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SV660F Series Servo Drive

User Guide

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

Data code PS00005951B01

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

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

Preface

Introduction

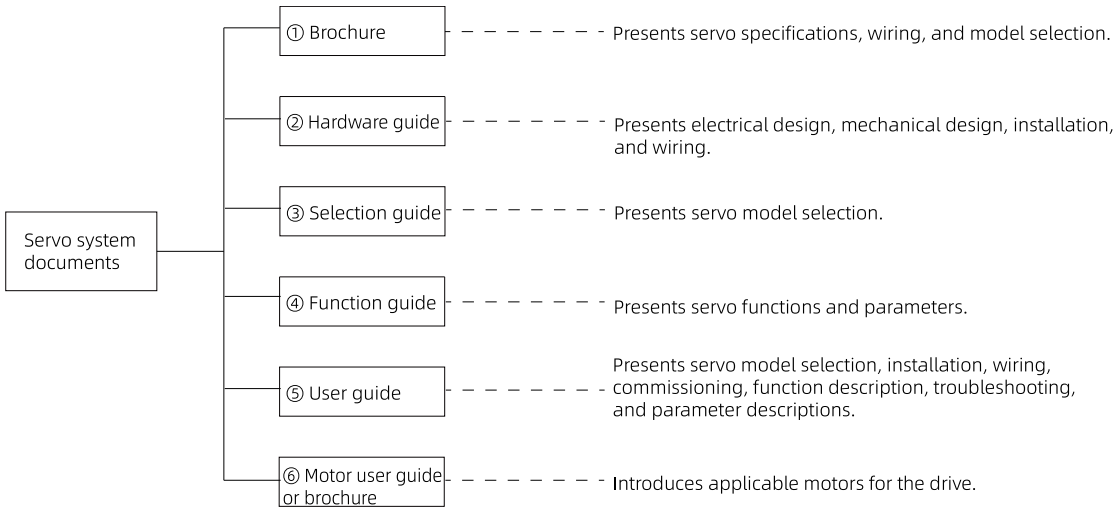
The SV660F series servo drive is a high-performance AC servo product developed by Inovance for small and medium power applications. With a power range from 0.05 kW to 7.5 kW, it supports PROFINET communication protocol and carries Ethernet communication interfaces to work with the host controller for a networked operation of multiple servo drives.

It features functions such as rigidity meter setting, inertia auto-tuning, and vibration suppression, simplifying operations. It can be used with the MS1 series high-response servo motor (with low or medium inertia) equipped with a 23-bit multi-turn absolute encoder to enable quiet and stable operation.

It is applicable for lithium battery pack, printing and packaging, logistics, automobile manufacturing, tobacco, and other industries to achieve fast and accurate collaborative control.

This guide provides information about selection, installation, commissioning, functions, troubleshooting, and parameters of the equipment.

More documents



No.	Name	Code	Description
①	SV660F High-Performance PROFINET Bus-Type Servo Drive	19120337	Describes product specifications, wiring, and model selection.
②	SV660F Series Servo Drive Hardware Guide	19011666	Provides the electrical design guidance of the servo drive, descriptions of wiring terminals, certification and standard requirements, and solutions to common EMC problems.
③	SV660FD Series Servo Drive Selection Guide	19011667	Provides information about product selection, including the list of supporting components, technical data on the drive and motor, and cable selection guide.
④	SV660F Series Servo Drive Function Guide	19011669	Describes the functions and parameters of the product, including function overview, basic servo functions, tuning instructions, and parameter descriptions.

No.	Name	Code	Description
⑤	SV660F Series Servo Drive User Guide (current guide)	PS00005951	Provides information about model selection, installation, commissioning, function, troubleshooting and parameters of the equipment.
⑥	MS1-R Series Servo Motor Selection Guide	PS00004605	Describes product information, general specifications, motor selection, cable selection, certification categories and standards of the motor.
	MS1-R-INT Series Servo Motor with Battery-less Encoder Selection Guide	PS00019892	Describes product information, general specifications, motor selection, cable selection, certification categories and standards of the motor.
	MS1-R Series Servo Motor Installation Guide	PS00005407	Describes the installation of the motor, including motor installation flowcharts, wiring, unpacking and handling, mechanical installation, and electrical installation.

Revision history

Date	Document version	Software version	Revision
August 2026	B01	Model: SV660F Version tag: H01-00=4303.3/ H00.02=000.00/ 0010	**Updated:** • Made structural optimization. • Updated section "Safety Precautions": Added precautions for power-on. • Updated section "Certifications, Directives, and Standards". • Updated section "Safety Parameters and Specifications": Updated the standards for environmental test requirements in the safety specifications. • Updated section "Drive Model and Nameplate": Added NDB and related descriptions. • Updated section "System Wiring Diagram". • Updated section "Main Circuit Terminals": Deleted the description of Size A in the terminal pin description of Sizes B/C/D/E terminals, and added description of the PE grounding terminal. • Updated the wiring diagram in section "Main Circuit Terminals". • Updated section "Monitoring Information Display": Updated the descriptions of H0b.03 and H0b.05. • Updated section "Parameter Description": Updated the latest parameter list. • Updated section "Troubleshooting": Updated the list of fault codes and alarm codes, and descriptions of fault codes and alarm codes according to the latest parameter guide. • Updated section "Wiring of the Surge Protection Device": Added wiring examples for single-phase surge protection devices. • Updated section "Servo Drive Technical Data": Modified the maximum braking energy that can be absorbed by the capacitor in the electrical specifications table of drives in size D, and added the formula for calculating the energy absorbed by the capacitor. • Added section "Acyclic read/write example". • Updated section "Braking resistor selection": Added the flowchart for selecting a braking resistor for the vertical axis and updated the calculation example. • Updated section "EMC Filter": Updated the filter model selection table. • Updated section "Surge Protection Device": Added models and dimensions of single-phase surge protection devices. • Made minor corrections.

Date	Document version	Software version	Revision
December 2025	B00	Model: SV660F Version tag: H01-00=4302.9/ H00-02=000.00/ 0E00	**Updated:** • Made structural optimization. • Made content optimization. • Updated parameters and faults. • Added model information for MS1H1-03B30CB-U210R-S in the selection list. • Renamed S6-C26 to MS1H1/MS1H4 pigtail motor connector. • Updated wiring notes and requirements of power supply cables, and updated TN/TT power grid to TT/TN star-type power grid. • Updated system connection diagram, and added the diagram for communication between CN3/CN4 and PC. • Updated cable specifications and model requirements of power supply cables, and updated the recommended main circuit terminal cable table. • Updated the wiring diagram of digital input circuit. • Updated CN3&CN4 communication terminal descriptions and deleted the note "When using redundant ring network, set H0E.36 to 1". • Updated CN3&CN4 communication terminal descriptions and tree-type diagram. • Updated the sequence of "Stop at zero speed, keeping de-energized state" at No.2 fault (without brake) during trial run. • Updated non-compatible DSC and added compatible DSC. • Updated description of switching between new and old software limit features. • Updated telegram 111 Run at specified speed (ModPos= 3). • Updated torque homing condition in telegram 111 Active homing mode (ModPos=4). • Updated 2 (absolute homing) to 0 (absolute homing) in telegram 111 Active homing mode (ModPos=5). • Updated interfaces and descriptions for step 1 in "User-defined area forced DO function" in telegram 111 User-defined area description. • Updated fixed stopper descriptions, updated value ranges of H28.32 to H28.62 to 0 to 2147483647, and added calculation formula in telegram 111 Running program segment (ModPos=6) • Updated SinaPOS function block pin descriptions. • Updated reset methods after troubleshooting. • Added FunIN.35 in DI/DO function definitions. • Added LU annotation (LU is instruction unit, also known as user unit) in IO data signals. **Added:** Added acyclic read/write operations. **Deleted:** Deleted content related to shield brackets.

Date	Document version	Software version	Revision
November 2024	A07	-	• Updated parameters descriptions. • Made minor corrections. • Added SV660FT017I model to three-phase 380 V power supply wiring diagram. • Added oil-resistant cable and cable fixation instructions for power cables. • Updated power cable specifications. • Added communication cable selection requirements. • Updated CN3/CN4 terminal diagrams. • Updated jog formulas in mode 6, mode 7, and mode 8 under AC3 mode. • Update data in section "Communication Functions" of technical specifications. • Updated energy data table for 220 V/380 V motors from rated no-load speed to stop. • Updated DI/DO functions. • Updated single device wiring diagram.
July 2024	A06	-	• Added supplementary notes to section "Black Box". • Added supplementary notes to section "AC4 Mode". • Updated relevant parameters and fault information due to software update. • Changed motor PE cable wiring method. • Updated the fundamental safety instructions. • Updated vacuum environment descriptions in installation environment requirements. • Added steps to install WinPcap. • Corrected pin definitions for the ConfigEpos.%X1 function block. • Updated "Status Indicator Display" in section "Component Description". • Changed DO3+ and DO3- function descriptions to brake output signal. • Updated interface screenshots in background software debugging steps. • Updated PROFINET control word and status word definitions. • Deleted mapping between keypad display and operation object of the host controller. • Corrected some minor errors. • Updated cable selection. • Updated UL certification requirements for servo drive power cable selection.

Date	Document version	Software version	Revision
March 2024	A05	-	• Updated H24 parameter descriptions. • Updated H02.01 and H0A.10. • Updated formula summary in section "Telegram 111 User-Defined Area Introduction". • Updated the "Terminal Description" in section "Introduction to CN3 & CN4 Communication Terminals". • Updated the instructions in section "Multi-drive Adjustment". • Updated H05.19 in section "Feedforward Gain". • Updated the handling measures for E625.0. • Updated "Status Indicator Display" in section "Component Description". • Updated the diagram "Single-phase 220V Main Circuit Wiring" in section "Power Wiring Examples". • Updated section "MS1-R Series Motor". • Added leakage current and EDM residual voltage requirements when DO is used as EDM output. • Added -INT model and model description in product model explanation. • Updated the Suzhou address and added the My Inovance QR code on the cover page.

Date	Document version	Software version	Revision
December 2023	A04	-	• Added "Installation Instructions for Shielding Bracket" and added recommended shielding brackets in connectors. • Updated CN5 terminal layout. • Added shielded power cable selection and shielded cable model description. • Deleted all descriptions regarding multi-speed operation throughout the document. • Deleted all descriptions regarding position comparison throughout the document. • Updated the DB brake timing diagram for DB stop and holding DB state. • Updated the procedure of setting an adaptive notch. • Added differences between old and new features of software limits. • Added introduction to S-curve function. • Added and optimized application guidance for telegram 111. • Updated program segment content. • In AC4 mode, added direction description for reverse encoder and rotation direction of reverse drive device. • Added parameters H05.30/H05.74/H06.42/H06.43/ H06.44/H06.45/H0A.45/H0C.71. • Update parameters H02.07/H02.33/H0A.71/H0b.81/ H0b.83/H24.12 to 24.37/H28.16/H28.17. • Deleted parameters in H12 group and H24.43. • Added parameter descriptions for H09.02 and H09.37. • Updated fault codes and fault sub-codes in the alarm list table to alarm codes and alarm sub-codes. • Updated "fault cause" to "cause", "fault mechanism" to "generation mechanism", and "solution" to "handling measures". • Added E122.9/E551.4/E731.0/E902.3/E902.4/E950.1/ E952.1. • Added reasons, confirmation methods, and handling measures for E731.0 regarding hot-swappable encoder cables. • Software information: 03029860 H01-00=4301.8/H00-02= 000.00/0E00 A08.

Date	Document version	Software version	Revision
October 2023	A03	-	• Updated the channels for accessing the document. • Added mechanical protection requirements for operators in safety precautions; • Added descriptions of using DI to make the servo drive jog. • Added troubleshooting for NR.X. • Changed modal axis start parameter to H02.01, and optimized statement descriptions for modal axis. • Optimized section "SinaPOS Function Block Pin Description". • Optimized the description of the number of slaves in the PROFINET communication specifications. • Deleted information on frequency-division output, analog signals, and full closed-loop from the parameter fault section. • Added description for H05.80. • Removed the description of 60B8h from the DIDO function definition. • Updated the description and illustration for input/output signal monitoring in panel monitoring display. • Added fault E551.4. • Optimized faults E601.2, E210.0, and EB00.0.
January 2023	A02	-	• Modified the technical specifications. • Updated the motor models in the energy data table.
October 2022	A01	-	• Added warranty information in the preface. • Changed the MS1-Z motor to MS1-R motor. • Added formulas and examples showing modulus to the modal axis. • Adjusted of the structure of section Commissioning and Operation. • Optimized the description of H02.18, and group H03, H07.07, H0A.27, H0A.90, H0A.91, H0A.92, group H17 and H29.27. • Changed the description of E735.0 to be consistent with the troubleshooting guide. • Optimized information on the program block. • Adjusted the ranges of OverV, OverAcc, and OverDec in the SinaPos function block pin description. • Added information on E625.0. • Deleted information on E631. • Updated the manual according to the fault table.
July 2022	A00	-	First release

Access to the guide

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

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For details, see the Warranty Card.

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1 Fundamental Safety Instructions

1.1 Safety Precautions

Safety disclaimer

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

Safety levels and definitions

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

Safety Precautions

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

Unpacking



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



- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package by following the unpacking sequence. Do not strike the package violently.
- Check for damage, rust, or dents on the surfaces of the product and accessories upon unpacking.
- After unpacking, check the contents against the packing list to ensure that the equipment and accessories are in the correct quantities, and that all documentation is complete.

Storage and transportation



- Large or heavy equipment must be handled by qualified professionals using specialized hoisting equipment. Failure to comply could result in personal injury or equipment damage.
- Before hoisting the equipment, ensure that components such as the front cover and terminal blocks are secured firmly with screws. Loosely connected components may fall off and result in personal injury or equipment damage.
- Do not stand or stay below the product which is being hoisted.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply could result in personal injury or equipment damage.



- Handle the equipment with care and mind your step during transportation to prevent personal injury or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply could result in personal injury.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply could result in equipment damage.
- Do not store or transport the equipment in environments where the equipment may be exposed to splashing water or rain, direct sunlight, strong electric field, strong magnetic field, or strong vibration.
- Store the equipment for up to three months. Take stricter protective measures and carry out the necessary inspections for a longer storage time.
- Pack the equipment securely and properly before transportation. Use a fully enclosed container for long-distance transportation.
- Do not transport the equipment with other devices or items that may impact or cause harm to the equipment.

Installation
DANGER • Ensure peripheral power distribution requirements are met, and select air switches, fuses, cables, and cable terminals correctly. • Use standard torque to fasten screws, and use appropriate terminal crimping tools for to crimp terminals. • Ensure heat dissipation requirements are met and design inlet and outlet airflow duct properly. • Avoid environments with dripping water, conductive foreign objects (such as carbon fiber filaments, conductive metal dust, metal chips), and salt spray. **Failure to follow the above instructions will pose a fire risk.** • This equipment must be operated only by trained and qualified electrical personnel. Operations can be performed by professionals only.
WARNING • Read through the guide and safety instructions before installation. • Do not install this equipment in places with strong electric or magnetic field. • Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply may 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 an enclosed environment (such as a cabinet or case), use cooling devices (such as fans or air conditioners) to cool the space and meet the installation environment requirements. Failure to do so can result in equipment overtemperature or fire accidents. • 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 terminal device, appropriate guard devices (guards for fire, electrical, and mechanical protection) meeting applicable IEC standards and local laws and regulations must be provided. • Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device 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 may result in a fire. **The edges of the equipment metal enclosure are sharp. Note the following precautions during installation to avoid personal injury or cable damage:** • When performing installation, handling, or maintenance operations, always wear cut-resistant gloves. • Avoid direct skin contact with enclosure edges and cut surfaces during operation.
Caution • Cover the top of the product with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the product and causing faults. After installation, remove the cloth or paper on top of the product 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
DANGER • Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Before wiring, switch off all power supplies of the device. Wait for at least the time designated on the 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 can result in electric shock. • Do not perform wiring, remove the equipment cover, or touch the circuit board and other exposed live parts with power on. Failure to comply can result in electric shock. • Make sure that the equipment and product are grounded properly. Failure to comply can result in the risk of electric shock.
WARNING • Do not connect the power cable to output terminals of the equipment or product. Failure to comply may cause equipment damage or even a fire. • When connecting a drive with the motor, make sure that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation. • Cables used must comply with corresponding cross-sectional area and shielding requirements. The shield of the shielded cable must be grounded at one end properly. • Tighten the terminal screws with the torque specified in the user guide. Insufficient or excessive torque may cause overheating and damage to the joint, which could result in fire. • After wiring is done, ensure that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply could result in electric shock or equipment damage. • Avoid direct skin contact with enclosure edges and cut surfaces during operation. • Route cables carefully during wiring. Keep them away from sharp edges to prevent squeezing or cutting. It is recommended to use protective sleeves. • If the enclosure has a protective film, remove it only after installation is completed and all work involving sharp edges has been finished.
Caution • During wiring, follow the proper electrostatic discharge (ESD) procedure and wear an anti-static wrist strap. Failure to comply may result in damage to the equipment or its internal circuits. • Use the shielded twisted pair cable to wire the control circuit, and connect the shield to the grounding terminal of the equipment. Failure to comply may result in equipment malfunction.

Power-on

• Before power-on, ensure that the motor is not being driven by loads. • Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted. • Before power-on, make sure that the power supply meets equipment requirements to prevent equipment damage or even a fire. • After power-on, do not open the cabinet door or protective cover of the equipment. Do not touch any terminals, or remove any part of the equipment at power-on. Failure to comply will result in an electric shock.

• Perform a trial run after wiring and parameter setting to ensure that 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. Using an incorrect supply voltage may cause a fire. • Before power-on, check that no one is near the equipment, motor, or other mechanical parts. Failure to comply may result in personal injury or even death.

Operation

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

• Do not touch the enclosure, fan, or resistor with bare hands. Failure to comply may result in burns. • Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

Maintenance

• Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Do not perform maintenance on the equipment with power-on. Failure to comply may result in an electric shock. • Before maintenance, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label. • When using a permanent magnet (PM) motor, do not touch the motor terminals while the motor is rotating, because induced voltage may be present at the terminals even after the product is powered off. Failure to comply may result in electric shocks.

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

Repair
DANGER • Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Do not repair the equipment with power-on. Failure to comply may result in electric shock. • Before inspection or repair, disconnect all the power supplies of the equipment and wait for at least the time specified on the warning label.
WARNING • Submit a request for repair based on the warranty agreement. • When the fuse is blown or the circuit breaker or earth leakage circuit breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply could result in equipment damage, personal injury, or death. • Troubleshooting and repair of a faulty or damaged equipment must be performed by professionals based on the repair instructions, with the repair records kept properly. • Replace quick-wear parts of the equipment according to the replacement instructions. • Do not use damaged equipment. Failure to comply can result in death, personal injury, or severe equipment damage. • Recheck the wiring and reset the parameters after equipment replacement.

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

Additional precautions

Cautions for the dynamic brake

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

Precautions for grounding

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

Effects of electromagnetic fields on medical implants

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

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

Safety Label

To ensure safe operation, comply with equipment-related safety labels. The following table describes the meanings of the safety labels.

Safety Label	Description
  	• Connect the grounding terminal properly to prevent electric shock. Read through the guide and follow the safety instructions. • Do not touch terminals within 15 minutes after power-off to prevent electric shock. • Do not touch the heatsink when power is on. Failure to comply may result in burn.

1.2 Industrial Information Security

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

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

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



Malware (such as viruses, Trojans, and worms) can bring the device into an unsafe operating state, resulting in death, serious injury, and property damage. Observe the following precautions:

- Always use the latest software version. If the product version is no longer supported or the latest version is not used, you will be exposed to increased risk of cyber attacks.
- Develop and maintain appropriate protective measures (including but not limited to antivirus software, firewalls, WAF, IPS/IDS, situational awareness system, identity authentication, and data encryption) to prevent the files in mobile storage devices from being damaged by malware, and to protect the products, networks, systems, and interfaces from unauthorized access, tampering, hacking, data leakage, or information theft.
- Check all safety-related interfaces and settings after commissioning.

1.3 Certifications, Directives, and Standards

Table 1–1 Compliance list

Certification	Directive		Standard
CE certification	EMC directive	2014/30/EU	EN IEC 61800-3
	LVD directive	2014/35/EU	EN 61800-5-1 EN 60034-1 EN 60034-5
	RoHS directive	2011/65/EU 2015/863/EU	-
UL/cUL certification	-		UL 61800-5-1 CSA C22.2 No.274 UL 1004-1 UL 1004-6 CSA C22.2 No.100
Functional safety certification	Machinery directive	2006/42/EC	EN ISO 13849-1 EN 61800-5-2 EN IEC 62061
	-		EN-AR-N 61508

1.4 Terms and Abbreviations

Terms and Abbreviations	Description
Cat.	Category of safety components in the control system. The categories are B, 1, 2, 3, and 4.
CCF	Common cause failure
DCavg	The average diagnostic coverage (%).
DTI	The diagnostic test interval time.
SFF	The safe failure fraction.
HFT	The hardware fault tolerance.
PFH	The probability of a dangerous failure per hour.
PL	The performance level.
SC	The system capability.
SIL	The safety integrity level.
T_1	The proof test interval.
DI	Digital input.
DO	Digital output.
PCB	Printed circuit board.
MCU	The microcomputer unit.
FPGA	The field programmable gate array.
MTTFd	The mean time to dangerous failure.
SRA	The safety-related application parameter.
nSRA	The non-SRA parameter.
STO	The safe torque off (STO) function brings the machine safely into a no-torque state and prevents it from unexpected start. When the STO function is enabled, the servo stops according to the stop mode (H02.08).

1.5 Safety Parameters and Specifications

Safety parameters

Item	Safety parameters
SIL	SIL3, IEC61508 Maximum SIL3, EN IEC62061
Probability of Failure per Hour (PFH) $_D$	PFH $_D \leq 1.1 \times 10^{-9}$[1/h] (1.1% of SIL3)
Cat.	3, EN ISO 13849-1
PL	e, EN ISO 13849-1
MTTFd	904 years (high)
DCavg	≥ 90% (medium)
T_1	20 years
HFT	1
SC	SC3
λ_S	2.5×10^{-7}/h
λ_{DD}	1.3×10^{-7}/h
λ_{DU}	2.0×10^{-9}/h
MTTR	0 hour
MRT	0 hour
Application mode	High demand or continuous mode
Device type	Type B

λ_S means the failure rate of safe failure which brings the system into safe state.

λ_{DD} means the failure rate of dangerous failure but can be diagnosed by the diagnosis subsystem.

λ_{DU} means the failure rate of dangerous failure and can't be diagnosed by the diagnosis subsystem.

Note

- See ISO13849-2: 2012 for failure modes of devices.
- Failure sharing of different failure modes of each device.
- See SN29500 for failure rate of each device.

Safety precautions

- Electrical safety according to IEC 61800-5-1:2016, overvoltage category II
- Environmental test requirements comply with IEC 61800-5-1:2016 and IEC 61800-2:2015
- Operating conditions are shown as follows.

Item	Description
Ambient/Storage temperature	0°C to +55°C/–20°C to +70°C
Ambient/Storage humidity	20% to 95% RH, non-condensing

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Vibration</td><td>
<table>
<tr><th>Item</th><th>Test condition</th></tr>
<tr><td>Test reference</td><td>See IEC 60068-2-6 4.6</td></tr>
<tr><td>Conditions</td><td>EUT powered on, operating normally</td></tr>
<tr><td>Move mode</td><td>Sinusoidal</td></tr>
<tr><td>Vibration amplitude/ Acceleration</td><td>-</td></tr>
<tr><td>10 Hz ≤ f ≤ 57 Hz</td><td>0.075 mm amplitude</td></tr>
<tr><td>57 Hz < f ≤ 150 Hz</td><td>1 g</td></tr>
<tr><td>Vibration duration</td><td>10 times on each of the three mutually perpendicular axes</td></tr>
<tr><td>Axis</td><td>X, Y, Z</td></tr>
<tr><td>Installation</td><td>According to the manufacturer's specifications</td></tr>
</table>
</td></tr>
<tr><td>Shock resistance</td><td>
<table>
<tr><th>Item</th><th>Test condition</th></tr>
<tr><td>Test reference</td><td>Test Ea of IEC 60068-2-27: 2008 Table 17</td></tr>
<tr><td>Conditions</td><td>EUT powered on, operating normally</td></tr>
<tr><td>Move mode</td><td>Half-sine pulse</td></tr>
<tr><td>Shock amplitude/ Time</td><td>50 m/s^2 (5 g) 30 ms</td></tr>
<tr><td>Number of shocks</td><td>3 per axis on each of three mutually perpendicular axes</td></tr>
<tr><td>Axis</td><td>±X, ±Y, ±Z</td></tr>
<tr><td>Installation</td><td>According to the manufacturer's specifications</td></tr>
</table>
</td></tr>
<tr><td>IP rating</td><td>IP20</td></tr>
<tr><td>Pollution degree (PD)</td><td>PD2: free of corrosive and explosive gases; free of exposure to water, oil, and chemicals; free of dust, salts, and iron dust</td></tr>
<tr><td>Altitude</td><td>2000 m or below</td></tr>
<tr><td>Cooling method</td><td>Dry clean air (natural convection)</td></tr>
<tr><td>Others</td><td>Free of static electricity, strong electromagnetic fields, magnetic fields, and exposure to radioactivity</td></tr>
</table>

- The drive complies with EMC standards EN/IEC 61800-3:2017, IEC 61326-3-1, and IEC 61800-5-2
- Others

Item	Description
Applicable servo drives	SV660FS1R6I-FS SV660FS2R8I-FS SV660FS5R5I-FS SV660FS7R6I-FS SV660FS012I-FS SV660FT3R5I-FS SV660FT5R4I-FS SV660FT8R4I-FS SV660FT012I-FS SV660FT017I-FS SV660FT021I-FS SV660FT026I-FS
Position	Integrated on the control board of the drive
Safety function - Inputs	Two channels: STO1 and STO2

The STO subsystem elements must always be able to operate within the range of temperature, humidity, corrosion, dust, and vibration and other requirements specified above.

2 List of Model Selection

2.1 List of Model Selection (Compatible with MS1-R Series Servo Motor)

Servo motor				Servo drive SV660 series			
Model without brake	Model with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Recommended model	Drive SN (H01.10)
Ratings of MS1H1 series motors (n_N = 3000 rpm, n_{max} = 7000 rpm)							
MS1H1-03B30CB-U210R-S	-	25	0.03	Single-phase 220 V	A	S1R6	00002
MS1H1-05B30CB-A330R	MS1H1-05B30CB-A332R	40	0.05	Single-phase 220 V			
MS1H1-10B30CB-A330R	MS1H1-10B30CB-A332R	40	0.1	Single-phase 220 V			
MS1H1-20B30CB-A331R	MS1H1-20B30CB-A334R	60	0.2	Single-phase 220 V			
MS1H1-40B30CB-A331R	MS1H1-40B30CB-A334R	60	0.4	Single-phase 220 V		S2R8	00003
MS1H1-55B30CB-A331R	-	80	0.55	Single-phase 220 V	B	S5R5	00005
MS1H1-75B30CB-A331R	MS1H1-75B30CB-A334R	80	0.75	Single-phase 220 V		S5R5	00005
MS1H1-10C30CB-A331R	MS1H1-10C30CB-A334R	80	1.0	Single/Three-phase 220 V	C	S7R6	00006
MS1H1-15C30CB-A330R	-	80	1.5	Single/Three-phase 220 V	D	S012	00007
MS1H1-15C30CB-A331R	-	80	1.5	Single/Three-phase 220 V		S012	00007
Ratings of MS1H2 series motors (n_N = 3000 rpm, n_{max} = 6000 rpm)							
MS1H2-10C30CB-A331R	MS1H2-10C30CB-A334R	100	1.0	Single/Three-phase 220 V	C	S7R6	00006
MS1H2-10C30CD-A331R	MS1H2-10C30CD-A334R	100	1.0	Three-phase 380 V		T3R5	10001
MS1H2-15C30CB-A331R	MS1H2-15C30CB-A334R	100	1.5	Single/Three-phase 220 V	D	S012	00007
MS1H2-15C30CD-A331R	MS1H2-15C30CD-A334R	100	1.5	Three-phase 380 V	C	T5R4	10002
MS1H2-20C30CB-A331R	MS1H2-20C30CB-A334R	100	2.0	Single/Three-phase 220 V	D	S012	00007
MS1H2-20C30CD-A331R	MS1H2-20C30CD-A334R	100	2.0	Three-phase 380 V	D	T8R4	10003

Servo motor				Servo drive SV660 series			
Model without brake	Model with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Recommended model	Drive SN (H01.10)
MS1H2-25C30CD-A331R	MS1H2-25C30CD-A334R	100	2.5	Three-phase 380 V	D	T012[1]	10004
MS1H2-30C30CD-A331R	MS1H2-30C30CD-A334R	130	3.0	Three-phase 380 V	D	T012	10004
MS1H2-40C30CD-A331R	MS1H2-40C30CD-A334R	130	4.0	Three-phase 380 V	E	T017	10005
MS1H2-50C30CD-A331R	MS1H2-50C30CD-A334R	130	5.0	Three-phase 380 V		T021[2]	10006
Ratings of MS1H3 series motors (n_N = 1500 rpm, n_{max} = 4500 rpm)							
MS1H3-85B15CB-A33*R	MS1H3-85B15CB-A334R	130	0.85	Single/Three-phase 220 V	C	S7R6	00006
MS1H3-85B15CD-A331R	MS1H3-85B15CD-A334R	130	0.85	Three-phase 380 V		T3R5	10001
MS1H3-13C15CB-A331R	MS1H3-13C15CB-A334R	130	1.3	Single/Three-phase 220 V	D	S012	00007
MS1H3-13C15CD-A331R	MS1H3-13C15CD-A334R	130	1.3	Three-phase 380 V	C	T5R4	10002
MS1H3-18C15CB-A331R	MS1H3-18C15CB-A334R	130	1.8	Single/Three-phase 220 V	D	S012	00007
MS1H3-18C15CD-A331R	MS1H3-18C15CD-A334R	130	1.8	Three-phase 380 V	D	T8R4	10003
MS1H3-29C15CD-A331R	MS1H3-29C15CD-A334R	180	2.9	Three-phase 380 V	D	T012	10004
MS1H3-44C15CD-A331R	MS1H3-44C15CD-A334R	180	4.4	Three-phase 380 V	E	T017	10005
MS1H3-55C15CD-A331R	MS1H3-55C15CD-A334R	180	5.5	Three-phase 380 V		T021	10006
MS1H3-75C15CD-A331R	MS1H3-75C15CD-A334R	180	7.5	Three-phase 380 V		T026	10007
Ratings of MS1H4 series motors (n_N = 3000 rpm, n_{max} = 7000 rpm)							

Servo motor				Servo drive SV660 series			
Model without brake	Model with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Recommended model	Drive SN (H01.10)
MS1H4-05B30CB-A330R	MS1H4-05B30CB-A332R	40	0.05	Single-phase 220 V	A	S1R6	00002
MS1H4-10B30CB-A330R	MS1H4-10B30CB-A332R	40	0.1	Single-phase 220 V		S1R6	00002
MS1H4-05B30CB-A331R	MS1H4-05B30CB-A334R	40	0.05	Single-phase 220 V		S1R6	00002
MS1H4-10B30CB-A331R	MS1H4-10B30CB-A334R	40	0.1	Single-phase 220 V		S1R6	00002
MS1H4-20B30CB-A331R	MS1H4-20B30CB-A334R	60	0.2	Single-phase 220 V		S1R6	00002
MS1H4-40B30CB-A331R	MS1H4-40B30CB-A334R	60	0.4	Single-phase 220 V		S2R8	00003
MS1H4-55B30CB-A331R	-	80	0.55	Single-phase 220 V	B	S5R5	00005
MS1H4-75B30CB-A331R	MS1H4-75B30CB-A334R	80	0.75	Single-phase 220 V		S5R5	00005
MS1H4-10C30CB-A331R	MS1H4-10C30CB-A334R	80	1.0	Single/Three-phase 220 V	C	S7R6	00006

Note

- [1] See the torque-speed characteristics curves of this model for drives with T8R4. The drive parameters does not change.
- [2] See the torque-speed characteristics curves of this model for drives with T017. The drive parameters does not change.

2.2 List of Model Selection (Compatible with MS1-R Series Servo Motor with Battery-free Encoder)

Servo motor				Servo drive SV660 series			
Model without brake	Model with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Recommended model	Drive SN (H01.10)
Ratings of MS1H1 series motors (n_N = 3000 rpm, n_{max} = 7000 rpm)							
MS1H1-05B30CB-V330R	MS1H1-05B30CB-V332R	40	0.05	Single/Three-phase 220 V	A	S1R6	00002
MS1H1-10B30CB-V330R	MS1H1-10B30CB-V332R	40	0.1	Single/Three-phase 220 V			
MS1H1-20B30CB-V331R	MS1H1-20B30CB-V334R	60	0.2	Single-phase 220 V			
MS1H1-40B30CB-V331R	MS1H1-40B30CB-V334R	60	0.4	Single-phase 220 V		S2R8	00003
MS1H1-55B30CB-V331R	-	80	0.55	Single-phase 220 V	B	S5R5	00005
MS1H1-75B30CB-V331R	MS1H1-75B30CB-V334R	80	0.75	Single-phase 220 V		S5R5	00005
MS1H1-10C30CB-V331R	MS1H1-10C30CB-V334R	80	1.0	Single/Three-phase 220 V	C	S7R6	00006
Ratings of MS1H2 series motors (n_N = 3000 rpm, n_{max} = 6000 rpm)							
MS1H2-10C30CB-V331R	MS1H2-10C30CB-V334R	100	1.0	Single/Three-phase 220 V	C	S7R6	00006
MS1H2-10C30CD-V331R	MS1H2-10C30CD-V334R	100	1.0	Three-phase 380 V		T3R5	10001
MS1H2-15C30CB-V331R	MS1H2-15C30CB-V334R	100	1.5	Single/Three-phase 220 V	D	S012	00007
MS1H2-15C30CD-V331R	MS1H2-15C30CD-V334R	100	1.5	Three-phase 380 V	C	T5R4	10002
MS1H2-20C30CB-V331R	MS1H2-20C30CB-V334R	100	2.0	Single/Three-phase 220 V	D	S012	00007
MS1H2-20C30CD-V331R	MS1H2-20C30CD-V334R	100	2.0	Three-phase 380 V	D	T8R4	10003
MS1H2-25C30CD-V331R	MS1H2-25C30CD-V334R	100	2.5	Three-phase 380 V	D	T012[1]	10004
MS1H2-30C30CD-V331R	MS1H2-30C30CD-V334R	130	3.0	Three-phase 380 V	D	T012	10004
MS1H2-40C30CD-V331R	MS1H2-40C30CD-V334R	130	4.0	Three-phase 380 V	E	T017	10005
MS1H2-50C30CD-V331R	MS1H2-50C30CD-V334R	130	5.0	Three-phase 380 V		T021[2]	10006
Ratings of MS1H3 series motors (n_N = 1500 rpm, n_{max} = 4500 rpm)							

Servo motor				Servo drive SV660 series			
Model without brake	Model with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Recommended model	Drive SN (H01.10)
MS1H3-85B15CB-V331R	MS1H3-85B15CB-V334R	130	0.85	Single/Three-phase 220 V	C	S7R6	00006
MS1H3-85B15CD-V331R	MS1H3-85B15CD-V334R	130	0.85	Three-phase 380 V		T3R5	10001
MS1H3-13C15CB-V331R	MS1H3-13C15CB-V334R	130	1.3	Single/Three-phase 220 V	D	S012	00007
MS1H3-13C15CD-V331R	MS1H3-13C15CD-V334R	130	1.3	Three-phase 380 V	C	T5R4	10002
MS1H3-18C15CB-V331R	MS1H3-18C15CB-V334R	130	1.8	Single/Three-phase 220 V	D	S012	00007
MS1H3-18C15CD-V331R	MS1H3-18C15CD-V334R	130	1.8	Three-phase 380 V	D	T8R4	10003
MS1H3-29C15CD-V331R	MS1H3-29C15CD-V334R	180	2.9	Three-phase 380 V	D	T012	10004
MS1H3-44C15CD-V331R	MS1H3-44C15CD-V334R	180	4.4	Three-phase 380 V	E	T017	10005
MS1H3-55C15CD-V331R	MS1H3-55C15CD-V334R	180	5.5	Three-phase 380 V		T021	10006
MS1H3-75C15CD-V331R	MS1H3-75C15CD-V334R	180	7.5	Three-phase 380 V		T026	10007
Ratings of MS1H4 series motors (n_N = 3000 rpm, n_{max} = 7000 rpm)							
MS1H4-05B30CB-V330R	MS1H4-05B30CB-V332R	40	0.05	Single/Three-phase 220 V	A	S1R6	00002
MS1H4-05B30CB-V331R	MS1H4-05B30CB-V334R	40	0.05	Single/Three-phase 220 V			
MS1H4-10B30CB-V330R	MS1H4-10B30CB-V332R	40	0.1	Single/Three-phase 220 V			
MS1H4-10B30CB-V331R	MS1H4-10B30CB-V334R	40	0.1	Single/Three-phase 220 V			
MS1H4-20B30CB-V331R	MS1H4-20B30CB-V334R	60	0.2	Single-phase 220 V			
MS1H4-40B30CB-V331R	MS1H4-40B30CB-V334R	60	0.4	Single-phase 220 V		S2R8	00003
MS1H4-55B30CB-V331R	-	80	0.55	Single-phase 220 V	B	S5R5	00005
MS1H4-75B30CB-V331R	MS1H4-75B30CB-V334R	80	0.75	Single-phase 220 V		S5R5	00005
MS1H4-10C30CB-V331R	MS1H4-10C30CB-V334R	80	1.0	Single/Three-phase 220 V		S7R6	00006

Note

- [1] See the torque-speed characteristics curves of this model for drives with T8R4. The drive parameters does not change.
- [2] See the torque-speed characteristics curves of this model for drives with T017. The drive parameters does not change.
- Models of drives:
  - S - 220 V voltage class
  - T - 380 V voltage class
  - 1R6: Rated output current = 1.6 A; 2R8: Rated output current = 2.8 A…; 026: Rated output current = 26 A; 027: Rated output current = 27 A.
- Servo motors designed to work with 23-bit (V3) or 26-bit (V6) encoders have the same dimensions.
- The MS1-R series motors equipped with the V6/V3/A6/A3 encoders have the same dimensions, except for motors in flange size 40.
- Servo motors match different series of servo drives. The maximum speed and maximum torque output of the motor vary slightly. See the servo drive selection guide for details.
- The SV660 series drive supports only 23-bit encoders.
- For models not listed in the table, confirm with Inovance technical support before placing an order.

3 Product Information

3.1 Drive

3.1.1 Model and Nameplate

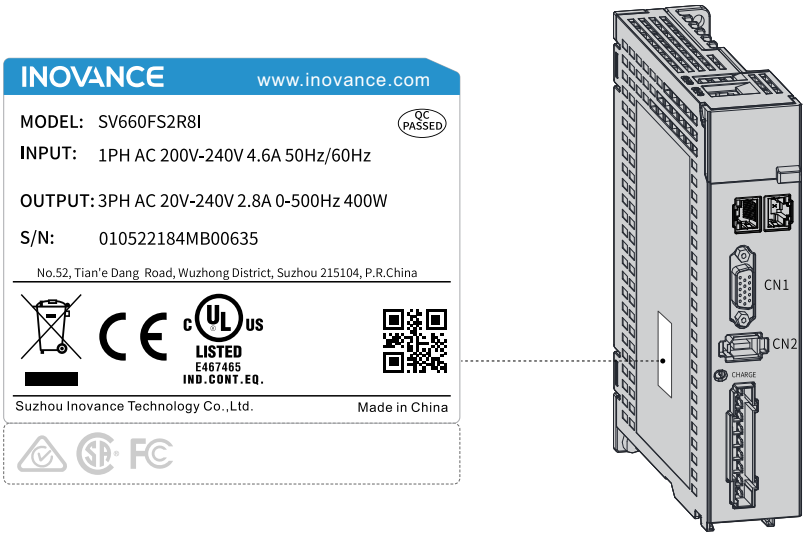
Model and Nameplate

SV660 F S 2R8 I - FH
① ② ③ ④ ⑤ ⑥

① **Product series** SV660: SV660 series servo drive	④ **Rated output current**		⑤ **Mounting method** I: Baseplate-mounted
② **Product type** F: PROFINET communication type	S: 220 V	1R6: 1.6 A 2R8: 2.8 A 5R5: 5.5 A 7R6: 7.6 A 012: 11.6 A	⑥ **Customized function** Blank: Standard FS: STO GFH[1]: high protection INT[2]: International version NDB[3]: no dynamic braking
③ **Voltage class** S: 220 V T: 380 V	T: 380 V	3R5: 3.5 A 5R4: 5.4 A 8R4: 8.4 A 012: 11.9 A 017: 16.5 A 021: 20.8 A 026: 25.7 A	

Note

- [1] - GHF: High protection model that features high reliability for environments with cutting fluids and excessive dust.
- [2] - INT: Products of the INT version support the global warranty service system by default, while other products support the Chinese warranty service system by default.
- [3] - NDB: The NDB model is required when the product is driven by loads.



Description of production serial number

01050202 4 S 7 00001
① ② ③ ④ ⑤

① **Internal code** Product code	③ **Year** 9: 2009 A: 2010 ... S: 2024 ... Note: I/L/O/Q are skipped.	⑤ **Lot number** 00001: 1st in the month of manufacturing 00002: 2nd in the month of manufacturing 00003: 3rd in the month of manufacturing ... Range: 00001 to 99999
② **Manufacturer code** 4: Suzhou Inovance	④ **Month** 1: January 2: February ... A: October B: November C: December	

Example: S/N 010502024S700001 indicates the drive is manufactured in July 2024.

3.1.2 Components

3.1.2.1 Servo Drives in Size A (0.2 kW to 0.4 kW)

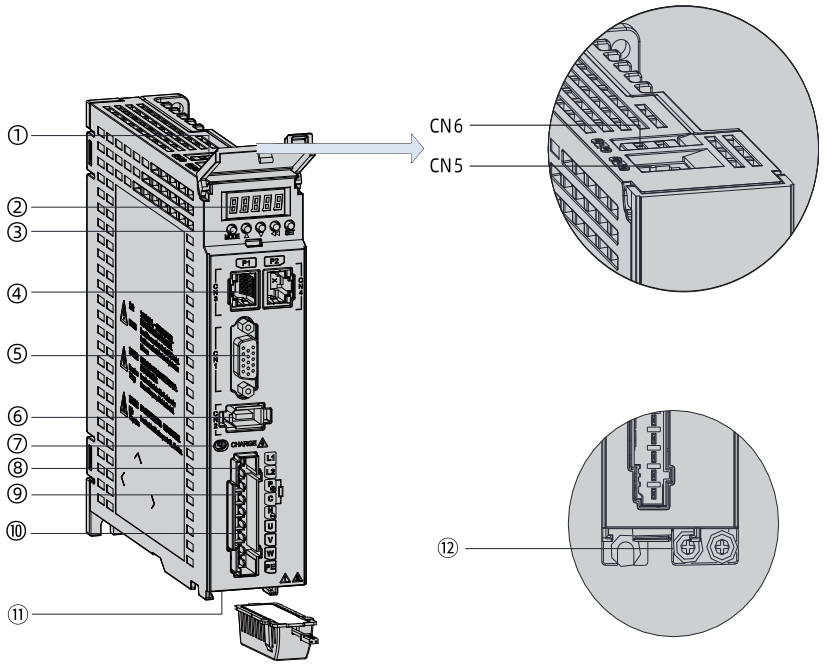


Figure 3-1 Components (SV660FS1R6I, SV660FS2R8I)

Table 3–1 Description of components (SV660FS1R6I, SV660FS2R8I)

No.	Component	Description
①	CN6 (STO safety function terminal)	Connected to external functional safety signal for functional safety purpose Note: This component is applicable to functional safety models (-FS).
	CN5 (communication terminal)	Connected to an RS232 communication instruction device.
②	LED display	The 5-digit 8-segment LED display is used to show operating state and parameter setting of the drive.
③	Key operator	MODE: Used to switch parameters in sequence △: Used to increase the value of the blinking bit ▽: Used to decrease the value of the blinking bit ◁◁: Used to shift the blinking bit leftwards (Hold down: Turning to the next page when the displayed number exceeds five digits) SET: Used to save settings and enter the next-level menu.
④	CN3, CN4 (PROFINET communication terminal)	PROFINET network connector. CN3(P1) is connected to the host controller, and CN4(P2) is connected to a slave.
⑤	CN1 (control terminal)	Used for reference input signals and other I/O signals.
⑥	CN2 (terminal for connecting the encoder)	Connected to the motor encoder.

No.	Component	Description
⑦	CHARGE (bus voltage indicator)	Indicates the bus capacitor with charges. When this indicator is on, charges possibly still exist in the internal capacitor of the servo unit, even if the power supply of the main circuit is OFF. To prevent electric shock, do not touch the power supply terminals when this indicator turns on.
⑧	L1, L2 (power input terminals)	See the nameplate for the rated voltage level.
⑨	P ⊕ , N ⊖ (servo bus terminals)	Used by the common DC bus for multiple drives. Contact Inovance for technical support.
	P ⊕ , C (terminals for connecting external braking resistor)	If an external braking resistor is needed, connect it between terminals P ⊕ and C.
⑩	U, V, W (terminals for connecting the servo motor)	Used to connect U, V, and W phases of the motor.
⑪	Battery box location	Used to hold the battery box of the absolute encoder
⑫	Grounding terminal	Connected to the grounding terminals of the power supply/motor for grounding purpose.

Note

The built-in braking resistor or jumper bar is not available in models S1R6 and S2R8. If an external braking resistor is needed for these models, connect it between terminals P ⊕ and C.

3.1.2.2 Servo Drives in Size B (0.75 kW)

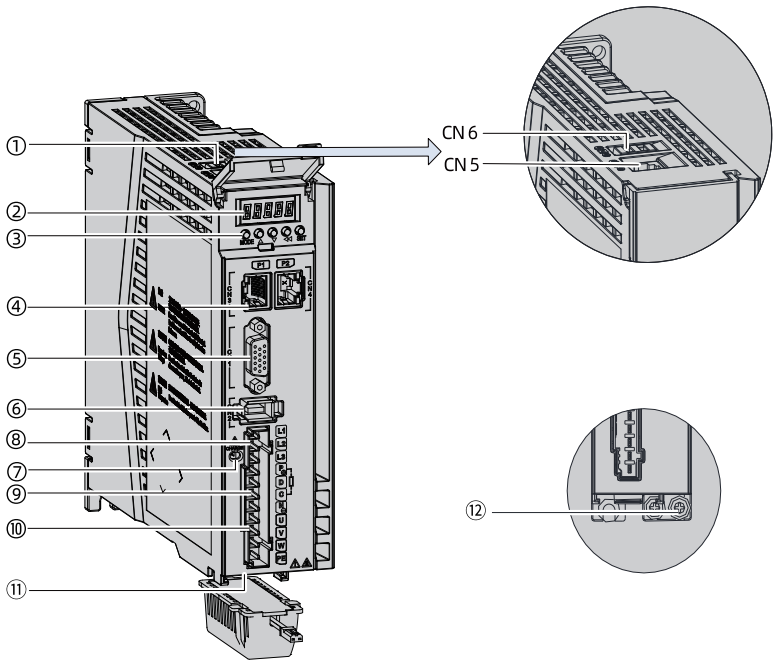


Figure 3-2 Components (SV660FS5R5I)

Table 3-2 Description of components (SV660FS5R5I)

No.	Component	Description
①	CN6 (STO safety function terminal)	Connected to external functional safety signal for functional safety purpose Note: This component is applicable to functional safety models (-FS).
	CN5 (communication terminal)	Connected to an RS232 communication instruction device.
②	LED display	The 5-digit 8-segment LED display is used to show operating state and parameter setting of the drive.
③	Key operator	MODE: Used to switch parameters in sequence △: Used to increase the value of the blinking bit ▽: Used to decrease the value of the blinking bit ◁◁: Used to shift the blinking bit leftwards (Hold down: Turning to the next page when the displayed number exceeds five digits) SET: Used to save settings and enter the next-level menu.
④	CN3, CN4 (PROFINET communication terminal)	PROFINET network connector. CN3(P1) is connected to the host controller, and CN4(P2) is connected to a slave.
⑤	CN1 (control terminal)	Used for reference input signals and other I/O signals.
⑥	CN2 (terminal for connecting the encoder)	Connected to the motor encoder.
⑦	CHARGE (bus voltage indicator)	Indicates the bus capacitor with charges. When this indicator is on, charges possibly still exist in the internal capacitor of the servo unit, even if the power supply of the main circuit is OFF. To prevent electric shock, do not touch the power supply terminals when this indicator turns on.
⑧	L1, L2, L3 (power input terminals)	See the nameplate for the rated voltage level. Note: S5R5 (0.75 kW) models support single-phase 220 V input only, with a 220 V power supply connected between terminals L1 and L2.
⑨	$P_{\oplus}$, $N_{\ominus}$ (servo bus terminals)	Used by the common DC bus for multiple drives. Contact Inovance for technical support.
	$P_{\oplus}$, D, C (terminals for connecting external braking resistor)	Remove the jumper bar between terminals $P_{\oplus}$ and D before connecting an external braking resistor between terminals $P_{\oplus}$ and C.
⑩	U, V, W (terminals for connecting the servo motor)	Used to connect U, V, and W phases of the motor.
⑪	Battery box location	Used to hold the battery box of the absolute encoder
⑫	Grounding terminal	Connected to the grounding terminal of the motor/power supply for grounding purpose.

3.1.2.3 Servo Drives in Size C and Size D (Rated Power: 1.0 kW to 3.0 kW)

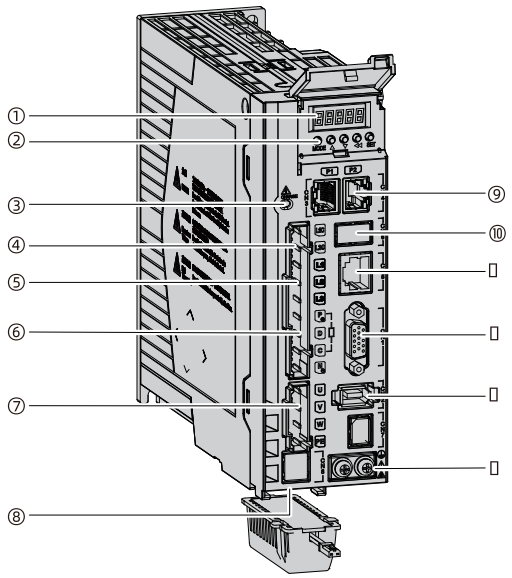


Figure 3-3 Components of servo drives in size C (SV660FS7R6I) and size D (SV660FS012I)

Table 3–3 Components of servo drives in size C (SV660FS7R6I) and size D (SV660FS012I)

No.	Component	Description
①	LED display	The 5-digit 8-segment LED display is used to show operating state and parameter setting of the drive.
②	Key operator	MODE: Used to switch parameters in sequence △: Used to increase the value of the blinking bit ▽: Used to decrease the value of the blinking bit ◁◁: Used to shift the blinking bit leftwards (Hold down: Turning to the next page when the displayed number exceeds five digits) SET: Used to save settings and enter the next-level menu.
③	CHARGE (bus voltage indicator)	Indicates the bus capacitor with charges. When this indicator is on, charges possibly still exist in the internal capacitor of the servo unit, even if the power supply of the main circuit is OFF. To prevent electric shock, do not touch the power supply terminals when this indicator turns on.
④	L1C, L2C (control circuit power input terminals)	Provides power supply to the control circuit as per the rated voltage class on the nameplate.
⑤	L1, L2, L3 (main circuit power input terminals)	The power input terminals for a three-phase 220 V servo drive. Input the main circuit power supply according to the rated voltage class on the nameplate.
⑥	$P_{\oplus}$, D, C (terminals for connecting external braking resistor)	Remove the jumper bar between terminals $P_{\oplus}$ and D before connecting an external braking resistor between terminals $P_{\oplus}$ and C.
	$P_{\oplus}$, $N_{\ominus}$ (servo bus terminals)	Used by the common DC bus for multiple drives. Contact Inovance for technical support.
⑦	U, V, W (terminals for connecting the servo motor)	Used to connect U, V, and W phases of the motor.
⑧	Battery box location	Used to hold the battery box of the absolute encoder

No.	Component	Description
⑨	CN3, CN4 (PROFINET communication terminal)	PROFINET network connector. CN3(P1) is connected to the host controller, and CN4(P2) is connected to a slave.
⑩	CN6 (STO safety function terminal)	Connected to external functional safety signal for functional safety purpose Note: This component is applicable to functional safety models (-FS).
⑪	CN5 (communication terminal)	Connected to an RS232 communication instruction device.
⑫	CN1 (control terminal)	Used for reference input signals and other I/O signals.
⑬	CN2 (terminal for connecting the encoder)	Connected to the motor encoder.
⑭	Grounding terminal	Connected to the grounding terminal of the motor/power supply for grounding purpose.

Note

The main circuits of models S7R6 and S012 can be connected to a single-phase or a three-phase power supply, depending on which one is available on site. The S7R6 and S012 models do not require derating when operating with single-phase input.

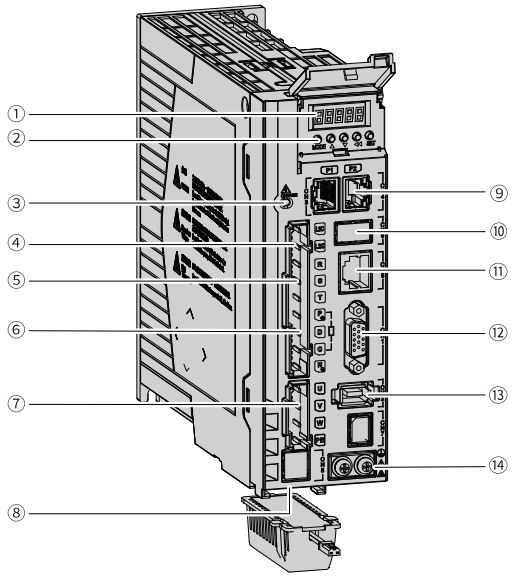


Figure 3-4 Components of servo drives in size C (SV660FT3R5I and SV660FT5R4I) and size D (SV660FT8R4I and SV660FT012I)

Table 3–4 Components of servo drives in size C (SV660FT3R5I and SV660FT5R4I) and size D (SV660FT8R4I and SV660FT012I)

No.	Component	Description
①	LED display	The 5-digit 8-segment LED display is used to show operating state and parameter setting of the drive.
②	Key operator	MODE: Used to switch parameters in sequence △: Used to increase the value of the blinking bit ▽: Used to decrease the value of the blinking bit ◁◁: Used to shift the blinking bit leftwards (Hold down: Turning to the next page when the displayed number exceeds five digits) SET: Used to save settings and enter the next-level menu.
③	CHARGE (bus voltage indicator)	Indicates the bus capacitor with charges. When this indicator is on, charges possibly still exist in the internal capacitor of the servo unit, even if the power supply of the main circuit is OFF. To prevent electric shock, do not touch the power supply terminals when this indicator turns on.
④	L1C, L2C (control circuit power input terminals)	Provides power supply to the control circuit as per the rated voltage class on the nameplate.
⑤	R, S, T (main circuit power input terminals)	See the nameplate for the rated voltage level.
⑥	$P_{\oplus}$, D, C (terminals for connecting external braking resistor)	Remove the jumper bar between terminals $P_{\oplus}$ and D before connecting an external braking resistor between terminals $P_{\oplus}$ and C.
	$P_{\oplus}$, $N_{\ominus}$ (servo bus terminals)	Used by the common DC bus for multiple drives. Contact Inovance for technical support.
⑦	U, V, W (terminals for connecting the servo motor)	Used to connect U, V, and W phases of the motor.
⑧	Battery box location	Used to hold the battery box of the absolute encoder
⑨	CN3, CN4 (PROFINET communication terminal)	PROFINET network connector. CN3(P1) is connected to the host controller, and CN4(P2) is connected to a slave.
⑩	CN6 (STO safety function terminal)	Connected to external functional safety signal for functional safety purpose Note: This component is applicable to functional safety models (-FS).
⑪	CN5 (communication terminal)	Connected to an RS232 communication instruction device.
⑫	CN1 (control terminal)	Used for reference input signals and other I/O signals.
⑬	CN2 (terminal for connecting the encoder)	Connected to the motor encoder.
⑭	Grounding terminal	Connected to the grounding terminal of the motor/power supply for grounding purpose.

3.1.2.4 Servo Drives in Size E (Rated Power: 5.0 kW to 7.5 kW)

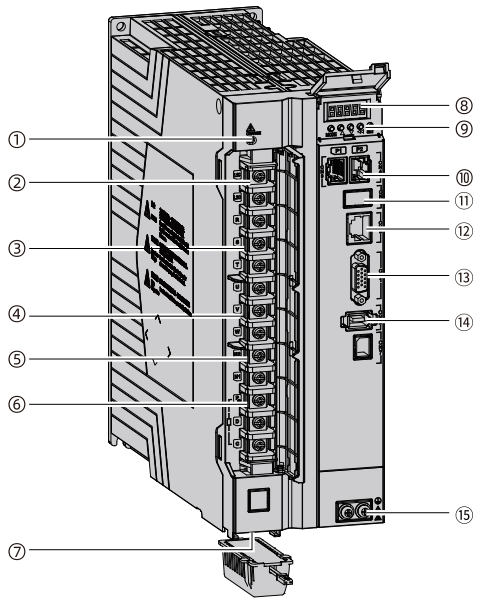


Figure 3-5 Components of servo drives in size E (SV660FT017I, SV660FT021I, SV660FT026I)

Table 3–5 Components (SV660FT017I, SV660FT021I, SV660FT026I)

No.	Component	Description
①	CHARGE (bus voltage indicator)	Indicates the bus capacitor with charges. When this indicator is on, charges possibly still exist in the internal capacitor of the servo unit, even if the power supply of the main circuit is OFF. To prevent electric shock, do not touch the power supply terminals when this indicator turns on.
②	L1C, L2C (control circuit power input terminals)	Provides power supply to the control circuit as per the rated voltage class on the nameplate.
③	R, S, T (main circuit power input terminals)	See the nameplate for the rated voltage level.
④	U, V, W (terminals for connecting the servo motor)	Used to connect U, V, and W phases of the motor.
⑤	N2, N1 (terminals for connecting an external reactor)	Terminals N1 and N2 are jumpered by default. To suppress harmonics in the power supply, remove the jumper between terminals N1 and N2 first and connect an external DC reactor between terminals N1 and N2.
⑥	$P_{\oplus}$, D, C (terminals for connecting external braking resistor)	Remove the jumper bar between terminals $P_{\oplus}$ and D before connecting an external braking resistor between terminals $P_{\oplus}$ and C.
⑦	Battery box location	Used to hold the battery box of the absolute encoder
⑧	LED display	The 5-digit 8-segment LED display is used to show operating state and parameter setting of the drive.
⑨	Key operator	MODE: Used to switch parameters in sequence △: Used to increase the value of the blinking bit ▽: Used to decrease the value of the blinking bit ◁◁: Used to shift the blinking bit leftwards (Hold down: Turning to the next page when the displayed number exceeds five digits) SET: Used to save settings and enter the next-level menu.

No.	Component	Description
⑩	CN3, CN4 (PROFINET communication terminal)	PROFINET network connector. CN3(P1) is connected to the host controller, and CN4(P2) is connected to a slave.
⑪	CN6 (STO safety function terminal)	Connected to external functional safety signal for functional safety purpose Note: This component is applicable to functional safety models (-FS).
⑫	CN5 (communication terminal)	Connected to an RS232 communication instruction device.
⑬	CN1 (control terminal)	Used for reference input signals and other I/O signals.
⑭	CN2 (terminal for connecting the encoder)	Connected to the motor encoder.
⑮	Grounding terminal	Connected to the grounding terminal of the motor/power supply for grounding purpose.

3.1.3 Description of Drive Models

Product series	Control mode	Communication protocol	Connecting terminal
SV660F	AC1 mode	PROFINET RS232	PROFINET RS232 STO
	AC3 mode		
	AC4 mode		

3.2 MS1-R Series Servo Motor Product Information

3.2.1 Models and Nameplate

Model

MS1 H1 - 75B 30C B - A3 3 1 R - *
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

① **MS1 series servo motor**	② **Inertia and capacity** H1: Low inertia, small capacity H2: Low inertia, medium capacity H3: Medium inertia, medium capacity H4: Medium inertia, small capacity	③ **Rated power (W)** Comprised of one letter and two digits B: × 10 C: × 100 Example: 75B means 750 W.
④ **Rated speed (rpm)** Comprised of one letter and two digits B: × 10 C: × 100 Example: 30C means 3,000 rpm.	⑤ **Voltage level (V)** B: 220 D: 380	⑥ **Encoder type** Comprised of one letter and one digit A3: 23-bit multi-turn absolute encoder U2: 20-bit single-turn absolute encoder (for 25-flange motors)

⑦ Shaft connection mode	⑧ Brake and oil seal	⑨ Sub-series No.
3: Solid shaft, with key and threaded hole	0: Without oil seal or brake 1: With oil seal but no brake 2: With brake but no oil seal 4: With brake and oil seal	R: R version ⑩ Customized function[1] Blank: Standard

Note

[1] For non-standard model selection, contact Inovance.

Description of nameplate

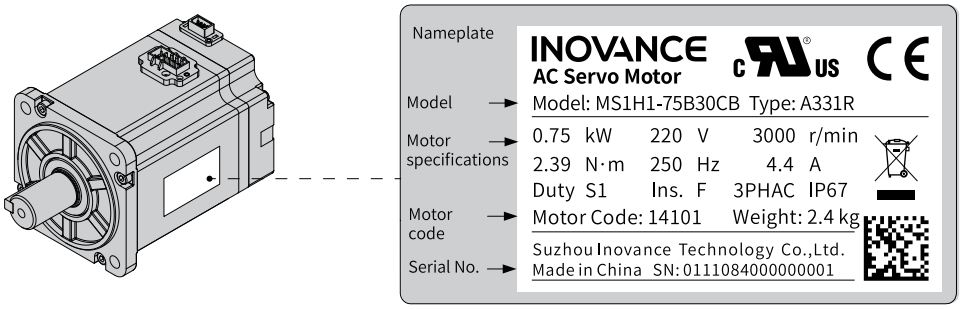


Figure 3-6 Nameplate

3.2.2 Components

Motor (40-flange)

- **Terminal-type servo motor**

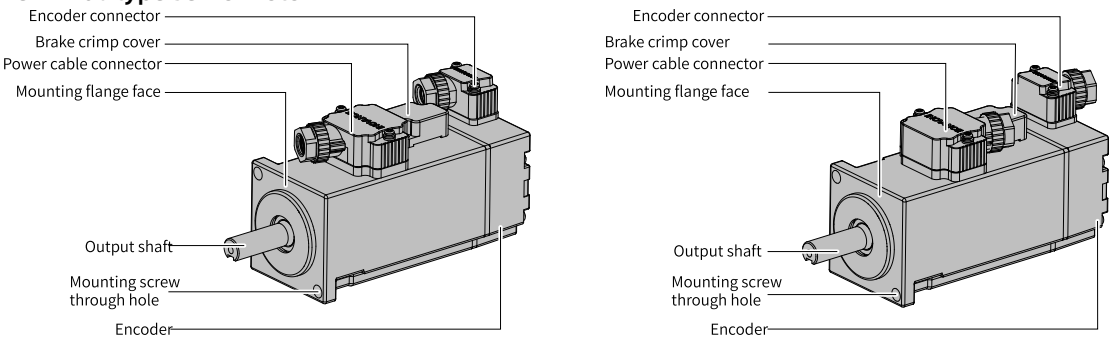


Figure 3-7 Components of terminal-type servo motors (Left: motor with front cable outlet; Right: motor with rear cable outlet)

- **Flying leads type servo motors**

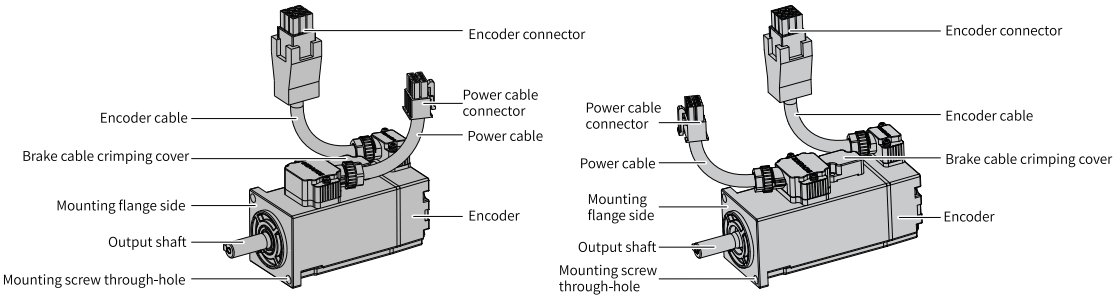


Figure 3-8 Components of the flying leads motor (left: 50 W flying leads motor, right: 100 W flying leads motor)

Note

- For 50 W terminal-type models, use rear outlet for power cables.
- For 100 W models, if the mounting flange face is internally stepped type, only terminal-type models can be used, which are equipped with power cables with rear outlet.
- For details, see the motor dimension diagrams.

Motor (60- and 80-flange)

- **Terminal-type servo motor**

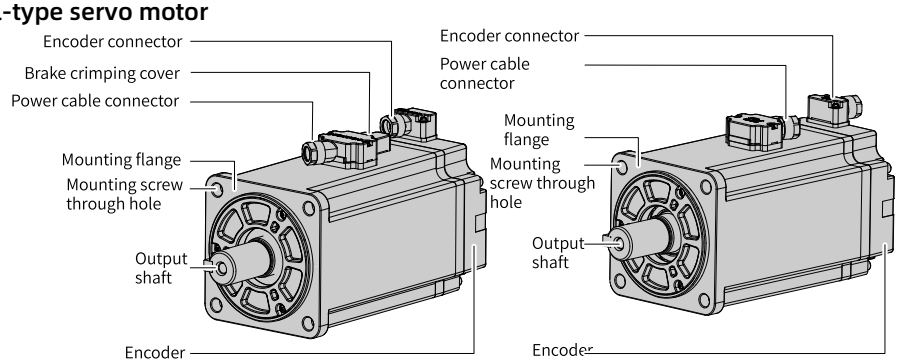


Figure 3-9 Components of terminal-type servo motors (Left: motor with front cable outlet; Right: motor with rear cable outlet)

- **Flying leads type servo motors**

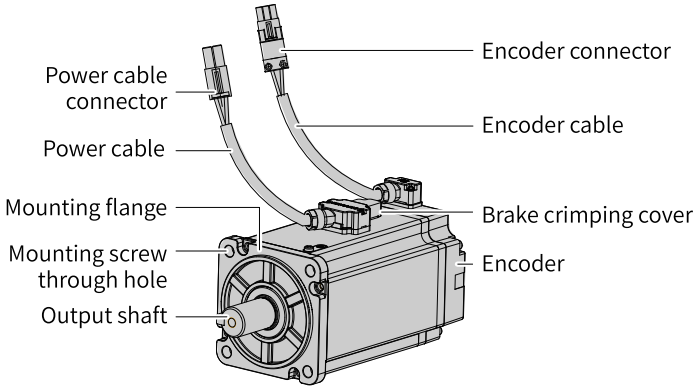


Figure 3-10 Components of the flying leads motor (front cable outlet as standard)

Motor (100-, 130- and 180-flange)

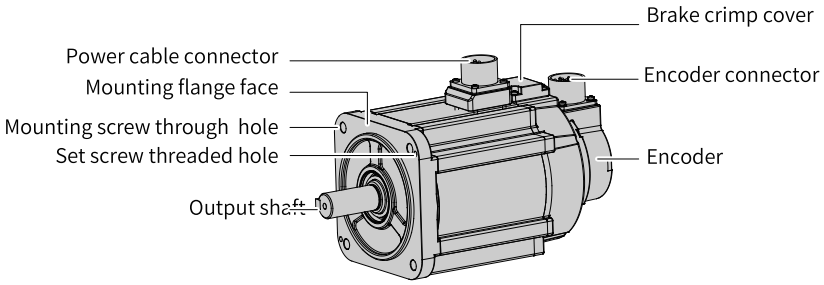


Figure 3-11 Components of servo drives in frame sizes 100/130/180

3.3 MS1-R Series Servo Motor with Battery-free Encoder

3.3.1 Models and Nameplate

Model Description

MS1 H1 - 75B 30C B - V3 3 1 R
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

① **MS1 series servo motor**	② **Inertia and capacity** H1: Low inertia and low capacity H2: Low inertia and medium capacity H3: Medium inertia, medium capacity H4: Medium inertia, small capacity	③ **Rated power (W)** One letter and two digits B: x 10 C: x 100 Example: 75B: 750 W
④ **Rated speed (rpm)** One letter and two digits B: x 10 C: x 100 Example: 30C: 3,000 rpm	⑤ **Voltage class (V)** B: 220 D: 380	⑥ **Encoder type** One letter and one digit V3: Battery-less 23-bit multi-turn absolute encoder
⑦ **Shaft connection mode** 3: Solid shaft, with key and threaded hole	⑧ **Brake and oil seal** 1: With oil seal but no brake 4: With brake and oil seal	⑨ **Sub-series** R: R version

Description of nameplate

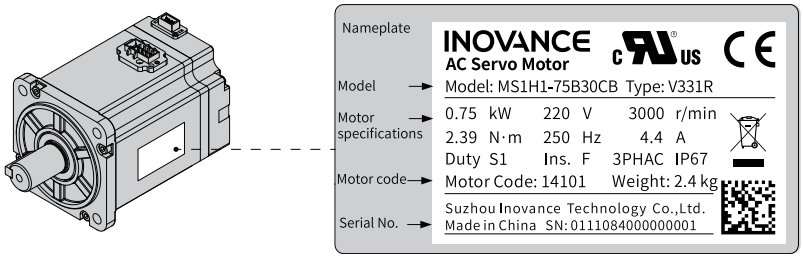


Figure 3-12 Nameplate

3.3.2 Components

Motor (frame sizes 40/60/80)

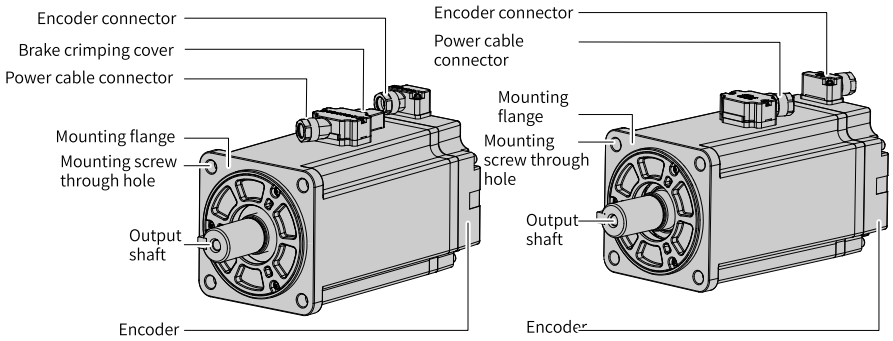


Figure 3-13 Components of servo drives in frame sizes 40/60/80 (Left: motor with front cable outlet; Right: motor with rear cable outlet)

Note

- For 50 W terminal-type models, use rear outlet for power cables.
- For 100 W models, if the mounting flange face is internally stepped type, only terminal-type models can be used, which are equipped with power cables with rear outlet.

Motor (frame sizes 100/ 130/180)

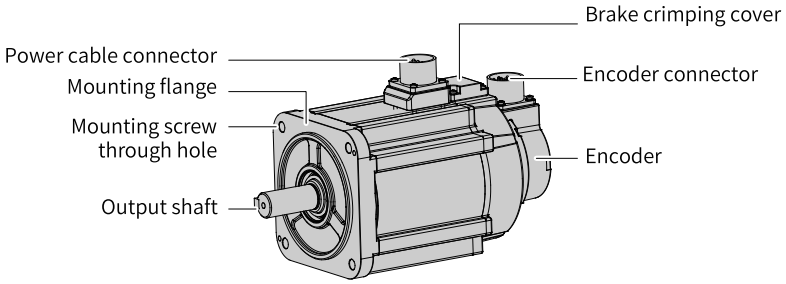


Figure 3-14 Components of servo drives in frame sizes 100/130/180

4 System Connection

4.1 System connection diagram

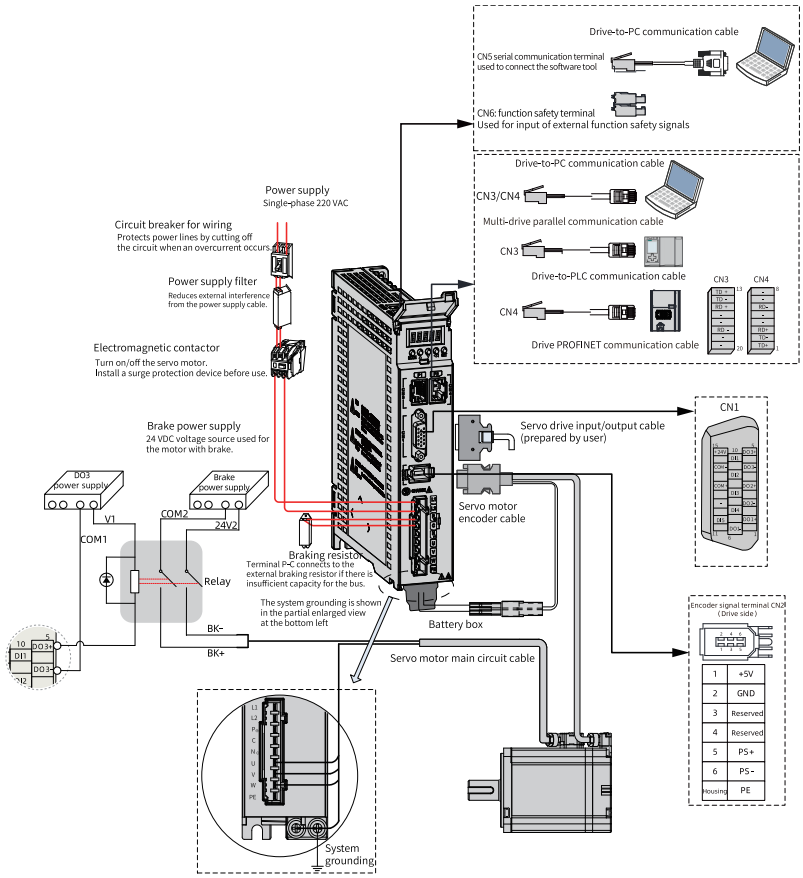


Figure 4-1 Example wiring diagram for single-phase 220 V system (SV660FS1R6I, SV660FS2R8I, SV660FS5R5I)

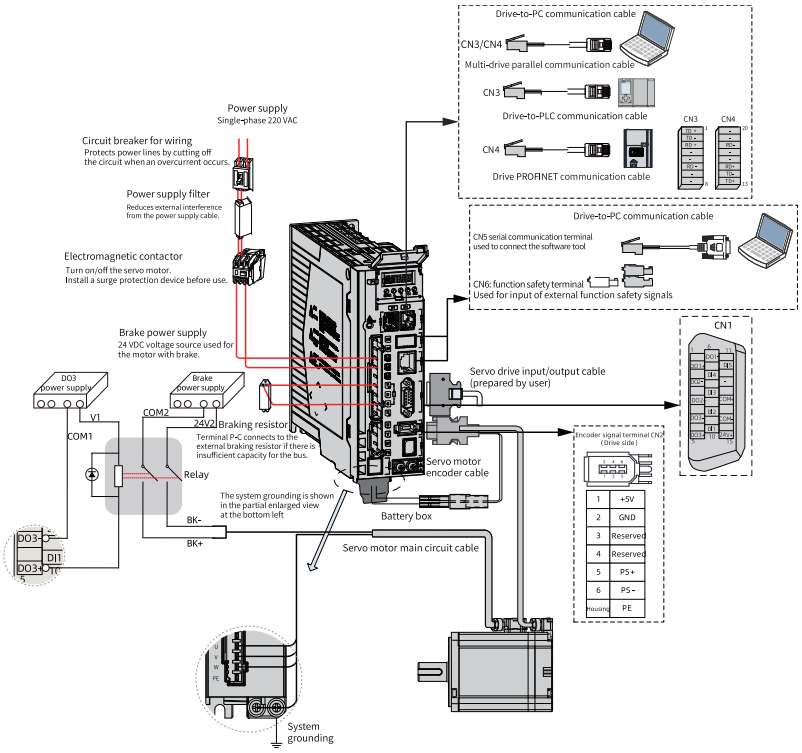


Figure 4-2 Example wiring diagram for single-phase 220 V system (SV660FS7R6I, SV660FS012I)

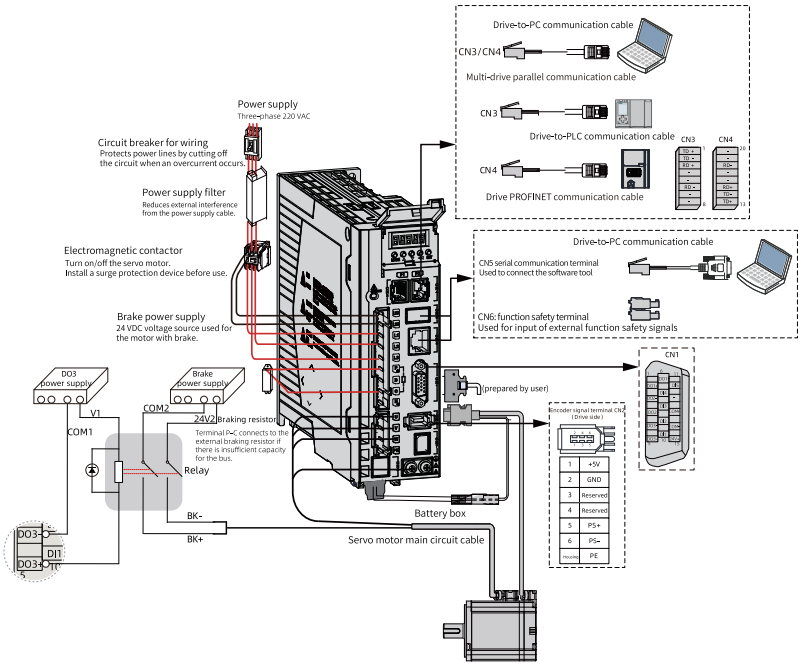


Figure 4-3 Example wiring diagram for three-phase 220 V system (SV660FS7R6I, SV660FS012I)

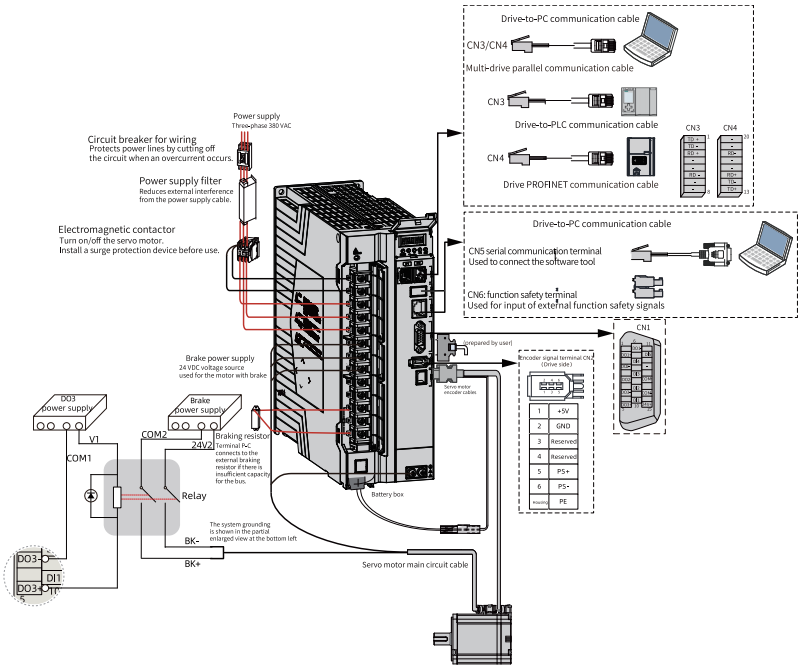


Figure 4-4 Example wiring diagram for three-phase 380 V system (SV660FT3R5I, SV660FT5R4I, SV660FT8R4I, SV660FT012I, SV660FT017I, SV660FT021I, SV660FT026I)

Note

- CN6 (STO terminal) is only applicable to non-standard "-FS" models.
- For safety reasons, connect the motor PE cable to the screw PE terminal first.

4.2 System Composition Description

- The servo drive is directly connected to an industrial power supply, with no isolation such as a transformer. In this case, connect a fuse or a circuit breaker to the input power supply to prevent cross electric shock. For safety, install a residual current device (RCD) that provides protection against overload and short circuit or a specialized ground fault circuit breaker.
- Do not use an electromagnetic contactor to start or stop the servo motor. As a high-inductance device, the motor may generate transient high voltage that may break down the contactor.
- Pay attention to the power capacity when connecting an external control power supply or a 24 VDC power supply, especially when the power supply is used to power up multiple servo drives or brakes. Insufficient power supply will lead to insufficient supply current, resulting in failure of the servo drives or brakes. The brake must be powered by a 24 VDC power supply that matches the motor model and meets the brake power requirements.

Caution

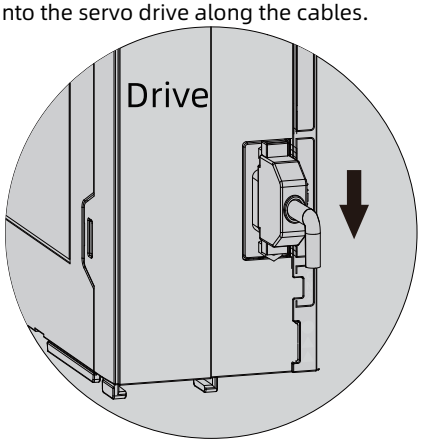
- Models S1R6 and S2R8 do not have built-in braking resistors or jumper bars. If an external braking resistor is required, connect it between terminals P ⊕ and C.
- Remove the jumper between terminals P ⊕ and D before using the external braking resistor. Failure to comply will result in overcurrent and damage the braking transistor.
- Do not directly connect the external braking resistor to the positive or negative electrode of the bus. Failure to comply will damage the drive and result in a fire.
- Do not select a resistor lower than the minimum allowed resistance value. Failure to comply will result in E201.0 (Hardware overcurrent) or damage the drive.
- Make sure that the parameters related to the braking resistor, H02.25, H02.26, and H02.27 are accurately set before using the drive.
- Install the external braking resistor on incombustible matters, such as metal.

5 Installation

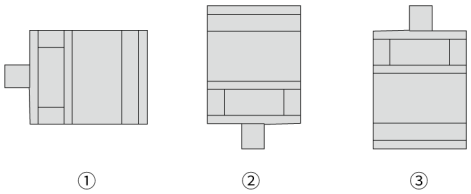
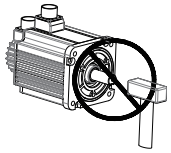
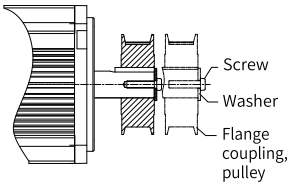
5.1 Safety Precautions

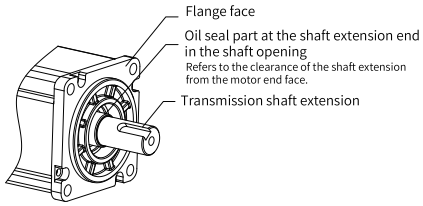
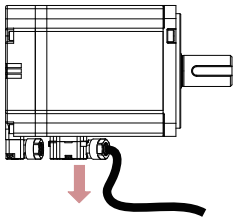
5.1.1 Precautions for Installing the Drive

Table 5–1 Precautions

Item	Description
Direction	• 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 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 face) facing the operator. • The mounting bracket (if needed) must be made of incombustible materials.
Grounding	Ground the grounding terminal properly. Failure to comply may result in electric shock or malfunction due to interference.
Wiring 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.  +
Others	• Do not put heavy objects on the equipment. Failure to comply may result in personal injury or equipment damage. • Do not subject the equipment to excessive impact force. Failure to comply may result in equipment damage.

5.1.2 Safety Precautions for Motors

Item	Description
Direction	The MS1 series motor is flange-mounted. It can be mounted in three directions, as shown in the following figure.  ① ② ③ The motor can be horizontally or vertically mounted. When adopting the mechanical structure ③: • Note the permissible axial force of the motor (gravity of the drive unit) and the IP rating requirement. • Install the output shaft upwards to prevent intrusion of the oil into the motor. • Ensure that the direction is suitable for operation conditions.
Rust-proof treatment	Clean the anti-rust agent applied at the shaft extension before installation, and then take rust-proof measures.
Shaft extension installation	Do not strike the shaft extension during installation. Failure to comply can damage the internal encoder. 
	• When you need to install related accessories to the shaft extension, press-in the accessories through mounting screws and washers to the shaft extension. Do not strike on the bearing. • To remove related accessories, you can use a thruster or similar to prevent the bearing from being damaged. • To ensure safety, install a protective cover or a similar device in the rotary area. 

Item	Description
Installation Direction	The servo motor can be installed horizontally or vertically.
Oil and moisture countermeasures	• The oil seal is only dust-proof. • Do not submerge the motor/cable in water or oil. • Confirm the IP level of the servo motor when using it in a place with water drops. (except for the shaft opening)  • Install the motor with its connecting terminals facing downwards (as shown in the following figure) when the motor is to be used in a place with liquid. This is to prevent the liquid from flowing into the motor along the cable.  • In environments where the shaft opening is exposed to oil drops, use a servo motor with an oil seal. • Observe the following requirements when using the servo motor with an oil seal: ■ Ensure the oil level is lower than the oil seal lip during use. ■ Avoid oil accumulation at the oil sealing lip when the motor is installed vertically upward. ■ For a motor with oil seal, if the output shaft is installed upwards, the engine oil may enter the motor. Ensure that the direction is suitable for operation conditions. ■ For a motor with reducer, leave a small amount of oil on the lip for lubrication. When the oil seal is submerged in the oil, the oil may enter the motor, leading to motor faults. As the shaft opening is not water-proof or oil-proof, take proper measures to prevent water drops or cutting oil from entering the motor, leading to motor faults.

5.2 Installation Flowchart

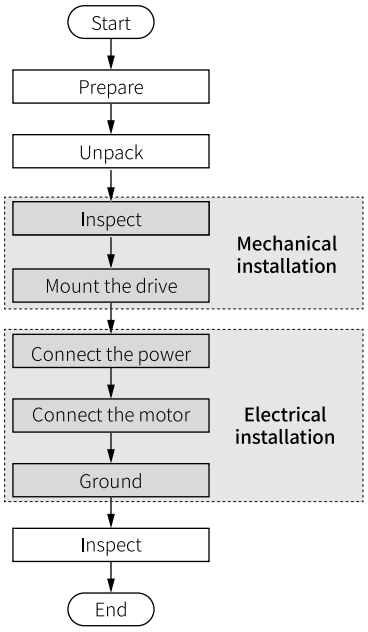


Figure 5-1 Installation flowchart

Note

- The figure shows the recommended installation procedure, which can be adjusted under the premise that the installation quality is ensured.
- For details about the electrical wiring, see *" Wiring" on page 82*.

5.3 Pre-installation Preparation

5.3.1 Requirements on Installation Personnel

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

All the mechanical operations may be executed only by trained professionals that not only familiar with the installation position, mechanical installation, troubleshooting/maintenance, but also meet the following requirements:

- Received safety training and passed related examinations or received training on mechanical operations (such as mechanical engineers or electrical engineers)
- Familiar with electrical equipment and basic mechanical characteristics and installation requirements of the motor
- Physically qualified for mechanical operations
- Familiar with this manual especially all the safety precautions

All the electrical operations may be executed only by trained professionals that not only familiar with the installation position, mechanical installation, troubleshooting/maintenance, but also meet the following requirements:

- Received professional electrical training (such as electrical engineers)
- Familiar with this manual especially all the safety precautions

5.3.2 Requirements on Installation Environment

5.3.2.1 Requirements on Servo Drive Installation Environment

Table 5–2 Environment requirements

Item	Requirement
Installation location	Indoor
Overvoltage category of the power grid	Overvoltage category III (OVC III)
Altitude	The maximum altitude is 2000 m. • 1000 m and below: Derating is not needed. • Derating is needed for altitudes above 1000 m (derate 1% for every additional 100 m). • For altitudes above 2000 m, contact Inovance.
Temperature/ Humidity	• Ambient temperature/humidity range: 0°C to 55°C (no derating required for 0°C to 45°C; derate by 2% for every 1°C increase above 45°C)/< 95% RH, without condensation; Class 3K3 (IEC 60721-3-3) • Storage temperature/humidity range: -25°C to +55°C/< 95% RH (at 40°C), without condensation; Class 1K2 (IEC 60721-3-1) • Transport temperature/humidity range: -40°C to +70°C/< 95% RH, without condensation; Class 2K2 (IEC 60721-3-2) • To improve the reliability of the drive, use the drive in environments without dramatic temperature change. • When used in enclosed spaces such as control cabinets, use cooling fans or air conditioner to cool the cabinet, ensuring the temperature inside the cabinet remains within the servo drive operating temperature range. Otherwise, overtemperature or fire may occur. • Install the drive on a flame-retardant surface, with sufficient clearance reserved for heat dissipation. • Take measures to prevent the drive from being frozen.
Vibration resistance	• Energized operating condition: Tested according to IEC60068-2-6, 3.5 mm amplitude at 5 Hz to 8.4 Hz; 1 g gravitational acceleration at 8.4 Hz to 200 Hz; 90-min test in each of the axial direction • Static operating condition in transport/storage: Tested according to IEC60068-2-64, 0.01g^2/Hz power spectral density at 5 Hz to 100 Hz; 0.001g^2/Hz power spectral density at 200 Hz; 1.14 g Grms; 30-min test in each of the axial direction
Shock resistance	Energized operating condition and static operation condition in transport/storage: This product has passed the shock test according to IEC60068-2-27, with a peak gravitational acceleration of 15 g, pulse width of 11 ms, and 3 tests in each direction.

Item	Requirement
IP rating	IP20 Note: Terminals are excluded, which have an IP rating of IP00.
Environment	Pollution degree 2 and below Install the drive in a place that meets the following requirements: • Install indoors for use inside the cabinet. Keep the product away from sunlight. • Do not expose the product to conductive filaments or dust, including but not limited to carbon fiber, gold bonding wire, and graphite powders, metal powder, and toner. • Do not expose the product to contaminated liquids, including but not limited to water/oil mist, cutting fluid, electroplating fluid, acid mist, hydrogen peroxide, detergent, and salt mist. • Do not expose the product to corrosive gases, including but not limited to hydrogen sulfide, sulfur dioxide flow, ammonia, chlorine, hydrogen chloride, and hydrogen fluoride. • Do not expose the product to explosive gas and dust. • Do not install the product on a device or machine with vibration source or shock source. • Do not install near flammable materials or combustible gases. • Keep the product away from heating sources.

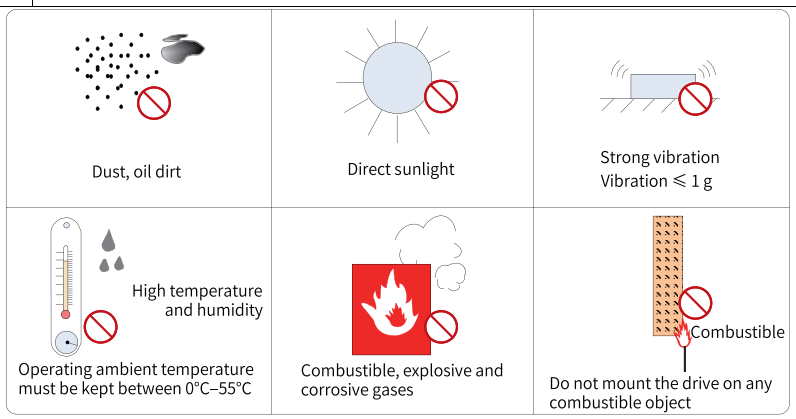


Figure 5-2 Environment requirements

5.3.2.2 Requirements on Motor Installation Environment

Item	Requirement
Altitude	Standard: 1000 m and below (Derating is required for altitudes above 1000 m. See section "Altitude-based Derating Curve" in MS1-R Series Servo Motor Selection Guide for details.)
Ambient temperature	0°C to 40°C (non-freezing)
Storage temperature	-20°C to +60°C (non-freezing)
Ambient humidity	20% to 80% RH (without condensation)
Storage humidity	20% to 80% RH (without condensation)
Vibration class	V15[1]
Vibration resistance[2][4]	Vibration acceleration (flange face as standard), 49 m/s^2 in radial direction and 24.5 m/s^2 in axial direction
Shock resistance [3][4]	490 m/s^2 (flange face as standard), number of shocks: 2

Item	Requirement
IP rating	After the wiring is done, the overall IP rating of the motor is as follows: IP67 (excluding shaft opening and flying leads type motor connectors)
Installation location	• Install the drive in a place free from corrosive and inflammable gases and combustible materials, such as the hydrogen sulfide, chlorine, ammonia, sulphur gas, chloridize gas, acid, soda and salt. • Use the motor with oil seal in places with grinding fluid, oil mist, iron powders or cuttings. • Away from heating sources such as a heating stove • Do not use the motor in an enclosed environment. Running in an enclosed environment can lead to motor overtemperature, shortening its service life. • The X-RAY absorbed dose of the storage site should be lower than 100 rad (silicone)/25 rad (air).

Note

- [1] Vibration class V15 indicates that the vibration amplitude is lower than 15 μm when the motor is operating at rated speed.
- [2] The vertical, side-to-side, and front-to-back resistance for vibration in three directions when the servo motor is mounted with the shaft in a horizontal position is shown in the preceding table.
- [3] The resistance for shock in the vertical direction when the servo motor is mounted with the shaft in a horizontal position is shown in the preceding table.
- [4] The vibration intensity applied on the motor is affected by the transmission structure, alignment accuracy, mounting conditions, and external vibration. These factors may enhance the vibration applied on the motor. When the maximum allowable vibration limit is exceeded, the motor may fail. Therefore, take necessary measures to limit resonance.

5.3.3 Requirements on Installation Clearance

5.3.3.1 Installation Clearance for Servo Drive

- Side-by-side installation
  Servo drives in different power ratings require different installation clearances. When installing multiple servo drives side by side, it is recommended to reserve a clearance of at least 20 mm (0.79 in.) between every two servo drives and a clearance of at least 50 mm (1.97 in.) above and below each servo drive for heat dissipation.

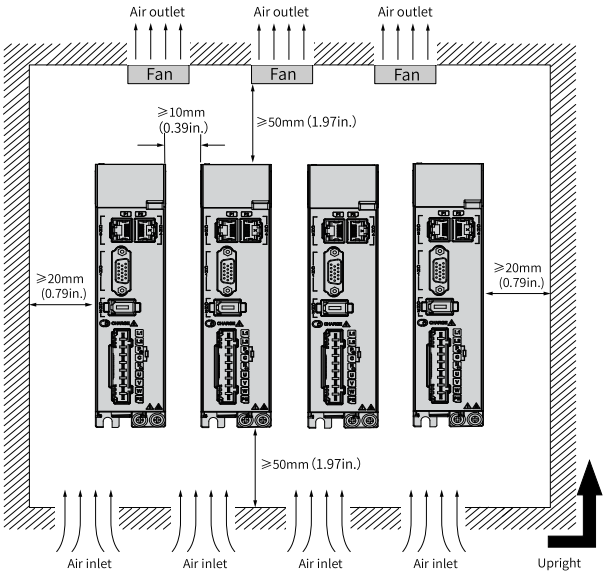


Figure 5-3 Clearance for side-by-side installation

- Compact installation
  Servo drives rated at 0.2 kW to 0.75 kW (Size A and Size B) support compact installation, in which a clearance of at least 1 mm (0.04 in.) must be reserved between every two servo drives. When adopting compact installation, derate the load to 75% of the rated load.

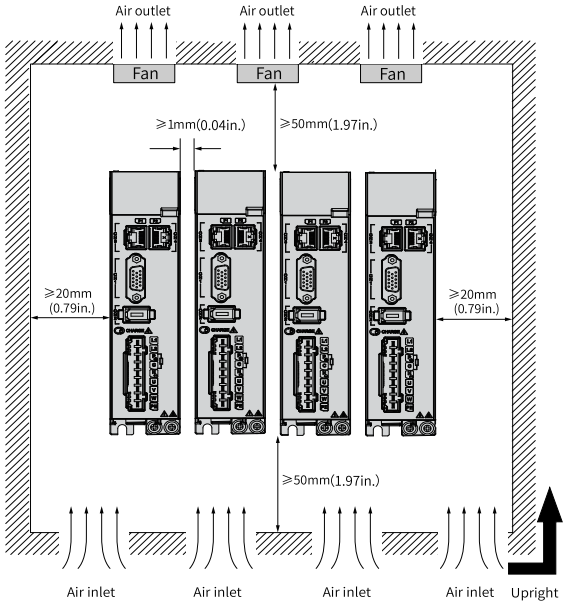


Figure 5-4 Clearance for compact installation

- Close installation
  Servo drives in sizes C, D, and E (rated power: 1.0 kW to 7.5 kW) support zero-clearance installation, without the need for derating.

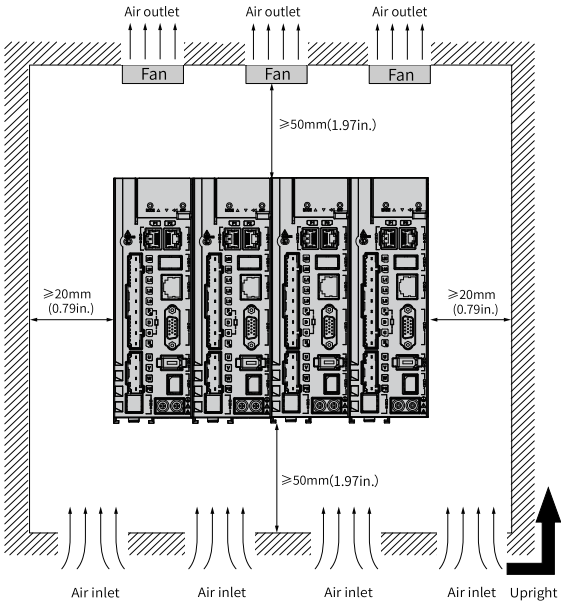


Figure 5-5 Zero-clearance installation

5.3.3.2 Requirements on Motor Installation Clearance

The MS1 series motor is naturally cooled. The internal heat is consumed through heat conduction, heat radiation, and natural convection. A heatsink is used for heat conduction. For details, see section "Installing the Motor" in User Guide. To ensure adequate heat dissipation, keep at least 100 mm spacing between adjacent parts on three sides.

When the motor is used together with a reducer, the motor needs to be derated based on the mounting surface dimensions of the reducer. For details, see the corresponding heatsink derating curve of the base in MS1-R Series Servo Motor Selection Guide.

5.3.4 Installation Dimensions

Size A drive (rated power: 0.2 kW–0.4 kW): SV660FS1R6I, SV660FS2R8I

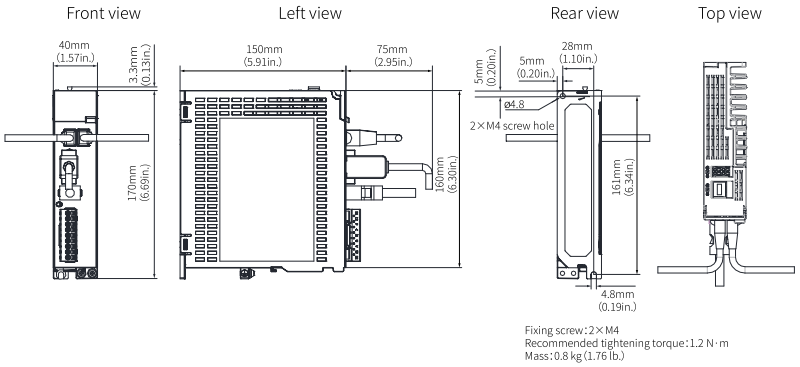


Figure 5-6 Dimensions of Size A

Size B drive (rated power: 0.75 kW): SV660FS5R5I

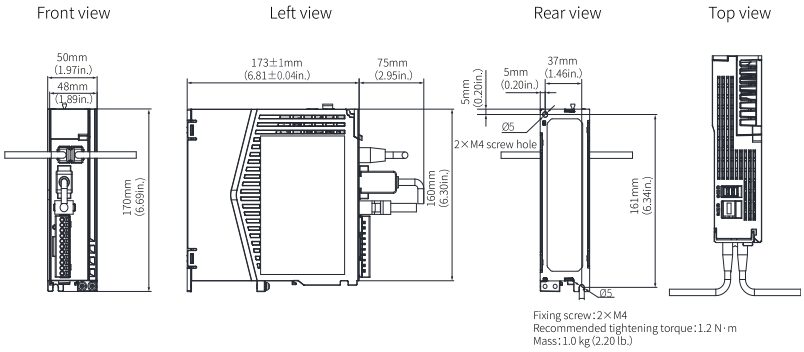


Figure 5-7 Dimensions of Size B

Size C drive (rated power: 1.0 kW–1.5 kW): SV660FS7R6I, SV660FT3R5I, SV660FT5R4I

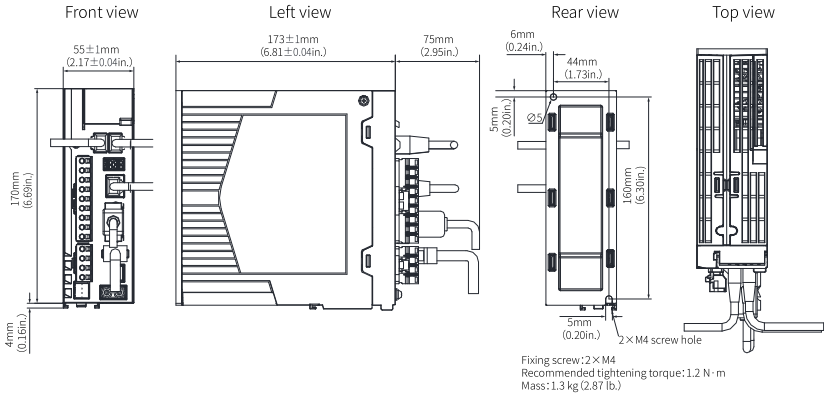


Figure 5-8 Dimensions of Size C

Size D drive (rated power: 1.5 kW–3.0 kW): SV660FS012I, SV660FT8R4I, SV660FT012I

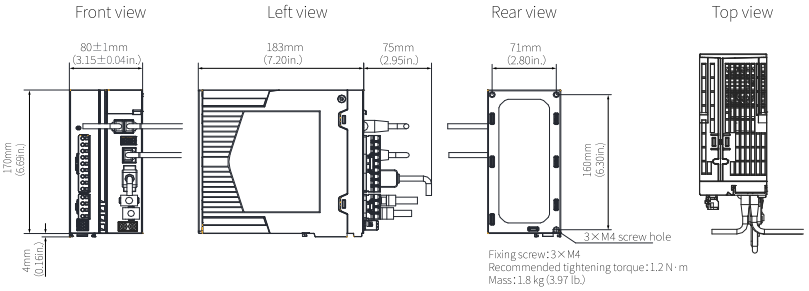


Figure 5-9 Dimensions of Size D

Size E drive (rated power: 5.0 kW–7.5 kW): SV660FT017I, SV660FT021I, SV660FT026I

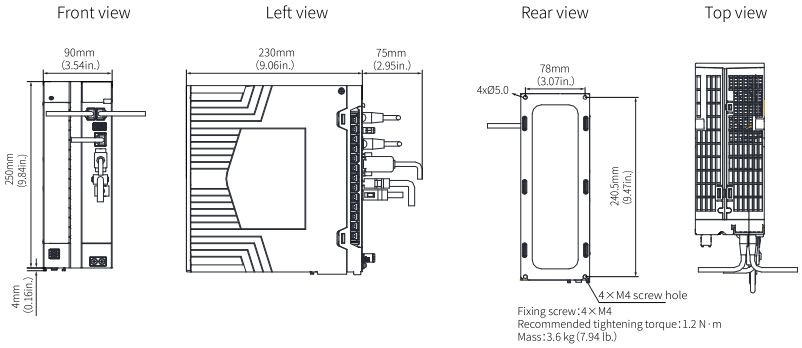


Figure 5-10 Dimensions of Size E

5.3.5 Requirements on Optional Parts

Instructions for installing the fuse and circuit breaker

Danger

To avoid electric shock, do not power on the drive or operate on peripherals immediately after a fuse is blown or a circuit breaker trips. Instead, wait for at least a period of time specified on the product warning label before further operations. Failure to comply can result in product damage, severe injury, or even death.

To comply with EN 61800-5-1 and UL 61800-5-1, install a fuse/circuit breaker on the input side of the servo drive to prevent accidents caused by short circuit in the internal circuit.

Instructions for installing the AC input reactor

The AC input reactor is an option used to suppress the harmonics in the input current. In applications where harmonics need to be suppressed, install an external AC input reactor.

The following figure shows the connection of the AC input reactor.

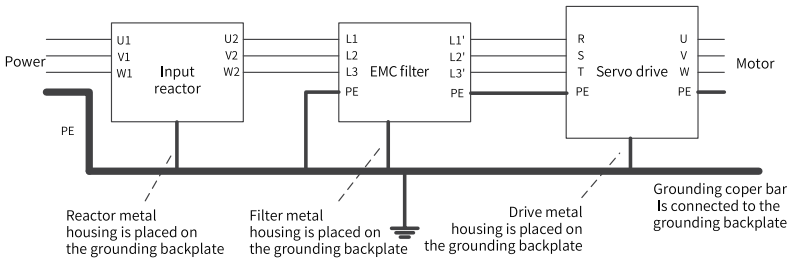


Figure 5-11 Installing the AC input reactor

Note

- The connecting cable between the filter and the drive must be as short as possible (shorter than 30 cm).
- Ensure that the filter and drive are connected to the same grounding reference plane, and ensure that the filter is reliably grounded, otherwise the filtering effect cannot be achieved.

Instructions for installing the magnetic ring and ferrite clamp

The drive generates strong interference during operation and may disturb or be disturbed by other devices in the case of improper routing or grounding. In this case, wind the drive output (U/V/W) cables around the magnetic ring by two to four turns, and wind the signal cable around the magnetic ring or ferrite clamp by one or two turns.

- Amorphous magnetic ring: featuring high permeability when the frequency is within 1 MHz and excellent anti-interference performance, but not as low-cost as the ferrite clamp.
- Ferrite clamp: featuring high permeability when the frequency is above 1 MHz and excellent suppression performance on interference generated by low-power drives and signal cables

The following figure shows the connection of the magnetic ring and ferrite clamp.

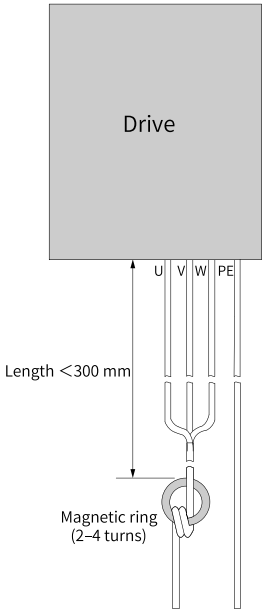


Figure 5-12 Installing the magnetic ring

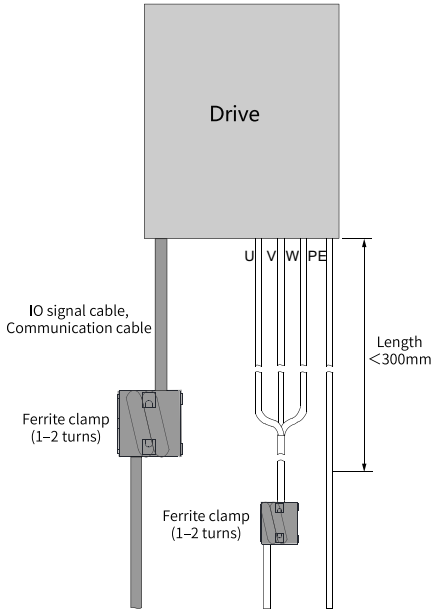


Figure 5-13 Installing the ferrite clamp

5.3.6 Cable installation requirements

There are many cables connecting to the drive, including the power supply cables, power cables, encoder cables, control cables and communication cables. For specific cable specifications, see section "Cables" and "Cable Specifications and Model Requirements" in the user guide.

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

5.4 Unpacking and Handling

5.4.1 Unpacking and Handling of Servo Drive

Check the following items upon unpacking.

Item	Remarks
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 5-3" on page 70*. The deliverables include the product, cushion, carton box, and screw bag, as shown in *"Figure 5-14" on page 70* .
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 5-3 Dimensions of the outer packing box

Size	Drive model SV660 series	Outer width (mm)	Outer height (mm)	Outer depth (mm)	Weight (kg)
A	S1R6, S2R8	250.0	90.0	195.0	0.96
B	S5R5	225.0	90.0	205.0	1.17
C	S7R6, T3R5, T5R4	235.0	105.0	215.0	1.48
D	S012, T8R4, T012	235.0	130.0	225.0	2.02
E	T017, T021, T026	320.0	150.0	280.0	3.94

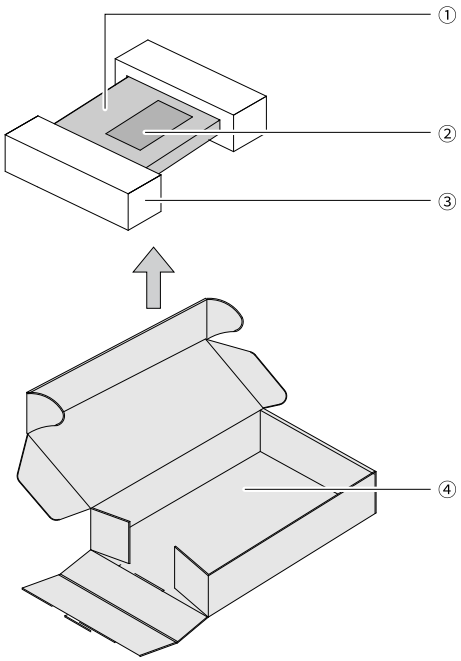


Figure 5-14 Packaging components

No.	Name
①	Product
②	Terminal accessories (varying with product models)
③	Cushion
④	Carton box

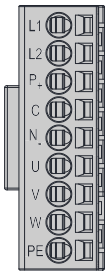
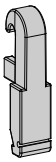
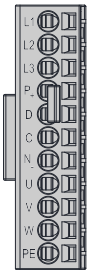
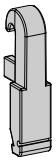
If you need to purchase the terminal accessory kit separately, contact Inovance. For the material code of the accessory kit for each model, see the following table.

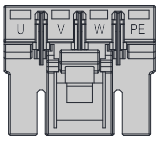
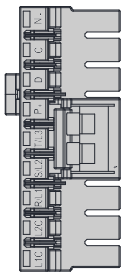
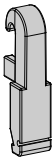
Table 5–4 Part number of the accessory package for each model

Material code	Name
98050331	Accessories (sale)-S6-C40-SV660 size A terminal accessory kit
98050332	Accessories (sale)-S6-C42-SV660 size B terminal accessory kit
98050333	Accessories (sale)-S6-C44-SV660 size C&D terminal accessory kit

The terminal accessory kit list is as follows:

Table 5–5 Terminal accessory kit list

Material code	Diagram	Name	Quantity
98050331		F9A-5.0-09P-A-0419	1
		NFS-004	1
	-	Self-sealing bag	1
	-	QR code label	1
98050332		F9A-5.0-11P-A-0419	1
		NFS-004	2
	-	Self-sealing bag	1
	-	QR code label	1

Material code	Diagram	Name	Quantity
98050333		F9A-7.5-04P-A-0416	1
		F9A-7.5-09P-A-0420	1
		NFS-004	2
	-	Self-sealing bag	1
	-	QR code label	1

Note

SV660 series servo drives share the same terminal accessory kit. The specific terminal accessory kit is subject to the actual product.

5.4.2 Motor Unpacking and Handling

5.4.2.1 Unpacking

Precautions for unpacking

- Pay attention to the handling icons on the package after receiving the motor.
  Handling icons and definitions:

Icon	Definition	Icon	Definition
	Upwards		Damp-proof
	Fragile		No stacking

- Check the integrity of the deliverables.
  - Check whether the deliverables are consistent with the order.
  - If there is any obvious damage caused during transportation, report it to the carrier immediately.

- If there is any part missing, report it to Inovance agent.
- The sheet Motor Safety Precautions is within the scope of delivery, keep it properly for future use.

Note

- Claims exceeding the deadline will not be accepted.
- Do not use damaged components.
- Observe local regulations when packing and handling the motor.

Check after unpacking

Check the following items upon unpacking.

Item	Description
Check whether the product complies with your order.	Check whether the motor model and specification comply with your order. **Note:** Check whether the packing box is intact. If the packing box is damaged, contact your supplier immediately.
Check whether the product is intact.	Check whether the product is in good condition. If there is any part missing or damaged, contact Inovance or your supplier immediately.

5.4.2.2 Handling

Use proper tools during handling and packaging to prevent damage caused by improper operations. Operating a damaged motor may damage the winding, bearing, or even the whole system.

Hoisting and handling the motor with dedicated tools

Frame size within 180 mm	Frame size 180 mm and above

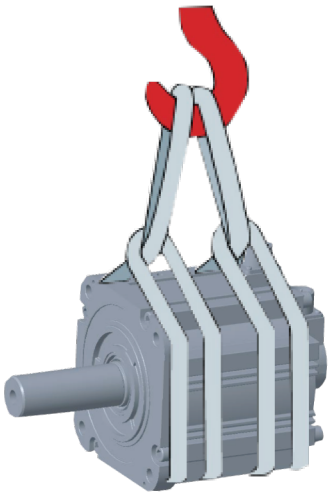


Figure 5-15 Hoisting and handling the motor with dedicated tools



Figure 5-16 Hoisting and handling the motor through the eyebolt

Caution

- The motor may fall in the case of improper hoisting tool or improper use of the hoisting tool, which may lead to death or serious personal injury.
- The hoisting tool must be able to bear the weight of the motor.
- Install the hoisting tool to the motor as shown in section "Hoisting and Handling the Motor with Hoisting Tool".
- Do not hold the motor cables or motor shaft with bare hands during handling. Failure to comply may lead to personal injury or fault.

Caution

- The motor may fall if the suspension point is incorrect or is not used, which may lead to serious personal injury or even death.
- For large-scale motors, hoist and handle the motor through the two eyebolt screws on the bearing end cover.
- The pull direction cannot exceed 45°.
- Screw down the eyebolt screws manually with a tightening torque of 6 N·m to 8 N·m. The screw hole may be damaged in case of excessively high tightening torque imposed by tools.
- Do not use deformed or damaged eyebolt screws.
- No external force is allowed in the direction perpendicular to the eyebolt plane.

Laying down the motor

1. Lay the motor on a fixed and flat surface.
2. Take measures to prevent the motor from operating unexpectedly.

Caution

If the motor has not been fixed properly after being put down, it may move accidentally and result in personal injury.

- Fix the motor properly after putting it down.
- Release the crane device after fixing the motor.

5.4.2.3 Storage

Pack the motor into the original package if possible. Apply protective coating on the exposed shaft end, sealing components, and flange size. Store the motor in a dry, dust-free, and vibration-free place indoors. This is to prevent the motor from being affected by extreme weather factors. Store the motor for at most two years. An excessively long storage time can affect the characteristics of the lubricating grease on the rolling bearing. Equipment damage caused by failure to comply with the preceding requirements is not covered by warranty.

The place where the motor is stored must meet the following requirements:

Table 5–6 Storage environment requirements

Item	Description
Ambient temperature	-20℃ to +60℃
Maximum relative humidity	< 60% RH (without condensation)
Mechanical environment requirements	Stable and vibration-free, V_{valid} < 0.2 mm/s The X-RAY absorbed dose of the storage site must be lower than 100 rad (silicone)/25 rad (air).

Check whether the motor state is normal every six months:

- Check whether the motor suffers from moisture through detecting the insulation resistance (detection voltage: 500 VDC).
- Check whether connectors and fasteners are corroded and whether the sealing parts are intact.
- Perform necessary maintenance.
- Check the desiccant state and replace it if necessary.
- Make a record of the storage operations for the convenience of future use.

The insulation resistance is related to the temperature. If the insulation resistance is excessively low after long-term storage, take desiccation measures on the motor, such as dry the motor with hot air.

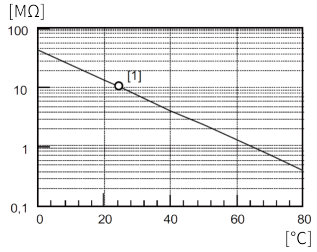


Figure 5-17 Curve of relationship between the insulation resistance and temperature

Note

Put a desiccant into the package and avoid the following conditions:

- Dramatic temperature change;
- Direct sunlight;
- High temperature during storage.

5.5 Mechanical Installation

5.5.1 Pre-installation Inspection

Table 5–7 Pre-installation checklist

No.	Content	Compliance
1	The delivered product is consistent with your order.	□
2	No deformation or cracks are present on the enclosure.	□
3	All screws are in place.	□
4	The signal terminal is free from fracture, foreign objects and bent pins.	□
5	All the necessary components in the drive system are present. Dimensions and specifications are correct. All the components are installed and connected correctly.	□
6	The installation environmental conditions are within the allowable range.	□
7	The equipment on the user side and mounting surfaces (such as the flange face and shaft) of the motor have been cleaned.	□
8	The mounting surface has not been corroded.	□
9	The mounting dimensions of the equipment on the user side (such as shaft diameter, shaft length, and radial runout) comply with the specifications.	□
10	The braking torque of the motor comply with related requirements and actual load on site.	□
11	When the motor is connected to the reducer, the mounting dimensions of the reducer comply with the motor specifications.	□
12	A protective cover has been installed to prevent contact with the motor shaft during operation.	□

5.5.2 Installing the Absolute Encoder Battery

Note

- When re-install the battery box, ensure the drive has been powered on and is in the non-operational state. Replacing the battery box with power off can result in loss of data saved in the encoder.
- If you replace the battery box after powering off the drive, E731.0 (Encoder battery fault) can occur at next power-on, leading to an abrupt change in the multi-turn data. In this case, set H0d.20 to 1 to reset the encoder fault. Then perform the homing operation again.

Color of battery box outer lead:

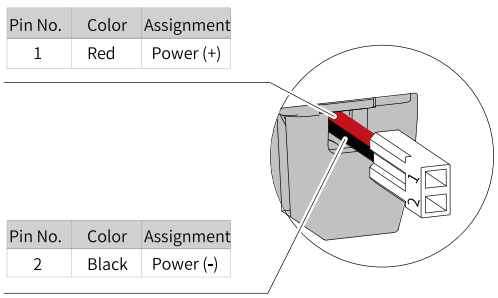


Figure 5-18 Lead wires of the absolute encoder battery

The battery box (model: S6-C4A) is optional and includes:

- One plastic case
- One battery (3.6 V, 2700 mAh)
- Terminal block and crimping terminal

Installing the battery box

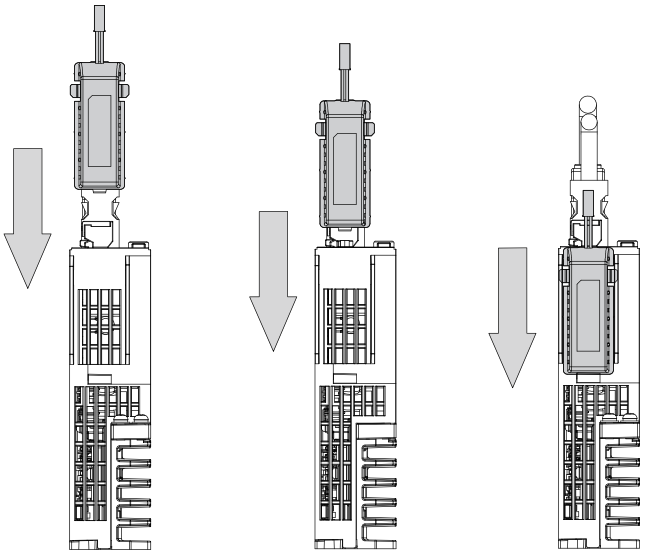
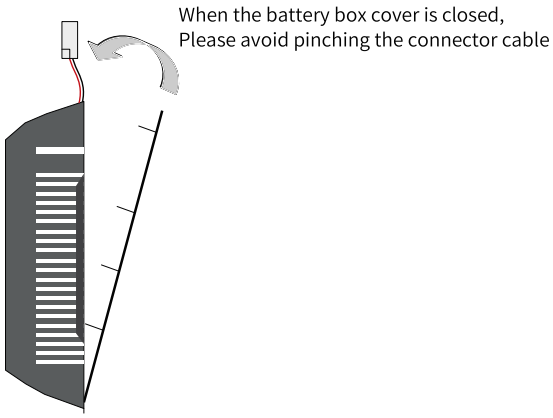


Figure 5-19 Installing the battery box (bottom view)

Removing the battery box:

The battery may have leakage after a long-time use. Replace it every two years. Remove the battery box in reversed order to the steps outlined in the preceding figure.

When closing the battery box cover, prevent the connector cables from being pinched.



If the battery is used improperly, it may result in battery leakage which rot the components or battery explosion. Observe the following precautions during use:

Caution

- Insert the battery with polarity (+/-) placed correctly.
- Save the battery in required temperature (*"5.5.2 Installing the Absolute Encoder Battery" on page 76*) and ensure reliable contact and sufficient electricity. Failure to comply may cause loss of the encoder position.
- Leaving an idled or retired battery inside the device may lead to electrolyte leakage. The electrolyte inside the battery is highly corrosive, not only corroding surrounding components but also incurring the risk of short circuit. Replace the battery periodically (recommended interval: Every 2 years).
- Do not decompose the battery. This is to prevent physical injury caused by spraying of the electrolyte.
- Do not throw the battery into the fire or heat up the battery. Failure to comply may result in an explosion.
- Do not short-circuit the battery or strip off the battery tube. Short-circuiting the battery terminals (positive to negative via conductive material) may induce instantaneous high-current discharge, leading to both rapid capacity depletion and explosion risks due to excessive heat generation.
- This battery is not rechargeable.
- Dispose of the retired battery according to local regulations.

5.5.3 Installing the Drive

The drive supports backplate mounting only.

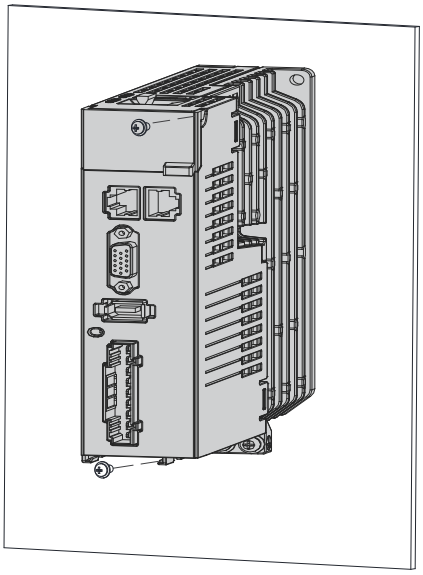


Figure 5-20 Backplate mounting diagram

Note

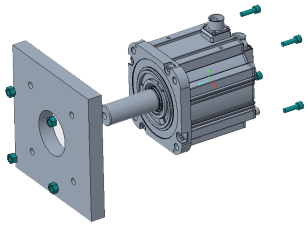
- Servo drives in sizes A to C are secured by two screws, with one screw on the top and the other one at the bottom.
- Servo drives in Size D are secured by three screws, with two screws on the top and another one at the bottom.
- Servo drives in Size E are secured by four screws, with two screws on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

5.5.4 Installing the Motor

Installation instructions

The mechanical and electrical installation of the motor must be performed by trained professionals:

- Obey the data on the nameplate and the warning labels attached to the motor.
- Ensure that the environmental conditions of the installation site (such as temperature and installation height) meet the requirements. It is forbidden to use the motor in explosive environment.
- Thoroughly remove the preservative from the shaft extension with a commonly used solvent.
- To ensure heat dissipation, install a heatsink between the machine tool and the motor. The larger the heatsink, the better the heat dissipation effect will be. The recommended size and material of the heatsink are as follows.



  - Frame sizes 40/60/80: 250 x 250 x 6 (aluminum)
  - Frame sizes 100/130: 400 x 400 x 20 (steel)
  - Frame size 180: 550 x 550 x 30 (aluminum)

  Do not put an insulator, such as a pad, between the servo motor and heat sink, otherwise motor temperature will rise and the motor may fail.

- For vertical mounting with the shaft extension upwards, ensure that no liquid enters the upper bearing.
- When using a motor with oil seal, lower the oil level until it is below the lip of the oil seal.
- To prevent excessive wear of the oil seal, leave a small amount of oil on the lip for lubrication.
- The motor can only be installed on a flat, vibration-free and distortion-resistant support flange surface according to the specified structure.
- Use hexagon socket screws with a property class of at least 8.8.
- When tightening the fixing screws, take measures to prevent the screws from deformation.
- Observe the recommended tightening torque values of motor flange fixing screws, as shown in *"Table 5-8 Recommended tightening torques for fixing screws" on page 79*.
- For motors with a flange of 180 mm or above, remove or tighten the lifting lugs after the motor is mounted.

Table 5–8 Recommended tightening torques for fixing screws

Flange Size	Screw qty and specifications	Tightening torque (N·m)
40	2xM4	2.4
60	4xM5	4.7
80	4xM6	8
100	4xM6	8
130	4xM8	20
180	4xM12	65

Note

- To avoid damage to the motor, do not hit or squeeze the shaft extension.
- To avoid corrosion,
  - When cleaning rust and stains at the end of motor shaft, use ordinary detergent.
  - Keep detergent away from the bearings and seals.
- Do not soak the oil seal in the oil. Oil inside the servo motor may cause malfunction.

Installing the brake motor

After the brake is energized, the electric excitation coil closes and the armature is released. After the power is cut off, the brake holds the motor shaft through a mechanical elastic device. The brake is only used for stopping the motor. Frequent use will shorten its service life. If it is not absolutely necessary, do not use it for emergency stop or deceleration.

The rated voltage of the brake is 24 VDC±10%. The minimum voltage that supplied on the connector at the motor side must be 24 VDC (-10%) to ensure proper brake release. When the maximum voltage (24 VDC (+10%)) is exceeded, the brake may be applied again. The voltage drop on the cable should be considered for long brake cables. The approximate calculation of voltage drop ΔU of a copper cable is as follows:

$\Delta U\ [V] = 0.042\ \Omega \cdot mm^2/m \cdot (L/q) \cdot I_{Brake}$

Where: L = cable length (m), q = cross-sectional area of brake cable conductor (mm^2), I_{brake} = brake DC current (A)

The close time and open time of the brake vary with the discharge circuit. Ensure that the operation delay time is obtained from the actual device.

Avoid starting the motor repeatedly for a short time when the brake is still connected. Therefore, the switching time of the brake and the switching time of the relay should be considered in the drive control circuit or the enabling circuit.

For applications where the gravity shaft or mechanical parts may fall, take protective measures such as using an anti-falling mechanism with dual safety structure.

Note

- When the motor with a brake is accelerating, stopping or running at low speed, the rotating disc of the brake will produce a slight friction sound, which is not a fault or abnormality.
- Because the brake backlash will occur when the brake is not electrified, there will be a tiny return clearance in the rotating direction of the motor shaft, which is normal.

Mechanical Connection

Install and remove transmission units, such as couplings, gears and pulleys, only using appropriate tools.

- Use the threaded hole on the shaft extension.
- Heat up the transmission unit when necessary.
- Use a washer to protect the shaft extension center during disassembly.
- The motor with a keyway has been tested for half-key balance before delivery. If necessary, you can perform full balancing for the motor with transmission units.

Coupling

- Use a dedicated flexible coupling. It is recommended to use a double leaf spring coupling that allow a certain eccentric angle.
- To prevent malfunction, use a coupling with a proper size.
- The centering of the coupling varies according to the speed used and the model of the coupling. Install the coupling according to the mechanical precision allowed by the coupling.

Conveyor connection

- Select the appropriate conveyor according to the allowable radial load of the servo motor and the output power of the motor.
- When installing the conveyor, ensure that its tension is lower than the specified allowable radial load.
- See the instructions of the conveyor manufacturer for detailed installation precautions.

5.5.5 Post-Installation Inspection

Table 5–9 Post-inspection checklist

No.	Item	Compliance
1	The drive and the external braking resistor are placed on incombustible objects.	□
2	No unwanted objects (such as cable terminals and metal chippings) that may cause short circuit of the signal cable/power cable are left inside or outside the drive.	□
3	All the active and live parts have been installed, with functional test conducted.	□
4	The motor has been installed and aligned as specified.	□
5	The motor rotor can rotate freely.	□
6	All the anchor bolts, connectors, and electrical interfaces are fixed with specified tightening torque.	□
7	The actual operating conditions of the motor are consistent with those indicated on the power nameplate.	□
8	The drive unit has been set properly based on its type. Example: • The coupler has been aligned and balanced. • The conveyor device has been set properly during conveyor transmission. • All gear clearances including gear backlash, tooth face clearance, tip clearance, and radial clearance are properly adjusted.	□
9	The brake has been released through the operating voltage.	□
10	The brake can be released and applied normally.	□
11	Terminal screws are tightened with the specified tightening torque and marked properly.	□
12	The motor is installed properly. The motor shaft is connected to the machine properly.	□
13	The servo motor and the machine that connected to the motor are in good condition and ready to run.	□
14	The connector of the main circuit cable is crimped and installed firmly.	□

Note

- The motor can only work together with applicable servo drives.
- The electrostatic-sensitive parts may be damaged by electrostatic discharge.
- Take protective measures against electrostatic discharge.
- Wear protective devices before touching the terminals of electrostatic-sensitive parts.
- Observe related EMC instructions.

6 Wiring

6.1 Wiring Precautions

6.1.1 Safety Precautions

Caution

- The drive must be powered by a TN/TT star-connected power system. Do not use the IT power system. Failure to comply may lead to electric shock.
- Do not connect the U/V/W terminal of the drive or motor to a three-phase power supply or mains frequency power supply. Failure to comply may result in personal injury or a fire.
- Cut off the main power supply through ALM (fault signal) only. Failure to comply may result in a fire due to overtemperature of the braking resistor upon braking transistor faults.
- A brake device must be installed for vertical shaft applications. Connect the 24 V brake power supply with correct polarity. Improper connection can result in falling of the shaft, leading to personal injury or product damage.
- Do not place heavy objects on the cable or pull the cable forcefully. Failure to comply may damage the cable and result in electric shock.
- An electromagnetic contactor must be installed between the input power supply and the main circuit power supply of the drive (single-phase: L1, L2; three-phase: L1, L2, L3/R, S, T) to ensure the power can be cut off upon faults.
- The main circuit cables must be kept away from the motor to prevent the cable insulation from being damaged by an overheated motor.

Note

- Use a power supply filter to reduce the electromagnetic interference on electronic devices surrounding the servo drive.
- Connect the servo drive to the motor directly. Do not use an electromagnetic contactor during wiring. Failure to comply may result in equipment fault.
- The specifications and installation method of external cables must comply with the applicable local regulations.
- Observe the following requirements during wiring of the power supply and main circuit:
  - Install safety devices such as a circuit breaker to prevent short circuit in external circuits. Failure to comply may result in a fire.
  - Perform operations only after the connector is completely de-energized, with single wire per terminal and proper insulation. Failure to comply may result in electric shock.
  - When inserting cables, take care to prevent the cable conductor burrs from being short-circuited to the adjacent cable.
  - Cut off the main circuit power supply and switch off the S-ON signal after an alarm signal is detected.
  - After all cables are connected, it is recommended to tie them at the point 10 cm to 20 cm away from the connector end.

6.1.2 Interference Resistance

1. Use single-point parallel grounding with grounding resistance ≤ 0.1 Ω and grounding conductor cross-sectional area ≥ phase conductor cross-sectional area.
2. For use in the residential environment or environment subject to strong noise interference, install an EMC filter on the input side of the power supply cable to prevent radio frequency interference.

3. To prevent malfunction due to electromagnetic interference, take the following measures:

   a. Route high-current cables and low-current cables through different routes with a distance of at least 30 cm. Do not bundle them together or route them in the same cable duct.
   b. Install the host controller and EMC filter near the servo drive.
   c. Install a surge protection device on the relay, threaded sleeve, and electromagnetic contactor coils.
   d. Do not share the power supply with an electric welder or a discharge machining device. When the servo drive is placed near a high-frequency generator, install an EMC filter on the input side of the power supply line.
   e. Use a metal backplate for as the mounting backplate, and apply protective coating to both the backplate and the mounting position of the drive. Ensure the backplate is in effective conductive connection with the heatsink of the drive.

4. To prevent potential electromagnetic interference, ground properly according to the following instructions.

   a. Grounding of the motor enclosure: Connect the grounding terminal of the motor to the grounding point of the drive, and ensure the grounding point is securely grounded (see section "System Connection Diagram" for the grounding point) to mitigate potential electromagnetic interference (EMI).
   b. Grounding of the power cable shield: Ground both ends of the shield or the metal conduit in the motor main circuit. Crimping is preferable to ensure good contact.
   c. Grounding of the drive: Ground the PE terminal of the drive properly, and secure the fixing screw of this terminal properly to ensure good contact.

6.1.3 Instructions for Use of Cables

- Do not bend or apply stress to cables. The conductor of a signal cable may be easily fractured. Be cautious during use.
- In scenarios where cables need to be moved, use flexible cables. Ordinary cables are easily damaged after being bent for a long time. Cables of low-power servo motors cannot be used for movement.
- If the cable drag chain is used, ensure the following requirements are met.
  - Do not fix or bundle the cables inside the cable carrier. The cables can be bundled and fixed only at two unmovable ends of the cable drag chain.
  - Cables cannot be wound or twisted.
  - The space factor inside the cable drag chain cannot exceed 60%.
  - Do not use cables with different sizes together; otherwise, the thick cable may crush the thin cable. If thick and thin cables need to be used together, use a spacer plate to separate them.

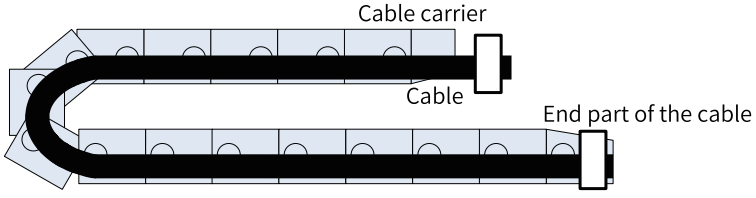


Figure 6-1 Cable drag chain

6.2 Electrical Connection

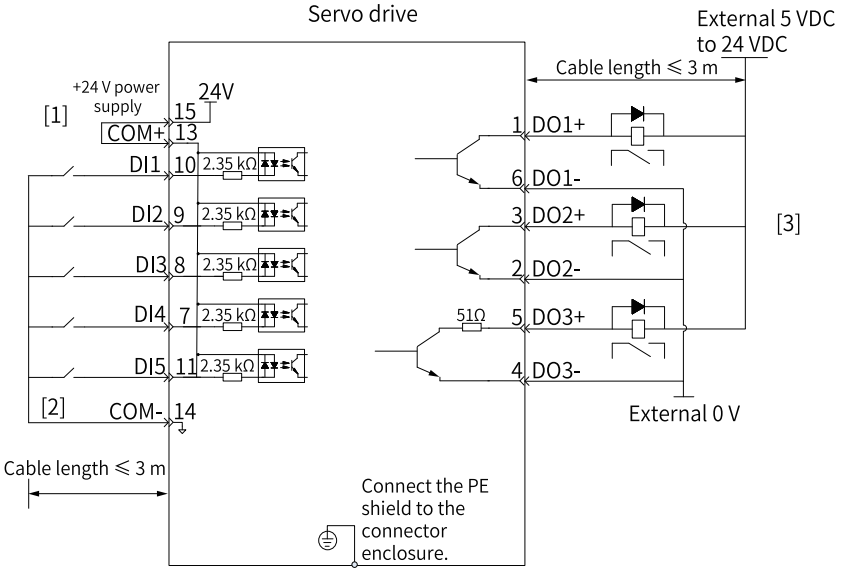


Figure 6-2 Electrical Wiring Diagram

Note

- [1] The voltage of the internal +24 V power supply ranges from 20 V to 30 V, and the maximum operating current is being 150 mA (@25℃).
- [2] The DI can be powered by an external power supply. For details, see *"6.4.4.1 DI circuit" on page 106*.
- [3] You need to prepare the DO power supply (range: 5-24 VDC). The DO terminals support up to 30 VDC voltage and 50 mA current. When the host controller provides optocoupler input, install a current-limiting resistor. See details in *" DO circuit" on page 107*.

6.3 Introduction to Main Circuit Terminals

6.3.1 Main Circuit Terminal Pin Layout

Size A (rated power: 0.2 kW to 0.4 kW): SV660FS1R6I, SV660FS2R8I

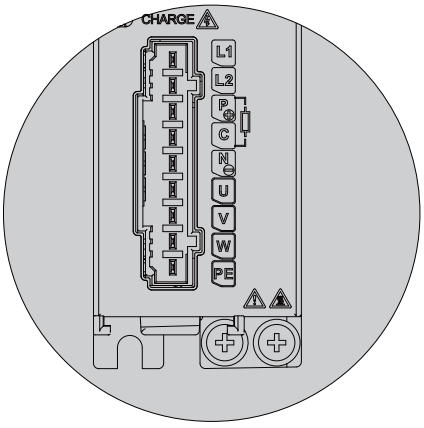


Figure 6-3 Main circuit terminal pins of drives in size A

Table 6–1 Description of main circuit terminal pins of drives in size A

No.	Component	Description
1	L1, L2 Power input terminals	See the nameplate for the rated voltage level.
2	$P_{\oplus}$, $N_{\ominus}$ DC bus terminals	Used by the common DC bus for multiple drives.
	$P_{\oplus}$, C Terminals for connecting external braking resistor	If an external braking resistor is needed, connect it between terminals $P_{\oplus}$ and C.
3	U, V, W Terminals for connecting the servo motor	Used to connect U, V, and W phases of the motor.
4	PE grounding terminal	It is not recommended to connect the motor PE cable here. Note: When a welding machine is used to weld structural parts, do not connect the PE cable of the power cable to the PE terminal of the main circuit of the drive.

Size B (rated power: 0.75 kW): SV660FS5R5I

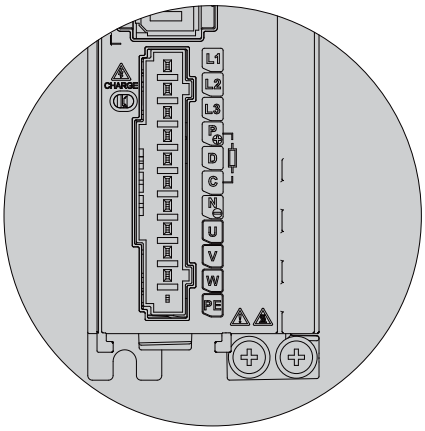


Figure 6-4 Main circuit terminal pins of drives in size B

Table 6–2 Description of main circuit terminal pins of drives in size B

No.	Component	Description
1	L1, L2, L3 Power input terminals	See the nameplate for the rated voltage level. Note: S5R5 (750 W) models support single-phase 220 V input only, with a 220 V power supply connected between terminals L1 and L2.
2	$P_{\oplus}$, $N_{\ominus}$ DC bus terminals	Used by the common DC bus for multiple drives.
	$P_{\oplus}$, D, C Terminals for connecting external braking resistor	If an external braking resistor is needed, connect it between terminals $P_{\oplus}$ and C. Servo drives in size B are equipped with the built-in braking resistor, with terminals $P_{\oplus}$ and D jumpered by default. Note: Remove the jumper between terminals $P_{\oplus}$ and D before using the external braking resistor. Failure to comply will result in overcurrent and damage the braking transistor.

No.	Component	Description
3	U, V, W Terminals for connecting the servo motor	Used to connect U, V, and W phases of the motor.
4	PE grounding terminal	It is not recommended to connect the motor PE cable here. Note: When a welding machine is used to weld structural parts, do not connect the PE cable of the power cable to the PE terminal of the main circuit of the drive.

Size C/D (rated power: 1.0 kW to 3.0 kW): SV660FS7R6I, SV660FS012I

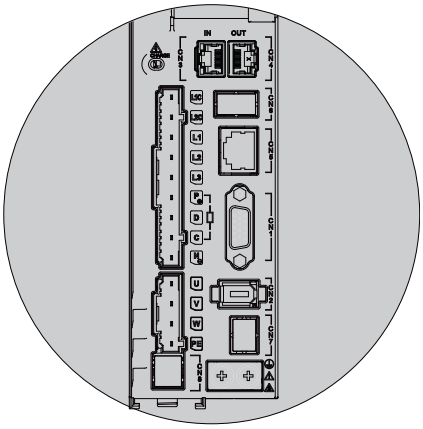


Figure 6-5 Main circuit terminal pins of drives in size C and D (220 V)

Table 6–3 Description of main circuit terminal pins of drives in sizes C and D (220 V)

No.	Component	Description
1	L1C, L2C Control circuit power input terminals	Provides power supply to the control circuit as per the rated voltage class on the nameplate.
2	L1, L2, L3 Main circuit power input terminals	Connected to the main circuit power supply as per the rated voltage on the nameplate.
3	$P_{\oplus}$, $N_{\ominus}$ DC bus terminals	Used by the common DC bus for multiple drives.
	$P_{\oplus}$, D, C Terminals for connecting external braking resistor	If an external braking resistor is needed, connect it between terminals $P_{\oplus}$ and C. Size C and Size D use a built-in braking resistor, with terminals $P_{\oplus}$ and D jumped. Note: Remove the jumper between terminals $P_{\oplus}$ and D before using the external braking resistor. Failure to comply will result in overcurrent and damage the braking transistor.
4	U, V, W Terminals for connecting the servo motor	Used to connect U, V, and W phases of the motor.
5	PE grounding terminal	It is not recommended to connect the motor PE cable here. Note: When a welding machine is used to weld structural parts, do not connect the PE cable of the power cable to the PE terminal of the main circuit of the drive.

Size C/D (rated power: 1.0 kW to 3.0 kW): SV660FT3R5I, SV660FT5R4I, SV660FT8R4I, SV660FT012I

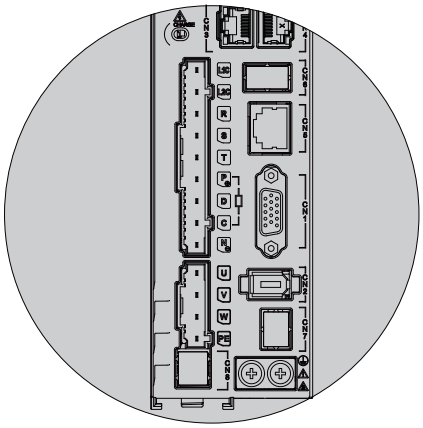


Figure 6-6 Main circuit terminal pins of drives in size C and D (380 V)

Table 6–4 Description of main circuit terminal pins of drives in size C and D (380 V)

No.	Component	Description
1	L1C, L2C Control circuit power input terminals	Provides power supply to the control circuit as per the rated voltage class on the nameplate.
2	R, S, T Main circuit power input terminals	Connected to the main circuit power supply as per the rated voltage on the nameplate.
3	$P_{\oplus}$, $N_{\ominus}$ DC bus terminals	Used by the common DC bus for multiple drives.
	$P_{\oplus}$, D, C Terminals for connecting external braking resistor	If an external braking resistor is needed, connect it between terminals $P_{\oplus}$ and C. Servo drives in size C and size D are built-in with braking resistors by default, with terminals $P_{\oplus}$ and D jumpered. Note: Remove the jumper between terminals $P_{\oplus}$ and D before using the external braking resistor. Failure to comply will result in overcurrent and damage the braking transistor.
4	U, V, W Terminals for connecting the servo motor	Used to connect U, V, and W phases of the motor.
5	PE grounding terminal	It is not recommended to connect the motor PE cable here. Note: When a welding machine is used to weld structural parts, do not connect the PE cable of the power cable to the PE terminal of the main circuit of the drive.

Size E (rated power: 5.0 kW to 7.5 kW): SV660FT017I, SV660FT021I, and SV660FT026I

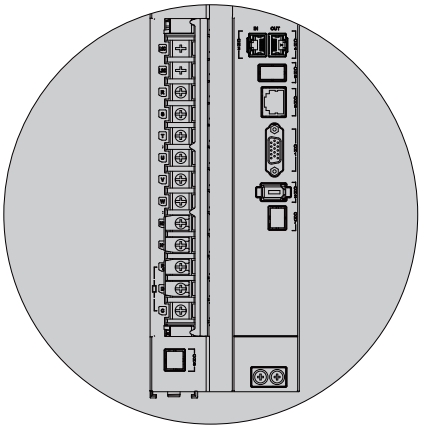


Figure 6-7 Main circuit terminal pins of drives in size E

Table 6–5 Description of main circuit terminal pins of drives in size E

No.	Component	Description
1	L1C, L2C Control circuit power input terminals	Provides power supply to the control circuit as per the rated voltage class on the nameplate.
2	R, S, T Main circuit power input terminals	Connected to the main circuit power supply as per the rated voltage on the nameplate.
3	U, V, W Terminals for connecting the servo motor	Used to connect U, V, and W phases of the motor.
4	N2 and N1 Terminals for connecting external reactor	N1 is shorted to N2 with a jumper by default. To suppress power supply harmonics, remove the jumper and connect an external DC reactor between N1 and N2.
5	$P_{\oplus}$, D, C Terminals for connecting external braking resistor	If an external braking resistor is needed, connect it between terminals $P_{\oplus}$ and C. Servo drives in size E are built-in with braking resistors by default, with terminals $P_{\oplus}$ and D jumpered. Note: Remove the jumper between terminals $P_{\oplus}$ and D before using the external braking resistor. Failure to comply will result in overcurrent and damage the braking transistor.

Description

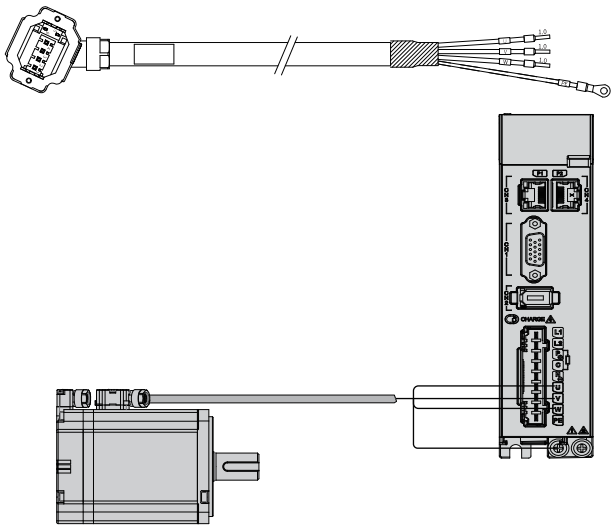
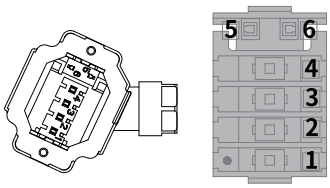


Figure 6-8 Wiring between the drive output and motor

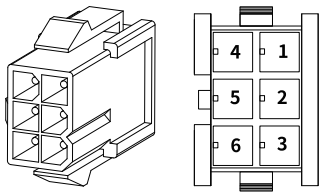
Table 6–6 Description of the power cable connector of the terminal-type motor (motor side)

Applicable flange size [1]	Connector appearance	Terminal pin layout		
		Pin No.	Signal name	Color
Terminal: 40 60 80	 Black 6-pin connector	1	PE	Yellow/Green
		2	W	Red
		3	V	Black
		4	U	White
		5	Brake (polarity insensitive)	Brown
		6		Blue

Note

- [1]: The flange size refers to the width of the mounting flange.
- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.
- Ground the motor to the PE position of the drive screw if possible. For details, see System Wiring Diagram.

Table 6–7 Power cable connector (motor side) of lead-type motor

Applicable flange size [1]	Connector appearance	Terminal pin layout		
		Pin No.	Signal name	Color
Flying-leads types: 40 60 80	 Black 6-pin connector Recommendation: Plastic housing: MOLEX-50361736; Terminal: MOLEX-39000061	1	U	White
		2	V	Black
		4	W	Red
		5	PE	Yellow/Green
		3	Brake (polarity insensitive)	Brown
		6		Blue

Note

- [1] The flange size refers to the width of the mounting flange.
- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.
- Ground the motor to the PE position of the drive screw if possible. For details, see System Wiring Diagram.

Table 6–8 Description of the power cable connector (servo motor side)

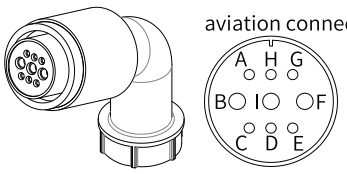
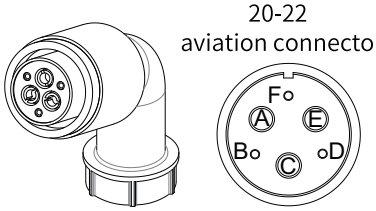
Applicable flange size [1]	Connector appearance	Terminal pin layout		
		Pin No.	Signal name	Color
100 130	20-18 aviation connector  MIL-DTL-5015 series 3108E20-18S aviation connector	B	U	Blue
		I	V	Black
		F	W	Red
		G	PE	Yellow/Green
		C	Brake (polarity insensitive)	Red
		E		Black

Table 6–9 Description of the power cable connector (servo motor side)

Applicable flange size [1]	Connector appearance	Terminal pin layout		
		Pin No.	Signal name	Color
180	20-22 aviation connector  MIL-DTL-5015 series 3108E20-22S aviation connector	A	U	Blue
		C	V	Black
		E	W	Red
		F	PE	Yellow/Green
		B	Brake (polarity insensitive)	Red
		D		Black

Note

- [1] The flange size refers to the width of the mounting flange.
- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.
- For motor grounding mode, see system wiring diagram.

6.3.2 Wiring Precautions and Requirements

To avoid electromagnetic interference caused by long-distance parallel routing of disturbing cables and control circuit cables, keep a distance of at least 30 cm between main circuit cables and signal cables during routing. Main circuit cables include the R/S/T cables, U/V/W cables, DC bus, and braking cables. Signal cables include the I/O signal cable, communication cable, and encoder cable.

Cable ducts must be connected and grounded properly. Aluminum cable ducts can be used to ensure equipotentiality of the device. The filter, servo drive, and motor must be properly connected to systems (machines or devices), with spraying protection applied at the installation part and the conductive metal kept in full contact.

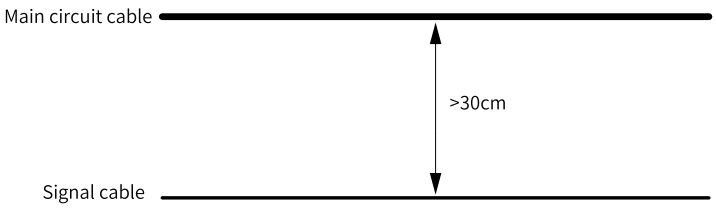


Figure 6-9 Cable layout

6.3.3 Cable Specifications and Models

6.3.3.1 Cable requirements

Cable requirements

1. Observe national or regional regulations when selecting cables. The IEC cable must meet the following requirements:
   - Compliant with EN 60204-1 and IEC 60364-5-52 standards
   - PVC insulated cables with copper conductors
   - Current ratings are based on a maximum permissible conductor operating temperature of 105℃ in 40℃ ambient temperature, assuming single freely separated conductors in air.
2. Ensure the cable bending radius meets the related requirements (fixed cable ≥ 5D, flexible cable ≥ 10D) to prevent internal conductor breakage due to long-term bending.
3. It is recommended to use Teflon cables featuring a higher temperature limit when the temperature inside the cabinet exceeds the temperature limit of regular cables. As the surface of regular cables may be easily hardened and cracked under low temperature, take thermal insulation measures for cables laid in environments with low temperature.
4. The allowable current value can be adjusted when the ambient temperature is high or when the cables are bundled together. You can calculate the allowable current density (A/mm^2) by using the following formula:
   Allowable current density = 8 × reduction coefficient of current-carrying conductor density × current correction coefficient

$$\text{Current correction coefficient} = \sqrt{(\text{Maximum allowable temperature} - \text{Ambient temperature}) \div 30}$$

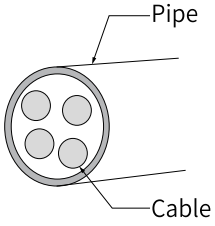


Table 6–10 Current carrying density derating coefficient of conductor

Number of cables in a duct	Current reduction coefficient
< 3	0.7
4	0.63

Number of cables in a duct	Current reduction coefficient
5 to 6	0.56
7 to 15	0.49

Note

Do not bundle the integrated cable. Failure to comply may result in a fire.

Cable type

To comply with the EMC standards, use shielded cables. You can use shield-less cables if EMC is not a concern.

Use a four-conductor shielded cable, with one conductor as the PE wire. See the following figure for details.

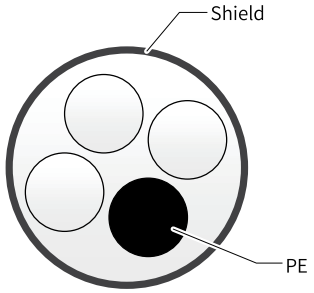


Figure 6-10 Diagram of four-conductor shielded cable

The shield of the shielded cable is made of cooper braids to suppress radio frequency interference. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than or equal to 85%.

Cable shield

Take appropriate shielding measures in the following locations. Otherwise, the product may be damaged:

- Locations prone to static interference
- Locations with strong electric or magnetic fields
- Locations with possible radiation exposure

The braided shields at both ends of the motor power cables must be connected to the PE grounding cable of the power cable to ensure reliable grounding at both ends, as shown in the figure below.

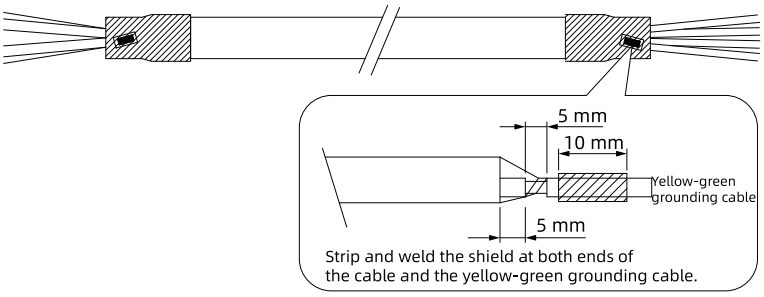


Figure 6-11 Wiring of the shield

6.3.3.2 Cable specifications

Table 6–11 Recommended main circuit cables

Drive model SV660F series			L1C, L2C		L1, L2, L3 (R, S, T), PE		P⊕, D/C P⊕, N/N1/N2 N1 and N2		U, V, W, PE		Grounding terminal	
Size	Model	Continuous input current of main circuit (A)	(mm^2)	AWG	(mm^2)	AWG	(mm^2)	AWG	(mm^2)	AWG	(mm^2)	AWG
Single-phase 220 V												
Size A	S1R6	2.3	2 × 0.75	18	4 × 0.52	20	2 × 0.75	18	4 × 0.52	20	0.52	20
	S2R8	4	2 × 0.75	18	4 × 0.52	20	2 × 0.75	18	4 × 0.52	20	0.52	20
Size B	S5R5	7.9	2 × 0.75	18	4 × 0.52	20	2 × 0.75	18	4 × 0.52	20	0.52	20
Size C	S7R6	9.6	2 × 0.75	18	4 × 1.31	16	2 × 0.75	18	4 × 0.52	20	0.52	20
Size D	S012	12.8	2 × 0.75	18	4 × 1.31	16	2 × 0.75	18	4 × 1.31	16	1.31	16
Three-phase 220 V												
Size C	S7R6	5.1	2 × 0.75	18	4 × 0.52	20	2 × 0.75	18	4 × 0.52	20	0.52	20
Size D	S012	8	2 × 0.75	18	4 × 1.31	16	2 × 0.75	18	4 × 1.31	16	1.31	16
Three-phase 380 V												
Size C	T3R5	2.4	2 × 0.75	18	3 × 0.52	20	2 × 0.75	18	4 × 0.52	20	0.52	20
	T5R4	3.6	2 × 0.75	18	3 × 0.52	20	2 × 0.75	18	4 × 0.52	20	0.52	20
Size D	T8R4	5.6	2 × 0.75	18	3 × 0.52	20	2 × 0.75	18	4 × 0.52	20	0.52	20
	T012	8	2 × 0.75	18	3 × 1.31	16	2 × 0.75	18	4 × 1.31	16	1.31	16
Size E	T017	12	2 × 0.75	18	3 × 2.08	14	2 × 0.75	18	4 × 2.08	14	2.08	14
	T021	16	2 × 0.75	18	3 × 2.08	14	2 × 0.75	18	4 × 2.08	14	2.08	14
	T026	21	2 × 0.75	18	3 × 3.33	12	2 × 0.75	18	4 × 3.33	12	3.33	12

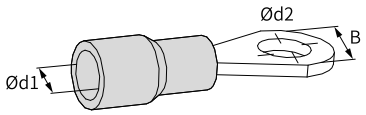
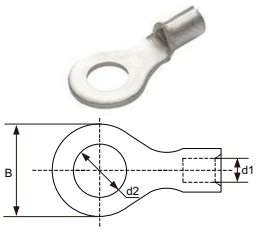
Table 6–12 Recommended cable specifications and models

Cable type	Cross-sectional area	Outer diameter (mm)
Power cable	4 × 12 AWG	12.2±0.4
	4 × 14 AWG	10.5±0.3
	4 × 16 AWG	9.5±0.4
	4 × 20 AWG	6.5±0.2
Shielded power cable	4 × 12 AWG	12.9±0.4
	4 × 14 AWG	11.2±0.4
	4 × 16 AWG	10.1±0.4
	4 × 20 AWG	6.5±0.2
Power cable+Brake cable	4 × 20 AWG + 2 × 24 AWG	6.5±0.2
Brake cable	2 × 18 AWG	5.8±0.2
	2 × 20 AWG	5.0±0.2

Table 6–13 Main circuit cable lug and tightening torque

Servo drive model SV660			Recommended PVC cable model (at 40℃)			
Size	Model	Rated input current (A)	U/V/W/PE cable lug model	Brake cable lug model	Grounding terminal cable lug	Terminal tightening torque (N·m)
Single-phase 220 V						
Size A	S1R6	2.3	GTVE10008	GTVE05008	TVR1.25-4	1.36
	S2R8	4				
Size B	S5R5	7.9				
Size C	S7R6	9.6	GTVE15008	GTVE10008		
Size D	S012	12.8			TVR2-4	1.36
Three-phase 220 V						
Size C	S7R6	5.1	GTVE10008	GTVE05008	TVR1.25-4	1.36
Size D	S012	8			TVR2-4	
Three-phase 380 V						
Size C	T3R5	2.4	GTVE10008	GTVE05008	TVR1.25-4	1.36
	T5R4	3.6				
Size D	T8R4	5.6				
	T012	8			TVR2-4	
Size E	T017	12	TVS1.25-4	GTVE10008	TVR2-4	1.36
	T021	16	TVS2-4	GTVE10008	TVR2-4	1.36
	T026	21	TVS3.5-4	GTVE10008	TVR3.5-4	1.36

Table 6–14 Drawing and appearance of recommended cable lug

Lug model		d1 (mm)	d2 (mm)	B (mm)	Appearance
TVR	1.25-4	4.0	4.3	8.0	
	2-4	4.5	4.3	8.5	
TNR	3.5-4	3.2	4.3	9.5	

6.3.4 Wiring Examples

6.3.4.1 Motor Wiring Instance

Terminal-type motor

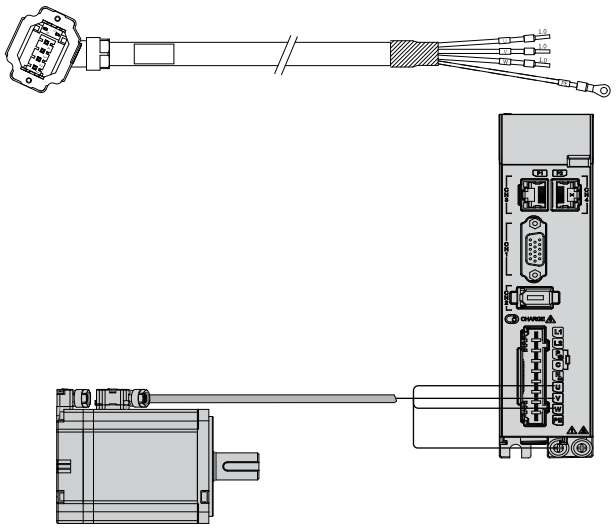


Figure 6-12 Wiring between the servo drive and terminal-type motor

Pigtail-type motor

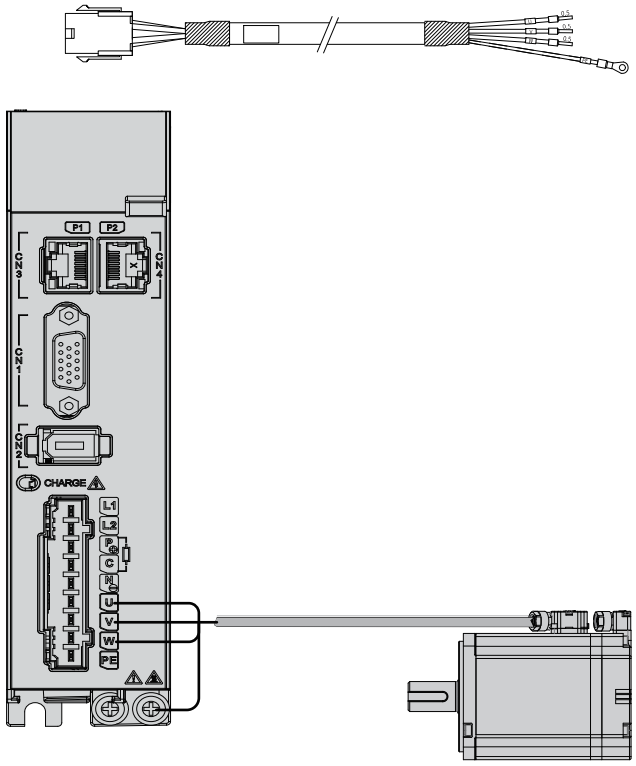


Figure 6-13 Wiring between the servo drive and terminal-type motor

Note

- Power cable colors are subject to the actual product. Cable colors mentioned in this guide apply to Inovance cables.
- For information regarding terminal-type, pigtail-type, and high-power motor power cable connectors, refer to Cable Terminal Description in the "Matching Cables" section.

6.3.4.2 Power Supply Wiring Instance

Single-phase 220 V

- **Main circuit power input terminals (L1, L2)**

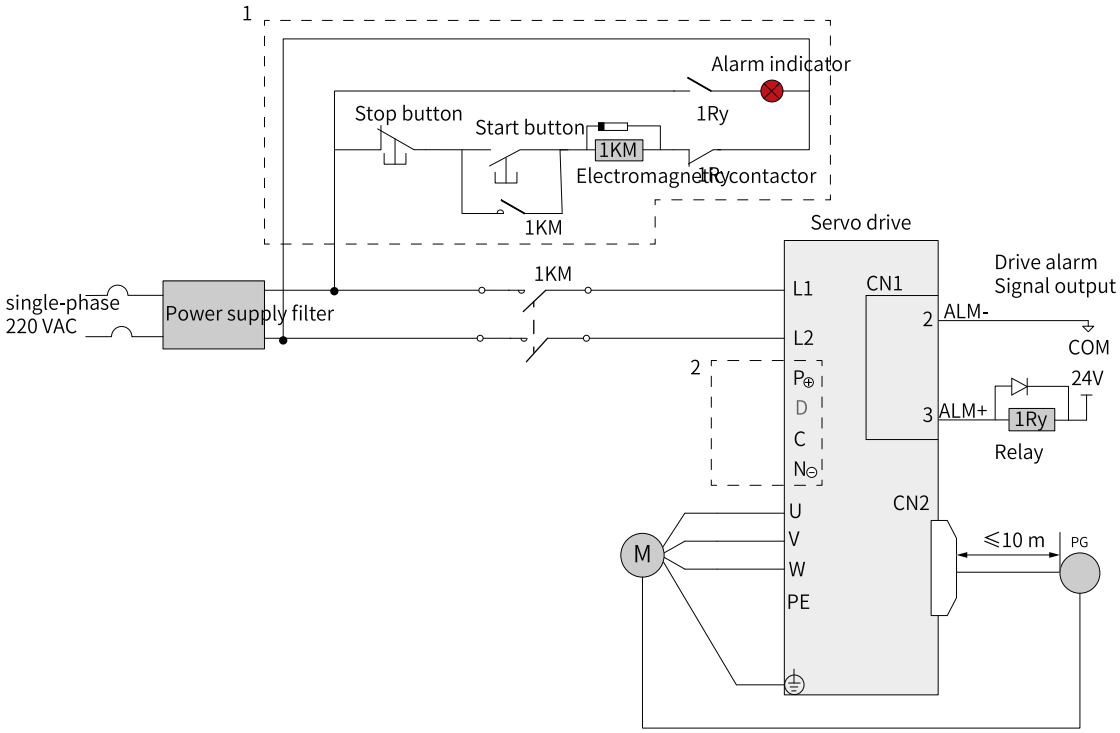


Figure 6-14 Main circuit wiring of single-phase 220 V models

Note

- 1KM: electromagnetic contactor; 1RY: relay; 1D: bypass diode
- ① Alarm protection circuit. The DO2 is set as alarm output (ALM+/-). When the servo drive alarms, the power supply is cut off automatically.
- ② Models S1R6 and S2R8 do not have a built-in braking resistor or a PD jumper bar. If necessary, connect an external braking resistor between terminals P ⊕ and C.
- Remove the jumper bar between terminals P ⊕ and D before connecting an external braking resistor between terminals P ⊕ and C for models S5R5, S7R6, and S012. If no external braking resistor is required, keep the jumper bar between terminals P ⊕ and D.

- **Main circuit power input terminals (L1, L2, L3)**

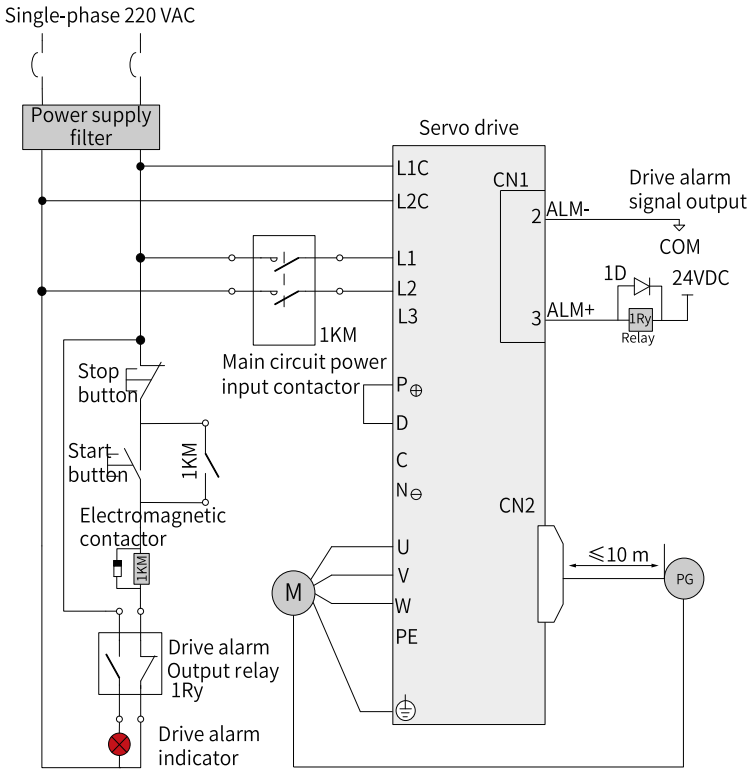


Figure 6-15 Main circuit wiring of single-phase 220 V models

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.

Three-phase 220 V

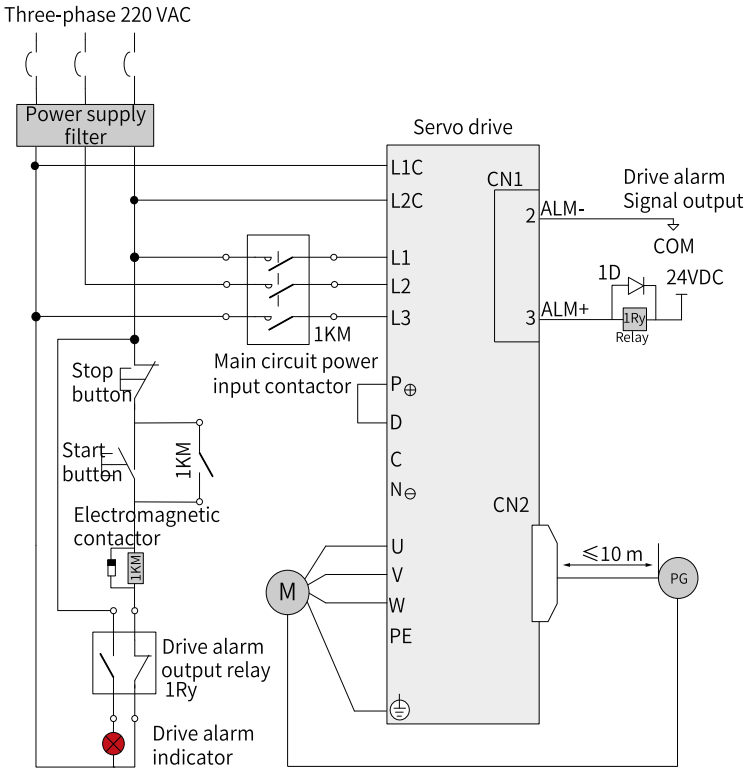


Figure 6-16 Main circuit wiring of three-phase 220 V models

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.

Three-phase 380 V

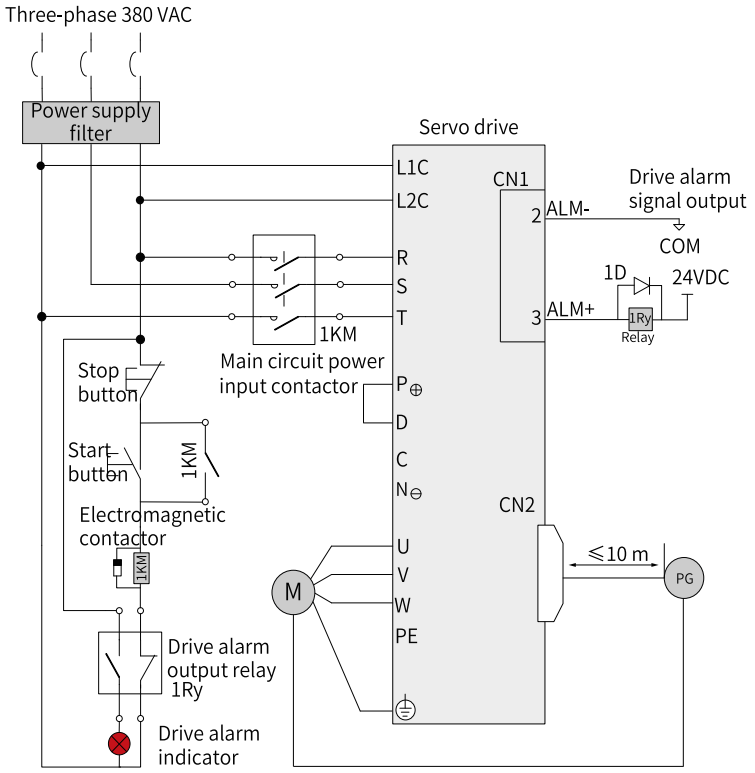


Figure 6-17 Main circuit wiring of three-phase 380 V models

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 automatically cut off and the alarm indicator lights up.

6.3.5 Power cable wiring procedure

Note

Terminals may vary in shape and wiring. The following installation procedure only describes wiring steps. Actual operations may vary.

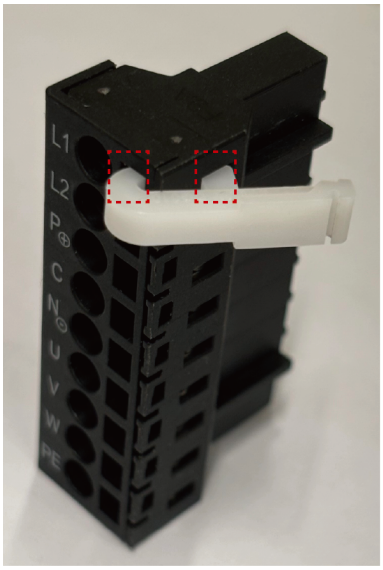
Installation procedure

Size A to size D

Step 1. Prepare materials: Take the terminal block (①) and plastic part (②) from the terminal kit.

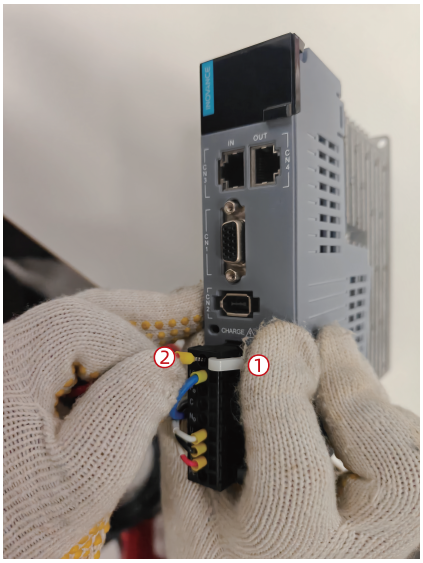


Step 2. Insert the plastic part into the terminal block, ensuring both ends are inserted into the holes.

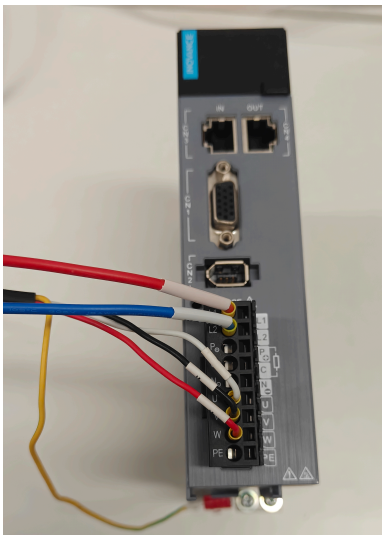


Step 3. Wiring: Hold the plastic part's tail (①) with one hand, and insert the cable into place (②) with the other hand. Release and remove the plastic part after insertion, and repeat for all cables.

Note: Insert it in place to avoid exposing coppers. Check the status and pull it back to verify that the plastic part is firmly inserted.



Step 4. Installing the terminal block: Align the terminal block with the servo silkscreen direction, it is installed in place when you hear a "click."

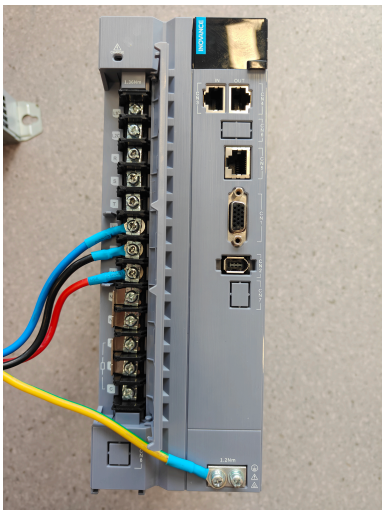


Step 5. Gently pull the terminal block. If the terminal block does not come loose, it is inserted in place.

Size E

Remove the M5 screw, insert the corresponding cable, then tighten the M5 screw with a recommended tightening torque of 2.5 N·m.

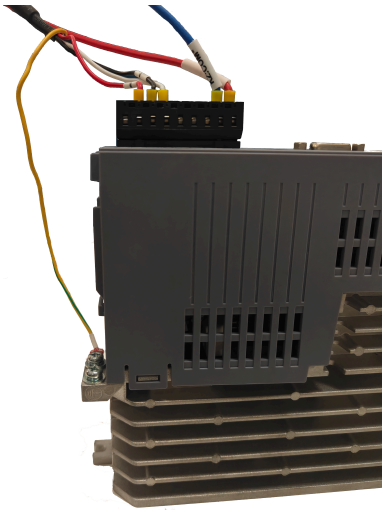
Note: The bending radius is 8 to 10 times the cable diameter. Do not bundle the cables with tie straps.



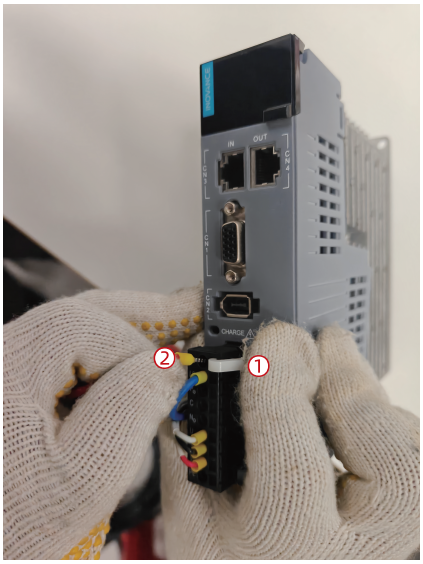
Disassembly procedure

Size A to size D

Step 1. Press the protrusion on the side of the terminal block and pull it outward.

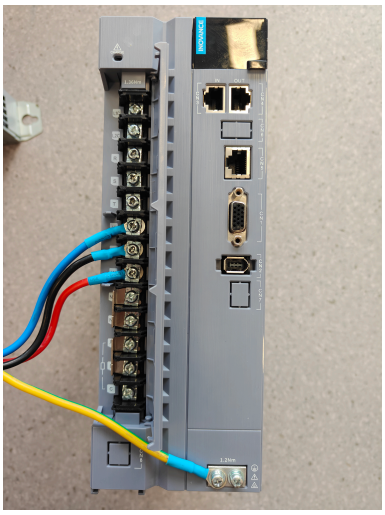


Step 2. Removal: Hold the plastic part's tail (①) with one hand, and pull the cable outward (②) with the other hand. Remove all cables in sequence.



Size E

Remove the M5 screw and take off the cable.



6.4 Control Terminal CN1

6.4.1 Terminal Drawing

Terminal Drawing

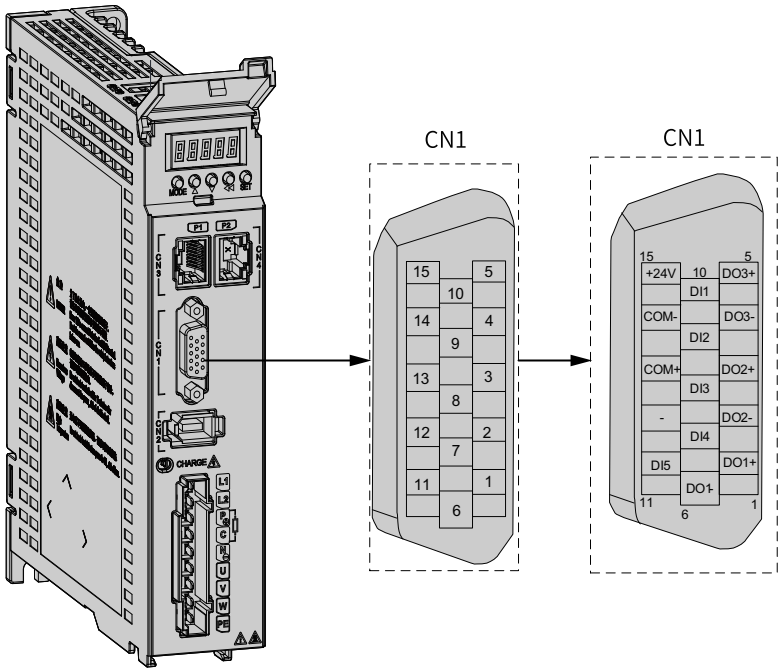


Figure 6-18 Control terminal pin layout of servo drives in sizes A and B

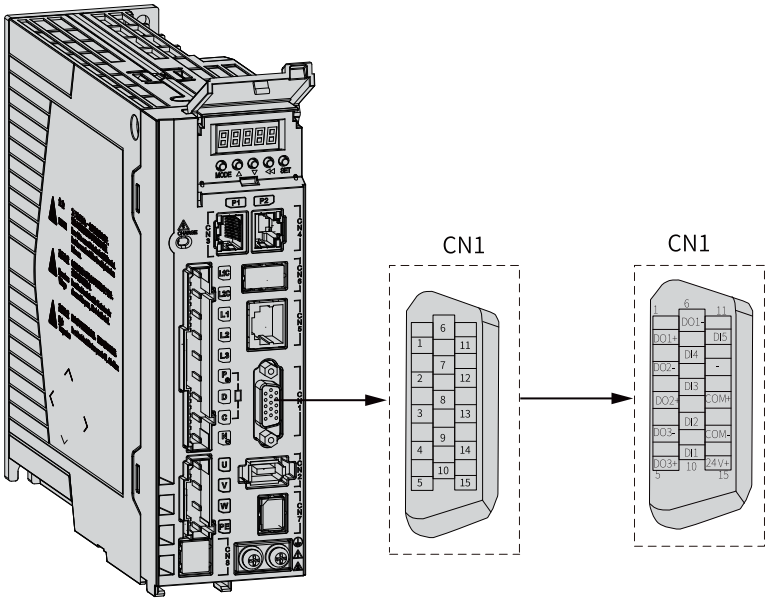


Figure 6-19 Control terminal pin layout of servo drives in sizes C, D and E

Note

Use shielded cables as signal cables, with both ends of the shielded cable grounded.

Terminals

Table 6–15 Description of DI/DO signals

Signal Name		Default Func	Pin No.	Function
General	DI1	P-OT	10	Positive limit switch
	DI2	N-OT	9	Negative overtravel switch
	DI3	HomeSwitch	8	Home switch
	DI4	Emergency Stop	7	Emergency stop
	DI5	TouchProbe1	11	Touch probe 1
	+24 V		15	Internal 24 V power supply, voltage range: 20 to 28 V, maximum output current: 200 mA
	COM-		14	
	COM+		13	Common terminal of DI terminals
	DO1+	S-RDY+	1	Servo ready
	DO1-	S-RDY-	6	
	DO2+	ALM+	3	Fault
	DO2-	ALM-	2	
	DO3+	BK+	5	Brake output signal
	DO3-	BK-	4	

Note

- DI logic level standard: "0" < 3V, "1" > 18V.
- When DO is used as EDM output, leakage current is lower than 0.3 μA and EDM residual voltage is lower than 1.65 V.
- The above table introduces default functions of DI/DO. For details on how to assign functions to DI/DO, see parameters in groups H03 and H04.

6.4.2 Wiring Precautions

Observe the requirements in standard EN/IEC 60204-1 during connecting control circuit cables.



- When connecting DO terminals to relays, ensure correct polarity of the flywheel diode. Incorrect polarity can result in product damage or signal output failure.
- Keep a distance of at least 30 cm between main circuit cables (RST/L1L2, UVW) and I/O signal cables/encoder cables. Otherwise, the equipment may malfunction due to disturbed I/O signals.
- Use twisted pairs or multi-conductor shielded twisted pairs as the I/O signal cable or encoder cable. Failure to comply may result in equipment malfunction.
- Use shielded cables as signal cables and ground both ends of each shielded cable.

6.4.3 Cable Specifications and Models

It is recommended to use shielded signal cables to prevent I/O signal circuit from being disturbed by external noise. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pair (STP) cables for digital signals.

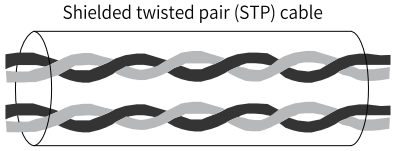


Figure 6-20 Diagram of shielded twisted pairs

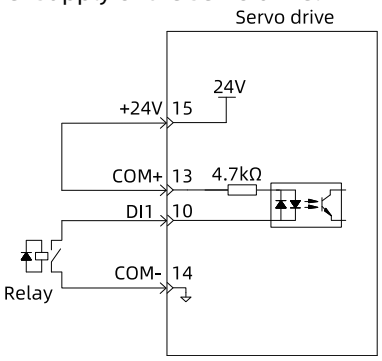
Control terminal	Recommended connector Kit/ material code	Recommended cable specifications (AWG)
CN1	DB15	24 to 30

6.4.4 Wiring Examples

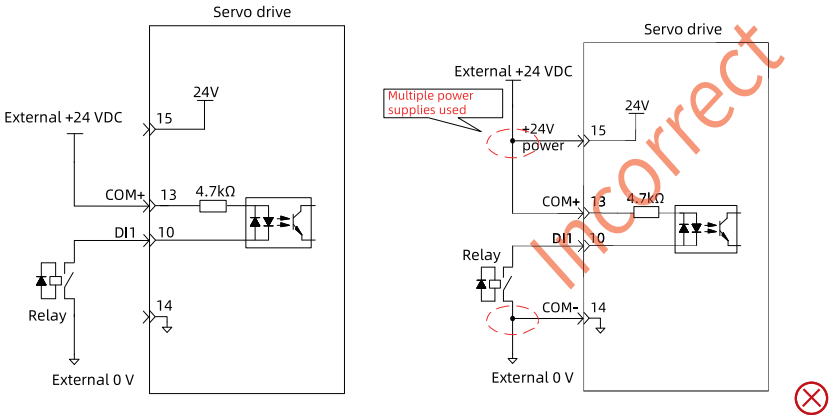
6.4.4.1 DI circuit

The following takes DI1 as an example. All the DI circuits are the same.

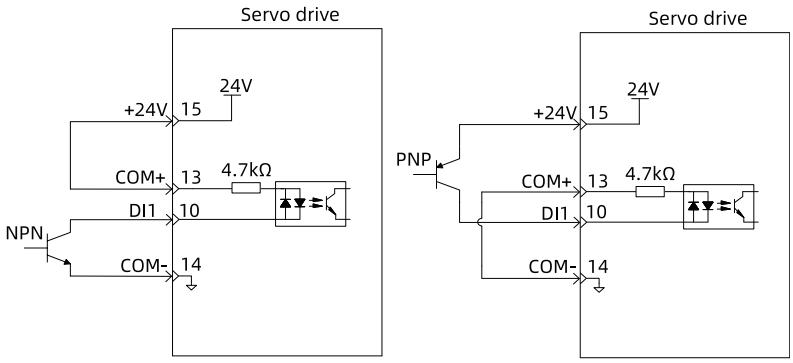
- When the host controller provides relay output, both internal and external power supplies for the drive are supported, as shown in the following figure.
  - For use of an internal 24 V power supply of the servo drive:



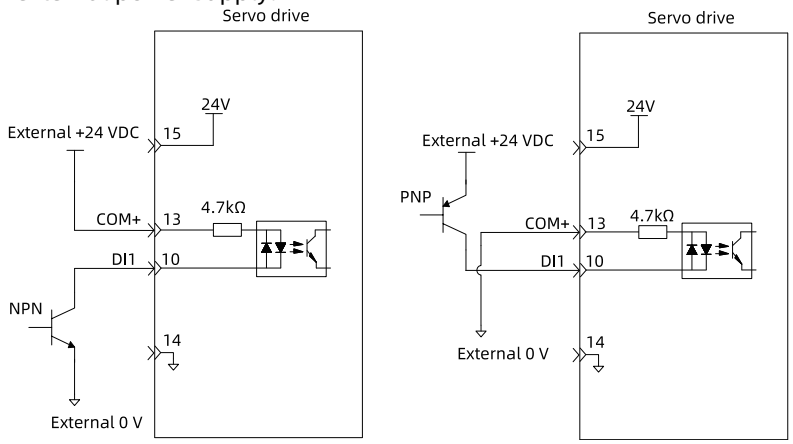
  - For use of an external power supply:



- When the host controller provides open collector output, mixing of PNP and NPN inputs is not supported, as shown in the following figure.
  - For use of an internal 24 V power supply:



- For use of an external power supply:



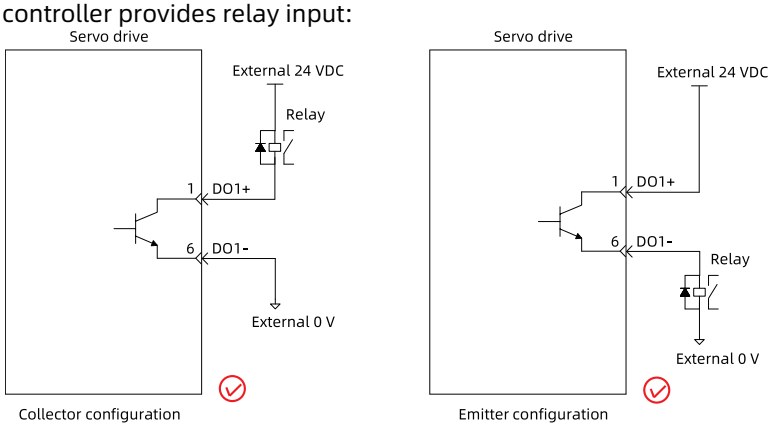
Note

Mixing use of PNP and NPN inputs are not allowed.

6.4.4.2 DO Circuit

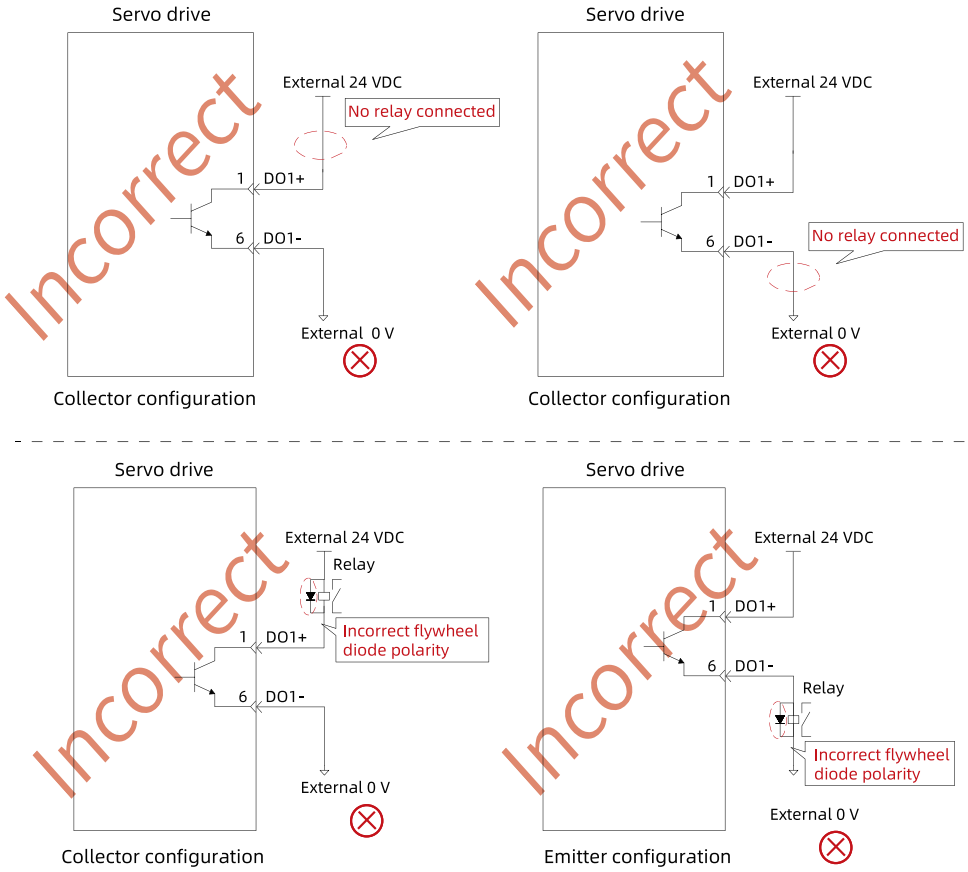
Digital output signal

- When the host controller provides relay input:

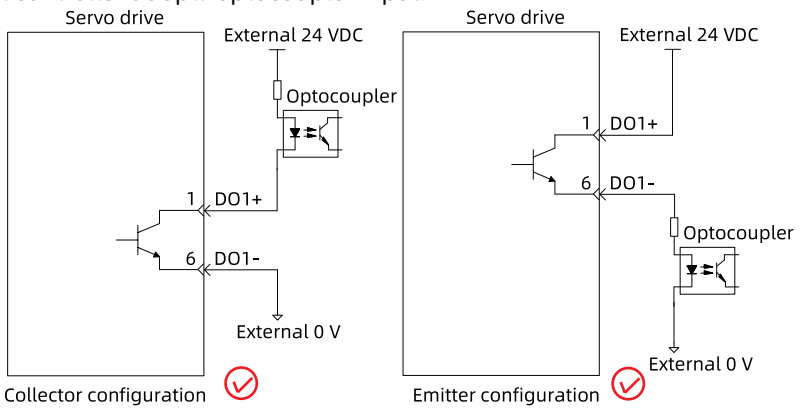


Note

When the host controller provides relay input, a flywheel diode must be installed. Otherwise, the DO terminals may be damaged.



- When the host controller adopts optocoupler input:

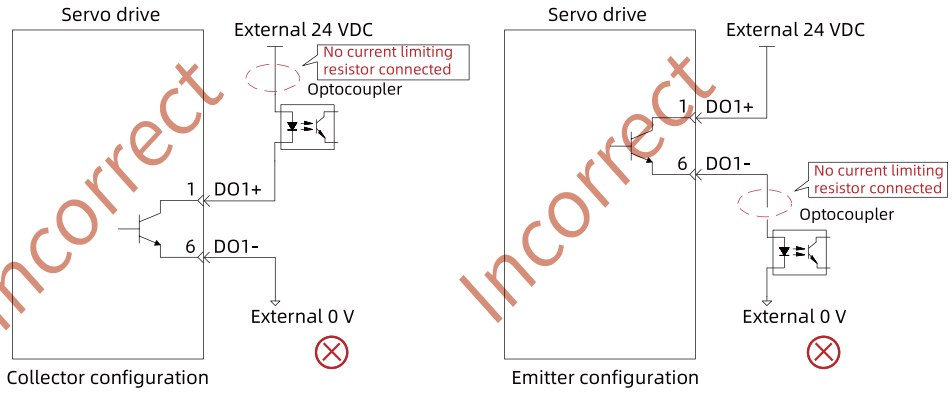


Note

- The maximum allowable voltage of the internal optocoupler output circuit in the drive is 30 VDC, with a maximum current capacity of 50 mA DC.
- The following formula is used to calculate the external current-limiting resistor for DO1 and DO2.

$$\frac{VIN-VF-0.75}{5} \geqslant R\,(k\Omega) \geqslant \frac{VIN-VF-0.75}{50}$$

In the preceding formula, VF is the diode ON voltage drop on the primary side of the external coupler, which is 1.2 V generally. VIN is the external power input voltage of DO, which is generally within 30 V.



6.4.4.3 Wiring of the Brake

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.

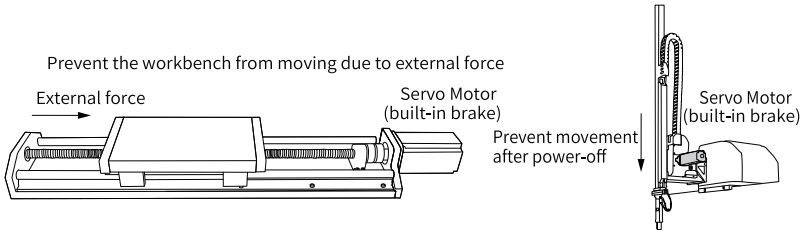


Figure 6-21 How the brake works

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 motor with brake should be controlled by the servo drive itself. It is not recommended to use a PLC to control the brake.
- The brake coil has no polarity.
- After the motor stops, switch off the servo-ON (S-ON) signal.
- When a motor with brake runs, the brake may generate a clicking sound, which does not affect its function.
- When brake coils are energized (the brake is released), magnetic flux leakage may occur at the shaft end. Pay special attention when using magnetic sensors around the motor.
- The brake must be powered by an independent power supply. This is to prevent voltage sags or current drops caused by parallel equipment operation that may trigger malfunction of the brake.

The connection of the motor brake input signal has no polarity. Users need to prepare a 24 V power supply. The following figure shows the standard wiring of the brake signal (BK) and holding brake power supply.

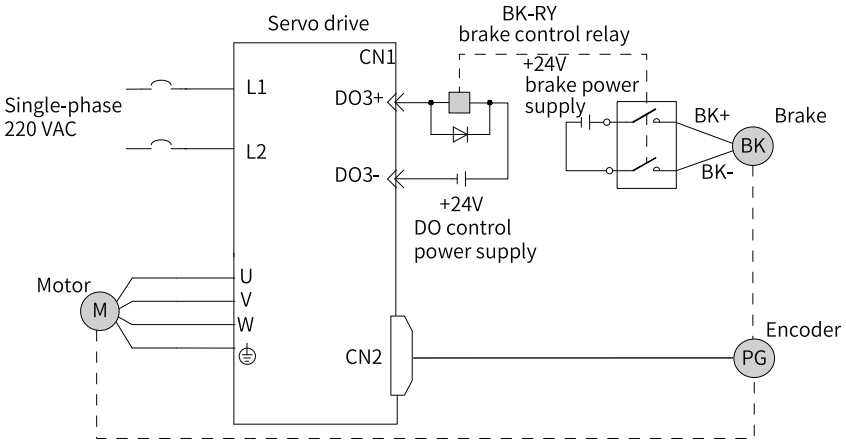


Figure 6-22 Wiring of the brake

Note

- Use different power supplies to supply power to the brake and the brake control signal respectively to avoid burning electronic components due to back EMF after the brake is powered off.
- A flywheel diode can suppress voltage spikes during the power-on and power-off of the relay. Recommended diode model: 1N4001 Required specifications: 1. Voltage reverse ≥ 50 V; 2. Forward current ≥ twice the rated current of the relay coil.
- Cables of 0.5 mm^2 and above are recommended.

Pay attention to the following precautions at wiring:

To decide the length of the cable on the motor brake side, consider voltage drop caused by the cable resistance. The input voltage must be at least 21.6 V to make the brake work. The following table lists brake specifications of Inovance motors.

Table 6–16 Brake specifications

Motor model	Holding torque (N·m)	Power supply voltage (VDC) ±10%	Coil resistance (Ω)±7%	Excitation current (A)	Release time (ms)	Close time (ms)	Backlash (°)
MS1H1-05B/10B MS1H4-10B	0.32	24	94.4	0.25	≤ 20	≤ 40	≤ 1.5
MS1H1-20B/40B MS1H4-20B/40B	1.5		75.79	0.32	≤ 20	≤ 60	≤ 1.5
MS1H1-75B/10C MS1H4-75B/10C	3.2		57.6	0.42	≤ 40	≤ 60	≤ 1
MS1H2-10C/15C/ 20C/25C	8		32.73	0.73	≤ 40	≤ 100	≤ 1
MS1H2-30C/40C/50C MS1H3-85B/13C/ 18C	16		24	1	≤ 60	≤ 120	≤ 1
MS1H3-29C/44C/ 55C/75C	50		18.58	1.29	≤ 100	≤ 200	≤ 1

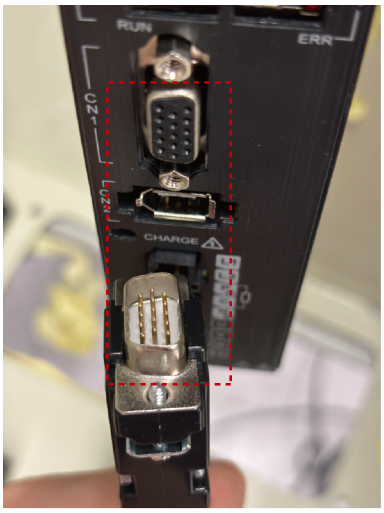
6.4.5 Wiring Procedure of Control Cables

Note

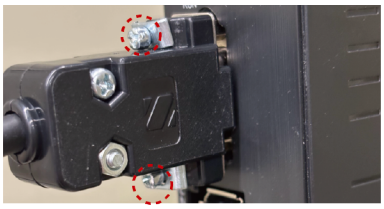
Terminals may vary in shape and wiring. The following installation procedure only describes wiring steps. Actual operations may vary.

Installation procedure

Step 1. Observe the terminal direction to ensure correct insertion.

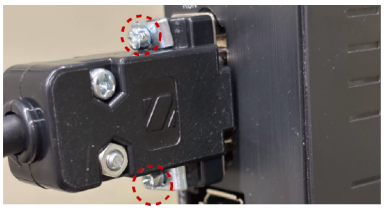


Step 2. After the cable is inserted, pre-tighten the M3 screws at both ends of the cable terminal, and then tighten them step by step in sequence. The recommended torque is 0.5 N·m. Tightening one side at a time is prohibited.



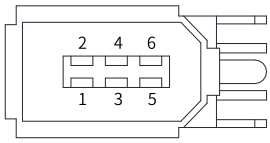
Disassembly procedure

Loosen the M3 screws that fix the cable terminal at both ends, then pull the screws outward to remove the cable.



6.5 CN2 Encoder Terminal

6.5.1 Terminal Drawing



Encoder signal terminal CN2 (drive side)

Figure 6-23 Encoder terminal layout

Table 6–17 Description of encoder terminal pins

No.	Name	Description
1	+5 V	5 V power supply
2	0 V	-
3	Reserved	-
4	Reserved	-
5	PS+	Encoder signal
6	PS-	
Enclosure	PE	Shield

6.5.2 Wiring Precautions and Requirements

- Ground the shielded layers on both the servo drive side and the motor side. Otherwise, the servo drive will report a false alarm.
- Given the voltage drop caused by cable resistance and signal attenuation caused by distributed capacitance, it is recommended to use twisted-pair cables of 26AWG or above (as per UL20276 standard) with length no longer than 10 m as the encoder cable.

6.5.3 Cable Specifications and Model Requirements

Note

It is recommended to use 22AWG to 26AWG cables for 10B, 20B, 40B, and 75B series motors. If the length of the cable needed exceeds the allowable value, increase the cross sectional area of the cable properly. See the following table for details.

Table 6–18 Recommended cables

Cable specifications (AWG)	Cable resistance per unit length (Ω/km)	Allowable cable length (m)
3P × 26	143	0–10
1P × 22 + 2P × 26	54.3	10–26.4
1P × 20 + 2P × 24	33.9	26.4–42.2
1P × 18 + 2P × 22	21.4	42.2~53.2

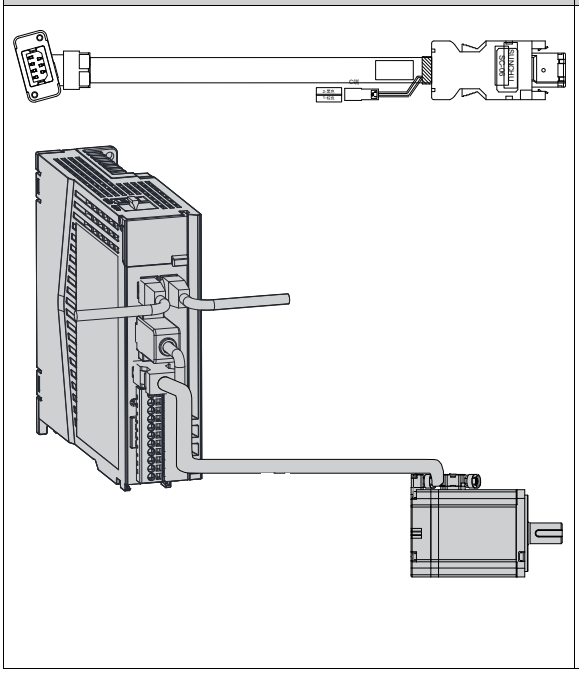
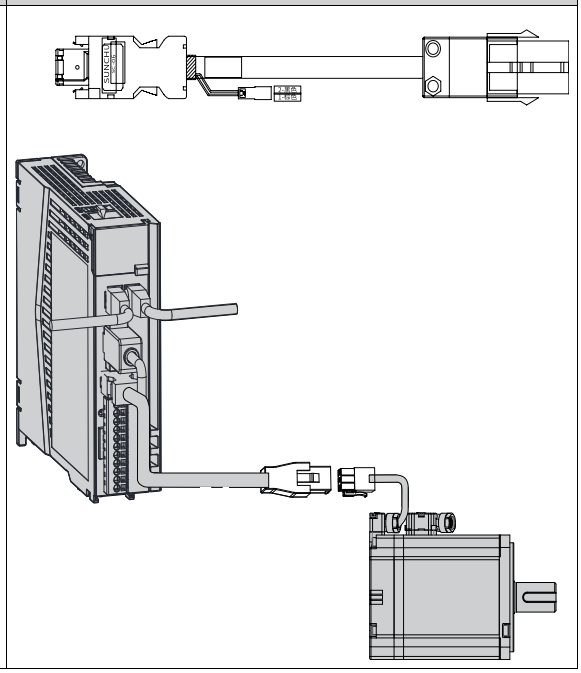
Note

- The preceding length can be increased by 2 m to 3 m.
- For cables higher than 16AWG, contact the sales personnel.
- The letter P in the preceding table indicates twisted pairs, in which 1P represents +5V/0V twisted pair, 2P represents DC+/- twisted pair and PS+/- twisted pair, and 3P represents +5V/0V twisted pair, DC+/- twisted pair, and PS+/- twisted pair.
- For cross-sectional areas of the cables, contact Inovance technical support.

6.5.4 Wiring Examples

6.5.4.1 Connecting the Absolute Encoder

Table 6–19 Wiring example of the absolute encoder signal [1]

Terminal-type motor	Lead-type motor
	

Note

- [1]: The preceding figure shows the wiring diagram of the absolute encoder cable, which is similar to that of the incremental encoder (without a battery box). The cable for the incremental encoder needs to be purchased separately.
- For external leads and installation of the battery box, see *"5.5.2 Installing the Absolute Encoder Battery" on page 76*.
- For motor encoder cable connectors, see section "Cable Terminals".

6.5.4.2 Power Cable and Encoder Cable Adapter Scheme

Recommended power cable connector models: Molex-39039062 and Molex-469990295;

Recommended encoder cable connector model: TE-1-172169-9 See the figure below.

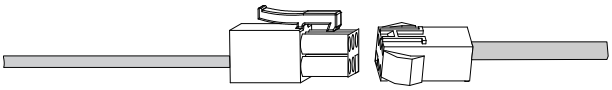


Figure 6-24 Power cable adapter scheme

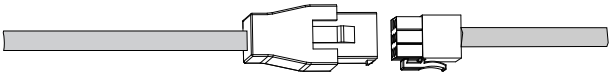


Figure 6-25 Encoder cable adapter scheme

6.5.5 Wiring Procedure of the Encoder Cable

Note

Terminals may vary in shape and wiring. The following installation procedure only describes wiring steps. Actual operations may vary.

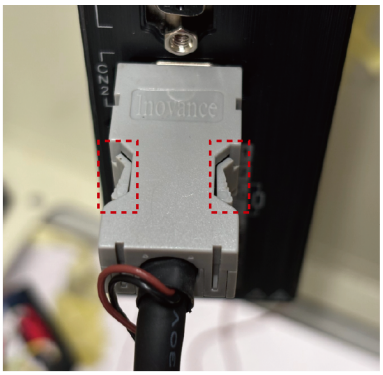
Installation procedure

Prepare an applicable encoder cable, and insert it in place. After insertion, gently pull the encoder cable outward, if it does not come loss, it is installed in place.



Removal procedure

Press the protrusions on both sides of the terminal block, first push it inward gently, and then pull it outward to remove it.



6.6 Communication Terminals CN3 and CN4

6.6.1 Terminal Drawing

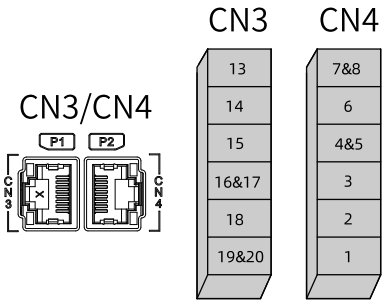


Figure 6-26 Communication terminal pin layout (sizes A and B)

Table 6–20 PROFINET communication terminal pin assignment (sizes A and B)

Pin No.	Name	Description
13	TD+	Data transmit+
14	TD-	Data transmit-
15	RD+	Data receive+
16 and 17	-	-
18	RD-	Receive data-
19 and 20	-	-
1	TD+	Data transmit+
2	TD-	Data transmit-
3	RD+	Data receive+
4 and 5	-	-
6	RD-	Receive data-
7 and 8	-	-

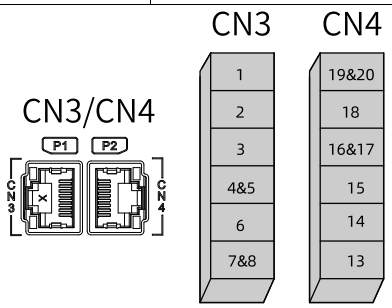


Figure 6-27 Communication terminal pin layout (sizes C, D and E)

Table 6–21 PROFINET communication terminal pin assignment (sizes C, D and E)

Pin No.	Name	Description
1	TD+	Data transmit+
2	TD-	Data transmit-
3	RD+	Data receive+
4 and 5	-	-
6	RD-	Receive data-
7 and 8	-	-
13	TD+	Data transmit+
14	TD-	Data transmit-
15	RD+	Data receive+

Pin No.	Name	Description
16 and 17	-	-
18	RD-	Receive data-
19 and 20	-	-

6.6.2 Cable Specifications and Model Requirements

Terminal information

Table 6–22 Cable specifications

Material code	Cable model	Length (m)
15040261	S6-L-T04-0.3	0.3
15040262	S6-L-T04-3.0	3.0
15041960	S6-L-T04-0.2	0.2
15041961	S6-L-T04-0.5	0.5
15041962	S6-L-T04-1.0	1.0
15041963	S6-L-T04-2.0	2.0
15041964	S6-L-T04-5.0	5.0
15041965	S6-L-T04-10.0	10.0

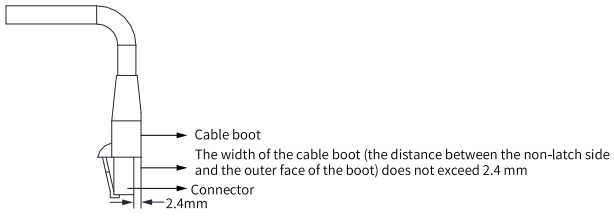


Figure 6-28 Network port connector

Note

- The head of the dual-port network terminal cannot be too thick, otherwise, interference may occur. The recommended thickness is 2.4 mm. For details, see *"Figure 6-28 Network port connector" on page 116*.
- The recommended crimping height of the RJ45 connector is 6.02±0.13 mm.

Table 6–23 Specifications

Item	Detailed description
UL certification	Compliant with UL certification
Cat 5e cable	Cat 5e four-conductor cable
Double-shielded	Braided shield (coverage: 85%), aluminum foil shield (coverage: 100%)
Environmental adaptability	Ambient temperature: -30°C to +60°C; Resistant to industrial oil and acid and alkali corrosion
EMC testing standard	GB/T 24808-2009

Selection of communication cables

Use Ethernet Category 5 (100Base-TX) network cables or high-strength shielded twisted pair network cables as communication cables. The cables used for the servo drive must also be shielded network cables with the length not longer than 65 m. The shielded network cable can enhance the anti-interference capacity of the system.

EMC standards

The servo drive complies with the following standards: IEC 61800-3:2004/A1:2011 (Adjustable speed electrical power drive systems–part 3:EMC requirements and specific test methods) and GB/T12668.3.

6.6.3 Wiring Examples

CN3 and CN4 are PROFINET communication port connectors. CN3(P1) is connected to the host controller, and CN4(P2) is connected to a slave. For assignment of CN3/CN4 terminal pins, see *"6.6.1 Terminal Drawing" on page 115*.

Note

You can also connect the drive to a PC using communication cables via the CN3 and CN4 terminals, which enables you to commission one or multiple drives through the Ethernet port.

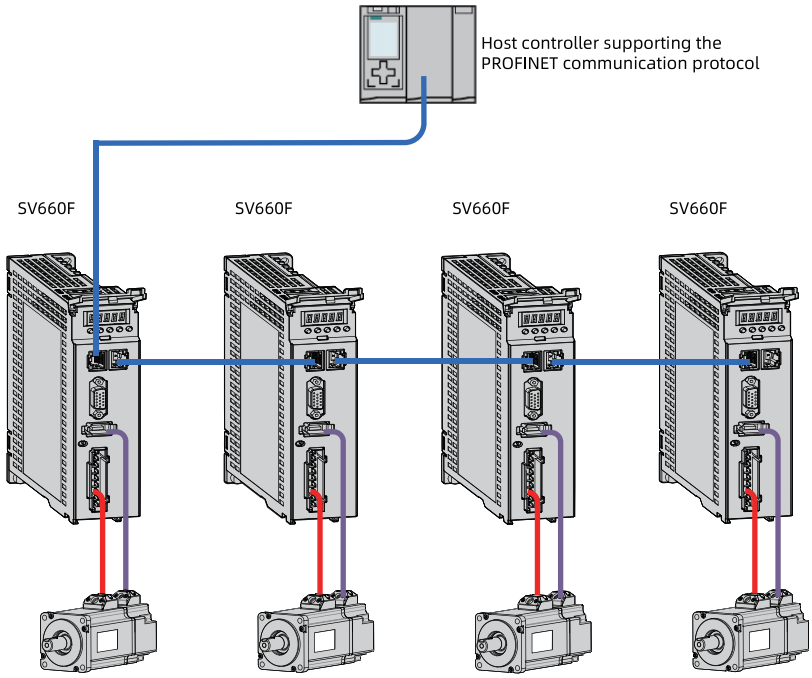
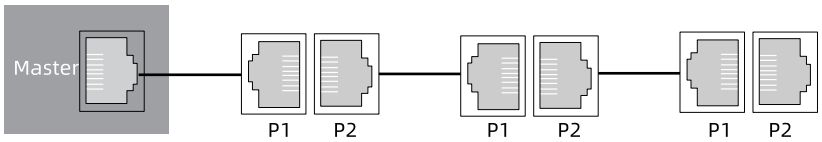


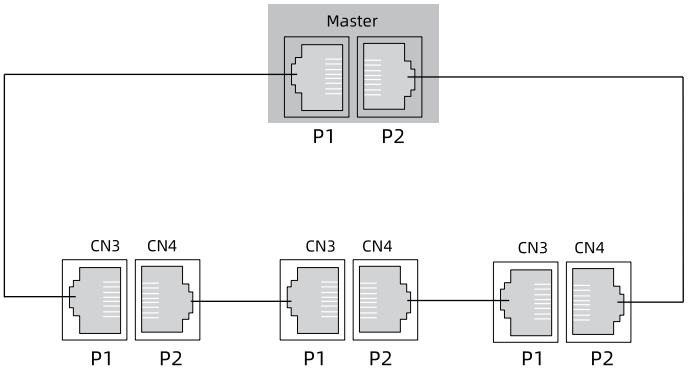
Figure 6-29 Communication networking topology

PROFINET communication topology is flexible and basically has no restrictions. However, in IRT communication mode, the actual physical topology connection sequence must be consistent with the topology connection sequence configured by the PLC.

Linear topology



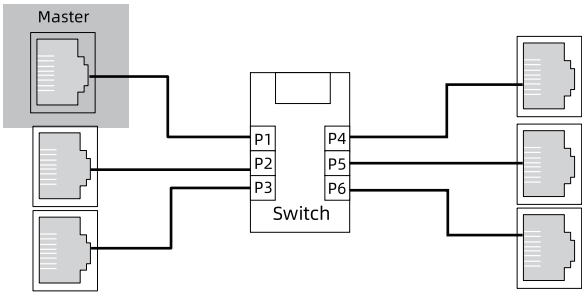
Redundant ring topology



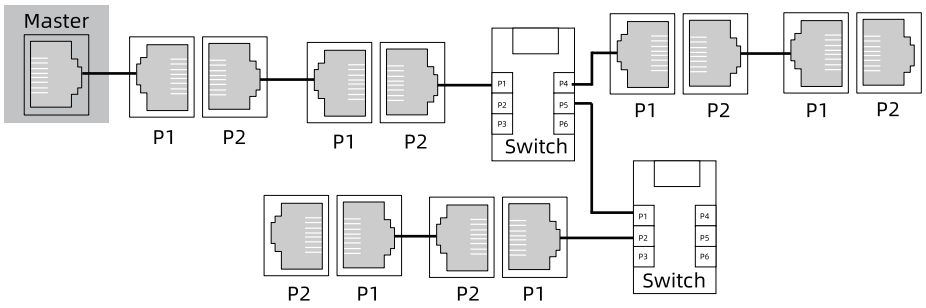
Note

Once enabled, the enhanced PROFINET link check function becomes active following a drive power cycle.

Star connection



Tree connection



6.7 Description of Communication Terminal (CN5)

6.7.1 Terminal Drawing

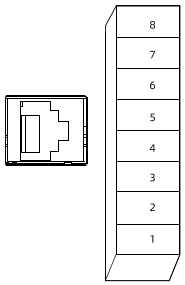


Figure 6-30 Layout of terminals

Table 6–24 Description of communication terminal pins

Pin No.	Definition
1 to 5	-
6	RS232-TXD
7	RS232-RXD
8	GND

6.7.2 Cable Specifications and Models

You can connect the servo drive and the PC using the PC communication cable during RS232 communication. It is recommended to use RS232 communication interface. The outline drawing of the PC communication cable is shown in the following figure.

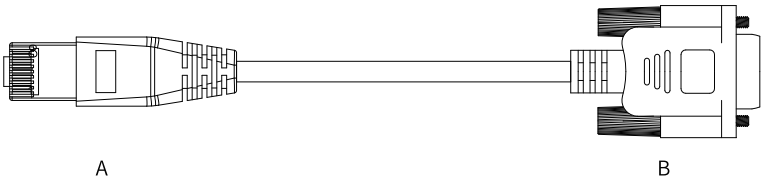


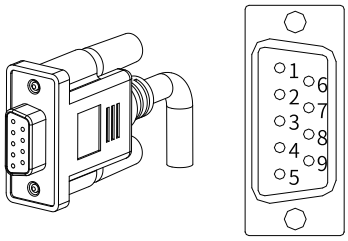
Figure 6-31 PC communication cable

Table 6–25 Pin connection relation between the servo drive and PC communication cable

RJ45 on the drive side (A)		DB9 on the PC side (B)	
Signal name	Pin No.	Signal name	Pin No.
RS232-TXD	6	PC-RXD	2
RS232-RXD	7	PC-TXD	3
GND	8	GND	5
PE (shield)	Enclosure	PE (shield)	Enclosure

The following table describes the pin definition of the DB9 terminal on PC side.

Table 6–26 Pin definition of DB9 terminal on the PC side ("B" in the preceding figure)

Pin No.	Definition	Description	Terminal pin arrangement
2	PC-RXD	PC reception end	
3	PC-TXD	PC transmission end	
5	GND	Ground	
Enclosure	PE	Shield	

6.7.3 Procedure for Connecting To PC

Note

Terminals may vary in shape and wiring. The following installation procedure only describes wiring steps. Actual operations may vary.

If the host controller provides only the USB interface, use the serial-to-USB cable for conversion.

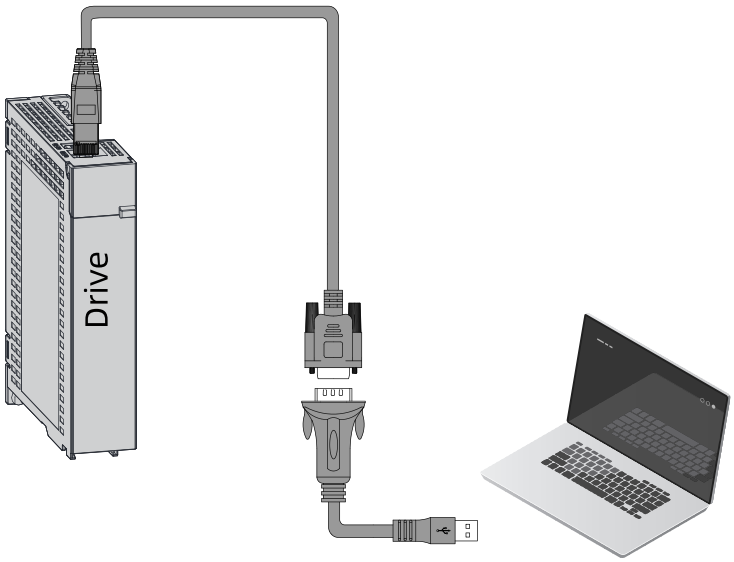


Figure 6-32 Serial-to-USB conversion

The recommended cable is as follows:

Z-TEK, model: ZE551A, 0.8-m USB extension cable, integrated circuit model: FT232

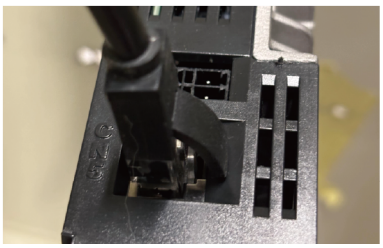
Installation procedure

Step 1. The top network port is equipped with a dust cap. Remove the dust cap before plugging in the network cable.

Step 2. Confirm the cable direction, and then connect the two cables.

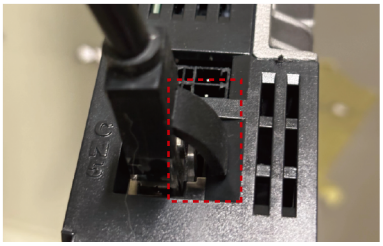


Step 3. Connect the network port to the servo.



Removal procedure

Press the side protrusion and pull the cable outward.



6.8 STO Safety Terminal (CN6)

Note

The CN6 STO safety function terminal is only suitable for -FS models.

6.8.1 Terminal Layout

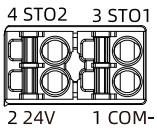
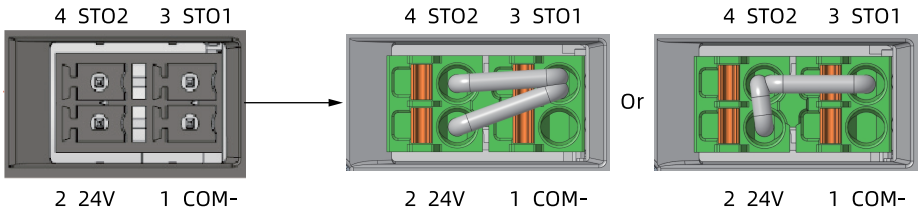


Table 6–27 Pin assignment of STO safety terminal

Pin No.	Definition	Description
1	COM-	STO reference ground
2	24 V	Internal 24 V power supply
3	STO1	Control input for STO1
4	STO2	Control input for STO2

Two isolated inputs are configured to dual-channel inputs of the STO function: STO1/STO2.

To facilitate commissioning, additional pin with supply voltage (+24V) is integrated. The bridging of the 24 V terminal to STO1/STO2 is needed in case the safety circuit is installed but STO function is not needed.



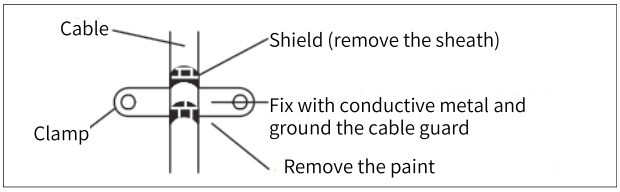
STO applies to the following servo drives:

Size	Power range (kW)	Structure	W x H x D (mm³)
A	0.2 to 0.4	Integrated structure	40×170×150
B	0.75	Integrated structure	50×170×173
C	1 to 1.5	Split-type structure	55×170×173
D	1.5 to 3	Split-type structure	80×170×183
E	5 to 7.5	Split-type structure	90×250×230

6.8.2 Wiring Precautions

EMC requirements

- To prevent short circuit between two adjacent conductors, use shielded cables with the shield connected to the protective ground.
- Double-shielded cables or single-shielded multi-twisted pair cables are recommended.
- Secure and ground the cable shield using a piece of conductive metal strip.
  Example of cable clamp:

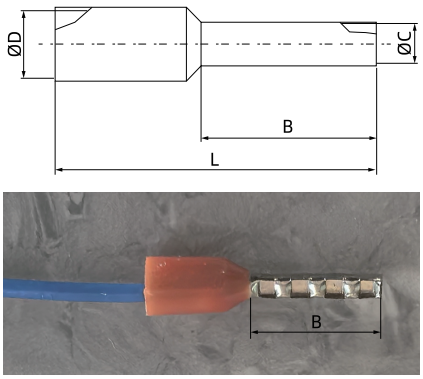
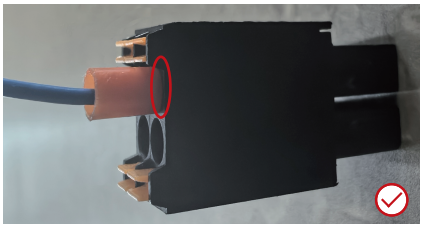
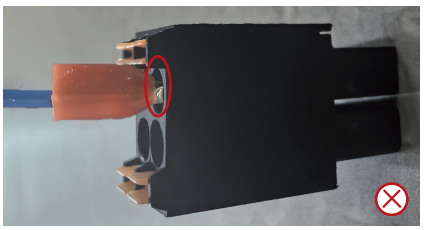


- The maximum allowable cable length between the drive and the activation switch is 30 cm.

Additional requirements

- All cables must be well protected, routed and secured where practicable.
- Ensure that cables are not pinched or pulled during installation.
- Route the two STO DI channels through different routes to prevent possible faults. If impossible, protect the cable with double shields.

Cable	Description
Category	Low voltage, double-shielded or single-shielded twisted multi-pair cable
Maximum size	0.8mm² (18 AWG)
Minimum size	0.3mm² (28 AWG)
Maximum length	The maximum distance between STO input and the operating contact is 30 m.

Pre-installation inspection	Installation
 	 
Ferrule contact area (B) ≤ 8 mm	Ensure proper insertion during installation to avoid exposing the ferrule contact area.

6.8.3 Cable Specifications and Models

Specifications

The servo drive operates normally only when the input states of STO1 and STO2 are both "High" ("1" or "H").

The servo drive does not operate when the input states of STO1 or STO2 are different or are both "Low" ("0" or "L").

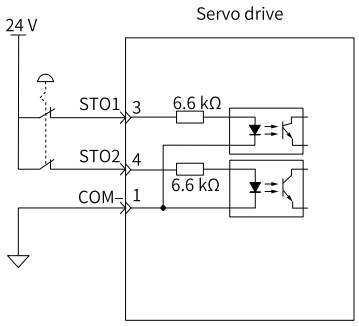
Electrical characteristics

Electrical characteristics of safety request input signal are as follows:

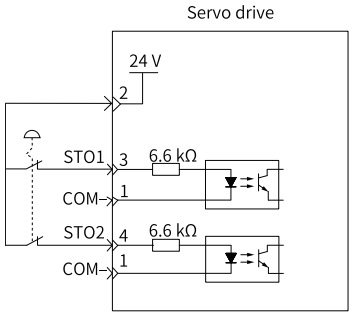
Item	Features	Description
Voltage range	24 VDC (±15%)	-
Input current	3.6 mA (Typ.)	Input current values of STO1 and STO2
Standards of logic levels	"0" < 5 V, "1" > 15 V	-
Digital input impedance	6.6 kΩ	-

6.8.4 Wiring Example

Example connection of external 24 V



Connection of internal 24 V



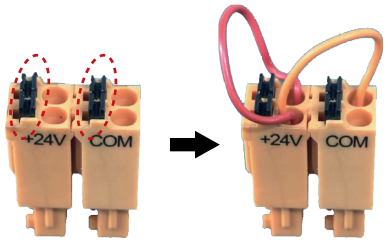
6.8.5 Wiring of STO terminals

Note

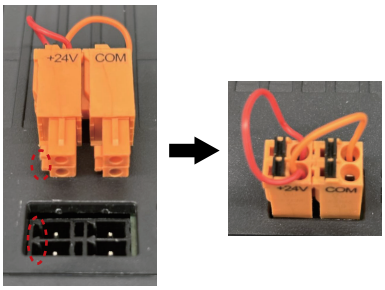
Terminals may vary in shape and wiring. The following installation procedure only describes wiring steps. Actual operations may vary.

Installation procedure

Step 1. Install the cable on the STO terminal: Press down the black protrusion, insert the cable, then release. Gently pull the cable after insertion. If it does not come loose, it is inserted in place.

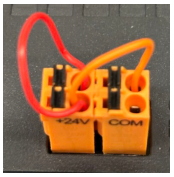


Step 2. Verify that the cable is inserted in the correct direction, and then insert the wired STO terminal to the servo port.



Disassembly procedure

Pull the STO terminal outward.



6.9 Grounding

6.9.1 Grounding Requirement (CE)

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

Danger

- Measures against electrical shock: Ground the grounding terminal properly. The grounding method must comply with the electrical installation regulations in the applicable country/region.
- When using a welding machine or other high-current equipment, ensure that no stray current flows through the internal protective earth (PE) conductor. Otherwise, fire accidents may occur.

Caution

1. Grounding conductor selection: The protective grounding conductor must meet the equipment technical specifications and IEC safety standards, and must be selected according to the following principles:
   - Single-drive system: Leakage current ≤ AC 3.5 mA/DC 10 mA, cross-sectional area ≥ cross-sectional area of phase conductor
   - Multi-drive in parallel: When leakage current > AC 3.5 mA, use a copper conductor with cross-sectional area ≥ 10 mm^2 or a dual-conductor for redundant connection.
2. Grounding cables (except motor grounding cables) must meet requirements of GB/T 12668.501 and EN/IEC 61800-5-1. In any case, the cross-sectional area of each protective grounding conductor that does not form part of the power cable or cable jacket cannot be less than 2.5 mm^2.
3. The grounding cable length must be minimized, and the cable dimensions must follow the electrical equipment technical standards to prevent potential drift of the grounding point due to leakage current.
4. For multi-drive systems, ground the system according to specifications. Improper grounding may cause equipment malfunction.
5. Do not share the grounding circuit with welding equipment or high-current devices. Failure to comply may result in system faults due to electrical interference.

6.9.2 Wiring Precautions

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

- The protective grounding conductor must be yellow-green copper cables and cannot be connected in series with circuit breakers or other switching devices.
- The grounding terminal must be grounded properly. Do not connect the grounding terminal to the power supply neutral (N) terminal.
- Install the drive on a conductive metal mounting surface. Ensure that the whole conductive bottom of the drive is bonded properly to the mounting surface.

6.9.3 Wiring Examples

6.9.3.1 Single-Drive Grounding

For grounding of a single drive, see *"4.1 System connection diagram" on page 54*.

6.9.3.2 Multi-Drive Grounding

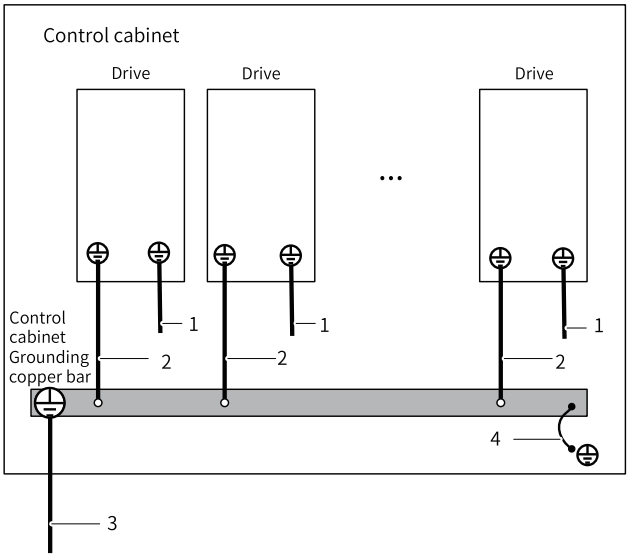


Figure 6-33 Multi-drive grounding

Table 6–28 Description of parallel grounding of multiple drives

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

6.9.3.3 Grounding of the Control Cabinet System

The most cost-effective method of suppressing interference in a control cabinet is to isolate the interference source from devices that may be interfered with. Divide the control cabinet into multiple EMC compartments or use multiple control cabinets based on the intensity of interference sources, and install each device in accordance with the following wiring principles.

Table 6–29 Wiring requirements

No.	Wiring requirements
1	Place the control unit and the drive unit in two separate control cabinets.
2	If multiple control cabinets are used, connect the control cabinets by using a grounding cable with a cross-sectional area of at least 16 mm^2 for equipotentiality between the control cabinets.
3	If only one control cabinet is used, place different devices in different compartments of the control cabinet based on signal intensity.
4	Apply equipotential bonding to devices in different compartments inside the control cabinet.
5	Shield all communication and signal cables routed out from the control cabinet.
6	Place the power input filter in a position near the input interface of the cabinet.
7	Apply spray coating to each grounding point in the control cabinet.

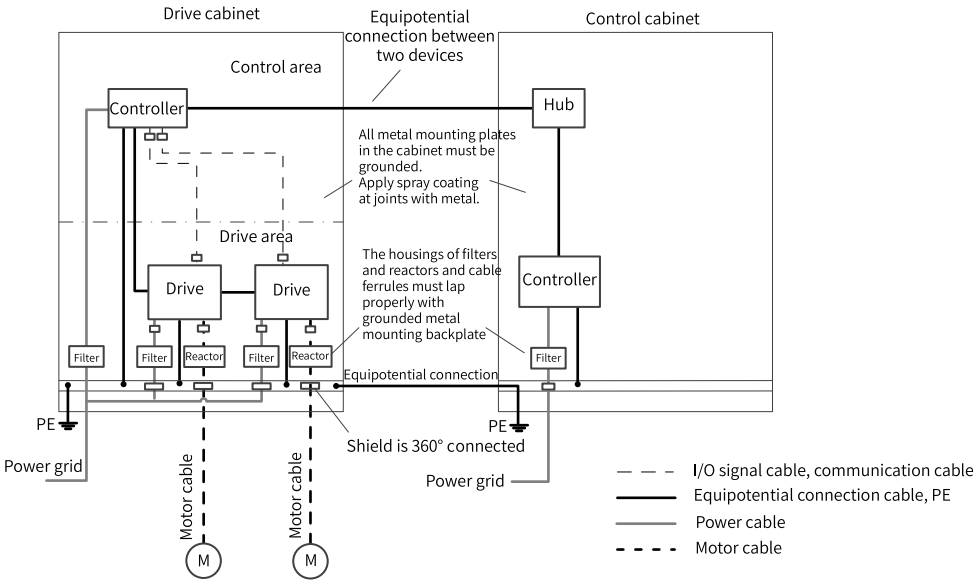


Figure 6-34 Recommended wiring for the control cabinet system

6.10 Wiring of Options

6.10.1 Connecting the Braking Resistor

When the capacitance of the bus is insufficient, the redundant energy can be consumed by connecting an external braking resistor between terminals P⊕ and C.

When the motor torque direction is opposite to the direction of rotation, the energy is fed back to the servo drive from the motor side, leading to bus voltage rise. Once the bus voltage rises to the braking threshold, the excessive energy must be consumed by a braking resistor. Otherwise, the drive will be damaged. The braking resistor can be a built-in or an external one. The built-in and external braking resistors cannot be used together.

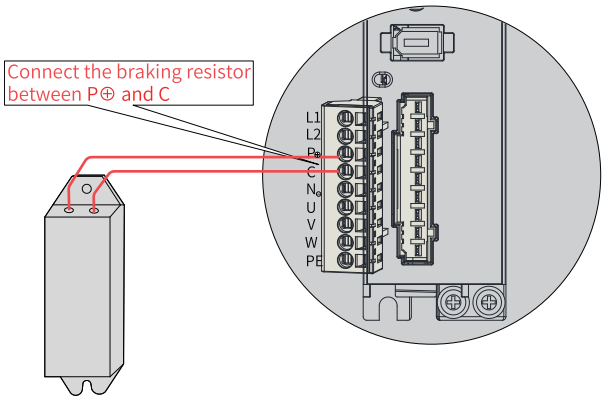


Figure 6-35 Connection of external braking resistor

For cables used for terminals P⊕ and C, see *"6.3.3.2 Cable specifications" on page 93*.

Caution

Observe the following precautions when wiring the external braking resistor:

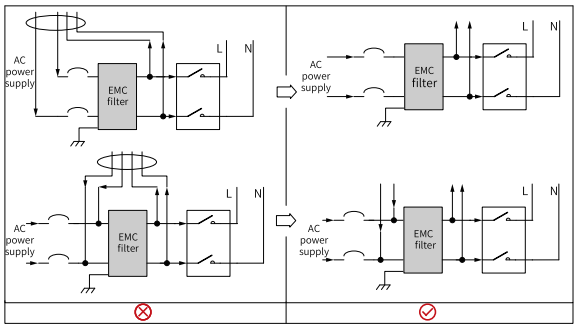
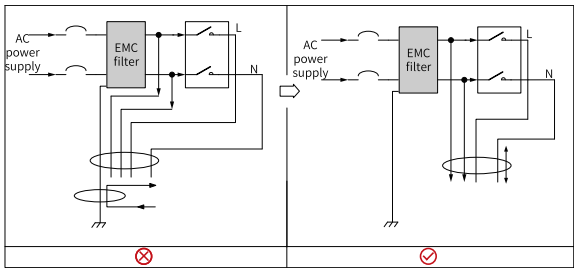
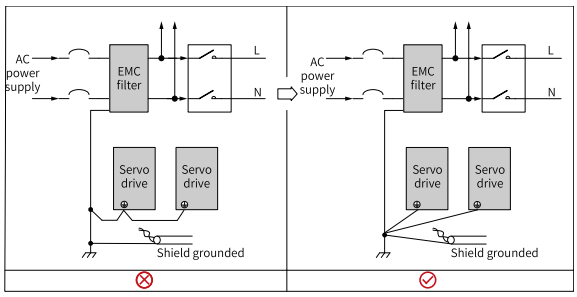
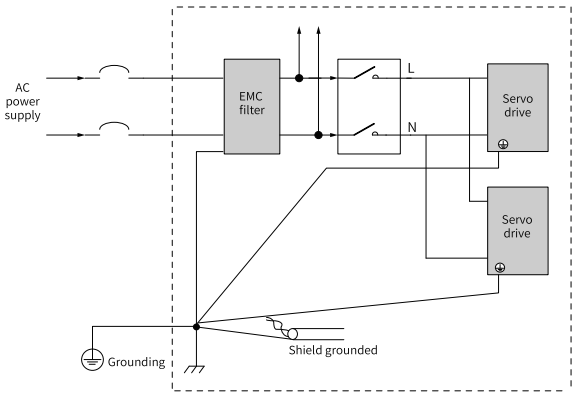
- Remove the jumper between terminals P ⊕ and D before using the external braking resistor. Failure to comply can result in overcurrent and damage the braking transistor.
- Do not connect the external braking resistor to the positive or negative pole of the bus directly. Failure to comply will damage the servo drive and result in a fire.
- Select a resistor with resistance higher than or equal to the minimum permissible value. Failure to comply will result in alarm E201 or damage the servo drive.
- Make sure parameters H02.25 (Braking resistor setting), H02.26 (Power of external braking resistor) and H02.27 (Resistance of external braking resistor) are set properly before operating the servo drive.
- Install the external braking resistor on incombustible surfaces (such as metal).
- Built-in braking resistors or jumper bars are not included in S1R6 and S2R8 models. If an external braking resistor is needed, connect it between terminals P ⊕ and C.

6.10.2 Electromagnetic Contactor Wiring

Turning on or off the side electromagnetic contactor can start or stop the servo drive. However, frequent turn-on/-off may cause drive faults. Therefore, start/stop the servo drive at most once per hour. Do not use the electromagnetic contactor as the power switch of the drive. Otherwise, the lifetime of the drive may be reduced.

6.10.3 Wiring of the Power Supply Filter

To prevent interference from the power cable and reduce impact of the servo drive on other sensitive devices, install a proper EMC filter on the input side of the power supply according to the input current. In addition, install an EMC filter on the power supply cable of peripheral equipment if necessary. Observe the following precautions when installing and wiring EMC filters.

No.	Precautions	Wiring example
1	Do not place the input and output cables of the EMC filer in the same duct or bundle them together.	 Figure 6-36 Separate routing of EMC filter input and output cables
2	Route the grounding cable and the output power cable of the EMC filter through different routes.	 Figure 6-37 Separate routing of the grounding cable and output power cable
3	Use a separate grounding cable as short and thick as possible for the EMC filter. Do not share the grounding cable with other grounding devices.	 Figure 6-38 Single-point grounding
4	Ground the EMC filter inside the cabinet. If the EMC filter and the servo drive are installed in the same control cabinet, fix the EMC filter and the servo drive on the same metal plate. Make sure the contact part is in good conductive condition, and ground the metal plate properly.	 Figure 6-39 Grounding of the EMC filter

6.10.4 Wiring of Surge Protection Device

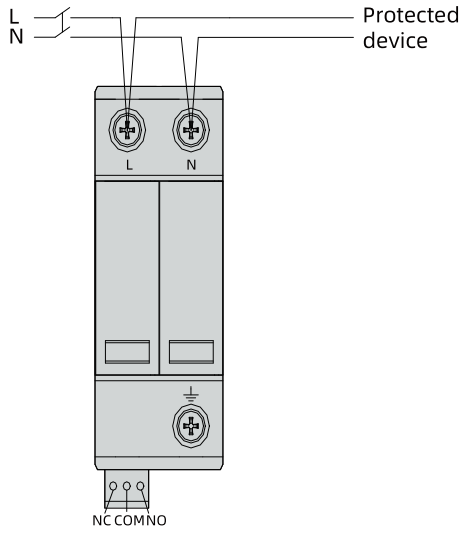
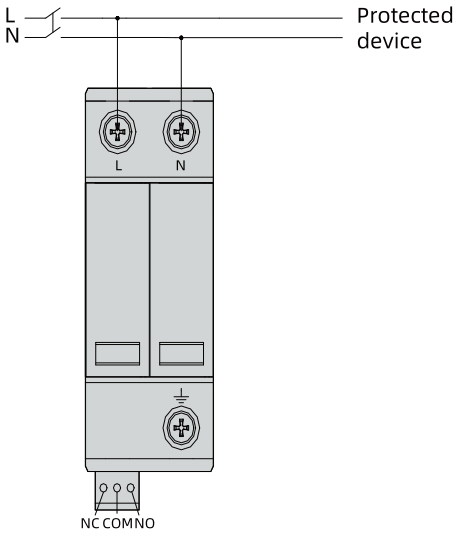
6.10.4.1 Wiring Precautions and Requirements

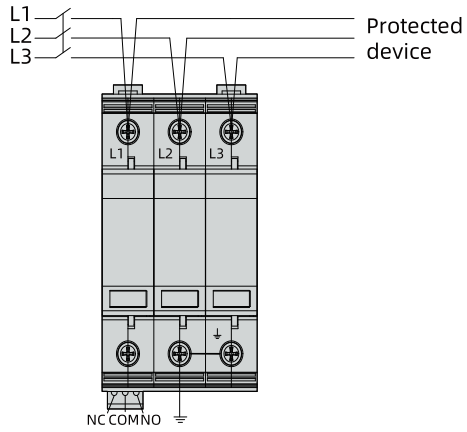
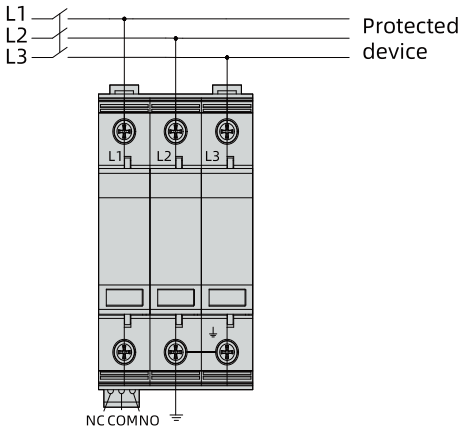
- A proper fuse or circuit breaker must be connected in series in the upstream of the power supply surge protection device.
- The power supply must be disconnected during wiring. Never operate with power on. When connecting to the power supply, strictly follow the wiring labels and PE on the product. Improper connection can damage the surge protection device.
- The power supply surge protection device requires no special maintenance. You only need to check whether the module is loose and whether the status indicator is normal regularly.
- If any one of the following conditions occurs, the power supply surge protection device fails. In this case, replace it.
  - The status indicator of the power supply surge protection device turns red.
  - The alarm dry contact NC-COM of the power supply surge protection device changes to the open circuit state, and NO-COM changes to the short circuit state.

6.10.4.2 Wiring Example

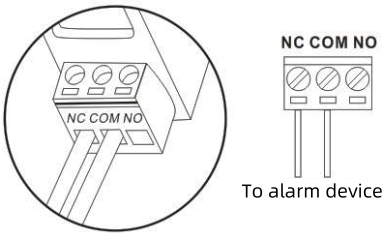
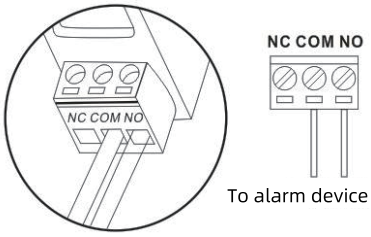
Wiring method

The product is fixed using a standard 35 mm rail. The wiring method is as follows.

V-shaped wiring (recommended) - Single-phase	Direct parallel wiring - Single-phase
 V-shaped wiring	 Direct parallel wiring • Total wiring length ≤ 0.5 m • Minimize the difference in length among phase cables.

V-shaped wiring (recommended) - Three-phase	Direct parallel wiring - Three-phase
 V-shaped wiring	 Direct parallel wiring • Total wiring length ≤ 0.5 m • Minimize the difference in length among phase cables.

Alarm wiring

Open circuit alarm: Use NO-COM terminal.	Short circuit alarm: Use NC-COM terminal.
 Remote alarm connection method 1 (NO normally, short-circuited upon fault)	 Remote alarm connection method 2 (NO normally, short-circuited upon fault)

Installation and inspection

After installation, insert the surge protection module into place and check whether it is operating normally. The operating status of the surge suppression device is described as follows:

Status	Indicator	NC-COM	NO-COM
Running	Green	Short circuit	Open circuit
Failure	Red	Open circuit	Short circuit

6.11 Post-wiring Inspection

After wiring is done, check the following items.

No.	Item	Pass
1	The drive is grounded properly.	□
2	The power supply (input power) voltage matches the rated input voltage of the drive.	□
3	The power supply (input power) is connected to L1/L2/L3 and secured with the specified tightening torque.	□

No.	Item	Pass
4	A proper power supply (input power) fuse and circuit breaker are installed.	□
5	The motor is connected to U/V/W, and all terminals are secured with the specified tightening torque.	□
6	An external braking resistor (if present) is connected to P and C and secured properly.	□
7	Motor cables (and braking resistor cables, if any) are routed away from other cables (>30 cm).	□
8	No power factor compensation devices are present in the motor cables.	□
9	External control circuit wiring of the control unit is correctly connected.	□
10	No tools, foreign objects, or dust from drilling are left inside the servo drive.	□
11	The power (input power) voltage is not directly connected to the output of the drive.	□

6.12 Solutions to Common EMC Problems

6.12.1 Residual Current Device Malfunction

If a residual current device (RCD) is needed, select the RCD according to the following requirements:

- Use a B-type RCD because the drive may generate DC leakage current in the protective conductor.
- For each drive, use an RCD whose tripping current is not lower than 100 mA to prevent RCD malfunction due to high-frequency leakage current generated by the drive.
- When multiple drives are connected in parallel and share the same RCD, select an RCD whose tripping current is not lower than 300 mA.
- It is recommended to use Chint or Schneider RCDs.

If the RCD malfunctions, perform troubleshooting according to the following table:

Table 6–30 Measures against current leakage

RCD malfunction	Possible cause	Solution
RCD malfunction upon power-on	The interference resistance performance of the residual current device is poor.	• Use RCDs of recommended brands. • Use an RCD with a higher tripping current. • Move the unbalanced load to the upstream side of the residual current device.
	The tripping current of the residual current device is excessively low.	
	An unbalanced load is connected at the downstream side of the residual current device.	
	Excessive ground capacitance exists in the upstream of the drive.	
RCD malfunction during operation	The interference resistance performance of the residual current device is poor.	• Use RCDs of recommended brands. • Use an RCD with a higher tripping current. • Install a simple filter on the input side of the drive and wind the LN and RST cables around the magnetic ring near the RCD, as shown in *"Figure 6-40 Magnetic ring on the input side" on page 134*. • Reduce the carrier frequency without compromising the performance. • Use shorter motor cables.
	The tripping current of the residual current device is excessively low.	
	An unbalanced load is connected at the downstream side of the residual current device.	
	The ground distributed capacitance of the motor cable and the motor is too high.	

Figure 6-40 Magnetic ring on the input side

6.12.2 Harmonic Suppression

To suppress harmonics and improve the power factor to allow the drive to fulfill the standards, install an AC input reactor on the input side of the drive. See section "AC Reactor" for reactor models. See the installation methods in *" Instructions for Installing the AC Input Reactor" on page 68*.

6.12.3 Noise Prevention

To prevent noise interference caused by switching on and off the IGBT, you can install a magnetic ring on the output UVW cables. For details, see *" Instructions for Installing Magnetic Ring and Ferrite Clamp" on page 69*. Tightly secure the back of the enclosure to the drive grounding metal housing. Use shielded power cables and ground the shield properly.

6.12.4 Common I/O Signal Interference

The drive generates very strong interference during operation. The drive may interfere with or be interfered with by other devices due to improper routing or grounding. In such cases, take the following measures.

No.	Step
1	Use shielded cables as the I/O signal cables and connect the shield to the PE terminal. For details, see " *Cable Specifications and Model Requirements" on page 105*.
2	Reliably connect the PE terminal of the motor to the PE terminal of the servo drive, and connect the PE terminal of the servo drive to the PE terminal of the grid.
3	Add an equipotential bonding grounding cable between the host controller and drive (see *"6.9.3.3 Grounding of the Control Cabinet System" on page 127*).
4	Main power cables (power cables + power supply cables) and I/O signal cables must be routed through different routes, with a distance of at least 30 cm between them.
5	Wind the drive output (U/V/W) cables around the magnetic ring by two to four turns (see " *Instructions for Installing Magnetic Ring and Ferrite Clamp" on page 69*).
6	Increase the filter capacitance for low-speed DIs. A capacitance up to 0.1 μF is recommended, as shown in *"Figure 6-41 Increasing filtering on I/O signal cables" on page 135*.
7	Increase the filter capacitance between AI and GND. A capacitance up to 0.22 μF is recommended.
8	Wind the magnetic ring or ferrite clamp to the signal cable by one or two turns (see " *Instructions for Installing Magnetic Ring and Ferrite Clamp" on page 69*).
9	Use shielded power cables and ground the shield properly.

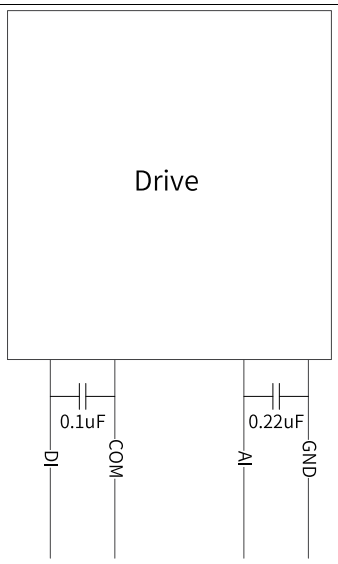


Figure 6-41 Increasing filtering on I/O signal cables

7 Commissioning Tools

7.1 Keypad

7.1.1 Components

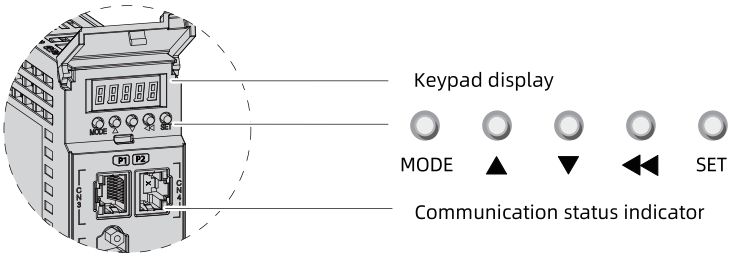


Figure 7-1 Magnified view of the operating panel

The operation panel of the SV660F Series servo drive consists of an LED (5-digit, 8-segment) and five buttons. The panel is used for display, parameter setting, user password setting, and general functions operations. The following table takes parameter setting as an example to describe the general functions of the keys.

Table 7–1 General functions of keys

Name	Illustration	Description
MODE	MODE	Switch between modes. Return to the upper-level menu.
UP	▲	Increase the number indicated by the blinking digit of the LED.
DOWN	▼	Decrease the number indicated by the blinking digit of the LED.
SHIFT	◀◀	Shift the blinking digit of the LED. View the high digits of the number consisting of more than 5 digits.
SET	SET	Switch to the next-level menu. Execute commands such as storing parameter setpoints.

Indicators

Table 7–2 Indicator status

Indicator	State	Status Indication
Link indicator	Green	• On: The interface is in the connected state. • Off: The interface is in the disconnected state. • Blinking: Data is being transmitted.
m: ACT indicator	Yellow indicator	The indicator's blink rate correlates with the port's data traffic: higher traffic results in a faster blink rate. Under very high traffic loads, the indicator may appear nearly solid.

7.1.2 LED Display

Table 7–3 LED display and actual data

Display	Equivalent	Display	Equivalent	Display	Equivalent	Display	Equivalent
	0		9		h		r
	1		A		c		t
	2		B		J		U
	3		C		L		y
	4		D		n		T
	5		E		N		u
	6		F		o		-
	7		H		P	-	-
	8		G		q	-	-

7.1.3 Keypad Display

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

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

7.1.3.1 Status Display

Display	Name	Applicable Scenario	Meaning
	reset Servo initializing	At the moment of 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.
	nr.x Servo not ready	Initialization done, but servo drive not ready	Meaning of "x" For specific reasons and troubleshooting methods, see *"Table 7-4" on page 139*.
	ry Servo ready (Ready)	Servo drive ready	The servo drive is ready to run and is waiting for the S-ON signal.

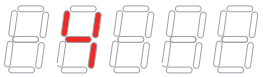
Display	Name	Applicable Scenario	Meaning
	rn Servo running	Servo ON (S-ON) signal activated (S-ON signal switched on)	The servo drive is running.
	1-4: operation modes	-	Displays present operation mode of the servo drive in hexadecimal. 1: AC1 3: AC3 4: AC4
	1 to 4: Communication status	-	Displays the status of the PROFINET state machine of a slave in characters. 1: Initializing 2: Pre-operational 4: Operational state
	- CN4 connection indication	CN4 indicates PROFINET output connection status.	OFF: No communication connection is detected in the physical layer. ON: A communication connection is detected in the physical layer.
	- CN3 connection indication	CN3 indicates successful PROFINET input connection.	
	ACE Blinking status	When the Siemens host controller configuration software scans the drive, if the "Blink LED" option is checked, the servo drive keypad will blink ACE. Unchecking the option restores the original display. If the InoDriverShop software scans the drive, and you right-click the device in the "Network configuration" interface and select "flicker", the drive keypad will blink ACE. Selecting "Unblink" restores the original display.	Check whether the detection software successfully scans the servo drive and locates the drive's position.

Table 7–4 Cause and solution for display of "nr.x"

nr.x	Cause	Solution
nr.1	The control voltage H0b.57 is less than the undervoltage threshold H01.78 (the input 220V threshold is 190V, and the input 380V threshold is 380V).	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.
nr.2	L1-L3 input is 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.
nr.3	The bus voltage H0b.26 is less than the undervoltage threshold H01.42 (the input 220V threshold is about 200V, and the input 380V threshold is about 380V).	1 .Check if input L1-L3 meet the input specifications. 2 .If yes, and H0b.26 is close to 0, the hardware circuit may be damaged.
nr.4	The pre-charge resistor of the drive is not bypassed.	Check if bus voltage H0b.26 is in the normal range (input 220V: 235V-378V, input 380V: 451V-689V).
nr.5	The encoder initialization is not done.	Contact the technical support.
nr.6	The ground fault detection is not done.	Check the value of H0b-57.

7.1.3.2 Parameter Display

- Display of parameter groups

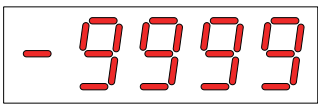
Display	Name	Content
HXX.YY	Parameter group	XX: Parameter group No. (Hexadecimal) YY: Offset within the parameter group (decimal)

For example, H02.00 is displayed as follows:

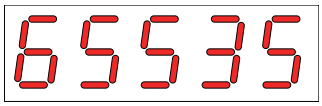
Display	Name	Content
	H02.00	02: Parameter group No. 00: Offset within the parameter group

- Display of negative numbers and numbers with different lengths
  - Signed number of 4 digits and below or unsigned number of 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 and Unsigned number with more than 5 digits
  Such numbers are displayed from low to high bits (5 bits per page) in several pages: Present page + Value on present page, as shown in the following figure. Hold down SHIFT for more than 2s to switch to the next page.

  For example, "-1073741824" is displayed as follows:

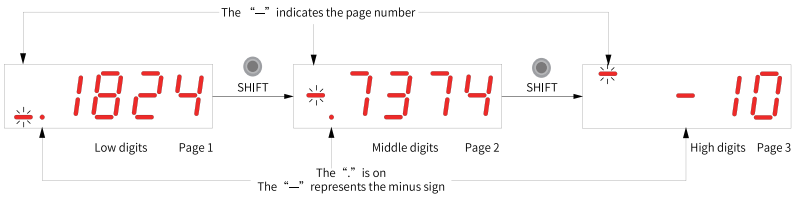


Figure 7-2 Display of "-1073741824"

For example, 1073741824 is displayed as follows:

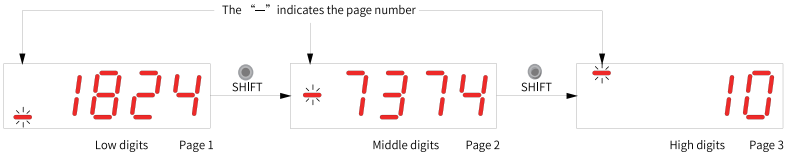
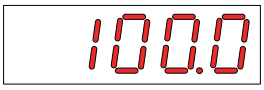
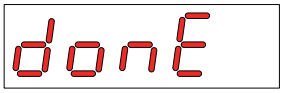
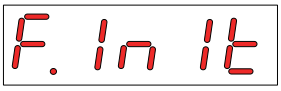
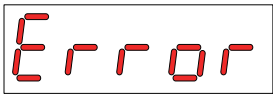


Figure 7-3 Display of "1073741824"

- Display of the decimal point
  The segment "." of the ones indicates the decimal point. This segment does not blink.

Display	Name	Content
	Decimal point	100.0

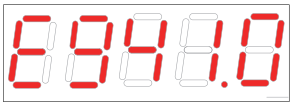
- Display of parameter setting status

Display	Name	Applicable Occasion	Description
	Done Parameter setting completed	The parameter has been set.	The parameter has been set and saved to the drive (Done). The servo drive can execute other operations.
	F.InIt Restore parameters to default values.	Parameter initialization is in progress (H02.31 = 1).	The servo drive is restoring parameters to default values. After parameter initialization is done, switch on the control power supply again.
	Error Password incorrect	The user password (H02.30) is activated and the password entered is wrong.	A wrong password is entered. You need to enter the password again.

7.1.3.3 Fault Display

- The keypad can be used to display present or previous fault and alarm codes. For analysis and solutions to the faults and warnings, see Chapter "Troubleshooting".
- 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 following:

Display	Name	Content
	E941.0 Active alarm code	E: A fault or an alarm occurs on the drive. 941.0: Alarm code

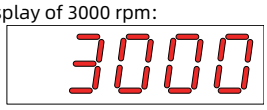
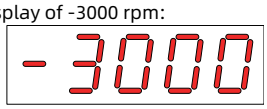
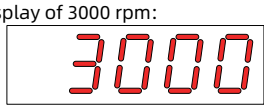
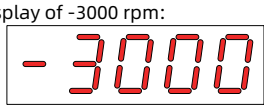
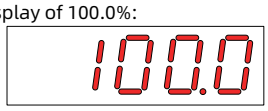
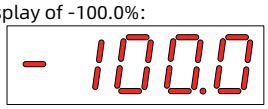
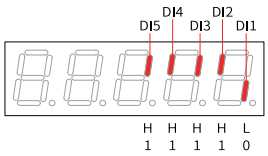
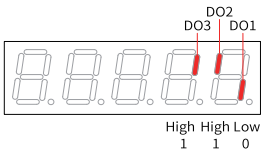
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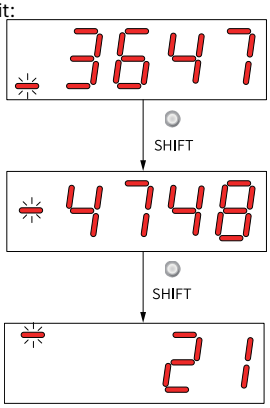
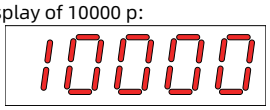
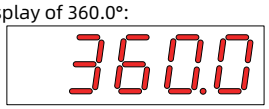
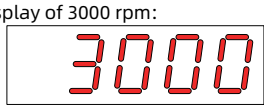
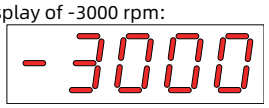
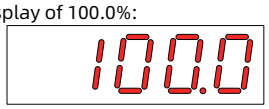
- If the panel displays "Hault/Fault", a system fault has occurred.
- The possible causes include program bugs, external interference like static electricity or electromagnetic interference, extreme operating temperature or radiation.
- In this case, record the values of H16.00 to H16.19, and contact Inovance.

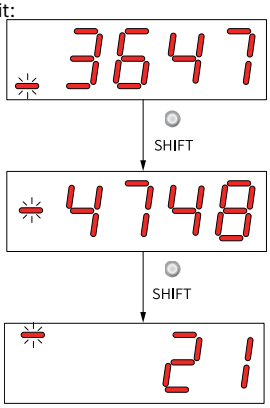
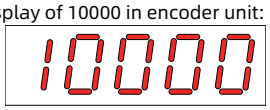
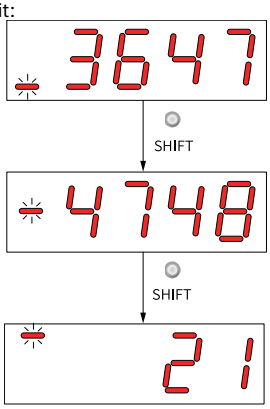
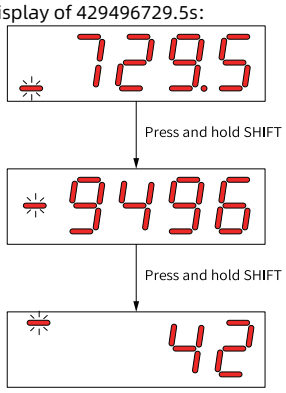
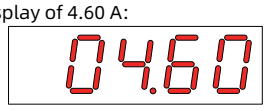
7.1.3.4 Monitored Value Display

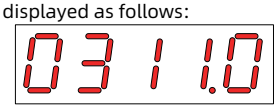
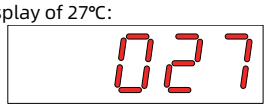
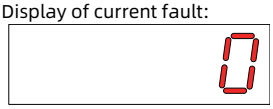
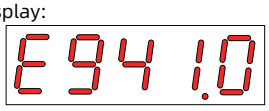
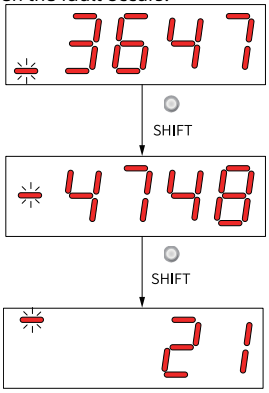
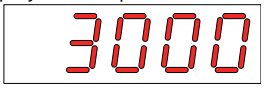
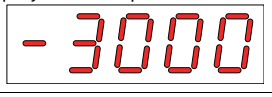
- Group H0b: The parameters in this group are used to monitor the running status of the servo drive. You can enable keypad monitoring display by setting H02.32. The parameter group number displayed is H0b and the group offset is the value set by H02.32.
- When H02.32 is set to a valid group offset, the motor enters the state display mode when it is at a standstill and enters the parameter display mode when the motor is in the rotating state. The mode switchover is irrelevant to the S-ON signal of the servo.
- For example, if the motor changes from the standstill state to the running state when H02.32 is set to 00, the display switches from "Status display mode" to "Parameter display mode" and displays the parameter value corresponding to H0b.00.

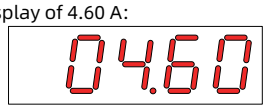
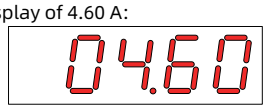
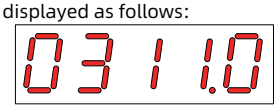
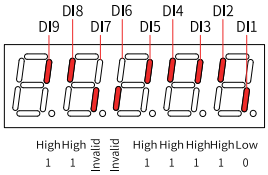
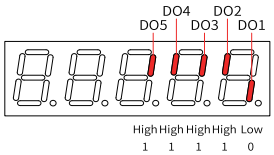
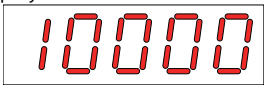
The following table illustrates the display of the monitored parameter H0b.00.

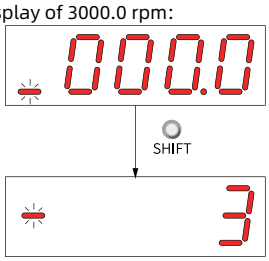
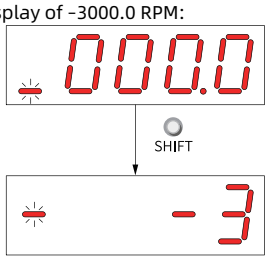
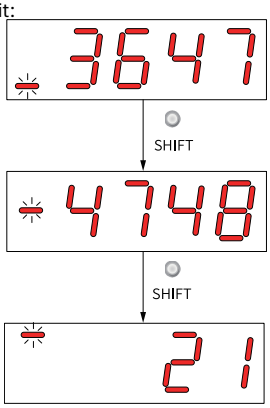
Parameter	Name	Unit	Description	Example
H0b.00	Actual motor speed	RPM	Displays the actual value of the motor speed after round-off, which can be accurate to 1 rpm.	Display of 3000 rpm:  Display of -3000 rpm: 
H0b.01	Speed reference	RPM	Displays the present speed reference of the servo drive.	Display of 3000 rpm:  Display of -3000 rpm: 
H0b.02	Internal torque reference	0.10%	Displays the ratio of actual torque output of the motor to the rated torque of the motor.	Display of 100.0%:  Display of -100.0%: 
H0b.03	Monitored DI states.	-	Displays the optocoupler status of five 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"). H0b.03 value read by the software tool is a decimal.	For example, if DI1 is at a low level and DI2 to DI5 are at high levels: The corresponding binary value is "11110", and the value of H0b.03 read in the software tool is 0x001E. Display on the keypad: 
H0b.05	Monitored DO states.	-	Displays optocoupler status of the three DO 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 H0b.05 value read by the software tool is a decimal.	For example, if DO1 is low level and DO2 and DO3 are high level, the binary value is "110". The value of H0b.05 read in the software tool is 0x0006. Display on the keypad: 

Parameter	Name	Unit	Description	Example
H0b.07	Absolute position counter (32-bit decimal display)	Reference unit	Displays THE current absolute position of the motor (reference unit).	Display of 1073741824 in reference unit: 
H0b.09	Mechanical angle (pulses starting from the home)	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 × 4 - 1. For example, the maximum value of H0b.09 for a 2500-PPR incremental encoder is 9999. The maximum value of H0b.09 for an absolute encoder is 65535. $\text{Actual mechanical angle} = \frac{\text{H0b.09}}{\text{H0b.09 max. value}+1} \times 360.0\text{deg}$	Display of 10000 p: 
H0b.10	Rotation angle (electrical angle)	0.1°	Indicates the present electrical angle of the motor.	Display of 360.0°: 
H0b.11	Speed corresponding to the input position reference	RPM	Displays the speed corresponding to the position reference per control cycle of the servo drive.	Display of 3000 rpm:  Display of -3000 rpm: 
H0b.12	Average load ratio	0.10%	Indicates the percentage of the average load torque to the rated torque of the motor.	Display of 100.0%: 

Parameter	Name	Unit	Description	Example
H0b.13	Input reference pulse counter (32-bit decimal display)	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 display)	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 display)	Encoder unit	Counts and displays the number of pulses fed back by the encoder (encoder unit).	Display of 1073741824 in encoder unit: 
H0b.19	Total power-on time (32-bit decimal display)	0.1s	Counts and displays the total power-on time of the servo drive.	Display of 429496729.5s: 
H0b.24	RMS value of phase current	0.01A	Displays the RMS value of the phase current of the servo motor.	Display of 4.60 A: 

Parameter	Name	Unit	Description	Example
H0b.26	Bus voltage	0.1 V	Displays the DC bus voltage of the main circuit.	After 220 V AC rectification, 311.0 V is displayed as follows:  After 380 VAC rectification, 537.0 V is displayed as follows: 
H0b.27	Module temperature	℃	Displays the temperature of the power module inside the servo drive.	Display of 27℃: 
H0b.33	Fault record	-	Set the number of historical faults to be viewed. 0: Present fault 1: Last fault 2: 2nd to last fault ... 19: 19th last fault	0: Display of current fault: 
H0b.34	Fault code of the selected fault	-	The fault selected by H0b.33 can be viewed through H0b.34. When no fault occurs, the displayed value of H0b.34 is E000.0.	If H0b.33 = 0 and H0b.34 = E941.0, the current fault code is 941. Display: 
H0b.35	Timestamp of the selected fault	s	Displays the total servo operation time when the selected fault occurs. If no fault occurs, the displayed value of H0b.35 is 0.	If H0b.34 = E941.0 and H0b.35 = 107374182.4, the present fault code is 941 and the total operating time of the servo drive is 107374182.4s when the fault occurs. 
H0b.37	Motor speed upon the selected fault	RPM	Indicates the motor speed upon occurrence of the selected fault. When no fault occurs, the value of H0b.37 is 0.	Display of 3000 rpm:  Display of -3000 rpm: 

Parameter	Name	Unit	Description	Example
H0b.38	Motor phase U current upon selected fault	0.01A	Indicates the effective value of motor phase U winding current upon occurrence of the selected fault. When no fault occurs, the value of H0b.38 is 0.	Display of 4.60 A: 
H0b.39	Motor phase V current upon displayed fault	0.01A	Indicates the effective value of motor phase V winding current upon occurrence of the selected fault. When no fault occurs, the value of H0b.39 is 0.	Display of 4.60 A: 
H0b.40	Bus voltage upon occurrence of the selected fault	V	Displays the DC bus voltage of the main circuit when the selected fault occurs. When no fault occurs, the value of H0b.40 is 0.	After 220 V AC rectification, 311.0 V is displayed as follows:  After 380 VAC rectification, 537.0 V is displayed as follows: 
H0b.41	Input terminal state upon selected fault	-	Indicates the high/low level state of the nine DI terminals upon occurrence of the selected fault. 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=414: 
H0b.42	Output terminal state upon selected fault	-	Indicates the high/low level state of the five DO terminals upon occurrence of the selected fault. View this parameter in the same way as viewing H0b.05. When no fault occurs, all DOs are displayed as low level in H0b.42 (indicated by the decimal value 0).	Display when H0b.42 is 15: 
H0b.53	Position deviation counter (32-bit decimal)	Reference unit	Position deviation = Total input position references (reference unit) – Total encoder feedback pluses (reference unit)	Display of 10000 in reference unit: 

Parameter	Name	Unit	Description	Example
H0b.55	Actual motor speed	0.1 rpm	Displays the actual value of the motor speed, which can be accurate to 0.1 RPM.	Display of 3000.0 rpm:  Display of -3000.0 RPM: 
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: 

7.1.3.5 Display mode switchover

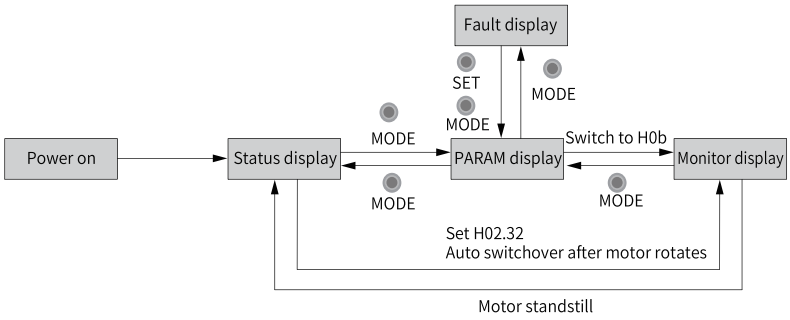


Figure 7-4 Switchover among different display modes

- The operating panel enters status display immediately upon power-on.
- Press MODE to switch among different display modes based on the conditions shown in *"Figure 7-4" on page 147* .
- In the status display mode, set H02.32 to select the monitored parameter. When the motor rotates, the operation panel automatically switches to the monitoring display mode. After the motor stops, the panel automatically restores to the status display mode.

- In the parameter display mode, after you select the parameter to be monitored in group H0b, the operating panel switches to monitored value display.
- Once a fault occurs, the keypad immediately enters the fault display mode, and all 5-digit LEDs blink. Press SET to stop the LEDs from blinking, and then press MODE to switch to parameter display.

7.1.4 Parameter Setting

7.1.4.1 Parameter Setting

You can set parameters through the keypad. For details on parameters, see Chapter "List of Parameters". The following figure shows how to switch from position control mode to speed control mode using the keypad after power-on.

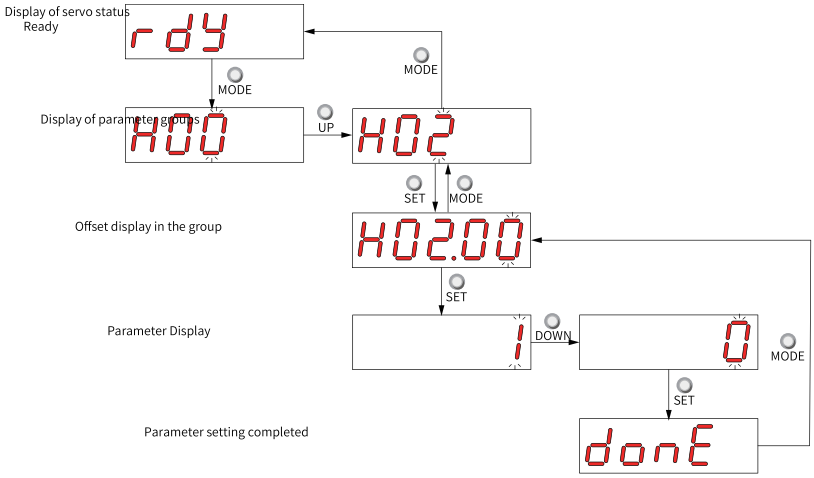


Figure 7-5 Parameter setting procedure

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"). If the parameter change mode is "At stop", the drive must be switched to the "ready" state before parameter setting.

7.1.4.2 Forced DI/DO Signal Setting

Digital signals include digital input signals (DI signals) and digital output signals (DO signals). You can configure the DI and DO functions and terminal logic to parameters in groups 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 drive can output DO signals to the host controller.

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

When the forced DI/DO function is used, the logics of both physical DIs and VDIs are determined by forced input.

Forced DI signal

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

- **Procedure**

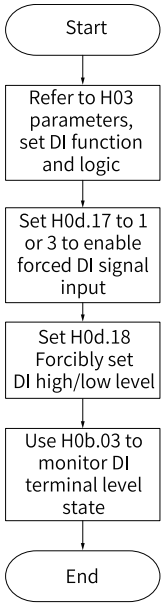


Figure 7-6 Procedure for setting forced DI function

Parameters in group H03 are used to set the level logic for DI function. H0d.18 is used to set the forced input value of DI, which is displayed in hexadecimal on the keypad. H0b.03 is used to monitor the level status of DI terminals.

- **Example**

  As shown in the figure below, when the DI function level logic is set to "active low", functions of DI2 to DI5 are inactive when the DI1 function is active. In this case, you can set H0d.18 to "1E", and the panel monitored by H0b.03 shows that the DI1 is of low level and DI2 to DI5 are of high level. If there is no fault in the DI function, the displayed value of H0b.03 matches the set value of H0d.18. The value of H0b.03 read through InoDriverShop is a decimal "30" (0x001E in hexadecimal).

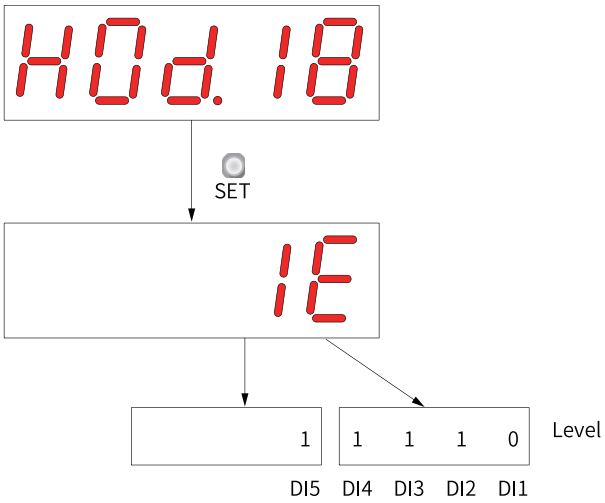


Figure 7-7 Meaning of the H0d.18 setpoint

You can monitor the DI level state through H0b.03, as shown below. Display on the keypad:

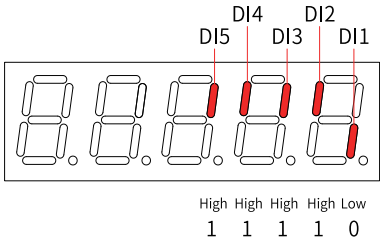


Figure 7-8 DI level states corresponding to H0b.03

Note

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

- **Exit**

  The forced DI signal function is not retentive upon power-off. Normal DIs apply after restart, or you can set H0d.17 to 0 to return to the normal DI mode.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0d.17	Forced DI/ DO setting switch	-	0 to 3	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	Position	**Name**	**Value**						
	bit0	Forced DI enable switch	0: Disable 1: Enable						
	bit1	Forced DO enable switch	0: Disable 1: Enable						
	Description of parameters:								
	Defines whether to enable forced DI/DO.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0d.18	Forced DI value	-	0x0 to 0xFF	-	0xFF	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the level logic of the DI functions set by the parameter when forced DI is activated. The value of H0d.18 is displayed as a hexadecimal on the keypad. When it is converted to a binary value, "bit(n) = 1" indicates the level logic of DI function is high level; "bit(n) = 0" indicates the level logic of the DI function is low level.								

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0b.03	Monitored DI states.	-	0x0 to 0xFFFF	-	0x0	UInt16	Read-only	Standard user	-
	Parameter description:								
	Displays the level status of DI1 to DI5 without filtering. Upper LED segments turned on: High level (indicated by "1"); Lower LED segments turned on: Low level (indicated by "0") For example, if DI1 is low level, DI2 to DI5 are high level, and the binary value is "11110", the decimal value of H0b.03 read by the Inovance software tool is 30 (0x001E in hexadecimal).								

Forced DO signal output

After this function is enabled, all DO levels are controlled by forced output (H0d.19) and not related to the internal DO function state.

Caution

If the motor is used in vertical motion, when the brake output (BK) signal (DO function 9: BK) is set to "Active", the brake will be released and the load may fall. Take protective measures on the machine to prevent the risk of falling.

- **Procedure**

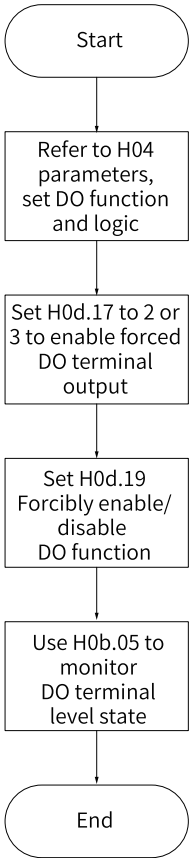


Figure 7-9 Procedure for setting forced DO signal output

Parameters in group H04 are used to set the level logic for DO function. H0d.19 is used to set the forced output value of DO, which is displayed in hexadecimal on the keypad. H0b.05 is used to monitor the level status of DO terminals.

- **Example**

  As shown in the figure below, when the DO function level logic in group H04 is set to "active high", DO1 function is inactive when functions of DO2 and DO3 are active. In this case, you can set H0d.19 to "6", because "110" in binary corresponds to "6" in hexadecimal.

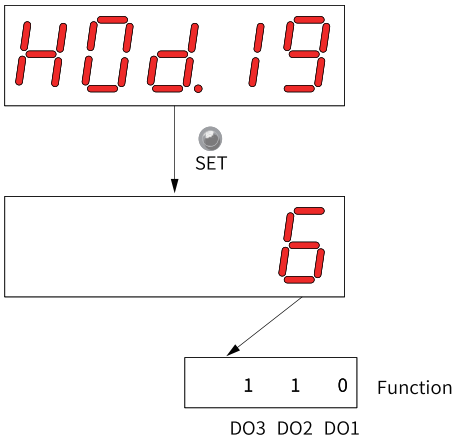


Figure 7-10 Setpoints of H0d.19

Monitoring the DO level status through H0b.05. Display on the keypad:

If the logic of all the three DOs are active at high level, then DO1 is low level and DO2 to DO3 are high level, the corresponding binary number is 110, and the value of H0b.05 (Monitored DO signal) read by the software tool is 6 (hexadecimal). Display on the keypad:

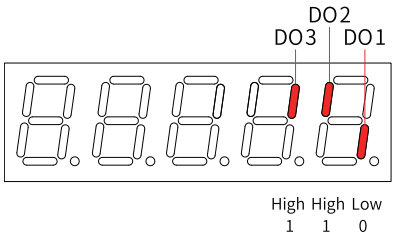


Figure 7-11 Display of H0b.05 when all DO are "active high"

- **Exit**
  The forced DO signal output function is non-retentive upon power failure. After restart, normal DO functions are restored, you can also set H0d.17 to 0 to return to the normal DO mode.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0d.17	Forced DI/ DO setting switch	-	0 to 3	-	0	UInt16	Real-time	Ordinary user	Effective in real time

Value:

Position	Name	Value
bit0	Forced DI enable switch	0: Disable 1: Enable
bit1	Forced DO enable switch	0: Disable 1: Enable

Description of parameters:

Defines whether to enable forced DI/DO.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0d.19	Forced DO value	-	0x0 to 0x1F	-	0x0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines whether the DO functions assigned in group H04 are active when forced DO function is active (H0d.17= 2 or 3). H0d.19 is displayed in hexadecimal on the keypad. In the converted binary value, bit(n) = 1 indicates that the DO function is active, and bit(n) = 0 indicates that the DO function is inactive. For example, if the value of H0d.19 is 6, the corresponding binary is "110", indicating that the DO1 function is active and functions of DO2 to DO3 are inactive. DO level is output based on DO level setting in parameter group H04.								

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0b.05	Monitored DO states.	-	0x0 to 0xFFFF	-	0x0	UInt16	Read-only	Standard user	-
	Parameter description:								
	Displays the unfiltered level states of three DO terminals. Upper LED segments turned on: High level (indicated by "1"). Lower LED segments turned on: Low level (indicated by "0") For example, if DO1 is low level, DO2 to DO3 are high level, and the binary value is "110", the decimal value of H0b.05 read by the Inovance software tool is 6.								

7.1.4.3 Setting the user password

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

Set bit5 of H0A.71 to 1. After setting the user password, you can't view or change the parameters in group H02 group through the keypad or the software tool.

Setting the user password

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

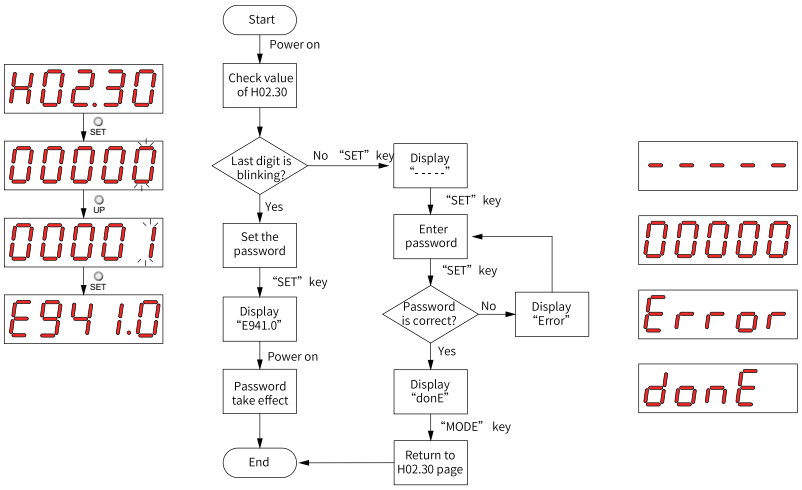


Figure 7-12 Procedure for setting the user password

Changing the user password

To change the user password, input the current password first to grant permissions on parameter setting. 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.

Canceling the user password

Enter the set user password, and set H02.30 to "00000" to cancel the user password.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.30	User password	-	0 to 65535	-	0	UInt16	Read only	Ordinary user	-
	Description of parameters:								
	Defines the user password.								

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0A.71	Servo function selection switch	-	0 to 65535	-	4098	UInt16	Real time	Standard user	Next power-on

Parameter description:

bit	Function	Description
0	Overload curve for motor overload protection	0: New overload curve 1: Old overload curve
1	Bleeder switch status upon power failure	0: Enable 1: Hide
2	Forced brake motor stop	0: Forced stop 1: No forced stop
3	Reserved	-
4	Mask the alarm indicating drive power is lower than motor power	0: Mask 1: Show
5	Prohibit software from reading parameter	0: Disable 1: Enable
6	Mask E108.4	0: Not mask 1: Mask
7	Reserved	-
8	Reserved	-
9	Power cable disconnection detection	0: Enable 1: Disable
10	Reserved	-
11	Ultra-precise speed feedback switch	0: Disable 1: Enable
12	Save homing completion flag bit upon power-off	0: Not retentive upon power failure 1: Retentive upon power failure
13	Reserved	-
14	Encoder adaptive function switch	0: Enable 1: Disable

Note: bit2, bit4, bit5, bit6, bit9, and bit14 are supported only in versions equal to or later than 4302.3 (H01.00 ≥ 4302.3).

7.2 Commissioning Software

7.2.1 Overview

The software tool InoDriverShop can be downloaded from *https://www.inovance.com/global*.

Use an S6-L-T00-3.0 communication cable for communication between the drive and the PC.

InoDriverShop supports 32-bit/64-bit Windows 7 and 64-bit Windows 10 operating systems. For details on how to use InoDriverShop, see the online help of InoDriverShop.

7.2.2 Installation

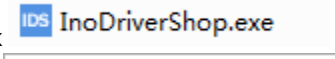
1. Access to the software

   a. Visit the official website of Inovance as shown below.
   https://www.inovance.com/global

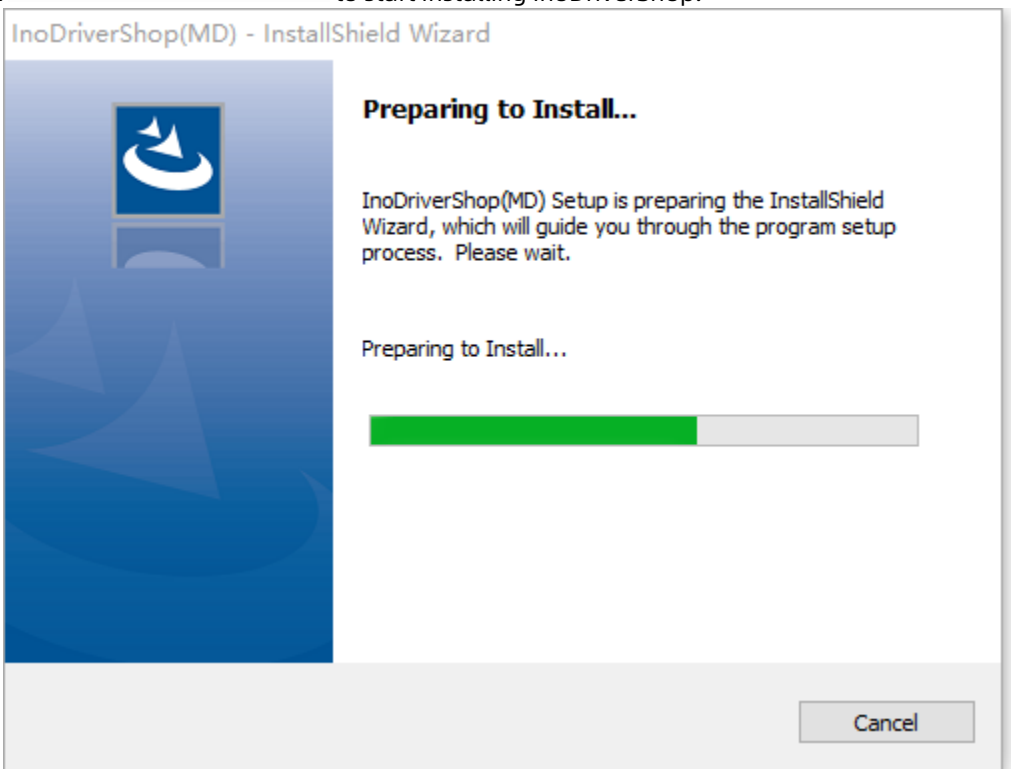
   b. Choose Support → Download, and then type in the keyword InoDriverShop and click "Search".

   c. Click "Download".

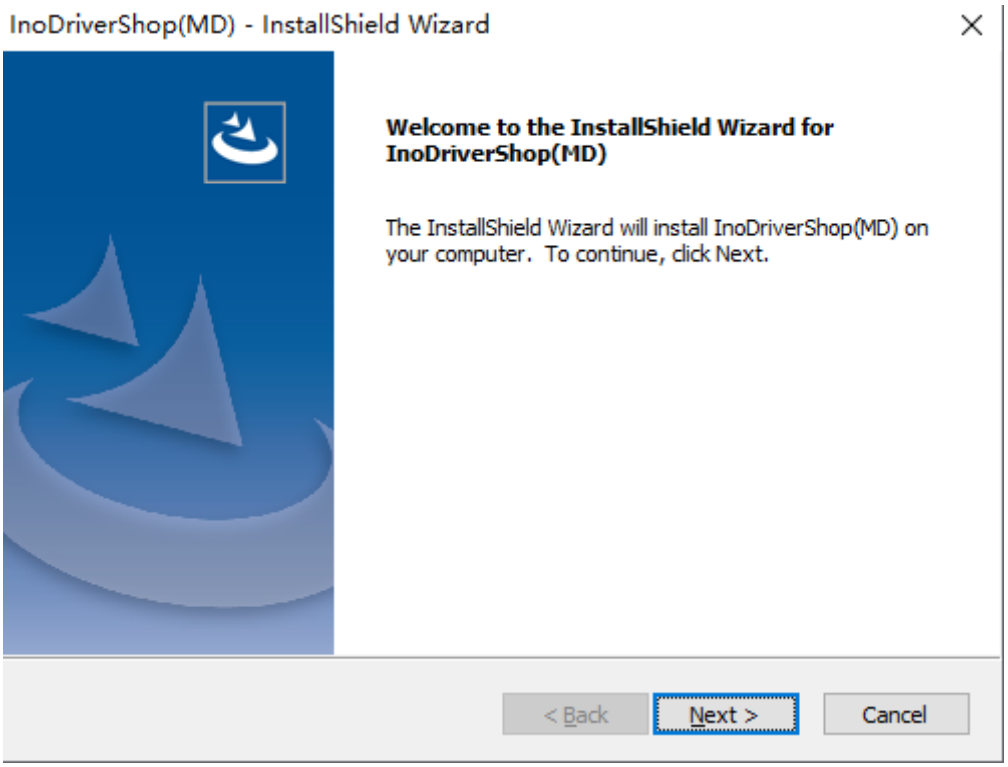
2. Unzip the package downloaded.

3. Click 

to start installing InoDriverShop.

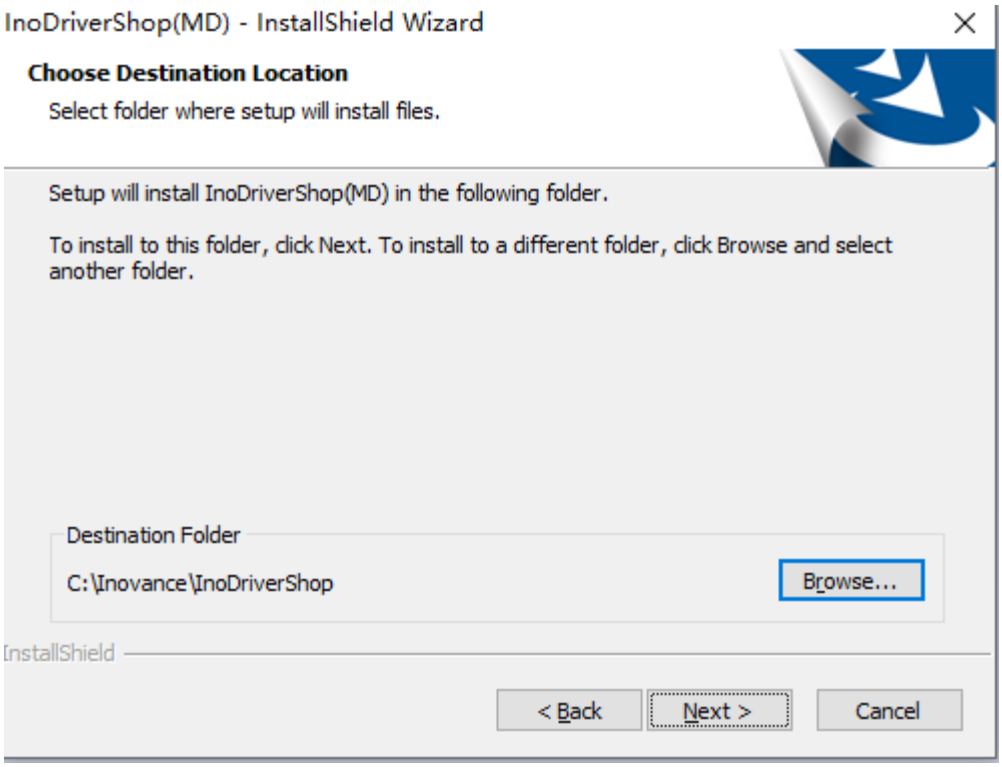


4. Click "Next".

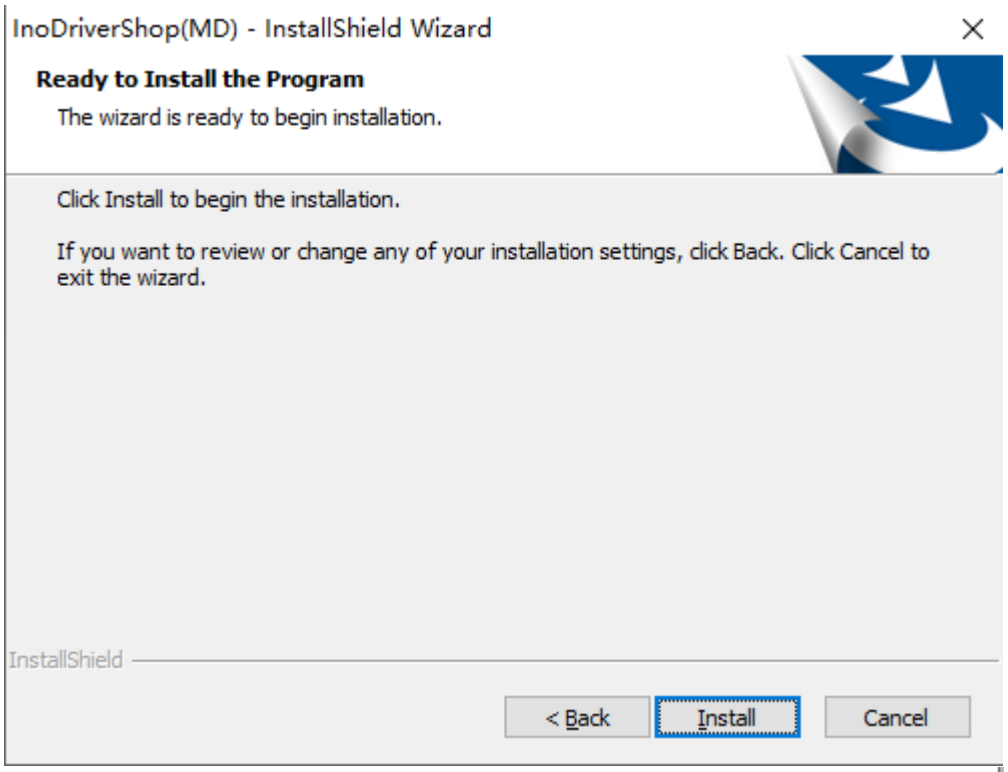


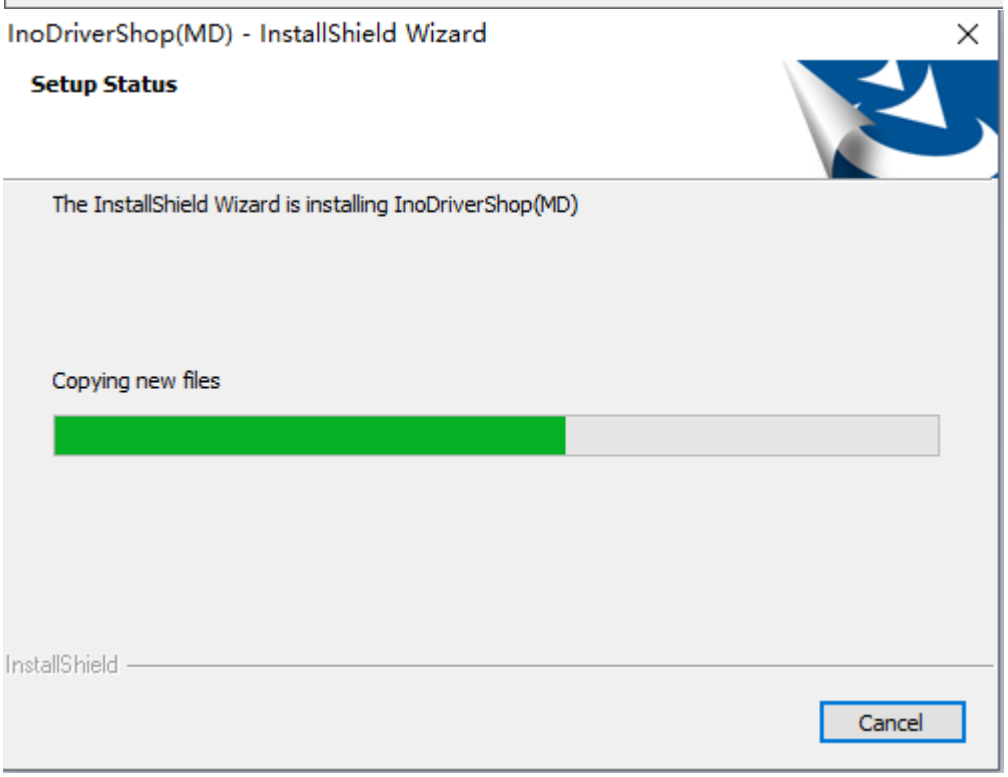
5. You can select the directory for installation as needed through the Browse button. The default directory for installation is "C:\Program Files\Inovance\InoDriverShop".
   In online upgrade, InoDriverShop will be upgraded directly in the original directory.

   After selecting the directory for installation, click "Next".

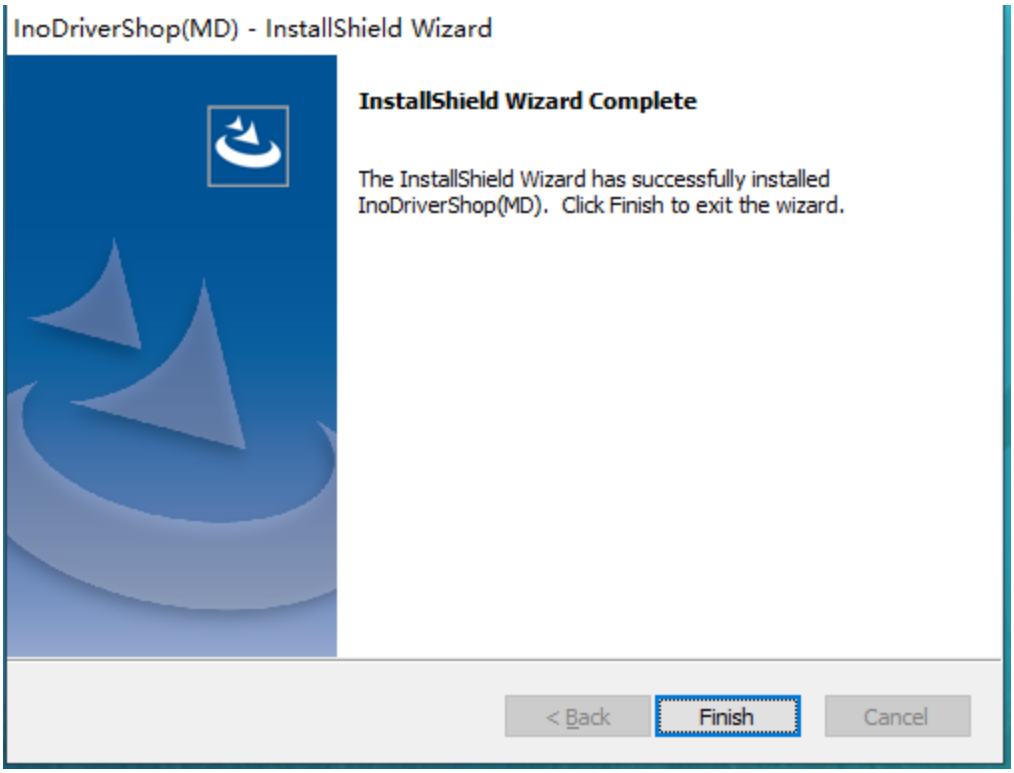


6. Click "Install" to start installation.





7. After installation is done, click "Finish".



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



7.2.3 Connect

1. Start InoDriverShop.

- Double-click  to start 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. Or, you can open a saved historical project via "②" or "③".

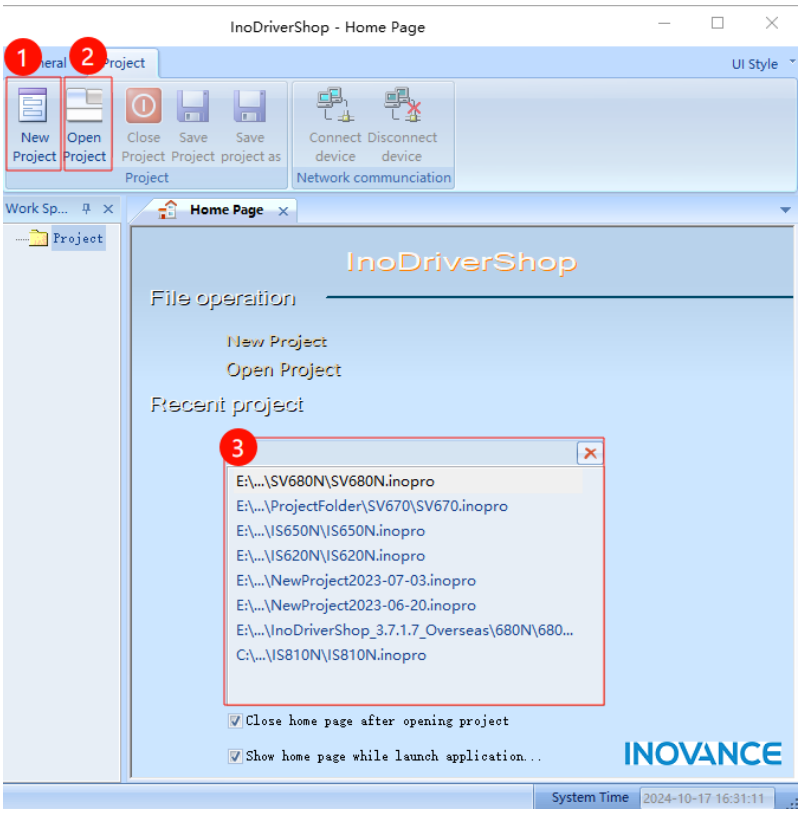


Figure 7-13 Start interface

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 7-14 Project Guide interface

c. Click "Next" 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".

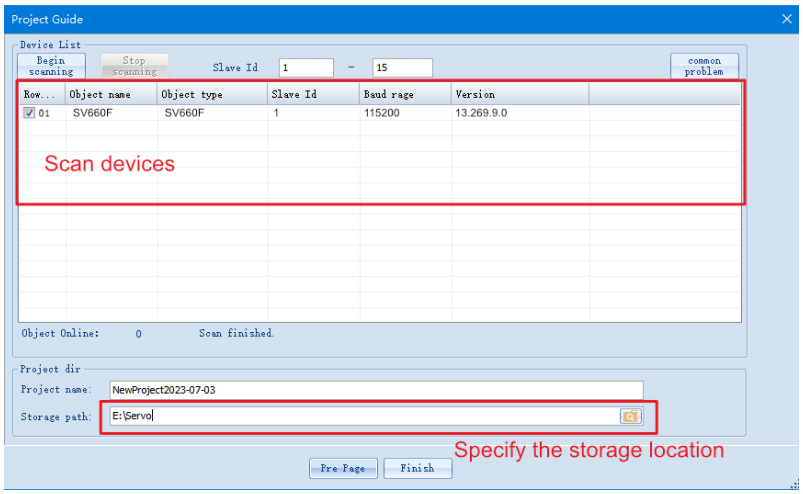


Figure 7-15 Scan interface

- 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.

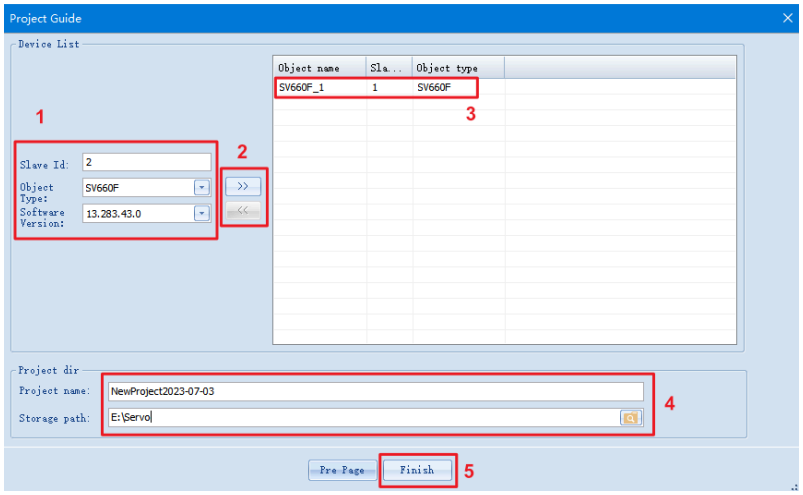


Figure 7-16 Project Guide interface for offline devices

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.

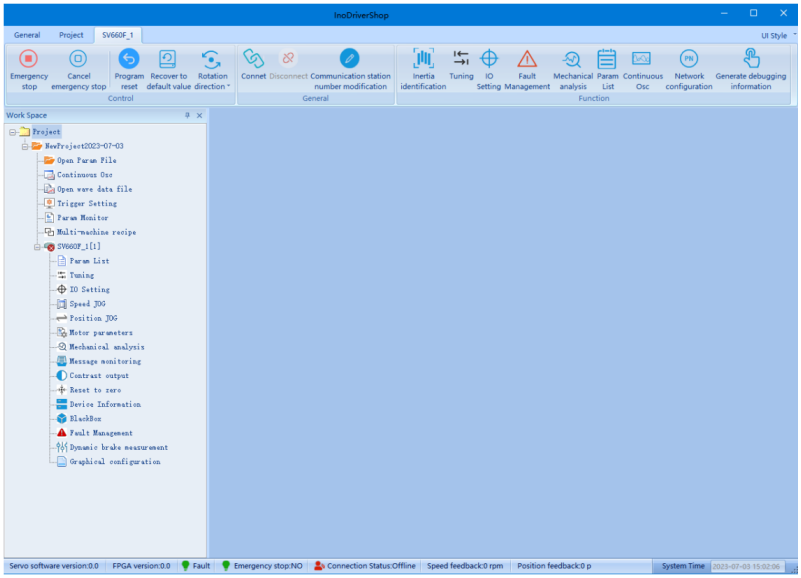
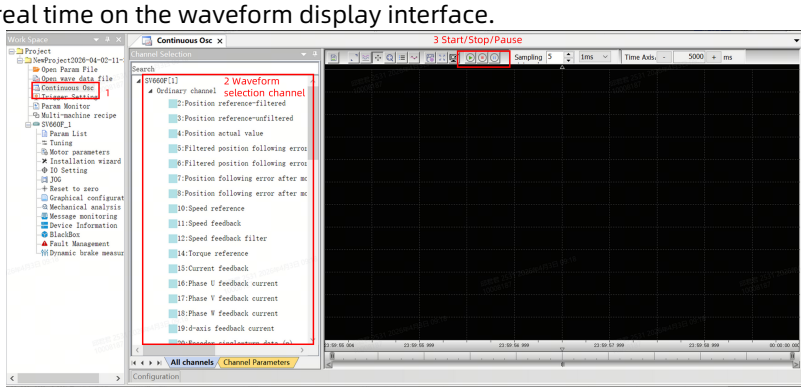


Figure 7-17 Main Interface

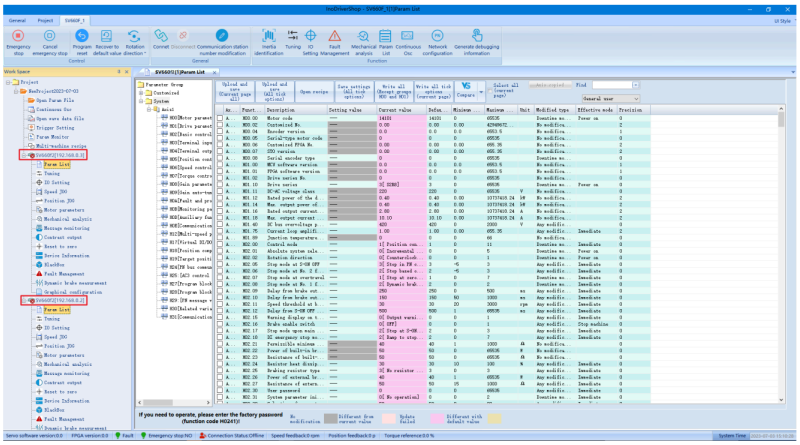
7.2.4 Common Functions

InoDriverShop provides the following functions:

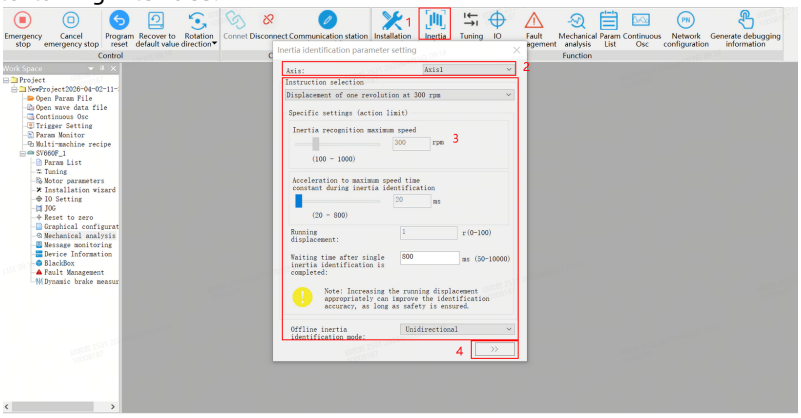
- Oscilloscope: Detects and saves the instantaneous data during operation. In the work area, double-click "Continuous OSC" in the navigation pane to open the view of the continuous oscilloscope in the right-side area. Select the drive waveform channel to be acquired, click "Start Oscilloscope" to obtain real-time waveform data from the drive. The waveform data will be refreshed in real time on the waveform display interface.



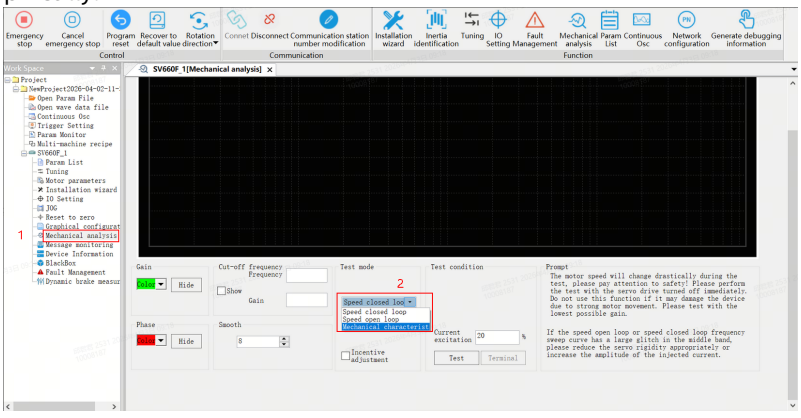
- Parameter list: The parameter list is used for managing the parameters of the servo drive. You can perform operations such as reading, writing, comparing, uploading, and saving parameters as needed. To facilitate viewing and locating, parameters are displayed in groups. You can also add parameters to customized groups.



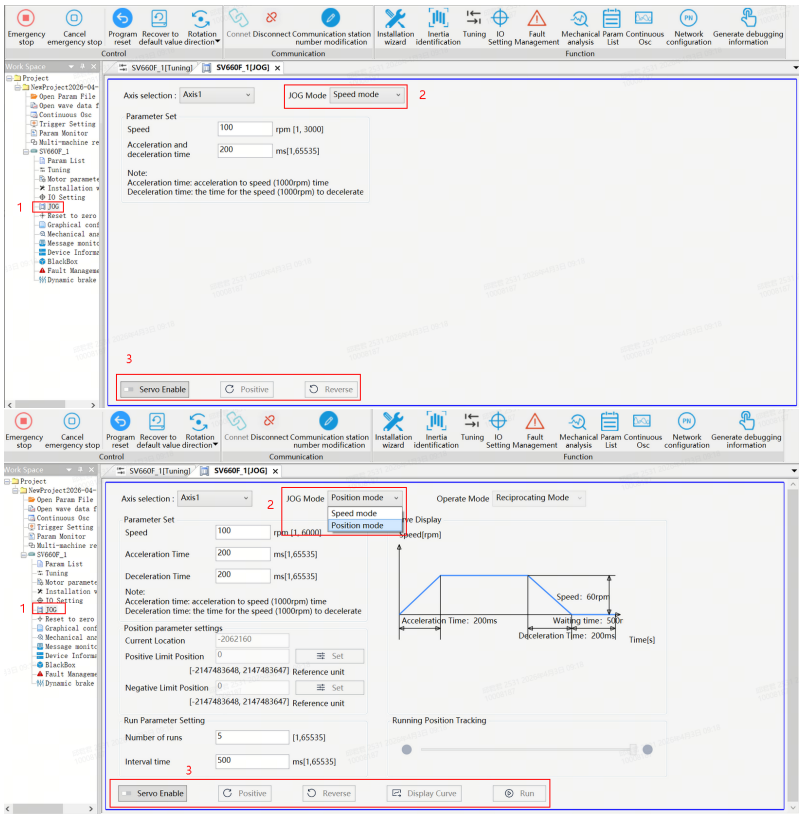
- Inertia auto-tuning: Performs auto-tuning on the load inertia ratio. Click "Inertia identification". Select the target axis of the drive to be operated through the drop-down list to configure the inertia auto-tuning parameters. After setting inertia auto-tuning parameters, click ">>" to enter the inertia auto-tuning interface.



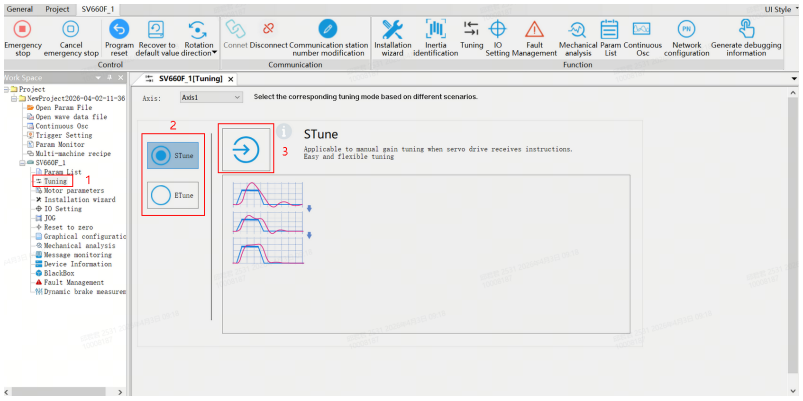
- Mechanical characteristic analysis: It is used to identify mechanical resonance points and system bandwidth, acting as a special oscilloscope. Three modes are supported: mechanical characteristics, speed open-loop, and speed closed-loop. The gain and phase after analysis are displayed graphically.



- Motion JOG: Generates position references to make the motor reciprocate. Speed and position modes are available. Turn on " Servo Enable" to start the servo drive. Click "Positive" and "Reverse" to enable the drive to jog forwardly and reversely.



- Usability adjustment: Usability adjustment is used to accurately and quickly adjust gain, ensuring quick response and stable operation of the servo drive. The background software provides two gain adjustment methods: ETune and STune.

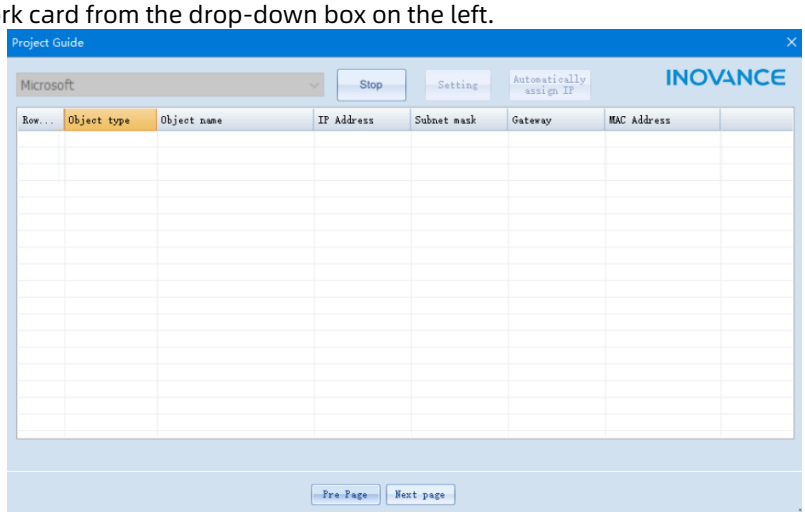


7.2.5 Multi-drive Adjustment

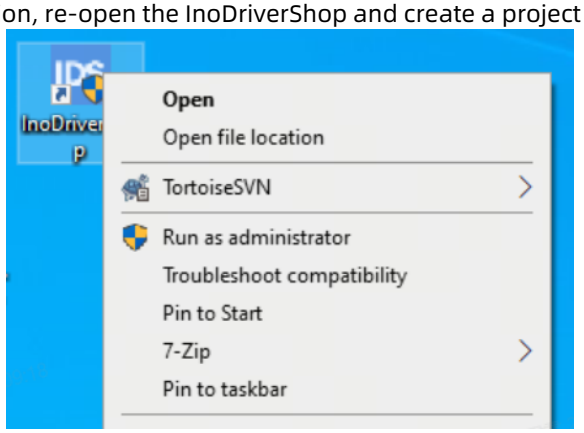
1. Click the SV660F icon, select "TCP_DCP" on the right, and then click "Next".

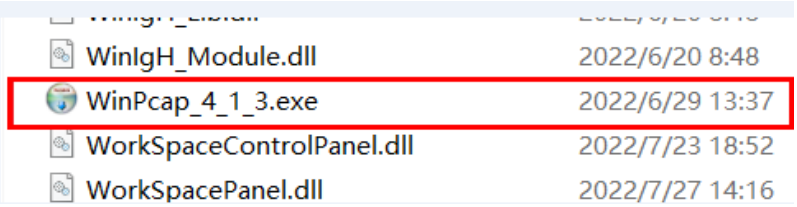


2. In the next page, devices are scanned with the default network card. If the network card connected to the device is not the currently selected network card, click Stop Scan and select the correct network card from the drop-down box on the left.



3. If a network card cannot be selected in the network configuration interface of the InoDriverShop, right-click the InoDriverShop shortcut, and locate the WinPcap application in the InoDriverShop installation root directory. Right-click the InoDriverShop and run as administrator to install the WinPcap. After installation, re-open the InoDriverShop and create a project again.

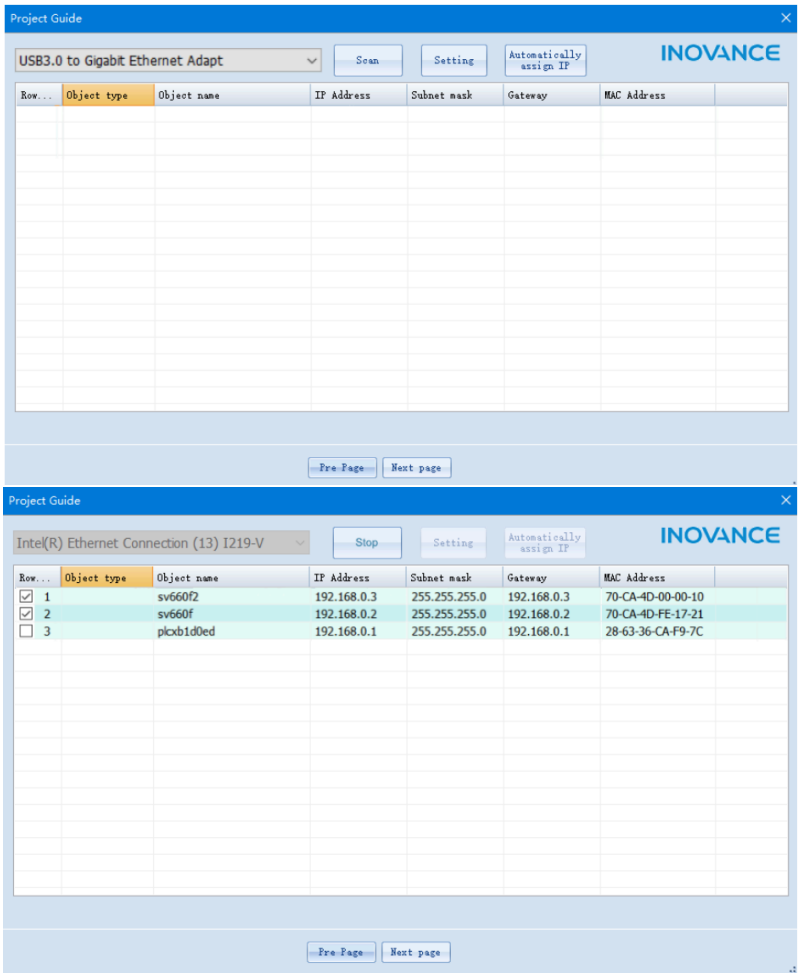


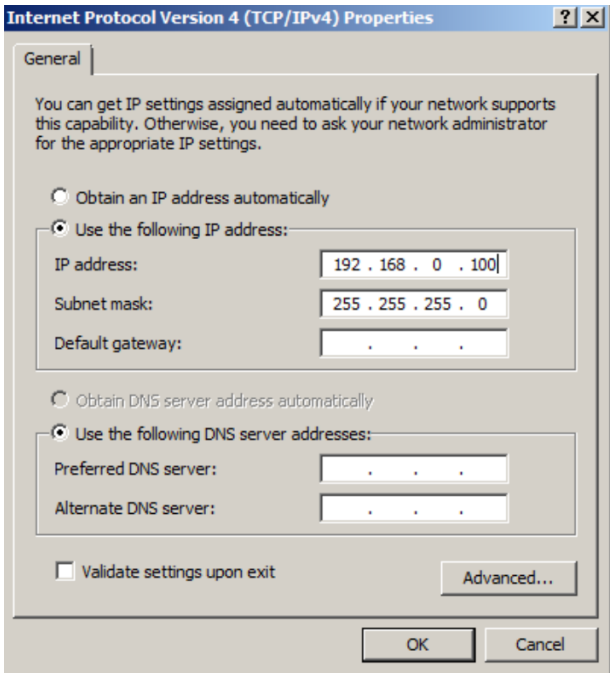


4. Click "Scan" and wait the connected device to be displayed. The network requires that the IP of the network card and that of the device are in the same network segment. You can modify the device name, IP, subnet mask, and default segment in this screen. Click the "Set" button to write the modifications to the device. Then click "Next".

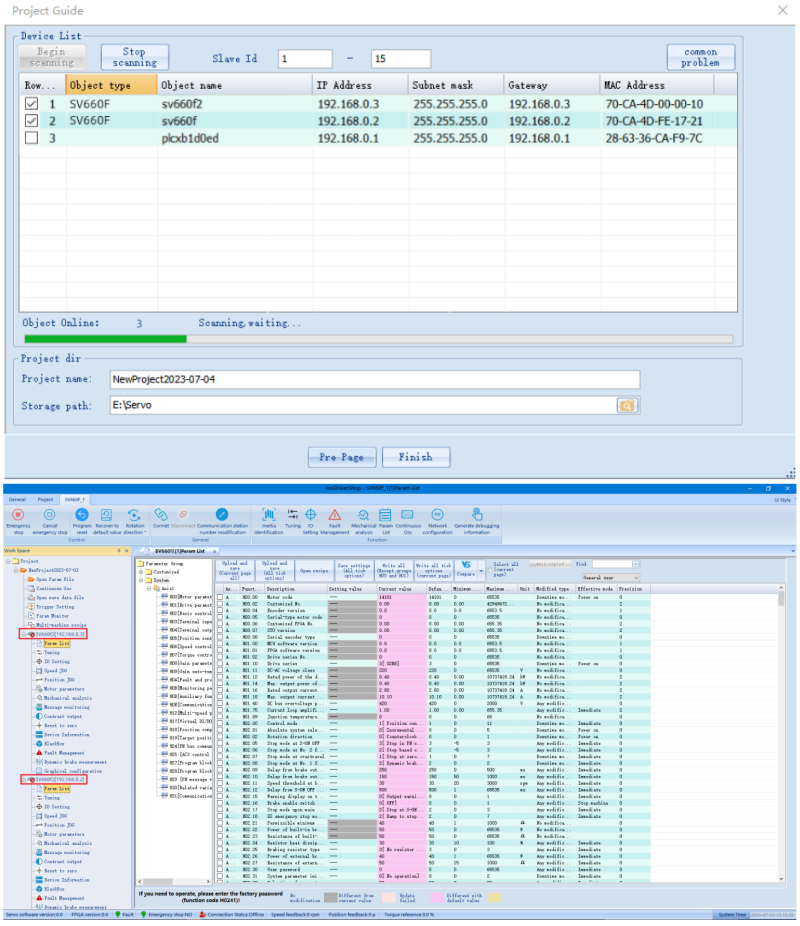
Note

After modifying the IP of the device, if the IP of the network card is not on the same network segment as the device, you need to manually adjust the IP of the network card.





5. Enter the scan screen. The scan result is displayed in the screen. After the scan is correct, click the "Finish" button. You can create a multi-drive project.

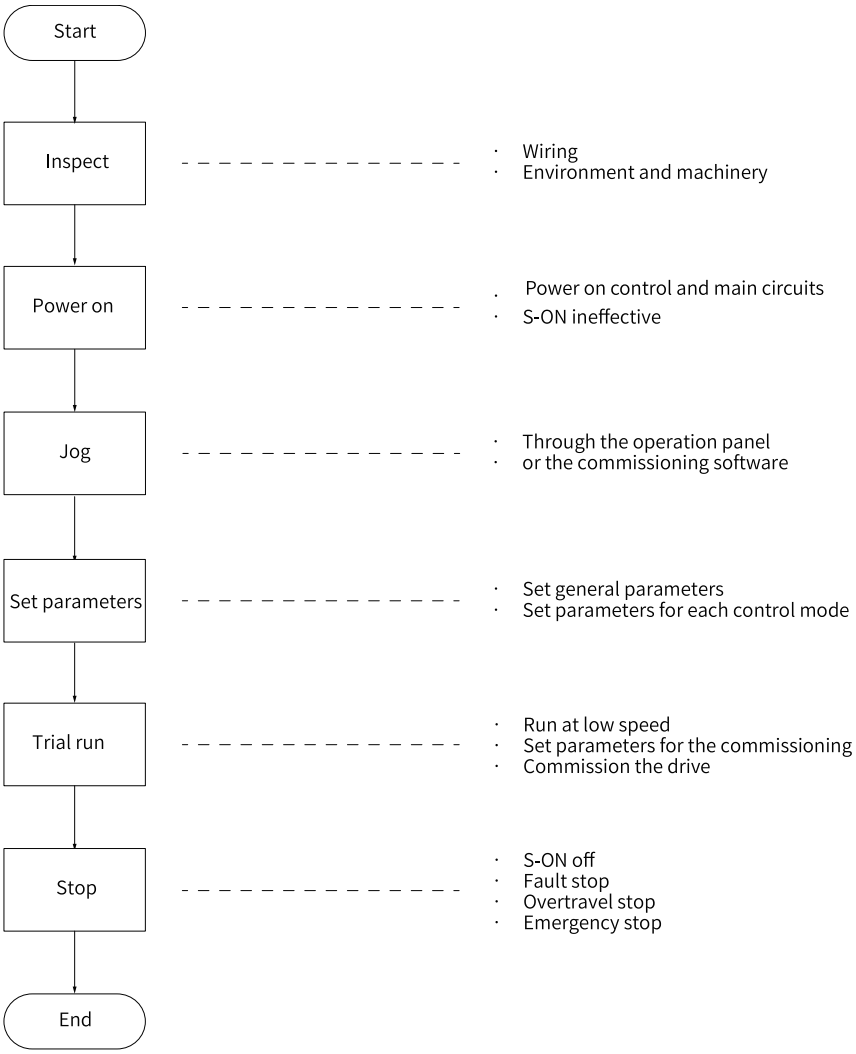


Note

You can also connect the drive to a PC using communication cables via the CN3 and CN4 terminals, which enables you to commission one or multiple drives through the Ethernet port.

8 Commissioning and Operation

8.1 Commissioning Flowchart



8.2 Pre-Commissioning Inspection

Check the following items before commissioning the drive and the motor.

Table 8–1 Pre-commissioning checklist

No.	Description	Tick
Wiring		
1	The power input terminals (L1, L2/L1, L2, L3/L1C, L2C/R, S, T) of the 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)/(L1, L2, L3)/(R, S, T)) or main circuit output terminals (U, V, W) of the drive.	□

No.	Description	Tick
4	The signal cables of the drive are connected correctly. The external signal cables such as the brake cable and the overtravel protection cable are connected properly.	☐
5	The drive and motor are grounded properly.	☐
6	The tension applied on the cable is within the specified range.	☐
7	All the wiring terminals are properly insulated.	☐
Environment and mechanical conditions		
1	No unwanted objects (such as cable terminals and metal chippings) that may cause short circuit of the signal cable and power cable exist inside or outside the servo drive.	☐
2	The drive and the external braking resistor are placed on incombustible objects.	☐
3	The servo motor is properly installed. The motor shaft is securely connected to the machine.	☐
4	The motor and the machine that connected to the motor are in good condition and ready to run.	☐

8.3 Power-on

1. Connect the input power

- The power input terminals for a single-phase 220 V power supply are L1 and L2.
- The power input terminals for a three-phase 220 V power supply are L1/L2/L3 (main circuit power input terminals) and L1C/L2C (control circuit power input terminals).
- The power input terminals for a three-phase 380 V power supply are R/S/T (Main circuit power input terminals) and L1C/L2C (control 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" → "nr" → "ry" in sequence, the servo drive is ready to run and waits for the S-ON signal.

Note

- To connect the main circuit to a single-phase 220 VAC power supply, use any two of terminals L1, L2, L3.
- If the keypad keeps displaying "nr.x" or a fault code, rectify the fault according to *"Table 7-4 Cause and solution for display of "nr.x"" on page 139*.

2. Switch off the S-ON signal.

Deactivate the S-ON signal sent from the host controller when switching the servo status.

☆Related parameters:

Code	Name	Function	Function
FunIN.1	S-ON	Servo ON	Inactive: Servo motor de-energized Active: Servo motor enabled upon power-on

8.4 Jogging



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

The jog function can be used in the trial run to check whether the motor rotates properly and no abnormal vibration or noise is generated during rotation. This operation can be performed via the keypad (jog), two external DIs, or InoDriveshop platform. The motor takes the value saved in H06.04 as the jog speed.

Note

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

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H06.12	Acceleration ramp time of jog speed	-	0 to 65535	ms	10	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the acceleration/deceleration time of jog speed references in the jog mode set through H0d.11 or the software tool.								

Jogging Through Keypad in Speed Control Mode

- **Commissioning procedure**

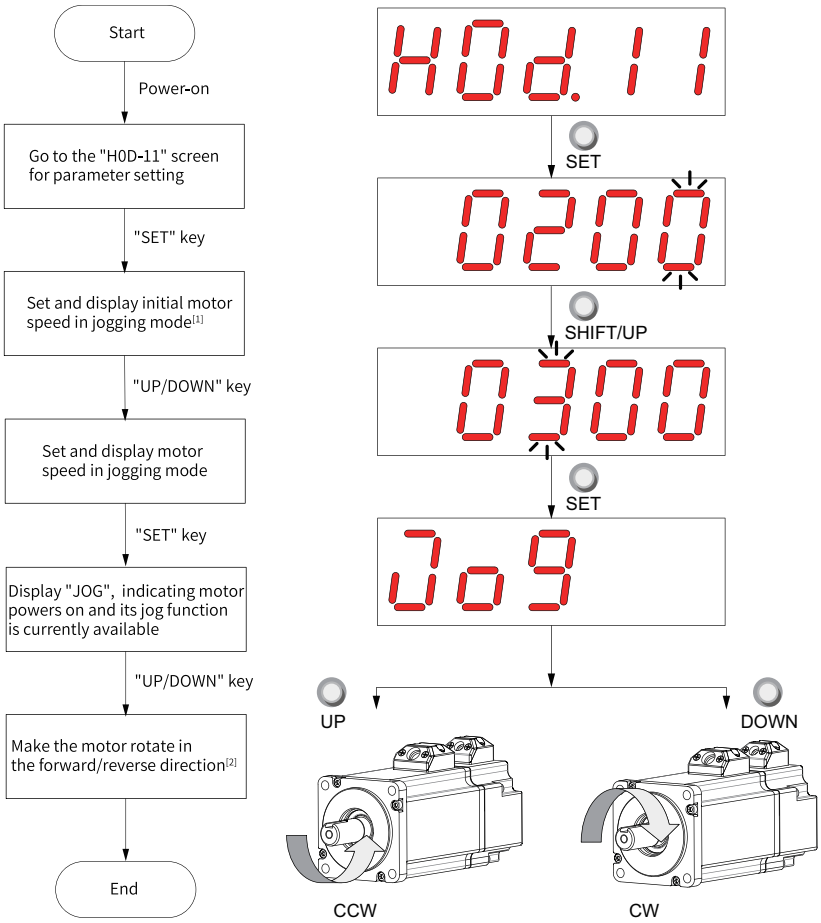


Figure 8-1 Jog setting procedure

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]: Press the UP or DOWN key to make the motor rotate forwardly or reversely. After you release the key, the motor stops immediately.

- Procedure:

  1. Enter the jog mode by setting H0d.11 through the keypad. The keypad displays the default jog speed.
  2. Press the SET key, adjust the jog speed by using the UP/DOWN key, and then press the SET key again. The keypad displays "JOG-P" at this moment, indicating the motor is energized.
  3. Press and hold the UP/DOWN key to make the motor jog forwardly or reversely.
  4. Press the MODE key to exit from jog and return to the upper-level menu. The setpoint of H06.04 is not saved, which is restored to the default value again.

Jogging Through Keypad in Position Control Mode

- **Commissioning procedure**

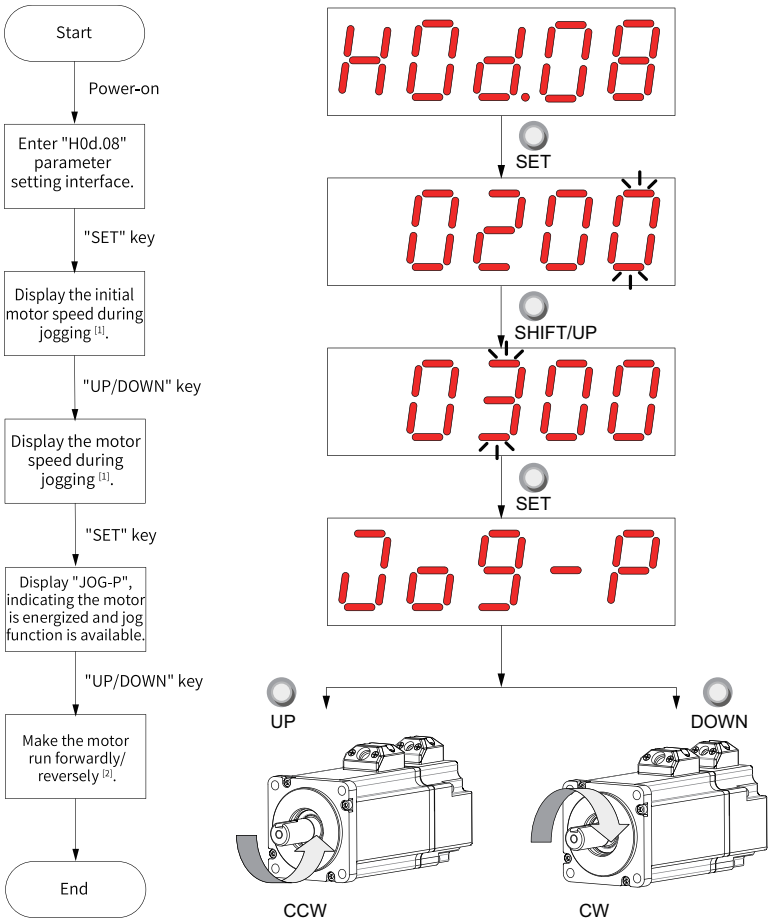


Figure 8-2 Procedure for triggering jog through keypad in position control mode

Note

- [1] Press the "UP" or "DOWN" key to increase or decrease the jog speed. After exiting from the jog mode, the initial speed applies.
- [2] Press the "UP" or "DOWN" key to make the motor rotate forwardly or reversely. After you release the key, the motor stops immediately.

- **Procedure:**

1. Enter the jog mode by setting H0d.08 on the keypad. The keypad displays the default jog speed.
2. After pressing the SET key, adjust the jog speed through the UP/DOWN key and press the SET key to enter the jog state. The keypad displays "JOG-P", indicating the motor is energized.
3. Press and hold the UP/DOWN key to make the motor jog forwardly or reversely.
4. Press the MODE key to exit the jog mode and return to the previous menu.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H06.04	DI speed reference	-	0 to 10000	rpm	150	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the DI jog speed reference.								

Jogging through DIs

Note

Jogging through DI is permitted in any mode.

Assign two external DIs with FunIN.18 and FunIN.19 respectively. After setting the jog speed through H06.04 switch on the S-ON signal to perform jog through the DI status.

Relevant function No.:

Code	Name	Function Name	Description
FunIN.18	JOGCMD+	Forward jog	Active: Input based on the reference Inactive: Operation reference input stopped
FunIN.19	JOGCMD-	Reverse jog	Active: Input based on the inverted reference Inactive: Operation reference input stopped

Jogging through the software tool

Open the "Speed JOG" page of the Inovance software tool, and set the JOG speed reference. Click the "Enable" button on the page, and achieve the jog forward and reverse jog by holding down the "Forward" and "Reverse" buttons on the page.

When you close the jog interface to exit from the jog mode, H06.04 returns to the default value, with previous setpoint abandoned.

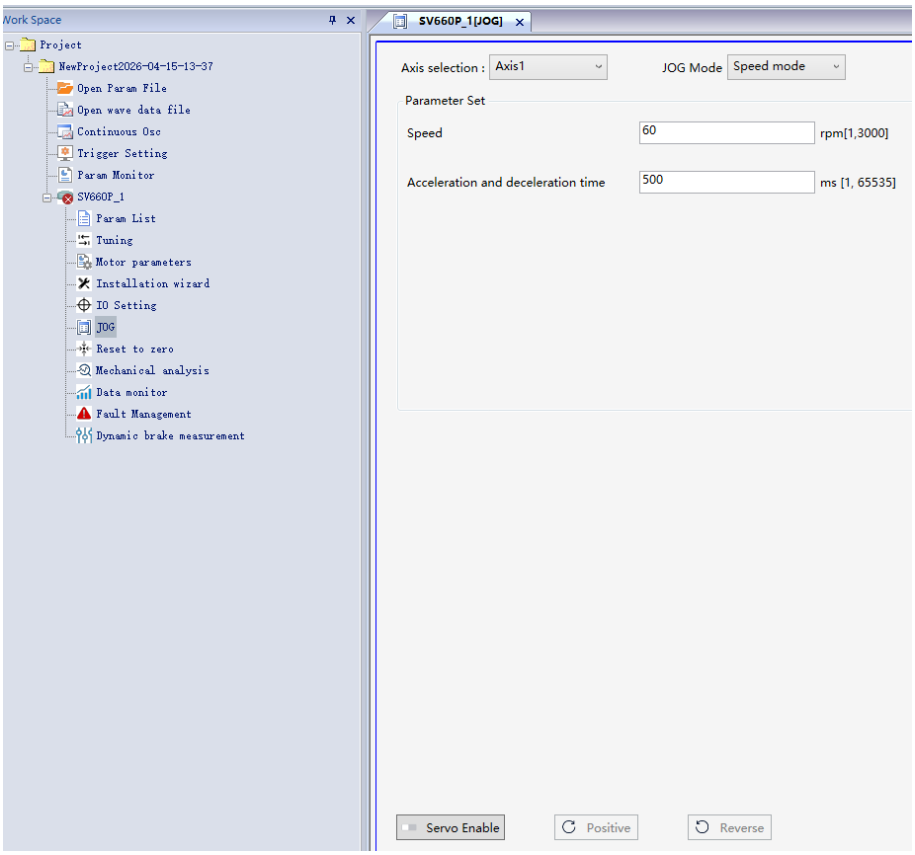


Figure 8-3 Jog page

8.5 Commissioning

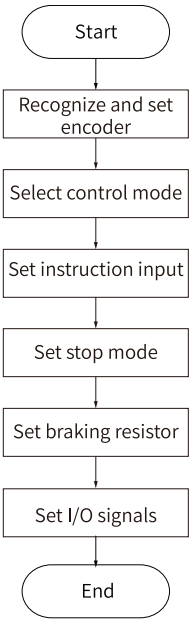


Figure 8-4 Flowchart for general parameter setting

8.5.1 Encoder identification and setting

Check whether H00.00 (Motor SN) is set to a value that matches the motor used.

Set H02.02 (Rotation direction) to change the direction of rotation without modifying the input command polarity.

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

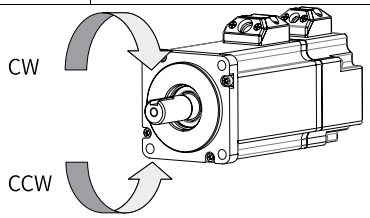
The direction of "forward drive" in overtravel prevention is the same as that defined by H02.02.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H00.00	Motor SN	-	0 to 65535	-	14101	UInt16	At stop	Ordinary user	Effective upon next power-on
	Description of parameters:								
	Sets the servo motor number with the value fixed to "14XXX". Setting the motor code to an incorrect value will result in E120.1 (Unknown motor model).								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.02	Rotation direction selection	-	0 to 1	-	0	UInt16	At stop	Ordinary user	Effective upon next power-on

Description of parameters:

Setpoint	Rotation Direction	Remarks
0	CCW direction as forward direction	When a forward command is input, the motor rotates in CCW direction viewed from the motor shaft side, that is, the motor rotates counterclockwise.
1	CW direction as forward direction	When a forward command is input, the motor rotates in CW direction viewed from the motor shaft side, that is, the motor rotates clockwise.



8.5.2 Setting Stop Mode

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

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.05	Stop mode at S-ON OFF	-	-5 to 3	-	3	Signed 16-bit	Real-time	Ordinary user	At stop

Description of parameters:

-5: Stop during PN communication (ramp/quick stop/ coast to stop), keeping dynamic braking state -4: Ramp to stop based on ramp 2, keeping dynamic braking state -3: Stop at zero speed, keeping dynamic braking state -2: Ramp to 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: Ramp to stop based on ramp 1, keeping de-energized state 2: Dynamic braking stop, keeping de-energized status 3: Stop during PN communication (ramp/quick stop/coast to stop), keeping de-energized status Note: After the brake function is enabled, H02.05 will be forcibly set to "-4: Ramp to stop based on ramp 2, keeping dynamic braking state".

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.06	Stop mode at No. 2 fault	-	-5 to 3	-	2	Signed 16-bit	Real-time	Ordinary user	At stop
	Description of parameters:								
	-5: Stop at zero speed, keeping dynamic braking state -4: Stop at emergency stop torque, keeping dynamic braking state -3: Ramp to stop based on ramp 2, keeping dynamic braking state -2: Ramp to 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: Ramp to stop based on ramp 1, keeping de-energized state 2: Ramp to stop based on ramp 2, keeping de-energized state 3: Stop at emergency stop torque, keeping de-energized state Note: After the brake function is enabled, H02.06 will be forcibly set to "-3: Ramp to stop based on ramp 2, keeping dynamic braking state".			

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.07	Stop mode at overtravel	-	0 to 8	-	1	UInt16	Real-time	Ordinary user	At stop
	Description of parameters:								
	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 based on ramp 2, keeping de-energized state 4: Ramp to 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 8: Stop upon No.2 fault Note: After the brake function is enabled, H02.07 will be forcibly set to "4: Ramp to stop based on ramp 2, keeping position lock state".			

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.08	Stop mode at No. 1 fault	-	0 to 2	-	2	UInt16	Real-time	Ordinary user	At stop
	Description of parameters:								
	0: Coast to stop, keeping de-energized state 1: Dynamic braking stop, keeping de-energized state 2: Dynamic braking stop, keeping dynamic braking state Note: After the brake function is enabled, H02.08 will be forcibly set to "2: Dynamic braking stop, keeping dynamic braking state".								

8.5.2.1 Setting Brake

8.5.2.1.1 Brake Hardware Setting

The brake is used to lock the motor position when the drive is in the non-operational status, preventing the mechanical load from moving due to gravity or external force.

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 servo-ON (S-ON) signal.
- When a motor with brake runs, the brake may generate a clicking sound, which does not affect its function.
- When brake coils are energized (the brake is released), magnetic flux leakage may occur at the shaft end. Pay special attention when using magnetic sensors around the motor.
- The brake must be powered by an independent power supply. This is to prevent voltage sags or current drops caused by parallel equipment operation that may trigger malfunction of the brake.

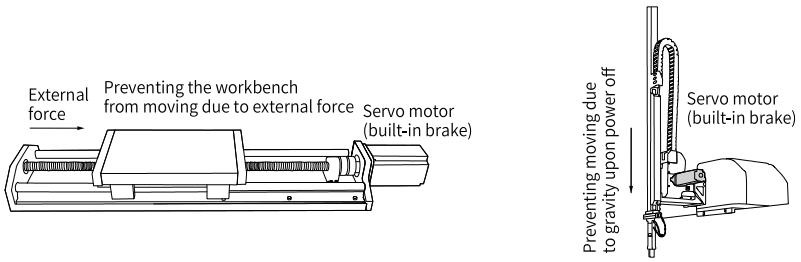


Figure 8-5 Application of the brake

Table 8–2 Brake specifications

Motor model	Holding torque (N·m)	Supply voltage (VDC) ±10%	Rated power (W)	Coil resistance (Ω)±7%	Excitation 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.

8.5.2.1.2 Brake Software Setting

For the motor with brake, assign function 9 (FunOUT.9: BK, brake output) to a DO terminal, and set the active logic of DO terminal.

☆ Related function numbers:

Code	Name	Description	Function
FunOUT.9	BK	Brake output	Inactive: The brake power supply is switched off and the brake applies. In this case, the motor is locked. Active: The brake power supply is switched on and the brake is released. In this case, the motor can rotate.

8.5.2.1.3 Servo Drive Brake Sequence

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

Brake sequence in normal state include *" Brake sequence for motor at standstill" on page 180*and *" Brake sequence in motor rotating status" on page 182*.

For the brake sequence in the fault state, see *" c. Brake time sequence in faulty state of servo drive" on page 184*.

Brake sequence for motor at standstill

If the servo ON signal becomes OFF, and the current motor speed is smaller than 20 RPM, the servo drive acts according to the brake time sequence for motor static state.

Caution

- 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.

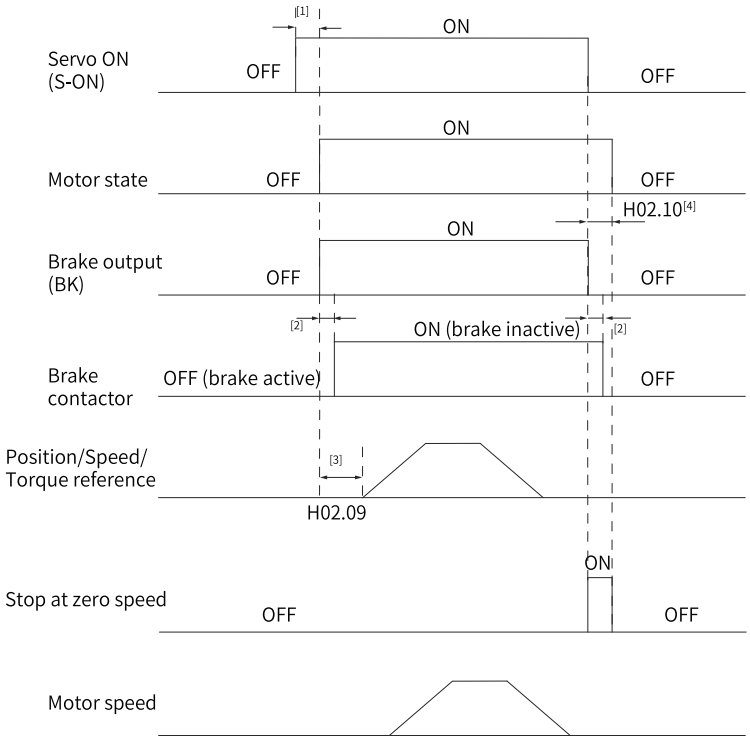


Figure 8-6 Brake sequence for motor at standstill

Note

- [1]: When the S-ON signal is activated, the brake (BK) output signal is set to "ON" at a delay of the time defined in H02.19 (ms), and the motor is energized at the same time.
- [2] For delay of the brake contactor actions, see *"Table 8-2 Brake specifications" on page 179*.
- [3]: The interval time, starting from the moment when brake output (BK) is set to "ON" to the moment when a reference 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".

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.09	Delay from brake output ON to command received	-	0 to 500	ms	250	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the delay from the moment the brake output signal is ON to the moment the servo drive starts to receive commands after power-on.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.10	Delay from brake output OFF to motor de-energized	-	50 to 1000	ms	150	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Sets the delay time from motor standstill (de-energized) to brake output OFF.								

Brake sequence in motor rotating status

If the S-ON signal is off, and the current motor speed is equal to or higher than 20 rpm, the drive acts according to the brake sequence in motor rotating 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 servo ON signal becomes OFF during servo motor rotation, the motor stops at zero speed, but the brake output signal becomes OFF only after 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.
- After the brake output signal changes to OFF, the motor remains in energized state within 50 ms to prevent the work from moving due to the gravity or external force.

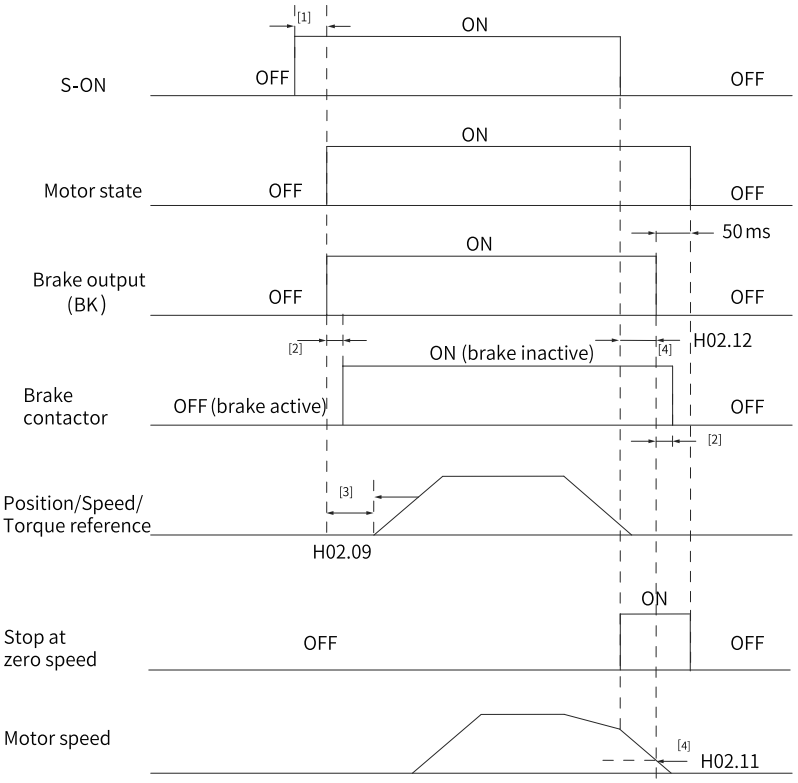


Figure 8-7 Brake sequence in motor rotating state

Note

- [1]: When the S-ON signal is switched on, the brake output is set to "ON" at a delay of about 100 ms, with motor being energized at the same time.
- [2] For delay of the brake contactor actions, see *"Table 8-2 Brake specifications" on page 179*.
- [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]: You can set in H02.11 and H02.12 the delay in setting the brake output to "OFF" when the S-ON signal is switched off in the rotation state. The motor is de-energized at a delay of 50 ms after the brake output is set to "OFF".

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.11	Motor speed threshold at brake output OFF in rotating state	-	20 to 3000	rpm	30	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the motor speed threshold when brake (BK) output is set to OFF in the rotating state.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.12	Delay from S-ON off to brake output off	-	1 to 65535	ms	500	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the delay from the moment the S-ON signal is OFF to the moment the brake (BK) output signal is OFF in the rotating state.								

c. Brake time sequence in faulty state of servo drive

Servo drive faults can be classified into No. 1 faults and No. 2 faults based on the stop mode. The brake time sequences in faulty state of servo drive includes two conditions:

- For No.1 faults:
  The brake DO output condition is the same as the "brake time sequence in the motor rotating state when the servo drive is in normal state". That is, the brake output signal becomes OFF 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.
- 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 smaller than 20 RPM, the brake output signal immediately becomes OFF once the preceding condition is met, but the motor is still in energized status within the time defined by H02.10.

8.5.3 Braking Resistor Setting

For detailed information about the braking resistor, refer to *" Braking Resistor" on page 798*.

8.5.4 Input/Output Signal Setting

The input/output signal setting is the same as "DI/DO setting mode selection". For details, see *"22.2 DI/DO Function Assignment" on page 817*.

8.6 Trial run

Switch on the S-ON signal.

When the servo drive is ready to run, the keypad displays "run". If there is no reference input at this moment, the servo motor does not rotate and stays locked. After a reference is input, the motor starts rotating.

Table 8–3 Checklist before operating the servo drive

No.	Description	Tick
1	During initial operation, set a proper command to make the motor run at a low speed and check whether the motor rotates properly.	☐
2	Observe whether the direction of rotation is correct. 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 rotates in the correct direction, you can view the actual speed in H0b.00 and the average load rate in H0b.12 through the keypad or the software tool.	☐
4	After checking the preceding conditions, adjust related parameters to make the motor operate as desired.	☐
5	Adjust the drive according to section "Tuning".	☐

Power-on sequence diagram

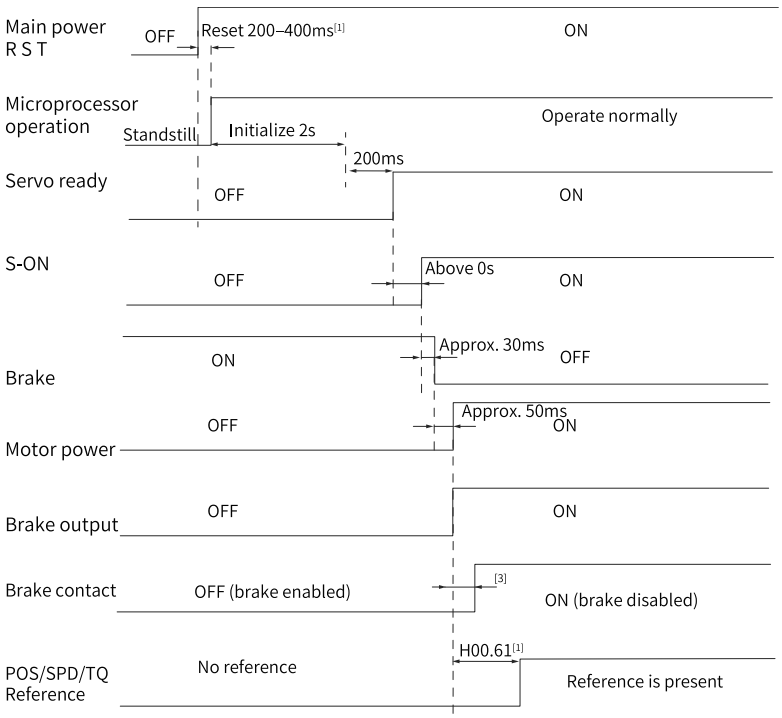


Figure 8-8 Power-on sequence diagram

Note

- [1] The reset time is determined by the setup time of the +5 V power supply of the microprocessor.
- [2] The dynamic brake is delivered as standard.
- [3] For delay of brake contactor actions, see *"Table 8-2 Brake specifications" on page 179*.
- [4] If the brake is not used, H00.61 is invalid. (The system defaults to output position/speed reference after the time set in H00.61 elapses. When H01.91 bit = 1, the position/speed reference is output after the time set in H02.09 elapses.)

Sequence diagram for stop at alarm or fault

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

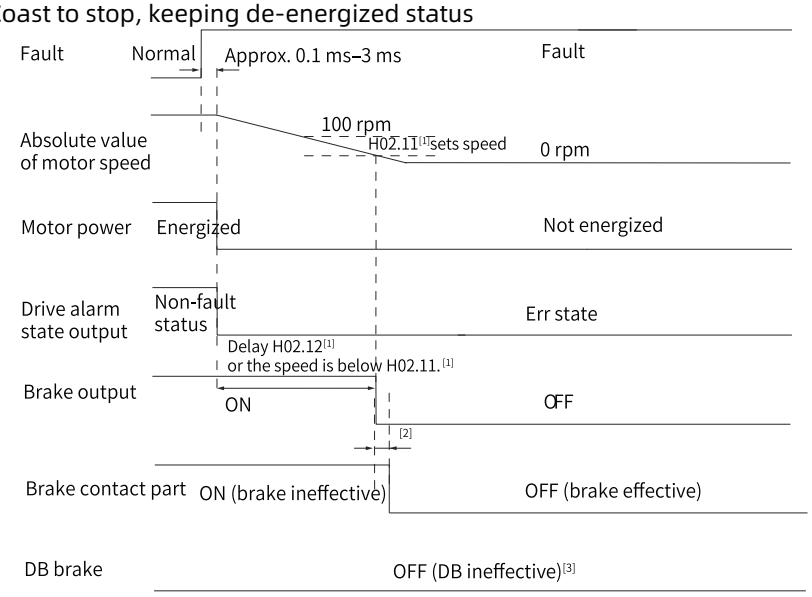


Figure 8-9 Sequence of "Coast to stop, keeping de-energized state" at No. 1 fault

Note

- [1] If the brake is not used, H02.11 and H02.12 are invalid.
- [2] For delay of brake contactor actions, see *"Table 8-2 Brake specifications" on page 179*.
- [3] The dynamic brake is delivered as standard.

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

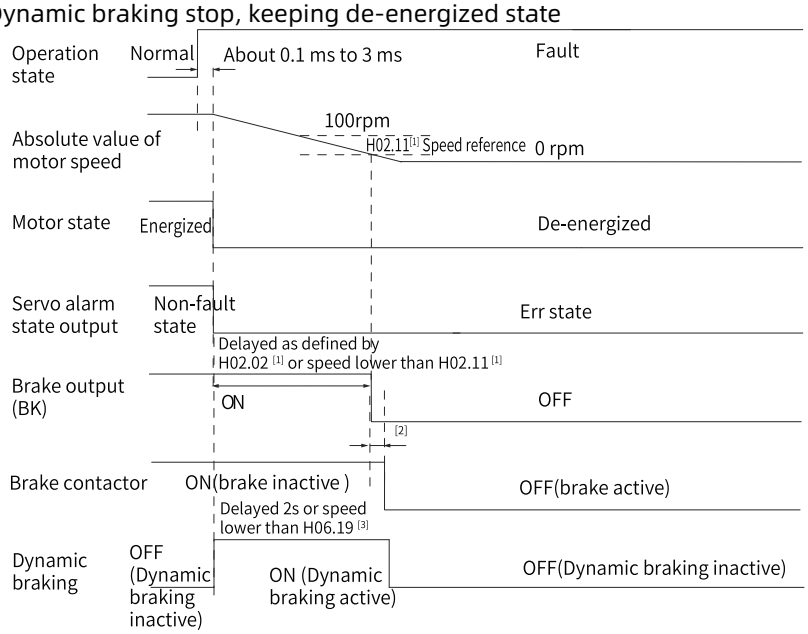


Figure 8-10 Sequence of "Dynamic braking stop, keeping de-energized state" at No. 1 fault

Note

- [1] If the brake is not used, H02.11 and H02.12 are invalid.
- [2] For delay of brake contactor actions, see *"Table 8-2 Brake specifications" on page 179*.
- [3] The dynamic brake is delivered as standard.

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

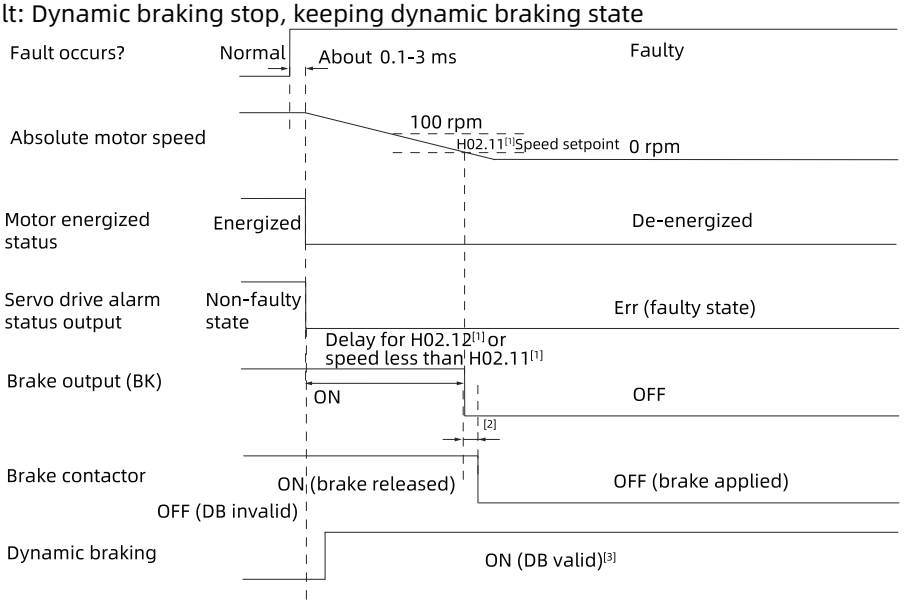


Figure 8-11 Sequence of "Dynamic braking stop, keeping dynamic braking state" at No. 1 fault

Note

- [1] If the brake is not used, H02.11 and H02.12 are invalid.
- [2] For delay of brake contactor actions, see *"Table 8-2 Brake specifications" on page 179*.
- [3] The dynamic brake is delivered as standard.

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

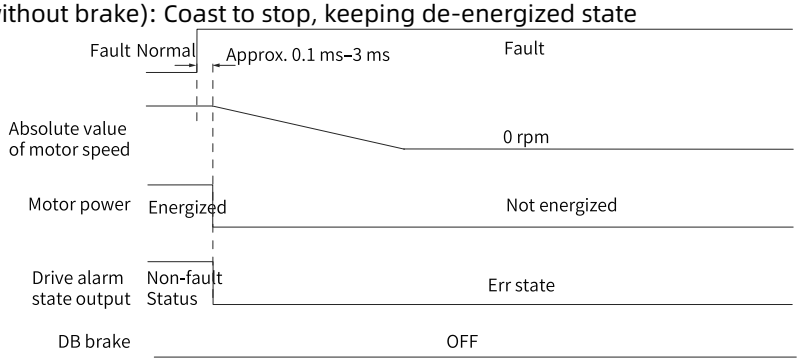


Figure 8-12 Sequence of "Coast to stop, keeping de-energized state" at No.2 fault

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

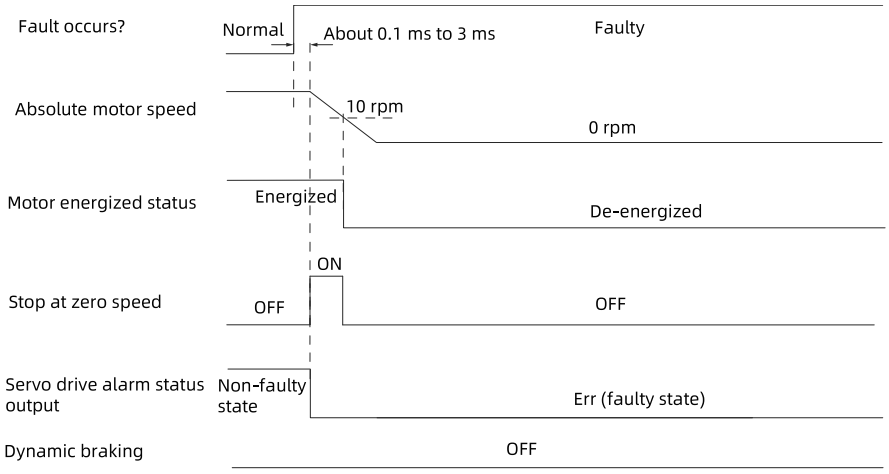


Figure 8-13 Sequence of "Stop at zero speed, keeping de-energized state" at No. 2 fault (without brake)

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

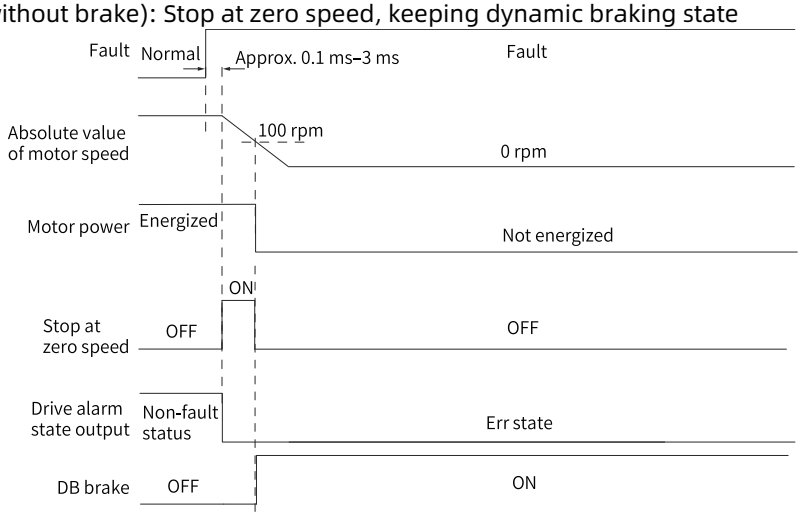


Figure 8-14 Sequence of "Stop at zero speed, keeping dynamic braking state" at No. 2 fault (without brake)

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

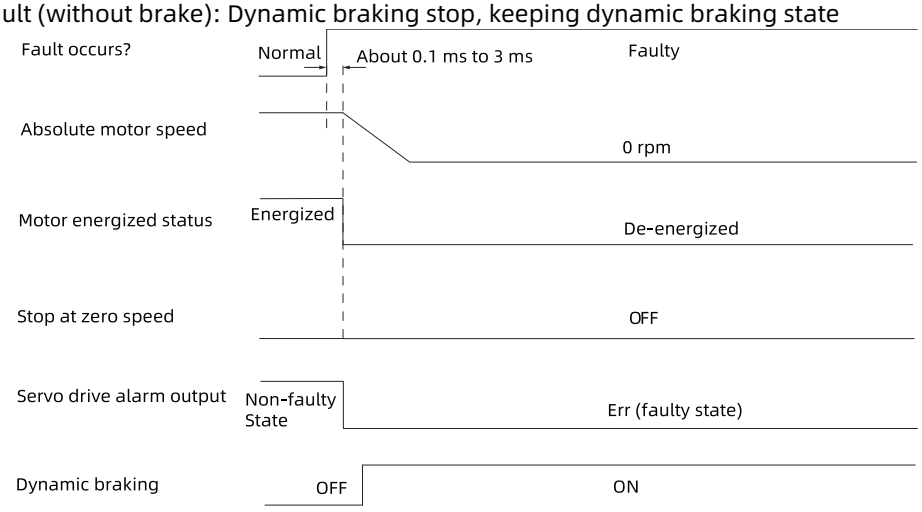


Figure 8-15 Sequence of "Dynamic braking stop, keeping dynamic braking state" at No. 2 fault (without brake)

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

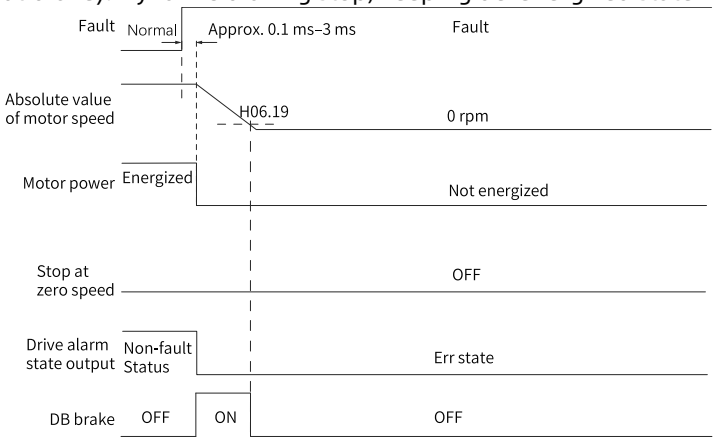


Figure 8-16 Sequence of "Dynamic braking stop, keeping de-energized state" at No. 2 fault (without brake)

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

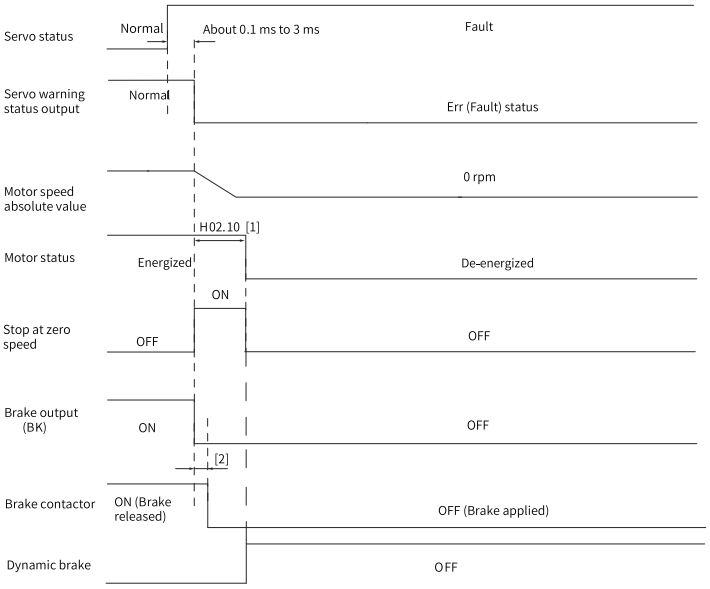


Figure 8-17 Sequence of "Stop at zero speed, keeping dynamic braking state" at No. 2 fault (with brake)

Note

- [1] If the brake is not used, H02.10 is invalid.
- [2] For delay of brake contactor actions, see *"Table 8-2 Brake specifications" on page 179*.

- When a No. 3 alarm occurs on the servo drive, such as E900.0 (DI emergency braking), E950.0 (Positive limit switch alarm), and E952.0 (Negative limit switch alarm), the servo drive stops according to *"Figure 8-18 Sequence for alarms that cause stop" on page 190*.
- Alarms that cause stop: Stop at zero speed, keeping position lock status

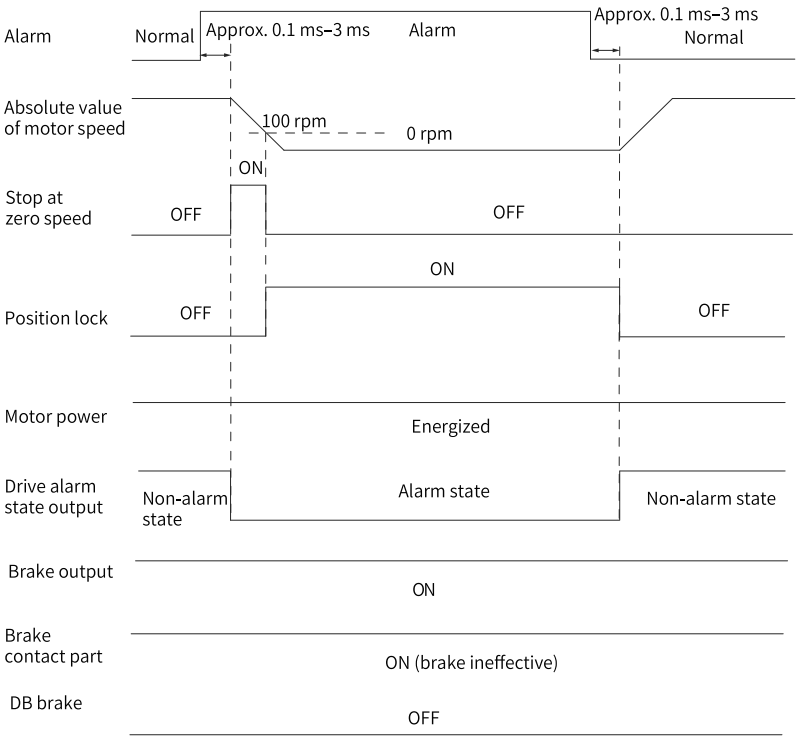


Figure 8-18 Sequence for alarms that cause stop

The other alarms do not affect the operation state of the drive. The sequence diagram for these alarms is shown in *"Figure 8-19 Sequence for alarms that do not cause stop" on page 190*.

- Alarms that do not cause stop

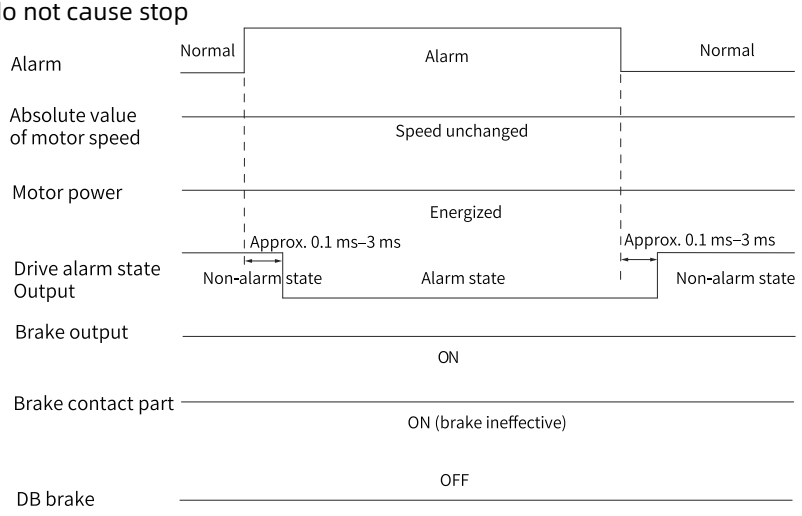


Figure 8-19 Sequence for alarms that do not cause stop

- Fault reset

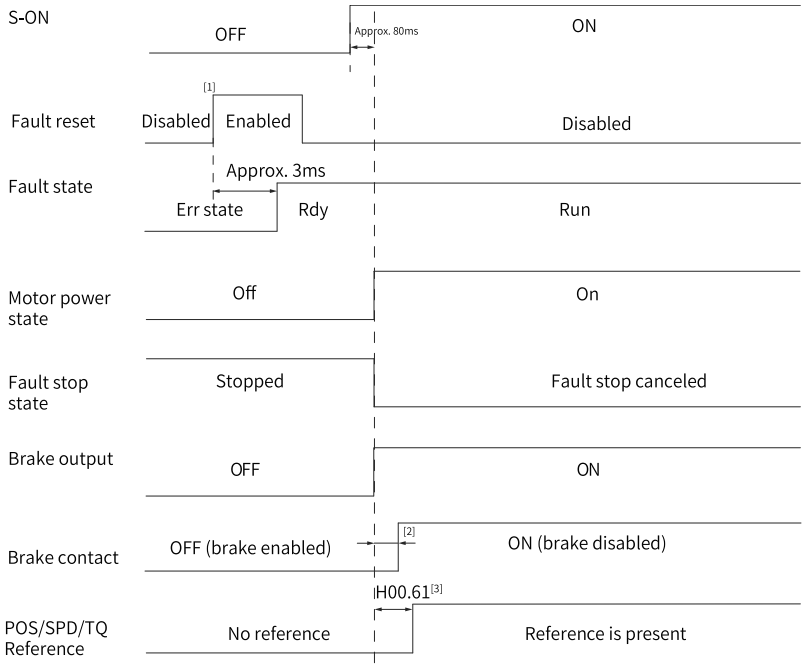


Figure 8-20 Sequence for fault reset

Note

- [1] The fault reset signal is edge-triggered.
- [2] For delay of brake contactor actions, see *"Table 8-2 Brake specifications" on page 179*.
- [3]: If the brake is not used, H00.61 is invalid. (The system defaults to output position/speed reference after the time set in H00.61 elapses. When H01.91 bit = 1, the position/speed reference is output after the time set in H02.09 elapses.)

8.7 Servo Drive Stop

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. When brake output is enabled, the stop mode is forcibly set by the drive. If you want to change it, set bit2 of H0A.71 to 1. See the following table for details.

Table 8–4 Comparison among different stop modes

Stop mode	Description	Characteristics
Coast to stop	The motor is de-energized and coasts to stop. The deceleration time is affected by the friction inertia and mechanical friction.	This mode features smooth and slow deceleration with small mechanical shocks.
Stop at zero speed	The motor takes 0 rpm as the target speed and decelerates immediately to 0 rpm 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 mode	Description	Characteristics
Stop at emergency-stop torque	The 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 8–5 Comparison among different stop states

Stop state	Description
De-energized	The motor is de-energized, but the motor shaft can rotate freely after the motor stops rotating.
Position lock	The motor shaft is locked and cannot rotate freely after the motor stops rotating.
Dynamic braking	The motor is de-energized and the motor shaft cannot 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, and ramp to stop. The following section describes the stop events.

Stop at S-ON OFF

Deactivate the S-ON signal via communication. The drive stops accordingly.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.05	Stop mode at S-ON OFF	-	-5 to 3	-	3	Signed 16-bit	Real-time	Ordinary user	At stop
	Description of parameters:								
	-5: Stop during PN communication (ramp/quick stop/ coast to stop), keeping dynamic braking state -4: Ramp to stop based on ramp 2, keeping dynamic braking state -3: Stop at zero speed, keeping dynamic braking state -2: Ramp to 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: Ramp to stop based on ramp 1, keeping de-energized state 2: Dynamic braking stop, keeping de-energized status 3: Stop during PN communication (ramp/quick stop/coast to stop), keeping de-energized status Note: After the brake function is enabled, H02.05 will be forcibly set to "-4: Ramp to stop based on ramp 2, keeping dynamic braking state".			

Stop upon fault

The stop mode varies with the fault type. For fault classification, see Chapter "Troubleshooting".

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.06	Stop mode at No. 2 fault	-	-5 to 3	-	2	Signed 16-bit	Real-time	Ordinary user	At stop
	Description of parameters:								
	-5: Stop at zero speed, keeping dynamic braking state -4: Stop at emergency stop torque, keeping dynamic braking state -3: Ramp to stop based on ramp 2, keeping dynamic braking state -2: Ramp to 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: Ramp to stop based on ramp 1, keeping de-energized state 2: Ramp to stop based on ramp 2, keeping de-energized state 3: Stop at emergency stop torque, keeping de-energized state Note: After the brake function is enabled, H02.06 will be forcibly set to "-3: Ramp to stop based on ramp 2, keeping dynamic braking state".			

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.08	Stop mode at No. 1 fault	-	0 to 2	-	2	UInt16	Real-time	Ordinary user	At stop
	Description of parameters:								
	0: Coast to stop, keeping de-energized state 1: Dynamic braking stop, keeping de-energized state 2: Dynamic braking stop, keeping dynamic braking state Note: After the brake function is enabled, H02.08 will be forcibly set to "2: Dynamic braking stop, keeping dynamic braking state".								

Stop at overtravel

Definition of Terms:

- "Overtravel": The distance of the mechanical movement 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.

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 (Stop at zero speed, keeping position lock state). When the workpiece moves linearly, install the limit switch to prevent mechanical damage. When overtravel occurs, input a reverse run command to make the motor (workpiece) run in the opposite direction.

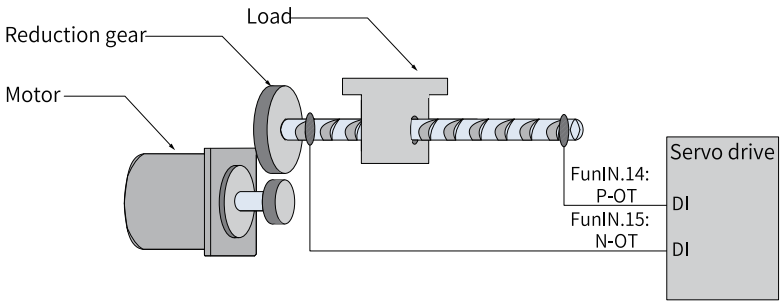


Figure 8-21 Installation of limit switches

To use the limit switch function, assign two DI terminals of the drive respectively with function 14 (FunIN.14: P-OT, positive limit switch) and function 15 (FunIN.15: N-OT, negative limit switch) to receive the limit switch input level signals, and set the active logics of DI terminals. The drive determines whether to enable or disable stop-upon-overtravel state based on the DI terminal level.

Code	Name	Description	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

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.07	Stop mode at overtravel	-	0 to 7	-	1	UInt16	At stop	Ordinary user	Effective in real time
	Value:								
	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				
	Description of parameters:								
	Defines the deceleration mode of the motor for stopping rotating upon overtravel and the motor status after stop. When the motor drives a vertical axis, set H02.07 to 1 or 4 to make the motor axis in position lock state after the limit switch signal is active to ensure safety. For compare of stop modes, see section "Servo Stop". After the brake output function is enabled, and the forced brake motor stop mode is set (bit2 of H0A.71 = 0), the stop mode at overtravel is forcibly set to "Ramp to stop as defined by 6085h, keeping position lock state".								

Emergency stop

Two emergency stop modes are supported:

- Using DI function 34: FunIN.34 (Emergency stop)
- Using the auxiliary function: Emergency stop (H0d.05)

☆ Related parameters:

No.	Name	Function name	Function
FunIN.34	EmergencyStop	Braking	Inactive: Current running state unaffected Active: The drive stops according to the defined quick stop mode

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0d.05	Emergency stop	-	0 to 1	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Emergency stop operation selection: 0: No operation; 1: Emergency stop								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.15	Display of keypad warning	-	0 to 1	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: Immediately output warning message 1: Do not output warning message								
	Description of parameters:								
	It sets whether the keypad switches to the fault display mode when a No.3 alarm occurs on the servo drive.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.18	DI emergency stop mode selection	-	0 to 3	-	2	UInt16	Real-time	Ordinary user	At stop
	Value:								
	0: Coast to stop, keeping de-energized state 1: Ramp to stop based on ramp 1, keeping de-energized state 2: Ramp to stop based on ramp 2, keeping de-energized state 3: Stop at emergency stop torque, keeping de-energized state								
	Description of parameters:								
	Defines the deceleration mode of the motor for stopping rotating upon quick stop and the motor status after stop. Note: After the brake function is enabled, H02.18 will be forcibly set to "2: Ramp to stop based on ramp 2, keeping de-energized state".								

Ramp to stop

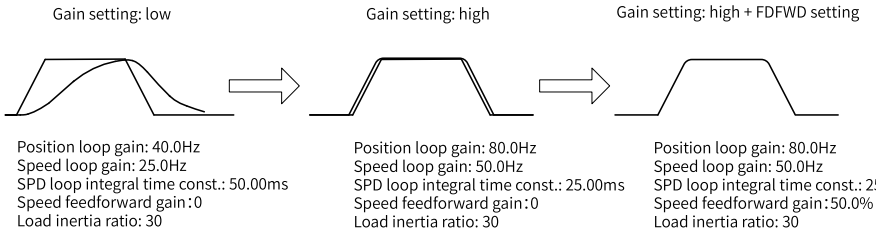
When the stop mode is set to "ramp to stop," to prevent excessive stopping distance caused by small deceleration, set H0A.72 to set the maximum time for ramp to stop.

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0A.72	Maximum stop time in ramp-to-stop	-	0 to 65535	ms	10000	UInt16	At stop	Standard user	Real time
	Parameter description:								
	Defines the maximum time taken by the motor in decelerating from 6000 rpm to 0 rpm in ramp-to-stop.								

9 Tuning

9.1 Overview

The servo drive must drive the motor as quick and accurate as possible to follow the commands from the host controller or internal setting. For this purpose, servo gain must be adjusted accordingly.



Gains are defined by a combination of multiple parameters that affect each other, including the position loop gain, speed loop gain, filter, and load moment of inertia ratio. Ensure that these parameters are balanced during adjustment.

Note

Before gain tuning, perform a trial run through jogging to ensure the motor operates properly.

The following figure shows the general flowchart for gain tuning.

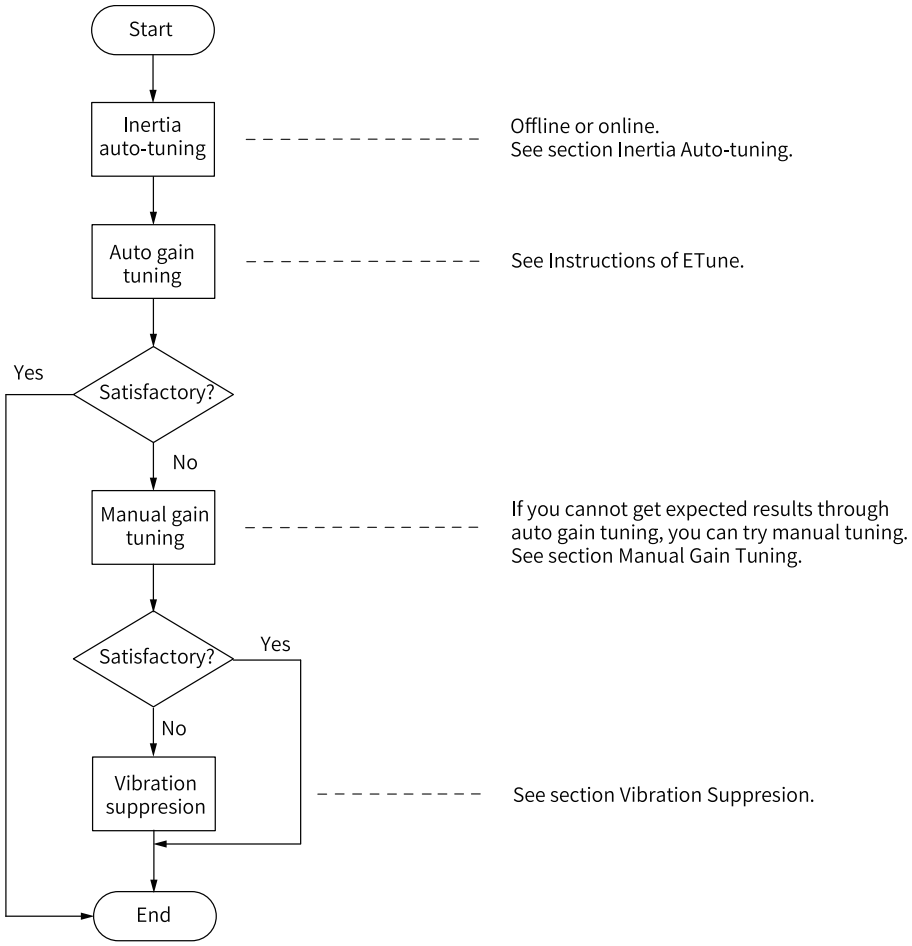


Figure 9-1 Step

Table 9–1 Description of gain tuning

Step			Function	Reference
1	Inertia auto-tuning	Offline	The servo drive calculates the load inertia ratio automatically through inertia auto-tuning.	*"9.2.1 Offline Inertia Auto-tuning" on page 201*
		Online	The host controller sends a command to make the motor rotate, and the drive calculates the inertia ratio in real time.	*"9.2.2 Online inertia auto-tuning" on page 204*
2	Automatic gain adjustment		The servo drive generates a group of gain parameters based on the correct inertia ratio.	*" ETune" on page 206* and *" STune" on page 211*

Step			Function	Reference
3	Manual gain adjustment	Basic gain	If the auto-tuned gain values fail to deliver desired performance, fine-tune the gains manually to improve the performance.	*"9.4.1 Basic Parameters" on page 231*
		Gain switchover	Switch to higher or lower gains depending on the actual condition for optimal auto-tuning performance.	*"9.4.2 Gain switchover" on page 236*
		Reference filter	It filters the position, speed, and torque references.	*"9.4.3 Position Reference Filter" on page 243*
		Gain	Improves the follow-up behavior.	*" Feedforward gain tuning" on page 244*
		Pseudo differential regulator	Adjusts the speed loop control mode to improve the anti-interference capability at high/low frequency range.	*"9.4.5 Pseudo Differential Feedforward Control" on page 248*
		Torque Disturbance Observer	Improves the resistance against torque disturbance.	*"9.4.6 Torque Disturbance Observer" on page 249*
		Model Tracking	The model tracking control can improve response and shorten the positioning time.	*"9.4.7 Model Tracking" on page 250*
		Speed Observer	Increases the gains while shortening the positioning time, and avoids high-frequency vibration.	*"9.4.8 Speed Observer" on page 254*
		Friction Compensation	Reduces the impact of friction in mechanical transmission on the operational performance.	*"9.4.9 Friction Compensa-tion" on page 257*
4	Vibration suppression	Mechanical resonance	Suppresses mechanical resonance through the notch.	*"9.7.2 Mechanical Resonance Suppression" on page 269*
		Low-frequency resonance	Activates the filter used to suppress low-frequency resonance.	*"9.7.3 Low-Frequency Resonance Suppression at the Mechanical End" on page 277*

9.2 Inertia Auto-tuning

Definition of the load inertia ratio (H08.15):

$$\text{Load inertia ratio} = \frac{\text{Total moment of inertia of mechanical load}}{\text{Motor moment of inertia}}$$

The inertia ratio is a critical parameter of the servo state. Quick commissioning can be implemented with a correct inertia ratio.

You can set the load inertia ratio manually or get the inertia ratio through inertia auto-tuning.

The following two inertia auto-tuning modes are available:

- Offline Inertia Auto-tuning
  To enable offline inertia auto-tuning, use H0d.02 (Offline inertia auto-tuning) and make the motor rotate and execute inertia auto-tuning through the keypad. Offline inertia auto-tuning does not involve the host controller.
- Online Inertia Auto-tuning
  Send a command to the servo drive through the host controller to make motor act accordingly to finish inertia auto-tuning. Online inertia auto-tuning involves the host controller.

Note

To accurately calculate the load inertia ratio using the inertia auto-tuning function, the following conditions must be met:

1. The actual motor maximum speed is higher than 150 rpm.
2. During motor acceleration/deceleration, the acceleration is above 3000 rpm/s.
3. The load torque is relatively stable and does not change drastically.
4. The actual load inertia ratio does not exceed 120:1.

If the actual inertia ratio is high but the gain is low, the motor may not be able to meet the maximum speed and acceleration requirements as motor actions will be slowed down. In this case, increase the speed loop gain (H08.00) and perform auto-tuning again.

If vibration occurs during auto-tuning, stop inertia auto-tuning immediately and decrease the gains.

Inertia auto-tuning may also fail in case of a large backlash of the transmission mechanism.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.00	Speed loop gain	-	0.1 to 2000.0	Hz	40.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed loop proportional gain. This parameter determines the response of the speed loop. The higher the setpoint, the higher the response. Note that an excessively high setpoint may cause vibration. In the position control mode, the position loop gain must be increased together with the speed loop gain.								
	Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H08.15	Load moment of inertia ratio	-	0.00 to 120.00	-	1.00	UInt16	Real time	Standard user	Real time
	Parameter description:								
	Defines the load-to-motor inertia ratio. The servo drive automatically calculates and updates the value of H08.15 through inertia auto-tuning (including offline and online). When online inertia auto-tuning is used, the drive sets this parameter automatically. To set it manually, disable the online inertia auto-tuning mode.								

9.2.1 Offline Inertia Auto-tuning

Note

Before offline inertia auto-tuning, first check that the motor's travel range meets the following two requirements:

- A travel distance of more than one revolutions in the forward/reverse direction is available between the limit switches.Before offline inertia auto-tuning, ensure limit switches are installed to the machine and a travel distance of more than one revolutions is reserved for the motor. This is to prevent overtravel during auto-tuning.
- The required number of revolutions (H09.09) is fulfilled.Check the following three parameters: maximum speed during inertia auto-tuning (H09.06), time to accelerate to maximum speed during inertia auto-tuning (H09.07), and the required number of motor revolutions to complete inertia auto-tuning (H09.09). Check that the travel distance of the motor at the stop position is larger than the value of H09.09. If not, decrease the value of H09.06 or H09.07 properly until the motor travel distance fulfills the requirement.

The following figure shows general flowchart for offline inertia auto-tuning.

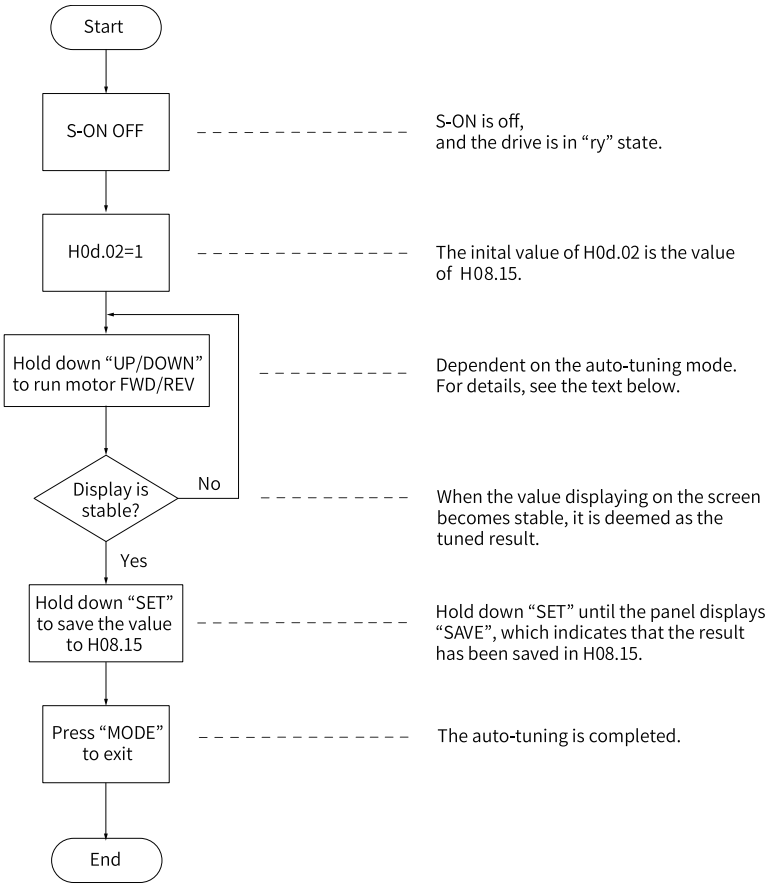


Figure 9-2 Offline inertia auto-tuning flowchart

Flowchart description:

1. In the parameter configuration interface, set the auto-tuning mode (H09.05).
   - 0: Bidirectional auto-tuning mode
   - 1: Unidirectional auto-tuning mode
2. Enter parameter display mode, switch to the H0d.02 parameter setting interface, set H0d.02 to 1, then press the "SET" key to enable offline inertia auto-tuning.
3. Return to the operation page, and press the UP/DOWN keys to start offline auto-tuning. The UP/DOWN keys determine the initial running direction. For applications allowing unidirectional operations only, set H09.05 to 1.
4. During auto-tuning, releasing the UP/DOWN key stops the drive. To start auto-tuning again, press the UP/DOWN key again.
5. If the motor cannot reach the maximum speed for inertia auto-tuning (H09.06), increase the stiffness level (H09.01) of the drive properly to achieve the maximum speed, delivering more accurate auto-tuned values.
6. Hold down the "SET" key until the panel displays "SAVE", indicating that the auto-tuned values have been saved to H08.15.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.05	Offline inertia auto-tuning mode	-	0 to 1	-	0	UInt16	At stop	Ordinary user	Effective in real time
	Value:								
	0: Bidirectional auto-tuning mode 1: Unidirectional auto-tuning mode								
	Description of parameters:								
	Defines the offline inertia auto-tuning mode. The offline inertia auto-tuning function can be enabled through H0d.02. For details on offline inertia auto-tuning, see section "Inertia Auto-tuning".								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.06	Maximum speed of inertia auto-tuning	-	100 to 1000	rpm	500	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the maximum permissible motor speed reference in the offline inertia auto-tuning mode. During inertia auto-tuning, the higher the speed, the more accurate the auto-tuned value. Use the default value in general applications.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.07	Time constant for accelerating to the maximum speed during inertia auto-tuning	-	20 to 800	ms	125	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the time for the motor to accelerate from 0 rpm to the maximum speed of inertia auto-tuning (H09.06) during offline inertia auto-tuning.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.08	Time interval after an individual inertia auto-tuning	-	50 to 10000	ms	800	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the interval time between two consecutive speed references when H09.05 (Offline inertia auto-tuning mode) is set to 0 (Bidirectional).								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.09	Number of motor revolutions per inertia auto-tuning	-	0.00 to 100.00	-	1.00	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the number of motor revolutions needed when H09.05 (Offline inertia auto-tuning mode) is set to 0 (Bidirectional).								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0d.02	Inertia auto-tuning selection	-	0 to 65	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Enables offline inertia auto-tuning through the keypad. In the parameter display mode, switch to H0d.02 and press the SET key to enable offline inertia auto-tuning. For details, see section "Inertia Auto-tuning". Note: This parameter is non-retentive upon power failure as it is not saved to EERPOM.								

9.2.2 Online inertia auto-tuning

The servo drive supports online inertia auto-tuning. The online inertia auto-tuning flowchart is shown as follows.

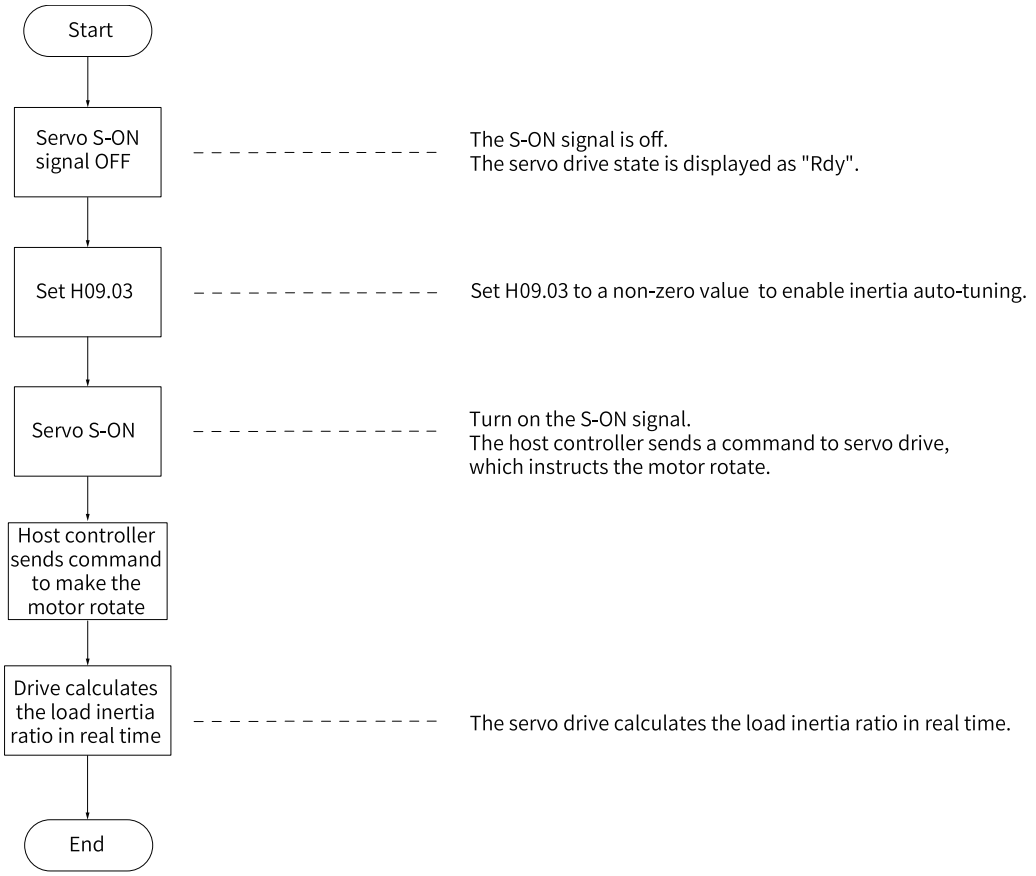


Figure 9-3 Online inertia auto-tuning flowchart

Note

The difference among setpoints 1 to 3 of H09.03 lies in the real-time update speed of the load inertia ratio (H08.15):

1. H09.03 = 1: Applicable to applications where the actual load inertia ratio changes slowly, such as machine tools and wood carving machines;
2. H09.03 = 2: Applicable to applications where the actual load inertia ratio changes moderately;
3. H09.03 = 3: Applicable to applications where the actual load inertia ratio changes rapidly, such as handling manipulators

.

Do not use online inertia auto-tuning in applications involving hitting against limit switches and press hitting.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.03	Online inertia auto-tuning mode	-	0 to 3	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: Disabled 1: Enabled, inertia ratio changing slowly 2: Enabled, inertia ratio changing normally 3: Enabled, inertia ratio changing quickly								
	Description of parameters:								
	Defines whether to enable online inertia auto-tuning and the inertia ratio update speed during online inertia auto-tuning. In applications where the inertia does not change, set H09.03 (Online inertia auto-tuning mode) to 1 (Enabled, changing slowly). In applications where the inertia changes quickly, set H09.03 to 3 (Enabled, changing quickly).								

9.3 Automatic Gain Tuning

9.3.1 ETune

9.3.1.1 Overview

ETune refers to the wizard-type auto-tuning function.After setting the corresponding curve trajectory and response demand parameters through the guided instructions, the servo will automatically run and learn the optimal gain parameters.After learning is complete, the parameters can be saved, and the parameters can also be exported as a recipe for copying and downloading to the same model. ETune refers to the wizard-type auto-tuning function.After setting the corresponding curve trajectory and response demand parameters through the guided instructions, the servo will automatically run and learn the optimal gain parameters.After learning is complete, the parameters can be saved, and the parameters can also be exported as a recipe for copying and downloading to the same model. ETune refers to the wizard-type auto-tuning function.After setting the corresponding curve trajectory and response demand parameters through the guided instructions, the servo will automatically run and learn the optimal gain parameters.

The STune function is intended to be used in applications featuring slight load inertia change.

9.3.1.2 Procedure

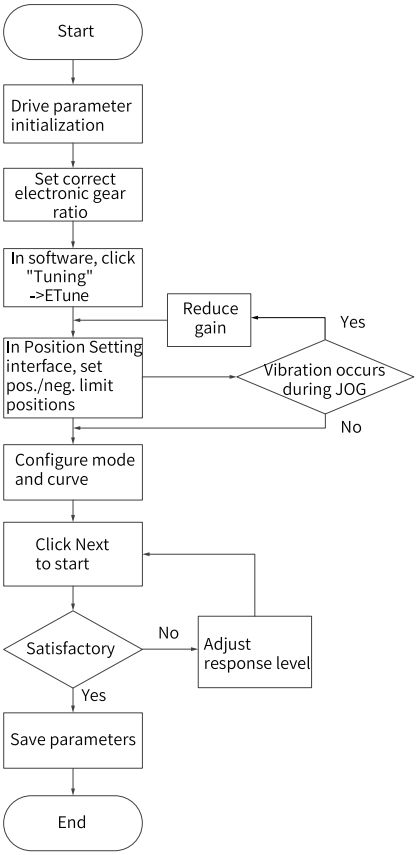
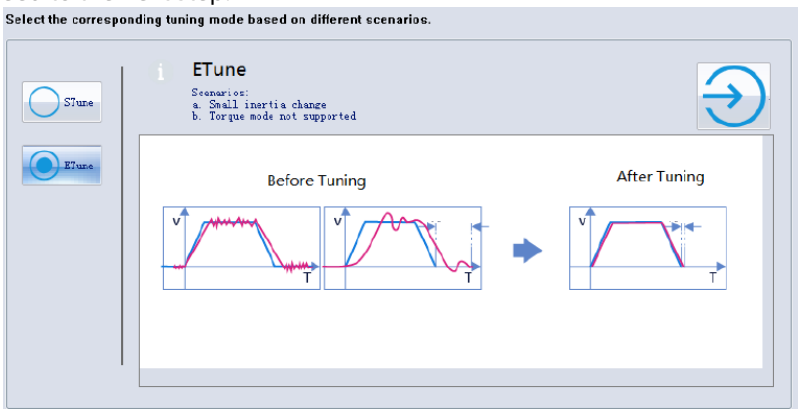


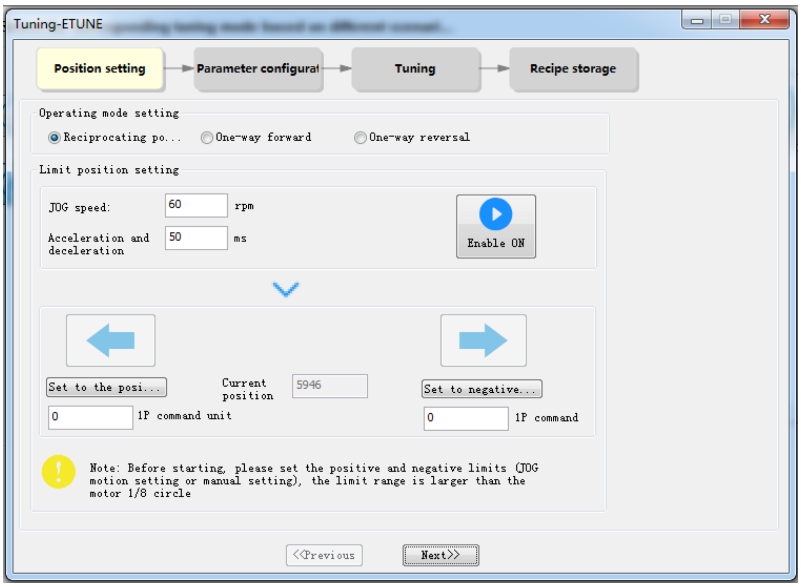
Figure 9-4 Procedure flowchart

Process description

1. Click the "Tune" button on the software toolbar or "Usability adjustment" in the left workspace area to enter the mode selection page. After selecting "ETune", click the button in the upper right corner to proceed to the next step.



2. Enter the "Position setting" step, as shown in the following figure:



a. First, select an operating mode based on the allowable motion direction of the mechanical system:

- In "Reciprocating positive and negative" mode, the motor keeps reciprocating within the positive and negative position limits.
- In "One-way forward" mode, the motor takes the difference between the positive and negative position limits as the maximum distance per action and keeps running in the forward direction.
- In "One-way reversal" mode, the motor takes the difference between the positive and negative position limits as the maximum distance per action and keeps running in the reverse direction.

b. Then, specify the positive and negative limit positions allowed by the motor. The difference between the positive and negative limits defines the position reference pulses for the motor, which is also the value before multiplication/division by the electronic gear ratio.
You can set the positive and negative position limits through the following two methods.

- Click "Servo ON" for JOG test run. Click "⬅" to make the motor move to the positive limit, and then click "Set to positive limit position". Follow the same procedure to set the negative position limit. Click "Enable OFF" (the "Enable ON" button turns to "Enable OFF" after a click).
- Directly enter the positive/negative limit positions in the white text box.

Note

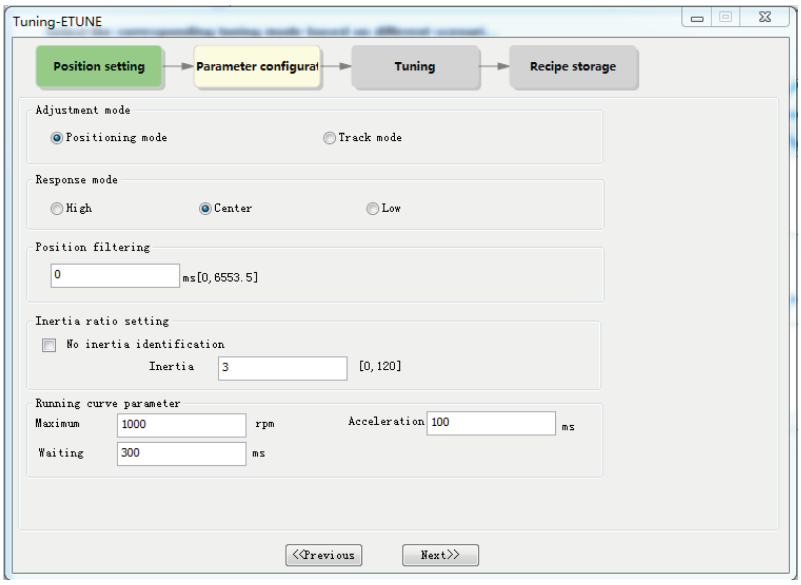
The difference between the positive and negative position limits must be larger than 1/8 of one revolution. The larger the value of the limit position, the better the adaptability of the auto-tuned parameters, but the longer will ETune adjustment take.

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3. Click "Next" to proceed to the "Parameter configuration" step.

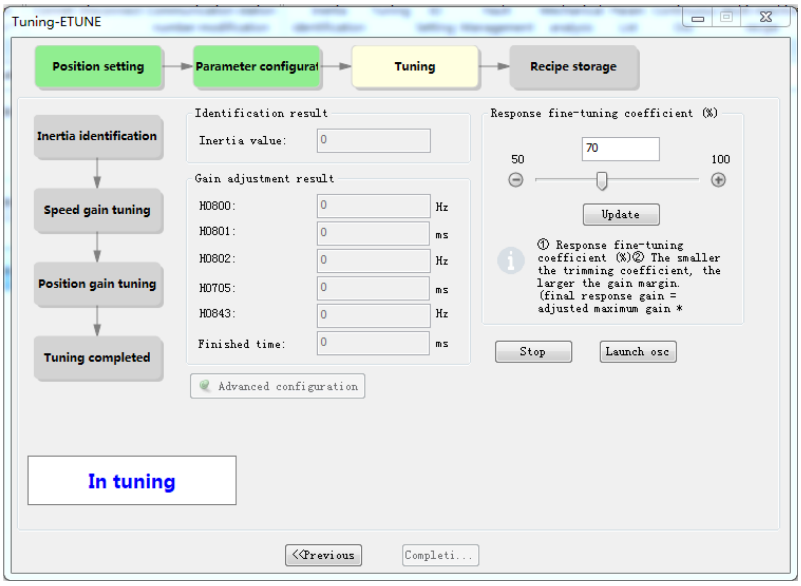
- The adjustment mode is divided into "Positioning mode" and "Track mode".
- Response mode and position filter time constant: Make corresponding adjustment according to the response performance needed and actual position reference noise.

- Inertia ratio setting: Choose whether to perform inertia auto-tuning. If inertia auto-tuning is not performed, set the correct inertia ratio, which can be directly modified.
- Operation curve parameter: Set the maximum speed, acceleration/deceleration time and interval time for auto-tuning.

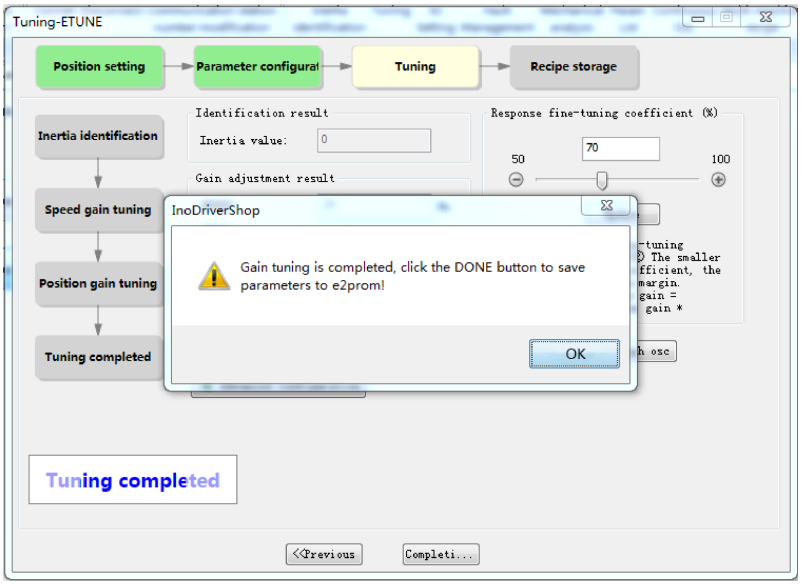


4. Click " **Next** " to enter the "Tuning" step.

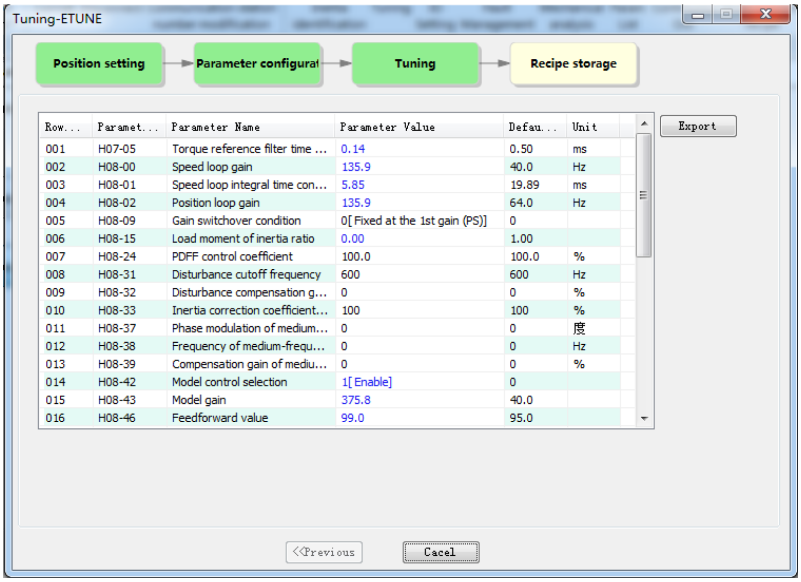
- If you choose to perform inertia auto-tuning, the drive starts inertia auto-tuning based on the set motion profile. After inertia auto-tuning is done, the drive starts gain auto-tuning.
- If you choose not to perform inertia auto-tuning in the previous step, the drive starts gain tuning directly after start.



5. In the "Tuning" phase, modify the response fine-tuning coefficient and click " **Update** ". The system will then continue adjusting the gain according to the specified fine-tuning coefficient. After adjustment is done, click " **Finish** " to done adjustment and save parameters to EEPROM.



6. After completion, you can export the parameters and save them as a recipe file.



Row...	Paramet...	Parameter Name	Parameter Value	Defau...	Unit
001	H07-05	Torque reference filter time ...	0.14	0.50	ms
002	H08-00	Speed loop gain	135.9	40.0	Hz
003	H08-01	Speed loop integral time con...	5.85	19.89	ms
004	H08-02	Position loop gain	135.9	64.0	Hz
005	H08-09	Gain switchover condition	0[Fixed at the 1st gain (PS)]	0	
006	H08-15	Load moment of inertia ratio	0.00	1.00	
007	H08-24	PDFF control coefficient	100.0	100.0	%
008	H08-31	Disturbance cutoff frequency	600	600	Hz
009	H08-32	Disturbance compensation g...	0	0	%
010	H08-33	Inertia correction coefficient...	100	100	%
011	H08-37	Phase modulation of medium...	0	0	度
012	H08-38	Frequency of medium-frequ...	0	0	Hz
013	H08-39	Compensation gain of mediu...	0	0	%
014	H08-42	Model control selection	1[Enable]	0	
015	H08-43	Model gain	375.8	40.0	
016	H08-46	Feedforward value	99.0	95.0	

9.3.1.3 Precautions

- Before gain tuning, set an electronic gear ratio according to the actual application.
- The maximum speed and acceleration/deceleration time of the operation curve can be set based on actual needs. You can also increase the acceleration/deceleration time properly to enable quick positioning after auto-tuning.
- If the acceleration/deceleration time is too short, overload may occur. In this case, increase the acceleration/deceleration time properly.
- For vertical axes, take anti-drop measures beforehand and set the stop mode upon fault to "Stop at zero speed".
- For lead screw transmission, shorten the travel distance if the tuning duration is excessively long.

9.3.1.4 Solutions to Common Faults

Fault symptom	Cause	Solution
E662.0: ETune failure	Check whether resonance during ETune operation cannot be suppressed.	1. When vibration cannot be suppressed automatically, set the notch manually 2. Modify the electronic gear ratio to improve the reference resolution, or increase the reference filter time properly in the parameter configuration interface. 3. Increase the value of H09.11 properly. 4. Check whether the machine fluctuates periodically. 5. Check whether positioning threshold is excessively low. Increase the reference acceleration/deceleration time.
E600.0: Angle auto-tuning failure	1. Continuous vibration exists during auto-tuning. 2. The auto-tuned values fluctuate dramatically. 3. Mechanical connections of the load are loosened or eccentric. 4. An alarm occurs during auto-tuning and causes interruption. 5. The vibration cannot be suppressed if the load carries large inertia. In this case, increase the acceleration/deceleration time to ensure the motor current is unsaturated.	1. Clear the fault and perform inertia auto-tuning again. 2. Enable vibration suppression when the vibration cannot be suppressed automatically. 3. Check and ensure mechanical connections are secure. 4. During ETune operations, increase the maximum operating speed, reduce the acceleration/deceleration time, and shorten the screw stroke.

9.3.2 STune

9.3.2.1 Overview

STune refers to the function of selecting the stiffness level. During STune, the drive automatically adjusts parameters to meet requirements for fast and stable control. This function will be turned off automatically after operating for 5 minutes.

The STune function is intended to be used in applications featuring slight load inertia change. For applications with large inertia variation or where inertia auto-tuning is difficult to apply (low operating speed or low acceleration), disable this function after the initial power-on.

Table 9–2 Six STune modes

Mode (Value of H09.00)	Name	Applicable occasion
0	Inactive	The gains need to be manually tuned.
1	Standard stiffness meter mode	The gain is automatically tuned based on the stiffness setting.
2	Positioning mode	The gain is automatically tuned based on the stiffness setting. This mode is applicable to scenarios requiring quick positioning.

Mode (Value of H09.00)	Name	Applicable occasion
4	Normal mode + Inertia auto-tuning	The gain is automatically tuned based on the stiffness setting. The inertia is auto-tuned and vibration is automatically suppressed. This mode is applicable to trajectory tracking.
6	Quick positioning mode + Inertia auto-tuning	The gain is automatically tuned based on the stiffness setting. Inertia is auto-tuned and vibration is automatically suppressed. This mode is applicable to occasions requiring quick positioning.

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H09.00	Auto-tuning mode selection	-	0 to 6	-	0	UInt16	Real time	Standard user	Real time

Value:

Mode (Value of H09.00)	**Name**	**Applicable occasion**
0	Inactive	The gains need to be manually tuned.
1	Standard stiffness meter mode	The gain is automatically tuned based on the stiffness setting.
2	Positioning mode	The gain is automatically tuned based on the stiffness setting. This mode is applicable to scenarios requiring quick positioning.
4	Normal mode + Inertia auto-tuning	The gain is automatically tuned based on the stiffness setting. The inertia is auto-tuned and vibration is automatically suppressed. This mode is applicable to trajectory tracking.
6	Quick positioning mode + Inertia auto-tuning	The gain is automatically tuned based on the stiffness setting. Inertia is auto-tuned and vibration is automatically suppressed. This mode is applicable to occasions requiring quick positioning.

Parameter description:

Defines different gain tuning modes.

9.3.2.2 Procedure

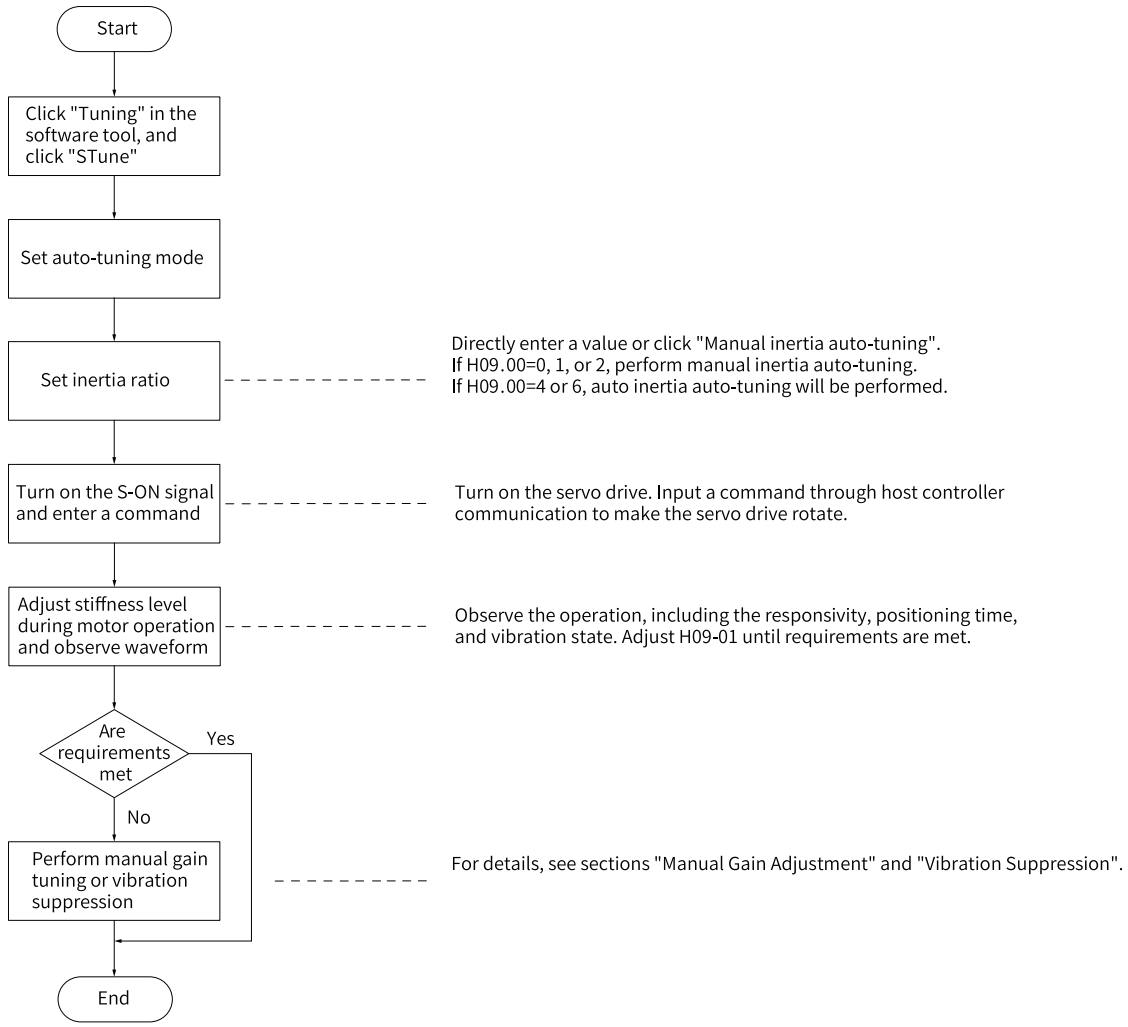


Figure 9-5 Procedure flowchart

Process description

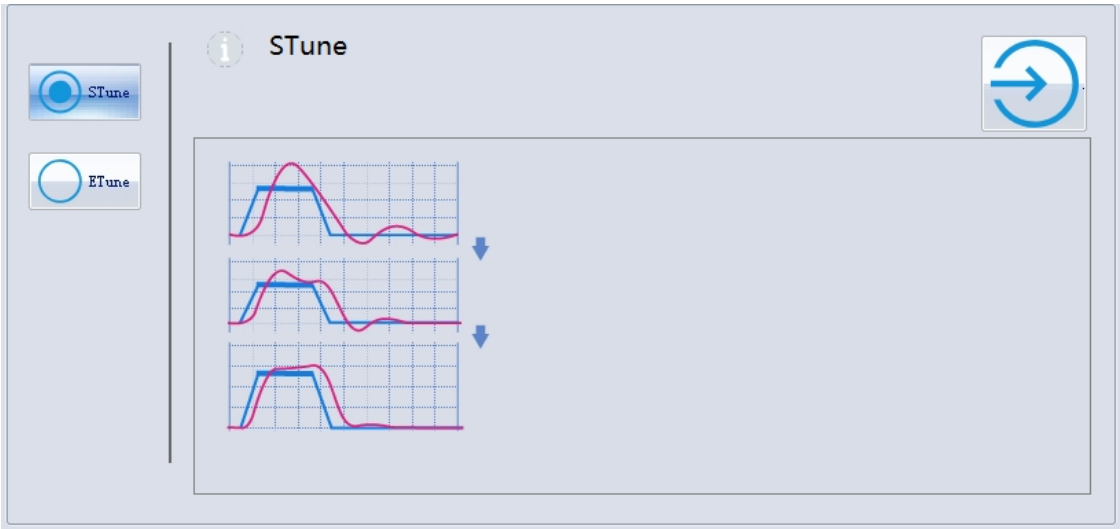
Quick setup method for modes 0/4/6:

Note

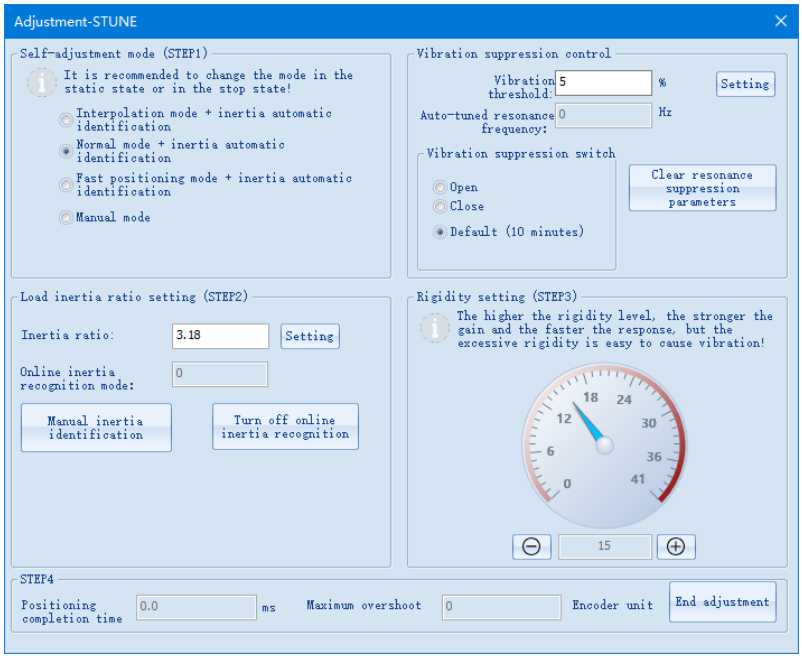
- Modes 4/6 are not applicable to situations with slow acceleration/deceleration, high vibration, or unstable mechanical couplings.
- If inertia auto-tuning is turned off automatically, switching to modes 4 or 6 will not activate inertia auto-tuning again.

---

1. Click the "Tune" button on the software toolbar or "Usability adjustment" in the left workspace area to enter the mode selection page. After selecting "ETune", click the button in the upper right corner to proceed to the next step.



2. Select an auto-tuning mode. For modes 4/6, no inertia ratio setting is required as inertia auto-tuning will be performed automatically. For manual mode (mode 0), the inertia ratio must be set. You can directly input the inertia ratio and set it in the "Load inertia ratio setting" panel below, or click "Manual inertia auto-tuning". If mechanical vibration exists, reduce the stiffness level before performing manual inertia auto-tuning.



Note

For STune modes 4 and 6, online inertia auto-tuning (H09.03) must be used for load inertia auto-tuning, and the following conditions must be met:

- The load inertia changes quickly.
- The load torque changes quickly.
- For ROT motors, the speed is lower than 100 rpm. For DDR motor, the speed is lower than 20 rpm. For DDL motors, the speed is lower than 20 mm/s.
- Acceleration/Deceleration is slow (lower than 1000 rpm per second).
- The acceleration/deceleration torque is lower than the unbalanced load/viscous friction torque.

If the conditions for online inertia auto-tuning cannot be fulfilled, set the correct inertia ratio manually.

3. Gradually adjust the stiffness level during operation of the load. The current stiffness level value will be automatically written to the drive.
4. Keep monitoring the operation waveform after increasing the stiffness level (increase by one level at a time) until desired performance is achieved.
5. In STune modes 4 and 6, when the speed keeps higher than 100 rpm for more than 5 min, H09.00 is set to 0 automatically. In this case, the drive exits the STune mode. Alternatively, once commissioning is done, you may manually set it to manual mode and exit STune mode in advance. To modify the STune operation time, set H09.37.
6. In STune modes 4 and 6, resonance will be suppressed automatically. If the performance of automatic resonance suppression is inadequate, set H09.58 to 1 to clear resonance suppression parameters, reduce the stiffness level, and perform STune again.
7. In multi-axis trajectories, perform single-axis commissioning first to determine the highest response of each axis and modify the response of each axis manually to ensure position responses of different axes are consistent.

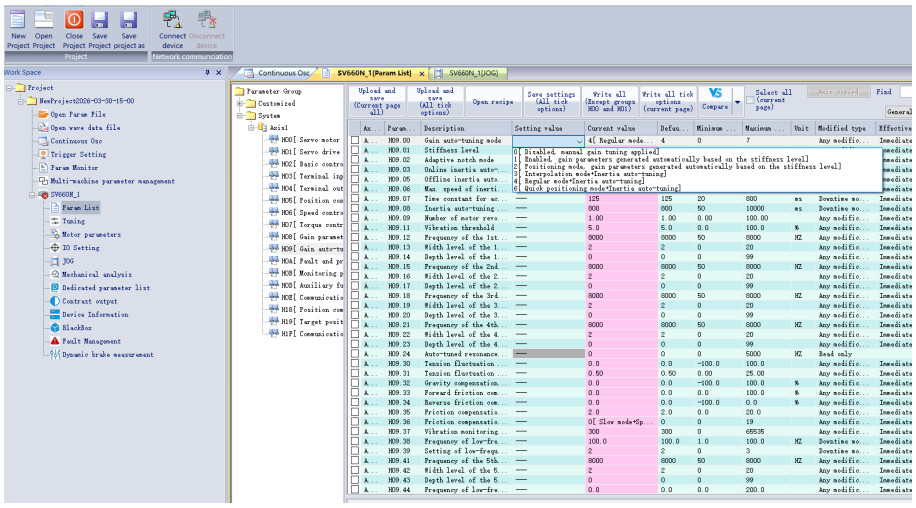
    - In STune mode 4, determine the minimum value of H08.02 (Position loop gain), and then set H09.00 of each axis to 0 and set H08.02 of each axis to the same value.
    - In STune mode 6, determine the minimum value of H08.43 (Model gain), and then set H09.00 of each axis to 0, and set H08.43 of each axis to the same value.

Note

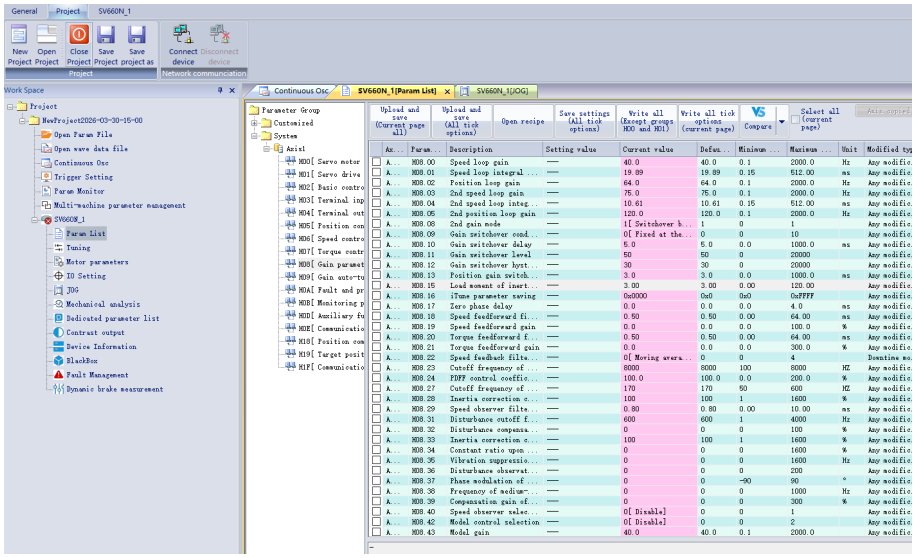
To ensure a stable operation in STune modes 4/6 with default parameter settings, gain parameters will be adjusted along with the inertia ratio when the inertia ratio is higher than 13:1. In multi-axis trajectory scenarios, the stiffness is consistent but the responsibilities are different.

Setting methods for modes 1/2:

1. In the left workspace, click "Parameter configuration" → "Parameters in group H09", and then select the desired mode in H09.00.



2. Set the inertia ratio in H08.15, as shown in the figure. If the inertia is unknown, adjust the inertia manually. If vibration occurs, decrease the stiffness level before manual gain tuning.



3. After setting the inertia ratio, set an appropriate stiffness level in H09.01.

9.3.2.3 Precautions

Recommended load inertia ratio

- In applications requiring high response, the inertia ratio must be lower than 5:1 and cannot exceed 10:1.

Recommended load inertia ratio	Load mechanisms
Within 10:1	For belt pulley or gear rack without high requirements on connection rigidity and accuracy, the inertia ratio cannot exceed 10:1.
Within 5:1	For direct connection of lead screws or couplings, the inertia ratio cannot exceed 5:1.
Within 2:1	Applicable to applications requiring high positioning accuracy or response speed

- In applications requiring medium-level accuracy and dynamic response, the inertia ratio cannot exceed 30:1.

- For inertia ratio higher than 30:1, trajectory control is not available. Inertia ratios that higher than 30:1 only apply to point-to-point control with low accuracy requirements and some rotary mechanism, with long acceleration/deceleration time needed.

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H08.15	Load moment of inertia ratio	-	0.00 to 120.00	-	1.00	UInt16	Real time	Standard user	Real time
	Parameter description:								
	Defines the load-to-motor inertia ratio. The servo drive automatically calculates and updates the value of H08.15 through inertia auto-tuning (including offline and online). When online inertia auto-tuning is used, the drive sets this parameter automatically. To set it manually, disable the online inertia auto-tuning mode.								

Recommended stiffness level

The value range of H09.01 (Stiffness level) is 0 to 41. The level 0 indicates the lowest stiffness and lowest gain and level 41 indicates the highest stiffness and highest gain.

The following table lists the stiffness levels for different load types for your reference.

Table 9–3 Recommended stiffness level table

Recommended stiffness level	Load mechanisms
Level 8 to level 12	Large-scale machineries
Level 12 to level 18	Applications with low stiffness such as the conveyors
Above level 18	Applications with high stiffness such as the ball screws and direct connections.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.01	Stiffness level	-	0 to 41	-	15	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the servo system stiffness. Level 0 indicates the lowest stiffness, and level 41 indicates the highest stiffness. The higher the stiffness level, the higher the gains and the quicker the response can be. But an excessively high stiffness level can result in vibration.								

Mode description

When any mode of automatic gain tuning is set (H09.00 = any value), the following parameters are restored to their default values, and H06.11 (Torque feedforward selection) is automatically set to 0.

H07.37	Torque reference filter selection
H08.08	2nd gain mode setting
H08.18	Speed feedforward filter time constant

H08.19	Speed feedforward gain
H08.20	Torque feedforward filter time constant
H08.21	Torque feedforward gain

Note: When the stiffness meter mode or positioning mode is set (H09.00 = 1 or 2), the following parameters are restored to their default values.

H08.09	Gain switchover condition selection
H08.24	Pseudo differential feedforward control coefficient
H08.30	Disturbance compensation time
H08.31	Disturbance cutoff frequency
H08.32	Disturbance compensation gain
H08.42	Model control enable
H08.46	Feedforward value
H09.02	Adaptive notch mode selection
H09.03	Online inertia auto-tuning mode

Parameters related to mode 1 (standard stiffness level mode)

In this mode (H09.00 = 1), the first gain set parameters (H08.00 to H08.02, H07.05) are automatically updated according to the set stiffness level (H09.01).

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H07.05	Torque reference filter time constant 1	-	0.00 to 30.00	ms	0.50	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the torque reference filter time constant 1. Low-pass filtering on the torque references smoothens the torque references and reduces vibration. Note that an excessively high setpoint can reduce responsiveness. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.00	Speed loop gain	-	0.1 to 2000.0	Hz	40.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed loop proportional gain. This parameter determines the response of the speed loop. The higher the setpoint, the higher the response. Note that an excessively high setpoint may cause vibration. In the position control mode, the position loop gain must be increased together with the speed loop gain.								
	Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.01	Speed loop integral time constant	-	0.15 to 512.00	ms	19.89	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed loop integral time constant. The lower the setpoint, the better the integral action, and the quicker will the deviation value be close to 0. There is no integral action when this parameter is set to 512.00. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.02	Position loop gain	-	0.1 to 2000.0	Hz	64.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the proportional gain of the position loop. This parameter defines the response of the position loop. A high setpoint shortens the positioning time. Note that an excessively high setpoint may cause vibration. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

Parameters related to mode 2 (positioning mode)

In this mode (H09.00 = 2), on the basis of mode 1, the second gain set parameters (H08.03 to H08.05, H07.06) are automatically updated according to the set stiffness level (H09.01), and the position loop gain of the second gain set parameters must be higher than that of the first gain set parameters by one stiffness level. Some parameters are set to fixed values, as shown in the table below:

Parameter type	Fixed value description
Second gain set parameters	If H08.04 is set to 512.00, the 2nd speed loop integral action is invalid and only proportional control is used in the speed loop.
Parameters related to speed feedforward	H08.19 = 30, H08.18 = 0.50
Parameters related to gain switchover (gain switchover automatically enabled in positioning mode)	H08.08 = 1, H08.09 = 10, H08.10 = 5.0, H08.11 = 50, H08.12 = 30

Note

In the gain auto-tuning mode, the parameters automatically updated along with H09.01 and those with fixed values cannot be modified manually. To modify these parameters, set H09.00 to 0 (exit auto-tuning mode and enter manual tuning mode).

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.03	2nd speed loop gain	-	0.1 to 2000.0	Hz	75.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the 2nd speed loop gain. This parameter determines the responsivity of the speed loop. The higher the setpoint, the faster the speed loop response is. Note that an excessively high setpoint may cause vibration. In the position control mode, the position loop gain must be increased together with the speed loop gain. Note: Parameters for the 2nd gain set include H08.03, H08.04, H08.05, and H07.06 (Torque reference filter time constant). For details on gain switchover, see section "Gain Switchover".								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.04	2nd speed loop integral time constant	–	0.15 to 512.00	ms	10.61	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the 2nd speed loop integral time constant. The lower the setpoint, the better the integral action, and the quicker will the deviation value be close to 0. There is no integral action when this parameter is set to 512.00.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.05	2nd position loop gain	-	0.1 to 2000.0	Hz	120.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the 2nd gain of the position loop. This parameter defines the response of the position loop. A high setpoint shortens the positioning time. Note that an excessively high setpoint may cause vibration.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H07.06	Torque reference filter time constant 2	-	0.00 to 30.00	ms	0.27	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the torque reference filter time constant 2. Low-pass filtering of torque references helps smoothen torque references and reduce vibration. Note that an excessively high setpoint can reduce responsiveness.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.08	Second gain mode setting	-	0 to 1	-	1	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: Fixed to the 1st gain, switched between P and PI by external DI 1: Switched between the 1st and 2nd gain according to H08.09								
	Description of parameters:								
	Defines the mode for switching to the 2nd gain.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.09	Gain switchover condition	-	0 to 10	-	0	UInt16	Real-time	Ordinary user	Effective in real time

Value:

0: Fixed to the 1st gain (PS) 1: DI (Func3) switchover 2: Torque reference too large (PS) 3: Speed reference too large (PS) 4: Speed reference change rate too large (PS) 5: Speed reference high-speed/low-speed thresholds (PS)	6: Position deviation too large (P) 7: Position reference available (P) 8: Positioning uncompleted (P) 9: Actual speed (P) 10: Position reference available + Actual speed (P)

Description of parameters:

Defines the gain switchover condition. See the following table for gain switchover conditions.

Set value	Gain switching condition	Remarks
0	Fixed to the first gain	The gain is fixed to the first gain.
1	DI (Func3) switchover	-
2	Torque reference too large	When the absolute value of the torque reference exceeds (level + hysteresis) [%] in the previous first gain, switch to second gain. If the absolute value of the torque reference is lower than (level – hysteresis) [%] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set.
3	Speed reference too large	When the absolute value of the speed reference exceeds (level + hysteresis) [rpm] in the 1st gain, the servo drive switches to the 2nd gain. When the absolute value of the speed reference is lower than (level - hysteresis) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set.
4	Speed reference change rate too large	It is effective only in non-speed control mode. When the absolute value of the speed reference change rate exceeds (level + hysteresis) [10 rpm/s] in the previous first gain, the drive switches to the 2nd gain. When the absolute value of the speed reference change rate is lower than (level – hysteresis) [10 rpm/s] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set. The 1st gain is always used in the speed control mode.
5	Speed reference high-speed/low-speed thresholds	When the speed reference absolute value exceeds (level - hysteresis) [rpm] in the last 1st gain, the drive starts to switch to the 2nd gain, with gains changing gradually. When the speed reference absolute value reaches (level + hysteresis) [rpm], the 2nd gain applies. When the speed reference absolute value is lower than (level + hysteresis) [rpm] in the last 2nd gain, the drive starts to return to the 1st gain, with gains changing gradually. When the speed reference absolute value reaches (level + hysteresis) [rpm], the 1st gain applies.

	6	Position deviation too large	It is effective only in position control mode. When the absolute value of the position deviation exceeds (level + hysteresis) [encoder units] in the previous first gain, the drive switches to the 2nd gain. When the absolute value of the position deviation is lower than (level - hysteresis) [encoder unit] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
	7	Position reference available	It is effective only in position control mode. When the position reference is not 0 in the previous first gain, the drive switches to the 2nd gain. When the position reference is 0 and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
	8	Positioning uncompleted	It is effective only in position control mode. When positioning is not complete in the previous first gain, the drive switches to the 2nd gain. When positioning is not complete and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the servo drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
	9	Actual speed	It is effective only in position control mode. When the absolute value of the actual speed exceeds (level + hysteresis) [rpm] in the previous first gain, the drive switches to the 2nd gain. When the absolute value of actual speed is lower than (level - hysteresis) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
	10	Position reference available + Actual speed	It is effective only in position control mode. When the position command is not 0 in the previous 1st gain, the drive switches to the 2nd gain. When the position reference is 0 and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the 2nd gain set applies. When the position reference is 0 and the delay defined by (H08.10) is reached, if the absolute value of actual speed is lower than (Level) [rpm], the speed loop integral time constant is fixed to the setpoint of H08.04 (2nd speed loop integral time constant), and others return to the 1st gain; if the absolute value of actual speed does not reach (level - hysteresis) [rpm], the speed integral also returns to the setpoint of H08.01 (Speed loop integral time constant). The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.10	Gain switchover delay	-	0.0 to 1000.0	ms	5.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the delay when the drive switches from the 2nd gain set to the 1st gain set.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.11	Gain switchover level	-	0 to 20000	-	50	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the gain switchover level. Gain switchover is affected by both the level and the hysteresis, as defined by H08.09. The unit of gain switchover level varies with the switchover condition.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.12	Gain switchover time lag	-	0 to 20000	-	30	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the dead time for gain switchover. Gain switchover is affected by both the level and the hysteresis, as defined by H08.09. The unit of gain switchover dead time varies with the switchover condition.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.18	Speed feedforward filter time constant	-	0.00 to 64.00	ms	0.50	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the filter time constant of speed feedforward. The larger the filter time constant, the smoother the speed feedforward, but the greater the delay.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.19	Speed feedforward gain	-	0.0 to 100.0	%	0.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	In the position control mode, speed feedforward is the value of H08.19 multiplied by the speed feedforward signal, which is a part of the speed reference. Increasing the setpoint improves the responsivity to position references and reduces the position deviation during operation at a constant speed. Set H08.18 to a fixed value first, and then increase the value of H08.19 gradually from 0 to a certain value at which speed feedforward achieves the desired effect. Adjust H08.18 and H08.19 repeatedly until a balanced performance is achieved.								
	Note: For how to enable the speed feedforward function and select the speed feedforward signal, see H05.19 (Speed feedforward control selection).								

Parameters related to modes 3/4/6

In the other three auto-tuning modes (H09.00=3/4/6), resonance suppression is automatically performed. The related parameters are as follows.

Note

- In modes 3/4/6, the drive suppresses vibration and performs inertia auto-tuning automatically within 10 min after power-on or stiffness level setting, and then exits from auto-tuning. The time can be adjusted by the vibration suppression switch (H09.37). If inertia auto-tuning is turned off automatically, switching to modes 3, 4, or 6 will not activate inertia auto-tuning again.
- Modes 3/4/6 do not apply to applications with slow acceleration/deceleration, excessive vibration, and unstable mechanical couplings.
- The system resonance frequency will change after the load changes or re-installation of mechanical couplings. In this case, set H09.58 to "Enable", clear the resonance suppression parameters, and then enable the STune again.
- In applications where the inertia does not change, set H09.03 (Online inertia auto-tuning mode) to 1 (Enabled, changing slowly). In applications where the inertia changes quickly, set H09.03 to 3 (Enabled, changing quickly).

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.37	Phase modulation for medium-frequency suppression 2	-	-90 to +90	°	0	Signed 16-bit	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the compensation phase of medium-frequency jitter suppression 2.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.38	Frequency for medium-frequency suppression 2	-	0 to 1000	Hz	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Set this parameter based on actual resonance frequency. The active suppression frequency range for medium-frequency jitter suppression 2 is 100 Hz to 1000 Hz.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.39	Compensation gain for medium-frequency suppression 2	-	0 to 300	%	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the compensation gain for medium-frequency jitter suppression 2. When the compensation gain is excessively low, the resonance suppression effect is poor. When the compensation gain is excessively high, new resonance may be incurred. Set this parameter to a value between 40% to 55% in general cases. Setting this parameter to 0 deactivates medium-frequency jitter suppression 2.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.18	3rd notch frequency	-	50 to 8000	Hz	8000	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the center frequency of the notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 8000 Hz deactivates the notch function.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.19	3rd notch width level	-	0 to 20	-	2	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the width level of the notch. Use the default value in general cases. Width level is the ratio of the notch width to the notch center frequency.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.20	3rd notch depth level	-	0 to 99	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the depth level of the notch. The depth level of the notch is the ratio of the input to the output at the notch center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.21	4th notch frequency	-	50 to 8000	Hz	8000	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the center frequency of the notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 8000 Hz deactivates the notch function.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.22	4th notch width level	-	0 to 20	-	2	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the width level of the notch. Use the default value in general cases. Width level is the ratio of the notch width to the notch center frequency.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.23	4th notch depth level	-	0 to 99	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the depth level of the notch. The depth level of the notch is the ratio of the input to the output at the notch center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively low setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.58	STune resonance suppression reset selection	-	0 to 1	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: Disable 1: Enable								
	Description of parameters:								
	Used to enable STune resonance suppression reset, which is to clear the resonance suppression parameters automatically set in the STune mode.								

9.3.2.4 Solutions to Common Faults

Fault symptom	Cause	Solution
E661.0: STune failure	Gain drop during STune adjustment reaching the lower limit: Position loop gain < 5; Speed loop gain < 5; Model loop gain < 10	1. Set the notch manually when vibration cannot be suppressed automatically. 2. Modify the electronic gear ratio to improve the reference resolution, and increase the reference filter time constant in the "Parameter configuration" interface. 3. Check the machine for cyclic fluctuation. 4. Set H09.58 to 1 to clear resonance suppression parameters and perform STune again. 5. Increase the threshold defined by H09.11 again.

9.3.3 ITune

9.3.3.1 Overview

ITune serves to stabilize responsiveness through auto-tuning based on the device and load types.

ITune is intended to be used in applications featuring slight load inertia change or where inertia auto-tuning is unavailable.

9.3.3.2 Operation flowchart

Step	Param.	Name	Adjustment
1	H09.27	ITune mode	Setting H09.27 to 1 enables the ITune function. Note: ITune mode 2 is the manufacturer commissioning mode, which should be used with caution.
2	H09.28 H09.29	Minimum inertia ratio of ITune Maximum inertia ratio of ITune	Parameter function: It is used to adjust the inertia ratio range controlled by ITune. Adjustment method: The minimum and maximum inertia ratios of ITune are 0.0 and 30.0 by default. If the actual maximum load inertia ratio is higher than 30.0, increase the value of H09.29 to prevent positioning jitter. If the actual load inertia change range is small, set H09.28 and H09.29 based on actual conditions to achieve optimal control effect.
3	H09.26	ITune responsivity	Parameter function: It is used to adjust ITune responsiveness. Adjustment method: If the ITune responsiveness cannot deliver desired effect, increase H08.20 properly. If resonance cannot be suppressed, decrease H08.26 properly.

9.3.3.3 Precautions

After ITune is enabled, inertia auto-tuning and gain switchover will be inhibited.

9.3.3.4 Common Troubleshooting

Fault symptom	Cause	Solution
E663.0: ITune failure	Check whether resonance that occurred during ITune operation cannot be suppressed.	Set the notch manually when vibration cannot be suppressed automatically.
		Modify the electronic gear ratio to improve the command resolution, increase the command filter time constant or in the parameter configuration interface.
		Increase the value of H09.11 as appropriate.
		Check whether the current of the machine fluctuates periodically.

9.3.3.5 Related Parameters

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.18	3rd notch frequency	-	50 to 8000	Hz	8000	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the center frequency of the notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 8000 Hz deactivates the notch function.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.19	3rd notch width level	-	0 to 20	-	2	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the width level of the notch. Use the default value in general cases. Width level is the ratio of the notch width to the notch center frequency.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.20	3rd notch depth level	-	0 to 99	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the depth level of the notch. The depth level of the notch is the ratio of the input to the output at the notch center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.21	4th notch frequency	-	50 to 8000	Hz	8000	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the center frequency of the notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 8000 Hz deactivates the notch function.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.22	4th notch width level	-	0 to 20	-	2	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the width level of the notch. Use the default value in general cases. Width level is the ratio of the notch width to the notch center frequency.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.23	4th notch depth level	-	0 to 99	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the depth level of the notch. The depth level of the notch is the ratio of the input to the output at the notch center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively low setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.24	Auto-tuned resonance frequency	-	0 to 5000	Hz	0	UInt16	Read only	Ordinary user	-
	Description of parameters:								
	When adaptive notch mode is set to 3, the current mechanical resonance frequency is displayed.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.26	ITune responsivity	-	30.0 to 600.0	%	100.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Sets the ITune responsivity.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.27	ITune mode	-	0 to 20	-	0	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Sets the ITune mode. 0: Disable 1: ITune mode 1 2: ITune mode 2								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.28	Minimum inertia ratio of ITune	-	0.0 to 80.0	%	0.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Sets the minimum inertia ratio of ITune.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.29	Maximum inertia ratio of ITune	-	0.1 to 120.0	%	30.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Sets the maximum inertia ratio of ITune.								

9.4 Manual Gain Tuning

9.4.1 Basic Parameters

When gain auto-tuning cannot deliver desired performance, fine-tune the gain manually to optimize the performance.

The servo system consists of three control loops, which are the position loop, the speed loop, and the current loop from external to internal. The basic control diagram is shown in the following figure.

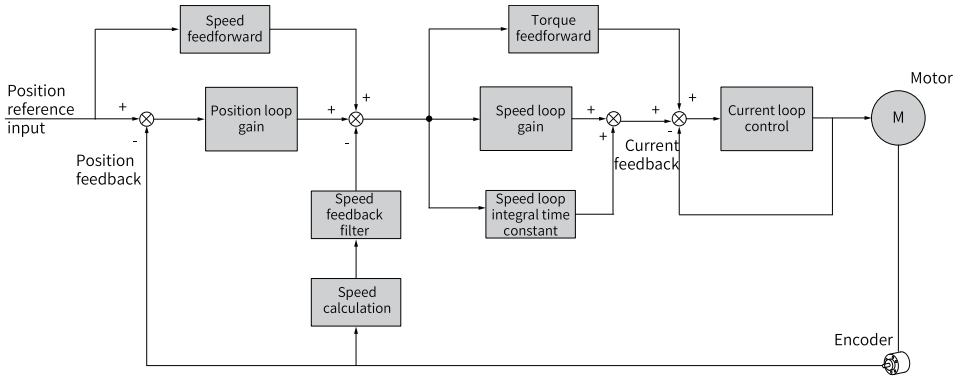


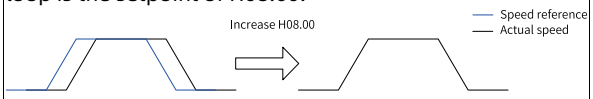
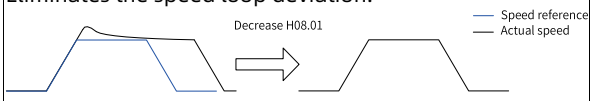
Figure 9-6 Basic control for manual gain tuning

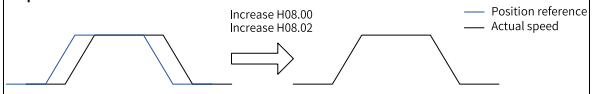
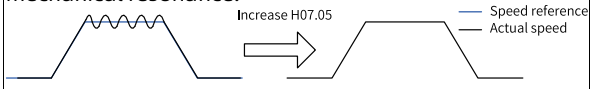
Note

The response level of the inner loop must be higher than that of the outer loop. If it is not observed, the system may be unstable.

The current loop gain has been set with the highest level of responsiveness by default, avoiding the need for tuning. You only need to adjust the position loop gain, speed loop gain, and other auxiliary gains. For gain tuning in position control mode, the position loop gain must be increased together with the speed loop gain, and the responsiveness of the former must be lower than the latter.

The following table describes how to tune the basic gain parameters.

Step	Parameter	Name	Description
1	H08.00	Speed loop gain	**Parameter function:** • Determines the maximum frequency of a variable speed reference that can be followed by the speed loop. • When H08.15 (Load inertia ratio) is correctly set, the maximum frequency that can be followed by the speed loop is the setpoint of H08.00.  **Tuning method:** • Increasing the setpoint without incurring extra noise or vibration shortens the positioning time, stabilizes the speed, and improves the follow-up behavior. • If noise occurs, decrease the setpoint. • If mechanical vibration occurs, enable the resonance suppression function according to *"9.7.2 Mechanical Resonance Suppression" on page 269*.
2	H08.01	Speed loop integral time constant	**Parameter function:** Eliminates the speed loop deviation.  **Tuning method:** • Set H08.01 according to the following formula: 500 ≤ H08.00 × H08.01 ≤ 1000.• For example, if H08.00 is set to 40.0 Hz, the setpoint of H08.01 must meet the following requirement: 12.50 ms ≤ H08.01 ≤ 25.00 ms. • Decreasing the setpoint strengthens the integral action and shortens the positioning time, but an excessively low setpoint may easily lead to mechanical vibration. • An excessively high setpoint prevents the speed loop deviation from being cleared. • When H08.01 is set to 512.00 ms, the integral is inactive.

Step	Parameter	Name	Description
3	H08.02	Position loop gain	**Parameter function:** • Defines the maximum frequency of position references that can be followed by the position loop. • The maximum following frequency of the position loop equals the value of H08.02.  **Tuning method:** • To ensure system stability, the maximum following frequency of the speed loop is 3 to 5 times of the maximum following frequency of the position loop. $3 \leqslant \frac{2 \times \pi \times H08.00}{H08.02} \leqslant 5$ • For example, when H08.00 is set to 40.0 Hz, H08.02 must meet the following requirement: 50.2 Hz ≤ H08.02 ≤ 83.7 Hz. • Adjust the setting based on the positioning time. Increasing the setpoint shortens the positioning time and improves the anti-interference capacity of a motor at standstill. • An excessively high setpoint may easily lead to system instability and oscillation.
4	H07.05	Torque reference filter time constant	**Parameter function:** Eliminates the high-frequency noise and suppresses mechanical resonance.  **Tuning method:** • Ensure that the cutoff frequency of the torque reference low-pass filter is higher than 4 times of the maximum follow frequency of the speed loop. $\frac{1000}{2 \times \pi \times H07.05} \geqslant (H08.00) \times 4$ • For example, when H08.00 is set to 40.0 Hz, the setpoint of H07.05 must be lower than or equal to 1.00 ms. • If increasing the setpoint of H08.00 incurs vibration, adjust the setpoint of H07.05 to suppress vibration. For details, see *"9.7.2 Mechanical Resonance Suppression" on page 269*. An excessively high setpoint weakens the response of the current loop. • To suppress vibration at stop, increase H08.00 and decrease H07.05. • If strong vibration occurs upon stop, decrease the setpoint of H07.05.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H07.05	Torque reference filter time constant 1	-	0.00 to 30.00	ms	0.50	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the torque reference filter time constant 1. Low-pass filtering on the torque references smoothens the torque references and reduces vibration. Note that an excessively high setpoint can reduce responsiveness. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.00	Speed loop gain	-	0.1 to 2000.0	Hz	40.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed loop proportional gain. This parameter determines the response of the speed loop. The higher the setpoint, the higher the response. Note that an excessively high setpoint may cause vibration. In the position control mode, the position loop gain must be increased together with the speed loop gain.								
	Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.01	Speed loop integral time constant	-	0.15 to 512.00	ms	19.89	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed loop integral time constant. The lower the setpoint, the better the integral action, and the quicker will the deviation value be close to 0. There is no integral action when this parameter is set to 512.00. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.02	Position loop gain	-	0.1 to 2000.0	Hz	64.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the proportional gain of the position loop. This parameter defines the response of the position loop. A high setpoint shortens the positioning time. Note that an excessively high setpoint may cause vibration. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

9.4.2 Gain switchover

Gain switchover, which is active in the position control and speed control modes only, can be triggered by the internal servo status or an external DI signal to achieve the following purposes:

- Switching to the lower gain when the motor is at a standstill (servo ON) to suppress vibration
- Switching to the higher gain when the motor is at a standstill to shorten the positioning time
- Switching to the higher gain during operation of the motor to achieve better reference tracking performance
- Switching between different gain settings through an external signal to fit different conditions of the load devices

H08.08=0

When H08.08 is set to 0, the 1st gain set (H08.00 to H08.02 and H07.05) is used. However, you can switch between proportional control and proportional integral control through .3 (GAIN_SEL, gain switchover) of the DI for the speed loop.

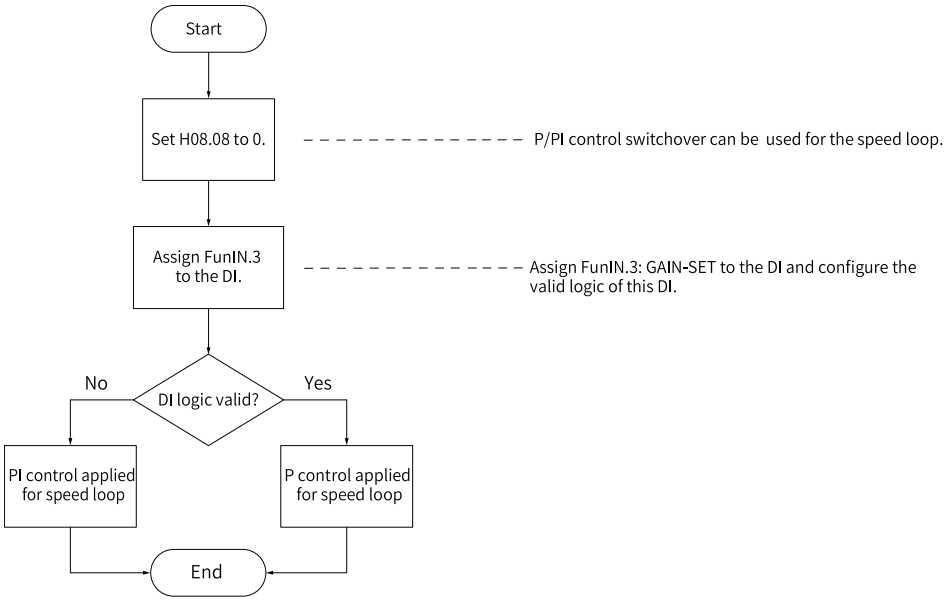


Figure 9-7 Gain switchover flowchart (H08.08 set to 0)

H08.08=1

You can switch between the 1st gain set (H08.00...H08.02, H07.05) and 2nd gain set (H08.03... H08.05, H07.06) based on the condition defined by H08.09.

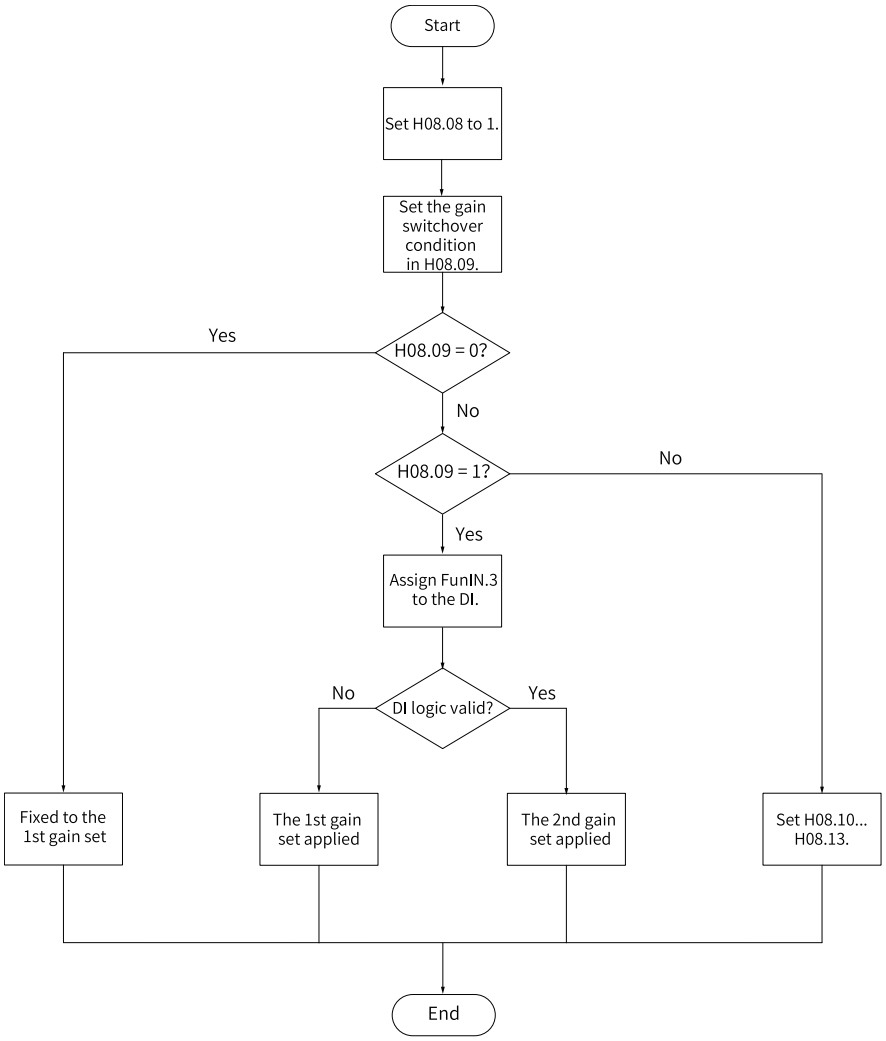
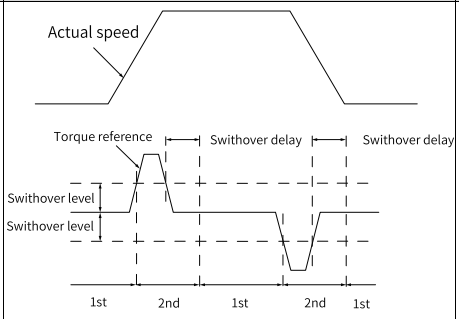
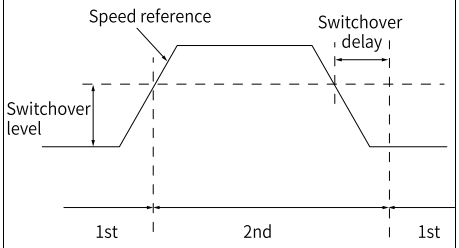
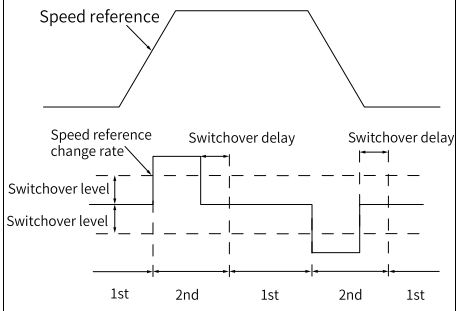
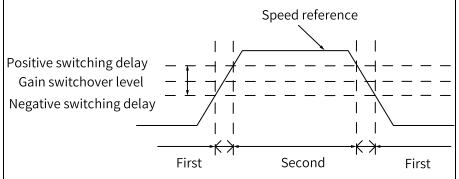
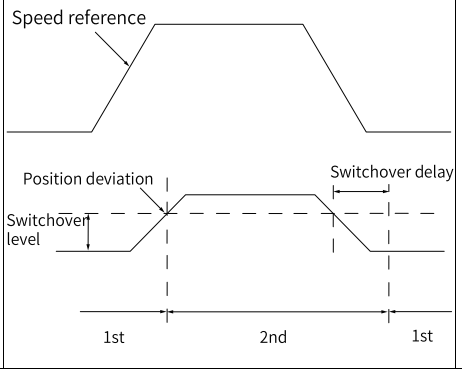


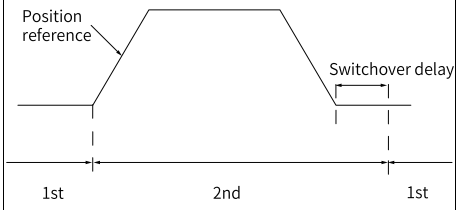
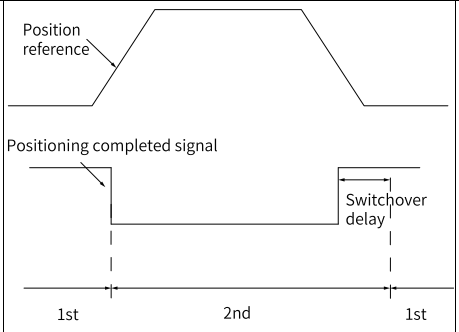
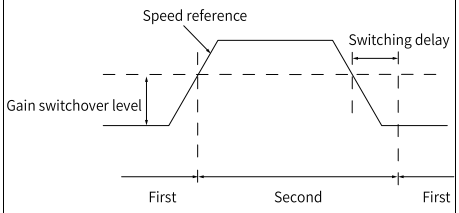
Figure 9-8 Gain switchover flowchart when H08.08 is set to 1

The following table describes the diagrams and parameters related to 11 kinds of gain switchover conditions.

Table 9–4 Gain switchover conditions

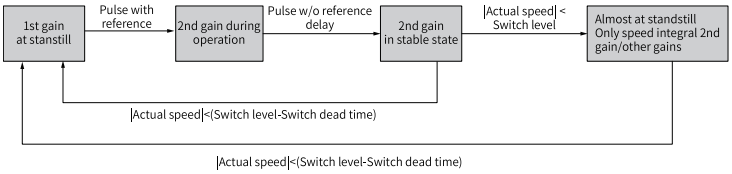
Gain Switchover Condition			Related Parameters		
H08.09	Condition	Diagram	Gain switchover delay (H08.10)	Switchover level (H08.11)	Switchover Dead Time (H08.12)
0	Fixed at 1st gain	-	Invalid	Invalid	Invalid
1	Switchover by DI	-	Invalid	Invalid	Invalid

Gain Switchover Condition			Related Parameters		
H08.09	Condition	Diagram	Gain switchover delay (H08.10)	Switchover level (H08.11)	Switchover Dead Time (H08.12)
2	Torque reference		Enable	Enable (%)	Enable (%)
3	Speed reference		Enable	Enable	Enable
4	Speed reference change rate		Enable	Enable (10 rpm/s)	Enable (10 rpm/s)
5	High/Low-speed threshold of speed reference		Invalid	Enable (rpm)	Enable (rpm)
6	Position deviation		Enable	Enable (encoder unit)	Enable (encoder unit)

Gain Switchover Condition			Related Parameters		
H08.09	Condition	Diagram	Gain switchover delay (H08.10)	Switchover level (H08.11)	Switchover Dead Time (H08.12)
7	Position demand value		Enable	Invalid	Invalid
8	Positioning not completed		Enable	Invalid	Invalid
9	Actual velocity		Enable	Enable (rpm)	Enable (rpm)
10	Position reference available + Actual speed	See the following note for details.	Enable	Enable (rpm)	Enable (rpm)

Note

- H08.10 (Gain switchover delay) is active only during switching to the 1st gain set.
- The logic flowchart for gain switchover is as follows:



Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.08	Second gain mode setting	-	0 to 1	-	1	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: Fixed to the 1st gain, switched between P and PI by external DI 1: Switched between the 1st and 2nd gain according to H08.09								
	Description of parameters:								
	Defines the mode for switching to the 2nd gain.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.09	Gain switchover condition	-	0 to 10	-	0	UInt16	Real-time	Ordinary user	Effective in real time

Value:

0: Fixed to the 1st gain (PS) 1: DI (Func3) switchover 2: Torque reference too large (PS) 3: Speed reference too large (PS) 4: Speed reference change rate too large (PS) 5: Speed reference high-speed/low-speed thresholds (PS)	6: Position deviation too large (P) 7: Position reference available (P) 8: Positioning uncompleted (P) 9: Actual speed (P) 10: Position reference available + Actual speed (P)

Description of parameters:

Defines the gain switchover condition. See the following table for gain switchover conditions.

Set value	Gain switching condition	Remarks
0	Fixed to the first gain	The gain is fixed to the first gain.
1	DI (Func3) switchover	-
2	Torque reference too large	When the absolute value of the torque reference exceeds (level + hysteresis) [%] in the previous first gain, switch to second gain. If the absolute value of the torque reference is lower than (level – hysteresis) [%] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set.
3	Speed reference too large	When the absolute value of the speed reference exceeds (level + hysteresis) [rpm] in the 1st gain, the servo drive switches to the 2nd gain. When the absolute value of the speed reference is lower than (level - hysteresis) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set.
4	Speed reference change rate too large	It is effective only in non-speed control mode. When the absolute value of the speed reference change rate exceeds (level + hysteresis) [10 rpm/s] in the previous first gain, the drive switches to the 2nd gain. When the absolute value of the speed reference change rate is lower than (level – hysteresis) [10 rpm/s] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set. The 1st gain is always used in the speed control mode.
5	Speed reference high-speed/low-speed thresholds	When the speed reference absolute value exceeds (level - hysteresis) [rpm] in the last 1st gain, the drive starts to switch to the 2nd gain, with gains changing gradually. When the speed reference absolute value reaches (level + hysteresis) [rpm], the 2nd gain applies. When the speed reference absolute value is lower than (level + hysteresis) [rpm] in the last 2nd gain, the drive starts to return to the 1st gain, with gains changing gradually. When the speed reference absolute value reaches (level + hysteresis) [rpm], the 1st gain applies.

	6	Position deviation too large	It is effective only in position control mode. When the absolute value of the position deviation exceeds (level + hysteresis) [encoder units] in the previous first gain, the drive switches to the 2nd gain. When the absolute value of the position deviation is lower than (level - hysteresis) [encoder unit] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
	7	Position reference available	It is effective only in position control mode. When the position reference is not 0 in the previous first gain, the drive switches to the 2nd gain. When the position reference is 0 and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
	8	Positioning uncompleted	It is effective only in position control mode. When positioning is not complete in the previous first gain, the drive switches to the 2nd gain. When positioning is not complete and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the servo drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
	9	Actual speed	It is effective only in position control mode. When the absolute value of the actual speed exceeds (level + hysteresis) [rpm] in the previous first gain, the drive switches to the 2nd gain. When the absolute value of actual speed is lower than (level - hysteresis) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
	10	Position reference available + Actual speed	It is effective only in position control mode. When the position command is not 0 in the previous 1st gain, the drive switches to the 2nd gain. When the position reference is 0 and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the 2nd gain set applies. When the position reference is 0 and the delay defined by (H08.10) is reached, if the absolute value of actual speed is lower than (Level) [rpm], the speed loop integral time constant is fixed to the setpoint of H08.04 (2nd speed loop integral time constant), and others return to the 1st gain; if the absolute value of actual speed does not reach (level - hysteresis) [rpm], the speed integral also returns to the setpoint of H08.01 (Speed loop integral time constant). The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.10	Gain switchover delay	-	0.0 to 1000.0	ms	5.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the delay when the drive switches from the 2nd gain set to the 1st gain set.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.11	Gain switchover level	-	0 to 20000	-	50	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the gain switchover level. Gain switchover is affected by both the level and the hysteresis, as defined by H08.09. The unit of gain switchover level varies with the switchover condition.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.12	Gain switchover time lag	-	0 to 20000	-	30	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the dead time for gain switchover. Gain switchover is affected by both the level and the hysteresis, as defined by H08.09. The unit of gain switchover dead time varies with the switchover condition.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.13	Position gain switchover time	-	0.0 to 1000.0	ms	3.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	In position control, if H08.05 (2nd position loop gain) is much higher than H08.02 (Position loop gain), you can set the time for switching from H08.02 to H08.05 through this parameter. This parameter can be used to reduce the impact caused by an increase in the position loop gain.								

9.4.3 Position Reference Filter

Name	Function	Applicable occasion	Impact of excessive filtering
Position Reference Filter	The position reference filter is used to filter the position references (in encoder unit) divided or multiplied by the electronic gear ratio, smoothening motor operation and reducing impact to the machine.	• Acceleration/Deceleration is not processed on the position references sent from the host controller. • The pulse frequency is low. • The electronic gear ratio is higher than 10.	The response delay is prolonged.

9.4.4 Feedforward Gain Tuning

Speed feedforward

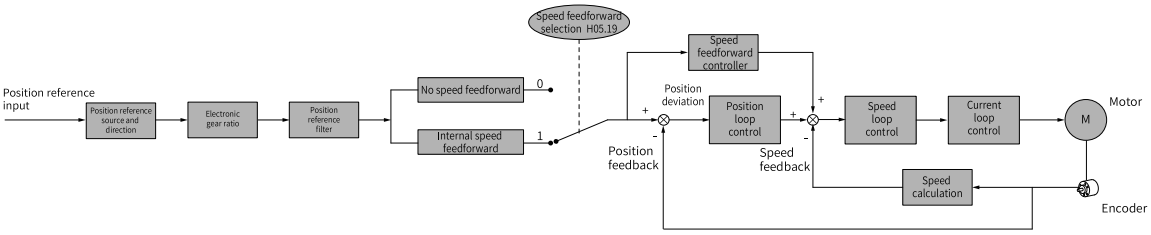


Figure 9-9 Block diagram of speed feedforward control

Speed feedforward can be applied to position control mode. The speed feedforward function can be used to improve the speed reference responsiveness and reduce the position deviation at fixed speed.

Operating procedure for speed feedforward:

1. Setting the speed feedforward signal source:
   Set H05.19 (Speed feedforward control) to a non-zero value to enable the speed feedforward function. The corresponding signal source will be selected as well.
2. Setting speed feedforward parameters:
   Speed feedforward parameters include H08.19 (Speed feedforward gain) and H08.18 (Speed feedforward filter time constant).

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H05.19	Speed feedforward control	-	0 to 2	-	1	UInt16	At stop	Ordinary user	Effective in real time
	Value:								
	0: No speed feedforward 1: Internal speed feedforward 2: PLC speed feedforward								
	Description of parameters:								
	Defines the source of the speed loop feedforward signal. In the position control mode, speed feedforward control can be used to improve the position reference response speed. Parameters for speed feedforward control include H08.18 (Speed feedforward filter time constant) and H08.19 (Speed feedforward gain). If PLC speed feedforward is set without the DSC function enabled, it is equivalent to no speed feedforward.								

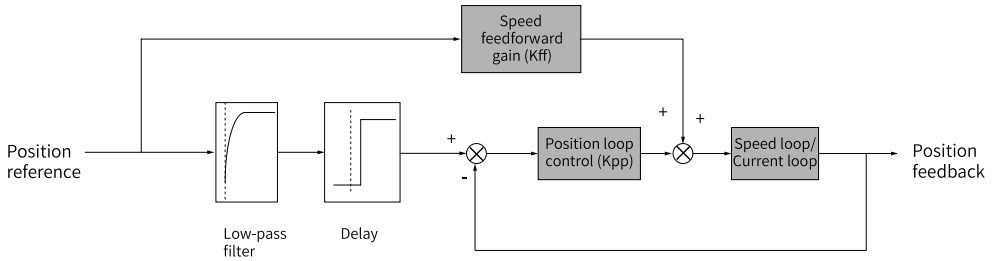
Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.18	Speed feedforward filter time constant	-	0.00 to 64.00	ms	0.50	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the filter time constant of speed feedforward. The larger the filter time constant, the smoother the speed feedforward, but the greater the delay.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.19	Speed feedforward gain	-	0.0 to 100.0	%	0.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	In the position control mode, speed feedforward is the value of H08.19 multiplied by the speed feedforward signal, which is a part of the speed reference. Increasing the setpoint improves the responsivity to position references and reduces the position deviation during operation at a constant speed. Set H08.18 to a fixed value first, and then increase the value of H08.19 gradually from 0 to a certain value at which speed feedforward achieves the desired effect. Adjust H08.18 and H08.19 repeatedly until a balanced performance is achieved.								
	Note: For how to enable the speed feedforward function and select the speed feedforward signal, see H05.19 (Speed feedforward control selection).								

Zero phase control

Zero phase control is used to compensate for the position deviation generated upon start delay of the position reference, reducing the position deviation upon start/stop in the position control mode.

The loop calculation model is shown in the following figure.



Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H05.04	Time constant of first-order low-pass filter	-	0.0 to 6553.5	ms	0.0	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the first-order low pass filter time constant of position references.								

Torque feedforward

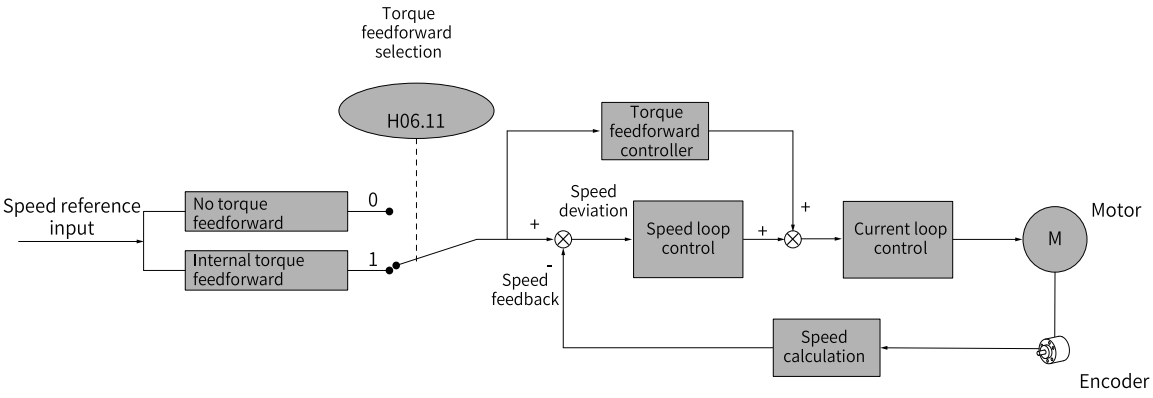


Figure 9-10 Block diagram of torque feedforward control

In the position control mode, torque feedforward can be used to improve torque reference response and reduce the position deviation during operation at constant acceleration/deceleration rate.
In the speed control mode, torque feedforward can be used to improve speed reference response and reduce the speed deviation during operation at constant speed.

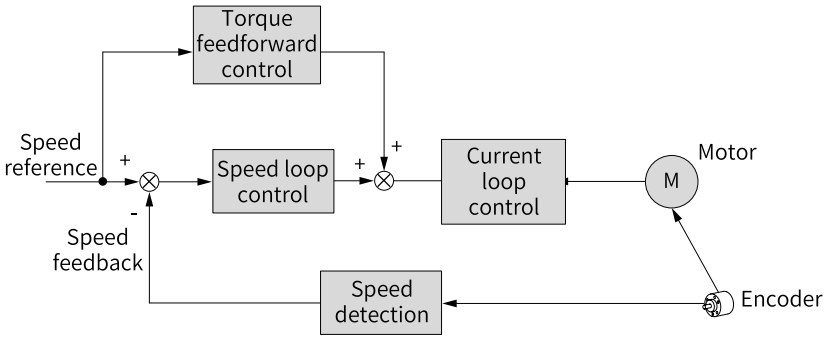
The procedure for setting torque feedforward is as follows:

1. Setting the torque feedforward signal source:
   Set H06.11 (Torque feedforward control) to a non-zero value to activate the torque feedforward function and locate the corresponding signal source.

2. Setting torque feedforward parameters:

   - H08.21 (Torque feedforward gain): Increasing this parameter improves response, but may cause overshoot during acceleration/deceleration.
   - H08.20 (Torque feedforward filter time constant): Increasing this parameter suppresses noise; decreasing this parameter suppresses overshoot during acceleration/deceleration.

   Keep H08.20 to the default value, and then gradually increase the value of H08.21 from 0 to a certain value at which torque feedforward achieves the desired effect. Adjust H08.20 and H08.21 repeatedly until a balanced performance is achieved.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H06.11	Torque feedforward control	-	0 to 1	-	1	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: No torque feedforward 1: Internal torque feedforward								
	Description of parameters:								
	Defines whether to enable the internal torque feedforward function in a non-torque control mode. Torque feedforward can be used to improve the torque reference response speed and reduce the position deviation during acceleration/deceleration at constant speed. Parameters of the torque feedforward function include H08.21 (Torque feedforward gain) and H08.20 (Torque feedforward filter time constant). For details, see section "Feedforward Gain". In control modes other than torque control, the control block diagram of torque feedforward is shown in the following figure.  								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.20	Torque feedforward filter time constant	-	0.00 to 64.00	ms	0.50	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the filter time constant of torque feedforward. The larger the filter time constant, the smoother the torque feedforward, but the greater the delay.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.21	Torque feedforward gain	-	0.0 to 300.0	%	0.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	In control modes other than torque control, torque feedforward is the product of torque feedforward signal multiplied by H08.21 and is part of the torque reference. Increasing the setpoint improves the response to variable speed references. Increasing the setpoint improves the responsivity to position references and reduces the position deviation during operation at a constant speed. When adjusting torque feedforward parameter, set H08.20 (Torque feedforward filter time constant) to the default value first, and then increase H08.21 gradually to enhance the effect of torque feedforward. When speed overshoot occurs, keep H08.21 unchanged and increase the value of H08.20. Adjust H08.20 and H08.21 repeatedly until a balanced performance is achieved.								

9.4.5 Pseudo Differential Feedforward Control

In control modes other than torque control, the speed loop control mode can be adjusted through pseudo differential feedforward control.

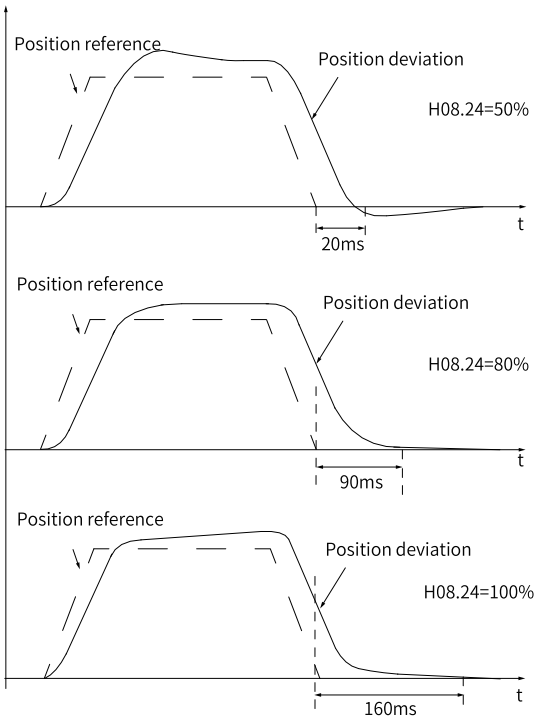


Figure 9-11 Example of pseudo differential feedforward control

Through adjusting the speed loop control method, pseudo differential feedforward control enhances the anti-disturbance capacity of the speed loop and improves the performance in following the speed references.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.24	Pseudo derivative feedforward control coefficient	-	0.0 to 200.0	%	100.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the control mode of the speed loop. • When this parameter is set to 100.0, the speed loop control method does not change and the default proportional integral control applies. • When the parameter is set to 200.0, PI control (default control mode of the speed loop) is applied to the speed loop, which features fast dynamic response. • When this parameter is set to 0.0, speed loop integral action is enhanced, which filters out low-frequency interference but also slows down the dynamic response. When the speed feedback overshoots, gradually decrease the setpoint of H08.24 from 100.0 to a certain value at which the PDFF control achieves the desired effect. This parameter can be used to keep a quick response of the speed loop, with the anti-interference capacity in low-frequency bands improved and the speed feedback overshoot unaffected.								

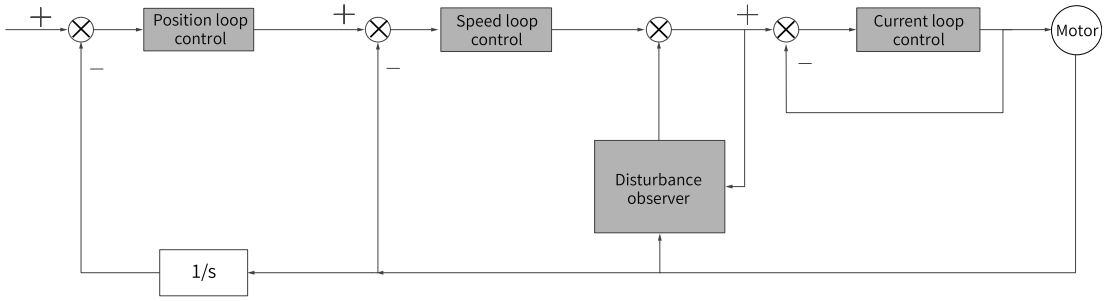
9.4.6 Torque Disturbance Observer

This function is intended to be used in the non-torque control modes.

Disturbance observer

The disturbance observer effectively observes and suppresses disturbances within the frequency range through different cutoff frequencies and compensation coefficients, therefore balancing response speed and stability.

The following figure shows the function block diagram for disturbance observer.



Note:

1/s: Integral term

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.31	Disturbance cut-off frequency	-	1 to 4000	Hz	600	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the cutoff frequency of the disturbance observer. Increasing the setpoint improves the responsivity of the disturbance observer and the compensation effect. Note that an excessively high setpoint may incur resonance.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.32	Disturbance compensation gain	-	0 to 100	%	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the compensation gain of the disturbance observer. When the gain is set to a value other than 0, the disturbance observer compensation function is enabled, allowing effective observation and suppression of disturbances within the frequency range. Full compensation applies when this parameter is set to 100.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.33	Disturbance observer inertia calibration coefficient	-	1 to 1600	%	100	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the disturbance observer inertia correction coefficient. If H08.15 is set based on the actual inertia, there is no need to adjust this parameter.								

9.4.7 Model Tracking

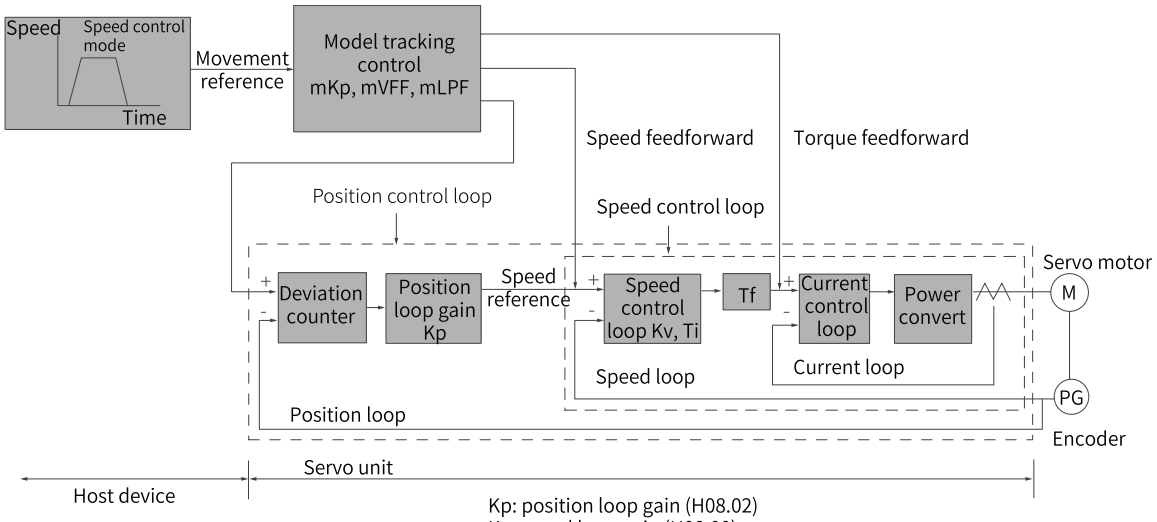
The model tracking control, which is only available in the position control mode, can be used to improve responsiveness and shorten the positioning time. It is only available in the position control mode.

Parameters used by model tracking are normally set automatically through STune or ETune along with the gain parameters.

However, manual tuning is needed in the following situations:

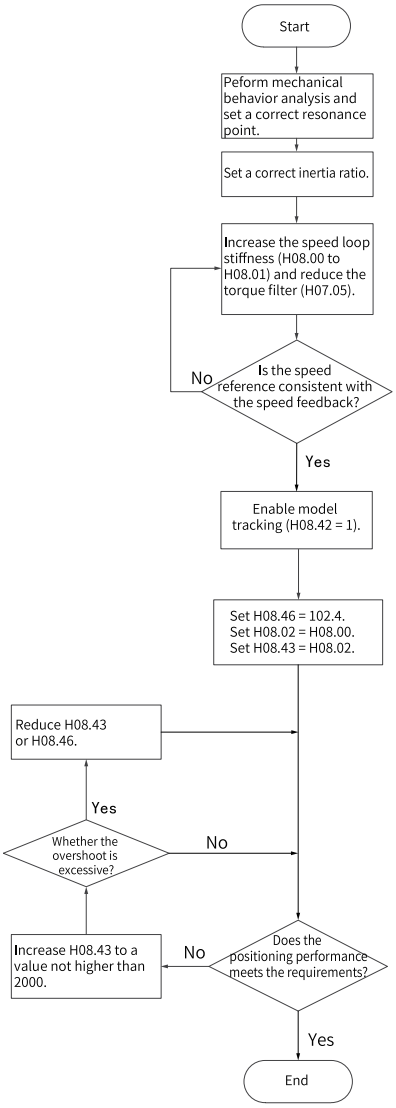
- The auto-tuned values cannot deliver desired performance.
- Improving the responsiveness takes priority over the auto-tuned or customized values.
- User-defined gain parameters or model tracking control parameters are needed.

The block diagram for model tracking control is as follows.



Kp: position loop gain (H08.02)
Kv: speed loop gain (H08.00)
Ti: speed loop integral time constant (H08.01)
Tf: torque reference filter time constant (H07.05)
mKp: model tracking control gain (H08.43)
mVFF: speed feedforward compensation in model tracking control (H08.46)
mLPF: model filter time

Commissioning procedure



Note

Ensure the set inertia is accurate. Otherwise, motor vibration may occur.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H07.05	Torque reference filter time constant 1	-	0.00 to 30.00	ms	0.50	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the torque reference filter time constant 1. Low-pass filtering on the torque references smoothens the torque references and reduces vibration. Note that an excessively high setpoint can reduce responsiveness. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.00	Speed loop gain	-	0.1 to 2000.0	Hz	40.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed loop proportional gain. This parameter determines the response of the speed loop. The higher the setpoint, the higher the response. Note that an excessively high setpoint may cause vibration. In the position control mode, the position loop gain must be increased together with the speed loop gain.								
	Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.01	Speed loop integral time constant	-	0.15 to 512.00	ms	19.89	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed loop integral time constant. The lower the setpoint, the better the integral action, and the quicker will the deviation value be close to 0. There is no integral action when this parameter is set to 512.00. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.02	Position loop gain	-	0.1 to 2000.0	Hz	64.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the proportional gain of the position loop. This parameter defines the response of the position loop. A high setpoint shortens the positioning time. Note that an excessively high setpoint may cause vibration. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.42	Model control selection	-	0 to 2	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: Disable 1: Enable 2: Dual-inertia model								
	Description of parameters:								
	Used to enable model tracking control. Enabling this function improves response and reduces positioning time. It is only available in the position control mode.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.43	Model gain	-	0.1 to 2000.0	-	40.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the single inertia model gain. The higher the gain, the faster the position response. Note that an excessively high setpoint may incur excessive overshoot.								

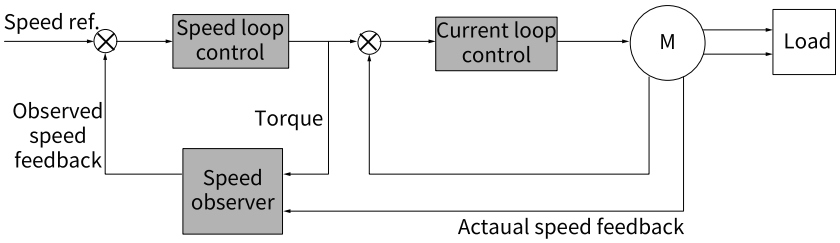
Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.46	Feedfor ward value	-	0.0 to 102.4	-	95.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed feedforward gain for single inertia model control. If overshoot occurs, reduce the setpoint properly.								

9.4.8 Speed Observer

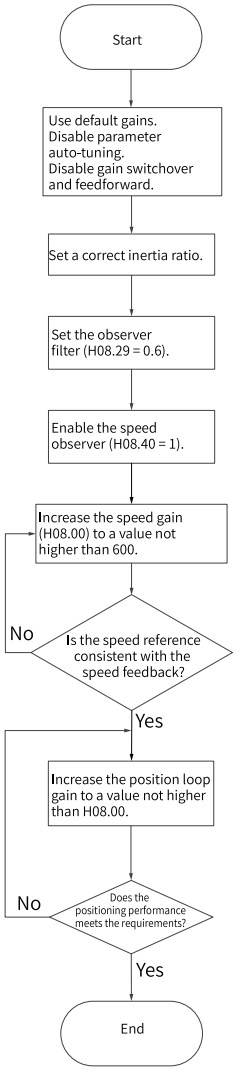
The speed observer is mainly applicable to scenarios with small variations in load characteristics and negligible inertia changes, which helps achieve rapid positioning.

It can be used to increase the response range, automatically filter out high-frequency components, thereby shortening positioning time while increasing gain, and simultaneously reducing high-frequency vibration.

The block diagram for the speed observer is shown as follows.



Commissioning procedure



Note

- Before using the speed observer, set H08.15 (Load inertia ratio) to a proper value or perform inertia auto-tuning. A wrong inertia ratio can cause vibration.
- Setting H08.27, H08.28, or H08.29 to excessively low or high values will result in motor vibration.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.00	Speed loop gain	-	0.1 to 2000.0	Hz	40.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed loop proportional gain. This parameter determines the response of the speed loop. The higher the setpoint, the higher the response. Note that an excessively high setpoint may cause vibration. In the position control mode, the position loop gain must be increased together with the speed loop gain.								
	Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.27	Cut-off frequency of speed observer	-	50 to 600	Hz	170	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the cutoff frequency of the speed observer. Note that an excessively high setpoint may incur resonance. Decrease the setpoint properly in case of excessive speed feedback noise.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.28	Inertia correction coefficient of speed observer	-	1 to 1600	%	100	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed observer inertia calibration coefficient. When H08.15 does not match the actual inertia ratio, the calibration factor = (actual inertia ratio + 1)/H08.15 x 100%. If H08.15 is set according to the actual inertia ratio, this calibration factor does not need to be modified.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.29	Speed observer filter time	-	0.00 to 10.00	ms	0.80	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the speed observer filter time. It is recommended to set this parameter to a value equal to the sum of H07.05 plus 0.2 ms. The longer the filtering time, the lower the fluctuation of the speed feedback observation value, but the greater the delay of the speed feedback observation value can be.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.40	Speed observer	-	0 to 1	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: Disable 1: Enable								
	Description of parameters:								
	Sets the enable bit for speed observer. After enabling this function, high-frequency noise in the speed feedback can be filtered out, improving the response range.								

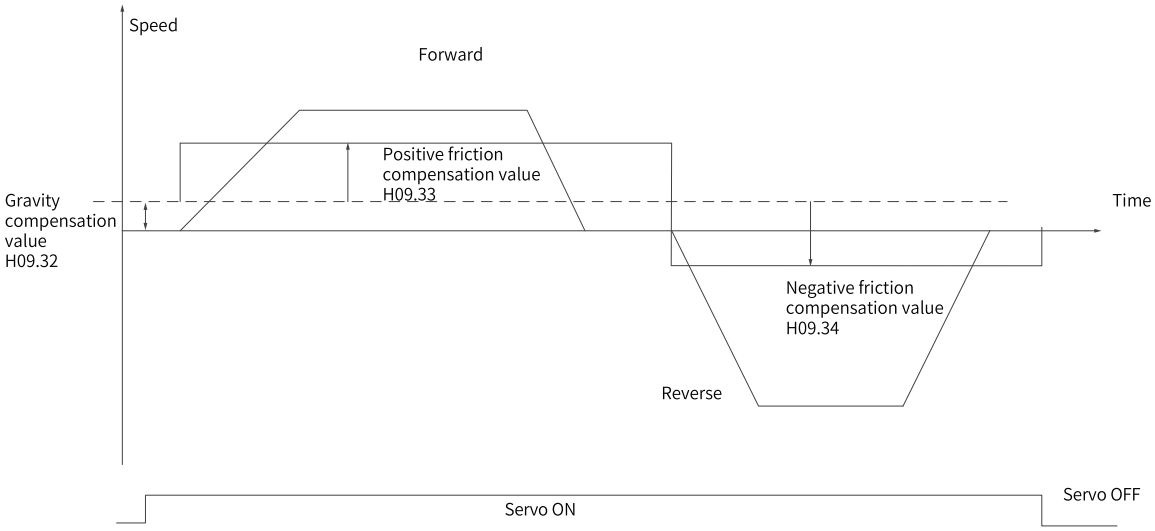
9.4.9 Friction Compensation

Friction compensation is used to reduce the impact of the friction on the operation effect during mechanical transmission. Use different positive/negative compensation values according to the direction of operation.

Note

Friction compensation is active only in the position mode.

The diagram for friction compensation is as follows.



Note

When the speed is lower than the speed threshold, static friction applies. When the speed exceeds the speed threshold, dynamic friction applies. The compensation direction is determined by the direction of the actual position reference. Forward direction requires positive compensation value. Reverse direction requires negative compensation value.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.32	Gravity compensation value	-	-100.0 to +100.0	%	0.0	Signed 16-bit	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the gravity compensation value. In vertical axis applications, this value can be set to counteract the effects of gravity, reducing the initial drop during startup. It is recommended to start with low values and gradually increase the setpoint.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.33	Positive friction compensation value	-	0.0 to 100.0	%	0.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the positive friction compensation value. See section "Friction Compensation" for details.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.34	Reverse friction compensation value	-	-100.0 to 0.0	%	0.0	Signed 16-bit	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the negative friction compensation value. See section "Friction Compensation" for details.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.35	Friction compensation speed	-	0.0 to 20.0	-	2.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the friction compensation speed. See section "Friction Compensation" for details.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.36	Friction compensation speed	-	0x0 to 0x13	-	0x0	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0x00: Slow speed mode + Speed reference 0x01: Slow speed mode + Model speed 0x02: Slow speed mode + Speed feedback 0x03: Slow speed mode + Observe speed 0x10: High speed mode + Speed reference 0x11: High speed mode + Model speed 0x12: High speed mode + Speed feedback 0x13: High speed mode + Observe speed								
	Description of parameters:								
	Defines the friction compensation speed source.								

9.5 Tuning in DSC Mode

9.5.1 DSC Mode Description

If the dynamic servo control (DSC) function of telegram 105 is enabled, the servo drive takes the place of the host controller in position loop calculation and interpolation. In this way, the fast control clock of the servo drive helps improve the quality and performance of positioning. Configure the DSC function of telegram 105 by modifying the values of different bits of H24.67.

- The position loop gain is used when DSC is enabled.
  Modifying the value of H24.67 bit0 allows you to select the effective position loop gain for the servo drive.

  When H24.67 bit0 is set to 1 (PLC gain enabled), the servo drive uses the position loop gain sent by the host controller. The local position loop gain (H08.02) of the drive becomes ineffective. By default, the drive uses the position loop gain sent by the host controller under message 105.

  When H24.67 bit0 is set to 0 (Local gain enabled), the servo drive uses the local position loop gain (H08.02). The position loop gain sent by the host controller becomes ineffective.

- Enable the speed feedforward NSOLL_B of the host controller.
  Modifying the value of H24.67 bit1 allows you to select whether to enable the speed feedforward NSOLL_B (pre-control) sent by the host controller.

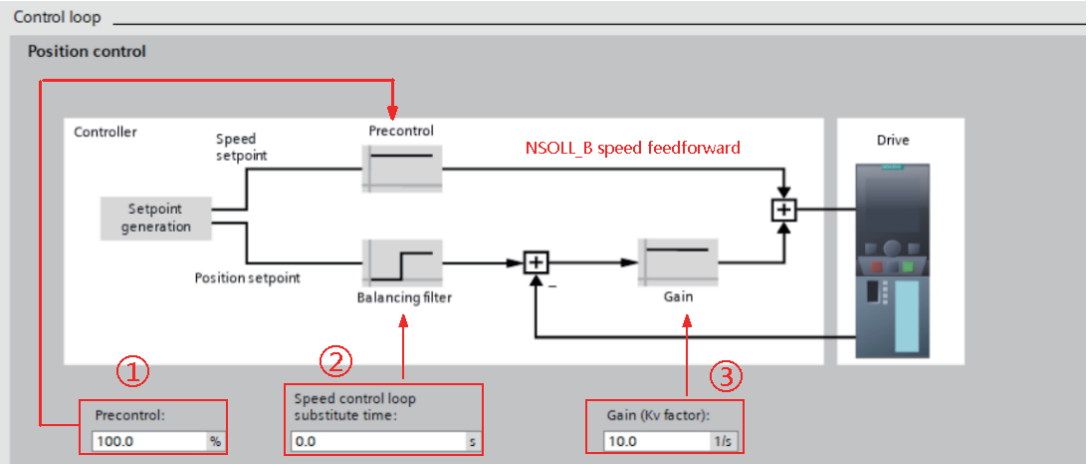
  When H24.67 bit1 is set to 1 (Enabled), the servo drive uses the speed feedforward sent by the host controller, which is the default setting under message 105.

  When H24.67 bit1 is set to 0 (Disabled), the servo drive uses the internal speed feedforward instead of the speed feedforward sent by the host controller.

9.5.2 DSC Parameter Adjustment Process

- **Adjusting parameters using the host controller gain**

  1. Set H24.67 bit0 to 1 (PLC gain enabled) and H24.67 bit1 to 1 (Enable NSOLL_B, default). The host controller periodically sends position commands and speed feedforward to the servo drive for execution. The servo drive operates using the position loop gain (as shown in ③) and speed feedforward (adjusted via the pre-control coefficient in ①) sent by the host controller.



2. It is recommended to set H09.00 to 1 and 4 (Stune modes 1 and 4). Then perform auto-tuning on the correct load inertia ratio.
3. Set the position loop gain of the process object (③) to the maximum DSC K_V coefficient estimation (H24.55). Set the replacement time of the revolution control circuit of the process object (unit: s, ②) to the symmetric time constant estimation x 0.001 (H24.56). Set the pre-control coefficient to 100 (①).
4. Monitor the position error of the servo drive or host controller. If overshoot occurs, increase the stiffness level of the servo drive (H09.01), increase the position loop gain of the host controller (within 200% of H24.55), and reduce the pre-control coefficient. If the response is too slow, increase the position loop gain of the host controller, increase the pre-control coefficient, and reduce the revolution control replacement time of the process object.

- **Adjusting parameters using the drive local gain**

1. Set H24.67 bit0 to 0 (Enable local gain) and H24.67 bit1 to 0 (Disable NSOLL_B). After the setting, the host controller periodically sends position commands to the servo drive for execution. The servo drive operates using the internal position loop gain (H08.02) and does not use speed feedforward sent by the host controller.
2. Parameter adjustment in this mode is the same as that in position control mode. For details, see *"9.6.1 Parameter Adjustment in Position Control Mode" on page 263*.

- **DSC spline interpolation function**

The DSC spline interpolation function performs spline interpolation on the commands received from the host periodically to generate smoother position, speed feedforward, and torque feedforward, thereby improving trajectory accuracy.

Confirm that the servo drive is configured to the DSC position mode through the host controller and the position commands meet a certain level of smoothness. Then set all bits of H24.68 (DSC control word) to "Enabled". In this case, the DSC spline interpolation function is enabled.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H24.67	Telegram 105 configuration	-	0x0 to 0x3	-	0x3	UInt16	At stop	Ordinary user	Effective in real time

Value:

Position	Name	Value
bit0	When DSC is enabled, enable the PLC position loop gain.	0: Enable local gain 1: Enable PLC gain
bit1	NSOLL_B	0: Disable 1: Enable

Description of parameters:

Configures the telegram 105.
Note: In the telegram 105, when DSC is enabled, NSOLL_B serves as speed feedforward; when DSC is disabled, NSOLL_B serves as speed reference.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H24.68	DSC control word (DSC_STW)	-	0x0 to 0xFFFF	-	0x0	UInt16	Real-time	Ordinary user	Effective in real time

Value:

Position	Name	Value
bit0	Spline-based DSC	0: Disable 1: Enable
bit4	Enable speed feedforward in spline-based DSC	0: Disable 1: Enable
bit5	Enable torque feedforward in spline-based DSC	0: Disable 1: Enable

Description of parameters:

It is the DSC control word, which is used to set the interpolation method for DSC.
Note: When spline interpolation is enabled, ensure the following conditions are met; otherwise, vibration and runaway may occur:
1. Process object configuration: Enable position control in the drive unit (Enable DSC), set the PLC pre-control to 100%, and set the replacement time for the revolution control loop to 0.
2. Instructions such as MC_POWER and MC_MOVEJOG are all configured to position mode (position-controlled axis).
3. H24.33 is properly set.

9.5.3 DSC Compatibility

Version 802.8 and later (H01.00) of the SV660F supports the DSC function. You can select the DSC function by modifying the value of H24.32.

Note

When H24.32 is not set to 0, the DSC compatibility function is enabled and a specific DSC compatibility function is selected. Modifying H24.67 will not affect the DSC compatibility function.

Table 9–5 DSC compatibility function selection

Param.	Data	Meaning
H24.32	1	PLC position loop gain
	3	DSC manual adjustment

- **PLC adjustment (H24.32 = 1)**

  Adjust the servo drive gain parameters by adjusting the pre-control and gain parameters of the PLC. When the servo drive is in non-STune mode, H09.00 must not be modified.

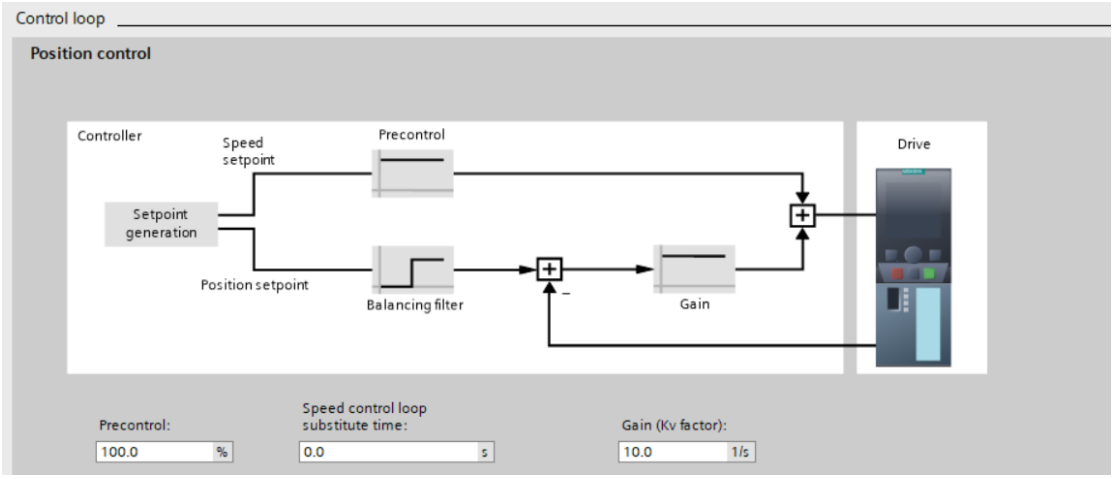


Figure 9-12 Gain adjustment at the PLC

- **DSC manual adjustment (H24.32 = 3)**

  The servo gain parameter can be manually adjusted.

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H24.32	DSC compatibility position loop gain selection	-	0 to 3	-	0	UInt16	At stop	Standard user	Real time
	Value:								
	0: Disable DSC compatibility function 1: PLC position loop gain 3: DSC manual adjustment								
	Parameter description:								
	If you use telegram 105, selecting 0 disables the DSC compatibility function. To enable DSC compatibility, select a non-zero value.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H24.34	DSC compatibility loop gain selection switch	-	0 to 1	-	0	UInt16	At stop	Ordinary user	Effective in real time
	Value:								
	0: Stiffness level adapted based on DSC gain 1: Stiffness level adapted based on H09.01								
	Description of parameters:								
	Sets the loop gain.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H24.48	DSC compatibility position loop gain coefficient	-	1 to 31	-	10	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Sets the DSC compatibility position loop gain coefficient.								

9.6 Parameter Tuning in Different Control Modes

Perform parameter adjustment in the sequence of "Inertia auto-tuning" → "Gain auto-tuning" → "Manual gain tuning" in all the control modes.

9.6.1 Parameter Adjustment in Position Control Mode

Obtain the value of H08.15 (load inertia ratio) by performing inertia auto-tuning.

Gain Parameters in Position Control Mode:

- 1st gain set:

Parameter code	Parameter name	Description	Default value
H07.05	Torque reference filter time constant 1	Defines the torque reference filter time constant.	0.50 ms
H08.00	Speed loop gain	Defines the speed loop proportional gain.	40.0 Hz
H08.01	Speed loop integral time constant	Defines the integral time constant of the speed loop.	19.89 ms
H08.02	Position loop gain	Defines the position loop proportional gain.	64.0 Hz

- 2nd gain set:

Parameter code	Parameter name	Description	Default value
H07.06	Torque reference filter time constant 2	Defines the torque reference filter time constant.	0.27 ms
H08.03	2nd speed loop gain	Defines the speed loop proportional gain.	75.0 Hz
H08.04	2nd speed loop integral time constant	Defines the integral time constant of the speed loop.	10.61 ms
H08.05	2nd position loop gain	Defines the position loop proportional gain.	120.0 Hz
H08.08	2nd gain mode setting	Defines the mode of the 2nd gain set.	1
H08.09	Gain switchover condition	Used to set the condition for gain switchover.	0
H08.10	Gain switchover delay	Defines the gain switchover delay.	5.0 ms
H08.11	Gain switchover level	Defines the gain switchover level.	50
H08.12	Gain switchover hysteresis	Defines the dead time of gain switchover.	30
H08.13	Position gain switchover time	Defines the position loop gain switchover time.	3.0 ms

- Common gain set

Parameter code	Parameter name	Description	Default value
H08.18	Time constant of speed feedforward filter	Defines the filter time constant of the speed feedforward signal.	0.50 ms
H08.19	Speed feedforward gain	Defines the speed feedforward gain.	0.0%
H08.20	Torque feedforward filter time constant	Defines the filter time constant of the torque feedforward signal.	0.50 ms
H08.21	Torque feedforward gain	Defines the torque feedforward gain.	0.0%
H08.22	Speed feedback filtering option	Defines the speed feedback filtering function.	0
H08.23	Cutoff frequency of speed feedback low-pass filter	Defines the cutoff frequency of the first-order low-pass filter for speed feedback.	8000 Hz
H08.24	PDFF control coefficient	Defines the coefficient of the PDFF controller.	100.0%
H09.30	Torque disturbance compensation gain	Defines the torque disturbance compensation gain.	0.0%
H09.31	Filter time constant of torque disturbance observer	Defines the filter time constant of the disturbance observer.	0.5 ms
H09.04	Low-frequency resonance suppression mode	Defines the low-frequency resonance suppression mode.	0
H09.38	Frequency of low-frequency resonance suppression 1 at the mechanical end	Defines the frequency of the low-frequency resonance suppression filter.	100.0 Hz
H09.39	Low-frequency resonance suppression 1 at the mechanical end	Defines the setting of low-frequency resonance suppression filter.	2

Perform automatic gain tuning to obtain the initial values of the 1st or 2nd gain set and the common gain set.

Manually fine-tune the following gains.

Parameter code	Parameter name	Description	Default value
H07.05	Torque reference filter time constant 1	Defines the torque reference filter time constant.	0.50 ms
H08.00	Speed loop gain	Defines the speed loop proportional gain.	40.0 Hz
H08.01	Speed loop integral time constant	Defines the integral time constant of the speed loop.	19.89 ms
H08.02	Position loop gain	Defines the position loop proportional gain.	64.0 Hz
H08.19	Speed feedforward gain	Defines the speed feedforward gain.	0.0%

9.6.2 Parameter Adjustment in Speed Control Mode

Parameter adjustment in speed control mode is the same as that in position control mode, except for the position loop gain (H08.02 and H08.05). For details, see *"9.6.1 Parameter Adjustment in Position Control Mode" on page 263*.

9.6.3 Parameter Adjustment in Torque Control Mode

Parameter adjustment in torque control mode vary with the following conditions:

- If the actual speed reaches the upper speed limit, the adjustment method is the same as that described in *"9.6.2 Parameter Adjustment in Speed Control Mode" on page 265*.
- If the actual speed does not reach the upper speed limit, the adjustment method is the same as that described in *"9.6.2 Parameter Adjustment in Speed Control Mode" on page 265*, except for the position and speed loop gain and speed loop integral time constant.

9.7 Vibration Suppression

The block diagram for vibration suppression is as follows.

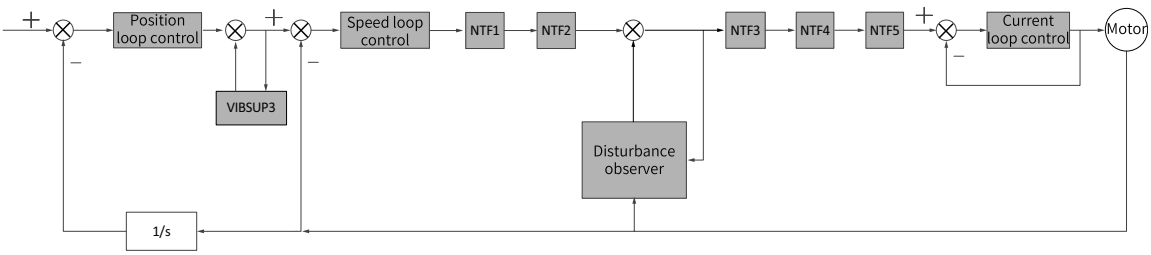


Diagram description:

- NTF1–5: 1st notch to 5th notch
- VIBSUP3: Suppression of medium- and low-frequency vibration Reduction applied at a carrier frequency lower than 8 k under 300 Hz

- 1/s: Integral term

The following are related parameters.

Note

Vibration suppression parameters are divided into the following three types:

- Vibration suppression frequency: Defines the vibration frequency to be suppressed.
- Vibration suppression compensation coefficient: Defines the compensation magnitude for jitter suppression.
- Vibration suppression phase modulation coefficient: Used for synchronous phase adjustment of the compensation value. It is recommended to use the default value. Adjustment is needed when the compensation value phase differs greatly from the vibration phase.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.53	Medium- and low-frequency jitter suppression frequency 3	-	0.0 to 300.0	Hz	0.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Set this parameter based on actual resonance frequency. The resonance suppression range is 100 Hz to 300 Hz.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.54	Medium- and low-frequency jitter suppression compensation 3	-	0 to 200	%	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the compensation gain for medium- and low-frequency jitter suppression 3. Full compensation applies when this parameter is set to 200%.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.56	Medium- and low-frequency jitter suppression phase modulation 3	-	0 to 600	%	100	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Adjust this parameter based on the actual compensation effect.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.59	Medium- and low-frequency jitter suppression frequency 4	-	0.0 to 300.0	Hz	0.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Set this parameter based on actual resonance frequency. The resonance suppression range is 100 Hz to 300 Hz.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.60	Medium- and low-frequency jitter suppression compensation 4	-	0 to 200	%	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the compensation gain for medium- and low-frequency jitter suppression 4. Full compensation applies when this parameter is set to 200%.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H08.61	Medium- and low-frequency jitter suppression phase modulation 4	-	0 to 600	%	100	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Adjust this parameter based on the actual compensation effect.								

9.7.1 Mechanical Characteristics Analysis

Overview

Mechanical characteristic analysis is used to determine the mechanical resonance point and system bandwidth. Up to 8 kHz response characteristic analysis is available and three modes including mechanical characteristics, speed open loop, and speed closed loop are supported.

Operation Flowchart

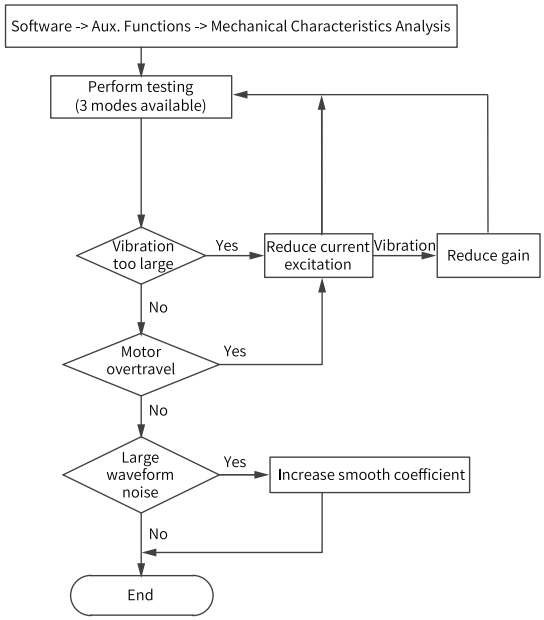


Figure 9-13 Operating procedure for mechanical characteristic analysis

Note

- To avoid excessive vibration during the test, set the current excitation to 10% during initial execution.
- The analysis waveform may be distorted if the current excitation is excessively low.
- If the vibration generated during test cannot be suppressed by reducing the current excitation, the possible causes and solutions are as follows: 1. The gain value is excessively high, reduce the speed gain or set the notch based on the auto-tuned resonance point. 2. The inertia is excessively high, set a correct inertia.
- In the mechanical characteristic test mode, waveforms before and after notch settings are consistent. In the speed closed loop and speed open loop modes, waveforms are attenuated after notch settings.

An example of the waveform obtained with the mechanical characteristic analysis is shown in the following figure.

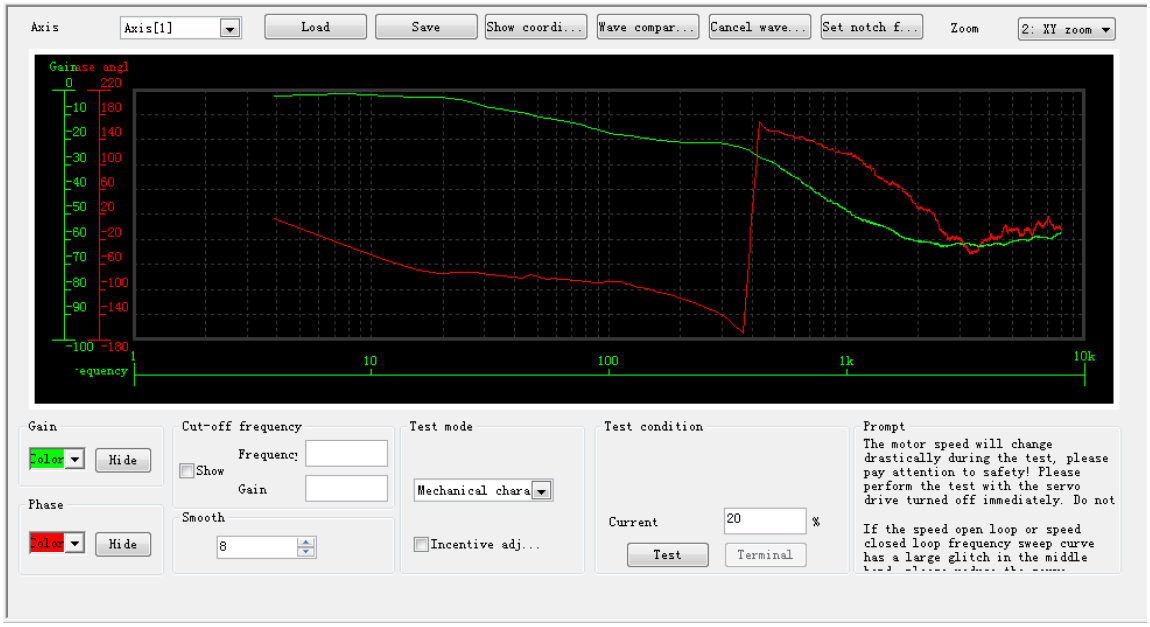


Figure 9-14 Example of the waveform obtained

9.7.2 Mechanical Resonance Suppression

Working principles

The mechanical system has a certain resonance frequency. When the servo gain is increased, resonance may occur near the mechanical resonance frequency, which can prevent further gain increase. Therefore, resonance must be suppressed.

Mechanical resonance can be suppressed in the following two ways:

- Torque reference filter (H07.05, H07.06)
  To suppress the mechanical resonance, set the filter time constant to enable the torque reference to be attenuated in the frequency range above the cutoff frequency.

  Filter cutoff frequency fc (Hz) = 1/[2π x H07.05 (ms) x 0.001]

- Notch
  The notch reduces the gain at certain frequencies to suppress mechanical resonance. After the vibration is suppressed by the notch, you can continue to increase the gain.

  The operating principle of the notch is shown in the following figure.

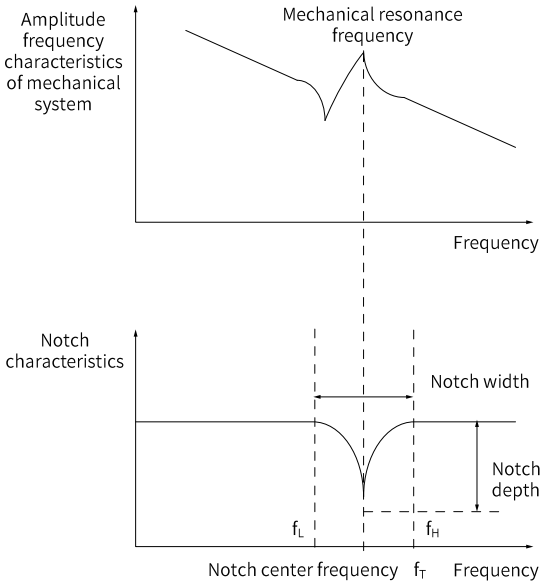


Figure 9-15 Operating principle of the notch

Note

If the amplitude frequency characteristic curve obtained through the mechanical analysis function does not have obvious peak, it indicates that vibration occurs actually. Such vibration may not be mechanical resonance, and cannot be suppressed by the notch. It occurs because the gain reaches the limit, and can be suppressed only by reducing the gain or the filter time of torque reference.

Description of the notch

A total of five notches can be used, and each notch is defined by three parameters: frequency, bandwidth level, and depth level.

The 1st, 2nd, and 5th notches are manual notches whose parameters need to be set by the user.

Parameters of the 3rd and 4th notches can be either set by the user or set automatically after being configured as an adaptive notch (H09.02 = 1 or 2).

Table 9–6 Description of the notch

Item	Manual notch			Manual/Adaptive notch	
	1st notch	2nd notch	5th notch	3rd notch	4th notch
Frequency	H09.12	H09.15	H09.41	H09.18	H09.21
Bandwidth level	H09.13	H09.16	H09.42	H09.19	H09.22
Depth level	H09.14	H09.17	H09.43	H09.20	H09.23

- Bandwidth level of the notch

  The bandwidth level indicates the ratio of the notch bandwidth to the center frequency of the notch.

$$\text{Width level of the notch} = \frac{f_H - f_L}{f_T}$$

  Where:

  f_T: Center frequency of the notch, which is also the mechanical resonance frequency

f_H-f_L: Notch filter bandwidth, indicating the frequency bandwidth where the amplitude attenuation reaches -3dB relative to the notch center frequency.

The following figure shows the mapping relationship. Use the default value (2) in normal cases.

- Depth level of the notch
  The notch depth level indicates the ratio of the input to the output at the center frequency.

  The input is completely shut with depth level 0 and fully received with depth level 99 at the center frequency. Therefore, the lower the depth level is, the higher the notch depth is, and the stronger the suppression effect will be. Note that an excessively low depth level may lead to system oscillation.

  The following figure shows the frequency characteristics of the notch.

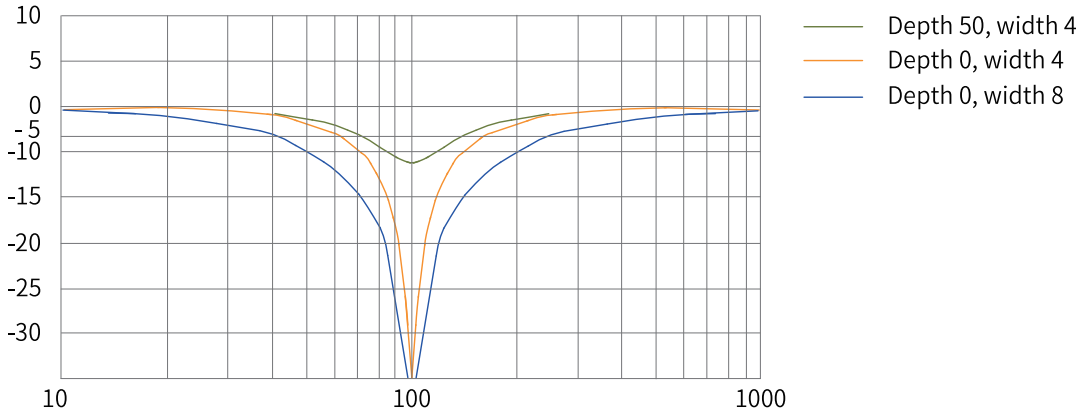


Figure 9-16 Notch frequency characteristics

Use of the notch

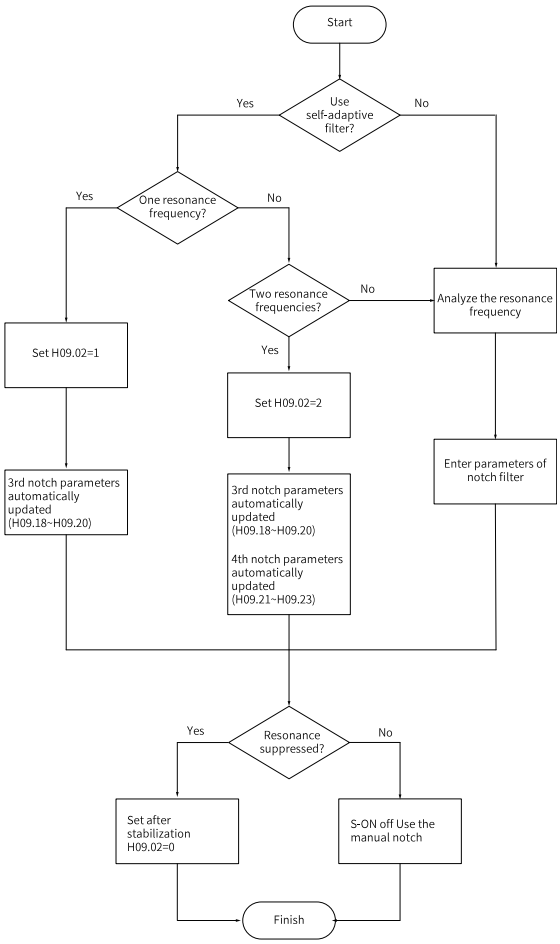


Figure 9-17 Flowchart for using the notch

Note

- The notch is inactive when the "Notch frequency" is set to the default value.
- The adaptive notch is preferred for resonance suppression. The manual notch can be used in cases where the adaptive notch cannot deliver desired performance.

Procedure for setting the adaptive notch:

1. Set H09.02 (Adaptive notch mode selection) to 1 or 2 based on the number of resonance frequencies.
2. When resonance occurs, set H09.02 to 1 first to enable one adaptive notch. If resonance occurs again after gain tuning, set H09.02 to 2 to enable two adaptive notches.
3. Parameters of the 3rd or 4th notches are updated automatically during operation, and parameter values are saved automatically to the corresponding parameters in group H09 every 30 min.
4. If resonance is suppressed, the adaptive notch works. After the servo drive runs stably for a period of time, set H09.02 to 0 and the parameters of the adaptive notch are fixed to the last updated values.

   This is to prevent notch parameters from being updated to wrong values due to misoperation. Wrong values will intensity resonance.

5. If resonance persists after the notch is working for a period of time, switch off the S-ON signal.
6. If there are more than two resonance frequencies, the problem cannot be solved by only using the adaptive notches. Additionally use the manual notch, or use all the four notches as manual ones (H09.02 = 0).

Note

- When adaptive notch is applied, if the S-OFF signal is activated within 30 min, the notch parameters will not be saved to the corresponding parameter
- When the resonance frequency is below 300 Hz, the suppression effect of the adaptive notch may degrade.

Procedure for setting the manual notch:

1. Analyze the resonance frequency.
2. When using the manual notch, set the notch frequency to same value as the actual resonance frequency obtained in the following ways:
   The resonance frequency can be obtained by using the following methods:
   a. Use the "Mechanical characteristic analysis" function in Inovance software tool.
   b. Calculate the resonance frequency based on the motor phase current displayed on the oscilloscope interface of the software tool.
   c. Set H09.02 (Adaptive notch mode) to 3. The drive detects the resonance frequency and saves the detected value to H09.24 automatically during operation.
3. Input the resonance frequency obtained in step 1 to the parameter of the selected notch, and input the bandwidth level and depth level of this notch.
4. If the resonance is suppressed, it indicates that the notch acts properly, and the gain can be further adjusted. If new resonance appears after increasing the gain, repeat the above steps.
5. If vibration persists after the notch is working for a period of time, switch off the S-ON signal.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.02	Adaptive notch mode	-	0 to 4	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: Adaptive notch no longer updated1 : One adaptive notch activated (3rd notch)2 : Two adaptive notches activated (3rd and 4th notches) 3: Resonance point tested only (mechanical resonance frequency displayed in H09.24) 4: Adaptive notch cleared, values of 3rd and 4th notches restored to default								
	Description of parameters:								
	Defines the operation mode of the adaptive notch.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.12	1st notch frequency	-	50 to 8000	Hz	8000	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the center frequency of the 1st notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 8000 Hz deactivates the notch function.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.13	1st notch width level	-	0 to 20	-	2	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the bandwidth level of the 1st notch. Use the default setpoint in general cases. Width level is the ratio of the notch width to the notch center frequency.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.14	1st notch depth level	-	0 to 99	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the depth level of the 1st notch. The depth level of the notch is the ratio of the input to the output at the notch center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.15	2nd notch frequency	-	50 to 8000	Hz	8000	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the center frequency of the 2nd notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 8000 Hz deactivates the notch function.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.16	2nd notch width level	-	0 to 20	-	2	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the bandwidth level of the 2nd notch. Use the default setpoint in general cases. Width level is the ratio of the notch width to the notch center frequency.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.17	2nd notch depth level	-	0 to 99	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the depth level of the 2nd notch. The depth level of the notch is the ratio of the input to the output at the notch center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.18	3rd notch frequency	-	50 to 8000	Hz	8000	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the center frequency of the notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 8000 Hz deactivates the notch function.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.19	3rd notch width level	-	0 to 20	-	2	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the width level of the notch. Use the default value in general cases. Width level is the ratio of the notch width to the notch center frequency.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.20	3rd notch depth level	-	0 to 99	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the depth level of the notch. The depth level of the notch is the ratio of the input to the output at the notch center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.21	4th notch frequency	-	50 to 8000	Hz	8000	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the center frequency of the notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 8000 Hz deactivates the notch function.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.22	4th notch width level	-	0 to 20	-	2	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the width level of the notch. Use the default value in general cases. Width level is the ratio of the notch width to the notch center frequency.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.23	4th notch depth level	-	0 to 99	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the depth level of the notch. The depth level of the notch is the ratio of the input to the output at the notch center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively low setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.24	Auto-tuned resonance frequency	-	0 to 5000	Hz	0	UInt16	Read only	Ordinary user	-
	Description of parameters:								
	When H09.02 (Adaptive notch mode) is set to 3, the current mechanical resonance frequency is displayed.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.41	5th notch frequency	-	50 to 8000	Hz	8000	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the center frequency of the 5th notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 8000 Hz deactivates the notch function.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.42	5th notch width level	-	0 to 20	-	2	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the bandwidth level of the 5th notch. Use the default setpoint in general cases. Width level is the ratio of the notch width to the notch center frequency. See section "Mechanical Resonance Suppression" for details.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.43	5th notch depth level	-	0 to 99	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the depth level of the 5th notch. The depth level of the notch is the ratio of the input to the output at the notch center frequency. The higher the setpoint , the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. See the "Mechanical Resonance Suppression" section for details.								

9.7.3 Low-Frequency Resonance Suppression at the Mechanical End

Working principles

If the mechanical load end is long and heavy, vibration may easily occur in this part during emergency stop, affecting the positioning effect. Such vibration is called low-frequency resonance as its frequency is generally within 100 Hz, which is lower than the mechanical resonance frequency.

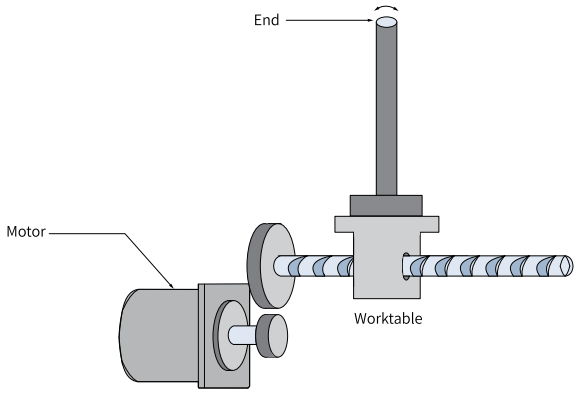


Figure 9-18 Low-frequency vibration at the mechanical end

Use of the filter

The low-frequency resonance suppression filter can effectively reduce such vibration.

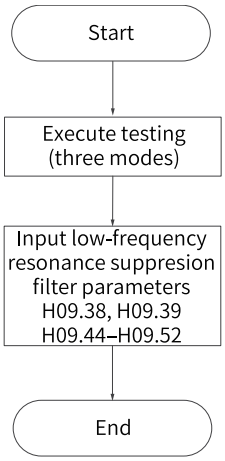


Figure 9-19 Flowchart for setting low-frequency resonance suppression filter

Flowchart description:

1. Collect the position deviation waveform in motor positioning mode by using the oscilloscope function of the Inovance software tool and calculate the position deviation fluctuation frequency, that is, low-frequency resonance frequency.
2. Manually enter H09.38 or H09.44, and H09.49 (low-frequency resonance frequency). Keep other parameters at default values generally.
3. The following shows the improved resonance suppression effect after using the low-frequency resonance suppression filter.

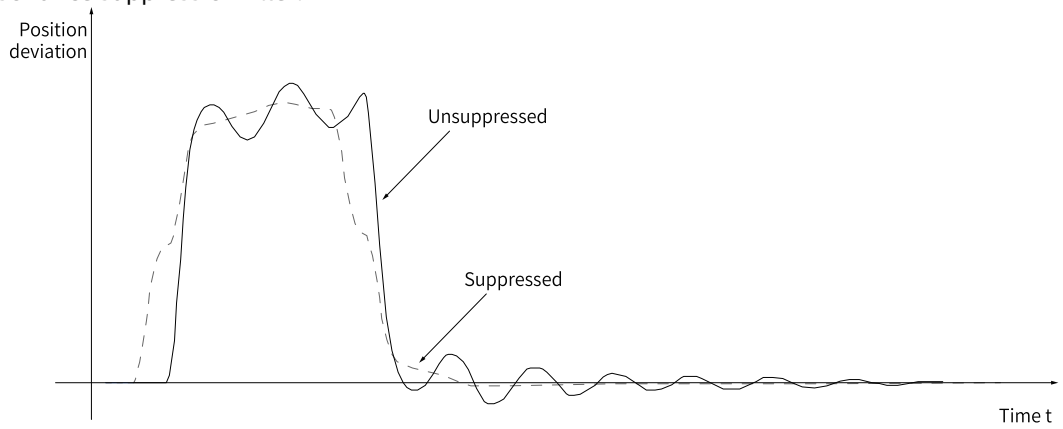


Figure 9-20 Low-frequency resonance suppression effect

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.38	Frequency of low-frequency resonance suppression 1 at the mechanical end	-	1.0 to 100.0	Hz	100.0	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Set this parameter based on the actual jitter frequency.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.39	Low-frequency suppression 1 at the mechanical end	-	0 to 3	-	2	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Defines different low-frequency resonance suppression types at the mechanical end. Type 1 features the shortest delay.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.44	Frequency of low-frequency suppression 2 at the mechanical end	-	0.0 to 200.0	-	0.0	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Set this parameter based on the actual jitter frequency. Note: For software version V09XXX, changes are applied in real time. For software version V102XXX, changes are allowed at stop.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.45	Response of low-frequency resonance suppression 2 at mechanical end	-	0.01 to 10.00	-	1.00	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Use the default setpoint in general cases. Increasing this setpoint can reduce the delay time.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.47	Bandwidth of low-frequency resonance suppression 2 at mechanical end	-	0.00 to 2.00	-	1.00	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Use the default setpoint in general cases. Increasing this setpoint can increase the delay time.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.49	Frequency of low-frequency resonance suppression 3 at the mechanical end	-	0.0 to 200.0	-	0.0	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Set this parameter based on the actual jitter frequency.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.50	Response of low-frequency resonance suppression 3 at the end-effector	-	0.01 to 10.00	-	1.00	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the response of low-frequency resonance suppression 3 at mechanical load end. Use the default setpoint in general cases. Increasing this setpoint can reduce the delay time.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H09.52	Width of low-frequency resonance suppression 3 at the end-effector	-	0.00 to 2.00	-	1.00	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Use the default setpoint in general cases. Increasing this setpoint can increase the delay time.								

10 Function Overview

Functions of the servo drive are listed below. See details in corresponding chapters.

Function	Content	Reference
Probe function	The servo drive latches the position information when an external DI signal or motor Z signal changes.	*" Probe function" on page 287*
Absolute System	After a power cycle, the servo drive calculates the mechanical absolute position based on the encoder absolute position without the mechanical homing operation.	*" Absolute Encoder System" on page 284*
Software Limit	The servo drive compares the internal position feedback with the limit position, and alarms or stops when determining that the motor exceeds the limit position.	*" Software Limit" on page 289*
Software Reset	The software reset function applies when power cycling of the drive is not allowed on the application site.	*" Software Reset" on page 293*
Black box function	The servo drive captures the data before and after the designated condition and cooperates with the software tool to read the data for further analysis.	*"12.8 Black Box" on page 300*
Motor Protection	The drive provides the motor overload protection function to prevent the motor from being damaged due to over-temperature.	*" Motor protection" on page 294*
DI Filter Time Setting	It is used to set the DI filter time.	*" DI Filter Time Setting" on page 298*
S-curve function	It is used to smoothen the position command.	*" S-curve function" on page 297*
Alarm history	Used to record the latest twenty faults/alarms, which can also be cleared.	*" Fault and warning records" on page 616*
Alarm code output	Used to output a four-bit alarm code when an alarm occurs.	*" List of Alarm Codes" on page 617*, *" List of Faults" on page 618*

11 Basic Functions of the Servo Drive

The servo system consists of three major parts, the servo drive, servo motor, and feedback encoder.

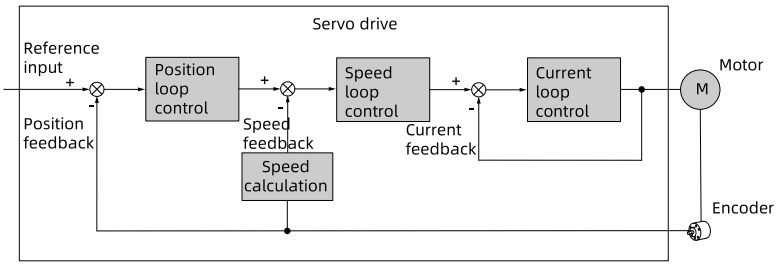


Figure 11-1 Structure of a basic servo system

As the control core of the servo system, the servo drive performs accurate position, speed, torque, or hybrid control on the servo motor by processing the input signals and feedback signals. Position control is the most important mode of a servo system.

Descriptions of the control modes are as follows:

- **Position control mode**
  Position control In the position control mode, the target position of a motor is determined by the sum of position references, and the motor speed is determined by the position reference frequency. The drive performs quick and accurate position control and speed control through the feedback encoder installed on the motor.

  The position control mode is applicable to scenarios requiring positioning control, such as manipulators, SMT machines, engraving and milling machines (pulse sequence reference), and CNC machine tools.

- **Speed control mode**
  In speed control, the device speed is controlled through speed references. In the speed control mode, the drive performs quick and accurate speed control through the speed reference set through communication.

  The speed control mode mainly applies to application requiring speed control or where a host controller is used for position control or the references sent from the host controller are used as the speed references for the drive, such as the engraving and milling machines.

- **Torque control mode**
  In the torque control mode, the motor current is linearly proportional to the torque. Therefore, torque control is implemented through current control. The drive controls the motor output torque based on torque references. The torque reference can be set through communication.

  This control mode is mainly applicable to the winding and unwinding devices with strict tension requirements. In these applications, the torque always changes with the winding radius so that the tension will not change along with the change of the winding radius.

12 Common Functions

12.1 Absolute System

12.1.1 Connecting the Absolute Encoder System

For how to connect the absolute encoder and how to install the battery box, see section "Connecting Absolute Encoder Cable" and "Installing Absolute Encoder Battery" for details.

12.1.2 Absolute Encoder System Setting

Overview

The absolute encoder, which carries a resolution of 8388608 (2^{23}) PPR, detects the motor position within one revolution and counts the number of revolutions, with 23-bit multi-turn data recorded. The absolute value encoder-based absolute system is divided into absolute position linear mode, absolute position rotation mode, and absolute position single-turn mode.

E731.0 (Encoder multi-turn position data loss) will be reported upon initial power-on of the battery. Set H0d.20 to 1 to reset E731.0 and perform a power cycle before performing the homing operation.

Note

When you change the value of H02.02 (Direction of rotation) or H0d.20 (Absolute encoder reset selection), the absolute position recorded by the encoder changes suddenly, causing the mechanical absolute position reference to change. In this case, perform the homing operation. After homing is done, the deviation between the mechanical absolute position and that recorded in the encoder will be calculated automatically and saved in the EEPROM of the drive.

Applicable scenarios

The absolute encoder system works in the position control, speed control, and torque control modes. When the servo drive is powered off, the encoder records data with the power supplied by the battery. The servo drive therefore can calculate the absolute mechanical position through the encoder after power-on, removing the need for homing.

Absolute value system setting

To match the absolute encoder with the SV660F series servo drive, set H00.00 (Motor code) to 14101 (Inovance 23-bit absolute encoder). Then set H02.01 (Absolute encoder system selection) based on actual conditions.

Encoder feedback data

The feedback data of the absolute encoder includes the encoder revolution count and the position within single-turn of the encoder. In incremental position mode, the encoder revolution count is not available.

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H00.00	Motor SN	-	0 to 65535	-	14101	UInt16	At stop	Ordinary user	Effective upon next power-on
	Description of parameters:								
	Sets the servo motor number with the value fixed to "14XXX". Setting the motor code to an incorrect value will result in E120.1 (Unknown motor model).								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H00.08	Serial encoder type	-	0 to 65535	-	0	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	14100: Multi-turn absolute encoder Others: Single-turn absolute encoder								

12.1.3 Absolute Position Linear Mode

This mode applies to applications where the axis travel range is fixed without multi-turn data overflow.

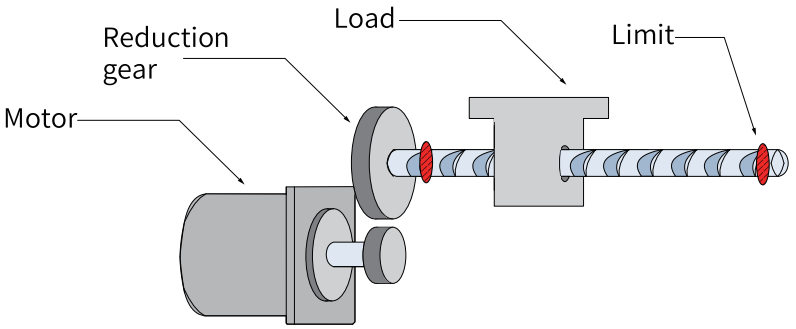


Figure 12-1 Application of the linear mode

Assume the mechanical absolute position (H0b.58 and H0b.60) is P_M, the encoder absolute position is P_E [P_E range is -2^{38}~ (2^{38}-1)], and the absolute position linear mode offset (H05.46 and H05.48) is P_O, then the relationship among the three is $P_M = P_E - P_O$.

If the electronic gear ratio is B/ A, then the following formula applies: H0b.07 (absolute position counter) = P_M / (B/A).

Position offset in the absolute position linear mode (H05.46 and H05.48) is 0 by default. After homing is done, The servo drive calculates the deviation between the absolute position of the machine and that fed back by the encoder, assigns the value to H05.46 and H05.48, and saves the deviation in EEPROM.

The encoder multi-turn data range in the absolute position linear mode is -32768 to +32767. If the number of forward revolutions exceeds 32767 or the number of reverse revolutions is lower than

-32768, E735.0 (encoder multi-turn count overflow) occurs. In this case, set H0d.20 to 2 (Reset multi-turn data), and then perform homing again.

In absolute position linear mode, set H0A.36 to shield the encoder multi-turn overflow fault.

12.1.4 Absolute Position Rotation Mode

This mode applies when the load traveling range is not limited and the number of unidirectional revolutions of the motor is lower than 32767 upon power failure, as shown in the following figure.

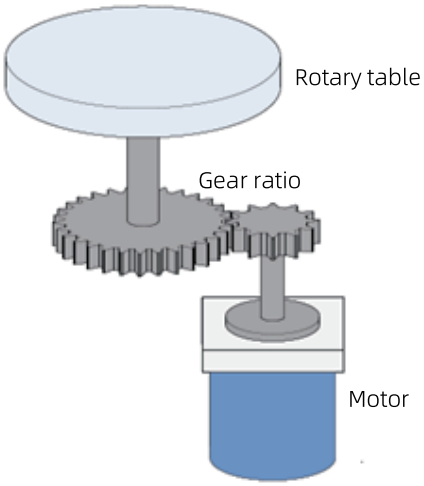
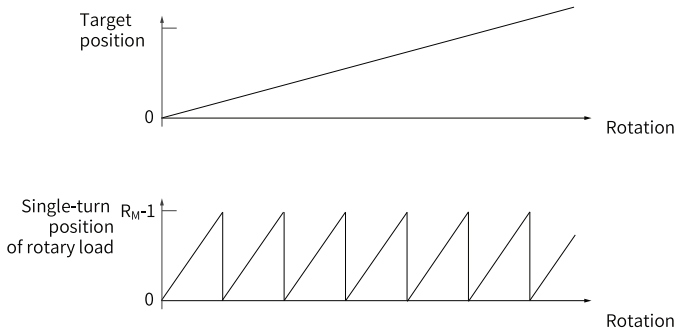
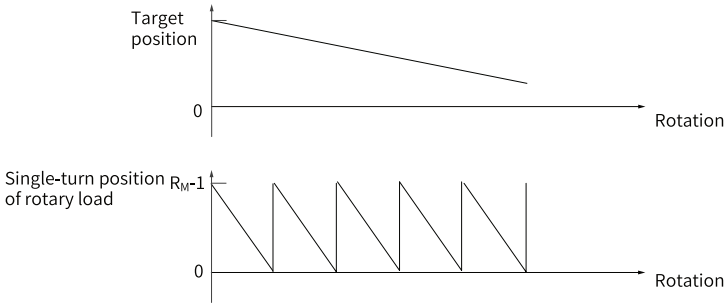


Figure 12-2 Rotating load

The single-turn position range of the rotary load is 0 to (R_M - 1) (R_M: Encoder pulses per load revolution). When the gear ratio is 1:1, the variation law of the target position and the single-turn position of the rotary load during forward operation is shown as follows.



The variation law of the target position and the single-turn position of the rotary load during reverse operation is as follows.



When the motor operates in the absolute rotation mode and the drive operates in the HM mode, the setting range of the home offset is 0 to (R_M - 1). If the home offset is set to a value outside this range, the drive reports EE09.1.

The multi-turn data range is not limited in the absolute position rotation mode. Therefore, E735.0 (Encoder multi-turn counting overflow) is masked automatically.

Note

The drive calculates the mechanical absolute position upper limit based on H05.52 and H05.54 first. If H05.52 and H05.54 are 0, H05.50 and H05.51 will be used.

12.1.5 Precautions for Use of the Battery Box

E731.0 (Encoder multi-turn position data loss) will be reported upon initial power-on of the battery. Set H0d.20 to 1 to reset E731.0 and perform a power cycle before performing the homing operation.

When the battery voltage detected is lower than 3.0 V, E730.0 (Encoder battery alarm) occurs. In this case, replace the battery according to the following procedure.

1. Power on the drive and make it stay in the non-operational state.
2. Replace the battery.
3. After the drive resets E730.0 automatically. If no other alarm occurs, continue to operate the drive.

Note

- If you replace the battery after powering off the drive, E731.0 (Encoder multi-turn position data loss) can occur at next power-on, leading to an abrupt change in the multi-turn data. In this case, set H0d.20 to 1 to reset the encoder fault. Then perform the homing operation again.
- Ensure the maximum motor speed does not exceed 6000 rpm upon power-down of the servo drive. This is to enable the encoder to record the position accurately.
- Store the battery in required temperature and ensure reliable contact and sufficient electricity. Failure to comply may cause loss of the encoder position.
- The absolute position recorded by the encoder changes abruptly after multi-turn data reset. In this case, perform mechanical homing.

12.2 Touch Probe

Description

The touch probe function is the same as the position latch function. The latch function latches the position actual value (reference unit) when a DI signal or the motor phase-Z signal changes. The SV660F provides two probes for recording the positions of two probe signal at the rising edge and falling edge, which means four positions can be latched.

Application scenario

- In the position control mode, the stop position of the drive is determined by feedback signals from external sensors.
- Detecting the material length: During operation of the drive, the real-time position of the encoder and material length can be obtained through external sensor feedback signals.

Working principles

When a DI is used to trigger the touch probe, the relationship between the DI logic and the touch probe edge is shown in the following table.

Table 12–1 Description of bit3 of H0A.40

Bit3 of H0A.40	Touch probe edge	DI logic	DI switch
0	Rising edge	NO	OFF→ON
		NC	ON→OFF
	Falling edge	NO	ON→OFF
		NC	OFF→ON
1	Rising edge	NO/NC	OFF→ON
	Falling edge	NO/NC	ON→OFF

When a DI is used to trigger the touch probe, you can set the filter window of the touch probe signal through H0A.19 and H0A.20.

The DI touch probe supports hardware action delay compensation to compensate for the precision loss incurred by ON/OFF delay of the DI. Related parameters are shown in the following table.

Param.		Description
H0A.40	bit1	Touch probe rising edge compensation: 1: Enabled, 0: Disabled
	bit2	Touch probe falling edge compensation: 1: Enabled, 0: Disabled
H0A.53		DI probe DI on compensation time (DI switch off→on)
H0A.54		DI probe DI off compensation time (DI switch on→off)

To shorten the hardware delay to about 7 μs, it is recommended to set the touch probe latch through the ON-edge of the DI.

There are two Z touch probe triggering sources: motor Z signal and frequency-division output Z signal, as shown in the following table.

Feedback source	Param.	Description
Motor encoder	H05.41.bit2 = 0, motor Z signal	The Z touch probe is triggered by the motor Z signal.
	H05.41.bit2 = 1, frequency-division output Z signal	The Z touch probe is triggered by the frequency-division output Z signal, including the multi-turn Z signal.

Related parameters

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0A.40	Compensation function enable	-	0x0 to 0xF	-	0x6	UInt16	At stop	Standard user	Real time
	Parameter description:								
	bit0: Overtravel compensation 0: Enable 1: Disable bit1: Touch probe rising edge compensation 0: Disable 1: Enable				bit2: Touch probe falling edge compensation 0: Disable 1: Enable bit3: Touch probe logic 0: Touch probe edge trigger coupled with DI logic 1: Touch probe edge trigger not coupled with DI logic				

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0A.53	Touch probe DI ON compensation time	-	-3000 to +3000	25 ns	200	Signed 16-bit	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Used to compensate for the action time when the touch probe is switched on. When triggering the probe using the rising edge of the DI signal, you can set the compensation time for advancing or delaying the probe latch trigger.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0A.54	Touch probe DI OFF compensation time	-	-3000 to +3000	25 ns	1512	Signed 16-bit	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Used to compensate for the action time when the touch probe is switched off. When triggering the probe using the falling edge of the DI signal, you can set the compensation time for advancing or delaying the probe latch trigger.								

12.3 Software Limit

Description

Soft limit function: The servo drive compares the internal position feedback with the limit position, and alarms and stops when determining that the motor exceeds the limit position. Software position limit is available both in the absolute position mode and the incremental position mode. To use the software position limit in the incremental position mode, set H0A.01 (Software position limit) to 2

(Enabled after homing) first, and then perform homing upon power-on before applying software position limit.

Hardware position limit is implemented by inputting external encoder signals to CN1 of the servo drive.

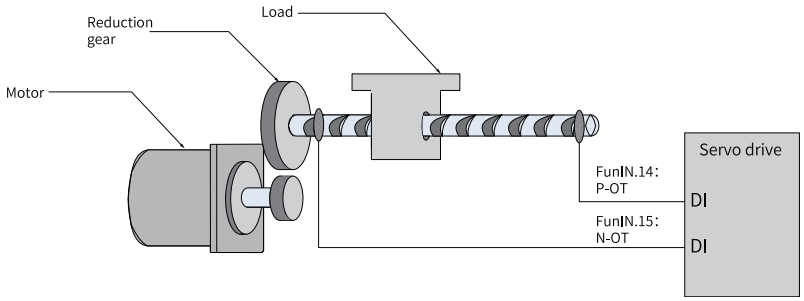


Figure 12-3 Installation of limit switches

Table 12–2 Comparison between traditional hardware limit function and soft limit function

Traditional Hardware Limit Function		Software Limit	
Disad-vantages	Restricted to linear motion and single-turn rotational motion.	Advantages	Applicable to both the linear motion and the rotational motion.
	Requires an external mechanical limit switch.		Hardware wiring is not required, preventing malfunction due to poor cable connection.

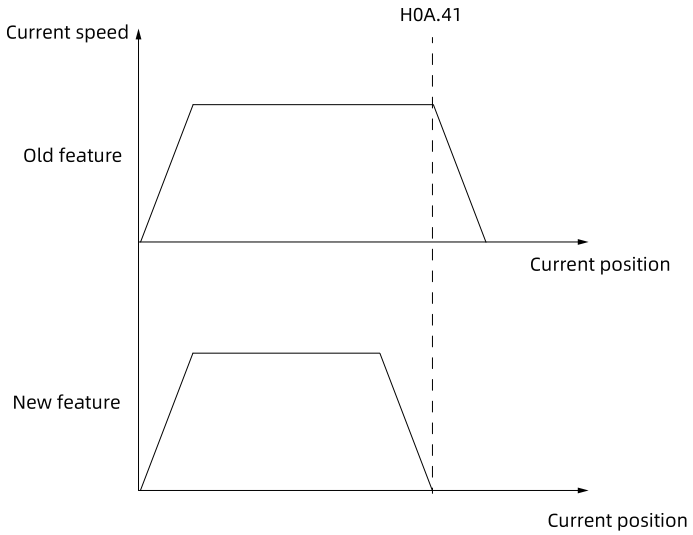
Switch Between Old and New Software Limit Features

The function to switch between old and new software limit features is supported only in firmware with the version equal to or later than 4301.7 (H01.00), where the new feature is enabled by default. Earlier versions support only the old features. You can set HOC.71 to switch between old and new features. When bit3 of HOC.71 is set to 0, the old feature is active. When bit3 is set to 1, the new feature is active. The switch takes effect only when the servo drive is disabled.

Setting H0A.01 to 1 enables the software limit function. If the host controller uses telegram 111, the function can also be enabled via bit2 of the ConfigEPos pin in the SinaPos function block.

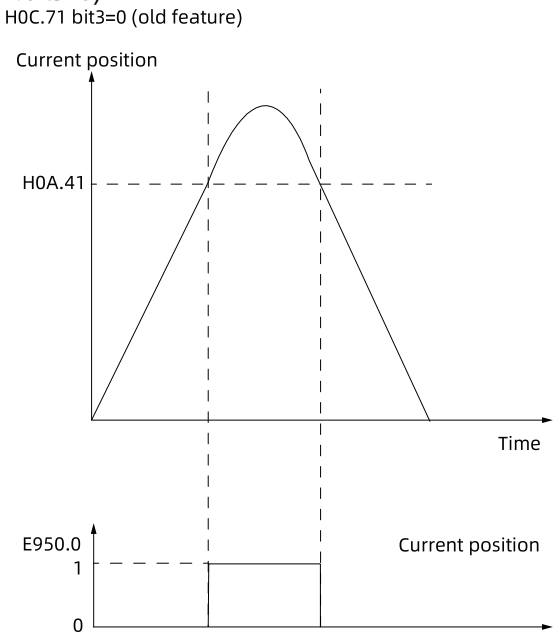
After the software limit function is enabled, take the positive software limit as an example.

- In the old feature, decelerate-to-stop is set after the software limit is reached, causing the actual position to exceed the software limit.
- In the new feature, decelerate-to-stop is set before the software limit is reached; therefore, the stop position is exactly at the software limit.



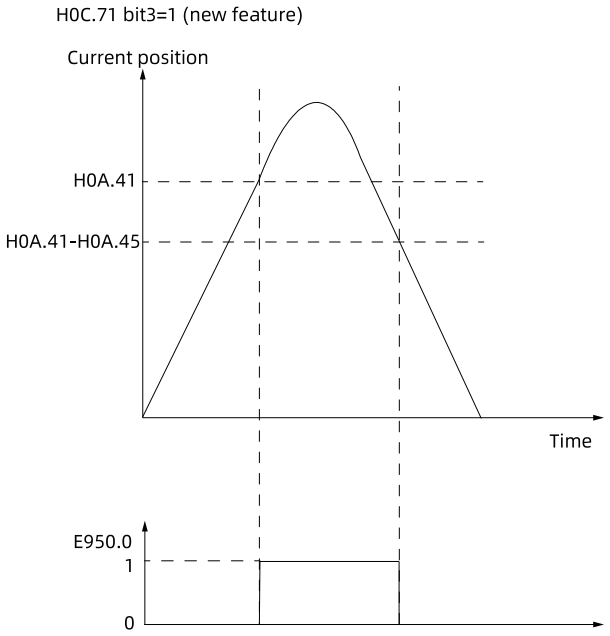
After the software limit function is enabled, take the positive software limit as an example to describe the conditions for reporting and clearing the overtravel warning.

- In the old feature (H0C.71.bit3=0)



  - Condition to trigger E950.0: The current position (in user command units) is greater than the positive software limit threshold.
  - Condition to clear E950.0: The current position (in user command units) is less than or equal to the positive software limit threshold.

- In the new feature (H0C.71.bit3=1)



- Condition to trigger E950.0: The current position (in user command units) is greater than the positive software limit threshold.
- Condition to clear E950.0: The current position (in user command units) is less than the positive software limit threshold.

Related parameters

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0A.01	Absolute position limit	-	0 to 2	-	0	UInt16	Real time	Standard user	Real time
	Value:								
	0: Disable 1: Enable 2: Enable after homing								
	Parameter description:								
	It sets whether the absolute position limit is enabled and the related condition. After the absolute position limit is enabled, when the target position reference exceeds the position limit in the position control mode, the servo drive takes the position limit as the target and stops after reaching the limit. When the absolute position feedback reaches the position limit in other control modes, the servo drive reports an overtravel warning and stops in the mode defined by the stop mode at overtravel. • When H0A.01 is set to 0, the software limit function is disabled. • When H0A.01 is set to 1, software position limit is enabled immediately upon power-on. When the value of the absolute position counter (H0b.07) is higher than the value of H0A.41, E950.0 (Forward overtravel alarm) is reported, and the drive stops accordingly. When the value of the absolute position counter (H0b.07) is lower than the value of H0A.43, E952.0 (Reverse overtravel warning) is reported, and the drive stops accordingly. • If H0A.01 is set to 2, software position limit is not enabled after homing upon power-on. When the value of the absolute position counter (H0b.07) is higher than the value of H0A.41 after homing, E950.0 (Forward overtravel alarm) occurs and the drive stops accordingly. When the value of the absolute position counter (H0b.07) is lower than the value of H0A.43 after homing, E952.0 (Reverse overtravel alarm) occurs and the drive stops accordingly.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0A.41	Forward position of software limit	-	-2147483648 to +2147483647	Reference unit	2147483647	Int32	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	When the absolute position counter (H0b.07) is larger than H0A.41, the servo drive reports E950.0 (Forward overtravel) and stops accordingly.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0A.43	Reverse position of software limit	-	-2147483648 to +2147483647	Reference unit	-2147483648	Int32	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	When the absolute position counter (H0b.07) is smaller than H0A.43, the servo drive reports E952.0 (Reverse overtravel) and stops accordingly.								

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0A.45	Software limit window	-	0 to 2147483647	Reference unit	1000	UInt32	At stop	Standard user	Real time
	Parameter description:								
	Defines the software limit window to prevent the motor from stopping near the software limit, which can repeatedly enable the software limit.								

12.4 Software Reset

Description

The software reset function applies when power cycling of the drive is not allowed on the application site.

Related parameters

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0d.00	Software reset	-	0 to 1	-	0	UInt16	At stop	Ordinary user	Effective in real time
	Value:								
	0: No operation 1: Software reset								
	Description of parameters:								
	Sets whether to support software reset. Conditions for software reset: The servo drive is not enabled and no non-resettable No. 1 fault has occurred. No EEPROM operation is performed. The software reset function is ineffective.								

12.5 Motor Protection

Motor overload protection

After power-on, the motor continuously generates heat due to thermal effect of the current. The heat is then dissipated to the surroundings. When the heat generated exceeds the heat dissipated, the motor temperature will rise to a point that could damage the motor. To prevent such risks, the drive offers the motor overload protection function to prevent the motor from being damaged due to over-temperature.

The motor is compliant with NEC and CEC requirements and equipped with protective functions against overload and overtemperature.

Set the motor overload protection gain (H0A.04) to adjust the report time of fault E620.0. Use the default value of H0A.04 in general conditions, however, in case of one of the following situations, modify H0A.04 based on the actual heating condition.

- The motor works in environments with high temperature.
- The motor is in the cyclic motion featuring short motion cycle and frequent acceleration/ deceleration.

Motor overload detection can be shielded (H0A.26 = 1) when you ensure that the motor will not be damaged.



Take caution when using the motor overload shielding function as it may easily lead to motor damage.

Related parameters

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0A.04	Motor overload protection gain	-	50 to 300	-	100	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Determines the motor overload duration before E620.0 (Motor overload) is reported. Change the value to advance or delay the overload protection time based on the motor heating condition. The value 50% indicates half of the base time, and 150% indicates 1.5 times of the base time. Set this parameter based on the actual temperature of the motor.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0A.26	Motor overload shielding	-	0 to 1	-	0	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: Show motor overload warning (E909.0) and fault (E620.0) 1: Hide motor overload warning (E909.0) and fault (E620.0)								
	Description of parameters:								
	Defines whether to enable motor overload detection.								

Over-temperature protection upon motor stall

When the motor is stalled, the motor speed is nearly 0 rpm at high current input. In this case, the motor can be overheated significantly. The motor is capable of operating upon stall in an allowable period of time, exceeding of which can lead to over-temperature and damage the motor. To prevent such a risk, the servo drive offers motor stall overtemperature protection to protect the motor from being damaged by overtemperature upon stall.

You can set the time for reporting E630.0 (Motor stall over-temperature fault) by setting the time threshold for motor overtemperature protection (H0A.32). The motor overtemperature protection function is enabled by default (H0A.33 = 1).



- To prevent damages to the motor, take caution when you use the motor stall over-temperature protection function.
- Use the dedicated motor for the drive. Failure to comply will result in the risk of short circuit due to ageing of insulation.

Related parameters

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0A.32	Over-temperature protection time window upon stall	-	10 to 65535	ms	200	UInt16	Real time	Standard user	Real time
	Parameter description:								
	Defines the duration before E630.0 (Motor stall overtemperature) is detected by the drive.								

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0A.33	Over-temperature protection selection upon stall	-	0 to 1	-	1	UInt16	Real time	Standard user	Real time
	Value:								
	0: Disable 1: Enable								
	Parameter description:								
	Defines whether to enable the detection for E630.0 (Motor stall overtemperature protection).								

Motor overspeed protection

A very large speed causes damage to the motor or machine. Motor overspeed protection is used to protect the motor in case of overspeed, preventing the motor or machine from being damaged due to overtemperature.

$$\text{Overspeed threshold} = \begin{cases} \text{Max. motor speed} \times 1.2 & \text{H0A.08} = 0 \text{ or H0A.08} > \text{Max. motor speed x 1.2} \\ \text{H0A.08} & \text{H0A.08} \neq 0 \text{ and H0A.08} < \text{Max. motor speed x 1.2} \end{cases}$$

Caution

- The servo drive also offers motor runaway protection to prevent motor stall caused by lose of control.
- In applications where the motor drives a vertical axis or is driven by load, set H0A.12 to 0 to hide runaway fault detection. Use this function with caution.

Besides runaway protection, the servo drive allows you to set the speed limit in speed control mode and torque control mode to protect the motor and machine.

Related parameters

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0A.08	Overspeed threshold	-	0 to 20000	rpm	0	UInt16	Real-time	Ordinary user	Effective in real time

Description of parameters:

Defines the overspeed threshold of the motor.

Setpoint	Overspeed Threshold	Condition for Reporting E500.0
0	Max. motor speed x 1.2	If the speed feedback exceeds the overspeed threshold several times, the drive reports E500.0 (Motor overspeed).
1 to 20000	If H0A.08 ≥ (maximum motor speed x 1.2), the overspeed threshold equals the maximum motor speed x 1.2.	
	If H0A.08 < (maximum motor speed x 1.2), the overspeed threshold equals H0A.08.	

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0A.12	Runaway protection	-	0 to 1	-	1	UInt16	Real time	Standard user	Real time

Value:

0: Disable
1: Enable

Parameter description:

Defines whether to enable runaway protection.

0: Disable (E234.0 can be masked when the motor drives a vertical axis or is driven by the load.)
1: Enable

12.6 S-curve Function

Function description

Set H05.74 to select a mode from modes 1 to 6 to enable the S-curve function. The higher the value, the smoother the position command after filtering.

When the S-curve function is enabled, set H05.06. The higher the value of H05.06, the smoother the position command after filtering.

Applicable scenarios

The S-curve function must be used in position mode.

Related parameters

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H05.06	Moving average filter time constant 1	-	0.0–28.0	ms	0.0	UInt16	At stop	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the moving average filter time constant for the first group of position references.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H05.74	S-curve mode selection	-	0 to 6	-	0	UInt16	At stop	Ordinary user	Effective in real time
	Value:								
	0: Enable one segment of filtering 1: Enable two segments of filtering, filter time ratio: 5:1 2: Enable two segments of filtering, filter time ratio: 2:1 3: Enable two segments of filtering, filter time ratio: 1:1				4: Enable three segments of filtering, filter time ratio: 4:1:1 5: Enable three segments of filtering, filter time ratio: 2:1:1 6: Enable three segments of filtering, filter time ratio: 1:1:1				
	Description of parameters:								
	Sets the S-curve mode in position mode.								

12.7 DI Filter Time Setting

Function description

The drive provides five physical DI terminals, in which DI1 to DI3 are normal DI terminals, and DI4 to DI5 are high-speed DI terminals.

When the two high-speed DIs of the drive are assigned with touch probe 1 and touch probe 2, the input signal frequency can be up to 4 kHz. If the DI signal is disturbed, set the filter time in H0A.19 and H0A.20.

When regular functions (touch probe excluded) are assigned to DIs, the filter time of these DIs is set in H03.60 to H03.64. Ensure the effective level hold time of the DI assigned with regular function is above 0.5 ms. Otherwise, the DI function may not be responded to.

When a high-speed DI is assigned with the touch probe function, the filter time of this DI is defined by H0A.19 and H0A.20. Ensure the effective level hold time of the high-speed DI is longer than the filter time.

Related parameters

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H03.60	DI1 filter time	-	0.00 to 500.00	ms	3.00	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the filter time of DI1. The DI function is active only after the effective level is kept within the time defined by H03.60.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H03.61	DI2 filter time	-	0.00 to 500.00	ms	3.00	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the filter time of DI2. The DI function is active only after the effective level is kept within the time defined by H03.61.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H03.62	DI3 filter time	-	0.00 to 500.00	ms	3.00	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the filter time of DI3. The DI function is active only after the effective level is kept within the time defined by H03.62.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H03.63	DI4 fitter time	-	0.00 to 500.00	ms	3.00	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the filter time of DI4. The DI function is active only after the effective level is kept within the time defined by H03.63.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H03.64	DI5 filter time	-	0.00 to 500.00	ms	3.00	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the filter time of DI5. The DI function is active only after the effective level is kept within the time defined by H03.64.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0A.19	Filter time constant of touch probe 1	-	0.00 to 6.30	μs	2.00	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the filter time of touch probe 1. An active input must last for the time defined by H0A.19.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H0A.20	Filter time constant of touch probe 2	-	0.00 to 6.30	μs	2.00	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the filter time of touch probe 2. An active input must last for the time defined by H0A.20.								

12.8 Black Box

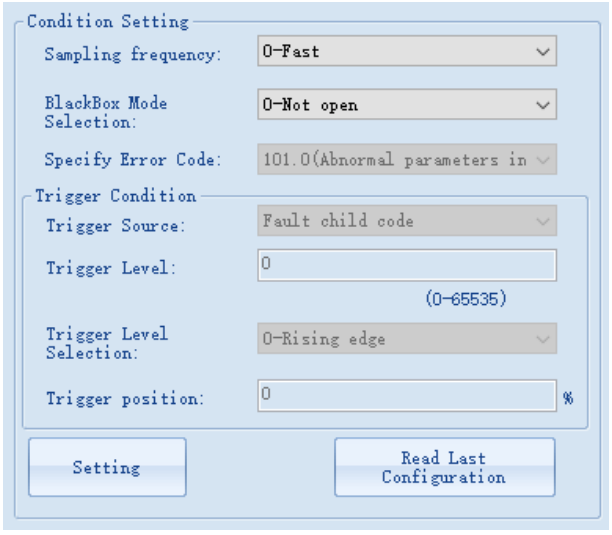
Function description

The black box function is used to capture and save the data generated upon occurrence of faults or under designated conditions. Such data can be read and uploaded by users through the software tool to facilitate troubleshooting.

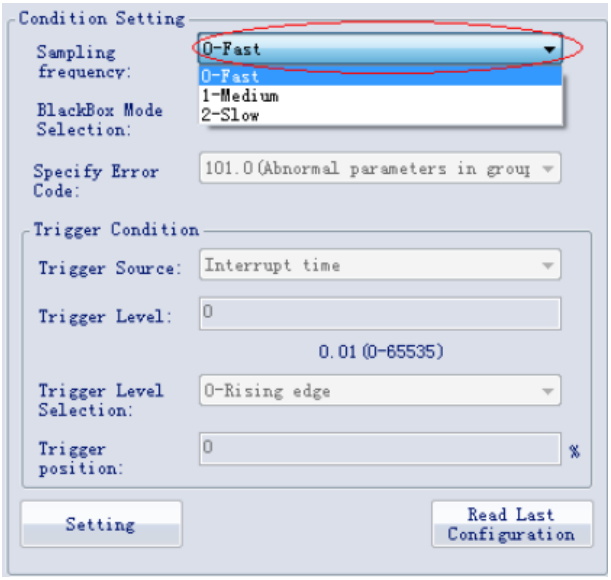
The black box is enabled by default. It is triggered upon occurrence of a fault or a sampling frequency of 16k. After the black box is triggered, it automatically deactivates. The following describes how to trigger it afterward.

1. If triggered by a fault (including faults and warnings), the black box will automatically activate after a power cycle.
2. If triggered by a resettable fault (excluding warnings), the black box will automatically activate after a fault reset or power cycle.
3. If triggered by a specified condition, the black box will activate only once. After successful triggering, the black box must be manually activated.

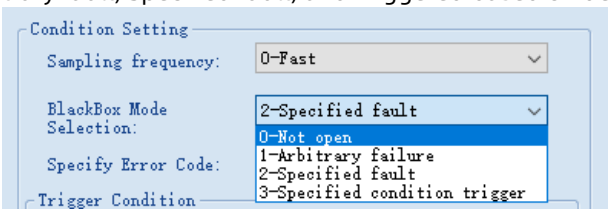
Triggering the black box



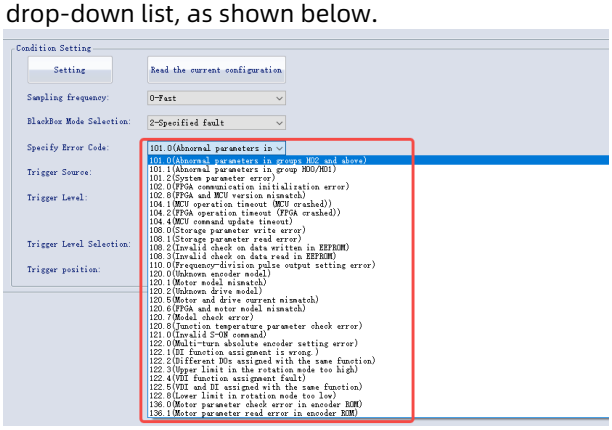
1. Sampling frequency: including three sampling frequencies, namely 16k (Fast), 4k (Medium), and 1k (Slow).



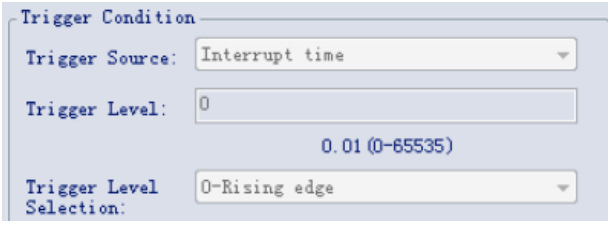
2. Black box modes: Arbitrary fault, Specified fault, and Triggered based on designated condition.



3. Select a fault from the drop-down list, as shown below.



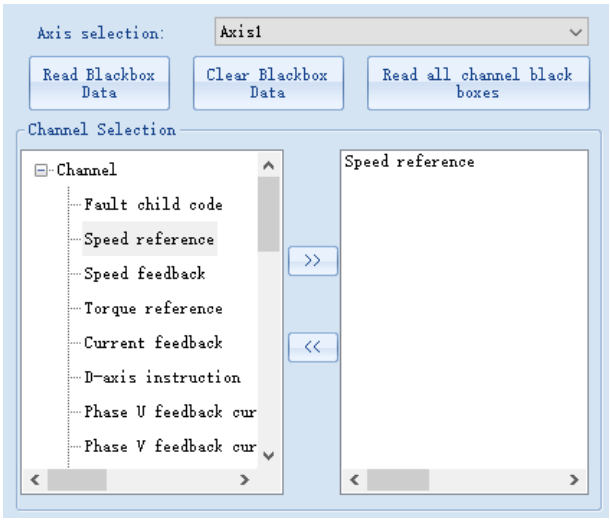
4. The Trigger Condition includes Trigger Source, Trigger Level, and Trigger Level Selection, as shown below.



5. Trigger position is used to set the position of the trigger time in the total sampling time, which is set to 75% by default.
6. After the black box is set, click "Setting" to download configuration parameters to the servo drive.

Reading data from the black box

You can select the black box channels (4 channels at most) by clicking >> or <<, or read data of all the channels by clicking "Read all", and then click "Save" to save the waveform files.



13 STO Integration

13.1 Safety Overview

Safe Torque Off (STO) is a safety function that complies with IEC 61800-5-2:2016.

The STO function inhibits the power semiconductor of the drive from outputting control signals, preventing the torque from be generated on the motor shaft end.



This function only cuts off the torque of the motor, without affecting the power supply of the servo/inverter. Before servicing the servo and inverter, cut off the power supply first and ensure that the servo and inverter are de-energized.

STO function prevents the movement of the motor by two redundant external hardware signals: STO1 and STO2 that block the PWM signals to the power layer of the servo drive. STO1 and STO2 input signals must be both active to allow the servo drive to operate normally.

The STO function table is shown below.

STO1 input	STO2 input	PWM signal
H	H	Normal
L	H	Inhibit
H	L	Inhibit
L	L	Inhibit

STO (safe torque off)	
Definition	Cuts off the power of the motor.
Description	The safe torque off (STO) function brings the machine safely into a no-torque state and prevents it from unexpected start. When the STO function is activated, the drive stops according to the stop mode upon the level 1 fault (H02.08).
Safety state	Disables the PWM gating signal of the drive.
Operation mode	High demand mode or continuous mode

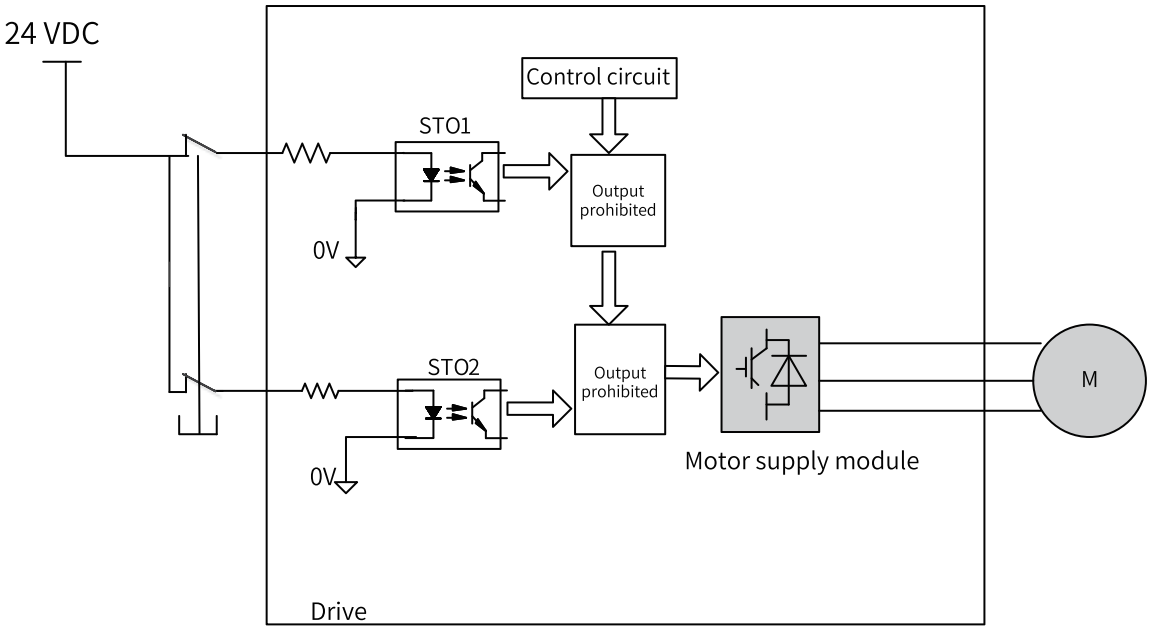


Figure 13-1 Schematics of the STO function

13.2 Precautions

Safety Precautions

The chapter contains the warning symbols used in this user guide and the safety instructions which you must obey when you install or connect an option module to a drive or inverter. If you ignore the safety instructions, injury, death or damage can occur. Read this chapter before you start the installation.

Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.

The products and specifications described in this guide or the content and presentation of the guide may be changed without notice to improve the product and/or the guide.

Table 13–1 Warnings, cautions, and notes

Label	Indication	Definition	Consequences of Negligence
Examples  General hazards  Special hazards Electric shock	DANGER	Danger	Indicates that failure to comply with the notice can result in death or severe personal injury.
	WARNING	Warning	Indicates that failure to comply with the notice may result in death or severe personal injury.
	CAUTION	Caution	Indicates that failure to comply with the notice may result in minor or moderate personal injury or equipment damage.
	STOP	Inhibit	Indicates that failure to comply with the notice can result in equipment or environmental damage.

Caution

- High attention is required for electrical installation and at the system design to avoid hazards either in normal operation or in the event of equipment malfunction.
- System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read the operating instruction and this safety information.

It is the responsibility of the machine builder/OEM/system integrator to make sure that the essential health and safety function requirements specified in the Machinery Directive are met. The manufacturer or its authorized distributor is obliged to conduct a hazard analysis before placing a product on the market, take appropriate measures to reduce/eliminate the related hazards and ensure proper components are selected.

This section describes the information that needs to be noted before you begin. Read the following safety instructions, risk assessment information, and limitations before you begin.

Before using the safety function, properly understand all the related information. Incorrect use of safety functions or use of safety functions that do not meet the safety requirements of the site may result in personal injury.

Safety measures

Carefully read the following important precautions and observe them when using the safety function.

- The safety torque off (STO) function is not a substitute for the emergency stop (E-stop) function. If only the STO function is triggered, with no extra measures taken, and the power supply cannot be cut off in emergency, high-voltage parts of the motor and drive are still energized. This may incur to take actions to prevent accidents when they notice any unexpected situations electric shock or other electricity-related risks. Therefore, maintenance work on electrical parts of the drive or motor can be performed only after the drive system is isolated from the main power supply.
- Depending on standards and requirements for particular applications, STO may be used as part of an E-stop system. However, the main purpose of STO in a dedicated safety control arrangement is to prevent risks without the use of an E-stop.
- An E-stop is often provided in a machine to allow for unexpected situations where an operator sees a hazard and can take actions to prevent accidents.
- The design requirement for an E-stop differs from that of a safety interlock. Generally, E-stop is required to be independent of any complex or intelligent control. It may use purely electromechanical devices to either disconnect the power or initiate a controlled rapid stop by using other measures such as dynamic or regenerative braking.

Note

- The design of safety-related systems requires specialist knowledge. To ensure that a complete control system is safe, it is necessary for the whole system to be designed according to recognized safety principles. The use of individual sub-systems such as drives with STO function, which are intended for safety-related applications, does not in itself ensure that the complete system is safe.
- The STO function can be used to stop the drive in emergency stop situations.
- In processes without personnel protection, it is recommended not to stop the drive by using the STO function. If a drive running is stopped by using STO, the drive performs a coast-to-stop. If this is not acceptable, the system should be stopped using the correct mode instead of the STO function.
- This publication is a guide to the application of safety functions, and also on the design of safety-related systems for machinery control.
- It is the responsibility of the designer of the end product or application to ensure that it is safe and in compliance with the relevant regulations.

Risk assessment

- When using safety functions, perform risk assessment on the servo system in advance. Make sure that the safety integrity level of the standards is met.
- The following residual risks may arise even when safety functions are operating. Therefore, safety must always be given consideration during risk assessment.
- If external force (such as gravitational force of a vertical axis) applies when the safety function is enabled, the motor will rotate. Therefore, you must use a separate mechanical brake to secure the motor.

Note

- In the case of failure of multiple IGBTs, no matter whether the STO function is enabled, the servo drive can generate an alignment torque. This torque can cause the motor shaft to rotate within a range of up to 180 ÷ Number of motor pole pairs (for a synchronous reluctance motor, the range is 180 ÷ 2 × Number of motor pole pairs).
- p indicates the number of pole pairs.

To ensure safety, you should determine all the risk assessments and residual risks in the entire machine equipment. A company and individual who constructed the safety related system must take full responsibility for installation and commissioning of the system. In addition, relevant sub-systems subject to the European Machinery Directive must be certified against safety standards, and risks and safety levels must be assessed for the machine or the entire system. It is recommended that a Certification Body final safety certification of the system be used.

The following describes the residual risks related to the safety function of this equipment.

Common residual risks

- At the shipment to end-users, check the settings of safety-related components by using programming tools and monitored/displayed contents on display and record and save the setting data concerning the safety observation function and the programming tools you used. Perform the checks by using a checklist.
- Safety will not be ensured such as in assembling machines until installation, wiring, and adjustment are completed properly. Install, wire, and adjust your system by referring to the user guide for each unit.

- Only qualified personnel are authorized to install, perform trial runs, repair, or adjust the equipment in which these components are installed. Only trained engineers should install and operate the equipment.
- Separate the wiring of the safety observation function from other signal wiring.
- Protect the cables with appropriate measures, such as routing them in a cabinet by using a cable guard.
- We recommend that you use a switch, a relay, or a sensor that complies with safety standards. If you need to use a switch, a relay, or a sensor that does not comply with safety standards, perform safety checks.
- Keep a required clearance and creepage distance depending on the voltage that you use.
- The time of a safety observation error depends on parameter settings.

Safe torque off (STO)

This function only cuts off the torque of the motor, and does not cut off the power supply of the servo or inverter. Before servicing the servo and inverter, cut off the power supply first and ensure that the servo and inverter are de-energized.

13.3 Function Use and Monitoring

The keypad displays the STO function state and fault information.

EDM signal DO output

When the 24 V voltage of STO1 and STO2 is cut off, the EDM DO signal is active. Otherwise, the EDM DO signal is inactive.

In this case, both STO1 and STO2 are filtered signals. When EDM is active, the PWM signal is blocked by the servo drive.

Signal name	Symbol	Optocoupler logic			
Safety input	STO1	ON	ON	OFF	OFF
	STO2	ON	OFF	ON	OFF
EDM output	EDM	OFF	OFF	OFF	ON

Note

The DO output of this EDM is only a monitoring signal to detect whether a safety function is triggered, not a safety signal output.

The EDM state of the integrated STO can only be output through the non-safe DO output of the drive, not through the DO output on the safety module.

EDM DO output wiring diagram

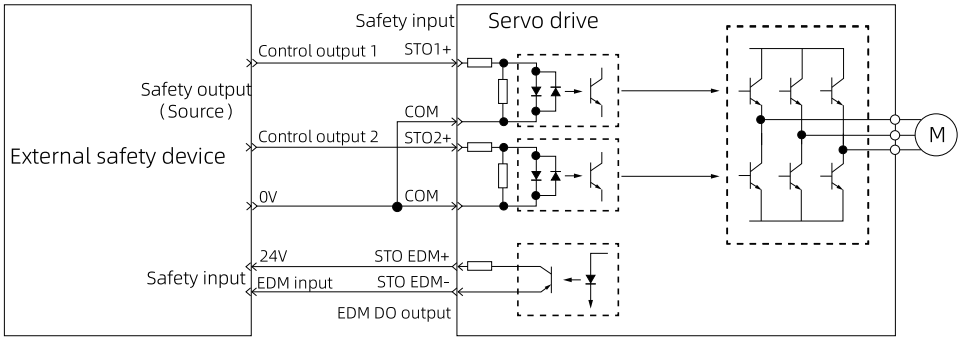
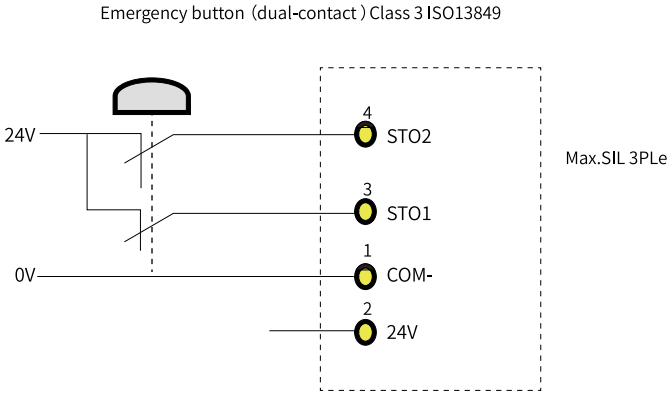


Figure 13-2 Wiring of external safety device and drive

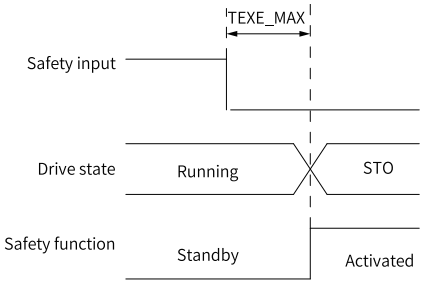
Application example



13.4 Safety Function Response Time

STO function prevents the movement of the motor by two redundant external hardware signals: STO1 and STO2 that block the PWM signals to the power layer of the servo drive. STO1 and STO2 input signals must be both active to allow the servo drive to operate normally.

If either or both of them are at low level simultaneously, the PWM signal will be blocked in the next 30 ms.



13.5 Fault reset

Fault reset means the normal operation can be recovered when the following conditions are met from the STO state to the ready state.

- The PWM buffer is disabled as the enable terminal is pulled up during power-on, so the PWM signal is inhibited.
- The PWM buffer is disabled as the enable terminal is pulled up during initialization of the MCU, so the PWM signal is inhibited. Such condition is cleared and servo drive works normally after initialization is done.
- When all the following conditions are met, the servo system that enters the safe state through the STO function can be back to normal with the safe state cleared after auto-reset of the drive.
  - The input state of the STO request must be "high".
  - The servo ON signal or the operation command must be inactive.
  - No dangerous faults exist.

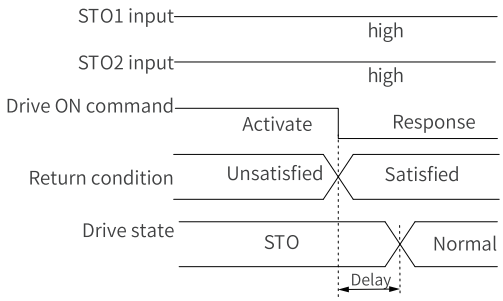


Figure 13-3 Return condition of servo ON/operation command

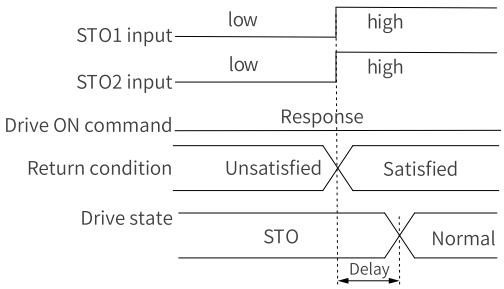


Figure 13-4 Return condition of external STO request state

Note

The servo-ON command is used to enable the drive. It is not the internal enable state of the drive.

- When STO_IN (STO1 or STO2 input) is restored to 24 V, the EDM and servo ready signals are immediately reset to 0. After 400 ms, the operation signal is activated (when STO_IN is stabilized at 24 V). When the drive operates, the PWM drive signals are outputted.

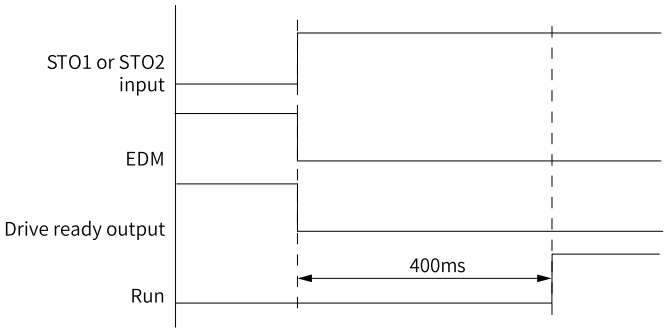


Figure 13-5 Servo drive reset sequence diagram

13.6 Acceptance

Basic Requirements

- Technical personnel must be trained to understand the requirements and principles of designing and commissioning safety-related systems.
- Person performing the maintenance must be trained to understand the requirements and principles of designing and operating safety-related systems.
- Operators must be trained to understand the requirements and principles of designing and operating safety-related systems.
- The safety-related circuit on the control board that fails to operate must be replaced with a new one as it is not repairable.

Commissioning checklist

- Start-up test and validation
  IEC 61508, EN/IEC 62061 and EN ISO 13849 require the final assembler of the equipment to verify the operation of the safety function through acceptance testing. This acceptance test is described in the drive manual. The testing of optional safety features is described in the corresponding manuals.

  The acceptance test must be performed:

  - Initial startup of the safety functions
  - After any changes related to safety functions (wiring, assembly, settings, or other related operations)
  - After any maintenance work related to safety functions is completed

  The acceptance test of the safety function must be carried out by an authorized person with expertise and knowledge of the safety function. The test must be documented and signed by the test staff.

  The signed acceptance test report must be kept in the log of the equipment. The report shall include documentation of start-up activities and test results, fault reports, and troubleshooting records. Any new acceptance tests due to changes or maintenance shall be recorded in the log.

- Safety function checklist for the servo drive integrated with the STO

Step	Test	Result
1	Ensure that the drive runs and stops freely during commissioning.	
2	Stop the drive (if running), switch the input power supply off and isolate the drive from the power line by a circuit breaker.	
3	Check the STO circuit connections based on the circuit diagram.	
4	Check that the shield of the STO input cable is grounded to the drive frame.	
5	Turn off the circuit breaker and switch the power supply on.	
5.1	Test the STO signal #1 when the motor stops: Set STO1 and STO2 to "H". Send a stop command to the drive (if running) and wait until the motor shaft is at standstill. Wake up the STO function by de-energizing (low state or open-circuit) the STO input signal #1 and send a start command to the drive. Ensure that the motor stays at a standstill and the keypad of the drive displays "E150.1".	
5.2	Set STO1 to "H" and disable the ON/RUN command of the drive. Then, reset the drive automatically and enable ON/RUN command of the drive. Finally, check whether the motor runs normally.	
5.3	Test the STO signal #2 when the motor stops: Set STO1 and STO2 to "H". Send a stop command to the drive (if running) and wait until the motor shaft is at standstill. Wake up the STO function by de-energizing (low state or open-circuit) the STO input signal #2 and give a start command for the drive. Ensure that the motor stays at a standstill and the keypad of the drive displays "E150.1".	
5.4	Set STO2 to "H" and disable the ON/RUN command of the drive. Then, reset the drive automatically and enable ON/RUN command of the drive. Finally, check whether the motor runs normally.	
6.1	Test the STO channel 1 when the motor is running: Set STO1 and STO2 to "H". Start the drive and ensure the motor is running. Wake up the STO function by de-energizing (low state or open-circuit) the STO input signal 1. Ensure that the motor stops and the drive trips. Reset the fault and try to start the drive. Ensure that the motor stays at a standstill and the keypad of the drive displays "E150.1".	
6.2	Set STO1 to "H" and disable the ON/RUN command of the drive. Then, reset the drive automatically and enable ON/RUN command of the drive. Finally, check whether the motor runs normally.	

Step	Test	Result
6.3	Test the STO channel 2 when the motor is running. Set STO1 and STO2 to "H". Start the drive and ensure the motor is running. Wake up the STO function by de-energizing (low state or open-circuit) the STO input signal 2. Ensure that the motor stops and the drive trips. Reset the fault and try to start the drive. Ensure that the motor stays at a standstill and the keypad of the drive displays "E150.1".	
6.4	Set STO2 to "H" and disable the ON/RUN command of the drive. Then, reset the drive automatically and enable ON/RUN command of the drive. Finally, check whether the motor runs normally.	
7	Record and sign the acceptance test report to prove that the safety function is safe and the equipment can be put into operation.	

Special requirements

You must conduct STO diagnosis every three month by powering off and powering on the drive once, or running the STO function once.

13.7 Troubleshooting

See the following table to identify the cause of fault and the action to be taken. Contact Inovance technical support if the fault persists after corrective actions listed in the following table are taken. Fault codes related to the STO function are listed in the following table.

Error code	Cause	Solution
E150.0	Two 24 V inputs are disconnected simultaneously, triggering the STO function.	The STO function is triggered normally. No action is required.
E150.1	The input states of STO1 and STO2 are inconsistent.	1 .Ensure that STO1 and STO2 voltage disconnection requests are triggered at the same time. 2 .The input circuit is abnormal. After the 24 V signal is disconnected, one STO input signal remains active ("24V"). Contact Inovance for technical support.
E150.2	OV/UV of the 5 V power supply.	Restore the 5 V power supply to normal state. Contact Inovance for technical support.
E150.3	The input circuit of STO works improperly.	Fix the input circuit fault. Contact Inovance for technical support.
E150.4	The pre-charge circuit of STO works improperly.	Fix the pre-charge circuit fault. Contact Inovance for technical support.

14 PROFINET Communication

14.1 Communication Overview

PROFINET is an automation bus standard based on the industrial Ethernet technology. PROFINET provides two kinds of real time communication: PROFINET IO RT and PROFINET IO IRT.

In PROFINET IO RT, the RT data is transferred via a prioritized Ethernet frame. No special hardware is required.

The PROFINET IO IRT channel is used to transmit data with more accurate time requirements, with a cycle of up to 500 μs. However, it requires special I/O devices and switches.

Alarm diagnosis is real-time acyclic data that is transmitted through the real-time channel. Configuration data, row rules, and function parameters are transmitted through the non-real-time channel.

IP protocol configuration instructions

When configuring the IP protocol using the "Set IP Address in Project" function in TIA Portal software, the actual effective IP protocol is determined by the TIA Portal configuration. However, the IP address will be cleared upon the power cycle of the drive.

14.2 Telegram Overview

14.2.1 Supported Telegrams

The drive supports the application of AC1, AC3 and AC4 and supports standard and Siemens telegrams in speed control and basic positioning controller control. The auxiliary telegrams can only be used with the main telegram. From the drive device point of view, the process data received is the receive word, and the process data to be sent is the transmit word. See the following table for details.

Telegram	Maximum number of PZDs (1 PZD = 1 word)	
	Receive word	Transmit word
Standard telegram 1	2	2
Standard telegram 2	4	4
Standard telegram 3	5	9
Siemens telegram 102	6	10
Siemens telegram 105	10	10
Siemens telegram 111	12	12
Siemens telegram 750 (auxiliary)	3	1
Inovance telegram 850 (auxiliary)	1	1

- **Telegram for speed control mode**

Telegram	1		2		3		102		105	
Application Mode	AC1		AC1		AC4		AC4		AC4	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_A	NIST_A	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B
PZD3										
PZD4			STW2	ZSW2	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2
PZD5					G1_STW	G1_ZSW	MOMRED	MELDW	MOMRED	MELDW
PZD6						G1_XIST1	G1_STW	G1_ZSW	G1_STW	G1_ZSW
PZD7								G1_XIST1	XERR	G1_XIST1
PZD8						G1_XIST2				
PZD9								G1_XIST2	KPC	G1_XIST2
PZD10										

- **Description of auxiliary telegrams**
  - When the 750 telegram is used, an uncontrollable acceleration occurs when either of the following settings is made:
    - Set the torque upper limit to a negative value through PZD M_LIMIT_POS.
    - Set the torque lower limit to a positive value through PZD M_LIMIT_NEG.

Telegram	750	
Application mode	-	
PZD1	M_ADD1	M_ACT
PZD2	M_LIMIT_POS	-
PZD3	M_LIMIT_NEG	

  - When the 850 telegram is used, you can customize the receive word and transmit word, and select the function through H24.35 and H24.36.

Telegram	850	
Application mode	-	
PZD1	USER_SEND	USER_RECIEVE

- **Telegrams for basic positioner mode**

Telegram	111	
Application mode	AC3	
PZD1	STW1	ZSW1
PZD2	POS_STW1	POS_ZSW1
PZD3	POS_STW2	POS_ZSW2
PZD4	STW2	ZSW2
PZD5	OVERRIDE	MELDW
PZD6	MDI_TARPOS	XIST_A
PZD7		
PZD8	MDI_VELOCITY	NIST_B
PZD9		
PZD10	MDI_ACC	FAULT_CODE

Telegram	111	
Application mode	AC3	
PZD11	MDI_DEC	WARN_CODE
PZD12	User	User

Note

user means user-defined receive word or send word.

14.2.2 I/O Data Signals

Signal	Description	Receive Word/Send Word	Data type	Scaling
STW1	Control word 1	Receive word	U16	
STW2	Control word 2	Receive word	U16	
ZSW1	Status word 1	Send word	U16	
ZSW2	Status Word 2	Send word	U16	
NSOLL_A	Speed setpoint A	Receive word	I16	4000H≒Rated motor speed
NSOLL_B	Speed setpoint B	Receive word	I32	40000000H≒Rated motor speed
NIST_A	Speed actual value A	Send word	I16	4000H≒Rated motor speed
NIST_B	Speed actual value B	Send word	I32	40000000H≒Rated motor speed
G1_STW	Encoder 1 control word	Receive word	U16	
G1_ZSW	Encoder 1 status word	Send word	U16	
G1_XIST1	Encoder 1 actual position 1	Send word	U32	
G1_XIST2	Encoder 1 actual position 2	Send word	U32	
MOMRED	Torque reduction	Receive word	I16	4000H≒Max. torque
MELDW	Message word	Send word	U16	
MDI_TARPOS	MDI position	Receive word	I32	1H≒1 LU<Note>
MDI_VELOCITY	MDI velocity	Receive word	I32	1H≒1000 LU/min
MDI_ACC	MDI acceleration multiplier	Receive word	I16	4000H≒100%
MDI_DEC	MDI deceleration multiplier	Receive word	I16	4000H≒100%
XIST_A	Position actual value A	Send word	I32	1H≒1 LU
OVERRIDE	Position velocity multiplier	Receive word	I16	4000H≒100%
FAULT_CODE	Fault code	Send word	U16	
WARN_CODE	Alarm code	Send word	U16	

Signal	Description	Receive Word/Send Word	Data type	Scaling
user	User-defined receive word 0: No function 1: Torque feedforward	Receive word	I16	4000H≒Motor max. torque/Motor rated torque x 100%
user	User-defined send word 0: No function 1: Actual torque 2: Actual absolute current 3: DI status	Send word	I16	4000H≒Motor max. torque/Motor rated torque x 100%

<Note>: LU stands for instruction unit, also known as user unit.

14.2.3 Control Word Definition

- **STW1 control word (for telegram 1 and 2)**

Signal	Description
STW1.0	1: ON (pulses can be enabled) 0: OFF1 (braking with ramp-function generator, then pulse suppression and ready for switching on)
STW1.1	1: No OFF2 (pulses can be enabled) 0: OFF2 (braking under inertia, immediate pulse suppression and switching on inhibited)
STW1.2	1 = No OFF3 (pulse can be enabled) 0: OFF3 (fast braking, then pulse suppression and switching on inhibited)
STW1.3	1: Enable operation 0: Inhibit operation (suppress pulses)
STW1.4	1: Enable ramp-function generator 0: Inhibit ramp-function generator (set the ramp-function generator output to zero)
STW1.5	1: Continue ramp-function generator 0: Freeze ramp-function generator output, not applicable to AC4
STW1.6	1: Enable setpoint 0: Inhibit setpoint (set the ramp-function generator input to zero)
STW1.7	Rising edge active, acknowledge faults
STW1.8~STW1.9	Reserved
STW1.10	1: Control via PLC 0: No control via PLC
STW1.11	1 = Invert setpoint 0 = Invert non-setpoint
STW1.12 to STW1.15	Reserved

- **STW1 control word (telegram 3 and 102)**

Signal	Description
STW1.0	1: ON (pulses can be enabled) 0: OFF1 (braking with ramp-function generator, then pulse suppression and ready for switching on)
STW1.1	1: No OFF2 (pulses can be enabled) 0: OFF2 (braking under inertia, immediate pulse suppression and switching on inhibited)
STW1.2	1 = No OFF3 (pulse can be enabled) 0: OFF3 (fast braking, then pulse suppression and switching on inhibited)
STW1.3	1: Enable operation 0: Inhibit operation (suppress pulses)
STW1.4	1: Operating condition (the ramp-function generator can be enabled) 0: Inhibit ramp-function generator (set the ramp-function generator output to zero)
STW1.5	1: Continue ramp-function generator 0: Freeze ramp-function generator output, not applicable to AC4
STW1.6	1: Enable setpoint 0: Inhibit setpoint (set the ramp-function generator input to zero)
STW1.7	Rising edge active, acknowledge faults
STW1.8~STW1.9	Reserved
STW1.10	1: Control via PLC 0: No control via PLC
STW1.11~STW1.15	Reserved

- **STW1 control word (for message 105)**

Signal	Description
STW1.0	1: ON (pulses can be enabled) 0: OFF1 (braking with ramp-function generator, then pulse suppression and ready for switching on)
STW1.1	1: No OFF2 (pulses can be enabled) 0: OFF2 (braking under inertia, immediate pulse suppression and switching on inhibited)
STW1.2	1 = No OFF3 (pulse can be enabled) 0: OFF3 (fast braking, then pulse suppression and switching on inhibited)
STW1.3	1: Enable operation 0: Inhibit operation (suppress pulses)
STW1.4	1: Enable ramp-function generator 0: Inhibit ramp-function generator
STW1.5	1: Continue ramp-function generator 0: Freeze ramp-function generator output, not applicable to AC4
STW1.6	1: Enable setpoint 0: Inhibit setpoint (set the ramp-function generator input to zero)
STW1.7	Rising edge active, acknowledge faults
STW1.8	Reserved

Signal	Description
STW1.9	Reserved
STW1.10	1: Control via PLC 0: No control via PLC
STW1.11~STW1.13	Reserved
STW1.14	1: Closed-loop torque control valid 0: Closed-loop speed control invalid
STW1.15	Reserved

- **STW1 control word (for message 111)**

Signal	Description
STW1.0	1: ON (pulses can be enabled) 0: OFF1 (braking with ramp-function generator, then pulse suppression and ready for switching on)
STW1.1	1: No OFF2 (pulses can be enabled) 0: OFF2 (braking under inertia, immediate pulse suppression and switching on inhibited)
STW1.2	1 = No OFF3 (pulse can be enabled) 0: OFF3 (fast braking, then pulse suppression and switching on inhibited)
STW1.3	1: Enable operation 0: Inhibit operation (suppress pulses)
STW1.4	1: Do not reject traversing task 0: Reject traversing task
STW1.5	1: No intermediate stop 0: Intermediate stop
STW1.6	Rising edge active, activate traversing task
STW1.7	Rising edge active, acknowledge faults
STW1.8	1: Enable JOG1 0: Disable JOG1
STW1.9	1: Enable JOG2 0: Disable JOG2
STW1.10	1: Control via PLC 0: No control via PLC
STW1.11~STW1.12	Reserved
STW1.13	1: External block change
STW1.14~STW1.15	Reserved

- **STW2 control word (telegram 2 and 3)**

Signal	Description
STW2.0 to STW2.11	Reserved
STW2.12	PLC heartbeat count value, bit 0
STW2.13	PLC heartbeat count value, bit 1
STW2.14	PLC heartbeat count value, bit 2
STW2.15	PLC heartbeat count value, bit 3

- **STW2 control word (telegram 102 and 105)**

Signal	Description
STW2.0 to STW2.7	Reserved
STW2.8	1: Traverse to fixed endstop
STW2.9 to STW2.11	Reserved
STW2.12	PLC heartbeat count value, bit 0
STW2.13	PLC heartbeat count value, bit 1
STW2.14	PLC heartbeat count value, bit 2
STW2.15	PLC heartbeat count value, bit 3

- **G1_STW control word (telegram 3, 102, and 105)**

<table>
<tr><th>Signal</th><th>Description</th></tr>
<tr><td>G1_STW.0</td><td>• G1_STW.7 = 0: Search for reference mark 1
• G1_STW.7 = 1: Probe 1 rising edge</td></tr>
<tr><td>G1_STW.1</td><td>If bit value is set to 1:
• G1_STW.7 = 0: Search for reference mark 2
• G1_STW.7 = 1: Probe 1 falling edge</td></tr>
<tr><td>G1_STW.2</td><td>If bit value is set to 1:
• G1_STW.7 = 0: Search for reference mark 3
• G1_STW.7 = 1: Probe 2 rising edge</td></tr>
<tr><td>G1_STW.3</td><td>If bit value is set to 1:
• G1_STW.7 = 0: Search for reference mark 4
• G1_STW.7 = 1: Probe 2 falling edge</td></tr>
<tr><td>G1_STW.4
G1_STW.5
G1_STW.6</td><td>
<table>
<tr><th>G1_STW.4</th><th>G1_STW.5</th><th>G1_STW.6</th><th>Definition</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>No function</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>Activate selected function</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>Read generated value</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>Interrupt operation</td></tr>
</table>
</td></tr>
<tr><td>G1_STW.7</td><td>1: Flying measurement
0: Search for reference mark</td></tr>
<tr><td>G1_STW.8 to G1_STW.11</td><td>Reserved</td></tr>
<tr><td>G1_STW.12</td><td>Rising edge active. Request setting of zero position</td></tr>
<tr><td>G1_STW.13</td><td>Rising edge active. Request value cyclic transfer of the absolute position value in G1_XIST2</td></tr>
<tr><td>G1_STW.14</td><td>Request parking encoder</td></tr>
<tr><td>G1_STW.15</td><td>Rising edge active, acknowledge encoder fault</td></tr>
</table>

- **POS_STW1 positioning control word (for telegram 111)**

Signal	Description
POS_STW1.0	Traversing block selection, bit 0
POS_STW1.1	Traversing block selection, bit 1
POS_STW1.2	Traversing block selection, bit 2
POS_STW1.3	Traversing block selection, bit 3
POS_STW1.4	Traversing block selection, bit 4
POS_STW1.5	Traversing block selection, bit 5

Signal	Description
POS_STW1.6 to POS_STW1.7	Reserved
POS_STW1.8	1: Absolute positioning 0: Relative positioning
POS_STW1.9	MDI direction selection: positive
POS_STW1.10	MDI direction selection: negative
POS_STW1.11	Reserved
POS_STW1.12	1: Continuous transfer 0: Activate MDI program segment switch by the rising edge of a running task (STW1.6)
POS_STW1.13	Reserved
POS_STW1.14	1: Signal setting-up selected 0: Signal positioning selected
POS_STW1.15	1 = Activate MDI 0 = Deactivate MDI

- **POS_STW2 positioning control word (for telegram 111)**

Signal	Description
POS_STW2.0	Reserved
POS_STW2.1	1: Set a reference point
POS_STW2.2	1 = Reference point stopper activated
POS_STW2.3 to POS_STW2.4	Reserved
POS_STW2.5	1: JOG mode, increment activated 0: JOG mode, speed activated
POS_STW2.6 to POS_STW2.13	Reserved
POS_STW2.14	1: Activate the soft limit switch 0: Deactivate the soft limit switch
POS_STW2.15	1: Activate the stop stopper 0: Deactivate the stop stopper

14.2.4 Status Word Definition

- **ZSW1 status word (for messages 1, 2, 3, 102)**

Signal	Description
ZSW1.0	1 = Power supply ready 0 = Not powered on
ZSW1.1	1: Ready for running 0: Not ready for running
ZSW1.2	1 = Enable 0 = Disable
ZSW1.3	1: Fault present 0: No fault
ZSW1.4	1: Coast to stop inactive (OFF2 invalid) 0: Coast to stop active

Signal	Description
ZSW1.5	1: Quick stop inactive (OFF3 invalid) 0: Quick stop active
ZSW1.6	1: Switching on inhibited active 0: Switching on inhibited inactive
ZSW1.7	1: Alarm present 0: No alarm
ZSW1.8	1: Speed error within tolerance 0: Speed error exceeding tolerance
ZSW1.9	1 = PLC control request present 0 = No PLC control request
ZSW1.10	1: Reach or exceed the reference frequency/speed 0: Not reach or exceed the reference frequency/speed
ZSW1.11	Reserved
ZSW1.12	1: Open the holding brake
ZSW1.13	Reserved
ZSW1.14	1: Motor runs forwardly (n_act ≥ 0) 0: Motor runs reversely (n_act < 0) Note: bit14 is not supported when the servo drive is running at ±1 rpm, as bit toggling may occur under this condition.
ZSW1.15	1 = Reserved

- **ZSW1 status word (for message 105)**

Signal	Description
ZSW1.0	1 = Power supply ready 0 = Not powered on
ZSW1.1	1 = Ready for operation 0 = Not ready for operation
ZSW1.2	1 = Enable 0 = Disable
ZSW1.3	1: Fault present 0: No fault
ZSW1.4	1: Coast to stop inactive 0: Coast to stop active
ZSW1.5	1: Quick stop inactive 0: Quick stop active
ZSW1.6	1: Switching on inhibited active 0: Switching on inhibited inactive
ZSW1.7	1: Alarm present 0: No alarm
ZSW1.8	Reserved
ZSW1.9	1 = PLC control request present 0 = No PLC control request
ZSW1.10 to ZSW1.11	Reserved
ZSW1.12	1: Open the holding brake
ZSW1.13	Reserved

Signal	Description
ZSW1.14	1: Closed-loop torque control active
ZSW1.15	Reserved

- **ZSW1 status word (for telegram 111)**

Signal	Description
ZSW1.0	1 = Power supply ready 0 = Not powered on
ZSW1.1	1 = Ready for operation 0 = Not ready for operation
ZSW1.2	1 = Enable 0 = Disable
ZSW1.3	1: Fault present 0: No fault
ZSW1.4	1: Coast to stop inactive (OFF2 invalid) 0: Coast to stop active (OFF2 valid)
ZSW1.5	1: Quick stop inactive (OFF3 invalid) 0: Quick stop active (OFF3 invalid)
ZSW1.6	1: Switching on inhibited active 0: Switching on inhibited inactive
ZSW1.7	1: Alarm present 0: No alarm
ZSW1.8	1: Position following error within tolerance 0: Position following error exceeding tolerance
ZSW1.9	1 = PLC control request present 0 = No PLC control request
ZSW1.10	1: Reach the target position 0: Not reach the target position
ZSW1.11	1: A reference point is set. Reference point approach is performed. The reference point position is active 0: No reference point is set
ZSW1.12	1: The rising edge movement task is confirmed. Accept a new movement task or MDI reference value based on the rising edge
ZSW1.13	1: The drive stops 0: The drive is running
ZSW1.14	1: The axis accelerates
ZSW1.15	1: Axis decelerated

- **ZSW2 status word (for telegrams 2 and 3)**

Signal	Description
ZSW2.0 to ZSW2.11	Reserved
ZSW2.12	Drive heartbeat count value, uploaded to PLC, bit 0
ZSW2.13	Drive heartbeat count value, uploaded to PLC, bit 1
ZSW2.14	Drive heartbeat count value, uploaded to PLC, bit 2
ZSW2.15	Drive heartbeat count value, uploaded to PLC, bit 3

- **ZSW2 status word (for telegram 102 and 105)**

Signal	Description
ZSW2.0 to ZSW2.7	Reserved
ZSW2.8	1: Traverse to fixed endstop
ZSW2.9~ZSW2.11	Reserved
ZSW2.12	Drive heartbeat count value, uploaded to PLC, bit 0
ZSW2.13	Drive heartbeat count value, uploaded to PLC, bit 1
ZSW2.14	Drive heartbeat count value, uploaded to PLC, bit 2
ZSW2.15	Drive heartbeat count value, uploaded to PLC, bit 3

- **G1_ZSW status word (for messages 3, 102 and 105)**

Signal	Description
G1_ZSW.0	1: Function 1 activated
G1_ZSW.1	1: Function 2 activated
G1_ZSW.2	1 = Function 3 activated
G1_ZSW.3	1 = Function 4 activated
G1_ZSW.4	1: Actual value 1 readable
G1_ZSW.5	1: Actual value 2 readable
G1_ZSW.6	1 = Actual value 3 readable
G1_ZSW.7	1 = Actual value 4 readable
G1_ZSW.8	Touch probe 1
G1_ZSW.9	Touch probe 2
G1_ZSW.10	Reserved
G1_ZSW.11	Acknowledge encoder fault
G1_ZSW.12	Set the zero position response
G1_ZSW.13	Transmit the absolute position in G1_XIST2 periodically
G1_ZSW.14	Parking encoder activated
G1_ZSW.15	Encoder fault

- **POS_ZSW1 status word (for message 111)**

Signal	Description
POS_ZSW1.0	Traversing block, bit 0
POS_ZSW1.1	Running program block, bit 1
POS_ZSW1.2	Running program block, bit 2
POS_ZSW1.3	Running program block, bit 3
POS_ZSW1.4	Running program block, bit 4
POS_ZSW1.5	Running program block, bit 5
POS_ZSW1.6 to POS_ZSW1.7	Reserved
POS_ZSW1.8	1: Negative hard limit activated (negative STOP cam) 0: Negative hard limit not activated (negative STOP cam)
POS_ZSW1.9	1: Positive hard limit activated (positive STOP cam) 0: Positive hard limit not activated (positive STOP cam)
POS_ZSW1.10	1: JOG mode activated 0: JOG mode not activated
POS_ZSW1.11	1: Reference point approach activated
POS_ZSW1.12	Reserved
POS_ZSW1.13	1: Traversing block active

Signal	Description
POS_ZSW1.14	Reserved
POS_ZSW1.15	1: MDI active 0: MDI inactive

- **POS_ZSW2 status word (for message 111)**

Signal	Description
POS_ZSW2.0	Reserved
POS_ZSW2.1	1: Speed limit active
POS_ZSW2.2 to POS_ZSW2.3	Reserved
POS_ZSW2.4	1: The axis moves forwardly 0: The axis does not move
POS_ZSW2.5	1: The axis moves reversely 0: The axis does not move
POS_ZSW2.6	1: Reach the reverse soft limit switch 0: Not reach the reverse soft limit switch
POS_ZSW2.7	1: Reach the forward soft limit switch 0: Not reach the forward soft limit switch
POS_ZSW2.8 to POS_ZSW2.9	Reserved
POS_ZSW2.10	1: Direct output 1 set by traversing block
POS_ZSW2.11	1: Direct output 2 set by traversing block
POS_ZSW2.12	1: Reach the fixed stop point
POS_ZSW2.13	1: Reach the clamping torque at the fixed stop point
POS_ZSW2.14	1: Travel to fixed stop point enabled
POS_ZSW2.15	Reserved

14.3 AC1 Mode

14.3.1 Overview

Siemens S7-200 Smart, S7-1200, S7-1500PLC can perform speed control on the drive through PROFINET. These PLCs use PROFINET RT and standard telegram 1 to start and stop the servo drive and control the servo drive speed.

14.3.2 Configuration Notes

1. Connect the PC to CN3 or CN4 of the drive through a communication cable.Go to network configuration in the commissioning software, and set the device name and IP address of the servo drive as shown in the figure.

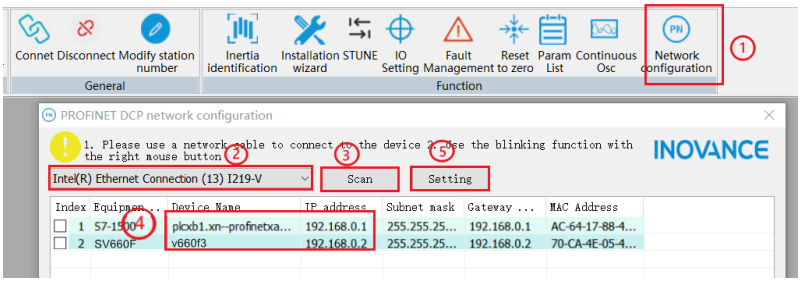


Figure 14-1 Set the device name and IP address

2. Installing SV660F GSD file: Run the PLC programming software → Options → Manage general-purpose station description file.

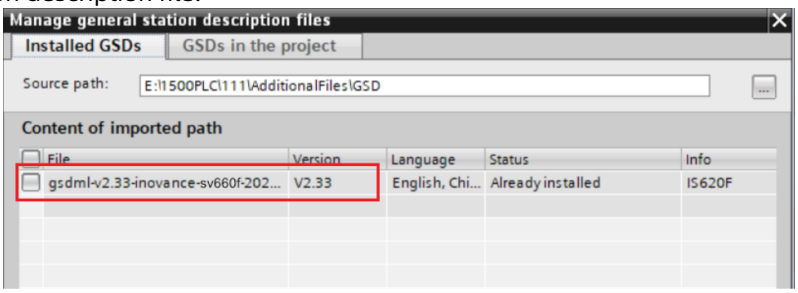


Figure 14-2 Install the GSD file

3. Select Device and Network, and import SV660F and establish connection with the PLC in the network view.

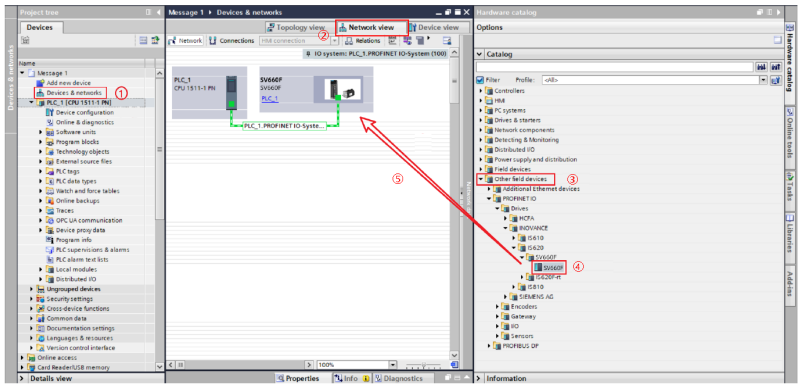


Figure 14-3 Connect IS620F to the PLC

4. Double-click SV660F in the device view and add message 1.

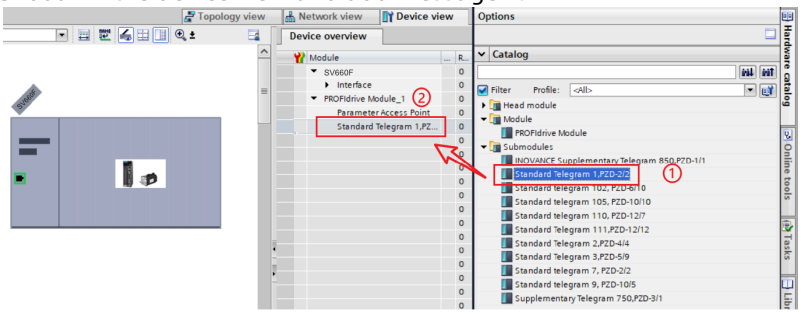


Figure 14-4 Adding message 1

5. To view the hardware identifier, right-click Telegram 1, choose Properties > System constants, and view the value under "Hardware identifier".

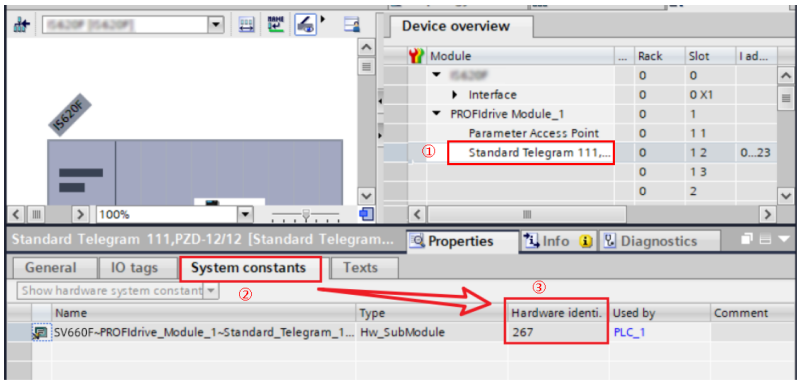


Figure 14-5 Finding hardware identifier

6. Go to OB1, drag the SINA_Speed (FB285) function block and drop it in the programming network section.

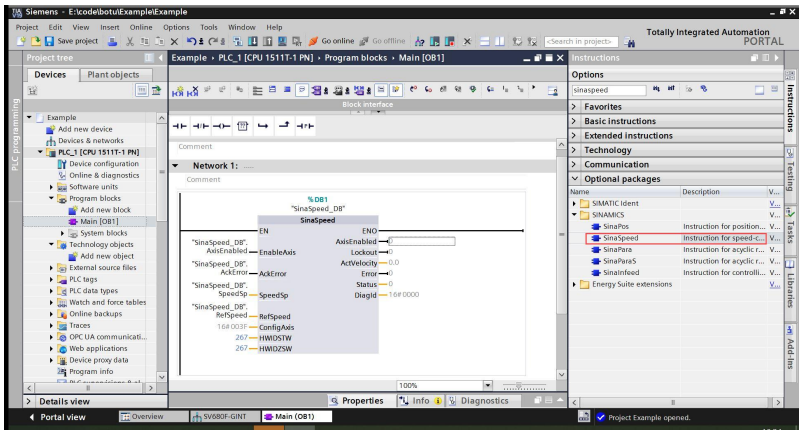


Figure 14-6 Calling the SINA_Speed function block

7. Note that, in section "Device view", the IP address and device name configured during networking should be consistent with the servo drive's IP address and device name configured in the background.

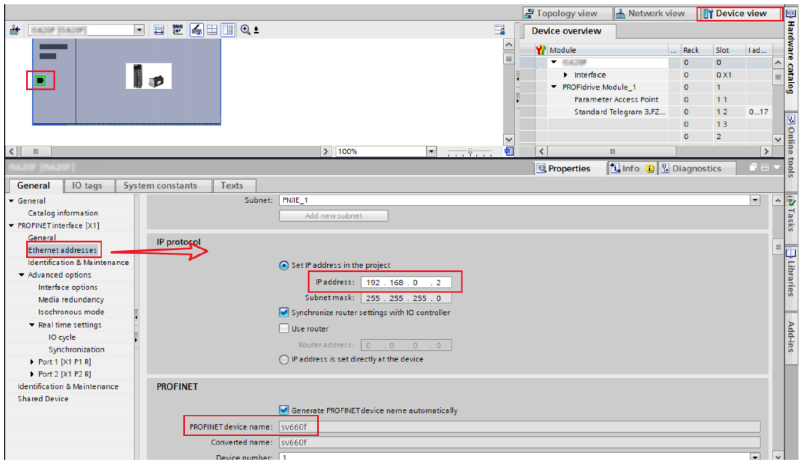


Figure 14-7 IP address and PROFINET device name configured during networking

AC1 acceleration/Deceleration time

Acceleration time for speed switchover (ms) = [(Target speed (rpm) – Current speed (rpm)) ÷ Rated speed (rpm)] × H06.05

Deceleration time for speed switchover (ms) = [(Target speed (rpm) – Current speed (rpm)) ÷ Rated speed (rpm)] × H06.06

Deceleration time (ms) for disabling OFF1 = (Current speed in rpm ÷ Rated speed in rpm) × H06.40 × $10^{H06.42}$

Deceleration time (ms) for disabling OFF3 = (Current speed in rpm ÷ Rated speed in rpm) × H06.41 × $10^{H06.43}$

14.4 AC3 Mode

14.4.1 Overview

S7-1200 and 1500 PLC can be connected to the drive through PROFINET communication and set the control mode of the drive to "Basic Position Control (EPOS)". The PLC performs basic positioning control through message 111 and SINA_POS in the drive library provided by TIA Portal.

14.4.2 SinaPOS Pins

Pin	Data type	Default	Description
Input			
ModePos	INT	0	Operation mode: 1: MDI relative positioning 2: MDI absolute positioning 3: MDI adjustment mode (continuous operation at specified speed) 4: Homing 5: Setting the homing mode 6: Running program segments 0 to 15 7: Jog 8: Jog increment
EnableAxis	BOOL	0	0: OFF 1: ON
CancelTransing	BOOL	1	0: Cancel active running task 1: Do not cancel active running task
IntermediateStop	BOOL	1	0: Pause running task 1: Do not pause running task
Jog1	BOOL	0	Jog1
Jog2	BOOL	0	Jog2
AckError	BOOL	0	Fault reset
ExecuteMode	BOOL	0	Activate positioning operation or receive setpoint
Position	DINT	0 (LU)	MDI position value

Pin	Data type	Default	Description
Velocity	DINT	0 (1000LU/min)	MDI speed setting (unit: 1000 LU/min)
OverV	INT	100 (%)	Speed multiplier: 1.00% to 199.00%
OverAcc	INT	100 (%)	Acceleration multiplier: 1.00% to 100.00%
OverDec	INT	100 (%)	Deceleration multiplier: 1.00% to 100.00%
ConfigEPos	DWORD	3	Control bit for transmitting telegram 111, which can be used to transmit signals such as hard limit enable, home switch, etc. If a variable is assigned to this pin in the program, ConfigEPos.%X0 and ConfigEPos.%X1 must both be 1 for the drive to operate. ConfigEPos.%X0: OFF2 stop ConfigEPos.%X1: OFF3 stop ConfigEPos.%X2: Enable soft limit ConfigEPos.%X3: Enable hard limit ConfigEPos.%X6: Home switch ConfigEPos.%X7: External program switch ConfigEPos.%X8: When ModePos is set to 2, continuous value changes are supported and the changes take effect immediately.
HWIDSTW	HW_IO	0	Hardware identifier of telegram 111
Output			
Error	BOOL	0	1: Faulty
Status	Word	0	Display status
DiagID	Word	0	Expansion communication fault
ErrorID	INT	0	Operation mode error/Block error 0: No error 1: Communication activated 2: Incorrect operation mode selected 3: Incorrect parameter settings 4: Invalid block number 5: Drive fault activated 6: Switch inhibition activated 7: Homing cannot start during operation
AxisEnabled	BOOL	0	The drive is enabled.
AxisError	BOOL	0	The drive is faulty.
AxisWarn	BOOL	0	The drive generates an alarm.
AxisPosOK	BOOL	0	The target position is reached.
AxisRef	BOOL	0	Homing is completed.
ActVelocity	DINT	0 (LU/min)	Actual speed (hexadecimal number 40000000h corresponds to the speed set by parameter H00.14)
ActPosition	DINT	0 (LU)	Current position (LU)
ActMode	INT	0	Current operation mode

Pin	Data type	Default	Description
EposZSW1	WORD	0	EPOS ZSW1 state
EposZSW2	WORD	0	EPOS ZSW2 state
ActWarn	WORD	0	The alarm code.
ActFault	WORD	0	The fault code.

Introduction to EnableAxis pin

- During operation, set EnableAxis to 0, that is, turn off OFF1. The drive performs ramp stop. At this time, the motor deceleration time is determined by H06.40.
- During operation, when OFF2 is turned off, the drive performs inertial stop.
- During operation, when OFF3 is turned off, the drive performs quick stop. At this time, the motor deceleration time is determined H06.41.

Deceleration time (ms) for disabling OFF1 = (current speed rpm/rated speed rpm) × H06.40 × $10^{H06.42}$

Deceleration time (ms) for disabling OFF3 = (current speed rpm/rated speed rpm) × H06.41 × $10^{H06.43}$

Introduction to CancelTraversing and IntermediateStop pins

1. Input signals CancelTraversing and IntermediateStop are effective for all operation modes except jog. During EPOS operation, they must be set to "1".
2. After CancelTraversing is set to 0, the axis decelerates to stop at a ramp speed, and discards work data. If CancelTraversing is set to 1 again, the axis will not resume operation.
3. After IntermediateStop is set to 0, the axis stops using maximum deceleration without discarding work data. If IntermediateStop is set to 1 again, the axis will resume operation. This indicates a pause of the axis.

Note

The deceleration time of CancelTraversing is related to H25.06, and the deceleration time of Intermediatestop is related to H25.04.

CancelTraversing deceleration time (seconds) = Velocity pin x OverV%/(60 x H25.06).

IntermediateStop deceleration time (seconds) = Velocity pin x OverV%/(60 x H25.04 x OverDec%)

Introduction to ActVelocity pin

The telegram specifies that 40000000h corresponds to the rated speed of motor (H00.14).
40000000H=1073741824D

Speed feedback (rpm) = (H00.14 x ActVelocity)/1073741824

Introduction to OverV, OverACC, and OverDec pins

Set speed (rpm) = (Velocity x OverV% x 1000 x gear ratio)/encoder resolution

Relative/Absolute positioning motor acceleration time (seconds) = (Velocity pin x OverV%)/(60 x H25.02 x OverAcc%)

Relative/Absolute positioning motor deceleration time (seconds) = (Velocity pin x OverV%)/(60 x H25.04 x OverDec%)

Note

The motor encoder resolution is 8388608.

Introduction to ConfigEPos pin

- In telegram 111, bit14 and bit15 of position control word 2 are defined as soft limit and hard limit activation switches, as shown in the following figure. Meanwhile, in the SINA_POS function block, bit2 and bit3 of the ConfigEPos pin are automatically associated with soft and hard limit activation, as shown in the following figure.

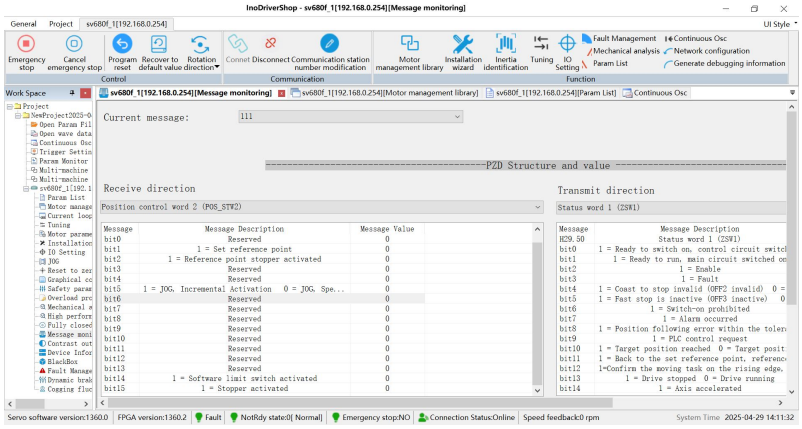
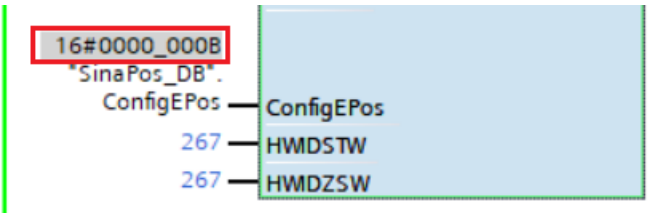


Figure 14-8 Telegram control word limit

Table 14–1 ConfigEPos basic positioning relationship

ConfigEPos bit	Function description
ConfigEPos.%X0	OFF2 for stop
ConfigEPos.%X1	OFF3 for stop
ConfigEPos.%X2	Activates software limit
ConfigEPos.%X3	Activates hardware limit
ConfigEPos.%X6	Home switch
ConfigEPos.%X7	External block switchover
ConfigEPos.%X8	When ModPos is set to 2, the setpoint can be changed continuously and the change takes effect in real time.

- **Activate hardware limit**
  In the SINA_POS function block, setting the ConfigEPos pin to 16#B activates the hard limit switch.



The positive and negative direction limit DI can be configured in the "H03 terminal input parameters", as shown in *"Figure 14-9" on page 331* .

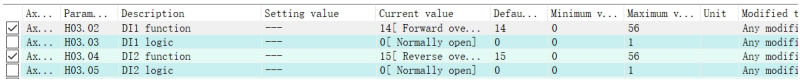


Figure 14-9 Hardware limit configuration

- **Activate software limit**

  In the SINA_POS function block, setting the ConfigEPos pin to 16#7 activates the soft limit switch.

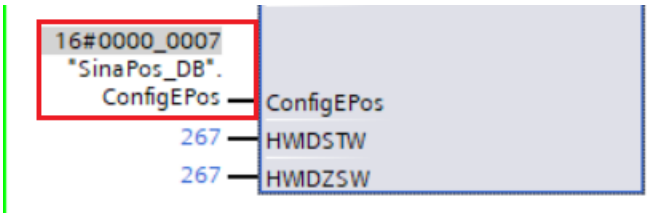


Figure 14-10 Activating soft limit through host controller

Alternatively, set H0A.01 to 1 to activate the software limit, as shown in *"Figure 14-11" on page 331* . The travel for positive and negative soft limits can be set in H0A.41 (positive soft limit setting) and H0A.43 (negative soft limit setting), as shown in *"Figure 14-12" on page 331* .

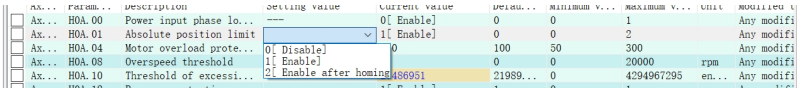


Figure 14-11 Activating software limit through servo drive

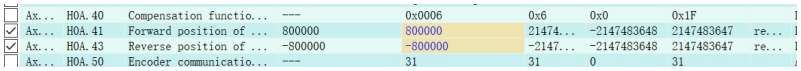


Figure 14-12 Setting positive and negative software limit travel

- **Correspondence between software limit and actual travel**

  (H0A.41 × gear ratio) ÷ encoder resolution = positive limit position corresponding to actual motor revolutions

  (H0A.43 × gear ratio) ÷ encoder resolution = negative limit position corresponding to actual motor revolutions

---

Note

The motor encoder resolution is 8388608.

During the ramp shutdown process after a pause task is triggered, if running parameters such as target position, target speed, target acceleration/deceleration rate, and running direction are changed and a new task is activated, the drive will not respond to these new task parameters. After the pause is canceled, rotation will resume according to the original task parameters.

14.4.3 Configuration

Operating condition

1. Setting ConfigEPOS to 3 sets OFF2 and OFF3 to 1. If the axis is ready and the drive has no faults (AxisErr = "0"), set EnableAxis to 1 to enable the axis. The output pin AxisEnabled will become 1.
2. Input signals CancelTransing, IntermediateStop are effective for all operating modes except jogging and homing. During EPOS operation, they must be set to "1". The settings are as follows:

1: Set CancelTransing. The axis stops with maximum deceleration and discards work data. After the axis stops, the operating mode can be switched.

2: Set IntermediateStop to 0. The axis performs ramp stop with the deceleration value currently in use and does not discard work data. If IntermediateStop is set back to 1, the axis will resume operation, which indicates pause of the axis. Operating modes can be switched after the axis becomes standstill.

3. If hard limit switches are used, set input pin ConfigEPos.%X3 (POS_STW2.15) of the SINA_POS function block to 1 to activate the hard limit function of the SV660F. Positive and negative hard limit switches can be connected to the DIs (DI1 to DI9 in group H03, default: DI1 and DI2) defined as positive and negative overtravel switches respectively by the SV660F drive.
4. If soft limit switches are used, set input pin ConfigEPos.%X2 (POS_STW2.14) of the SINA_POS function block to 1 to activate the soft limit function of the SV660F, and set the positive and negative soft limit positions in the SV660F.

Telegram 111 configuration

1. Add the SV660F drive to the network view and create network connection with the PLC, as shown in *"Figure 14-13" on page 332* .

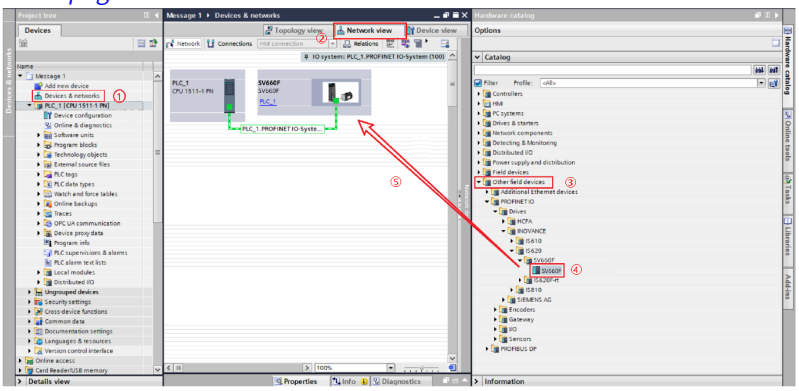


Figure 14-13 Adding the SV660F

2. In "Device view", double-click "SV660F" Double-click the drive object under "Module" on the right pane. The "Submodules" option will appear. Delete telegram 3 and replace it with telegram 111, as shown in *"Figure 14-13" on page 332* .

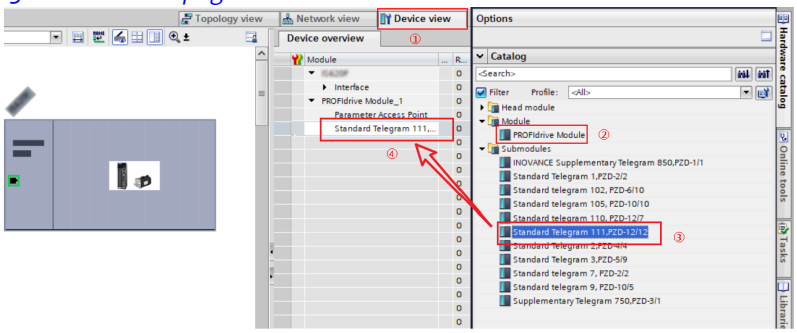


Figure 14-14 Adding telegram 111

3. Set the IP address and PROFINET device name for the PLC and SV660F, as shown in *"Figure 14-15" on page 333* .

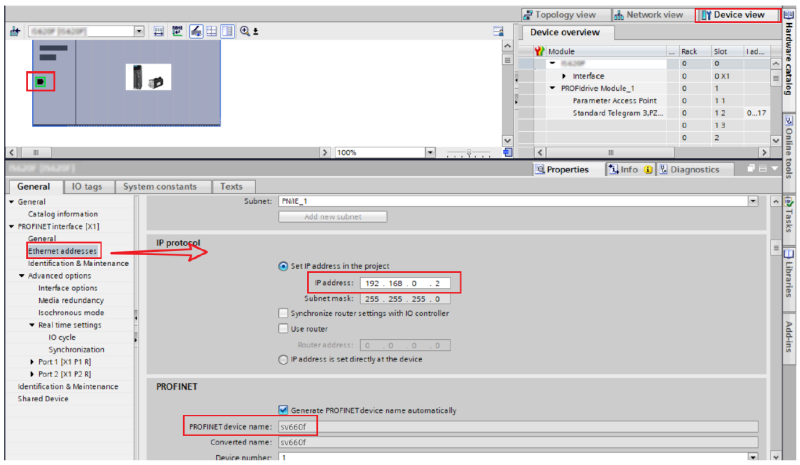


Figure 14-15 Setting the IP address and device name of the SV660F

4. Apply the SinaPOS function block in the main program, as shown in *"Figure 14-16" on page 333* .

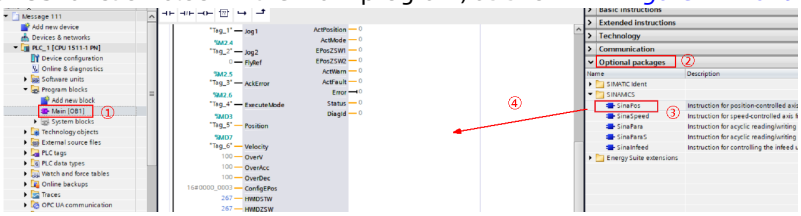


Figure 14-16 SinaPOS function block

5. To set the function block pins HWI DSTW and HWI DSZW, in "Device view", double-click SV660F. Right-click "Standard telegram 111" and select "Properties". Then locate "Hardware identifier" on the "System constants" tab, as shown in *"Figure 14-17" on page 333* .

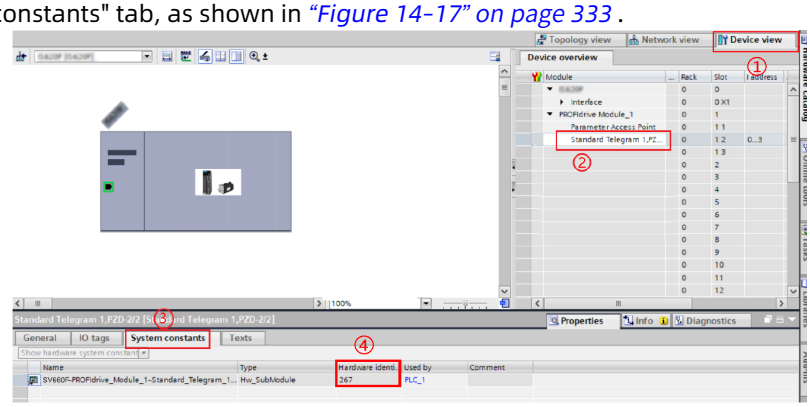


Figure 14-17 Locating the hardware identifier

6. If torque limit and torque reading functions need to enabled, set H24.38 and H24.39 to 1, as shown in *"Figure 14-18" on page 333* .

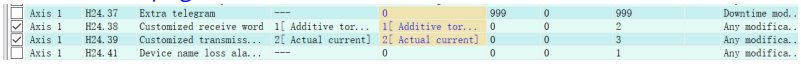


Figure 14-18 Enabling torque limit and torque reading functions

7. Telegram 111 networking is configured.

14.4.4 SINA_POS Block Function

14.4.4.1 Telegram 111 Relative or Absolute Positioning Function (ModPos=1 or 2)

Relative/Absolute positioning function

In the SINA_POS function block, input pins CancelTransing and IntermediateStop are effective for all operating modes except jog mode. During EPOS operation, they must be set to 1.

Position is in LU units, Velocity is in 1000 LU/min, and Velocity can only be larger than 0.

The currently running command can be replaced by a new command via the rising edge of ExecuteMode, but this is applicable only for operating modes 1 and 2 (ModPOS=1 or 2).

During positioning, AxisPosOK is false. After positioning is complete, AxisPosOK is true.

Table 14–2 MDI relative/absolute positioning steps

Terminal signal	Step 1: Prepare	Step 2: Enable	Step 3: Start
ModPos	1: Relative positioning 2: Absolute positioning	1: Relative positioning 2: Absolute positioning	1: Relative positioning 2: Absolute positioning
CancelTransing	1	1	1
IntermediateStop	1	1	1
EnableAxis	0	0 to 1	1
ExecuteMode	0	0	0 to 1
Position	Position reference	Position reference	Position reference
Velocity	Velocity reference	Velocity reference	Velocity reference
OverV	100	100	100
OverAcc	100	100	100
OverDec	100	100	100

Related formulas:

Number of motor revolutions for relative/absolute positioning = (position × gear ratio) ÷ encoder resolution

Motor speed for relative/absolute positioning (rpm) = (velocity input × 1000 × OverV% × gear ratio) ÷ encoder resolution

Motor acceleration time for relative/absolute positioning (seconds) = velocity input × OverV% ÷ (60 × H25.02 × OverAcc%)

Motor deceleration time for relative/absolute positioning (seconds) = velocity input × OverV% ÷ (60 × H25.04 × OverDec%)

Note

During relative/absolute positioning, speed can be adjusted in real-time by modifying OverV (1% to 199%) or by modifying Velocity (must be > 0) and OverV.

Continuous position reference in absolute positioning mode (ModPos=2, ConfigEpos.%X8= 1)

In absolute positioning mode (ModPos=2), if ConfigEpos.%X8 in telegram 111 is set to 1, after Position, Velocity, OverV, OverACC, and OverDEC are updated on the PLC side, only the first trigger of ExecuteMode is required to start the drive. Subsequent updates to target position and speed will take effect immediately without requiring a new trigger of ExecuteMode. The drive will update the corresponding values in real time, which take effect immediately.

14.4.4.2 Telegram 111 Running at the Specified Speed (ModPos=3)

MDI adjustment mode allows the axis to run continuously in the forward or reverse direction in a speed mode, with the running speed specified by input parameter Velocity (>0), and the speed and acceleration/deceleration multiplier specified by input parameters OverV, OverAcc, and OverDec. The running conditions "CancelTransing" and "IntermediateStop" must be set to 1, and JOG1 and JOG2 must be set to 0. Positioning motion is triggered by the rising edge of ExecuteMode. To update the target speed, you must trigger ExecuteMode.

Note

The running direction in the MDI mode is determined by the Positive (forward) and Negative (reverse) terminals. Positive = 1 indicates the forward direction and Negative = 1 indicates the reverse direction. When both are 1 or 0, the axis stops. Velocity must be larger than 0. Otherwise, the motor stops.

Table 14–3 MDI adjustment mode steps

Terminal signal	Step 1: Prepare	Step 2: Enable	Step 3: Forward running	Step 3: Reverse running	Step 4: Stop	Step 4: Pause
ModPos	3	3	3	3	3	3
CancelTrans-ing	1	1	1	1	1 → 0	1
Intermediate-Stop	1	1	1	1	1	1 → 0
EnableAxis	0	0→1	1	1	1	1
Positive	0	1	1	0	0	0
Negative	0	0	0	1	1	1
ExecuteMode	0	0	0→1	0→1	1 → 0	1 → 0
Position	Irrelevant	Irrelevant	Irrelevant	Irrelevant	Irrelevant	Irrelevant
Velocity	Speed reference	Speed reference	Speed reference	Speed reference	Speed reference	Speed reference
OverV	100	100	100	100	100	100
OverAcc	100	100	100	100	100	100
OverDec	100	100	100	100	100	100

Related formulas:

Motor speed (rpm) = (Velocity pin x 1000 x OverV% x gear ratio)/encoder resolution

Motor acceleration time (second) = (Velocity pin x OverV%)/(60 x H25.02 x OverAcc%)

CancelTransing deceleration time (second) = (Velocity pin x OverV%)/(60 x H25.06)

IntermediateStop deceleration time (second) = (Velocity pin x OverV%)/(60 x H25.04 x OverDec%)

Deceleration time (ms) for disabling OFF1 = (current speed rpm/rated speed rpm) x H06.40 x $10^{H06.42}$

Deceleration time (ms) for disabling OFF3 = (current speed rpm/rated speed rpm) x H06.41 x $10^{H06.43}$

14.4.4.3 Telegram 111 Active Homing Mode (ModPos=4)

Home switch introduction

In telegram 111, bit2 of position control word 2 (EPOS_STW2) defaults to determine whether the reference point block is effective. Meanwhile, the ConfigEPos.%x6 of the SINA_POS function block corresponds to bit2 of POS_STW2, as shown in the figure below.

ConfigEPos Bit	111 Telegram Bit
ConfigEPos.%X0	STW1.%X1
ConfigEPos.%X1	STW1.%X2
ConfigEPos.%X2	EposSTW2.%X14
ConfigEPos.%X3	EposSTW2.%X15
ConfigEPos.%X4	EposSTW2.%X11
ConfigEPos.%X5	EposSTW2.%X10
ConfigEPos.%X6	EposSTW2.%X2
ConfigEPos.%X7	STW1.%X13
ConfigEPos.%X8	EposSTW1.%X12
ConfigEPos.%X9	STW2.%X0
ConfigEPos.%X10	STW2.%X1
ConfigEPos.%X11	STW2.%X2
ConfigEPos.%X12	STW2.%X3
ConfigEPos.%X13	STW2.%X4
ConfigEPos.%X14	STW2.%X7

Receive direction

Position control word 2 (POS_STW2)

Message	Message Description	Message Value
H29.19	Position control word 2 (POS_STW2)	0H
bit0	Reserved	0
bit1	1 = Set reference point	0
bit2	1 = Reference point stopper activated	0
bit3	Reserved	0
bit4	Reserved	0
bit5	1 = JOG, Incremental Activation 0 = JOG, Spe...	0
bit6	Reserved	0
bit7	Reserved	0
bit8	Reserved	0
bit9	Reserved	0
bit10	Reserved	0
bit11	Reserved	0

Figure 14-19 Corresponding bit of ConfigEPos

In the program, setting the ConfigEPos pin to 16#4B activates the home, as shown in the figure.

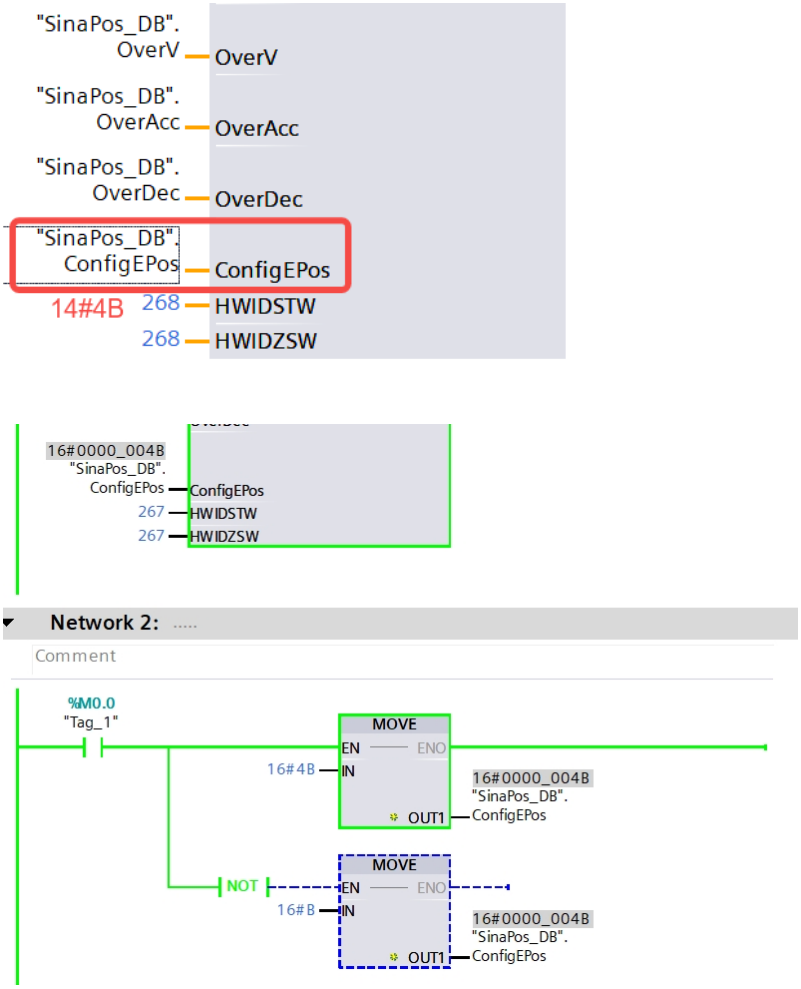


Figure 14-20 Activating the home

Note

You can assign 16#B to pin ConfigEPOS, and set the DI terminal as the home switch in group H03.

Homing function operation

The homing function in telegram 111 is automatically planned internally by the servo drive (ModPos=4). The host controller only provides the signal for triggering homing. H25.22 is used to set the homing type.

If absolute homing is selected (H05.40=0), the value of H05.36 is used as the value after homing. If relative homing is selected (H05.40=1), the value of H05.36 plus the current position is used as the position after homing.

Before homing is completed, ExecuteMode of the SIna_POS function block must remain TRUE to complete the homing action. When H02.01 is set to 1, AxisRef is set to 1 after the first homing action, and remains 1 even after a power cycle of the drive.

Table 14–4 Homing procedure

Terminal signal	Step 1: Prepare	Step 2: Enable	Step 3: Start homing
ModPos	4	4	4
CancelTransing	1	1	1
IntermediateStop	1	1	1
EnableAxis	0	0 to 1	1
ExecuteMode	0	0	0 to 1
OverV	100	100	100
Homing-related parameters are H25.22/H25.23/H25.25/H25.27/H05.36/H05.35/H05.66.			

Related formula

Homing acceleration/deceleration time at high speed (second) = (H25.27 × H25.23) ÷ (60 × H25.02)

Homing acceleration/deceleration time at low speed (second) = (H25.27 × H25.25) ÷ (60 × H25.02)

Special homing type (torque homing)

Note

Telegram 111 supports torque homing and no overtravel switch is required.

1. H25.22 (homing type) = -1: After reaching the hardware limit while moving in the negative direction, the motor reverses and searches for the first Z signal to set as the home.
2. H25.22 (origin return type) = -2: After reaching the hardware limit while moving in the positive direction, the motor reverses and searches for the first Z signal to set as the home.

Torque homing condition: The motor reaches the hardware limit. The condition for detecting hardware limit reach is that the torque reaches H05.58 (mechanical limit torque, unit: 0.1%). When the speed reference is less than H06.19, a zero-speed signal is output. In this case, the motor searches for the first Z signal to set as the home in the reverse direction.

Homing trajectory

- **H25.22 = -2**
  The servo motor runs in the forward direction at a high speed first. If the torque reaches the limit and the speed is near zero when the motor hits the mechanical limit, and such status persists, it indicates that the motor reaches the mechanical limit position. In this case, the motor runs in the reverse direction at a low speed and stops at the first Z signal after reaching the rising edge.

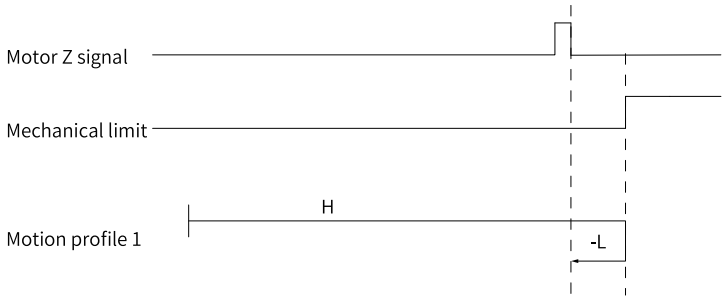


Figure 14-21 Motor running curve and speed in mode –2

- **H25.22 = -1**

  The motor runs in the reverse direction at a high speed first. If the status where the torque reaches the limit and the speed is near zero after the axis hits the mechanical limit persists, it indicates that the axis has reached the mechanical limit position. In this case, the motor runs in the forward direction at a low speed and stops after reaching the rising edge of the Z signal for the first time.

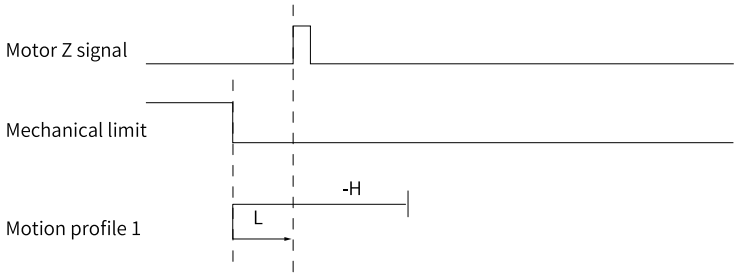


Figure 14-22 Motor running curve and speed in mode –1

- **H25.22 = 1**

  Mechanical home: motor Z signal

  Deceleration point: negative limit switch

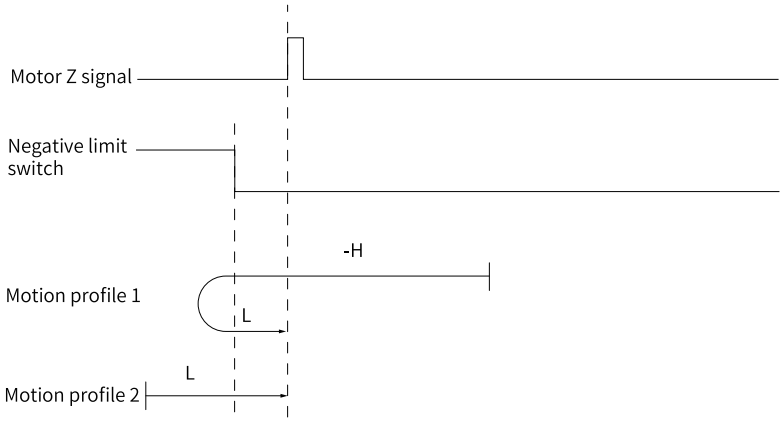


Figure 14-23 Motor operation curve and speed in mode 1

  - Motion profile 1: Deceleration point signal inactive at start of homing
  - Motion profile 2: Deceleration point signal active at start of homing

Note

Note: In the figure, "H" represents high speed H25.23, and "L" represents low speed H25.25, and “-” indicates reverse run.

- **H25.22 = 2**

  Home: Z signal

  Deceleration point: positive limit switch

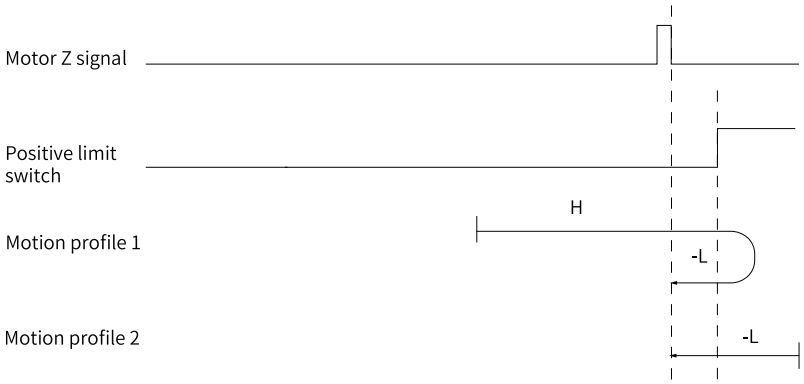


Figure 14-24 Motor operation curve and speed in mode 2

  - Motion profile 1: Deceleration point signal inactive at start of homing
  - Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 3**

  Home: Z signal

  Deceleration point: home switch (HW)

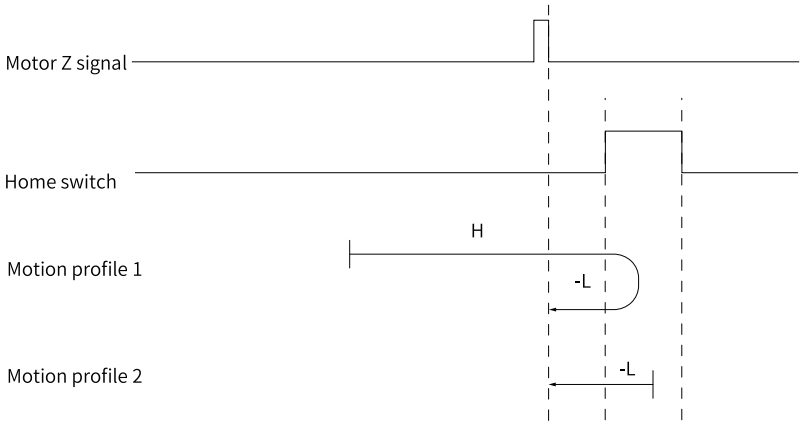


Figure 14-25 Motor operation curve and speed in mode 3

  - Motion profile 1: Deceleration point signal inactive at start of homing
  - Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 4**

  Home: Z signal

  Deceleration point: home switch (HW)

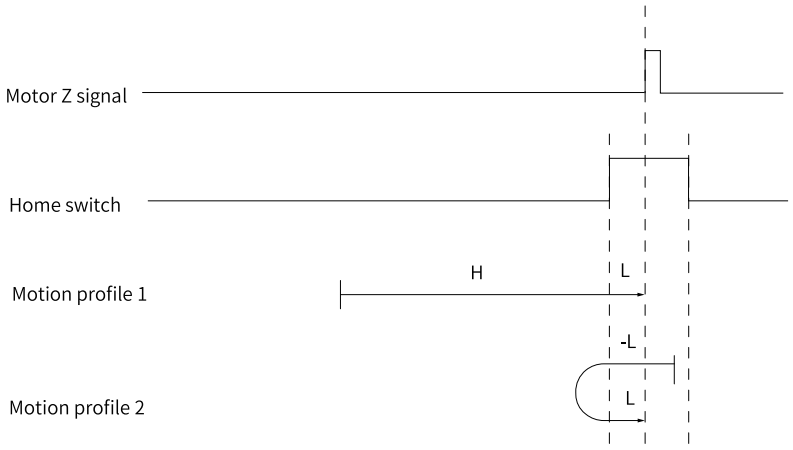


Figure 14-26 Motor running curve and speed in mode 4

- Motion profile 1: Deceleration point signal inactive at start of homing
- Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 5**

  Home: Z signal

  Deceleration point: home switch (HW)

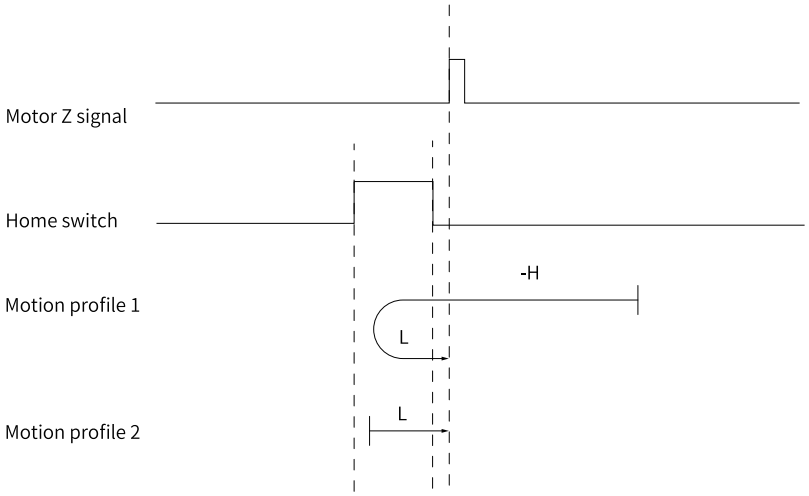


Figure 14-27 Motor running curve and speed in mode 5

- Motion profile 1: Deceleration point signal inactive at start of homing
- Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 6**

  Home: Z signal

  Deceleration point: home switch (HW)

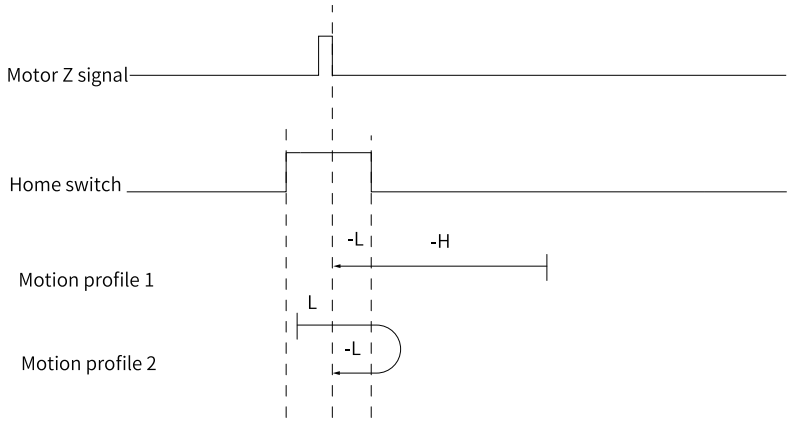


Figure 14-28 Motor running curve and speed in mode 6

- Motion profile 1: Deceleration point signal inactive at start of homing
- Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 7**

  Home: Z signal

  Deceleration point: home switch (HW)

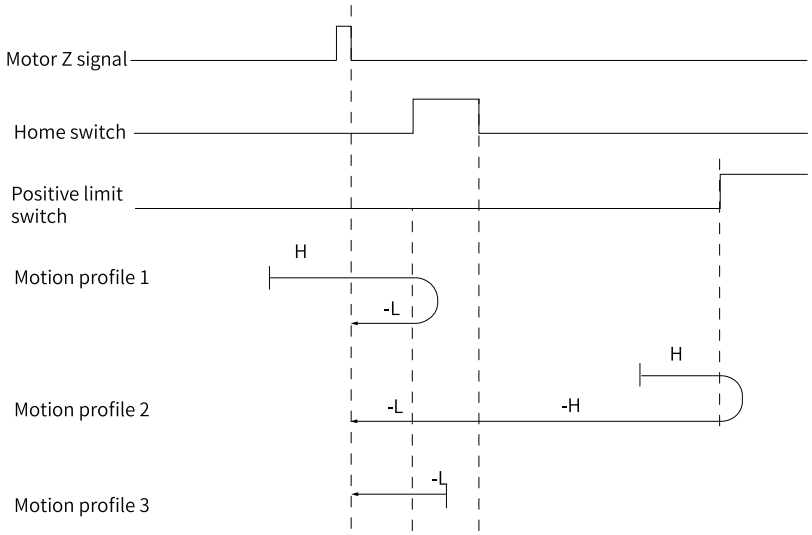


Figure 14-29 Motor operation curve and speed in mode 7

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the positive limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the positive limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 8**

  Home: Z signal

  Deceleration point: home switch (HW)

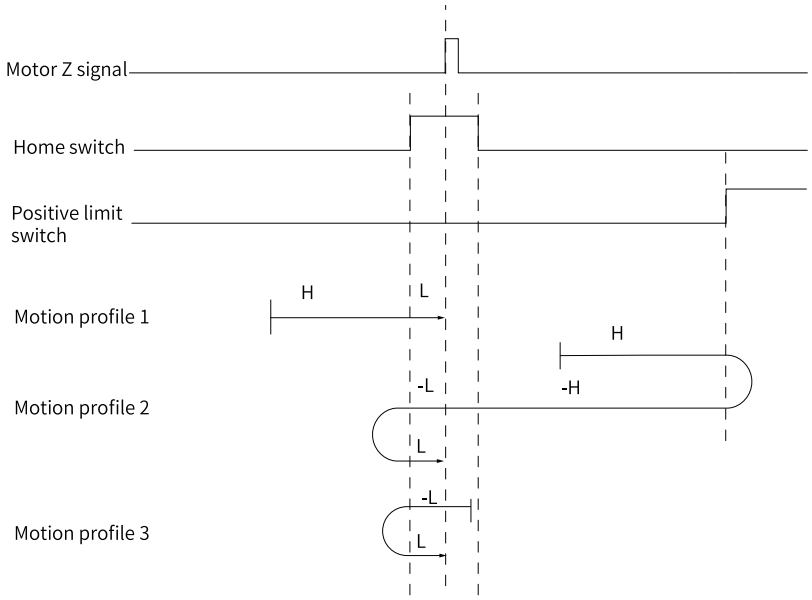


Figure 14-30 Motor running curve and speed in mode 8

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the positive limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the positive limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 9**

  Home: Z signal

  Deceleration point: home switch (HW)

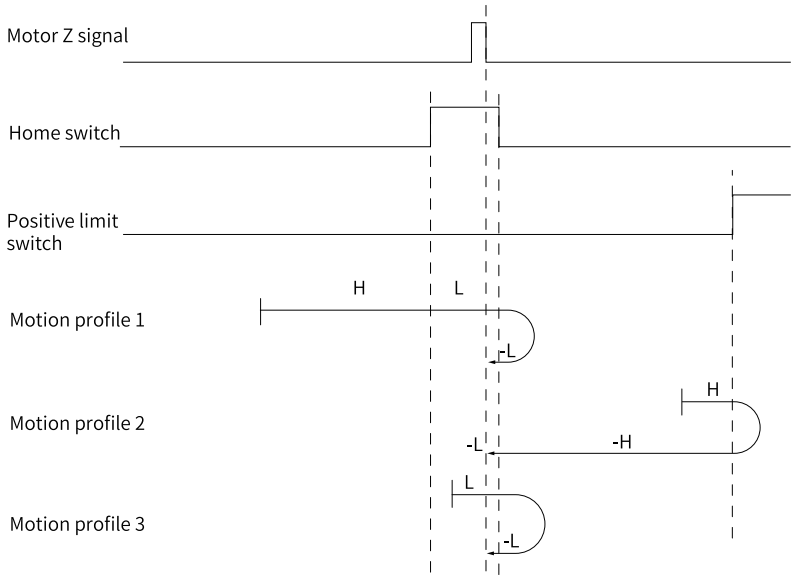


Figure 14-31 Motor running curve and speed in mode 9

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the positive limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the positive limit switch.

- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 10**
  Home: Z signal

  Deceleration point: home switch (HW)

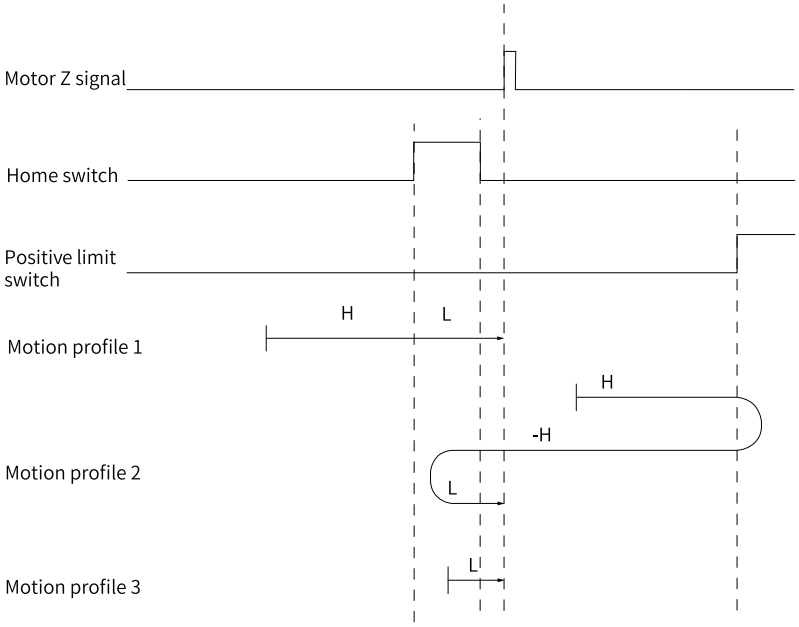


Figure 14-32 Motor running curve and speed in mode 10

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the positive limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the positive limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 11**
  Home: Z signal

  Deceleration point: home switch (HW)

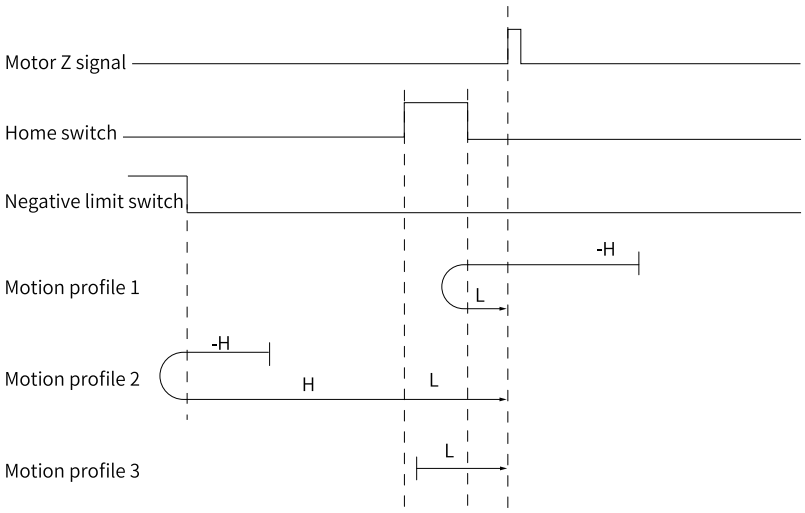


Figure 14-33 Motor running curve and speed in mode 11

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the reverse limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the reverse limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 12**
  Home: Z signal

  Deceleration point: home switch (HW)

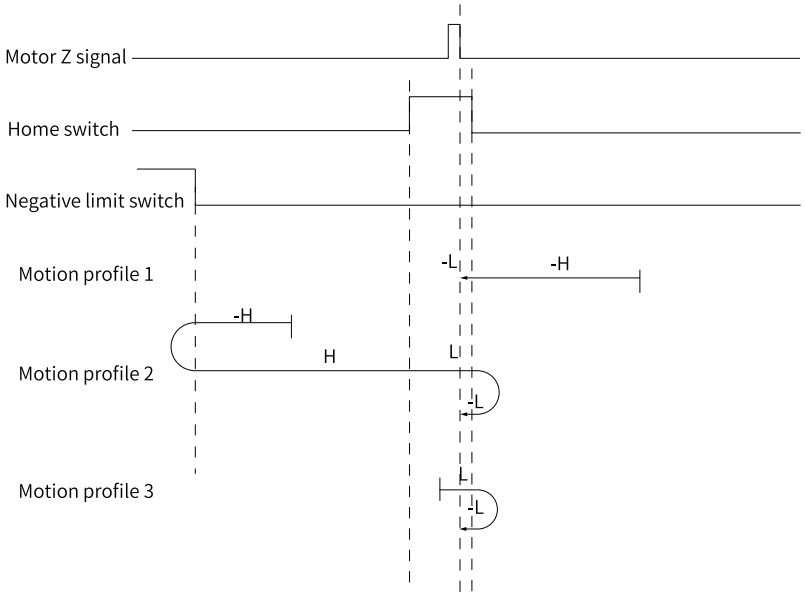


Figure 14-34 Motor running curve and speeds in mode 12

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the reverse limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the reverse limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 13**
  Home: Z signal

  Deceleration point: home switch (HW)

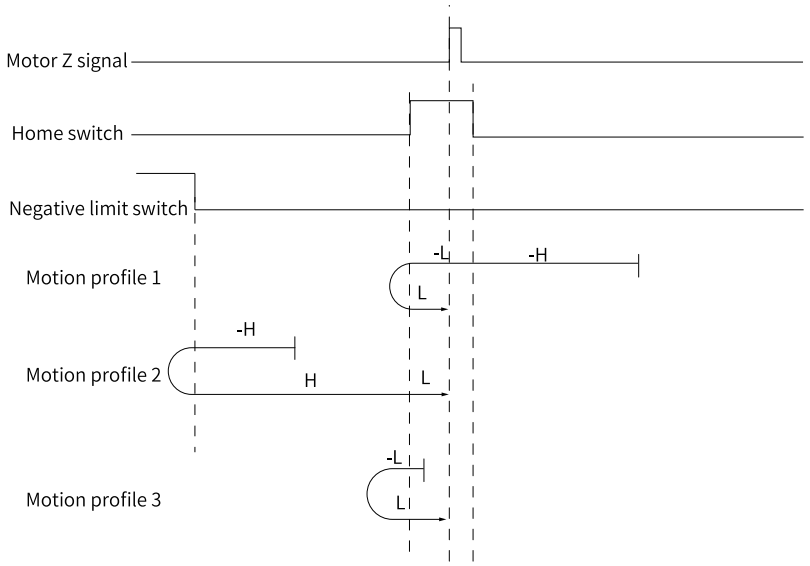


Figure 14-35 Motor running curve and speed in mode 13

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the reverse limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the reverse limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 14**

  Home: Z signal

  Deceleration point: home switch (HW)

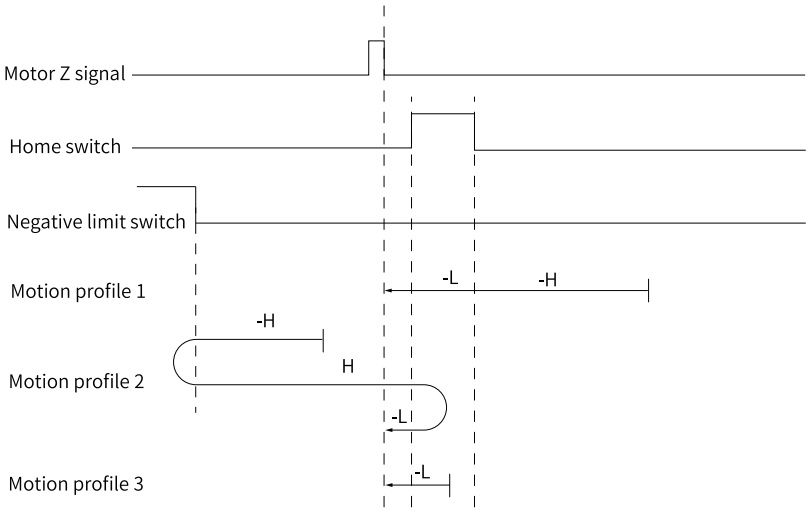


Figure 14-36 Motor running curve and speed in mode 14

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the reverse limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the reverse limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 17**

Home: negative limit switch

Deceleration point: negative limit switch

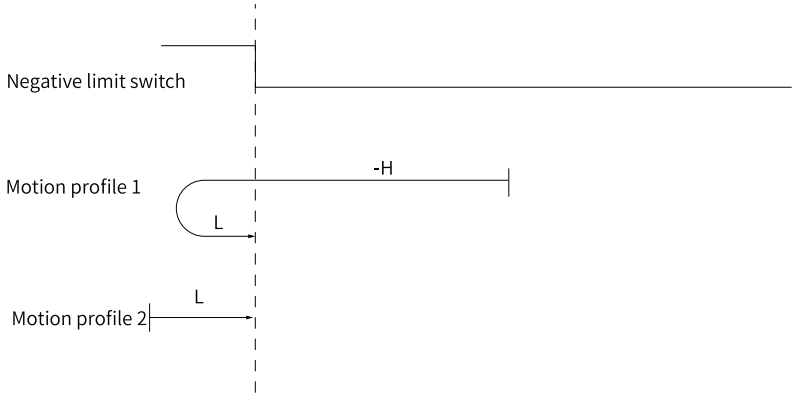


Figure 14-37 Motor running curve and speed in mode 17

- Motion profile 1: Deceleration point signal inactive at start of homing
- Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 18**
  Home: positive limit switch

  Deceleration point: positive limit switch

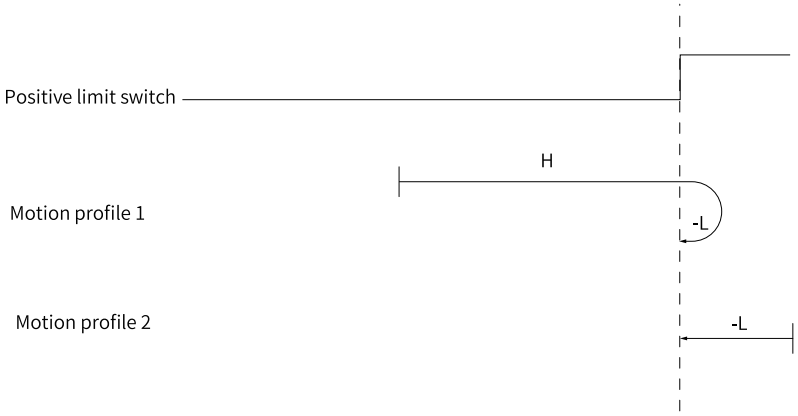


Figure 14-38 Motor running curve and speed in mode 18

- Motion profile 1: Deceleration point signal inactive at start of homing
- Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 19**
  Home: home switch (HW)

  Deceleration point: home switch (HW)

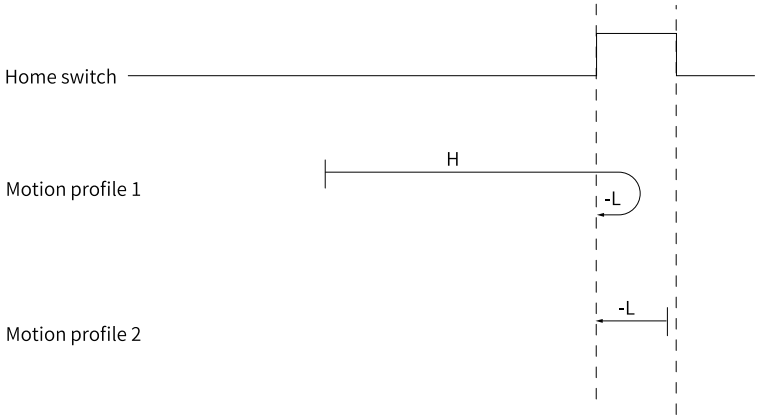


Figure 14-39 Motor running curve and speed in mode 19

- Motion profile 1: Deceleration point signal inactive at start of homing
- Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 20**

  Home: home switch (HW)

  Deceleration point: home switch (HW)

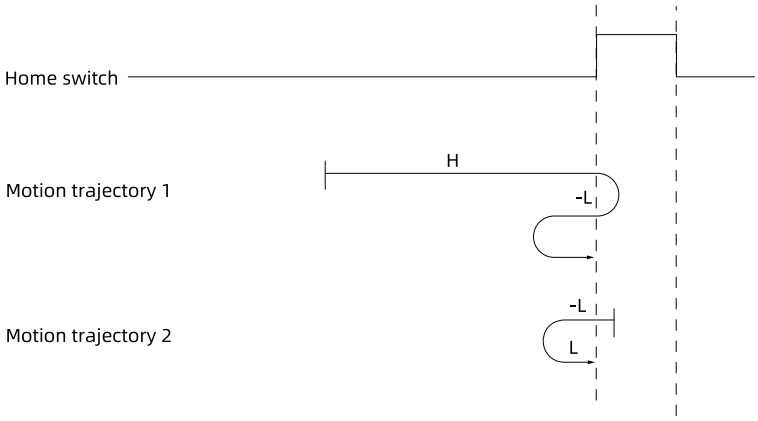


Figure 14-40 Motor running curve and speed in mode 20

- Motion profile 1: Deceleration point signal inactive at start of homing
- Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 21**

  Home: home switch (HW)

  Deceleration point: home switch (HW)

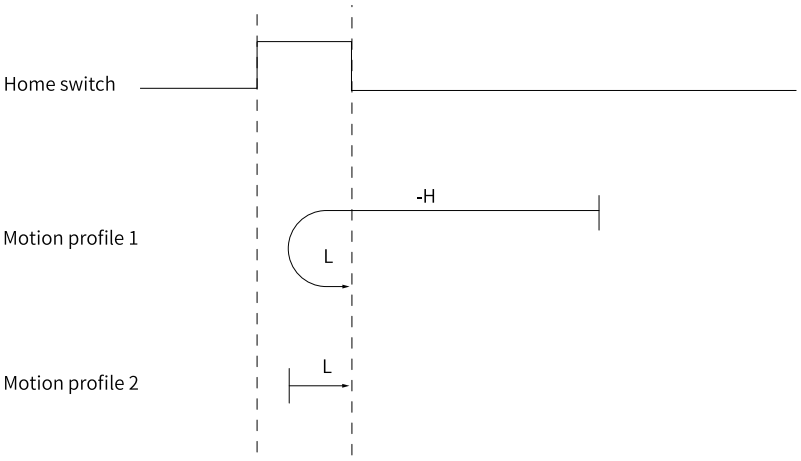


Figure 14-41 Motor running curve and speed in mode 21

- Motion profile 1: Deceleration point signal inactive at start of homing
- Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 22**

  Home: home switch (HW)

  Deceleration point: home switch (HW)

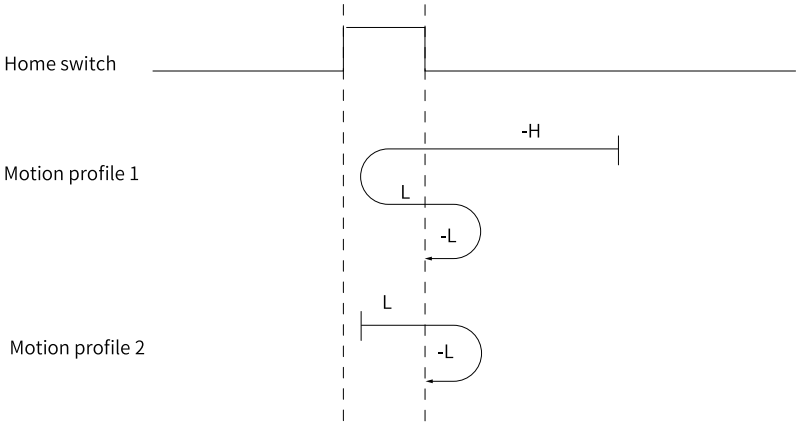


Figure 14-42 Motor running curve and speed in mode 20

- Motion profile 1: Deceleration point signal inactive at start of homing
- Motion profile 2: Deceleration point signal active at start of homing

- **H25.22 = 23**

  Home: home switch (HW)

  Deceleration point: home switch (HW)

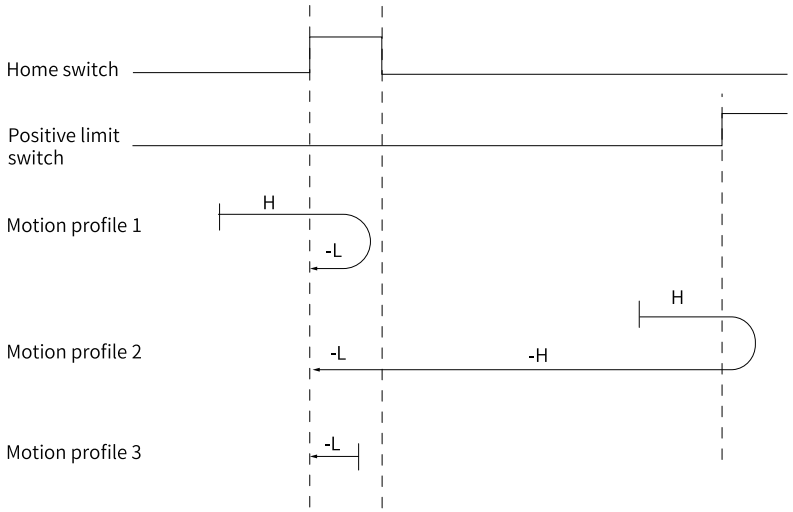


Figure 14-43 Motor running curve and speed in mode 23

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the positive limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the positive limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 24**

  Home: home switch (HW)

  Deceleration point: home switch (HW)

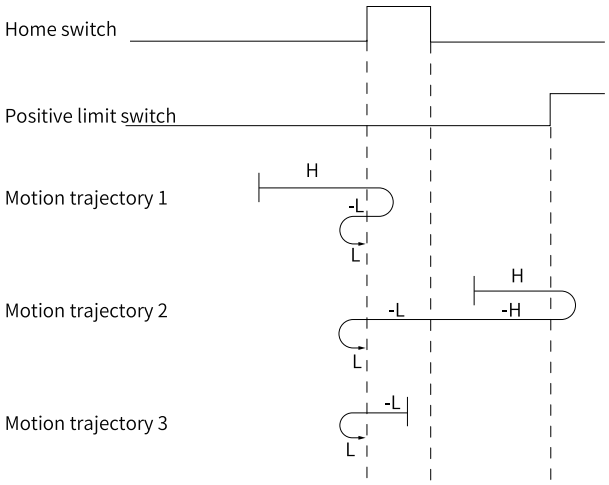


Figure 14-44 Motor running curve and speed in mode 24

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the positive limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the positive limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 25**

  Home: home switch (HW)

Deceleration point: home switch (HW)

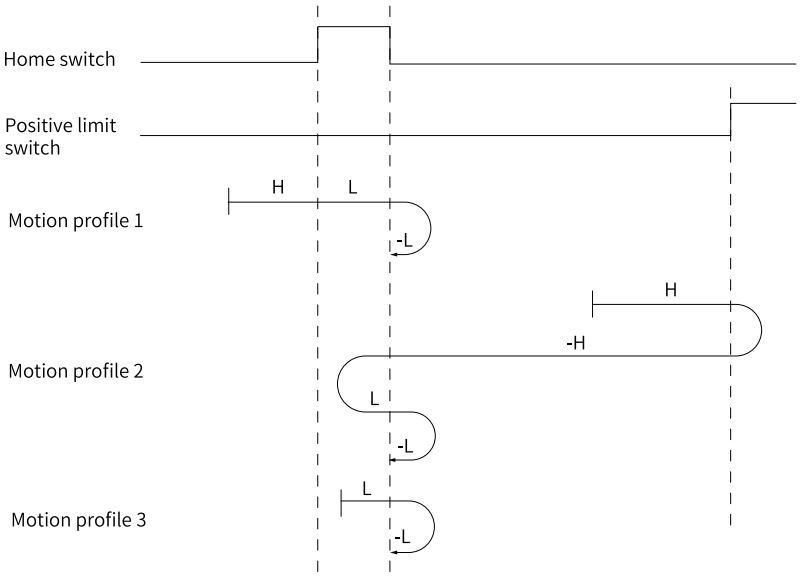


Figure 14-45 Motor running curve and speed in mode 25

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the positive limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the positive limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 26**

  Home: home switch (HW)

  Deceleration point: home switch (HW)

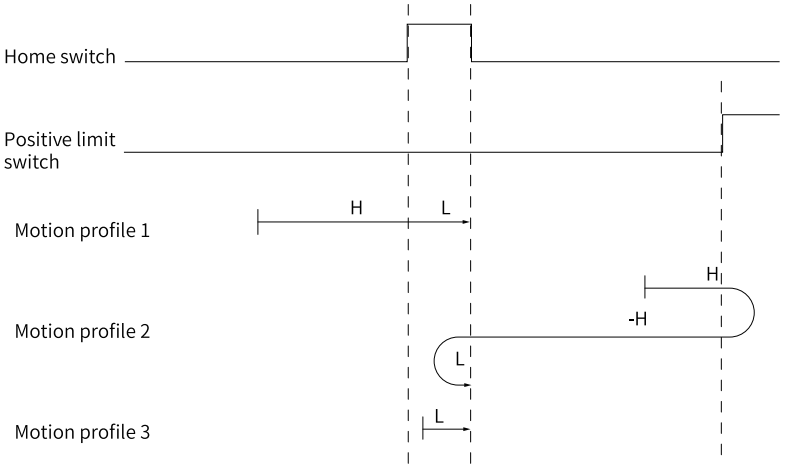


Figure 14-46 Motor running curve and speed in mode 26

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the positive limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the positive limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 27**
  Home: home switch (HW)

  Deceleration point: home switch (HW)

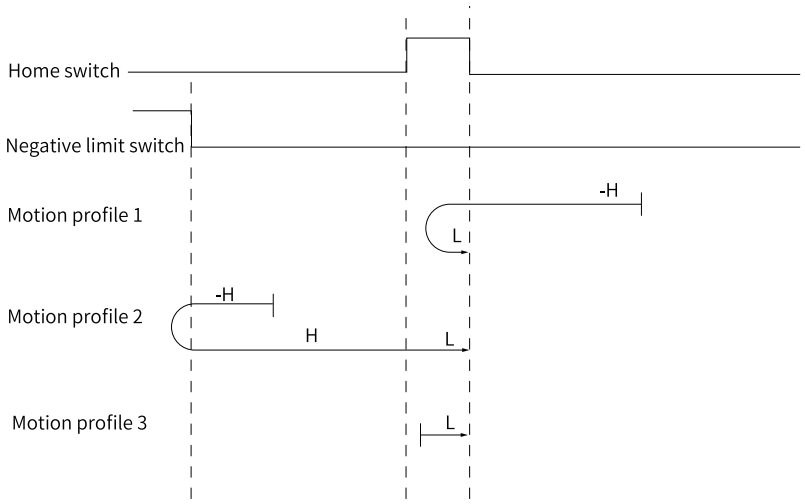


Figure 14-47 Motor running curve and speed in mode 27

  - Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the reverse limit switch.
  - Motion profile 2: HW signal inactive at startup in homing mode, hitting the reverse limit switch.
  - Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 28**
  Home: home switch (HW)

  Deceleration point: home switch (HW)

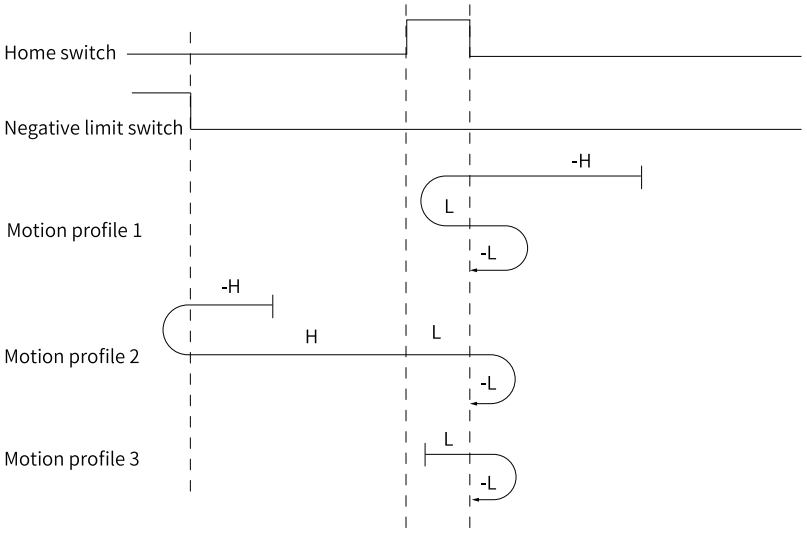


Figure 14-48 Motor running curve and speed in mode 28

  - Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the reverse limit switch.
  - Motion profile 2: HW signal inactive at startup in homing mode, hitting the reverse limit switch.

- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 29**
  Home: home switch (HW)

  Deceleration point: home switch (HW)

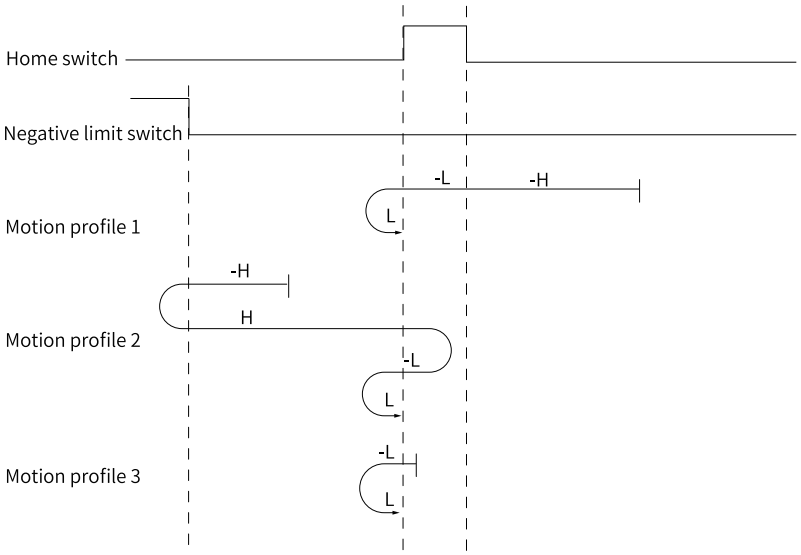


Figure 14-49 Motor running curve and speed in mode 29

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the reverse limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the reverse limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 30**
  Home: home switch (HW)

  Deceleration point: home switch (HW)

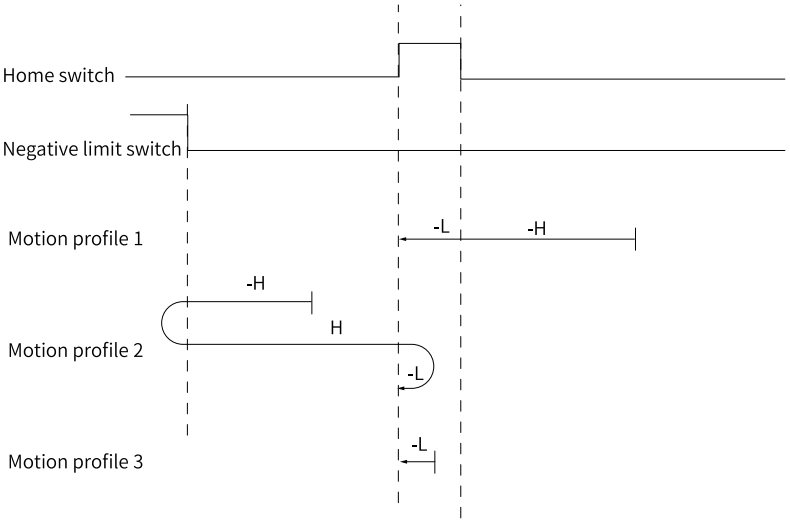


Figure 14-50 Motor running curve and speed in mode 30

- Motion profile 1: Deceleration point signal inactive at startup in homing mode, not hitting the reverse limit switch.
- Motion profile 2: HW signal inactive at startup in homing mode, hitting the reverse limit switch.
- Motion profile 3: Deceleration point signal active at start.

- **H25.22 = 31/32**
  The homing mode is undefined.
- **H25.22 = 33/34**
  Home: Z signal

  Deceleration point: none

The homing method does not support homing at the limit switch.

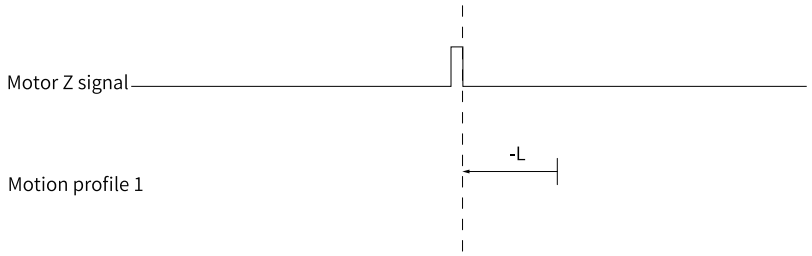


Figure 14-51 Motor running curve and speed in mode 33

- Motion profile 1: The motor runs in the reverse direction at low speed and stops at the first Z signal.

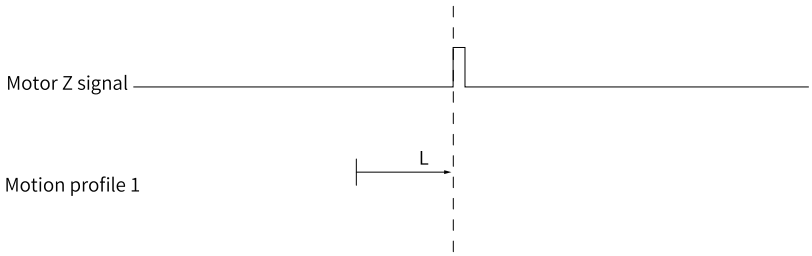


Figure 14-52 Motor running curve and speed in mode 34

- Motion profile 1: The motor runs in the forward direction at low speed and stops at the first Z signal.

- **H25.22 = 35**

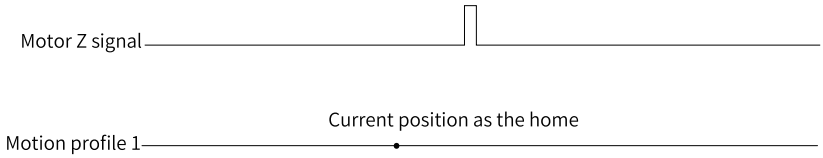


Figure 14-53 Motor running curve and speed in mode 35

In homing method 35, after homing is triggered, the current position is taken as the mechanical home.

Related parameters

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H05.58	Torque threshold in homing upon hit-and-stop	-	0.0 to 400.0	%	100.0	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the maximum positive/negative torque limit during homing upon hit-and-stop.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H25.22	Homing type	-	-2 to +35	-	0	Signed 16-bit	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Sets the homing type								

14.4.4.4 Telegram 111 Setting Homing Position (ModPos=5)

To set the homing position function, directly change the current axis position based on H05.40 (homing type). The following table lists the steps for directly setting the reference point using Sina_Pos.

Table 14–5 Trigger process in mode 5

Terminal signal	Step 1: Prepare	Step 2: Directly set reference point
ModPos	5	5
EnableAxis	0	0 to 1
ExecuteMode	0	0 to 1

Table 14–6 Current position data after executing mode 5

H05.40 (Homing offset type)	H05.36 (Homing offset value)	Current position data (H0b.07) after triggering mode 5
0 (Mechanical home offset (H05.36) as coordinate after homing)	Set the offset value.	H05.36
1 (Mechanical home offset (H05.36) as relative offset after homing)		Current position + H05.36

14.4.4.5 Telegram 111 Operation Program Segment (ModPos=6)

Overview

The program segment function allows the axis to run step by step according to the steps previously set in the servo drive. The operation mode and target position are set in the running block of the servo drive. OverV scales the speed setpoint in the program block.

At the same time, the running conditions "CancelTransing" and "Intermediatestop" must be set to 1, and "JOG1" and "JOG2" must be set to 0. The start segment number of the program segment is set in the input parameter Position, with the value ranging from 0 to 15 (representing program tasks 1 to 16). The start segment number indicates that execution starts from the program step with the number.

The running direction and operation mode are determined by the settings in the program segment, and are independent of the Positive and Negative parameters, which must be set to 0. After the program segment is selected, running is triggered by a rising edge on ExecuteMode. Up to 16 different operating tasks can be stored in the drive system and can be used by the controller to control the drive.

Configuration

You can configure program block parameters in the commissioning software through Graphical Configuration. You can also achieve that through parameters H27 and H28, as shown in *"Figure 14-54" on page 356* and *"Figure 14-55" on page 356* .

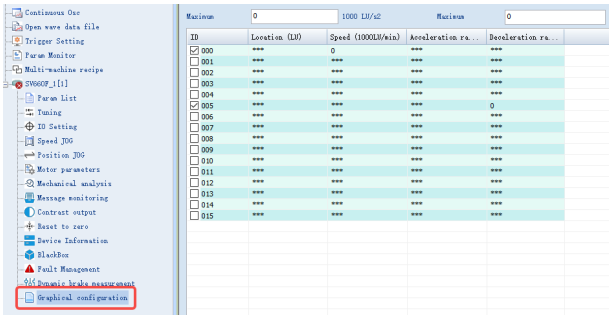


Figure 14-54 Graphic configuration of program segment parameters

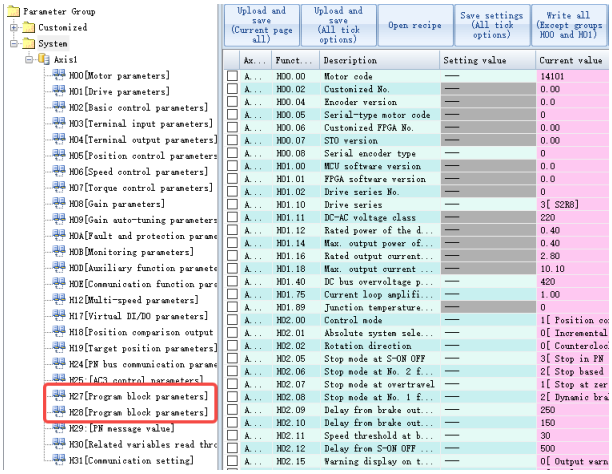


Figure 14-55 Settings of program segment parameters

Relationship between parameters in groups H27 and H28 in the parameter list and graphical configuration

The parameters in the parameter list and those in graphical configuration correspond to each other.

1. After setting the parameter list, click “Upload all parameters” in the graphical configuration to upload the parameter list settings to the graphical configuration, as shown in *“Figure 14-56” on page 357*.
2. After setting the graphical configuration, click “Download selected” to download the graphical configuration parameters to the parameter list. You can view the parameters that have been changed in the graphical configuration in the parameter list, as shown in *“Figure 14-56” on page 357*.

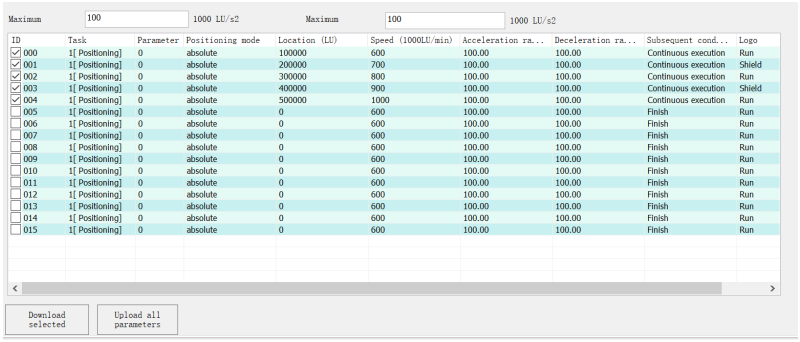


Figure 14-56 Graphical configuration task bar

3. Use the parameter settings in *“Figure 14-57” on page 357* as an example. The actual waveform is as shown in *“Figure 14-58” on page 357*.

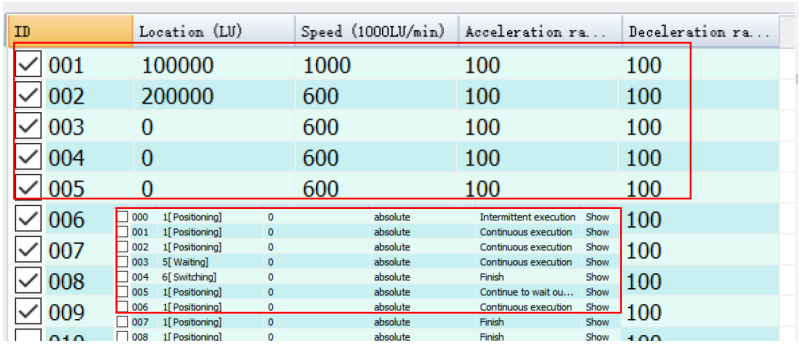


Figure 14-57 Parameter setting example

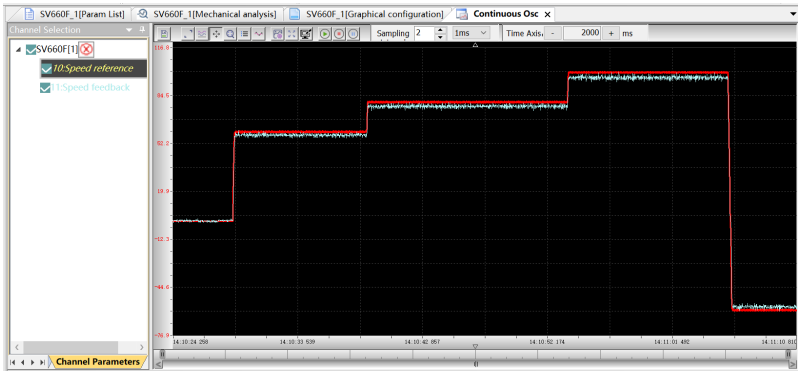


Figure 14-58 Displayed waveform

Parameter code	Setting range	Unit	Description	Remarks
H27.00	0 to 15	-	Current segment	Set the current program segment through the "Position" pin of the "SinaPos_DB" module. 0 to 15 represent program segments 1 to 16.
H27.01 to H27.16	1 to 8	-	Segment x task	For details, see positioning, fixed stopper, forward cycle, reverse cycle, waiting, switching, setting I/O, and resetting I/O in " *Task setting" on page 360*.
H27.17 to H27.47	-2147483648 to 2147483648	LU	Position of segment x task	This parameter specifies the position of segment x task. When the set value is 100000, the motor runs 10 revolutions. One revolution corresponds to 10000 LU. Note that in this case, the numerator of H05.07 (Electronic gear ratio 1) equals 8388608, and the denominator of H05.09 (Electronic gear ratio 2) equals 10000.
H27.49 to H27.79	0 to 4294967295	1000 LU/min.	Speed of segment x task	This parameter specifies the speed of segment x task. When the set value is 1000 and the default gear ratio is used, if the speed ratio OverV given by the host controller is 100%, the actual speed is 100 rpm, and so on.
H27.81 to H27.96	0.01 to 100	%	Acceleration multiplier of segment x task	Acceleration multiplier of segment x task
H28.00 to H28.15	0.01 to 100	%	Deceleration multiplier of segment x task	Deceleration multiplier of segment x task

Parameter code	Setting range	Unit	Description	Remarks
H28.16 to H28.30	0 to 65535	-	Mode of segment x task	This parameter indicates whether the program segment is relative positioning or absolute positioning, as well as the task end mode. The task end mode corresponds to the subsequent conditions in the graphical configuration. For details, see subsequent conditions in the program segment in " *Task setting*" *on page 360*. The set value corresponds to the graphical configuration as shown below: 0: Absolute positioning + end 1: Absolute positioning + end + hide indicator 16: Absolute positioning + intermittent execution 17: Absolute positioning + intermittent execution + hide indicator 32: Absolute positioning + continuous execution 33: Absolute positioning + continuous execution + hide indicator 48: Absolute positioning + continue external execution 49: Absolute positioning + continue external execution + hide indicator 64: Absolute positioning + continue external waiting 65: Absolute positioning + continue external waiting + hide indicator 80: Absolute positioning + continue external alarm 81: Absolute positioning + continue external alarm + hide indicator 256: Relative positioning + end 257: Relative positioning + end + hide indicator 272: Relative positioning + intermittent execution 273: Relative positioning + intermittent execution + hide indicator 288: Relative positioning + continuous execution 289: Relative positioning + continuous execution + hide indicator 304: Relative positioning + continue external execution 305: Relative positioning + continue external execution + hide indicator 320: Relative positioning + continue external waiting 321: Relative positioning + continue external waiting + hide indicator 336: Relative positioning + continue external alarm 337: Relative positioning + Continue external alarm + Hide identifier

Parameter code	Setting range	Unit	Description	Remarks
H28.32 to H28.62	0 to 2147483647	Parameter of segment x task	Parameter of segment x task	• When the task segment is used as the fixed stopper, this parameter sets the motor clamping torque in the unit of 0.01 N·m. • When the program segment is used for waiting commands, this parameter sets the time to wait for the next task in the unit of ms. • When the program segment is used for jumping, this parameter sets the number of the program segment to jump to. • When the program segment is used for setting output, the parameter can be set to 1, 2, or 3, corresponding to three types of setting outputs. • When the program segment is used for reset output, the parameter can be set to 1, 2, or 3, corresponding to three types of reset outputs.
H28.64	0 to 4294967295	LU	Fixed stopper monitoring window	Actual position fluctuation range after reaching the fixed stopper state during motion
H28.66	0 to 4294967295	LU	Max. following error of fixed stop	This parameter is used to determine whether the fixed stop point has been reached when compared with the actual position difference.
H28.68	0 to 1	-	External trigger source	0: Triggered by STW1.bit13 1: Triggered by DI

Task setting

Open the graphical configuration tab and click "Task settings" to select the task mode, as shown in *"Figure 14-59" on page 360* . The task modes are positioning, fixed stopper, forward cycle, reverse cycle, waiting, switching, setting I/O and resetting I/O.

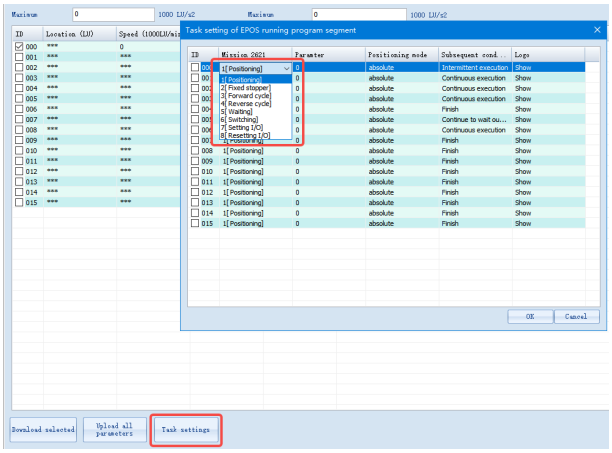


Figure 14-59 Task setting of the program segment

The task modes are described as follows:

- Positioning: positioning mode
- Fixed stopper: Move the axis to the stopper until the torque reaches the specified torque limit value. The unit of the torque limit is percentage (%), and the calculation is based on two parameters: torque limit = (user setting value/base value) x 100%. The base value is calculated

using the following formula: linear back EMF coefficient x rated current x 0.01653986. The following cases need to be considered for the linear back EMF coefficient and rated current:

1. When H00.98 ≥ 0xA502, the linear back EMF coefficient equals H00.69, and the rated current equals H00.65.
2. When H00.98 < 0xA502, the linear back EMF coefficient equals H00.21, and the rated current equals H00.11. The unit of the user setting value is 0.01 N·m, determined by H28.32 to H28.62.

Example: If the user setting value is 1.5 N·m, and the base value calculated by the formula is 1.2 N·m, then the torque limit is 125%.

- Forward cycle: Rotation in the forward direction
- Reverse cycle: Rotation in the reverse direction
- Waiting: You can set the waiting time (ms) before executing the next task.
- Switching: You can jump to the specified program segment, which is determined by parameters.
- Setting I/O: OUTPUT1 and OUTPUT2 (POS_ZSW2.10 and POS_ZSW2.11) can be set to 1.
  - If H28.32 to H28.62 are 1, OUTPUT1 is set to 1 (POS_ZSW2.10=1).
  - If H28.32 to H28.62 are 2, OUTPUT2 is set to 1 (POS_ZSW2.11 = 1).
  - If H28.32 to H28.62 are 3, OUTTPUT1 is set to 1 (POS_ZSW2.10 = 1) and OUTPUT2 is set to 1 (POS_ZSW2.11 = 1).
- Reset I/O: OUTPUT1 and OUTPUT2 (POS_ZSW2.10 and POS_ZSW2.11) can be reset.
  - If H28.32 to H28.62 are 1, OUTPUT1 is set to 0 (POS_ZSW2.10=0).
  - If H28.32 to H28.62 are 2, OUTPUT2 is set to 0 (POS_ZSW2.11 = 0).
  - If H28.32 to H28.62 are 3, OUTPUT1 is set to 0 (POS_ZSW2.10 = 0) and OUTPUT2 is set to 0 (POS_ZSW2.11 = 0).

The subsequent conditions of the program segment are finish, intermittent execution, continue execution, continue external execution, continue external waiting, and continue external alarm, as shown in *"Figure 14-60" on page 361* .

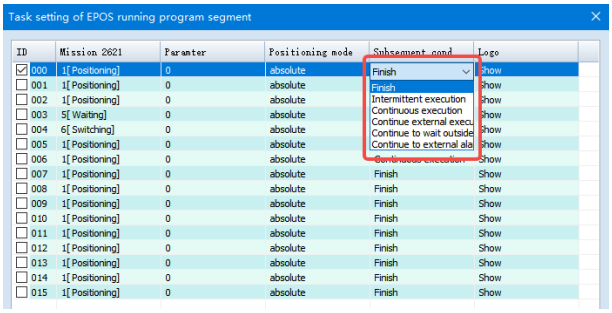


Figure 14-60 Subsequent conditions of the program segment

- Finish: Operation stops after the program segment finishes.
- Intermittent execution: The axis stops after reaching the target position before carrying out the next task.
- Continue execution: The next program segment is executed without deceleration after the current program segment is finished.
- Continue external execution: Determine the external execution signal source based on H28.68. If the signal does not indicate a triggering event, the next program block is executed continuously. If the signal indicates a triggering event, the next program segment is executed in advance.

- Continue external waiting: Wait for the execution signal after the program segment is finished. The signal source is determined by H28.68. When the signal is 1, the next program segment is executed.
- Continue external alarm: Wait for the execution signal after the program segment is finished. The signal source is determined by H28.68. When the signal is 1, the next program block is executed. Warning E550.2 is issued during waiting.

Summary

Number of motor revolutions for relative/absolute positioning = ((H27.17 to H27.47) x gear ratio)/ encoder resolution

Motor speed = ((H27.49 to H27.79) x 1000 x gear ratio)/encoder resolution

Fixed stopper torque limit = ((H28.32 to H28.62) x 0.01)/(H00.21 x H00.11 x 0.01653986 x 100%) (H00.98 < 0xA502)

Fixed stopper torque limit = ((H28.32 to H28.62) x 0.01)/(H00.21 x H00.65 x 0.01653986 x 100%) (H00.98 = 0xA502)

Fixed stopper torque limit = ((H28.32 to H28.62) x 0.01)/(H00.69 x H00.65 x 0.01653986 x 100%) (H00.98 ≥ 0xA503)

14.4.4.6 Telegraom 111 Speed Jog (ModPos=7)

Setting ModPos to 7 indicates that the speed jog function is selected. The jog speed is set by H25.14 and H25.16. The jog direction is independent of Positive and Negative, and is determined by the sign of the jog speed.

Table 14–7 Speed jog procedure

Terminal signal	Step 1: Enable	Step 2: Reverse jog	Step 2: Forward start
ModPos	7	7	7
OverV	100	100	100
EnableAxis	0→1	1	1
JOG1	0	0→1	0
JOG2	0	0	0→1
Jog speed is set by H25.14 and H25.16.			

Related formula

JOG1 speed (rpm) = (H25.14 x 1000 x OverV% x (H05.07/H05.09))/encoder resolution

JOG1 acceleration time (seconds) = (H25.14 x OverV%)/(60 x H25.02)

JOG1 deceleration Time (seconds) = (H25.14 x OverV%)/(60 x H25.04)

JOG2 speed (rpm) = (H25.16 x 1000 x OverV% x (H05.07/H05.09))/encoder resolution

JOG2 acceleration time (seconds) = (H25.16 x OverV%)/(60 x H25.02)

JOG2 deceleration time (seconds) = (H25.16 x OverV%)/(60 x H25.04)

Note

The jogging speed can be adjusted in real time by modifying OverV (1% to 199%) or modifying H25.14 and H25.16.

14.4.4.7 Telegram 111 Incremental Jog (ModPos=8)

Setting ModPos to 8 indicates that the increment jog mode is selected. The jog speed is set by the servo drive, and the speed multiplier OverV scales the jog speed setting. The running direction is determined by the sign of the jog speed. The running conditions "CancelTransing" and "IntermediateStop" are irrelevant to the jog operation mode. By default, JOG1 is for negative incremental jog, while JOG2 is for positive incremental jog.

Table 14–8 Incremental jog procedure

Terminal signal	Step 1: Enable	Step 2: Reverse incremental jog	Step 2: Forward incremental start
ModPos	8	8	8
OverV	100	100	100
EnableAxis	0→1	1	1
JOG1	0	0→1	0
JOG2	0	0	0→1
The jog speed and jog increment are set by H25.14 to H25.20.			

Related formula

JOG1 position increment: H25.18, unit: LU

JOG1 speed: H25.14 x OverV%, unit: 1000 LU/min

JOG1 acceleration time (seconds) = (H25.14 x OverV%)/(60 x H25.02)

JOG1 deceleration Time (seconds) = (H25.14 x OverV%)/(60 x H25.04)

JOG2 position increment: H25.20, unit: LU

JOG2 speed: H25.16 x OverV%, unit: 1000 LU/min

JOG2 acceleration time (seconds) = (H25.16 x OverV%)/(60 x H25.02)

JOG2 deceleration time (seconds) = (H25.16 x OverV%)/(60 x H25.04)

14.4.5 Telegram 111 User-Defined Area Introduction

Additional torque limit and real-time torque reading function

After the torque limit function of telegram 111 is enabled, if the motor torque reaches the limit value and the motor stops running, positions cannot be further given. Otherwise, the motor will report EB00.0 (excessive position deviation). The position deviation threshold is set by H0A.10, defaulting to three revolutions.

1. Set H24.38 and H24.39 to 1 to enable additional torque, as shown in *"Figure 14-61 Enabling torque limit" on page 364*.

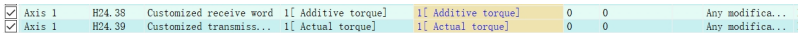
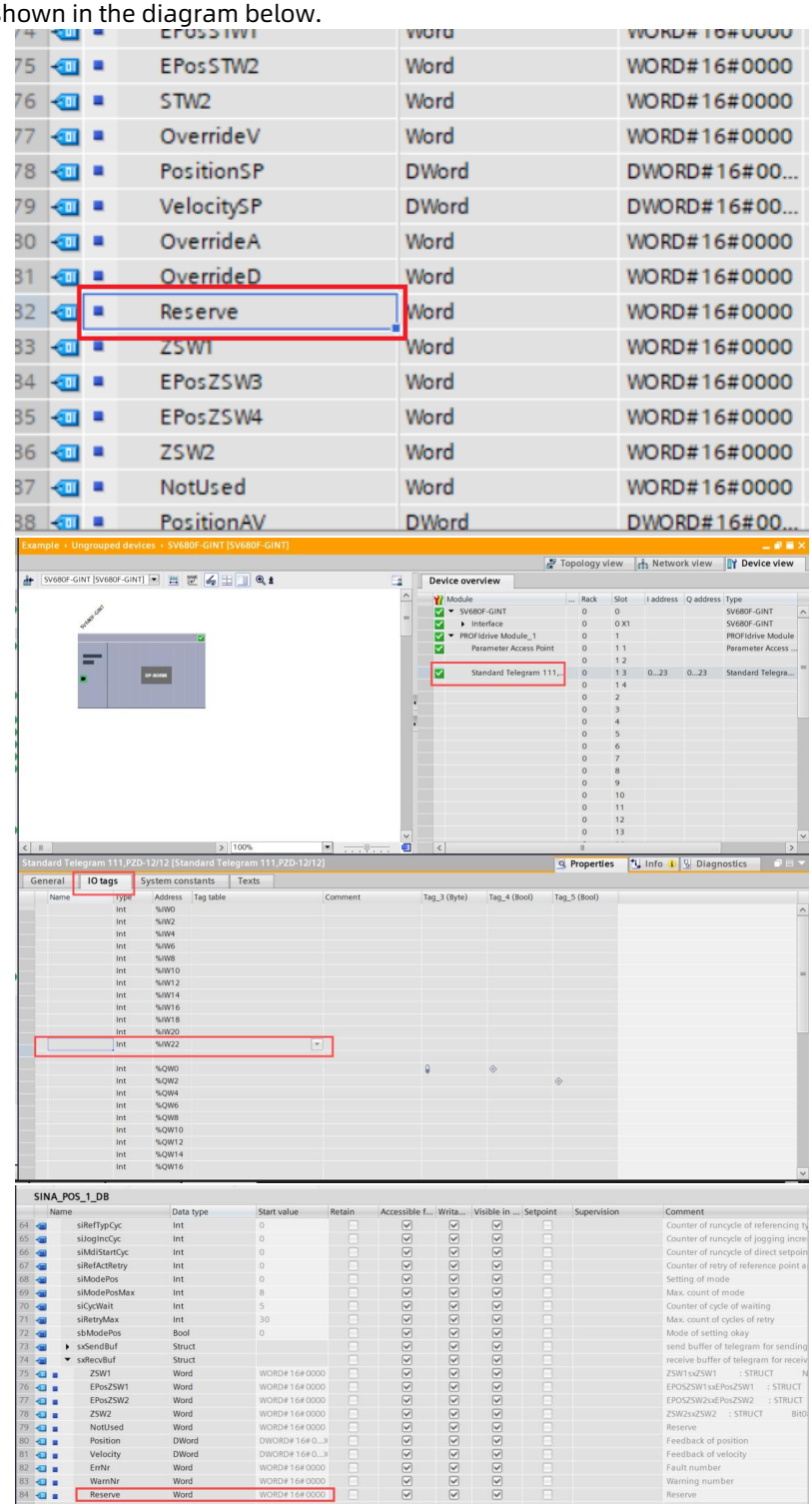
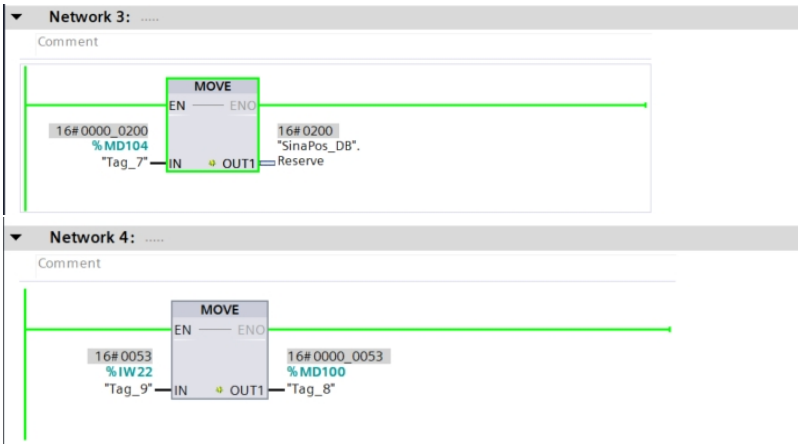


Figure 14-61 Enabling torque limit

2. Torque is set via the Reserve field in the SINA_POS data block. The torque value for FB284 (a library file requiring installation) is read from Reserve in SxRecvBuf, while the torque value for FB300 (a function block included with TIA Portal V16 and later) is read from IW22 of the telegram channel, as shown in the diagram below.



3. Write the following program in the application to implement torque limiting and reading, where the additional torque in the user-defined receive word serves as the torque limit. See the figure below.



Note

The torque limit reference value 0 to 0x4000 corresponds linearly to the rated torque of the motor (0 to H00.13÷H00.12). If it set to 0, the motor cannot output forcibly.

Example

1. If torque limiting is disabled, when the motor runs at -3000 rpm in JOG mode, the background current feedback is 2.8%, as shown in *"Figure 14-62" on page 365* .

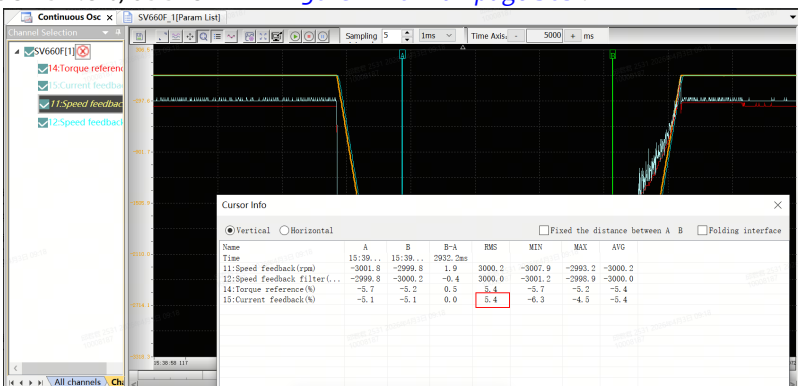


Figure 14-62 Current feedback at 100 rpm

2. After torque reading, the displayed value is 16#A3, as shown in *"Figure 14-63" on page 365* .



Figure 14-63 Torque reading

3. 16#FFDB equals 10#-37 and 16#4000 equals 10#16384. Therefore, the current feedback (%) = maximum torque ÷ rated torque × (-37) ÷ 16384 × 100%, which matches the value read from the background. Real-time torque (N m) = current feedback (%) × H00.12 (rated torque)

Summary

Real-time torque (N m) = current feedback (%) × H00.12 (rated torque)

FB284: Real-time current feedback (%) = H00.13 ÷ H00.12 × (converted decimal value of "SinaPos_DB".Reserve) ÷ 16384 × 100%

FB300: Real-time current feedback (%) = H00.13 ÷ H00.12 × (converted decimal value of IW address area) ÷ 16384 × 100%

If the torque limit is set to 5%, then (5 × 16384) ÷ 300 = 273D = 111H. Therefore, writing 16#111 to "SinaPos_DB".Reserve sets the motor torque limit to 5%.

Reading DI status from user-defined area

Set H24.39 to 3 (user-defined transmission DI status). The PLC determines the corresponding DI status by reading "SinaPos_DB".Reserve.

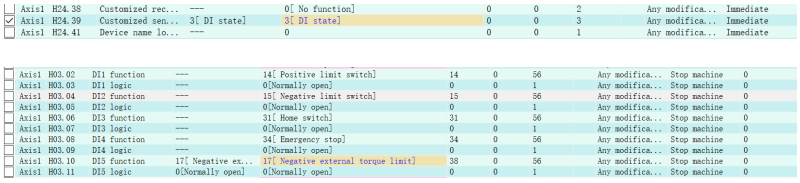


Figure 14-64 DI function setting

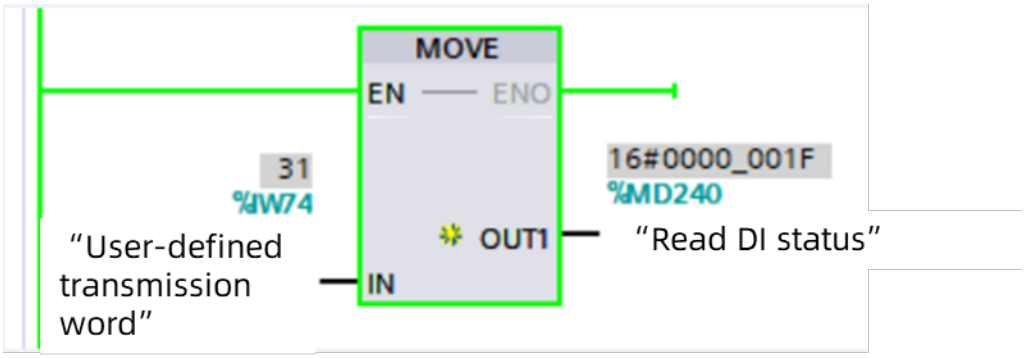


Figure 14-65 DI function reading

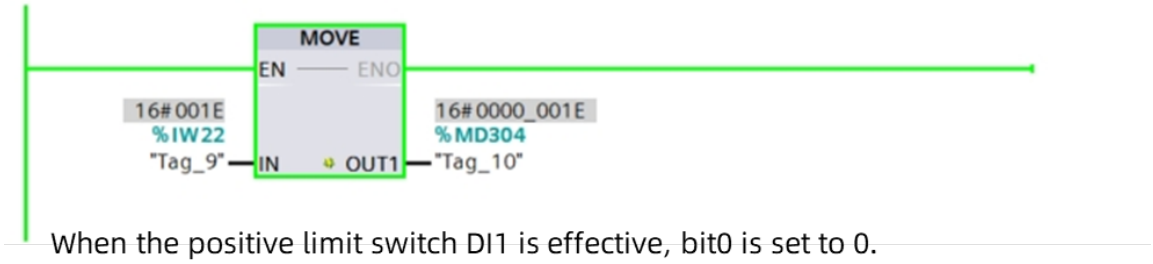


Figure 14-66 DI1 positive limit valid

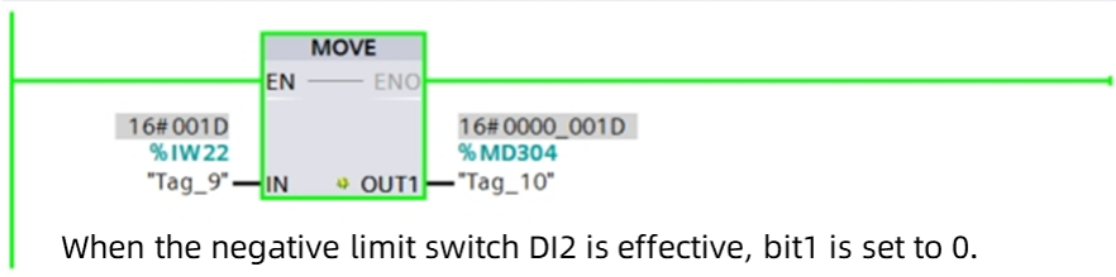


Figure 14-67 DI2 negative limit valid

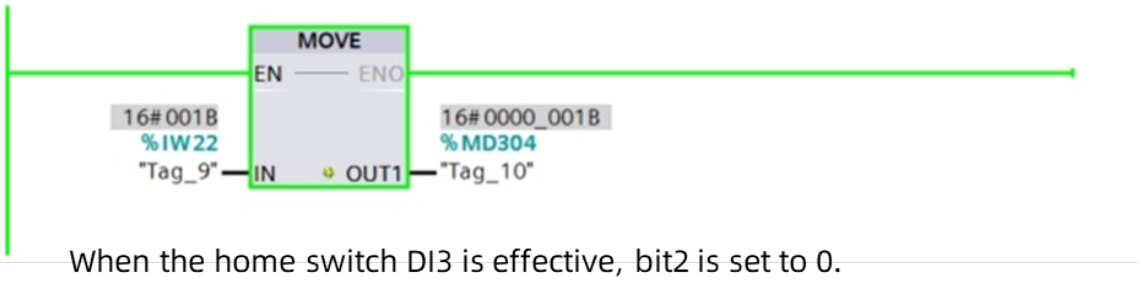
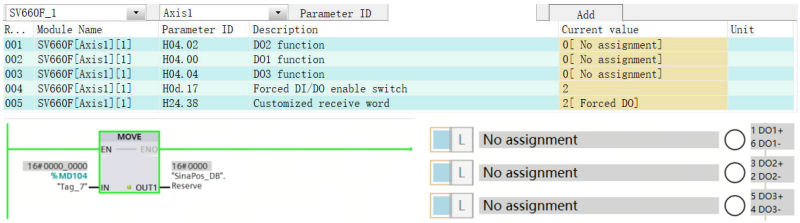


Figure 14-68 DI3 home signal active

Forced DO function in the user-defined area

1. Set H24.38 to 2 (forced DO function). H0d.17 will automatically become 2 (forces the enablement of the DO but does not force the enablement of the DI). Then, set the DO function to be forced to undefined.



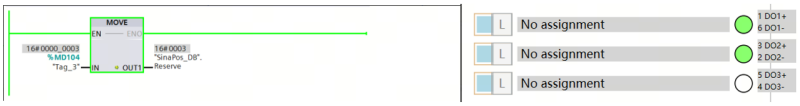
2. Set the user-defined area to 16#1 to force DO1 output.



3. Set the user-defined area to 16#2 to force DO2 output.



4. Set the user-defined area to 16#3 to force DO1 and DO2 output.



Note

If the forced DO function is not required, set H24.38 to 0 and H0d.17 to 0 to use the DO as a standard terminal.

14.4.6 Model Axis

Overview

The modal axis feature restates the position signal to 0 after a distance. If it is applied to a rotary axis, you can set the angle signal to return to zero after a specific angle, or a specific distance if applied to a linear axis.

Description

Set H02.01 = 2 or 5 when using the modal axis feature.

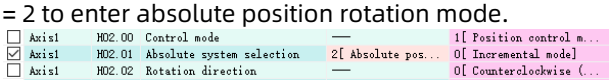
- When H02.01 = 2, the absolute position command in this mode can be greater than the modulus. If it is greater than N times the modulus, then the distance of movement exceeds N modulus revolutions.
- When H02.01 = 5, the position command number is first modulated in this mode and then the modulus is fed into the position loop as a new command, that is, the distance of movement is always less than 1 modulus revolution.

When H02.01 = 5, the direction of motion for absolute positioning can be selected by the control words POS_STW1.bit9 and POS_STW1.bit10.

- The direction is forward only if POS_STW1.bit9 is 1.
- The direction is reverse only if POS_STW1.bit10 is 1.
- When both POS_STW1.bit9 and POS_STW1.bit10 are 1 or 0, the axis moves in the direction with the least distance.

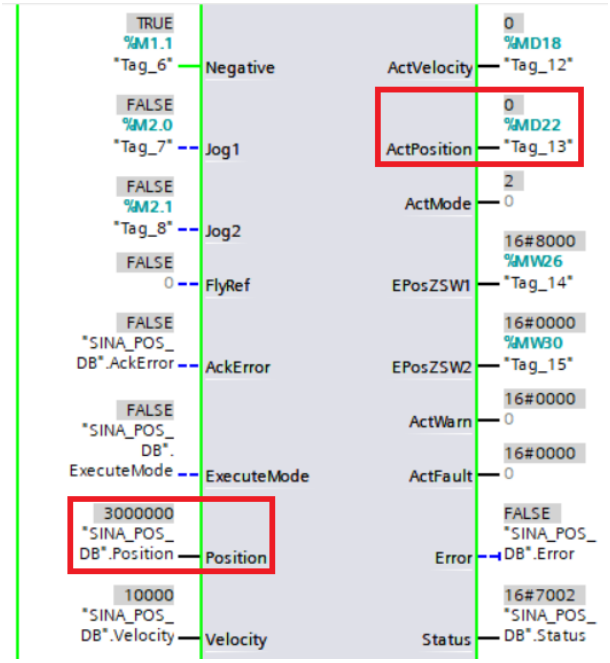
Configuration case

1. Connect the PLC to the drive through telegram 111. If the drive shows 43ry, the communication is successful. Set H02.01 = 2 to enter absolute position rotation mode.

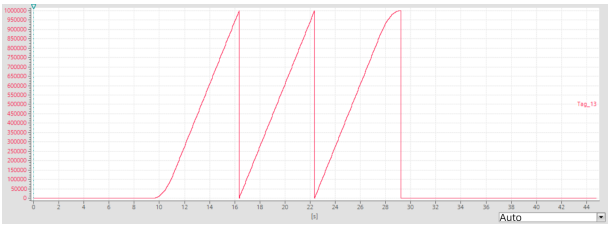


☐	Axis1	H02.00	Control mode	—	1[Position control m...
☑	Axis1	H02.01	Absolute system selection	2[Absolute pos...	0[Incremental mode]
☐	Axis1	H02.02	Rotation direction	—	0[Counterclockwise (...

2. The axis is controlled by telegram 111. The operating mode is MDI absolute positioning. Set H29.90 to 1000000 and the absolute position is 3000000. Current axis position is 0.

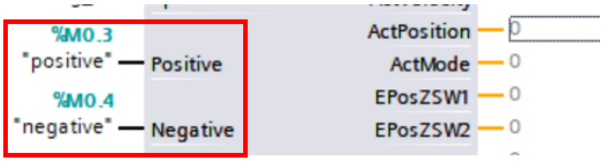


The position feedback curve is as follows:



3. Set H02.01 = 5 to enter absolute position rotation mode, modal axis single modulus revolution absolute command. Set the absolute position to 3995000. The motion distance of the axis is 1000000-995000 = 5000.
   Setting H02.01 = 5 allows direction selection.

   - When FB284 Function Block Pin Positive is set to 1, the motion direction is positive.
   - When Negative is set to 1, the direction is negative.
   - When both positive pins and negative pins are 1 or 0, the axis moves in the direction with the least distance.



Modulus formula

- **When the pulses per revolution of the load in absolute rotation mode (H05.52和H05.54) is not 0:**
  The absolute position rotation mode mechanical gear ratios (H05.50 and H05.51) become ineffective, and the pulses per revolution of absolute rotation mode load (H05.52 and H05.54) take effect:

$$\text{Modal axis modulus} = \text{PPR of load in abs. rotation mode} \div \frac{\text{E-gear ratio numerator}}{\text{E-gear ratio denominator}}$$

- **When the pulses per revolution of the load in absolute rotation mode (H05.52和H05.54) is 0:**
  The pulses per revolution of absolute rotation mode load (H05.52 and H05.54) become ineffective, and the absolute position rotation mode mechanical gear ratio (H05.50 and H05.51) takes effect:

$$\text{Modal axis modulus} = \text{Encoder resolution} \div \frac{\text{E-gear ratio numerator}}{\text{E-gear ratio denominator}} \times \frac{\text{Abs. pos. rotation mode mechanical GR numerator}}{\text{Abs. pos. rotation mode mechanical GR denominator}}$$

- **Example**
  When the drive works with a 23-bit motor, the encoder resolution is a fixed value of 8388608. Set H05.07 = 8388608, H05.09 = 10000, H05.02 = 0.
  - When H05.52 = 838860800 and H05.54 = 0, H05.50 and H05.51 become ineffective, and the modulus of the modal axis is:

$$\text{Modal axis modulus} = 838860800 \div \frac{8388608}{10000} = 1000000$$

  - When H05.52 = 0, H05.54 = 0, H05.50 = 60000, H05.51 = 100, The modal axis modulus is:

$$\text{Modal axis modulus} = 8388608 \div \frac{8388608}{10000} \times \frac{60000}{100} = 6000000$$

  - If the user wants to set the modal axis modulus to 360, the parameters can be set as follows:
    H05.02 = 0

    H05.07 = 8388608

    H05.09 = 36

    H05.52 = 83886080

    H05.54 = 0

    Then, the modal axis modulus H29.90 = 360.

14.5 AC4 Mode

14.5.1 Overview

Axis technology objects are configured in the PLC. The drive uses standard messages 3, 102 or 105 for control through PLC Open standard program blocks such as MC_Power and MC_MoveAbsolute. Below is a configuration example of S7-1500PLC message 3.

14.5.2 Configuration

1. Configure SV660F and add Telegram 3.

Configure the SV660F and add message 3.

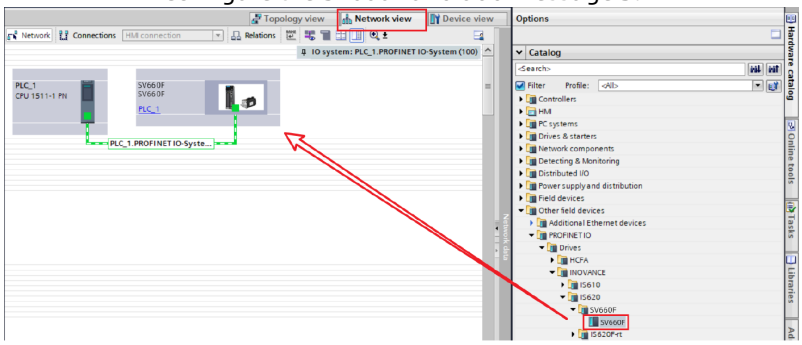


Figure 14-69

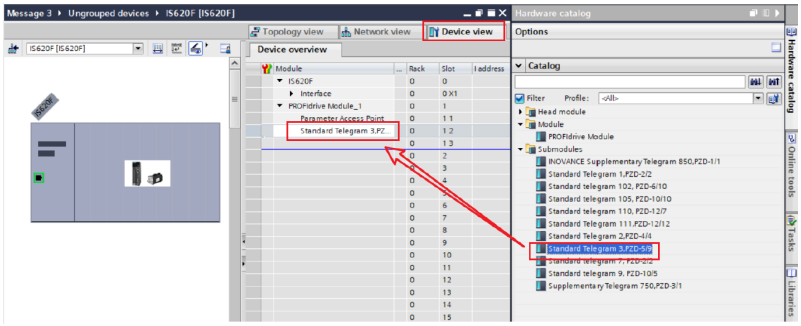
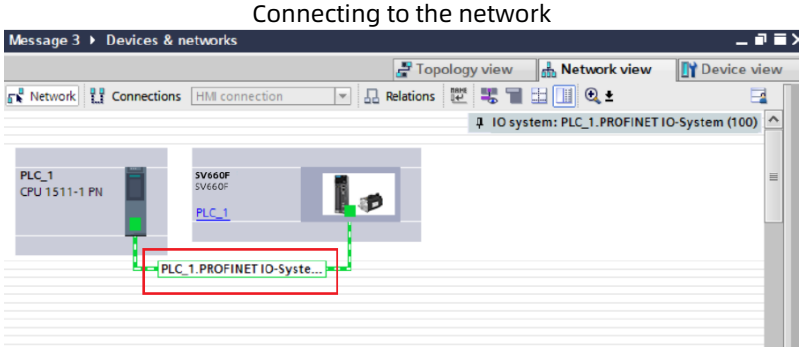


Figure 14-70

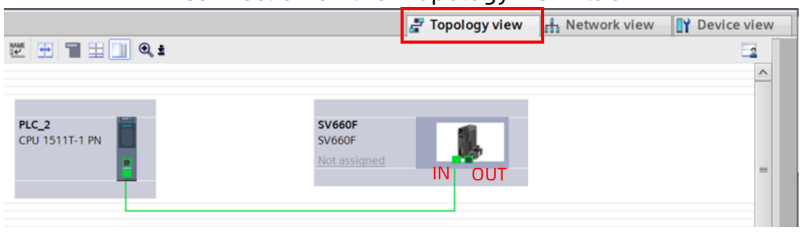
2. In the "Network view" section, connect PLC to SV660F.

Connecting to the network



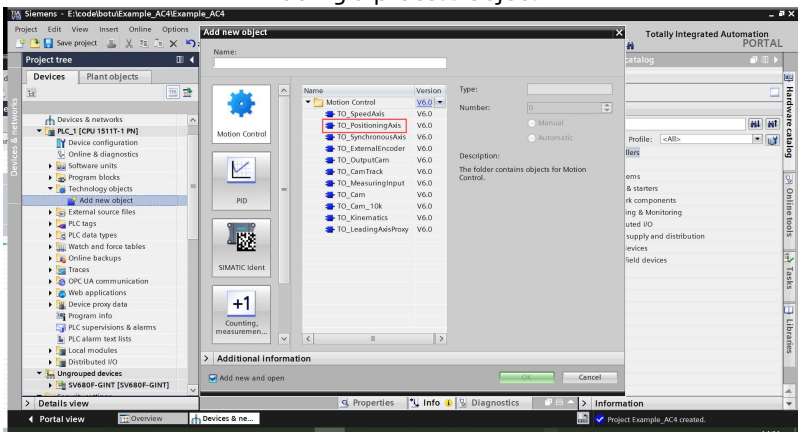
3. To enable IRT communication (only message 105) between PLC and SV660F, connect them on the "Topology view" tab and connect the physical devices according to the topology view. For RT communication (default), connection is not required in the "Topology view" tab.

Connection on the "Topology view" tab



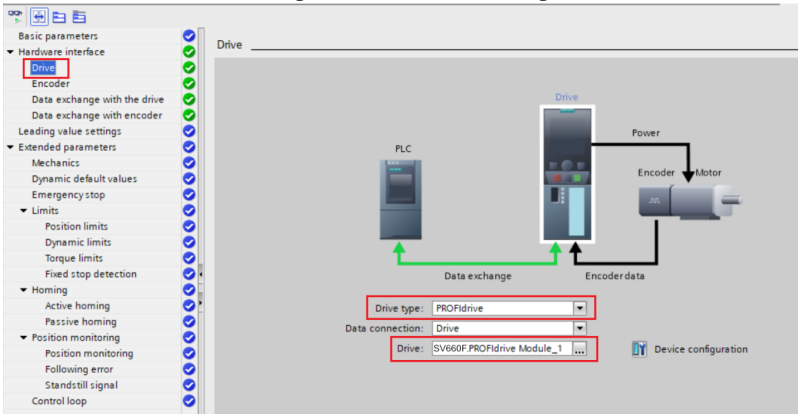
4. Add a process object.

Adding a process object



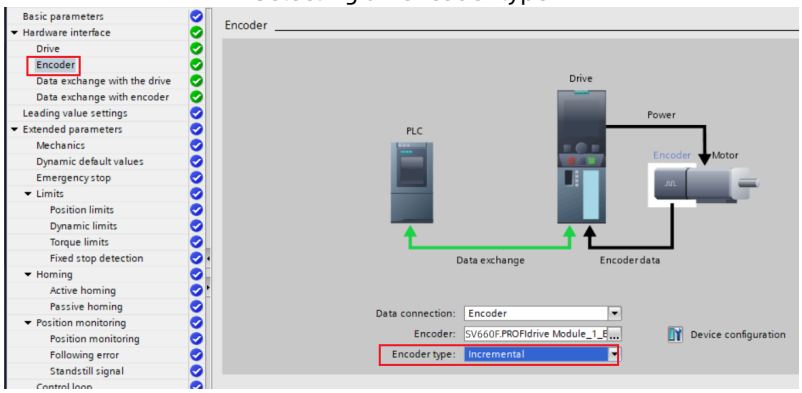
5. From networking configuration, select PROFIdrive and Standard telegram 3.

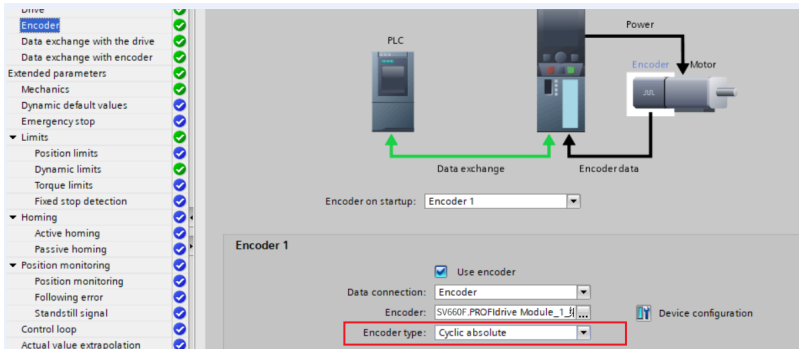
Selecting PROFIdrive and telegram



6. If H02.01 is set to 0 (Incremental position mode), select "Incremental" from the drop-down list of "Encoder type". If H02.01 is set to 1 (Absolute position linear mode), select "Cyclic absolute" from the drop-down list of "Encoder type".

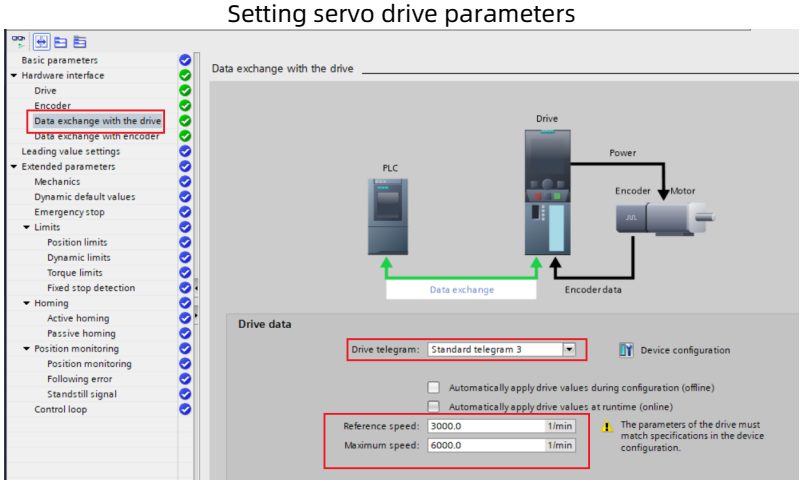
Selecting an encoder type





7. If "Automatically apply drive values at runtime" cannot be selected for reference speed, maximum speed, and base torque of the motor, manually set them according to the drive parameters. The reference speed is the rated motor speed, corresponding to the servo parameter H00.14. The maximum speed corresponds to the servo parameter H00.15.

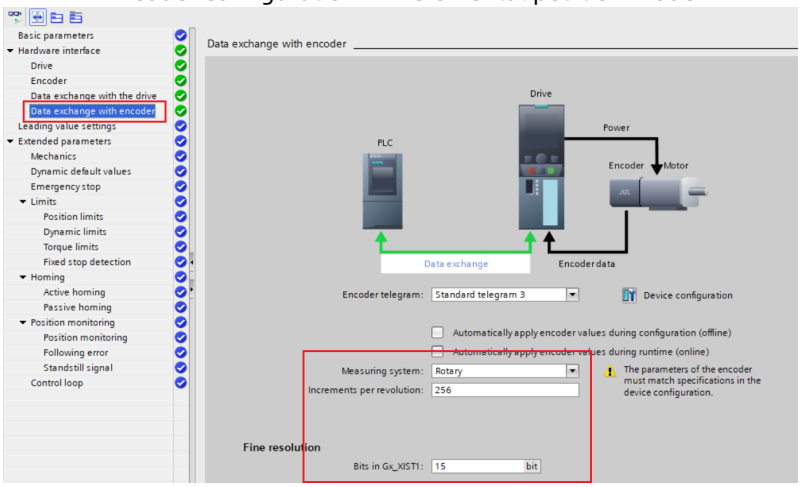
Setting servo drive parameters



8. In the "Data exchange with encoder" section, select "Automatically apply encoder values during runtime". If you do not want to select this item:

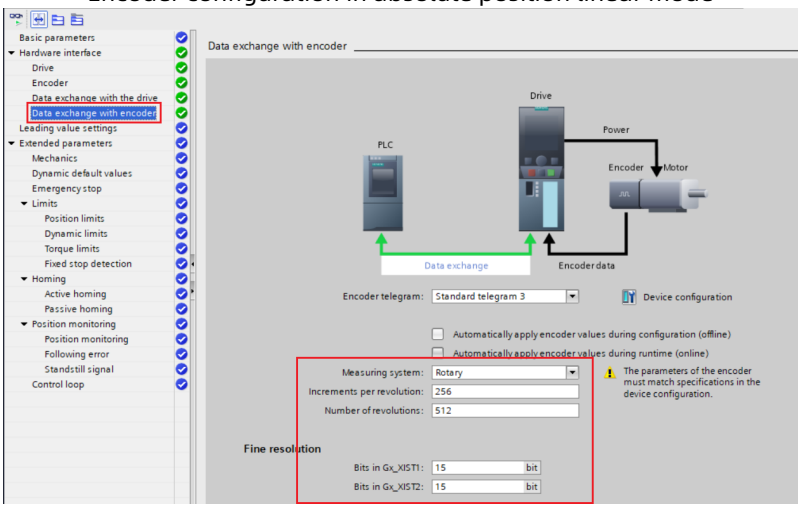
- If H02.01 is set to 0 (Incremental position mode), select "Incremental" from the drop-down list of "Encoder type".

Encoder configuration in incremental position mode



- If H02.01 is set to 1 (Absolute position linear mode), select "Cyclic absolute" from the drop-down list of "Encoder type".

Encoder configuration in absolute position linear mode

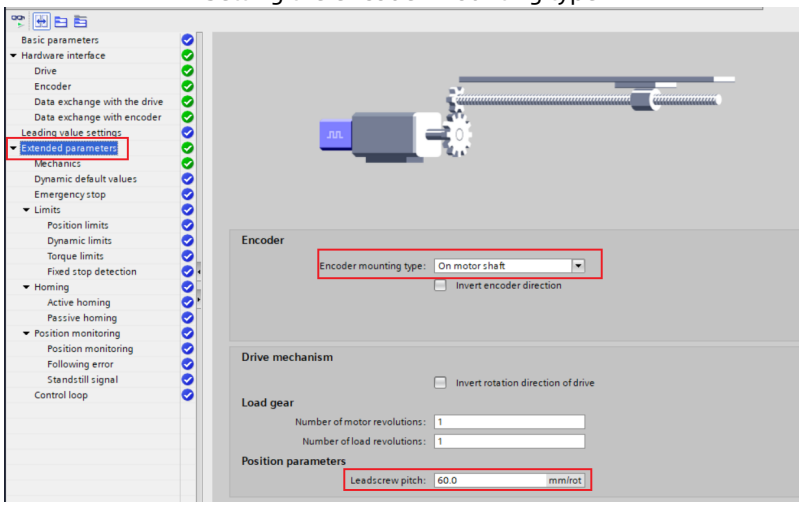


9. In the "Extended parameters" section, select "On motor shaft" from the drop-down list of "Encoder mounting type", and set the position.

Caution

Do not select "Reverse encoder direction" or "Reverse drive rotating direction" unless you really need to. Check the application conditions and servo parameter configuration carefully. Failure to comply may result in safety risks such as runaway.

Setting the encoder mounting type



10. You can deselect the "Enable following error monitoring". If this item is selected and a small following error is set, the host controller reports an error when the motor runs. Clearing "Enable following error monitoring"

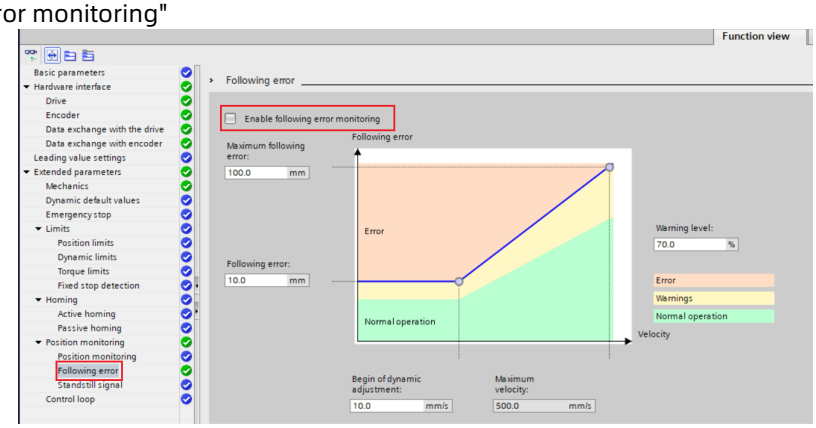
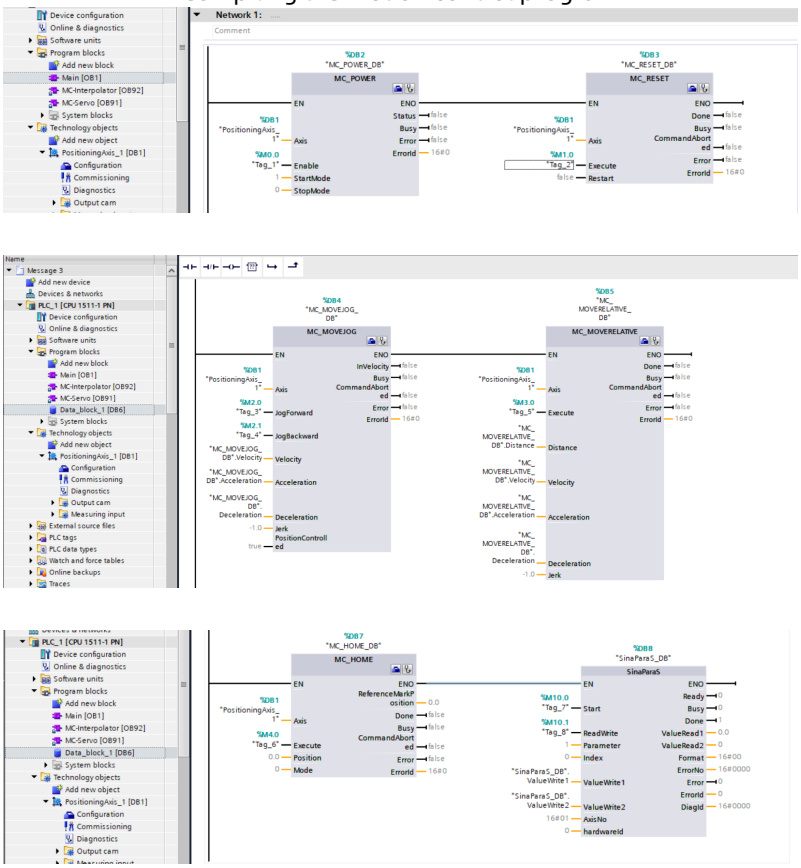


Figure 14-71

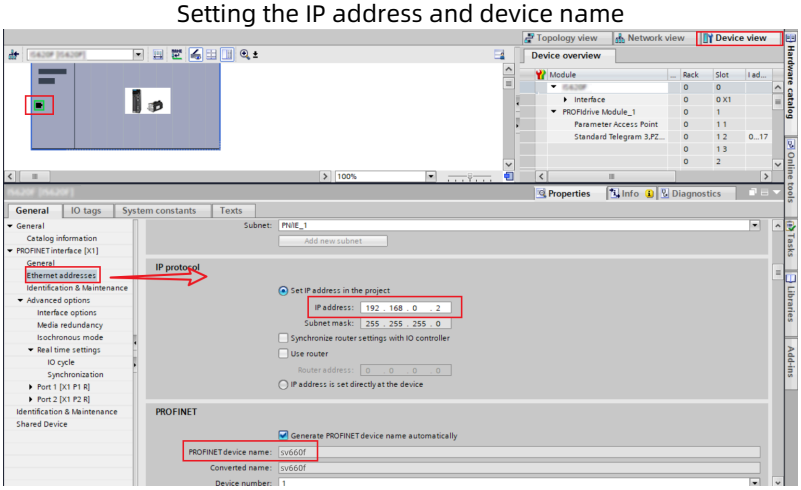
11. Compile a program in the main program.

Compiling the motion control program



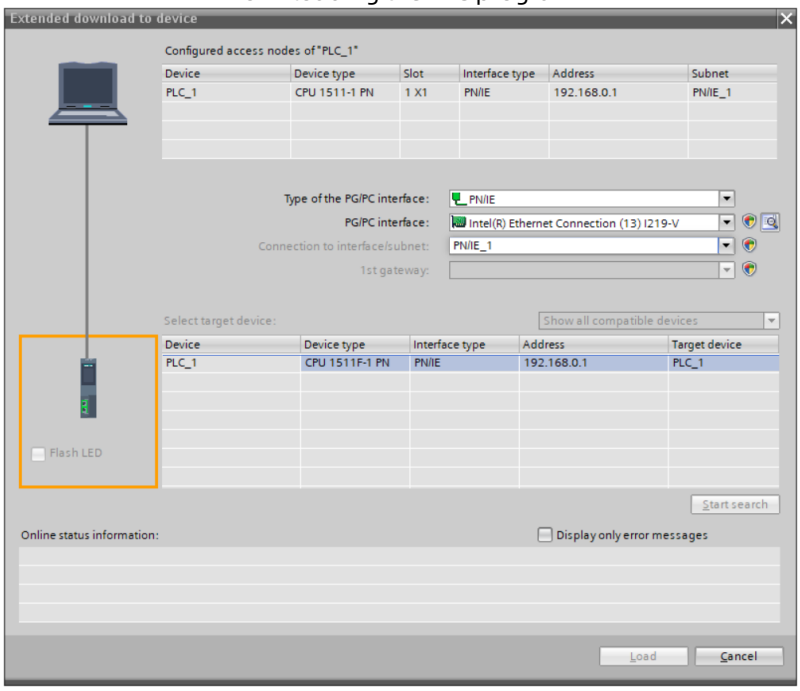
12. Go to the "Device view" section, double-click SV660F, and set the IP address and PROFINET device name for the servo drive.

Setting the IP address and device name



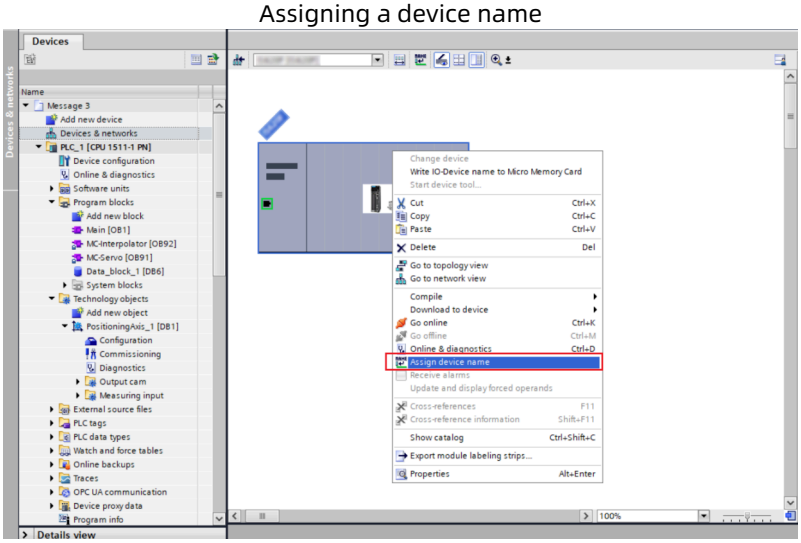
13. Download the PLC program.

Downloading the PLC program



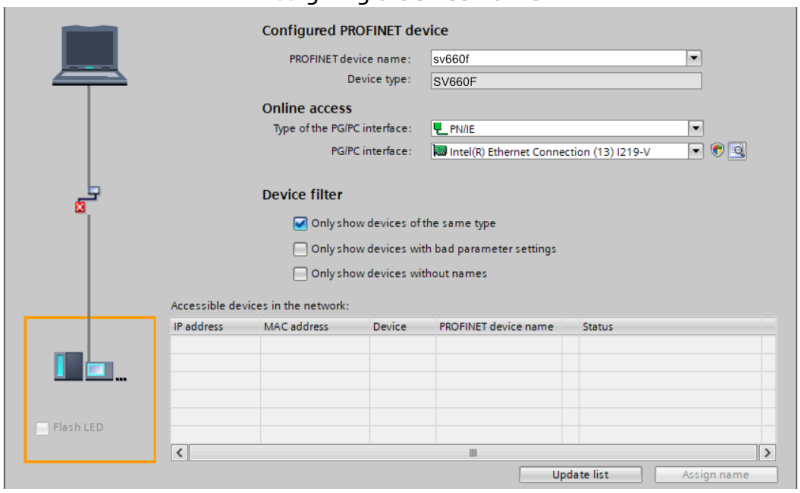
14. After the program is downloaded, check whether the PLC reports an error or the servo panel switches to the 44ry status. If any problem exists, right-click SV660F in the device view, and select "Assign device name".

Assigning a device name



15. To assign a name for SV660F, click "Update list", select the servo drive for which you want to assign a name, and then click "Assign device name". After assigning a name for the device, click "Update list", check whether the device name is updated, and whether the servo drive status and PLC status errors are cleared.

Assigning a device name



16. Telegram 3 networking and programming are completed.

Caution

In AC4 mode, it is not recommended to use the following functions when the PLC performs position closed-loop control. Otherwise, abnormalities may occur, leading to safety risks. It is recommended to connect the hardware limit switches to the PLC, with the PLC process object handling the related logic for limit functions.

- Local setting of the reference point function of the drive
- Local DI limit function and soft limit function of the drive
- Setting the speed command ramp-down/ramp-up time to a non-zero value

14.6 Acyclic Read/Write Example

Notes: AxisNO in SINA_PARA_S starts from 1 by default. Regardless of how many SV660F servo drives are connected, all AxisNOs are set to 1. Axes are distinguished by hardware ports.

In TIA Portal, the SinaPara function block can be used to read or write up to 16 parameters of the SV660F drive.

14.6.1 Acyclic Read/Write Rules

Defining PN acyclic parameter read/write policy

ABBCC (decimal)

A = 1 indicates the manufacturer parameter, the offset base number in the group is 0, and the offset range in the group is: 04 + CC = between 0 and 99.

A = 2 indicates the manufacturer parameter, the offset base number in the group is 100, and the offset range in the group is: 100 + CC = between 100 and 199.

BB indicates the parameter group number.

CC indicates the offset in the parameter group.

Example of PN acyclic parameter read/write

Example 1: To read H24.19, the acyclic read/write parameter number is 13619 = H24.19 A = 1, BB = 24 (hexadecimal) = 36 (decimal), and CC = 19 (decimal).

Example 2: To read H19.102, the acyclic read/write parameter number is 22502 = H19.102, A = 2, BB = 19 (hexadecimal) = 25 (decimal), and CC = 02 (decimal).

Conversion between parameter number and acyclic access parameter number

Parameter No.: H YY.XX(x)	Description
H	Fixed character
YY	The parameter group number in hexadecimal
XX(x)	The parameter offset in decimal

Parameter number: ABBCC	Description
A	Fixed value. A = 1 means ... A = 2 means ...
BB	The parameter group number in decimal. Therefore, you need ti convert YY from hexadecimal to decimal to obtain BB.
CC	The parameter offset in decimal. When A is 1, CC is XX. When A is 2, CC is XX(x) - 100.

14.6.2 Acyclic Read/Write (Single-Parameter Read/Write) of Sina_Para between S7-1500 and PN Servo

1. Calling the Sina_Para_S function block

   On the basis of the original configuration, you only need to call the Sina_Para_S function block in the program, as shown in the following figure.

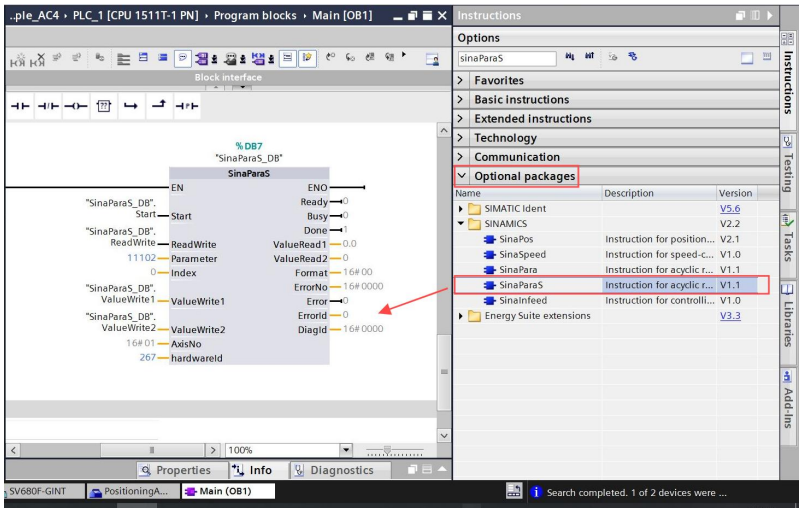


Figure 14-72 S7 1500 acyclic read/write function block

2. The Sina_Para_S function block is described in the table below:

   Input:

Table 14–9 Description of Sina_Para_S function block output pins

Input signal	Type	Default value	Definition
Start	BOOL	0	Starts operation (0 = No operation or operation canceled; 1 = Start and execute operation)
ReadWrite	BOOL	0	Operation type 0 = Read; 1 = Write
Parameter	UINT	1	Parameter No.
Index	UINT	0	Parameter index
ValueWrite1	REAL	0.0	Parameter value (in REAL format)
ValueWrite2	DINT	0	Parameter value (in DINT format)
AxisNo	INT	1	Axis number/Axis ID in the multi-axis system
hardwareId	HW IO	0	Hardware ID of the actual value telegram slot for the axis or drive to which the module is connected

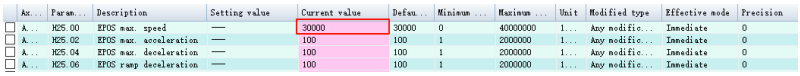
Output:

Table 14–10 Description of Sina_Para_S function block output pins

Output signal	Type	Default value	Definition
Ready	BOOL	0	Feedback signal connected in the LAcycCom environment. 1 = operation ended or canceled (one cycle)
Busy	BOOL	0	Operation in progress (If Busy = 1)
Done	BOOL	0	If the task ends correctly, the edge value changes from 0 to 1.
ValueRead1	REAL	0.0	Read the parameter value (in REAL format)
ValueRead2	DINT	0	Read the parameter value (in DINT format)
FORMAT	INT	0	Format of parameters read
ErrorNo	INT	0	Error code compliant with PROFIdrive
Error	BOOL	0	If Error changes to 1, group fault is activated
Status	DWORD	0	First word: the parameter access fault in binary code. Second word: the fault type.
DiagId	WORD	0	Extended communication error: SFB call error

3. Example

① Read an integer parameter, such as H25.00. The address of the servo parameter No. is 13700. After you start the read task, the parameter read area 2 displays 30000, which is the correct value of H25.00.



Ax...	Param...	Description	Setting value	Current value	Defau...	Minimum ...	Maximum ...	Unit	Modified type	Effective mode	Precision
A...	H25.00	EPOS max. speed	---	30000	30000	0	40000000	1...	Any modific...	Immediate	0
A...	H25.02	EPOS max. acceleration	---	100	100	1	2000000	1...	Any modific...	Immediate	0
A...	H25.04	EPOS max. deceleration	---	100	100	1	2000000	1...	Any modific...	Immediate	0
A...	H25.06	EPOS ramp deceleration	---	100	100	1	2000000	1...	Any modific...	Immediate	0

Figure 14-73 Value of H25.00

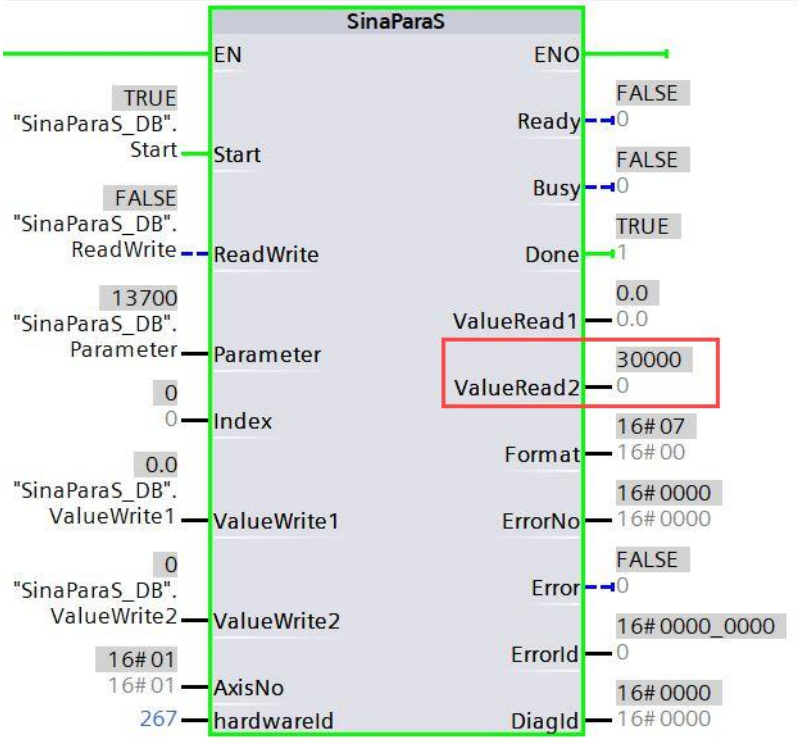
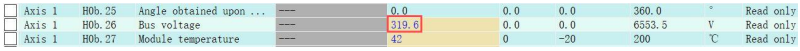


Figure 14-74 Acyclically read the value of H25.00

② If the value is read from a floating-point parameter, such as H0b.26, the address of the servo parameter No. is 11126. After the read operation is started, the value 30000 is displayed in the parameter read area 1, which is correct.



Axis 1	H0b.25	Angle obtained upon ...	---	0.0	0.0	0.0	360.0	°	Read only
Axis 1	H0b.26	Bus voltage	---	319.6	0.0	0.0	6553.5	V	Read only
Axis 1	H0b.27	Module temperature	---	42	0	-20	200	℃	Read only

Figure 14-75 Value of H0b.26

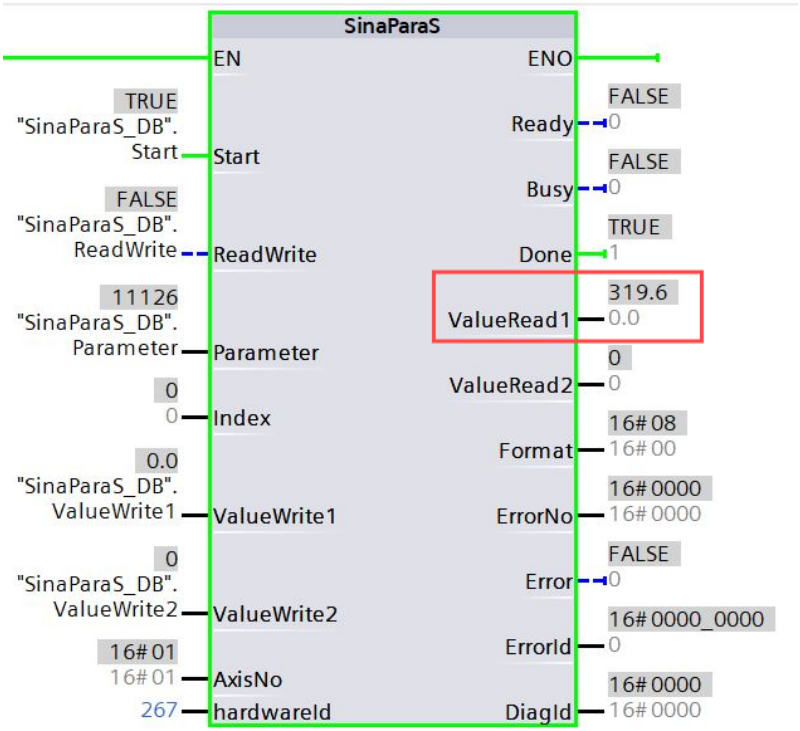


Figure 14-76 Acyclically read the value of H0b.26

③ If the value is written to an integer parameter, such as H25.00, then the address of the servo parameter No. is 13700, and the value in the parameter write area 2 is 2500. Switch ValueWrite 1/ ValueRead 1 to the write mode. Then, the start task is triggered and the write operation is performed.

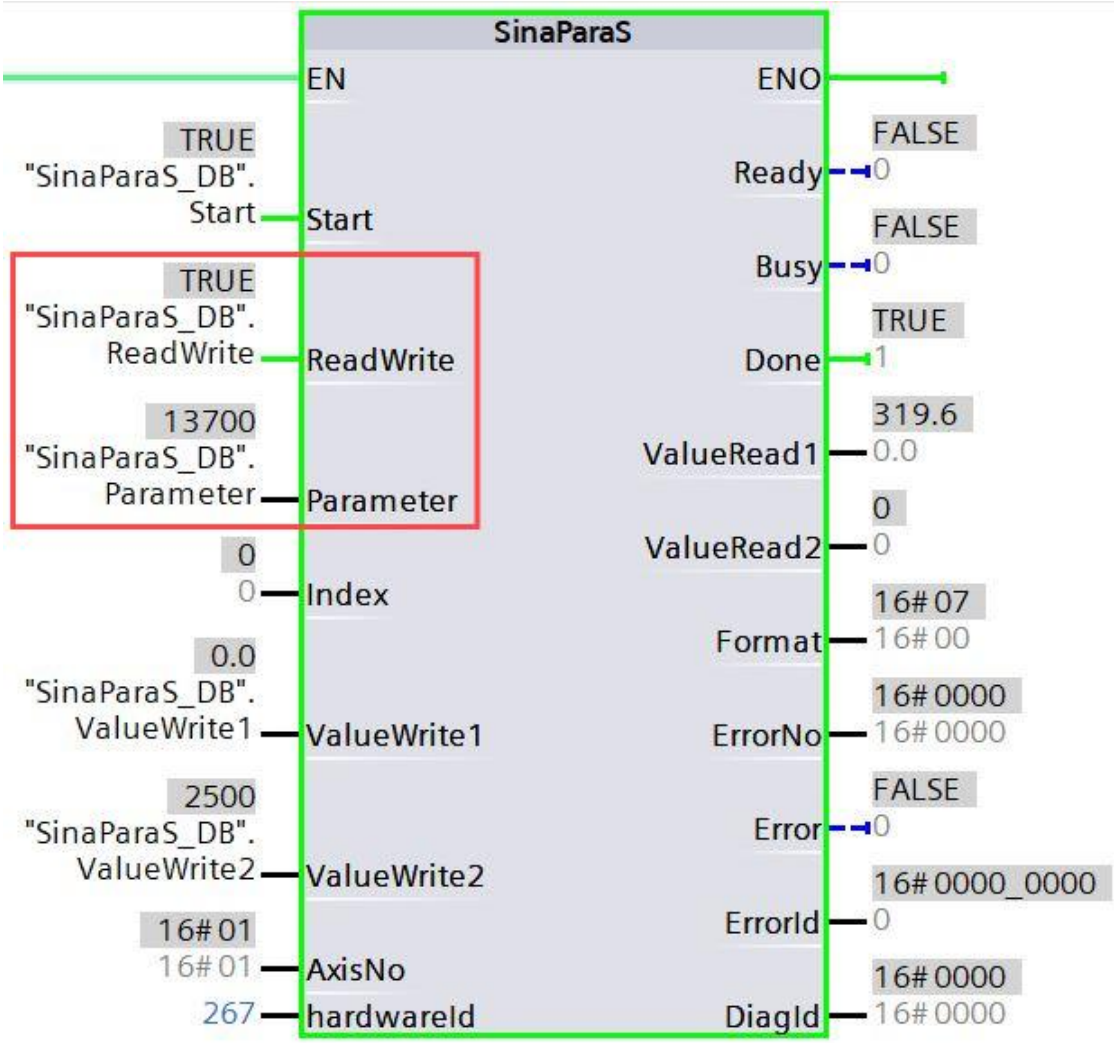
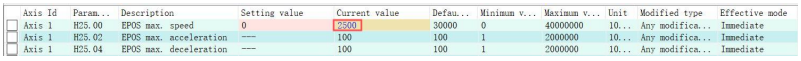


Figure 14-77 Acyclically write the value of H25.00



	Axis Id	Param...	Description	Setting value	Current value	Defau...	Minimum v...	Maximum v...	Unit	Modified type	Effective mode
☐	Axis 1	H25.00	EPOS max. speed	0	2500	30000	0	40000000	10...	Any modifica...	Immediate
☐	Axis 1	H25.02	EPOS max. acceleration	---	100	100	1	2000000	10...	Any modifica...	Immediate
☐	Axis 1	H25.04	EPOS max. deceleration	---	100	100	1	2000000	10...	Any modifica...	Immediate

Figure 14-78 Value of H25.00

④ If the value is written to a floating-point parameter, such as H08.00, the address of the servo parameter is 10800. Assign 50.5 to ValueWrite 1, and switch the ValueWrite 1/Value Read 1 to the write mode to trigger the start task, which writes the value.

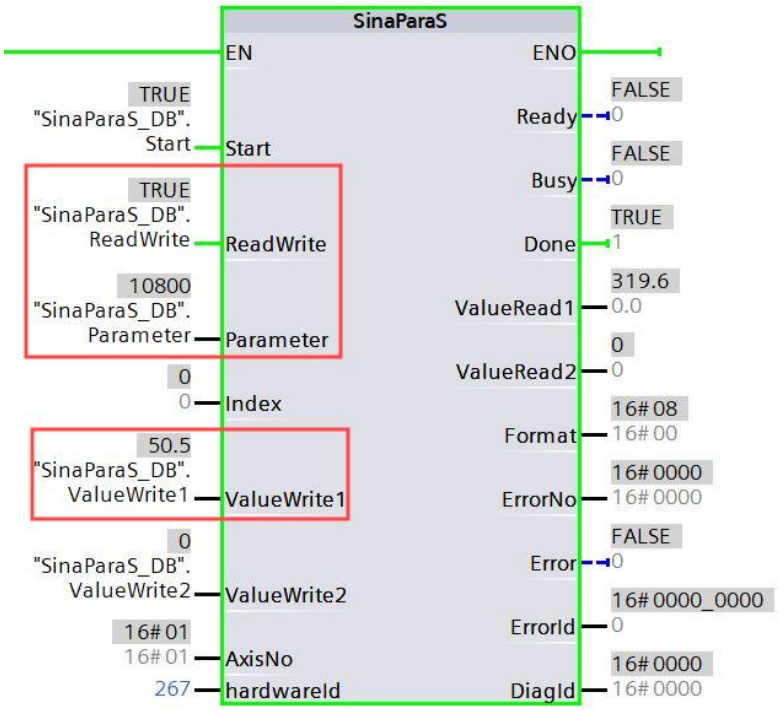
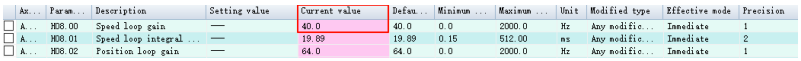


Figure 14-79 Acyclically write the value of H08.00



Ax...	Param...	Description	Setting value	Current value	Defau...	Minimum ...	Maximum ...	Unit	Modified type	Effective mode	Precision
A...	H08.00	Speed loop gain	—	40.0	40.0	0.0	2000.0	Hz	Any modific...	Immediate	1
A...	H08.01	Speed loop integral ...	—	19.89	19.89	0.15	512.00	ms	Any modific...	Immediate	2
A...	H08.02	Position loop gain	—	64.0	64.0	0.0	2000.0	Hz	Any modific...	Immediate	1

Figure 14-80 Value of H08.00

4. Precautions

Note 1: AxisNO in SINA_PARA_S starts from 1 by default. Regardless of how many drives are connected, all AxisNOs are set to 1. Axes are distinguished by hardware ports.

Note 2: Set the function block input parameter Parameter_No as follows: Set the address of Parameter_NO (in decimal) on the host controller to ABBCC (in decimal). A is a fixed value. A = 1 indicates a manufacturer parameter, with an offset base value of 0 within the group, and an offset range of 04 + CC = between 0 and 99. A = 2 indicates a manufacturer parameter, with an offset base value of 100 within the group, and an offset range of 100 + CC = between 100 and 199. BB indicates the parameter group number in decimal. Therefore, YY needs to be converted from hexadecimal to decimal to obtain BB. CC indicates the parameter offset in decimal. When A is 1, CC is XX. When A is 2, CC is XX(x) - 100.

Note 3: valueWriter1 is a 16-bit data write area, valueWriter2 is a 32-bit data write area, ValueRead1 is a 16-bit data read area, and ValueRead2 is a 32-bit data read area. If the data range of the servo parameter is within the 16-bit data range, assign a value in valueWriter1. If the data range of the servo parameter is outside the 16-bit data range, assign a value in valueWriter2.

Table 14–11 Fault code list

Fault code	Description
0x00	The parameter does not exist.
0x01	Read-only parameter cannot be modified.
0x02	The parameter value exceeds the upper or lower limit.
0x03	Sub-index error.

Fault code	Description
0x04	The data is not of the array type.
0x05	Incorrect data type.
0x06	Reset-only faults are not allowed.
0x07	The description element cannot be modified.
0x09	The description data does not exist and access to description information is not supported.
0x0B	No permissions to modify manufacturer-protected parameters.
0x0F	The text data does not exist and access to text information is not supported.
0x11	Stop-related parameters cannot be modified because the drive is operating.
0x14	Reserved parameters cannot be accessed when the drive is in this state.
0x15	The response frame is too long. Reduce the number of parameters to be accessed or modified.
0x16	Invalid parameter address. The accessed data is not a parameter.
0x17	Invalid format. The parameter format is not supported.
0x18	The number of values is inconsistent.
0x19	The axis does not exist or the axis number is incorrect.
0x21	The service is not supported. It is not an access or modification request.
0x22	Request parameters too long, accessing or modifying too many parameters.
0x23	Multi-parameter access is not supported.
0x65	The high-order bits of 32-bit data are accessed. Change the accessed data or modify the requested data address.
0x66	Request frame too long, accessing or modifying too many parameters.
0x67	Mixed access to profile parameters and function code parameters is not supported.
0x68	Inconsistent format of continuous array parameters, which are not set as array elements.
0x69	Data index too large.

14.6.3 Acyclic Read/Write (Multi-Parameter Read/Write) of Sina_Para between S7-1500 and PN Servo

1. Overview

   In TIA Portal, the SinaPara function block can be used to read or write up to 16 parameters of the drive.

2. Calling the Sina_Para function block

   On the basis of the original configuration, you only need to call the Sina_Para function block in the program, as shown in the following figure.

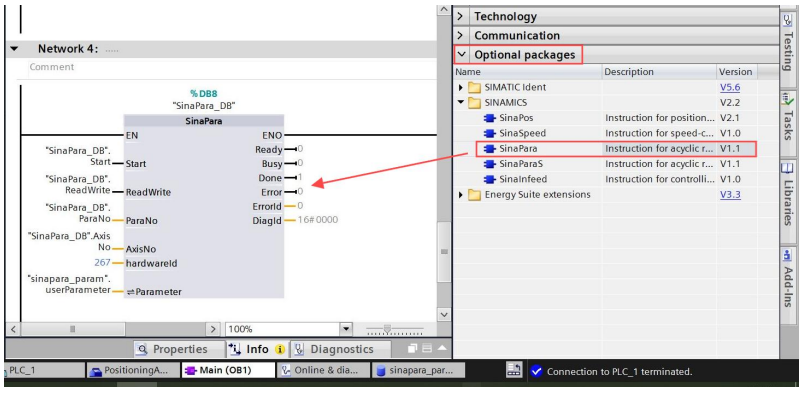


Figure 14-81 S7 1500 acyclic read/write function block

3. The Sina_Para function block is described in the table below:
Input:

Table 14–12 Description of Sina_Para function block input pins

Input signal	Type	Default value	Definition
Start	BOOL	0	Starts operation (0 = No operation or operation canceled; 1 = Start and execute operation)
ReadWrite	BOOL	0	Operation type 0 = Read; 1 = Write
ParaNo	INT	1	Number of parameters: 1 to 16
AxisNo	INT	1	Axis number/Axis ID in the multi-axis system
hardwareId	HW IO	0	Hardware ID of the actual value telegram slot for the axis or drive to which the module is connected

Table 14–13 Description of Sina_Para_S function block output pins

Output signal	Type	Default value	Definition
Ready	BOOL	0	Feedback signal connected in the LAcycCom environment. 1 = operation ended or canceled (one cycle)
Busy	BOOL	0	Operation in progress (If Busy = 1)
Done	BOOL	0	Edge changes from 0 to 1: indicates the task is completed.
Error	BOOL	0	If Error changes to 1, group fault is activated
Status	DWORD	0	First word: the parameter access fault in binary code. Second word: the fault type.
DiagId	WORD	0	Extended communication error: SFB call error

Parameter definition method and data structure

- 1. Add the sinapara instruction in the option package to the program, and then add a new global DB block and name it sinapara_param (or any other name). Open the background data editor and add an element of the userParameter data type. Select "Array[0..1]of" first, as shown in the following figure.



Figure 14-82 Select a data type

- 2. Select "Array[0..1]of SinaParameter", as shown in the following figure.



Figure 14-83 Select "Array[0..1]of SinaParameter"

- 3. Change the index value of the array elements to 1 to 16. Note that the parameter index starts from 1, not 0, as shown in the following figure.

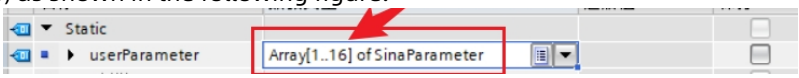


Figure 14-84 Modify the index value.

The generated DB data table is shown in the following figure.

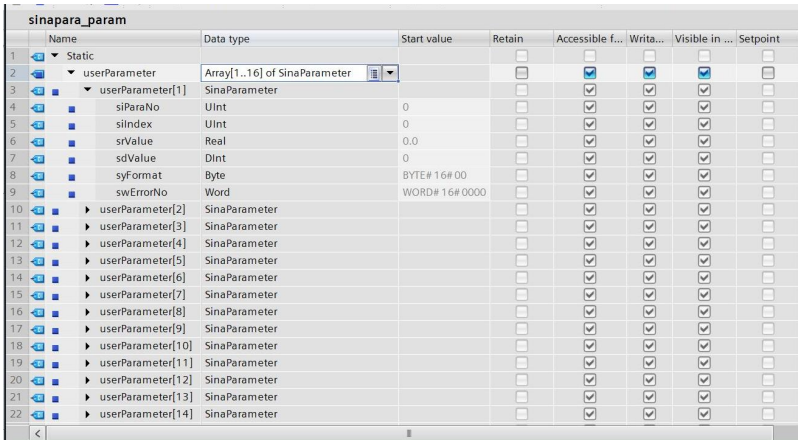


Figure 14-85 DB data table

Data structure in the "Parameter" section

Parameter[x].siParaNo.: the parameter number (valid values: 1 to 65535)

Parameter[x1].siIndex.:= the parameter index (valid values: 1 to 65535)

Parameter[x].srValue: = the parameter value (valid values: 1.175495e-38 to 3.402823e+38)

Parameter[x].sdValue: = the parameter value (valid values: -214748364810 (-2^{31}) to +214748364710 (2^{31}))

Note that all drive parameters of the DWORD or DINT type must be written to Parameter[x]. sdValue. Write all other parameter types to Parameter[x].srValue. Before setting drive parameters, familiarize yourself with the format of the parameter to be read/written, such as DWORD, DINT, or other formats (byte, word, real, INT).

Parameter[x].syFormat.: the parameter format

Value range: 0x40 = Zero 0x41/0x02/0x05 = Byte 0x42/0x03/0x06 = Word 0x43/0x04/0x07/0x08 = DWord 0x44 = Error

Parameter[x].swErrorNo.: the parameter error number (valid values: 0x0000 to 0x00FF)

4. Example

① Read the parameters with integer values and floating-point values at the same time, such as H25.14 and H08.00. Assign 13714 to userParameter[1].siParaNo and 10800 to userParameter[2].siParaNo. After starting the read task, userParameter[1].sdValue displays 30000 and userParameter[2].sdValue displays 50.5. If the values are the same as those of the servo parameters, the values are read correctly, as shown in the following figures.

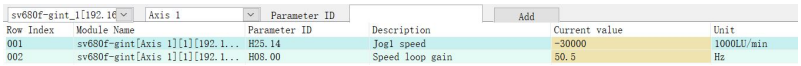


Figure 14-86 Servo parameters

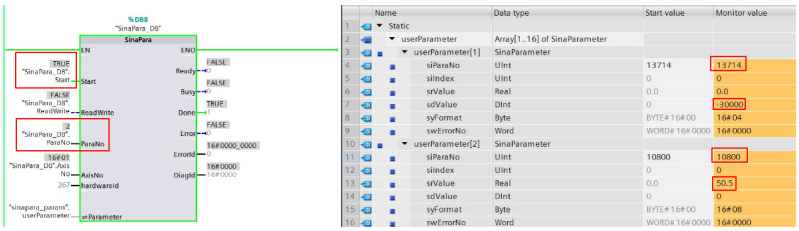


Figure 14-87 SinaPara function block

② Write parameters with integer and floating point values at the same time, such as H25.14 and H08.00. In this case, assign 13714 to userParameter[1].siParaNo, 10800 to userParameter[2].siParaNo, 5000 to userParameter[1].sdValue, and 10.5 to userParameter[2].sdValue. After starting the write task, check whether the servo parameters are consistent. If yes, the values are correctly written, as shown in the following figures.

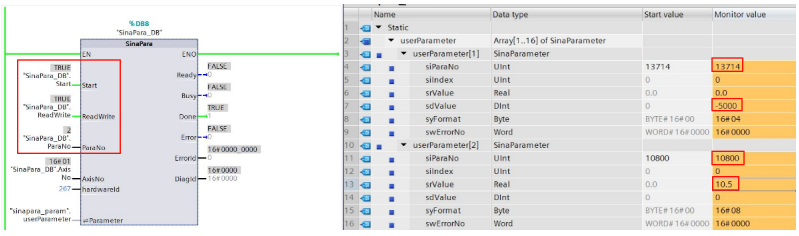


Figure 14-88 SinaPara function block

行号	模块名	功能码ID	描述	当前值	单位
001	sv680f...	H25.14	EPOS-Jog1速度	-5000	1000LU/min
002	sv680f...	H08.00	速度环增益	10.5	Hz

Figure 14-89 Servo parameters

5. Precautions

Note 1: The AxisNO parameter in SinaPara starts from 1 by default. No matter how many Inovance PN servos are connected later, AxisNO is set to 1, and the axes are distinguished by hardware port.

Note 2: Set the function block input parameter userParameter[X].siParaNo as follows: Set the address of userParameter[X].siParaNo (in decimal) on the host controller to ABBCC (in decimal). A is a fixed value. A = 1 indicates a manufacturer parameter, with an offset base value of 0 within the group, and an offset range of 04 + CC = between 0 and 99. A = 2 indicates a manufacturer parameter, with an offset base value of 100 within the group, and an offset range of 100 + CC =

between 100 and 199. BB indicates the parameter group number in decimal. Therefore, YY needs to be converted from hexadecimal to decimal to obtain BB. CC indicates the parameter offset in decimal. When A is 1, CC is XX. When A is 2, CC is XX(x) - 10.

Note 3: Depending on how many parameters need to be read or written on site, assign the corresponding value to the ParaNo pin. For now, the userParameter[X].siIndex pin is not required for Inovance technical parameters, so the default value 0 is used.

15 Parameter Descriptions

15.1 H00 Servo Motor Parameters

H00.00 **Motor SN**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	14101	Change mode:	At stop

Range:
0 to 65535
Parameter description
Sets the SN of the servo motor. Fixed to 14XXX. Setting the motor code to a wrong value will result in E120.1 (Unknown motor model).

H00.02 **Customized SN**

Address:	-	Effective mode:	-
Min.:	0.00	Unit:	-
Max.:	42949672.95	Data type:	UInt32
Default:	0.00	Change mode:	Read only

Range:
0.00 to 42949672.95
Parameter description
Differentiates the customized MCU software version, which is not applicable to standard models.

H00.04 **Encoder version**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	-
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0 to 6553.5
Parameter description
Saved in the encoder and used to differentiate the encoder software version.

H00.05 **Serial encoder motor SN**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535

Parameter description

Displays the code of the serial-type motor, which is determined by the motor model and unchangeable.

H00.06 **FPGA customized SN**

Address:	-	Effective mode:	-
Min.:	0.00	Unit:	-
Max.:	655.35	Data type:	UInt16
Default:	0.00	Change mode:	Read only

Range:

0.00 to 655.35

Parameter description

Differentiates the customized FPGA software version, which is not applicable to standard models.

H00.07 **STO version**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	-
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:

0.0 to 6553.5

Parameter description

Displays the software version of STO function.

H00.08 **Serial encoder type**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

0 to 65535

Parameter description

14100: Multi-turn absolute encoder

Others: Single-turn absolute encoder

15.2 H01 Drive Parameters

H01.00 **MCU software version**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	-
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0 to 6553.5
Parameter description
Displays the MCU software version.

H01.01 **FPGA software version**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	-
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0 to 6553.5
Parameter description
Displays the FPGA software version.

H01.02 **Servo drive series No.**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Displays the servo drive series.

H01.07 **Software sub-version**

Address:	-	Effective mode:	-
Min.:	0.00	Unit:	-
Max.:	655.35	Data type:	UInt16
Default:	0.00	Change mode:	Read only

Range:
0.00 to 655.35
Parameter description
Displays the software test version.

H01.08 **Model parameter version 1**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	-
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0 to 6553.5
Parameter description
Displays the model parameter version.

H01.09 **Model parameter version 2**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Displays the model parameter version 2.

H01.10 **Drive series No.**

Comm. address:	-	Effective mode:	Next power-on
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16
Default value:	3	Change mode:	At stop

Value range:
2: S1R6
3: S2R8
5: S5R5
6: S7R6
7: S012
10001: T3R5
10002: T5R4
10003: T8R4
10004: T012
10005: T017
10006: T021
10007: T026
Parameter description
Displays the drive series number.

H01.11 **DC-AC voltage class**

Address:	-	Effective mode:	-
Min.:	0	Unit:	V
Max.:	65535	Data type:	UInt16
Default:	220	Change mode:	Read only

Range:
0 to 65535
Parameter description
Defines the DC-AC voltage class.

H01.12 **Rated power of the drive**

Address:	-	Effective mode:	-
Min.:	0.00	Unit:	kW

Max.:	42949672.95	Data type:	UInt32
Default:	0.40	Change mode:	Read only

Range:
0.00 to 42949672.95
Parameter description
Displays the rated power of the drive.

H01.14 **Maximum output power of the drive**

Address:	-	Effective mode:	-
Min.:	0.00	Unit:	kW
Max.:	42949672.95	Data type:	UInt32
Default:	0.40	Change mode:	Read only

Range:
0.00 to 42949672.95
Parameter description
Displays the max. output power of the drive.

H01.16 **Rated output current of the drive**

Address:	-	Effective mode:	-
Min.:	0.00	Unit:	A
Max.:	42949672.95	Data type:	UInt32
Default:	2.80	Change mode:	Read only

Range:
0.00 to 42949672.95
Parameter description
Defines the rated output current of the drive.

H01.18 **Maximum output current of the drive**

Address:	-	Effective mode:	-
Min.:	0.00	Unit:	A
Max.:	42949672.95	Data type:	UInt32
Default:	10.10	Change mode:	Read only

Range:
0.00 to 42949672.95
Parameter description
Displays the max. output current of the drive.

H01.40 **DC bus overvoltage protection threshold**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	V
Max.:	2000	Data type:	UInt16
Default:	420	Change mode:	Real-time

Range:

0 V to 2000 V

Parameter description

Displays the DC bus overvoltage protection threshold.

H01.88 **Junction temperature parameter version 1**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	-
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:

0.0 to 6553.5

Parameter description

Display the version 1 of the junction temperature parameter.

H01.89 **Junction temperature parameter version 2**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

0 to 65535

Parameter description

Displays version 2 of the junction temperature parameter.

15.3 H02 Basic Control Parameters

H02.00 **Control mode selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	11	Data type:	UInt16
Default:	11	Change mode:	At stop

Range:

0: Speed control mode

1: Position control mode

2: Torque control mode

11: PN mode

Parameter description

Sets the control mode of the servo drive.

H02.01 **Absolute system selection**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	-
Max.:	5	Data type:	UInt16

Default:	0	Change mode:	At stop

Range:

0: Incremental mode

1: Absolute position linear mode

2: Absolute position rotation mode

3: Absolute position linear mode (without encoder overflow warning)

4: Absolute position single-turn mode

5: Absolute position rotational mode, modal axis single modal revolution absolute command

Parameter description

It sets the mode of the absolute system.

Setpoint	Absolute system selection	Remarks
0	Incremental mode	The encoder is used as a serial incremental encoder, and the position retentive at power failure is not supported.
1	Absolute position linear mode	The encoder is used as an absolute encoder, and the position is retentive at power failure. It is applicable to the scenario where the travel range of the device load is fixed and the encoder multi-turn data does not overflow.
2	Absolute position rotation mode	The encoder is used as an absolute encoder, and the position is retentive at power failure. This mode is mainly applicable to the scenario where the load travel range is not limited and the number of motor single-direction revolutions is smaller than 32767.
3	Absolute position linear mode (without encoder overflow warning)	Encoder overflow warnings are not present.
4	Absolute position single-turn mode	-
5	Absolute position rotational mode, modal axis single modal revolution absolute command	In this mode, the position command is first processed through a modulo operation. The resulting remainder is then used as the new command, ensuring the movement distance is always less than one modulo revolution.

H02.02 **Rotation direction selection**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

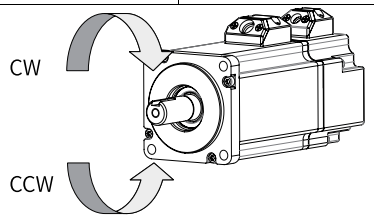
0: CCW direction as the forward direction

1: CW direction as the forward direction

Parameter description

Defines the forward direction of the motor when viewed from the motor shaft side.

Setpoint	Rotation Direction	Remarks
0	CCW direction as forward direction	When a forward command is input, the motor rotates in CCW direction viewed from the motor shaft side, that is, the motor rotates counterclockwise.
1	CW direction as forward direction	When a forward command is input, the motor rotates in CW direction viewed from the motor shaft side, that is, the motor rotates clockwise.



H02.05 **Stop mode at S-ON OFF**

Address:	-	Effective mode:	At stop
Min.:	-5	Unit:	-
Max.:	3	Data type:	Signed 16-bit
Default:	3	Change mode:	Real-time

Range:

-5: Stop in PN communication state (ramp-to-stop/quick stop/coast-to-stop), keeping dynamic braking state

-4: Ramp to stop based on ramp 2, keeping dynamic braking state

-3: Stop at zero speed, keeping dynamic braking state

-2: Ramp to 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: Ramp to stop based on ramp 1, keeping de-energized state

2: Dynamic braking stop, keeping de-energized state

3: Stop in PN communication state (ramp-to-stop/quick stop/coast-to-stop), keeping de-energized state

Parameter description

Defines the deceleration mode of the motor for stopping rotating upon S-ON OFF and the motor status after stop.

Set the correct stop mode according to the mechanical status and running requirement.

Note: After the brake function is enabled, H02.05 will be forcibly set to "-4: Ramp to stop based on ramp 2, keeping dynamic braking state".

H02.06 **Stop mode at No. 2 fault**

Address:	-	Effective mode:	At stop
Min.:	-5	Unit:	-
Max.:	3	Data type:	Signed 16-bit
Default:	2	Change mode:	Real-time

Range:

-5: Stop at zero speed, keeping dynamic braking state
-4: Stop at emergency stop torque, keeping dynamic braking state
-3: Ramp to stop based on ramp 2, keeping dynamic braking state
-2: Ramp to 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: Ramp to stop based on ramp 1, keeping de-energized state
2: Ramp to stop based on ramp 2, keeping de-energized state
3: Stop at emergency stop torque, keeping de-energized state

Parameter description

Defines the deceleration mode of the motor for stopping rotating upon No. 2 fault and the motor status after stop.
After the brake output is enabled, the stop mode at No. 2 fault will be forcibly set to "Ramp to stop based on ramp 2, keeping dynamic braking state".
Note: After the brake function is enabled, H02.06 will be forcibly set to "-3: Ramp to stop based on ramp 2, keeping dynamic braking state".

H02.07 Stop mode at overtravel

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	8	Data type:	UInt16
Default:	1	Change mode:	Real-time

Range:

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 based on ramp 2, keeping de-energized state
4: Ramp to 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
8: Stop upon level 2 fault

Parameter description

Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when overtravel occurs.
When the servo motor drives vertical axis, your setting must make the motor axis in position locking state after the limit switch signal is active to ensure safety.
Note: After the brake function is enabled, H02.07 will be forcibly set to "4: Ramp to stop based on ramp 2, keeping position lock state".

H02.08 Stop mode at No.1 fault

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	2	Change mode:	Real-time

Range:

0: Coast to stop, keeping de-energized state

1: Dynamic braking stop, keeping de-energized state

2: Dynamic braking stop, keeping dynamic braking state

Parameter description

Defines the deceleration mode of the motor for stopping rotating upon No. 1 and the motor status after stop.

For details on No.1 faults, see Chapter "Troubleshooting".

Note: After the brake function is enabled, H02.08 will be forcibly set to "2: Dynamic braking stop, keeping dynamic braking state".

H02.09 **Delay from brake output ON to command received**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	500	Data type:	UInt16
Default:	250	Change mode:	Real-time

Range:

0 to 500

Parameter description

Defines the delay from the moment the servo drive starts to receive commands after power-on to the moment the brake (BK) output signal is ON.

H02.10 **Delay from brake output OFF to motor de-energized**

Address:	-	Effective mode:	Effective in real time
Min.:	50	Unit:	ms
Max.:	1000	Data type:	UInt16
Default:	150	Change mode:	Real-time

Range:

50 to 1000

Parameter description

Defines the delay from the moment when the motor at standstill enters the de-energized status to the moment brake (BK) output is OFF.

H02.11 **Motor speed threshold at brake output OFF in rotating state**

Address:	-	Effective mode:	Effective in real time
Min.:	20	Unit:	rpm
Max.:	3000	Data type:	UInt16
Default:	30	Change mode:	Real-time

Range:

20 to 3000

Parameter description

Defines the motor speed threshold when brake (BK) output is OFF in the rotation state.

H02.12 **Delay from S-ON off to brake output off**

Address:	-	Effective mode:	Effective in real time

Min.:	1	Unit:	ms
Max.:	65535	Data type:	UInt16
Default:	500	Change mode:	Real-time

Range:

1 to 65535

Parameter description

Defines the delay from the moment the S-ON signal is OFF to the moment the brake (BK) output is OFF in the rotation state.

H02.15 Display of keypad warning

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Immediately output warning message

1: Do not output warning message

Parameter description

It sets whether the keypad switches to the fault display mode when a No.3 alarm occurs on the servo drive.

For details on No.3 alarms, see Chapter "Troubleshooting".

H02.17 Stop mode upon main circuit power failure

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	3	Data type:	UInt16
Default:	2	Change mode:	Real-time

Range:

0: Keep current action

1: Stop upon fault as defined by H02.06

2: Stop at S-ON OFF as defined by H02.05

3: Stop quickly as defined by H02.18

Parameter description

Defines the stop mode of the motor for stopping rotating upon main circuit power failure.

0: Keep current action

1: Stop upon fault as defined by H02.06

2: Stop at S-ON OFF as defined by H02.05

3: Stop quickly as defined by H02.18

H02.18 DI emergency stop mode selection

Comm. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	3	Data type:	UInt16
Default value:	2	Change mode:	Real time

Value range:

0: Coast to stop, keeping de-energized state

1: Ramp to stop based on ramp 1, keeping de-energized state

2: Ramp to stop based on ramp 2, keeping de-energized stat

3: Stop at emergency stop torque, keeping de-energized state

Parameter description

Defines the deceleration mode of the motor for stopping rotating upon quick stop and the motor state after stop.

0: Coast to stop, keeping de-energized state

1: Ramp to stop based on ramp 1, keeping de-energized state

2: Ramp to stop based on ramp 2, keeping de-energized state

3: Stop at emergency stop torque, keeping de-energized state

Note: After the brake function is enabled, H02.18 will be forcibly set to "2: Ramp to stop based on ramp 2, keeping de-energized state".

H02.20 Energizing delay of DB relay coil

Address:	-	Effective mode:	Effective in real time
Min.:	10	Unit:	ms
Max.:	30000	Data type:	UInt16
Default:	30	Change mode:	Real-time

Range:

10 to 30000

Parameter description

Set this parameter based on hardware dynamic brake relay response time.

H02.21 Min. allowable resistance of braking resistor

Comm. address:	-	Effective mode:	-
Min. value:	1	Unit:	Ω
Max. value:	1000	Data type:	UInt16
Default value:	40	Change mode:	Read-only

Value range:

1 to 1000

Parameter description

The minimum allowable resistance of the braking resistor is only related to the drive model.

The minimum allowable resistance varies with the drive model. The following table describes the specifications of braking resistors.

Table 15–1 Braking resistor specifications

Drive model	Specifications of built-in braking resistor			External braking resistor Min. allowable resistance (Ω) (H02.21)
	Resistance (Ω)	Power Pr (W)	Processing power Pa (W)	
SV660FS1R6I	-	-	-	40
SV660FS2R8I	-	-	-	40
SV660FS5R5I	50	50	25	40

Drive model	Specifications of built-in braking resistor			External braking resistor Min. allowable resistance (Ω) (H02.21)
	Resistance (Ω)	Power Pr (W)	Processing power Pa (W)	
SV660FS7R6I	25	80	40	20
SV660FS012I				15
SV660FT3R5I	100	80	40	80
SV660FT5R4I	100	80	40	60
SV660FT8R4I	50	80	40	45
SV660FT012I				40
SV660FT017I	35	100	50	35
SV660FT021I				25
SV660FT026I				

Note

The built-in braking resistor is not available in S1R6 or S2R8 models. For these models, you can install an external braking resistor as needed.

H02.22 **Power of built-in braking resistor**

Address:	-	Effective mode:	-
Min.:	0	Unit:	W
Max.:	65535	Data type:	UInt16
Default:	50	Change mode:	Read only

Range:
0 to 65535
Parameter description
The power of the built-in braking resistor is only related to the servo drive model, which is unmodifiable.

H02.23 **Resistance of built-in braking resistor**

Comm. address:	-	Effective mode:	-
Min. value:	0	Unit:	Ω
Max. value:	65535	Data type:	UInt16
Default value:	50	Change mode:	Read-only

Value range:
0 to 65535
Parameter description
The resistance of the built-in braking resistor is only related to the servo drive model, which is read-only.
The built-in braking resistor is used when the maximum braking energy absorbed by the bus capacitor is lower than the calculated maximum braking energy.
When using the built-in braking resistor, connect a jumper bar between terminals P⊕ and D.
When H01.02 (servo drive No.) is set to 2 or 3, there is no built-in braking resistor.

Table 15–2 Braking resistor specifications

Drive model	Specifications of built-in braking resistor			External braking resistor Min. allowable resistance (Ω) (H02.21)
	Resistance (Ω)	Power Pr (W)	Processing power Pa (W)	
SV660FS1R6I	-	-	-	50
SV660FS2R8I	-	-	-	45
SV660FS5R5I	50	50	25	40
SV660FS7R6I	25	80	40	20
SV660FS012I				15
SV660FT3R5I	100	80	40	80
SV660FT5R4I	100	80	40	60
SV660FT8R4I	50	80	40	45
SV660FT012I				40
SV660FT017I	35	100	50	35
SV660FT021I				25
SV660FT026I				

H02.24 **Resistor heat dissipation coefficient**

Address:	-	Effective mode:	Effective in real time
Min.:	10	Unit:	%
Max.:	100	Data type:	UInt16
Default:	30	Change mode:	Real-time

Range:

10% to 100%

Parameter description

Defines the heat dissipation coefficient of the braking resistor, which is applicable to both external and built-in braking resistors.

Set this parameter properly according to actual heat dissipation conditions of the resistor (heat dissipation coefficient).

Recommendations:

Generally, the coefficient cannot exceed 30% for natural cooling.

It cannot exceed 50% for forced air cooling.

H02.25 **Braking resistor setting**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	3	Data type:	UInt16
Default:	3	Change mode:	Real-time

Range:

0: Built-in

1: External, natural cooling

2: External, forced cooling

3: No resistor needed

Parameter description

It sets the mode of absorbing and releasing the braking energy.

H02.26 **Power of external braking resistor**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	W
Max.:	65535	Data type:	UInt16
Default:	40	Change mode:	Real-time

Range:
1 to 65535
Parameter description
Defines the power of the external braking resistor.
Note: The value of this parameter cannot be lower than the calculated braking power.

H02.27 **Resistance of external braking resistor**

Address:	-	Effective mode:	Effective in real time
Min.:	15	Unit:	Ω
Max.:	1000	Data type:	UInt16
Default:	50	Change mode:	Real-time

Range:
15 to 1000
Parameter description
Defines the power of the external braking resistor.
Note: The value of this parameter cannot be lower than the calculated braking power.

H02.30 **User password**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Defines the user password.

H02.31 **System parameter initialization**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0: No operation
1: Restore factory settings
2: Clear the fault records
Parameter description

Used to restore default values or clear fault records.
0: No operation
1: Restore factory settings
2: Clear the fault records

H02.32 Selection of parameters in group H0b

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	99	Data type:	UInt16
Default value:	50	Change mode:	Real time

Value range:
0 to 99
Parameter description
Defines the offset of the parameter to be displayed on the keypad.
For example, the setpoint 0 indicates the value of H0b.00 (Motor speed actual value) is displayed on the keypad.
The setpoint 1 indicates the value of H0b.01 (Speed reference) is displayed on the keypad.

H02.33 200P software version

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	-
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0 to 6553.5
Parameter description
Displays the 200P software version.

H02.35 Keypad data refresh frequency

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	Hz
Max.:	20	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 20
Parameter description
Defines the keypad data refresh frequency.

H02.38 Overload time of external resistor

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	s
Max.:	200	Data type:	UInt16
Default:	40	Change mode:	Real-time

Range:

0 to 200

Parameter description

Defines the overload time threshold of the external braking resistor.

H02.41 **Manufacturer password**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0 to 65535

Parameter description

Enter the manufacturer password to enable the manufacturer protection parameters.

H02.47 **Delay time from power cable disconnection to brake OFF**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	1000	Data type:	UInt16
Default:	10	Change mode:	Real-time

Range:

0 ms to 1000 ms

Parameter description

It is the same as H02.12. In case of power cable disconnection, this parameter is used instead of H02.12 to avoid the vertical axis falling.

15.4 H03 Terminal Input Parameters

H03.02 **DI1 function selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	14	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
38: Probe 1
39: Probe 2
56: External switch of EPOS program block

Parameter description

It sets the function of DI1 terminal.

H03.03 **DI1 logic selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Normally open
1: Normally closed

Parameter description

It sets the level logic of DI1 for enabling the DI1 function.
DI1 to DI4 are normal DIs, requiring the input signal width to be larger than 1 ms.

H03.04 **DI2 function selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	15	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
38: Probe 1
39: Probe 2
56: External switch of EPOS program block

Parameter description

It sets the function of DI2 terminal.

H03.05 **DI2 logic selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Normally open
1: Normally closed

Parameter description

Defines the level logic of DI2 when the function assigned to DI2 is active.
DI1 to DI4 are normal DIs, requiring the input signal width to be larger than 1 ms.

H03.06 **DI3 function selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	31	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
38: Probe 1
39: Probe 2
56: External switch of EPOS program block

Parameter description

It sets the function of DI3 terminal.

H03.07 **DI3 logic selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Normally open
1: Normally closed

Parameter description

Defines the level logic of DI3 when the function assigned to DI is active.
DI1 to DI4 are normal DIs, requiring the input signal width to be larger than 1 ms.

H03.08 **DI4 function selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	34	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
38: Probe 1
39: Probe 2
56: External switch of EPOS program block

Parameter description

It sets the function of DI4 terminal.

H03.09 **DI4 logic selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Normally open
1: Normally closed

Parameter description

Defines the level logic of DI4 when the function assigned to DI is active.
DI1 to DI4 are normal DIs, requiring the input signal width to be larger than 1 ms.

H03.10 **DI5 function selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	38	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
38: Probe 1
39: Probe 2
56: External switch of EPOS program block

Parameter description

Defines the function of DI5.

H03.11 **DI5 logic selection**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:

0: Normally open
1: Normally closed

Parameter description

Defines the level logic of DI5 when the function assigned to DI is active.

H03.34 **DI function assignment 3 (activated upon power-on)**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Real-time

Range:

bit0: FunIN.33
bit1: FunIN.34
bit2: FunIN.35
bit3: FunIN.36
bit4: FunIN.37
bit5: FunIN.38
bit6: FunIN.39
bit7: FunIN.40
bit8: FunIN.41
bit9: FunIN.42
bit10: FunIN.43
bit11: FunIN.44
bit12: FunIN.45
bit13: FunIN.46
bit14: FunIN.47
bit15: FunIN.48

Parameter description

Used to enable a certain DI function (FunIN.33 to FunIN.48) to be activated immediately at next power-on.

H03.35 **DI function assignment 4 (activated upon power-on)**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Real-time

Range:

bit0: FunIN.49
bit1: FunIN.50
bit2: FunIN.51
bit3: FunIN.52
bit4: FunIN.53
bit5: FunIN.54
bit6: FunIN.55
bit7: FunIN.56
bit8: FunIN.57
bit9: FunIN.58
bit10: FunIN.59
bit11: FunIN.60
bit12: FunIN.61
bit13: FunIN.62
bit14: FunIN.63
bit15: FunIN.64

Parameter description

Used to enable a certain DI function (FunIN.49 to FunIN.64) to be activated immediately at next power-on.

H03.60 **DI1 filter time**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	ms
Max.:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	Real-time

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI1. The DI function is active only after the effective level is kept within the time defined by H03.60.

H03.61 **DI2 filter time**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	ms
Max.:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	Real-time

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI2. The DI function is active only after the effective level is kept within the time defined by H03.61.

H03.62 **DI3 filter time**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	ms
Max.:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	Real-time

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI3. The DI function is active only after the effective level is kept within the time defined by H03.62.

H03.63 **DI4 fitter time**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	ms
Max.:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	Real-time

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI4. The DI function is active only after the effective level is kept within the time defined by H03.63.

H03.64 **DI5 filter time**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	ms
Max.:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	Real-time

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI5. The DI function is active only after the effective level is kept within the time defined by H03.64.

15.5 H04 Terminal Output Parameters

H04.00 **DO1 function selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	1	Change mode:	Real-time

Range:
0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output
Parameter description
It sets the function of DO1 terminal.
Different VDOs can be assigned with the same function.

H04.01 **DO1 logic selection**

Address:	-	Effective mode:	Effective in real time

Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Normally open

1: Normally closed

Parameter description

Defines the level logic of DO1 when the function assigned to DO1 is active.

DO1 to DO3 are normal DOs, requiring the minimum output signal width to be 1 ms. Configure the host controller properly to ensure that it receives effective DO logic changes.

Before receiving DO logic changes, check the setting of forced DI/DO selection to see whether the DO level is determined by the actual operating status of the drive or by forced DO.

H04.02 DO2 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	11	Change mode:	Real-time

Range:

0: Not defined

1: Servo ready

2: Motor rotation signal

3: Zero speed signal

4: Speed matching signal

5: Positioning completed

6: Proximity

7: Torque limited signal

8: Speed limited signal

9: Brake output signal

10: Alarm

11: Fault

16: Homing completed

18: Torque reached signal

19: Speed reached signal

21: Enable completed

30: Alarm or fault output

32: EDM output

Parameter description

It sets the function of DO2 terminal.

Different VDOs can be assigned with the same function.

H04.03 DO2 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-

Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Normally open

1: Normally closed

Parameter description

Defines the level logic of DO2 when the function assigned to DO2 is active.

DO1 to DO3 are normal DOs, requiring the minimum output signal width to be 1 ms. Configure the host controller properly to ensure that it receives effective DO logic changes.

Before receiving DO logic changes, check the setting of forced DI/DO selection to see whether the DO level is determined by the actual operating status of the drive or by forced DO.

H04.04 **DO3 function selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	9	Change mode:	Real-time

Range:

0: No function

1: Servo ready

2: Motor rotation signal

3: Zero speed signal

4: Speed matching signal

5: Positioning completed

6: Positioning near

7: Torque limited signal

8: Speed limited signal

9: Braking

10: Warning

11: Fault

16: Homing completed

18: Torque reached signal

19: Speed reached signal21: Enable completed

25: Comparison output

30: Warning or fault output32: EDM output

Parameter description

It sets the function of DO3 terminal.

Different VDOs can be assigned with the same function.

H04.05 **DO3 logic**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Normally open

1: Normally closed

Parameter description

Defines the level logic of DO3 when the function assigned to DO3 is active.

DO1 to DO3 are normal DOs, requiring the minimum output signal width to be 1 ms. Configure the host controller properly to ensure that it receives effective DO logic changes.

Before receiving DO logic changes, check the setting of forced DI/DO selection to see whether the DO level is determined by the actual operating status of the drive or by forced DO.

H04.22 DO source

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	31	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:

bit0: DO1

0: DO1 function output

1: Communication (bit0 of H31.04)

bit1: DO2

0: DO2 function output

1: Communication (bit1 of H31.04)

bit2: DO3

0: DO3 function output

1: Communication (bit2 of H31.04)

Parameter description

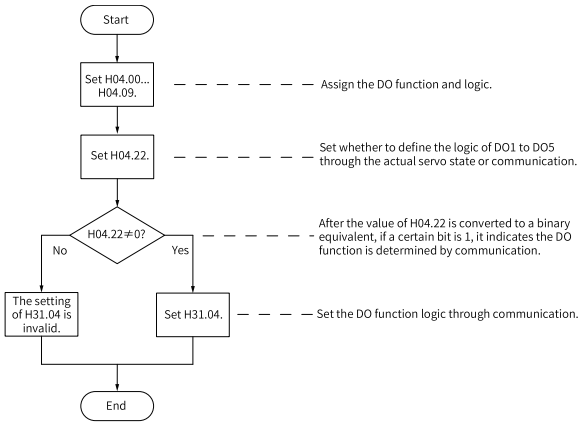
Defines whether the logic of a physical DO terminal is defined by the actual state of the drive or by communication.

H04.22 is displayed in decimal format on the keypad. After H04.22 is converted to a binary equivalent, setting bit(n) of H04.22 to 0 indicates that DO (n+1) logic is determined by the servo drive state. Setting bit(n) of H04.22 to 1 indicates that DO(n+1) logic is determined by communication (H31.04).

Setpoint (decimal)				DO logic	
	bit2	bit1	bit0	Defined by the drive state	Defined by communication (H31.04)
	DO3	DO2	DO1		
0	0	0	0	DO1-DO3	None
1	0	0	1	DO2-DO3	DO1
...	...	...	...	...	...
7	1	1	1	None	DO1-DO3

Set H04.22 to a value listed in the preceding table.

H31.04 is not displayed on the keypad and can only be modified through communication. For H31.04, "bit(n) = 1" indicates the logic of DO(n+1) is active. "bit(n) = 0" indicates the logic of DO(n +1) is inactive.



15.6 H05 Position Control Parameters

H05.02 **Pulses per revolution**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	P/Rev
Max.:	4294967295	Data type:	UInt32
Default:	0	Change mode:	At stop

Range:

0 to 4294967295

Parameter description

Sets the number of position references when the motor rotates one revolution.

H05.04 **Time constant of first-order low-pass filter**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	ms
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	At stop

Range:

0.0 to 6553.5

Parameter description

Defines the first-order low pass filter time constant of position references.

H05.06 **Moving average filter time constant 1**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	ms
Max.:	128.0	Data type:	UInt16
Default:	0.0	Change mode:	At stop

Range:

0.0 to 128.0

Parameter description

Defines the moving average filter time constant for the first group of position references.

H05.07 **Electronic gear ratio 1 (numerator)**

Comm. address:	-	Effective mode:	Real time
Min. value:	1	Unit:	-
Max. value:	1073741824	Data type:	UInt32
Default value:	8388608	Change mode:	Real time

Value range:
1 to 1073741824
Parameter description
Defines the numerator of electronic gear ratio that converted from encoder unit to user unit.
Change this parameter after servo off.

H05.09 **Electronic gear ratio 1 (denominator)**

Comm. address:	-	Effective mode:	Real time
Min. value:	1	Unit:	-
Max. value:	1073741824	Data type:	UInt32
Default value:	10000	Change mode:	Real time

Value range:
1 to 1073741824
Parameter description
Defines the denominator of the electronic gear ratio that is converted from encoder unit to user unit. Change this parameter after servo off.

H05.16 **Clear action selection**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	2	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:
0: Clear position deviation upon S-OFF or fault.
2: Clear position deviation when servo status is not RUN or DI terminal function 35 is active.
Parameter description
Defines the condition for clearing the position deviation.

H05.19 **Speed feedforward control**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	1	Change mode:	At stop

Range:
0: No speed feedforward
1: Internal speed feedforward
2: PLC speed feedforward
Parameter description
Defines the source of the speed loop feedforward signal.

In the position control mode, the speed feedforward control can improve the position reference responsivity.
Speed feedforward control parameters include speed feedforward filter time constant and speed feedforward gain. See section "Feedforward Gain" for details.
If PLC speed feedforward is set without the DSC function enabled, it is equivalent to no speed feedforward.

H05.20 **Condition for positioning completed signal output**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	10	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:

0: The positioning completion signal ON is outputted when the absolute value of position deviation is lower than the value of H05.21.
1: The positioning completion signal ON is outputted when the absolute position deviation is lower than the setpoint of H05.21 and the filtered position reference is 0.
2: The positioning completion signal ON is outputted when the absolute position deviation is lower than H05.21 and the unfiltered position reference is 0.
3: The positioning completion signal ON is outputted when the absolute position deviation is lower than H05.21 and the unfiltered position reference is 0. If the positioning hold time is within the time defined by H05.60 continuously and the position reference is 0, the positioning completion signal will be output. After the positioning hold time defined by H05.60 elapses, whether the positioning completion signal is outputted depends on the non-filtered position reference and absolute value of position deviation.
4: The positioning completion signal ON is outputted when the absolute position deviation is lower than the setpoint of H05.21 and the filtered position reference is 0. If the positioning hold time is within the time defined by H05.60 continuously and the position reference is 0, the positioning completion signal will be output. After the positioning hold time defined by H05.60 elapses, whether the positioning completion signal is output depends on the filtered position reference and absolute value of position deviation.
5: The positioning completion signal ON is outputted when the non-filtered position reference is 0, the zero speed signal is ON, and the absolute value of position deviation is lower than H05.21.
6: The positioning completion signal ON is outputted when the absolute position deviation is lower than H05.21, the zero speed signal is ON, and the filtered position reference is 0.
7: Positioning completion is judged after the delay defined by H05.60 elapses, with unfiltered position reference being 0. The positioning completion signal ON is output when the non-filtered position reference is 0 and the absolute position deviation is lower than H05.21.
8: Positioning completion is judged after the delay defined by H05.60 elapses and the filtered position reference is 0. The positioning completion signal ON is output when the filtered position reference is 0 and the absolute position deviation is lower than H05.21.
9: Positioning completion is judged after the delay defined by H05.60 elapses when the non-filtered position reference is 0 and the absolute value of position deviation is lower than H05.21. The positioning completion signal ON is output when the non-filtered position reference is 0 and the absolute position deviation is lower than H05.21.
10: Positioning completion is judged after the delay defined by H05.60 elapses when the filtered position reference is 0 and absolute position deviation is lower than H05.21. The positioning completion signal ON is output when the filtered position reference is 0 and the absolute position deviation is lower than H05.21.

Parameter description

Defines the condition for outputting positioning completed/proximity signal. In position control mode, if the absolute value of the position deviation during operation is within the setpoint of H05.21, the drive outputs the positioning completed/proximity signal. You can set the condition for outputting the positioning completed/proximity signal in H05.20.
0: The positioning completion signal ON is outputted when the absolute value of position deviation is lower than the value of H05.21.
1: The positioning completion signal ON is outputted when the absolute position deviation is lower than the setpoint of H05.21 and the filtered position reference is 0.
2: The positioning completion signal ON is outputted when the absolute position deviation is lower than H05.21 and the unfiltered position reference is 0.
3: The positioning completion signal ON is outputted when the absolute position deviation is lower than H05.21 and the unfiltered position reference is 0. If the positioning hold time is within the time defined by H05.60 continuously and the position reference is 0, the positioning completion signal will be output. After the positioning hold time defined by H05.60 elapses, whether the positioning completion signal is outputted depends on the non-filtered position reference and absolute value of position deviation.
4: The positioning completion signal ON is outputted when the absolute position deviation is lower than the setpoint of H05.21 and the filtered position reference is 0. If the positioning hold time is within the time defined by H05.60 continuously and the position reference is 0, the positioning completion signal will be output. After the positioning hold time defined by H05.60 elapses, whether the positioning completion signal is output depends on the filtered position reference and absolute value of position deviation.
5: The positioning completion signal ON is outputted when the non-filtered position reference is 0, the zero speed signal is ON, and the absolute value of position deviation is lower than H05.21.
6: The positioning completion signal ON is outputted when the absolute position deviation is lower than H05.21, the zero speed signal is ON, and the filtered position reference is 0.
7: Positioning completion is judged after the delay defined by H05.60 elapses, with unfiltered position reference being 0. The positioning completion signal ON is output when the non-filtered position reference is 0 and the absolute position deviation is lower than H05.21.
8: Positioning completion is judged after the delay defined by H05.60 elapses and the filtered position reference is 0. The positioning completion signal ON is output when the filtered position reference is 0 and the absolute position deviation is lower than H05.21.
9: Positioning completion is judged after the delay defined by H05.60 elapses when the non-filtered position reference is 0 and the absolute value of position deviation is lower than H05.21. The positioning completion signal ON is output when the non-filtered position reference is 0 and the absolute position deviation is lower than H05.21.
10: Positioning completion is judged after the delay defined by H05.60 elapses when the filtered position reference is 0 and absolute position deviation is lower than H05.21. The positioning completion signal ON is output when the filtered position reference is 0 and the absolute position deviation is lower than H05.21.

H05.21 **Threshold of positioning completed**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	Encoder unit
Max.:	65535	Data type:	UInt16

Default:	5872	Change mode:	Real-time

Range:
1 to 65535
Parameter description
Defines the threshold of the absolute value of position deviation when the drive outputs the positioning completed signal.

H05.22 Positioning near threshold

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	Encoder unit
Max.:	65535	Data type:	UInt16
Default:	65535	Change mode:	Real-time

Range:
1 to 65535
Parameter description
Defines the threshold of the absolute value of position deviation when the drive outputs the proximity signal.

H05.30 Homing enable selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	6	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0: Disable
6: Current position used as the home
Parameter description
Defines the homing mode and the trigger signal source.
0: Disable
6: Current position used as the home

H05.35 Time of home searching

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	10000	Change mode:	Real-time

Range:
0 to 65535
Parameter description
Defines the maximum home search time, time unit set through H05.66.

H05.36 Offset of mechanical home

Address:	-	Effective mode:	Effective in real time
Min.:	-2147483648	Unit:	Reference unit

Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 to +2147483647

Parameter description

Defines the absolute position value of the motor after homing.

H05.40 Mechanical home offset and action upon active limit signal

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: H05.36 (Mechanical home offset) used as the coordinate after homing

1: H05.36 (Mechanical home offset) used as the relative offset after homing

Parameter description

Defines the offset relationship between the mechanical home and mechanical zero, as well as the action upon overtravel during homing.

0: H05.36 (Mechanical home offset) used as the coordinate after homing

1: H05.36 (Mechanical home offset) used as the relative offset after homing

H05.50 Mechanical gear ratio in absolute position rotation mode (numerator)

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	1	Change mode:	At stop

Range:

1 to 65535

Parameter description

Defines the numerator of transmission ratio between the mechanical rotary load and the motor in the absolute position rotation mode.

H05.51 Mechanical gear ratio in absolute position rotation mode (denominator)

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	1	Change mode:	At stop

Range:

1 to 65535

Parameter description

Defines the denominator of transmission ratio between the mechanical rotary load and the motor in the absolute position rotation mode.

H05.52 **Pulses per revolution of the load in absolute position rotation mode (low 32 bits)**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	Encoder unit
Max.:	4294967295	Data type:	UInt32
Default:	0	Change mode:	At stop

Range:
0 to 4294967295
Parameter description
Defines the number of pulses per revolution of the rotary load in the absolute position rotation mode (low 32 bits).

H05.54 **Pulses per revolution of the load in absolute position rotation mode (high 32 bits)**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	Encoder unit
Max.:	2147483647	Data type:	UInt32
Default:	0	Change mode:	At stop

Range:
0 to 2147483647
Parameter description
Defines the number of pulses per revolution of the rotary load in the absolute position rotation mode (high 32 bits).

H05.58 **Torque threshold in homing upon hit-and-stop**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	400.0	Data type:	UInt16
Default:	100.0	Change mode:	Real-time

Range:
0.0% to 400.0%
Parameter description
Defines the maximum positive/negative torque limit during homing upon hit-and-stop.

H05.59 **Positioning window time**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	30000	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 30000
Parameter description
When the position deviation remains smaller than the threshold of positioning completed for more than the time set in this parameter, the positioning completed signal can output the valid state.

H05.60 **Hold time of positioning completion**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	ms
Max. value:	30000	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:
0 to 30000
Parameter description
Defines the hold time of an active positioning completion signal.

H05.66 **Homing time unit**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	2	Change mode:	At stop

Range:
0: 1 ms
1: 10 ms
2: 100 ms
Parameter description
Defines the homing time unit. The actual timeout time is H05.35 x H05.66 (ms).

H05.67 **Offset between zero point and single-turn absolute position**

Address:	-	Effective mode:	Effective in real time
Min.:	-2147483648	Unit:	Encoder unit
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	At stop

Range:
-2147483648 to +2147483647
Parameter description
Displays or defines the offset position relative to the home in the single-turn absolute mode (H02.01 = 4).

H05.70 **Moving average filter time constant 2**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	ms
Max.:	1000.0	Data type:	UInt16
Default:	0.0	Change mode:	At stop

Range:
0.0 to 1000.0
Parameter description
Defines the moving average filter time constant for the second group of position references.

H05.71 **Motor Z signal width**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	ms
Max.:	100	Data type:	UInt16
Default:	4	Change mode:	Real-time

Range:
1 to 100
Parameter description
Defines the pulse width output upon active motor Z signal.

H05.74 **S-curve mode selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	6	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0: Enable one segment of filtering
1: Enable two segments of filtering, filter time ratio: 5:1
2: Enable two segments of filtering, filter time ratio: 2:1
3: Enable two segments of filtering, filter time ratio: 1:1
4: Enable three segments of filtering, filter time ratio: 4:1:1
5: Enable three segments of filtering, filter time ratio: 2:1:1
6: Enable three segments of filtering, filter time ratio: 1:1:1
Parameter description
Sets the S-curve mode in position mode.
0: Enable one segment of filtering
1: Enable two segments of filtering, filter time ratio: 5:1
2: Enable two segments of filtering, filter time ratio: 2:1
3: Enable two segments of filtering, filter time ratio: 1:1
4: Enable three segments of filtering, filter time ratio: 4:1:1
5: Enable three segments of filtering, filter time ratio: 2:1:1
6: Enable three segments of filtering, filter time ratio: 1:1:1

15.7 H06 Speed Control Parameters

H06.03 **Speed reference set through operating panel**

Address:	-	Effective mode:	Effective in real time
Min.:	-10000	Unit:	rpm
Max.:	10000	Data type:	Signed 16-bit
Default:	200	Change mode:	Real-time

Range:
-10000 to +10000

Parameter description
Defines the speed reference value set through the keypad.

H06.04 **DI speed reference**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	rpm
Max.:	10000	Data type:	UInt16
Default:	150	Change mode:	Real-time

Range:
0 to 10000
Parameter description
Defines the DI jog speed reference.

H06.05 **Acceleration ramp time of speed reference**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	ms
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:
0 to 65535
Parameter description
Defines the ramp-up time of speed references. The ramp-up/down time constant of multi-speed references are defined only by parameters in group H12.

H06.05: Defines the time for the speed reference to change from 0 rpm to 1000 rpm.

H06.06: Defines the time for the speed reference to change from 1000 rpm to 0 rpm.

The formulas of calculating the actual ramp-up/down time are as follows:

Actual ramp-up time t1 = Speed reference/1000 × Ramp-up time of speed reference

Actual ramp-down time t2 = Speed reference/1000 × Ramp-down time of speed reference

H06.06 **Deceleration ramp time of speed reference**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	ms
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:
0 to 65535
Parameter description
Defines the ramp-down time of speed reference.

H06.07 **Maximum rotational speed limit**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	rpm
Max.:	10000	Data type:	UInt16

Default:	7000	Change mode:	Real-time

Range:
0 to 10000
Parameter description
Defines the maximum speed limit.

H06.08 **Forward speed limit**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	rpm
Max.:	10000	Data type:	UInt16
Default:	7000	Change mode:	Real-time

Range:
0 to 10000
Parameter description
Defines the forward speed threshold.

H06.09 **Reverse speed limit**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	rpm
Max.:	10000	Data type:	UInt16
Default:	7000	Change mode:	Real-time

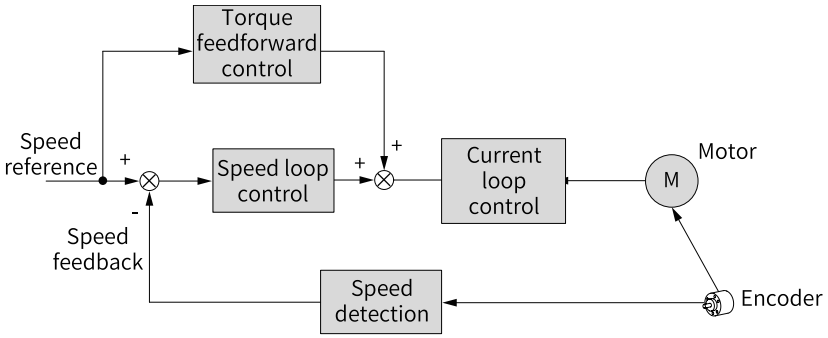
Range:
0 to 10000
Parameter description
Defines the reverse speed threshold.

H06.11 **Torque feedforward control**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	1	Change mode:	Real-time

Range:
0: No torque feedforward
1: Internal torque feedforward
Parameter description
Defines whether to enable the internal torque feedforward function in a non-torque control mode.
The torque feedforward function can improve the torque reference responsivity and reduce the position deviation during operation at constant acceleration/deceleration rate.

Parameters of the torque feedforward function include torque feedforward filter time constant and torque feedforward gain. For details, see section Feedforward Gain.
In a non-torque control mode, the control block diagram of torque feedforward is as follows:



H06.12 **Acceleration ramp time of jog speed**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	ms
Max. value:	65535	Data type:	UInt16
Default value:	10	Change mode:	Real time

Value range:
0 to 65535
Parameter description
Defines the ramp-up time of jog speed.

H06.13 **Speed feedforward smoothing filter**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	μs
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 65535
Parameter description
Defines the speed feedforward smoothing filter time constant.

H06.16 **Threshold of motor rotation status**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	rpm
Max.:	1000	Data type:	UInt16
Default:	20	Change mode:	Real-time

Range:
0 to 1000
Parameter description
Defines the threshold of TGON (motor rotation) signal.

H06.17 **Threshold of speed match signal**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	rpm
Max.:	100	Data type:	UInt16
Default:	10	Change mode:	Real-time

Range:
0 to 100
Parameter description
Defines the threshold of speed matching signal.

H06.18 **Threshold of speed reached signal**

Address:	-	Effective mode:	Effective in real time
Min.:	20	Unit:	rpm
Max.:	10000	Data type:	UInt16
Default:	1000	Change mode:	Real-time

Range:
20 to 10000
Parameter description
Defines the threshold of speed reached signal.

H06.19 **Threshold of zero speed output signal**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	rpm
Max.:	10000	Data type:	UInt16
Default:	10	Change mode:	Real-time

Range:
1 to 10000
Parameter description
Defines the threshold of zero speed output signal.

H06.36 **Moving average filter time constant of speed references**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	ms
Max.:	100.0	Data type:	UInt16
Default:	0.0	Change mode:	At stop

Range:
0.0 ms to 100.0 ms
Parameter description
Defines the moving average filter time constant of speed references.

H06.40 **Deceleration time of ramp 1/PN ramp stop**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms

Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 65535
Parameter description
Sets ramp 1 deceleration time. H06.40 x H06.42 (deceleration time multiplier of ramp 1/PN ramp stop) equals the time required by the motor to decelerate from the rated speed to 0 rpm.

H06.41 **Dec. time of ramp 2/PN quick stop**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 65535
Parameter description
Sets ramp 2 deceleration time. H06.41 x H06.43 (deceleration time multiplier of ramp 2/PN quick stop) equals the time required by the motor to decelerate from the rated speed to 0 rpm.

H06.42 **Deceleration time multiplier of ramp 1/PN ramp stop**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0: 1x time unit
1: 10x time unit
Parameter description
Set the multiplier of the ramp 1 deceleration time (H06.40).

H06.43 **Deceleration time multiplier of ramp 2/PN quick stop**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0: 1x time unit
1: 10x time unit
Parameter description
Set the multiplier of the ramp 2 deceleration time (H06.41).

H06.44 **Acceleration ramp time multiplier of PN speed reference**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-

Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:
0: 1 × time unit
1: 10 × time unit
Parameter description
Sets the multiplier for the acceleration ramp time of speed reference (H06.05).

H06.45 Deceleration ramp time multiplier of PN speed reference

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:
0: 1 × time unit
1: 10 × time unit
Parameter description
Sets the multiplier for the deceleration ramp time of speed reference (H06.06).

H06.50 Speed S-curve enable switch

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0: Disable
1: Enable
Parameter description
Sets whether to enable speed S-curve.
0: Disable
1: Enable

H06.51 Acceleration jerk during the acceleration phase of speed S-curve

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	100.0	Data type:	UInt16
Default:	50.0	Change mode:	At stop

Range:
0.0% to 100.0%
Parameter description
Sets the acceleration jerk during the acceleration phase of speed S-curve.

H06.52 Deceleration jerk during the acceleration phase of speed S-curve

Address:	-	Effective mode:	Effective in real time

Min.:	0.0	Unit:	%
Max.:	100.0	Data type:	UInt16
Default:	50.0	Change mode:	At stop

Range:
0.0% to 100.0%
Parameter description
Sets the deceleration jerk during the acceleration phase of speed S-curve.

H06.53 **Acceleration jerk during the deceleration phase of speed S-curve**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	100.0	Data type:	UInt16
Default:	50.0	Change mode:	At stop

Range:
0.0% to 100.0%
Parameter description
Sets the acceleration jerk during the deceleration phase of speed S-curve.

H06.54 **Deceleration jerk during the deceleration phase of speed S-curve**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	100.0	Data type:	UInt16
Default:	50.0	Change mode:	At stop

Range:
0.0% to 100.0%
Parameter description
Sets the deceleration jerk during the deceleration phase of speed S-curve.

15.8 H07 Torque Control Parameters

H07.05 **Torque reference filter time constant 1**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	ms
Max.:	30.00	Data type:	UInt16
Default:	0.50	Change mode:	Real-time

Range:
0.00 to 30.00
Parameter description
Defines the torque reference filter time constant 1.

H07.06 **Torque reference filter time constant 2**

Address:	-	Effective mode:	Effective in real time

Min.:	0.00	Unit:	ms
Max.:	30.00	Data type:	UInt16
Default:	0.27	Change mode:	Real-time

Range:
0.00 to 30.00
Parameter description
Defines the torque reference filter time constant 2.

H07.07 **Torque limit source**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	5	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0: Positive and negative internal torque limit
1: Positive and negative external torque limit
5: PN torque limit
Parameter description
Defines the torque reference source of torque limit source.
0: Positive and negative internal torque limit
1: Positive and negative external torque limit
5: PN torque limit

H07.09 **Positive internal torque limit**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	Real-time

Range:
0.0% to 400.0%
Parameter description
Defines the forward internal torque limit.

H07.10 **Negative internal torque limit**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	Real-time

Range:
0.0% to 400.0%
Parameter description
Defines the reverse internal torque limit.

H07.11 **Forward external torque limit**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	Real-time

Range:
0.0% to 400.0%
Parameter description
Defines the forward external torque limit.

H07.12 **Reverse external torque limit**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	Real-time

Range:
0.0% to 400.0%
Parameter description
Defines the reverse external torque limit.

H07.15 **Emergency stop torque**

Address:	-	Effective mode:	At stop
Min.:	0.0	Unit:	%
Max.:	400.0	Data type:	UInt16
Default:	100.0	Change mode:	Real-time

Range:
0.0% to 400.0%
Parameter description
Defines the torque of emergency stop.

H07.17 **Speed limit source**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0: Internal speed limit
2: H07.19 or H07.20 as defined by DI
Parameter description
When H07.17 is set to 0,
the forward speed limit takes the minimum of H00.15 and H07.19;
the reverse speed limit takes the minimum of H00.15 and H07.20.
When H07.17 is set to 2 and
the DI is assigned with function 36,

if the DI is active, the forward and reverse speed limit takes the minimum of H00.15 and H07.19; if the DI is inactive, the forward and reverse speed limit takes the minimum of H00.15 and H07.20.

H07.19 Positive speed limit/Speed limit 1 in torque control

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	rpm
Max.:	10000	Data type:	UInt16
Default:	3000	Change mode:	Real-time

Range:
0 to 10000
Parameter description
Defines the positive speed limit/speed limit 1 in torque control.

H07.20 Negative speed limit/Speed limit 2 in torque control

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	rpm
Max.:	10000	Data type:	UInt16
Default:	3000	Change mode:	Real-time

Range:
0 to 10000
Parameter description
Defines the negative speed limit/speed limit 2 in torque control.

H07.21 Base value for torque reach

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	400.0	Data type:	UInt16
Default:	0.0	Change mode:	Real-time

Range:
0.0% to 400.0%
Parameter description
Defines the base value for torque arrival.

H07.22 Threshold of valid torque arrival

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	400.0	Data type:	UInt16
Default:	20.0	Change mode:	Real-time

Range:
0.0% to 400.0%
Parameter description
Defines the threshold of valid torque arrival.

H07.23 **Threshold of invalid torque arrival**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	400.0	Data type:	UInt16
Default:	10.0	Change mode:	Real-time

Range:

0.0% to 400.0%

Parameter description

Defines the threshold of invalid torque arrival.

H07.24 **Field weakening depth**

Address:	-	Effective mode:	Effective in real time
Min.:	60	Unit:	%
Max.:	115	Data type:	UInt16
Default:	115	Change mode:	Real-time

Range:

60% to 115%

Parameter description

Defines the field weakening depth.

H07.25 **Maximum allowable demagnetizing current**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	%
Max.:	300	Data type:	UInt16
Default:	100	Change mode:	Real-time

Range:

0 to 300

Parameter description

Defines the maximum allowable demagnetization current.

H07.26 **Field weakening function**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

0: Disable

1: Enable

Parameter description

Used to enable field weakening.

0: Disable

1: Enable

H07.27 **Field weakening gain**

Address:	-	Effective mode:	Effective in real time
Min.:	0.001	Unit:	Hz
Max.:	1.000	Data type:	UInt16
Default:	0.030	Change mode:	Real-time

Range:

0.001 to 1.000

Parameter description

Defines the gain of field weakening.

H07.28 **Speed of field weakening point**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

0 to 65535

Parameter description

Defines the speed of field weakening point.

H07.36 **Time constant of low-pass filter 2**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	ms
Max.:	10.00	Data type:	UInt16
Default:	0.00	Change mode:	Real-time

Range:

0.00 to 10.00

Parameter description

Defines the time constant of low-pass filter 2.

H07.37 **Torque reference filter selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: First-order filter

1: Second-order filter

Parameter description

Used to select torque reference filter.

0: First-order filter

1: Second-order filter

H07.38 **Biquad filter attenuation ratio**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	50	Data type:	UInt16
Default:	16	Change mode:	At stop

Range:
0 to 50
Parameter description
Defines the biquad filter attenuation ratio.

H07.40 **Speed limit window in torque control mode**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	300	Data type:	UInt16
Default:	10	Change mode:	Real-time

Range:
0 to 300
Parameter description
Defines the speed limit time window in the torque control mode.

15.9 H08 Gain Parameters

H08.00 **Speed loop gain**

Address:	-	Effective mode:	Effective in real time
Min.:	0.1	Unit:	Hz
Max.:	2000.0	Data type:	UInt16
Default:	40.0	Change mode:	Real-time

Range:
0.1 to 2000.0
Parameter description
Defines the speed loop proportional gain.
This parameter determines the responsivity of the speed loop. The higher the setpoint, the faster the speed loop response is. Note that an excessively high setpoint may cause vibration.
In the position control mode, the position loop gain must be increased together with the speed loop gain.

H08.01 **Speed loop integral time constant**

Address:	-	Effective mode:	Effective in real time
Min.:	0.15	Unit:	ms
Max.:	512.00	Data type:	UInt16
Default:	19.89	Change mode:	Real-time

Range:

0.15 to 512.00

Parameter description

Defines the speed loop integral time constant.

The lower the setpoint, the better the integral action, and the quicker will the deviation value be close to 0.

Note: There is no integral action when H08.01 is set to 512.00.

H08.02 **Position loop gain**

Address:	-	Effective mode:	Effective in real time
Min.:	0.1	Unit:	Hz
Max.:	2000.0	Data type:	UInt16
Default:	64.0	Change mode:	Real-time

Range:

0.1 to 2000.0

Parameter description

Defines the proportional gain of the position loop.

This parameter defines the response of the position loop. A high setpoint shortens the positioning time.

Note that an excessively high setpoint may cause vibration. The torque reference filter time constant is called the 1st gain.

H08.03 **2nd speed loop gain**

Address:	-	Effective mode:	Effective in real time
Min.:	0.1	Unit:	Hz
Max.:	2000.0	Data type:	UInt16
Default:	75.0	Change mode:	Real-time

Range:

0.1 to 2000.0

Parameter description

Defines the 2nd speed loop gain.

H08.04 **2nd speed loop integral time constant**

Address:	-	Effective mode:	Effective in real time
Min.:	0.15	Unit:	ms
Max.:	512.00	Data type:	UInt16
Default:	10.61	Change mode:	Real-time

Range:

0.15 to 512.00

Parameter description

Defines the 2nd speed loop integral time constant.

H08.05 **2nd position loop gain**

Address:	-	Effective mode:	Effective in real time
Min.:	0.1	Unit:	Hz
Max.:	2000.0	Data type:	UInt16

Default:	120.0	Change mode:	Real-time

Range:
0.1 to 2000.0
Parameter description
Defines the 2nd gain of the position loop and speed loop. The 2nd torque reference filter time constant is called 2nd gain. For details on gain switchover, see section "Gain Switchover".

H08.08 **Second gain mode setting**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	1	Change mode:	Real-time

Range:
0: Fixed to the 1st group of gains, P/PI switched through external
DI1:Switched between the 1st and 2nd group of gains as defined by H08.09
Parameter description
Defines the mode for switching to the 2nd gain.

H08.09 **Gain switchover condition**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	10	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0: Fixed to the 1st gain set (PS)
1: Switched as defined by Func3 of DI
2: Torque reference too large (PS)
3: Speed reference too large (PS)
4: Speed reference change rate too large (PS)
5: Speed reference low/high speed threshold (PS)
6: Position deviation too large (P)
7: Position reference available (P)
8: Positioning unfinished (P)
9: Actual speed (P)
10: Position reference + Actual speed (P)
Parameter description
See the following table for gain switchover conditions.

Setpoint	Gain Switchover Condition	Remarks
0	Fixed at 1st gain	The 1st gain is always used.
1	DI (Func3) switchover	-

Setpoint	Gain Switchover Condition	Remarks
2	Large torque reference	If the torque reference absolute value exceeds (level + hysteresis) [%] in the last 1st gain set, the drive switches to the 2nd gain set. If the absolute value of the torque reference is lower than (level – hysteresis) [%] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set.
3	Large speed reference	If the speed reference absolute value exceeds (level + hysteresis) [rpm] in the last 1st gain set, the drive switches to the 2nd gain set. When the absolute value of the speed reference is lower than (level - hysteresis) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set.
4	Large speed reference change rate	It is valid only in non-speed control modes. If the absolute value of the change rate of the speed reference exceeds (level + hysteresis) [10 rpm/s] in the last 1st gain set, the drive switches to the 2nd gain set. When the absolute value of the speed reference change rate is lower than (level – hysteresis) [10 rpm/s] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set. The 1st gain is always used in the speed control mode.
5	High/Low-speed threshold of speed reference	If the speed reference absolute value exceeds (level - hysteresis) [rpm] in the last 1st gain set, the drive starts to switch to the 2nd gain set, with gains changed gradually. When the speed reference absolute value reaches (level + hysteresis) [rpm], the 2nd gain set applies. If the speed reference absolute value is lower than (level + hysteresis) [rpm] in the last 2nd gain set, the drive starts to return to the 1st gain set, with gains changed gradually. When the speed reference absolute value reaches (level - hysteresis) [rpm], the 1st gain set applies.
6	Excessive position deviation	Active only in the position control mode If the position deviation absolute value exceeds (level + hysteresis) [encoder unit] in the last 1st gain set, the drive switches to the 2nd gain set. When the absolute value of the position deviation is lower than (level - hysteresis) [encoder unit] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
7	Position reference available	Active only in the position control mode When the position reference is not 0 in the 1st gain, the drive switches to the 2nd gain. When the position reference is 0 and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
8	Positioning not completed	Active only in the position control mode When positioning is not completed in the 1st gain, the drive switches to the 2nd gain. When positioning is not complete and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the servo drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.

Setpoint	Gain Switchover Condition	Remarks
9	Actual velocity	Active only in the position control mode If the absolute value of actual speed exceeds (level + hysteresis) [rpm] in the last 1st gain set, the drive switches to the 2nd gain set. When the absolute value of actual speed is lower than (level - hysteresis) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain. The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.
10	Position reference available + Actual speed	Active only in the position control mode When the position reference is not 0 in the 1st gain, the drive switches to the 2nd gain. When the position reference is 0 and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the 2nd gain set applies. When the position reference is 0 and the delay defined by (H08.10) is reached, if the absolute value of actual speed is lower than (Level) [rpm], the speed loop integral time constant is fixed to the setpoint of H08.04 (2nd speed loop integral time constant), and others return to the 1st gain; if the absolute value of actual speed does not reach (level - hysteresis) [rpm], the speed integral also returns to the setpoint of H08.01 (Speed loop integral time constant). The applicable gain mode is fixed to the 1st gain in modes other than the position control mode.

H08.10 **Gain switchover delay**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	ms
Max.:	1000.0	Data type:	UInt16
Default:	5.0	Change mode:	Real-time

Range:
0.0 to 1000.0
Parameter description
Defines the delay when the drive switches from the 2nd gain set to the 1st gain set.

H08.11 **Gain switchover level**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	20000	Data type:	UInt16
Default:	50	Change mode:	Real-time

Range:
0 to 20000
Parameter description
Defines the gain switchover level.
Defines the gain switchover level. The unit of gain switchover level varies with the switchover condition.

H08.12 **Gain switchover time lag**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	20000	Data type:	UInt16

Default:	30	Change mode:	Real-time

Range:
0 to 20000
Parameter description
Defines the dead time for gain switchover.
Defines the gain switchover level. The unit of gain switchover dead time varies with the switchover condition.

H08.13 Position gain switchover time

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	ms
Max.:	1000.0	Data type:	UInt16
Default:	3.0	Change mode:	Real-time

Range:
0.0 to 1000.0
Parameter description
In position control, if 2nd position loop gain is much higher than position loop gain, set the time for switching from the latter to the former.
It can reduce the impact caused by an increase in the position loop gain.

H08.15 Load inertia ratio

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	-
Max.:	120.00	Data type:	UInt16
Default:	1.00	Change mode:	Real-time

Range:
0.00 to 120.00
Parameter description
Defines the mechanical load inertia ratio relative to the motor moment of inertia.
The servo drive automatically calculates and updates the value of H08.15 through inertia auto-tuning (including offline and online).
When online inertia auto-tuning is used, the drive sets this parameter automatically. To set it manually, disable the online inertia auto-tuning mode.

H08.18 Speed feedforward filter time constant

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	ms
Max.:	64.00	Data type:	UInt16
Default:	0.50	Change mode:	Real-time

Range:
0.00 to 64.00
Parameter description
Defines the filter time constant of speed feedforward.

H08.19 **Speed feedforward gain**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	100.0	Data type:	UInt16
Default:	0.0	Change mode:	Real-time

Range:
0.0% to 100.0%
Parameter description
Increasing the setpoint improves the responsivity to position references and reduces the position deviation during operation at a constant speed.

H08.20 **Torque feedforward filter time constant**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	ms
Max.:	64.00	Data type:	UInt16
Default:	0.50	Change mode:	Real-time

Range:
0.00 to 64.00
Parameter description
Defines the filter time constant of torque feedforward.

H08.21 **Torque feedforward gain**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	300.0	Data type:	UInt16
Default:	0.0	Change mode:	Real-time

Range:
0.0% to 300.0%
Parameter description
Increasing the setpoint improves the response to variable speed references.
Increasing the setpoint improves the response to position references and reduces the position deviation during operation at a constant speed.

H08.22 **Speed feedback filter**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	4	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0: Inhibited
1: 2 times
2: 4 times
3: 8 times
4: 16 times

Parameter description
Defines the moving average filtering count on the speed feedback.
The higher the setpoint, the weaker the speed feedback fluctuation, but the longer the feedback delay.

H08.23 **Cut-off frequency of speed feedback low-pass filter**

Address:	-	Effective mode:	Effective in real time
Min.:	100	Unit:	Hz
Max.:	8000	Data type:	UInt16
Default:	8000	Change mode:	Real-time

Range:
100 to 8000
Parameter description
Defines the cutoff frequency for first-order low-pass filtering on the speed feedback.

H08.24 **Pseudo derivative feedforward control coefficient**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	200.0	Data type:	UInt16
Default:	100.0	Change mode:	Real-time

Range:
0.0% to 200.0%
Parameter description
Defines the control mode of the speed loop.
When the parameter is set to 200.0, PI control (default control mode of the speed loop) is applied to the speed loop, which features fast dynamic response.
When the setpoint is 0.0, speed loop integral action is enhanced, which filters out low-frequency interference but also slows down the dynamic response.

H08.27 **Cut-off frequency of speed observer**

Address:	-	Effective mode:	Effective in real time
Min.:	50	Unit:	Hz
Max.:	600	Data type:	UInt16
Default:	170	Change mode:	Real-time

Range:
50 to 600
Parameter description
Defines the cutoff frequency of the speed observer. Note that an excessively high setpoint may incur resonance. Decrease the setpoint properly in case of large speed feedback noise.

H08.28 **Inertia correction coefficient of speed observer**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	%
Max.:	1600	Data type:	UInt16

Default:	100	Change mode:	Real-time

Range:
1 to 1600
Parameter description
Defines the speed observer inertia correction coefficient. If H08.15 is set based on the actual inertia, there is no need to adjust this parameter.

H08.29 **Speed observer filter time**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	ms
Max.:	10.00	Data type:	UInt16
Default:	0.80	Change mode:	Real-time

Range:
0.00 to 10.00
Parameter description
Defines the speed observer filter time. It is recommended to set this parameter to a value equal to the sum of H07.05 plus 0.2 ms.

H08.31 **Disturbance cut-off frequency**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	Hz
Max.:	4000	Data type:	UInt16
Default:	600	Change mode:	Real-time

Range:
1 to 4000
Parameter description
Defines the cutoff frequency of the disturbance observer. Increasing the setpoint improves the responsivity of the disturbance observer and the compensation effect. Note that an excessively high setpoint may incur resonance.

H08.32 **Disturbance compensation gain**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	%
Max.:	100	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0% to 100%
Parameter description
Defines the compensation gain of the disturbance observer. The setpoint 100% indicates full compensation.

H08.33 **Disturbance observer inertia calibration coefficient**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	%

Max.:	1600	Data type:	UInt16
Default:	100	Change mode:	Real-time

Range:
1 to 1600
Parameter description
Defines the disturbance observer inertia correction coefficient. If H08.15 is set based on the actual inertia, there is no need to adjust this parameter.

H08.37 Phase modulation for medium-frequency suppression 2

Address:	-	Effective mode:	Effective in real time
Min.:	-90	Unit:	°
Max.:	90	Data type:	Signed 16-bit
Default:	0	Change mode:	Real-time

Range:
-90° to +90°
Parameter description
Defines the compensation phase of medium-frequency jitter suppression 2.

H08.38 Frequency for medium-frequency suppression 2

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	Hz
Max.:	1000	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 1000
Parameter description
Set this parameter based on actual resonance frequency. The valid suppression frequency range for medium-frequency jitter suppression 2 is 100 Hz to 1000 Hz.

H08.39 Compensation gain for medium-frequency suppression 2

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	%
Max.:	300	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 300
Parameter description
Defines the compensation gain for medium-frequency jitter suppression 2. Set this parameter to a value between 40% to 55% in general cases. Setting this parameter to 0 deactivates medium-frequency jitter suppression 2.

H08.40 Speed observer

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-

Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0: Disable
1: Enable
Parameter description
Sets the enable bit for speed observer.
0: Disable
1: Enable

H08.42 **Model control selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0: Disabled
1: Enabled
2: Dual-inertia model
Parameter description
Used to enable model tracking control.
0: Disable
1: Enable
2: Reserved

H08.43 **Model gain**

Address:	-	Effective mode:	Effective in real time
Min.:	0.1	Unit:	-
Max.:	2000.0	Data type:	UInt16
Default:	40.0	Change mode:	Real-time

Range:
0.1 to 2000.0
Parameter description
Defines the single inertia model gain. The higher the gain, the faster the position response. Note that an excessively high setpoint may incur excessive overshoot.

H08.46 **Feedforward value**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	-
Max.:	102.4	Data type:	UInt16
Default:	95.0	Change mode:	Real-time

Range:
0.0 to 102.4

Parameter description

Defines the speed feedforward gain for single inertia model control. If overshoot occurs, reduce the setpoint properly.

H08.53 Medium- and low-frequency jitter suppression frequency 3

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	Hz
Max.:	300.0	Data type:	UInt16
Default:	0.0	Change mode:	Real-time

Range:

0.0 to 300.0

Parameter description

Set this parameter based on actual resonance frequency. The resonance suppression range is 100 Hz to 300 Hz.

H08.54 Medium- and low-frequency jitter suppression compensation 3

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	%
Max.:	200	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0% to 200%

Parameter description

Defines the compensation gain for medium- and low-frequency suppression compensation 3. The setpoint 200% indicates full compensation.

H08.56 Medium- and low-frequency jitter suppression phase modulation 3

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	%
Max.:	600	Data type:	UInt16
Default:	100	Change mode:	Real-time

Range:

0% to 600%

Parameter description

Adjust this parameter based on the actual compensation effect.

H08.59 Medium- and low-frequency jitter suppression frequency 4

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	Hz
Max.:	300.0	Data type:	UInt16
Default:	0.0	Change mode:	Real-time

Range:

0.0 to 300.0

Parameter description

Set this parameter based on actual resonance frequency. The resonance suppression range is 100 Hz to 300 Hz.

H08.60 Medium- and low-frequency jitter suppression compensation 4

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	%
Max.:	200	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0% to 200%

Parameter description

Defines the compensation gain for medium- and low-frequency suppression 4. The setpoint 200% indicates full compensation.

H08.61 Medium- and low-frequency jitter suppression phase modulation 4

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	%
Max.:	600	Data type:	UInt16
Default:	100	Change mode:	Real-time

Range:

0% to 600%

Parameter description

Adjust this parameter based on the actual compensation effect.

H08.62 Position loop integral time constant

Address:	-	Effective mode:	Effective in real time
Min.:	0.15	Unit:	-
Max.:	512.00	Data type:	UInt16
Default:	512.00	Change mode:	Real-time

Range:

0.15 to 512.00

Parameter description

Defines the position loop integral time constant.

H08.63 2nd position loop integral time constant

Address:	-	Effective mode:	Effective in real time
Min.:	0.15	Unit:	-
Max.:	512.00	Data type:	UInt16
Default:	512.00	Change mode:	Real-time

Range:

0.15 to 512.00

Parameter description

Defines the 2nd position loop integral time constant.

H08.64 **Speed observation feedback source**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Disable

1: Enable

Parameter description

Defines the speed observer feedback source.

0: Observer speed output

1: Speed observed by the observer

H08.65 **Zero deviation control selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Disable

1: Enable

Parameter description

Used to enable/disable zero deviation control.

0: Disable

1: Enable

H08.66 **Average filter for zero deviation control position**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	ms
Max.:	320.0	Data type:	UInt16
Default:	5.0	Change mode:	At stop

Range:

0.0 to 320.0

Parameter description

Defines the moving average filter time of zero deviation control position. It is recommended to increase the setpoint in case of loud noise caused by low command resolution.

H08.68 **Speed feedforward of zero deviation control**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	100.0	Data type:	UInt16
Default:	100.0	Change mode:	Real-time

Range:

0.0% to 100.0%

Parameter description
Defines the speed feedforward of zero deviation control.

H08.69 **Torque feedforward of zero deviation control**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	100.0	Data type:	UInt16
Default:	100.0	Change mode:	Real-time

Range:
0.0% to 100.0%
Parameter description
Defines the torque feedforward of zero deviation control.

H08.81 **Anti-resonance frequency of dual-inertia model**

Address:	-	Effective mode:	Effective in real time
Min.:	1.0	Unit:	Hz
Max.:	400.0	Data type:	UInt16
Default:	20.0	Change mode:	Real-time

Range:
1.0 to 400.0
Parameter description
Sets the anti-resonance frequency of dual-inertia model. You can set this parameter based on the frequency sweeping analysis of mechanical characteristics.

H08.82 **Resonance frequency of dual-inertia model**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	Hz
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Real-time

Range:
0.0 to 6553.5
Parameter description
Defines the resonance frequency of dual-inertia model. You can set this parameter based on the frequency sweeping analysis of mechanical characteristics. If accurate resonance frequency is unknown, set H08.84 based on the inertia ratio of the resonance model.

H08.83 **Dual-inertia model gain**

Address:	-	Effective mode:	Effective in real time
Min.:	0.1	Unit:	Hz
Max.:	300.0	Data type:	UInt16
Default:	60.0	Change mode:	Real-time

Range:
0.1 Hz~300.0Hz

Parameter description
Defines the dual-inertia model gain.

H08.84 **Inertia ratio of dual-inertia model**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	-
Max.:	120.00	Data type:	UInt16
Default:	1.00	Change mode:	Real-time

Range:
0.00 to 120.00
Parameter description
If the resonance frequency of dual-inertia model is set accurately, there is no need to set this parameter.

H08.88 **Speed feedforward value of dual-inertia model**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	-
Max.:	6553.5	Data type:	UInt16
Default:	100.0	Change mode:	Real-time

Range:
0.0 to 6553.5
Parameter description
Defines the speed feedforward value of dual-inertia model. Set this parameter to 100% in general cases.

H08.89 **Torque feedforward value of dual-inertia model**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	-
Max.:	6553.5	Data type:	UInt16
Default:	100.0	Change mode:	Real-time

Range:
0.0 to 6553.5
Parameter description
Defines the torque feedforward value of dual-inertia model. Set this parameter to 100% in general cases.

15.10 H09 Auto-tuning Parameters

H09.00 **Auto-tuning mode selection**

Comms. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	6	Data type:	UInt16

Default value:	0	Change mode:	Real time

Value range:

0: Disabled, manual gain tuning required

1: Enabled, gain parameters generated automatically based on the stiffness level

2: Positioning mode, gain parameters generated automatically based on the stiffness level

4: Normal mode+Inertia auto-tuning

6: Quick positioning mode+Inertia auto-tuning

Parameter description

Defines different gain tuning modes.

H09.01 **Stiffness level**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	41	Data type:	UInt16
Default:	15	Change mode:	Real-time

Range:

0 to 41

Parameter description

Defines the stiffness level of the servo system. The higher the stiffness level, the stronger the gains and the quicker the response. But an excessively high stiffness level will cause vibration. The setpoint 0 indicates the lowest rigidity and 41 indicates the highest rigidity.

H09.02 **Adaptive notch mode selection**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	4	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:

0: Adaptive notch no longer updated

1: One adaptive notch activated (3rd notch)

2: Two adaptive notches activated (3rd and 4th notches)

3: Resonance point tested only (displayed in H09.24)

4: Adaptive notch cleared, values of 3rd and 4th notches restored to default

Parameter description

Defines the operation mode of the adaptive notch.

H09.03 **Online inertia auto-tuning mode**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	3	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Disabled

1: Enabled, changing slowly

2: Enabled, changing normally

3: Enabled, changing quickly

Parameter description

Defines whether to enable online inertia auto-tuning and the inertia ratio update speed during online inertia auto-tuning.

H09.05 **Offline inertia auto-tuning mode**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

0: Bidirectional

1: Unidirectional

Parameter description

Sets the offline inertia auto-tuning mode.

For details on offline inertia auto-tuning, see section "Inertia Auto-tuning" in SV630N Series Servo Drive Function Guide.

H09.06 **Maximum speed of inertia auto-tuning**

Address:	-	Effective mode:	Effective in real time
Min.:	100	Unit:	rpm
Max.:	1000	Data type:	UInt16
Default:	500	Change mode:	At stop

Range:

100 rpm to 1000 rpm

Parameter description

Defines the maximum permissible motor speed reference in the offline inertia auto-tuning mode. During inertia auto-tuning, the higher the speed, the more accurate the auto-tuned value. Use the default value in general applications.

H09.07 **Time constant for accelerating to the maximum speed during inertia auto-tuning**

Address:	-	Effective mode:	Effective in real time
Min.:	20	Unit:	ms
Max.:	800	Data type:	UInt16
Default:	125	Change mode:	At stop

Range:

20 to 800

Parameter description

Defines the time for the motor to accelerate from 0 rpm to the maximum speed of inertia auto-tuning during offline inertia auto-tuning.

H09.08 **Time interval after an individual inertia auto-tuning**

Address:	-	Effective mode:	Effective in real time
Min.:	50	Unit:	ms
Max.:	10000	Data type:	UInt16
Default:	800	Change mode:	At stop

Range:
50 to 10000
Parameter description
Defines the time interval between two consecutive speed references when bi-directional offline inertia auto-tuning mode is used.

H09.09 **Number of motor revolutions per inertia auto-tuning**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	-
Max.:	100.00	Data type:	UInt16
Default:	1.00	Change mode:	Real-time

Range:
0.00 to 100.00
Parameter description
Displays the number of motor revolutions needed when bi-directional offline inertia auto-tuning mode is used.

H09.11 **Oscillation threshold**

Comm. address:	-	Effective mode:	Real time
Min. value:	0.0	Unit:	%
Max. value:	100.0	Data type:	UInt16
Default value:	5.0	Change mode:	Real time

Value range:
0.0% to 100.0%
Parameter description
Defines the threshold of vibration detected by the notch. When the current feedback exceeds the threshold, the notch starts working.

H09.12 **1st notch frequency**

Address:	-	Effective mode:	Effective in real time
Min.:	50	Unit:	Hz
Max.:	8000	Data type:	UInt16
Default:	8000	Change mode:	Real-time

Range:
50 to 8000
Parameter description
Defines the center frequency of the notch, which is the mechanical resonance frequency.
If the notch frequency is 8000 Hz in torque control mode, the notch function is disabled.

H09.13 **1st notch width level**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	20	Data type:	UInt16
Default:	2	Change mode:	Real-time

Range:
0 to 20
Parameter description
Defines the width level of the notch. Use the default value in general cases. Width level is the ratio of the notch width to the notch center frequency.

H09.14 **1st notch depth level**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	99	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 99
Parameter description
Defines the depth level of the notch.
The depth level of the notch is the ratio of the input to the output at the notch center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability.
For use of notches, see section "Vibration Suppression".

H09.15 **2nd notch frequency**

Address:	-	Effective mode:	Effective in real time
Min.:	50	Unit:	Hz
Max.:	8000	Data type:	UInt16
Default:	8000	Change mode:	Real-time

Range:
50 to 8000
Parameter description
Defines the frequency of the 2nd notch.

H09.16 **2nd notch width level**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	20	Data type:	UInt16
Default:	2	Change mode:	Real-time

Range:
0 to 20
Parameter description
Defines the width level of the 2nd notch.

H09.17 **2nd notch depth level**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	99	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 99
Parameter description
Defines the depth level of the 2nd notch.

H09.18 **3rd notch frequency**

Address:	-	Effective mode:	Effective in real time
Min.:	50	Unit:	Hz
Max.:	8000	Data type:	UInt16
Default:	8000	Change mode:	Real-time

Range:
50 to 8000
Parameter description
Defines the frequency of the 3rd notch.

H09.19 **3rd notch width level**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	20	Data type:	UInt16
Default:	2	Change mode:	Real-time

Range:
0 to 20
Parameter description
Defines the width level of the 3rd notch.

H09.20 **3rd notch depth level**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	99	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 99
Parameter description
Defines the depth level of the 3rd notch.

H09.21 **4th notch frequency**

Address:	-	Effective mode:	Effective in real time
Min.:	50	Unit:	Hz

Max.:	8000	Data type:	UInt16
Default:	8000	Change mode:	Real-time

Range:
50 to 8000
Parameter description
Defines the frequency of the 4th notch.

H09.22 4th notch width level

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	20	Data type:	UInt16
Default:	2	Change mode:	Real-time

Range:
0 to 20
Parameter description
Defines the width level of the 4th notch.

H09.23 4th notch depth level

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	99	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 99
Parameter description
Defines the depth level of the 4th notch.

H09.24 Auto-tuned resonance frequency

Address:	-	Effective mode:	-
Min.:	0	Unit:	Hz
Max.:	5000	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 5000
Parameter description
When adaptive notch mode is set to 3, the current mechanical resonance frequency is displayed.

H09.26 ITune responsivity

Address:	-	Effective mode:	Effective in real time
Min.:	30.0	Unit:	%
Max.:	600.0	Data type:	UInt16
Default:	100.0	Change mode:	Real-time

Range:

30.0 %~600.0%

Parameter description

Sets the ITune responsivity.

H09.27 **ITune mode**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	20	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

0: Disabled

1: ITune mode 1

2: ITune mode 2

Parameter description

ITune mode

0: Disabled

1: ITune mode 1

2: ITune mode 2

H09.28 **Minimum inertia ratio of ITune**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	80.0	Data type:	UInt16
Default:	0.0	Change mode:	Real-time

Range:

0.0 % to 80.0%

Parameter description

Sets the minimum inertia ratio of ITune.

H09.29 **Maximum inertia ratio of ITune**

Address:	-	Effective mode:	Effective in real time
Min.:	0.1	Unit:	%
Max.:	120.0	Data type:	UInt16
Default:	30.0	Change mode:	Real-time

Range:

0.1 % to 120.0%

Parameter description

Sets the maximum inertia ratio of ITune.

H09.32 **Gravity compensation value**

Address:	-	Effective mode:	Effective in real time
Min.:	-100.0	Unit:	%
Max.:	100.0	Data type:	Signed 16-bit
Default:	0.0	Change mode:	Real-time

Range:
-100.0% to +100.0%
Parameter description
Defines the gravity compensation value. Setting this parameter properly in vertical axis applications can reduce the falling amplitude upon start.

H09.33 **Positive friction compensation value**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	%
Max.:	100.0	Data type:	UInt16
Default:	0.0	Change mode:	Real-time

Range:
0.0% to 100.0%
Parameter description
Defines the positive friction compensation value.

H09.34 **Reverse friction compensation value**

Address:	-	Effective mode:	Effective in real time
Min.:	-100.0	Unit:	%
Max.:	0.0	Data type:	Signed 16-bit
Default:	0.0	Change mode:	Real-time

Range:
-100.0% to 0.0%
Parameter description
Defines the negative friction compensation value.

H09.35 **Friction compensation speed**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	-
Max.:	20.0	Data type:	UInt16
Default:	2.0	Change mode:	Real-time

Range:
0.0 to 20.0
Parameter description
Defines the friction compensation speed.

H09.36 **Friction compensation speed selection**

Comm. address:	-	Effective mode:	Real time
Min. value:	0x0	Unit:	-
Max. value:	0x13	Data type:	UInt16
Default value:	0x0	Change mode:	Real time

Value range:

0x00: Slow speed mode + Speed reference
0x01: Slow speed mode + Model speed
0x02: Slow speed mode + Speed feedback
0x03: Slow speed mode + Observe speed
0x10: High speed mode + Speed reference
0x11: High speed mode + Model speed
0x12: High speed mode + Speed feedback
0x13: High speed mode + Observe speed

Parameter description

Friction compensation speed
0: Slow mode+Speed reference
1: Slow mode+Model speed
2: Slow mode+Speed feedback
3: Slow mode+Observed speed
16: Quick mode +Speed reference
17: Quick mode +Model speed
18: Quick mode +Speed feedback
19: Quick mode+Observed speed

H09.37 Vibration monitoring time

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	300	Change mode:	Real-time

Range:
0 to 65535

Parameter description

The resonance detection suppression function is turned off automatically after the time defined by this parameter elapses. To suppress the resonance suppression function, set this parameter to 65535.

H09.38 Frequency of low-frequency resonance suppression 1 at the mechanical end

Address:	-	Effective mode:	Effective in real time
Min.:	1.0	Unit:	Hz
Max.:	100.0	Data type:	UInt16
Default:	100.0	Change mode:	At stop

Range:
1.0 to 100.0

Parameter description

Set this parameter based on the actual jitter frequency.

H09.39 Low-frequency suppression 1 at the mechanical end

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	3	Data type:	UInt16

Default:	2	Change mode:	At stop

Range:
0 to 3
Parameter description
Defines different low-frequency resonance suppression types at the mechanical end. Type 1 features the shortest delay.

H09.41 **5th notch frequency**

Hex:	2009 to 2Ah	Effective mode:	Effective in real time
Min.:	50	Unit:	Hz
Max.:	8000	Data type:	UInt16
Default:	8000	Change mode:	Real-time

Value Range:
50 to 8000
Description
-

H09.42 **Width level of the 5th notch**

Hex:	2009 to 2Bh	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	20	Data type:	UInt16
Default:	2	Change mode:	Real-time

Value Range:
0 to 20
Description
-

H09.43 **Depth level of the 5th notch**

Hex:	2009-2Ch	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	99	Data type:	UInt16
Default:	0	Change mode:	Real-time

Value Range:
0 to 99
Description
-

H09.44 **Frequency of low-frequency suppression 2 at the mechanical end**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	-
Max.:	200.0	Data type:	UInt16
Default:	0.0	Change mode:	At stop

Range:

0.0 to 200.0

Parameter description

Set this parameter based on the actual jitter frequency.

H09.45 **Response of low-frequency resonance suppression 2 at mechanical end**

Address:	-	Effective mode:	Effective in real time
Min.:	0.01	Unit:	-
Max.:	10.00	Data type:	UInt16
Default:	1.00	Change mode:	At stop

Range:

0.01 to 10.00

Parameter description

Defines the end low-frequency suppression 2 response. Use the default setpoint in general cases. To increase the setpoint, decrease the delay time.

H09.47 **Bandwidth of low-frequency resonance suppression 2 at mechanical end**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	-
Max.:	2.00	Data type:	UInt16
Default:	1.00	Change mode:	At stop

Range:

0.00 to 2.00

Parameter description

Defines the end low-frequency suppression 2 width. Use the default setpoint in general cases. To increase the setpoint, increase the delay time.

H09.49 **Frequency of low-frequency resonance suppression 3 at the mechanical end**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	-
Max.:	200.0	Data type:	UInt16
Default:	0.0	Change mode:	At stop

Range:

0.0 to 200.0

Parameter description

Defines the frequency of low-frequency resonance suppression 3 at mechanical load end.

H09.50 **Response of low-frequency resonance suppression 3 at the end-effector**

Address:	-	Effective mode:	Effective in real time
Min.:	0.01	Unit:	-
Max.:	10.00	Data type:	UInt16
Default:	1.00	Change mode:	At stop

Range:

0.01 to 10.00

Parameter description
Defines the responsiveness of low-frequency resonance suppression 3 at mechanical load end.

H09.52 **Width of low-frequency resonance suppression 3 at the end-effector**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	-
Max.:	2.00	Data type:	UInt16
Default:	1.00	Change mode:	At stop

Range:
0.00 to 2.00
Parameter description
Defines the width of low-frequency resonance suppression 3 at mechanical load end.

H09.54 **Oscillation threshold**

Comm. address:	-	Effective mode:	Real time
Min. value:	0.0	Unit:	%
Max. value:	300.0	Data type:	UInt16
Default value:	50.0	Change mode:	Real time

Value range:
0.0 to 300.0
Parameter description
Defines the vibration threshold. If the torque fluctuation exceeds this threshold, an alarm can be reported. Setting this parameter to 0 masks the resonance detection function.

H09.56 **Max. overshoot allowed by ETune**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	2936	Change mode:	Real-time

Range:
0 to 65535
Parameter description
Defines the maximum overshoot value allowed during ETune adjustment.

H09.57 **STune resonance suppression switchover frequency**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	Hz
Max.:	4000	Data type:	UInt16
Default:	900	Change mode:	Real-time

Range:
0 to 4000
Parameter description
If the resonance frequency is lower than the setpoint, use medium-frequency resonance suppression 2 to suppress resonance. Otherwise, use the notch to suppress resonance.

H09.58 **STune resonance suppression reset selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Disable

1: Enable

Parameter description

Used to enable STune resonance suppression reset to clear parameters related to resonance suppression, medium-frequency resonance suppression 2, and notches 3 and 4.

0: Disable

1: Enable

15.11 H0A Fault and Protection Parameters

H0A.00 **Power input phase loss protection**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:

0: Enable

1: Disable

Parameter description

Servo drives supporting single-phase/three-phase 220 V and three-phase 380 V power supplies are available. When voltage fluctuation or phase loss occurs on the input power supply, the drive triggers power input phase loss protection according to the setting.

H0A.01 **Absolute position limit**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Disable

1: Enable

2: Enable after homing

Parameter description

It sets whether the absolute position limit is enabled and the related condition.
After the absolute position limit is enabled, when the target position reference exceeds the position limit in the position control mode, the servo drive takes the position limit as the target and stops after reaching the limit; when the absolute position feedback reaches the position limit in other control modes, the servo drive reports an overtravel warning and stops in the mode defined by the stop mode at overtravel.

H0A.04 **Motor overload protection gain**

Address:	-	Effective mode:	Effective in real time
Min.:	50	Unit:	-
Max.:	300	Data type:	UInt16
Default:	100	Change mode:	Real-time

Range:
50 to 300
Parameter description
Defines the motor overload duration before E620.0 (Motor overload fault) is reported.
Change the value to advance or delay the overload protection time based on the motor heating condition. The value 50% indicates half of the base time, and 150% indicates 1.5 times of the base time.
Set this parameter based on the actual temperature of the motor.

H0A.08 **Overspeed threshold**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	rpm
Max.:	20000	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 20000
Parameter description
Defines the overspeed threshold of the motor.

Setpoint	Overspeed Threshold	Condition for Reporting E500.0
0	Max. motor speed x 1.2	If the speed feedback exceeds the overspeed threshold several times, the drive reports E500.0 (Motor overspeed).
1 to 20000	If H0A-08 ≥ (Maximum motor speed x 1.2): the overspeed threshold equals the maximum motor speed x 1.2.	
	If H0A-08 < (Maximum motor speed x 1.2): the overspeed threshold equals H0A.08.	

H0A.10 **Threshold of excessive local position deviation**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	4294967295	Data type:	UInt32

Default:	27486951	Change mode:	Real-time

Range:
0 to 4294967295
Parameter description
Defines the threshold for excessive position deviation in the position control mode.
When the position deviation exceeds this threshold, the drive reports EB00.0 (Position deviation too large).

H0A.12 **Runaway protection function**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	1	Change mode:	Real-time

Range:
0: Disable
1: Enable
Parameter description
Used to enable runaway protection.

H0A.17 **Reference unit**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0: Pulse unit1
: Reference unit
Parameter description
Sets the reference unit, that is, sets the unit for determining the threshold of excessive position deviation, positioning completion, and positioning proximity.
0: Pulse unit1
: Reference unit

H0A.19 **Filter time constant of touch probe 1**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	μs
Max.:	6.30	Data type:	UInt16
Default:	2.00	Change mode:	Real-time

Range:
0.00 to 6.30
Parameter description
Defines the filter time of touch probe 1. An active input must last for the time defined by H0A.19.

H0A.20 **Filter time constant of touch probe 2**

Address:	-	Effective mode:	Effective in real time
Min.:	0.00	Unit:	μs
Max.:	6.30	Data type:	UInt16
Default:	2.00	Change mode:	Real-time

Range:
0.00 to 6.30
Parameter description
Defines the filter time of touch probe 2. An active input must last for the time defined by H0A.20.

H0A.21 **STO function display selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	5	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 5
Parameter description
Defines whether to display the STO status or report E150.0 after the STO function is triggered.
0: Displays the STO status. The keypad displays "sto_" after the STO function is triggered. In this case, the drive does not report a fault and the faulty DO does not output signals.
1: Displays the STO fault. The keypad displays "E150.0" after the STO function is triggered. In this case, the dive reports the fault and the faulty DO outputs signals.

H0A.23 **TZ signal filter time**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	25 ns
Max.:	31	Data type:	UInt16
Default:	15	Change mode:	At stop

Range:
0 to 31
Parameter description
Defines the TZ signal filter time.

H0A.25 **Speed display DO low-pass filter time**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	5000	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0 to 5000
Parameter description
Defines the low-pass filter time constant of the speed information for speed feedback and position references.

H0A.26 **Motor overload shielding**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Show motor overload warning (E909.0) and fault (E620.0)

1: Hide motor overload warning (E909.0) and fault (E620.0)

Parameter description

Defines whether to enable motor overload detection.

H0A.27 **Motor rotation DO speed filter time**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	100	Data type:	UInt16
Default:	50	Change mode:	At stop

Range:

0 to 100

Parameter description

It sets the low-pass filter time constant of speed feedback signals.

This parameter is effective only when the speed feedback signals are used to judge the speed-related DO signals.

H0A.32 **Time window of locked rotor over-temperature protection**

Address:	-	Effective mode:	Effective in real time
Min.:	10	Unit:	ms
Max.:	65535	Data type:	UInt16
Default:	200	Change mode:	Real-time

Range:

10 to 65535

Parameter description

Defines the over-temperature duration before E630.0 (Motor stall) is detected by the servo drive.

H0A.33 **Locked rotor over-temperature protection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	1	Change mode:	Real-time

Range:

0: Disable

1: Enable

Parameter description

Defines whether to enable the detection for E630.0 (Motor stall over-temperature protection).

H0A.36 **Encoder multi-turn overflow fault mask**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Disable

1: Enable

Parameter description

Defines whether to hide E735.0 (Encoder multi-turn counting overflow) in the absolute position linear mode.

H0A.39 **Current sampling clock signal tolerance count**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	-
Max.:	3	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

0 to 3

Parameter description

Defines the current sampling clock signal tolerance count.

H0A.40 **Compensation function enable**

Comm. address:	-	Effective mode:	Real time
Min. value:	0x0	Unit:	-
Max. value:	0xF	Data type:	UInt16
Default value:	0x6	Change mode:	At stop

Value range:

bit0: Overtravel compensation

0: Enabled

1: Disabled

bit1: Touch probe rising edge compensation

0: Disabled

1: Enabled

bit2: Touch probe falling edge compensation

0: Disabled

1: Enabled

bit3: Touch probe logic

0: Edge-trigger of touch probe coupled with DI logic

1: Edge-trigger of touch probe not coupled with DI logic

Parameter description

bit	Name	Description
0	Overtravel compensation	0: Enable
		1: Disable
1	Touch probe rising edge compensation	0: Disable
		1: Enable
2	Touch probe falling edge compensation	0: Disable
		1: Enable
3	Touch probe logic	0: Touch probe edge trigger coupled with DI logic
		1: Touch probe edge trigger not coupled with DI logic

H0A.41 **Positive software position limit**

Address:	-	Effective mode:	Effective in real time
Min.:	-2147483648	Unit:	Reference unit
Max.:	2147483647	Data type:	Int32
Default:	2147483647	Change mode:	At stop

Range:

-2147483648 to +2147483647

Parameter description

When the absolute position counter (H0b.07) is higher than H0A.41, the drive reports E950.0 (Forward overtravel) and stops accordingly.

H0A.43 **Negative software position limit**

Address:	-	Effective mode:	Effective in real time
Min.:	-2147483648	Unit:	Reference unit
Max.:	2147483647	Data type:	Int32
Default:	-2147483648	Change mode:	At stop

Range:

-2147483648 to +2147483647

Parameter description

When the absolute position counter (H0b.07) is lower than H0A.43, the drive reports E952.0 (Reverse overtravel) and stops accordingly.

H0A.45 **Soft limit window**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	Reference unit
Max.:	2147483647	Data type:	UInt32
Default:	1000	Change mode:	At stop

Range:
0 to 2147483647
Parameter description
Sets the soft limit window to prevent the motor from stopping near the soft limit and repeatedly enabling the soft limit.

H0A.50 **Encoder communication fault tolerance threshold**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	-
Max.:	31	Data type:	UInt16
Default:	31	Change mode:	Real-time

Range:
0 to 31
Parameter description
When the number of communication failures between the encoder and the drive exceeds the number defined by H0A.50, the communication between the encoder and the drive fails.

H0A.51 **Phase loss detection filter times**

Address:	-	Effective mode:	Effective in real time
Min.:	3	Unit:	55 ms
Max.:	36	Data type:	UInt16
Default:	20	Change mode:	Real-time

Range:
3 ms to 36 ms
Parameter description
Phase loss fault is reported when phase loss keeps active for a period longer than that defined by H0A.51.

H0A.52 **Encoder temperature protection threshold**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	℃
Max.:	175	Data type:	UInt16
Default:	125	Change mode:	Real-time

Range:
0 to 175
Parameter description
0: Disable (default)

H0A.53 **Touch probe DI ON compensation time**

Address:	-	Effective mode:	Effective in real time
Min.:	-3000	Unit:	25 ns
Max.:	3000	Data type:	Signed 16-bit
Default:	200	Change mode:	Real-time

Range:

-3000 to +3000

Parameter description

Used to compensate for the action time when the touch probe is switched on.

H0A.54 **Touch probe DI OFF compensation time**

Address:	-	Effective mode:	Effective in real time
Min.:	-3000	Unit:	25 ns
Max.:	3000	Data type:	Signed 16-bit
Default:	1512	Change mode:	Real-time

Range:

-3000 to +3000

Parameter description

Used to compensate for the action time when the touch probe is switched off.

H0A.55 **Runaway current threshold**

Address:	-	Effective mode:	Effective in real time
Min.:	100.0	Unit:	%
Max.:	400.0	Data type:	UInt16
Default:	200.0	Change mode:	Real-time

Range:

100.0 to 400.0

Parameter description

Defines the current threshold for runaway protection detection.

H0A.56 **Fault reset delay**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	60000	Data type:	UInt16
Default:	10000	Change mode:	Real-time

Range:

0 to 60000

Parameter description

Faults E620.0, E630.0, E640.0, E640.1, and E650.0 can be reset only after the set delay.

H0A.57 **Runaway speed threshold**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	rpm

Max.:	1000	Data type:	UInt16
Default:	50	Change mode:	Real-time

Range:
1 rpm to 1000 rpm
Parameter description
Defines the overspeed threshold for runaway protection detection.

H0A.58 **Runaway speed filter time**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0.1	Unit:	ms
Max.:	100.0	Data type:	UInt16
Default:	2.0	Change mode:	Real-time

Range:
0.1 to 100.0
Parameter description
Defines the speed feedback filter time for runaway protection detection.

H0A.59 **Runaway protection detection time**

Address:	-	Effective mode:	Effective in real time
Min.:	10	Unit:	ms
Max.:	1000	Data type:	UInt16
Default:	30	Change mode:	Real-time

Range:
10 to 1000
Parameter description
The runaway fault will be reported when runaway fault keeps active for a period longer than that defined by H0A.59.

H0A.60 **Black box function mode**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	3	Data type:	UInt16
Default:	1	Change mode:	Real-time

Range:
0: Disable
1: Any fault
2: Designated fault
3: Triggered by designated condition
Parameter description
Defines the condition for triggering black box sampling.
0: Disable
1: Any fault
2: Designated fault
3: Triggered by designated condition

H0A.61 **Specified fault code**

Address:	-	Effective mode:	Effective in real time
Min.:	0.0	Unit:	-
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Real-time

Range:

0.0 to 6553.5

Parameter description

Defines the fault code for triggering the black box function.

H0A.62 **Trigger source**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	31	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0 to 31

Parameter description

Defines the fault code for triggering the black box function through designated channel.

H0A.63 **Trigger level**

Address:	-	Effective mode:	Effective in real time
Min.:	-2147483648	Unit:	-
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 to +2147483647

Parameter description

Defines the trigger level for triggering the black box function through designated channel.

H0A.65 **Trigger level selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	3	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Rising edge

1: Equal

2: Falling edge

3: Edge-triggered

Parameter description

Defines the trigger mode for triggering the black box function through H0A.63.
0: Rising edge
1: Equal
2: Falling edge
3: Edge-triggered

H0A.66 Trigger position

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	%
Max.:	100	Data type:	UInt16
Default:	75	Change mode:	Real-time

Range:
0% to 100%
Parameter description
Defines the pre-trigger position for triggering black box sampling.

H0A.67 Sampling frequency

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0: Current loop
1: Position loop
2: Main cycle
Parameter description
Defines the frequency sampling mode during black box sampling.
0: Current loop
1: Position loop
2: Main cycle

H0A.70 Overspeed judgment threshold 2

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	rpm
Max.:	20000	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 20000
Parameter description
Defines the speed threshold for reporting E500.2 (Position feedback pulse overspeed).

H0A.71 Servo function selection switch

Comm. address:	-	Effective mode:	Next power-on
Min. value:	0	Unit:	-

Max. value:	65535	Data type:	UInt16
Default value:	4098	Change mode:	Real time

Value range:
0 to 65535
Parameter description

bit	Description
bit0	0: New motor overload curve 1: Legacy motor overload curve
bit1	0: Enable braking resistor switch upon power failure 1: Disable braking resistor switch upon power failure
bit2	0: Forced stop applied to the brake motor 1: Forced stop not applied to the brake motor
bit4	0: Not mask the alarm indicating that the rated power of the drive is insufficient to drive the motor 1: Mask the alarm indicating that the rated power of the drive is insufficient to drive the motor
bit5	0: Disable the function that inhibits parameters from being read/ written through the software tool 1: Enable the function that inhibits parameters from being read/ written through the software tool
bit6	0: Not mask alarm E108.4 1: Mask alarm E108.4
bit9	0: Enable open circuit detection 1: Disable open circuit detection
bit11	0: Disable ultra-precise speed feedback switch 1: Enable ultra-precise speed feedback switch
bit12	0: Homing completion flag non-retentive upon power failure 1: Home completion flag retentive upon power failure
bit14	0: Enable encoder adaptive function switch 1: Disable encoder adaptive function switch

Note: bit2, bit4, bit5, bit6, bit9, and bit14 are supported only in versions equal to or later than 4302.3 (H01.00 ≥ 4302.3).

H0A.72 Maximum downtime upon stop according to ramp

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	65535	Data type:	UInt16
Default:	10000	Change mode:	At stop

Range:
0 to 65535
Parameter description
Defines the maximum time taken by the motor in decelerating from 6000 RPM to 0 RPM under ramp stop.

H0A.73 **STO 24 V disconnection filter time**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	ms
Max.:	5	Data type:	UInt16
Default:	5	Change mode:	Real-time

Range:
1 to 5
Parameter description
Defines the delay from the moment when 24 V is disconnected to the moment when the STO state applies.

H0A.74 **Filter time for two inconsistent STO channels**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	ms
Max.:	1000	Data type:	UInt16
Default:	100	Change mode:	Real-time

Range:
1 to 1000
Parameter description
Defines the delay from the moment 24 V is inputted to the drive inconsistently through two channels to the moment when the STO state applies.

H0A.75 **Servo OFF delay after STO triggered**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	25	Data type:	UInt16
Default:	20	Change mode:	Real-time

Range:
0 to 25
Parameter description
Defines the delay from the moment the STO state is triggered to the moment the S-ON signal is switched off.

H0A.90 **Moving average filter time constant for speed display values**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	100	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0 to 100
Parameter description
Defines the low-pass filter time constant for displayed speed values.

H0A.91 **Moving average filter time constant for torque display values**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	100	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0 to 100
Parameter description
Defines the moving average filter time constant for torque display values.

H0A.92 **Moving average filter time constant for position display values**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	100	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0 to 100
Parameter description
Defines the moving average filter time constant for position display values.

H0A.93 **Low-pass filter time constant for voltage display values**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	250	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 250
Parameter description
Defines the low-pass filter time constant for voltage display values.

H0A.94 **Low-pass filter time constant for thermal display values**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	250	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 250
Parameter description
Defines the low-pass filter time constant for thermal display values.

15.12 H0b Monitoring Parameters

H0b.00 Actual motor rotational speed

Address:	-	Effective mode:	-
Min.:	-32767	Unit:	rpm
Max.:	32767	Data type:	Signed 16-bit
Default:	0	Change mode:	Read only

Range:
-32767 to +32767
Parameter description
Indicates the actual motor speed after round-off, which is accurate to 1 RPM. Set the filter time constant in H0A.25 (Filter time constant of speed feedback display).

H0b.01 Speed reference

Comm. address:	-	Effective mode:	-
Min. value:	-32767	Unit:	RPM
Max. value:	32767	Data type:	Int16
Default value:	0	Change mode:	Read-only

Value range:
-32767 to +32767
Parameter description
Defines the speed reference in local speed mode.

H0b.02 Internal torque reference

Address:	-	Effective mode:	-
Min.:	-3276.7	Unit:	%
Max.:	3276.7	Data type:	Signed 16-bit
Default:	0.0	Change mode:	Read only

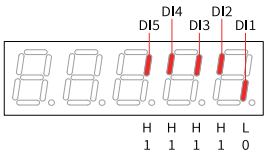
Range:
-3276.7 % to +3276.7%
Parameter description
It displays the current torque reference, in unit of 0.1%. The value 100.0% corresponds to the rated motor torque.

H0b.03 Monitored DI states

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Indicates the level status of DI1 to DI5 without filtering.

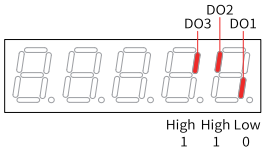
Upper LED segments ON: high level (indicated by "1"); Lower LED segments ON: low level (indicated by "0") For example, if DI1 is low level and DI2 to DI5 are high level, and the binary value is 11110, then the decimal value read from Inovance servo commissioning software is 30.
The keypad displays as follows:



H0b.05 **Monitored DO states**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
It displays the level states of three DO terminals without filtering.
Upper LED segments ON: high level (indicated by "1"); Lower LED segments ON: low level (indicated by "0") For example, if DO1 is low level and DO2 to DO3 are high level, and the binary value is 110, then the decimal value of H0b-05 read from Inovance servo commissioning software is 6.
The keypad displays as follows:



H0b.07 **Absolute position counter**

Address:	-	Effective mode:	-
Min.:	-2147483648	Unit:	p
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Read only

Range:
-2147483648 p to +2147483647 p
Parameter description
Displays current motor absolute position in reference unit.
This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.09 **Mechanical angle**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	°
Max.:	360.0	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0° to 360.0°
Parameter description
Displays the present mechanical angle (encoder unit) of the motor. The setpoint 0 indicates the mechanical angle is 0°.

H0b.10 Electrical angle

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	°
Max.:	360.0	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0° to 360.0°
Parameter description
Displays the present electrical angle of the motor, which is accurate to 0.1°.
The electrical angle varies from -360.0° to +360.0° when the motor is rotating.
If the motor has four pole pairs, four rounds of angle changes from 0° to 359.9° are generated per each revolution.
Similarly, if the motor has five pole pairs, five rounds of angle changes from 0° to 359.9° are generated per each revolution.

H0b.12 Average load rate

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	%
Max.:	800.0	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0% to 800.0%
Parameter description
Displays the percentage of the average load torque to the rated torque of the motor, which is accurate to 0.1%. The value 100.0% corresponds to the rated torque of the motor.

H0b.13 Input reference counter

Address:	-	Effective mode:	-
Min.:	-2147483648	Unit:	p
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Read only

Range:
–2147483648 p to +2147483647 p
Parameter description
Displays the input reference counter.

H0b.15 Position follow-up deviation (encoder unit)

Address:	-	Effective mode:	-
Min.:	-2147483648	Unit:	p

Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Read only

Range:

-2147483648 p to +2147483647 p

Parameter description

Counts the position pulses fed back by the encoder in any control mode.
This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.17 Feedback pulse counter

Address:	-	Effective mode:	-
Min.:	-2147483648	Unit:	p
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Read only

Range:

-2147483648 p to +2147483647 p

Parameter description

Counts the position pulses fed back by the encoder in any control mode.
This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.19 Total power-on time

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	s
Max.:	429496729.5	Data type:	UInt32
Default:	0.0	Change mode:	Read only

Range:

0.0s to 429496729.5s

Parameter description

Used to record the total operating time of the servo drive.
This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.24 RMS value of phase current

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	A
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:

0.0 A to 6553.5 A

Parameter description

Displays the effective value of the phase current of the motor in units of 0.1 A.

H0b.25 Angle obtained upon voltage injection auto-tuning

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	°
Max.:	360.0	Data type:	UInt16

Default:	0.0	Change mode:	Read only

Range:
0.0° to 360.0°
Parameter description
Displays angle obtained upon voltage injection auto-tuning.

H0b.26 Bus voltage

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	V
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0 V to 6553.5 V
Parameter description
Displays the DC bus voltage of the main circuit input voltage after rectification, which is accurate to 0.1 V.

H0b.27 IGBT temperature

Address:	-	Effective mode:	-
Min.:	-20	Unit:	℃
Max.:	200	Data type:	Signed 16-bit
Default:	0	Change mode:	Read only

Range:
–20°C to +200°C
Parameter description
Indicates the temperature of the module inside the servo drive, which can be used as a reference for estimating the actual temperature of the drive.

H0b.28 Absolute encoder fault information sent by FPGA

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the absolute encoder fault information sent by FPGA.

H0b.29 Axis status information sent by FPGA

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the axis status information sent by FPGA.

H0b.30 Axis fault information sent by FPGA

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the axis fault information sent by FPGA.

H0b.31 Encoder internal fault information

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the encoder fault information.

H0b.33 Fault record

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	19	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Present fault
1: Last fault
2: 2nd last fault
3: 3rd last fault
4: 4th last fault
5: 5th last fault
6: 6th last fault
7: 7th last fault
8: 8th last fault
9: 9th last fault
10: 10th last fault
11: 11th last fault
12: 12th last fault
13: 13th last fault
14: 14th last fault
15: 15th last fault
16: 16th last fault
17: 17th last fault
18: 18th last fault
19: 19th last fault

Parameter description

Used to view any one of the latest 20 faults that occurred on the servo drive.

H0b.34 Fault code of selected fault record

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:

0x0 to 0xFFFF

Parameter description

Displays the fault code of the selected fault.

H0b.35 Time stamp of selected fault

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	s
Max.:	429496729.5	Data type:	UInt32
Default:	0.0	Change mode:	Read only

Range:

0.0s to 429496729.5s

Parameter description

Displays the time stamp of the selected fault.

H0b.37 Motor speed upon occurrence of the selected fault

Address:	-	Effective mode:	-

Min.:	-32767	Unit:	rpm
Max.:	32767	Data type:	Signed 16-bit
Default:	0	Change mode:	Read only

Range:
-32767 to +32767
Parameter description
Displays the motor speed upon occurrence of the selected fault.

H0b.38 Motor phase U current upon selected fault

Address:	-	Effective mode:	-
Min.:	-3276.7	Unit:	A
Max.:	3276.7	Data type:	Signed 16-bit
Default:	0.0	Change mode:	Read only

Range:
-3276.7 to +3276.7
Parameter description
Displays the motor phase U current upon occurrence of the selected fault.

H0b.39 Motor phase V current upon selected fault

Address:	-	Effective mode:	-
Min.:	-3276.7	Unit:	A
Max.:	3276.7	Data type:	Signed 16-bit
Default:	0.0	Change mode:	Read only

Range:
-3276.7 to +3276.7
Parameter description
Displays the motor phase V current upon occurrence of the selected fault.

H0b.40 Bus voltage upon occurrence of the selected fault

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	V
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0 V to 6553.5 V
Parameter description
Displays the bus voltage upon occurrence of the selected fault.

H0b.41 Input terminal state upon selected fault

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the input terminal state upon the selected fault.

H0b.43 Output terminal status upon selected fault

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the output terminal status upon occurrence of the selected fault.

H0b.45 Internal fault code

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the internal fault code.

H0b.46 Absolute encoder fault information sent by FPGA upon selected fault

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the absolute encoder fault information given by FPGA upon occurrence of the selected fault.

H0b.47 System status information sent by FPGA upon selected fault

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF

Parameter description
Displays the system status information sent by FPGA upon occurrence of the selected fault.

H0b.48 System fault information sent by FPGA upon occurrence of the selected fault

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the system fault information sent by FPGA upon occurrence of the selected fault.

H0b.49 Encoder internal fault information upon selected fault

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the encoder fault information upon occurrence of the selected fault.

H0b.51 Internal fault code upon selected fault

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the internal fault code upon occurrence of the selected fault.

H0b.52 FPGA timeout fault standard bit upon occurrence of the selected fault

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the FPGA timeout fault standard bit upon occurrence of the selected fault.

H0b.53 Position follow-up deviation (reference unit)

Address:	-	Effective mode:	-
Min.:	-2147483648	Unit:	p
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Read only

Range:

-2147483648 p to +2147483647 p

Parameter description

Indicates the position deviation value which has not been divided or multiplied by the electronic gear ratio in the position control mode.

Position deviation (reference unit) is the value obtained after encoder position deviation calculation. The precision is compromised during division.

This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.55 Actual motor rotational speed

Address:	-	Effective mode:	-
Min.:	-214748364.8	Unit:	rpm
Max.:	214748364.7	Data type:	Int32
Default:	0.0	Change mode:	Read only

Range:

-214748364.8 to +214748364.7

Parameter description

Indicates the actual motor speed after round-off, which is accurate to 1 RPM. You can set the filter time constant for H0b-00 in filter time constant of speed feedback display.

H0b.57 Bus voltage of the control circuit

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	V
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:

0.0 V to 6553.5 V

Parameter description

It displays the DC bus voltage of the input control power after rectification.

H0b.58 Mechanical absolute position (low 32 bits)

Address:	-	Effective mode:	-
Min.:	0	Unit:	p
Max.:	4294967295	Data type:	UInt32
Default:	0	Change mode:	Read only

Range:

0 p to 4294967295 p

Parameter description

Displays the low 32-bit value (encoder unit) of the mechanical position feedback when the absolute encoder is used.

H0b.60 Mechanical absolute position (high 32 bits)

Address:	-	Effective mode:	-
Min.:	-2147483648	Unit:	p
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Read only

Range:

-2147483648 p to +2147483647 p

Parameter description

Displays the high 32-bit value (encoder unit) of the mechanical position feedback when the absolute encoder is used.

H0b.63 NotRdy state

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	7	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

0: Normal

1: Control circuit error

2: Main circuit power input error

3: Bus undervoltage

4: Soft start failed

5: Encoder initialization undone

6: Short circuit to ground failed

7: Others

Parameter description

Displays the reason for NotRdy state.

0: Normal

1: Control circuit error

2: Main circuit power input error

3: Bus undervoltage

4: Soft start failed

5: Encoder initialization undone

6: Short circuit to ground failed

7: Others

H0b.64 Real-time position reference counter

Address:	-	Effective mode:	-
Min.:	-2147483648	Unit:	Reference unit
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Read only

Range:
-2147483648 to +2147483647
Parameter description
Displays the counter for real-time position reference input.

H0b.66 Encoder temperature

Address:	-	Effective mode:	-
Min.:	-32768	Unit:	℃
Max.:	32767	Data type:	Signed 16-bit
Default:	0	Change mode:	Read only

Range:
-32768 to +32767
Parameter description
Indicates the encoder temperature value.

H0b.67 Load factor of braking resistor

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	%
Max.:	200.0	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0% to 200.0%
Parameter description
Indicates the braking load rate. When the load rate exceeds 100%, the servo drive stops braking.

H0b.70 Number of absolute encoder revolutions

Address:	-	Effective mode:	-
Min.:	0	Unit:	Rev
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 Rev to 65535 Rev
Parameter description
Indicates the number of revolutions of the absolute encoder.

H0b.71 Position of absolute encoder within one turn

Address:	-	Effective mode:	-
Min.:	0	Unit:	p
Max.:	2147483647	Data type:	UInt32
Default:	0	Change mode:	Read only

Range:
0 p to 2147483647 p
Parameter description
It displays the single-turn position feedback of the absolute encoder.

H0b.74 **System fault information sent by FPGA**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the system fault information sent by FPGA.

H0b.77 **Encoder position (low 32 bits)**

Address:	-	Effective mode:	-
Min.:	0	Unit:	p
Max.:	4294967295	Data type:	UInt32
Default:	0	Change mode:	Read only

Range:
0 p to 4294967295 p
Parameter description
It displays the low 32-bit data of the position feedback of the absolute encoder.

H0b.79 **Encoder position (high 32 bits)**

Address:	-	Effective mode:	-
Min.:	-2147483648	Unit:	p
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Read only

Range:
–2147483648 p to +2147483647 p
Parameter description
It displays the high 32-bit data of the position feedback of the absolute encoder.

H0b.81 **Rotating load single-turn position (low 32 bits)**

Address:	-	Effective mode:	-
Min.:	0	Unit:	p
Max.:	4294967295	Data type:	UInt32
Default:	0	Change mode:	Read only

Range:
0 p to 4294967295 p
Parameter description
It displays the low 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.

H0b.83 **Single-turn position of the rotating load (high 32 bits)**

Address:	-	Effective mode:	-

Min.:	-2147483648	Unit:	p
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Read only

Range:
-2147483648 p to +2147483647 p
Parameter description
It displays the high 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.

H0b.85 Single-turn position of the rotating load (reference unit)

Address:	-	Effective mode:	-
Min.:	-2147483648	Unit:	p
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Read only

Range:
-2147483648 p to +2147483647 p
Parameter description
It displays the high 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.

H0b.87 IGBT junction temperature

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	200	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 200
Parameter description
Displays the IGBT junction temperature.

H0b.90 Group No. of the abnormal parameter

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the group number of the abnormal parameter.

H0b.91 Offset of the abnormal parameter within the group

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16

Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Displays the offset within the group of the abnormal parameter.

H0b.94 **Individual power-on time**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	s
Max.:	429496729.5	Data type:	UInt32
Default:	0.0	Change mode:	Read only

Range:
0.0s to 429496729.5s
Parameter description
Displays the individual power-on time of the drive.

H0b.96 **Individual power-on time upon occurrence of the selected fault**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	s
Max.:	429496729.5	Data type:	UInt32
Default:	0.0	Change mode:	Read only

Range:
0.0s to 429496729.5s
Parameter description
Displays the individual power-on time upon occurrence of the selected fault.

H0b-70 **Dynamic braking resistor load rate**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	%
Max.:	200.0	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0% to 200.0%
Parameter description
Displays the load rate of dynamic braking resistor.

15.13 H0C Fault and Protection Parameters 2

H0C.71 **Servo function selection switch**

Comms. address:	-	Effective mode:	Next power-on
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16

Default value:	8	Change mode:	Real time

Value range:

bit3: Software limit feature switch

0: Old feature

1: New feature

Parameter description

bit3: AC3 software limit function switch planned in advance

H0C.73 **Servo function selection switch 3**

Comms. address:	-	Effective mode:	Next power-on
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:

bit1: Switch encoder baud rate to 2 M automatically upon power-up

0: Enable

1: Disable

Parameter description

bit1: 2 M of communication rate for active encoder switchover upon power-on

15.14 H0d Auxiliary Function Parameters

H0d.00 **Software reset**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:

0: No operation

1: Software reset

Parameter description

Defines whether to enable software reset.

Software reset is available in the following cases:

The servo is in the S-OFF state.

There is no non-resettable fault such as No. 1 fault.

No EEPROM operation is performed. The software reset function is ineffective.

H0d.01 **Fault reset**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

0: No operation

1: Fault reset

Parameter description

Sets whether to support fault reset.

For fault classification, see Chapter "Troubleshooting".

After fault reset, the keypad stops displaying the fault only, but parameter modification still does not take effect.

This function is invalid to non-resettable faults. Take caution with this function if the fault causes are not removed.

H0d.02 Inertia auto-tuning selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	65	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0 to 65

Parameter description

Enables offline inertia auto-tuning through the keypad. In the parameter display mode, switch to H0d.02 and press the SET key to enable offline inertia auto-tuning.

H0d.04 Read/Write in encoder ROM

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	3	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

0: No operation

1: Write to ROM

2: Read from ROM

3: ROM failure

Parameter description

For Inovance encoders, parameters written to the ROM area can be activated only after the USB and control power supplies are restarted. Ensure that the drive is powered on during parameter writing.

0: No operation

1: Write to ROM

2: Read from ROM

3: ROM failure

H0d.05 Emergency stop

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:
0: No operation
1: Emergency stop
Parameter description
Enable emergency stop through parameters.
0: No operation
1: Emergency stop
Note: The H0d.05 stop mode is defined by H02.05.

H0d.12 Phase U/V current balance calibration

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0: Disable
1: Enable
Parameter description
Phase U/V current balance calibration
0: Disable
1: Enable

H0d.17 Forced DI/DO enable switch

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	3	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
bit0: Forced DI enable switch
0: Disable
1: Enable
bit1: Forced DO enable switch
0: Disable
1: Enable
Parameter description
Defines whether to enable forced DI/DO.
bit0: Forced DI enable switch
0: Disable
1: Enable
bit1: Forced DO enable switch
0: Disable
1: Enable

H0d.18 Forced DI value

Address:	-	Effective mode:	Effective in real time
Min.:	0x0	Unit:	-

Max.:	0xFF	Data type:	UInt16
Default:	0xFF	Change mode:	Real-time

Range:
0x0 to 0xFF
Parameter description
Defines the level logic of the DI functions set by the parameter when forced DI is activated.
The value of H0d.18 is displayed as a hexadecimal on the keypad. When it is converted to a binary value, "bit(n) = 1" indicates the level logic of DI function is high level; "bit(n) = 0" indicates the
level logic of the DI function is low level.

H0d.19 Forced DO value

Address:	-	Effective mode:	Effective in real time
Min.:	0x0	Unit:	-
Max.:	0x1F	Data type:	UInt16
Default:	0x0	Change mode:	Real-time

Range:
0x0 to 0x1F
Parameter description
Defines whether the DO functions assigned by the parameter are active when forced DO is active.
The value of H0d.19 is displayed as a hexadecimal on the keypad. When it is converted to a binary value, "bit(n) = 1" indicates the DO function is active; "bit(n) = 0" indicates the DO function is inactive.

H0d.20 Absolute encoder reset selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0: No operation
1: Reset the fault
2: Reset the fault and multi-turn data
Parameter description
You can reset the encoder error or the multi-turn data fed back by the encoder by setting H0d.20.

H0d.23 Torque fluctuation auto-tuning

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0 to 1
Parameter description

Motor cogging torque fluctuation auto-tuning
0: Disable
1: Enable
2: Auto-tuning failed (setting not supported, used for display)

15.15 H0E Communication Function Parameters

H0E.00 **Node address**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	-
Max.:	127	Data type:	UInt16
Default:	1	Change mode:	At stop

Range:
1 to 127
Parameter description
Defines the servo drive axis address during RS232 communication.
0: Broadcast address. The host controller performs the write operation on all the servo drives through the broadcast address. The servo drives acts accordingly after receiving the broadcast address frames without responding to the host controller.
1 to 127: Each of the servo drive networked must have a unique address. Otherwise, communication error or failure can occur.

H0E.01 **Saving parameters written through communication to EEPROM**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	1	Change mode:	Real-time

Range:
0: Disable
1: Enable
Parameter description
Sets whether to save parameters written through the serial port or non-periodic communication.
0: Disable
1: Enable

H0E.30 **E15 detection delay**

Comm. address:	-	Effective mode:	Next power-on
Min. value:	0	Unit:	-
Max. value:	60000	Data type:	UInt16
Default value:	100	Change mode:	Real time

Value range:
0 to 60000
Parameter description
Defines the E15 detection delay.

H0E.32 **Synchronization error threshold**

Address:	-	Effective mode:	Effective in real time
Min.:	100	Unit:	-
Max.:	4000	Data type:	UInt16
Default:	3000	Change mode:	At stop

Range:

100 to 4000

Parameter description

Sets the synchronization deviation threshold.

H0E.80 **Modbus communication baud rate**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	9	Data type:	UInt16
Default:	9	Change mode:	Real-time

Range:

4: 4800 bps

5: 9600 bps

6: 19200 bps

7: 38400 bps

8: 57600 bps

9: 115200 bps

Parameter description

Defines the communication rate between the servo drive and the host controller. The baud rate set in the servo drive must be the same as that in the host controller. Otherwise, communication can fail.

4: 4800 bps

5: 9600 bps

6: 19200 bps

7: 38400 bps

8: 57600 bps

9: 115200 bps

H0E.81 **Modbus data format**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	3	Data type:	UInt16
Default value:	3	Change mode:	Real time

Value range:

0: No parity, 2 stop bits (N-2)

1: Even parity, 1 stop bit (E-1)

2: Odd parity, 1 stop bit (O-1)

3: No parity, 1 stop bit (N-1)

Parameter description

Defines the data verification method for communication between the drive and host controller.
0: No parity, 2 stop bits (N-2)
1: Even parity, 1 stop bit (E-1)
2: Odd parity, 1 stop bit (O-1)
3: No parity, 1 stop bit (N-1)
The data format set in the drive must be the same as that in the host controller. Otherwise, communication can fail.

H0E.82 Modbus response delay

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	20	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 ms to 20 ms
Parameter description
Defines the delay from the moment the slave receives a command to the moment the slave returns a response.

H0E.83 Modbus communication timeout period

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	600	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 600
Parameter description
Defines the Modbus communication timeout.

H0E.84 Modbus communication data sequence

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	1	Change mode:	Real-time

Range:
0: High-order bits are followed by low-order bits.
1: Low-order bits are followed by high-order bits.
Parameter description
Defines the 32-bit data transmission format of Modbus communication.
0: High-order 16 bits are followed by low-order 16 bits.
1: Low-order 16 bits are followed by high-order 16 bits.

H0E.90 Modbus version

Address:	-	Effective mode:	-

Min.:	0.00	Unit:	-
Max.:	655.35	Data type:	UInt16
Default:	0.00	Change mode:	Read only

Range:
0.00 to 655.35
Parameter description
Displays the communication version.

15.16 H17 VDI/DO Parameters

H17.00 **VDI1 function selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block
Parameter description
Defines the DI function assigned to VDI1.

H17.01 **VDI1 logic level**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0: Active when the written value is 11: Active when the written value changes from 0 to 1
Parameter description
Defines the active level of VDI1.

H17.02 **VDI2 function selection**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined

1: Servo ON

3: Gain switchover

14: Positive limit switch

15: Negative limit switch

16: Positive external torque limit

17: Negative external torque limit

18: Forward jog

19: Reverse jog

31: Home switch

34: Emergency stop

35: Clear position deviation

36: Internal speed limit

56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI2.

H17.03 **VDI2 logic level selection**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1 1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI2.

H17.04 **VDI3 function selection**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI3.

H17.05 VDI3 logic selection

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI3.

H17.06 VDI4 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI4.

H17.07 VDI4 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI4.

H17.08 VDI5 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI5.

H17.09 VDI5 logic level selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI5.

H17.10 VDI6 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI6.

H17.11 VDI6 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI6.

H17.12 VDI7 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI7.

H17.13 VDI7 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI7.

H17.14 VDI8 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI8.

H17.15 VDI8 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI8.

H17.16 VDI9 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI9.

H17.17 VDI9 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI9.

H17.18 VDI10 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI10.

H17.19 VDI10 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI10.

H17.20 VDI11 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI11.

H17.21 VDI11 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 11: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI11.

H17.22 VDI12 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI12.

H17.23 VDI12 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI12.

H17.24 VDI13 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI13.

H17.25 VDI13 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI13.

H17.26 VDI14 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI14.

H17.27 VDI14 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI14.

H17.28 VDI15 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI15.

H17.29 VDI15 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1
1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI15.

H17.30 VDI16 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	56	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ON
3: Gain switchover
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
31: Home switch
34: Emergency stop
35: Clear position deviation
36: Internal speed limit
56: External switch of EPOS program block

Parameter description

Defines the DI function assigned to VDI16.

H17.31 VDI16 logic level selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Active when the written value is 1 1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level for VDI16.

H17.32 VDO virtual level

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:

0x0 to 0xFFFF

Parameter description

Displays the VDO virtual level.

H17.33 VDO1 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Defines the function of VDO1.

H17.34 VDO1 logic level selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Defines the active level of VDO1.

H17.35 VDO2 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.36 VDO2 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.37 VDO3 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.38 VDO3 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.39 VDO4 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.40 VDO4 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.41 VDO5 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.42 VDO5 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.43 VDO6 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.44 VDO6 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.45 VDO7 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.46 VDO7 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.47 VDO8 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.48 VDO8 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.49 VDO9 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.50 **VDO9 logic selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.51 **VDO10 function selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.52 VDO10 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.53 VDO11 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.54 **VDO11 logic selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.55 **VDO12 function selection**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.56 VDO12 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.57 VDO13 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.58 VDO13 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.59 VDO14 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.60 VDO14 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.61 VDO15 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.62 VDO15 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.63 VDO16 function selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	32	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Not defined
1: Servo ready
2: Motor rotation signal
3: Zero speed signal
4: Speed matching signal
5: Positioning completed
6: Proximity
7: Torque limited signal
8: Speed limited signal
9: Brake output signal
10: Alarm
11: Fault
16: Homing completed
18: Torque reached signal
19: Speed reached signal
21: Enable completed
30: Alarm or fault output
32: EDM output

Parameter description

Same as H17.33

H17.64 VDO16 logic selection

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.90 Communication VDI enabling

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

0: Disable
1: Enable

Parameter description

To use the VDI function:
1. Set H17.90 to enable VDI.
2. Set the default level after power-on through H17.91.
3. Set the DI function of the VDI terminal through parameters in group H17.
4. Set VDI output through H31.00.

H17.91 **Default VDI selection after power-on**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: 0x0 - No default

1: 0x01 - Use VDI1 as default

2: 0x02 - Use VDI2 as default

4: 0x04 - Use VDI3 as default

8: 0x08 - Use VDI4 as default

16: 0x10 - Use VDI5 as default

32: 0x20 - Use VDI6 as default

64: 0x40 - Use VDI7 as default

128: 0x80 - Use VDI8 as default

256: 0x100 - Use VDI9 as default

512: 0x200 - Use VDI10 as default

1024: 0x400 - Use VDI11 as default

2048: 0x800 - Use VDI12 as default

4096: 0x1000 - Use VDI13 as default

8092: 0x2000 - Use VDI14 as default

16384: 0x4000 - Use VDI15 as default

32768: 0x8000 - Use VDI16 as default

Parameter description

Configures the initial value of VDI upon power-on.

bit0 corresponds to VDI1.

bit1 corresponds to VDI2.

…

bit15 corresponds to VDI16.

H17.92 **Communication VDO enable**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

0: Disable

1: Enable

Parameter description

To use the VDO function:

1. Enable VDO through H17.92.

2. Set the default level after power-on in H17.93.

3. Set the DO function of the VDO through parameters in group H17.

4: Read the output level of the VDO in H17.32.

H17.93 **Default VDO selection after power-on**

Address:	-	Effective mode:	Effective in real time
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	At stop

Range:

0: 0x00 - No default

1: 0x01 - Use VDO1 as default

2: 0x02 - Use VDO2 as default

4: 0x04 - Use VDO3 as default

8: 0x08 - Use VDO4 as default

16: 0x10 - Use VDO5 as default

32: 0x20 - Use VDO6 as default

64: 0x40 - Use VDO7 as default

128: 0x80 - Use VDO8 as default

256: 0x100 - Use VDO9 as default

512: 0x200 - Use VDO10 as default

1024: 0x400 - Use VDO11 as default

2048: 0x800 - Use VDO12 as default

4096: 0x1000 - Use VDO13 as default

8192: 0x2000 - Use VDO14 as default

16384: 0x4000 - Use VDO15 as default

32768: 0x8000 - Use VDO16 as default

Parameter description

Used to configure the initial values of VDO upon power-on.

bit0 corresponds to VDO1.

bit1 corresponds to VDO2.

…

bit15 corresponds to VDO16.

15.17 H24 PN Bus Communication Parameters

H24.00 **Message number selection [PN922]**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	3	Change mode:	Read only

Range:

0 to 65535

Parameter description

Displays sent and received messages, and accepts message settings of the controller.

H24.01 **Heartbeat warning threshold [PN925]**

Address:	-	Effective mode:	Effective in real time

Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	5	Change mode:	At stop

Range:
0 to 65535
Parameter description
Defines the number of consecutive faulty heartbeat value allowed by the synchronous master.

H24.02 **Fault message counter [PN944]**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Displays the counter of the faulty buffer.

H24.03 **Fault code [PN947]**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the fault code.

H24.04 **Fault SN**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	63	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0 to 63
Parameter description
Displays the fault number.

H24.05 **Fault condition counter [PN952]**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0 to 65535
Parameter description
Displays the number of faults since the last reset.

H24.06 **Sensor header [PN979[0]]**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0x0	Unit:	-
Max.:	0xFFFFFFFF	Data type:	UInt32
Default:	0x5112	Change mode:	At stop

Range:
0x0 to 0xFFFFFFFF
Parameter description
Displays the sensor header [PN979[0]].

H24.08 **Sensor type [PN979[1]]**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0x0	Unit:	-
Max.:	0xFFFFFFFF	Data type:	UInt32
Default:	0x80000002	Change mode:	At stop

Range:
0x0 to 0xFFFFFFFF
Parameter description
Displays the sensor type [PN979[1]].

H24.10 **Sensor resolution [PN979[2]]**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	-
Max.:	4294967295	Data type:	UInt32
Default:	256	Change mode:	At stop

Range:
0 to 4294967295
Parameter description
Displays the sensor resolution [PN979[2]].

H24.12 **Sensor G1X1ST1 displacement factor [PN979[3]]**

Comm. address:	-	Effective mode:	Next power-on
Min. value:	0	Unit:	-
Max. value:	4294967295	Data type:	UInt32
Default value:	15	Change mode:	At stop

Value range:
0 to 4294967295
Parameter description
Displays the displacement factor [PN979[3]] of sensor G1_X1ST1.

H24.14 **Sensor G1X1ST2 displacement factor [PN979[4]]**

Comm. address:	-	Effective mode:	Next power-on
Min. value:	0	Unit:	-
Max. value:	4294967295	Data type:	UInt32
Default value:	15	Change mode:	At stop

Value range:
0 to 4294967295
Parameter description
Displays the displacement factor [PN979[4]] of sensor G1_X1ST2.

H24.16 **Sensor multi-turn number [PN979[5]]**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	-
Max.:	4294967295	Data type:	UInt32
Default:	512	Change mode:	At stop

Range:
0 to 4294967295
Parameter description
Displays the sensor multi-turn number [PN979[5]].

H24.19 **Synchronization cycle**

Address:	-	Effective mode:	-
Min.:	0.000	Unit:	-
Max.:	65.535	Data type:	UInt16
Default:	0.000	Change mode:	Read only

Range:
0.000 to 65.535
Parameter description
Displays the synchronization cycle.

H24.22 **IP Address**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFFFFFF	Data type:	UInt32
Default:	0xC0A80002	Change mode:	Read only

Range:
0x0 to 0xFFFFFFFF
Parameter description
Displays the IP address.

H24.24 **Subnet mask**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-

Max.:	0xFFFFFFFF	Data type:	UInt32
Default:	0xFFFFFF00	Change mode:	Read only

Range:
0x0 to 0xFFFFFFFF
Parameter description
Displays the subnet mask.

H24.26 **Default gateway**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFFFFFF	Data type:	UInt32
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFFFFFF
Parameter description
Displays the default gateway.

H24.32 **DSC compatibility position loop gain selection**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	3	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:
0: Disable DSC compatibility function
1: PLC position loop gain
3: DSC manual adjustment
Parameter description
If you use telegram 105, selecting 0 disables the DSC compatibility function. To enable DSC compatibility, select a non-zero value.

H24.33 **Number of Sync with advanced DSC position feedback**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	16	Data type:	UInt16
Default:	2	Change mode:	Real-time

Range:
0 to 16
Parameter description
Defines the number of Sync with advanced DSC position feedback.

H24.34 **DSC compatibility loop gain selection switch**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16

Default value:	0	Change mode:	At stop

Value range:

0: Stiffness level adapted based on DSC gain

1: Stiffness level adapted based on H09.01

Parameter description

Sets the loop gain.

0: Stiffness level adapted based on DSC gain

1: Stiffness level adapted based on H09.01

H24.35 850 telegram customized sending

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: No assignment

1: VDO

2: External DI state

Parameter description

When the extra message 850 is selected, the servo sends data to PLC through 850 message.

H24.36 Customized reception of message 850

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: No assignment

1: VDI

2: External DO state

Parameter description

When the extra message 850 is selected, PLC sends data to the servo through 850 message.

H24.37 Attach telegram

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	999	Data type:	UInt16
Default:	999	Change mode:	At stop

Range:

0 to 999

Parameter description

Displays the current extra message number. 999 indicates no additional message.

H24.38 **User-defined receive word**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	2	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: No function

1: Additive torque

2: Forced DO

Parameter description

Message 111 indicates PLC sends customized data to the servo through message.

H24.39 **User-defined send word**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	3	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: No function

1: Actual torque

2: Actual current

3: DI state

Parameter description

Message 111 indicates the servo sends customized data to PLC through message.

H24.41 **Device name lost alarm**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0 to 1

Parameter description

The value 1 indicates the function is enabled. If the device name is lost, E18.0 is reported.

H24.42 **Number of consecutive disconnection detections**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	8	Change mode:	At stop

Range:

0 to 65535

Parameter description

Defines the number of consecutive loss detections.

H24.44 **FPGA synchronization detection deviation threshold**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ns
Max.:	65535	Data type:	UInt16
Default:	3000	Change mode:	At stop

Range:
0 ns to 65535 ns
Parameter description
Defines the FPGA sync detection deviation threshold.

H24.45 **MAC address**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the MAC address.

H24.46 **MAC address**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the MAC address.

H24.47 **MAC address**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:
0x0 to 0xFFFF
Parameter description
Displays the MAC address.

H24.48 **DSC compatibility position loop gain coefficient**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	-

Max.:	31	Data type:	UInt16
Default:	10	Change mode:	At stop

Range:
1 to 31
Parameter description

H24.49 **PN disconnection fault code**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Displays the PN disconnection fault code.

H24.55 **Max. Kv coefficient estimation in the DSC mode**

Address:	-	Effective mode:	-
Min.:	0.0	Unit:	1/s
Max.:	6553.5	Data type:	UInt16
Default:	0.0	Change mode:	Read only

Range:
0.0/s to 6553.5/s
Parameter description
It is recommended to set the Kv gain through PLC in DSC average interpolation mode.
Note: Set the process object gain Kv (factor) to H24.55.

H24.56 **Symmetric time constant estimation in the DSC mode**

Address:	-	Effective mode:	-
Min.:	0.00	Unit:	ms
Max.:	655.35	Data type:	UInt16
Default:	0.00	Change mode:	Read only

Range:
0.00 to 655.35
Parameter description
It is recommended to set number of revolutions control through PLC in DSC average interpolation mode.
Note: The replacement time for process object revolution control is set to H24.56 x 0.001(s).

H24.57 **Ti**

Address:	-	Effective mode:	-
Min.:	0.000	Unit:	ms
Max.:	65.535	Data type:	UInt16

Default:	0.000	Change mode:	Read only

Range:
0.000 to 65.535
Parameter description
Displays time settings of Ti in synchronous mode.

H24.58 **To**

Address:	-	Effective mode:	-
Min.:	0.000	Unit:	ms
Max.:	65.535	Data type:	UInt16
Default:	0.000	Change mode:	Read only

Range:
0.000 to 65.535
Parameter description
Displays time settings of To in synchronous mode.

H24.60 **PN function selection**

Address:	-	Effective mode:	Effective upon next power-on
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0 to 65535
Parameter description
PN function selection

H24.61 **User-defined high-precision subdivision resolution enable**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:
0: Disable
1: Enable
Parameter description
After the function is enabled, you can modify the high-precision subdivision resolution.

H24.62 **User-defined G1XIST1 high-precision subdivision**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	18	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:

0 to 18

Description

Sets the user-defined G1_XIST1 high-precision subdivision resolution.

H24.63 **User-defined G1XIST2 high-precision subdivision**

Comm. address:	-	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	18	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:

0 to 18

Description

Sets the user-defined G1_XIST2 high-precision subdivision resolution.

H24.64 **Reference speed**

Address:	-	Effective mode:	Effective in real time
Min.:	1.000	Unit:	rpm
Max.:	10000.000	Data type:	UInt32
Default:	3000.000	Change mode:	At stop

Range:

1.000 rpm to 10000.000 rpm

Parameter description

The speed parameter for PN telegram interaction is a percentage of the reference speed. 100% is represented by 0x4000 for telegram 1, and 0x40000000 for other telegrams, with a maximum of 200%. To obtain the actual set speed or feedback speed, multiply the percentage by the reference speed. When bit3 of H24.60 is set to 0 (default), this parameter is forcibly set to the value of the rated speed (H00.14). When bit3 of H24.60 is set to 1, this parameter can be modified to any value within the permissible range.

H24.67 **Telegram 105 configuration**

Address:	-	Effective mode:	Effective in real time
Min.:	0x0	Unit:	-
Max.:	0x3	Data type:	UInt16
Default:	0x3	Change mode:	At stop

Range:

bit0: When DSC is enabled, enable PLC position loop gain

0: Enable local gain

1: Enable PLC gain

bit1: Enable NSOLL_B

0: Disable

1: Enable

Parameter description

Sets telegram 105

bit0: When DSC is enabled, enable the PLC position loop gain.

bit1: Enable NSOLL_B
Note: In the telegram 105, when DSC is enabled, NSOLL_B serves as speed feedforward; when DSC is disabled, NSOLL_B serves as speed reference.

H24.68 **DSC control word (DSC_STW)**

Address:	-	Effective mode:	Effective in real time
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Real-time

Range:
bit0: Enable DSC with spline 0
Disable
1: Enable
bit4: Enable speed feedforward in DSC with spline
0: Disable
1: Enable
bit5: Enable torque feedforward in DSC with spline
0: Disable
1: Enable

Parameter description
It is the DSC control word, which is used to set the interpolation method for DSC.
bit0: Enable spline-based DSC
bit4: Enable speed feedforward in spline-based DSC
bit5: Enable torque feedforward in spline-based DSC
Note: When spline interpolation is enabled, ensure the following conditions are met. Otherwise, vibration or runaway risks may occur.
1. Process object configuration: Position control is enabled for the drive unit (DSC enabled), PLC pre-control is set to 100%, and the replacement time for revolution control loop is set to 0.
2. MC_POWER, MC_MOVEJOG, and other instructions are set to position mode (position-controlled axis).
3. H24.33 is properly configured.

15.18 H25 AC3 Control Parameters

H25.00 **EPOS max. speed**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	1000 LU/min.
Max.:	40000000	Data type:	UInt32
Default:	30000	Change mode:	Real-time

Range:
0 to 40000000

Parameter description
Sets the speed limit value effective in all EPOS operating modes (user units).

H25.02 **EPOS max. acceleration**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	1000 LU/s/s
Max.:	2000000	Data type:	UInt32
Default:	100	Change mode:	Real-time

Range:

1 LU/s/s to 2000000 LU/s/s

Parameter description

Sets the EPOS maximum acceleration.

Running mode for "Running program segment":

Acceleration multiplier set in the program segment (H27.81 to H27.96) couples with this parameter to determine the effective acceleration.

Running mode for "MDI":

Acceleration multiplier (H29.16, 0x4000=100%) couples with this parameter to determine the effective acceleration.

Running mode for "Jog":

No acceleration multiplier is effective. Axis starts with the maximum acceleration.

Running mode for "Return to Reference Point":

Acceleration/deceleration multiplier for homing (H25.27) couples with this parameter to determine the effective acceleration.

H25.04 **EPOS max. deceleration**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	1000 LU/s/s
Max.:	2000000	Data type:	UInt32
Default:	100	Change mode:	Real-time

Range:

1 LU/s/s to 2000000 LU/s/s

Parameter description

Sets the EPOS maximum deceleration.

Running mode for "Running program segment":

Deceleration multiplier set in the program segment (H28.00 to H28.15) couples with this parameter to determine the effective deceleration.

Running mode for "MDI":

Deceleration multiplier (H29.17, 0x4000=100%) couples with this parameter to determine the effective deceleration.

Running mode for "Jog":

No acceleration multiplier is effective. Axis starts with the maximum deceleration.

Running mode for "Return to Reference Point":

Acceleration/deceleration multiplier for homing (H25.27) couples with this parameter to determine the effective deceleration.

H25.06 **EPOS ramp deceleration**

Address:	-	Effective mode:	Effective in real time
Min.:	1	Unit:	1000 LU/s/s
Max.:	2000000	Data type:	UInt32
Default:	100	Change mode:	Real-time

Range:
1 LU/s/s to 2000000 LU/s/s
Parameter description
During EPOS operation, the ramp deceleration that triggers the rejection of tasks takes effect.

H25.10 **EPOS positioning reach threshold**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	LU
Max.:	2147483647	Data type:	UInt32
Default:	7	Change mode:	Real-time

Range:
0 LU to 2147483647 LU
Parameter description
Sets the positioning arrival threshold for EPOS relative or absolute positioning mode.

H25.12 **EPOS positioning reached window time**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	ms
Max.:	2147483647	Data type:	UInt32
Default:	0	Change mode:	Real-time

Range:
0 ms to 2147483647ms
Parameter description
Sets the positioning arrival window for EPOS relative or absolute positioning mode.

H25.14 **EPOS: Jog1 speed**

Address:	-	Effective mode:	Effective in real time
Min.:	-40000000	Unit:	1000 LU/min.
Max.:	40000000	Data type:	Int32
Default:	-300	Change mode:	Real-time

Range:
-40000000 Lu/min. to 40000000 LU/min.
Parameter description
Sets the speed during Jog1 operation in EPOS mode 7 or 8.

H25.16 **EPOS: Jog2 speed**

Address:	-	Effective mode:	Effective in real time
Min.:	-40000000	Unit:	1000 LU/min.
Max.:	40000000	Data type:	Int32
Default:	300	Change mode:	Real-time

Range:
-40000000 Lu/min. to 40000000 LU/min.
Parameter description
Sets the speed during Jog2 operation in EPOS mode 7 or 8.

H25.18 **EPOS-JOG1 position increment**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	LU
Max.:	2147483647	Data type:	UInt32
Default:	1000	Change mode:	Real-time

Range:
0 LU to 2147483647 LU
Parameter description
Sets the position increment during Jog1 operation in EPOS mode 8.

H25.20 **EPOS-JOG2 position increment**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	LU
Max.:	2147483647	Data type:	UInt32
Default:	1000	Change mode:	Real-time

Range:
0 LU to 2147483647 LU
Parameter description
Sets the position increment during Jog2 operation in EPOS mode 8.

H25.22 **Homing type**

Address:	-	Effective mode:	Effective in real time
Min.:	-2	Unit:	-
Max.:	35	Data type:	Signed 16-bit
Default:	0	Change mode:	Real-time

Range:
-2 to 35
Parameter description
Homing track selection

H25.23 **Homing high speed**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	1000 LU/min.
Max.:	40000000	Data type:	UInt32
Default:	5000	Change mode:	Real-time

Range:
0 to 40000000
Parameter description
Sets the speed during the high-speed phase of homing.

H25.25 **Homing low speed**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	1000 LU/min.

Max.:	40000000	Data type:	UInt32
Default:	300	Change mode:	Real-time

Range:
0 to 40000000
Parameter description
Sets the speed during the low-speed phase of homing.

H25.27 **Homing acceleration/deceleration multiplier**

Address:	-	Effective mode:	Effective in real time
Min.:	0.01	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:
0.01 %~100.00%
Parameter description
Set the acceleration/deceleration multiplier for homing.

15.19 H27 Program Block Parameters

H27.00 **Current segment**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	15	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 15
Parameter description
Displays the number of the currently running program segment. It displays as 0 when no program segment is running.

H27.01 **Segment 0 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.02 **Segment 1 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.03 **Segment 2 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.04 **Segment 3 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning

2: Fixed stopper

3: Forward cycle

4: Reverse cycle

5: Waiting

6: Switching

7: Setting O

8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.05 **Segment 4 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning

2: Fixed stopper

3: Forward cycle

4: Reverse cycle

5: Waiting

6: Switching

7: Setting O

8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.06 **Segment 5 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.07 **Segment 6 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.08 **Segment 7 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.09 **Segment 8 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:
1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description
Selects the task type for the program segment.

H27.10 **Segment 9 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:
1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description
Selects the task type for the program segment.

H27.11 **Segment 10 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.12 **Segment 11 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.13 **Segment 12 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.14 **Segment 13 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning

2: Fixed stopper

3: Forward cycle

4: Reverse cycle

5: Waiting

6: Switching

7: Setting O

8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.15 **Segment 14 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning

2: Fixed stopper

3: Forward cycle

4: Reverse cycle

5: Waiting

6: Switching

7: Setting O

8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.16 **Segment 15 task**

Comm. address:	-	Effective mode:	At stop
Min. value:	1	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:

1: Positioning
2: Fixed stopper
3: Forward cycle
4: Reverse cycle
5: Waiting
6: Switching
7: Setting O
8: Resetting O

Parameter description

Selects the task type for the program segment.

H27.17 **Position of block 0**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.19 **Position of block 1**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.21 **Position of block 2**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.23 **Position of block 3**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU

Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.25 **Position of block 4**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.27 **Position of block 5**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.29 **Position of block 6**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.31 **Position of block 7**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.33 **Position of block 8**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.35 **Position of block 9**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.37 **Position of block 10**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.39 **Position of block 11**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.41 **Position of block 12**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.43 **Position of block 13**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.45 **Position of block 14**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.47 **Position of block 15**

Address:	-	Effective mode:	At stop
Min.:	-2147483648	Unit:	LU
Max.:	2147483647	Data type:	Int32
Default:	0	Change mode:	Real-time

Range:

-2147483648 LU to 2147483647 LU

Parameter description

Sets the position for program segment positioning or fixed stopper task.

H27.49 **Block 0 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.

Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.51 **Block 1 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.53 **Block 2 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.55 **Block 3 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.57 **Block 4 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.59 **Block 5 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.61 **Block 6 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.63 **Block 7 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.65 **Block 8 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.67 **Block 9 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.69 **Block 10 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.71 **Block 11 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.73 **Block 12 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.75 **Block 13 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.

Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.77 **Block 14 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.79 **Block 15 speed**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	600	Change mode:	Real-time

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the speed for program segment positioning, loop, and fixed stopper task.

H27.81 **Block 0 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.82 **Block 1 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.83 **Block 2 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.84 **Block 3 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.85 **Block 4 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.86 **Block 5 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.87 **Block 6 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.88 **Block 7 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.89 **Block 8 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.90 **Block 9 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.91 **Block 10 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%

Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.92 **Block 11 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.93 **Block 12 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.94 **Block 13 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.95 **Block 14 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

H27.96 **Block 15 acceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the acceleration multiplier for program segment positioning, loop, and fixed stopper task.

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H28.00 **Block 0 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.01 **Block 1 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.02 **Block 2 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.03 **Block 3 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.04 **Block 4 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.05 **Block 5 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.06 **Block 6 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.07 **Block 7 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.08 **Block 8 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.09 **Block 9 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.10 **Block 10 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.11 **Block 11 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%

Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.12 **Block 12 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.13 **Block 13 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.14 **Block 14 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.15 **Block 15 deceleration multiplier**

Address:	-	Effective mode:	At stop
Min.:	1.00	Unit:	%
Max.:	100.00	Data type:	UInt16
Default:	100.00	Change mode:	Real-time

Range:

1.00 % to 100.00%

Parameter description

Sets the deceleration multiplier for program segment positioning, loop, and fixed stopper task.

H28.16 **Task mode of block 0**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 0.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.17 **Task mode of block 1**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 1.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.18 **Task mode of block 2**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 2.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.19 **Task mode of block 3**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 3.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.20 **Task mode of block 4**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 4.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.21 **Task mode of block 5**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 5.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.22 **Task mode of block 6**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 6.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.23 **Task mode of block 7**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 7.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.24 **Task mode of block 8**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 8.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.25 **Task mode of block 9**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 9.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.26 **Task mode of block 10**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 10.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.27 **Task mode of block 11**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 11.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.28 **Task mode of block 12**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 12.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)
1: CONTINUE_WITH_STOP (intermittent execution)
2: CONTINUE_ON_THE_FLY (continuous execution)
3: CONTINUE_EXTERNAL (continue external execution)
4: CONTINUE_EXTERNAL_WAIT (continue external waiting)
5: CONTINUE_EXTERNAL_ALARM (continue external alarm)
bit8 to bit11: Positioning mode
0: Absolute positioning
1: Relative positioning

H28.29 **Task mode of block 13**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0: Absolute positioning + end
1: Absolute positioning + end + hide indicator
16: Absolute positioning + intermittent execution
17: Absolute positioning + intermittent execution + hide indicator
32: Absolute positioning + continuous execution
33: Absolute positioning + continuous execution + hide indicator
48: Absolute positioning + continue external execution
49: Absolute positioning + continue external execution + hide indicator
64: Absolute positioning + continue external waiting
65: Absolute positioning + continue external waiting + hide indicator
80: Absolute positioning + continue external alarm
81: Absolute positioning + continue external alarm + hide indicator
256: Relative positioning + end
257: Relative positioning + end + hide indicator
272: Relative positioning + intermittent execution
273: Relative positioning + intermittent execution + hide indicator
288: Relative positioning + continuous execution
289: Relative positioning + continuous execution + hide indicator
304: Relative positioning + continue external execution
305: Relative positioning + continue external execution + hide indicator
320: Relative positioning + continue external waiting
321: Relative positioning + continue external waiting + hide indicator
336: Relative positioning + continue external alarm
337: Relative positioning + Continue external alarm + Hide identifier
Parameter description
Sets the task mode for segment 13.
bit0: Task identifier
0: Execute task
1: Hide task
bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.30 **Task mode of block 14**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 14.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode

0: Absolute positioning

1: Relative positioning

H28.31 **Task mode of block 15**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:

0: Absolute positioning + end

1: Absolute positioning + end + hide indicator

16: Absolute positioning + intermittent execution

17: Absolute positioning + intermittent execution + hide indicator

32: Absolute positioning + continuous execution

33: Absolute positioning + continuous execution + hide indicator

48: Absolute positioning + continue external execution

49: Absolute positioning + continue external execution + hide indicator

64: Absolute positioning + continue external waiting

65: Absolute positioning + continue external waiting + hide indicator

80: Absolute positioning + continue external alarm

81: Absolute positioning + continue external alarm + hide indicator

256: Relative positioning + end

257: Relative positioning + end + hide indicator

272: Relative positioning + intermittent execution

273: Relative positioning + intermittent execution + hide indicator

288: Relative positioning + continuous execution

289: Relative positioning + continuous execution + hide indicator

304: Relative positioning + continue external execution

305: Relative positioning + continue external execution + hide indicator

320: Relative positioning + continue external waiting

321: Relative positioning + continue external waiting + hide indicator

336: Relative positioning + continue external alarm

337: Relative positioning + Continue external alarm + Hide identifier

Parameter description

Sets the task mode for segment 15.

bit0: Task identifier

0: Execute task

1: Hide task

bit4 to bit7: Subsequent condition

0: END (End)

1: CONTINUE_WITH_STOP (intermittent execution)

2: CONTINUE_ON_THE_FLY (continuous execution)

3: CONTINUE_EXTERNAL (continue external execution)

4: CONTINUE_EXTERNAL_WAIT (continue external waiting)

5: CONTINUE_EXTERNAL_ALARM (continue external alarm)

bit8 to bit11: Positioning mode
0: Absolute positioning

1: Relative positioning

H28.32 **Segment 0 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.34 **Segment 1 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.36 **Segment 2 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.38 **Segment 3 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.40 **Segment 4 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.42 **Segment 5 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:

0 to 2147483647

Parameter description

Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.44 **Segment 6 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:

0 to 2147483647

Parameter description

Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.46 **Segment 7 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:

0 to 2147483647

Parameter description

Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.48 **Segment 8 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:

0 to 2147483647

Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.50 **Segment 9 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.52 **Segment 10 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.54 **Segment 11 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description

Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.56 **Segment 12 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.58 **Segment 13 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.60 **Segment 14 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).

Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.62 **Segment 15 task parameter**

Comms. address:	-	Effective mode:	At stop
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Real time

Value range:
0 to 2147483647
Parameter description
Sets the torque limit for the program segment fixed stopper task (0.01 N·m).
Defines the waiting time for the program block waiting task (ms).
Defines the target block number for the program block jump task.
Operation bit setting value (0-3) for the program segment set or reset O task:
Setting bit0 to 1: Output signal 1, EPOS_ZSW2.bit10.
Setting bit1 to 1: Output signal 2, EPOS_ZSW2.bit11.

H28.64 **Fixed stopper monitoring window**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	LU
Max.:	4294967295	Data type:	UInt32
Default:	100	Change mode:	Real-time

Range:
0 LU to 4294967295 LU
Parameter description
After the program segment fixed stopper task arrives, monitor whether the motor rotation position exceeds the set value of this parameter. If yes, E550.9 is reported.

H28.66 **Max. following error of fixed stop**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	LU
Max.:	4294967295	Data type:	UInt32
Default:	1000	Change mode:	Real-time

Range:
0 LU to 4294967295 LU
Parameter description
Sets the threshold of the position deviation for the program segment fixed stop task.

H28.68 **External trigger source**

Address:	-	Effective mode:	At stop
Min.:	0	Unit:	-

Max.:	1	Data type:	UInt16
Default:	0	Change mode:	At stop

Range:

0: Triggered by STW1.bit13

1: Triggered by DI

Parameter description

Sets the source for switching the external signal of the program segment task.

15.21 H29 PN Message Value

H29.00 **Control word 1 (STW1)**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:

bit0: 1: Pulse enabling allowed; 0: OFF1 ramp to stop, pulse cleared, and ready to switch on

bit1: 1: Without OFF2 (pulse enabling allowed); 0: OFF2 Coast to stop, pulse cleared immediately, and switch-on prohibited

bit2: 1: Without OFF3 (pulse enabling allowed); 0: OFF3 rapid stop, P1135 brake, pulse cleared, and switch-on prohibited

bit3: 1: Enabling allowed; 0: Running prohibited (pulse cleared)

bit4: 1: Ramp function generator available; 0: Ramp function generator prohibited

bit5: 1: Ramp function generator continued; 0: Ramp function generator output frozen

bit6: 1: Setpoint enabled; 0 = Setpoint prohibited (ramp function generator input being 0)

bit7: Valid at the rising edge, response fault

bit8: JOG1

bit9: JOG2

bit10: 1: Controlled via PLC

bit11: Reserved

bit12: Reserved

bit13: Reserved

bit14: Reserved

bit15: Reserved

Parameter description

Sets the real-time value of control word 1 (STW1).

H29.01 **Control word 2 (STW2)**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:

0x0 to 0xFFFF

Parameter description

Sets the real-time value of control word 2 (STW2).

H29.02 **Speed reference A (VELNSOLLA)**

Comm. address:	-	Effective mode:	-
Min. value:	-32768	Unit:	-
Max. value:	32767	Data type:	Int16
Default value:	0	Change mode:	Read-only

Value range:

-32768 to +32767

Description

Sets the real-time value of speed setpoint A (VEL_NSOLL_A). 0x4000 corresponds to the rated speed.

H29.04 **Speed reference B (VELNSOLLB)**

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFFFFFF	Data type:	UInt32
Default value:	0x0	Change mode:	Read-only

Value range:

0x0 to 0xFFFFFFFF

Parameter description

Sets the real-time value of speed setpoint B (VEL_NSOLL_B). 0x40000000 corresponds to the rated speed.

H29.06 **Encoder control word (G1STW)**

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Read-only

Value range:

Bit0: bit7 = 0, searching for reference point 1; bit7 = 1, measure pointer 1
bit1: bit7 = 0, searching for reference point 2; bit7 = 1, measure pointer 2
bit2: bit7 = 0, searching for reference point 3; bit7 = 1, measure pointer 3
bit3: bit7 = 0, searching for reference point 4; bit7 = 1, measure pointer 4
bit4: bit4-bit6; 000b = Not activated; 001b = Selected functions activated; 010b = Read value; 011b = Cancel operation
bit5: bit4-bit6; 000b = Not activated; 001b = Selected functions activated; 010b = Read value; 011b = Cancel operation
bit6: bit4-bit6; 000b = Not activated; 001b = Selected functions activated; 010b = Read value; 011b = Cancel operation
bit7: Mode selection; 1 = Real-time measurement; 0 = Searching for the reference point
bit8: Reserved
bit9: Reserved
bit10: Reserved
bit11: Zero setting mode; 0 = Absolute position; 1 = Relative position
bit12: Rising edge-triggered; Request for setting the zero bit
bit13: Rising edge-triggered; Request for cyclic transmission of absolute position in G1_XIST2
bit14: Parking encoder
bit15: Rising-edge triggered; Response encoder gripper fault

Description

Sets the real-time value of encoder control word (G1_STW).

H29.07 **Position deviation (XERR)**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFFFFFF	Data type:	UInt32
Default:	0x0	Change mode:	Read only

Range:

0x0 to 0xFFFFFFFF

Parameter description

Sets the real-time value of position deviation (XERR).

H29.09 **Position loop gain (KPC)**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFFFFFF	Data type:	UInt32
Default:	0x0	Change mode:	Read only

Range:

0x0 to 0xFFFFFFFF

Parameter description

Sets the real-time value of position loop gain (KPC).

H29.11 **Position control word 1 (POSSTW1)**

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-

Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Read-only

Value range:

bit0: bit0-bit5 block selection; supports up to 16 blocks

bit1: bit0-bit5 block selection; supports up to 16 blocks

bit2: bit0-bit5 block selection; supports up to 16 blocks

bit3: bit0-bit5 block selection; supports up to 16 blocks

bit4: bit0-bit5 block selection; supports up to 16 blocks

bit5: bit0-bit5 block selection; supports up to 16 blocks

bit6: Reserved

bit7: Reserved

bit8: 1 = Absolute positioning 0 = Relative positioning

bit9: 1 = Forward

bit10: 1 = Reverse

bit11: Reserved

bit12: 1 = Continuous transmission 0 = MDI block modification activated by running the rising edge of the program segment (STW1.6)

bit13: Reserved

bit14: 1 = Setting signal selected; 0 = Positioning signal selected

bit15: 1= MDI sub-mode; 0 = Program segment sub-mode

Description

Sets the real-time value of position control word 1 (POS_STW1).

H29.12 MDI position setting (EPOS)

Address:	-	Effective mode:	-
Min.:	0	Unit:	LU
Max.:	4294967295	Data type:	UInt32
Default:	0	Change mode:	Read only

Range:

0 LU to 4294967295 LU

Parameter description

Sets the real-time value of MDI position setting (EPOS).

H29.14 MDI speed setting (EPOS)

Address:	-	Effective mode:	-
Min.:	0	Unit:	1000 LU/min.
Max.:	4294967295	Data type:	UInt32
Default:	0	Change mode:	Read only

Range:

0 LU/min. to 4294967295 LU/min.

Parameter description

Sets the real-time value of MDI speed setting (EPOS).

H29.16 **MDI acceleration multiplier (EPOS)**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

0 to 65535

Parameter description

Sets the real-time value of MDI acceleration multiplier (EPOS). 0x4000 corresponds to 100%.

H29.17 **MDI deceleration multiplier (EPOS)**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

0 to 65535

Parameter description

Sets the real-time value of MDI deceleration multiplier (EPOS). 0x4000 corresponds to 100%.

H29.18 **MDI mode (EPOS)**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

bit0: 1: Absolute positioning; 0: Relative positioning

bit1: 1: Positive direction

bit2: 1: Negative direction

bit3: Reserved

bit4: Reserved

bit5: Reserved

bit6: Reserved

bit7: Reserved

bit8: Reserved

bit9: Reserved

bit10: Reserved

bit11: Reserved

bit12: Reserved

bit13: Reserved

bit14: Reserved

bit15: Reserved

Parameter description

Sets the real-time value for MDI mode (EPOS).

H29.19 **Position control word 2 (POSSTW2)**

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Read-only

Value range:

bit0: 1 = Tracking mode activated

bit1: 1 = Set reference point

bit2: 1 = Reference point stopper activated

bit3: Reserved

bit4: Reserved

bit5: 1 = JOG incremental positioning activated; 0 = Speed activated

bit6: Reserved

bit7: Reserved

bit8: Reserved

bit9: 1 = Searching for the reference point in the reverse direction; 0 = Start searching for the reference point in the forward direction

bit10: Reserved

bit11: Reserved

bit12: Reserved

bit13: Reserved

bit14: 1 = Software limit switch activated

bit15: 1 = Stopper activated

Description

Sets the real-time value of position control word 2 (POS_STW2).

H29.20 **Position velocity multiplier (EPOS)**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:

0x0 to 0xFFFF

Parameter description

Sets the real-time value of position velocity multiplier (EPOS). 0x4000 corresponds to 100%.

H29.21 **Customized receiving word in telegram 111**

Address:	-	Effective mode:	-
Min.:	0x0	Unit:	-
Max.:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	Read only

Range:

0x0 to 0xFFFF

Parameter description
Sets the real-time value of customized receiving word in telegram 111.

H29.22 **Torque reduction (MOMRED)**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Sets the real-time value of torque reduction (MOMRED). 0x4000 corresponds to the ratio of the maximum motor torque to the rated torque.

H29.23 **Torque reference (AdditiveTorque)**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Sets the real-time value of torque reference (AdditiveTorque). 0x4000 corresponds to the ratio of the maximum motor torque to the rated torque.

H29.24 **Torque upper limit**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Sets the real-time value of the torque upper limit. 0x4000 corresponds to the ratio of the maximum motor torque to the rated torque.

H29.25 **Torque lower limit**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535

Parameter description

Sets the real-time value of the torque lower limit. 0x4000 corresponds to the ratio of the maximum motor torque to the rated torque.

H29.26 Customized receiving word in additional telegram 850

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

0 to 65535

Parameter description

Sets the real-time value of customized receiving word in additional telegram 850.

H29.27 Message word (MELDW)

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

0 to 65535

Parameter description

Sets the real-time value of the message word (MELDW).

H29.50 Status word 1 (ZSW1)

Comms. address:	-	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Read-only

Value range:

bit0: 1 = Ready to switch on, control circuit switched on, initialization done

bit1: 1 = Ready to run, main circuit switched on

bit2: 1 = Run enable

bit3: 1 = Fault

bit4: 1 = Coast to stop deactivated (OFF2 deactivated) 0 = Cost to stop activated (OFF2 activated)

bit5: 1 = Quick stop deactivated (OFF2 deactivated) 0 = Quick stop activated (OFF2 activated)

bit6: 1 = Switch-on inhibited

bit7: 1 = Warning existed

bit8: Reserved

bit9: 1 = PLC control request

bit10: Reserved

bit11: Reserved

bit12: Reserved

bit13: Reserved

bit14: Reserved

bit15: Reserved

Parameter description

Defines the real-time value of status word 1 (ZSW1).

H29.51 **Status word 2 (ZSW2)**

Comm. address:	-	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Read-only

Value range:

bit0: Reserved

bit1: Reserved

bit2: Reserved

bit3: Reserved

bit4: Reserved

bit5: Reserved

bit6: Reserved

bit7: Reserved

bit8: Reserved

bit9: Reserved

bit10: Reserved

bit11: Reserved

bit12: bit12-bit15 drive heartbeat count value, uploaded to PLC

bit13: bit12-bit15 drive heartbeat count value, uploaded to PLC

bit14: bit12-bit15 drive heartbeat count value, uploaded to PLC

bit15: bit12-bit15 drive heartbeat count value, uploaded to PLC

Parameter description

Sets the real-time value of status word 2 (ZSW2).

H29.52 **Speed actual value A (VELNISTA)**

Comm. address:	-	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Read-only

Value range:
0 to 65535
Description
Sets the real-time value of the actual speed A (VEL_NIST_A). 0x4000 corresponds to the rated speed.

H29.53 **Speed actual B (VELNISTB)**

Comm. address:	-	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	4294967295	Data type:	UInt32
Default value:	0	Change mode:	Read-only

Value range:
0 to 4294967295
Parameter description
Sets the real-time value of the actual speed B (VEL_NIST_B). 0x40000000 corresponds to the rated speed.

H29.55 **Encoder status word (G1ZSW)**

Comm. address:	-	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Read-only

Value range:
bit0: 1 = Function 1 activated
bit1: 1 = Function 2 activated
bit2: 1 = Function 3 activated
bit3: 1 = Function 4 activated
bit4: 1 = Actual value 1 readable
bit5: 1 = Actual value 2 readable
bit6: 1 = Actual value 3 readable
bit7: 1 = Actual value 4 readable
bit8: Touch probe 1
bit9:Touch probe 2
bit10: Reserved
bit11: Response encoder fault
bit12: Set zero response
bit13: Cyclic transmission of the absolute position in G1_XIST2
bit14: Parking encoder activated
bit15: encoder fault

Description
Sets the real-time value of encoder status word (G1_ZSW).

H29.56 **Encoder 1 position actual value 1 (G1XIST1)**

Comm. address:	-	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	4294967295	Data type:	UInt32
Default value:	0	Change mode:	Read-only

Value range:
0 to 4294967295
Parameter description
Sets the real-time position actual value 1 of encoder 1 (G1_XIST1).

H29.58 **Encoder 1 position actual value 2 (G1XIST2)**

Comm. address:	-	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	4294967295	Data type:	UInt32
Default value:	0	Change mode:	Read-only

Value range:
0 to 4294967295
Parameter description
Sets the real-time position actual value 2 of encoder 1 (G1_XIST2).

H29.60 **Position status word 1 (POSZSW1)**

Comm. address:	-	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Read-only

Value range:
bit0: bit0-bit5: active program block; up to 16 blocks supported
bit1: bit0-bit5: active program block; up to 16 blocks supported
bit2: bit0-bit5 active program block; up to 16 blocks supported
bit3: bit0-bit5 active program block; up to 16 blocks supported
bit4: bit0-bit5 active program block; up to 16 blocks supported
bit5: bit0-bit5 active program block; up to 16 blocks supported
bit6: Reserved
bit7: Reserved
bit8: 1 = Reverse stopper activated
bit9: 1 = Forward stopper activated
bit10: 1 = JOG activated
bit11: 1 = Active homing activated
bit12: Reserved
bit13: 1: Traversing block active
bit14: 1: Setting active
bit15: 1 = MDI activated; 0 = MDI deactivated

Description
Sets the real-time value of position status word 1 (POS_ZSW1).

H29.61 **Position status word 2 (POSZSW2)**

Comm. address:	-	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Read-only

Value range:
bit0: 1 = Tracking mode activated
bit1: 1 = Speed limit activated
bit2: 1 = Setpoint available
bit3: Reserved
bit4: 1 = Axis moving forwardly
bit5: 1 = Axis moving reversely
bit6: 1 = Negative limit switch reached
bit7: 1 = Positive limit switch reached
bit8: 1 = Position actual value < = Limit switch position 1
bit9: 1 = Position actual value < = limit switch position 2
bit10: 1 = Direct output 1 through running block setting
bit11: 1 = Direct output 2 through running block setting
bit12: 1 = Fixed stop point reached
bit13: 1 = Fixed stop point fastening torque reached
bit14: 1 = Running to the fixed stop point activated
bit15: 1 = Running command effective
Description
Sets the real-time value of position status word 2 (POS_ZSW2).

H29.63 **Customized transmission word in telegram 111**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Sets the real-time value of customized transmission word in telegram 111.

H29.65 **Fault code**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

0 to 65535

Parameter description

Sets the real-time value of the fault code (FaultCode).

H29.66 **Warning code**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

0 to 65535

Parameter description

Sets the real-time value of the warning code (WarnCode).

H29.67 **Actual torque**

Address:	-	Effective mode:	-
Min.:	-32768	Unit:	-
Max.:	32767	Data type:	Signed 16-bit
Default:	0	Change mode:	Read only

Range:

-32768 to 32767

Parameter description

Sets the real-time value of the actual torque (ActualTorque). 0x4000 corresponds to the ratio of the maximum motor torque to the rated torque.

H29.68 **User-defined transmission word in additional telegram 850**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:

0 to 65535

Parameter description

Sets the real-time value of customized transmission word in additional telegram 850.

H29.69 **XIST_A position feedback**

Comm. address:	-	Effective mode:	-
Min. value:	-2147483648	Unit:	-
Max. value:	2147483647	Data type:	Int32
Default value:	0	Change mode:	Read-only

Value range:

-2147483648 to 2147483647

Parameter description

Sets the real-time value of XIST_A position feedback. This parameter corresponds to H0b.07.

H29.90 **Modulo axis modulus**

Comm. address:	-	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	2147483647	Data type:	UInt32
Default value:	0	Change mode:	Read-only

Value range:
0 to 2147483647
Parameter description
Sets the real-time effective value of AC3 modulo axis modulus (user unit).

15.22 H30 Variables Read Through Communication

H30.00 **Servo state read through communication**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
Displays the current operating state of the drive, which is used for interaction with the software tool.

H30.01 **DO function state 1 read via communication**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
bit0 corresponds to DO function 1.
bit1 corresponds to DO function 2.
bit2 corresponds to DO function 3.
…
By analogy

H30.02 **DO function state 2 read via communication**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
bit0 corresponds to DO function 17.
bit1 corresponds to DO function 18.
bit2 corresponds to DO function 19.
…
By analogy

H30.04 **DI function active state read through communication**

Address:	-	Effective mode:	-
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Read only

Range:
0 to 65535
Parameter description
DI function active state read through communication

H30.20 **bit0 and bit1 of servo drive SN**

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Read-only

Value range:
0x0 to 0xFFFF
Parameter description
H30.20 to H30.27 indicate the 16-bit SN of the servo drive, which is displayed in the form of ASCII codes.

H30.21 **bit2 and bit3 of servo drive SN**

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Read-only

Value range:
0x0 to 0xFFFF
Parameter description
H30.20 to H30.27 indicate the 16-bit SN of the servo drive, which is displayed in the form of ASCII codes.

H30.22 **bit4 and bit5 of servo drive SN**

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16

Default value:	0x0	Change mode:	Read-only

Value range:
0x0 to 0xFFFF
Parameter description
H30.20 to H30.27 indicate the 16-bit SN of the servo drive, which is displayed in the form of ASCII codes.

H30.23 bit6 and bit7 of servo drive SN

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Read-only

Value range:
0x0 to 0xFFFF
Parameter description
H30.20 to H30.27 indicate the 16-bit SN of the servo drive, which is displayed in the form of ASCII codes.

H30.24 bit8 and bit9 of servo drive SN

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Read-only

Value range:
0x0 to 0xFFFF
Parameter description
H30.20 to H30.27 indicate the 16-bit SN of the servo drive, which is displayed in the form of ASCII codes.

H30.25 bit10 and bit11 of servo drive SN

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Read-only

Value range:
0x0 to 0xFFFF
Parameter description
H30.20 to H30.27 indicate the 16-bit SN of the servo drive, which is displayed in the form of ASCII codes.

H30.26 bit12 and bit13 of servo drive SN

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16

Default value:	0x0	Change mode:	Read-only

Value range:
0x0 to 0xFFFF
Parameter description
H30.20 to H30.27 indicate the 16-bit SN of the servo drive, which is displayed in the form of ASCII codes.

H30.27 **bit14 and bit15 of servo drive SN**

Comm. address:	-	Effective mode:	-
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Read-only

Value range:
0x0 to 0xFFFF
Parameter description
H30.20 to H30.27 indicate the 16-bit SN of the servo drive, which is displayed in the form of ASCII codes.

15.23 H31 References Set Through Communication

H31.00 **VDI virtual level set via communication**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 65535
Parameter description
When H17.90 is set to 1, the VDI state is defined by this parameter.
The VDI logic is determined by H17.91 (Default VDI virtual level value upon power-on) upon initial power-on. Thereafter, the VDI logic is determined by H31.00.
"bit(n) = 1" of H31.00 indicates the logic of VDI (n+1) is "1". "bit(n)=0" indicates the logic of VDI (n +1) is "0".

H31.04 **DO state set via communication**

Address:	-	Effective mode:	Effective in real time
Min.:	0	Unit:	-
Max.:	65535	Data type:	UInt16
Default:	0	Change mode:	Real-time

Range:
0 to 65535
Parameter description
Set H04.22 to define H31.04 as the source of DO state.

H31.09 **Speed reference set through communication**

Comm. address:	-	Effective mode:	Real time
Min. value:	-10000.000	Unit:	RPM
Max. value:	10000.000	Data type:	Int32
Default value:	0.000	Change mode:	Real time

Value range:

-10000.000 to +10000.000

Parameter description

Set H06.02 to 4 to define H31.09 as the source of the speed reference in speed control mode (unit: RPM).

H31.11 **Torque reference set through communication**

Address:	-	Effective mode:	Effective in real time
Min.:	-100.000	Unit:	%
Max.:	100.000	Data type:	Int32
Default:	0.000	Change mode:	Real-time

Range:

-100.000 % to 100.000%

Parameter description

Set H07.02 to 4 to define the torque reference in the torque control mode through this parameter (unit: 0.001%). The setpoint 100.000% corresponds to the rated torque of the motor.

16 Troubleshooting

16.1 Fault and warning levels

Fault and warning levels

Faults and alarms of the servo drive are classified into three levels in descending order of severity: class 1 fault, class 2 fault, and class 3 alarm. Class 1 faults are further divided into non-resettable and resettable faults. See the following table for details.

- Class 1 (No.1) non-resettable fault
- Class 1 (No. 1) resettable fault
- Class 2 (No. 2) resettable fault
- Class 3 (No. 3) resettable alarm

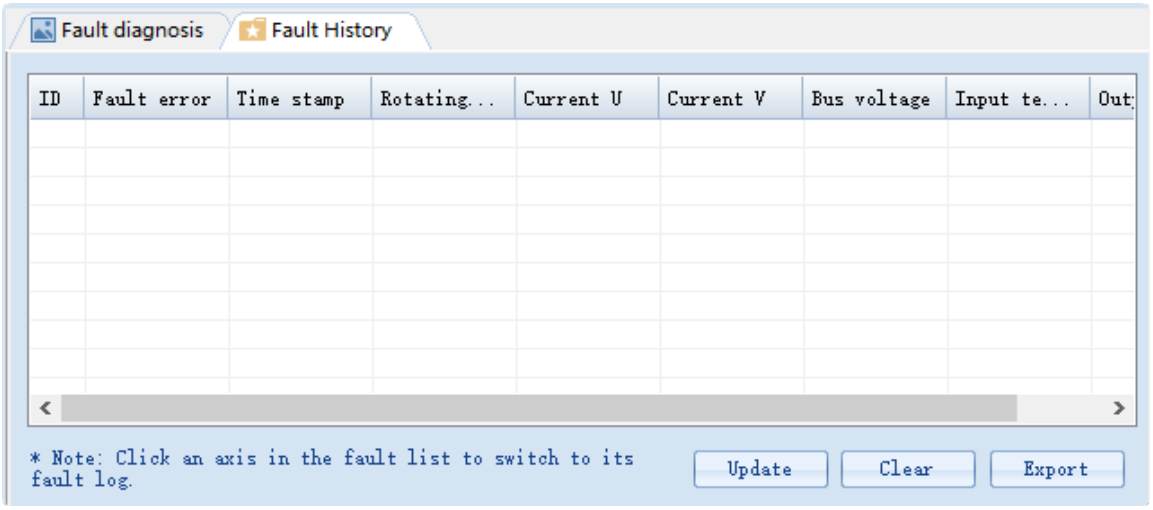
Note

"Resettable" means the keypad stops displaying the fault/alarm once a "Reset signal" is input.

Fault and warning records

The servo drive can record the latest 20 faults and warnings and values of status parameters upon fault/warning. Repeated faults or warnings among the latest 5 logs are logged as one fault or warning, and the servo drive status upon its occurrence is logged only once.

After a fault or warning is reset, the servo drive still keeps the log of the fault or warning. To remove the fault/alarm record from the fault log, set H02.31 to 2. See the following figure for details.



Read the value of H0b.34 through InoDrivershop to get the fault/alarm name. See examples in the following table.

H0b.34 (Hexadecimal)	Description of H0b.34 (hexadecimal)
0101	0: fault subcode 101: fault code

16.2 Reset After Troubleshooting

You can set H0d.01 to 1 (Fault reset) to stop the keypad from displaying the fault. Procedure:

- To reset No. 1 and No. 2 faults, switch off the S-ON signal first, and then set H0d.01 to 1.
- To reset No.3 alarms, set H0d.01 to 1.

☆ Related parameters:

Parameter	Name	Value range	Unit	Default setting	Setting mode	Effective time	Related modes
H0d.01	Fault reset	0: Inactive 1: Active	-	0	At stop	Real time	-

Caution

When a resettable fault occurs, reset the fault as instructed. Failure to comply may result in sudden startup of the motor, leading to personal injury.

Note

- Some faults and alarms can be reset only after the fault causes are rectified by modifying the settings. The fault can be reset only after the fault causes are rectified.
- For modifications that can be activated only at next power-on. Power off and on the drive again.
- For modifications that can be activated only after stop, switch off the S-ON signal. The drive can operate normally after the modification is activated.

16.3 List of Alarm Codes

Table 16–1 List of alarm codes

Fault code	Fault name	Fault level	Resettable
E108.0	Storage parameter write error	3	Yes
E108.1	Storage parameter read error	3	Yes
E108.2	Verification error on the data written to EEPROM	3	Yes
E108.3	Verification error on data read from EEPROM	3	Yes
E108.4	A single piece of data is stored too many times	3	Yes
E120.3	Drive and motor power not match	3	Yes
E121.0	Invalid S-ON command	3	Yes
E122.0	Multi-turn absolute encoder setting error	3	Yes
E550.2	External switchover waiting alarm	3	Yes
E600.0	Inertia auto-tuning failure	3	Yes
E601.0	Homing alarm	3	Yes
E601.1	Homing switch error	3	Yes
E601.2	Homing mode setting error	3	Yes
E730.0	Encoder battery alarm	3	Yes

Fault code	Fault name	Fault level	Resettable
E900.0	DI emergency braking	3	Yes
E902.0	Invalid DI/VDI setting	3	Yes
E902.1	Invalid DO/VDO setting	3	Yes
E902.2	Invalid torque arrival setting	3	Yes
E908.0	Model ID checksum failure	3	Yes
E909.0	Motor overload alarm	3	Yes
E910.0	Control circuit overvoltage	3	Yes
E920.0	Braking resistor overloaded	3	Yes
E921.0	Dynamic braking resistor overload alarm	3	Yes
E922.0	Excessively low resistance of the external braking resistor	3	Yes
E924.0	Braking transistor over-temperature	3	Yes
E941.0	Modified parameters activated at next power-on	3	No
E942.0	Parameter stored too frequently	3	Yes
E950.0	Forward overtravel	3	Yes
E950.1	The target position exceeds the positive software limit threshold.	3	Yes
E952.0	Reverse overtravel	3	Yes
E952.1	Target position lower than the negative software limit threshold	3	Yes
E980.0	Encoder algorithm error	3	Yes

16.4 List of Fault Codes

Table 16–2 List of Faults

Fault code	Fault Name	Fault level	Resettable
E101.0	Abnormal parameters in groups H02 and above	1	No
E101.1	Parameter error in group H00/H01	1	No
E101.2	Address error in read/write operation after the number of parameters changes	1	No
E102.0	FPGA communication establishment error	1	No
E102.8	Software versions of MCU and FPGA not match	1	No
E104.1	MCU operation timeout (MCU crashed)	1	No
E104.2	FPGA operation timeout (FPGA break down)	1	No
E104.4	MCU reference update timeout	1	No
E120.0	Unknown encoder model	1	No
E120.1	Unknown motor model	1	No
E120.2	Unknown drive model	1	No
E120.5	Motor and drive current matching error	1	No

Fault code	Fault Name	Fault level	Resettable
E120.6	FPGA and motor model mismatch	1	No
E120.7	Model parameter check error	1	No
E120.8	Junction temperature parameter check error	1	No
E122.1	DI function allocation fault	2	Yes
E122.3	Upper limit in rotation mode too large	2	Yes
E122.4	VDI function assignment error	2	Yes
E122.5	DI and VDI assigned with the same function	2	Yes
E122.8	Small lower limit of the rotation mode	2	Yes
E122.9	Modal axes and rotation modes prohibited	2	Yes
E136.0	Parameter check error in the encoder ROM	1	No
E136.1	Parameter reading error in the encoder ROM	1	No
E140.0	Encryption chip check error	1	Yes
E150.0	STO entering safety state	1	Yes
E150.1	STO input status exception	1	Yes
E150.2	Buffer 5 V voltage detection error	1	Yes
E150.3	STO input circuit hardware diagnosis failure	1	Yes
E150.4	PWM buffer hardware diagnosis failure	1	Yes
E201.0	Phase P overcurrent	1	No
E201.1	Phase U overcurrent	1	No
E201.2	Phase V overcurrent	1	No
E201.4	Phase N overcurrent	1	No
E208.2	Encoder communication timeout	1	Yes
E208.4	FPGA current loop operation timeout	1	Yes
E210.0	Output short-circuited to ground	1	No
E234.0	Runaway	1	No
E320.0	Braking resistor overload	1	Yes
E321.0	Dynamic braking resistor overload fault	1	Yes
E400.0	Main circuit power overvoltage	1	Yes
E410.0	Main circuit undervoltage	1	Yes
E410.1	Main circuit powered off	2	Yes
E420.0	Main circuit phase loss	2	Yes
E430.0	Control power supply undervoltage	2	Yes
E500.0	Motor overspeed	1	Yes
E500.1	Speed feedback overflow	1	Yes
E500.2	FPGA position feedback pulse overspeed	1	Yes
E550.0	Initial operation block number not exist	2	Yes
E550.1	Relative/absolute attribute of positioning or fixed stopper commands set improperly	2	Yes
E550.3	The task switchover condition is set improperly.	2	Yes

Fault code	Fault Name	Fault level	Resettable
E550.7	Wrong task type	2	Yes
E550.8	Fixed stopper point not found	2	Yes
E550.9	Fixed stopper beyond the window	2	Yes
E551.1	Program block stop exception	2	Yes
E551.3	Jump block not exist	2	Yes
E551.4	Continuous position reference not supported in relative positioning.	2	Yes
E551.5	Improper setting of H25.06 for task cancellation	2	Yes
E602.0	Angle auto-tuning failure	1	Yes
E602.2	U/V/W phase sequence reversed	1	Yes
E605.0	Speed too fast upon S-ON	1	Yes
E620.0	Motor overload	1	Yes
E625.0	Brake release error	1	Yes
E626.0	Brake apply error	1	Yes
E630.0	Motor stall over-temperature protection	1	Yes
E640.0	High inverter IGBT junction temperature	1	Yes
E640.1	Flywheel diode junction temperature too high	1	Yes
E650.0	Heatsink overtemperature	1	Yes
E660.0	The motor temperature is too high.	1	Yes
E661.0	STune failure	2	Yes
E662.0	ETune failure	2	Yes
E663.0	ITune failure	2	Yes
E664.0	Excessive resonance	2	Yes
E731.0	Encoder battery failure	2	Yes
E733.0	The encoder multi-turn counting is incorrect.	2	Yes
E735.0	Encoder multi-turn counting overflow	2	Yes
E740.0	Absolute encoder communication timeout	1	No
E740.2	Absolute encoder fault	1	No
E740.3	Absolute encoder single-turn calculation error	1	No
E740.6	Encoder write fault	1	No
E760.0	Encoder overheat	2	Yes
E939.0	Motor power cable disconnected	1	Yes
E939.1	U phase power cable disconnection	1	Yes
E939.2	V phase power cable disconnection	1	Yes
E939.3	W phase power cable disconnection	1	Yes
EA33.0	Encoder read/write check error	1	No
EB00.0	Excessive position deviation	1	Yes
EB00.1	Position deviation overflow	2	Yes
EB03.0	Electronic gear ratio beyond the limit - H05.02	2	Yes

Fault code	Fault Name	Fault level	Resettable
EB03.1	Electronic gear ratio beyond the limit - Electronic gear ratio 1	2	Yes
EE01.0	PN parameter error	2	Yes
EE03.0	Communication timeout	2	Yes
EE03.1	Communication status abnormal	2	Yes
EE08.0	PLC sync loss	2	Yes
EE08.1	PLC stopped	2	Yes
EE08.7	Heartbeat error	2	Yes
EE08.8	No network connection during synchronous communication	2	Yes
EE08.9	LAN cable disconnected	2	Yes
EE09.0	Software limit position setting error	2	Yes
EE09.1	Home position setting error	2	Yes
EE11.1	Failure to read data from EEPROM through bus	2	Yes
EE11.2	Failure of update to EEPROM through bus	2	Yes
EE12.0	Parallel port detection error	1	No
EE13.0	PN synchronization cycle setting error	2	Yes
EE15.0	PN sync signal deviation too large	2	Yes
EE16.0	Logic configuration fault	1	No
EE18.0	PN device name lost	2	Yes
EE19.8	Modification of subdivision settings is not supported in DSC mode.	2	Yes

16.5 Description of Alarm Codes

E108.0: Storage parameter write fault

Cause:

Parameter values cannot be written to EEPROM.

Troubleshooting:

Cause	Verification method	Solution
A fault occurs when writing parameters.	Modify a certain parameter, power cycle the drive, and check whether the modified value is saved.	If the modified value is not saved and the fault persists after the drive is powered off and on several times, replace the drive.

E108.1: Storage parameter read fault

Cause:

Parameter values cannot be read from EEPROM.

Troubleshooting:

Cause	Verification method	Solution
The parameter-read operation is abnormal, and the system indicates an EEPROM read failure.	The keypad displays E108.1 when reading parameters from the EEPROM fails.	If the fault persists after the drive is powered off and on several times, replace the drive.

E108.2: EEPROM data write verification error

Cause:

The verification on the data written to EEPROM failed.

Troubleshooting:

Cause	Verification method	Solution
Parameter writing fails the check.	Modify a certain parameter, power cycle the drive, and check whether the modified value is saved.	If the modified value is not saved and the fault persists after the drive is powered off and on several times, replace the drive.

E108.3: EEPROM data read verification error

Cause:

The check on the data read from EEPROM failed.

Troubleshooting:

Cause	Verification method	Solution
The check on the data read from EEPROM failed.	Modify a certain parameter, power cycle the drive, and check whether the modified value is saved.	If the modified value is not saved and the fault persists after the drive is powered off and on several times, replace the drive.

E108.4: Single data saved frequently

Cause:

Single data is saved frequently to EEPROM.

Troubleshooting:

Cause	Verification method	Solution
Saving single data frequently to the EEPROM may damage the EEPROM.	1. Check H0b.90 and H0b.91. H0b.90 displays parameters that are saved frequently (displayed in hex). If H0b.91 is set to 15, H0b.90 displays the internal variable of the software. 2. Check "Func test 1" (displayed in hex) through the oscilloscope. This channel displays the address that is being saved by EEPROM. 3. Check the number of saving events through "Func test 2" of the oscilloscope.	1. If the alarm is caused by manual modification of a parameter, and frequent data storage during operation does not occur, directly perform fault reset. 2. Check the abnormal storage fault code through H0b.90 or oscilloscope channel to locate the cause. For example, if the host controller frequently writes parameters, modify the host controller program to avoid frequent parameter writing, or set H0E.01 to 0 (parameters are not saved to EEPROM when written through communication).

E120.3: Different power between motor and drive

Cause:

The rated power of the motor does not match that of the drive.

Troubleshooting:

Cause	Verification method	Solution
The rated current/voltage of the motor is higher than that of the servo drive.	Check whether the rated motor current/voltage is larger than the rated current of the servo drive.	Replace the motor or drive.

E121.0: S-ON command inactive

Cause:

A redundant S-ON signal is sent when some auxiliary functions are used.

Troubleshooting:

Cause	Verification method	Solution
1. The S-ON signal is activated through communication when the servo drive is already enabled internally.	Check whether an S-ON signal is sent by the host controller when auxiliary functions (H0d.02, H0d.03, H0d.12) are used.	Switch off the S-ON signal sent from the host controller.

E122.0: Multi-turn absolute encoder setting error

Cause:

The motor does not match the absolute position mode or the motor code is set improperly.

Troubleshooting:

Cause	Verification method	Solution
The motor does not match the absolute position mode or the motor code is set incorrectly.	View the motor nameplate to confirm if the motor is a multi-turn absolute encoder motor. Check whether the motor model (H00.00) is correct.	Reset H00.00 (motor code) according to the motor nameplate or use a suitable motor.

E550.2: External switchover wait warning

Cause:

If the condition for continuing the current running segment is set to "Continue on external alarm", an alarm will be displayed after the current segment is done executing.

Troubleshooting:

Cause	Verification method	Solution
If the condition for continuing the current running segment is set to "Continue on external alarm", an alarm will be displayed after the current segment is done executing.	Check bit4 to bit7 of the task mode (H28.16–H28.31) of the current running block.	The alarm will be cleared automatically when the next block is triggered by the external signal.

E600.0: Angle auto-tuning failure

Cause:

Vibration cannot be suppressed. You can set notch parameters (H09.12 to H09.23) manually to suppress vibration.
The auto-tuned values fluctuate dramatically. Increase the maximum operating speed, and reduce the acceleration/deceleration time to shorten the stroke of the lead screw during ETune operation.
Mechanical couplings of the load are loose, or the mechanism is eccentric. Rectify mechanical faults.
An alarm occurs during auto-tuning and causes interruption. Clear the alarm and perform auto-tuning again.
The vibration cannot be suppressed if the load carries large inertia. In this case, increase the acceleration/deceleration time to ensure the motor current is not saturated.

Troubleshooting:

Cause	Verification method	Solution
1. Continuous vibration exists during auto-tuning. 2. The auto-tuned values fluctuate dramatically. 3. Mechanical connections of the load are loosened or eccentric. 4. A warning occurs during auto-tuning and causes interruption. 5. The vibration cannot be suppressed if the load carries large inertia. In this case, increase the acceleration/deceleration time to ensure the motor current is unsaturated.	1. During internal detection shutdown, the torque fluctuation exceeds the threshold defined by H09.54. 2. Under conditions where the load-to-inertia ratio is less than 5, the auto-tuned value (B) differs from the last auto-tuned value (A) by more than A ± 3 times the load-to-inertia ratio. Under conditions where the load-to-inertia ratio is greater than 5, the auto-tuned value (B) differs from the last auto-tuned value A by more than ±0.5 × A times the load-to-inertia ratio.	1. Clear the fault and perform auto-tuning again. 2. Enable vibration suppression when the vibration cannot be suppressed automatically. 3. Check and ensure mechanical connections are secure. 4. During ETune operations, increase the maximum running speed, and reduce the acceleration/deceleration time, to shorten the screw stroke.

E601.0: Homing alarm

Cause:

The homing time exceeds the setpoint.

Troubleshooting:

Cause	Verification method	Solution
1. The home switch is faulty.	During homing, high-speed search is performed without low-speed search. After high-speed search during homing, the system remains in the reverse low-speed search process.	If a hardware DI is used, check whether the corresponding DI function is assigned to a certain DI in group H03 and check the wiring of this DI. Change the DI logic manually and observe the value of H0b.03 to monitor whether the servo drive receives corresponding DI level changes. If the home signal is Z signal but it cannot be found, check the condition of the Z signal.
2. The home-searching time is too short.	Check whether the value of H05.35 (Time limit for homing) is too low.	Increase the value of H05.35.

Cause	Verification method	Solution
3. The speed for searching for the home switch signal at high speed is excessively low.	Check the distance between the start position of homing and the home switch. Then check whether the setpoint of H25.23 is too low, resulting in a long homing process.	Increase the value of H25.23.
4. The switch is set improperly.	Check whether the limit signals on both side are activated. Check whether a limit signal is activated while the home signal is active.	Set the position of the hardware switch properly.

E601.1: Homing switch error

Cause:

The home switch is set improperly.

Troubleshooting:

Cause	Verification method	Solution
1. The home switch is faulty.	During homing, high-speed search is performed without low-speed search. After high-speed search during homing, the system remains in the reverse low-speed search process.	If a hardware DI is used, check whether the corresponding DI function is assigned to a certain DI in group H03 and check the wiring of this DI. Change the DI logic manually and observe the value of H0b.03 to monitor whether the servo drive receives corresponding DI level changes. If the home signal is Z signal but it cannot be found, check the condition of the Z signal.
2. The home-searching time is too short.	Check whether the value of H05.35 (Time limit for homing) is too low.	Increase the value of H05.35.
3. The speed for searching for the home switch signal at high speed is excessively low.	Check the distance between the start position of homing and the home switch. Then check whether the setpoint of H25.23 is too low, resulting in a long homing process.	Increase the value of H25.23.
4. The switch is set improperly.	Check whether the limit signals on both side are activated. Check whether a limit signal is activated while the home signal is active.	Set the position of the hardware switch properly.

E601.2: Homing mode setting error

Cause:

The homing mode value exceeds the existing homing mode value.

Troubleshooting:

Cause	Verification method	Solution
The homing mode value exceeds the existing homing mode value.	Check if the value of homing method exceeds the value of the existed homing method.	Adjust H25.22 to a value within the allowable range.

E730.0: Encoder battery alarm

Cause:

The battery voltage of the absolute encoder is lower than 3.0 V.

Troubleshooting:

Cause	Verification method	Solution
The battery voltage of the absolute encoder is lower than 3.0 V.	Measure the battery voltage.	Use a new battery of matching voltage.

E900.0: DI emergency braking

Cause:

The logic of the DI (including the hardware DI and virtual DI) assigned with DI function 34 (FunIN.34: Emergency stop) is active.

Troubleshooting:

Cause	Verification method	Solution
The logic of the DI (including the hardware DI and virtual DI) assigned with DI function 34 (FunIN.34) is effective.	Check whether the logic of DI assigned with FunIN.34: Emergency stop is activated.	Check the operation mode and deactivate the DI braking signal without affecting the safety performance.

E902.0: Invalid DI/VDI settings

Cause:

DI/VDI function parameters are set to invalid values.

Troubleshooting:

Cause	Verification method	Solution
DI or VDI function parameters are set to invalid values.	Check whether DI function configuration parameters in groups H03 and H17 are set to invalid values.	Set DI/VID function parameters to valid values.

E902.1: Invalid DO/VDO settings

Cause:

DO/VDO function parameters are set to invalid values.

Troubleshooting:

Cause	Verification method	Solution
DO or VDO function parameters are set to invalid values.	Check whether DO function configuration parameters in groups H04 and H17 are set to invalid values.	Set DO/VDO function parameters to valid values.

E902.2: Torque arrival setting inactive

Cause:

The DO parameters set for torque arrival in the torque control mode are inactive.

Troubleshooting:

Cause	Verification method	Solution
The DO parameters set for torque reach in torque control mode are inactive.	Check whether the value of H07.22 is lower than or equal to the value of H07.23 (unit: 0.1%).	Set H07.22 to a value higher than that of H07.23.

E908.0: Model identification check code failure

Cause:

1. The model ID check word saved in EEPROM is incorrect.
2. The model parameters are not written in the drive before delivery.

Troubleshooting:

Cause	Verification method	Solution
1. The model check word saved in EEPROM is wrong. 2. The model parameters are not programmed before delivery.	1. Check whether the alarm persists after a restart. 2. Check whether EEPROM can normally store parameters.	Set H01.72 to 1 to disable model identification function temporarily.

E909.0: Motor overload alarm

Cause:

The accumulative heat of the motor reaches 90% of the fault threshold.

Troubleshooting:

Cause	Verification method	Solution
1. Wiring of the motor and encoder is incorrect or in poor contact.	Check the wiring among the servo drive, servo motor and the encoder according to the correct wiring diagram.	Connect cables according to the correct wiring diagram. Preferably use the cables provided by Inovance. When customized cables are used, prepare and connect the cables according to the hardware wiring instructions.
2. The load is excessive. The motor keeps outputting effective torque that higher than the rated torque for a long time.	Confirm the overload characteristics of the servo drive or servo motor. Check whether the average load rate (H0b. 12) of the servo drive keeps exceeding 100.0%.	Replace with a servo drive of higher capacity and a matching servo motor, or reduce the load and increase the acceleration/ deceleration time.
3. Acceleration/deceleration is frequent, or the load inertia is high.	View the mechanical inertia ratio or perform inertia auto-tuning and view H08.15 (Inertia ratio). Confirm the single-shot operation cycle when the motor runs cyclically.	Increase the acceleration/ deceleration time.
4. The gain is improper, or the stiffness is excessively high.	Check whether the motor vibrates and generates unusual noise during operation.	Adjust the gain again.
5. The drive or motor model is set incorrectly.	View the serial-type motor model in H00.06 and the drive model in H00.10.	Check the servo drive nameplate, and set the drive model (H01.10) correctly and use a matching motor according to Section 2.3.

Cause	Verification method	Solution
6. The motor is stalled due to mechanical factors, resulting in excessive load during operation.	Check the reference and motor speed (H0b.00) through the software tool or keypad: Reference in the position control mode: H0b.13 (Input position reference counter); Reference in the speed control mode: H0b.01 (Speed reference); Reference in the torque control mode: H0b.02 (Internal torque reference). Check whether the reference is not 0 or excessively high but the motor speed is 0 in the corresponding mode.	Eliminate mechanical factors.
7. The servo drive is faulty.	Power cycle the servo drive.	If the fault persists after a power cycle, replace the drive.

E910.0: Control circuit overvoltage

Cause:

The control circuit voltage exceeds the overvoltage threshold.

Troubleshooting:

Cause	Verification method	Solution
Overvoltage occurred on the control circuit of the drive.	1. Check the input power specifications of the servo drive and measure whether the input voltage of the control cable complies with the following specifications: 220 V servo drive: Valid value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) 380 V servo drive: Valid value: 380 V to 440 V Allowable deviation: -10% to +10% (342 V to 484 V) 2. Check whether control circuit cables are connected properly and whether the voltage of control circuit cables (L1C and L2C) on the drive side is within the specified range.	Re-connect or replace the cables.

E920.0: braking resistor overload

Cause:

The accumulative heat of the braking resistor exceeds the threshold.

Troubleshooting:

Cause	Verification method	Solution
1. The cable of the external braking resistor is loose or disconnected, or breaks.	Remove the external braking resistor and measure whether its resistance is "∞" (infinite). Measure whether the resistance between terminals P and C is "∞" (infinite).	Replace with a new external braking resistor. After measuring the resistance to ensure it matches the rated value, connect the ends of the braking resistor between P and C by using high-quality cables.
2. H02.25 is set improperly when an external braking resistor is used. 3. The resistance of the external braking resistor used is excessively high. 4. The value of H02.27 is higher than the resistance of the external braking resistor used.	Check the value of H02.25. Measure the resistance of the external resistor connected between P and C and compare the measured value with the braking resistor specifications in the "Electrical Specifications". Check whether the resistance of the external resistor is too high. Check whether the value of H02.27 is larger than the resistance of the external braking resistor.	Set H02.25 to 1 (use external resistor, natural cooling) or 2 (use external resistor, forced air cooling) as required. Refer to section "Electrical Specifications" for braking resistor specifications. Set H02.27 according to the resistance of the external braking resistor used.
5. The input voltage of the main circuit exceeds the specifications.	Measure whether the main circuit input voltage on the drive side complies with the following specifications: 220 V servo drive: Valid value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) 380 V servo drive: Valid value: 380 V to 440V Allowable deviation: -10% to +10% (342 V to 484 V)	Replace or adjust the power supply according to the specified range.
6. The load moment of inertia ratio is excessively high. 7. The motor speed is excessively high and deceleration is not done within the set time. The motor is in the continuous deceleration status during cyclic operation. 8. The capacity of the drive or braking resistor is insufficient.	Refer to inertia auto-tuning to perform inertia auto-tuning during rotation. Or calculate the total mechanical inertia manually based on mechanical parameters. Check whether the actual load inertia ratio exceeds 30. Observe the motor speed curve during periodic motion to check if the motor remains in deceleration for a long time. Examine the motor speed curve for a single cycle and calculate whether the maximum braking energy can be fully absorbed.	Select an external braking resistor of large capacity and set H02.26 according to the actual value. Select a servo drive of large capacity. Reduce the load if allowed. Increase the acceleration/ deceleration time if allowed. Increase the motor running cycle if allowed.
9. The servo drive is faulty.	None	Replace the servo drive.

E921.0: Dynamic brake resistor overload alarm

Cause:

The dynamic braking resistor is close to overload.

Troubleshooting:

Cause	Verification method	Solution
The accumulative heat of the dynamic braking resistor is close to the maximum thermal capacity of the resistor.	Check whether the value of H0b.98 exceeds 70%.	To avoid excessively high discharge current, prevent the motor from being driven reversely.

E922.0: Resistance of the external braking resistor too small

Cause:

The value of H02.27 (resistance of external braking resistor) is lower than the value of H02.21 (allowed minimum resistance of external braking resistor).

Troubleshooting:

Cause	Verification method	Solution
When an external braking resistor is used (H02.25 = 1 or 2), the resistance of this resistor is lower than the minimum resistance allowed by the servo drive.	1. Measure whether the resistance of the braking resistor is consistent with the setpoint of H02.27. 2. Check whether the resistance of the external braking resistor defined by H02.27 is lower than the value of H02.21.	If yes, replace with an external braking resistor that matches the servo drive, and connect this resistor between terminals P and C. If not, set H02.27 to a value consistent with the resistance of this resistor.

E924.0: Braking transistor overtemperature

Cause:

The estimated temperature of the braking transistor is higher than H0A.49.

Troubleshooting:

Cause	Verification method	Solution
1. The junction temperature controlled by the braking transistor is excessively high. 2. The braking transistor will be turned off automatically after overload occurs.	The braking transistor temperature exceeds the threshold defined by H0A.49.	Adjust the operating conditions and avoid activating the braking transistor frequently.

E941.0: Parameter modifications activated at next power-on

Cause:

Modifications of some parameters are designed to be activated at next power-on. If these parameters are modified, a power cycle is needed.

Troubleshooting:

Cause	Verification method	Solution
Parameters whose modification is activated at next power-on have been updated.	Check whether parameters you modified are designed to be activated at next power-on.	Power off and on the servo drive again.

E942.0: Frequent parameter storage

Cause:

The number of parameters modified at a time exceeds 200.

Troubleshooting:

Cause	Verification method	Solution
A great number of parameters are modified and stored frequently to EEPROM.	Check whether parameters are modified frequently through the host controller.	Check the operation mode. For parameters that need not be saved to EEPROM, set H0E.01 properly.

E950.0: Forward overtravel alarm

Cause:

The logic of the DI allocated with FunIN.14: P-OT (Positive limit switch) is valid.

Troubleshooting:

Cause	Verification method	Solution
The logic of the DI assigned with FunIN.14: P-OT (Positive limit switch) is active.	Check whether a DI in group H03 is assigned with FunIN.14 and whether the DI logic of the corresponding bit of H0b.03 (Monitored DI status) is active.	Check the operation mode. On the prerequisite of safety, send a reverse run command or rotate the motor to deactivate the DI function 14.
Positive software position limit	Check whether the software limit is enabled through H0A.01 and whether the motor position exceeds the positive software limit in the reverse direction.	Check whether the motor travel distance needs to exceed the positive software limit. If yes, adjust the positive software limit value. If not, adjust the motor travel distance.

E950.1: Target position exceeds the positive software limit threshold.

Cause:

The target position exceeds the software limit threshold in the positive direction.

Troubleshooting:

Cause	Verification method	Solution
The target position value is excessively high or the positive software limit threshold is excessively low.	Check the target position setpoint in the program. Check whether the software limit function of H0A.01 is enabled. Check the value of H0A.41 and the target position.	Decrease the target position setpoint or increase the positive software limit threshold.

E952.0: Reverse overtravel alarm

Cause:

The logic of the DI allocated with FunIN.15: N-OT (negative limit switch) is valid.

Troubleshooting:

Cause	Verification method	Solution
The logic of the DI assigned with function 15 (FunIN.15, N-OT, negative overtravel switch) is active.	Check whether a DI in group H03 is assigned with FunIN.14 and whether the DI logic of the corresponding bit of H0b.03 (Monitored DI status) is active.	Check the operation mode. Send a forward run command or rotate the motor to deactivate the logic of DI assigned with FunIN.15 without affecting the safety performance.
Negative software limit active	Check whether the software limit is enabled through H0A.01 and whether the motor position exceeds the positive software limit in the reverse direction.	Check whether the motor travel distance needs to exceed the negative software limit. If yes, adjust the negative software limit value. If not, adjust the motor travel distance.

E952.1: Target position is lower than the negative software limit threshold.

Cause:

The target position is lower than the negative software limit threshold

Troubleshooting:

Cause	Verification method	Solution
The target position value is excessively low or the negative software limit threshold is excessively high.	Check the target position setpoint in the program. Check whether the software limit function of H0A.01 is enabled and the value of H0A.43 and the target position.	Increase the target position setpoint or decrease the negative software limit threshold.

E980.0: Encoder algorithm error

Cause:

An encoder algorithm error occurs.

Troubleshooting:

Cause	Verification method	Solution
An encoder algorithm error occurs	1. Check the wiring. 2. If the fault persists after repeated restart, the encoder is faulty.	Replace the servo motor.

16.6 Description of Fault Codes

16.6.1 Troubleshooting Faults

E101.0: Abnormal parameters in groups H02 and above

Cause:

The total number of parameters changes, which generally occurs after software update. Values of parameters in groups H02 and above exceed the limit, which generally occurs after software update.

Troubleshooting:

Cause	Verification method	Solution
1. The control power voltage drops instantaneously.	1. Check whether the control power is being cut off (L1C, L2C) or instantaneous power failure occurs. 2. Measure whether the input voltage of the control cable on the non-drive side during operation meets the following specifications: 220 V drive: Effective value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) 380 V drive: Effective value: 380 V to 440 V Allowable deviation: -10% to +10% (342 V to 484 V) 3. View H0b.90 and H0b.91 to check the fault code.	1. Restore system parameters to default settings (H02.31 = 1), and write parameters again. 2. Enlarge the power capacity or replace with a power supply of higher capacity. After restoring system parameters to default settings (H02.31 = 1), write parameters again.
2. Instantaneous power failure occurs during parameter storage.	Check whether instantaneous power failure occurs during parameter storage. Read H0b.90 and H0b.91 to check the parameter group that the abnormal parameter belongs to.	Power on the system again, restore system parameters to default (H02.31 = 1), and write parameters again.
3. The number of parameter-write operations within a certain period of time exceeds the limit.	1. Confirm whether an instantaneous power outage occurs when the parameter value is being stored. 2. Confirm whether the host controller frequently changes parameters. 3. Read H0b.90 and H0b.91 to view the fault code.	1. Power off and then power on the drive again. After system parameters are restored to initial values (H02.31=1), re-enter the parameters. 2. Change the parameter writing method and re-enter the parameters. Replace the servo drive if the servo drive is faulty.
4. The software is upgraded.	Check whether parameter values in group H02 and above exceed the upper/lower limit due to software update. Read H0b.90 and H0b.91 to check the parameter group that the abnormal parameter belongs to.	Reset the drive model and motor model, and restore system parameters to default settings (H02.31 = 1).
5. The servo drive is faulty.	Restart the power supply and restore parameters to default values. If the fault persists, the drive is faulty. Read H0b.90 and H0b.91 to check the parameter group that the abnormal parameter belongs to.	Replace the drive.

E101.1: Parameter error in group H00/H01

Cause:

The total number of parameters changes, which generally occurs after software update. Values of parameters in groups H00 or H01 exceed the limit, which generally occurs after software update.

Troubleshooting:

Cause	Verification method	Solution
The drive detects parameter values in groups H00 and H01 during initialization upon power-on. When the parameter value exceeds the limit, E101.1 occurs. Motor parameters in group H00 are read from the encoder. Drive parameters in group H01 are mapped based on the drive model defined by H01.10.	Check whether the value of any parameter in group H00 or H01 exceeds the upper or lower limit range. Read H0b.90 and H0b.91 to view the group number of the abnormal parameter.	Replace the motor or drive.

E101.2: Address error in read/write operation after the number of parameters changes

Cause:

Address error in read/write operation after the number of parameters changes.

Troubleshooting:

Cause	Verification method	Solution
Address error in read/write after total number of parameters changes.	Read H0b.90 and H0b.91 to check the parameter group that the abnormal parameter belongs to.	Set the abnormal parameter to a proper value or restore the parameter value to default value.

E102.0: FPGA communication establishment error

Cause:

The communication between MCU and FPGA cannot be established.

Troubleshooting:

Cause	Verification method	Solution
1. The FPGA is faulty. 2. The communication between MCU and FPGA fails.	The fault persists after repeated power cycling.	Replace the drive.

E102.8: FPGA and MCU versions mismatch

Cause:

FPGA and MCU software versions do not match.

Troubleshooting:

Cause	Verification method	Solution
The software versions of MCU and FPGA do not match.	View the FPGA software version (H01.01), MCU software version (H01.00) and 200P software version (H02.33) through the keypad or Inovance software tool. Check whether the non-zero values of the most significant bit of these software versions are consistent.	Contact Inovance for technical support. Update the FPGA or MCU software.

E104.1: MCU operation timeout (MCU crashed)

Cause:

The access to MCU times out.

Troubleshooting:

Cause	Verification method	Solution
1. The MCU operates improperly. 2. The real-time communication between MCU and FPGA is abnormal.	The fault persists after repeated power cycling.	Replace the drive.

E104.2: FPGA operation timeout (FPGA crashed)

Cause:

The MCU torque interrupt scheduling time is abnormal. This fault is reported only in the commissioning stage.

Troubleshooting:

Cause	Verification method	Solution
1. The FPGA is faulty. 2. The communication handshake between the FPGA and the MCU is abnormal.	The fault persists after repeated power cycling.	Replace the drive.

E104.4: MCU reference update timeout

Cause:

Taking the moment when the interruption starts as the starting time, if the time when commands are written to MCU is larger than the time when position and speed regulators are started by FPGA, an alarm will be reported.

Troubleshooting:

Cause	Verification method	Solution
The command calculation time is excessively long.	The fault persists after repeated power cycling.	Replace the drive.

E120.0: Unknown encoder type

Cause:

The servo drive detects the encoder model during initialization upon power-on. If the encoder model does not comply with the requirement, E120.0 occurs.

Troubleshooting:

Cause	Verification method	Solution
1. The motor code is not supported by the FPGA software. 2. The encoder model does not match.	Check whether the encoder model is correct.	The motor number does not exist. When using SV660F servo drive with 23-bit servo motor, ensure that H00.00 equals 14101. If the servo drive number does not exist, set the correct servo drive model according to the servo drive nameplate.

E120.1: Unknown motor model

Cause:

The drive detects the motor model defined by H00.00 during initialization upon power-on. If the motor model does not exist, E120.1 occurs.

Troubleshooting:

Cause	Verification method	Solution
The motor model defined by H00.00 is abnormal.	Check whether the value of H00.00 matches the motor used.	Set a correct motor model (H00.00).

E120.2: Unknown drive model

Cause:

The servo drive detects the servo drive model defined by H01.10 during initialization upon power-on. If the servo drive model does not exist, E120.2 occurs.

Troubleshooting:

Cause	Verification method	Solution
The drive model (H01.10) is set improperly.	Check whether the value of H01.10 is abnormal.	Disable drive model auto-tuning and set H01.10 to a proper value manually.

E120.5: Motor and drive current mismatch

Cause:

The rated output of the servo drive is greatly higher than the rated current of the motor. You must use a servo drive of lower rated output or a motor with higher rated current.

Troubleshooting:

Cause	Verification method	Solution
The internal scale value is abnormal.	Check whether the drive model is correct. If the set current sampling coefficient is excessively high, calculation overflow can occur.	Replacing the Drive

E120.6: FPGA and motor model mismatch

Cause:

1. The motor model is set improperly, causing mismatch and malfunction of the servo drive.
2. The motor model is set properly, but the motor encoder is not supported by the servo drive.

Troubleshooting:

Cause	Verification method	Solution
The FPGA software version does not match the motor model specified by H00.00.	Check whether the FPGA software version (H01.01) supports the motor model set by H00.00.	Update the FPGA software to support the motor model defined by H00.00.

E120.7: Model parameter verification error

Cause:

The drive model parameter cannot be identified.

Troubleshooting:

Cause	Verification method	Solution
Model parameter CRC failed.	Check whether the model parameter is not programmed or is lost.	Program the model parameter again.

E120.8: Junction temperature parameter verification error

Cause:

The junction temperature parameter is identified incorrectly.

Troubleshooting:

Cause	Verification method	Solution
The junction temperature parameter is programmed improperly or not programmed at all.	Check whether the junction temperature parameters are lost or not programmed.	Program the junction parameters properly.

E122.1: Different DIs assigned with the same function

Cause:

1. The same function is assigned to different DIs.
2. The DI function No. exceeds the maximum number allowed for DI functions.

Troubleshooting:

Cause	Verification method	Solution
1. At least two DIs are assigned with the same function number. 2. The DI function No. exceeds the maximum setting number allowed for DI functions.	1. Check whether the DI functions set through H03.02, H03.04, H03.06, H03.08, and H03.10 are repetitive. 2. Check whether the MCU program is updated.	1. Ensure DI functions set through H03.02, H03.04, H03.06, H03.08, and H03.10 are different. 2. Power off and on the servo drive after restoring system parameters to default settings (H02-31 = 1).

E122.3: Invalid upper limit in rotation mode

Cause:

The upper limit of mechanical single-turn position exceeds 2^{31} in the absolute rotation mode.

Troubleshooting:

Cause	Verification method	Solution
The upper limit of the mechanical single-turn position (modal axis modulus) exceeds 2^{31}.	Check the setting of the mechanical gear ratio, the upper limit of mechanical single-turn position and the electronic gear ratio when the servo drive runs in the absolute rotation mode (H02.01 = 2 or 5).	Reset the mechanical gear ratio, the upper limit of mechanical single-turn position, and the electronic gear ratio to ensure the upper limit of the mechanical single-turn position (modulo axis modulus) does not exceed 2^{31}.

E122.4: Different VDIs assigned with the same function

Cause:

The same function is assigned to different VDIs. The VDI function No. exceeds the maximum number allowed for VDI functions.

Troubleshooting:

Cause	Verification method	Solution
Two or more DIs and VDIs are assigned with the same function No.	Check whether DI function numbers set in H03 and H17 are repetitive.	Change any repetitive function No.

E122.5: DI and VDI assigned with the same function

Cause:

The same function is assigned to different VDIs. The VDI function No. exceeds the maximum number allowed for VDI functions.

Troubleshooting:

Cause	Verification method	Solution
Two or more DIs and VDIs are assigned with the same function No.	Check whether DI function numbers set in H03 and H17 are repetitive.	Change any repetitive function No.

E122.8: Lower limit of the rotation mode too small

Cause:

The upper limit is less than 1 in the rotation mode.

Troubleshooting:

Cause	Verification method	Solution
The lower limit of the mechanical single-turn position (modal axis modulus) is less than 1.	Check the setting of the mechanical gear ratio, the upper limit of mechanical single-turn position and the electronic gear ratio when the servo drive runs in the absolute rotation mode (H02.01 = 2 or 5).	Reset the mechanical gear ratio, the upper limit of mechanical single-turn position, and the electronic gear ratio to ensure the lower limit of the mechanical single-turn position (modulo axis modulus) is not below 1.

E122.9: Modal axis and rotation mode prohibited

Cause:

When the host controller is in AC1/AC4 mode, the local modal axis and rotation mode are inhibited from being enabled.

Troubleshooting:

Cause	Verification method	Solution
When the host controller is in AC1/AC4 mode, the modal axis function and the rotation mode are controlled by the host controller. The modal axis function and the rotation mode cannot be enabled locally.	Check whether the local modal axis and rotation mode match the control mode of the host controller.	Modify the control mode of the host controller or the enable state of the local modal axis and rotation mode.

E136.0: Encoder ROM motor parameter check error

Cause:

When reading parameters from the encoder ROM, the servo drive detects that no parameters are saved or parameter values are inconsistent with the setpoints.

Troubleshooting:

Cause	Verification method	Solution
A parameter check error occurs, or no parameter is saved in the ROM of the bus incremental encoder.	Check whether the encoder cable provided by Inovance is used. For cable specifications, see section "Matching Cables" in the user guide. Cables are connected securely without scratching, breaking or poor contact on both ends. Measure signals PS+, PS-, +5V and GND on both ends of the encoder cable and observe whether signals at both ends are consistent. For signal assignment, see Chapter "Wiring" in the hardware guide.	Use the encoder cable provided by Inovance. Ensure motor terminals and drive screws are connected securely. Use a new encoder cable if necessary. Do not bundle the encoder cable and power cable (RST, UVW) together. Route them through different routes.

E136.1: Encoder ROM motor parameter read error

Cause:

The encoder cable is not connected properly. A communication error occurs on the encoder due to interference.

Troubleshooting:

Cause	Verification method	Solution
1. The encoder cable connections are incorrect or loosened.	Check the encoder cable connection. Check whether ambient vibration is excessive, which loosens the encoder cable and even damages the encoder.	Connect the cables again according to the correct wiring diagram and ensure encoder terminals are connected securely.
2. The drive is faulty.	The fault persists after the servo drive is restarted.	Replace the drive.

E140.0: Encryption integrated circuit verification fault

Cause:

Encryption chip check failure

Troubleshooting:

Cause	Verification method	Solution
The encryption software is not programmed.	Check whether the fault persists after restart upon power-off.	Contact the manufacturer to re-program the encryption software.

E150.0: STO safety state applied

Cause:

The STO input protection applies (safety state).

Troubleshooting:

Cause	Verification method	Solution
Two 24 V inputs are disconnected simultaneously, triggering the STO function.	Check whether the external 24 V power signal is normal.	When the external 24 V signal is cut off, the drive enters STO safety state and the motor coasts to stop.

E150.1: STO input state error

Cause:

The single-channel input of STO is inactive.

Troubleshooting:

Cause	Verification method	Solution
The 24 V input signal of STO1 or STO2 is abnormal. Only one STO input signal is disconnected.	Check whether the external 24 V power signal is normal.	The 24 V input signal is normal, but the drive reports E150.1 after restart. This may be caused by an abnormal 24 V input circuit. It is recommended to replace the drive.

E150.2: Buffer 5 V voltage detection error

Cause:

The MCU monitors the 5 V power supply of the PWM Buffer to detect whether overvoltage or undervoltage occurs. If the voltage is abnormal, this fault code will be displayed.

Troubleshooting:

Cause	Verification method	Solution
The 5 V voltage supplied to the STO Buffer is abnormal due to undervoltage or overvoltage.	Check whether the fault can be removed by a restart. If not, the 5 V voltage supplied to the Buffer is abnormal.	Replace the drive.

E150.3: STO input circuit hardware diagnosis failure

Cause:

Short circuit occurs on the optocoupler of the upstream hardware circuit of STO.

Troubleshooting:

Cause	Verification method	Solution
Short circuit occurs on the upstream optocoupler of STO.	Check whether the fault persists and the keypad displays E150.3 after the drive is powered on again.	Replace the drive.

E150.4: PWM buffer hardware diagnosis failure

Cause:

An error occurs on the PWM buffer integrated circuit during initialization detection upon power-on (the PWM signal cannot be blocked). The drive displays E150.4.

Troubleshooting:

Cause	Verification method	Solution
An error occurs on the STO buffer during detection upon power-on.	The fault persists and the keypad displays E150.4 after restart.	Replace the drive.

E201.0: Phase P overcurrent

Cause:

An excessively high current flows through the positive pole of the DC-AC circuit.

Troubleshooting:

Cause	Verification method	Solution
1. Gains are set improperly, leading to motor oscillation.	Check whether the motor vibrates or generates a sharp noise during startup and operation, or view the current feedback through software tool.	Perform gain tuning.
2. The encoder cable is aged, corroded, or connected improperly or loosely.	Check whether the encoder cable provided by Inovance is used and whether the cable is aging, corroded, or connected loosely. Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.17 changes as motor shaft rotates.	Re-solder, tighten or replace the encoder cable.
3. The drive is faulty.	Disconnect the motor cables and check whether the fault persists at next power-on.	Replace the drive.
4. Overcurrent occurs on the braking resistor.	Check whether resistance of the external braking resistor is excessively low or the braking resistor is short-circuited (between terminals P and C).	Replace with a braking resistor of proper resistance. Perform wiring again.

E201.1: Phase U overcurrent

Cause:

A current higher than the detection threshold is collected in the phase-U current.

Troubleshooting:

Cause	Verification method	Solution
1. The motor cables are in poor contact.	Check whether the drive power cables and motor cables on the U, V, and W sides of the drive are loose.	Tighten the cables that are loose or disconnected.
2. The motor cables are grounded.	After confirming the servo drive power cables and motor cables are connected properly, measure whether the insulation resistance between the servo drive U/V/W side and the PE cable is at MΩ level.	Replace the motor if the insulation is poor.
3. The motor cables (U/V/W) are short-circuited.	Disconnect motor cables and check whether short circuit occurs among motor U/V/W cables and whether burrs exist in the wiring.	Connect the motor cables correctly.
4. The motor is damaged.	Disconnect the motor cables and measure whether the resistance among U/V/W phases of motor cables is balanced.	Replace the motor if the resistance is unbalanced.

E201.2: Phase-V overcurrent

Cause:

A current higher than the threshold is collected in the phase-V current.

Troubleshooting:

Cause	Verification method	Solution
1. The motor cables are in poor contact.	Check whether the drive power cables and motor cables on the U, V, and W sides of the drive are loose.	Tighten the cables that are loose or disconnected.
2. The motor cables are grounded.	After confirming the servo drive power cables and motor cables are connected properly, measure whether the insulation resistance between the servo drive U/V/W side and the PE cable is at MΩ level.	Replace the motor if the insulation is poor.
3. The motor cables (U/V/W) are short-circuited.	Disconnect motor cables and check whether short circuit occurs among motor U/V/W cables and whether burrs exist in the wiring.	Connect the motor cables correctly.
4. The motor is damaged.	Disconnect the motor cables and measure whether the resistance among U/V/W phases of motor cables is balanced.	Replace the motor if the resistance is unbalanced.

E201.4: Phase N overcurrent

Cause:

An excessively high current flows through the negative pole of the DC-AC circuit.

Troubleshooting:

Cause	Verification method	Solution
1. Gains are set improperly, leading to motor oscillation.	Check whether the motor vibrates or generates a sharp noise during startup and operation, or view the current feedback through software tool.	Perform gain tuning.
2. The encoder cable is aged, corroded, or connected improperly or loosely.	Check whether the encoder cable provided by Inovance is used and whether the cable is aging, corroded, or connected loosely. Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.17 changes as motor shaft rotates.	Re-solder, tighten or replace the encoder cable.
3. The drive is faulty.	Disconnect the motor cables and check whether the fault persists at next power-on.	Replace the drive.
4. Overcurrent occurs on the braking resistor.	Check whether resistance of the external braking resistor is excessively low or the braking resistor is short-circuited (between terminals P and C).	Replace with a braking resistor of proper resistance. Perform wiring again.

E208.2: Encoder communication timeout

Cause:

The FPGA detects a communication timeout with the encoder.

Troubleshooting:

Cause	Verification method	Solution
The servo drive fails to receive the data fed back by the encoder in three consecutive cycles.	Check whether bit12 of H0b.30 is 1. The encoder cable is wired improperly. The encoder cable is loosened. The encoder cable is too long. The encoder communication suffers from interference. The encoder is faulty.	1. Check whether the motor model is correct. 2. Check whether the encoder cable is normal. 3. Check the encoder version (H00.04). 4. Check whether the drive is faulty. If yes, replace the drive.

E208.4: FPGA current loop operation timeout

Cause:

The operating time of the current loop exceeds the interval threshold.

Troubleshooting:

Cause	Verification method	Solution
FPGA operation timeout	Internal fault code H0b.45 = 4208: Current loop operation timeout	Disable unnecessary functions to extend the operation time of the current loop.

E210.0: Output ground fault

Cause:

The drive detects an abnormal motor phase current or bus voltage during self-test upon power-on.

1. The bus voltage exceeds the discharge threshold.
2. The phase U current of drives in size C/D/E exceeds 1/4 of the value of H01.16.
3. Overcurrent occurs on phase P and phase N of drives in sizes A and B.

Troubleshooting:

Cause	Verification method	Solution
1. The drive power cables (U/V/W) are short-circuited to ground.	Disconnect the motor cables, and measure whether the drive power cables (U/V/W) are short-circuited to ground (PE).	Re-connect the cables or replace the drive power cables.
2. The motor is short-circuited to ground.	After confirming the servo drive power cables and motor cables are connected properly, measure whether the insulation resistance between the servo drive U/V/W side and the PE cable is at MΩ level.	Replace the motor.
3. The drive is faulty.	Disconnect the power cables from the servo drive, but the fault persists after the servo drive is powered off and on repeatedly.	Replace the drive.

E234.0: Runaway

Cause:

In torque control mode, the torque reference direction is reverse to the speed feedback direction. The speed feedback direction is opposite to the speed reference direction in the position or speed control mode.

Troubleshooting:

Cause	Verification method	Solution
1. The U/V/W cables are connected improperly.	Check whether the drive power cables are connected in the correct sequence at both ends.	Connect the UVW cables according to the correct sequence.
2. The motor rotor initial phase error is detected due to interference signals upon power-on.	The U/V/W phase sequence is correct, but E234.0 is reported when the servo drive is enabled.	Power cycle the drive.
3. The encoder type is set incorrectly, or the wiring is incorrect.	Check whether the set motor code (H00.00) matches the one on the motor nameplate.	Set the correct motor code (H00.00) according to the motor nameplate.
4. The encoder cable is aged or corroded, or connected incorrectly or loosely.	Check whether the encoder cable provided by Inovance is used and whether the cable is aging, corroded, or connected loosely. Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.17 changes as motor shaft rotates.	Re-solder, tighten or replace the encoder cable.
5. Improper parameter settings lead to excessive vibration.	The stiffness level is set to an excessively high value, leading to excessive vibration.	Set a proper stiffness level to avoid excessive vibration.

E320.0: braking resistor overload

Cause:

The braking resistor is overloaded.

Troubleshooting:

Cause	Verification method	Solution
The accumulative heat of the braking resistor is excessive.	Power off and check the braking resistor for overtemperature.	1. Check whether the bus voltage is excessively high, leading to excessively high bleeder current. 2. Check whether the motor is being driven by external force in the reverse direction, leading to excessively high bleeder current. 3. Replace the servo drive.

E321.0: Dynamic brake resistor overload

Cause:

The dynamic braking resistor is overloaded.

Troubleshooting:

Cause	Verification method	Solution
The accumulative heat of the dynamic braking resistor exceeds the maximum thermal capacity of the resistor.	Check whether the value of H0b.98 exceeds 100%.	To avoid excessively high discharge current, prevent the motor from being driven reversely.

E400.0: Main circuit overvoltage

Cause:

The DC bus voltage between P⊕ and N⊖ exceeds the threshold:
For 220 V servo drive, the normal value is 310 V, and the overvoltage threshold is 420 V.
For 380 V servo drive, the normal value is 540 V, and the overvoltage threshold is 760 V.

Troubleshooting:

Cause	Verification method	Solution
1. The main circuit input voltage is excessively high.	Check the input power supply specifications of the drive. Measure whether the input voltage of the main circuit cable on the drive side (RST) meets the following specifications: Effective value for 220 V drive: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V).	Replace or adjust the power supply according to the specifications in the confirmation method.
2. The power supply is unstable or affected by the lightning strike.	Check whether the power supply is unstable, affected by lightning or satisfies the preceding specifications.	Connect a surge protection device (SPD) and switch on the power supplies of the control circuit and the main circuit. If the fault persists, replace the servo drive.
3. The braking resistor fails.	If an external braking resistor is used (H02.25 = 1 or 2), measure the resistance between terminals P⊕ and C. Refer to the brake resistor specifications in section "Electrical Specifications" for details.	If the resistance is "∞" (infinite), the braking resistor is disconnected internally. If an external braking resistor is used, replace it with an external braking resistor of recommended resistance, and connect it between terminals P⊕ and C. Set H02.26 (Power of external braking resistor) and H02.27 (Resistance of external braking resistor) to values consistent with the specifications of the external braking resistor used.
4. The resistance of the braking resistor is excessively high, and energy absorption during braking is insufficient.	Measure the resistance of the external braking resistor connected between terminals P⊕ and C. Compare the measured value with the recommended value.	Replace with an external braking resistor of recommended resistance, and connect it between terminals P⊕ and C. Set H02.26 (Power of external braking resistor) and H02.27 (Resistance of external braking resistor) to values consistent with the specifications of the external braking resistor used.

Cause	Verification method	Solution
5. The motor is in abrupt acceleration/deceleration status. The maximum braking energy exceeds the energy absorption value.	Confirm the acceleration/ deceleration time during operation and measure whether the DC bus voltage between P⊕ and N⊖ exceeds the overvoltage threshold during deceleration.	After checking that the input voltage of the main circuit is within the specified range, increase the acceleration/deceleration time if allowed.
6. The bus voltage sampling value deviates greatly from the measured value.	Check whether H0b.26 (Bus voltage) for 220 V drive is higher than 420 V. Measure whether the DC bus voltage between P⊕ and N⊖ is within the normal range and lower than H0b.26.	Contact Inovance for technical support.
7. The servo drive is faulty.	Check whether the fault persists after repeated power cycling of the main circuit.	Replace the drive.

E410.0: Main circuit undervoltage

Cause:

The DC bus voltage between terminals P⊕ and N⊖ is lower than the threshold:
220 V servo drive: Normal value: 310 V; Undervoltage threshold: 200 V (180 V for S5R5 models)
For 380 V servo drive, the normal voltage is 540 V, and the undervoltage threshold is 380 V.

Troubleshooting:

Cause	Verification method	Solution
1. The power supply of the main circuit is unstable or a power failure occurs. 2. An instantaneous power failure occurs.	Check the input power supply specifications of the drive. Measure whether the input voltage of the main circuit cable on the non-drive side and drive side (RST) meets the following specifications. For 220 V drive, the effective value ranges from 220 V to 240 V with the allowable deviation range of -10% to +10% (198 V to 264 V). All three phases need to be measured.	Increase the power capacity.
3. The power voltage drops during operation.	Check the power input voltage and check whether the main circuit power supply is applied to other devices, resulting in insufficient power capacity and a voltage dip.	Increase the power capacity.

Cause	Verification method	Solution
4. Phase loss exists. A single-phase power supply is used for the three-phase servo drive.	Check whether the main circuit is wired correctly.	Replace the cables and connect the main circuit cables correctly.
5. The servo drive is faulty.	Check whether the value of H0b.26 (Bus voltage) is within the following range. For 220 V drive, H0b.26 is lower than 200 V. For 380 V drive, H0b.26 is lower than 380 V. The fault persists after the main circuit is restarted several times.	Replace the drive.

E410.1: Main circuit de-energized

Cause:

Phase loss occurs on the three-phase servo drive.

Troubleshooting:

Cause	Verification method	Solution
The power supply is disconnected during operation.	Check the input power specifications of the servo drive. Measure whether the input voltage of the main circuit cable on the non-drive side and the drive side (RST) meets the following specifications. For 220 V servo drive, the effective value ranges from 220 V to 240 V with the allowable deviation range of -10% to +10%. For 380 V servo drive, the effective value ranges from 380 V to 440 V with the allowable deviation range of -10% to +10%. All three phases need to be measured.	Increase the power capacity.
The power supply is disconnected during operation.	Check the power input voltage and check whether the main circuit power supply is applied to other devices, resulting in insufficient power capacity and a voltage dip.	Increase the power capacity.

Cause	Verification method	Solution
The power supply is disconnected during operation.	Check whether the value of H0b.26 (Bus voltage) is within the following range. For 220 V drive, H0b.26 is lower than 200 V. For 380 V drive, H0b.26 is lower than 380 V. The fault persists after the main circuit is restarted several times.	Replace the drive.
The power supply is disconnected during operation.	Check whether the main circuit is wired correctly.	Replace the cables and connect the main circuit cables properly (three-phase: R/S/T; single-phase: L1/L2).

E420.0: Main circuit phase loss

Cause:

Three-phase input phase loss fault of the drive

Troubleshooting:

Cause	Verification method	Solution
1. The three-phase power cables are not connected well.	Check whether the power cables (R/S/T) on servo drive side and non-servo drive side are in good condition and connected securely.	Replace the cables and connect the main circuit cables correctly.
2. A single-phase power supply is used for a three-phase drive. 3. The three-phase power supply is unbalanced or the three-phase voltage is too low.	Check the input power supply specifications of the drive and check the actual input voltage specifications. Measure whether the input voltage of the main circuit meets the following specifications. For 220 V servo drive, the effective value ranges from 220 V to 240 V with the allowable deviation range of -10% to +10% (198 V to 264 V). For 380 V servo drive, the effective value ranges from 380 V to 440 V with the allowable deviation range of -10% to +10% (342 V to 484 V). All the three phases need to be measured.	Three-phase servo drives of 0.75 kW (H01.10 = 5) can be supplied by single-phase power supplies. If the input voltage is within the specified range, set H0A.00 to 2 (Inhibit power input phase loss fault and warning). If it exceeds the specified range, replace or adjust the power supply according to the specified range.

E430.0: Control circuit power supply undervoltage

Cause:

The drive circuit power voltage is lower than the undervoltage threshold.

Troubleshooting:

Cause	Verification method	Solution
1. The control circuit power supply of drives in size C/D/E is unstable or fails.	Check the input power specifications of the servo drive and measure whether the input voltage of the control cable meets the following specifications. For 220 V servo drive, the effective value ranges from 220 V to 240 V with the allowable deviation range of -10% to +10% (198 V to 264 V). For 380 V servo drive, the effective value ranges from 380 V to 440 V with the allowable deviation range of -10% to +10% (242 V to 484 V)	Increase the power capacity.
2. The control circuit power supply of drives in size C/D/E is unstable or fails.	Check whether control circuit cables are connected properly and whether the voltage of control circuit cables (L1C, L2C) on the drive side is within the specified range.	Re-connect or replace the cables.

E500.0: Motor overspeed

Cause:

The actual speed of the motor exceeds the overspeed threshold.

Troubleshooting:

Cause	Verification method	Solution
1. The U/V/W phase sequence of the motor is incorrect.	Check whether the drive power cables are connected in the correct sequence at both ends.	Connect the UVW cables according to the correct sequence.
2. H0A.08 is set to an improper value.	Check whether the overspeed threshold is lower than the maximum speed needed in actual applications: Overspeed threshold = 1.2 times the maximum motor speed (H0A-08 = 0). Overspeed threshold = H0A-08 (H0A-08 ≠ 0, and H0A-08 < 1.2 times the maximum motor speed).	Reset the overspeed threshold according to the mechanical requirements.
3. The input reference is higher than the overspeed threshold.	Check whether the motor speed corresponding to the input reference exceeds the overspeed threshold. Check the set speed and speed threshold.	Reduce the speed or increase the overspeed threshold (H0A.08).
4. The motor speed overshoots.	Check in the software tool whether the speed feedback exceeds the overspeed threshold.	Adjust the gains or mechanical operating conditions.
5. The servo drive is faulty.	The fault persists after a power cycle.	Replace the drive.

E500.1: Speed feedback overflow

Cause:

The FPGA speed measurement overflows.

Troubleshooting:

Cause	Verification method	Solution
1. FPGA internal speed overflows.	Check whether the drive power cables are connected in the correct sequence at both ends.	Connect the UVW cables according to the correct sequence.
2. The motor speed overshoots.	Check in the software tool whether the speed feedback exceeds the overspeed threshold.	Adjust the gains or mechanical operating conditions.

E500.2: FPGA position feedback pulse overspeed

Cause:

The MCU has detected that the position feedback increment from the FPGA is excessive.

Troubleshooting:

Cause	Verification method	Solution
The MCU has detected that the position feedback increment from the FPGA is excessive.	1. Check whether the value of H0b-17 changes abruptly. 2. Check whether the communication between the servo drive and the encoder is being disturbed.	Modify the value of H0A.70 (Overspeed threshold), which is 0 by default. Use the maximum speed of the motor as the threshold for excessive feedback increment.

E550.0: initial operation block number not exist

Cause:

The block number designated by PLC through POS_STW1.0-5 is outside the range of 0 to 15 or is within this range, but the attribute is set to "Invisible".

Troubleshooting:

Cause	Verification method	Solution
The block number designated by PLC through POS_STW1.0-5 is outside the range of 0 to 15 or is within this range, but the attribute is set to "Invisible".	Check the block No. selected and its property.	Rectify the running block No. of the initial segment or change the property to "Visible".

E550.1: relative/absolute attribute of positioning or fixed stopper commands set improperly

Cause:

The relative/absolute property of the positioning or fixed stop commands are set improperly.

Troubleshooting:

Cause	Verification method	Solution
The relative/absolute property of the positioning or fixed stop commands are set improperly.	Check whether bit8 to bit11 of the task mode (H28.16–H28.31) of current operation block are 0 or 1.	Set bit4 to bit 7 of the corresponding task mode of the positioning or fixed stopper to 0 to 1 (absolute or relative).

E550.3: Task switching conditions are set incorrectly.

Cause:

The task switchover condition is set improperly.

Troubleshooting:

Cause	Verification method	Solution
The task switchover condition is set improperly.	Check whether bit4 to bit7 of the task mode (H28.16 to H28.31) of current operation block are 0 to 5.	Set proper switchover conditions for bit8–11 of the task mode.

E550.7: Incorrect task type selection

Cause:

An unsupported task type is selected.

Troubleshooting:

Cause	Verification method	Solution
The selected task type is outside the range supported.	Check the task type selected for corresponding blocks.	Set the task type within the range supported.

E550.8: fixed stopper point not found

Cause:

The fixed stop is not found within the operation range of the displacement reference.

Troubleshooting:

Cause	Verification method	Solution
The fixed stop is not found within the operation range of the displacement reference.	Check whether the stop is within the operation range of the reference.	Set the displacement reference (H27.17–H27.47) properly.

E550.9: fixed stopper beyond the window

Cause:

The position feedback fluctuation exceeds the monitoring window (H28.64) after the fixed stop is found.

Troubleshooting:

Cause	Verification method	Solution
The position feedback fluctuation exceeds the monitoring window (H28.64) after the fixed stop is found.	Check whether H28.64 is set properly.	Set a proper monitoring window value.

E551.1: program block stop exception

Cause:

The switchover condition for the last block is not "Complete".

Troubleshooting:

Cause	Verification method	Solution
The switchover condition for the last block is not "Complete".	Check whether bit4 to bit7 of the task mode (H18.16 to H28.31) of the last block in operation are 0.	Set the switchover condition for the last block to "Stop".

E551.3: jump block not exist

Cause:

The block number designated by the jump task does not exist.

Troubleshooting:

Cause	Verification method	Solution
The block number designated by the jump task does not exist.	Check whether the setting range of corresponding task parameters (H28.32 to H28.62) of the jump block is 0 to 15.	Set task parameters for the jump block properly.

E551.4: Consecutive position reference not supported by relative positioning

Cause:

Continuous position reference is not supported in the relative positioning mode.

Troubleshooting:

Cause	Verification method	Solution
Continuous position reference enabled in relative positioning of telegram 111.	Check whether ConfigEPos_X8 (bit12 of POS_STW1) is 1.	Set ConfigEPos_X8 (bit12 of POS_STW1) to 0 in the relative positioning mode.

E551.5: Improper setting of H25.06 for task cancellation

Cause:

This fault occurs when H25.06 is lower than H25.04.

Troubleshooting:

Cause	Verification method	Solution
This fault occurs when H25.06 is lower than H25.04.	Check whether H25.06 is higher than or equal to H25.04.	Set H25.06 to a value higher than or equal to H25.04.

E602.0: Angle auto-tuning failure

Cause:

Unusual jitter occurs on the encoder feedback during angle auto-tuning.

Troubleshooting:

Cause	Verification method	Solution
The data fed back by the encoder is abnormal.	Check whether the encoder communication is disturbed.	Check the hardware wiring of the encoder.

E602.2: U/V/W phase sequence reversed

Cause:

A wrong U/V/W phase sequence or cable disconnection is detected during angle auto-tuning.

Troubleshooting:

Cause	Verification method	Solution
A wrong U/V/W phase sequence or cable disconnection is detected during angle auto-tuning.	Check whether the UVW three-phase wiring of the motor is correct and whether the cable is disconnected.	Check whether the UVW three-phase wiring is correct, or swap any two phases of the UVW three-phase sequence. Then perform auto-tuning again.

E605.0: Motor overspeed upon S-ON

Cause:

The motor speed exceeds the rated speed when the servo drive in size A/B is enabled.

Troubleshooting:

Cause	Verification method	Solution
The motor speed exceeds the rated speed when the servo drive is enabled.	Check whether the drive is enabled when the motor is in the generating state.	Enable the drive when the motor is at standstill.

E620.0: Motor overload

Cause:

Heat accumulation of the motor reaches the fault threshold.

Troubleshooting:

Cause	Verification method	Solution
1. Wiring of the motor and encoder is incorrect or in poor contact.	Check the wiring among the drive, motor, and encoder according to the correct wiring diagram.	Connect cables according to the correct wiring diagram. Preferably use the cables provided by Inovance. When customized cables are used, prepare and connect the cables according to the hardware wiring instructions.
2. The load is excessive. The motor keeps outputting effective torque that higher than the rated torque for a long time.	Confirm the overload characteristics of the servo drive or servo motor. Check whether the average load rate (H0b.12) of the servo drive keeps exceeding 100.0%.	Replace with a servo drive of higher capacity and a matching servo motor, or reduce the load and increase the acceleration/ deceleration time.
3. Acceleration/deceleration is frequent, or the load inertia is large.	Calculate the mechanical inertia ratio or perform inertia auto-tuning and view H08.15 (Inertia ratio). Confirm the single-shot operation cycle when the motor runs cyclically.	Increase the acceleration/ deceleration time during single-shot operation.
4. The gain is improper, or the stiffness is excessively high.	Check whether the motor vibrates and generates unusual noise during operation.	Adjust the gain again.
5. The drive or motor model is set incorrectly.	View the serial-type motor model in H00.05 and the drive model in H01.10.	Check the servo drive nameplate, and set the drive model (H01.10) correctly and use a matching motor according to Section 2.3.

Cause	Verification method	Solution
6. The motor is stalled due to mechanical problems, resulting in excessive load during operation.	Check the reference and motor speed (H0b.00) through the software tool or panel: Reference in position control mode: H0b.13 (Input position reference counter); Reference in speed control mode: H0b.01 (Speed reference); Reference in torque control mode: H0b.02 (Internal torque reference). Check whether the reference is not 0 but the motor speed is 0 in the corresponding mode.	Eliminate mechanical factors.
7. The servo drive is faulty.	The fault persists after the servo drive is powered off and on again.	Replace the drive.

E625.0: Brake abnormality enabled

Cause:

The brake is applied improperly.

Troubleshooting:

Cause	Verification method	Solution
Abnormal brake engagement occurs when the brake is released.	Check whether the motor shaft end is locked by the brake when the brake release signal is active.	Replace the motor with brake. Check the wiring of the brake.

E626.0: brake abnormality disabled

Cause:

Abnormal brake release occurs.

Troubleshooting:

Cause	Verification method	Solution
The brake fails when it closes.	Check whether the motor shaft end is not held tightly by the brake when the brake apply signal is active.	Replace the brake motor. Check the brake wiring.

E630.0: Motor stall over-temperature protection

Cause:

The actual motor speed is lower than 10 rpm but the torque reference reaches the limit, and such status lasts for the time defined by H0A.32.

Troubleshooting:

Cause	Verification method	Solution
1. Phase loss or incorrect phase sequence occurs at the drive UVW output.	Perform a no-load trial run on the motor and check the wiring.	Connect cables again according to the correct wiring diagram or replace the cables.
2. The motor rotor is stalled due to mechanical factors.	Check the reference and motor speed through the software tool or keypad: Reference in position control mode: H0b.13 (Input position reference counter) Reference in speed control mode: H0b.01 (Speed reference) Reference in torque control mode: H0b.02 (Internal torque reference) Check whether the reference is not 0 but the motor speed is 0 in the corresponding mode.	Eliminate mechanical factors.

E640.0: IGBT junction temperature excessively high

Cause:

The estimated IGBT temperature of the drive is excessively high.

Troubleshooting:

Cause	Verification method	Solution
1. The ambient temperature is too high.	Measure the ambient temperature.	Improve the cooling conditions for the servo drive to reduce the ambient temperature
2. The servo drive is powered off and powered on for several times to reset the overload fault.	View the fault log (set H0b.33 and view H0b.34) to check whether an overload fault/warning is reported (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0).	Change the fault reset method. After overload occurs, wait for 30s and then perform the reset operation. Increase the capacity of the servo drive and servo motor, increase the acceleration/ deceleration time, and reduce the load.
3. The fan is damaged.	Observe whether the fan works during operation.	Replace the drive.
4. The installation direction and clearance between servo drives are improper.	Check whether the servo drive is installed properly.	Install the servo drive according to the requirements.
5. The servo drive is faulty.	The fault persists after a system restart that is executed five minutes following a power loss.	Replace the drive.

E640.1: Flywheel diode junction temperature excessively high

Cause:

The estimated temperature of the flywheel diode of the drive is excessively high.

Troubleshooting:

Cause	Verification method	Solution
1. The ambient temperature is too high.	Measure the ambient temperature.	Improve the cooling conditions for the servo drive to reduce the ambient temperature
2. The servo drive is powered off and powered on for several times to reset the overload fault.	View the fault log to check whether an overload fault/warning is reported (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0).	Change the fault reset method. After overload occurs, wait for 30s and then perform the reset operation. Increase the capacity of the servo drive and servo motor, increase the acceleration/ deceleration time, and reduce the load.
3. The fan is damaged.	Observe whether the fan works during operation.	Replace the drive.
4. The installation direction and clearance between servo drives are improper.	Check whether the servo drive is installed properly.	Install the servo drive according to the requirements.
5. The servo drive is faulty.	The fault persists after a system restart that is executed five minutes following a power loss.	Replace the drive.

E650.0: Heatsink over-temperature

Cause:

The temperature of the servo drive power module is higher than the over-temperature threshold.

Troubleshooting:

Cause	Verification method	Solution
1. The ambient temperature is too high.	Measure the ambient temperature.	Improve the cooling conditions for the servo drive to reduce the ambient temperature
2. The servo drive is powered off and powered on for several times to reset the overload fault.	View the fault log (set H0b.33 and view H0b.34) to check whether an overload fault/warning is reported (E620.0, E630.0, E650.0).	Change the fault reset method. After overload occurs, wait for 30s and then perform the reset operation. Increase the capacity of the servo drive and servo motor, increase the acceleration/ deceleration time, and reduce the load.
3. The fan is damaged.	Observe whether the fan works during operation.	Replace the drive.
4. The installation direction and clearance between servo drives are improper.	Check whether the servo drive is installed properly.	Install the servo drive according to the requirements.
5. The servo drive is faulty.	The fault persists after a system restart that is executed five minutes following a power loss.	Replace the drive.

E660.0: Motor over-temperature

Cause:

The temperature of the air-cooled motor is too high.

Troubleshooting:

Cause	Verification method	Solution
1. The temperature of the air-cooled motor is excessively high.	Observe whether the temperature of the air-cooled motor is excessively high.	Cool the motor down.

E661.0: STune failure

Cause:

During STune tuning, gain reduction has reached the lower limit:
Position loop gain < 5;
Speed loop gain < 5;
Model loop gain < 10.

Troubleshooting:

Cause	Verification method	Solution
During STune operation, the gain drops to the lower limit and the stiffness level is lower than or equal to 10.	Check whether vibration resonance is properly suppressed in the system. The torque vibration amplitude exceeds the setpoint of H09.11.	Set the notch manually when vibration cannot be suppressed automatically. Modify the electronic gear ratio to improve the command resolution, or increase the command filter time constant in the "Parameter configuration" interface. Increase the threshold defined by H09.11 properly. Check the machine for cyclic fluctuation.

E662.0: ETune failure

Cause:

Resonance during ETune operation cannot be suppressed.

Troubleshooting:

Cause	Verification method	Solution
During ETune adjustment, gain reduction has reached the lower limit: position loop gain < 5; speed loop gain < 5; model loop gain < 10.	Check whether vibration resonance is properly suppressed in the system. The torque vibration amplitude exceeds the setpoint of H09.11.	1. When vibration cannot be suppressed automatically, set the notch manually. 2. Modify the electronic gear ratio to improve the reference resolution, or increase the reference filter time properly in the parameter configuration interface. 3. Increase the value of H09.11 properly. 4. Check whether the machine fluctuates periodically. 5. Check whether positioning threshold is excessively low. Increase the reference acceleration/deceleration time.

E663.0: ITune failure

Cause:

Check whether resonance that occurred during ITune operation cannot be suppressed.

Troubleshooting:

Cause	Verification method	Solution
Resonance cannot be suppressed during ITune operation.	Check whether vibration resonance is properly suppressed in the system. The torque vibration amplitude exceeds the setpoint of H09.11.	1. When vibration cannot be suppressed automatically, set the notch manually. 2. Modify the electronic gear ratio to improve the reference resolution, or increase the reference filter time properly in the parameter configuration interface. 3. Increase the value of H09.11 properly. 4. Check whether the machine fluctuates periodically.

E664.0: Excessive resonance

Cause:

Resonance occurs on the servo system and the torque fluctuation amplitude is higher than the value of H09.54.

Troubleshooting:

Cause	Verification method	Solution
Duration of system resonance exceeds 1s	Check whether the torque fluctuation range exceeds the value of H09.54.	1. Suppress the resonance. 2. Increase the threshold defined by H09.54.

E731.0: Encoder battery failure

Cause:

The voltage of the absolute encoder battery is lower than 2.9 V.

Troubleshooting:

Cause	Verification method	Solution
The battery is not connected during power-off.	Check whether the battery is connected during power-off.	Set H0d.20 to 1 to clear the fault.
The encoder battery voltage is excessively low.	Measure the battery voltage.	Use a new battery of matching voltage.
The encoder cable is plugged/ unplugged with power-on.	Check whether the encoder communication cable is plugged/ unplugged when the drive is powered on.	Do not hot-plug the encoder cable. Set H0d.20 to 1 to clear the fault.

E733.0: Encoder multi-turn counting error

Cause:

An encoder multi-turn counting error occurs.

Troubleshooting:

Cause	Verification method	Solution
The encoder is faulty.	Set H0d.20 (Absolute encoder reset function) to 2 (Reset the fault) to clear the fault, but E733.0 persists after the servo drive is powered off and on again.	Replace the motor.

E735.0: Encoder multi-turn count overflow

Cause:

A multi-turn counting overflow occurs on the absolute encoder.

Troubleshooting:

Cause	Verification method	Solution
The absolute encoder rotates more than 32767 turns in one direction in linear mode.	View the value of H0b.70 and check whether the encoder continues to run in this direction after the value of H0b.70 reaches 32767.	View the instructions for use of the absolute encoder. 1. This fault can be hidden in cases where the absolute position during operation needs to be recorded but the multi-turn absolute position can be left unrecorded. 2. The rotation mode applies when only single-turn absolute position needs to be recorded.

E740.0: Absolute encoder communication timeout

Cause:

Communication timeout occurs on the absolute encoder.

Troubleshooting:

Cause	Verification method	Solution
Connection of the encoder cable becomes loose.	1. Check encoder wiring. 2. Check whether on-site vibration is too strong, causing the encoder cable to loosen or even be damaged. 3. Replace the encoder cable. If the fault no longer occurs after replacement, the original encoder cable is damaged.	Replace the encoder cable or motor.

E740.2: Absolute encoder error

Cause:

A communication error occurs on the RX side of the encoder.

Troubleshooting:

Cause	Verification method	Solution
1. The encoder cables are connected improperly.	Check the encoder wiring.	Connect the encoder cables according to the correct wiring diagram.
2. The encoder cable is connected loosely.	Check whether on-site vibration is excessive, which loosens the encoder cable and even damages the encoder.	Re-connect the encoder cables and ensure the encoder terminals are connected securely.
3. The encoder Z signal is disturbed.	Check the on-site wiring. Check whether there are any large equipment nearby generating interference, or there are multiple power supply and drive devices in the cabinet generating interference. Put the servo drive in the "Rdy" state. Manually rotate the motor shaft counterclockwise and monitor whether the electrical angle increases or decreases smoothly, with one rotation corresponding to five (for Z-series motors) or four (for X-series motors) times of change in the range of 0° to 360°. If the electrical angle shows abnormal sudden changes during rotation, the encoder may be faulty. If no alarm occurs during rotation but an alarm occurs during servo drive operation, interference may exist.	It is recommended to use the standard cables recommended by Inovance. If a non-standard cable is used, check whether the cable complies with the specifications and whether it is a shielded twisted pair cable. Do not bundle the motor cables and the encoder cables together. Ensure the servo motor and the servo drive are well grounded. Check whether the connectors at both ends of the encoder are in good contact and whether any pin retracts.
4. The encoder is faulty.	Replace with a new encoder cable. If the fault no longer occurs after cable replacement, the original encoder cable is damaged. Keep the motor at the same position, and power on several times and check the value of H0b.10. The electrical angle deviation should be within ±30°.	Replace with a new encoder cable. If the fault persists, the encoder may be faulty. In this case, replace the motor.

E740.3: Absolute encoder single-turn calculation error

Cause:

An internal fault occurs on the encoder.

Troubleshooting:

Cause	Verification method	Solution
The encoder is faulty.	Replace with a new encoder cable. If the fault no longer occurs after cable replacement, the original encoder cable is damaged. Keep the motor at the same position, and power on several times and check whether the electrical angle deviation is within ±30°.	Replace with a new encoder cable. If the fault persists, the encoder may be faulty. In this case, replace the motor.

E740.6: Encoder write fault

Cause:

The attempt to write the encoder data fails.

Troubleshooting:

Cause	Verification method	Solution
An error occurs when writing the position offset after angle auto-tuning.	Replace with a new encoder cable. If the fault no longer occurs after cable replacement, the original encoder cable is damaged. Keep the motor at the same position, and power on several times and check whether the electrical angle deviation is within ±30°.	Replace with a new encoder cable. If the fault persists, the encoder may be faulty. In this case, replace the motor.

E760.0: Encoder over-temperature

Cause:

The temperature of the absolute encoder is too high.

Troubleshooting:

Cause	Verification method	Solution
The temperature of the absolute encoder is too high.	Measure the encoder or motor temperature.	Switch off the S-ON signal to wait for the encoder to cool down.

E939.0: Motor power cable disconnected

Cause:

At least one phase of the motor power cables is disconnected.

Troubleshooting:

Cause	Verification method	Solution
Motor power cables are disconnected.	Check and ensure that the motor is connected properly.	1. Check whether the power cables are disconnected or in poor contact. If yes, re-connect the power cables. 2. Replace the motor.

E939.1: Phase-U power cable disconnected

Cause:

Phase U power cable disconnected

Troubleshooting:

Cause	Verification method	Solution
Phase U power cable disconnected	Check and ensure that the motor is connected properly.	1. Check whether the power cables are disconnected or in poor contact. If yes, re-connect the power cables. 2. Replace the motor.

E939.2: Phase-V power cable disconnected

Cause:

Phase V power cable disconnected

Troubleshooting:

Cause	Verification method	Solution
Phase V power cable disconnected	Check and ensure that the motor is connected properly.	1. Check whether the power cables are disconnected or in poor contact. If yes, re-connect the power cables. 2. Replace the motor.

E939.3: Phase-W power cable disconnected

Cause:

Phase W power cable disconnected

Troubleshooting:

Cause	Verification method	Solution
Phase W power cable disconnected	Check and ensure that the motor is connected properly.	1. Check whether the power cables are disconnected or in poor contact. If yes, re-connect the power cables. 2. Replace the motor.

EA33.0: Encoder read/write check error

Cause:

Internal parameters of the encoder are abnormal.

Troubleshooting:

Cause	Verification method	Solution
1. The serial incremental encoder cable is disconnected or connected loosely.	Check the wiring.	Check for incorrect connection, open circuit, and poor contact of the encoder cable. Route the motor cable and encoder cable through different routes.
2. The attempt to read/write bus incremental encoder parameters failed.	If the fault persists after repeated power cycling, the encoder is faulty.	Replace the servo motor.

EB00.0: Excessive position deviation

Cause:

The position deviation is higher than the setpoint of H0A.10 in the position control mode.

Troubleshooting:

Cause	Verification method	Solution
1. Phase loss or incorrect phase sequence occurs at the drive UVW output.	Perform a no-load trial run on the motor and check the wiring.	Connect cables again according to the correct wiring diagram or replace the cables.
2. The servo drive U/V/W cables or encoder cable is disconnected.	Check the wiring.	Perform wiring again. The U/V/W terminals of the servo motor power cables must correspond with those of the drive power cables. If necessary, replace all cables and connect cables properly.
3. The motor rotor is stalled due to mechanical factors.	Check the reference and motor speed (H0b.00) through the software tool or panel: Reference in position control mode: H0b.13 (Input position reference counter); Reference in speed control mode: H0b.01 (Speed reference); Reference in torque control mode: H0b.02 (Internal torque reference). Check whether the reference is not 0 but the motor speed is 0 in the corresponding mode.	Eliminate mechanical factors.
4. The servo drive gains are excessively low.	Check the position loop gain and speed loop gain of the drive: 1st gain set: H08.00...H08.02; 2nd gain set: H08.03...H08.05	Adjust the gain manually or perform automatic gain auto-tuning.
5. The value of H0A.10 is excessively low under the operating conditions.	Check whether the setpoint of H0A.10 is too low.	Increase the value of H0A.10.
6. The servo drive or motor is faulty.	Monitor the operation waveform through the oscilloscope function in the software tool: position reference, position feedback, speed reference, and torque reference.	If the position reference is not 0, but the position feedback is always 0, replace the servo drive or motor.

EB00.1: Position deviation overflow

Cause:

Deviation of the position calculated by the drive is excessive.

Troubleshooting:

Cause	Verification method	Solution
1. Phase loss or incorrect phase sequence occurs at the drive UVW output.	Perform a no-load trial run on the motor and check the wiring.	Connect cables again according to the correct wiring diagram or replace the cables.
2. The servo drive U/V/W cables or encoder cable is disconnected.	Check the wiring.	Perform wiring again. The U/V/W terminals of the servo motor power cables must correspond with those of the drive power cables. If necessary, replace all cables and connect cables properly.
3. The motor rotor is stalled due to mechanical factors.	Check the reference and motor speed (H0b.00) through the software tool or panel: Reference in position control mode: H0b.13 (Input position reference counter); Reference in speed control mode: H0b.01 (Speed reference); Reference in torque control mode: H0b.02 (Internal torque reference). Check whether the reference is not 0 but the motor speed is 0 in the corresponding mode.	Eliminate mechanical factors.
4. The servo drive gains are excessively low.	Check the position loop gain and speed loop gain of the drive: 1st gain set: H08.00...H08.02; 2nd gain set: H08.03...H08.05	Adjust the gain manually or perform automatic gain auto-tuning.
5. The servo drive or motor is faulty.	Monitor the operation waveform through the oscilloscope function in the software tool: position reference, position feedback, speed reference, and torque reference.	If the position reference is not 0, but the position feedback is always 0, replace the servo drive or motor.

EB03.0: Electronic gear ratio beyond the limit - H05.02

Cause:

The electronic gear ratio (H05.02) exceeds the limit: (0.001, 4000 × Encoder resolution ÷ 10000).

Troubleshooting:

Cause	Verification method	Solution
The electronic gear ratio converted by H0502 exceeds the maximum gear ratio or is lower than the minimum gear ratio.	Check whether the electronic gear ratio converted by H05.02 is within the range of 0.001 to 4000 × Encoder resolution/10000.	Adjust the value of H05.02.

EB03.1: Electronic gear ratio 1 beyond the limit

Cause:

The electronic gear ratio 1 exceeds the limit: (0.001 to 4000 × Encoder resolution ÷ 10000).

Troubleshooting:

Cause	Verification method	Solution
The electronic gear ratio 1 exceeds the maximum gear ratio or is lower than the minimum gear ratio.	Check whether the electronic gear ratio 1 is within the range of 0.001 to 4000 × Encoder resolution ÷ 10000.	Adjust electronic gear ratio 1 (H05.07/H05.09).

EE01.0: PN system parameter fault

Cause:

The value of H24.04 (Fault No.) is greater than the length of the PN fault buffer length.

Troubleshooting:

Cause	Verification method	Solution
The fault No. (H24.04) exceeds the PN fault buffer length of 63.	Check the value of H24.04.	Adjust the value of H24.04.

EE03.0: Communication timeout

Cause:

Communication frames are present between the host controller and the drive, but the drive is in the waiting state for communication.

Troubleshooting:

Cause	Verification method	Solution
Communication frames are present between the host controller and the drive, but the drive is in the waiting state for communication.	Check whether the PLC is in the normal operation status. Check whether shielded twisted pairs are used as communication cables. Check whether the drive is properly grounded. Check whether the communication cables are connected. If the IRT mode is used, check whether the host controller topology connection matches the actual connection. The PLC is connected to too many axes, causing watchdog timeout.	Switch the PLC to normal operation status. Use shielded twisted pair cables. Follow the standard wiring instructions for wiring. Check that the host controller topology connection matches the actual connection. Increase the watchdog time.

EE03.1: Communication status abnormal

Cause:

200P heartbeat check error

Troubleshooting:

Cause	Verification method	Solution
The communication chip is faulty.	Check whether the PLC is in the normal operation status. Check whether shielded twisted pairs are used as communication cables. Check whether the drive is properly grounded. Check whether the communication cables are connected. If the IRT mode is used, check whether the host controller topology connection matches the actual connection. The PLC is connected to too many axes, causing watchdog timeout.	Switch the PLC to normal operation status. Use shielded twisted pair cables. Follow the standard wiring instructions for wiring. Check that the host controller topology connection matches the actual connection. Increase the watchdog time.

EE08.0: PLC synchronization lost

Cause:

The SYNC signal is turned off when the network is in the OP state.

Troubleshooting:

Cause	Verification method	Solution
bit10 of the PLC control word changes after the servo drive is enabled in host controller control mode.	Check whether STW1.bit10 is 0.	If STW1.bit10 is 0, set bit10 to 1.

EE08.1: PLC stopped

Cause:

When the drive is enabled, the network status switches from OP to other status.

Troubleshooting:

Cause	Verification method	Solution
The PLC stops during synchronous communication.	Check whether the PLC operates normally. Check whether shielded twisted pairs are used as communication cables. Check whether the drive is grounded properly. Check whether the communication cable is connected.	Switch the PLC to the normal operating status. Use shielded twisted pairs. Connect cables according to the standard wiring instructions.

EE08.7: Abnormal heartbeat

Cause:

The heartbeat sent by the host controller is abnormal during synchronous communication.

Troubleshooting:

Cause	Verification method	Solution
The heartbeat is abnormal during synchronous communication.	Check whether shielded twisted pairs cables are used for communication. Check whether the servo drive is grounded properly. Check the value of H29.01.	Use shielded twisted pair cables. Connect cables according to the standard wiring instructions.

EE08.8: No network connection during synchronous communication

Cause:

No network connection during synchronous communication

Troubleshooting:

Cause	Verification method	Solution
No network connection during synchronous communication	Check whether shielded twisted pairs are used as communication cables. Check whether the drive is grounded properly. Check whether the communication cable is connected.	Use shielded twisted pair cables. Connect cables according to the standard wiring instructions.

EE08.9: LAN cable disconnected

Cause:

The network cable is disconnected during synchronous communication.

Troubleshooting:

Cause	Verification method	Solution
The network cable is disconnected during synchronous communication.	Check whether shielded twisted pairs are used as communication cables. Check whether the drive is grounded properly. Check whether the communication cable is connected.	Use shielded twisted pair cables. Connect cables according to the standard wiring instructions.

EE09.0: Software limit setting error

Cause:

The lower limit of the software limit is equal to or larger than the upper limit.

Troubleshooting:

Cause	Verification method	Solution
The software lower limit is equal to or higher than the software upper limit.	Check the values of H0A.41 and H0A.43.	Reset the values of H0A.43 and H0A.41 and ensure the former is lower than the latter.

EE09.1: Home setting error

Cause:

The home offset exceeds the upper/lower limit.

Troubleshooting:

Cause	Verification method	Solution
1. The home offset is outside the software limit range.	The home offset is outside the software position limit when the encoder works in the incremental mode, absolute linear mode, and single-turn absolute mode.	Set the home offset to a value between the software limits.
2. The home offset is beyond the upper/lower limit in rotation mode.	The home offset is outside the mechanical single-turn upper/ lower limit when the encoder works in the rotation mode.	Set the home offset to a value between the limits of the mechanical single-turn.

EE11.1: Failed to read from EEPROM by bus

Cause:

Communication with the external EEPROM fails.

Troubleshooting:

Cause	Verification method	Solution
The attempt to read the data in EEPROM failed.	This fault persists after the drive is powered off and on several times.	Replace the drive.

EE11.2: EEPROM update failure by bus

Cause:

The communication is normal but the message in the EEPROM is incorrect or lost.

Troubleshooting:

Cause	Verification method	Solution
The attempt to update the data in EEPROM failed.	This fault persists after the drive is powered off and on several times.	Replace the drive.

EE12.0: Parallel port detection error

Cause:

Peripheral initialization failed after power-on.

Troubleshooting:

Cause	Verification method	Solution
Internal integrated circuit fault	The fault persists after repeated power cycling.	Replace the drive.

EE13.0: PN synchronization cycle setting error

Cause:

After the system switches to the operation mode, the synchronization cycle is not an integer multiple of 125 μs or 250 μs.

Troubleshooting:

Cause	Verification method	Solution
The synchronization cycle is not an integer multiple of 125 μs or 250 μs.	Check the synchronization cycle set in the host controller.	Modify the synchronization cycle to an integer multiple of 125 μs or 250 μs.

EE15.0: Excessive PN synchronization signal error

Cause:

The synchronization cycle deviation exceeds the threshold.

Troubleshooting:

Cause	Verification method	Solution
Internal integrated circuit fault	The fault persists after repeated power cycling.	Replace the drive.

EE16.0: Logic configuration fault

Cause:

Communication between MCU and ESC times out.

Troubleshooting:

Cause	Verification method	Solution
ESC coprocessor communication initialization error	Check whether the ESC software version is normal.	Replace the drive.

EE18.0: PN device name lost

Cause:

The device name in the PN flash is missing.

Troubleshooting:

Cause	Verification method	Solution
The communication is faulty, leading to device name loss.	Check whether the device name is present through the software tool network.	Assign the device name again.

EE19.8: Modification of subdivision settings not supported in DSC mode

Cause:

DSC does not support user-defined high-precision subdivision resolution.

Troubleshooting:

Cause	Verification method	Solution
Modification of subdivision settings is not supported in DSC mode of the 105 telegram.	Check whether H24.61 is set to 1 (enable), and then check whether 105 message is present.	Change H24.61 to 0.

16.6.2 Internal Faults

When any one of the following faults occurs, contact Inovance for technical support.

- E220.0: Phase sequence fault
- EA40.0: Parameter auto-tuning failure
- E111.0: Internal parameter fault

17 Maintenance

17.1 Safety Instructions for Maintenance

- Maintenance, inspection, and parts replacement must be performed only by professionals.
- Never service the equipment with power on. Failure to comply can result in an electric shock.
- Cut off all power supplies of the equipment, and wait for at least the time specified on the warning label before maintenance.
- Measure the voltage between the positive and negative electrodes of the equipment battery and the voltage between the positive and negative electrodes and the ground. Ensure that the voltage is below 36 V before any operation.
- Keep the product and components away from inflammable materials and take anti-static measures.
- Prevent the cover from falling off. Otherwise, equipment damage and personal injury may occur.
- Prevent contamination or damage to the sealing ring. Failure to comply may shorten the product service life or even damage the product.

17.2 Maintenance Interval

The electrical and electronic parts inside the servo drive and motor may be mechanically worn out and degraded. To keep the drive and motor in good condition, perform parts replacement based on the replacement intervals listed in the following table. Before replacement, contact the agent or Inovance first to check whether the components need to be replaced.

Item	Category	Standard replacement interval	Remarks
Drive	Power bus capacitor	About 8 years (ambient temperature: 30°C; load rate: 80%; uptime per day: 20 hours; standard environment [1])	The standard replacement cycle is for reference only. If any device or component works improperly before the replacement cycle expires, replace it immediately. The electrolytic capacitor will deteriorate after long-term storage. Therefore, switch on the drive once for at least 5 hours every 6 months. Increase the input voltage slowly to the rated value by using a voltage regulator. Contact Inovance for technical support if necessary.
	Cooling fan	About 5 years (ambient temperature: 30°C; load rate: 80%; uptime per day: 20 hours; standard environment[1])	
	Aluminum electrolytic capacitor on the PCB	About 10 years (ambient temperature: 30°C; load rate: 80%; uptime per day: 20 hours; standard environment [1])	
	Pre-charge relay	100,000 operations (depending on the operating conditions)	
	Pre-charge resistor	20,000 operations (depending on the operating conditions)	
	Dynamic brake relay	About 1,000 operations (rated motor speed; interval: 5 min; inertia: 20)	
	Dynamic braking resistor		
Motor	Bearing	22,000 to 40,000 hours	The standard replacement cycle is for reference only. If any device or component works improperly before the replacement cycle expires, replace it immediately.
	Fan	30,000 h to 40,000 h	
	Encoder	22,000 to 40,000 hours	
	Encoder battery	22,000 to 40,000 hours	
	Insulation resistance	Check the insulation resistance at least once per year.	Use an insulation resistance gauge (set to 500 VDC) to measure the insulation resistance. Measurement method: Measure the resistance between the PE (grounding) and any phase among U/V/W. The resistance measured should be higher than 10 MΩ.
Device	Overall inspection	Perform overall inspection at least once every five years or every 20,000 hours, whichever comes first.	Perform maintenance based on the related maintenance guide of the equipment.

Note

[1]: See " *Installation Environment Requirements" on page 62* for the standard environment.

17.3 Routine Maintenance

17.3.1 Routine Maintenance Checklist

The standard environmental conditions are as follows: average ambient temperature: 30°C; average load rate: < 80%; uptime: < 20 hours per day

Routine checklist

Table 17–1 Routine checklist

No.	Routine checklist	Tick
1	The ambient temperature and humidity are normal. There is no dust or unwanted objects in the servo drive.	☐
2	There is no abnormal vibration or noise.	☐
3	The voltage of the power supply is normal.	☐
4	There is no strange smell.	☐
5	There are no fibers adhered to the air inlet.	☐
6	There is no intrusion of unwanted objects on the load end.	☐
7	The brake circuit is functioning properly. The control circuit is not loose or showing any other abnormalities, such as blackening or melting. Perform a separate brake functional test to verify that the brake operates normally.	☐

Routine cleaning checklist

Table 17–2 Routine cleaning checklist

No.	Routine cleaning checklist	Tick
1	Clean the dust on the equipment surface, especially the metallic dust.	☐
2	Keep the front end of the servo drive and the connectors clean.	☐
3	The service life of the bearing may be reduced when the motor rotates forwardly/reversely continuously at an angle lower than 150°. Therefore, rotate the motor shaft for more than one revolution at least once a day.	☐

Note

- Before cleaning, switch off the power supply and clean with an air gun or a piece of dry cloth.
- Do not use gasoline, dilutes, alcohol, or acid or alkaline detergent to prevent enclosure discolor or damage.

17.3.2 Regular Checklist

Table 17–3 Regular checklist

No.	Item	Tick
1	The screws used to fix the couplings between devices are in place.	☐
2	There is no sign of overtemperature.	☐
3	Terminal blocks are in good condition without any sign of damage.	☐
4	The clamping units of terminal blocks are in place.	☐
5	Check and clean the heatsink (every 6 to 12 months).	☐

Dust easily accumulates on the fins of the heatsink. If the heatsink is not cleaned, the drive may trigger an overtemperature alarm, with the service life shortened. In normal environments, the heatsink must be checked annually. In dirty environments (such as cutting fluid, textile fibers, greasy dirt, high dust levels), reduce the heatsink cleaning interval.

Clean the heatsink as follows (as needed):

1. Remove the cooling fan (for air-cooled equipment only).

2. Blow the air from bottom to top using compressed air (dry), and collect dust using a vacuum cleaner at the outlet.

Note

If there is a risk of dust entering adjacent equipment, move the equipment to another room for cleaning.

3. Replace the cooling fan (for air-cooled equipment only).

17.4 Replacing Components

17.4.1 Replacing the Drive



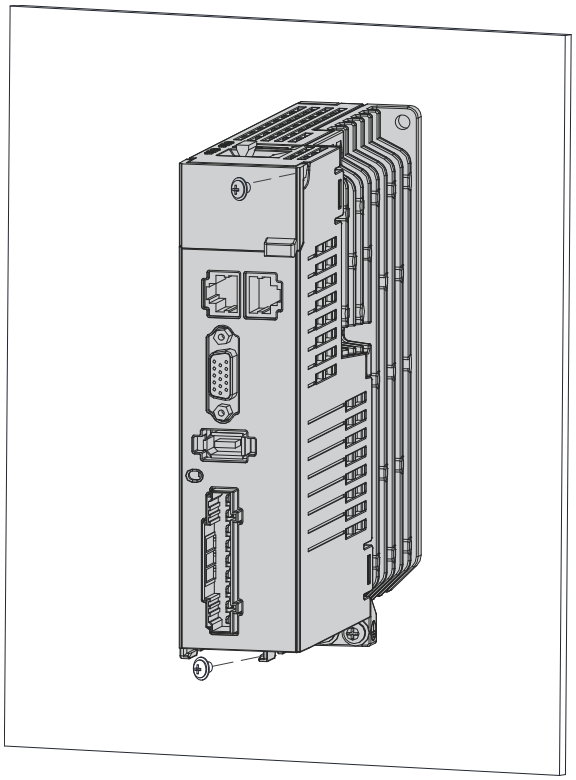
- Note that the drive is energized with high voltage. All the wiring work can be performed with power off only.
- Before maintenance, power off and wait for at least 15 minutes until the voltage of drive is lower than 36 VDC. Failure to comply may result in personal injury caused by the residual voltage in the capacitor.
- Only trained professionals are allowed to perform inspection and maintenance on the drive. Failure to comply may result in severe personal injury, death, or major property loss.
- Even if the motor is not running, the power supply and terminals may still be live due to presence of an external power supply. Be careful when you operate with the equipment.
- Take cautious when handling heavy equipment or equipment with high center of gravity. Improper lifting or handling may result in death, serious personal injury, or major property loss.

Procedure

1. Disconnect the drive power supply.
2. After power off for 15 minutes, check that the drive voltage has dropped to a safe level.
3. Remove all cables from the drive.
4. Remove the two M4 screws that secure the drive and take off the drive.

   Note:

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



5. Install the drive and secure it with two M4 screws. The recommended torque is 1.2 N·m. After the drive is installed, check the items on the checklist. For details about mechanical installation and the post-installation checklist, see *" Mechanical installation" on page 76*.
6. Re-connect the cables and check the items according to the post-installation checklist. For details about electrical installation and the post-wiring checklist, see *" Wiring" on page 82*.
7. Connect the power supply of the drive.
8. Complete commissioning with the commissioning tool. For details about the commissioning tool and commissioning procedure, see *" Commissioning Tool" on page 136* and *" Commissioning and Operation" on page 170*.

17.4.2 Replacing the Motor Flat Key

Caution

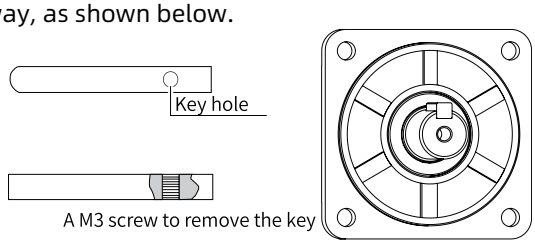
- Observe all the requirements presented in this chapter. Failure to comply may result in equipment fault or damage.
- Violent disassembly is not allowed. Take enough care during disassembly to prevent personal injury.

The MS1 series standard motors in frame sizes 60, 80, and 130 adopt C-type flat keys with disassembly holes. To disassemble the flat key, select a proper disassembly bolt (inner hexagon bolt recommended) based on the following table.

Specification of disassembly bolt for MS1 series motor		
Motor Frame Size	Flat Key Dimensions	Disassembly Bolt Specifications (Inner Hexagon Bolt)
40	A-type flat key: A3 × 3 × 14	No disassembly hole
60	C-type flat key: C5 × 5 × 16.5	M3 x 10 and above
80	C-type flat key: C6 × 6 × 25	M3 x 15 and above
100	C-type flat key: C8 × 7 × 35	M3 x 20 and above
130	C-type flat key: C8 × 7 × 35	M3 x 20 and above
180	C-type flat key: C10 × 8 × 64	M3 x 20 and above

- Tool needed: an Allen wrench
- Disassembly procedure:

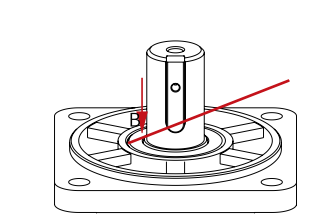
1. Select a proper disassembly bolt (inner hexagon bolt recommended) based on the motor model.
2. Use an Allen wrench to screw down the screw clockwise until the A-A end of the flat key is detached from the keyway, as shown below.



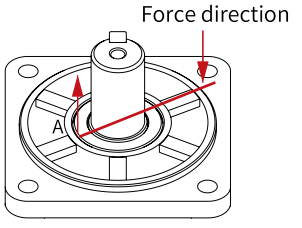
17.4.3 Replacing the Motor Oil Seal

- Tools needed: a pair of needle-nose pliers, a pair of slip-proof gloves, and a piece of cotton cloth.
- Disassembly procedure:

1. Put the cotton cloth onto the supporting point B to avoid the end cover from being scratched during disassembly.
2. Secure the motor and use the needle-nose pliers to hold point A of the oil seal lip.
3. Pry the oil seal out gradually against the supporting point B.



(Support point B is at the step of the extension)



(Support point A is at the outer lip of the oil seal)

18 Technical Specifications

18.1 Electrical Specifications

- Single-phase 220 V drive

Item		Size A		Size B	Size C	Size D
Drive model		S1R6	S2R8	S5R5	S7R6	S012
Drive power (kW)		0.2	0.4	0.75	1	1.5
Max. applicable motor capacity (kW)		0.2	0.4	0.75	1	1.5
Power supply equipment capacity (kVA)		1.4	2.8	4.6	6.0	8.0
Continuous output current (Arms)		1.6	2.8	5.5	7.6	11.6
Max. output current (Arms)		5.8	10.1	16.9	23.0	32.0
Main circuit [1]	Continuous input current (Arms)	2.3	4.0	7.9	9.6	12.8
	Main circuit power supply	Single-phase 200 VAC to 240 VAC, -10% to +10%, 50 Hz/60 Hz				
	Energy loss (W)[2]	10.21	23.8	38.2	47.32	69.84
Control circuit	Control circuit power supply	No separate power supply required [5]			Single-phase 200 VAC to 240 VAC, -10% to +10%, 50 Hz/60 Hz	
	Energy loss (W)[3]	16				
Braking resistor	Resistance (Ω)	-	-	50	25	
	Power (W)	-	-	50	80	
	Minimum resistance of external resistor (Ω)	40	40	40	20	15
	Maximum braking energy absorbed by capacitor (J)[6]	7.86	15.72	22.39	32.39	47.6
	Braking resistor	All models support built-in and external braking resistors. Only drives in size A do not come with a built-in braking resistor as standard.				
Cooling method		Naturally-ventilated		Air cooling		
Overvoltage category		III				
Maximum input surge current (A)		18.65	18.65	18.65	12.44	12.44
3τ (ms) (3 × RC time constant)		19.8	39.6	56.4	122.4	180

- Three-phase 220 V drives

Item	Size C	Size D
Drive model	S7R6	S012
Drive power (kW)	1	1.5
Max. applicable motor capacity (kW)	1	1.5
Power supply equipment capacity (kVA)	5.05	6.68
Continuous output current (Arms)	7.6	11.6
Max. output current (Arms)	23	32

Item		Size C	Size D
Main circuit [1]	Continuous input current (Arms)	5.1	8.0
	Main circuit power supply	Three-phase 200 VAC to 240 VAC, -10% to +10%, 50 Hz/60 Hz	
	Energy loss (W)[2]	47.32	69.84
Control circuit	Control circuit power supply	Single-phase 200 VAC to 240 VAC, -10% to +10%, 50 Hz/60 Hz	
	Energy loss (W)[3]	16	
Braking resistor	Resistance (Ω)	25	
	Power (W)	80	
	Minimum resistance of external resistor (Ω)	20	15
	Maximum braking energy absorbed by capacitor (J)[6]	32.39	47.6
	Braking resistor	Built-in braking resistor (external braking resistor supported)	
Cooling method		Air cooling	
Overvoltage category		III	
Maximum input surge current (A)		12.44	12.44
3τ (ms) (3 × RC time constant)		122.4	180

- Three-phase 380 V drive

Item		Size C		Size D		Size E		
Drive model		T3R5	T5R4	T8R4	T012	T017	T021	T026
Drive power (kW)		1	1.5	2	3	5	6	7.5
Max. applicable motor capacity (kW)		1	1.5	2	3	5	6	7.5
Power supply equipment capacity (kVA)		6.05	9.08	10.23	15.15	22.25	25.0	31.25
Continuous output current (Arms)		3.5	5.4	8.4	11.9	16.5	20.8	25.7
Max. output current (Arms)		11	14	20	29.75	42	55	65
Main circuit [1]	Continuous input current (Arms)	2.4	3.6	5.6	8.0	12.0	16.0	21.0
	Main circuit power supply	Three-phase 380 VAC to 440 VAC, -10% to +10%, 50 Hz/60 Hz						
	Energy loss (W)[2]	39.5	63.25	94.82	135.47	187.62	228.28	258.63
Control circuit	Control circuit power supply	Single-phase 380 VAC to 440 VAC, -10% to +10%, 50 Hz/60 Hz						
	Energy loss (W)[3]	16						
Braking resistor	Resistance (Ω)	100	100	50	50	35	35	35
	Power (W)	80	80	80	80	100	100	100
	Minimum resistance of external resistor (Ω)	80	60	45	40	35	25	25
	Maximum braking energy absorbed by capacitor (J)[6]	28.18	34.22	50.32	50.32	82.49	100.64	100.64
	Braking resistor	Built-in braking resistor (external braking resistor supported)						
Cooling method		Air cooling						
Overvoltage category		III						

Item	Size C		Size D		Size E		
Maximum input surge current (A)	24.89	24.89	24.89	24.89	24.89	24.89	24.89
4 τ (ms)[3] (3 × RC time constant)	30.6	30.6	45	45	73.8	90	90

Note

- [1]: The main circuit of the S7R6 and S012 drives support single-phase 220 V power supplies without derating.
- [2]: Main circuit energy loss refers to the energy loss under rated output current of the drive.
- [3]: Control circuit energy loss refers to the energy loss under rated input current of the drive.
- [4] RC time constant = Buffer resistor R × Bus capacitor C, which is used to indicate the power-on time (when the bus voltage reaches the stable state after a time of 3τ).
- [5]: The control circuit and power circuit of drives in size A and size B share the same input power supply (L1/L2), with power drawn from the bus and rectifier unit used jointly. Therefore, there is no independent power supply terminal.
- Select the external braking resistor according to actual operating conditions.
- [6]: The default braking threshold of a single-phase/three-phase 220 V drive is 380 V. The default braking threshold of a three-phase 380 V drive is 700 V. The maximum braking energy (E_C, J) that can be absorbed by the capacitor is determined by the power supply voltage (220 Vac or 380 Vac). Calculation formula:

$$E_C = \frac{1}{2}C\left[V_{\text{Discharge threshold voltage}}^{\ 2} - \left(V_{\text{Power supply voltage}} \times \sqrt{2}\right)^2\right]$$

When the power supply voltage changes, adjust the values proportionally for calculation.

$$E_C = E_{C\text{Original table data in the manual}} \times \frac{V_{\text{Actual discharge threshold voltage}}^{\ 2} - \left(V_{\text{Actual power supply voltage}} \times \sqrt{2}\right)^2}{V_{\text{Default discharge threshold voltage}}^{\ 2} - \left(V_{\text{Default power supply voltage}} \times \sqrt{2}\right)^2}$$

For example, assume that the energy absorbed by the capacitor of the S2R8 model servo drive at a supply voltage of 220 Vac is 15.72 J. In this case, the energy absorbed by the capacitor at a supply voltage of 240 Vac is calculated as follows:

$$E_C = 15.72 \times \frac{380^2 - \left(240 \times \sqrt{2}\right)^2}{380^2 - \left(220 \times \sqrt{2}\right)^2} = 9.64\text{J}$$

18.2 Technical Specifications

Item			Description
General Specifications	Control mode		IGBT PWM control, sine wave current drive mode 220 V, 380 V: single-phase/three-phase full wave bridge rectification
	Encoder feedback		23-bit multi-turn absolute encoder, which can be used as an incremental encoder when no battery is connected
	Condition for use	Ambient/Storage temperature[1]	0℃ to 55℃ (If the ambient temperature exceeds 45℃, derate by 10% for every additional 5℃.)/-20℃ to +70℃
		Operating/Storage humidity	Below 90% RH (no condensation)
		Vibration resistance	4.9 m/s^2
		Shock resistance	19.6 m/s^2
		IP rating	IP20, excluding terminals (IP00)
		Pollution degree	PD2
		Protection class	Class I
		Short circuit rating	5KA, 65KA
		Altitude	The maximum altitude is 2000 m. 1000 m and below: Derating is not needed. Derating is needed for altitudes above 1000 m (derate 1% for every additional 100 m). For altitudes above 2000 m, contact Inovance.
Speed/Torque Control mode	Performance	Speed control range	1 rpm to 6000 rpm (Under the rated torque control, the drive can keep running as long as the lower limit of the speed control range is not exceeded.)
		Speed loop bandwidth	3 kHz
		Torque control accuracy (repeatability)	±2%
		Soft startup time setting	0s to 65s (This parameter can be set for acceleration and deceleration separately.)
	Input Signal	Speed reference input	Network-type instructions are from PROFINET communication.
		Torque reference input	Local mode supported
Position control mode	Performance	Positioning time	1 ms–10 ms
	Input Signal	Position reference	Network-type instructions are from PROFINET communication. Local mode supported

Item			Description
Position control mode	DI signal	DI signal function assignment	5 DIs
			P-OT (Forward overtravel switch) N-OT (Reverse overtravel switch) HomeSwitch (Home switch) TouchProbe1 (Touch probe 1) TouchProbe2 (Touch probe 2)
	DO signal	Output signal function assignment	3 DOs; with-load capacity: 50 mA; voltage range: 5 V to 30 V
			S-RDY (Servo ready) TGON (Motor rotation output) Comparison output, brake output, and EDM output
Built-in functions	Overtravel (OT) prevention		The servo drive stops immediately when P-OT or N-OT is active.
	Protective functions		Providing protections against overcurrent, overvoltage, undervoltage, overload, main circuit detection error, heatsink overheat, overspeed, encoder error, CPU error, and parameter error
	LED display		Main circuit CHARGE indicator, 5-digit LED display
	Vibration suppression		5 notches (including two adaptive notches) available, 50 Hz to 5,000 Hz
	Communication Function	Software tool commissioning	RS232
		Connection protocol	PROFINET
		Multi-station communication	Max. number of connections: 65535 (PROFINET, PLC-dependent)
		Axis address setting	Automatic allocation by host controller (PROFINET)
		Function	Including status display, user parameter setting, monitored value display, fault tracing display, jog and auto-tuning, and speed/torque reference signal observation
	Others		Gain tuning, alarm log, and jog

Note

[1]: Install the servo drive within the allowable ambient temperature range. When it is installed inside a control cabinet, the temperature inside the cabinet must also be within this range.

18.3 Communication Specifications

Item	Specification
Communication protocol	PROFINET protocol
Process data	RT and IRT
Acyclic	Support for access to industry standard parameters and function code parameters
Bus cycle	RT mode: Minimum 1 ms IRT mode: Minimum 500 μs
Synchronization jitter	< 1 μs
Physical layer	100Base-TX
Baud rate	100 Mbit/s (100Base-TX)

Item	Specification
Duplex mode	Full duplex
Topology	Ring, linear, star, and tree
Transmission medium	Shielded CAT 5E cable or better
Number of slaves	Up to 65535 slaves supported by the protocol (determined by PLC performance)
Bit error rate	10^{-10} Ethernet standard
I&M data	I&M0 to I&M4
Configuration version	TIA Portal software V14 or later STEP7 V5.5 SP3 or later SMOTION and 200 SMART compatible version, consistent with SV660F
PROFINET version	V2.4
PROFINET interface	Number of ports: 2

Function	Specification
Alarm/Diagnosis information	Supported
DCP CALL (device search)	Supported
MRP (ring network)	Supported
MRPD (rapidly recovering ring network)	Supported
PROFINET system redundancy	Supported
Boost priority	Supported
Port disabling	Supported
Configuration-free upon device change	Supported

18.4 Dynamic Brake Characteristic Curve

According to the motor model, initial speed and load inertia, the dynamic braking distance can be estimated. The approximate value of the dynamic braking distance can be calculated by the following formula. For the accurate value, please use the dynamic braking calculation function provided by our software.

Maximum braking distance s (turn) is:

$$s = \frac{V_0}{60}\left(t_e + (\tau_1 + \tau_2 V_0^2)\left(1 + \frac{J_L}{J_M}\right)\right)$$

The coefficient is as follows:

$$\tau_1 = \frac{2R_s J}{3p_n^2 \Psi_f^2} = \frac{10000\pi^2 R_s J}{9K_e^2}$$

$$\tau_2 = \frac{\pi^2 L_d^2 J}{4050 R_s \Psi_f^2} = \frac{100 L_d^2 \pi^4 P_n^2 J}{243 R_s K_e^2}$$

$$\Psi_f = \frac{\sqrt{6} K_e}{100\pi P_n}$$

- V_0: Maximum feedback speed
- t_e: Dynamic brake program and relay delay
- J_L: Load moment of inertia

- J_M: Motor moment of inertia
- P_n: Number of motor pole pairs
- R_s: Stator resistance (Ω)
- L_q, L_d: q-axis inductance (mH), d-axis inductance (mH).

18.5 Load Moment of Inertia

The load moment of inertia represents the ratio of the load inertia to the rotor inertia. The higher the load inertia ratio, the weaker the responsiveness will be. An excessively high inertia ratio can result in unstable operation. The allowable load inertia ratio of the servo motor is limited. The value is a general standard and varies according to the driving conditions of the servo motor.

An overvoltage alarm may occur during deceleration if the load moment of inertia exceeds the allowable value. For servo drives with a built-in braking resistor, an overload alarm may be reported. In cases of such alarms, take one of the following measures:

- Reduce the torque limit value.
- Reduce the deceleration rate.
- Reduce the maximum speed.
- Install an external braking resistor if the alarm cannot be cleared using the above measures.

Caution

- For the built-in braking resistor of the drive, see Components.
- Even you use a built-in resistor, the energy generated in some regenerative conditions may exceed the allowable capacity loss (W) of the resistor. In this case, an external braking resistor is required.

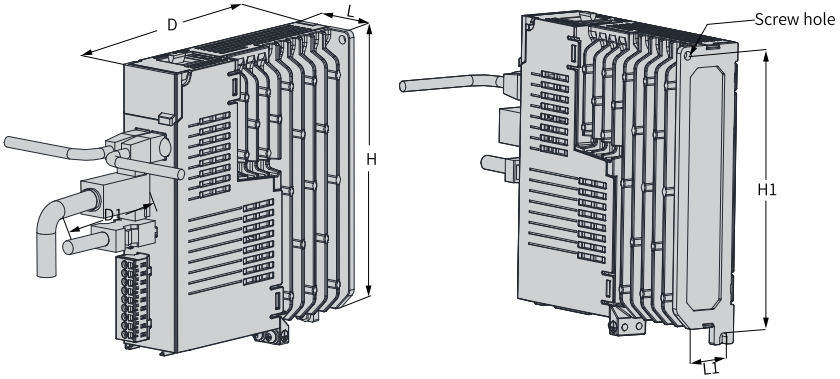
Table 18–1 Permissible load moment of inertia

<table>
<tr><td rowspan="3">Motor speed (RPM)</td><td colspan="12">Drive model
SV660 series</td></tr>
<tr><td colspan="2">Size A</td><td>Size B</td><td colspan="3">Size C</td><td colspan="3">Size D</td><td colspan="3">Size E</td></tr>
<tr><td>S1R6</td><td>S2R8</td><td>S5R5</td><td>S7R6</td><td>T3R5</td><td>T5R4</td><td>S012</td><td>T8R4</td><td>T012</td><td>T017</td><td>T021</td><td>T026</td></tr>
<tr><td>1500</td><td colspan="12">× 20</td></tr>
<tr><td>3000</td><td colspan="9">× 20</td><td colspan="3">× 10</td></tr>
<tr><td>4500</td><td colspan="9">× 20</td><td colspan="3">× 5</td></tr>
<tr><td>6000</td><td colspan="9">× 20</td><td colspan="2">× 5</td><td>Not supported</td></tr>
<tr><td>7000</td><td colspan="5">× 20</td><td colspan="7">Not supported</td></tr>
</table>

Note

- Motor speed: Represents the maximum speed supported by the motor. For example, MS1H1/H4 supports up to 7000 rpm, MS1H2 supports up to 6000 rpm, and MS1H3 supports up to 4500 rpm.
- When operating at more than 10 x maximum inertia speed, setting the acceleration and deceleration time to excessively low values may trigger a drive alarm.

18.6 Product Dimensions

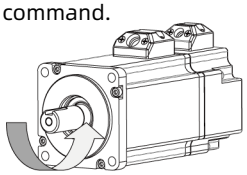


Size	L	H	D	L1	H1	D1	Screw Hole	Tightening Torque	Weight
	Unit: mm (in.)							Unit: N·m	Unit: kg (lb.)
A	40 (1.57)	170 (6.69)	150 (5.91)	28 (1.10)	161 (6.34)	75 (2.95)	2xM4	0.6 to 1.2	0.8 (1.76)
B	50 (1.97)	170 (6.69)	173 (6.81)	37 (1.46)	161 (6.34)	75 (2.95)	2xM4	0.6 to 1.2	1.0 (2.20)
C	55 ± 1 (2.17±0.04)	170 (6.69)	173 ± 1 (6.81±0.04)	44 (1.73)	160 (6.30)	75 (2.95)	2xM4	0.6 to 1.2	1.3 (2.87)
D	80 ± 1 (3.15±0.04)	170 (6.69)	183 (7.20)	71 (2.80)	160 (6.30)	75 (2.95)	3×M4	0.6 to 1.2	1.8 (3.97)
E	90 (3.54)	250 (9.84)	230 (9.06)	78 (3.07)	240.5 (9.47)	75 (2.95)	4xM4	0.6 to 1.2	3.6 (7.94)

19 Motor Technical Specifications

19.1 General Specifications (MS1-R Motor)

19.1.1 Mechanical Characteristics

Item	Description
Duty type	S1 (Continuous duty)
Vibration class[1]	V15
Insulation resistance	500 VDC, above 10 MΩ
Excitation mode	Permanent magnet
Installation method	Flange
Thermal class	F (155℃)
Insulation voltage	1500 VAC, 1 minute (220 V class) 1800 VAC, 1 minute (380 V class)
IP rating	IP67 (excluding shaft opening and flying leads type motor connectors)
Direction of rotation	Rotates counterclockwise (CCW) when viewed from the shaft extension side with a forward run command.  CCW

Item		Description
Ambient condition	Ambient temperature	0°C to 40°C (non-freezing)
	Ambient humidity	20% RH to 80% RH (without condensation)
	Rated operating altitude	1000 m
	Altitude-based derating	• 1000 m and below: Derating is not needed. • For use above 1000 m, derate according to *"19.1.3 Derating Characteristics" on page 690*. For altitudes above 2000 m, install an isolation transformer at the power input end.
	Installation location	• Free from corrosive or explosive gases • Well ventilated with minimum amount of dust, waste, and moisture • Convenient for inspection and cleaning • Away from sources that may generate strong magnetic field • Away from heating sources such as heating stoves. • Use a motor with oil seal in places with grinding fluid, oil mist, iron powders or cuttings. • Oil seal protection capability: The oil seal is only dust-proof. It cannot withstand the intrusion of oil for a long term. For direct-connected reducer applications requiring long-term oil resistance on the motor oil seal, contact Inovance technical support. • Not applicable to vacuum environments. • Not applicable to inching (not full-turn) [2] and may be stuck. • The motor with brake may generate a pattering sound. • In upstream applications of the motor, ensure the force applied on the shaft end is lower than the allowable axial force and radial force of the motor. • The system should avoid continuous operation at a natural frequency. Exceeding the allowable vibration value may damage the system.
	Storage environment	Observe the following requirements for storing a de-energized motor. • Temperature: -20°C to +60°C (non-freezing) • Storage humidity: 20% to 80% RH (without condensation)
Shock resistance [3][5]	Shock acceleration (taking flange side as standard)	490m/s^2
	Number of shocks	2
Vibration resistance [4][5]	Vibration acceleration (taking flange side as standard)	• Radial 49 m/s^2 • Axial 24.5 m/s^2

Note

- [1] Vibration class V15 indicates that the amplitude of vibration is lower than 15 μm when an individual motor rotates at rated values.
- [2] For applications that require the motor shaft to swing back and forth at a certain angle, contact Inovance.
- [3] The resistance for shock in the vertical direction when the motor is mounted with the shaft in a horizontal position is shown in the preceding table.
- [4] The vertical, side-to-side, and front-to-back resistance for vibration in three directions when the servo motor is mounted with the shaft in a horizontal position is shown in the preceding table.
- [5] The vibration intensity applied on the motor is affected by the transmission structure, alignment accuracy, mounting conditions, and external vibration. These factors may enhance the vibration applied on the motor. When the maximum allowable vibration limit is exceeded, the motor may fail. Therefore, take necessary measures to limit resonance.
- The vibration intensity applied on the motor varies with applications.

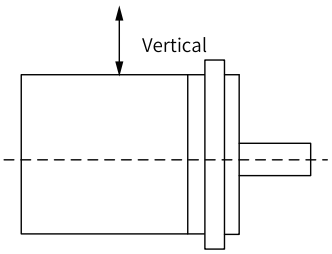


Figure 19-1 Shock applied to the servo motor

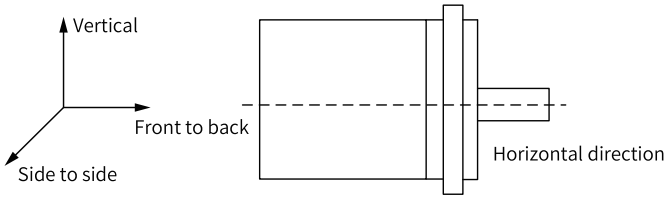


Figure 19-2 Vibration applied to the servo motor

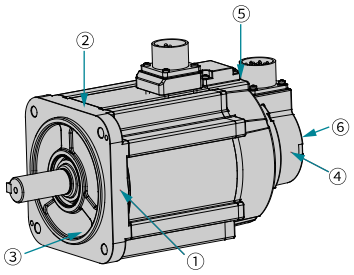


Figure 19-3 Max. allowable vibration limit of the motor

Direction	Measuring point	Limit value (10 Hz to 2000 Hz)
Radial	①②④⑤	49m/s²
Axial	③⑥	24.5m/s²

Note

The preceding vibration/shock standards cannot be applied for a long term. For long-term application, contact Inovance.

19.1.2 Overload Characteristics

The drive is compliant with NEC and CEC requirements and equipped with protective functions against overload and overtemperature.

The following overload protection curve applies to hot start at an ambient temperature of 40℃, which cannot guarantee continuous duty in cases of 100% output or above. During use, keep the effective torque of the load within the continuous duty zone.

To protect different load motors, set the motor overload protection gain based on the overload capacity of the motor. Use the default gain in general conditions. However, when one of the following conditions occurs, change the gain based on actual motor temperature:

- The motor operates in environments with high temperature.
- The motor is in cyclic motion featuring a short motion cycle and frequent acceleration/deceleration.
- Overload thermal protection only occurs during continuous energized operation. You need to check the motor temperature when the drive is powered off.

The motor overload protection curve is shown in the following figure.

- **MS1H1/H4 (frame size 40/60/80)**

Load ratio (%)	Operating time (s)
120	230
130	80
140	40
150	30
160	20
170	17
180	15
190	12
200	10
210	8.5
220	7
230	6
240	5.5
250	5
300	3
350	2

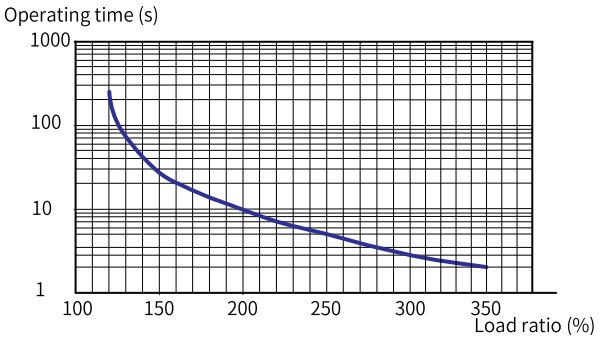


Figure 19-4 MS1H1/H4 (frame size 40/60/80) series motor overload curve

Note

The maximum torque of H1 and H4 models is the rated torque × 3.5.

- **MS1H2/MS1H3**

Load ratio (%)	Operating time (s)
115	6000
120	2533
125	1226
130	915
135	769
140	527
145	352
150	221
155	128
160	99
165	83
170	67
175	55
180	49
185	45
190	41
195	38
200	34
205	31
210	28
215	24
220	22
225	21
230	19
235	18
240	16
245	14
250	13
255	12
260	11
265	10
270	9
275	9
280	8
285	7
290	6
295	5
300	5

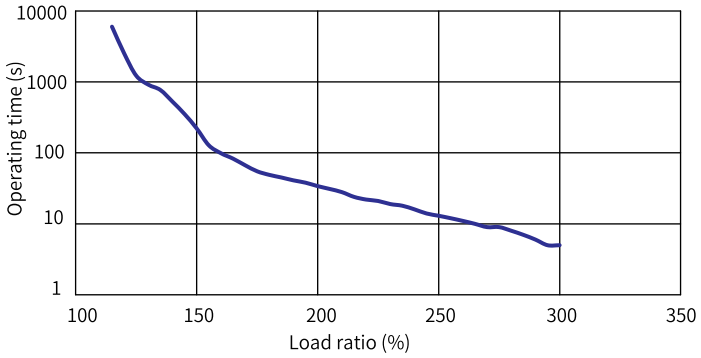


Figure 19-5 Overload curve of MS1H2 and MS1H3 series motors

Note

- The maximum torque of H2 model is 3 times the rated torque.
- The maximum torque of H3 model is 2.5 times the rated torque.

- **MS1H1-03B30CB-U210R-S**

Load ratio (%)	Operating time (s)
120	75.00
130	43.39
140	27.97
150	19.84
160	15.10
170	15.02
180	9.82
190	8.12
200	6.70
210	5.62
220	4.79
230	4.14
240	3.63
250	3.22
260	2.89
270	2.61
280	2.38
290	2.18
300	2.01
310	1.86
320	1.73
330	1.60
340	1.50
350	1.40

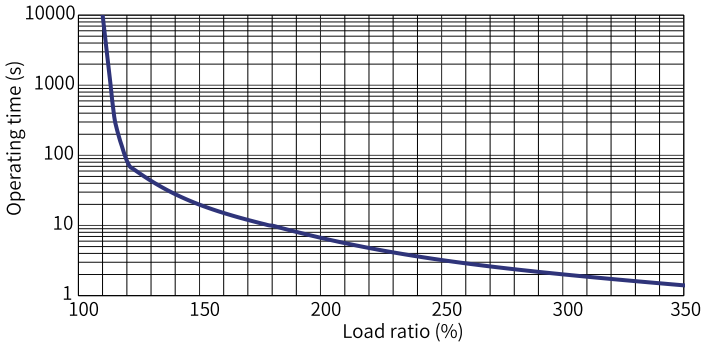


Figure 19-6 Overload curve of MS1H1-03B30CB-U210R-S series motors

19.1.3 Derating Characteristics

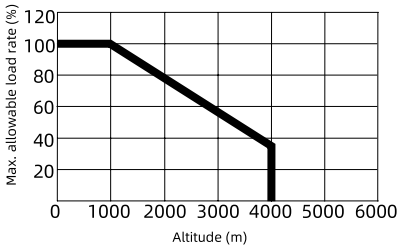
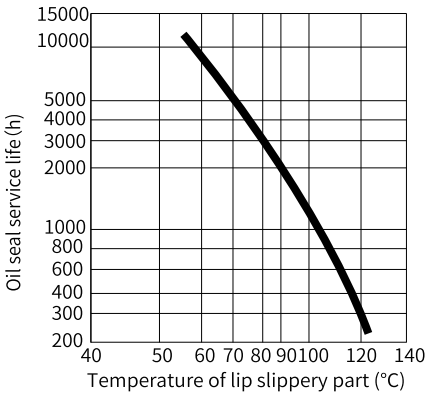


Figure 19-7 Altitude-based derating curve

19.1.4 Temperature Curve of the Oil Seal



19.1.5 Load Moment of Inertia

The load moment of inertia represents the ratio of the load inertia to the rotor inertia. The higher the load inertia ratio, the weaker the responsiveness will be. An excessively high inertia ratio can result in unstable operation. The allowable load inertia ratio of the servo motor is limited. The value is a general standard and varies according to the driving conditions of the servo motor.

An overvoltage alarm may occur during deceleration if the load moment of inertia exceeds the allowable value. For servo drives with a built-in braking resistor, an overload alarm may be reported. In cases of such alarms, take one of the following measures:

- Reduce the torque limit value.
- Reduce the deceleration rate.
- Reduce the maximum speed.
- Install an external braking resistor if the warning cannot be cleared using the above measures.

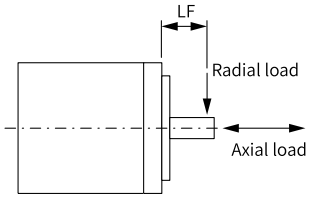
Caution

- For the built-in braking resistor of the drive, see section "Components".
- Even if you use a built-in resistor, the energy generated in some regenerative conditions may exceed the allowable capacity loss (W) of the resistor. Therefore, an external braking resistor is required.

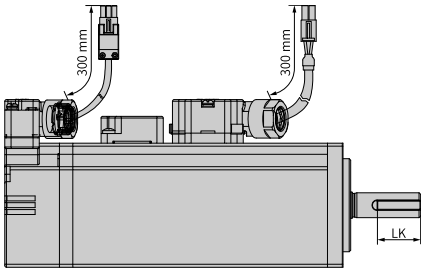
19.2 Motor Models (MS1-R Series Servo Motor)

19.2.1 Selection Precautions

- Description of torque-speed characteristics curves:
  - All parameters and torque-speed characteristic values are subject to the conditions that the motor works with an Inovance servo drive and the armature coil temperature is 20°C.
  - Continuous working area: refers to a series of states in which the motor can operate safely and continuously, and the actual torque must be located in this area.
  - Intermittent duty zone: refers to a series of states in which the motor can run within a short period of time when the actual torque is greater than the rated torque.
- The characteristic values are obtained in cases where the motor is installed with the following heatsink (unit: mm):
  - MS1H1 to MS1H4: 250 × 250 × 6 (aluminum)
  - MS1H2-10C to 25C: 400 × 400 × 20 (steel)
  - MS1H2-30C to 50C: 400 × 400 × 20 (steel)
  - MS1H3-85B to 18C: 400 × 400 × 20 (steel)
  - MS1H3-29C to 55C: 550 × 550 × 30 (aluminum)
  - MS1H3-75C: 700 × 700 × 30 (aluminum)
- Radial and axial loads of the motor:



- Dimensions of flying leads type motors
  Flying leads type motors with frame size 80 and below (model ended with "-S") provide a drain wire of about 300 mm in length, as shown in the following figure.



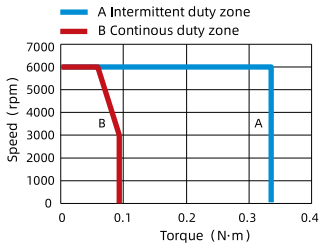
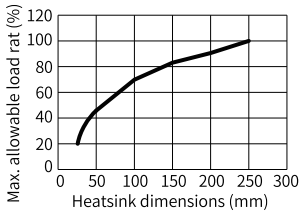
- As shown in the preceding figure, the product is marked with an LK value in the dimension diagram in the section of each model. LK indicates the length of the shaft key.
- MS1H3 (130-flange and 180-flange) comes with a key slot. When the operating speed is above 3000 rpm, the motor must run with the keyway. If you need to run the motor without the keyway at speeds higher than 3000 rpm, contact Inovance.

Note

- Values inside the parentheses in the sections corresponding to the models are parameters of the servo motor carrying a brake.
- The motor with oil seal must be derated by 10% during use.
- Use your own DC power supply as 24 V power supply of the brake. For the cable connecting the DC power supply to the motor brake, it is recommended to use cables with a diameter of 0.2 mm^2 or above for motors with low power of 750 W or below. It is recommended to use cables with a diameter of 0.8 mm^2 or above for motors with a power of 750 W or above. The brake cannot share the power supply with other appliances to prevent the voltage or current from falling due to the simultaneous operation of other electrical appliances, which may result in brake malfunction.
- Do not share a power supply with multiple brakes. Otherwise, the coil is short-circuited after one brake is dry-worn, causing failures to start the brakes that are connected to the power supply in parallel.
- The brake apply time and release time vary with the discharge circuit. Check the actual action delay of the product during use. The holding brake cannot be used for braking purpose.

19.2.2 Low Inertia and Small Capacity (MS1H1)

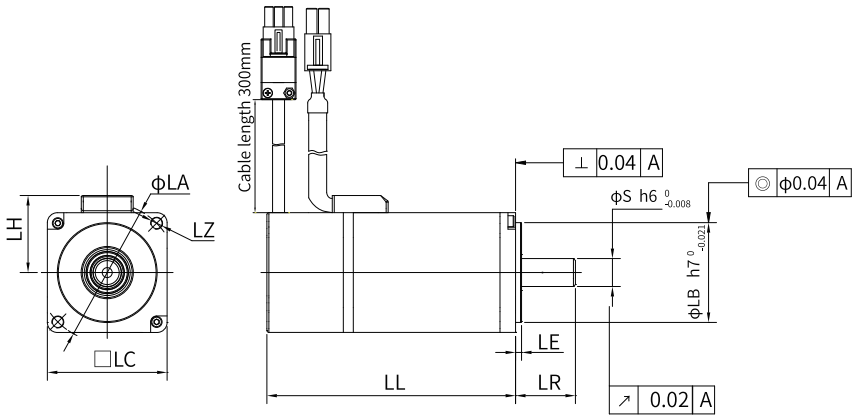
19.2.2.1 MS1H1-03B30CB-U210R-S

<table>
<tr><th colspan="3">Motor specifications</th><th>Torque-speed characteristics</th></tr>
<tr><td colspan="2">Frame size (mm)</td><td>25</td><td rowspan="7">
</td></tr>
<tr><td colspan="2">Inertia and capacity</td><td>Low inertia, small capacity</td></tr>
<tr><td colspan="2">Rated power (kW)</td><td>0.03</td></tr>
<tr><td colspan="2">Rated voltage (V)</td><td>220</td></tr>
<tr><td colspan="2">Rated torque (N·m)</td><td>0.0955</td></tr>
<tr><td colspan="2">Maximum torque (N·m)</td><td>0.33</td></tr>
<tr><td colspan="2">Rated frequency (Hz)</td><td>150</td></tr>
<tr><td colspan="2">Rated current (A)</td><td>0.93</td><td>Heatsink-based derating curve</td></tr>
<tr><td colspan="2">Maximum current (A)</td><td>3.34</td><td rowspan="6">
</td></tr>
<tr><td colspan="2">Rated speed (rpm)</td><td>3000</td></tr>
<tr><td colspan="2">Maximum speed (rpm)</td><td>6000</td></tr>
<tr><td colspan="2">Torque coefficient (N·m/A)</td><td>0.15</td></tr>
<tr><td rowspan="2">Rotor moment of inertia ($kg·cm^2$)</td><td>Motor without brake</td><td>0.00668±10 %</td></tr>
<tr><td>Motor with brake</td><td>-</td></tr>
</table>

Allowable loads

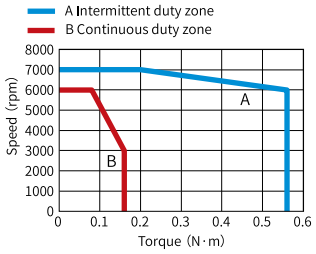
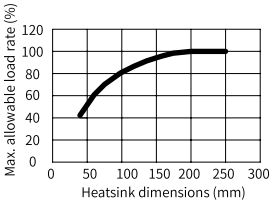
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

Product dimensions (in mm)



LL	LC	LR	LA	LZ	LH	LG	LE	
73.5	25	16±0.5	28	2 × ϕ3	17	-	2.5±0.3	
S	LB	TP	LK	KH	KW	W	T	Weight (kg)
5	20	-	-	-	-	-	-	0.2

19.2.2.2 MS1H1-05B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	40		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	0.05		
Rated voltage (V)	220		
Rated torque (N·m)	0.16		
Maximum torque (N·m)	0.56		
Rated frequency (Hz)	250		
Rated current (A)	1.2		Heatsink-based derating curve
Maximum current (A)	4.8		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.15		
Rotor moment of inertia (kg·cm²)	Motor without brake	0.018 ± 10%	
	Motor with brake	0.0208 ± 10%	

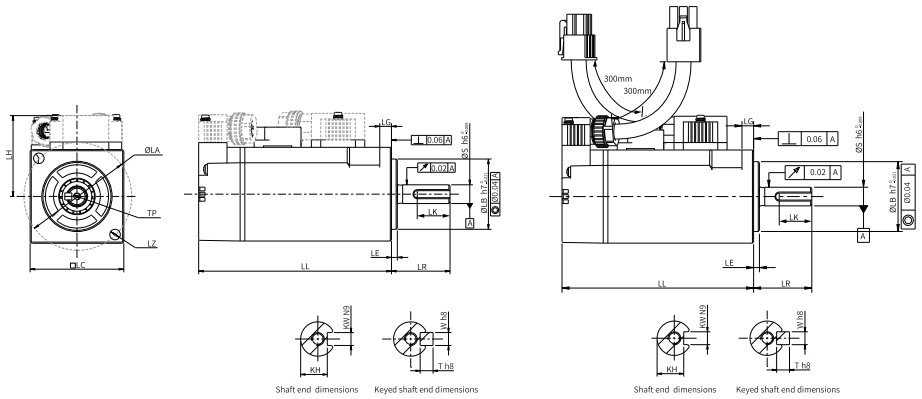
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
0.32	24	6.9	83.5	0.29	≤ 40	≤ 20	≤ 1.5

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

Dimensions (mm)

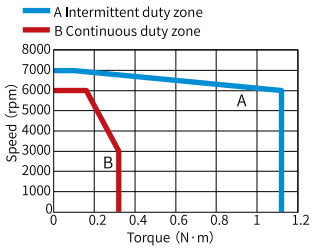


LL	LC	LR	LA	LZ	LH	LG	LE	
54.5 (81.8)	40	25 ± 0.5	46	2 × ϕ4.5	34.5	5	2.5 ± 0.5	
S	LB	TP	LK	KH	kW	W	T	Weight (kg)
8	30	M3 × 6	140 $^{-0.36}$	6.2$^{0}_{-0.1}$	3	3	3	0.26 (0.43)

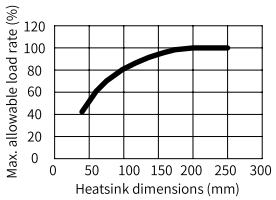
19.2.2.3 MS1H1-10B30CB-A33*R

Motor specifications		
Frame size (mm)	40	
Inertia, capacity	Low inertia, small capacity	
Rated power (kW)	0.1	
Rated voltage (V)	220	
Rated torque (N·m)	0.32	
Maximum torque (N·m)	1.12	
Rated frequency (Hz)	250	
Rated current (A)	1.2	
Maximum current (A)	4.8	
Rated speed (rpm)	3000	
Maximum speed (rpm)	7000	
Torque coefficient (N·m/A)	0.30	
Rotor moment of inertia (kg·cm^2)	Motor without brake	0.0316 ± 10%
	Motor with brake	0.0345 ± 10%

Torque-speed characteristics



Heatsink-based derating curve



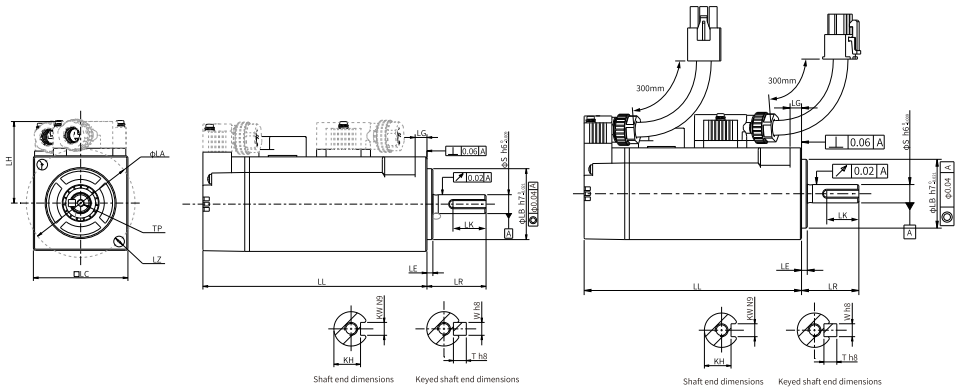
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
0.32	24	6.9	83.5	0.29	≤ 40	≤ 20	≤ 1.5

Allowable load

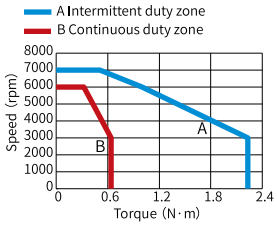
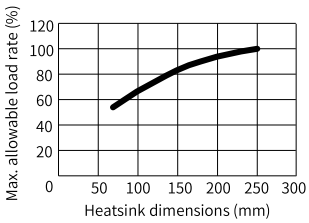
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

Dimensions (mm)



LL	LC	LR	LA	LZ	LH	LG	LE	
67 (94.3)	40	25 ± 0.5	46	2 × ϕ4.5	34.5	5	2.5 ± 0.5	
S	LB	TP	LK	KH	kW	W	T	Weight (kg)
8	30	M3 × 6	140 - $^{0.36}$	$6.2^{0}_{-0.1}$	3	3	3	0.35 (0.52)

19.2.2.4 MS1H1-20B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	60		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	0.2		
Voltage (V)	220		
Rated torque (N·m)	0.64		
Maximum torque (N·m)	2.24		
Rated frequency (Hz)	250		
Rated current (A)	1.5		Heatsink-based derating curve
Maximum current (A)	5.3		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.51		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	0.094 ± 10%	
	Motor with brake	0.106 ± 10%	

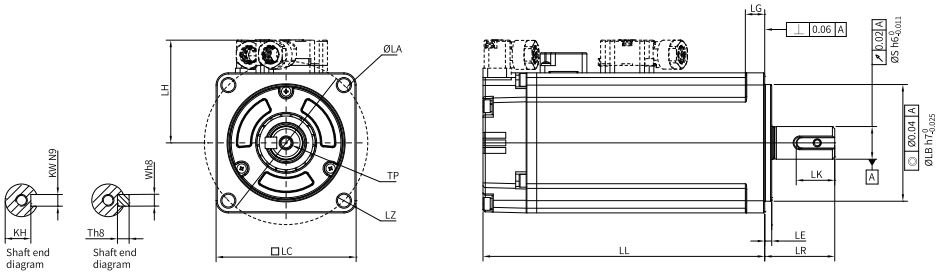
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
1.5	24	7.6	75.79	0.32	≤ 60	≤ 20	≤ 1

Allowable load

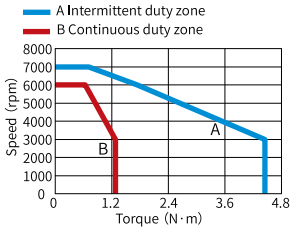
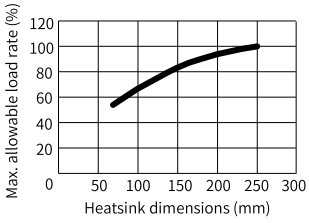
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	
60	75.5 (103)	30 ± 0.5	70	4 × ϕ5.5	44	8.0	3 ± 0.5	
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
50	14	M5 × 12	160 -0.53	110 -0.1	5	5	5	0.80 (1.17)

19.2.2.5 MS1H1-40B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	60		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	0.4		
Voltage (V)	220		
Rated torque (N·m)	1.27		
Maximum torque (N·m)	4.45		
Rated frequency (Hz)	250		
Rated current (A)	2.5		Heatsink-based derating curve
Maximum current (A)	9.8		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.57		
Rotor moment of inertia (kg·cm²)	Motor without brake	0.145 ± 10%	
	Motor with brake	0.157 ± 10%	

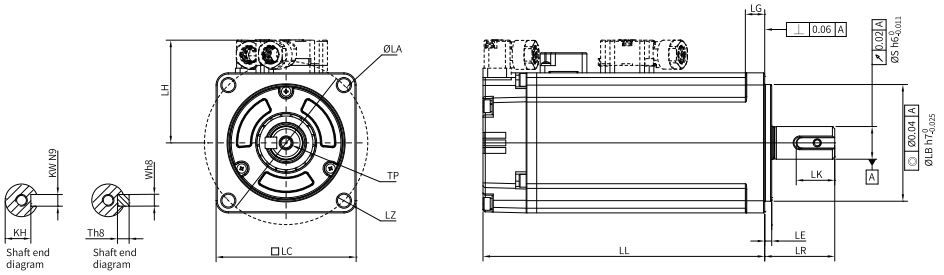
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
1.5	24	7.6	75.79	0.32	≤ 60	≤ 20	≤ 1

Allowable load

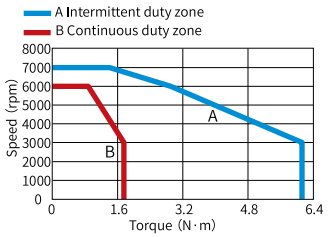
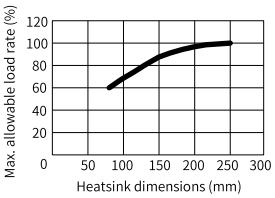
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	
60	93 (121)	30 ± 0.5	70	4 × ϕ5.5	44	8.0	3 ± 0.5	
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
50	14	M5 × 12	160 -0.53	110 -0.1	5	5	5	1.11 (1.48)

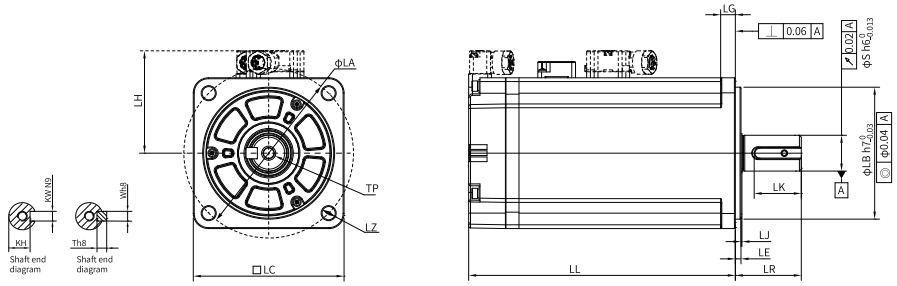
19.2.2.6 MS1H1-55B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	0.55		
Voltage (V)	220		
Rated torque (N·m)	1.75		
Maximum torque (N·m)	6.13		
Rated frequency (Hz)	250		
Rated current (A)	3.9		Heatsink-based derating curve
Maximum current (A)	15		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.51		
Rotor moment of inertia (kg·cm²)	Motor without brake	0.55 ± 10%	
	Motor with brake	-	

Allowable load

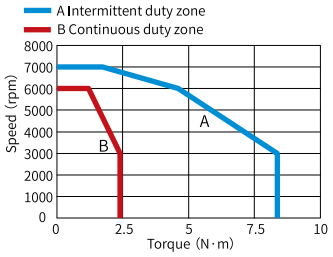
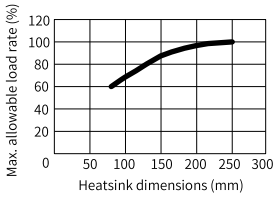
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	96.7	35 ± 0.5	90	4 × φ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	250 -0.62	15.50 -0.1	6	6	6	1.88

19.2.2.7 MS1H1-75B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	0.75		
Voltage (V)	220		
Rated torque (N·m)	2.39		
Maximum torque (N·m)	8.36		
Rated frequency (Hz)	250		
Rated current (A)	4.4		Heatsink-based derating curve
Maximum current (A)	16.9		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.62		
Rotor moment of inertia (kg·cm²)	Motor without brake	0.68 ± 10%	
	Motor with brake	0.71 ± 10%	

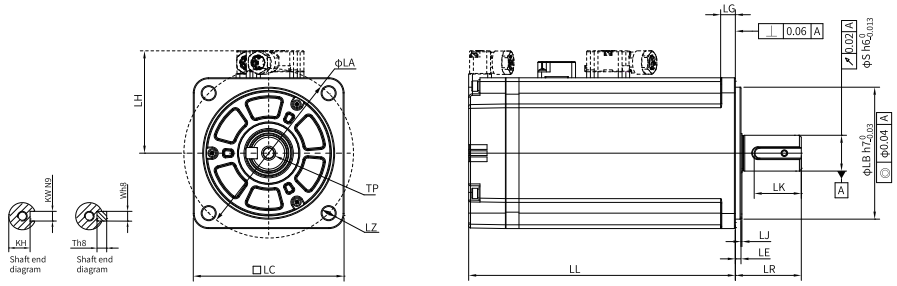
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
3.2	24	10	57.6	0.42	≤ 60	≤ 40	≤ 1

Allowable load

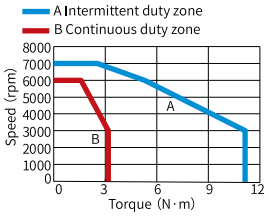
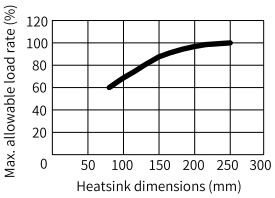
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	107.3 (141.5)	35 ± 0.5	90	4 × ϕ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	250 -0.62	15.50 -0.1	6	6	6	2.22 (2.88)

19.2.2.8 MS1H1-10C30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	1.0		
Voltage (V)	220		
Rated torque (N·m)	3.18		
Maximum torque (N·m)	11.13		
Rated frequency (Hz)	250		
Rated current (A)	6.2		Heatsink-based derating curve
Maximum current (A)	24		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.59		
Rotor moment of inertia (kg·cm²)	Motor without brake	0.82 ± 10%	
	Motor with brake	0.87 ± 10%	

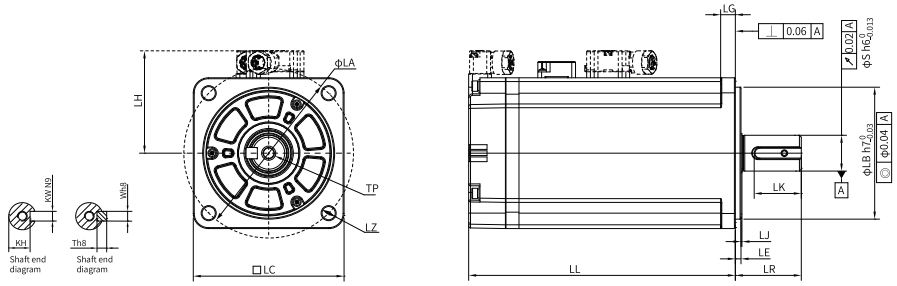
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
3.2	24	10	57.6	0.42	≤ 60	≤ 40	≤ 1

Allowable load

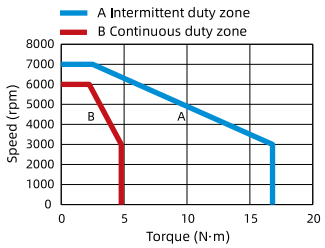
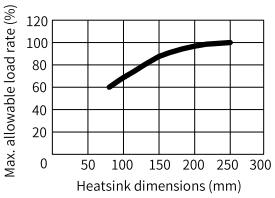
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	119.2 (153.4)	35 ± 0.5	90	4 × φ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	250 -0.62	15.50 -0.1	6	6	6	2.61 (3.27)

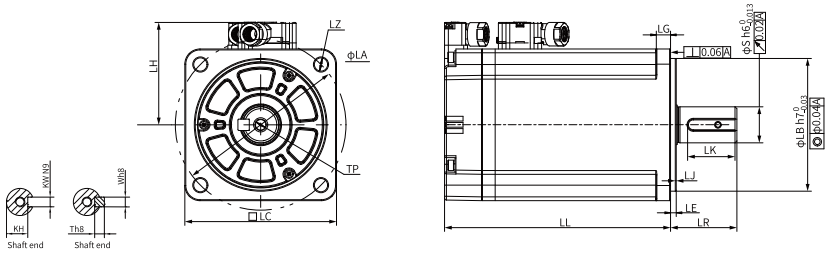
19.2.2.9 MS1H1-15C30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Low inertia and small capacity		
Rated power (kW)	1.5		
Voltage (V)	220		
Rated torque (N·m)	4.78		
Maximum torque (N·m)	16.8		
Rated frequency (Hz)	250		
Rated current (A)	6.5		Heatsink-based derating curve
Maximum current (A)	26		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.74		
Rotor moment of inertia (kg·cm²)	Brake-less motor	1.2±10%	
	Brake motor	-	

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

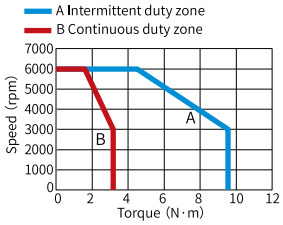
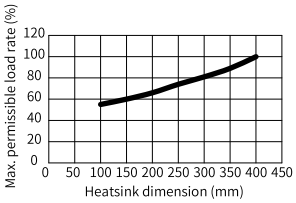
Product dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	155	35± 0.5	90	4 x ϕ7	54	7.5	3±0.5	0.5±0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6x20	$25^{0}_{-0.62}$	$15.5^{0}_{-0.1}$	6	6	6	3.65

19.2.3 Low Inertia and Medium Capacity (MS1H2)

19.2.3.1 MS1H2-10C30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia and capacity	low inertia, medium capacity		
Rated power (kW)	1.0		
Voltage (V)	220		
Rated torque (N·m)	3.18		
Maximum torque (N·m)	9.54		
Rated frequency (Hz)	250		
Rated current (A)	6.4		Heatsink-based derating curve
Maximum current (A)	23		
Rated speed (rpm)	3000		
Maximum Speed (rpm)	6000		
Torque coefficient (N·m/A)	0.54		
Rotor moment of inertia (kg·cm^2)	Motor without brake	1.78±10%	
	Motor with brake	2.6±10%	

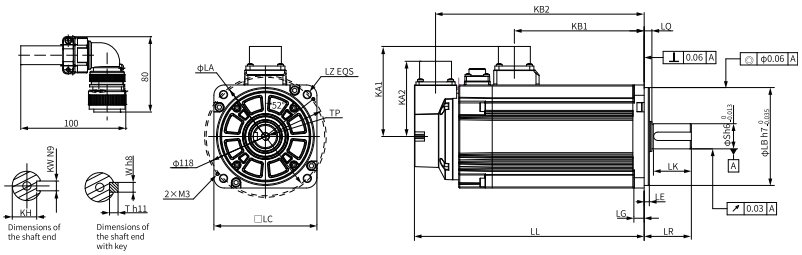
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC)±10%	Rated power (W)	Coil resistance (Ω)±10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable loads

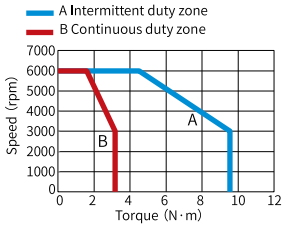
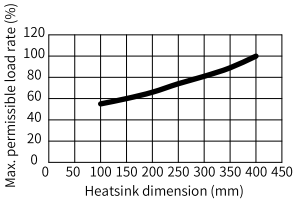
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Product dimensions (in mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	144 (172)	45±1	115	4 × ϕ7	88	75	73	123.5 (151.5)	10	5±0.3
LQ	LB		S	TP	LK	KH	KW	W	T	Weight (kg)
7.5±0.75	95		24	M8 × 16	$35^{0}_{-0.62}$	$20^{0}_{-0.2}$	8	8	7	3.85 (4.9)

19.2.3.2 MS1H2-10C30CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	1.0		
Voltage (V)	380		
Rated torque (N·m)	3.18		
Maximum torque (N·m)	9.54		
Rated frequency (Hz)	250		
Rated current (A)	3.3		Heatsink-based derating curve
Maximum current (A)	11		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.07		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	1.78 ± 10%	
	Motor with brake	2.6 ± 10%	

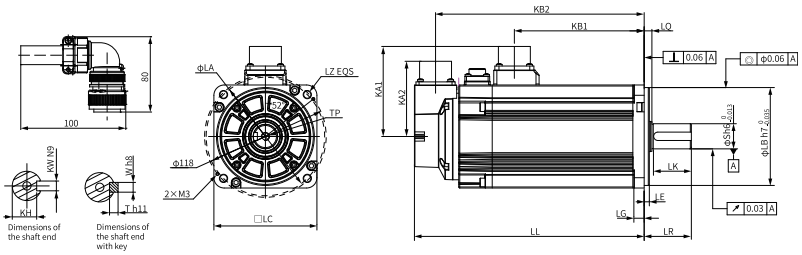
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

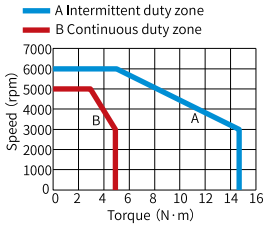
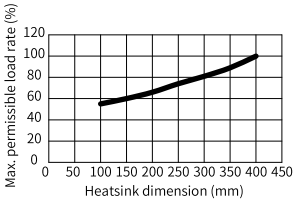
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	144 (172)	45 ± 1	115	4 × ϕ7	88	75	73	123.5 (151.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	3.85 (4.9)

19.2.3.3 MS1H2-15C30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	1.5		
Voltage (V)	220		
Rated torque (N·m)	4.9		
Maximum torque (N·m)	14.7		
Rated frequency (Hz)	250		
Rated current (A)	8.6		Heatsink-based derating curve
Maximum current (A)	32		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	0.62		
Rotor moment of inertia (kg·cm²)	Motor without brake	2.35 ± 10%	
	Motor with brake	3.17 ± 10%	

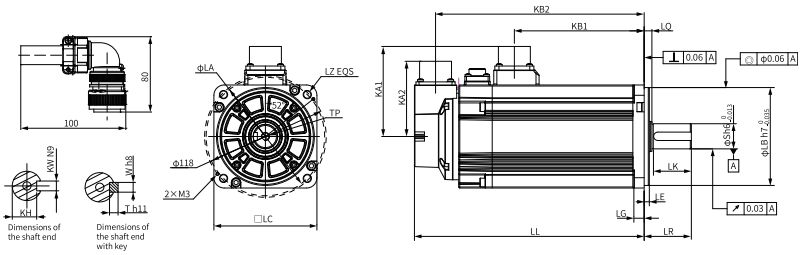
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

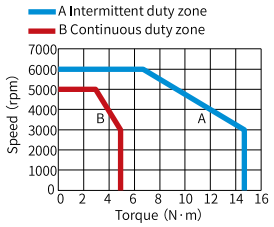
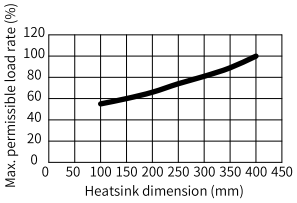
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	161 (189)	45 ± 1	115	4 × ϕ7	88	92	73	140.5 (168.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 - 0.62	200 - 0.2	8	8	7	4.65 (5.75)

19.2.3.4 MS1H2-15C30CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	1.5		
Voltage (V)	380		
Rated torque (N·m)	4.9		
Maximum torque (N·m)	14.7		
Rated frequency (Hz)	250		
Rated current (A)	4.2		Heatsink-based derating curve
Maximum current (A)	14		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.28		
Rotor moment of inertia (kg·cm²)	Motor without brake	2.35 ± 10%	
	Motor with brake	3.17 ± 10%	

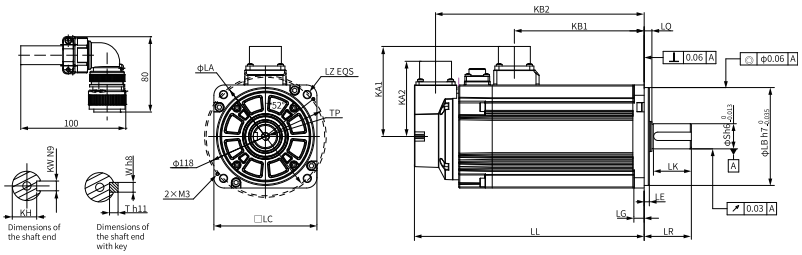
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

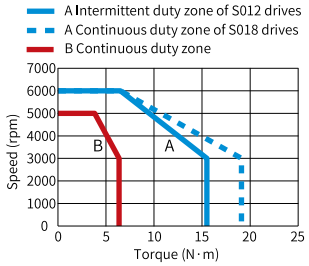
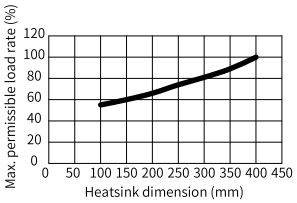
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	161 (189)	45 ± 1	115	4 × ϕ7	88	92	73	140.5 (168.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	4.65 (5.75)

19.2.3.5 MS1H2-20C30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	2.0		
Voltage (V)	220		
Rated torque (N·m)	6.36		
Maximum torque (N·m)	19.1		
Rated frequency (Hz)	250		
Rated current (A)	11.3		Heatsink-based derating curve
Maximum current (A)	42		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	0.60		
Rotor moment of inertia (kg·cm^2)	Motor without brake	2.92 ± 10%	
	Motor with brake	3.74 ± 10%	

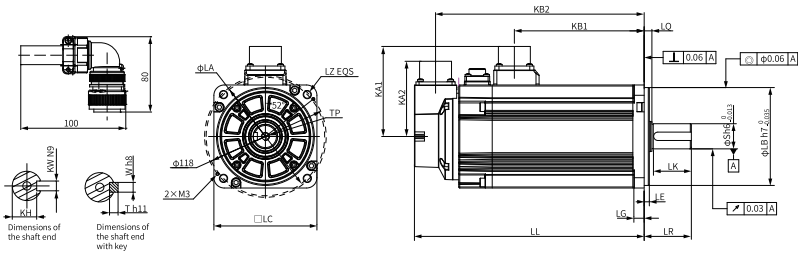
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

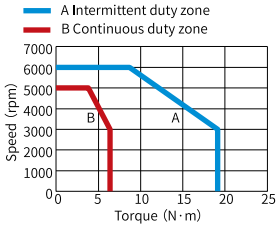
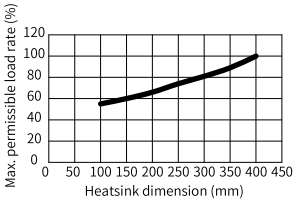
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	177 (205)	45 ± 1	115	4 × ϕ7	88	108	73	156.5 (184.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	5.5 (6.55)

19.2.3.6 MS1H2-20C30CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	2.0		
Voltage (V)	380		
Rated torque (N·m)	6.36		
Maximum torque (N·m)	19.1		
Rated frequency (Hz)	250		
Rated current (A)	5.6		Heatsink-based derating curve
Maximum current (A)	20		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.19		
Rotor moment of inertia (kg·cm²)	Motor without brake	2.92 ± 10%	
	Motor with brake	3.74 ± 10%	

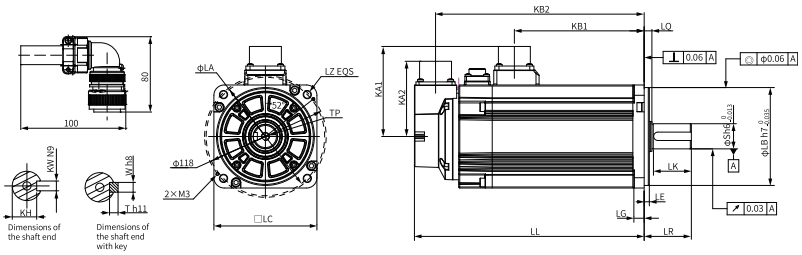
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

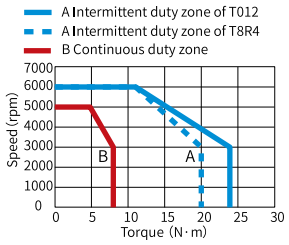
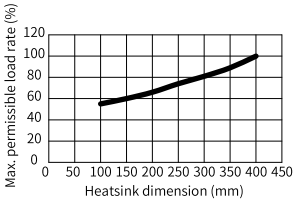
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	177 (205)	45 ± 1	115	4 × ϕ7	88	108	73	156.5 (184.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	5.5 (6.55)

19.2.3.7 MS1H2-25C30CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	2.5		
Voltage (V)	380		
Rated torque (N·m)	7.96		
Maximum torque (N·m)	23.9		
Rated frequency (Hz)	250		
Rated current (A)	7.2		Heatsink-based derating curve
Maximum current (A)	26		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.18		
Rotor moment of inertia (kg·cm²)	Motor without brake	3.49 ± 10%	
	Motor with brake	4.3 ± 10%	

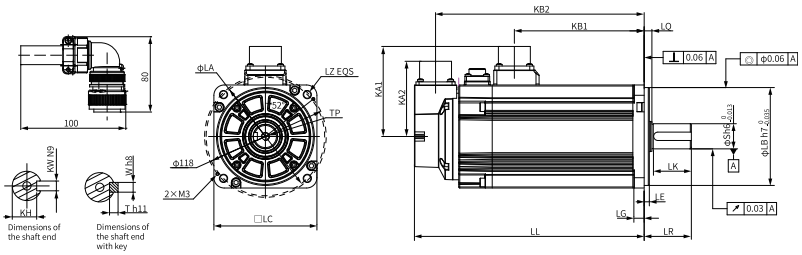
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

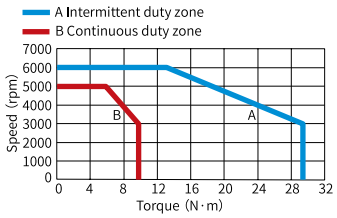
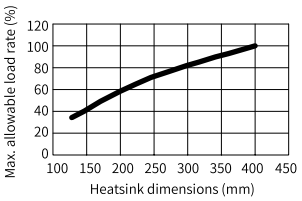
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	195 (223)	45 ± 1	115	4 × ϕ7	88	126	73	174.5 (202.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 - 0.62	200 - 0.2	8	8	7	6.3 (7.35)

19.2.3.8 MS1H2-30C30CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	3.0		
Voltage (V)	380		
Rated torque (N·m)	9.8		
Maximum torque (N·m)	29.4		
Rated frequency (Hz)	150		
Rated current (A)	8.9		Heatsink-based derating curve
Maximum current (A)	29		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.25		
Rotor moment of inertia (kg·cm²)	Motor without brake	6.4 ± 10%	
	Motor with brake	9.38 ± 10%	

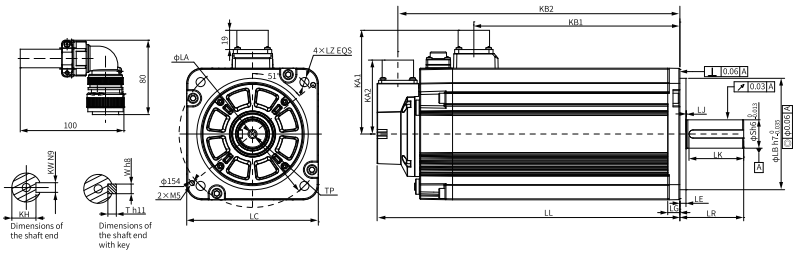
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

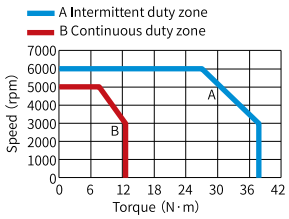
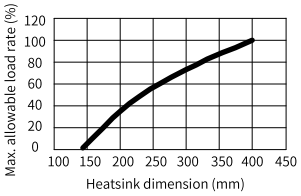
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	198 (223)	63 ± 1	145	4 × ϕ9	102.4	127.5	73	177.5 (202.5)	10.5	6 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		28	M8 × 20	530 $^{0.62}_{-}$	240 $^{0.2}_{-}$	8	8	7	10.0 (11.9)

19.2.3.9 MS1H2-40C30CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	4.0		
Voltage (V)	380		
Rated torque (N·m)	12.6		
Maximum torque (N·m)	37.8		
Rated frequency (Hz)	150		
Rated current (A)	13.5		Heatsink-based derating curve
Maximum current (A)	42.5		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.06		
Rotor moment of inertia (kg·cm^2)	Motor without brake	9 ± 10%	
	Motor with brake	11.98 ± 10%	

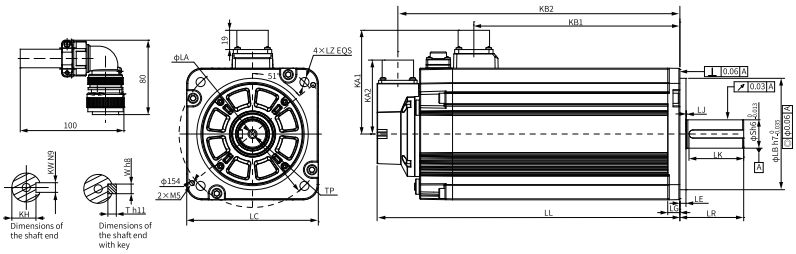
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

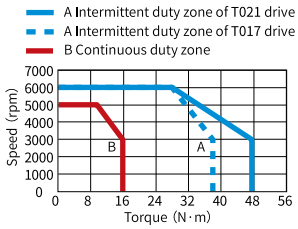
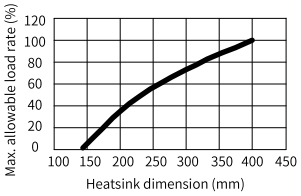
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	236 (261)	63 ± 1	145	4 × ϕ9	102.4	165.5	73	215.5 (240.5)	10.5	6 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		28	M8 × 20	530 $^{0.62}_{-}$	240 $^{0.2}_{-}$	8	8	7	13.2 (15.1)

19.2.3.10 MS1H2-50C30CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	5.0		
Voltage (V)	380		
Rated torque (N·m)	15.8		
Maximum torque (N·m)	47.4		
Rated frequency (Hz)	150		
Rated current (A)	17		Heatsink-based derating curve
Maximum current (A)	52.5		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.04		
Rotor moment of inertia (kg·cm^2)	Motor without brake	11.6 ± 10%	
	Motor with brake	14.58 ± 10%	

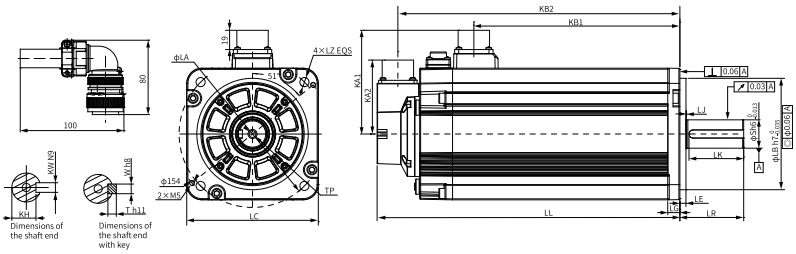
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

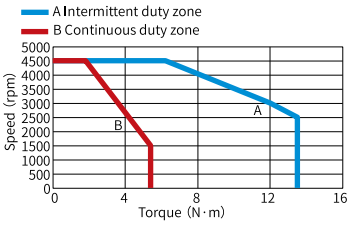
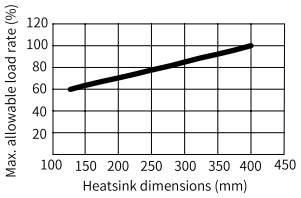
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	274 (299)	63 ± 1	145	4 × ϕ9	102.4	203.5	73	253.5 (278.5)	10.5	6 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		28	M8 × 20	530 $^{0.62}_{-}$	240 $^{0.2}_{-}$	8	8	7	16.35 (18.25)

19.2.4 Medium Inertia and Medium Capacity (MS1H3)

19.2.4.1 MS1H3-85B15CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	0.85		
Voltage (V)	220		
Rated torque (N·m)	5.39		
Maximum torque (N·m)	13.5		
Rated frequency (Hz)	125 m		
Rated current (A)	6.6		Heatsink-based derating curve
Maximum current (A)	17.2		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	0.93		
Rotor moment of inertia (kg·cm^2)	Motor without brake	13.56 ± 10%	
	Motor with brake	15.8 ± 10%	

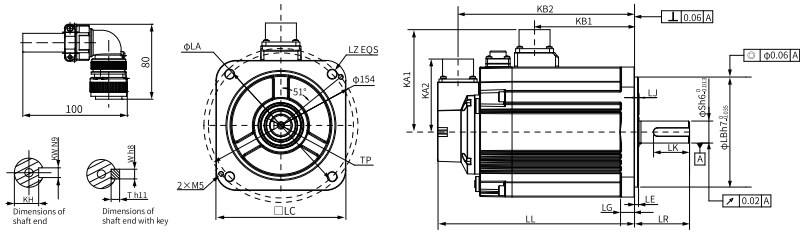
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

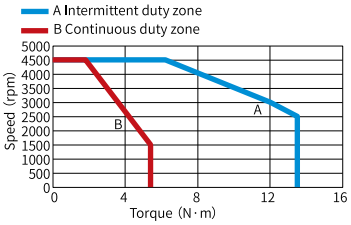
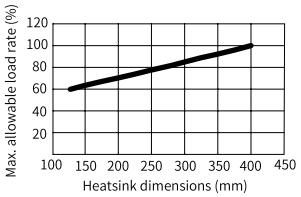
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	142 (167)	55 ± 1	145	4 × ϕ9	103	70	73	121.5 (146.5)	14	4

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110	22	M6 × 20	350 $^{0}_{-0.62}$	180 $^{0}_{-0.2}$	8	8	7	5.8 (7.7)

19.2.4.2 MS1H3-85B15CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	0.85		
Voltage (V)	380		
Rated torque (N·m)	5.39		
Maximum torque (N·m)	13.5		
Rated frequency (Hz)	125 m		
Rated current (A)	3.5		Heatsink-based derating curve
Maximum current (A)	8.5		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.84		
Rotor moment of inertia (kg·cm^2)	Motor without brake	13.56 ± 10%	
	Motor with brake	15.8 ± 10%	

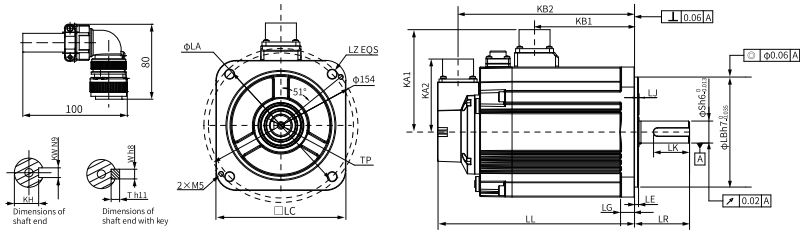
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

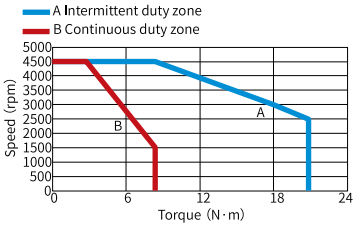
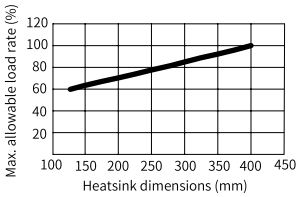
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	142 (167)	55 ± 1	145	4 × ϕ9	103	70	73	121.5 (146.5)	14	4

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110	22	M6 × 20	350 -0.62	180 -0.2	8	8	7	5.8 (7.7)

19.2.4.3 MS1H3-13C15CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	1.3		
Voltage (V)	220		
Rated torque (N·m)	8.34		
Maximum torque (N·m)	20.85		
Rated frequency (Hz)	125 m		
Rated current (A)	10.5		Heatsink-based derating curve
Maximum current (A)	27.3		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	0.89		
Rotor moment of inertia (kg·cm²)	Motor without brake	19.25 ± 10%	
	Motor with brake	21.5 ± 10%	

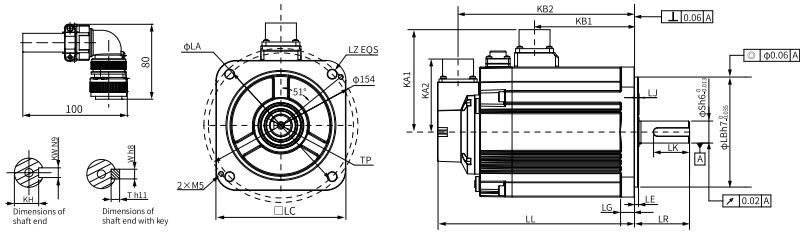
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

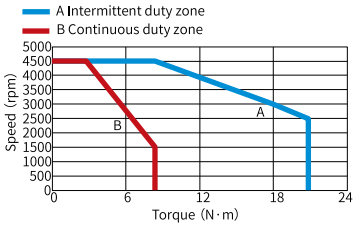
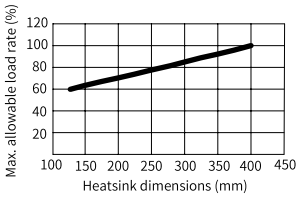
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	157 (182)	55 ± 1	145	4 × ϕ9	103	85	73	136.5 (161.5)	14	4
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		22	M6 × 20	350 -0.62	180 -0.2	8	8	7	7.1 (8.9)

19.2.4.4 MS1H3-13C15CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	1.3		
Voltage (V)	380		
Rated torque (N·m)	8.34		
Maximum torque (N·m)	20.85		
Rated frequency (Hz)	125 m		
Rated current (A)	5.1		Heatsink-based derating curve
Maximum current (A)	12.6		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.85		
Rotor moment of inertia (kg·cm²)	Motor without brake	19.25 ± 10%	
	Motor with brake	21.5 ± 10%	

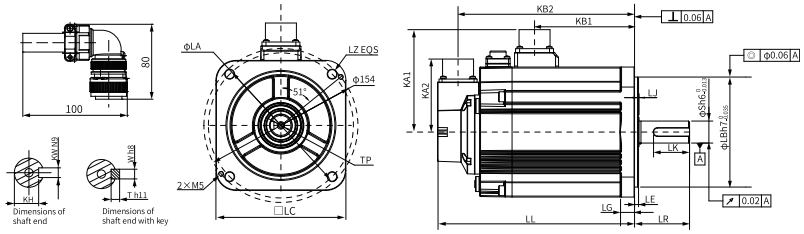
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

Dimensions (mm)

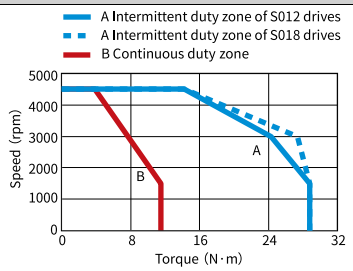


LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	157 (182)	55 ± 1	145	4 × ϕ9	103	85	73	136.5 (161.5)	14	4
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		22	M6 × 20	350 -0.62	180 -0.2	8	8	7	7.1 (8.9)

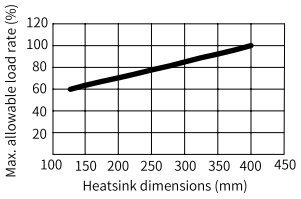
19.2.4.5 MS1H3-18C15CB-A33*R

Motor specifications		
Frame size (mm)	130	
Inertia, capacity	Medium inertia, medium capacity	
Rated power (kW)	1.8	
Voltage (V)	220	
Rated torque (N·m)	11.5	
Maximum torque (N·m)	28.75	
Rated frequency (Hz)	125 m	
Rated current (A)	11.9	
Maximum current (A)	32.2	
Rated speed (rpm)	1500	
Maximum speed (rpm)	4500	
Torque coefficient (N·m/A)	1.09	
Rotor moment of inertia (kg·cm²)	Motor without brake	24.9 ± 10%
	Motor with brake	27.2 ± 10%

Torque-speed characteristics



Heatsink-based derating curve



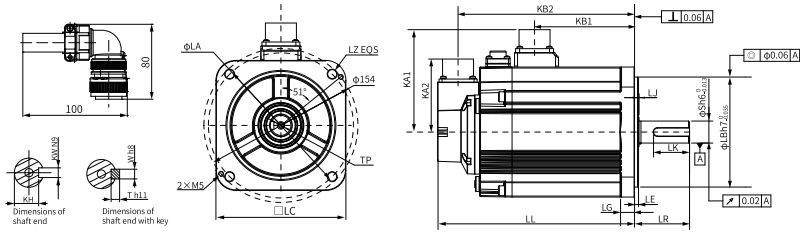
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

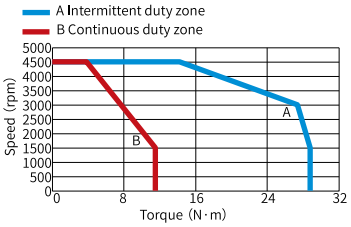
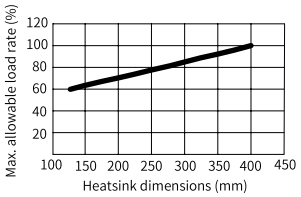
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	172 (197)	55 ± 1	145	4 × ϕ9	103	100	73	151.5 (176.5)	14	4
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		22	M6 × 20	350 -0.62	180 -0.2	8	8	7	8.5 (10.3)

19.2.4.6 MS1H3-18C15CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	1.8		
Voltage (V)	380		
Rated torque (N·m)	11.5		
Maximum torque (N·m)	28.75		
Rated frequency (Hz)	125 m		
Rated current (A)	6.75		Heatsink-based derating curve
Maximum current (A)	17.7		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.87		
Rotor moment of inertia (kg·cm²)	Motor without brake	24.9 ± 10%	
	Motor with brake	27.2 ± 10%	

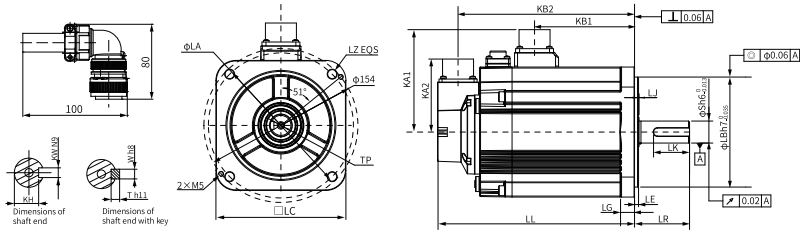
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

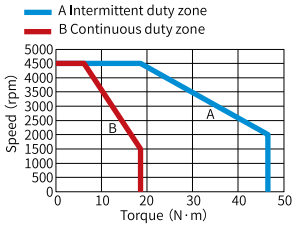
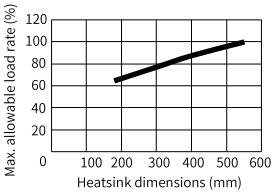
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	172 (197)	55 ± 1	145	4 × ϕ9	103	100	73	151.5 (176.5)	14	4

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110	22	M6 × 20	350 $^{0}_{-0.62}$	180 $^{0}_{-0.2}$	8	8	7	8.5 (10.3)

19.2.4.7 MS1H3-29C15CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	180		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	2.9		
Voltage (V)	380		
Rated torque (N·m)	18.6		
Maximum torque (N·m)	46.5		
Rated frequency (Hz)	125 m		
Rated current (A)	10.5		Heatsink-based derating curve
Maximum current (A)	29.75		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.94		
Rotor moment of inertia (kg·cm^2)	Motor without brake	44.7 ± 10%	
	Motor with brake	52.35 ± 10%	

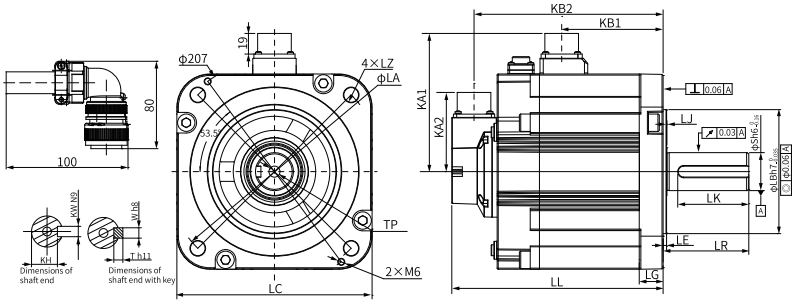
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
50	24	31	18.58	1.29	≤ 200	≤ 100	≤ 1

Allowable load

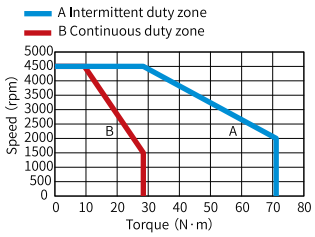
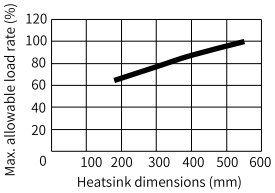
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
79	≤ 1470	≤ 490

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	161 (194.8)	79 ± 1	200	4 × Φ13.5	127.4	93.5	73	140.5 (174.3)	20.5	3.2 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.3 ± 0.75	114.3		35	M12 × 25	640 $^{-0.74}$	300 $^{-0.2}$	10	10	8	13.8 (17.9)

19.2.4.8 MS1H3-44C15CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	180		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	4.4		
Voltage (V)	380		
Rated torque (N·m)	28.4		
Maximum torque (N·m)	71.1		
Rated frequency (Hz)	125 m		
Rated current (A)	16		Heatsink-based derating curve
Maximum current (A)	42		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.96		
Rotor moment of inertia (kg·cm^2)	Motor without brake	64.9 ± 10%	
	Motor with brake	72.55 ± 10%	

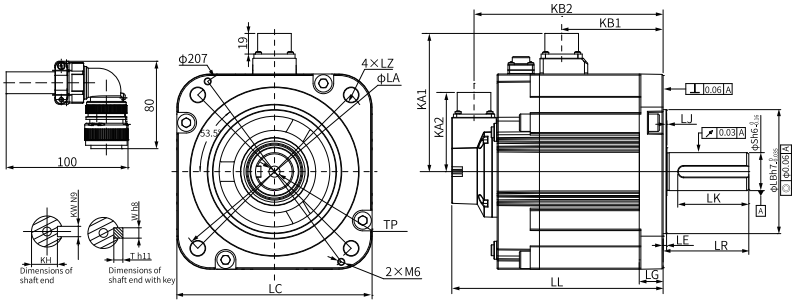
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
50	24	31	18.58	1.29	≤ 200	≤ 100	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
79	≤ 1470	≤ 490

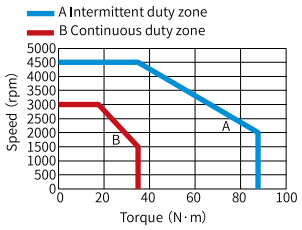
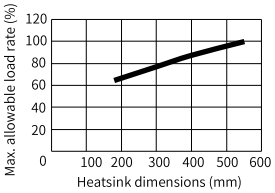
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	184.5 (218.3)	79 ± 1	200	4 × ϕ13.5	127.4	117	73	164 (197.8)	20.5	3.2 ± 0.3

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.3 ± 0.75	114.3	35	M12 × 25	640 $^{-0.74}$	300 $^{-0.2}$	10	10	8	17.4 (21.6)

19.2.4.9 MS1H3-55C15CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	180		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	5.5		
Voltage (V)	380		
Rated torque (N·m)	35		
Maximum torque (N·m)	87.6		
Rated frequency (Hz)	125 m		
Rated current (A)	20.7		Heatsink-based derating curve
Maximum current (A)	52		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.92		
Rotor moment of inertia (kg·cm^2)	Motor without brake	86.9 ± 10%	
	Motor with brake	94.55 ± 10%	

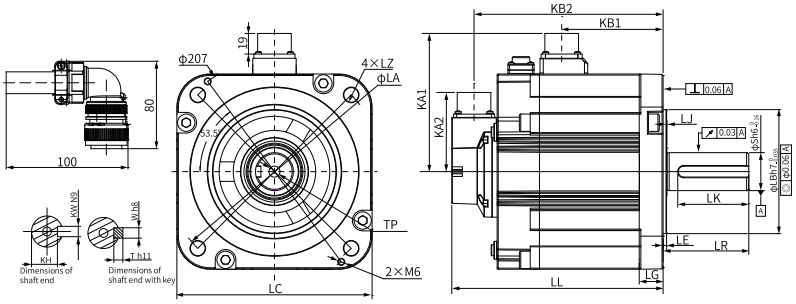
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
50	24	31	18.58	1.29	≤ 200	≤ 100	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
113	≤ 1764	≤ 588

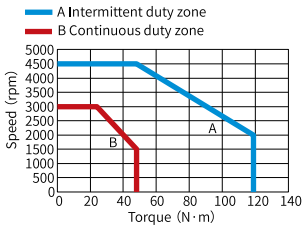
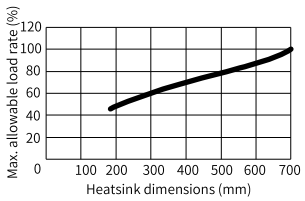
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	208 (241.8)	113 ± 1	200	4 × ϕ13.5	127.4	140.5	73	187.5 (221.3)	20.5	3.2 ± 0.3

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.3 ± 0.75	114.3	42	M16 × 32	950 - $^{0.87}$	370 - $^{0.2}$	12	12	8	21.7 (25.9)

19.2.4.10 MS1H3-75C15CD-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	180		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	7.5		
Voltage (V)	380		
Rated torque (N·m)	48		
Maximum torque (N·m)	119		
Rated frequency (Hz)	125 m		
Rated current (A)	25		Heatsink-based derating curve
Maximum current (A)	65		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	2.13		
Rotor moment of inertia (kg·cm^2)	Motor without brake	127.5 ± 10%	
	Motor with brake	135.15 ± 10%	

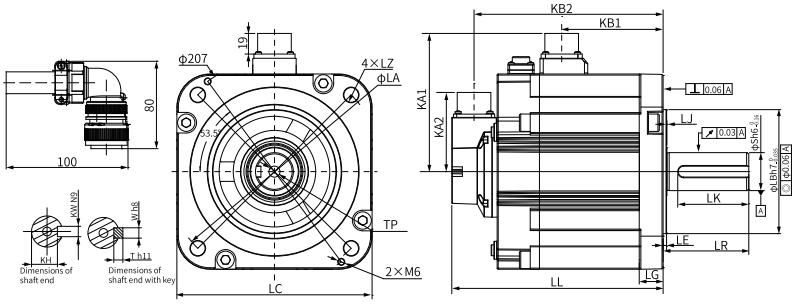
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
50	24	31	18.58	1.29	≤ 200	≤ 100	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
113	≤ 1764	≤ 588

Dimensions (mm)

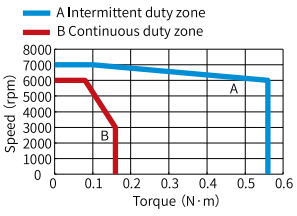
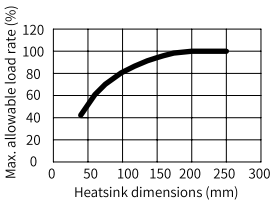


LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	255 (288.8)	113 ± 1	200	4 × ϕ13.5	127.4	187.5	73	234.5 (268.5)	20.5	3.2 ± 0.3

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.3 ± 0.75	114.3	42	M16 × 32	950 - 0.87	370 - 0.2	12	12	8	29 (33.2)

19.2.5 Medium Inertia and Small Capacity (MS1H4)

19.2.5.1 MS1H4-05B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	40		
Inertia, capacity	Medium inertia, low capacity		
Rated output (kW)	0.05		
Voltage (V)	220		
Rated torque (N·m)	0.16		
Maximum torque (N·m)	0.56		
Rated frequency (Hz)	350		
Rated current (A)	1.27		Heatsink-based derating curve
Maximum current (A)	4.78		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.15		
Rotor moment of inertia (kg·cm²)	Motor without brake	0.038 ± 10%	
	Motor with brake	0.04 ± 10%	

Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
0.32	24	6.9	83.5	0.29	≤ 40	≤ 20	≤ 1.5

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

Dimensions (mm)

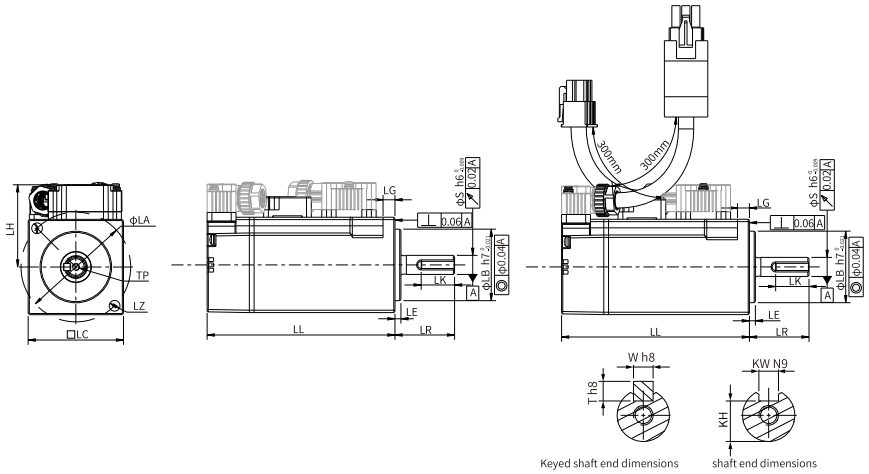


Figure 19-8 MS1H4-05B30CB-A330R and MS1H4-05B30CB-A332R

LL	LC	LR	LA	LZ	LH	LG	LE	
51 (78.3)	40	25 ± 0.5	46	2 × ϕ4.5	34.5	5	2.5 ± 0.5	
S	LB	TP	LK	KH	kW	W	T	Weight (kg)
8	30	M3 × 6	140 - 0.36	$6.2^{0}_{-0.1}$	3	3	3	0.24 (0.40)

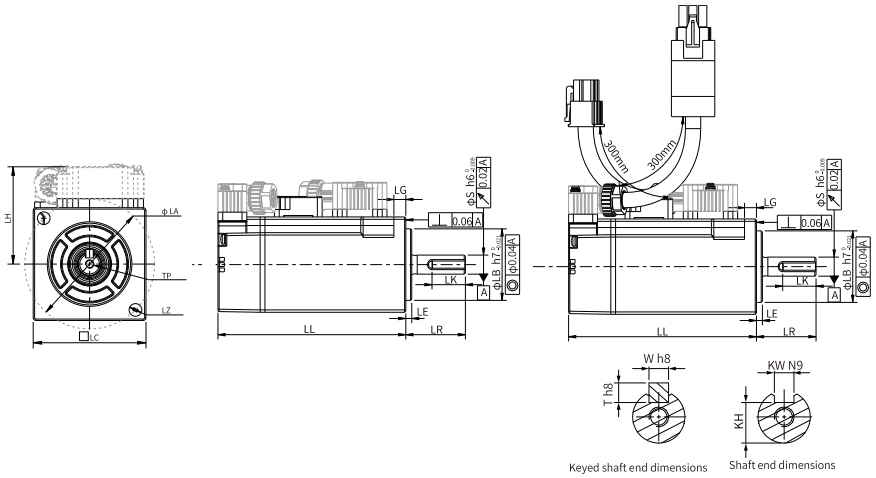
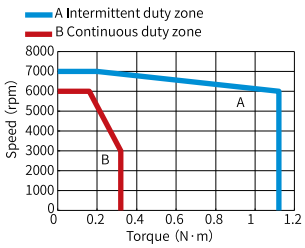
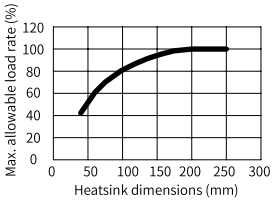


Figure 19-9 MS1H4-05B30CB-A331R and MS1H4-05B30CB-A334R

LL	LC	LR	LA	LZ	LH	LG	LE	
53.7 (81)	40	25 ± 0.5	46	2 × ϕ4.5	34.5	5	2.5 ± 0.5	
S	LB	TP	LK	KH	kW	W	T	Weight (kg)
8	30	M3 × 6	140 -0.36	6.2 0 -0.1	3	3	3	0.26 (0.42)

19.2.5.2 MS1H4-10B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	40		
Inertia, capacity	Medium inertia, low capacity		
Rated output (kW)	0.1		
Voltage (V)	220		
Rated torque (N·m)	0.32		
Maximum torque (N·m)	1.12		
Rated frequency (Hz)	350		
Rated current (A)	1.27		Heatsink-based derating curve
Maximum current (A)	4.78		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.29		
Rotor moment of inertia (kg·cm²)	Motor without brake	0.072 ± 10%	
	Motor with brake	0.074 ± 10%	

Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
0.32	24	6.9	83.5	0.29	≤ 40	≤ 20	≤ 1.5

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

Dimensions (mm)

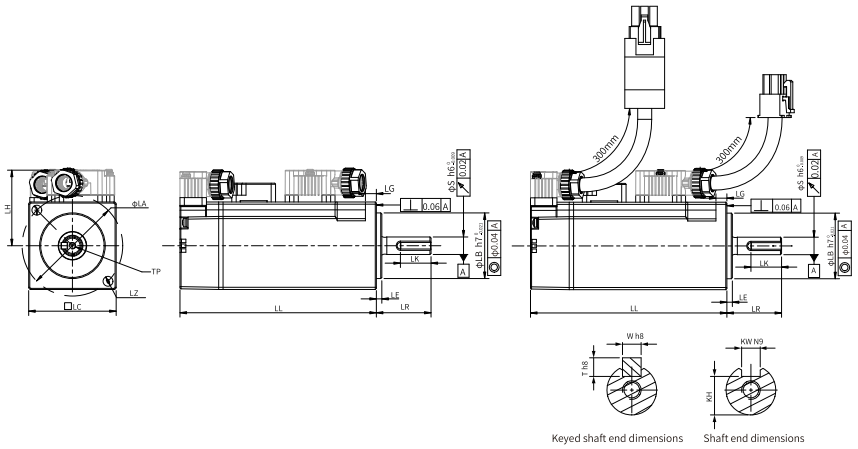


Figure 19-10 MS1H4-10B30CB-A330R and MS1H4-10B30CB-A332R

LL	LC	LR	LA	LZ	LH	LG	LE	
62 (89.3)	40	25 ± 0.5	46	2 × ϕ4.5	34.5	5	2.5 ± 0.5	
S	LB	TP	LK	KH	kW	W	T	Weight (kg)
8	30	M3 × 6	140 - $^{0.36}$	$6.2^{0}_{-0.1}$	3	3	3	0.32 (0.48)

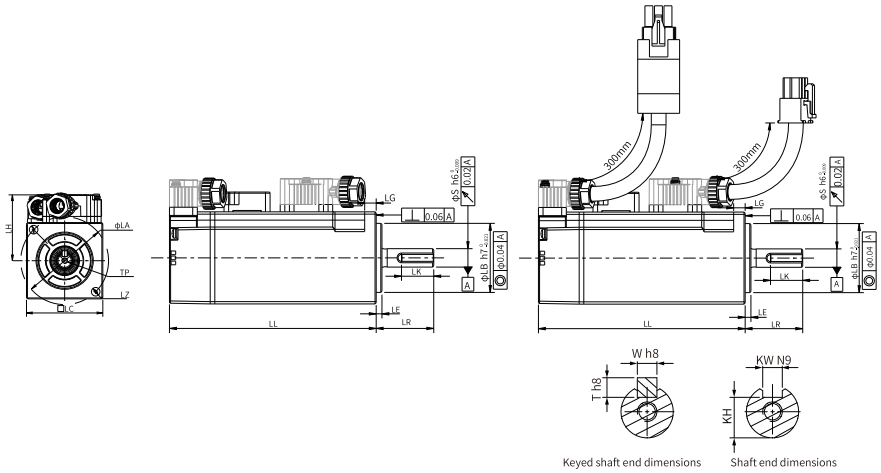
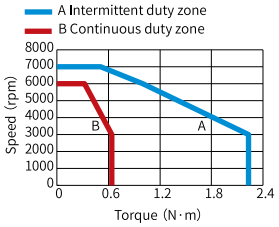
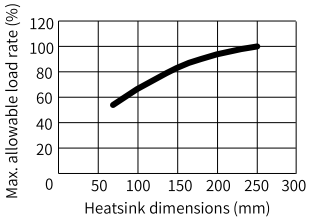


Figure 19-11 MS1H4-10B30CB-A331R and MS1H4-10B30CB-A334R

LL	LC	LR	LA	LZ	LH	LG	LE	
64.7 (92)	40	25 ± 0.5	46	2 × ϕ4.5	34.5	5	2.5 ± 0.5	
S	LB	TP	LK	KH	kW	W	T	Weight (kg)
8	30	M3 × 6	$140_{-0.36}$	$6.2^{0}_{-0.1}$	3	3	3	0.34 (0.50)

19.2.5.3 MS1H4-20B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	60		
Inertia, capacity	Medium inertia, low capacity		
Rated power (kW)	0.2		
Voltage (V)	220		
Rated torque (N·m)	0.64		
Maximum torque (N·m)	2.24		
Rated frequency (Hz)	250		
Rated current (A)	1.3		Heatsink-based derating curve
Maximum current (A)	5.3		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.55		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	0.22 ± 10%	
	Motor with brake	0.23 ± 10%	

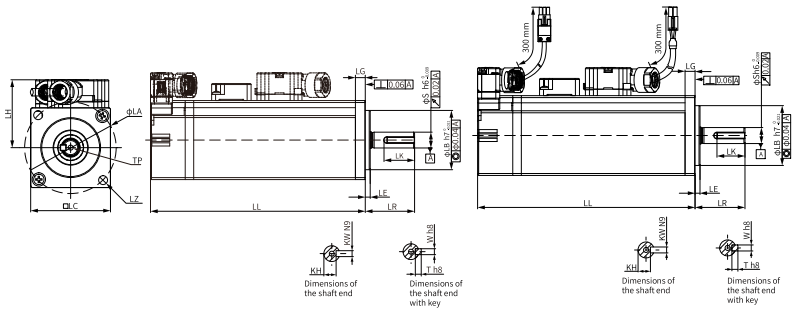
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
1.5	24	7.6	75.79	0.32	≤ 60	≤ 20	≤ 1.5

Allowable load

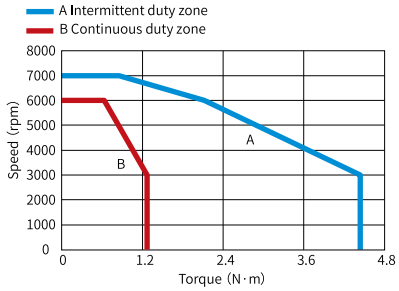
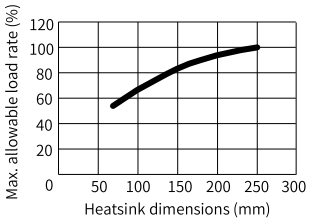
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	
60	73.5 (101.1)	30 ± 0.5	70	4 × ϕ5.5	44	8.0	3 ± 0.5	
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
50	14	M5 × 8	16.50 $_{-0.53}$	110 $_{-}^{0.1}$	5	5	5	0.78 (1.16)

19.2.5.4 MS1H4-40B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	60		
Inertia and capacity	Medium inertia, small capacity		
Rated power (kW)	0.4		
Voltage (V)	220		
Rated torque (N·m)	1.27		
Maximum torque (N·m)	4.45		
Rated frequency (Hz)	250		
Rated current (A)	2.4		Heatsink-based derating curve
Maximum current (A)	9.2		
Rated speed (rpm)	3000		
Maximum Speed (rpm)	7000		
Torque coefficient (N·m/A)	0.58		
Rotor moment of inertia (kg·cm^2)	Motor without brake	0.43±10%	
	Motor with brake	0.44±10%	

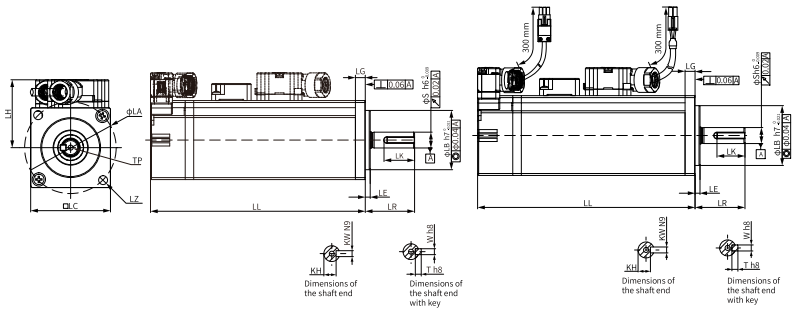
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC)±10%	Rated power (W)	Coil resistance (Ω)±10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
1.5	24	7.6	75.79	0.32	≤ 60	≤ 20	≤ 1.5

Allowable loads

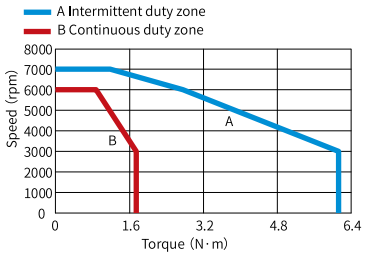
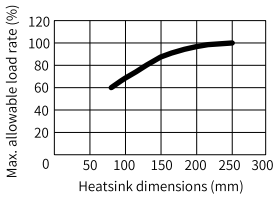
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

Product dimensions (in mm)



LC	LL	LR	LA	LZ	LH	LG	LE	
60	92 (119.8)	30±0.5	70	4 × ϕ5.5	44	8.0	3±0.5	
LB	S	TP	LK	KH	KW	W	T	Weight (kg)
50	14	M5 × 8	$16.5^{0}_{-0.53}$	$11^{0}_{-0.1}$	5	5	5	1.11 (1.48)

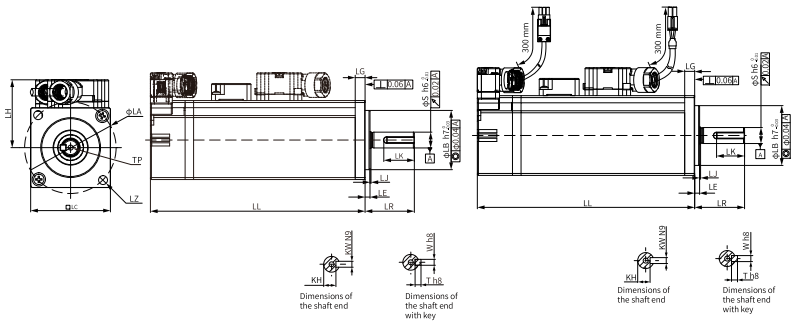
19.2.5.5 MS1H4-55B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Medium inertia, low capacity		
Rated power (kW)	0.55		
Voltage (V)	220		
Rated torque (N·m)	1.75		
Maximum torque (N·m)	6.13		
Rated frequency (Hz)	250		
Rated current (A)	3.3		Heatsink-based derating curve
Maximum current (A)	13.2		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.58		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	1.12 ± 10%	
	Motor with brake	-	

Allowable load

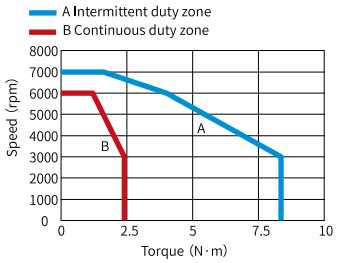
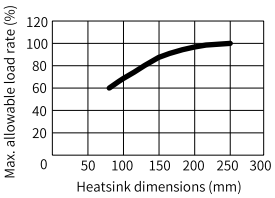
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	96.7	35 ± 0.5	90	4 × ϕ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	250 $^{0.62}_{-}$	15.50 $_{-0.1}$	6	6	6	1.85

19.2.5.6 MS1H4-75B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Medium inertia, small capacity		
Rated power (kW)	0.75		
Voltage (V)	220		
Rated torque (N·m)	2.39		
Maximum torque (N·m)	8.37		
Rated frequency (Hz)	250		
Rated current (A)	4.4		Heatsink-based derating curve
Maximum current (A)	16.9		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.63		
Rotor moment of inertia (kg·cm^2)	Brake-less motor	1.46±10%	
	Brake motor	1.51±10%	

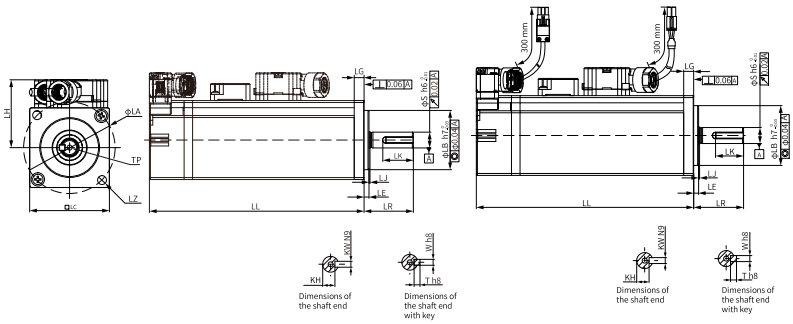
Electrical specifications of the brake

Holding torque (N·m)	Supply voltage (VDC)±10%	Rated power (W)	Coil resistance (Ω)±10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
3.2	24	10	57.6	0.42	≤ 60	≤ 40	≤ 1

Allowable load

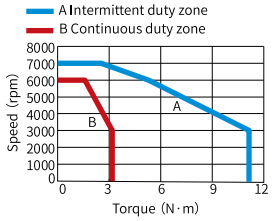
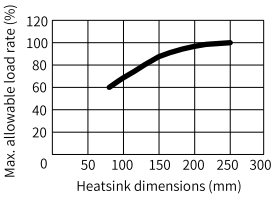
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Product dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	107.3 (140.5)	35± 0.5	90	4 x ϕ7	54	7.5	3±0.5	0.5±0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6x20	$25^{0}_{-0.62}$	$15.5^{0}_{-0.1}$	6	6	6	2.18 (2.82)

19.2.5.7 MS1H4-10C30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Medium inertia, low capacity		
Rated power (kW)	1.0		
Voltage (V)	220		
Rated torque (N·m)	3.18		
Maximum torque (N·m)	11.13		
Rated frequency (Hz)	250		
Rated current (A)	6.5		Heatsink-based derating curve
Maximum current (A)	24		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.53		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	1.87 ± 10%	
	Motor with brake	1.97 ± 10%	

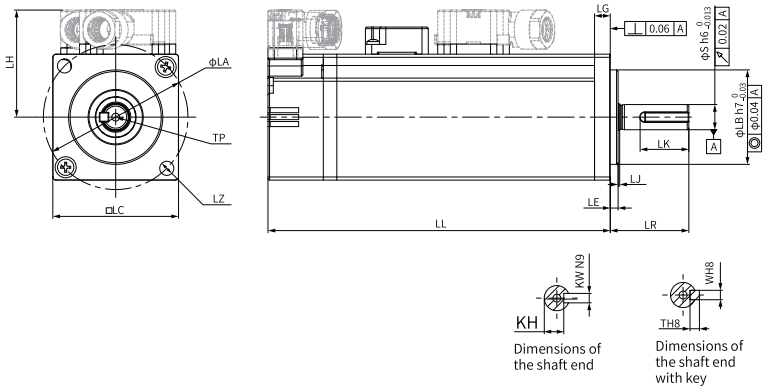
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
3.2	24	10	57.6	0.42	≤ 60	≤ 40	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Dimensions (mm)

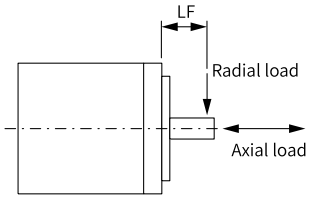


LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	118.7 (153.2)	35 ± 0.5	90	4 × ϕ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	250 -0.62	15.50 -0.1	6	6	6	2.55 (2.9)

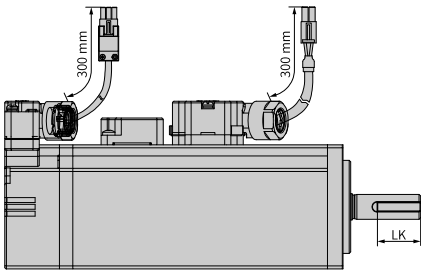
19.3 Motor Models (MS1-R Series Servo Motor with Battery-free Encoder)

19.3.1 Selection Instructions

- Description of torque-speed characteristics curves:
  - All parameters and torque-speed characteristic values are subject to the conditions that the motor works with an Inovance servo drive and the armature coil temperature is 20°C.
  - Continuous duty zone: refers to a series of states in which the motor can operate safely and continuously, and the actual torque must be located in this area.
  - Intermittent duty zone: refers to a series of states in which the motor can run within a short period of time when the actual torque is greater than the rated torque.
- The characteristic values are obtained in cases where the motor is installed with the following heatsink (unit: mm):
  - MS1H1/MS1H4: 250 x 250 x 6 (aluminum)
  - MS1H2-10C to 25C: 400 x 400 x 20 (steel)
  - MS1H2-30C to 50C: 400 x 400 x 20 (steel)
  - MS1H3-85B to 18C: 400 x 400 x 20 (steel)
  - MS1H3-29C to 55C: 550 x 550 x 30 (aluminum)
  - MS1H3-75C: 700 x 700 x 30 (aluminum)
- Radial and axial loads of the motor:



- Dimensions of flying leads type motors
  Flying leads type motors with frame sizes 60/80 (model ended with "-S") provide a drain wire of about 300 mm in length, as shown in the following figure.



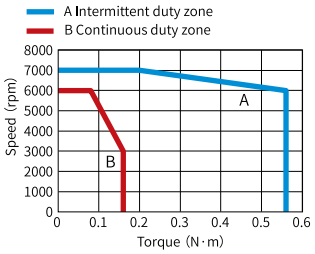
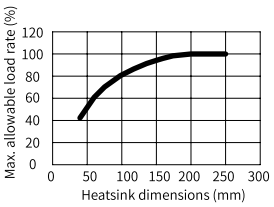
- As shown in the preceding figure, the product is marked with an LK value in the dimension diagram. LK indicates the length of the shaft key.
- MS1H3 (130-flange and 180-flange) comes with a key slot. When the operating speed is above 3000 rpm, the motor must run with the keyway. If you need to run the motor without the keyway at speeds higher than 3000 rpm, contact Inovance.

Note

- Values inside the parentheses in the following sections are parameters of the servo motor with a brake.
- The motor with oil seal must be derated by 10% during use.
- Use your own DC power supply as 24 V power supply of the brake. For the cable connecting the DC power supply to the motor brake, it is recommended to use cables with a cross-sectional area of 0.2 mm^2 or above for motors with rated 750 W or below. It is recommended to use cables with a cross-sectional area of 0.8 mm^2 or above for motors rated 750 W or above. The brake cannot share the same power supply with other appliances to prevent the voltage or current from falling due to the simultaneous operation of other electrical appliances, which may result in brake malfunction.
- Do not share a power supply among multiple brakes. Otherwise, a short-circuited coil caused by dry friction will lock other brakes that are connected to the power supply in parallel, resulting in dry friction on these brakes.
- The brake apply time and release time vary with the discharge circuit. Check the actual action delay of the product during use. The holding brake cannot be used for braking purpose.

19.3.2 Low Inertia and Small Capacity (MS1H1)

19.3.2.1 MS1H1-05B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	40		
Inertia and capacity	Low inertia, small capacity		
Rated power (kW)	0.05		
Rated voltage (V)	220		
Rated torque (N·m)	0.16		
Maximum torque (N·m)	0.56		
Rated frequency (Hz)	250		
Rated current (A)	1.2		Heatsink-based derating curve
Maximum current (A)	4.8		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.15		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	0.018±10%	
	Motor with brake	0.0208±10%	

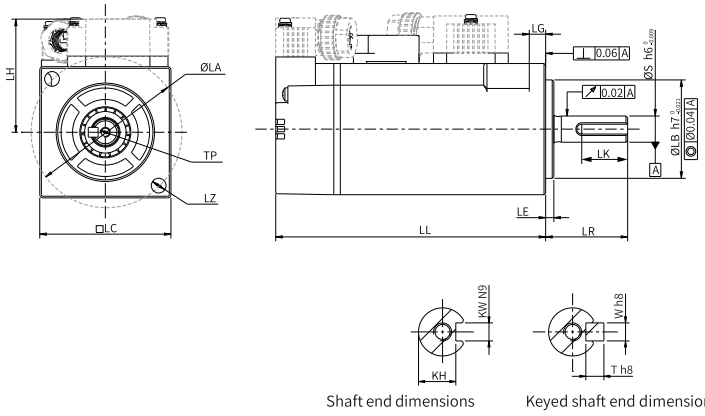
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC)±10%	Rated power (W)	Coil resistance (Ω)±10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
0.32	24	6.9	83.5	0.29	≤ 40	≤ 20	≤ 1.5

Allowable loads

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

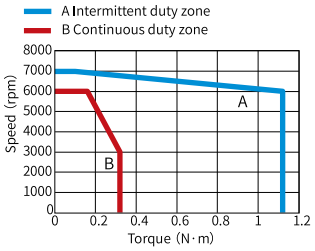
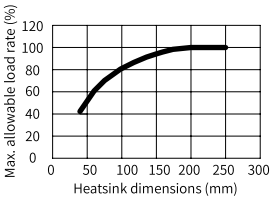
Product dimensions (in mm)



Shaft end dimensions Keyed shaft end dimensions

LL	LC	LR	LA	LZ	LH	LG	LE	
57 (84.3)	40	25±0.5	46	2 × ϕ4.5	34.5	5	2.5±0.5	
S	LB	TP	LK	KH	KW	W	T	Weight (kg)
8	30	M3 × 7	$14^{0}_{-0.36}$	$6.2^{0}_{-0.1}$	3	3	3	0.26 (0.43)

19.3.2.2 MS1H1-10B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	40		
Inertia and capacity	Low inertia, small capacity		
Rated power (kW)	0.1		
Rated voltage (V)	220		
Rated torque (N·m)	0.32		
Maximum torque (N·m)	1.12		
Rated frequency (Hz)	250		
Rated current (A)	1.2		Heatsink-based derating curve
Maximum current (A)	4.8		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.30		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	0.0316±10%	
	Motor with brake	0.0345±10%	

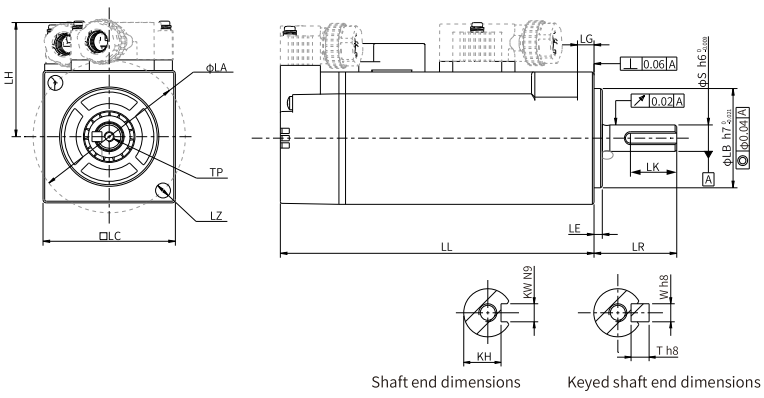
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC)±10%	Rated power (W)	Coil resistance (Ω)±10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
0.32	24	6.9	83.5	0.29	≤ 40	≤ 20	≤ 1.5

Allowable loads

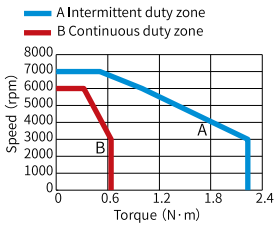
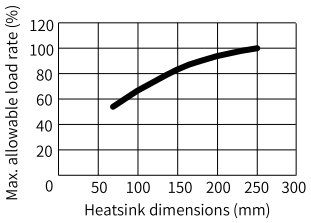
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

Product dimensions (in mm)



LL	LC	LR	LA	LZ	LH	LG	LE	
69.5 (96.8)	40	25±0.5	46	2 × ϕ4.5	34.5	5	2.5±0.5	
S	LB	TP	LK	KH	KW	W	T	Weight (kg)
8	30	M3 × 7	$14^{0}_{-0.36}$	$6.2^{0}_{-0.1}$	3	3	3	0.35 (0.52)

19.3.2.3 MS1H1-20B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	60		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	0.2		
Voltage (V)	220		
Rated torque (N·m)	0.64		
Maximum torque (N·m)	2.24		
Rated frequency (Hz)	250		
Rated current (A)	1.5		Heatsink-based derating curve
Maximum current (A)	5.3		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.51		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	0.094 ± 10%	
	Motor with brake	0.106 ± 10%	

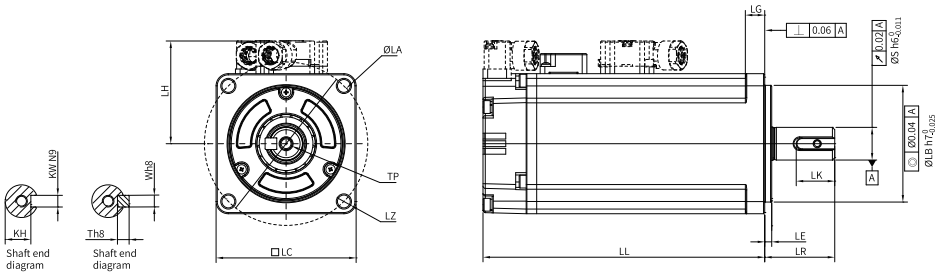
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
1.5	24	7.6	75.79	0.32	≤ 60	≤ 20	≤ 1

Allowable load

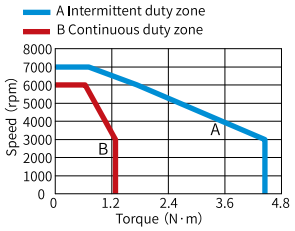
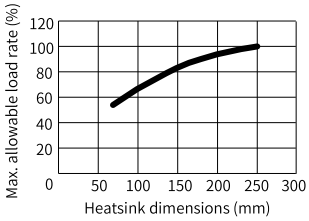
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	
60	75.5 (103)	30 ± 0.5	70	4 × ϕ5.5	44	8.0	3 ± 0.5	
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
50	14	M5 × 12	160 $^{-0.53}_{-0.1}$	110 $^{-0.1}$	5	5	5	0.80 (1.17)

19.3.2.4 MS1H1-40B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	60		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	0.4		
Voltage (V)	220		
Rated torque (N·m)	1.27		
Maximum torque (N·m)	4.45		
Rated frequency (Hz)	250		
Rated current (A)	2.5		Heatsink-based derating curve
Maximum current (A)	9.8		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.57		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	0.145 ± 10%	
	Motor with brake	0.157 ± 10%	

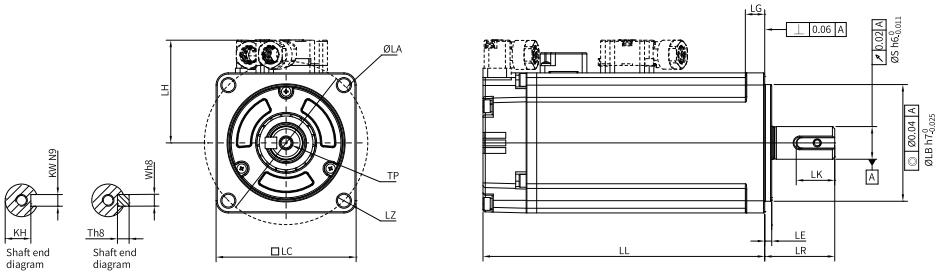
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
1.5	24	7.6	75.79	0.32	≤ 60	≤ 20	≤ 1

Allowable load

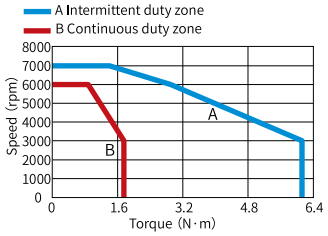
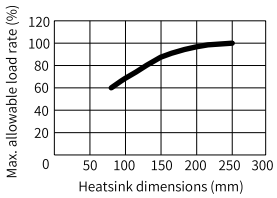
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	
60	93 (121)	30 ± 0.5	70	4 × ϕ5.5	44	8.0	3 ± 0.5	
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
50	14	M5 × 12	160 -0.53	110 -0.1	5	5	5	1.11 (1.48)

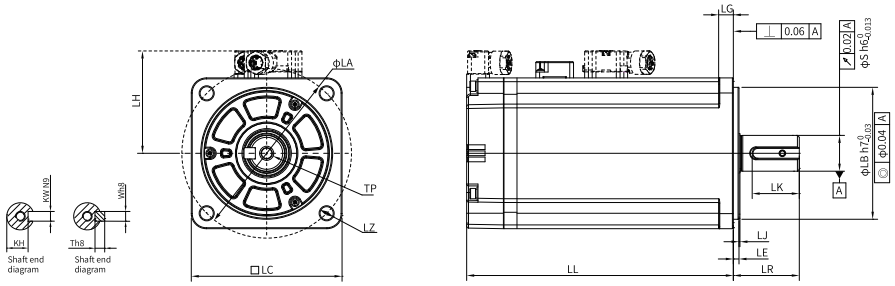
19.3.2.5 MS1H1-55B30CB-V331R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	0.55		
Voltage (V)	220		
Rated torque (N·m)	1.75		
Maximum torque (N·m)	6.13		
Rated frequency (Hz)	250		
Rated current (A)	3.9		Heatsink-based derating curve
Maximum current (A)	15		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.51		
Rotor moment of inertia (kg·cm²)	Motor without brake	0.55 ± 10%	
	Motor with brake	-	

Allowable load

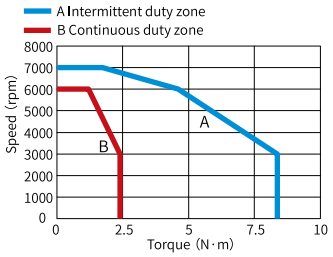
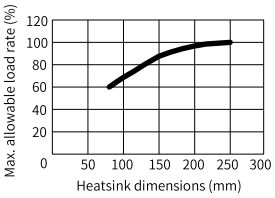
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	96.7	35 ± 0.5	90	4 × ϕ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	250 -0.62	15.50 -0.1	6	6	6	1.88

19.3.2.6 MS1H1-75B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	0.75		
Voltage (V)	220		
Rated torque (N·m)	2.39		
Maximum torque (N·m)	8.36		
Rated frequency (Hz)	250		
Rated current (A)	4.4		Heatsink-based derating curve
Maximum current (A)	16.9		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.62		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	0.68 ± 10%	
	Motor with brake	0.71 ± 10%	

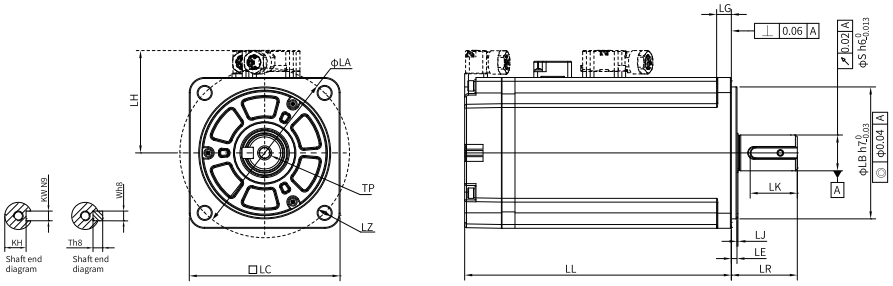
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
3.2	24	10	57.6	0.42	≤ 60	≤ 40	≤ 1

Allowable load

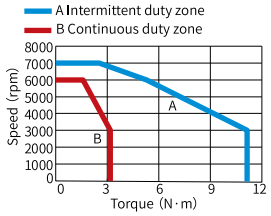
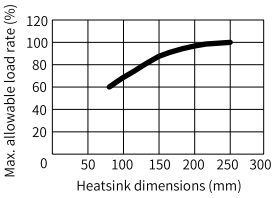
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	107.3 (141.5)	35 ± 0.5	90	4 × ϕ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	250 -0.62	15.50 -0.1	6	6	6	2.22 (2.88)

19.3.2.7 MS1H1-10C30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Low inertia, small capacity		
Rated power (kW)	1.0		
Voltage (V)	220		
Rated torque (N·m)	3.18		
Maximum torque (N·m)	11.13		
Rated frequency (Hz)	250		
Rated current (A)	6.2		Heatsink-based derating curve
Maximum current (A)	24		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.59		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	0.82 ± 10%	
	Motor with brake	0.87 ± 10%	

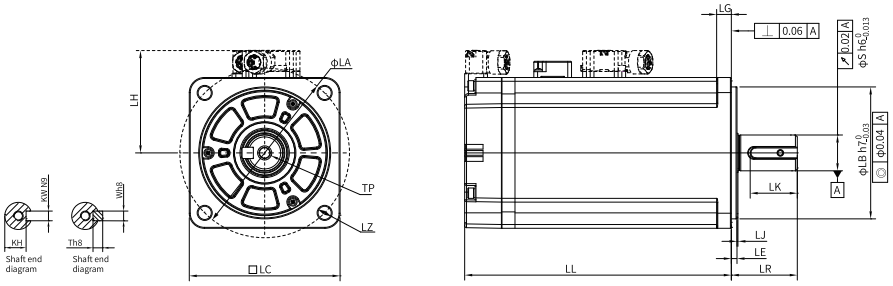
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
3.2	24	10	57.6	0.42	≤ 60	≤ 40	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

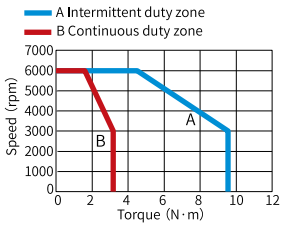
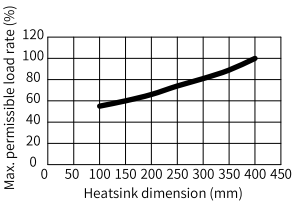
Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	119.2 (153.4)	35 ± 0.5	90	4 × ϕ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	250 - 0.62	15.50 -0.1	6	6	6	2.61 (3.27)

19.3.3 Low Inertia and Medium Capacity (MS1H2)

19.3.3.1 MS1H2-10C30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia and capacity	low inertia, medium capacity		
Rated power (kW)	1.0		
Voltage (V)	220		
Rated torque (N·m)	3.18		
Maximum torque (N·m)	9.54		
Rated frequency (Hz)	250		
Rated current (A)	6.4		Heatsink-based derating curve
Maximum current (A)	23		
Rated speed (rpm)	3000		
Maximum Speed (rpm)	6000		
Torque coefficient (N·m/A)	0.54		
Rotor moment of inertia (kg·cm^2)	Motor without brake	1.78±10%	
	Motor with brake	2.6±10%	

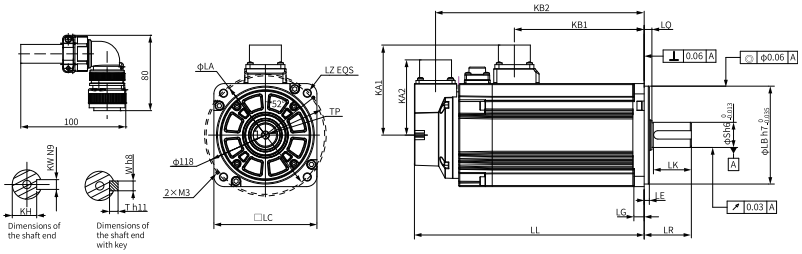
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC)±10%	Rated power (W)	Coil resistance (Ω)±10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable loads

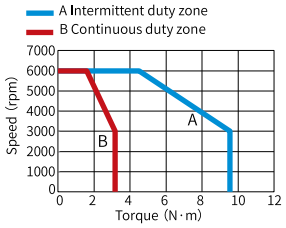
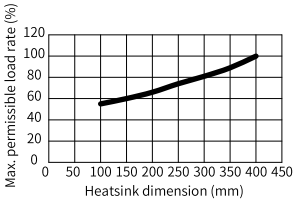
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Product dimensions (in mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	144 (172)	45±1	115	4 × ϕ7	88	75	73	123.5 (151.5)	10	5±0.3
LQ	LB		S	TP	LK	KH	KW	W	T	Weight (kg)
7.5±0.75	95		24	M8 × 16	$35^{0}_{-0.62}$	$20^{0}_{-0.2}$	8	8	7	3.85 (4.9)

19.3.3.2 MS1H2-10C30CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	1.0		
Voltage (V)	380		
Rated torque (N·m)	3.18		
Maximum torque (N·m)	9.54		
Rated frequency (Hz)	250		
Rated current (A)	3.3		Heatsink-based derating curve
Maximum current (A)	11		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.07		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	1.78 ± 10%	
	Motor with brake	2.6 ± 10%	

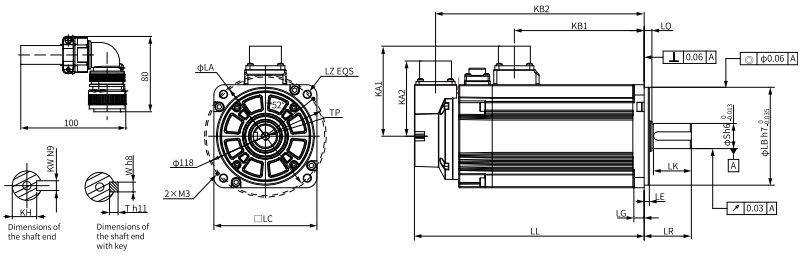
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

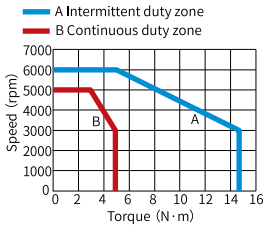
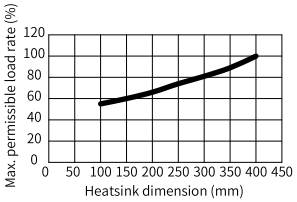
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	144 (172)	45 ± 1	115	4 × ϕ7	88	75	73	123.5 (151.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	3.85 (4.9)

19.3.3.3 MS1H2-15C30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	1.5		
Voltage (V)	220		
Rated torque (N·m)	4.9		
Maximum torque (N·m)	14.7		
Rated frequency (Hz)	250		
Rated current (A)	8.6		Heatsink-based derating curve
Maximum current (A)	32		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	0.62		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	2.35 ± 10%	
	Motor with brake	3.17 ± 10%	

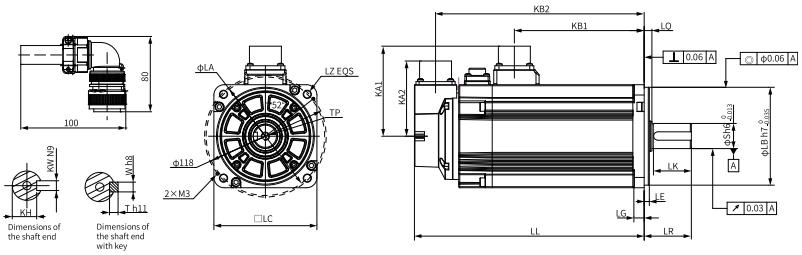
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

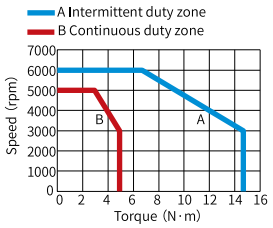
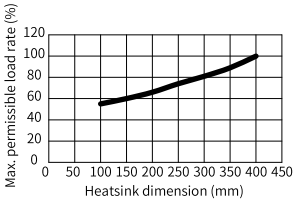
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	161 (189)	45 ± 1	115	4 × ϕ7	88	92	73	140.5 (168.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	4.65 (5.75)

19.3.3.4 MS1H2-15C30CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	1.5		
Voltage (V)	380		
Rated torque (N·m)	4.9		
Maximum torque (N·m)	14.7		
Rated frequency (Hz)	250		
Rated current (A)	4.2		Heatsink-based derating curve
Maximum current (A)	14		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.28		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	2.35 ± 10%	
	Motor with brake	3.17 ± 10%	

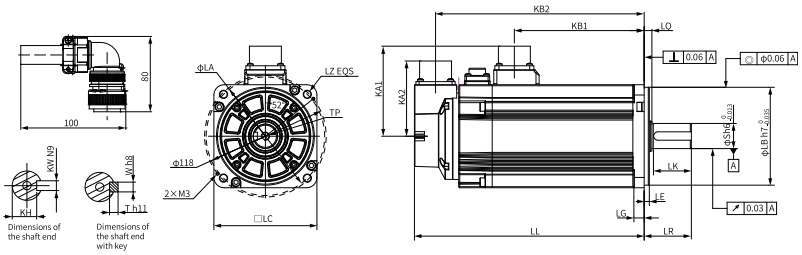
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

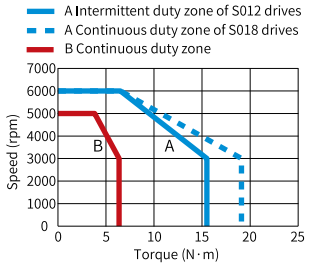
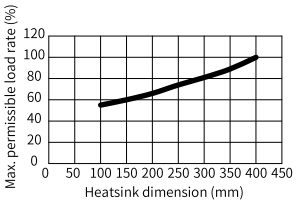
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	161 (189)	45 ± 1	115	4 × ϕ7	88	92	73	140.5 (168.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	4.65 (5.75)

19.3.3.5 MS1H2-20C30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	2.0		
Voltage (V)	220		
Rated torque (N·m)	6.36		
Maximum torque (N·m)	19.1		
Rated frequency (Hz)	250		
Rated current (A)	11.3		Heatsink-based derating curve
Maximum current (A)	42		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	0.60		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	2.92 ± 10%	
	Motor with brake	3.74 ± 10%	

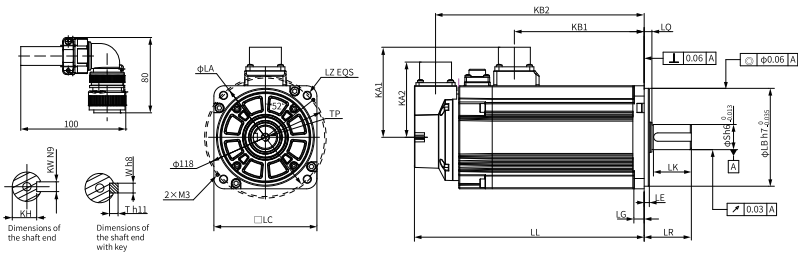
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

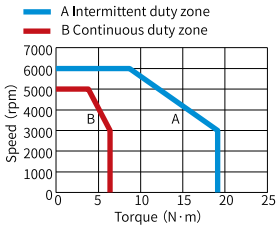
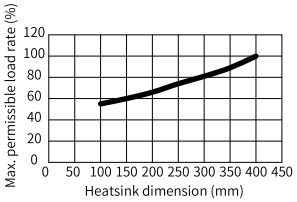
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	177 (205)	45 ± 1	115	4 × φ7	88	108	73	156.5 (184.5)	10	5 ± 0.3
LQ	**LB**		**S**	**TP**	**LK**	**KH**	**kW**	**W**	**T**	**Weight (kg)**
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	5.5 (6.55)

19.3.3.6 MS1H2-20C30CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	2.0		
Voltage (V)	380		
Rated torque (N·m)	6.36		
Maximum torque (N·m)	19.1		
Rated frequency (Hz)	250		
Rated current (A)	5.6		Heatsink-based derating curve
Maximum current (A)	20		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.19		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	2.92 ± 10%	
	Motor with brake	3.74 ± 10%	

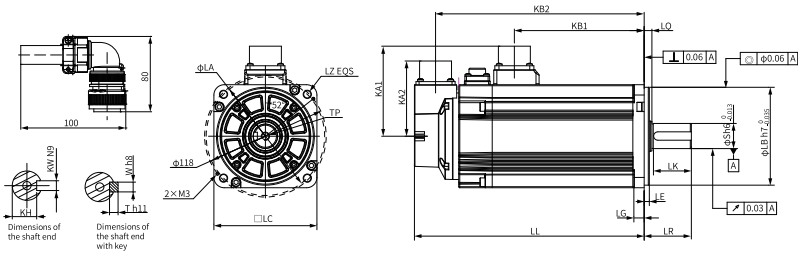
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

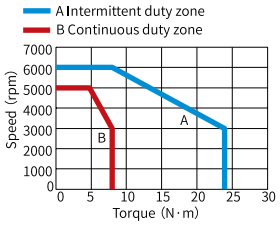
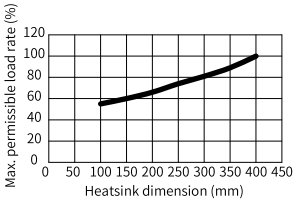
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	177 (205)	45 ± 1	115	4 × ϕ7	88	108	73	156.5 (184.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	5.5 (6.55)

19.3.3.7 MS1H2-25C30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	2.5		
Voltage (V)	220		
Rated torque (N·m)	7.96		
Maximum torque (N·m)	23.9		
Rated frequency (Hz)	250		
Rated current (A)	14.7		Heatsink-based derating curve
Maximum current (A)	53		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	0.60		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	3.49 ± 10%	
	Motor with brake	4.3 ± 10%	

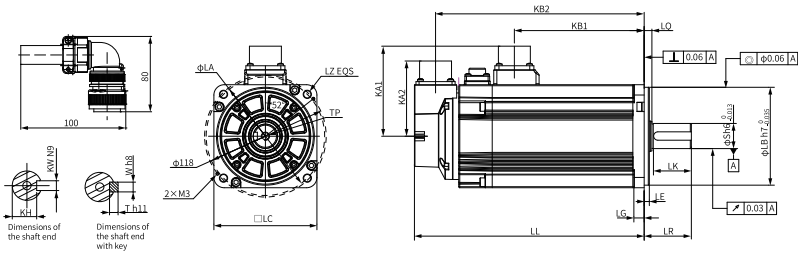
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

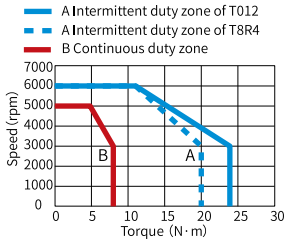
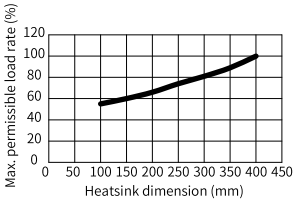
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	195 (223)	45 ± 1	115	4 × ϕ7	88	126	73	174.5 (202.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	6.3 (7.35)

19.3.3.8 MS1H2-25C30CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	2.5		
Voltage (V)	380		
Rated torque (N·m)	7.96		
Maximum torque (N·m)	23.9		
Rated frequency (Hz)	250		
Rated current (A)	7.2		Heatsink-based derating curve
Maximum current (A)	26		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.18		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	3.49 ± 10%	
	Motor with brake	4.3 ± 10%	

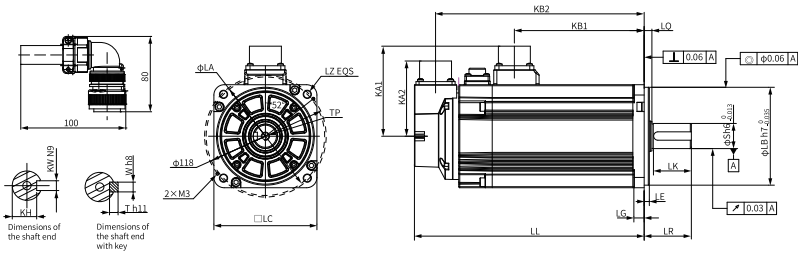
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

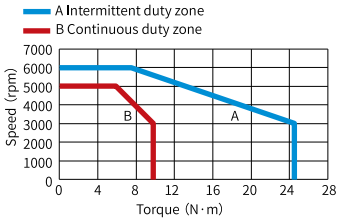
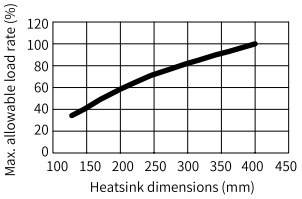
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	195 (223)	45 ± 1	115	4 × ϕ7	88	126	73	174.5 (202.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	6.3 (7.35)

19.3.3.9 MS1H2-30C30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	3.0		
Voltage (V)	220		
Rated torque (N·m)	9.8		
Maximum torque (N·m)	24.5		
Rated frequency (Hz)	150		
Rated current (A)	16.6		Heatsink-based derating curve
Maximum current (A)	55		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	0.67		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	6.4 ± 10%	
	Motor with brake	9.38 ± 10%	

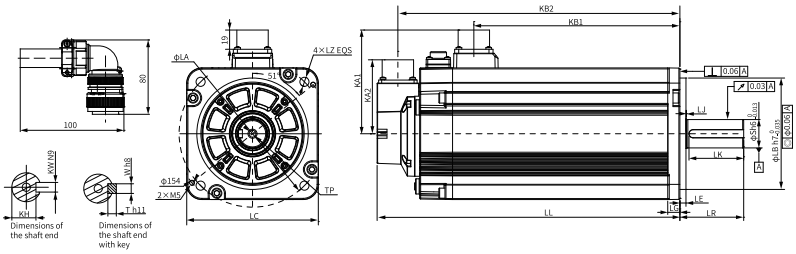
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

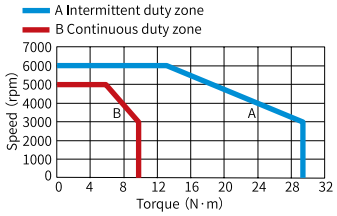
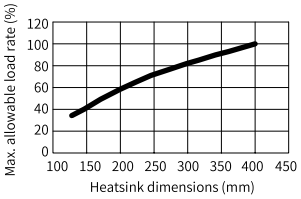
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	198 (223)	63 ± 1	145	4 × ϕ9	102.4	127.5	73	177.5 (202.5)	10.5	6 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		28	M8 × 20	530 $^{0}_{-0.62}$	240 $^{0}_{-0.2}$	8	8	7	10.0 (11.9)

19.3.3.10 MS1H2-30C30CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	3.0		
Voltage (V)	380		
Rated torque (N·m)	9.8		
Maximum torque (N·m)	29.4		
Rated frequency (Hz)	150		
Rated current (A)	8.9		Heatsink-based derating curve
Maximum current (A)	29		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.25		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	6.4 ± 10%	
	Motor with brake	9.38 ± 10%	

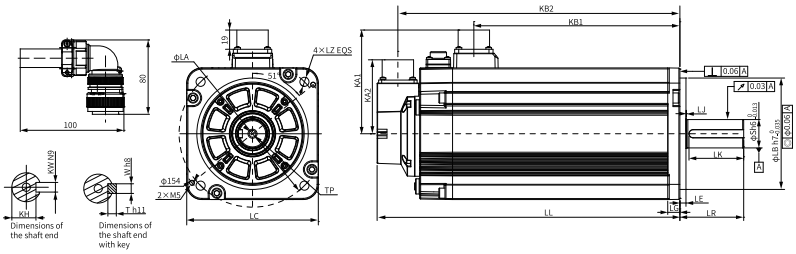
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

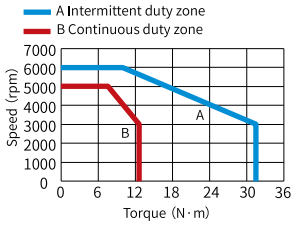
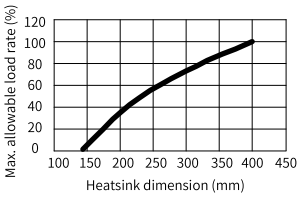
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	198 (223)	63 ± 1	145	4 × ϕ9	102.4	127.5	73	177.5 (202.5)	10.5	6 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		28	M8 × 20	530 $^{0}_{-0.62}$	240 $^{0}_{-0.2}$	8	8	7	10.0 (11.9)

19.3.3.11 MS1H2-40C30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	4.0		
Voltage (V)	220		
Rated torque (N·m)	12.6		
Maximum torque (N·m)	31.5		
Rated frequency (Hz)	150		
Rated current (A)	22		Heatsink-based derating curve
Maximum current (A)	67.5		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	0.65		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	9 ± 10%	
	Motor with brake	11.98 ± 10%	

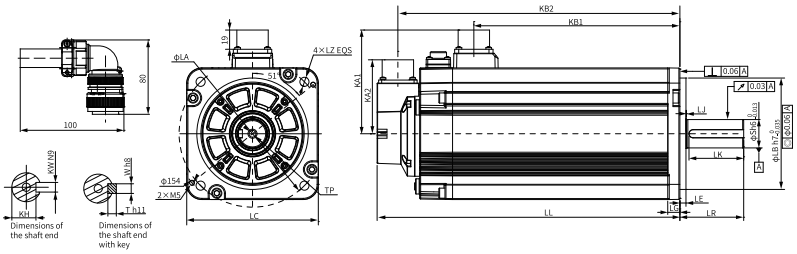
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

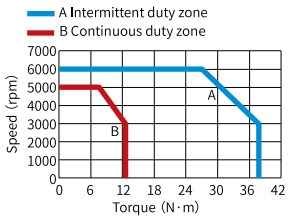
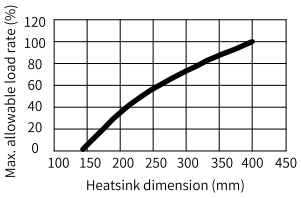
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	236 (261)	63 ± 1	145	4 × φ9	102.4	165.5	73	215.5 (240.5)	10.5	6 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		28	M8 × 20	530 $^{0}_{-0.62}$	240 $^{0}_{-0.2}$	8	8	7	13.2 (15.1)

19.3.3.12 MS1H2-40C30CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	4.0		
Voltage (V)	380		
Rated torque (N·m)	12.6		
Maximum torque (N·m)	37.8		
Rated frequency (Hz)	150		
Rated current (A)	13.5		Heatsink-based derating curve
Maximum current (A)	42.5		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.06		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	9 ± 10%	
	Motor with brake	11.98 ± 10%	

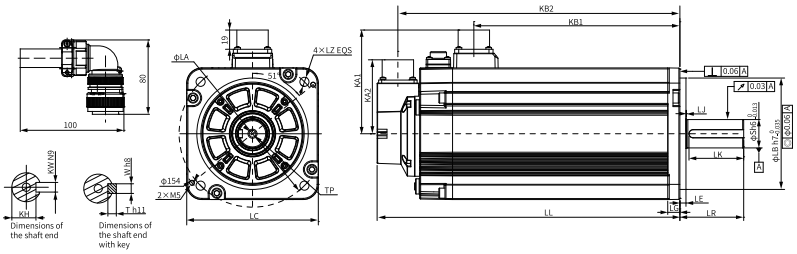
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

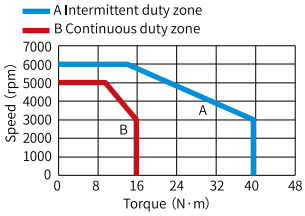
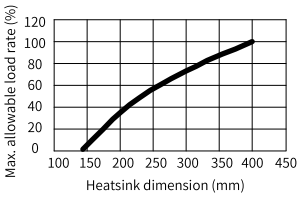
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	236 (261)	63 ± 1	145	4 × ϕ9	102.4	165.5	73	215.5 (240.5)	10.5	6 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		28	M8 × 20	530 $^{-0.62}$	240 $^{-0.2}$	8	8	7	13.2 (15.1)

19.3.3.13 MS1H2-50C30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	5.0		
Voltage (V)	220		
Rated torque (N·m)	15.8		
Maximum torque (N·m)	39.5		
Rated frequency (Hz)	150		
Rated current (A)	22		Heatsink-based derating curve
Maximum current (A)	67.5		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	0.81		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	11.6 ± 10%	
	Motor with brake	14.58 ± 10%	

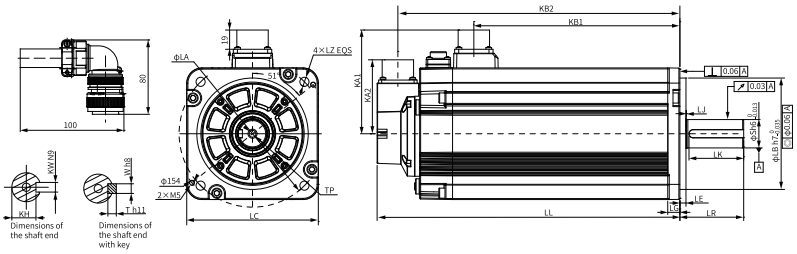
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

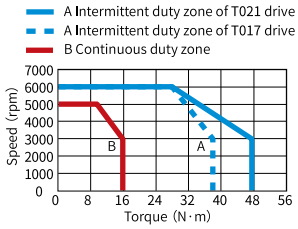
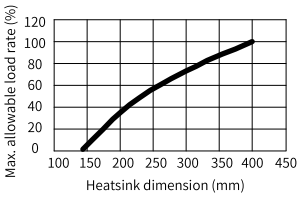
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	274 (299)	63 ± 1	145	4 × φ9	102.4	203.5	73	253.5 (278.5)	10.5	6 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		28	M8 × 20	530 $^{0}_{-0.62}$	240 $^{0}_{-0.2}$	8	8	7	16.35 (18.25)

19.3.3.14 MS1H2-50C30CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Low inertia, medium capacity		
Rated power (kW)	5.0		
Voltage (V)	380		
Rated torque (N·m)	15.8		
Maximum torque (N·m)	47.4		
Rated frequency (Hz)	150		
Rated current (A)	17		Heatsink-based derating curve
Maximum current (A)	52.5		
Rated speed (rpm)	3000		
Maximum speed (rpm)	6000		
Torque coefficient (N·m/A)	1.04		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	11.6 ± 10%	
	Motor with brake	14.58 ± 10%	

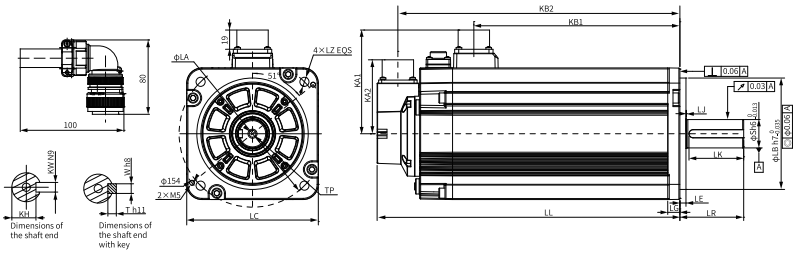
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

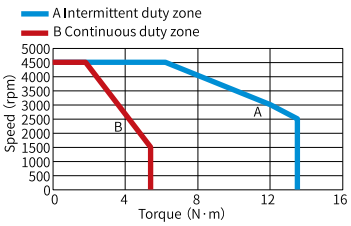
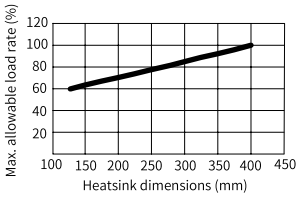
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	274 (299)	63 ± 1	145	4 × ϕ9	102.4	203.5	73	253.5 (278.5)	10.5	6 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		28	M8 × 20	530 $^{0}_{-0.62}$	240 $^{0}_{-0.2}$	8	8	7	16.35 (18.25)

19.3.4 Medium Inertia and Medium Capacity (MS1H3)

19.3.4.1 MS1H3-85B15CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	0.85		
Voltage (V)	220		
Rated torque (N·m)	5.39		
Maximum torque (N·m)	13.5		
Rated frequency (Hz)	125 m		
Rated current (A)	6.6		Heatsink-based derating curve
Maximum current (A)	17.2		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	0.93		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	13.56 ± 10%	
	Motor with brake	15.8 ± 10%	

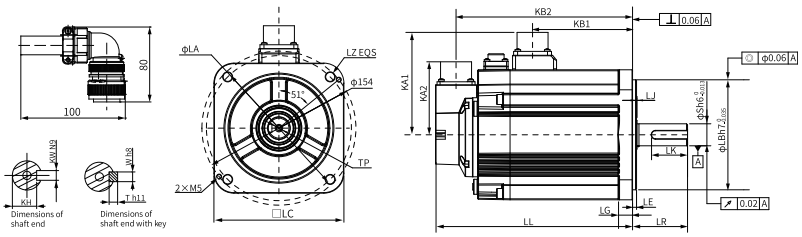
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

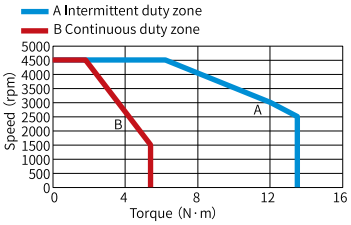
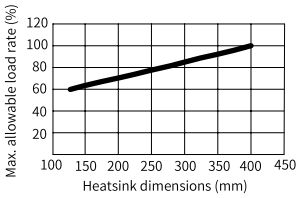
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	142 (167)	55 ± 1	145	4 × φ9	103	70	73	121.5 (146.5)	14	4
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110		22	M6 × 20	350 -0.62	180 -0.2	8	8	7	5.8 (7.7)

19.3.4.2 MS1H3-85B15CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	0.85		
Voltage (V)	380		
Rated torque (N·m)	5.39		
Maximum torque (N·m)	13.5		
Rated frequency (Hz)	125 m		
Rated current (A)	3.5		Heatsink-based derating curve
Maximum current (A)	8.5		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.84		
Rotor moment of inertia (kg·cm^2)	Motor without brake	13.56 ± 10%	
	Motor with brake	15.8 ± 10%	

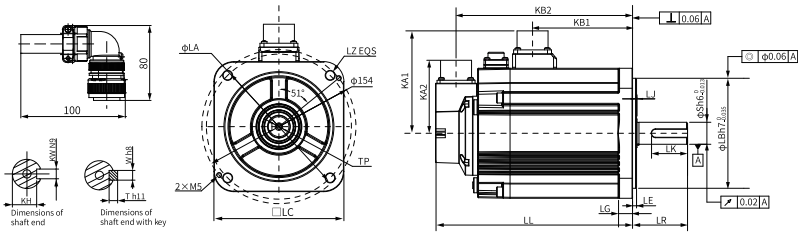
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

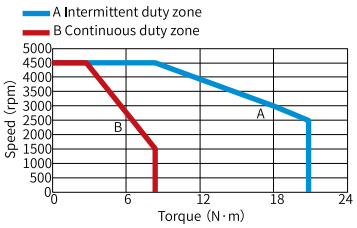
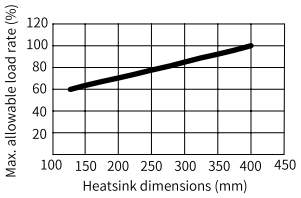
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	142 (167)	55 ± 1	145	4 × ϕ9	103	70	73	121.5 (146.5)	14	4

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110	22	M6 × 20	350 -0.62	180 -0.2	8	8	7	5.8 (7.7)

19.3.4.3 MS1H3-13C15CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	1.3		
Voltage (V)	220		
Rated torque (N·m)	8.34		
Maximum torque (N·m)	20.85		
Rated frequency (Hz)	125 m		
Rated current (A)	10.5		Heatsink-based derating curve
Maximum current (A)	27.3		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	0.89		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	19.25 ± 10%	
	Motor with brake	21.5 ± 10%	

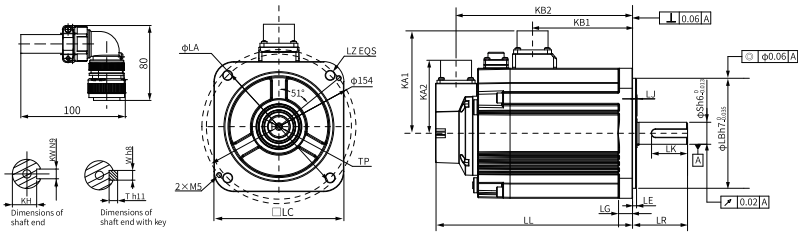
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

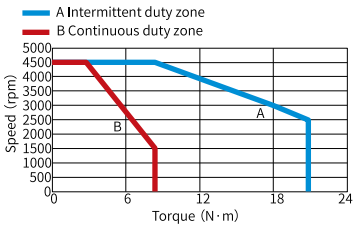
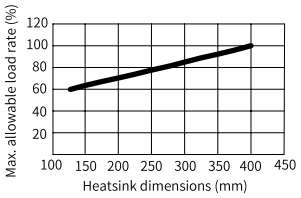
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	157 (182)	55 ± 1	145	4 × φ9	103	85	73	136.5 (161.5)	14	4

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110	22	M6 × 20	350 -0.62	180 -0.2	8	8	7	7.1 (8.9)

19.3.4.4 MS1H3-13C15CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	1.3		
Voltage (V)	380		
Rated torque (N·m)	8.34		
Maximum torque (N·m)	20.85		
Rated frequency (Hz)	125 m		
Rated current (A)	5.1		Heatsink-based derating curve
Maximum current (A)	12.6		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.85		
Rotor moment of inertia (kg·cm^2)	Motor without brake	19.25 ± 10%	
	Motor with brake	21.5 ± 10%	

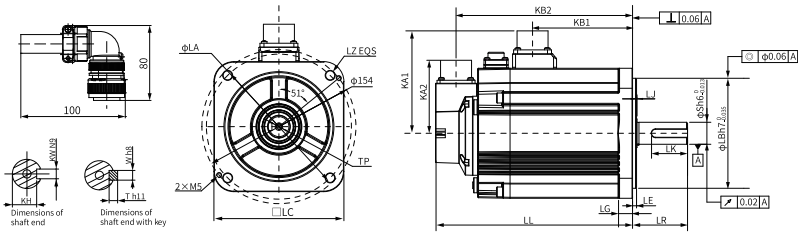
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

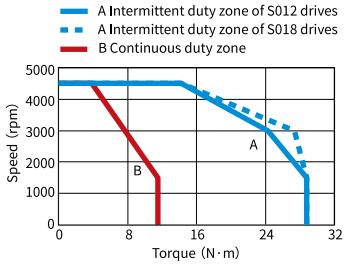
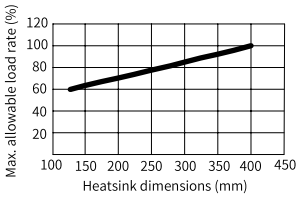
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	157 (182)	55 ± 1	145	4 × φ9	103	85	73	136.5 (161.5)	14	4

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110	22	M6 × 20	350 $^{0}_{-0.62}$	180 $^{0}_{-0.2}$	8	8	7	7.1 (8.9)

19.3.4.5 MS1H3-18C15CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	1.8		
Voltage (V)	220		
Rated torque (N·m)	11.5		
Maximum torque (N·m)	28.75		
Rated frequency (Hz)	125 m		
Rated current (A)	11.9		Heatsink-based derating curve
Maximum current (A)	32.2		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.09		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	24.9 ± 10%	
	Motor with brake	27.2 ± 10%	

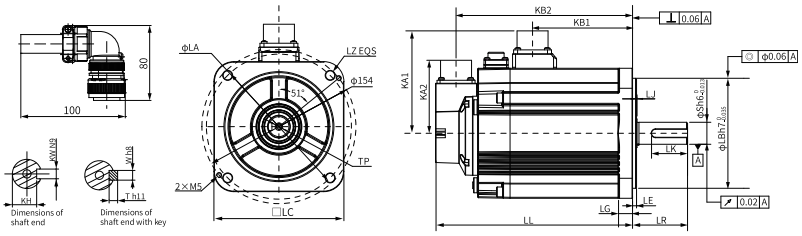
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

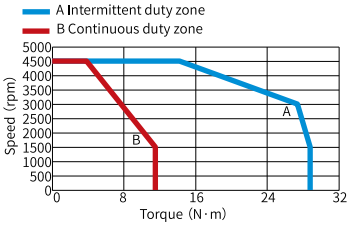
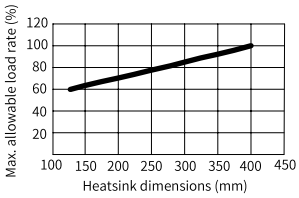
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	172 (197)	55 ± 1	145	4 × ϕ9	103	100	73	151.5 (176.5)	14	4

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110	22	M6 × 20	350 -0.62	180 -0.2	8	8	7	8.5 (10.3)

19.3.4.6 MS1H3-18C15CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	130		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	1.8		
Voltage (V)	380		
Rated torque (N·m)	11.5		
Maximum torque (N·m)	28.75		
Rated frequency (Hz)	125 m		
Rated current (A)	6.75		Heatsink-based derating curve
Maximum current (A)	17.7		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.87		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	24.9 ± 10%	
	Motor with brake	27.2 ± 10%	

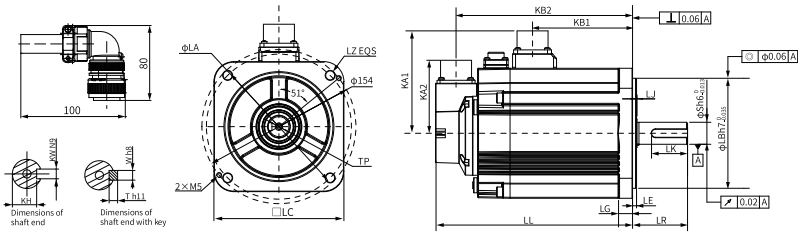
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
16	24	24	24	1	≤ 120	≤ 60	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

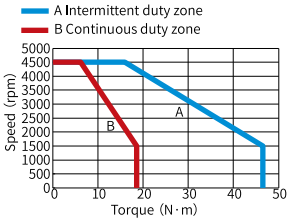
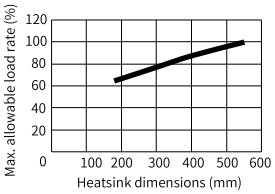
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
130	172 (197)	55 ± 1	145	4 × ϕ9	103	100	73	151.5 (176.5)	14	4

LJ	LB	S	TP	LK	KH	kW	W	T	Weight (kg)
0.5 ± 0.75	110	22	M6 × 20	350 $^{-0.62}$	180 $^{-0.2}$	8	8	7	8.5 (10.3)

19.3.4.7 MS1H3-29C15CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	180		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	2.9		
Voltage (V)	220		
Rated torque (N·m)	18.6		
Maximum torque (N·m)	46.5		
Rated frequency (Hz)	125 m		
Rated current (A)	18		Heatsink-based derating curve
Maximum current (A)	52.5		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.16		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	44.7 ± 10%	
	Motor with brake	52.35 ± 10%	

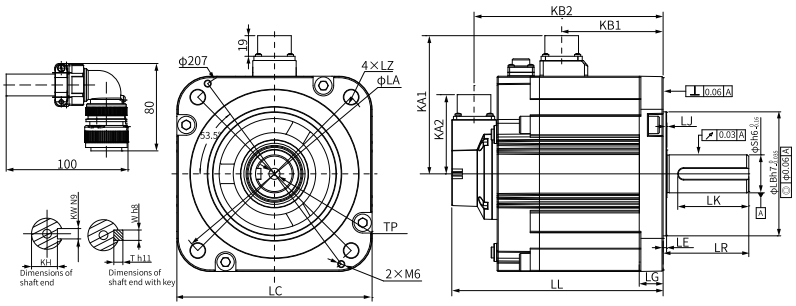
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
50	24	31	18.58	1.29	≤ 200	≤ 100	≤ 1

Allowable load

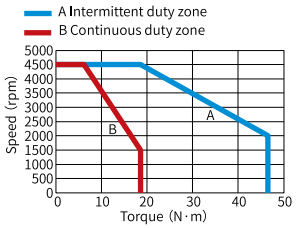
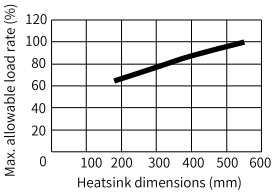
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
79	≤ 1470	≤ 490

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	161 (194.8)	79 ± 1	200	4 × ϕ13.5	127.4	93.5	73	140.5 (174.3)	20.5	3.2 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.3 ± 0.75	114.3		35	M12 × 25	640 $^{-0.74}$	300 $^{-0.2}$	10	10	8	13.8 (17.9)

19.3.4.8 MS1H3-29C15CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	180		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	2.9		
Voltage (V)	380		
Rated torque (N·m)	18.6		
Maximum torque (N·m)	46.5		
Rated frequency (Hz)	125 m		
Rated current (A)	10.5		Heatsink-based derating curve
Maximum current (A)	29.75		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.94		
Rotor moment of inertia (kg·cm^2)	Motor without brake	44.7 ± 10%	
	Motor with brake	52.35 ± 10%	

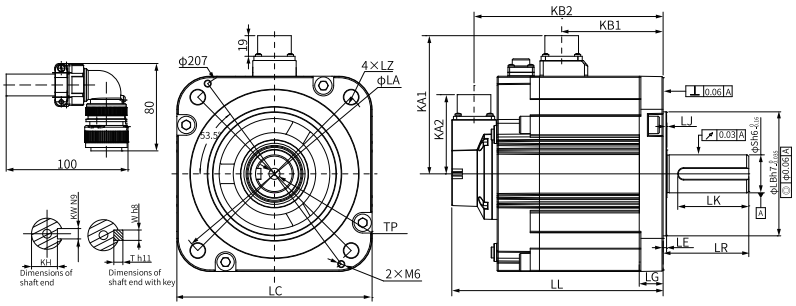
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
50	24	31	18.58	1.29	≤ 200	≤ 100	≤ 1

Allowable load

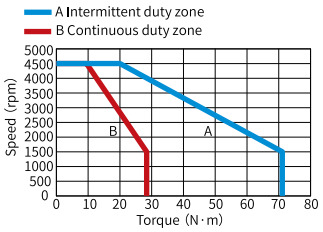
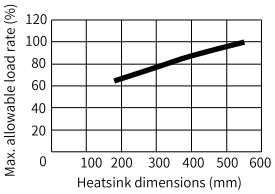
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
79	≤ 1470	≤ 490

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	161 (194.8)	79 ± 1	200	4 × ϕ13.5	127.4	93.5	73	140.5 (174.3)	20.5	3.2 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.3 ± 0.75	114.3		35	M12 × 25	640 $^{-0.74}$	300 $^{-0.2}$	10	10	8	13.8 (17.9)

19.3.4.9 MS1H3-44C15CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	180		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	4.4		
Voltage (V)	220		
Rated torque (N·m)	28.4		
Maximum torque (N·m)	71.1		
Rated frequency (Hz)	125 m		
Rated current (A)	25.5		Heatsink-based derating curve
Maximum current (A)	67		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.25		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	64.9 ± 10%	
	Motor with brake	72.55 ± 10%	

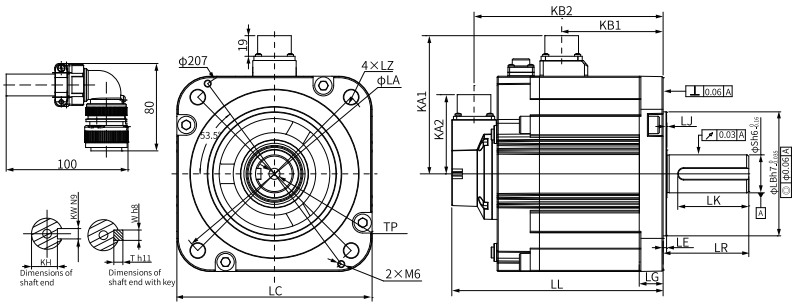
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
50	24	31	18.58	1.29	≤ 200	≤ 100	≤ 1

Allowable load

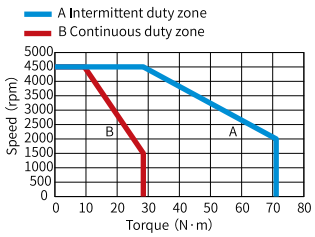
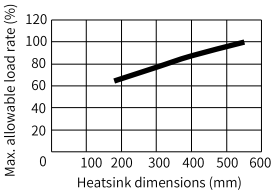
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
79	≤ 1470	≤ 490

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	184.5 (218.3)	79 ± 1	200	4 × ϕ13.5	127.4	117	73	164 (197.8)	20.5	3.2 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.3 ± 0.75	114.3		35	M12 × 25	640 $^{-0.74}$	300 $^{-0.2}$	10	10	8	17.4 (21.9)

19.3.4.10 MS1H3-44C15CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	180		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	4.4		
Voltage (V)	380		
Rated torque (N·m)	28.4		
Maximum torque (N·m)	71.1		
Rated frequency (Hz)	125 m		
Rated current (A)	16		Heatsink-based derating curve
Maximum current (A)	42		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.96		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	64.9 ± 10%	
	Motor with brake	72.55 ± 10%	

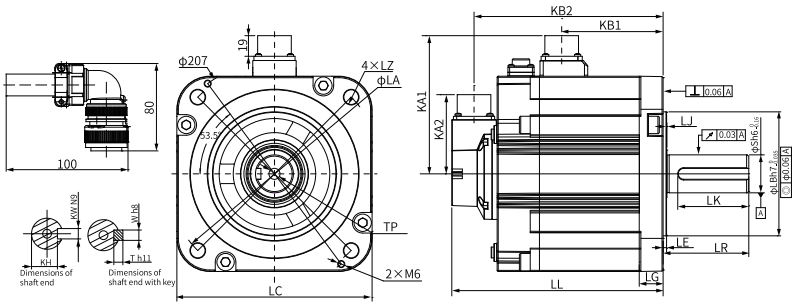
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
50	24	31	18.58	1.29	≤ 200	≤ 100	≤ 1

Allowable load

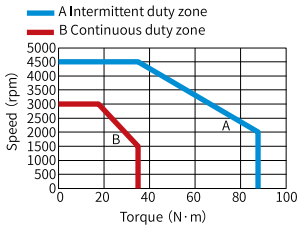
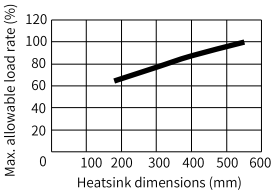
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
79	≤ 1470	≤ 490

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	184.5 (218.3)	79 ± 1	200	4 × ϕ13.5	127.4	117	73	164 (197.8)	20.5	3.2 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.3 ± 0.75	114.3		35	M12 × 25	640 $^{-0.74}$	300 $^{-0.2}$	10	10	8	17.4 (21.6)

19.3.4.11 MS1H3-55C15CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	180		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	5.5		
Voltage (V)	380		
Rated torque (N·m)	35		
Maximum torque (N·m)	87.6		
Rated frequency (Hz)	125 m		
Rated current (A)	20.7		Heatsink-based derating curve
Maximum current (A)	52		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	1.92		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	86.9 ± 10%	
	Motor with brake	94.55 ± 10%	

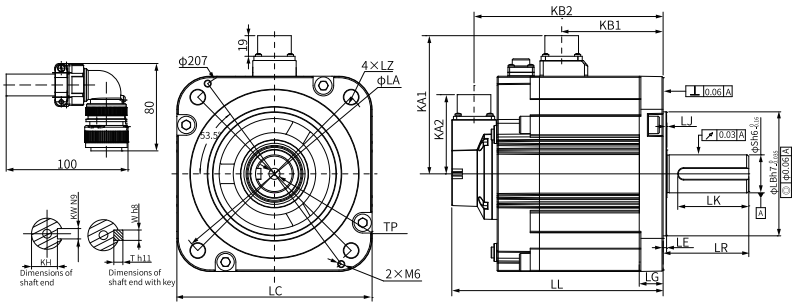
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
50	24	31	18.58	1.29	≤ 200	≤ 100	≤ 1

Allowable load

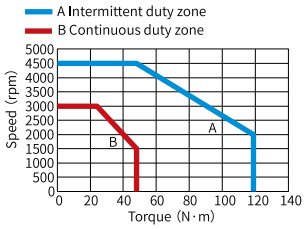
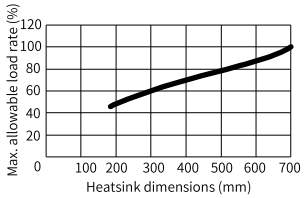
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
113	≤ 1764	≤ 588

Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	208 (241.8)	113 ± 1	200	4 × ϕ13.5	127.4	140.5	73	187.5 (221.3)	20.5	3.2 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.3 ± 0.75	114.3		42	M16 × 32	950 $^{-0.87}$	370 $^{-0.2}$	12	12	8	21.7 (25.9)

19.3.4.12 MS1H3-75C15CD-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	180		
Inertia, capacity	Medium inertia, medium capacity		
Rated power (kW)	7.5		
Voltage (V)	380		
Rated torque (N·m)	48		
Maximum torque (N·m)	119		
Rated frequency (Hz)	125 m		
Rated current (A)	25		Heatsink-based derating curve
Maximum current (A)	65		
Rated speed (rpm)	1500		
Maximum speed (rpm)	4500		
Torque coefficient (N·m/A)	2.13		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	127.5 ± 10%	
	Motor with brake	135.15 ± 10%	

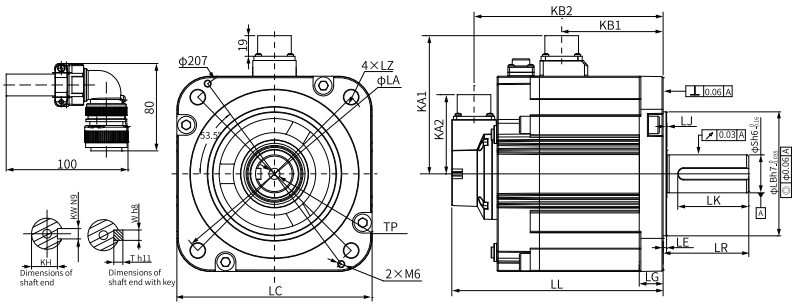
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
50	24	31	18.58	1.29	≤ 200	≤ 100	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
113	≤ 1764	≤ 588

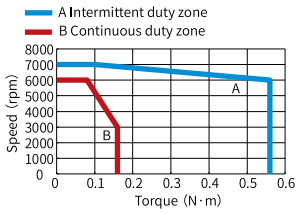
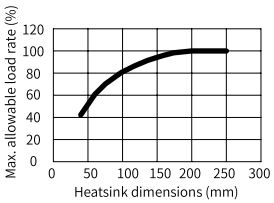
Dimensions (mm)



LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	255 (288.8)	113 ± 1	200	4 × ϕ13.5	127.4	187.5	73	234.5 (268.5)	20.5	3.2 ± 0.3
LJ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
0.3 ± 0.75	114.3		42	M16 × 32	950 -0.87	370 -0.2	12	12	8	29 (33.2)

19.3.5 Medium Inertia and Small Capacity (MS1H4)

19.3.5.1 MS1H4-05B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	40		
Inertia and capacity	Medium inertia, small capacity		
Rated output (kW)	0.05		
Voltage (V)	220		
Rated torque (N·m)	0.16		
Maximum torque (N·m)	0.56		
Rated frequency (Hz)	350		
Rated current (A)	1.27		Heatsink-based derating curve
Maximum current (A)	4.78		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.15		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	0.038±10%	
	Motor with brake	0.04±10%	

Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC)±10%	Rated power (W)	Coil resistance (Ω)±10%	Excitation current (A)	Close time (ms)	Release time (ms)	Backlash (°)
0.32	24	6.9	83.5	0.29	≤ 40	≤ 20	≤ 1.5

Allowable loads

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

Product dimensions (in mm)

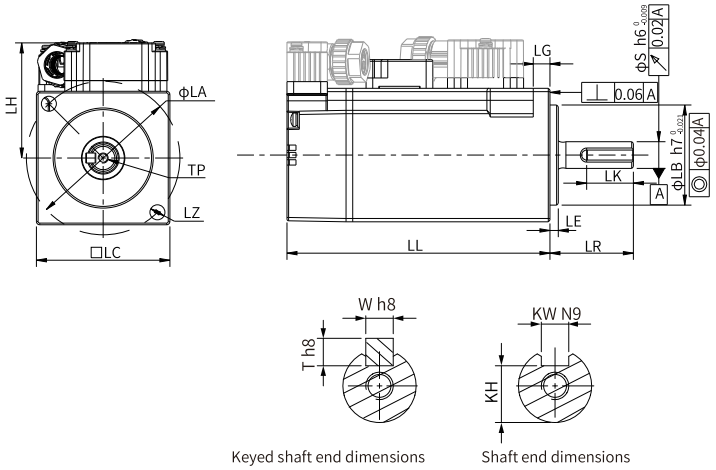


Figure 19-12 MS1H4-05B30CB-V330R and MS1H4-05B30CB-V332R

LL	LC	LR	LA	LZ	LH	LG	LE	
53.5 (80.8)	40	25±0.5	46	2 × ϕ4.5	34.5	5	2.5±0.5	
S	LB	TP	LK	KH	kW	W	T	Weight (kg)
8	30	M3 × 7	$14^{0}_{-0.36}$	$6.2^{0}_{-0.1}$	3	3	3	0.24 (0.40)

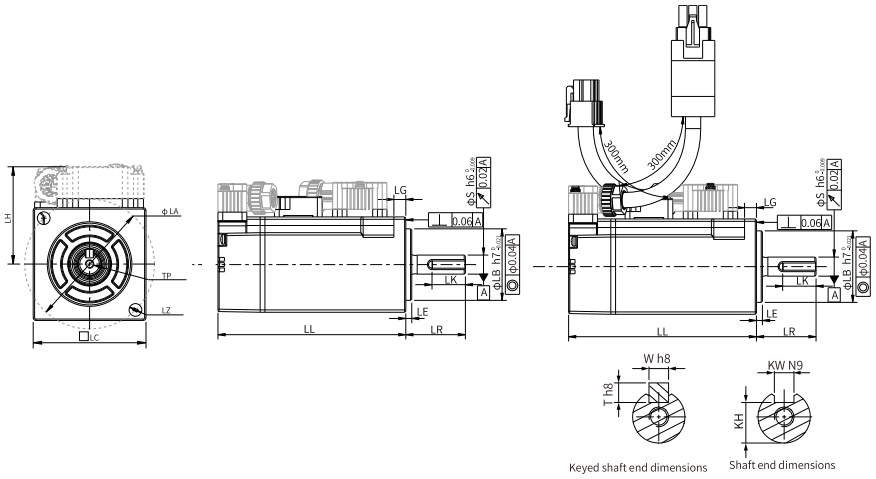
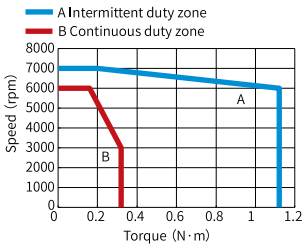
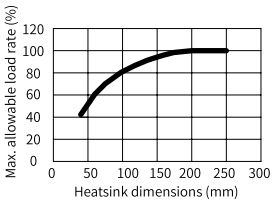


Figure 19-13 MS1H4-05B30CB-V331R and MS1H4-05B30CB-V334R

LL	LC	LR	LA	LZ	LH	LG	LE	
56.15 (83.45)	40	25±0.5	46	2 × ϕ4.5	34.5	5	2.5±0.5	
S	LB	TP	LK	KH	kW	W	T	Weight (kg)
8	30	M3 × 7	$14^{0}_{-0.36}$	$6.2^{0}_{-0.1}$	3	3	3	0.26 (0.42)

19.3.5.2 MS1H4-10B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	40		
Inertia and capacity	Medium inertia, small capacity		
Rated output (kW)	0.1		
Voltage (V)	220		
Rated torque (N·m)	0.32		
Maximum torque (N·m)	1.12		
Rated frequency (Hz)	350		
Rated current (A)	1.27		Heatsink-based derating curve
Maximum current (A)	4.78		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.29		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	0.072±10%	
	Motor with brake	0.074±10%	

Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC)±10%	Rated power (W)	Coil resistance (Ω)±10%	Excitation current (A)	Close time (ms)	Release time (ms)	Backlash (°)
0.32	24	6.9	83.5	0.29	≤ 40	≤ 20	≤ 1.5

Allowable loads

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

Product dimensions (in mm)

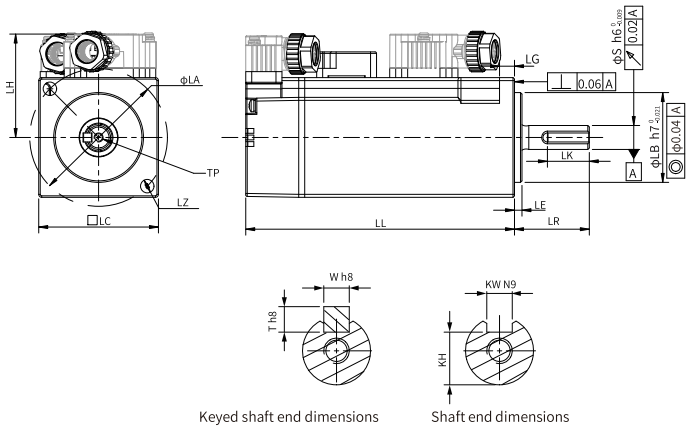


Figure 19-14 MS1H4-10B30CB-V330R and MS1H4-10B30CB-V332R

LL	LC	LR	LA	LZ	LH	LG	LE	
64.5 (91.8)	40	25±0.5	46	2 × ϕ4.5	34.5	5	2.5±0.5	
S	LB	TP	LK	KH	kW	W	T	Weight (kg)
8	30	M3 × 7	$14^{0}_{-0.36}$	$6.2^{0}_{-0.1}$	3	3	3	0.32 (0.48)

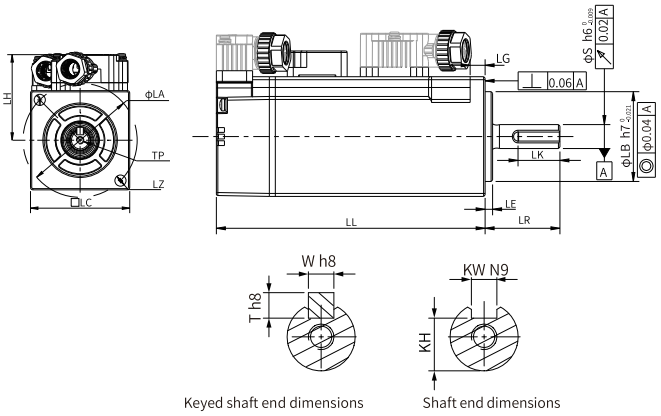
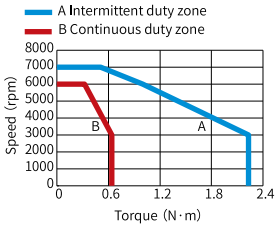
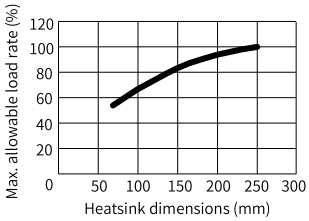


Figure 19-15 MS1H4-10B30CB-V331R and MS1H4-10B30CB-V334R

LL	LC	LR	LA	LZ	LH	LG	LE	
67.15 (94.45)	40	25±0.5	46	2 × ϕ4.5	34.5	5	2.5±0.5	
S	LB	TP	LK	KH	kW	W	T	Weight (kg)
8	30	M3 × 7	$14^{0}_{-0.36}$	$6.2^{0}_{-0.1}$	3	3	3	0.34 (0.50)

19.3.5.3 MS1H4-20B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	60		
Inertia, capacity	Medium inertia, low capacity		
Rated power (kW)	0.2		
Voltage (V)	220		
Rated torque (N·m)	0.64		
Maximum torque (N·m)	2.24		
Rated frequency (Hz)	250		
Rated current (A)	1.3		Heatsink-based derating curve
Maximum current (A)	5.3		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.55		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	0.22 ± 10%	
	Motor with brake	0.23 ± 10%	

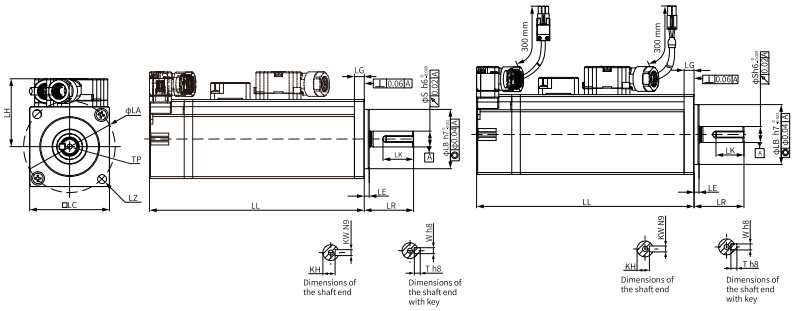
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
1.5	24	7.6	75.79	0.32	≤ 60	≤ 20	≤ 1.5

Allowable load

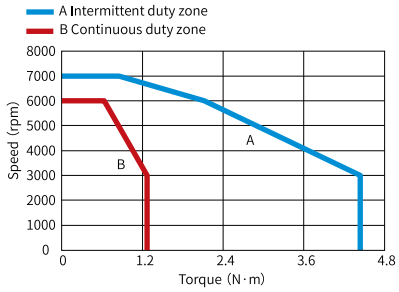
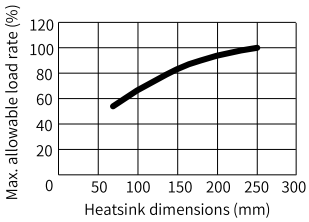
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	
60	73.5 (101.1)	30 ± 0.5	70	4 × ϕ5.5	44	8.0	3 ± 0.5	
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
50	14	M5 × 8	$16.50_{-0.53}$	$110_{-0.1}$	5	5	5	0.78 (1.16)

19.3.5.4 MS1H4-40B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	60		
Inertia and capacity	Medium inertia, small capacity		
Rated power (kW)	0.4		
Voltage (V)	220		
Rated torque (N·m)	1.27		
Maximum torque (N·m)	4.45		
Rated frequency (Hz)	250		
Rated current (A)	2.4		Heatsink-based derating curve
Maximum current (A)	9.2		
Rated speed (rpm)	3000		
Maximum Speed (rpm)	7000		
Torque coefficient (N·m/A)	0.58		
Rotor moment of inertia ($kg·cm^2$)	Motor without brake	0.43±10%	
	Motor with brake	0.44±10%	

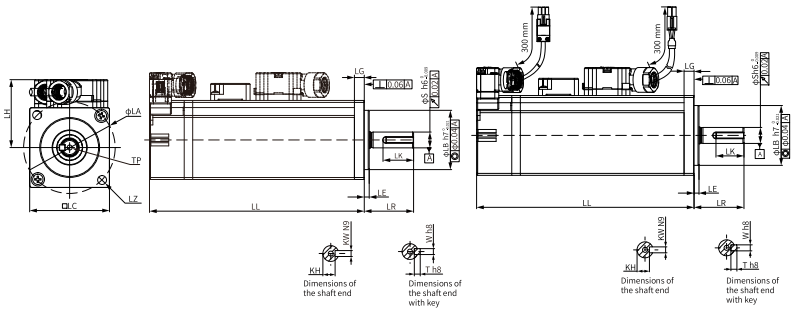
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC)±10%	Rated power (W)	Coil resistance (Ω)±10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
1.5	24	7.6	75.79	0.32	≤ 60	≤ 20	≤ 1.5

Allowable loads

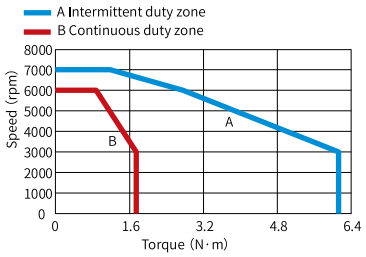
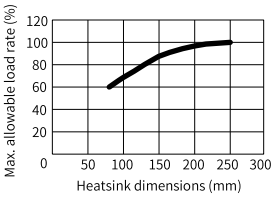
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

Product dimensions (in mm)



LC	LL	LR	LA	LZ	LH	LG	LE	
60	92 (119.8)	30±0.5	70	4 × ϕ5.5	44	8.0	3±0.5	
LB	S	TP	LK	KH	KW	W	T	Weight (kg)
50	14	M5 × 8	$16.5^{0}_{-0.53}$	$11^{0}_{-0.1}$	5	5	5	1.11 (1.48)

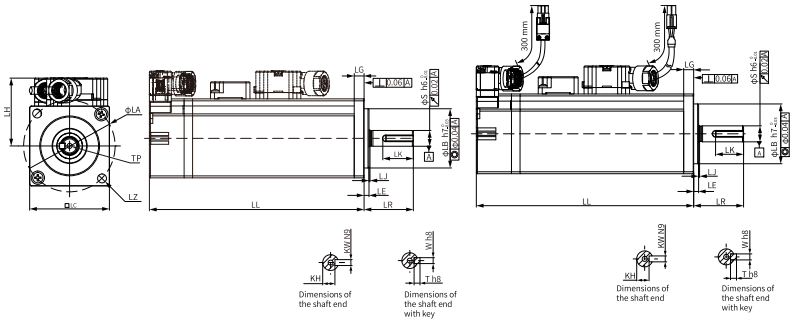
19.3.5.5 MS1H4-55B30CB-V331R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Medium inertia, low capacity		
Rated power (kW)	0.55		
Voltage (V)	220		
Rated torque (N·m)	1.75		
Maximum torque (N·m)	6.13		
Rated frequency (Hz)	250		
Rated current (A)	3.3		Heatsink-based derating curve
Maximum current (A)	13.2		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.58		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	1.12 ± 10%	
	Motor with brake	-	

Allowable load

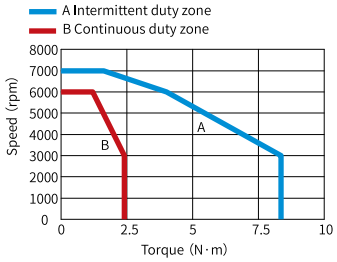
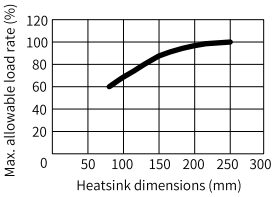
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	96.7	35 ± 0.5	90	4 × ϕ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	250 $^{-0.62}$	15.50 $_{-0.1}$	6	6	6	1.85

19.3.5.6 MS1H4-75B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Medium inertia, small capacity		
Rated power (kW)	0.75		
Voltage (V)	220		
Rated torque (N·m)	2.39		
Maximum torque (N·m)	8.37		
Rated frequency (Hz)	250		
Rated current (A)	4.4		Heatsink-based derating curve
Maximum current (A)	16.9		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.63		
Rotor moment of inertia ($kg·cm^2$)	Brake-less motor	1.46±10%	
	Brake motor	1.51±10%	

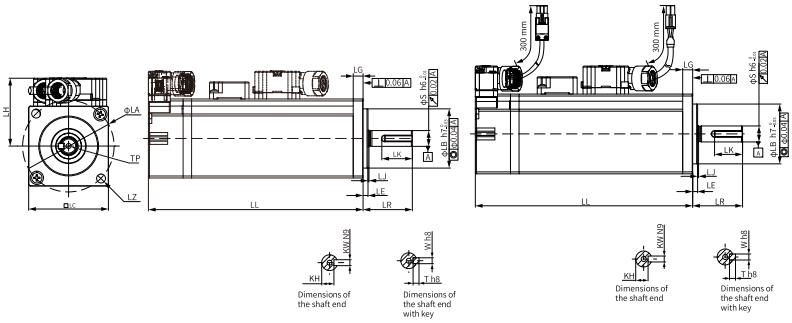
Electrical specifications of the brake

Holding torque (N·m)	Supply voltage (VDC)±10%	Rated power (W)	Coil resistance (Ω)±10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
3.2	24	10	57.6	0.42	≤ 60	≤ 40	≤ 1

Allowable load

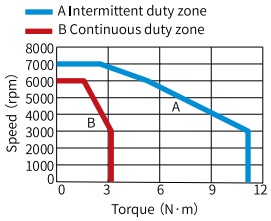
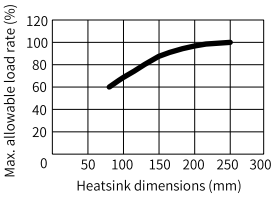
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Product dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	107.3 (140.5)	35± 0.5	90	4 x ϕ7	54	7.5	3±0.5	0.5±0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6x20	$25^{0}_{-0.62}$	$15.5^{0}_{-0.1}$	6	6	6	2.18 (2.82)

19.3.5.7 MS1H4-10C30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	80		
Inertia, capacity	Medium inertia, low capacity		
Rated power (kW)	1.0		
Voltage (V)	220		
Rated torque (N·m)	3.18		
Maximum torque (N·m)	11.13		
Rated frequency (Hz)	250		
Rated current (A)	6.5		Heatsink-based derating curve
Maximum current (A)	24		
Rated speed (rpm)	3000		
Maximum speed (rpm)	7000		
Torque coefficient (N·m/A)	0.53		
Rotor moment of inertia ($kg \cdot cm^2$)	Motor without brake	1.87 ± 10%	
	Motor with brake	1.97 ± 10%	

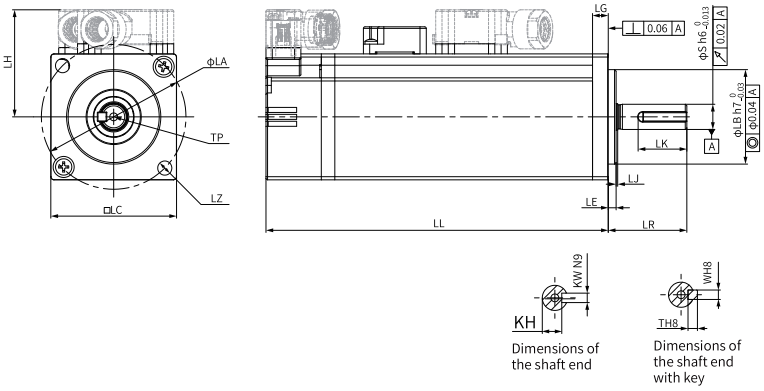
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Excitation current (A)	Apply time (ms)	Release time (ms)	Backlash (°)
3.2	24	10	57.6	0.42	≤ 60	≤ 40	≤ 1

Allowable load

LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	118.7 (153.2)	35 ± 0.5	90	4 × ϕ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	$250_{-0.62}$	$15.50_{-0.1}$	6	6	6	2.55 (2.9)

20 Options

20.1 Cables

20.1.1 Model Description

Power cable model

S6-L-M ① 0 ② 0 ③ 1 ④ - 3.0 ⑤ - T ⑥ - OR ⑦

① **Cable type** S6-L-B/M: Motion control power cable B: With brake M: Without brake	③ **Cable size (mm²)** 0: Frame sizes 25/40/60/80 1: Frame sizes 100/130/180 2: Frame size 180 (motors of 4.4 kW and above)	⑤ **Cable length** 3.0: 3 m 5.0: 5 m 10.0: 10 m
② **Connector type at drive end** 0: U-shaped cable lug 1: Pin-type cable lug	④ **Connector type at motor end** 0: 6-core plastic connector 1: 9-core aviation connector 2: 6-core aviation connector 7: MS1 custom connector (front outlet) 8: MS1 custom connector (rear outlet)	⑥ _: Fixed cable T: Flexible cable ≥ 10 million bending cycles S: Shielded TS: Shielded flexible cable ≥ 10 million bending cycles ⑦ OR: Oil-resistant

Description of encoder cable model

S6-L-P ① 1 ② 1 ③ 1 ④ - 3.0 ⑤ - T ⑥ -OR ⑦

① **Cable type** S6-L-P: Motion control encoder cable	③ **Encoder application mode** 1: Communication-type incremental encoder 2: Communication-type multi-turn absolute encoder	⑤ **Cable length** 3.0: 3 m 5.0: 5 m 10.0: 10 m
② **Connector type at drive end** 0: DB9 1: USB	④ **Connector type at motor end** 0: 9-core plastic connector 1: 9-core aviation connector 4: MS1 custom connector (front outlet) 5: MS1 custom connector (rear outlet)	⑥ _: Fixed cable T: Flexible cable ≥ 10 million bending cycles ⑦ OR: Oil-resistant

Note

Encoder cables are shielded by default.

Model of communication cables

S6-L-T ① 00 ② - 3.0 ③

① Cable type	② Cable connection type	③ Cable length
S6-L-T: Motion control communication cable	00: Servo drive to PC communication cable 01: Multi-drive communication cable (CAN & RS485) 02: Servo drive to PLC communication cable 03: Drive communication termination resistor cable (CAN & RS485) 04: Servo drive network communication cable (Cat 5e) 07: Servo drive network communication cable (Cat 6A) 08: Servo drive network communication cable (Cat 7A)	0.3: 0.3 m 3.0: 3 m 5.0: 5 m 10.0: 10 m

20.1.2 Cable types

Fixed cables

Do not bend or move fixed cables during use. Bending or moving fixed cables may damage the cables and lead to a series of cable-related faults such as poor contact. Secure fixed cables through fixed binding. Certain bending radius must be available for the cables to prevent stress.

Recommended bending radius ≥ 5D (D: Cable diameter)

Flexible cables

Drag chain cables are special cables that are highly flexible and wear resistant. They are used to follow drag chains to move back and forth. They are also known as motion-connect cables and trailing cables.

Recommended bending radius ≥ 10D (D: Cable diameter)

Note

- Do not wind or twist the cables in the cable carrier.
- Ensure the cable can move within the bending radius. Do not move the cables forcibly. Check that a relative movement between cables or between the cable and the guiding device is allowed.
- Do not fix or bundle the cables inside the cable carrier. The cables can be bundled and fixed only at two unmovable ends of the cable carrier.

Oil-resistant cables

Oil-resistant cables apply to applications such as machine tools, cutting fluids, and cutting compounds.

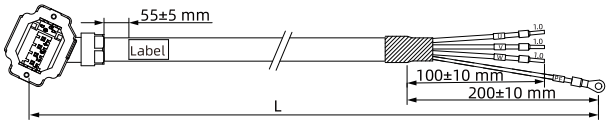
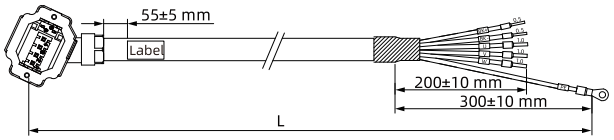
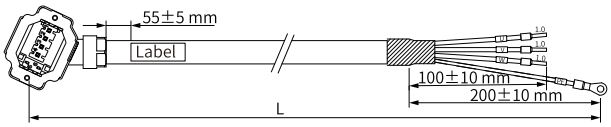
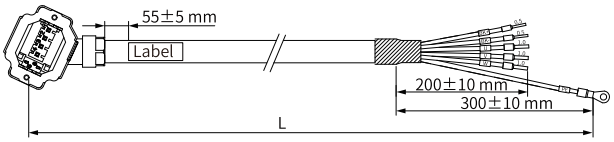
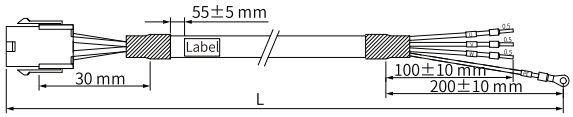
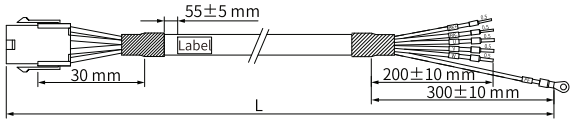
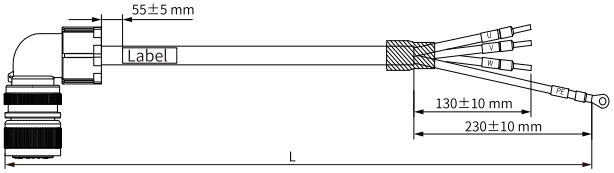
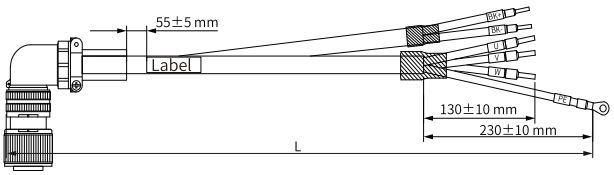
More information

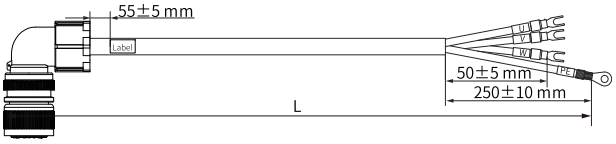
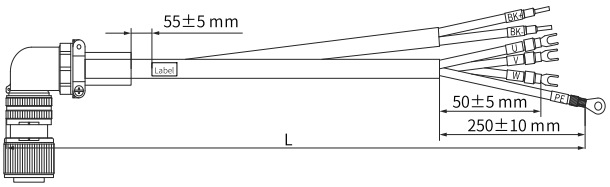
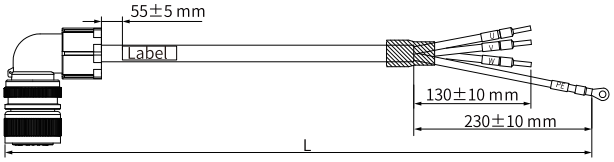
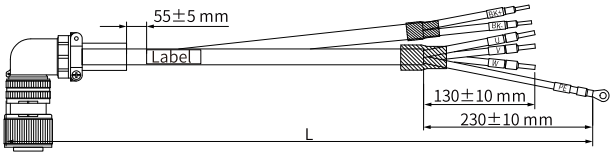
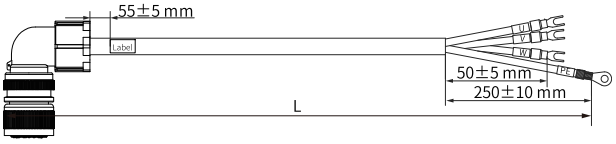
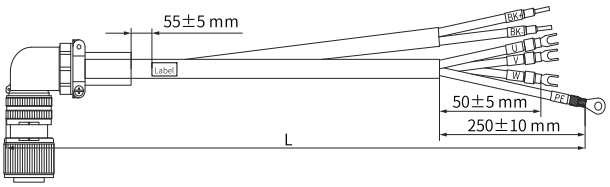
The terminal-type motor power cables and encoder cables require dedicated equipment and tooling for assembly. Order finished cables from channels authorized by Inovance.

For motor information, see the user guide of the servo drive.

20.1.3 List of Cables

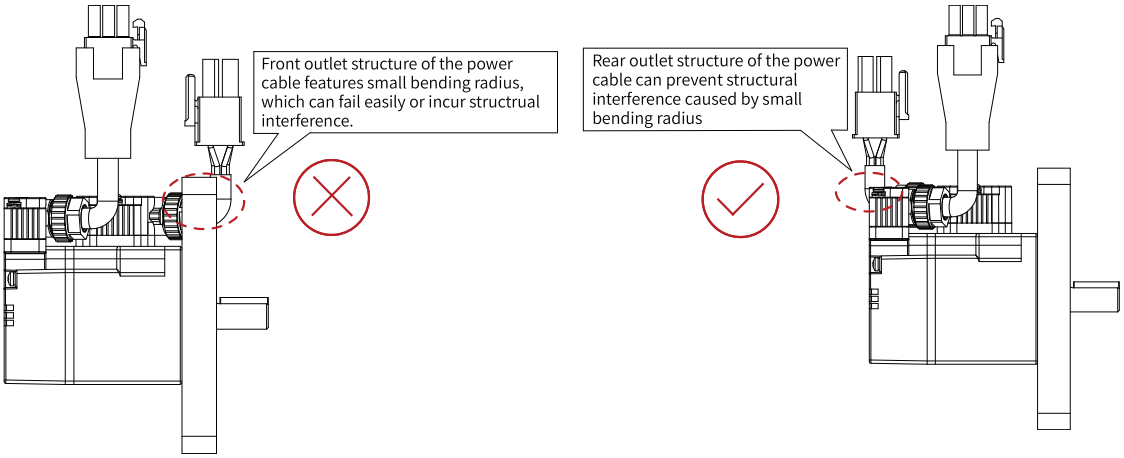
Power cables

Motor model	Cable		Cable model	Cable length (L) (mm)	Appearance
MS1H1/ MS1H4 terminal-type motor	Front outlet	Without brake	S6-L-M107-3.0	3100	
			S6-L-M107-5.0	5100	
			S6-L-M107-10.0	10100	
		Brake	S6-L-B107-3.0	3100	
			S6-L-B107-5.0	5100	
			S6-L-B107-10.0	10100	
	Rear outlet	Without brake	S6-L-M108-3.0	3100	
			S6-L-M108-5.0	5100	
			S6-L-M108-10.0	10100	
		Brake	S6-L-B108-3.0	3100	
			S6-L-B108-5.0	5100	
			S6-L-B108-10.0	10100	
MS1H1/ MS1H4 flying leads (-S) motor	Without brake		S6-L-M100-3.0	3100	
			S6-L-M100-5.0	5100	
			S6-L-M100-10.0	10100	
	Brake		S6-L-B100-3.0	3100	
			S6-L-B100-5.0	5100	
			S6-L-B100-10.0	10100	
MS1H2 motors rated 3 kW or below/ MS1H3 motors rated 1.8 kW or below	Without brake		S6-L-M111-3.0	3100	
			S6-L-M111-5.0	5100	
			S6-L-M111-10.0	10100	
	Brake		S6-L-B111-3.0	3100	
			S6-L-B111-5.0	5100	
			S6-L-B111-10.0	10100	

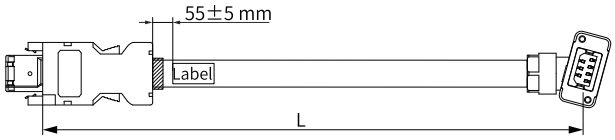
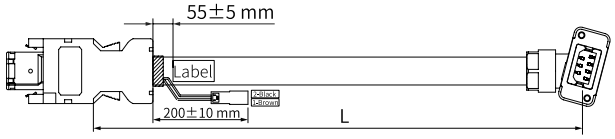
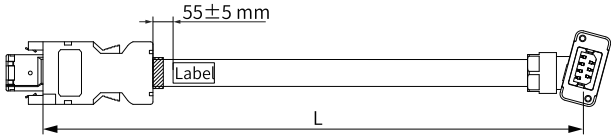
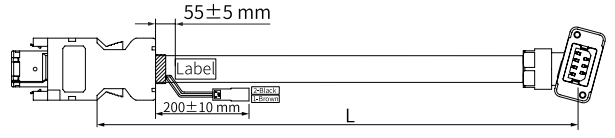
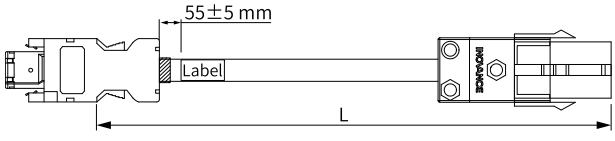
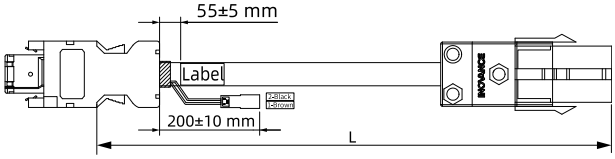
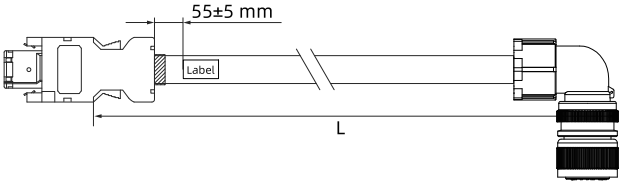
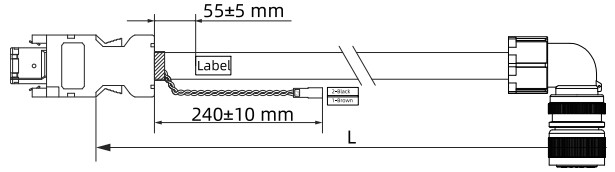
Motor model	Cable	Cable model	Cable length (L) (mm)	Appearance
MS1H2 motors rated 4 kW/5 kW	Without brake	S6-L-M011-3.0	3000	
		S6-L-M011-5.0	5000	
		S6-L-M011-10.0	10000	
	Brake	S6-L-B011-3.0	3000	
		S6-L-B011-5.0	5000	
		S6-L-B011-10.0	10000	
MS1H3 motors rated 2.9 kW	Without brake	S6-L-M112-3.0	3100	
		S6-L-M112-5.0	5100	
		S6-L-M112-10.0	10100	
	Brake	S6-L-B112-3.0	3100	
		S6-L-B112-5.0	5100	
		S6-L-B112-10.0	10100	
MS1H3 motors rated 4.4 kW and above	Without brake	S6-L-M022-3.0	3000	
		S6-L-M022-5.0	5000	
		S6-L-M022-10.0	10000	
	Brake	S6-L-B022-3.0	3000	
		S6-L-B022-5.0	5000	
		S6-L-B022-10.0	10000	

Note

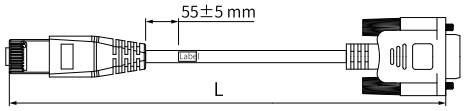
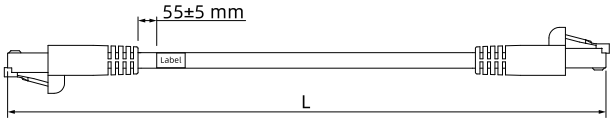
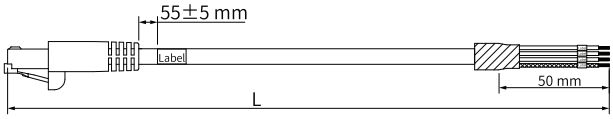
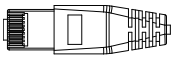
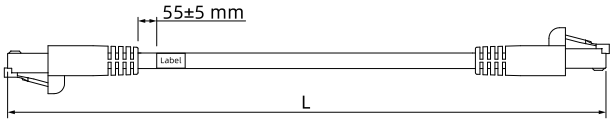
- For 50 W terminal-type models, use rear outlet for power cables.
- For 100 W models, if the mounting flange face is internally stepped type, only terminal-type models can be used, which are equipped with power cables with rear outlet.


Front outlet structure of the power cable features small bending radius, which can fail easily or incur structrual interference.
Rear outlet structure of the power cable can prevent structural interference caused by small bending radius

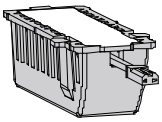
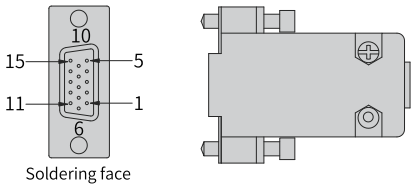
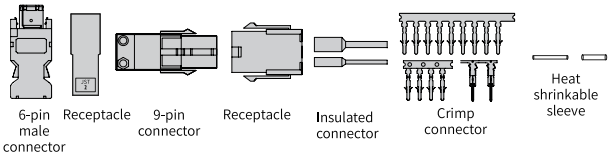
Encoder cables

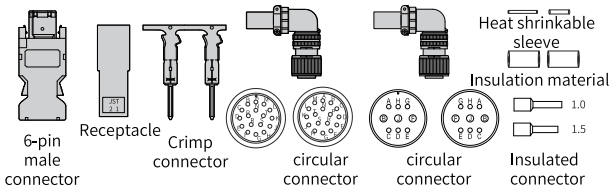
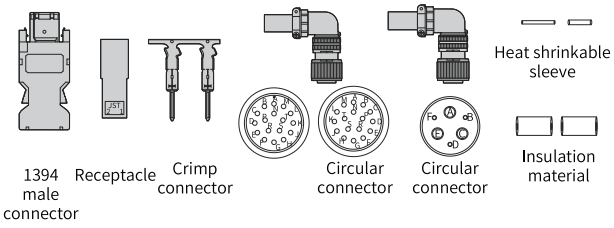
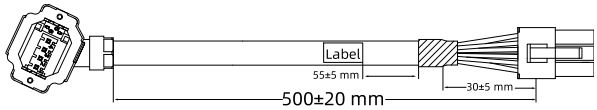
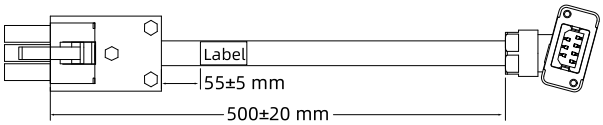
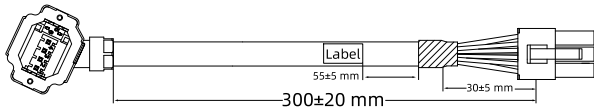
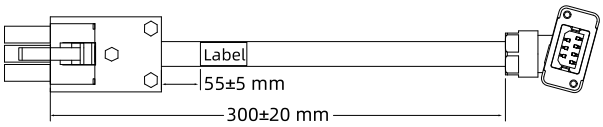
Motor model	Cable		Cable model	Cable length (L) (mm)	Appearance
MS1H1/ MS1H4 terminal-type motor	Front outlet	Single-turn absolute encoder cable	S6-L-P114-3.0	3000	
			S6-L-P114-5.0	5000	
			S6-L-P114-10.0	10000	
		Multi-turn absolute	S6-L-P124-3.0	3000	
			S6-L-P124-5.0	5000	
			S6-L-P124-10.0	10000	
	Rear outlet	Single-turn absolute encoder cable	S6-L-P115-3.0	3000	
			S6-L-P115-5.0	5000	
			S6-L-P115-10.0	10000	
		Multi-turn absolute	S6-L-P125-3.0	3000	
			S6-L-P125-5.0	5000	
			S6-L-P125-10.0	10000	
MS1H1/MS1H4 flying leads (-S) motor		Single-turn absolute encoder cable	S6-L-P110-3.0	3000	
			S6-L-P110-5.0	5000	
			S6-L-P110-10.0	10000	
		Multi-turn absolute	S6-L-P120-3.0	3000	
			S6-L-P120-5.0	5000	
			S6-L-P120-10.0	10000	
MS1H2/MS1H3 motors		Single-turn absolute encoder cable	S6-L-P111-3.0	3000	
			S6-L-P111-5.0	5000	
			S6-L-P111-10.0	10000	
		Multi-turn absolute	S6-L-P121-3.0	3000	
			S6-L-P121-5.0	5000	
			S6-L-P121-10.0	10000	

Communication cables

Cable	Cable model	Cable length (L) (mm)	Appearance
Drive-to-PC communication cable	S6-L-T00-3.0	3000	
Multi-drive communication cable (CAN & RS485)	S6-L-T01-0.3	300	
Servo drive-to-PLC communication cable	S6-L-T02-2.0	2000	
Drive communication termination resistor cable (CAN & RS485)	S6-L-T03-0.0	-	
Servo drive network communication cable (Cat 5e)	S6-L-T04-0.3	300	
Servo drive network communication cable (Cat 6A)	S6-L-T07-0.3	300	
Servo drive network communication cable (Cat 7A)	S6-L-T08-0.3	300	

20.1.4 Connector Kit

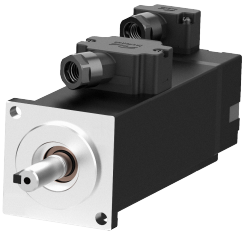
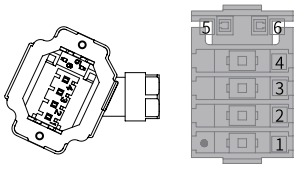
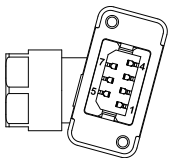
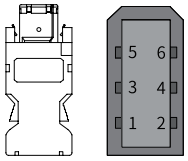
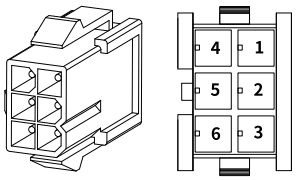
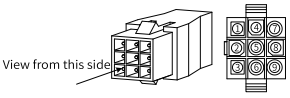
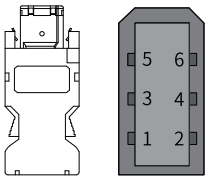
Name	Model	Drawing
Battery kit	S6-C4A	
CN1 terminal (DB15)	S6-C6	
MS1H1/MS1H4 flying leads motor connector	S6-C26	

Name	Model	Drawing
MS1H2/MS1H3 (1.8 kW and below) motor connector	S6-C29	
MS1H3 motor (2.9 kW and above) connector	S6-C39	
Flying leads at motor side with power below 750 W - 500 mm	S6-C23	 Power cable  Encoder cable
Flying leads at motor side with power below 750 W - 300 mm	S6-C24	 Power cable  Encoder cable

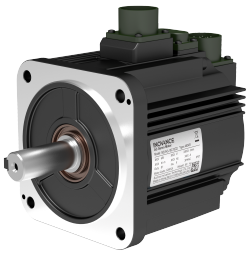
Note

The battery-less encoder does not need the battery kit. Connecting the battery-less encoder to the battery box can damage the encoder.

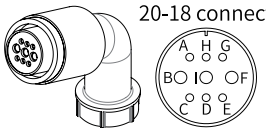
20.1.5 Description of Cable Terminals

<table>
<tr><td>Name</td><td>Motor diagram</td><td colspan="3">Power cable 6-pin connector</td><td colspan="3">7-pin connector of the encoder on the motor side</td><td colspan="3">6-pin male on the drive side</td></tr>
<tr><td rowspan="10">Assignment of terminals on the terminal-type motor side (frame sizes 40/60/80)</td><td rowspan="10"></td><td colspan="3"></td><td colspan="3"></td><td colspan="3"></td></tr>
<tr><td>Pin No.</td><td>Signal name</td><td>Color</td><td>Pin No.</td><td>Signal name</td><td>Color</td><td>Pin No.</td><td>Signal name</td><td>Color</td></tr>
<tr><td>1</td><td>PE</td><td>Yellow/ Green</td><td>1</td><td>PS+</td><td>Blue</td><td>1</td><td>+5V</td><td>Red</td></tr>
<tr><td>2</td><td>W</td><td>Red</td><td>2</td><td>PS-</td><td>Purple</td><td>2</td><td>GND</td><td>Orange</td></tr>
<tr><td>3</td><td>V</td><td>Black</td><td>3</td><td>DC+</td><td>Brown</td><td>5</td><td>PS+</td><td>Blue</td></tr>
<tr><td>4</td><td>U</td><td>White</td><td>4</td><td>DC-</td><td>Black</td><td>6</td><td>PS-</td><td>Purple</td></tr>
<tr><td>5</td><td rowspan="2">Brake (polarity insensitive)</td><td>Brown</td><td>5</td><td>+5V</td><td>Red</td><td rowspan="2">Enclosure</td><td rowspan="2">PE</td><td rowspan="2">-</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Blue</td><td>6</td><td>GND</td><td>Orange</td></tr>
<tr><td>7</td><td>PE</td><td>-</td></tr>
<tr><td rowspan="10">Assignment of terminals on the flying leads motor side (frame sizes 40/60/80)</td><td rowspan="10"></td><td colspan="3">Power cable 6-pin connector</td><td colspan="3">9-pin connector of the encoder on the motor side</td><td colspan="3">6-pin male on the drive side</td></tr>
<tr><td colspan="3">
Recommendation: Plastic housing: MOLEX-50361736; Terminal: MOLEX-39000061</td><td colspan="3">
Plastic housing: AMP 172161-1; Terminal: AMP 770835-1</td><td colspan="3"></td></tr>
<tr><td>Pin No.</td><td>Signal name</td><td>Color</td><td>Pin No.</td><td>Signal name</td><td>Color</td><td>Pin No.</td><td>Signal name</td><td>Color</td></tr>
<tr><td>1</td><td>U</td><td>White</td><td>1</td><td>Battery +</td><td>Brown</td><td>1</td><td>+5V</td><td>Red</td></tr>
<tr><td>2</td><td>V</td><td>Black</td><td>4</td><td>Battery -</td><td>Black</td><td>2</td><td>GND</td><td>Orange</td></tr>
<tr><td>4</td><td>W</td><td>Red</td><td>3</td><td>PS+</td><td>Blue</td><td>5</td><td>PS+</td><td>Blue</td></tr>
<tr><td>5</td><td>PE</td><td>Yellow/ Green</td><td>6</td><td>PS-</td><td>Purple</td><td>6</td><td>PS-</td><td>Purple</td></tr>
<tr><td>3</td><td rowspan="2">Brake (polarity insensitive)</td><td>Brown</td><td>9</td><td>+5V</td><td>Red</td><td rowspan="3">Enclosure</td><td rowspan="3">PE</td><td rowspan="3">-</td></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Blue</td><td>8</td><td>GND</td><td>Orange</td></tr>
<tr><td>7</td><td>Shield</td><td>-</td></tr>
</table>

Assignment of terminals on the motor side (frame sizes 100/130)



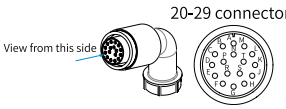
Power cable connector



MIL-DTL-5015 series 3108E20-18S aviation connector

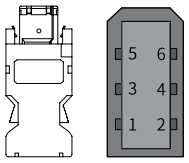
Pin No.	Signal name	Color
B	U	Blue
I	V	Black
F	W	Red
G	PE	Yellow/ Green
C	Brake	Red
E	(polarity insensitive)	Black

Encoder cable connector



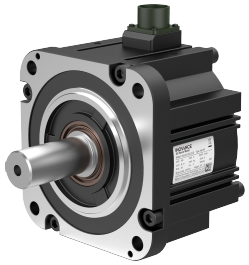
Pin No.	Signal name	Color
A	PS+	Blue
B	PS-	Purple
E	Battery +	Brown
F	Battery -	Black
G	+5V	Red
H	GND	Orange
J	Shield	-

6-pin male on the drive side

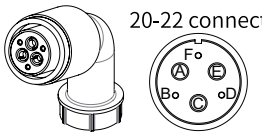


Pin No.	Signal name	Color
1	+5V	Red
2	GND	Orange
5	PS+	Blue
6	PS-	Purple
Enclosure	PE	-

Assignment of terminals on the motor side (frame size 180)



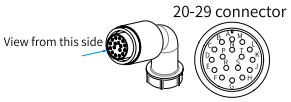
Power cable connector



MIL-DTL-5015 series 3108E20-22S aviation connector

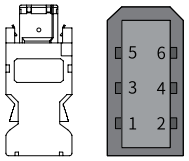
Pin No.	Signal name	Color
A	U	Blue
C	V	Black
E	W	Red
F	PE	Yellow/ Green
B	Brake	Red
D	(polarity insensitive)	Black

Encoder cable connector



Pin No.	Signal name	Color
A	PS+	Blue
B	PS-	Purple
E	Battery +	Brown
F	Battery -	Black
G	+5V	Red
H	GND	Orange
J	Shield	-

6-pin male on the drive side



Pin No.	Signal name	Color
1	+5V	Red
2	GND	Orange
5	PS+	Blue
6	PS-	Purple
Enclosure	PE	-

20.1.6 Cable Materials

20.1.6.1 Power cable material

Table 20–1 Specifications of motor output cables

MS1H1/H4 05B to 10C (0.05 kW to 1 kW)			
Cable type	Regular cable	Drag chain cable	Oil-resistant shielded drag chain cable
Cable model	S6-L-M/B***-X.X	S6-L-M/B***-X.X-T	S6-L-M/B***-X.X-TS
Cable specifications	UL2517 (rated temperature: 105°C) 4Ex20 AWG+2Cx24 AWG	UL2517 (rated temperature: 105°C) 4Ex20 AWG+2Cx24 AWG	UL2517 (rated temperature: 105°C) 4Ex20 AWG+2Cx24 AWG
	Power cable: 20 AWG (0.52 mm^2) Insulation outer diameter: ϕ1.7 mm	Power cable: 20 AWG (0.52 mm^2) Insulation outer diameter: ϕ1.7 mm	Power cable: 20 AWG (0.52 mm^2) Insulation outer diameter: ϕ1.7 mm
	Brake cable: 24 AWG (0.205 mm^2) Outer diameter of insulation: ϕ 1.1 mm	Brake cable: 24 AWG (0.205 mm^2) Outer diameter of insulation: ϕ 1.1 mm	Brake cable: 24 AWG (0.205 mm^2) Outer diameter of insulation: ϕ 1.1 mm
Sheath outer diameter	ϕ6.5±0.2 mm		
Internal structure and conductor colors			
• Fill in "X.X" in the model number with the designated cable length. • Sheath outer diameter: Refers to the overall diameter of the cable, including the conductor and insulation layer.			

Table 20–2 Specifications of motor output cables

MS1H2 10C to 50C (1 kW to 5 kW)/MS1H3 85B to 18C (0.85 kW to 1.8 kW)			
Cable type	Regular cable	Drag chain cable	Oil-resistant shielded drag chain cable
Cable model	S6-L-M/B***-X.X	S6-L-M/B***-X.X-T	S6-L-M/B***-X.X-TS
Cable specifications	UL2586 (rated temperature: 105°C) 4Ex16 AWG, 2Cx18 AWG	UL2586 (rated temperature: 105°C) 4Ex16 AWG, 2Cx18 AWG	UL2586 (rated temperature: 105°C) 4Ex16 AWG, 2Cx18 AWG
	Power cable: 16 AWG (1.31 mm^2) Outer diameter of insulation: ϕ 3.1 mm	Power cable: 16 AWG (1.31 mm^2) Outer diameter of insulation: ϕ 3.25 mm	Power cable: 16 AWG (1.31 mm^2) Outer diameter of insulation: ϕ 3.25 mm
	Brake cable: 18 AWG (0.823 mm^2) Outer diameter of insulation: ϕ 2.0 mm	Brake cable: 18 AWG (0.823 mm^2) Outer diameter of insulation: ϕ 2.15 mm	Brake cable: 18 AWG (0.823 mm^2) Outer diameter of insulation: ϕ 2.15 mm
Sheath outer diameter	ϕ9.5±0.3 mm (main circuit)	ϕ10.0±0.3 mm (main circuit)	ϕ10.5±0.3 mm (main circuit)

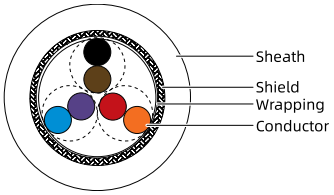
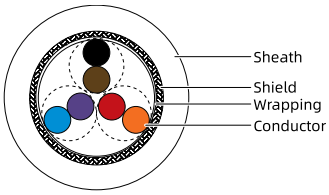
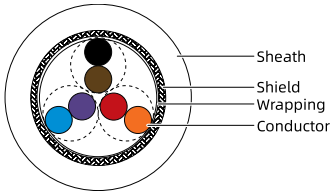
MS1H2 10C to 50C (1 kW to 5 kW)/MS1H3 85B to 18C (0.85 kW to 1.8 kW)			
Internal structure and conductor colors			
• Fill in "X.X" in the model number with the designated cable length. • Sheath outer diameter: Refers to the overall diameter of the cable, including the conductor and insulation layer.			

Table 20–3 Specifications of motor output cables

MS1H3 29C to 75C (2.9 kW to 7.5 kW)			
Cable type	Regular cable	Drag chain cable	Oil-resistant shielded drag chain cable
Cable model	S6-L-M/B***-X.X	S6-L-M/B***-X.X-T	S6-L-M/B***-X.X-TS
Cable specifications	UL2586 (rated temperature: 105°C) 4Ex12 AWG, 2Cx18 AWG	UL2586 (rated temperature: 105°C) 4Ex12 AWG, 2Cx18 AWG	UL2586 (rated temperature: 105°C) 4Ex12 AWG, 2Cx18 AWG
	Power cable: 12 AWG (3.31 mm^2) Outer diameter of insulation: ϕ 4.1 mm	Power cable: 12 AWG (3.31 mm^2) Outer diameter of insulation: ϕ 4.2 mm	Power cable: 12 AWG (3.31 mm^2) Outer diameter of insulation: ϕ 4.2 mm
	Brake cable: 18 AWG (0.823 mm^2) Outer diameter of insulation: ϕ 2.0 mm	Brake cable: 18 AWG (0.823 mm^2) Outer diameter of insulation: ϕ 2.15 mm	Brake cable: 18 AWG (0.823 mm^2) Outer diameter of insulation: ϕ 2.15 mm
Sheath outer diameter	ϕ12.2±0.4 mm (main circuit)	ϕ12.5±0.4 mm (main circuit)	ϕ13.2±0.4 mm (main circuit)
Internal structure and conductor colors			
• Fill in "X.X" in the model number with the designated cable length. • Sheath outer diameter: Refers to the overall diameter of the cable, including the conductor and insulation layer.			

20.1.6.2 Encoder cable material

Cable type	Regular cable	Drag chain cable	Oil-resistant shielded drag chain cable
Cable model	S6-L-P***-X.X	S6-L-P***-X.X-T	S6-L-P***-X.X-TS
Cable specifications	UL2517 (Rated temperature: 105°C) 3P × 26 AWG	UL2517 (Rated temperature: 105°C) 3P × 26 AWG	UL2517 (Rated temperature: 105°C) 3P × 26 AWG
	Signal cable: 26 AWG (0.12 mm^2); OD of insulation: ϕ0.5 mm	Signal cable: 26 AWG (0.12 mm^2); OD of insulation: ϕ0.5 mm	Signal cable: 26 AWG (0.12 mm^2); OD of insulation: ϕ0.5 mm

Sheath outer diameter	5.8±0.2 mm		6.0±0.2 mm
Internal structure and conductor colors			
Fill in "X.X" in the model number with the designated cable length.			

20.2 Peripheral Component Design

20.2.1 List of peripheral electrical components

Component type	Component	Installation position	Applicable model	Function description
Peripheral electrical components	Fuse and circuit breaker	Input side of the drive	All models	A fuse/circuit breaker must be connected on the input side to prevent accidents caused by internal short circuits.
	Electromagnetic contactor	Input side of the drive		-
	AC input reactor	Input side of the drive		Eliminates harmonics and improves the power factor on the input side.
	EMC filter	Input side of the drive		Reduces the conduction and radiation interference generated by the AC drive to external devices.
	Magnetic ring and magnetic buckle	Output side of the drive		Reduces interference to the outside and the bearing current.
		Signal cable		Improves the anti-interference performance of signals.
	Surge protection device	Input side of the drive		Protects the drive from damage caused by lightning surge and external high-current interference.

20.2.2 Circuit Breaker (CE)

Table 20–4 Recommended circuit breaker models

Size	Servo drive		Recommended circuit breaker
	Model	Continuous input current of main circuit (A)	Current (A)
Single-phase 220 V			
A	SV660FS1R6I	2.3	4
	SV660FS2R8I	4	6
B	SV660FS5R5I	7.9	16
C	SV660FS7R6I	9.6	16
D	SV660FS012I	12.8	20
Three-phase 220 V			

Size	Servo drive		Recommended circuit breaker
	Model	Continuous input current of main circuit (A)	Current (A)
C	SV660FS7R6I	5.1	10
D	SV660FS012I	8	16
Three-phase 380 V			
C	SV660FT3R5I	2.4	4
	SV660FT5R4I	3.6	6
D	SV660FT8R4I	5.6	10
	SV660FT012I	8	16
E	SV660FT017I	12	16
	SV660FT021I	16	25
	SV660FT026I	21	32

The recommended values in the preceding table are based on the following conditions. If the conditions vary from the prerequisites described in the table, select a model according to the actual conditions.

- The ambient temperature of the device is 35°C without forced air cooling.
- The altitude is 2000 m.
- Only a single drive is installed.
- The current-carrying density of the conductor is 1.3 A/mm².

When you select a circuit breaker, take into account parameter "Max. input surge current (A)" in section "Electrical Specifications" in the User Guide. Make sure that the trip characteristics curve of the circuit breaker can support the surge current working conditions.

20.2.3 Fuse (CE)

To prevent accidents caused by short circuit, install a fuse on the input side of the drive.

Table 20–5 Recommended fuse

Size	Servo drive		Recommended fuse
	Model	Continuous input current of main circuit (A)	Rated current (A)
Single-phase 220 V			
A	SV660FS1R6I	2.3	5
	SV660FS2R8I	4	12
B	SV660FS5R5I	7.9	12
C	SV660FS7R6I	9.6	15
D	SV660FS012I	12.8	20
Three-phase 220 V			
C	SV660FS7R6I	5.1	12
D	SV660FS012I	8	15
Three-phase 380 V			
C	SV660FT3R5I	2.4	5
	SV660FT5R4I	3.6	10
D	SV660FT8R4I	5.6	15
	SV660FT012I	8	15

Size	Servo drive		Recommended fuse
	Model	Continuous input current of main circuit (A)	Rated current (A)
E	SV660FT017I	12	20
	SV660FT021I	16	25
	SV660FT026I	21	30

The recommended values in the preceding table are based on the following conditions. If the conditions vary from the prerequisites described in the table, select a model according to the actual conditions.

- The ambient temperature of the device is 35°C without forced air cooling.
- The altitude is 2000 m.
- Only a single drive is installed.
- The current-carrying density of the conductor is 1.3 A/mm².

When you select a fuse, take into account the maximum input surge current parameter in the "Electrical Specifications" section of the User Guide to ensure that the fuse pre-arcing (I^2t) can withstand surge current conditions multiple times over its expected service life.

20.2.4 Electromagnetic Contactor

Table 20–6 Recommended electromagnetic contactor model

Size	Drive model	Rated input current (A)	Recommended contactor		
			Manufacturer	Current (A)	Model
Single-phase 220 V					
A	SV660FS1R6I	2.3	Schneider	9	LC1 D09
	SV660FS2R8I	4		9	LC1 D09
B	SV660FS5R5I	7.9		9	LC1 D09
C	SV660FS7R6I	9.6		12	LC1 D12
D	SV660FS012I	12.8		18	LC1 D18
Three-phase 220 V					
C	SV660FS7R6I	5.1	Schneider	9	LC1 D09
D	SV660FS012I	8		9	LC1 D09
Three-phase 380 V					
C	SV660FT3R5I	2.4	Schneider	9	LC1 D09
	SV660FT5R4I	3.6		9	LC1 D09
D	SV660FT8R4I	5.6		9	LC1 D09
	SV660FT012I	8		9	LC1 D09
E	SV660FT017I	12		12	LC1 D12
	SV660FT021I	16		18	LC1 D18
	SV660FT026I	21		25	LC1 D25

20.2.5 AC Input Reactor

Model selection

An AC input reactor is optional and mainly used to reduce harmonic waves in the input current. In applications where strong suppression of harmonics is required, install an external reactor.

Table 20–7 AC input reactor models

Size	Drive model	Rated input current (A)	Applicable reactor (recommended)	Inductance (mH)
Three-phase 220 V				
C	SV660FS7R6I	5.1	MD-ACL-10-5-4T	5
D	SV660FS012I	8	MD-ACL-10-5-4T	5
Three-phase 380 V				
C	SV660FT3R5I	2.4	MD-ACL-10-5-4T	5
	SV660FT5R4I	3.6	MD-ACL-10-5-4T	5
D	SV660FT8R4I	5.6	MD-ACL-10-5-4T	5
	SV660FT012I	8	MD-ACL-10-5-4T	5
E	SV660FT017I	12	MD-ACL-15-3-4T	3
	SV660FT021I	16	MD-ACL-40-1.45-4T	1.45
	SV660FT026I	21	MD-ACL-40-1.45-4T	1.45

Dimensions

- Inovance input reactors

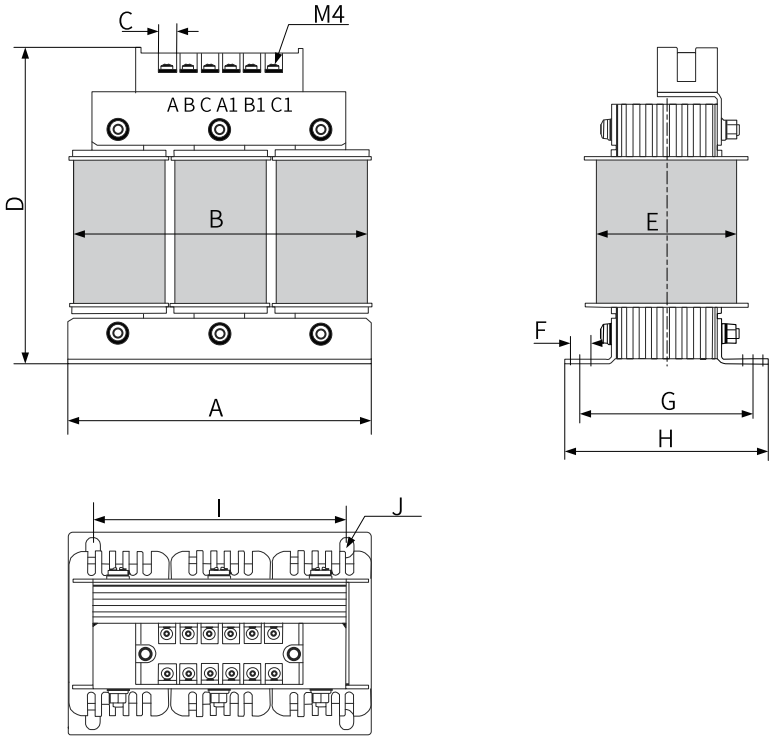


Figure 20-1 Dimensions of AC input reactors (10 A to 15 A)

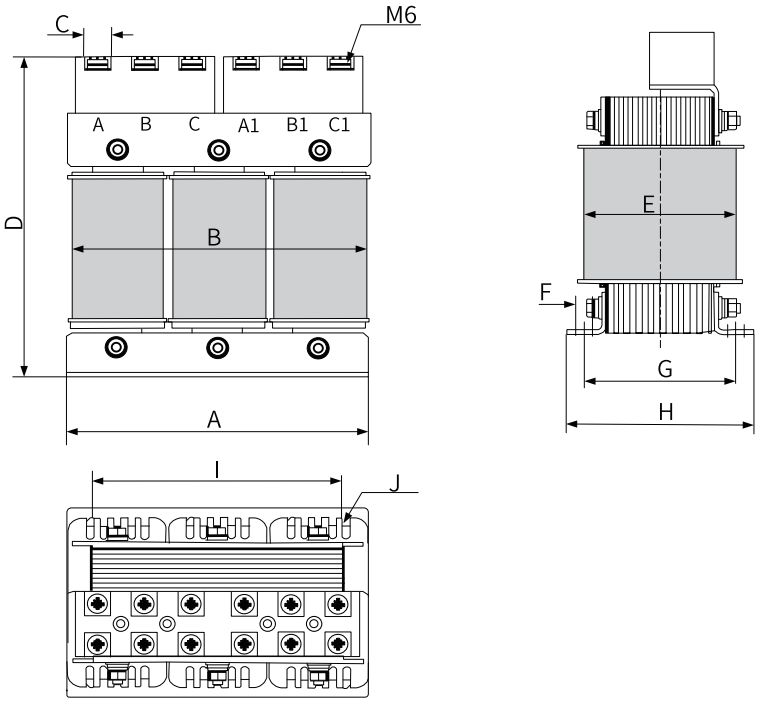


Figure 20-2 Dimensions of 40 A (1.45 mH) AC input reactors

Table 20–8 Dimensions of Inovance AC input reactors (unit: mm)

Model	A	B	C	D	E	F	G	H	I	J
MD-ACL-10-5-4T	150±2	155	8	160	80	10	85±2	100±2	125±1	Φ7 × 10
MD-ACL-15-3-4T	150±2	155	8	160	80	10	85±2	100±2	125±1	Φ7 × 10
MD-ACL-40-1.45-4T	180±2	185	16	200	105	10	95±2	117±2	150±1	Φ7 × 10

20.2.6 EMC Filter

Model selection

To comply with the radiated and conducted emission requirements of EN 61800-3, install an external EMC filter. The recommended EMC filters for this drive are Schaffner FN2090 and FN3287 filters. Filters of equivalent specifications and performance from other brands are also acceptable. The specifications of Schaffner FN2090 and FN3287 filters are as follows.

Table 20–9 Standard EMC filter model and appearance

Filter model (recommended)		Appearance
Schaffner	FN2090	
	FN3287	

Table 20–10 Filter model selection (Schaffner)

Size	Drive model	Rated input current (A)	Applicable Filter
Single-phase 220 V			
A	SV660FS1R6I	2.3	FN2090-10-06
	SV660FS2R8I	4	FN2090-10-06
B	SV660FS5R5I	7.9	FN2090-10-06
C	SV660FS7R6I	9.6	FN2090-10-06
D	SV660FS012I	12.8	FN2090-16-06
Three-phase 220 V			
C	SV660FS7R6I	5.1	FN3287-10-44-C28-R65
D	SV660FS012I	8	FN3287-10-44-C28-R65
Three-phase 380 V			
C	SV660FT3R5I	2.4	FN3287-10-44-C28-R65
	SV660FT5R4I	3.6	FN3287-10-44-C28-R65
D	SV660FT8R4I	5.6	FN3287-10-44-C28-R65
	SV660FT012I	8	FN3287-10-44-C28-R65
E	SV660FT017I	12	FN3287-16-44-C33-R65
	SV660FT021I	16	FN3287-16-44-C33-R65
	SV660FT026I	21	FN3287-25-33-C33-R65

Dimensions

- Dimensions of Schaffner FN 2090 series filters

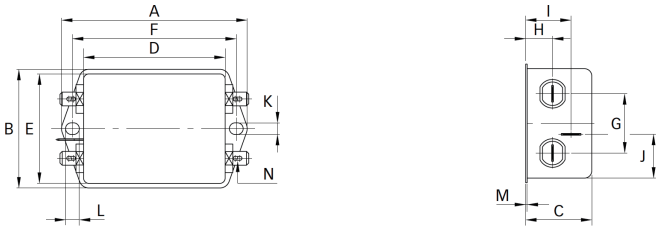


Figure 20-3 Dimensions of FN 2090 series filters (unit: mm)

Table 20–11 Dimensions of FN 2090 series filters (unit: mm)

Rated Current (A)	A	B	C	D	E	F	G	H	I	J	K	L	M	N
3	85	54	30.3	64.8	49.8	75	27	12.3	20.8	19.9	5.3	6.3	0.7	6.3 × 0.8
4														
6														
8	113.5±1	57.5± 1	45.4± 1	94± 1	56	103	25	12.4	32.4	15.5	4.4	6	1	6.3 × 0.8

- Dimensions of Schaffner FN 3287 series filters

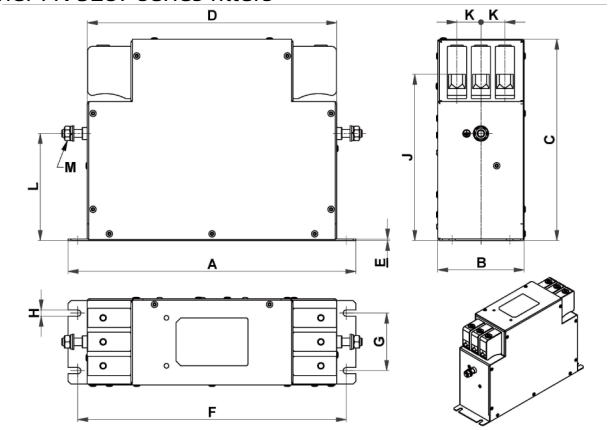


Figure 20-4 Dimension drawing of FN 3287 series filters (unit: mm)

Table 20–12 Dimensions of FN3287 filters (in mm)

Rated Current (A)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	J±2 (mm)	K (mm)	L±1 (mm)	M
10	180	40	112	153	0.8	170	20	4.5	94	11	68	M5
16	200	45	112	170	0.8	185	25	5.4	102	11	76	M5
25	205	45	132	173	0.8	190	25	5.4	113	13	83	M5

20.2.7 Surge Protective Device

Model selection

Table 20–13 Recommended surge protective device

Recommended surge protective device		
Manufacturer	Phase system	Model
Chengdu Pedaro	Single phase	RPM-40/1 N
Chengdu Pedaro	Three phase	RPM-40/3P

Dimensions

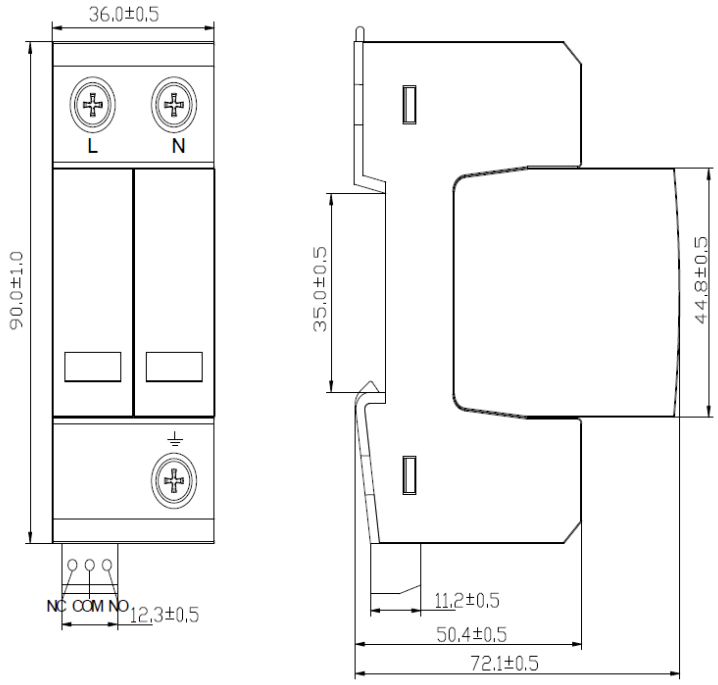


Figure 20-5 Dimensions of single-phase surge protective device (unit: mm)

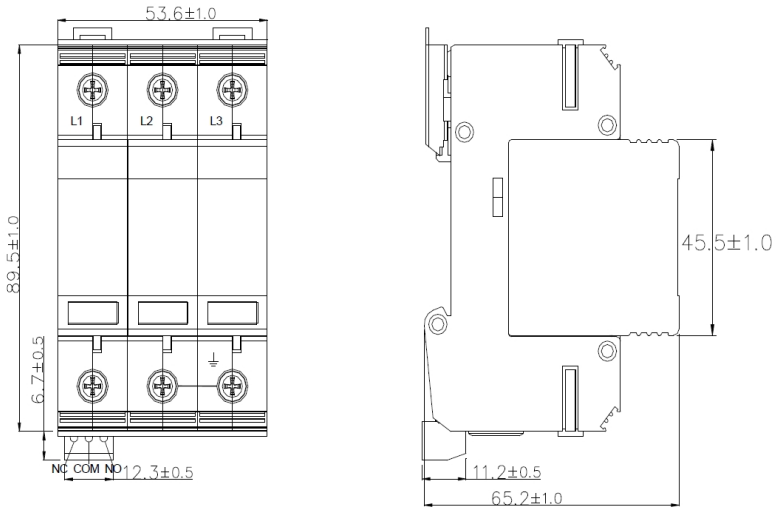


Figure 20-6 Dimensions of the three-phase surge protective device (unit: mm)

20.2.8 Magnetic Ring and Magnetic Buckle

The magnetic ring can be installed on the input or output side of the drive. Install the magnetic ring as close to the drive as possible. Installing the magnetic ring on the input side can suppress the noise in the input power supply system of the drive. A magnetic ring on the output side is mainly used to reduce the external interference of the drive and reduce the bearing current.

In applications with leakage current and signal cable interference, install a magnetic ring or a ferrite clamp.

Model selection

- Amorphous magnetic ring: featuring high permeability when the frequency is within 1 MHz and excellent anti-interference performance, but not as low-cost as the ferrite clamp. See *" Dimensions" on page 795* for details.
- Ferrite clamp: featuring a good interference suppression performance within a frequency band above 1MHz, applicable to low-power servo drives and signal cables, low-cost and easy to install.

Magnetic ring and magnetic buckle (recommended)		Manufacturer	Appearance
Magnetic ring	DY644020H	DAYOU-TECH	
	DY805020H	DAYOU-TECH	
Magnetic buckle	DYR-130-B	Dongyang	

Dimensions

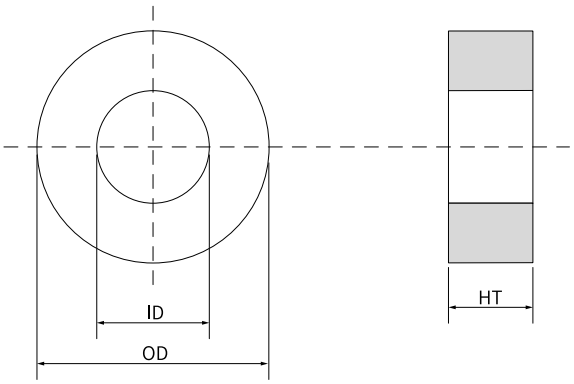


Figure 20-7 Dimensions of the magnetic ring

Table 20–14 Dimensions of the magnetic ring

Model	Dimension (OD × ID × HT) (mm)
DY644020H	64 × 40 × 20
DY805020H	80 × 50 × 20

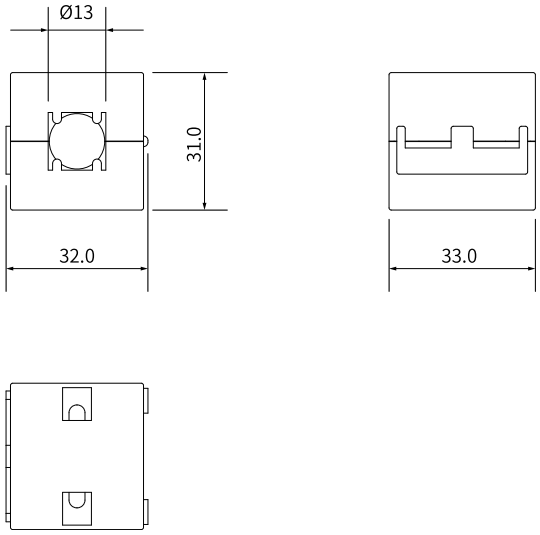


Figure 20-8 Dimensions of the magnetic buckle

Table 20–15 Dimensions of the magnetic buckle

Model	Dimension (width × outer diameter × inner diameter) (mm)
DYR-130-B	32 × 31 × 13

20.2.9 Residual Current Device

Selection method

During the operation of the drive, high-frequency leakage current generated by IGBT operation may affect operation of the residual current device.

See the following formula to select the residual current device.

- Rated sensitivity current (Ig) ≥ Im + Ic + Is + Iy
- Servo motor leakage current (Im)
- Power cable leakage current (Ic)
- Power frequency leakage current of the drive (Is + Iy)

Condition of the servo drive

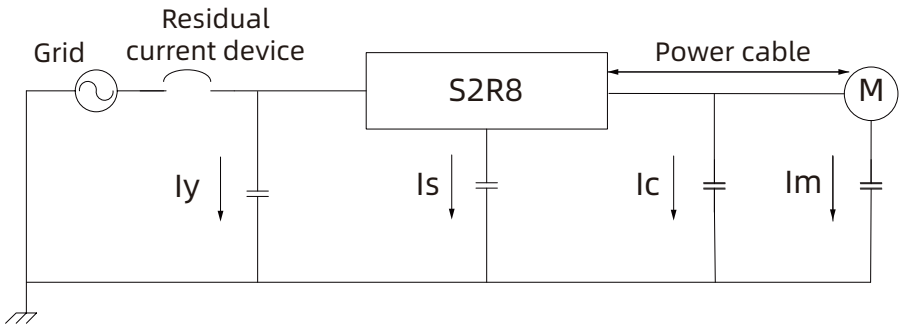


Figure 20-9 Leakage current of the drive

Example of leakage current per unit length for power cables with different cross-sectional areas

Cross-sectional area (AWG)	Leakage current per unit length (mA/m)
20	0.1
14	0.1
12	0.1

Note

Leakage current Ic (mA) for a power cable = Cable length (m) x Leakage current per unit length (mA/m)

Example of servo motor leakage current

Applicable motor model	Motor leakage current (mA)
MS1H4-40B30CB-A33*R	0.5

Motor leakage current estimation formula: Im = 1.235 × Motor power (kW)

Note

The asterisk (*) in the model number may be 1 or 4, indicating a motor with or without a brake.

Example of servo drive power frequency leakage current

Drive model	Leakage current (mA)
SV660FS1R6I SV660FS2R8I	0.35
SV660FS5R5I SV660FS7R6I SV660FS012I	0.52
SV660FT3R5I SV660FT5R4I SV660FT8R4I SV660FT012I SV660FT017I	0.48

Drive model	Leakage current (mA)
SV660FT021I SV660FT026I	0.64

Selection example

The following takes SV660FS2R8I servo drive and MS1H4-40B30CB-A331R motor with 3-m 12AWG power cables as an example.

Where:

Im = 0.5 (mA). See detailed specifications of motor leakage current in the preceding table *" Example of servo motor leakage current" on page 797*.

Ic = 0.1 × 3 = 0.3 (mA). See detailed specifications of power cable leakage current in the preceding table *" Example of leakage current per unit length for power cables with different cross-sectional areas" on page 797*.

Is + Iy = 0.35 (mA). See detailed specifications of drive power frequency leakage current in the preceding table *" Example of servo drive power frequency leakage current" on page 797*.

Therefore, the following formula applies:

Ig ≥ Im + Ic + Is + Iy

Ig ≥ 0.5 + 0.3 + 0.35

Ig ≥ 1.15 (mA)

Based on the calculation result, the rated sensitivity current (Ig) is 1.15 mA.

When only one drive is used, select a residual current device with a rated sensitivity current greater than 2 × 1.15 mA. When three servo drives are connected in parallel, select a residual current device with a rated sensitivity current greater than 2 × (3 × 1.15) mA.

Note

- In the case of n drives connected in parallel, the rated sensitivity current of the selected residual current device is: Ig = Ig1 + Ig2 + Ig3 + ... + Ign.
- The leakage current must be lower than 50% of the rated residual non-operating current of the residual current device. Therefore, during actual selection, ensure that the rated residual non-operating current of the selected residual current device > 2 × Ig.
- It is recommended to use residual current devices (RCDs) made by CHINT and Schneider.
- When a residual current device trips or leakage current occurs on site, see section "Common Faults and Solutions" for specific troubleshooting recommendations regarding tripping and leakage current of residual current device.
- Leakage current is affected by the load, cable length, power supply voltage and frequency, component tolerances, and protective conductor connection. Therefore, the actual value may differ significantly from the example values in the table.

20.3 Braking Resistor

Braking resistor specifications

When the motor torque direction is opposite to the speed direction, the energy is transmitted from the motor back to the servo drive, causing rise of the bus voltage. When the bus voltage rises to the

braking threshold, the energy is consumed by the braking resistor according to the braking requirements. Otherwise, the drive will be damaged. You can use either a built-in or external braking resistor. Do not use a built-in braking resistor and an external braking resistor at the same time. Specifications of the braking resistor are as follows.

Table 20–16 Braking resistor specifications

Drive model	Specifications of built-in braking resistor			External braking resistor Min. allowable resistance (Ω) (H02.21)
	Resistance (Ω)	Power Pr (W)	Processing power Pa (W)	
SV660FS1R6I	-	-	-	40
SV660FS2R8I	-	-	-	40
SV660FS5R5I	50	50	25	40
SV660FS7R6I	25	80	40	20
SV660FS012I				15
SV660FT3R5I	100	80	40	80
SV660FT5R4I	100	80	40	60
SV660FT8R4I	50	80	40	45
SV660FT012I				40
SV660FT017I	35	100	50	35
SV660FT021I				25
SV660FT026I				

Note

The built-in braking resistor is not available in S1R6 or S2R8 models. For these models, you can install an external braking resistor as needed.

- **Without external load torque**
  The kinetic energy generated upon braking of a reciprocating motor is converted into electric energy that is fed back to the bus capacitor. When the bus voltage rises above the braking voltage threshold, the braking resistor starts consuming the excessive energy fed back by the motor. The following figure takes motor no-load running from 3000 RPM to static as an example to show the motor speed curve and energy data.

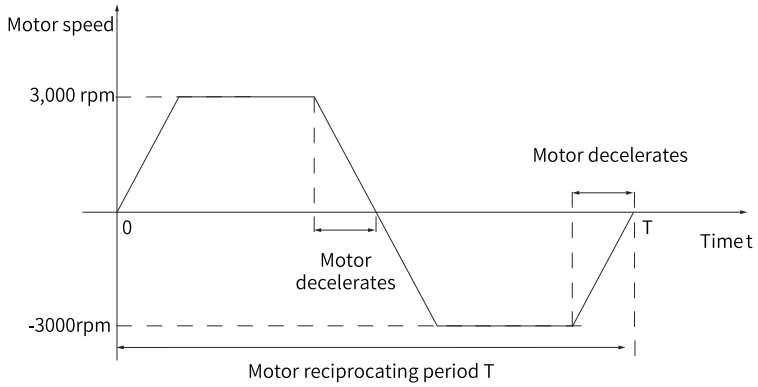


Figure 20-10 Example of motor speed curve (without external load torque)

- **External load torque applied, motor in generating state**

When rotation directions of the motor and shaft are the same, the motor is in the motoring state. In some special applications where the motor torque direction is opposite to the rotating direction, the motor is in generating state, and pumps the electric energy back to the servo drive.

When the load is in the continuous generating state continuously, it is recommended to use the common DC bus mode.

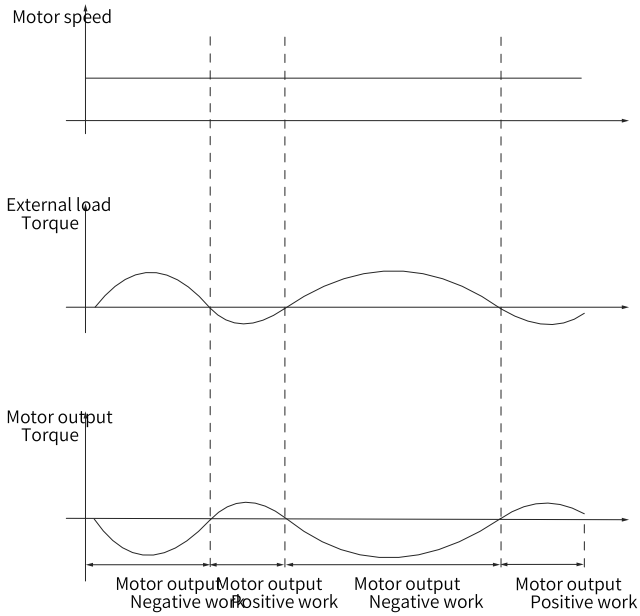


Figure 20-11 Example of the curve with external load torque

Among them, $P = FV = T/R \times 2\pi \times R \times V_1$.

Take the H1 series 400 W motor (rated torque 2.39 N·m) as an example. If the external load torque is 60% of the rated torque and the speed reaches 1500 rpm:

$$P = FV = \frac{T}{R} \times 2\pi \times R \times V_1 = (60\% \times 2.39) \times (1500 \times 2\pi/60) = 225\ W$$

Power fed back to the drive

Given that the braking resistor needs to be derated by 70%, the power of the external braking resistor must be 225/(1 - 70%) = 0.75 kW, with a resistance value of 50 Ω. Ensure the resistance value meets the minimum allowable resistance value limit condition. The minimum resistance value allowed by the drive can be found in *"Table 20-16 Braking resistor specifications" on page 799*.

Note

F = T (torque)/R (radius)

V (linear velocity, m/s) = 2π x R (radius) x V_1 (rotational speed, rev/s).

- **Energy calculation**

  S1R6 and S2R8 models do not have built-in braking resistors. See section "Wiring of the Braking Resistor" in the user guide for the energy that can be charged through capacitors. An external braking resistor is needed when the rotational energy of the motor and the load exceeds the values listed in the following table.

Drive model	Processable regenerative energy	Remarks
SV660FS1R6I	13.15	The input voltage of the main circuit power supply is 220 VAC.
SV660FS2R8I	26.29	

- The following table shows the energy generated by a 220 V motor in decelerating from the rated speed to a standstill during no-load operation.

Table 20–17 220 V motor energy data

Capacity (kW)	Servo motor model MS1H*-*******-*****	Rotor inertia J ($kg \cdot m^2$)	Braking energy generated from rated speed to standstill: E_O (J)	Max. braking energy absorbed by the capacitor E_C (J)[1]
0.05	MS1H1-05B30CB-A332R	(0.028×10^{-4})	(0.14)	7.86
0.1	MS1H1-10B30CB-A332R	(0.043×10^{-4})	(0.21)	
0.2	MS1H1-20B30CB-A331R	0.0938×10^{-4}	0.46	
	MS1H1-20B30CB-A334R	(0.106×10^{-4})	(0.52)	
0.4	MS1H1-40B30CB-A331R	0.145×10^{-4}	0.72	15.72
	MS1H1-40B30CB-A334R	(0.157×10^{-4})	(0.78)	
0.55	MS1H1-55B30CB-A331R	0.55×10^{-4}	2.72	22.39
0.75	MS1H1-75B30CB-A331R	0.68×10^{-4}	3.36	22.39
	MS1H1-75B30CB-A334R	(0.71×10^{-4})	(3.51)	
1	MS1H1-10C30CB-A331R	0.82×10^{-4}	4.05	32.39
	MS1H1-10C30CB-A334R	(0.87×10^{-4})	(4.30)	
1	MS1H2-10C30CB-A331R	1.78×10^{-4}	8.80	32.39
	MS1H2-10C30CB-A334R	(2.6×10^{-4})	(12.86)	
1.5	MS1H2-15C30CB-A331R	2.35×10^{-4}	11.6	47.6
	MS1H2-15C30CB-A334R	(3.17×10^{-4})	(15.68)	
2.0	MS1H2-20C30CB-A331R	2.92×10^{-4}	14.44	32.39
	MS1H2-20C30CB-A334R	(3.74×10^{-4})	(18.49)	
0.85	MS1H3-85B15CB-A331R	13.56×10^{-4}	16.45	32.39
	MS1H3-85B15CB-A334R	(15.8×10^{-4})	(17.3)	
1.3	MS1H3-13C15CB-A331R	19.25×10^{-4}	22	32.39
	MS1H3-13C15CB-A334R	(21.5×10^{-4})	(22.86)	
0.1	MS1H4-10B30CB-A330Z	0.102×10^{-4}	0.50	7.86
	MS1H4-10B30CB-A332Z	(0.104×10^{-4})	(0.51)	
0.2	MS1H4-20B30CB-A331R	0.22×10^{-4}	1.09	7.86
	MS1H4-20B30CB-A334R	(0.23×10^{-4})	(1.14)	
0.4	MS1H4-40B30CB-A331R	0.43×10^{-4}	2.13	15.72
	MS1H4-40B30CB-A334R	(0.44×10^{-4})	(2.18)	
0.55	MS1H4-55B30CB-A331R	1.12×10^{-4}	5.54	22.39

Capacity (kW)	Servo motor model MS1H*-*******-*****	Rotor inertia J (kg·m ^{2})	Braking energy generated from rated speed to standstill: E_O (J)	Max. braking energy absorbed by the capacitor E_C (J)[1]
0.75	MS1H4-75B30CB-A331R MS1H4-75B30CB-A334R	1.46×10^{-4} (1.51×10^{-4})	7.22 (7.47)	22.39
1.0	MS1H4-10C30CB-A331R MS1H4-10C30CB-A334R	1.87×10^{-4} (1.97×10^{-4})	9.25 (9.74)	32.39

- The following table shows the energy generated by a 380 V motor in decelerating from the rated speed to a standstill during no-load operation.

Table 20–18 380 V motor energy data

Capacity (kW)	Servo motor model MS1H*-*******-*****	Rotor inertia J (kg·m ^{2})	Braking energy E_O (J) generated during process from no-load rated speed to a standstill (J)	Max. braking energy absorbed by the capacitor E_C (J)[1]
1.0	MS1H2-10C30CD-A331R MS1H2-10C30CD-A334R	1.78×10^{-4} (2.6×10^{-4})	8.8 (12.86)	28.18
1.5	MS1H2-15C30CD-A331R MS1H2-15C30CD-A334R	2.35×10^{-4} (3.17×10^{-4})	11.62 (15.68)	34.22
2.0	MS1H2-20C30CD-A331R MS1H2-20C30CD-A334R	2.92×10^{-4} (3.74×10^{-4})	14.44 (18.49)	50.32
2.5	MS1H2-25C30CD-A331R MS1H2-25C30CD-A334R	3.49×10^{-4} (4.3×10^{-4})	17.26 (21.26)	50.32
3.0	MS1H2-30C30CD-A331R MS1H2-30C30CD-A334R	6.4×10^{-4} (9.38×10^{-4})	31.65 (46.38)	50.32
4.0	MS1H2-40C30CD-A331R MS1H2-40C30CD-A334R	9×10^{-4} (11.98×10^{-4})	44.51 (59.24)	82.53
5.0	MS1H2-50C30CD-A331R MS1H2-50C30CD-A334R	11.6×10^{-4} (14.58×10^{-4})	57.36 (72.10)	82.49
0.85	MS1H3-85B15CD-A331R MS1H3-85B15CD-A334R	13.56×10^{-4} (15.8×10^{-4})	16.76 (19.53)	28.18
1.3	MS1H3-13C15CD-A331R MS1H3-13C15CD-A334R	19.25×10^{-4} (21.5×10^{-4})	23.8 (26.58)	34.22
1.8	MS1H3-18C15CD-A331R MS1H3-18C15CD-A334R	24.9×10^{-4} (27.2×10^{-4})	30.78 (33.63)	50.32
2.9	MS1H3-29C15CD-A331R MS1H3-29C15CD-A334R	44.7×10^{-4} (52.35×10^{-4})	55.26 (64.72)	50.32
4.4	MS1H3-44C15CD-A331R MS1H3-44C15CD-A334R	64.9×10^{-4} (72.55×10^{-4})	80.23 (89.69)	82.53

Capacity (kW)	Servo motor model MS1H*-*******-*****	Rotor inertia J (kg·m ^{2})	Braking energy E_O (J) generated during process from no-load rated speed to a standstill (J)	Max. braking energy absorbed by the capacitor E_C (J)[1]
5.5	MS1H3-55C15CD-A331R MS1H3-55C15CD-A334R	86.9×10^{-4} (94.55×10^{-4})	107.43 (116.89)	100.64
7.5	MS1H3-75C15CD-A331R MS1H3-75C15CD-A334R	127.5×10^{-4} (135.15×10^{-4})	157.62 (167.08)	100.64

Note

- Values inside the parentheses "()" are for the motor with brake.
- If the total braking time T is known, you can determine whether an external braking resistor is needed and the power required using the resistor selection flowchart and formula.
- [1]: The default braking threshold of a single-phase/three-phase 220 V drive is 380 V. The default braking threshold of a three-phase 380 V drive is 700 V. The maximum braking energy (E_C, J) that can be absorbed by the capacitor is determined by the power supply voltage (220 Vac or 380 Vac). Calculation formula:

$$E_C = \frac{1}{2}C\left[V_{\text{Discharge threshold voltage}}^{\ 2} - \left(V_{\text{Power supply voltage}} \times \sqrt{2}\right)^2\right]$$

When the power supply voltage changes, adjust the values proportionally for calculation.

$$E_C = E_{C\text{Original table data in the manual}} \times \frac{V_{\text{Actual discharge threshold voltage}}^{\ 2} - \left(V_{\text{Actual power supply voltage}} \times \sqrt{2}^2\right)}{V_{\text{Default discharge threshold voltage}}^{\ 2} - \left(V_{\text{Default power supply voltage}} \times \sqrt{2}^2\right)}$$

For example, assume that the energy absorbed by the capacitor of the S2R8 model servo drive at a supply voltage of 220 Vac is 15.72 J. In this case, the energy absorbed by the capacitor at a supply voltage of 240 Vac is calculated as follows:

$$E_C = 15.72 \times \frac{380^2 - \left(240 \times \sqrt{2}\right)^2}{380^2 - \left(220 \times \sqrt{2}\right)^2} = 9.64\text{J}$$

Braking resistor selection

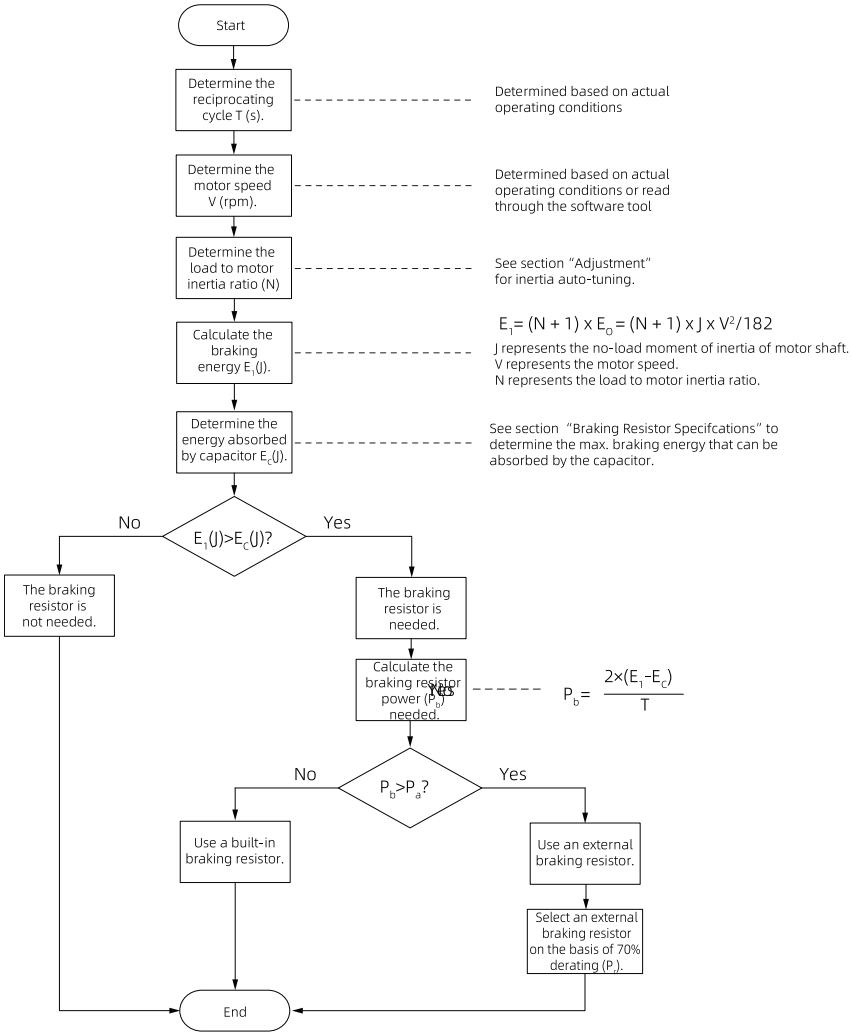


Figure 20-12 Flowchart for selecting the braking resistor (horizontal movement)

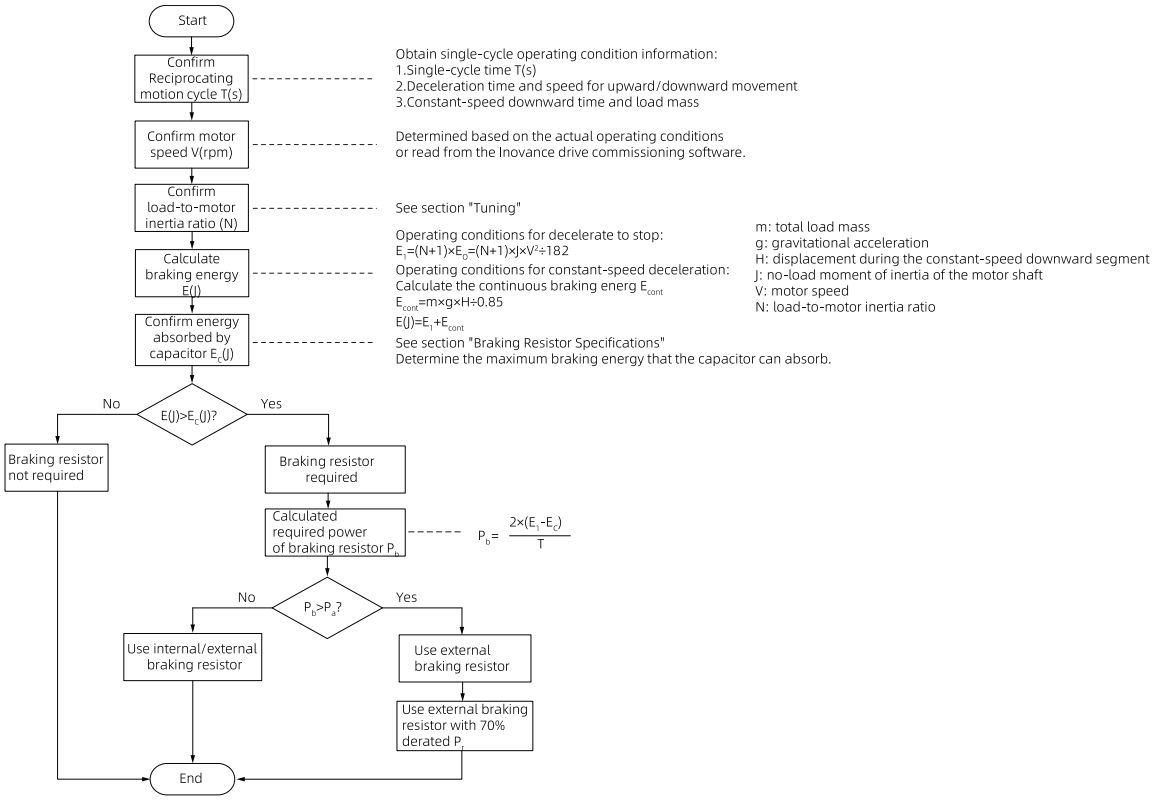


Figure 20-13 Flowchart for selecting the braking resistor (vertical axis)

Table 20–19 Description of braking resistor selection factors

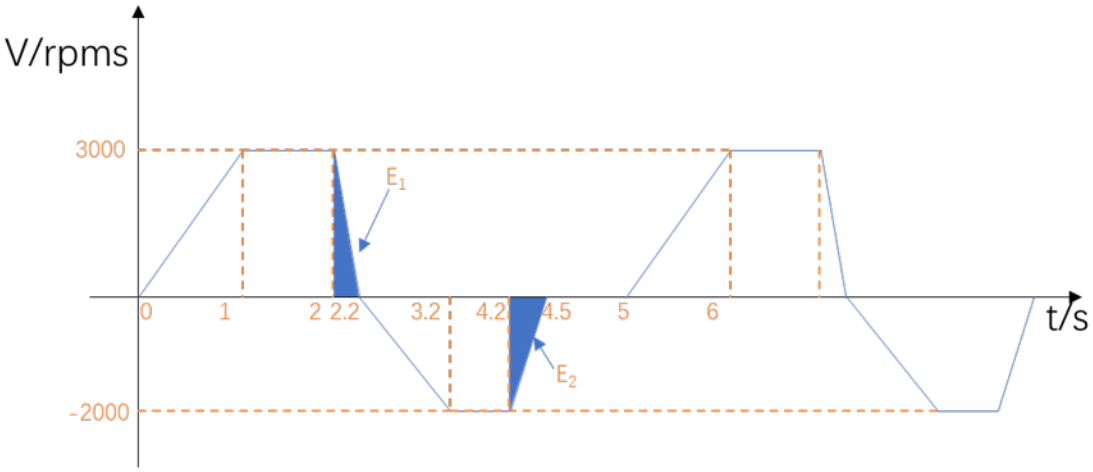
Factor	Unit	Definition
Reciprocating motion cycle T	s	Set it based on actual conditions.
Motor speed (V)	RPM	Determined based on actual operating conditions or read from the Inovance software tool.
Inertia ratio (N)	-	For details, see section "Tuning".
Rotor inertia (J)	kg·m^2	For the specific rotor inertia of MS1 series motors, see *"Table 20-17 220 V motor energy data" on page 801*
Braking energy E_1	J	$E_1 = (N + 1) \times J \times V^2 \div 182$
Energy absorbed by capacitor E_c	J	For the maximum braking energy absorbed by capacitor, see *"Table 20-17 220 V motor energy data" on page 801*
Power of braking resistor (P_b)	W	$P_b = 2 \times (E_1 - E_C) \div T$
Power of built-in braking resistor (P_a)	W	The built-in braking resistor is not available in models S1R6 or S2R8 ($P_a = 0$). For details, see *"Table 20-16 Braking resistor specifications" on page 799*

Note

- Assuming an MS1H1 brake-less 400 W motor decelerates from a rated speed of 3000 rpm to a standstill, with the load inertia being N x motor inertia, then the following formula applies during deceleration: Braking energy $E_1 = (N + 1) \times J \times V^2/182 = (N + 1) \times E_O$. The energy consumed by the braking resistor is $(N + 1) \times E_O - E_C$ joule, after subtracting the energy E_C absorbed by the capacitor. Assume that the reciprocating movement period is T, the required braking resistor power is $2 \times [(N+1) \times E_O - E_C]/T$. See *"Table 20-17 220 V motor energy data" on page 801* for values of E_O and E_C.
- Based on the preceding figure, you can determine whether the braking resistor is currently in use. Then, set H02.25 accordingly.
- The resistor with aluminum case is recommended.
- For the specification of the braking resistor, see *"Table 20-16 Braking resistor specifications" on page 799*.

Application example:

1. Horizontal/Circular movement



Take the MS1H1 400 W motor without brake as an example. Assume that the reciprocating movement cycle T = 5s, and the motor first moves in the forward direction: forward acceleration for 1s, constant speed for 1s, and deceleration for 0.2s, then moves in the reverse direction: reverse acceleration for 1s, constant speed for 1s, deceleration for 0.3s, and stops for 0.5s. If the motor decelerates from the rated speed 3000 rpm to a standstill, and the load inertia is 4 times of the motor inertia, then the required braking resistor power is:

$$P_b = \frac{(E_1 - E_C) + (E_2 - E_C)}{T}$$

The braking energy per operation is calculated as follows:

$E = (N + 1) \times E_0 = (N + 1) \times J \times V^2 \div 182$

The braking energy during deceleration is generated from the process of running at the maximum speed to a standstill. Therefore:

$E_1 = (4 + 1) \times 0.145 \times 10^{-4} \times 3000^2 \div 182 = 3.58\ J$

$E_2 = (4 + 1) \times 0.145 \times 10^{-4} \times 2000^2 \div 182 = 1.59\ J$

$$P_b = \frac{(3.58 - 15.72) + (1.59 - 15.72)}{5} = -5.25W$$

The S2R8 model does not have a built-in resistor, so $P_a = 0$ W, and $P_b < P_a$, and external brake resistor is not needed.

If the inertia ratio is 40 and other conditions are the same, the required braking resistor power is:

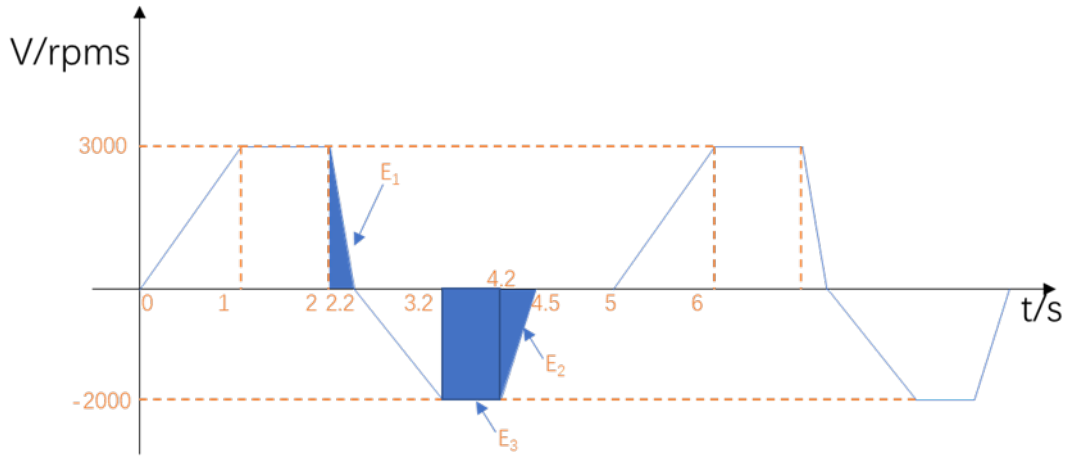
$E_1 = (40 + 1) \times 0.145 \times 10^{-4} \times 3000^2 \div 182 = 29.4\ J$

$E_2 = (40 + 1) \times 0.145 \times 10^{-4} \times 2000^2 \div 182 = 13.07\ J$

$$P_b = \frac{(29.4-15.72)+(13.07-15.72)}{5} = 2.21W$$

$P_b > 0$ W Therefore, an external braking resistor is required. The recommended power of the external braking resistor is $P_b \div (1 - 70\%) \approx 8$ W.

2. Movement of the vertical axis



Take the MS1H1 400 W motor without brake as an example. Assume that the reciprocating movement cycle T = 5s, and the motor first moves in the forward direction: forward acceleration for 1s, constant speed for 1s, and deceleration for 0.2s, then moves in the reverse direction: reverse acceleration for 1s, constant speed for 1s, deceleration for 0.3s, and stops for 0.5s. If the motor decelerates from the rated speed 3000 rpm to a standstill, the load inertia is 4 times of the motor inertia, the total load mass is 50 kg, and the displacement during constant-speed deceleration is 0.2 m, then the required braking resistor power is:

$$P_b = \frac{(E_1-E_C)+(E_2-E_C)+(E_3-E_C)}{T}$$

The braking energy per operation is calculated as follows:

$E = (N + 1) \times E_0 = (N + 1) \times J \times V^2 \div 182$

$E_{cont} = m \times g \times H \div 0.85$

The braking energy during deceleration is generated from the maximum speed to a standstill. The braking energy during constant-speed deceleration is determined by the work done to overcome the gravitational potential energy. Therefore:

$E_1 = (4 + 1) \times 0.145 \times 10^{-4} \times 3000^2 \div 182 = 3.58\ J$

$E_2 = (4 + 1) \times 0.145 \times 10^{-4} \times 2000^2 \div 182 = 1.59\ J$

$E_3 = 50 \times 9.8 \times 0.2 \div 0.85 = 23.06\ J$

$$P_b = \frac{(3.58-15.72)+(1.59-15.72)+(23.06-15.72)}{5} = -3.786W$$

The S2R8 model does not have a built-in resistor, so $P_a = 0$ W, and $P_b < P_a$, and external brake resistor is not needed.

If the inertia ratio is 40 and other conditions are the same, the required braking resistor power is:

$E_1 = (40 + 1) \times 0.145 \times 10^{-4} \times 3000^2 \div 182 = 29.4$ J

$E_2 = (40 + 1) \times 0.145 \times 10^{-4} \times 2000^2 \div 182 = 13.07$ J

$E_3 = 50 \times 9.8 \times 0.2 \div 0.85 = 23.06$ J

$$P_b = \frac{(29.4-15.72)+(13.07-15.72)+(23.06-15.72)}{5} = 6.41W$$

$P_b > 0$ W Therefore, an external braking resistor is required. The recommended power of the external braking resistor is $P_b \div (1 - 70\%) \approx 22$ W.

- **Using the built-in braking resistor**
  When $P_b < P_a$ and $E_1 > E_C$, use the built-in braking resistor. In this case, set H02.25 to 0.

  When using the built-in braking resistor, connect terminals $P_\oplus$ and D with a jumper bar.

- **Braking resistor not needed**
  When $E_1 < E_C$, no braking resistor is needed, because the braking energy can be absorbed by the bus capacitor. In this case, set H02.25 to 3.

- **Using an external braking resistor**
  When P_b is greater than P_a, use an external braking resistor. Set H02.25 to 1 or 2 based on the cooling mode of the braking resistor.

  Use the external braking resistor with 70% derated, that is, $P_r = P_b \div (1 - 70\%)$, and ensure the resistance of the braking resistor is higher than the minimum permissible resistance allowed by the drive. Remove the jumper bar between terminals $P_\oplus$ and D, and connect the external braking resistor between terminals $P_\oplus$ and C.

  For the wiring diagram and lead wire specifications of the external braking resistor, see section "Wiring of Braking Resistor". Depending on the braking resistor cooling method, set H02.25 to 1 or 2, check and set the minimum braking resistor value allowed by the drive (H02.21), external braking resistor power (H02.26), and external braking resistor resistance (H02.27).

Caution

- Set the power and resistance of the external braking resistor in H02.26 and H02.27 correctly.
- Ensure the resistance of the external braking resistor is higher than or equal to the permissible minimum resistance.
- In natural environment, when the braking resistor is used at its rated power rather than the processing power (average), the temperature of the resistor will rise to above 120℃ under continuous braking. To ensure safety, cool the resistor down through forced air cooling, or use a resistor equipped with a thermal switch. For the load characteristics of the braking resistor, consult with the manufacturer.

Set the heat dissipation coefficient (H02.24) based on the heat dissipation condition of the external braking resistor.

Note

Higher resistor heat dissipation coefficient indicates higher braking efficiency.

Related parameters

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.21	Permissible minimum resistance of braking resistor	-	1 to 1000	Ω	40	UInt16	Read only	Ordinary user	-
	Description of parameters:								
	The permissible minimum resistance of the braking resistor is only related to the servo drive model.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.24	Resistor heat dissipation coefficient	-	10 to 100	%	30	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the heat dissipation coefficient of the braking resistor, which is applicable to both external and built-in braking resistors. Set this parameter properly according to actual heat dissipation conditions of the resistor. Recommended value: Generally, the value of H02.24 (Resistor heat dissipation coefficient) cannot exceed 30% for natural cooling or 50% for forced air cooling.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.25	Braking resistor setting	-	0 to 3	-	3	UInt16	Real-time	Ordinary user	Effective in real time
	Value:								
	0: Built-in 1: External, natural cooling 2: External, forced cooling 3: No resistor needed								
	Description of parameters:								
	It sets the mode of absorbing and releasing the braking energy.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.26	Power of external braking resistor	-	1 to 65535	W	40	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the power of the external braking resistor. Note: The value of this parameter cannot be lower than the calculated braking power. If the rated power of the braking resistor is higher than the actual value, a false alarm E920.0 (resistor overload) can be reported. If the rated power of the braking resistor is lower than the actual value, the resistor may be damaged.								

Param.	Name	Comm. address	Range	Unit	Default	Data type	Change Mode	User authority	Effective Time
H02.27	Resistance of external braking resistor	-	15 to 1000	Ω	50	UInt16	Real-time	Ordinary user	Effective in real time
	Description of parameters:								
	Defines the power of the external braking resistor. Note: The value of H02.27 (Resistance of external braking resistor) must not be lower than the value of H02.21 (Permissible min. resistance of external braking resistor). Otherwise, real-time power calculation of the brake resistor can be affected. When the calculated power is lower than the actual value, the resistor may be damaged. When the calculated power is higher than the actual value, E920.0 can be reported.								

20.4 Absolute Encoder Batteries

Model selection

Select an appropriate battery according to the following table.

Table 20–20 Battery specifications for the absolute encoder

Battery specification	Item and unit	Rated value			Condition
		Min. value	Typical value	Max. value	
Output: 3.6 V, 2700 mAh	External battery voltage (V)	3.2	3.6	3.8	In standby mode[1]
	Circuit fault voltage (V)	-	2.6	-	In standby mode
	Battery alarm voltage (V)	2.85	3	3.15	-
	Current consumed by the circuit (μA)	-	2	-	In normal operation mode[2]
		-	10	-	In standby mode, with the axis at a standstill
		-	300	-	In standby mode, with the axis operating
	Battery ambient temperature (℃)	0	-	40	Same as the motor temperature requirements
	Battery storage temperature (℃)	0	-	30	

Note

- [1]: The "standby state" means the encoder counts the multi-turn data by using the power from the external battery when the drive power supply is not switched on. In this case, data transceiving stops.
- [2]: During normal operation, the absolute encoder supports one-turn or multi-turn data counting and transceiving. After the absolute encoder is correctly connected, it can receive and send data after a short delay (about 5s) when the drive is powered on. The motor speed must be lower than or equal to 10 rpm during transition from the standby state to the normal operation state (upon power-on). Otherwise, ER.740 (Encoder fault) may occur. In this case, you need to power off and on the drive again.
- The preceding data is measured in the 20℃ ambient temperature.
- The battery case must be stored in a cool, clean, and dry environment, with a recommended temperature ≤ 30℃ and relative humidity ≤ 60% RH. Keep the battery case away from corrosive substances, fire sources, and heating sources.
- Check the encoder battery voltage when E730 or E731 is reported. In this case, connect an external 1 kΩ load to the battery for measurement.

21 Certification and Standard Requirements

21.1 CE Certification



Figure 21-1 CE Marking

- The "CE mark" indicates compliance with the Low Voltage Directive (LVD), Electromagnetic Compatibility (EMC), and Restriction of Hazardous Substances (RoHS) directives.
- The CE mark is mandatory for engaging in commercial business (production, importation, and distribution) in Europe.
- The product complies with the LVD, EMC, and RoHS directives and is labeled with the CE mark.
- Machines and devices integrated with this drive must also comply with CE requirements for distribution in Europe.
- The integrator who integrates this drive into other products and attaches CE mark to the final assembly has the responsibility of ensuring compliance with CE certification.

21.1.1 Requirements for Compliance with EMC Directive

This drive, which is applicable to the Second environment, complies with EMC Directive 2014/30/EU and standard EN IEC 61800-3.

To satisfy the EMC Directive and standard requirements, install an EMC filter on the input end of the drive and use a recommended shielded cable for the output end. In addition, ensure reliable grounding of the filter and a 360° overlap connection of the shield of the output cable.



When applied in the first environment, the drive may generate radio interference. In addition to the CE compliance requirements described in this chapter, take additional measures to prevent radio interference if necessary.

Introduction to EMC standards

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices or systems to work properly in the electromagnetic environment without introducing electromagnetic interferences that disturb the operation of other local devices or systems. In other words, EMC includes two aspects: 1. The electromagnetic interference generated by a device during normal operation cannot exceed a certain limit. 2. The device must have sufficient immunity to the electromagnetic interference in the environment.

EN IEC 61800-3 defines the following two types of environments.

- First environment: Environment that includes domestic premises, and establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes
- Second environment: Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes

Devices are divided into the following four categories based on the intended environment.

- C1 equipment: Power drive systems with the rated voltage less than 1000 V, intended for use in the first environment:
- Category C2 equipment: PDS with rated voltage less than 1000 V, which is neither a plug-in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by professionals.
- Category C3 equipment: PDS of rated voltage less than 1000 V, intended for use in the Second Environment only and not the First Environment.
- Category C4 equipment: PDS of rated voltage greater than or equal to 1000 V, or rated current greater than or equal to 400 A, or intended for use in complex systems in the Second Environment.

21.1.2 Requirements for Compliance with LVD

The drive has been tested in accordance with EN61800-5-1 to determine compliance with LVD. Observe the following requirements to enable machines and devices integrated with this drive to comply with the LVD.

Installation location

Install the product in a place with overvoltage category III and pollution degree 1 or 2 as specified by IEC 60664-1.

Installation environment

Refer to section "Installation Environment Requirements" for installation environment requirements.

Installation protection requirements

The drive must be installed in a fireproof control cabinet as part of a final system that is provided with effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations, and to relevant IEC requirements.

Products (IP20) intended to be installed inside the cabinet must be installed in a structure that prevents intrusion of unwanted objects from the top and the front.

Wiring requirements of main circuit

For wiring requirements of main circuit terminals, see *"6.3.1 Main Circuit Terminal Pin Layout" on page 84*.

Requirements for protective devices

To comply with EN 61800-5-1, install a fuse/circuit breaker on the input side to prevent accidents caused by internal short circuits.

See *"20.2.3 Fuse (CE)" on page 788* and *"20.2.2 Circuit Breaker (CE)" on page 787* for recommended fuse/circuit breaker selection.

21.2 UL/cUL



Figure 21-2 UL/cUL mark

The UL/cUL mark commonly applies to products sold in the United States and Canada. Products with UL/cUL mark have been inspected and assessed by the UL organization. To pass UL/cUL certification, main built-in components of electrical products must also be UL certified.

The drive has been tested in accordance with UL 61800-5-1 and CSA C22.2 No. 274-17 to determine compliance with UL/cUL standards. Observe the following requirements to enable machines and devices integrated with this drive to comply with UL/cUL standards.

Installation location

Install the drive in a place with overvoltage category III and pollution degree 1 or 2 as specified by UL61800-5-1.

Ambient temperature

According to the protection level, the ambient temperature must be maintained within the following range:

0°C to 50°C for open-type products

Installation requirements

Installation requirements for open-type products:

SV660F series servo drives are open-type drives that must be installed in a fireproof cabinet with the enclosure that provides effective electrical and mechanical protection. The installation must conform to local laws and regulations and related NEC requirements.

Wiring requirements of main circuit



Warning: It is not allowed to connect output terminals (such as P⊕, C, and N⊖) in the field.

- Terminals P⊕, C, and N⊖ are used to connect options. Do not connect these terminals to an AC power supply.
- To protect the main circuit, separate and cover the surface that may come into contact with the main circuit.
- The control circuit is the internal safety extra-low voltage (SELV) circuit, which must be insulated and isolated from other circuits. Make sure that the control circuit is connected to the external SELV circuit.
- Prevent foreign matters from entering the wiring part of the terminal block.
- Do not solder the twisted conductors.
- The tightening torque may vary with terminals. Tighten terminal screws with the specified tightening torque. You can use the torque screwdriver, ratchet, or wrench.
- When using an electric screwdriver to tighten terminal screws, set a low speed to prevent damage to the terminal screws.
- Tighten the terminal screws with an angle not higher than 5°. Failure to comply may damage the terminal screws.

Wiring requirements of control circuit

Observe the requirements in UL508 during wiring.

Cable requirements

Cable dimensions must be compliant with requirements in NEC (National Electric Code) and CEC (Canadian Electrical Code) Part I and local regulations.

- Use cables with copper conductors.
- The recommended cable for the main circuit is a class 2 600V indoor heat-resistant PVC cable with continuous maximum allowable temperature of 75 ° C. The following conditions are used as premises:
  - Ambient temperature: < 40°C
  - Normal operating ratings

If the recommended cable specifications for peripheral devices or options do not comply with the applicable cable specifications, contact Inovance.

Terminal cable selection

To comply with UL61800-5-1 and CSA C22.2 No. 274-17, power cables used for the drive must meet the following requirements:

- Compliant with NEC, Table 310-16 of NFPA70, and NFPA79
- Comprised of copper conductors with a rated temperature not lower than 75°C (167°F)

- Compliant with 14AWG or higher.
- With a rated voltage not lower than the rated voltage of the drive
- It is recommended to use cables compliant with UL758 Style 2517 and Style 2586 as motor main circuit cables.

Requirements for protective devices

To comply with UL61800-5-1, install a fuse/circuit breaker on the input side of the drive to prevent accidents caused by short circuit in the internal circuit.

Install sufficient protective devices against short circuit in branch circuits according to applicable regulations and this guide. The drive is applicable to circuits with a rated breaking capacity lower than 5000 A and a maximum voltage of 480 VAC (class 400 V).

22 Appendix

22.1 Accessory

22.1.1 Recommended Terminal Blocks

Table 22–1 Recommended terminal blocks

Drive model SV660 series		Terminal Block
Size A	S1R6	9EDGK-5.0-09P-13-01AH & Gaozheng & B/BBB1
	S2R8	
Size B	S5R5	9EDGK-5.0-11P-13-05AH & Gaozheng & B/BBA2
Size C	S7R6	9EDGK-7.5-09P-13-1014A(H) & Gaozheng & B/BAB1+9EDGK-7.5-04P-13-1015A_H & Gaozheng & B/BAA2
	T3R5	
	T5R4	
Size D	S012	
	T8R4	
	T012	
Size E	T017	-
	T021	
	T026	

22.2 DI/DO Function Assignment

No.	Name	Function name	Description	Remarks
Description of DI signals				
FunIN.1	S-ON	Enable servo	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.3	GAIN-SEL	Gain Switchover	• H08.09 = 1: • Inactive: Speed control loop being PI control • Inactive: 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.

No.	Name	Function name	Description	Remarks
FunIN.14	P-OT	Positive limit switch	Enabled: Forward drive inhibited Disabled: Forward drive allowed	When the mechanical movement is beyond the movable range, the overtravel prevention function will be activated. It is recommended to set the logic of the corresponding terminal to level valid.
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.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 enabled Inactive: Positive internal torque limit enabled	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 enabled Inactive: Negative internal torque limit enabled	The corresponding terminal logic is recommended to be level-triggered.
FunIN.18	JOGCMD+	Forward jog	Active: Input according to the command. Inactive: Reference 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: Reference input stopped.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.31	HomeSwitch	Home switch	Inactive: Not triggered. Active: Triggered	The corresponding terminal logic must be level-triggered. Allocate this function to the high-speed DI terminal. If the logic is set to 2 (rising edge triggered), the servo drive forcibly changes it to 1 (high level triggered). If the logic is set to 3 (falling edge triggered), the servo drive forcibly changes it to 0 (low level triggered). If the logic is set to 4 (both rising edge and falling edge triggered), the servo drive forcibly changes it to 0 (low level triggered).

No.	Name	Function name	Description	Remarks
FunIN.32	HomingStart	Homing	Inactive: Disabled Active: Enabled	-
FunIN.34	Emergence Stop	Emergency stop	Active: The drive stops according to the defined quick stop mode Inactive: Current operating state unaffected	The corresponding terminal logic is recommended to be level-triggered.
FunIN.35	ClrPosErr	Position deviation cleared	Inactive: Position deviation not cleared Active: Position deviation cleared	The corresponding terminal logic is recommended to be level-triggered.
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.38	TouchProbe1	Touch probe 1	Inactive: Touch probe not triggered Enabled: Touch probe is triggerable.	The touch probe logic is only related to the touch probe function.
FunIN.39	TouchProbe2	Touch probe 2	Inactive: Touch probe not triggered Enabled: Touch probe is triggerable.	The touch probe logic is only related to the touch probe function.
FunIN.41	HomeRecord	Present position as the home	Inactive: Not triggered. Active: Triggered.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.56	MExTriger	External switch of EPOS program block	Active: If H28.68 = 1, the program block function triggers the enabling operation. Inactive: No external DI program block trigger signal.	-
Description of DO signals				
FunOUT.1	S-RDY	Ready to switch on	The servo drive is ready to receive S-ON signal: Active - Ready to switch on Inactive: Not ready to switch on	-
FunOUT.2	TGON	Motor rotation signal	Inactive: The absolute value of filtered motor speed is lower than the setpoint of H06.16. Active: The absolute value of filtered motor speed reaches the setpoint of H06.16.	-
FunOUT.3	ZERO	Zero speed signal	Inactive: The difference between motor speed feedback and reference value is 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.	-

No.	Name	Function name	Description	Remarks
FunOUT.4	V-CMP	Speed consistent	In speed control mode, when the absolute value of the deviation between the motor rotational speed and the speed reference is smaller than the value of H06.17, this signal is valid.	-
FunOUT.5	COIN	Positioning completed	In the position control mode, when the position deviation pulses reach the value of H05.21, this signal is valid.	-
FunOUT.6	NEAR	Positioning almost completed	In the position control mode, when the position deviation pulses reach the value of H05.22, this signal is valid.	-
FunOUT.7	C-LT	Torque limit	Confirming torque limit: Active: Motor torque limited Inactive: Motor torque not limited	-
FunOUT.8	V-LT	Torque limit	Confirming rotational speed limit in torque control: Active: Motor speed limited Inactive: Motor speed not limited	-
FunOUT.9	BK	Brake output	Brake output: Active: Brake released Inactive: Brake applied	-
FunOUT.10	WARN	Warning	Active: Alarm occurred on the servo drive Inactive: No alarm occurred on the servo drive or the alarm has been reset	-
FunOUT.11	ALM	Fault	Active: Fault occurred on the servo drive Inactive: No fault occurred on the servo drive or the fault has been reset.	-
FunOUT.16	HomeAttain	Homing completed	Homing state: Active: Homing completed in position control mode Inactive: Homing not completed	-
FunOUT.18	ToqReach	Torque reached output	Active: The absolute value of torque reference reaches the reference value. Inactive: The absolute value of torque reference is lower than the reference value.	-
FunOUT.19	V-Arr	Speed reached output	Active: Speed feedback reaches the set value. Inactive: Speed feedback smaller than the set value.	-

No.	Name	Function name	Description	Remarks
FunOUT.21	SrvOn	Enable operation completion	Active: Operation enabled. Inactive: Operation not enabled.	-
FunOUT.30	WARN OR ALM	Alarm or fault output	Active: An alarm or a fault occurred. Inactive: No alarm or fault.	-
FunOUT.32	EDM	EDM output	Active: STO function triggered Inactive: STO function not triggered.	The EDM outputs active signals only when the 24 V input voltages for STO1 and STO2 are disconnected simultaneously.

22.3 Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

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PS00005951B01

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