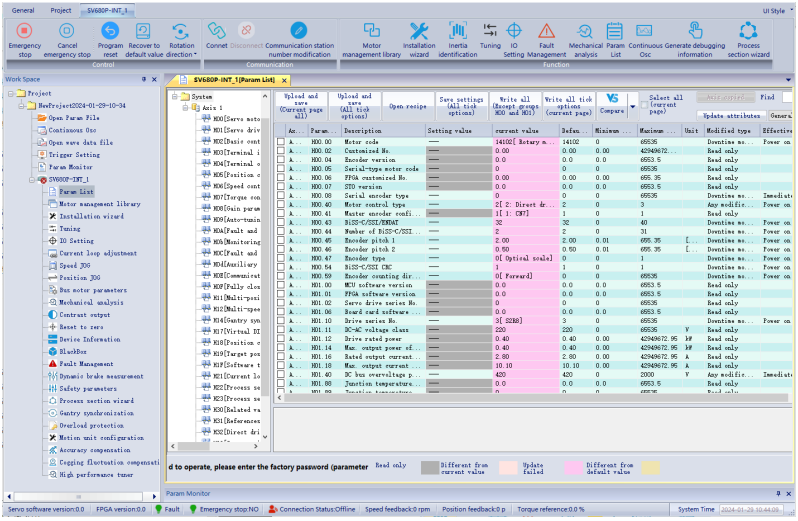
5.2.4 Introduction to the Software Tool

InoDriverShop provides the following functions:

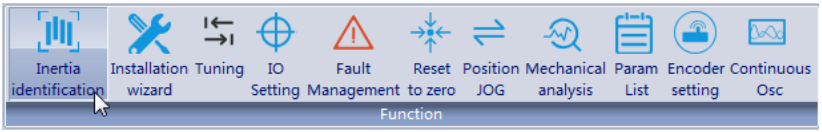
- Oscilloscope: Detects and saves the instantaneous data during operation.

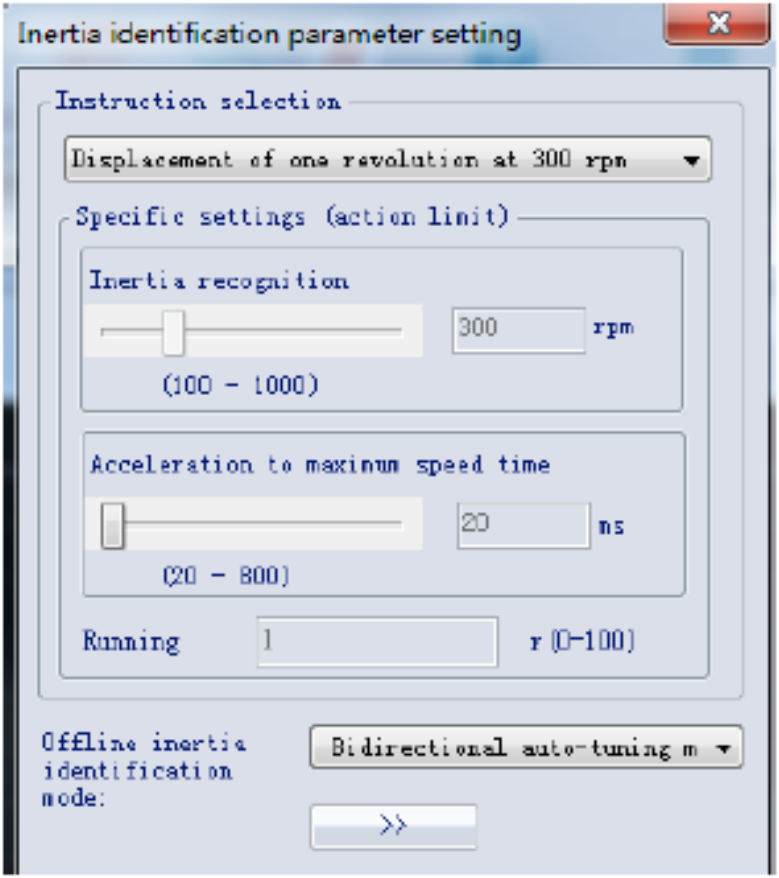


- Parameter management: Reads and downloads parameters in batches.

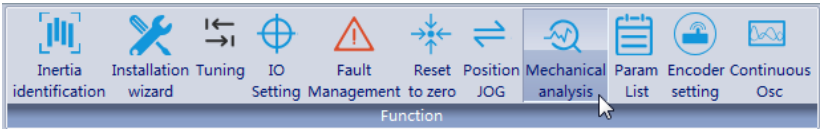


- Inertia auto-tuning: Performs auto-tuning on the load inertia ratio.

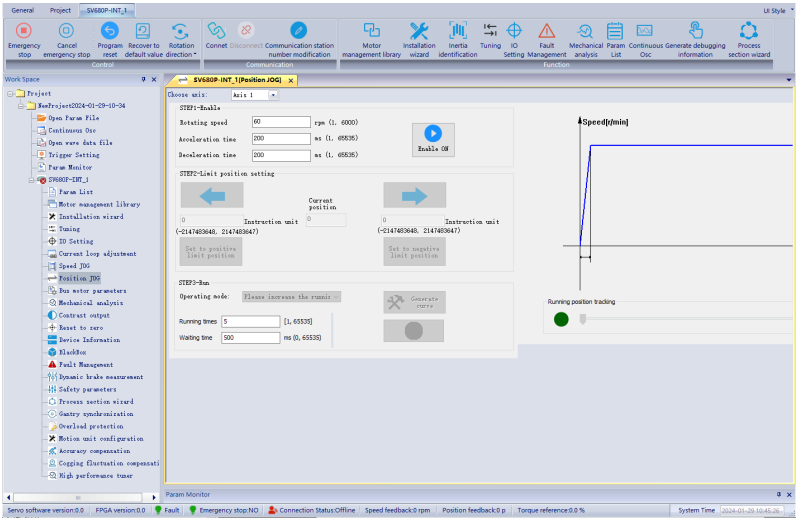




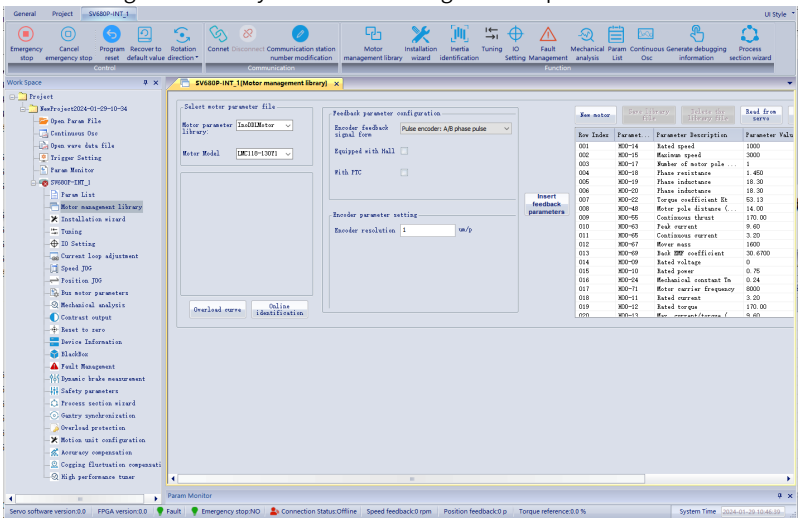
- Mechanical characteristic analysis: Analyzes the resonance frequency of the mechanical system.



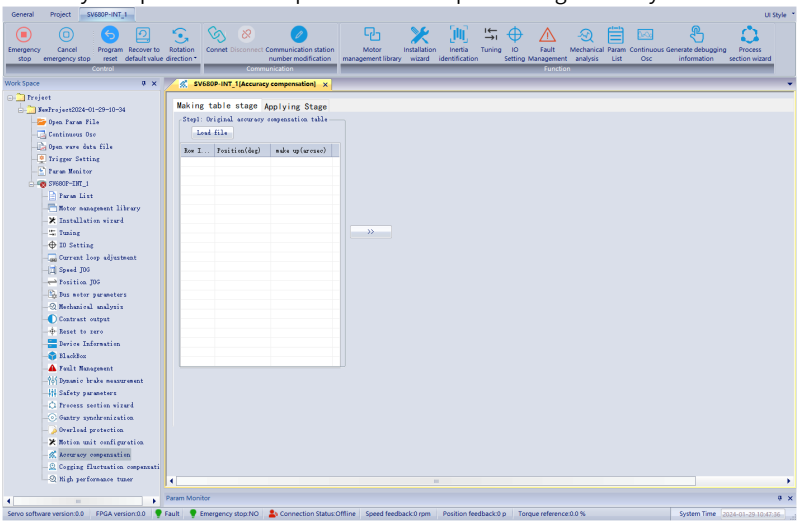
- Motion JOG: Generates position references to make the motor reciprocate.



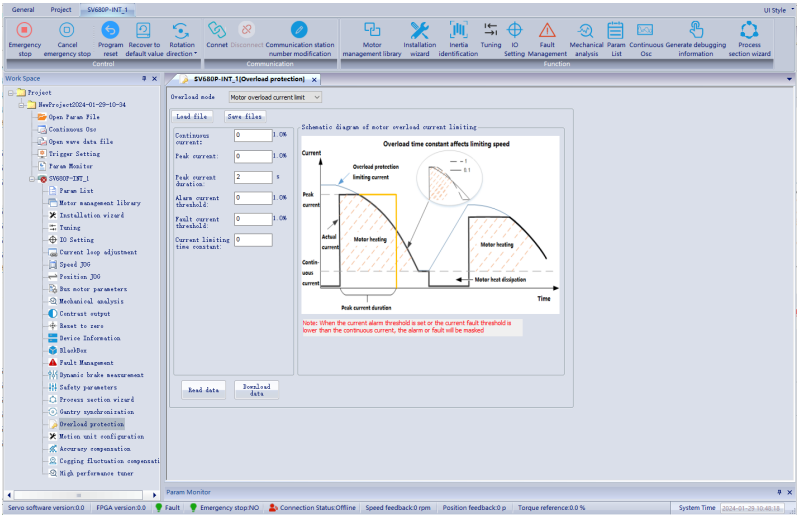
- Gain tuning: Adjusts the rigidity level and monitors the motion data.
- Motor management library: Saves and manages motor parameters.



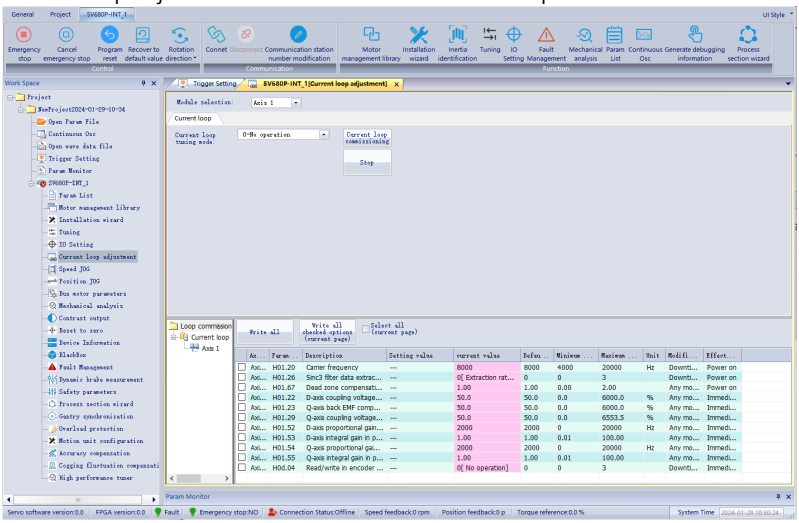
- Accuracy compensation: Compensates motor positioning accuracy.



- Overload curve: Selects motor overload protection methods.



- Current loop adjustment: Commissions the current loop.



- Homing of the host controller: For the homing method, see 6098h descriptions in *SV680-INT Series Servo Drive Function Guide*.

6 Commissioning and Operation

6.1 Commissioned Object

The following table describes types of motors supported by the SV680-INT.

Motor Type	Component Type	Compatibility	Remarks
DDL motor	Temperature detection	Switching PTC	-
	Position feedback	Inovance communication encoder	-
		Sin-cos analog encoder	It must be used together with Inovance T5 interpolator.
		ABZ incremental encoder	The maximum frequency supported before AB quadrature is 4 MHz.
		BiSS-C encoder	The maximum data length is 32-bit.
		SSI encoder	The maximum data length is 32-bit.
		EnDat 2.2 encoder	-
		Switching UVW Hall sensor	-
	Limit signal device	Switch	For details, see the DI specifications.
DDR motor	Temperature detection	Switching PTC	-
	Position feedback	Inovance communication encoder	23-bit, 26-bit
		Sin-cos analog encoder	It must be used together with Inovance T5 interpolator.
		ABZ incremental encoder	The maximum frequency supported before AB quadrature is 4 MHz.
		BiSS-C encoder	The maximum data length is 32-bit.
		Switching UVW Hall sensor	-
	Limit signal device	Switch	For details, see the DI specifications.

Motor Type	Component Type	Compatibility	Remarks
Servo motor	Temperature detection	Switching PTC	-
	Position feedback	Inovance communication encoder	23-bit, 26-bit
		Sin-cos analog encoder	It must be used together with Inovance T5 interpolator.
		ABZ incremental encoder	The maximum frequency supported before AB quadrature is 4 MHz.
		BiSS-C encoder	The maximum data length is 32-bit.
		EnDat 2.2 encoder	-
		SSI encoder	-
		Nikon encoder	17-bit, 20-bit
		TAMAGAWA encoder	17-bit, 23-bit
		Switching UVW Hall sensor	-
	Limit signal device	Switch	For details, see the DI specifications.

6.2 Commissioning Flowchart

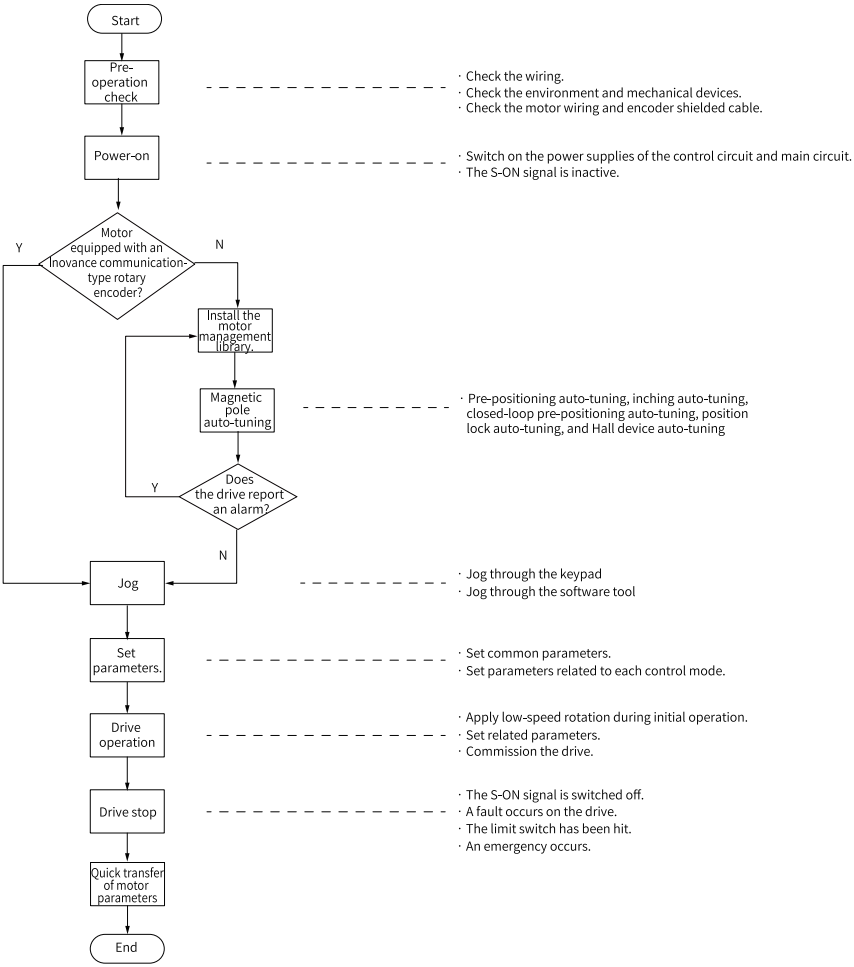


Figure 6-1 Commissioning flowchart of the drive

6.3 Pre-operation Inspection

Check the following items before operating the servo drive and the servo motor.

Table 6–1 Pre-operation checklist

No.	Item	Compliance
Wiring		
1	The power input terminals (L1C, L2C, L1, L2, L3, R, S, T) of the servo drive are connected properly.	☐
2	The main circuit cables (U, V, W) of the motor are connected to the U/V/W terminals of the drive correctly.	☐
3	No short circuit exists in the power input terminals (L1, L2, L3, R, S, T) or main circuit output terminals (U, V, W) of the servo drive.	☐
4	The control signal cables, such as the brake signal cable and overtravel protection signal cable, are connected properly.	☐
5	The servo drive and servo motor are grounded properly.	☐
6	The stress suffered by the cable is within the specified range.	☐
7	All the wiring terminals are insulated properly.	☐
8	The encoder shield is reliably connected to the PE interface of the encoder.	☐
Environment and Mechanical Conditions		
1	There are no unwanted objects (such as cable terminals and metal chippings) that may cause short circuit of the signal cable and power cable inside or outside the servo drive.	☐
2	The servo drive and the external regenerative resistor are placed on incombustible objects.	☐
3	The motor is installed properly. The motor shaft is connected to the machine securely.	☐
4	The motor and the machine it is connected to are in good condition and ready to run.	☐

6.4 Power-on

Switching on the input power supply

The power input terminals are L1C/L2C (control circuit power input terminals) and L1/L2/L3 or R/S/T (main circuit power input terminals).

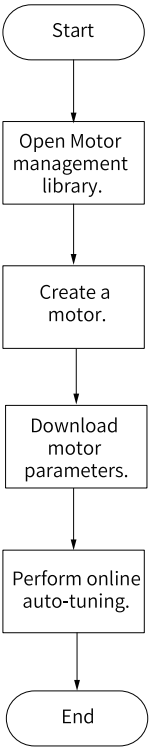
After the power supply is switched on, if the bus voltage indicator is in the normal state and the keypad displays "reset"→"nrd.x"→"rdy" in sequence, the drive is ready to run and waits for the S-ON signal.

Note

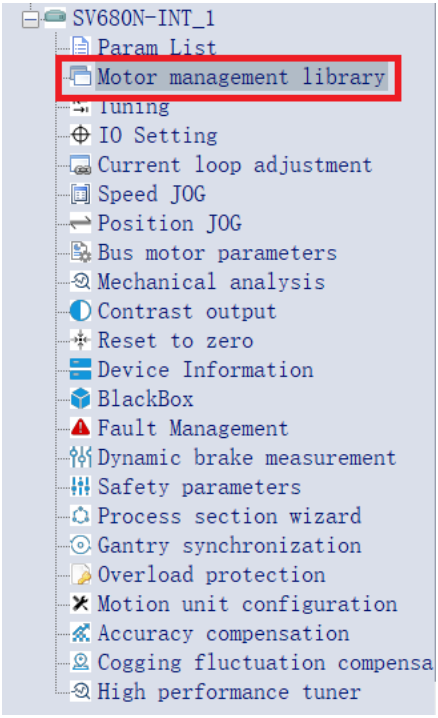
- To connect the main circuit to a single-phase 200–240 VAC power supply, use any two of terminals L1, L2, L3.
- If the keypad keeps displaying "nrd.x" or a fault code, eliminate the fault according to *"5.1.2 Keypad Display" on page 35*.

6.5 Installation of Motor management library

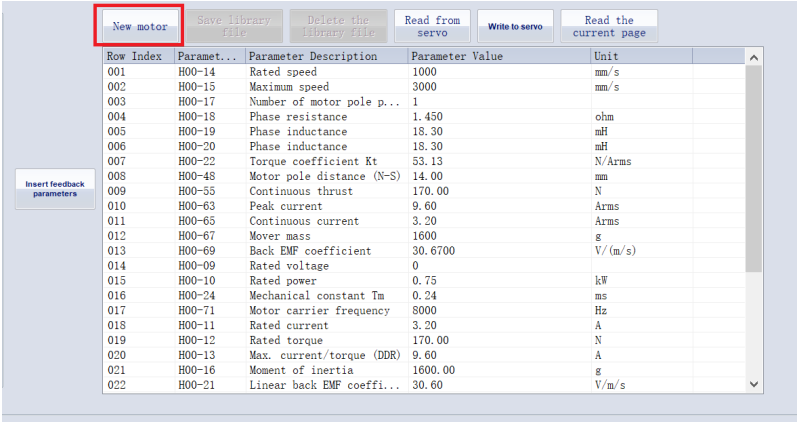
New motor matching



1. Open InoDriverShop, create an SV680-INT project, and click Motor Management Library in the left panel. The motor management library allows you to create and manage your own motor library.



2. Select **New Motor**.



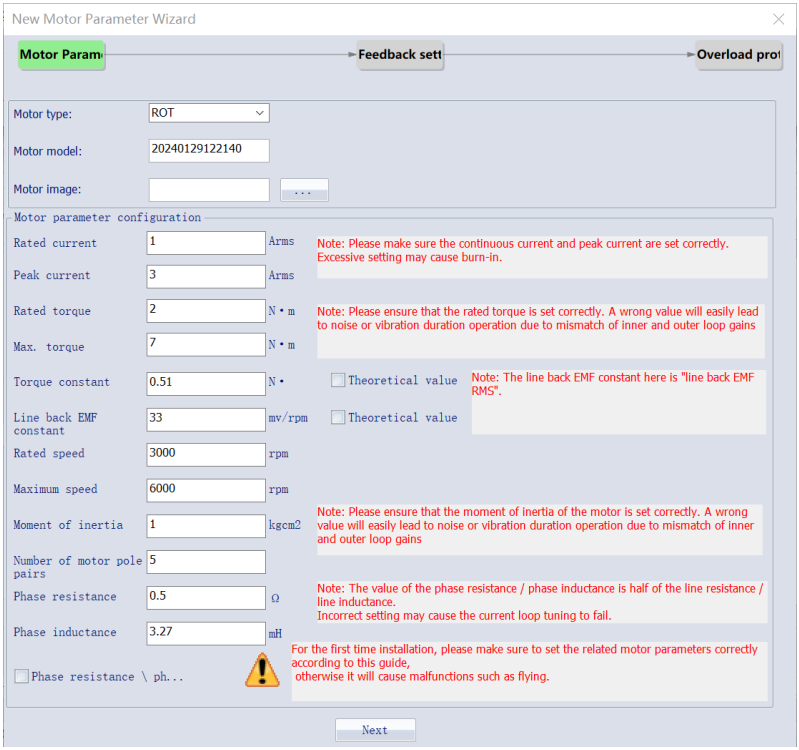
3. Create motor parameters.

   a. First, select the motor type, input the motor model name, and input the corresponding motor parameters.

Note

Parameters of different motors may differ, so it is important to choose the correct motor type. Failure to comply may result in:

- Motor malfunctions, such as runaway, locked-rotor and overspeed of the motor.
- Misreport of a motor overheat protection (E630.0), runaway (E234.0), or motor overspeed (E500.x) error.

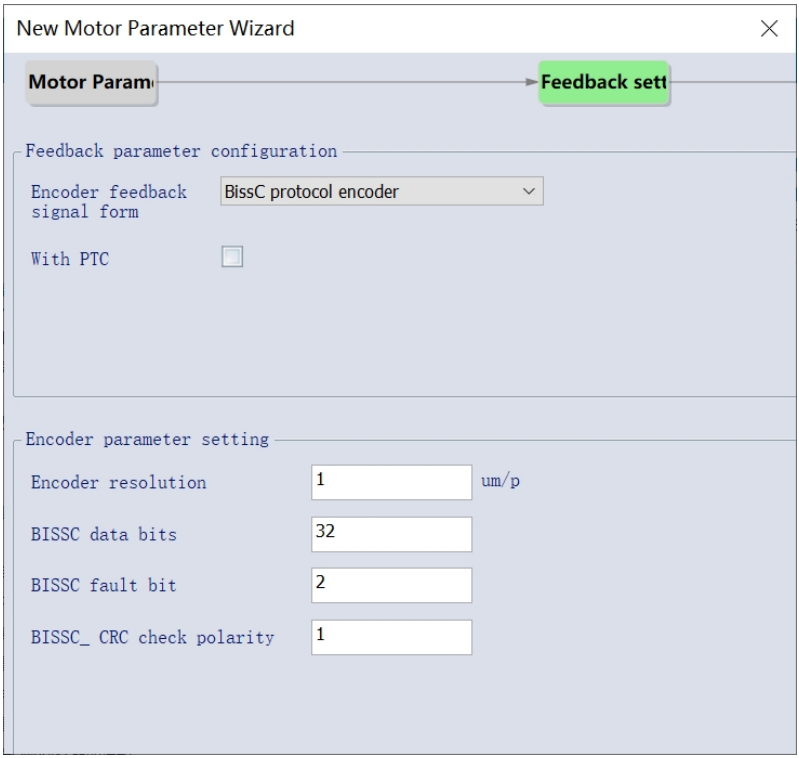


b. Select the correct encoder and configure the correct parameters according to the corresponding encoder manual.

Note

Select the correct encoder type and ensure that the encoder parameters are set correctly. Failure to comply may result in:

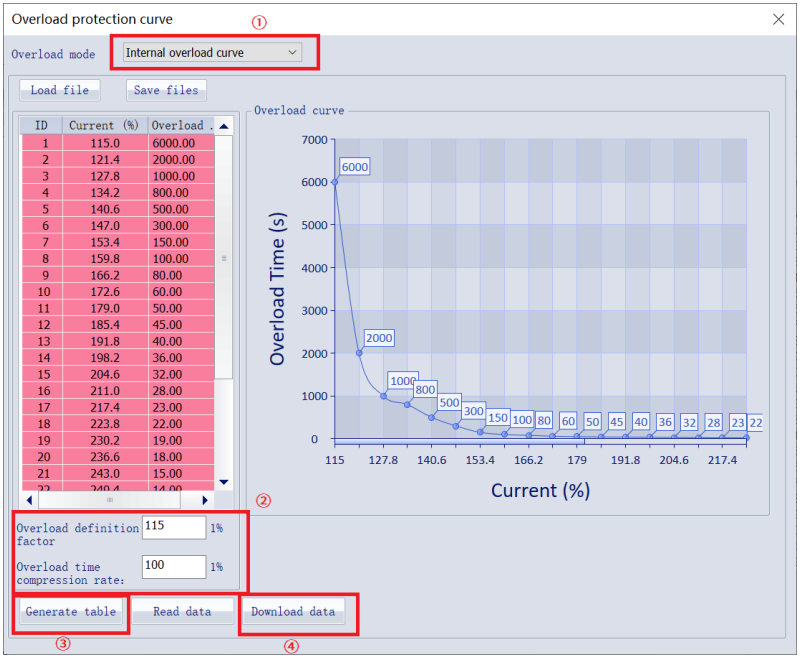
- The servo position information is incorrect, which prevents the motor from operating properly.
- Motor malfunctions, such as runaway, locked-rotor and overspeed of the motor.
- Misreport of a motor overheat protection (E630.0), runaway (E234.0), or motor overspeed (E500.x) error.



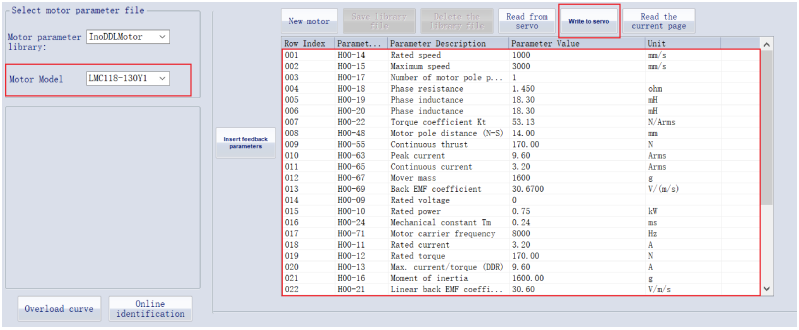
Note

- ABZ incremental encoder: It consists of the encoder with Z signals and that without Z signals. Incorrect configurations may cause errors.
- Inovance T5 interpolator: The T5 interpolator converts analog signals or pulse signals into communication signals. The number of communication signal lines converted is fixed to 8388608. You need to configure the parameters of the input interpolator.
- BiSS-C encoder:
  - BiSS-C encoders generally have data bits and fault bits, whose length can be found in the corresponding encoder manual. For linear motors, the total length of the data bit is required. For rotating motors, the total length of the data bit and the length of single-turn data are required. Generally, the length of the fault bit is 2-bit.
  - Check the communication frequency and recovery time according to the encoder manual.
  - The CRC mode is used.
  - You need to configure the communication frequency (baud rate) and recovery time (from the time for the first falling edge of the clock signal to the time for the first rising edge of the data signal).
- SSI encoder:
  - SSI encoders generally have data bits and fault bits, whose length can be found in the corresponding encoder manual. For linear motors, the total length of the data bit is required. For rotating motors, the total length of the data bit and the length of single-turn data are required.
  - The SSI encoder uses the parity check method.
  - You need to configure the communication frequency (baud rate) and recovery time (from the time for the first falling edge of the clock signal to the time for the first rising edge of the data signal).
- EnDat 2.2 encoder:
  - The data length needs to be set for EnDat 2.2 encoders. For linear motors, only the total length of the data bit is required. For rotating motors, the total length of the data bit and the length of single-turn data are required.
  - You need to configure the communication frequency (baud rate) and recovery time (from the time for the first falling edge of the clock signal to the time for the first rising edge of the data signal).

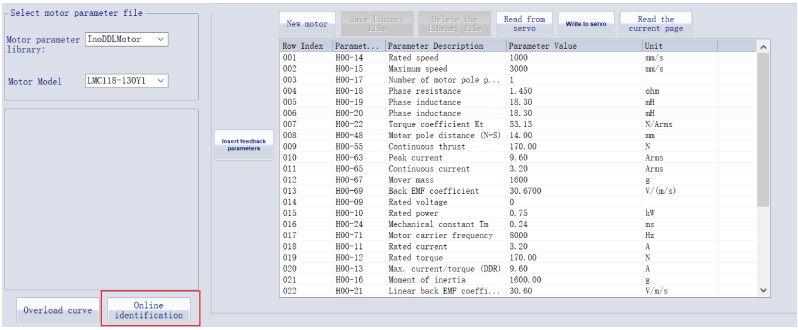
c. Select the overload protection mode and click **Done**. For details of overload protection settings, see *" Motor overload protection" on page 76*.



4. Return to the Motor Management Library page, where all motor parameters are displayed in the table on the right side. Ensure the parameters are set correctly, and click Write to Drive to download the parameters.



5. Click **Online Auto-tuning** to start auto-tuning.



Motor overload protection

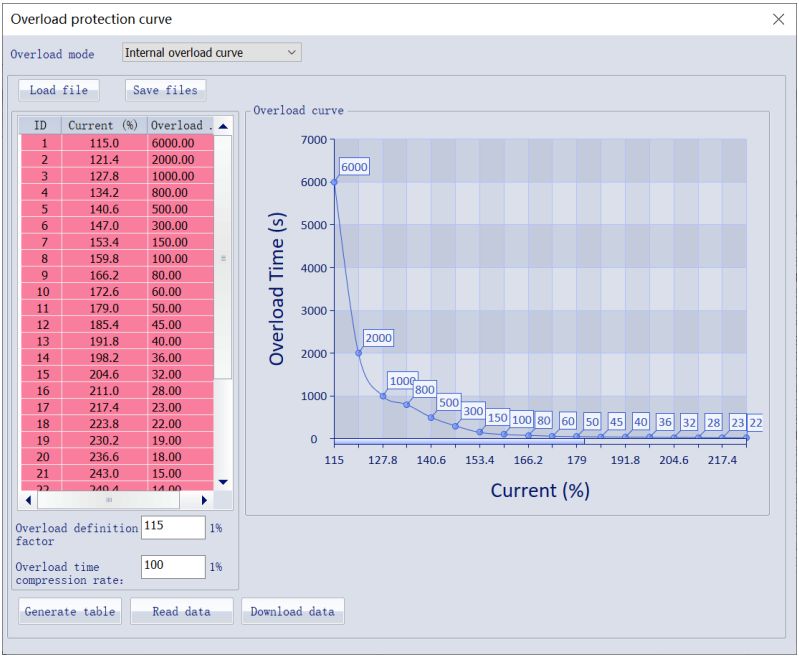
The SV680-INT provides three kinds of motor overload protection methods: internal overload curve download, overload curve download and motor overload current limit.

Method 1

To fit more applications, the internal overload curve provides two parameter adjustment overload curves, namely overload thermal limit coefficient and overload time compression ratio.

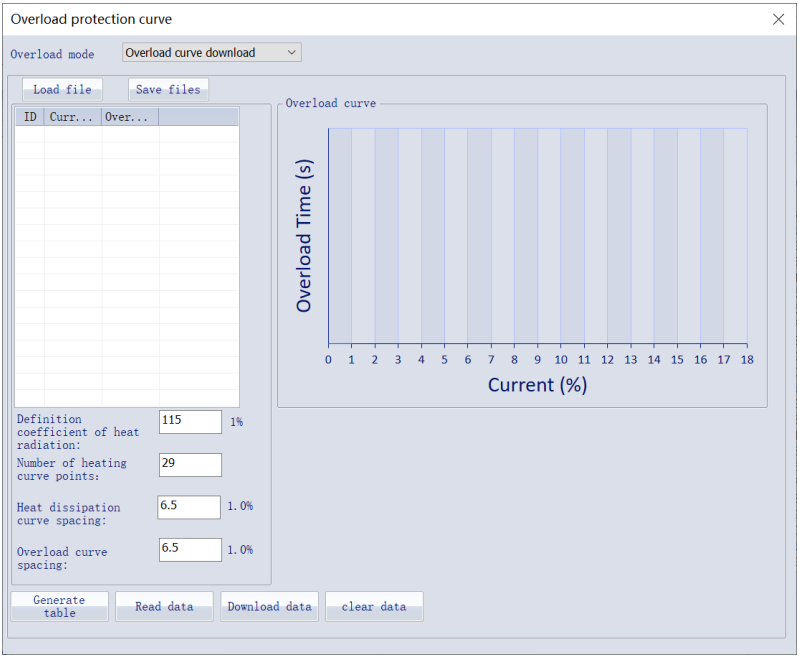
The overload thermal limit coefficient is a current value (the empirical value is about 115%) around which the motor keeps running continuously. The motor can finally stay at a constant temperature due to balance between heating and heat dissipation , that is, if the motor current is higher than this value, the motor will continue to heat up, and if it is lower than this value, the motor will be in a heat dissipation state.

The overload time compression ratio is the overall compression overload time. For example, if the current keeps at 200% for 30 seconds, an alarm is raised. If you modify the overload time compression ratio to 150% and generate a table, the current keeps at 200% for about 50 seconds.



Method 2

Overload curve download is applied to applications which require high motor overload performance. You need to know the overload curve of the matched motor and then write it into the drive.



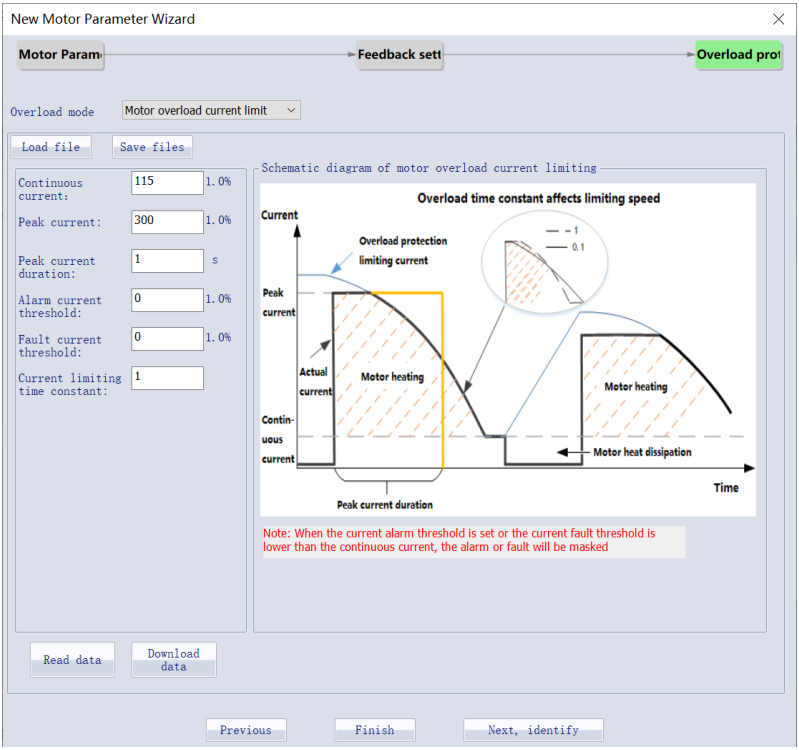
Method 3

Motor overload current limit estimates the motor heat threshold according to the duration of peak current, and then limits the motor current according to the heat generated by the motor real-time current, so as to protect the motor.

- Thermal limit current is a percentage of motor rated current defaulted to 100%, above which the motor starts to heat continuously. The motor current will be finally maintained at this value.
- Peak current: Defines the ratio of the peak current that can be reached by the motor to the rated current of the motor.
- Peak current duration: Calculate the maximum heat that can be reached by the motor based on the maximum current continuous time, and take this value as the motor overload alarm threshold.
- Alarm current threshold: If current limit protection is effective, and the limited current is lower than this value, the drive will raise an alarm.
- Fault current threshold: If current limit protection is effective, and the limited current is lower than this value, the drive will report an error.

Note

As the minimum value of the current limit protection is the thermal threshold current, when the current threshold for alarms and faults is lower than the thermal threshold current, the fault and alarm cannot be reported.



6.6 Auto-tuning of Magnetic Pole

Overview

Before using the drive to control a direct drive or third-party motor, perform magnetic pole auto-tuning (that is, initial electrical angle auto-tuning) to determine the control electrical reference of the drive, after which the motor can run normally.

The drive provides 5 magnetic pole identification methods, which are detailed as follows.

Method	Motion Range	Applicable Motor	Applicable Encoder	Load Capacity
Pre-positioning	Large	Barrel/U-shaped	All	Weak
Inching	Small	All	Optical scale	Medium
Hall device auto-tuning	/	High power	All	Strong
Position lock	Tiny	All	All	Strong
Closed-loop pre-positioning	Large	All	All	Strong

Method	Characteristics	Applicable Scenario	Advantage and Disadvantage
Pre-positioning	Dynamic auto-tuning	Scenario where the rotor is allowed to move between two pole pitches.	Advantages: Extensive applications
			Disadvantages: • The rotor may move violently (overshoot within the travel range). • Disturbance is not allowed.
Closed-loop pre-positioning		Scenario where the rotor is allowed to move between two pole pitches. Auto-tuning can be performed at the hard limit.	Advantages: Extensive applications
			Disadvantages: Long movement distance
Inching		Scenarios with light load (within half rated load) or no load	Advantages: The motor movement range is very small (within hundreds of pulses, which is related to the set value), which cannot be observed by naked eyes.
			Disadvantages: • It is not recommended for the following occasions. • Disturbance is not allowed.
Position lock	Quasi-static auto-tuning	With load, Z-axis, and external disturbance. The auto-tuning process allows the range of 100P (encoder unit).	Advantages: It features barely observable movement and strong disturbance resistance. An alarm will be triggered in case of mechanical interference.
			Disadvantage: For a specific DDL motor or application, you may need to fine tune the default parameters to ensure successful auto-tuning.

Method	Characteristics	Applicable Scenario	Advantage and Disadvantage
Hall device auto-tuning	Static auto-tuning	Scenarios where the rotor is not allowed to move when the motor is powered on.	Advantages: Initial angle auto-tuning is not required after power-on. Disadvantages: Increased cost since an additional Hall device is required. (If static auto-tuning is selected, it is recommended to use this method first.)

Note

Dynamic identification is preferred when the mover has small inertia and is able to move, while static identification is preferred when the mover has large inertia and is hard to move.

Auto-tuning state

The states are different when you match different encoders.

- For the motor with incremental encoder, the magnetic pole auto-tuning is automatically carried out during first enabling after power-on by default. If starting conditions of angle auto-tuning are set, auto-tuning will be started according to the conditions.
- For the motor with absolute encoder or after first auto-tuning on the magnetic pole for the motor with incremental encoder is successful upon power-on, auto-tuning can only be carried out by setting H0d.03.

Auto-tuning states are as follows.

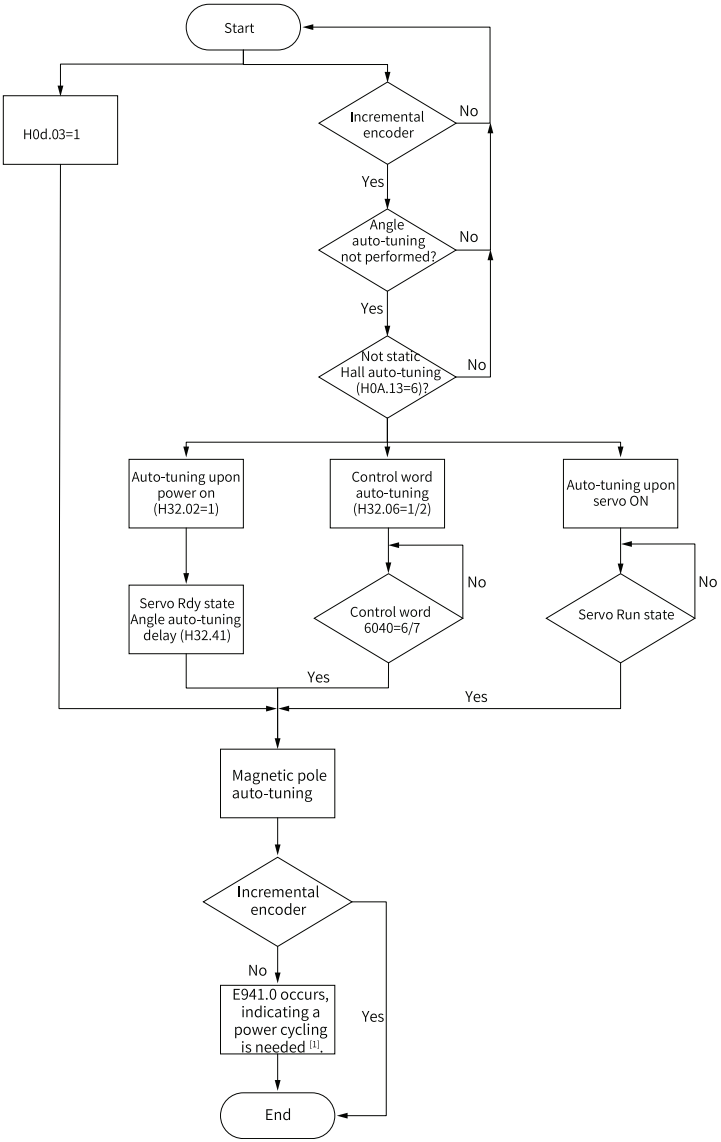


Figure 6-2 Flow chart of magnetic pole auto-tuning state

Note

- [1]: Inovance motor with absolute encoder needs to be powered on after complete power-off. Complete power-off: It means unplugging the USB cable and disconnecting the control power supply.After angle auto-tuning of Inovance encoder, wait until parameters are written (H0d.04 restores to 0 or 3) and then disconnect the power supply.
- If angle auto-tuning of the incremental encoder is not performed upon power-on, it is not prompted by default. You can set the prompt through the bit of H32.04. If both bit 0 (alarm bit defined by 6041h) and bit 1 (E602.9) of H32.04 are set to 1, only bit 0 takes effect. The alarm bit or the warning/alarm is automatically reset after angle auto-tuning is completed.
- For N-type models, when angle auto-tuning is performed for the first time upon power-on of the non-Hall incremental encoder, the motor will move. This leads to inconsistence between 607Ah (target position) and 6064h (position feedback) after auto-tuning is completed. After auto-tuning is completed and the enabling signal is received, the motor moves toward the target position. In this case, the motor vibrates lightly, which is normal. To suppress vibration, set H32.06 to 1. After the first angle auto-tuning, 607Ah (target position) and 6064h (position feedback) are aligned automatically, and the motor no longer moves.

6.6.1 Auto-tuning Process

The magnetic pole auto-tuning processes are different for motors with or without a Hall device.

Process without a Hall device

Applicable method: pre-positioning auto-tuning, inching auto-tuning, closed-loop prepositioning auto-tuning, and position lock auto-tuning.

The flow chart is as follows.

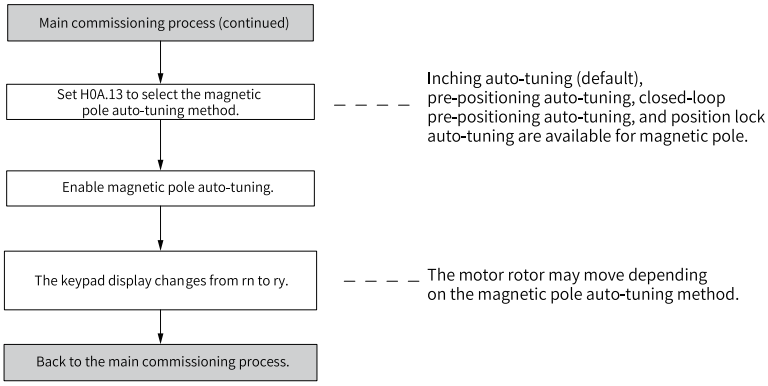


Figure 6-3 Flowchart for magnetic pole auto-tuning without a Hall device

Process with a Hall device

Applicable method: Hall device auto-tuning

The flow chart is as follows.

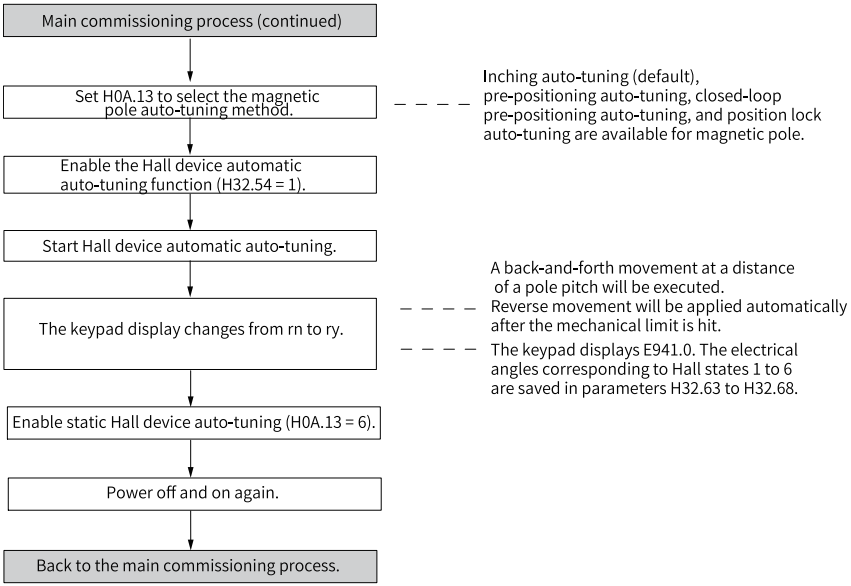


Figure 6-4 Flowchart for magnetic pole auto-tuning with a Hall device

6.6.2 Pre-positioning Auto-tuning

For the use of pre-positioning auto-tuning, see *" Process without a Hall device" on page 83*.

During pre-positioning auto-tuning, the drive controls the motor to reciprocate several times, and the mover is finally positioned near the electrical angle.

Table 6–2 Pre-positioning Auto-tuning

Mover operation	Max. movement range	Completion
Move quickly from the power-on position to the pre-positioning 0° electrical angle, and then try to move in a smaller range. (Avoid mechanical interference)	The mover may move violently in a large range, up to the distance between N and S.	If the status displayed on the drive screen changes from "rn" to "ry", it means that the auto-tuning is successful. The auto-tuning takes about 10s.

Related Parameters:

Parameter Group			Name	Option Description	Value range	Default	Change Mode	Effective Time
Hexadecimal		Decimal						
Group	Index	Parameter						
200 A	0Eh	H0A.13	Initial angle auto-tuning mode	0: Pre-positioning 1: Inching 6: Static Hall 8: Closed loop pre-positioning 9: Position lock	0–9	0	Stop setting	At once
200D	04h	H0d.03	Initial angle auto-tuning	0: No auto-tuning 1: Angle auto-tuning enabled 2: Phase sequence auto-tuning enabled	0–2	0	Stop setting	At once

6.6.3 Inching Auto-tuning

For the use of inching auto-tuning, see *" Process without a Hall device" on page 83*.

During inching auto-tuning, the motor mover will move left and right in a small range, and you will hear the sound of current. If the state display on the the drive changes from "rn" to "ry", it means that the auto-tuning is successful and you can perform further commissioning. If Er602 is displayed in the auto-tuning process, it indicates that the auto-tuning failed.

Related Parameters:

Parameter Group			Name	Option Description	Value range	Default	Change Mode	Effective Time
Hexadecimal		Decimal						
Group	Index	Parameter						
200 A	0Eh	H0A.13	Initial angle auto-tuning mode	0: Pre-positioning 1: Inching 6: Static Hall 8: Closed-loop pre-positioning 9: Position locking	0–9	0	Stop setting	At once
200D	04h	H0d.03	Initial angle auto-tuning	0: No auto-tuning 1: Angle auto-tuning enabled 2: Phase sequence auto-tuning enabled	0–2	0	Stop setting	At once
2032	0Ah	H32.10	Max. reference current in angle auto-tuning through inching	-	10% to 300%	100%	Stop setting	At once

Parameter Group			Name	Option Description	Value range	Default	Change Mode	Effective Time
Hexadecimal		Decimal						
Group	Index	Parameter						
2032	0Dh	H32.13	Ramp-up rate of injection current in angle auto-tuning through inching	-	0.001deg to 20.000deg	0.2deg	Stop setting	At once
2032	0Eh	H32.14	Motor operation threshold (ROT/DDR) in angle auto-tuning through inching	-	0.1[mm/s]/[rpm]–100.0[mm/s]/[rpm]	1.0 [mm/s]/[rpm]	Stop setting	At once
2032	0Fh	H32.15	Motor operation threshold (DDL) in angle auto-tuning through inching	-	0.001 millimeters–20.000 millimeters	0.2 mm	Stop setting	At once
2032	10h	H32.16	Motor standstill threshold (DDL) in angle auto-tuning through inching	-	0.1 mm/s–100.0 mm/s	1.0 mm/s	Stop setting	At once

Note

- When angle auto-tuning is performed through inching, ensure that the phase sequence of the motor is correct.
- If the auto-tuning fails, see the specific fault subcode *"Table 6–3 " on page 86* to troubleshoot.

Table 6–3 Related fault codes:

Fault Code	Name	Description
E602.0	Locked-rotor	• Check for locked-rotor. • Check the connection of the power cable. • If locked rotor is reported when the motor operates, check the motor operation evaluation threshold and reduce it if necessary.
E602.3	Large encoder jitter during angle auto-tuning	When the encoder resolution is low and there is ripple, the motor standstill conditions are not met. Check the static speed feedback ripple of the encoder, and increase the standstill evaluation threshold appropriately.

6.6.4 Closed-loop Pre-positioning Auto-tuning

For the use of closed loop pre-positioning auto-tuning, see *" Process without a Hall device" on page 83*.

Closed-loop pre-positioning is similar to pre-positioning. The drive controls the motor to move left and right in a range to determine the initial electrical angle of the motor, and closed-loop control is introduced to ensure smooth operation. This auto-tuning method features high load capacity. It is immune to the characteristics of the motor and encoder, and can provide accurate results.

If the mechanical limit is encountered during auto-tuning, the mover will automatically return and complete the auto-tuning.

Related Parameters:

Parameter Group			Name	Option Description	Value range	Default	Change Mode	Effective Time
Hexadecimal		Decimal						
Group	Index	Parameter						
200 A	0Eh	H0A.13	Initial angle auto-tuning mode	0: Pre-positioning 1: Inching 6: Static Hall 8: Closed-loop pre-positioning 9: Position locking	0–9	0	Stop setting	At once
200D	04h	H0d.03	Initial angle auto-tuning	0: No auto-tuning 1: Angle auto-tuning enabled 2: Phase sequence auto-tuning enabled	0–2	0	Stop setting	At once
2032	14h	H32.20	Max. reference current in angle auto-tuning through pre-positioning (closed-loop)	-	10% to 300%	100%	Stop setting	At once
2032	16h	H32.22	Electric angle for closed-loop pre-positioning	-	0.0deg to 360.0deg	0.0deg	Stop setting	At once
2032	17h	H32.23	Electrical angle reference change range in angle auto-tuning through pre-positioning (closed-loop)	-	10.0deg to 170.0deg	90.0deg	Stop setting	At once

Parameter Group			Name	Option Description	Value range	Default	Change Mode	Effective Time
Hexadecimal		Decimal						
Group	Index	Parameter						
2032	18h	H32.24	Motor stop threshold (ROT/DDR) in angle auto-tuning through pre-positioning (closed-loop)	-	0.1[mm/s]/[rpm]–100.0[mm/s]/[rpm]	1.0 [mm/s]/[rpm]	Stop setting	At once
2032	1Ah	H32.26	Damping in angle auto-tuning through pre-positioning (closed-loop)	-	0.00[N/(m/s)]/[N·m/rpm]–655.35[N/(m/s)]/[N·m/rpm]	0.00[N/(m/s)]/[N·m/rpm]	Stop setting	At once

Note

If the auto-tuning fails, see the specific fault subcode *"Table 6–4 " on page 88* to troubleshoot.

Table 6–4 Related fault codes:

Fault Code	Name	Description
E602.0	Locked-rotor	• Check for locked-rotor. • Check the connection of the power cable.
E602.1	Angle auto-tuning overtravel	The movement exceeds 1 polar distance during auto-tuning. • Check for external disturbance. • If the auto-tuning current is too large or the rising slope is too large or the damping of the auto-tuning speed loop is too small, the overshoot of the motor will lead to overtravel.
E602.2	Wrong U/V/W phase sequence detected in angle auto-tuning	• First adjust phase sequence through phase sequence auto-tuning, and then carry out closed-loop pre-positioning auto-tuning again. • Adjust the phase sequence manually.

Fault Code	Name	Description
E602.3	Large encoder jitter during angle auto-tuning	When the encoder resolution is low and there is ripple, the motor stop evaluation conditions cannot not be met. Check the static speed feedback ripple of the encoder, and increase the motor stop evaluation threshold appropriately.
E602.4	Auto-tuning failed. Auto-tuning timeout.	The single-step overtravel of left and right movement exceeds 30s. • Check for locked-rotor. • Check the connection of the power cable. • If the motor moves slowly and gives an alarm, increase the auto-tuning current or reduce the damping of the auto-tuning speed loop. • If the motor stops after moving for a certain distance and then a timeout alarm is raised, increase the motor stop evaluation threshold appropriately.

6.6.5 Position Locking Auto-tuning

For the use of position locking auto-tuning, see *" Process without a Hall device" on page 83*.

This auto-tuning feature barely observable movement and strong disturbance resistance. Moreover, the magnetic pole position can be correctly identified regardless of any mechanical interference and no alarm is raised.

Related Parameters:

Parameter Group			Name	Option Description	Value range	Default	Change Mode	Effective Time
Hexadecimal		Decimal						
Group	Index	Parameter						
200 A	0Eh	H0A.13	Initial angle auto-tuning mode	0: Pre-positioning 1: Inching 6: Static Hall 8: Closed-loop pre-positioning 9: Position locking	0–9	0	Stop setting	At once
200D	04h	H0d.03	Initial angle auto-tuning	0: No auto-tuning 1: Angle auto-tuning enabled 2: Phase sequence auto-tuning enabled	0–2	0	Stop setting	At once

Parameter Group			Name	Option Description	Value range	Default	Change Mode	Effective Time
Hexadecimal		Decimal						
Group	Index	Parameter						
2032	1Eh	H32.30	Max. reference current in angle auto-tuning through position lock	-	10% to 300%	100%	Stop setting	At once
2032	21h	H32.33	Motor action threshold (ROT/DDR) in angle auto-tuning through position lock	-	0.001deg to 20.000deg	0.2deg	Stop setting	At once
2032	22h	H32.34	Motor standstill threshold (ROT/DDR) in angle auto-tuning through position lock	-	0.1[mm/s]/[rpm]–100.0[mm/s]/[rpm]	1.0 [mm/s]/[rpm]	Stop setting	At once
2032	23h	H32.35	Motor action threshold (DDL) in angle auto-tuning through position lock	-	0.001 millimeters–20.000 millimeters	0.2 mm	Stop setting	At once
2032	24h	H32.36	Motor standstill threshold (DDL) in angle auto-tuning through position lock	-	0.1 mm/s–100.0 mm/s	1.0 mm/s	Stop setting	At once
2032	26h	H32.38	Inertia ratio in angle auto-tuning through position lock	-	0.00–120.0	0.00	Stop setting	At once
2032	27h	H32.39	Gain class in angle auto-tuning through position lock	-	4level to 31level	16level	Stop setting	At once

Note

- Position lock is an angle auto-tuning method with position closed loop. The position closed loop mode ensures that the movement of auto-tuning is much smaller than other angle auto-tuning methods.
- However, you need to set the auto-tuning gain parameters due to the position closed loop regulator.
- Set the auto-tuning inertia ratio and auto-tuning gain level according to the actual applications.
- If you do not know the load inertia or loop gain level during the first installation of the motor, it is recommended to use other auto-tuning methods to complete inertia auto-tuning and basic gain auto-tuning before switching to the position locking method.

Table 6–5 Related fault codes:

Fault Code	Name	Description
E602.0	Locked-rotor	• Check for locked-rotor. • Check the connection of the power cable. • If locked rotor is reported when the motor operates, check the motor operation evaluation threshold and reduce it if necessary.
E602.1	Angle auto-tuning overtravel	Large movement during auto-tuning. • Set a reasonable auto-tuning inertia ratio and appropriately increase the auto-tuning gain level. • Contact the manufacturer technical personnel.
E602.3	Large encoder jitter during angle auto-tuning	When the encoder resolution is low and there is ripple, the motor standstill conditions are not met. Check the static speed feedback ripple of the encoder, and increase the standstill evaluation threshold appropriately.

6.6.6 Hall Auto-tuning

For the use of Hall auto-tuning, see *" Process with a Hall device" on page 84*.

To use Hall auto-tuning, you must install a Hall assembly and trigger dynamic auto-tuning of the Hall sensor. The state of the currently installed Hall sensor and the electrical angle value will be stored in H32.63–H32.68, and static Hall sensor auto-tuning will be enabled automatically (H0A.13=6) and a power cycle.

Related Parameters:

Parameter Group			Name	Option Description	Value range	De fault	Unit	Width	Chang e Mode	Effec tive Time
Hexadecimal		Decimal								
Group	Index	Parame ter								
200 A	0Eh	H0A.13	Initial angle auto-tuning mode	0: Pre-positioning 1: Inching 6: Static Hall 8: Closed-loop pre-positioning 9: Position locking	0–9	0	1	16-bit	Stop set ting	At once
200D	04h	H0d.03	Initial angle auto-tuning	0: No auto-tuning 1: Angle auto-tuning enabled 2: Phase sequence auto-tuning enabled	0–2	0	1	16-bit	Stop set ting	At once
2032	37h	H32.54	Hall auto-tuning selection	-	0–65535	0	1	16-bit	Stop set ting	At once
2032	38h	H32.55	Hall signal UVW manual adjustment	Hall signal active level Bit0: 0: U active high 1: U active low Bit1: 0: V active high 1: V active low Bit2: 0: W active high 1: W active low	0–7	0	1	16-bit	Any condi tion	At once
2032	39h	H32.56	UVW filter time of Hall signal	-	0 ms–10 ms	5ms	1ms	16-bit	Any condi tion	At once
2032	3Ah	H32.57	Hall closed-loop locked-rotor speed	The speed to determine if locked-rotor occurs during Hall dynamic auto-tuning	0[mm/s]/[rp m]–65535[m m/s]/[rpm]	2 [mm/ s]/ [rpm]	1 [mm/ s]/ [rpm]	16-bit	Any condi tion	At once
2032	3Bh	H32.58	Hall closed-loop locked-rotor current	-	0.0% to 300.0%	120.0 %	0.1%	16-bit	Any condi tion	At once
2032	3Ch	H32.59	Hall closed-loop locked-rotor time window	-	0 ms–2000 ms	10ms	1ms	16-bit	Any condi tion	At once

Parameter Group			Name	Option Description	Value range	De fault	Unit	Width	Chang e Mode	Effec tive Time
Hexadecimal		Decimal								
Group	Index	Parame ter								
2032	3Dh	H32.60	Hall closed-loop inertia ratio	-	0.00–120.00	0	0.01	16-bit	Any condi tion	At once
2032	3Eh	H32.61	Hall closed-loop rigidity	-	4–31	16	1	16-bit	Any condi tion	At once
2032	3Fh	H32.62	Hall electrical angle saved flag	0: Not saved 1: Saved	0–65535	0	1	16-bit	Any condi tion	Take effect after pow er-off.
2032	40h	H32.63	Electric angle corresponding to Hall state 1	-	0–65535	0	1	16-bit	Any condi tion	At once
2032	41h	H32.64	Electric angle corresponding to Hall state 2	-	0–65535	0	1	16-bit	Any condi tion	At once
2032	42h	H32.65	Electric angle corresponding to Hall state 3	-	0–65535	0	1	16-bit	Any condi tion	At once
2032	43h	H32.66	Electric angle corresponding to Hall state 4	-	0–65535	0	1	16-bit	Any condi tion	At once
2032	44h	H32.67	Electric angle corresponding to Hall state 5	-	0–65535	0	1	16-bit	Any condi tion	At once
2032	45h	H32.68	Electric angle corresponding to Hall state 6	-	0–65535	0	1	16-bit	Any condi tion	At once

6.7 Jog

When using the jog function, set the S-ON signal to OFF. Otherwise, this function cannot be used.

The jog function can be used in trial run to check whether the motor rotates properly, without abnormal vibration or noise generated during rotation.

This operation can be performed through keypad speed mode jogging, keypad position mode jogging, software speed mode jogging and DI jogging.

Note

The acceleration and deceleration time constants of speed and position references can be set through H06.12 during jogging.

Using the keypad (speed control mode)

- Commissioning Steps

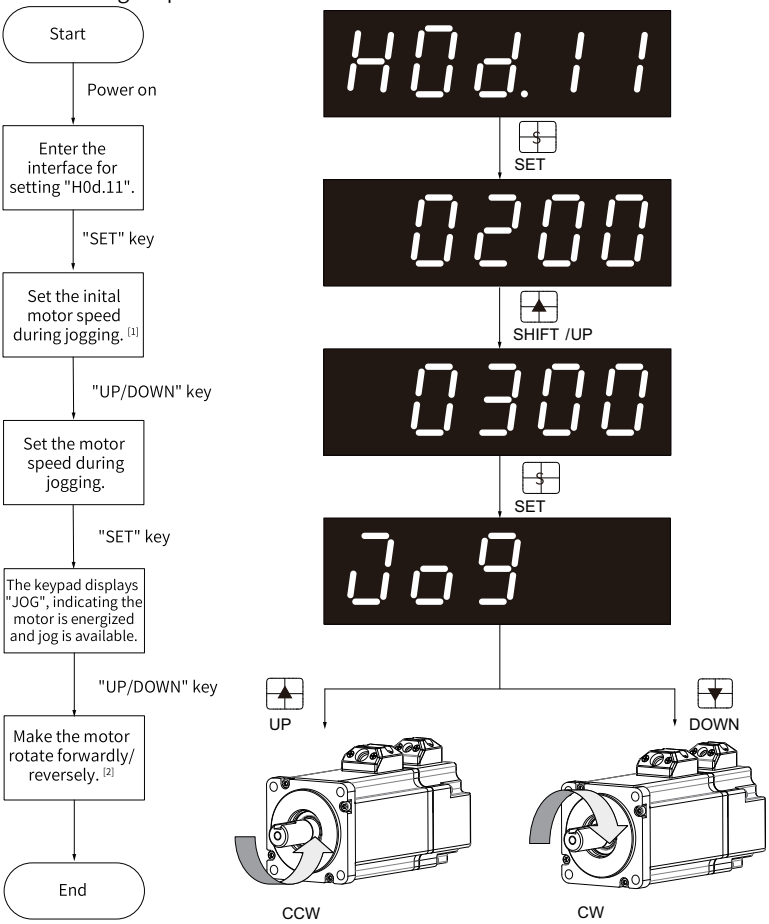


Figure 6-5 Procedure for setting the jog function

Note

- [1]: Press the UP or DOWN key to increase or decrease the jog speed. After exiting from the jog mode, the motor reverts to the initial speed.
- [2]: If magnetic pole identification is not performed after the incremental encoder motor is powered on, the identification will be automatically carried out at this time. After identification, press key UP or DOWN to enable the motor to rotate in forward or reverse direction. After you release the key, the motor stops running immediately.

- Procedure:

  1. Enter the jog mode by setting H0d.11 through the keypad.

     The keypad displays the default jog speed at this moment.
  2. Adjust the jog speed through the UP/DOWN key and press the SET key to enter the jog state.

     The keypad displays "JOG" at this moment, and the motor is energized.
  3. Hold the UP/DOWN key down to make the motor jog forwardly or reversely.
  4. Press the MODE key to exit the jog mode and return to the upper-level menu.

     The setpoint of H06.04 returns to the default value.

  ☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H06.04	2006-05h	DI jog speed reference	0[Mm/s]/[rpm]–0[mm/s]/[rpm]	150	[mm/s]/[rpm]	Real-time

Jogging through the software tool

Procedure:

1. Open the Speed JOG interface in the software tool.
2. Set the jog speed.
3. After switching the servo status to ON, press the forward/reverse arrow displayed on the interface to switch between forward and reverse jog.

Jogging through the DI

Note

Note: The jog function can be activated through the DI in any control mode.

Procedure:

1. Assign FunIN.18 and FunIN.19 to two external DIs.
2. Set H06.04.
3. Make the motor jog forwardly or reversely through changing the DI status.

☆ Related parameters:

Code	Name	Function Name	Description
FunIN.18	JOGCMD+	Forward jog	Active: Input based on command Inactive: Command input stopped
FunIN.19	JOGCMD–	Reverse jog	Active: Input in reverse to the command Inactive: Command input stopped

Using the keypad (position control mode)

Procedure:

1. Enter the jog mode by setting H0d.08 through the keypad.
   The keypad displays the default jog speed at this moment.
2. Adjust the jog speed through the UP/DOWN key and press the SET key to enter the jog state.
   The keypad displays "JOG-P" at this moment, and the motor is energized.
3. Hold the UP/DOWN key down to make the motor jog forwardly or reversely.
   Press the MODE key to exit from jogging and return to the previous menu.

☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H06.12	2006-0Dh	Acceleration ramp time of jog speed	0 ms to 65535 ms	10	ms	Real-time

6.8 Setting Parameters [P]

For general parameter settings, see **Setup wizard** in InoDriverShop.

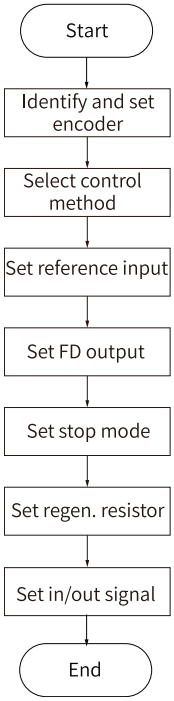


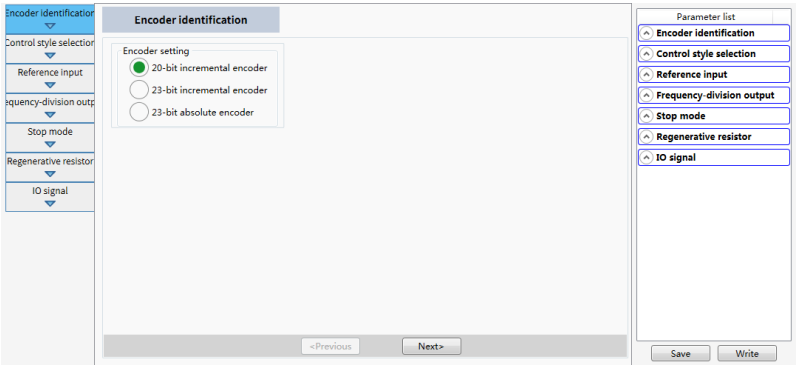
Figure 6-6 Setup wizard process

Note

Parameters set in **Installation wizard** will not be written to the drive. After all settings in **Installation wizard** are done, you can check the configured parameters in **Parameter List** and click **Write** to write parameters to the drive in batches.

Identify and set the encoder.

After setting the encoder type in **Encoder identification** > **Encoder setting**, click **Next** to select the **Rotation direction**, and then click **Application**. The set parameters will be generated in **Parameter list** on the right.



Set H02.02 to change the direction of rotation directly.

☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.02	2002-03h	Rotation direction selection	0: Counterclockwise (CCW) as forward direction 1: Clockwise (CW) as forward direction	0	-	At stop

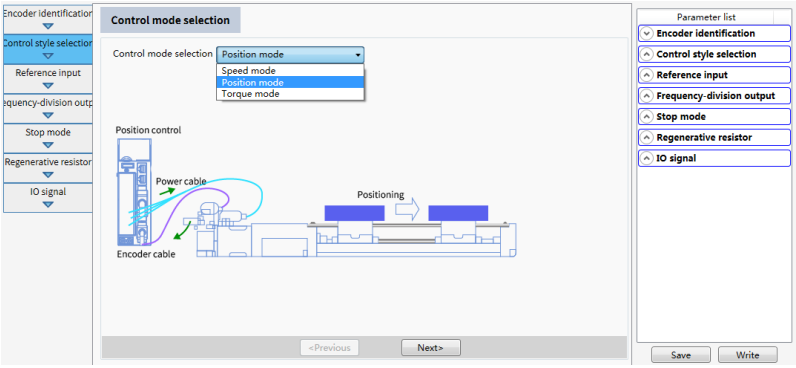
The change of H02.02 does not affect the pulse output form or the sign (+/-) of monitoring parameter values.

The direction of "forward drive" in overtravel prevention is the same as that defined by H02.02.

Control mode selection

You can select **Speed mode**, **Position mode**, or **Torque mode** in the control mode selection interface. After selecting the control mode, click **Next** to set corresponding parameters. The sub-process that needs to be set vary with the control mode. The following takes position control as an example.

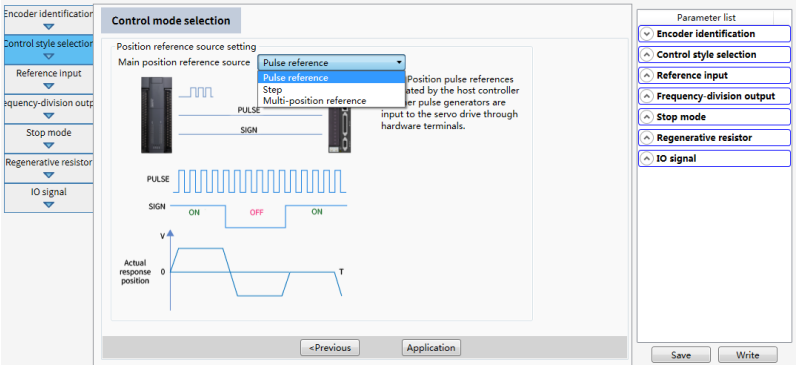
1. Select **Position mod**e in Control mode selection.



☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.00	2002-01h	Control mode	0: Speed control mode 1: Position control mode 2: Torque control mode 3: Torque/Speed control mode 4: Speed/Position control mode 5: Torque/Position control mode 6: Torque/Speed/Position compound mode 7: Process segment 8: CANopen mode	1	-	At stop

2. Select **Pulse reference** in **Main position reference source**.



☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H05.00	2005-01h	Primary position reference source	0: Pulse reference 1: Step reference 2: Multi-position reference	0	-	Real-time

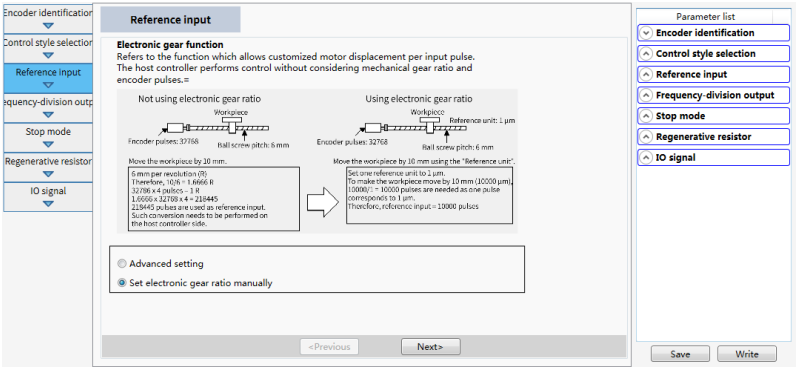
3. After setting the sub-process of the control mode, click **Application** to enter the sub-process of **Reference input**.

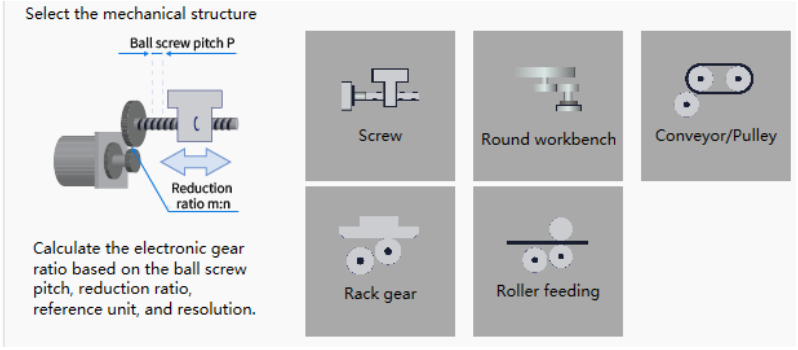
Reference input setting

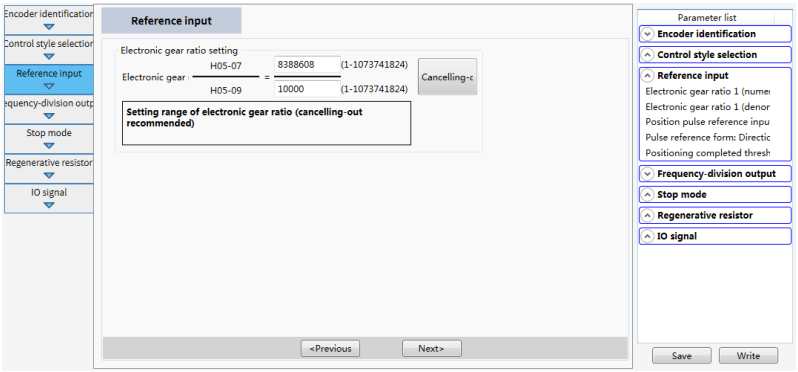
This sub-process is used to set the gear ratio, pulse access selection, reference form, and positioning completed threshold.

- The gear ratio can be set in two ways: **Advanced setting** and **Set electronic gear ratio manually**.
  Advanced setting: You can infer the gear ratio based on different mechanical transmission mode. The mechanical transmission models shown in the following figures are supported.

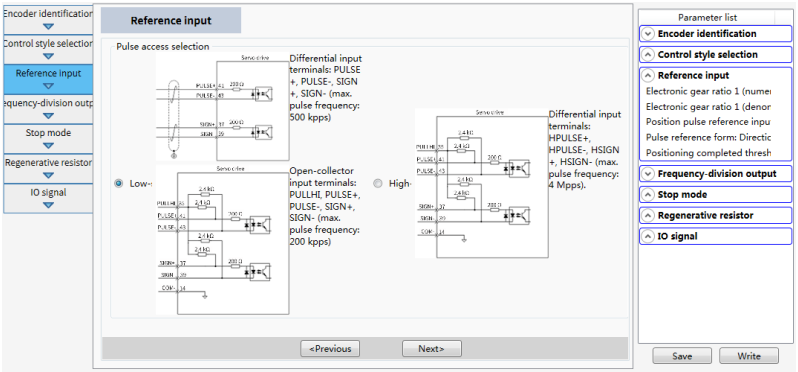
  Set electronic gear ratio manually: You can input the gear ratio manually.



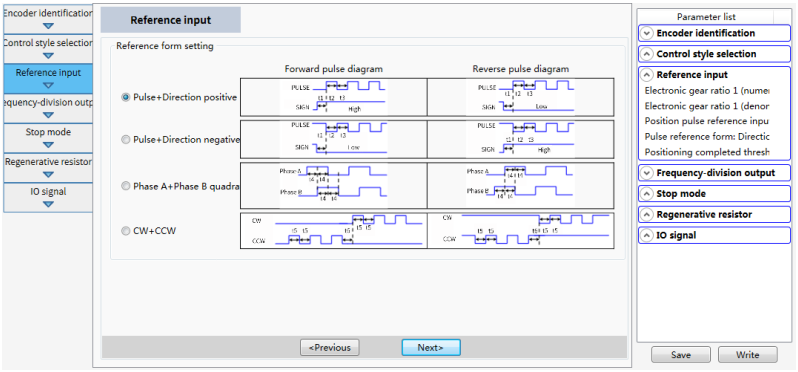




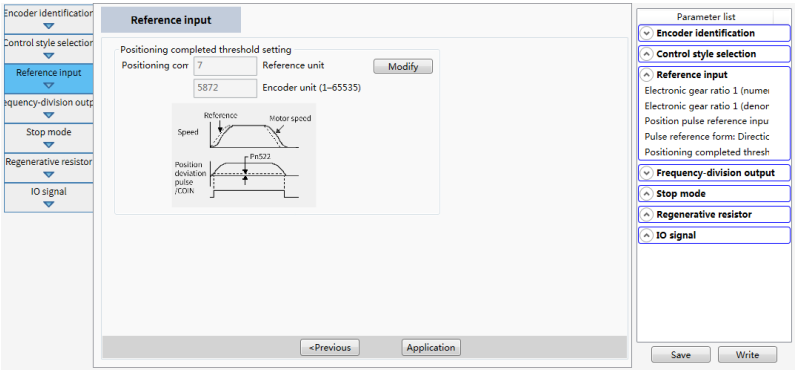
- Pulse access selection



- Reference form setting



- Positioning completed threshold setting



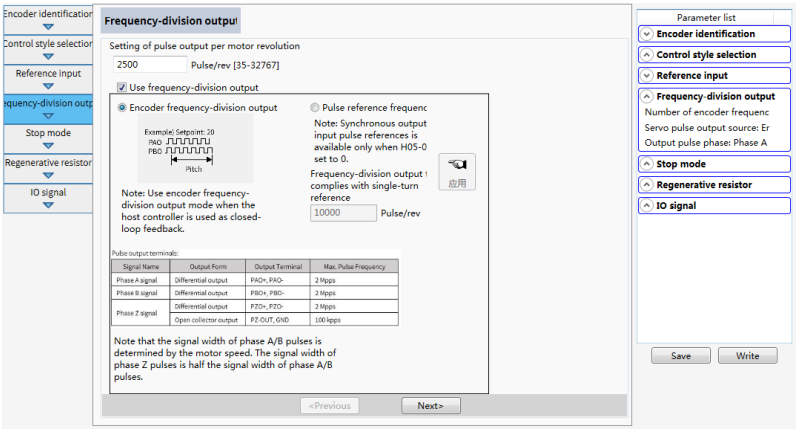
☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H05.02	2005-03h	Pulses per revolution	0–4294967295	0	[P/N-N]/[P/Rev]	At stop
H05.07	2005-08h	Electronic gear ratio 1 (numerator)	1–1073741824	67108864	-	Real-time
H05.09	2005-0Ah	Electronic gear ratio 1 (denominator)	1–1073741824	10000	-	Real-time
H05.11	2005-0Ch	Electronic gear ratio 2 (numerator)	1–1073741824	67108864	-	Real-time
H05.13	2005-0Eh	Electronic gear ratio 2 (denominator)	1–1073741824	10000	-	Real-time

Frequency-division output

This sub-process is mainly used to set the encoder frequency-division output, pulse output source, and pulse output feedback direction.

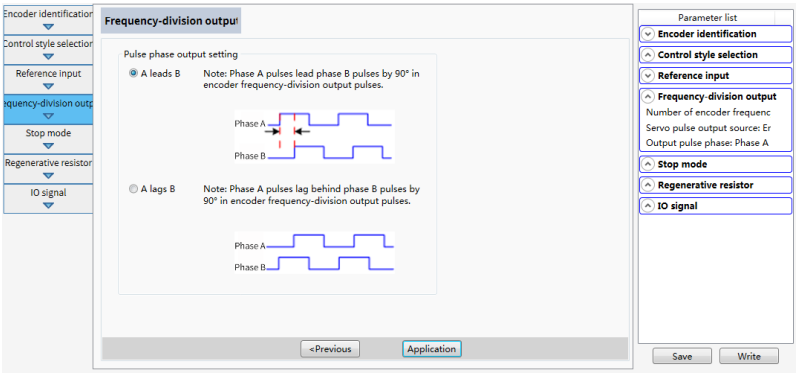
- Encoder frequency-division output



☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H05.17	2005-12h	Number of encoder frequency-division pulses	0–4194303	2500	[P/N-N]/[P/Rev]	At stop

- Pulse output source



☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.03	2002-04h	Output pulse phase	0: Phase A leads phase B 1: Phase A lags behind phase B	0	-	At stop

The change of H02.02 does not affect the pulse output form or the sign (+/-) of monitoring parameter values.

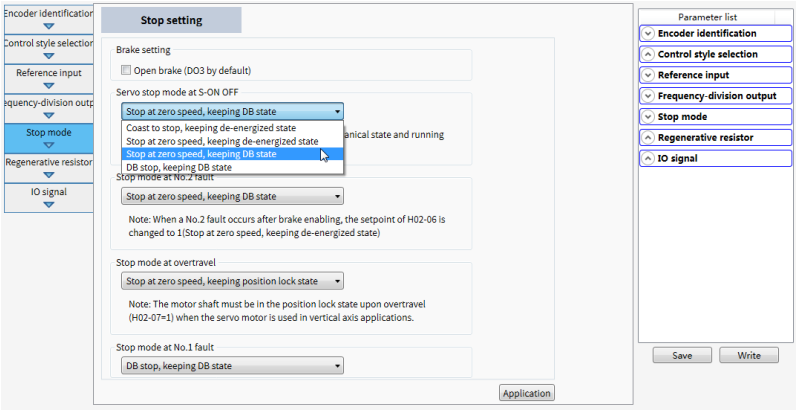
The direction of "forward drive" in overtravel prevention is the same as that defined by H02.02.

The output pulse of the servo drive is phase A + phase B quadrature pulse. The relationship between phase A and phase B pulses can be changed directly through H02.03.

Stop mode

The stop modes include Brake setting, Servo stop mode at S-ON OFF, Stop mode at No.2 fault, Stop mode at overtravel, and Stop mode at No.1 fault.

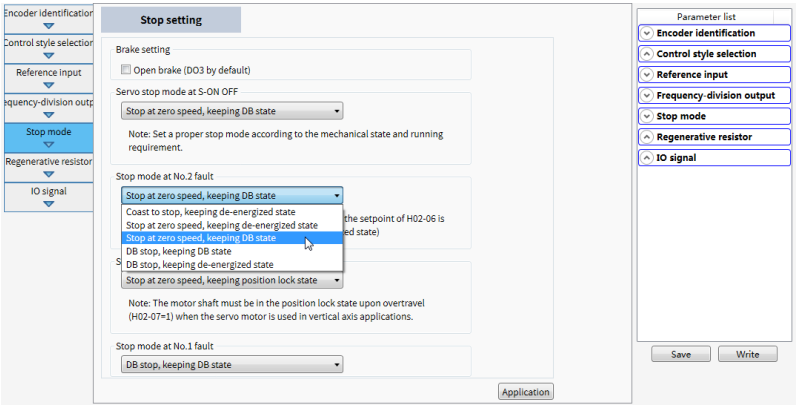
1. Select whether to use the brake in **Brake setting**.
2. Select the stop mode for stop at S-ON OFF.



☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.05	2002-06h	Stop mode at S-ON OFF	-4: Stop based on ramp 2, keeping dynamic braking state -3: Stop at zero speed, keeping dynamic braking state -2: Stop based on ramp 1, keeping dynamic braking state -1: Dynamic braking stop, keeping dynamic braking state 0: Coast to stop, keeping de-energized state 1: Stop based on ramp 1, keeping de-energized state 2: Dynamic braking stop, keeping de-energized state	0	-	Real-time

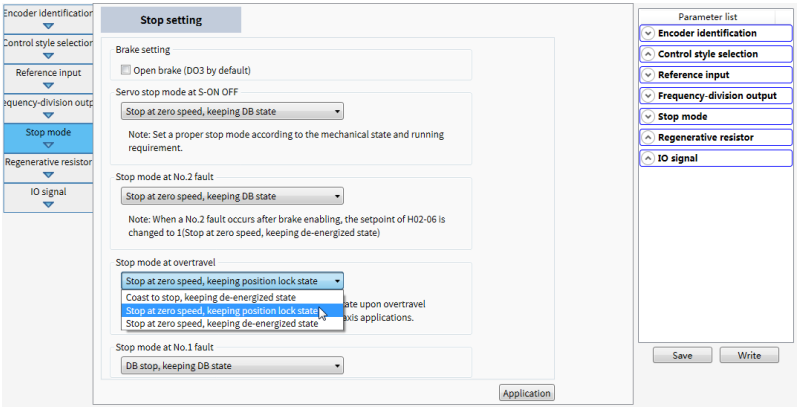
3. Select the stop mode at No.2 fault.



☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.06	2002-07h	Stop mode at No.2 fault	-5: Stop at zero speed, keeping dynamic braking state -4: Stop at emergency stop torque, keeping dynamic braking state -3: Stop based on ramp 2, keeping dynamic braking state -2: Stop based on ramp 1, keeping dynamic braking state -1: Dynamic braking stop, keeping dynamic braking state 0: Coast to stop, keeping de-energized state 1: Stop based on ramp 1, keeping de-energized state 2: Stop based on ramp 2, keeping de-energized state 3: Stop at emergency stop torque, keeping de-energized state 4: Dynamic braking stop, keeping de-energized state	2	-	Real-time

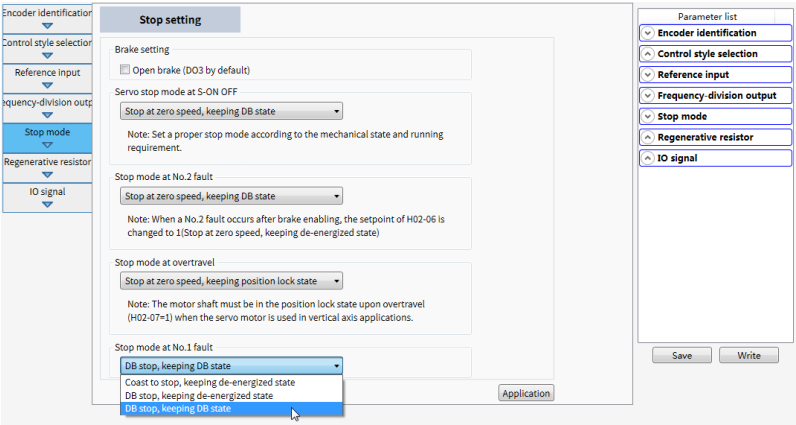
4. Select the stop mode at overtravel.



☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.07	2002-08h	Stop mode at overtravel	0: Coast to stop, keeping de-energized state 1: Stop at zero speed, keeping position lock state 2: Stop at zero speed, keeping de-energized state 3: Stop based on ramp 2, keeping de-energized state 4: Stop based on ramp 2, keeping position lock state 5: Dynamic braking stop, keeping de-energized state 6: Dynamic braking stop, keeping dynamic braking state 7: Not responding to overtravel	1	-	At stop

5. Select the stop mode at No.1 fault.



☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.08	2002-09h	Stop mode at No.1 fault	0: Coast to stop, keeping de-energized state 1: Dynamic braking stop, keeping de-energized state 2: Dynamic braking stop, keeping dynamic braking state	2	-	At stop

Brake setting

The brake is used to prevent the motor shaft from moving and lock the position of the motor and the motion part when the drive is in the non-operational status.

Caution

- Use the built-in brake for position-lock purpose only. Do not use this brake for any other purposes (such as braking) other than position lock in the stop state.
- The brake coil has no polarity.
- After the motor stops, switch off the S-ON signal.
- When the motor with brake runs, the brake may generate a click sound, which does not affect its function.
- If instruments such as a magnetic sensor is operating near the motor, flux leakage may occur on the motor shaft end when brake coils are energized (brake released).

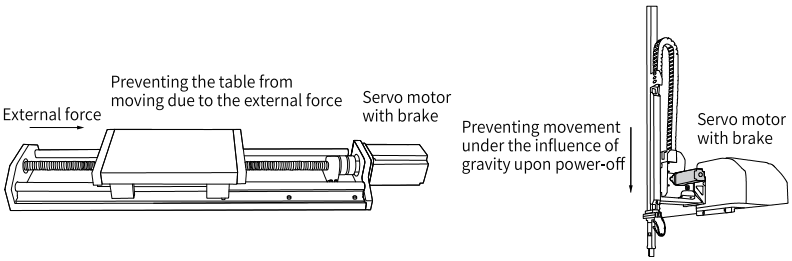


Figure 6-7 Application of the brake

Table 6–6 Brake specifications

Motor Model	Holding Torque (N·m)	Supply Voltage (VDC) ±10%	Rated power (W)	Coil Resistance (Ω)±7%	Exciting Current (A)	Release Time (ms)	Apply Time (ms)	Backlash (°)
MS1H1-05B/10B MS1H4-10B	0.32	24	6.1	94.4	0.25	⩽ 20	⩽ 40	⩽ 1.5
MS1H1-20B/40B MS1H4-20B/40B	1.5		7.6	75.79	0.32	⩽ 20	⩽ 60	⩽ 1.5
MS1H1-75B/10C MS1H4-75B/10C	3.2		10	57.6	0.42	⩽ 40	⩽ 60	⩽ 1
MS1H2-10C/ 15C/20C/25C	8		17.6	32.73	0.73	⩽ 40	⩽ 100	⩽ 1
MS1H2-30C/ 40C/50C	16		24	24	1	⩽ 60	⩽ 120	⩽ 1
MS1H3-85B/ 13C/18C	16		24	24	1	⩽ 60	⩽ 120	⩽ 1
MS1H3-29C/ 44C/55C/75C	50		31	18.58	1.29	⩽ 100	⩽ 200	⩽ 1

Note

- Do not use a holding brake for braking.
- The release time and operation time of the brake depend on the discharge circuit. Be sure to confirm the operation delay of your equipment before use.
- You need to prepare the 24 VDC power supply yourself.

- Brake software setting
  For the motor with a brake, use BK+/BK– of CN8 on the servo drive and set H02.16 to 1.

  The operating sequences of the brake are different in the normal state and fault state.

☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.16	2002-11h	Brake enable switch	0: OFF 1: ON	0	-	Real-time

- Brake sequence in normal state
  The brake sequence in the normal state is further divided into the following two types:
  - Standstill: The actual motor speed is lower than 20 RPM.
  - Rotating: The motor speed is equal to or higher than 20 RPM.
- Brake sequence for motor at standstill
  If the servo enabling (S-ON) signal changes from ON to OFF, and the present motor speed is lower than 20 RPM, the servo drive acts according to the brake time sequence in the static state of the motor.

- After the brake output signal changes from "OFF" to "ON", do not input a position/speed/torque reference within the time defined by H02.09. Otherwise, reference loss or an operation error may occur.
- When the motor is used to drive a vertical axis, the motion part may move slightly under the influence of gravity or external force. If the S-ON signal is switched off, the brake output is set to "OFF" immediately when the motor is at standstill. However, within the time defined by H02.10, the motor is still energized, preventing the load from moving under the influence of gravity or external force.

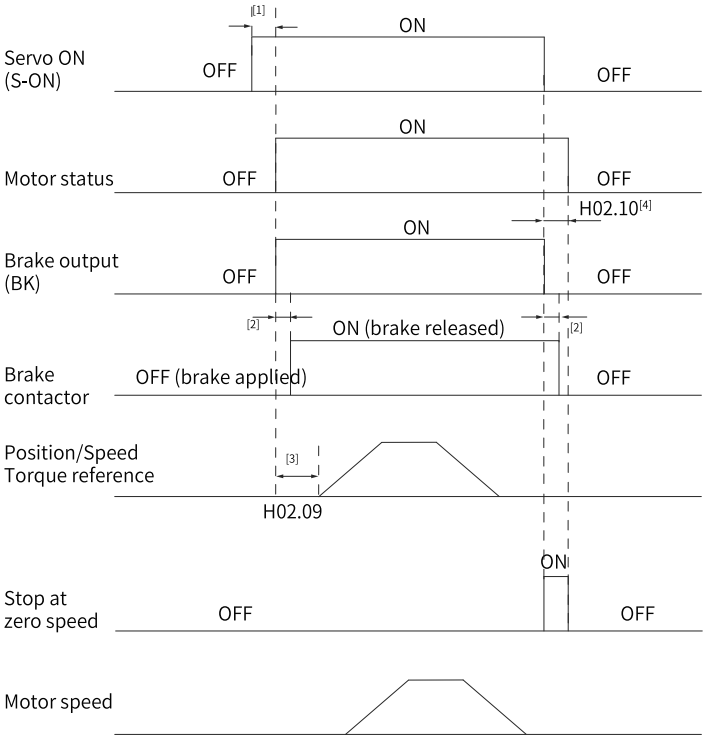


Figure 6-8 Brake sequence for motor at standstill

Note

- [1]: When the S-ON signal is switched on, the brake output is set to "ON" at a delay of about 80 ms, with motor being energized at the same time.
- [2]: For delay of brake contactor actions, see *"Table 6–6 " on page 108*.
- [3]: The interval time, starting from the moment when brake output is set to "ON" to the moment when a command is input, must be higher than the setpoint of H02.09.
- [4]: When the S-ON signal is switched off with motor at standstill (motor speed lower than 20 rpm), the brake output is set to "OFF". You can set in H02.10 the delay of the motor in entering the de-energized state after the brake output is set to "OFF".

☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.09	2002-0Ah	Delay from brake output ON to command received	0 ms to 500 ms	250	ms	Real-time
H02.10	2002-0Bh	Delay from brake output OFF to motor de-energized	50 ms to 1000 ms	150	ms	Real-time

- Brake sequence for motor in the rotation state
  If the S-ON signal changes from ON to OFF, and the present motor speed is equal to or higher than 20 RPM, the servo drive acts according to the brake time sequence in motor rotating state.

- When the S-ON signal is switched on, do not input a position/speed/torque reference within the time defined by H02.09. Otherwise, reference loss or an operation error may occur.
- If the S-ON signal is switched off when the motor is still rotating, the motor enters the "Stop at zero speed" state, but the brake output can be set to "OFF" only when one of the following conditions is met:
  - The motor has decelerated to the value defined by H02.11, but the time defined by H02.12 is not reached.
  - The time defined by H02.12 has been reached, but the motor speed is still higher than the value defined by H02.11.
- The motor is still energized within 50 ms after the brake output changes from "ON" to "OFF". This is to prevent the motion parts from moving under the influence of gravity or external force.

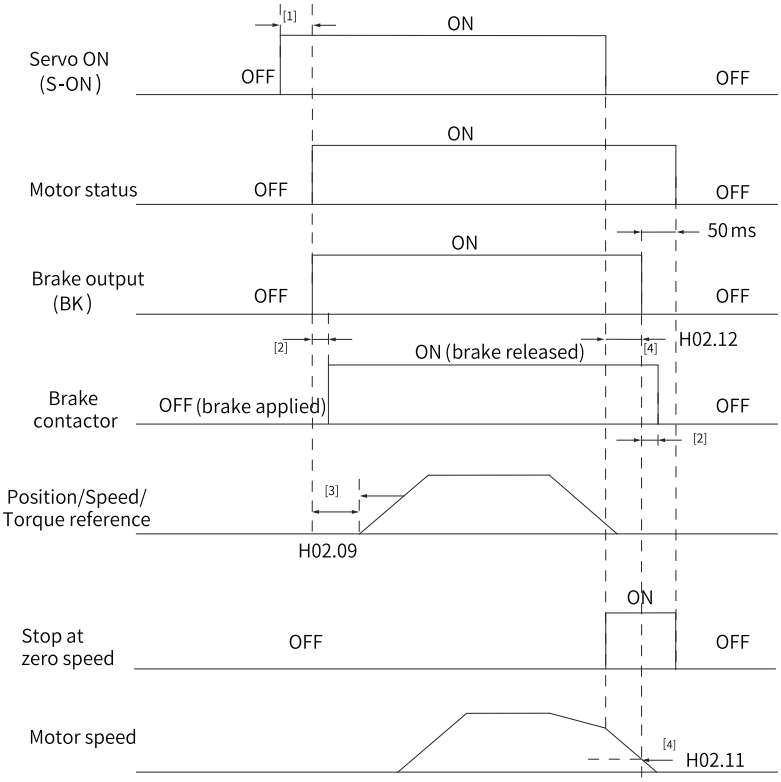


Figure 6-9 Brake sequence for a rotating motor

Note

- [1]: When the S-ON signal is switched on, the brake output is set to "ON" at a delay of about 80 ms, with motor being energized at the same time.
- [2]: For delay of brake contactor actions, see *"Table 6–6 " on page 108*.
- [3]: The interval time, starting from the moment when brake output is set to "ON" to the moment when a command is input, must be higher than the setpoint of H02.09.
- [4]: When the motor is rotating and S-ON is OFF, the motor enters a non-energized state when the brake outputs OFF after the delay set in H02.12 or the speed feedback is less than H02.11.

☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.11	2002-0Ch	Motor speed threshold at brake output OFF in rotation state	20[mm/s]/[rpm]–3000[mm/s]/[rpm]	30	[mm/s]/[rpm]	Real-time
H02.12	2002-0Dh	Delay from S-ON OFF to brake output OFF in rotation state	1 ms to 65535 ms	500	ms	Real-time

- Brake sequence in the fault state
  Servo drive faults can be classified into No. 1 faults and No. 2 faults based on the stop mode, see Chapter "Troubleshooting" for details. The brake sequences in the fault state are further divided into the following two types:
  - In case of No. 1 faults:
    The condition for brake output is the same as the brake sequence for the motor in the rotation state. Which is to say: The brake output can be set to "OFF" only when any one of the following conditions is met:
    - The motor has decelerated to the value defined by H02.11, but the time defined by H02.12 is not reached.
    - The time defined by H02.12 has been reached, but the motor speed is still higher than the value defined by H02.11.
  - In case of No. 2 faults:
    When a No. 2 fault occurs and the brake is enabled, the stop mode is forced to "Stop at zero speed, keeping dynamic braking status".

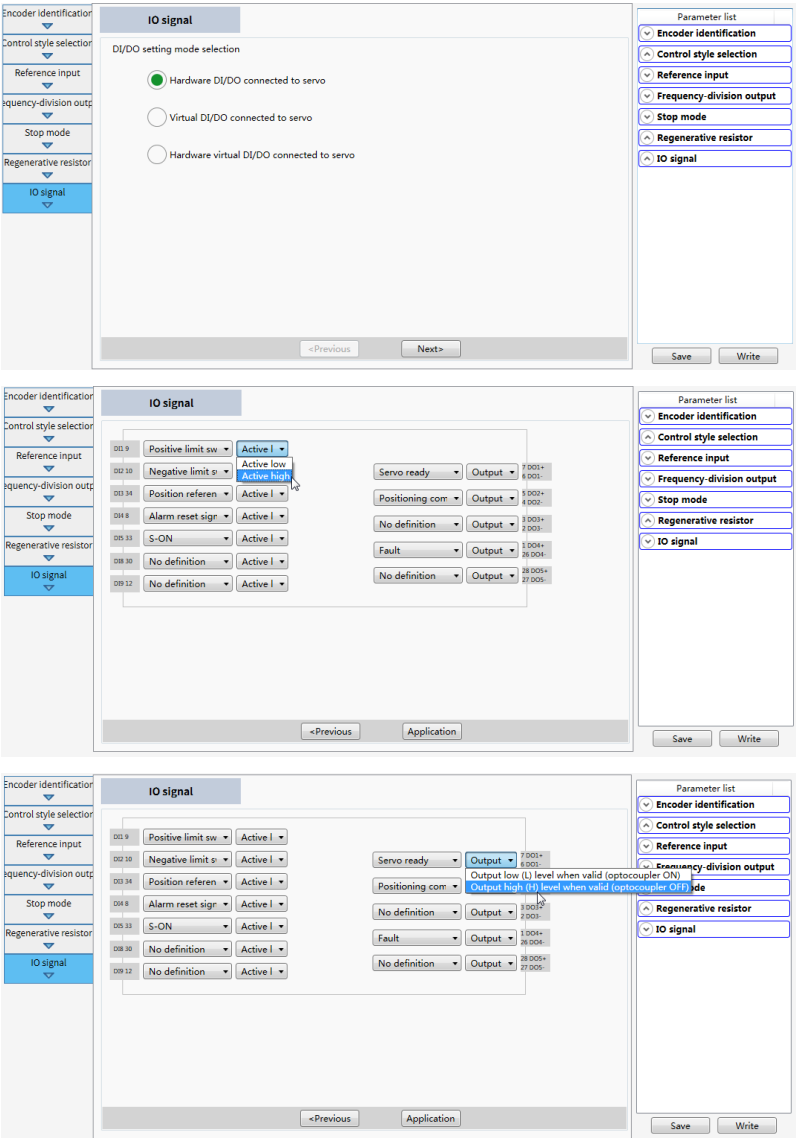
    In this case, the servo motor stops at zero speed first. When the actual motor speed is lower than 20 RPM, the brake output signal immediately becomes OFF, but the motor is still in the energized state within the time defined by H02.10.

Input/Output signal setting

The input/output signal setting is the same as "DI/DO setting mode selection".

The DI/DO setting modes include "Hardware DI/DO connected to servo", "Virtual DI/DO connected to servo", and "Hardware virtual DI/DO connected to servo".

The corresponding default function will be generated based on different control modes selected in "Control Mode", or you can define the function as needed.



General parameters of the servo drive are set.

After preceding steps are done, you can view all the configured parameters in **Parameter list**. If parameters in the sub-process need to be adjusted, click the corresponding table to enter the sub-process directly and reset parameters.

After confirming parameters are set correctly, click **Write** to write parameters to the drive or click **Save** to save parameters as a recipe.

6.9 Parameter Settings (N)

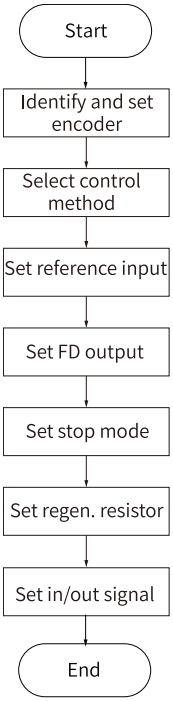


Figure 6-10 General parameter setting flowchart

Encoder identification and settings

Check whether parameter H00.00 (motor SN) matches the motor.

Set H02.02 (rotation direction) to change the rotation direction directly without changing the input command polarity.

☆Related parameters

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H00.00	2000-01h	Motor SN	20000: Linear motor - Pulse-type encoder 14203: Linear motor - BiSS-C encoder 14206: Linear motor - SSI encoder 14207: Linear motor - EnDat 2.2 encoder 14202: Linear motor - Inovance communication-type 23-bit encoder 14205: Linear motor - Inovance interpolator 23-bit encoder 20001: DDR motor - Pulse-type encoder 14210: DDR motor - Inovance interpolator 23-bit encoder 14201: DDR motor - Inovance communication-type 23-bit encoder 14211: DDR motor - BiSS-C encoder 14212: DDR motor - EnDat 2.2 encoder 14213: DDR motor - SSI encoder 20002: Rotary motor - Pulse-type encoder 14000: Rotary motor - Inovance communication-type 20-bit encoder	14102	-	At stop

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H00.00	2000-01h	Motor SN	14101: Rotary motor - Inovance communication-type 23-bit encoder 14102: Rotary motor - Inovance communication-type 26-bit encoder 14020: Rotary motor - Harmonic 20-bit encoder (baud rate: 2.5 Mbps, single-turn) 14021: Rotary motor - Harmonic 17-bit encoder (baud rate: 2.5 Mbps, single-turn) 14022: Rotary motor - Harmonic 17-bit encoder (baud rate: 4 Mbps, single-turn) 14120: Rotary motor - Nikon 20-bit encoder (baud rate: 2.5 Mbps, multi-turn) 14121: Rotary motor - Nikon 17-bit encoder (baud rate: 2.5 Mbps, multi-turn) 14122: Rotary motor - Nikon 17-bit encoder (baud rate: 4 Mbps, multi-turn) 14130: Rotary motor - TAMAGAWA 17-bit encoder 14131: Rotary motor - TAMAGAWA 23-bit encoder 14140: Rotary motor - EnDat 2.2 encoder 14150: Rotary motor - SSI encoder 14160: Rotary motor - BiSS-C encoder	14102	-	At stop

The change of H02.02 does not affect the pulse output form or the sign (+/-) of monitoring parameter values.

The direction of "forward drive" in overtravel prevention is the same as that defined by H02.02.

Setting electronic gear ratio

☆Related parameters

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
6091.01h	6091-01h	Motor resolution	1–4294967295	1	-	At stop
6091.02h	6091-02h	Shaft resolution	1–4294967295	1	-	At stop

Setting stop mode

The stop modes include "Brake setting", "Servo stop mode at S-ON OFF", "Stop mode at No.2 fault", "Stop mode at overtravel", and "Stop mode at No.1 fault".

1. Select whether to use the brake in "Brake setting".

☆Related parameters

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H02.16	2002-11h	Brake enable switch	0: OFF 1: ON	0	-	Real time

2. Select the stop mode for stop at S-ON OFF.

☆ Related parameters:

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H02.05	2002-06h	Stop mode at S-ON OFF	–4: Ramp to stop as defined by 6085h, keeping dynamic braking state –3: Stop at zero speed, keeping dynamic braking state –2: Ramp to stop as defined by 6084h/609Ah (HM), keeping dynamic braking state –1: Dynamic braking stop, keeping dynamic braking state 0: Coast to stop, keeping de-energized state 1: Ramp to stop as defined by 6084h/609Ah (HM), keeping de-energized state 2: Dynamic braking stop, keeping de-energized state	0	-	Real time

3. Stop mode at No .2 fault

☆ Related parameters

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H02.06	2002-07h	Stop mode at NO.2 fault	–5: Stop at zero speed, keeping dynamic braking state –4: Stop at emergency stop torque, keeping dynamic braking state –3: Ramp to stop as defined by 6085h, keeping dynamic braking state –2: Ramp to stop as defined by 6084h/ 609Ah (HM), keeping dynamic braking state –1: Dynamic braking stop, keeping dynamic braking state 0: Coast to stop, keeping de-energized state 1: Ramp to stop as defined by 6084h/ 609Ah (HM), keeping de-energized state 2: Ramp to stop as defined by 6085h, keeping de-energized state 3: Stop at emergency stop torque, keeping de-energized state 4: Dynamic braking stop, keeping de-energized state	2	-	Real time

4. Select the stop mode at overtravel.

☆ Related parameters

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H02.07	2002-08h	Stop mode at overtravel	0: Coast to stop, keeping de-energized state 1: Stop at zero speed, keeping position lock state 2: Stop at zero speed, keeping de-energized state 3: Ramp to stop as defined by 6085h, keeping de-energized state 4: Ramp to stop as defined by 6085h, keeping position lock state 5: Dynamic braking stop, keeping de-energized state 6: Dynamic braking stop, keeping dynamic braking state 7: Not responding to overtravel	1	-	At stop

5. Stop mode at No. 1 fault

☆ Related parameters

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H02.08	2002-09h	Stop mode at NO.1 fault	0: Coast to stop, keeping de-energized state 1: Dynamic braking stop, keeping de-energized state 2: Dynamic braking stop, keeping dynamic braking state	2	-	At stop

Setting brake

The brake is used to prevent the servo motor shaft from moving and lock the motor position when the servo drive is not running. This is to keep the mechanical motion parts from moving due to gravity or external forces.

Caution

- Use the built-in brake for position-lock purpose only. Do not use this brake for any other purposes (such as braking) other than position lock in the stop state.
- The brake coil has no polarity.
- After the motor stops, switch off the S-ON signal.
- When the motor with brake runs, the brake may generate a click sound, which does not affect its function.
- If instruments such as a magnetic sensor is operating near the motor, flux leakage may occur on the motor shaft end when brake coils are energized (brake released).

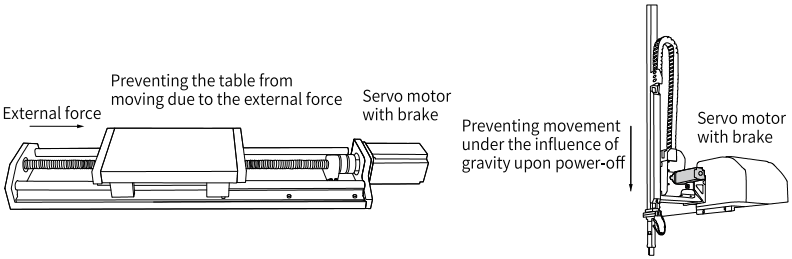


Figure 6-11 Application of the brake

Table 6–7 Brake specifications

Motor Model	Holding Torque (N·m)	Power Supply Voltage (VDC) ±10%	Rated Power (W)	Coil Resistance (Ω) (±7%)	Exciting current (A)	Release Time (ms)	Apply Time (ms)	Backlash (°)
MS1H1-05B/10B MS1H4-10B	0.32	24	6.1	94.4	0.25	⩽ 20	⩽ 40	⩽ 1.5
MS1H1-20B/40B MS1H4-20B/40B	1.5		7.6	75.79	0.32	⩽ 20	⩽ 60	⩽ 1.5
MS1H1-75B/10C MS1H4-75B/10C	3.2		10	57.6	0.42	⩽ 40	⩽ 60	⩽ 1
MS1H2-10C/ 15C/20C/25C	8		17.6	32.73	0.73	⩽ 40	⩽ 100	⩽ 1
MS1H2-30C/ 40C/50C	16		24	24	1	⩽ 60	⩽ 120	⩽ 1
MS1H3-85B/ 13C/18C	16		24	24	1	⩽ 60	⩽ 120	⩽ 1
MS1H3-29C/ 44C/55C/75C	50		31	18.58	1.29	⩽ 100	⩽ 200	⩽ 1

Note

- Do not use a holding brake for braking.
- The release time and operation time of the brake depend on the discharge circuit. Be sure to confirm the operation delay of your equipment before use.
- You need to prepare the 24 VDC power supply yourself.

- Brake software setting
  For the servo motor with a brake, use BK+/BK– of CN8 on the servo drive and set H02.16 to 1.

  The operating time sequences of the brake are different between normal state and fault state of the servo drive.

  ☆ Related parameters

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H02.16	2002-11h	Brake enable switch	0: OFF 1: ON	0	-	Real time

- Brake time sequence in the normal state of the servo drive
  The brake time sequence in the normal state of the servo drive changes with the motor state (static and rotation).

- Static: The actual motor speed is smaller than 20 RPM.
- Rotation: The actual motor speed is equal to or larger than 20 RPM.

- Brake time sequence for the motor in the static state
  If the servo enabling signal (S-ON) changes from ON to OFF, and the current motor speed is smaller than 20 RPM, the servo drive acts according to the brake time sequence for the motor in the static state.

- After the brake output signal changes from "OFF" to "ON", do not input a position/speed/torque reference within the time defined by H02.09. Otherwise, reference loss or an operation error may occur.
- When the motor is used to drive a vertical axis, the motion part may move slightly under the influence of gravity or external force. If the S-ON signal is switched off, the brake output is set to "OFF" immediately when the motor is at standstill. However, within the time defined by H02.10, the motor is still energized, preventing the load from moving under the influence of gravity or external force.

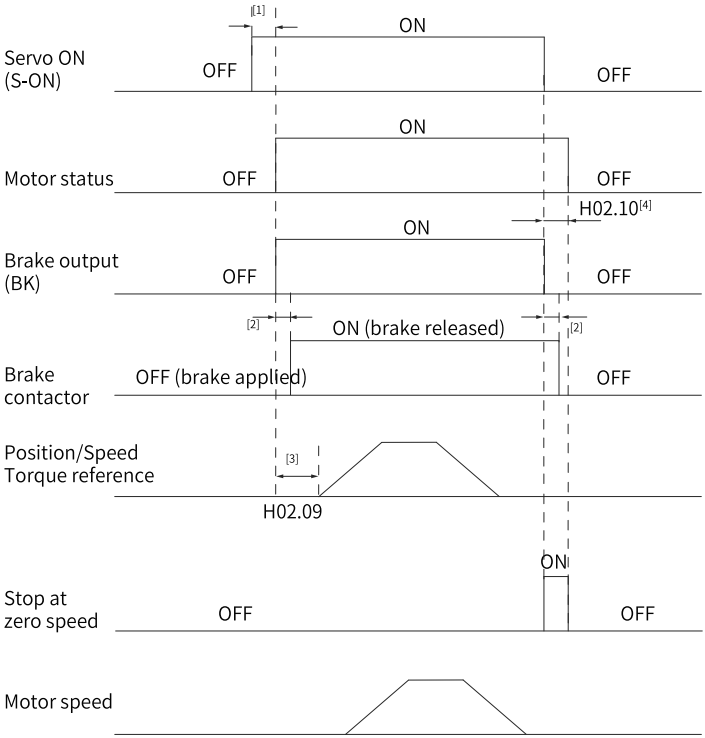


Figure 6-12 Brake time sequence for the motor in the static state

Note

- [1]: When the S-ON signal is switched on, the brake output is set to "ON" at a delay of about 80 ms, with motor being energized at the same time.
- [2]: For delay of brake contactor actions, see *"Table 6–7 " on page 121*.
- [3]: The interval time, starting from the moment when brake output is set to "ON" to the moment when a command is input, must be higher than the setpoint of H02.09.
- [4]: When the S-ON signal is switched off with motor at standstill (motor speed lower than 30 rpm), the brake output is set to "OFF". You can set in H02.10 the delay of the motor in entering the de-energized state after the brake output is set to "OFF".

☆ Related parameters

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H02.09	2002-0Ah	Delay from brake output ON to command received	0 to 500	250	ms	Real time
H02.10	2002-0Bh	Delay from brake output OFF to motor de-energized	50 ms to 1000 ms	150	ms	Real time

- Brake sequence of the motor in the rotation state
  If the servo enabling signal (S-ON) changes from OFF to ON, and the current motor speed is equal to or larger than 20 RPM, the servo drive acts according to the brake time sequence for the motor in the rotation state.

Caution

- When the S-ON signal is switched on, do not input a position/speed/torque reference within the time defined by H02.09. Otherwise, reference loss or an operation error may occur.
- If the S-ON signal is switched off when the motor is still rotating, the motor enters the "Stop at zero speed" state, but the brake output can be set to "OFF" only when one of the following conditions is met:
  - The motor has decelerated to the value defined by H02.11, but the time defined by H02.12 is not reached.
  - The time defined by H02.12 has been reached, but the motor speed is still higher than the value defined by H02.11.
- The motor is still energized within 50 ms after the brake output changes from "ON" to "OFF". This is to prevent the motion parts from moving under the influence of gravity or external force.

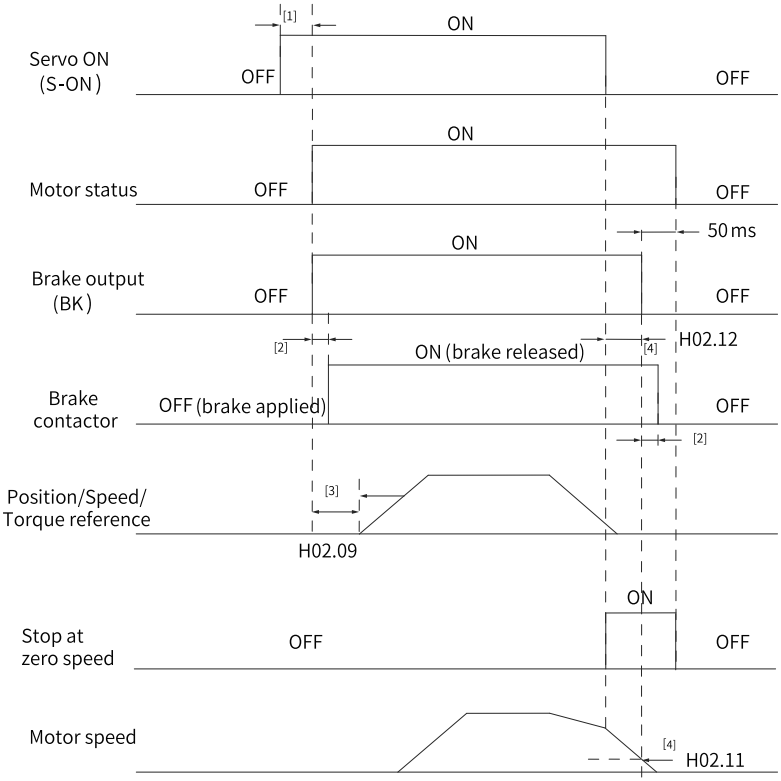


Figure 6-13 Brake time sequence for the motor in the rotation state

Note

- [1] When the S-ON signal is switched on, the brake output is set to "ON" at a delay of about 80 ms, with motor being energized at the same time.
- [2] For delay of brake contactor actions, see *"Table 6–7 " on page 121*.
- [3] The interval time, which starts from the moment when brake output is set to "ON" to the moment when a command is input, must be higher than the setpoint of H02.09.
- [4] When the S-ON signal is switched off during rotation of the motor, the motor enters the de-energized state only after the delay defined by H02.12 elapses or the speed feedback is lower than H02.11 after the brake output is off.

☆ Related parameters

Parameter Code	Communication Address	Parameter Name	Value Range	Default	Unit	Change Mode
H02.11	2002-0Ch	Motor speed threshold at brake output OFF in rotation state	20 (mm/s)/RPM to 3000 (mm/s)/RPM	30	(mm/s)/RPM	Real time
H02.12	2002-0Dh	Delay from S-ON OFF to brake output OFF in rotation state	1 ms to 65535 ms	500	ms	Real time

- Brake sequence in the fault state
  Servo drive faults can be classified into No. 1 faults and No. 2 faults based on the stop mode. See chapter "Troubleshooting" for details. The brake time sequence for the servo drive in the fault state changes with the fault class.
  - For No.1 faults:
    The condition for brake output is the same as that for the brake time sequence for the motor in the rotation state when the servo drive is normal. That is, the brake output signal becomes OFF only when one of the following conditions is met:
    - The motor has decelerated to the value defined by H02.11, but the time defined by H02.12 is not reached.
    - The time defined by H02.12 is reached, but the motor speed is still higher than the value defined by H02.11.
  - For No.2 faults:
    When a No. 2 fault occurs and the brake is enabled, the stop mode is forced to "Stop at zero speed, keeping dynamic braking status".

    In this case, the servo motor stops at zero speed first. When the actual motor speed is lower than 20 RPM, the brake output signal immediately becomes OFF, but the motor is still in the energized state within the time defined by H02.10.

Setting I/O signal

The I/O signal setting is the same as "DI/DO setting mode selection".

See *"7.3 DIDO Function Assignment [N]" on page 163* for details.

6.10 Servo Drive Operation

Switch on the S-ON signal.

When the SV680P-INT is in the ready for operation state, the keypad displays "run".
When the SV680N-INT is in the ready for operation state, the keypad displays "88rn".

If no command is input, the motor does not rotate and stays locked. After a command is input, the motor starts operation.

Table 6–8 Operation of the servo drive

No.	Item	Compliance
1	During initial operation, set a proper command to make the motor run at low speed and check whether the motor rotates properly.	☐
2	Check whether the motor rotates in the correct direction. If the direction of rotation is opposite to the expected direction, check the input command signal and the command direction setting signal.	☐
3	If the motor direction of rotation is correct, view the actual speed in H0b.00 and average load ratio in H0b.12 through the keypad or the software tool.	☐
4	After checking preceding conditions, adjust related parameters to make the motor operate as desired.	☐
5	Commission the drive according to the section of "Adjustment".	☐

Power-on sequence diagram

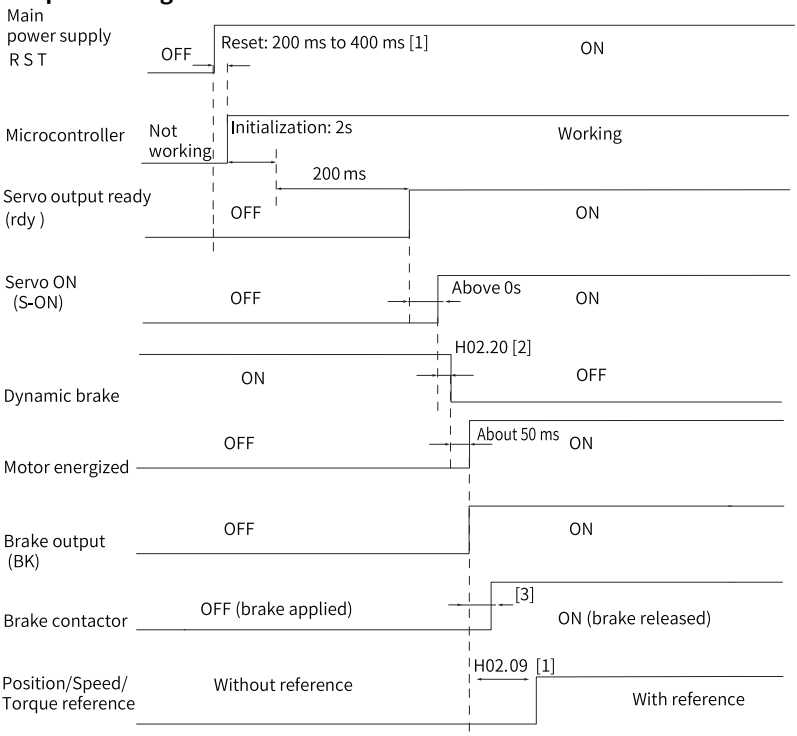


Figure 6-14 Power-on sequence diagram

Note

- [1] The DI signal used for fault reset (FunIN.2: ALM-RST) is edge triggered.
- [2] The dynamic brake is included in the standard configuration.
- [3] For the delay of brake contactor operation, see the technical data of the motor for details.
- [4] If the brake is not used, H02.09 is invalid.

Sequence diagram for stop at alarm or fault

- No. 1 fault: Coast to stop, keeping de-energized status

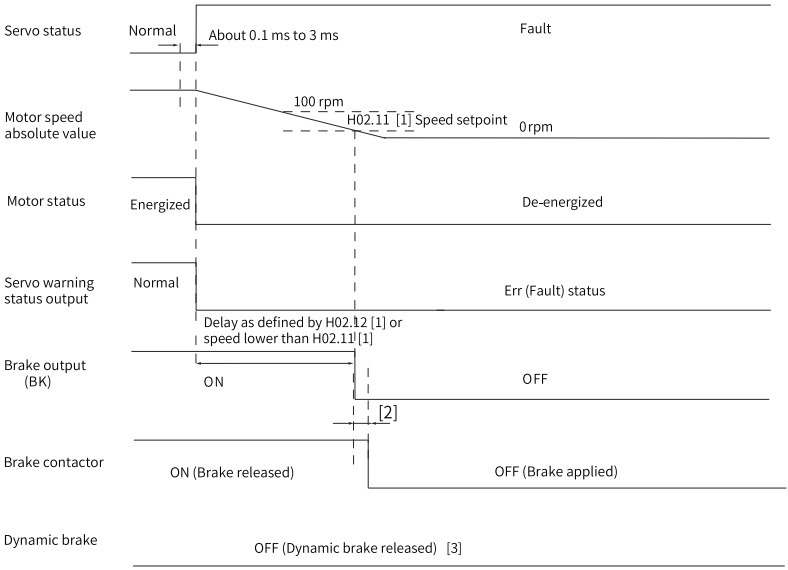


Figure 6-15 Sequence of "coast to stop, keeping de-energized state" at No. 1 fault

Note

- [1] If the brake is not used, H02.11 and H02.12 are ineffective.
- [2] For the delay of brake contactor operation, see the technical data of the motor for details.
- [3] The dynamic brake is included in the standard configuration.

- No. 1 fault (without brake): Dynamic braking stop, keeping de-energized state

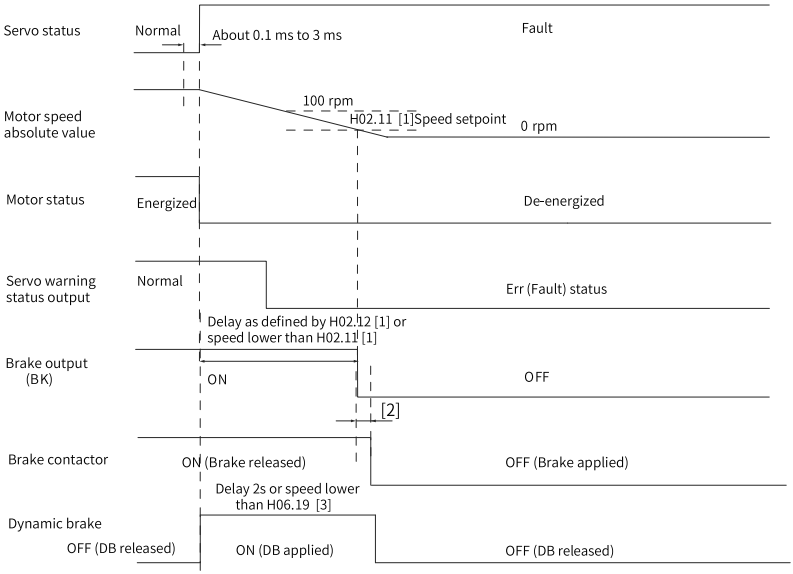


Figure 6-16 Sequence of "Dynamic braking stop, keeping de-energized state" at No. 1 fault

Note

- [1] If the brake is not used, H02.11 and H02.12 are ineffective.
- [2] For the delay of brake contactor operation, see the technical data of the motor for details.
- [3] The dynamic brake is included in the standard configuration.

- No. 1 fault: Dynamic braking stop, keeping dynamic braking state

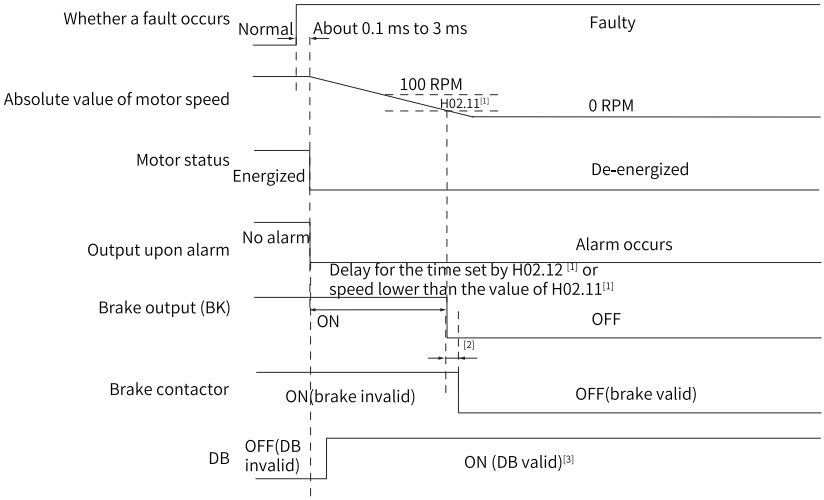


Figure 6-17 Sequence of "Dynamic braking stop, keeping dynamic braking state" at No. 1 fault

Note

- [1] If the brake is not used, H02.11 and H02.12 are ineffective.
- [2] For the delay of brake contactor operation, see the technical data of the motor for details.
- [3] The dynamic brake is included in the standard configuration.

- No. 2 fault (without brake): Coast to stop, keeping de-energized state

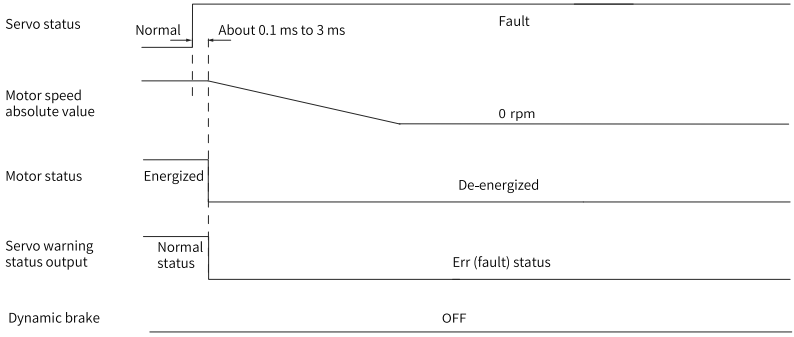


Figure 6-18 Sequence of "Coast to stop, keeping de-energized state" at No. 2 fault

- No. 2 fault (without brake): Stop at zero speed, keeping de-energized status

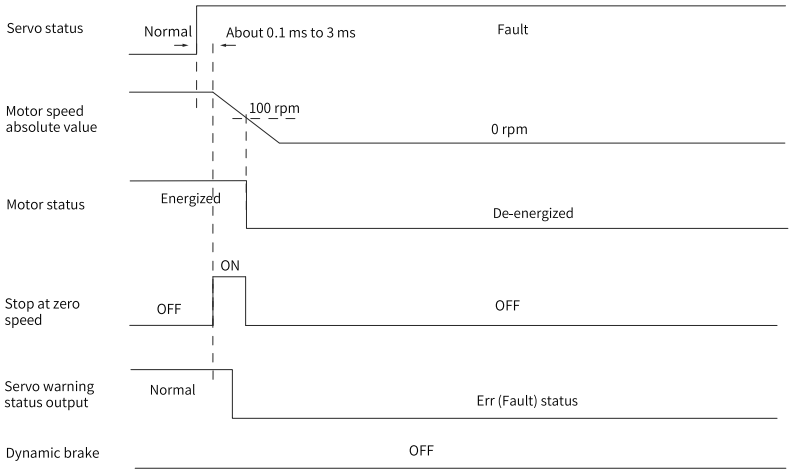


Figure 6-19 Sequence of "Stop at zero speed, keeping de-energized state" at No. 2 fault (without brake)

- No. 2 fault (without brake): Stop at zero speed, keeping dynamic braking state

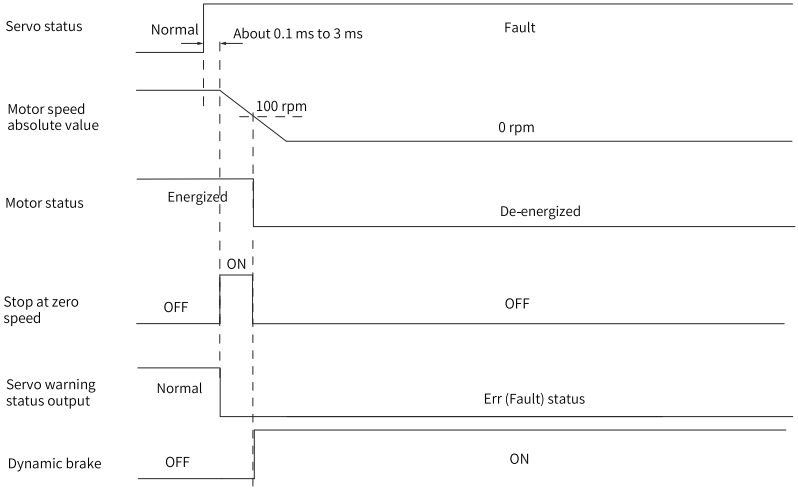


Figure 6-20 Sequence of "Stop at zero speed, keeping dynamic braking state" at No. 2 fault (without brake)

- No. 2 fault (without brake): Dynamic braking stop, keeping dynamic braking state

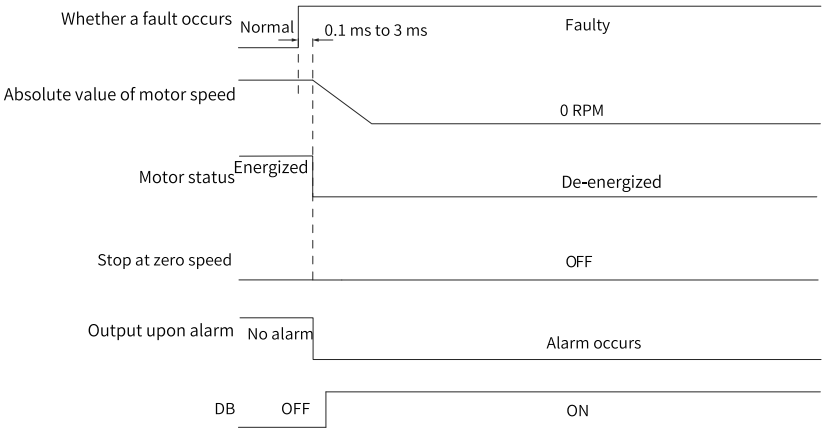


Figure 6-21 Sequence of "Dynamic braking stop, keeping dynamic braking state" at No. 2 fault (without brake)

- No. 2 fault (without brake): Dynamic braking stop, keeping de-energized state

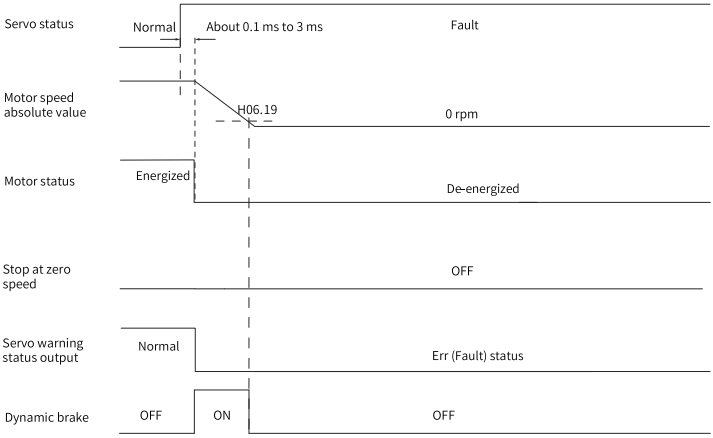


Figure 6-22 Sequence of "Dynamic braking stop, keeping de-energized state" at No. 2 fault (without brake)

- No. 2 fault (with brake): Stop at zero speed, keeping dynamic braking status

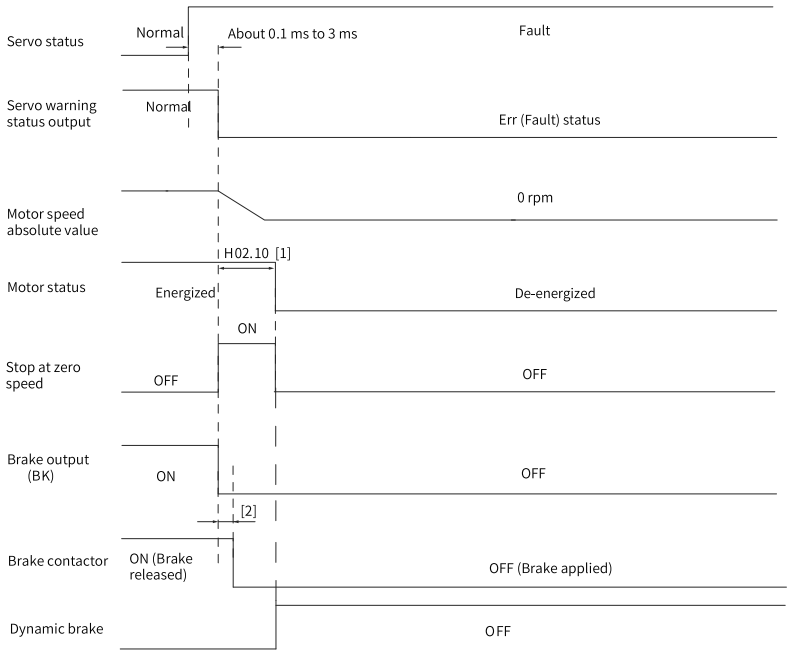


Figure 6-23 Sequence of "Stop at zero speed, keeping dynamic braking state" at No. 2 fault (with brake)

Note

- [1] If the brake is not used, H02.10 is invalid.
- [2] For the delay of brake contactor operation, see the technical data of the motor for details.

- When a No. 3 alarm occurs on the servo drive, such as E900.0 (DI emergency braking), E950.0 (Positive limit switch warning), and E952.0 (Negative limit switch warning), the servo drive stops according to *"Figure 6–24 Sequence for alarms that cause stop" on page 135*.
- Alarms for stop caused by overtravel or brake: Stop at zero speed, keeping position lock state

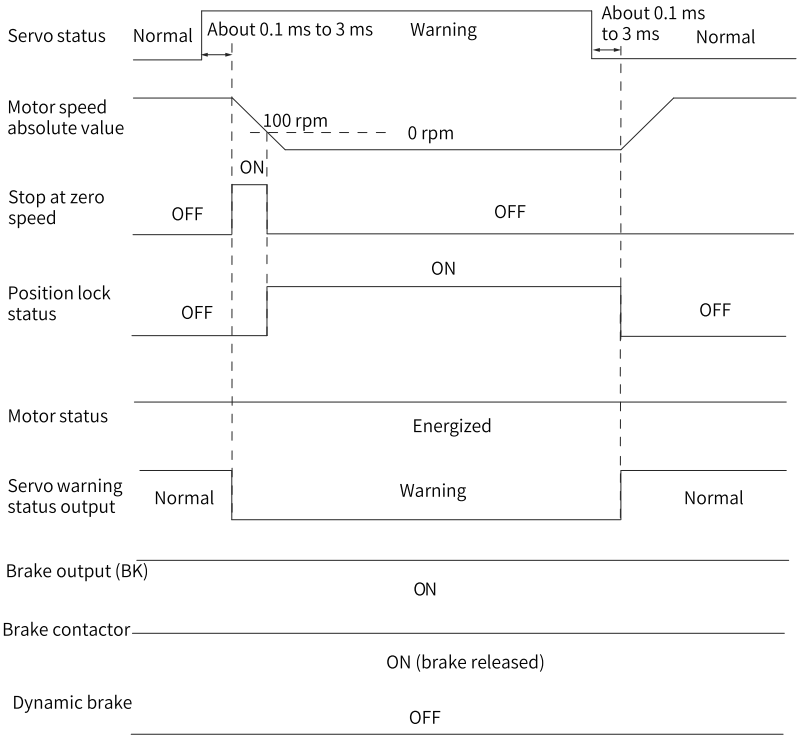


Figure 6-24 Sequence for alarms that cause stop

Other alarms do not affect the operation state of the drive. The sequence diagram for these alarms is shown in *"Figure 6–25 Sequence for alarms that do not cause stop" on page 136*.

- Alarms that do not cause stop

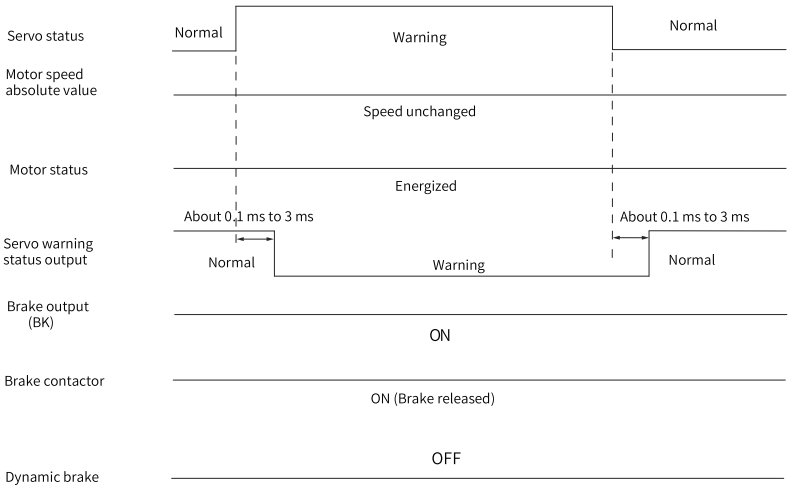


Figure 6-25 Sequence for alarms that do not cause stop

- Fault reset

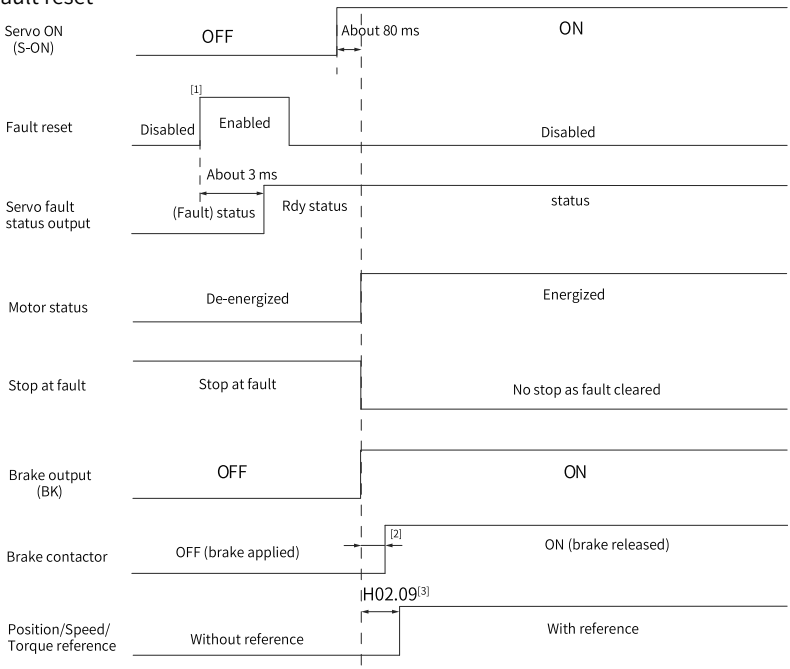


Figure 6-26 Sequence for fault reset

Note

- [1] The DI signal used for fault reset (FunIN.2: ALM-RST) is edge triggered.
- [2] For the delay of brake contactor operation, see the technical data of the motor for details.
- [3] If the brake is not used, H02.09 is invalid.

6.11 Servo OFF

Five type of stop modes are available for the servo drive: coast to stop, stop at zero speed, ramp to stop, stop at emergency-stop torque, and dynamic braking stop, along with three kinds of stop status: de-energized, position lock, and dynamic braking. See the following table for details.

Table 6–9 Comparison of the stop modes

Stop Mode	Description	Feature
Coast to stop	The motor is de-energized and coasts to 0 RPM. The deceleration time is affected by the mechanical inertia and mechanical friction.	This mode features smooth and slow deceleration with small mechanical shock.
Stop at zero speed	The motor decelerates to 0 rpm immediately and stops.	Features quick deceleration with obvious mechanical shock.
Ramp to stop	The motor decelerates to 0 rpm smoothly upon position/speed/torque reference input.	Features smooth and controllable deceleration with small mechanical shock.
Stop at emergency-stop torque	The servo drive outputs reverse braking torque to stop the motor.	Features quick deceleration with obvious mechanical shock.
Dynamic braking	The motor is in the dynamic braking status.	Features quick deceleration with obvious mechanical shock.

Table 6–10 Comparison of the stop status

Stop Status	Description
De-energized	The motor is de-energized and the motor shaft can be rotated freely after the motor stops rotating.
Position Lock	The motor shaft is locked and cannot be rotated freely after the motor stops rotating.
DB state	The motor is de-energized and the motor shaft can be rotated freely after the motor stops rotating.

The stop events can be divided into the following types: stop at S-ON OFF, stop at fault, stop at overtravel, emergency stop, quick stop, and halt. See the following descriptions for details.

Stop at S-ON OFF

Deactivate the S-ON signal through communication to make the drive stop according to the stop mode at S-ON OFF.

☆ Related parameters: [P]

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.05	2002-06h	Stop mode at S-ON OFF	-4: Stop based on ramp 2, keeping dynamic braking state -3: Stop at zero speed, keeping dynamic braking state -2: Stop based on ramp 1, keeping dynamic braking state -1: Dynamic braking stop, keeping dynamic braking state 0: Coast to stop, keeping de-energized state 1: Stop based on ramp 1, keeping de-energized state 2: Dynamic braking stop, keeping de-energized state	0	-	Real-time

☆ Related parameters: [N]

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.05	2002-06h	Stop mode at S-ON OFF	–4: Ramp to stop as defined by 6085h, keeping dynamic braking state –3: at zero speed, keeping dynamic braking state –2: Ramp to stop as defined by 6084h/609Ah (HM), keeping dynamic braking state –1: Dynamic braking stop, keeping dynamic braking state 0: Coast to stop, keeping de-energized state 1: Ramp to stop as defined by 6084h/609Ah (HM), keeping de-energized state 2: Dynamic braking stop, keeping de-energized state	0	-	Real-time

Fault reaction

The stop mode varies according to the fault type. For fault classification, see section "Troubleshooting" of SV680-INT Series Servo Drive Function Guide.

☆ Related parameters: [P]

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.06	2002-07h	Stop mode at No.2 fault	-5: Stop at zero speed, keeping dynamic braking state -4: Stop at emergency stop torque, keeping dynamic braking state -3: Stop based on ramp 2, keeping dynamic braking state -2: Stop based on ramp 1, keeping dynamic braking state -1: Dynamic braking stop, keeping dynamic braking state 0: Coast to stop, keeping de-energized state 1: Stop based on ramp 1, keeping de-energized state 2: Stop based on ramp 2, keeping de-energized state 3: Stop at emergency stop torque, keeping de-energized state 4: Dynamic braking stop, keeping de-energized state	2	-	Real-time

☆ Related parameters: [N]

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.06	2002-07h	Stop mode at No.2 fault	–5: Stop at zero speed, keeping dynamic braking state –4: Stop at emergency stop torque, keeping dynamic braking state –3: Ramp to stop as defined by 6085h, keeping dynamic braking state –2: Ramp to stop as defined by 6084h/ 609Ah (HM), keeping dynamic braking state –1: Dynamic braking stop, keeping dynamic braking state 0: Coast to stop, keeping de-energized state 1: Ramp to stop as defined by 6084h/ 609Ah (HM), keeping de-energized state 2: Ramp to stop as defined by 6085h, keeping de-energized state 3: Stop at emergency stop torque, keeping de-energized state 4: Dynamic braking stop, keeping de-energized state	2	-	Real-time

Stop at overtravel

★ Definition of terms:

- "Overtravel": The mechanical motion exceeds the designed range of safe movement.
- Stop at overtravel: When a motion part moves beyond the range of safe movement, the limit switch outputs a level change signal, and the servo drive forcibly stops the motor.

☆ Related parameters: [P]

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.07	2002-08h	Stop mode at overtravel	0: Coast to stop, keeping de-energized state 1: Stop at zero speed, keeping position lock state 2: Stop at zero speed, keeping de-energized state 3: Stop based on ramp 2, keeping de-energized state 4: Stop based on ramp 2, keeping position lock state 5: Dynamic braking stop, keeping de-energized state 6: Dynamic braking stop, keeping dynamic braking state 7: Not responding to overtravel	1	-	At stop

☆ Related parameters: [N]

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H02.07	2002-08h	Stop mode at overtravel	0: Coast to stop, keeping de-energized state 1: Stop at zero speed, keeping position lock state 2: Stop at zero speed, keeping de-energized state 3: Stop based on ramp, keeping de-energized state 4: Stop based on ramp, keeping position lock state 5: Dynamic braking stop, keeping de-energized state 6: Dynamic braking stop, keeping dynamic braking state 7: Not responding to overtravel	1	-	At stop

When overtravel occurs on a motor used to drive a vertical axis, the workpiece may fall. To prevent the risk of falling, set H02.07 (Stop mode at overtravel) to 1. When the workpiece moves linearly, install the limit switch to prevent mechanical damage. When overtravel occurs, input a reverse running command to make the motor (workpiece) run in the opposite direction.

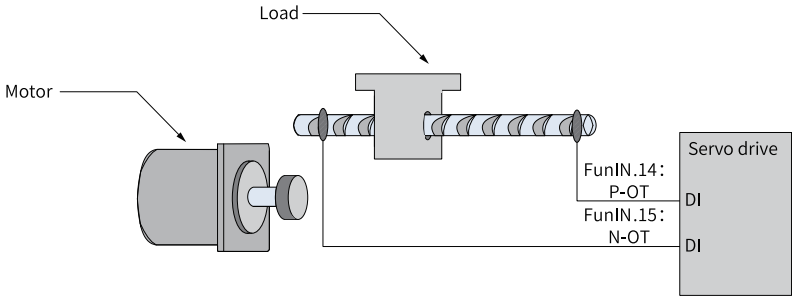


Figure 6-27 Installation of limit switches

To use the limit switches, assign FunIN.14 (P-OT, positive limit switch) and FunIN.15 (N-OT, negative limit switch) to two DIs of the servo drive and set the active logic of these DIs. This is to enable the servo drive to receive the level signals input from the limit switches. The servo drive determines whether to enable the limit switch function based on the state of the DI terminal level.

☆ Related parameters:

Code	Name	Function Name	Function
FunIN.14	P-OT	Positive limit switch	When the machine moves beyond the specified range, overtravel prevention applies. Inactive: Forward drive permitted Active: Forward drive inhibited
FunIN.15	N-OT	Negative limit switch	When the machine moves beyond the specified range, overtravel prevention applies. Inactive: Reverse drive permitted Active: Reverse drive inhibited

Emergency stop

The servo drive supports two emergency stop modes:

- Using DI function 34: FunIN.34 (EmergencyStop)
  ☆ Related parameters:

Code	Name	Function Name	Function
FunIN.34	Emergency Stop	Braking	Inactive: Current operating state unaffected Active: The servo drive stops according to the stop mode defined by H02.18 or 605Ah.

- Using the auxiliary function: emergency stop (H0d.05)
  When emergency stop is enabled, the servo drive stops immediately in the stop mode defined by H02.05 or 605Ch regardless of the operating status.

☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
H0d.05	200d-06h	Emergency stop	0: No operation 1: Emergency stop	0	-	Real-time

Quick stop

Quick stop applies when bit 2 (Quick stop) of the control word 6040h is set to 0 (Active) during operation of the servo drive. The stop mode is defined by 605Ah.

☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
605Ah	605Ah	Quick stop mode	0: Coast to stop, keeping de-energized state 1: Ramp to stop as defined by 6084h/609Ah (HM), keeping de-energized state 2: Ramp to stop as defined by 6085h, keeping de-energized state 3: Stop at emergency stop torque, keeping de-energized state 5: Ramp to stop as defined by 6084h/609Ah (HM), keeping position lock state 6: Ramp to stop as defined by 6085h, keeping position lock state 7: Stop at emergency stop torque, keeping position lock state	2	-	Real-time

Halt

The halt function applies when bit 8 of the control word 6040h is set to 1 (Halt) during operation of the servo drive. The halt mode is defined by 605Dh.

☆ Related parameters:

Parameter	Communication Address	Name	Value	Default	Unit	Change Mode
605Dh	605Dh	Halt mode	1: Ramp to stop as defined by 6084h/ 609Ah (HM), keeping position lock state 2: Ramp to stop as defined by 6085h, keeping position lock state 3: Stop at emergency stop torque, keeping position lock state	1	-	Real-time

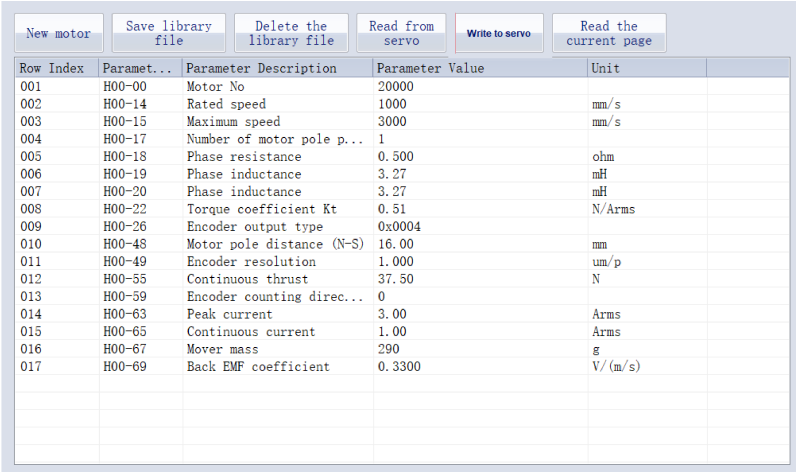
Caution

Do not set the deceleration time to an excessively low value. An excessively low value will lead to a long stop distance, incurring the risk of collision.

6.12 Quick Transfer of Motor Parameters

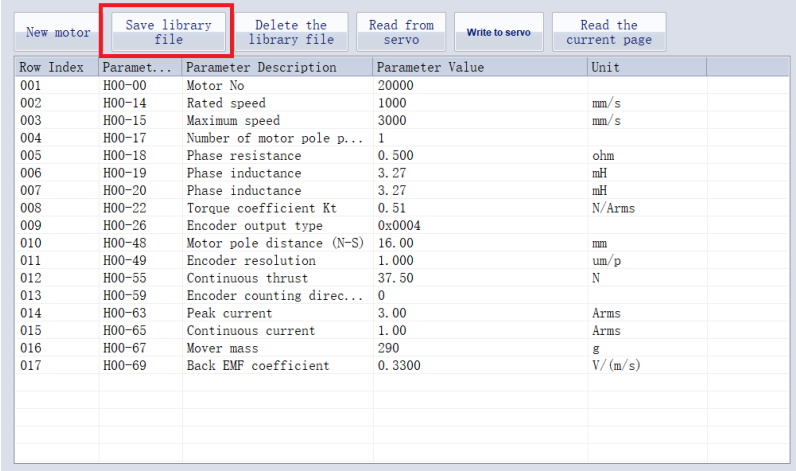
If you want to import parameters of a normal running motor from a drive to another one which will connect to a motor of the same type, do as follows:

1. Open the **Motor Management Library** interface, connect the drive with the motor connected, and select **Read from servo**.



Row Index	Paramet...	Parameter Description	Parameter Value	Unit
001	H00-00	Motor No	20000	
002	H00-14	Rated speed	1000	mm/s
003	H00-15	Maximum speed	3000	mm/s
004	H00-17	Number of motor pole p...	1	
005	H00-18	Phase resistance	0.500	ohm
006	H00-19	Phase inductance	3.27	mH
007	H00-20	Phase inductance	3.27	mH
008	H00-22	Torque coefficient Kt	0.51	N/Arms
009	H00-26	Encoder output type	0x0004	
010	H00-48	Motor pole distance (N-S)	16.00	mm
011	H00-49	Encoder resolution	1.000	um/p
012	H00-55	Continuous thrust	37.50	N
013	H00-59	Encoder counting direc...	0	
014	H00-63	Peak current	3.00	Arms
015	H00-65	Continuous current	1.00	Arms
016	H00-67	Mover mass	290	g
017	H00-69	Back EMF coefficient	0.3300	V/(m/s)

2. After parameters are read, click **Save library file** to save the current motor parameters.



Row Index	Paramet...	Parameter Description	Parameter Value	Unit
001	H00-00	Motor No	20000	
002	H00-14	Rated speed	1000	mm/s
003	H00-15	Maximum speed	3000	mm/s
004	H00-17	Number of motor pole p...	1	
005	H00-18	Phase resistance	0.500	ohm
006	H00-19	Phase inductance	3.27	mH
007	H00-20	Phase inductance	3.27	mH
008	H00-22	Torque coefficient Kt	0.51	N/Arms
009	H00-26	Encoder output type	0x0004	
010	H00-48	Motor pole distance (N-S)	16.00	mm
011	H00-49	Encoder resolution	1.000	um/p
012	H00-55	Continuous thrust	37.50	N
013	H00-59	Encoder counting direc...	0	
014	H00-63	Peak current	3.00	Arms
015	H00-65	Continuous current	1.00	Arms
016	H00-67	Mover mass	290	g
017	H00-69	Back EMF coefficient	0.3300	V/(m/s)

3. Connect a new drive. In the left pane, select the user motor library from the motor parameter library, select the library file saved in step 2 from the motor model, and click **Write to servo**.
4. Click the online auto-tuning button and select the angle auto-tuning interface to complete auto-tuning.

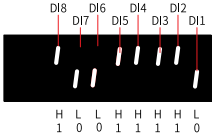
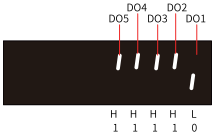
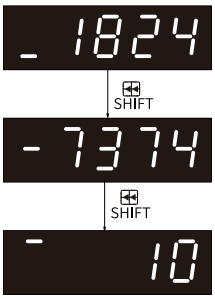
7 Appendix

7.1 Display of Monitoring Parameters

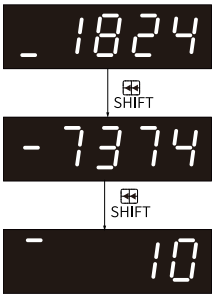
- Group H0b: Displays parameters used to monitor the operating state of the servo drive.
- Set H02.32 (Default keypad display) properly. After the motor operates normally, the keypad switches from status display to parameter display. The parameter group number is H0b and the offset within the group is the setpoint of H02.32.
- For example, if H02.32 is set to 00 and the motor speed is not 0 rpm, the keypad displays the value of H0b.00.

The following table describes the monitoring parameters in group H0b.

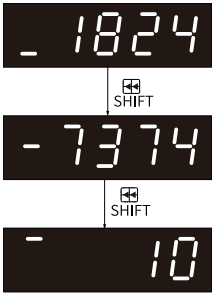
Parameter	Name	Unit	Meaning	Example
H0b.00	Motor speed actual value	[mm/s]/ [rpm]	Indicates the actual motor speed after round-off, which is accurate to 1 [mm/s]/ [rpm].	3000 [mm/s]/[rpm] is displayed as:  -3000 [mm/s]/[rpm] is displayed as: 
H0b.01	Speed reference	[mm/s]/ [rpm]	Indicates the present speed reference (accurate to 1 [mm/s]/ [rpm]) of the drive in the position and speed control modes.	3000 [mm/s]/[rpm] is displayed as:  -3000 [mm/s]/[rpm] is displayed as: 
H0b.02	Internal torque reference	%	Displays present torque reference (accurate to 0.1%). The value 100.0% corresponds to the rated torque of the motor.	Display of 100.0%:  Display of -100.0%: 

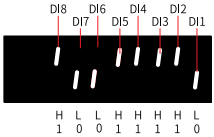
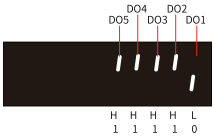
Parameter	Name	Unit	Meaning	Example
H0b.03	Input (DI) signal monitoring	-	Displays the optocoupler status of DI terminals: Upper LED segments turned on: The optocoupler is switched off (indicated by "1"). Lower LED segments turned on: The optocoupler is switched on (indicated by "0"). The value of H0b.03 read in the software tool is a decimal.	For example, if DI1 is low level and DI2 to DI8 are high level, the corresponding binary value is "10011110", and the value of H0b.03 read in the software tool is 158. Display on the operating panel: 
H0b.05	Output (DO) signal monitoring	-	Displays the optocoupler status of DO1 to DO5: Upper LED segments turned on: The optocoupler is switched off (indicated by "1"). Lower LED segments turned on: The optocoupler is switched on (indicated by "0"). The value of H0b.05 read in the software tool is a decimal.	For example, if DO1 is low level and DO2 to DO5 are high level, then, the binary value is "11110". and the value of H0b.05 read in the software tool is 30. Display on the operating panel: 
H0b.07	Absolute position counter	Reference unit	Displays current absolute position of the motor (reference unit).	Display of 1073741824 in reference unit: 

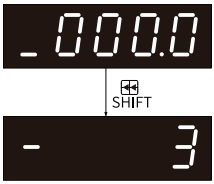
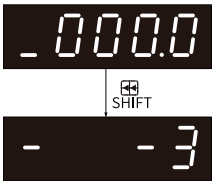
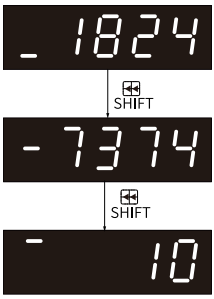
Parameter	Name	Unit	Meaning	Example
H0b.09	Mechanical angle	p	Indicates the current mechanical angle (p) of the motor. The value 0 indicates that the mechanical angle is 0°. Maximum value of H0b.09 for an incremental encoder: Number of encoder pulses per revolution x 4 - 1. For example, the maximum value of H0b.09 for a 2500-PPR incremental encoder is 9999. Maximum value of H0b.09 for an absolute encoder is 65535. The actual mechanical angle is calculated using the following formula: $\text{Actual mechanical angle} = \frac{\text{H0B-09}}{\text{Max. H0B-09+1}} \times 360.0°$	Display of 10000p: 
H0b.10	Electrical angle	°	Indicates the present electrical angle of the motor, which is accurate to 0.1°.	Display of 360.0°: 
H0b.12	Average load ratio	%	It indicates the percentage of the average load torque to the rated torque of the motor, accurate to 0.1%.	Display of 100.0%: 

Parameter	Name	Unit	Meaning	Example
H0b.13	Input position reference counter (32-bit decimal)	Reference unit	Counts and displays the number of input position references.	Display of 1073741824 in reference unit: 
H0b.15	Encoder position deviation counter (32-bit decimal)	Encoder unit	Encoder position deviation = Sum of input position references (encoder unit) – Sum of pulses fed back by the encoder (encoder unit)	Display of 10000 in encoder unit: 
H0b.17	Feedback pulse counter (32-bit decimal)	Encoder unit	Counts and displays the number of pulses fed back by the motor encoder (encoder unit).	Display of 1073741824 in encoder unit: 
H0b.19	Total power-on time (32-bit decimal)	0.1s	Counts and displays the total power-on time of the servo drive.	Display of 429496729.5s: 

Parameter	Name	Unit	Meaning	Example
H0b.24	Phase current RMS value	0.01 A	Displays the RMS value of the phase current of the motor.	Display of 4.60 A: 
H0b.26	Bus voltage	V	Displays the DC bus voltage of the main circuit input voltage after rectification, which is accurate to 0.01 V.	Display of 311.0 V rectified from 220 VAC:  Display of 537.0 V rectified from 380 VAC: 
H0b.27	Module temperature	°C	Displays the temperature of the power module inside the servo drive.	Display of 27°C: 
H0b.33	Fault log	-	Used to select the previous fault to be viewed. 0: Present fault 1: Last fault 2: 2nd to last fault ... 20: 20th to last fault	0: Display of present fault: 
H0b.34	Fault code set by H0B-33	-	Displays the code of the fault selected in H0b.33. When no fault occurs, the value of H0b.34 is 0.	If H0b.33 is 0, and H0b.34 is E941.0, the current fault code is 941.0. Corresponding display: 

Parameter	Name	Unit	Meaning	Example
H0b.35	Timestamp of the selected fault	s	Displays the total operating time of the servo drive when the fault displayed in H0b.34 occurred. When no fault occurs, the value of H0b.35 is 0.	If H0b.34 is E941.0 and H0b.35 is 1073741824, the current fault code is 941 and the total operating time of the servo drive is 1073741824s when the fault occurs. 
H0b.37	Motor speed upon occurrence of the selected fault	[mm/s]/ [rpm]	Displays the speed of the motor when the fault displayed in H0b.34 occurred. When no fault occurs, the value of H0b.37 is 0.	3000 [mm/s]/[rpm] is displayed as:  -3000 [mm/s]/[rpm] is displayed as: 
H0b.38	Motor phase U current upon occurrence of the selected fault	0.01 A	Displays the RMS value of motor phase U winding current when the fault displayed in H0b.34 occurred. When no fault occurs, the value of H0b.38 is 0.	Display of 4.60 A: 
H0b.39	Motor phase V current upon occurrence of the selected fault	A	Displays the RMS value of motor phase V winding current when the fault displayed in H0b.34 occurred. When no fault occurs, the value of H0b.39 is 0.	Display of 4.60 A: 

Parameter	Name	Unit	Meaning	Example
H0b.40	Bus voltage upon occurrence of the selected fault	V	Displays the DC bus voltage of the main circuit when the fault displayed in H0b.34 occurred. When no fault occurs, the value of H0b.40 is 0.	Display of 311.0 V rectified from 220 VAC:  Display of 537.0 V rectified from 380 VAC: 
H0b.41	Input terminal state on selected fault	-	Displays the high/low level status of DI1 to DI8 when the fault displayed in H0b.34 occurred. The method for determining the DI level status is the same as that of H0b.03. When no fault occurs, all DIs are displayed as low level in H0b.41 (indicated by the decimal value 0).	Display of H0b.41 = 158: 
H0b.42	Output terminal status upon occurrence of the selected fault	-	Displays the high/low level status of DO1 to DO5 when the fault displayed in H0b.34 occurred. The method for determining the DO level status is the same as that of H0b.05. When no fault occurs, all DOs are displayed as low level in H0b.42 (indicated by the decimal value 0).	Display of H0b.42 = 15: 

Parameter	Name	Unit	Meaning	Example
H0b.53	Position deviation counter (32-bit decimal)	Reference unit	Position deviation = Sum of input position references (reference unit) - Sum of pulses fed back by the encoder (reference unit)	Display of 10000 in reference unit: 
H0b.55	Motor speed actual value	[mm/s]/[rpm]	Displays the actual motor speed, accurate to 0.1 [mm/s]/[rpm].	3000.0 [mm/s]/[rpm] is displayed as:  -3000.0 [mm/s]/[rpm] is displayed as: 
H0b.64	Real-time input position reference counter	Reference unit	Displays the value of the position reference counter before being divided or multiplied by the electronic gear ratio. This value is independent of the servo drive status and the control mode.	Display of 1073741824 in reference unit: 

7.2 DIDO Function Assignment [P]

Code	Name	Function Name	Description	Remarks
Description of DI Signals				
FunIN.1	S-ON	Servo ON	Disabled: Servo motor disabled Enabled: Servo motor enabled	The corresponding terminal logic must be level-triggered. The change of the corresponding DI/VDI or terminal logic is activated at next power-on.
FunIN.2	ALM-RST	Alarm reset signal	Inactive: Disabled Active: Enabled	Edge-triggered will be applied even if level-triggered is selected. To reset No. 1 and NO.2 resettable faults, switch off the S-ON signal first. The servo drive may, depending on the alarm type, continue running after reset.
FunIN.3	GAIN-SEL	Gain switchover switch	• H08.09 = 1: • Inactive: Speed control loop being PI control • Active: Speed control loop being P control • H08.09 = 2: • Inactive: Fixed to the 1st group of gains • Active: Fixed to the 2nd group of gains	The corresponding terminal logic is recommended to be level-triggered.
FunIN.4	CMD-SEL	Main/Auxiliary reference switchover	Inactive: Current reference being A Active: Current reference being B	The corresponding terminal logic is recommended to be level-triggered.
FunIN.5	DIR-SEL	Multi-reference direction	Inactive: Reference direction by default Active: Reverse to reference direction.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.6	CMD1	Multi-reference switchover CMD1	Used to select a reference from 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.7	CMD2	Multi-reference switchover CMD2	Used to select a reference from 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.8	CMD3	Multi-reference switchover CMD3	Used to select a reference from 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.9	CMD4	Multi-reference switchover CMD4	Used to select a reference from 16 references.	The corresponding terminal logic is recommended to be level-triggered.

Code	Name	Function Name	Description	Remarks
FunIN.10	M1-SEL	Mode switchover M1-SEL	Used to perform switchover between speed control, position control, and torque control based on the selected control mode (values 3, 4, 5 of H02-00).	The corresponding terminal logic is recommended to be level-triggered.
FunIN.11	M2-SEL	Mode switchover M2-SEL	Used to perform switchover between speed control, position control, and torque control based on the selected control mode (value 6 of H02-00).	The corresponding terminal logic is recommended to be level-triggered.
FunIN.12	ZCLAMP	Zero clamp enable	Active: Zero clamp enabled Inactive: Zero clamp disabled	The corresponding terminal logic is recommended to be level-triggered. • When H06.15 is set to 100 or above, zero clamp is performed when the speed is lower than H06.15. The movement is triggered again only when the speed command is greater than (H06.15) + 20 RPM. • When H06.15 is set to below 100, zero clamp is performed when the speed is lower than H06.15. The movement is triggered again only when the speed command is greater than (H06.15) + 10 RPM.
FunIN.13	INHIBIT	Position reference inhibited	Active: Pulse reference input inhibited Inactive: Pulse reference input allowed	It is originally pulse inhibit. The position references include internal and external position references. The corresponding terminal logic must be level-triggered.
FunIN.14	P-OT	Positive limit switch	Active: Forward drive inhibited Inactive: Forward drive permitted	Overtravel prevention applies when the machine moves beyond the limit. It is recommended that the corresponding terminal logic is level-triggered.
FunIN.15	N-OT	Negative limit switch	Overtravel prevention applies when the load moves beyond the limit. Active: Reverse drive inhibited Inactive: Reverse drive allowed	The corresponding terminal logic is recommended to be level-triggered.

Code	Name	Function Name	Description	Remarks
FunIN.16	P-CL	Positive external torque limit	The torque limit source is switched based on H07.07 (Torque limit source). H07.07 = 1: Active: Positive external torque limit activated Inactive: Positive internal torque limit activated	The corresponding terminal logic is recommended to be level-triggered.
FunIN.17	N-CL	Negative external torque limit	The torque limit source is switched based on H07.07 (Torque limit source). H07.07 = 1: Active: Negative external torque limit activated Inactive: Negative internal torque limit activated	The corresponding terminal logic is recommended to be level-triggered.
FunIN.18	JOGCMD+	Forward jog	Active: Input based on command Inactive: Command input stopped	The corresponding terminal logic is recommended to be level-triggered.
FunIN.19	JOGCMD–	Reverse jog	Active: Input in reverse to the command Inactive: Command input stopped	The corresponding terminal logic is recommended to be level-triggered.
FunIN.20	POSSTEP	Step reference	Active: Execute step reference set in H05-05, servo motor running Inactive: Servo motor in locked state	The corresponding terminal logic is recommended to be level-triggered.
FunIN.21	HX1	Hand wheel override signal 1	HX1 active, HX2 inactive: X10. HX1 inactive, HX2 active: X100. Other: X1.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.22	HX2	Hand wheel override signal 2		
FunIN.23	HX_EN	Handwheel enable signal	Inactive: Execute position control as defined by H05-00. Active: Execute position control based on handwheel signal in position mode	The corresponding terminal logic is recommended to be level-triggered.
FunIN.24	GEAR_SEL	Electronic gear ratio switchover	Inactive: Electronic gear ratio 1 Active: Electronic gear ratio 2	The corresponding terminal logic is recommended to be level-triggered.
FunIN.25	TOQDirSel	Torque reference direction	Inactive: Forward. Active: Reverse	The corresponding terminal logic is recommended to be level-triggered.
FunIN.26	SPDDirSel	Speed reference direction	Inactive: Forward. Active: Reverse	The corresponding terminal logic is recommended to be level-triggered.

Code	Name	Function Name	Description	Remarks
FunIN.27	POSDirSel	Position reference direction	Inactive: Actual position reference direction same as the set direction Active: Actual position reference direction opposite to the set direction	The corresponding terminal logic is recommended to be level-triggered.
FunIN.28	PosInSen	Multi-position reference enable	Inactive: The reference is ineffective. Active: The reference is enabled.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.29	XintFree	Interruption fixed length cleared	Inactive: Disabled Active: Enabled	-
FunIN.31	HomeSwitch	Home switch	Inactive: The switch is not triggered Active: The switch is triggered.	The corresponding terminal logic must be level-triggered. It is recommended to assign this function to a high-speed DI terminal. If the logic is set to 2 (rising edge active), the servo drive forcibly changes it to 1 (active high). If the logic is set to 3 (falling edge active), the servo drive forcibly changes it to 0 (active low). If the logic is set to 4 (both rising edge and falling edge active), the servo drive forcibly changes it to 0 (low level active).
FunIN.32	HomingStart	Homing enable	Inactive: Disabled Active: Enabled	-
FunIN.33	XintInhibit	Interrupt positioning inhibited	Active: Interrupt positioning inhibited. Inactive: Interrupt positioning allowed.	The corresponding terminal logic must be level-triggered. • If the logic is set to 2 (rising edge active), the servo drive forcibly changes it to 1 (active high). • If the logic is set to 3 (falling edge active), the servo drive forcibly changes it to 0 (active low). • If the logic is set to 4 (both rising edge and falling edge active), the servo drive forcibly changes it to 0 (low level active).
FunIN.34	Emergence Stop	Emergency stop	Active: Position lock is applied after stop at zero speed. Inactive: Current operating state is unaffected.	The corresponding terminal logic is recommended to be level-triggered.

Code	Name	Function Name	Description	Remarks
FunIN.35	ClrPosErr	Position deviation cleared	Active: Clear the position deviation Inactive: Do not clear the position deviation	It is recommended to assign this function to DI8 or DI9.
FunIN.36	V_LmtSel	Internal speed limit source	Inactive: H07.19 used as positive/negative internal speed limit Active: H07.20 used as positive/ negative internal speed limit	The corresponding terminal logic is recommended to be level-triggered.
FunIN.37	PulseInhibit	Pulse reference inhibited	When the position reference source is pulse reference (H05.00 = 0) in the position control mode: Inactive: Respond to pulse references Active: Not respond to pulse references	The corresponding terminal logic is recommended to be level-triggered.
FunIN.38	TouchProbe1	Touch probe 1	Inactive: Touch probe is not triggered. Active: Touch probe is triggerable.	The touch probe logic is only related to the touch probe function (60B8h).
FunIN.39	TouchProbe2	Touch probe 2	Inactive: Touch probe is not triggered. Active: Touch probe is triggerable.	The touch probe logic is only related to the touch probe function (60B8h).
FunIN.40	Multi-speed	Multi-speed enable	Inactive: The internal multi-speed reference is ineffective. Active: The internal multi-speed reference is enabled.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.41		Present position as the home	Inactive: The switch is not triggered Active: Triggered	The corresponding terminal logic is recommended to be level-triggered.
FunIN.42	MultiBlockTrig	Axis control command executed immediately	Inactive: Do not execute Active: Execute immediately	-
FunIN.43	MultiBlockWr	Axis control command not executed immediately	Inactive: Do not execute Active: Execute (not immediately)	-
FunIN.44	ClrCmdOkAndArrOk	Positioning and reference completed signal cleared	Inactive: No operation Active: Clear	-
FunIN.45	XintEn	Interrupt positioning selection	Inactive: Disabled Active: Enabled	-
FunIN.46	PrEnable	Technology segment enable	Inactive: Stop technology segment Active: Start technology segment	The corresponding terminal logic is recommended to be level-triggered.

Code	Name	Function Name	Description	Remarks
FunIN.47	PrCMD1	Technology segment command switchover 1	Switchover among 16 technology segments	The corresponding terminal logic is recommended to be level-triggered.
FunIN.48	PrCMD2	Technology segment command switchover 2	Switchover among 16 technology segments	The corresponding terminal logic is recommended to be level-triggered.
FunIN.49	PrCMD3	Technology segment command switchover 3	Switchover among 16 technology segments	The corresponding terminal logic is recommended to be level-triggered.
FunIN.50	PrCMD4	Technology segment command switchover 4	Switchover among 16 technology segments	The corresponding terminal logic is recommended to be level-triggered.
FunIN.51	PrEvent1	Event trigger technology segment 1	Process segment A triggered by rising edge. Process segment B triggered by falling edge.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.52	PrEvent2	Event trigger technology segment 2	Process segment A triggered by rising edge. Process segment B triggered by falling edge.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.53	PrEvent3	Event trigger technology segment 3	Process segment A triggered by rising edge. Process segment B triggered by falling edge.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.54	PrEvent4	Event trigger technology segment 4	Process segment A triggered by rising edge. Process segment B triggered by falling edge.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.55	PrSuspend	Process segment suspend	Inactive: Continue the already enabled technology segment. Active: Suspend the technology segment	The corresponding terminal logic is recommended to be level-triggered.
FunIN.56	GantryTrqAlignEnable	Gantry torque alignment	Inactive: Disabled Active: Enabled	-
FunIN.57	Gantry-DI-AlignClear	Gantry DI alignment	Inactive: Disabled Active: Enabled	-
FunIN.58	Gantry-DI-AlignEnable	Gantry DI alignment clear	Inactive: Disabled Active: Enabled	-
FunIN.59	GantrySyncEnable	Gantry sync enable	Inactive: Disabled Active: Enabled	-
Description of DO signals				
FunOUT.1	S-RDY	Ready to switch on	The servo drive is ready to receive the S-ON signal. Inactive: The servo drive not ready. Active: The servo drive is ready.	-

Code	Name	Function Name	Description	Remarks
FunOUT.2	TGON	Motor rotation signal	Inactive. Absolute value of filtered motor speed is lower than the setpoint of H06.16. Active. Absolute value of filtered motor speed reaches the setpoint of H06.16.	-
FunOUT.3	ZERO	Zero speed signal	Inactive: Difference between motor speed feedback and reference value larger than H06.19 (Threshold of zero speed output signal) Active: The difference between the motor speed feedback and the reference value is within the threshold defined by H06.19.	-
FunOUT.4	V-CMP	Speed matching signal	Active when the absolute value of the difference between the motor speed and the speed reference lower than H06.17 (Threshold of V-Cmp signal) in the speed control mode	-
FunOUT.5	COIN	Positioning completed	Inactive - positioning not completed Active - Positioning completed	-
FunOUT.6	NEAR	Proximity	Inactive: large positioning deviation Active: position deviation near	-
FunOUT.7	C-LT	Torque limited signal	Confirming torque limit: Active: Servo drive torque reference reaching the torque limit value and restricted to this value Inactive: Servo drive torque reference not reaching the torque limit value	-
FunOUT.8	V-LT	Velocity limited signal	Confirming speed limit in torque control: Active: Motor speed limited Inactive: Motor speed unlimited	-
FunOUT.9	BK	Brake	Active - Brake signal is output. Disabled - Brake signal not output.	-
FunOUT.10	WARN	Warning	Inactive - The servo drive issued no alarm or the alarm has been reset. Active - The servo drive issued an alarm.	-

Code	Name	Function Name	Description	Remarks
FunOUT.11	ALM	Fault	The servo drive is faulty. Inactive - No fault occurred on the servo drive or the fault has been reset.	-
FunOUT.15	Xintcoin	Interrupt positioning completed	Active: Interrupt positioning completed Invalid: Interruption fixed length not completed	-
FunOUT.16	HomeAttain	Homing is completed.	Homing state: Active: Homing completed in the position control mode Inactive: Homing not completed	-
FunOUT.17	ElecHome Attain	Electrical homing completed	Electrical homing state: Active: Electrical homing completed Inactive: Electrical homing not completed	-
FunOUT.18	ToqReach	Torque reached signal	Active: Absolute value of torque reference reached setpoint Inactive: Absolute value of torque reference smaller than setpoint	-
FunOUT.19	V-Arr	Speed reached signal	Active: Speed feedback reaches setpoint Inactive: Speed feedback smaller than setpoint	-
FunOUT.21	SrvOn	Enable completed	Active: Enable completed. Inactive: Enable not completed.	-
FunOUT.22	CmdOk	Internal command completed	Inactive: Internal command transmit not completed. Active: Internal command transmit completed.	-
FunOUT.23	WrNextBlockEn	Command input	Active: Writing the next segment allowed. Inactive: Writing the next segment inhibited.	-
FunOUT.24	MC_OK	Internal motion completed	Inactive: Internal command transmit or positioning not completed. Active: Internal command transmit and positioning completed.	-

Code	Name	Function Name	Description	Remarks
FunOUT.25	CMP	Comparison DO	Inactive: The servo drive did not pass the target position comparison point. Active: The servo drive passed the target position comparison point.	-
FunOUT.26	LoopState	Closed loop state	0: Semi-closed-loop Position feedback signals come from the built-in encoder of the servo motor. 1: Full closed-loop Position feedback signals come from the full closed-loop external encoder.	-
FunOUT.27	LEFTLIMT	Left limit	Inactive: The drive is not at the left limit. Active: The drive is at the left limit.	Only Inovance DDL communication reading head supports this feature.
FunOUT.28	RIGHTLIMT	Right limit	Inactive: The drive is not at the right limit. Active: The drive is at the right limit.	Only Inovance DDL communication reading head supports this feature.
FunOUT.30	WARN OR ALM	Warning or fault output	Active: An alarm or fault is present. Inactive: No warning or fault.	-
FunOUT.31	Communication-forced DO		See *"Table 7–1 Communication forced DO wire breakage output" on page 162*.	-
FunOUT.32	EDM	EDM output	Active - STO is triggered Inactive - STO is not triggered	The EDM outputs active signals only when both the 24 V input voltages for STO1 and STO2 are disconnected.
FunOUT.33	GantryAlignStatus	Gantry alignment	Inactive: Not aligned Active: Aligned	-

Table 7–1 Communication forced DO wire breakage output

Type	Data	Description
bit0	0	Maintain DO1 output
	1	DO1 output prohibited
bit1	0	Maintain DO2 output
	1	DO2 output prohibited
bit2	0	Maintain DO3 output
	1	DO3 output prohibited

Type	Data	Description
bit3	0	Maintain DO4 output
	1	DO4 output prohibited
bit4	0	Maintain DO5 output
	1	DO5 output prohibited

7.3 DIDO Function Assignment [N]

Code	Name	Function Name	Description	Remarks
Description of DI Signals				
FunIN.1	S-ON	Servo ON	Disabled: Servo motor disabled Enabled: Servo motor enabled	The corresponding terminal logic must be level-triggered. The change of the corresponding DI/VDI or terminal logic is activated at next power-on.
FunIN.2	ALM-RST	Alarm reset signal	Inactive: Disabled Active: Enabled	Edge-triggered will be applied even if level-triggered is selected. To reset No. 1 and NO.2 resettable faults, switch off the S-ON signal first. The servo drive may, depending on the alarm type, continue running after reset.
FunIN.5	DIR-SEL	Multi-reference direction	Inactive: Reference direction by default Active: Reverse to reference direction.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.6	CMD1	Multi-reference switchover CMD1	Used to select a reference from 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.7	CMD2	Multi-reference switchover CMD2	Used to select a reference from 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.8	CMD3	Multi-reference switchover CMD3	Used to select a reference from 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.9	CMD4	Multi-reference switchover CMD4	Used to select a reference from 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.14	P-OT	Positive limit switch	Active: Forward drive inhibited Inactive: Forward drive permitted	Overtravel prevention applies when the machine moves beyond the limit. It is recommended that the corresponding terminal logic is level-triggered.

Code	Name	Function Name	Description	Remarks
FunIN.15	N-OT	Negative limit switch	Overtravel prevention applies when the load moves beyond the limit. Active: Reverse drive inhibited Inactive: Reverse drive allowed	The corresponding terminal logic is recommended to be level-triggered.
FunIN.18	JOGCMD+	Forward jog	Active: Input based on command Inactive: Command input stopped	The corresponding terminal logic is recommended to be level-triggered.
FunIN.19	JOGCMD–	Jog in the reverse direction	Active: Input in reverse to the command Inactive: Command input stopped	The corresponding terminal logic is recommended to be level-triggered.
FunIN.24	GEAR_SEL	Electronic gear ratio switchover	Inactive: Electronic gear ratio 1 Active: Electronic gear ratio 2	The corresponding terminal logic is recommended to be level-triggered.
FunIN.28	PosInSen	Multi-position reference enable	Inactive: The reference is ineffective. Active: The reference is enabled.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.31	HomeSwitch	Home switch	Inactive: The switch is not triggered Active: The switch is triggered.	The corresponding terminal logic must be level-triggered. It is recommended to assign this function to a high-speed DI terminal. If the logic is set to 2 (rising edge active), the servo drive forcibly changes it to 1 (active high). If the logic is set to 3 (falling edge active), the servo drive forcibly changes it to 0 (active low). If the logic is set to 4 (both rising edge and falling edge active), the servo drive forcibly changes it to 0 (low level active).
FunIN.34	Emergence Stop	Emergency stop	Active: Position lock is applied after stop at zero speed. Inactive: Current operating state is unaffected.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.38	TouchProbe1	Touch probe 1	Inactive: Touch probe is not triggered. Active: Touch probe is triggerable.	The touch probe logic is only related to the touch probe function (60B8h).
FunIN.39	TouchProbe2	Touch probe 2	Inactive: Touch probe is not triggered. Active: Touch probe is triggerable.	The touch probe logic is only related to the touch probe function (60B8h).

Code	Name	Function Name	Description	Remarks
FunIN.40	Multi-speed	Multi-speed enable	Inactive: The internal multi-speed reference is ineffective. Active: The internal multi-speed reference is enabled.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.46	PrEnable	Technology segment enable	Inactive: Stop technology segment Active: Start technology segment	The corresponding terminal logic is recommended to be level-triggered.
FunIN.47	PrCMD1	Technology segment command switchover 1	Switchover among 16 technology segments	The corresponding terminal logic is recommended to be level-triggered.
FunIN.48	PrCMD2	Technology segment command switchover 2	Switchover among 16 technology segments	The corresponding terminal logic is recommended to be level-triggered.
FunIN.49	PrCMD3	Technology segment command switchover 3	Switchover among 16 technology segments	The corresponding terminal logic is recommended to be level-triggered.
FunIN.50	PrCMD4	Technology segment command switchover 4	Switchover among 16 technology segments	The corresponding terminal logic is recommended to be level-triggered.
FunIN.51	PrEvent1	Event trigger technology segment 1	Process segment A triggered by rising edge. Process segment B triggered by falling edge.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.52	PrEvent2	Event trigger technology segment 2	Process segment A triggered by rising edge. Process segment B triggered by falling edge.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.53	PrEvent3	Event trigger technology segment 3	Process segment A triggered by rising edge. Process segment B triggered by falling edge.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.54	PrEvent4	Event trigger technology segment 4	Process segment A triggered by rising edge. Process segment B triggered by falling edge.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.55	PrSuspend	Process segment suspend	Inactive: Continue the already enabled technology segment. Active: Suspend the technology segment	The corresponding terminal logic is recommended to be level-triggered.
FunIN.56	GantryTrqAlignEnable	Gantry torque alignment	Inactive: Disabled Active: Enabled	-
FunIN.57	Gantry-DI-AlignClear	Gantry DI alignment	Inactive: Disabled Active: Enabled	-
FunIN.58	Gantry-DI-AlignEnable	Gantry DI alignment clear	Inactive: Disabled Active: Enabled	-

Code	Name	Function Name	Description	Remarks
FunIN.59	GantrySyncEnable	Gantry sync enable	Inactive: Disabled Active: Enabled	-
Description of DO signals				
FunOUT.1	S-RDY	Ready to switch on	The servo drive is ready to receive the S-ON signal. Inactive: The servo drive not ready. Active: The servo drive is ready.	-
FunOUT.2	TGON	Motor rotation signal	Inactive. Absolute value of filtered motor speed is lower than the setpoint of H06.16. Active. Absolute value of filtered motor speed reaches the setpoint of H06.16.	-
FunOUT.9	BK	Brake	Active - Brake signal is output. Disabled - Brake signal not output.	-
FunOUT.10	WARN	Warning	Inactive - The servo drive issued no alarm or the alarm has been reset. Active - The servo drive issued an alarm.	-
FunOUT.11	ALM	Fault	The servo drive is faulty. Inactive - No fault occurred on the servo drive or the fault has been reset.	-
FunOUT.25	CMP	Position compare DO	Inactive: The servo drive did not pass the target position comparison point. Active: The servo drive passed the target position comparison point.	-
FunOUT.26	LoopState	Closed loop state	0: Semi-closed-loop Position feedback signals come from the built-in encoder of the servo motor. 1: Full closed-loop Position feedback signals come from the full closed-loop external encoder.	-
FunOUT.27	LEFTLIMT	Left limit	Inactive: The drive is not at the left limit. Active: The drive is at the left limit.	Only Inovance DDL communication reading head supports this feature.
FunOUT.28	RIGHTLIMT	Right limit	Inactive: The drive is not at the right limit. Active: The drive is at the right limit.	Only Inovance DDL communication reading head supports this feature.

Code	Name	Function Name	Description	Remarks
FunOUT.31	Communication-forced DO		See *"Table 7–2 Communication forced DO wire breakage output" on page 167*.	-
FunOUT.32	EDM	EDM output	Active - STO is triggered Inactive - STO is not triggered	The EDM outputs active signals only when both the 24 V input voltages for STO1 and STO2 are disconnected.
FunOUT.33	GantryAlignStatus	Gantry alignment	Inactive: Not aligned Active: Aligned	-

Table 7–2 Communication forced DO wire breakage output

Type	Data	Description
bit0	0	Maintain DO1 output
	1	DO1 output prohibited
bit1	0	Maintain DO2 output
	1	DO2 output prohibited

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Shenzhen Inovance Technology Co., Ltd.

www.inovance.com

Add.: Inovance Headquarters Tower, High-tech Industrial Park,
Guanlan Street, Longhua New District,
Shenzhen 518000, P.R. China
Tel: (0755) 2979 9595 Fax: (0755) 2961 9897

Suzhou Inovance Technology Co., Ltd.

www.inovance.com

Add.: No.52, Tian'e Dang Road, Wuzhong District,
Suzhou 215104, P.R. China
Tel: (0512) 6637 6666 Fax: (0512) 6285 6720