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SV660P Series Servo Drive

User Guide

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

Data code PS00005513D00

Legal Information

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The contents are subject to change without notice due to product upgrade.

Waste Disposal

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

Qualified Personnel

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.

Proper Use of the Product

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

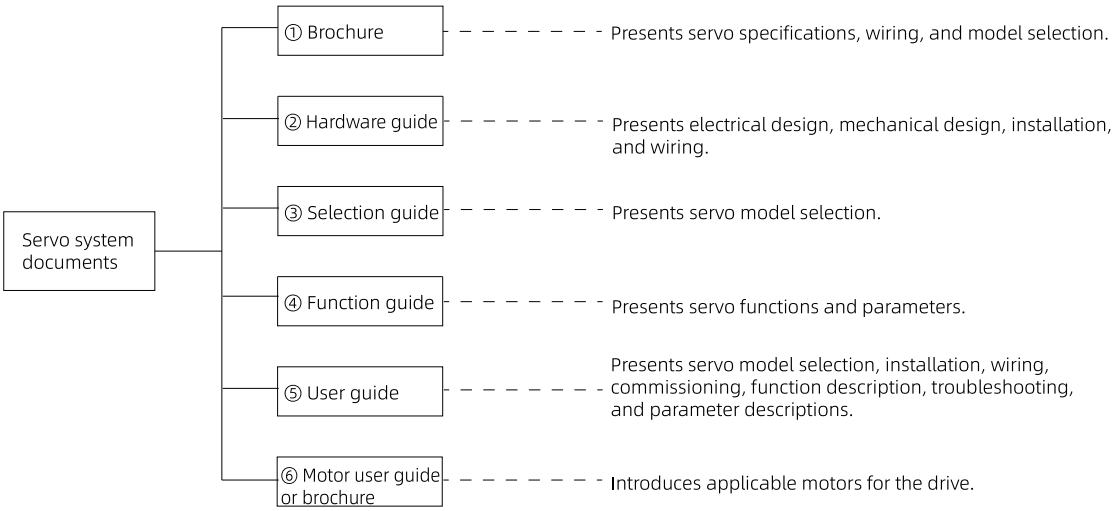
The SV660P series is a high-performance AC servo drive developed by Inovance for small and medium power applications. The servo drive covers a power range from 0.05 kW to 7.5 kW and carries Modbus communication interfaces to work with the host controller for a networked operation of multiple servo drives.

The SV660P series servo drive supports adaptive stiffness level setting, inertia auto-tuning, and vibration suppression for easy use. It allows quiet and stable operations and accurate positioning through working with a MS1 series high-response servo motor configured with a 23-bit absolute multi-turn encoder.

The SV660P series servo drive serves to achieve quick and accurate position control, speed control, and torque control in automation equipment such as electronic manufacturing devices, manipulators, packing devices, and machine tools.

This manual provides information on selection, installation, commissioning, function, troubleshooting and parameters of the equipment.

More documents



No.	Name	Code	Description
①	SV660 Series Servo Drive Brochure	19120119	Presents product specifications, wiring, and model selection.
②	SV660P Series Servo Drive Hardware Guide	19011391	Presents the electrical design guidance of the servo drive, descriptions of wiring terminals, certification and standard requirements, and solutions to common EMC problems.
③	SV660P Series Servo Drive Selection Guide	19011390	Provides instructions on product selection, including the list of supporting components, technical data on the drive and motor, and the cable selection guide.
④	SV660P Series Servo Drive Function Guide	19011393	Presents the functions and parameters of the product, including function overview, basic servo functions, adjustment instructions, and parameter description.

No.	Name	Code	Description
⑤	SV660P Series Servo Drive User Guide	PS00005513	Presents model selection, installation, wiring, commissioning, function description, troubleshooting, and parameter descriptions.
⑥	MS1-R Series Servo Motor Selection Guide	PS00004605	Presents product information, general specifications, motor selection, cable selection, certifications, and standards of the motor.
	MS1-R-INT Series Servo Motor with Battery-less Encoder Selection Guide	PS00019892	Presents product information, general specifications, motor selection, cable selection, certifications, and standards of the motor.
	MS1-R Series Servo Motor Installation Guide	PS00005407	Presents 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
December 2025	D00	Model: SV660P Version tag: H01-00= 0607.3/H00-02=000.00/ DD00	• Updated the architecture of the user guide. • Updated the content. • Deleted content related to shielding brackets. • Added information about MS1-R series battery-free encoder servo motors. • Add wiring steps. • Updated parameters and faults. • Set the value of H07.02 to 0 and 4. • Optimize fault descriptions of E980.0 and E924.0. • Corrected some minor errors.
February 2025	B05	-	• Corrected some minor errors. • Updated connector kit selection.

Date	Document version	Software version	Revision
October 2024	B04	-	• Added explanation in the preface. • Added notes on motor grounding and the impact of electromagnetic fields on medical implants. • Added surge current specifications and modified maximum input surge current specifications, and 3 times the RC time constant. • Modified input signal function selection specifications. • Added accurate dynamic braking distance. • Modified applicable cable selection and cable selection table. • Added surge protector selection specifications. • Modified absolute encoder battery specifications and add explanations. • Added installation precautions. • Added vibration level, shock level, and installation environment descriptions. • Added installation space requirements and cover opening angle requirements. • Added screw tightening torque requirements. • Added network cable installation instructions and absolute encoder battery box installation instructions. • Updated the system wiring diagram. • Updated electrical wiring diagrams and descriptions. • Updated the wiring instructions. • Updated main circuit cable specifications and models, and add shield requirements. • Updated power wiring examples. • Updated description of DI/DO signals. • Added DO3 digital output circuit example and current-limiting resistor calculation formula. • Updated brake wiring diagram and add brake wiring precautions. • Updated encoder cable specifications. • Added power cable and encoder cable adapter schemes. • Updated communication connection method. • Updated communication cable information. • Added chapter on related EMC wiring requirements. • Updated the fault cause and troubleshooting for display of "x". • Updated panel monitoring display description. • Updated daily inspection items. • Updated regular maintenance items. • Added chapter on common faults and recommended solutions. • Updated parameters descriptions.

Date	Document version	Software version	Revision
August 2024	B02	-	• Updated the sections "Solutions to Alarms" and "Solutions to Faults". • Added H01.02 Drive series No. to the "Model selection". • Added status display "nrd.x" and specify the exact cause and troubleshooting method for the displayed value x. • Updated the handling measures for E400.0. • Updated the fault description for E620.0. • Updated the confirmation method for E740.3. • Updated the fault description for E430.0. • Updated the generation reason for E605.0. • Updated the "Model and Nameplate" section in the "Model Description" chapter. • Updated the description of "Fault and Alarm Log" in the "Fault Level and Display" chapter. • Updated the ground wire specifications in the "Wiring Precautions" chapter. • Updated the description of "HXX.YY" parameters in the "Panel Display" chapter. • Updated the wiring diagram of the brake in the "Brake Wiring" chapter. • Updated the "MS1-R Series Motor" section. • Removed fault ED02.0. • Updated the address of Suzhou Inovance Technology Co., Ltd. and added the My Inovance QR code on the cover page. • Changed motor PE cable wiring method. • Added selection specification requirements for freewheeling diode in brake wiring. • Updated the fundamental safety instructions. • Updated vacuum environment description in installation environment requirements. • Updated cable selection. • Updated UL certification requirements for servo drive power cable selection.

Date	Document version	Software version	Revision
December 2023	B01	-	• Updated document acquisition channels. • Added descriptions for single-phase 220 V power supply. • Updated the fuse and circuit breaker model selection. • Updated main circuit terminal cable specifications. • Updated recommended breakers and fuse. • Added the mounting instructions for the shield bracket. Added recommended shield bracket. • Added shielded power cable model selection in the "Cable List" table. Added shielded cable model description in power cable model description. • Added DI logic level standard for DI/DO signals. • Added descriptions for -FH models. • Updated CN3, CN4 terminal layout description. • Added FunOUT.26, FunOUT.27, and H0A.18. • Updated the descriptions for H31.00, H0d.19, H02.00, H09.35, H09.38, H09.39, H07.07, H05.20, H0A.47, H00.00, EB01.0, E731.0, E735.0, E120.2, E994.0, E122.5, FunIN.29, and FunIN.32. • Updated the sections "Solutions to Alarms", "Solutions to Faults", "List of Alarm Codes", and "List of Fault Codes". • Updated the description of switching operation mode through DI in the "Speed Reference Input Setting" chapter. • Updated the examples in the "Setting Parameters" chapter. • Remove H07.15.
March 2023	B00	-	• Optimized H0b.33 and H0b.63. • Optimized the detailed description of H02.00 and H05.26. • Updated information on faults according to the latest fault list.
January 2023	A03	-	• Added warranty information in the preface. • Change the name of the magnetic clamp to DYR-130-B. • Unified the naming rule of the fault code to Er.xxx. • Changed “General Specifications” to “Product Specifications”. • Modified motor selection instructions. • Deleted information on AI. • Changed the MS1-Z motor to MS1-R motor. • Added voltage data in the content related to correspondence between pulse input frequency and pulse width. • Added description of high and low speed pulse reference input. • Changed the resistance at the pulse interface to 200 Ω. • Added a hexadecimal value for the parameters in the detailed description of parameters. • Updated the list of parameters and description of parameters. • Updated information on faults. • Modified the technical specifications. • Modified the description of fault logging.

Date	Document version	Software version	Revision
August 2022	A02	-	• Added information on port damage due to absence of a current limiting resistor. • Added information on the electrical specifications of the drive. • Modified the storage temperature range. • Added the information on AI. • Removed the "Installation of the Servo Motor" chapter. • Updated the list of parameters and description of parameters. • Added fault E991.1.
April 2022	A01	-	Added additional safety precautions in Safety Instructions.
April 2022	A00	-	Initial release.

Access to the guide

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

- **Inovance website:** Visit ***https://www.inovance.com/global*** and choose **Service&Support> Support > Documentation Download**.
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Warranty

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is caused by proper operation of the user. Maintenance will be charged after the warranty expires.

Even within the warranty period, maintenance can be charged for the following product damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by using the product for unintended functions
- Damage caused by using the product outside the specified scope
- Secondary damage caused by force majeure (natural disaster, earthquake, lightning strike)

When applicable, relevant maintenance fee will be charged according to the latest Price List of Inovance. If otherwise agreed upon, the agreed terms and conditions shall prevail.

For detailed warranty information, refer to *Product Warranty Card*.

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1 Safety Precautions

1.1 Safety Precautions

Safety Disclaimer

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

Safety Levels and Definitions

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

General Safety Instructions

- 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 precautions to protect personal safety and wear protective equipment, such as anti-smashing shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking



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



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

Storage and Transportation



- Large-scale or heavy equipment must be handled by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injury or equipment damage.
- Before hoisting the equipment, ensure the equipment components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.



- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply may result in equipment damage.
- Do not store or transport the drive in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Do not store the drive for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the drive strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the drive with other device or materials that may harm or have negative impacts on the drive.

Installation
 . The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed.
 . Read through the guide and safety instructions before installation. . Do not install the equipment in places with strong electric or magnetic fields. . Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards. . Do not wear loose clothes or accessories during installation. Failure to comply may result in electric shock. . When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire. . Do not retrofit the equipment. . Do not fiddle with the bolts used to fix equipment components or the bolts marked in red. . When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations. . Before installing 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 will result in a fire.
 . Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes. . Resonance may occur when the equipment operating at a constant speed switches to variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring



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



- Do not connect the input power supply to the output end of the equipment. Failure to comply will result in equipment damage or even a fire.
- When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used for wiring must meet cross-sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.
- Tighten the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may result in overheat, damage to the connecting parts, or a fire.
- After wiring is done, check that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply may result in electric shock or equipment damage.



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

Power-on



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



- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in a fire.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injuries.

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

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

Repair
 • Equipment installation, wiring, maintenance, inspection, or component replacement must be performed only by professionals. • Do not repair the equipment with power ON. Failure to comply can result in an electric shock. • Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
 • Submit the repair request according to the warranty agreement. • When the fuse is blown or the circuit breaker or earth leakage circuit breaker (ELCB) trips, wait as specified on the product warning sign before power-on or further operations. Failure to comply may result in personal injuries, equipment damage or even death. • When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record. • Replace quick-wear parts of the equipment according to the replacement instructions. • Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage. • After the equipment is replaced, check the wiring and set parameters again.

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

Additional Precautions

Precautions for 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 rotary mechanical structures. When a motor is stopped by dynamic braking, the inertia of the load keeps making it rotate. This generates a short-circuit current that flows through the dynamic brake. If this situation continues, the drive, and even the motor, may be burned.

Precautions for grounding

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

Effects of electromagnetic fields on medical implants

- The motor is hazardous to persons wearing medical implants nearby the equipment.
- The electromagnetic field affects the function of medical implants being used (such as cardiac pacemakers), resulting in malfunctioning.

Safety Labels

To ensure safe operation, comply with equipment-related safety labels. See the following table for descriptions of the safety labels.

Safety Labels	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 heat sink with power on to prevent burns.

1.2 Industrial Information Security

The product provides interfaces for network connection and data transmission. To protect factories, systems, machines, and networks from cyber attacks, 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.

Caution

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

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

1.3 Compliance List

Table 1–1 Compliance list

Certification	Directive		Standard
CE certification	EMC directive	2014/30/EU	EN IEC 61800-3:2018
	LVD directive	2014/35/EU	EN 61800-5-1:2007/A11:2021 EN 60034-1:2010
	RoHS directive	2011/65/EU 2015/863/EU	EN 50581
UL/cUL certification	-		UL61800-5-1:2021 CSA C22.2 No.274:2017 UL 1006-1:2021 UL 1004-1:2020 CSA C22.2 No.100-14:2017

Note

The product certifications comply with the directives and standards specified in the preceding table.

2 Selection Table

2.1 Model Selection List (Matching MS1-R Series Servo Motor)

Servo motor				Servo drive SV660 series			
Motor without brake	Motor with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Recommended model	No.
Ratings of MS1H1 (n_N= 3000 rpm, n_{max}=7000 rpm) series motors							
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-phase/ Three-phase 220 V	C	S7R6	00006
MS1H1-15C30CB-A330R	-	80	1.5	Single-phase/ Three-phase 220 V	D	S012	00007
MS1H1-15C30CB-A331R	-	80	1.5	Single-phase/ Three-phase 220 V		S012	00007
Ratings of MS1H2 (n_N= 3000 rpm, n_{max}= 6000 rpm) series motors							
MS1H2-10C30CB-A331R	MS1H2-10C30CB-A334R	100	1.0	Single-phase/ 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-phase/ Three-phase 220 V	D	S012	00007
MS1H2-15C30CD-A331R	MS1H2-15C30CD-A334R	100	1.5	Three-phase 380 V	C	T5R4	10002

Servo motor				Servo drive SV660 series			
Motor without brake	Motor with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Recommended model	No.
MS1H2-20C30CB-A331R	MS1H2-20C30CB-A334R	100	2.0	Single-phase/ Three-phase 220 V	D	S012	00007
MS1H2-20C30CD-A331R	MS1H2-20C30CD-A334R	100	2.0	Three-phase 380 V	D	T8R4	10003
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 (n_N=1500 rpm, n_{max}= 4500 rpm) series motors							
MS1H3-85B15CB-A33*R	MS1H3-85B15CB-A334R	130	0.85	Single-phase/ 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-phase/ 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-phase/ 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 (n_N= 3000 rpm, n_{max}=7000 rpm) series motors							

Servo motor				Servo drive SV660 series			
Motor without brake	Motor with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Recommended model	No.
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-phase/ 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 Model Selection List (Matching MS1-R Series Servo Motor with Battery-Free Encoder)

Servo motor				Servo drive SV660 series			
Motor without brake	Motor with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Model	No.
Ratings of MS1H1 (n_N= 3000 rpm, n_{max}=7000 rpm) series motors							
MS1H1-20B30CB-V331R	MS1H1-20B30CB-V334R	60	0.2	Single-phase 220 V	A	S1R6	00002
MS1H1-40B30CB-V331R	MS1H1-40B30CB-V334R	60	0.4	Single-phase 220 V		S2R8	00003

Servo motor				Servo drive SV660 series			
Motor without brake	Motor with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Model	No.
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-phase/ Three-phase 220 V	C	S7R6	00006
Ratings of MS1H2 (n_N= 3000 rpm, n_{max}= 6000 rpm) series motors							
MS1H2-10C30CB-V331R	MS1H2-10C30CB-V334R	100	1.0	Single-phase/ 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-phase/ 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-phase/ 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 (n_N=1500 rpm, n_{max}= 4500 rpm) series motors							
MS1H3-85B15CB-V33*R	MS1H3-85B15CB-V334R	130	0.85	Single-phase/ 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-phase/ Three-phase 220 V	D	S012	00007
MS1H3-13C15CD-V331R	MS1H3-13C15CD-V334R	130	1.3	Three-phase 380 V	C	T5R4	10002

Servo motor				Servo drive SV660 series			
Motor without brake	Motor with brake	Frame size (mm)	Capacity (kW)	Voltage class	Size	Model	No.
MS1H3-18C15CB-V331R	MS1H3-18C15CB-V334R	130	1.8	Single-phase/ 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 (n_N= 3000 rpm, n_{max}=7000 rpm) series motors							
MS1H4-20B30CB-V331R	MS1H4-20B30CB-V334R	60	0.2	Single-phase 220 V	A	S1R6	00002
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-phase/ 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.
- Description of drive models:
  - S - 220 V voltage level
  - T - 380 V voltage level
  - 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
- Different motors match different series of servo drives. The maximum speed and maximum torque output of the motor vary slightly. See the selection guide of the servo drive for details.
- 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.

3 Product Information

3.1 Servo Drive Product Information

3.1.1 Model and Nameplate

Model description

SV660 P S 2R8 I - FH
① ② ③ ④ ⑤ ⑥

① **Product series** SV660: SV660 series servo drive	④ **Rated output current**		⑤ **Installation method** I: Baseplate-mounted
② **Product type** P: Pulse 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 FH: High protection INT: International version
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

-FH: High-protection models with enhanced stability, special for environments prone to cutting fluid and dust.

-INT: -INT products are covered by our global warranty system.

Description of nameplate

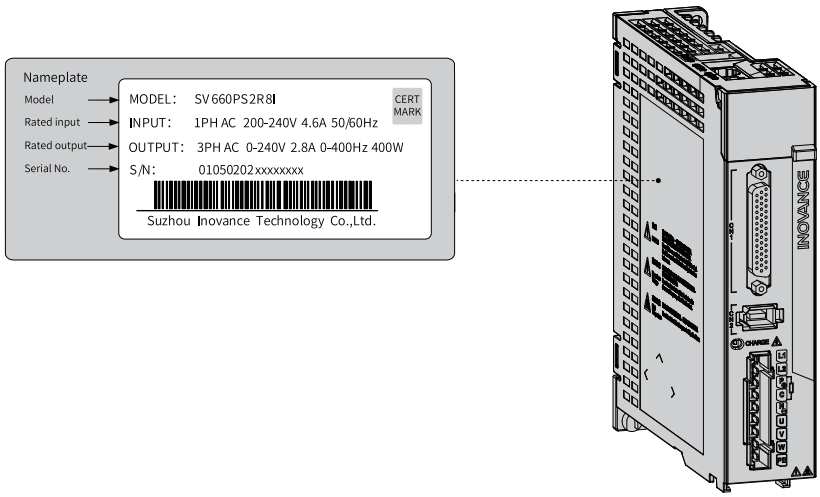


Figure 3-1 Nameplate

Description of production serial number

01050202 4 S 7 00001
① ② ③ ④ ⑤

① **Internal code** Product material code	③ **Year** 9: 2009 A: 2010 ... N: 2021 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: The S/N 010502024P700001 indicates that the drive is manufactured in July, 2022.

3.1.2 Components

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

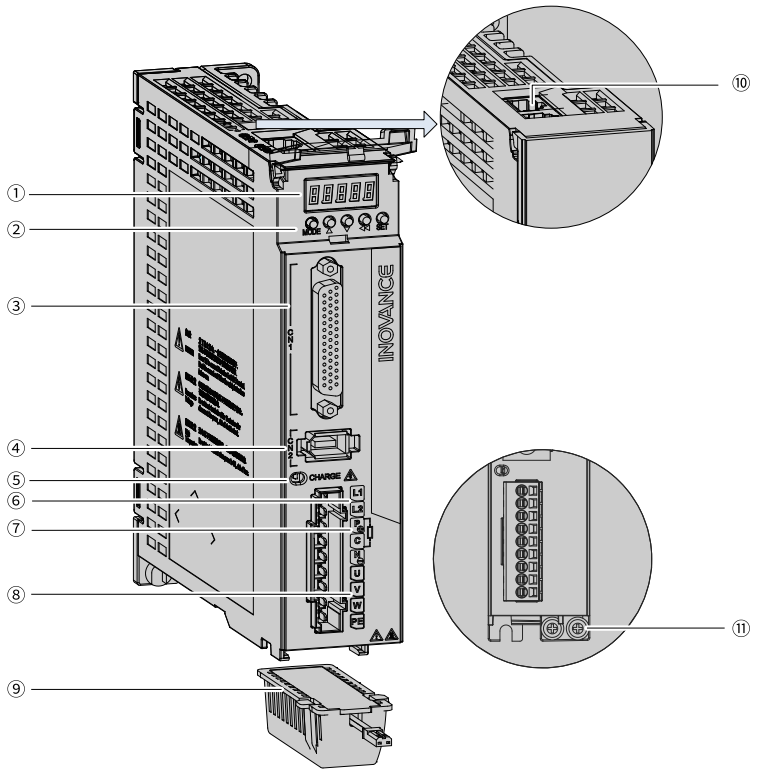


Figure 3-2 Components of servo drives in size A (SV660PS1R6I and SV660PS2R8I)

Table 3–1 Components of servo drives in size A (SV660PS1R6I and SV660PS2R8I)

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 modifications and enter the next menu.
③	CN1 (control terminal)	Used for reference input signals and other I/O signals
④	CN2 (terminal for connecting the encoder)	Connected to the motor encoder.
⑤	CHARGE (bus voltage indicator)	Indicates that electric charges are present in the bus capacitor. When this indicator is on, it indicates that electric charge may still exist in the internal capacitor of the servo unit even if the main circuit power supply is off. To avoid electric shock, do not touch the power terminals when this indicator is on.
⑥	L1, L2 (power input terminals)	See the nameplate for the rated voltage level.

No.	Component	Description
⑦	$P_{\oplus}$ and $N_{\ominus}$ (Bus terminals)	Used by the common DC bus for multiple drives. Contact Inovance for technical support.
	$P_{\oplus}$, C (Terminals for connecting external regenerative resistors)	If an external braking resistor is needed, connect it between terminals $P_{\oplus}$ and C.
⑧	U, V, W (terminals for connecting the servo motor)	Used to connect U, V, and W phases of the motor.
⑨	Battery box location	Used to hold the battery box of the absolute encoder
⑩	CN3, CN4 (communication terminals)	Connected to RS232 and RS485 host controllers in parallel.
⑪	Grounding terminal	Connected to the grounding terminal of the motor/power supply 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 $P_{\oplus}$ and C.

3.1.2.2 Drives in Size B (Rated Power: 0.75 kW)

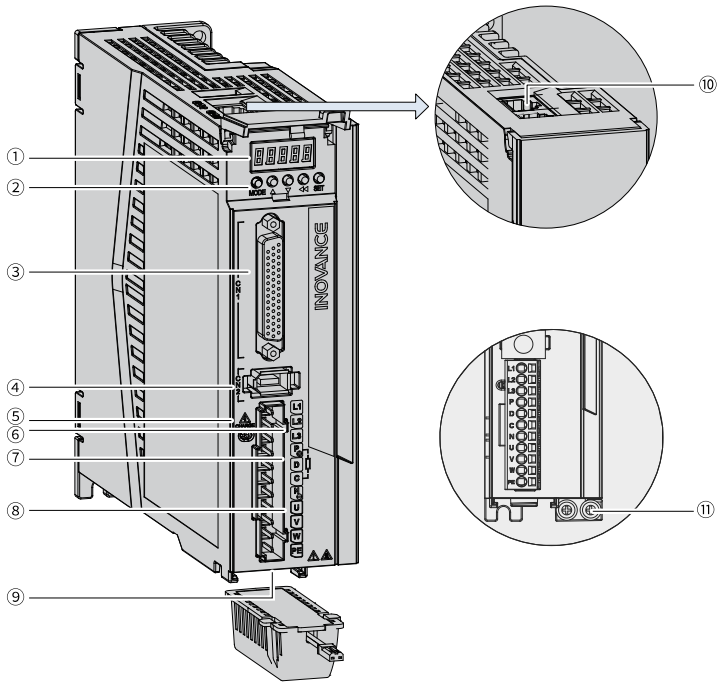


Figure 3-3 Components of servo drives in size B (SV660PS5R5I)

Table 3–2 Components of servo drives in size B (SV660PS5R5I)

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 modifications and enter the next menu.
③	CN1 (control terminal)	Used for reference input signals and other I/O signals
④	CN2 (terminal for connecting the encoder)	Connected to the motor encoder.
⑤	CHARGE (bus voltage indicator)	Indicates that electric charges are present in the bus capacitor. When this indicator is on, it indicates that electric charge may still exist in the internal capacitor of the servo unit even if the main circuit power supply is off. To avoid electric shock, do not touch the power terminals when this indicator is on.
⑥	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.
⑦	P⊕ and N⊖ (Bus terminals)	Used by the common DC bus for multiple drives. Contact Inovance for technical support.
	P⊕ D, C (Terminals for connecting external regenerative resistors)	When an external braking resistor is required (first remove the jumper between P⊕ and D), connect the braking resistor between P⊕ and C. If external braking resistor is not required, short terminals P⊕ and D. Drives in size A are not equipped with built-in braking resistor or jumper bar between terminals P⊕ and D.
⑧	U, V, W (terminals for connecting the servo motor)	Used to connect U, V, and W phases of the motor.
⑨	Battery box location	Used to hold the battery box of the absolute encoder
⑩	CN3, CN4 (communication terminals)	Connected to RS232 and RS485 host controllers in parallel.
⑪	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)

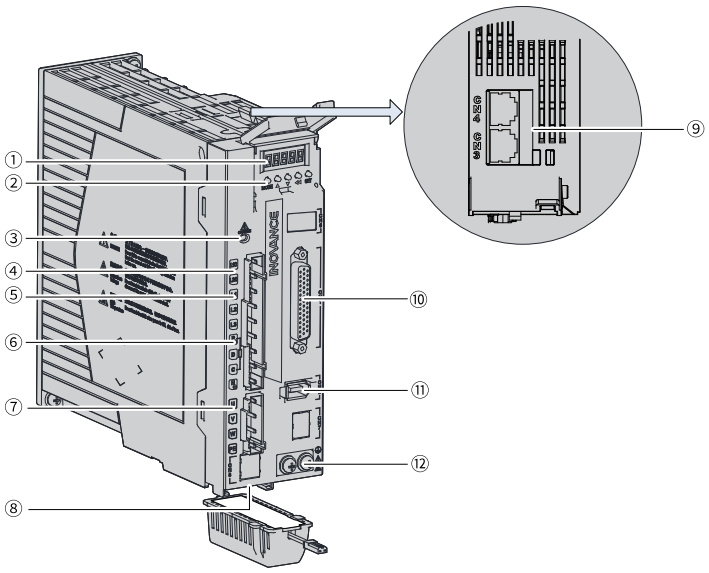


Figure 3-4 Components of servo drives in size C (SV660PS7R6I) and size D (SV660PS012I)

Table 3–3 Description of components (size C: SV660FS7R6I/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 modifications and enter the next menu.
③	CHARGE (bus voltage indicator)	Indicates that electric charges are present in the bus capacitor. When this indicator is on, it indicates that electric charge may still exist in the internal capacitor of the servo unit even if the main circuit power supply is off. To avoid electric shock, do not touch the power terminals when this indicator is on.
④	L1C, L2C (control circuit power input terminals)	Used to provide power supply to the control circuit as per the rated voltage class on the nameplate
⑤	L1, L2, L3 (main circuit power input terminals)	Used as the power input terminals for a three-phase 220 V servo drive. See the nameplate for the rated voltage class.
⑥	P ⊕ D, C (Terminals for connecting external regenerative resistors)	When an external braking resistor is required (first remove the jumper between P ⊕ and D), connect the braking resistor between P ⊕ and C. If external braking resistor is not required, short terminals P ⊕ and D. Drives in size A are not equipped with built-in braking resistor or jumper bar between terminals P⊕ and D.
	P ⊕ and N ⊖ (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.

No.	Component	Description
⑧	Battery box location	Used to hold the battery box of the absolute encoder
⑨	CN3, CN4 (communication terminals)	Connected to RS232 and RS485 host controllers in parallel.
⑩	CN1 (control terminal)	Used for reference input signals and other I/O signals
⑪	CN2 (terminal for connecting the encoder)	Connected to the motor encoder.
⑫	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.
- For models S7R6 and S012, no derating is required when a single-phase power supply is connect to L1 and L2.

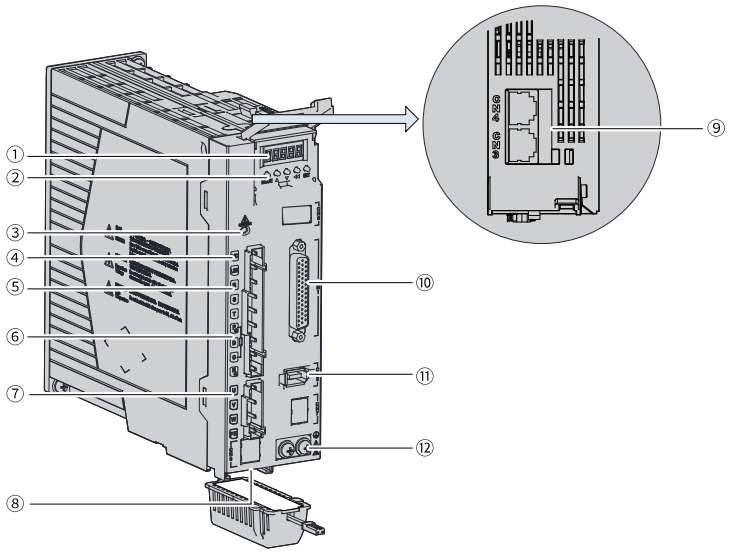


Figure 3-5 Components of servo drives in size C (SV660PT3R5I and SV660PT5R4I) and size D (SV660PT8R4I and SV660PT012I)

Table 3–4 Components of servo drives in size C (SV660PT3R5I and SV660PT5R4I) and size D (SV660PT8R4I and SV660PT012I)

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 modifications and enter the next menu.

No.	Component	Description
③	CHARGE (bus voltage indicator)	Indicates that electric charges are present in the bus capacitor. When this indicator is on, it indicates that electric charge may still exist in the internal capacitor of the servo unit even if the main circuit power supply is off. To avoid electric shock, do not touch the power terminals when this indicator is on.
④	L1C, L2C (control circuit power input terminals)	Used to provide power supply to the control circuit as per the rated voltage class on the nameplate
⑤	R, S, T (main circuit power input terminals)	Used as the power input terminals for a three-phase 380 V servo drive. See the nameplate for the rated voltage class.
⑥	P ⊕ D, C (Terminals for connecting external regenerative resistors)	When an external braking resistor is required (first remove the jumper between P ⊕ and D), connect the braking resistor between P ⊕ and C. If external braking resistor is not required, short terminals P ⊕ and D. Drives in size A are not equipped with built-in braking resistor or jumper bar between terminals P⊕ and D.
	P ⊕ and N ⊖ (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 (communication terminals)	Connected to RS232 and RS485 host controllers in parallel.
⑩	CN1 (control terminal)	Used for reference input signals and other I/O signals
⑪	CN2 (terminal for connecting the encoder)	Connected to the motor encoder.
⑫	Grounding terminal	Connected to the grounding terminal of the motor/power supply for grounding purpose.

3.1.2.4 Size E Drives (rated power: 5.0 kW to 7.5 kW)

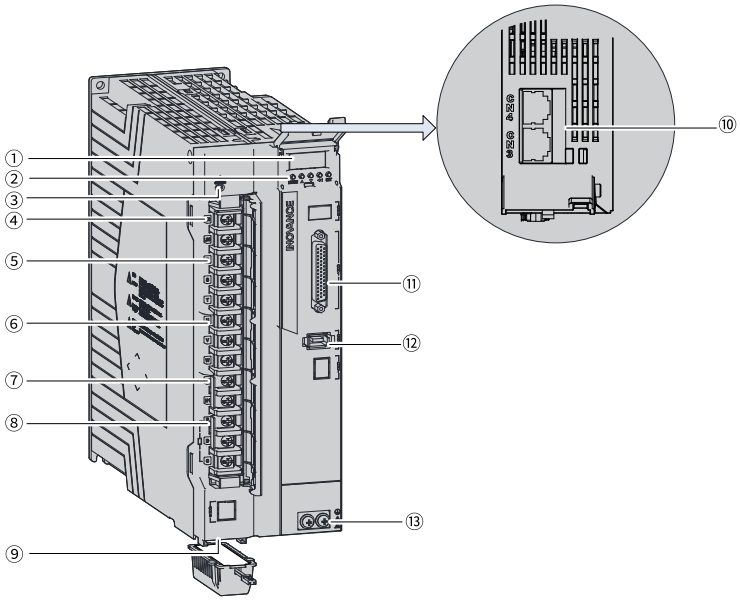


Figure 3-6 Components of servo drives in size E (SV660PT017I, SV660PT021I, and SV660PT026I)

Table 3–5 Description of components (SV660PT017I, SV660PT021I, SV660PT026I)

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 modifications and enter the next menu.
③	CHARGE (bus voltage indicator)	Indicates that electric charges are present in the bus capacitor. When this indicator is on, it indicates that electric charge may still exist in the internal capacitor of the servo unit even if the main circuit power supply is off. To avoid electric shock, do not touch the power terminals when this indicator is on.
④	L1C, L2C (control circuit power input terminals)	Used to provide power supply to the control circuit as per the rated voltage class on the nameplate
⑤	R, S, T (main circuit power input terminals)	Used as the power input terminals for a three-phase 380 V servo drive. See the nameplate for the rated voltage class.
⑥	U, V, W (terminals for connecting the servo motor)	Used to connect U, V, and W phases of the motor.
⑦	N2, N1 (terminals for connecting an external reactor)	N1 is shorted to N2 with a jumper by default. To suppress power supply harmonic(s), remove the jumper and connect an external DC reactor between N1 and N2.
⑧	P⊕ D, C (Terminals for connecting external regenerative resistors)	When an external braking resistor is required (first remove the jumper between P⊕ and D), connect the braking resistor between P⊕ and C. If external braking resistor is not required, short terminals P⊕ and D. Drives in size A are not equipped with built-in braking resistor or jumper bar between terminals P⊕ and D.
⑨	Battery box location	Used to hold the battery box of the absolute encoder
⑩	CN3, CN4 (communication terminals)	Connected to RS232 and RS485 host controllers in parallel.
⑪	CN1 (control terminal)	Used for reference input signals and other I/O signals
⑫	CN2 (terminal for connecting the encoder)	Connected to the motor encoder.
⑬	Grounding terminal	Connected to the grounding terminal of the motor/power supply for grounding purpose.

3.2 Information of MS1-R Series Servo Motor

3.2.1 Model and Nameplate

Model Description

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 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 A3: 23-bit multi-turn absolute encoder
⑦ **Shaft connection mode** 3: Solid shaft, with key and threaded hole	⑧ **Brake and oil seal** 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	⑨ **Sub-series** R: R version ⑩ **Non-standard function**[1] _: Standard

Note

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

Description of nameplate

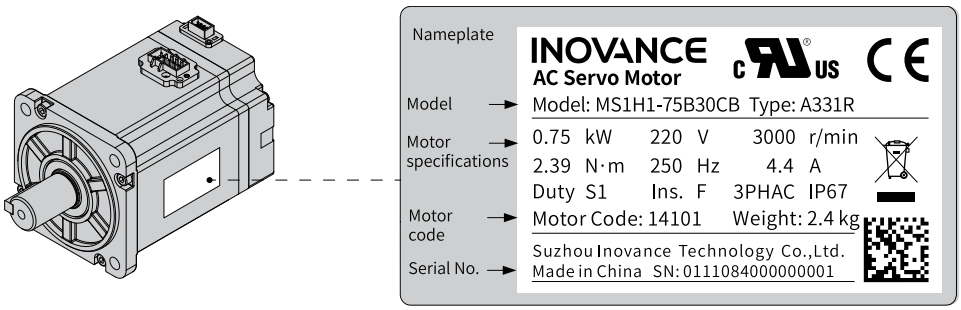


Figure 3-7 Nameplate

3.2.2 Components

Motor (frame size 40)

- **Terminal-type motor**

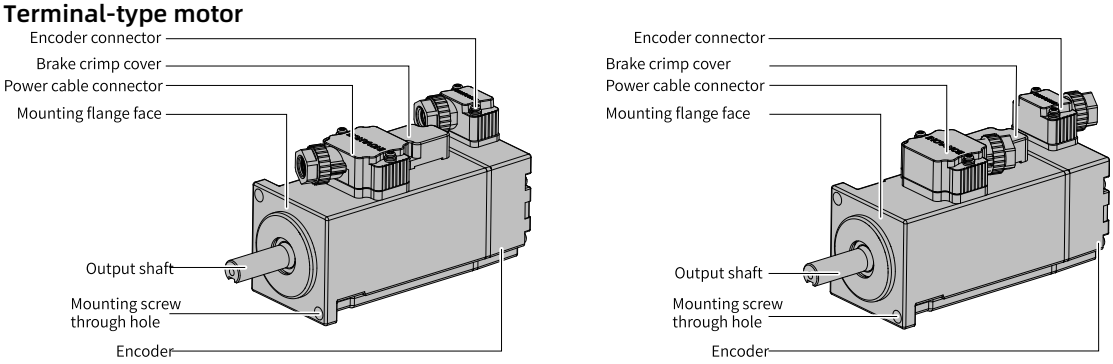


Figure 3-8 Components of a terminal-type motor (Left: motor with front cable outlet; Right: motor with rear cable outlet)

- **Flying leads motor**

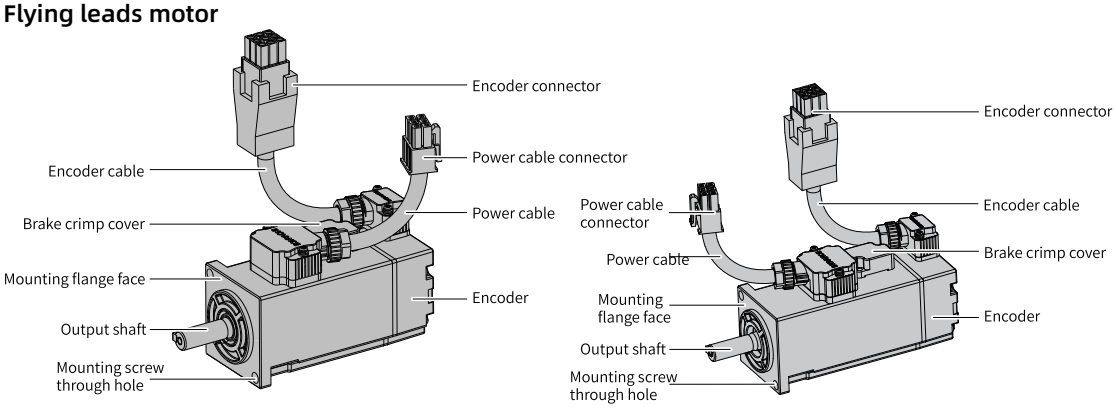


Figure 3-9 Components of the flying leads motor (left: 50 W flying leads motor, right: 100 W flying leads motor)

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 drawings.

Motor (frame sizes 60/80)

- **Terminal-type motor**

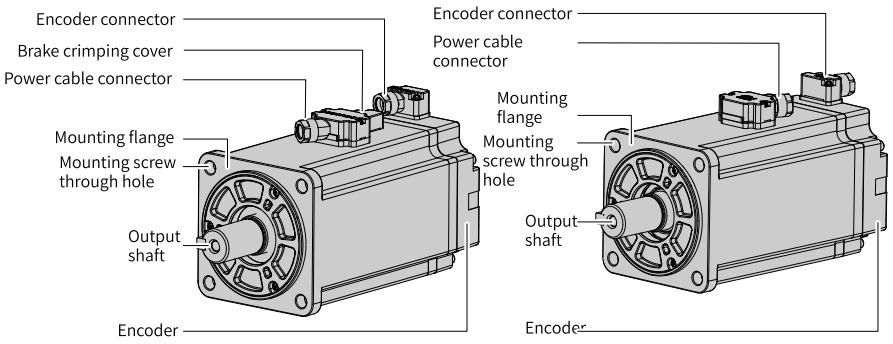


Figure 3-10 Components of a terminal-type motor (Left: motor with front cable outlet; Right: motor with rear cable outlet)

- **Flying leads motor**

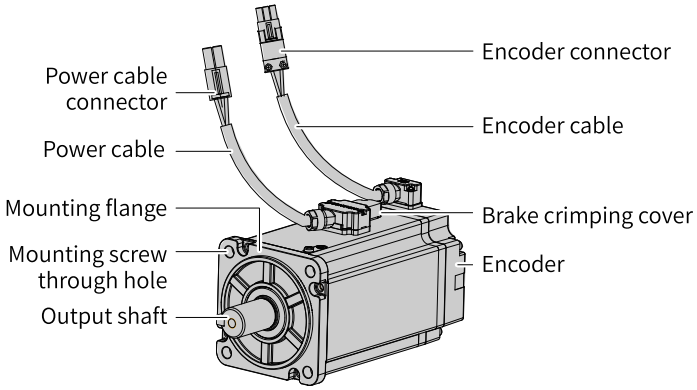


Figure 3-11 Components of the flying leads motor (front cable outlet as standard)

Motor (frame sizes 100, 130, and 180)

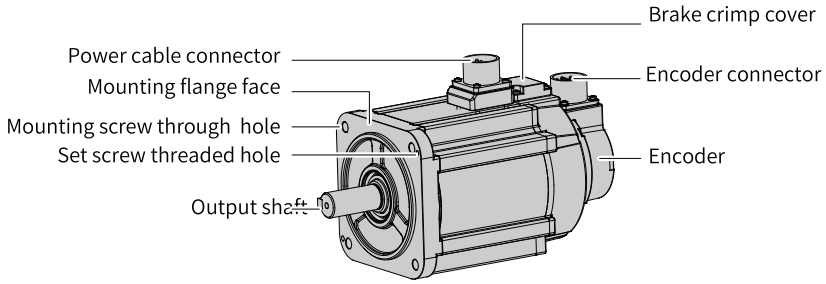


Figure 3-12 Components of motors in frame sizes 100/130/180

3.3 Information of MS1-R Series Servo Motor with Battery-Free Encoder

3.3.1 Model 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

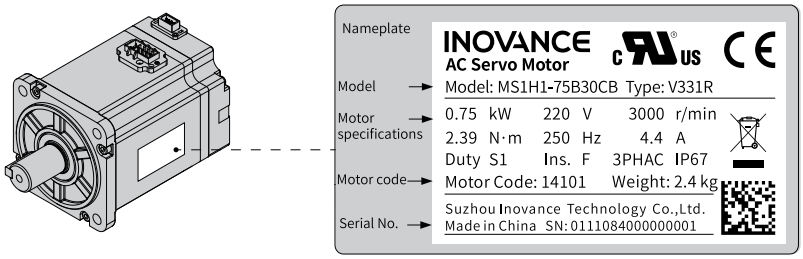


Figure 3-13 Nameplate

3.3.2 Components

Motor with frame sizes 60/80

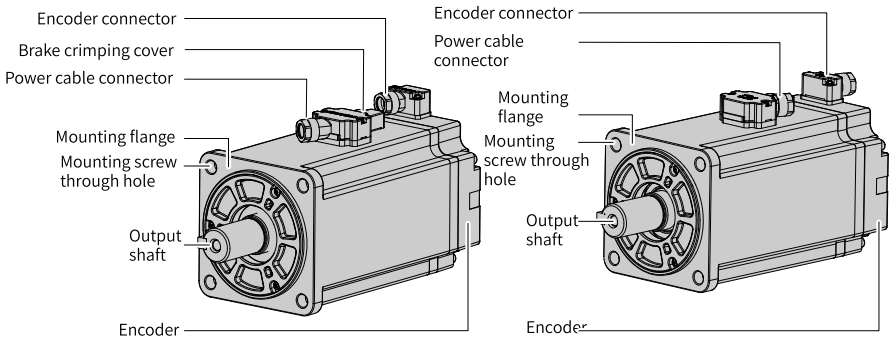


Figure 3-14 Components of the motor (frame sizes 60/80) (Left: Front outlet; Right: Rear outlet)

Motor with frame sizes 100/130/180

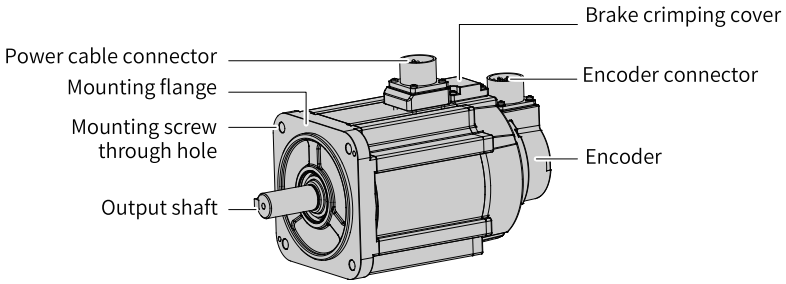


Figure 3-15 Components of the motor (frame sizes 100/130/180)

4 System Connection

4.1 System Connection Diagram

Caution

During wiring and commissioning, to prevent electric shock and protect the drive from damage, do not plug or unplug terminals with power on.

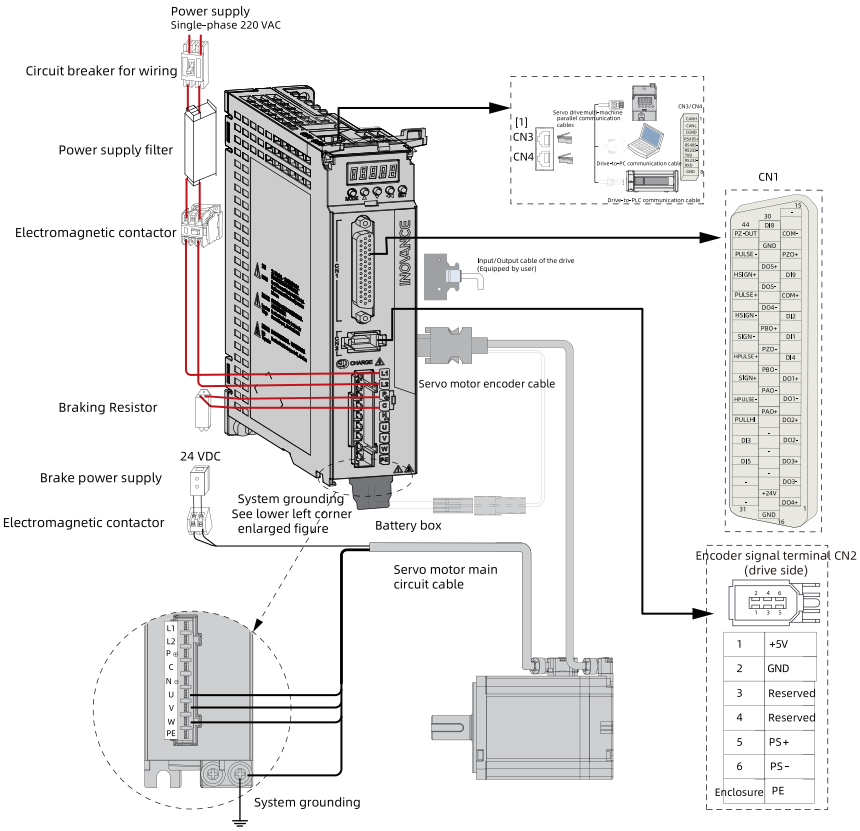


Figure 4-1 Example wiring of a single-phase 220 V system

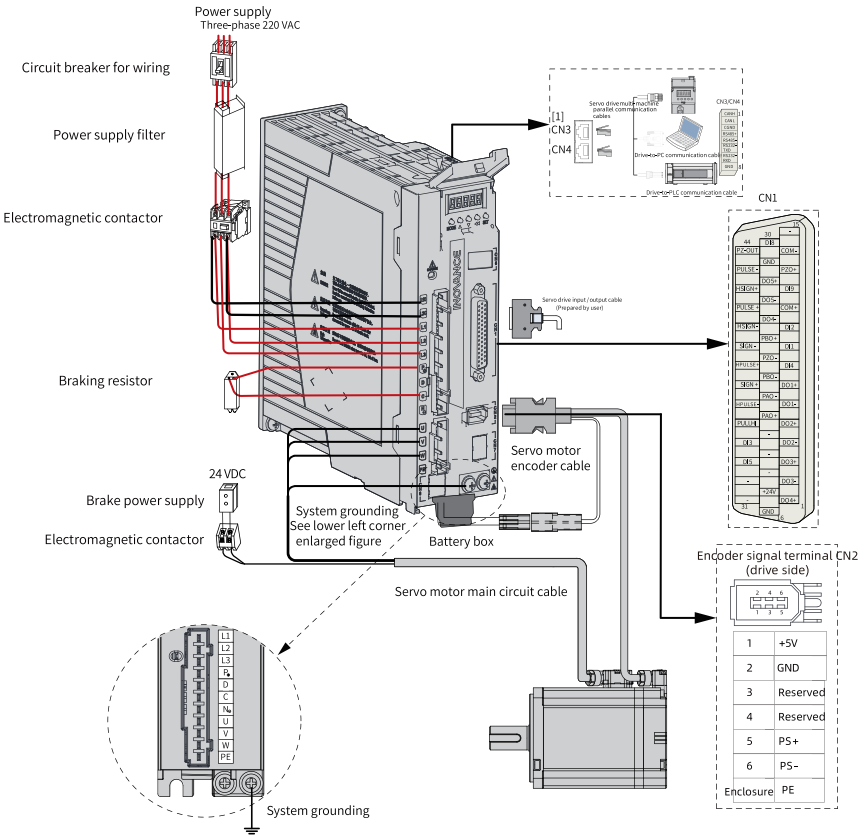


Figure 4-2 Wiring example of a three-phase 220 V system

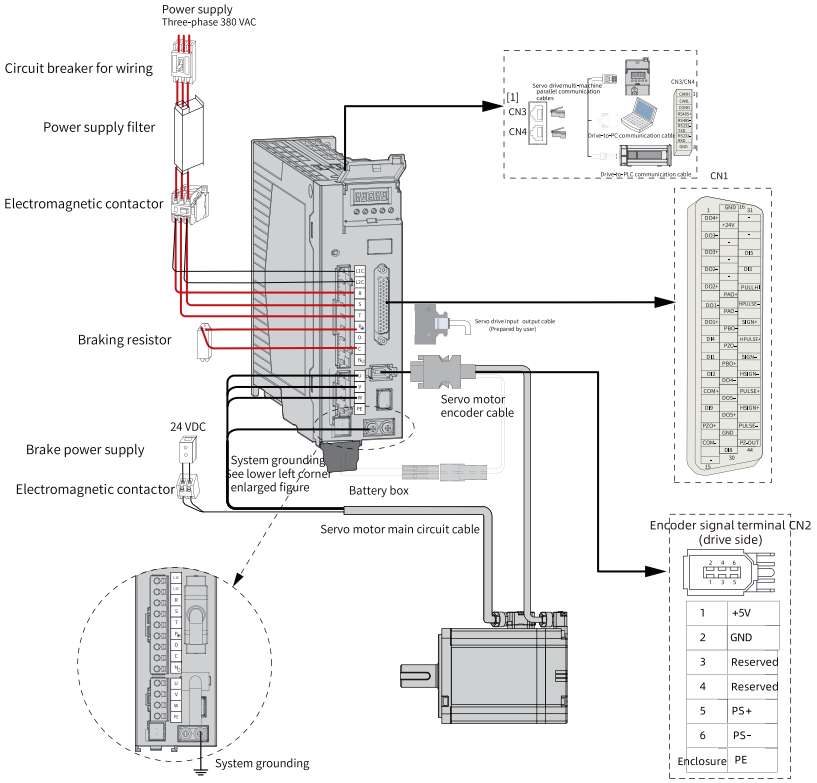


Figure 4-3 三相380V系统配线图举例

Note

- When an external braking resistor is required (first remove the jumper between P⊕, and D, and connect it to P⊕ and C. If external brake resistor is not required, short terminals P⊕ and D. Only Size A models do not have the built-in resistor or the jumper bar for short-connecting terminals P⊕ and D as the standard. Before you use these models, ensure that braking resistor parameters H02.25, H02.26, and H02.27 are correctly configured.
- CN3 and CN4 are identical communication ports with the same pin definition, and either can be used. Among them, only CANopen model supports CANopen communication, and CANlink model supports CANlink communication.

4.2 System Composition

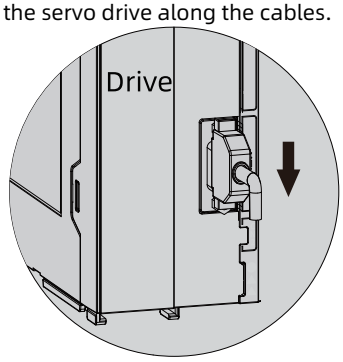
- The servo drive is directly connected to an industrial power supply, with no isolation such as a transformer. A fuse or circuit breaker therefore must be connected to the input power supply to prevent electric shock in the servo system. For the sake of safety, install a residual current device (RCD) to provide protections against overload and short circuit or a specialized RCD to protect the grounding cable.
- 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.
- When configuring external control power supply or brake power supply, pay attention to the following.
  - When multiple drives are paralleled to share the same power supply or multiple brakes operate simultaneously, calculate the total power needed to prevent drive system errors due to insufficient power capacity.
  - The brake power supply must be a 24 VDC power supply, with power rating matching the specific motor model and meeting the technical requirements of the braking device.
  - External control power supply and brake power supply must be independently powered to prevent the brake from disturbing control signals.

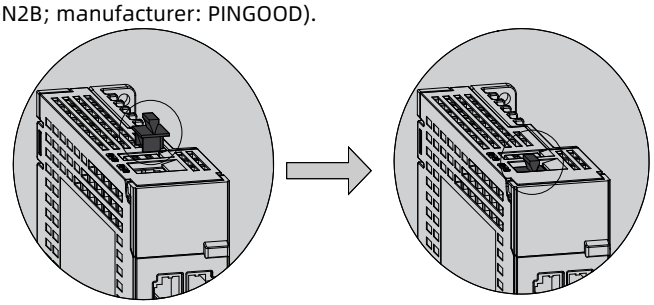
5 Installation

5.1 Fundamental Safety Instructions

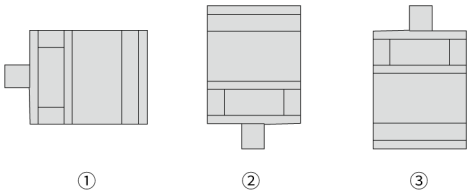
5.1.1 Precautions for Installing the Drive

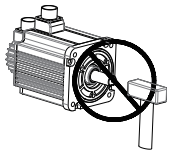
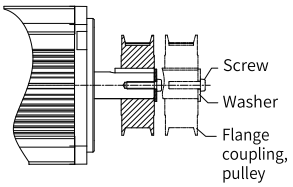
Table 5–1 Installation precautions

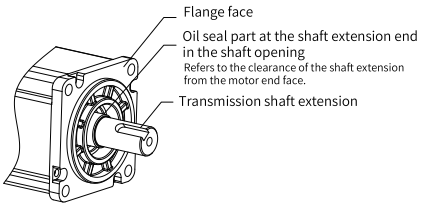
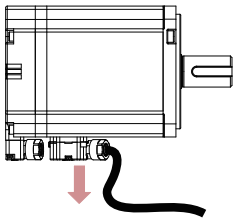
Item	Description
Direction	• Install the drive vertically and upward to facilitate heat dissipation. For installation of multiple drives inside the cabinet, install them side by side. For dual-row installation, install an air guide plate. • Make sure the drive is installed vertically to the wall. Cool the drive down with natural convection or a cooling fan. Secure the drive to the mounting surface through two to four mounting holes (the number of mounting holes depends on the capacity of the drive). • Install the 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.
Routing requirements	As shown in the figure below, route the servo drive cables downwards to prevent liquid from flowing into the servo drive along the cables.  Route the cables downwards.

Item	Description
Dust-proof cover for top ports (standard: inserted to the ports and delivered together with the drive)	Insert the dust-proof cover into the port not in use. This is to prevent unwanted objects (such as solids or liquids) from falling into the drive and causing faults. Each drive is delivered with two dust-proof covers inserted into the ports by default. You can place an order for more dust-proof covers as needed (model: NEX-02-N2B; manufacturer: PINGOOD).  **Note:** • Dust-proof cover: Prevents unwanted objects, such as solids or liquids, from falling into the drive and resulting in faults. • Dust-proof covers are delivered along with the drive. Keep the dust-proof covers in a proper place.
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 Precautions for Installing the Motor

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.

Item	Description
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. 
Installation Direction	The servo motor can be installed horizontally or vertically.

Item	Description
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

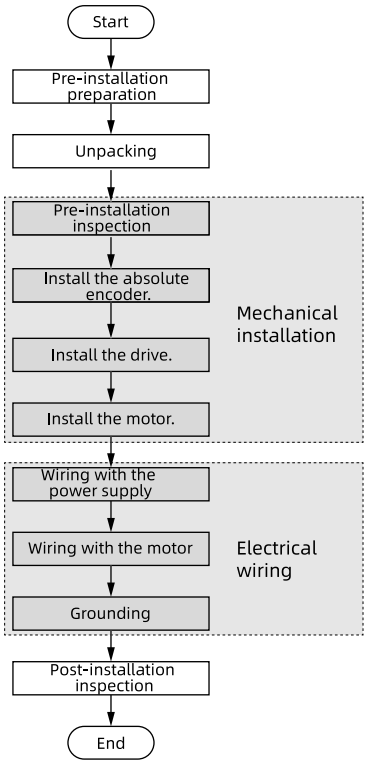


Figure 5-1 Installation Flowchart

Note

- The figure shows the recommended installation procedure, which can be adjusted under the premise that the installation quality is ensured.
- See the electrical wiring diagram in *" Wiring" on page 76*.

5.3 Preparations Before Installation

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 Installation Environment Requirements

5.3.2.1 Installation Environment of the Drive

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.

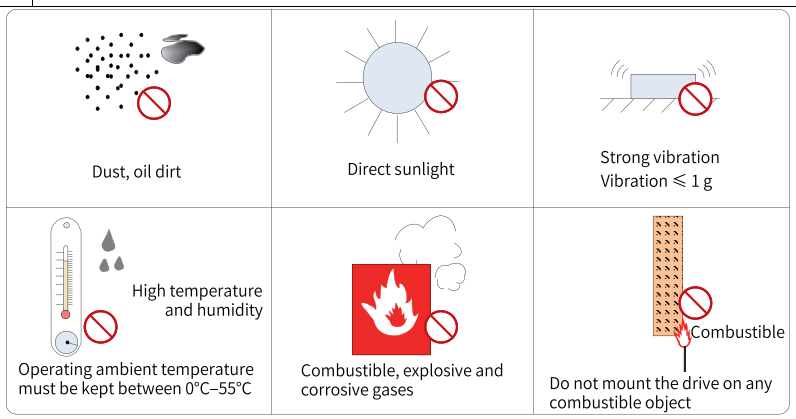


Figure 5-2 Environment requirements

5.3.2.2 Installation Environment of the Motor

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 Installation Space Requirements

5.3.3.1 Installation Clearance of the Drive

Caution

To prevent condensation and conductive objects from affecting the functions and performance of the drive, install the drive into an IP54 control cabinet compliant with EN60529. If you can ensure that there is no condensation or conductive objects on the installation site, use a control cabinet with lower protection rating.

Drives with different power ratings require different installation clearances. It is recommended to reserve a horizontal clearance of at least 10 mm (0.39 in.) on both sides among drives, a horizontal clearance of at least 20 mm (0.79 in.) on both sides between the drive and control cabinet, and a vertical clearance of at least 50 mm (1.97 in.) on both sides.

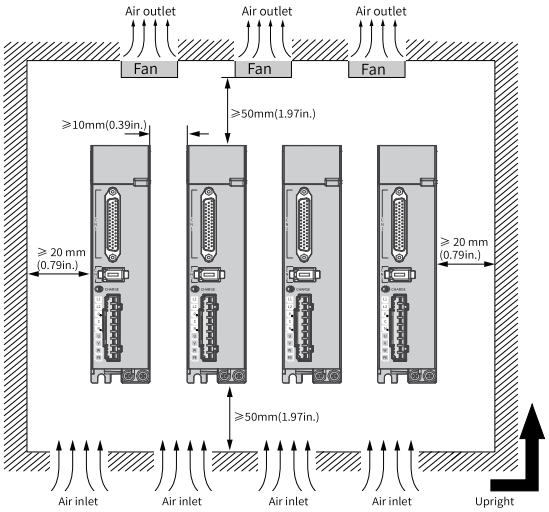


Figure 5-3 Clearance for side-by-side installation

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.

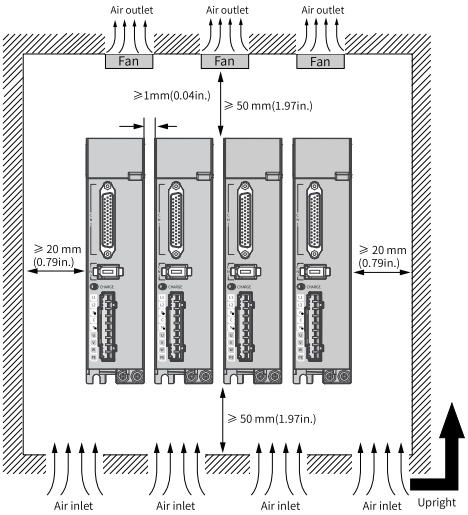


Figure 5-4 Clearance for compact installation

Servo drives rated at 1.0 kW to 3 kW (size C and size D) support close between every two servo drives, without the need for derating.

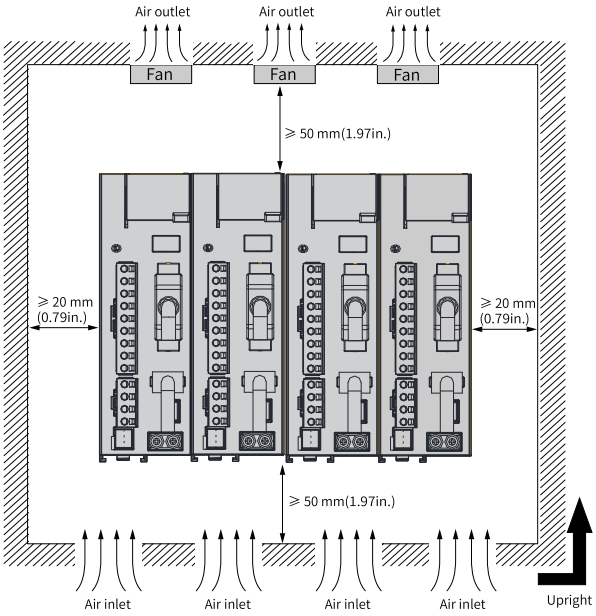


Figure 5-5 Close installation

Note

Exhaust fan airflow > n × 5 cfm, and air inlet area > n × 1580 mm², where n is the number of parallel units.

5.3.3.2 Installation Clearance of the Motor

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 *"5.5.4 Installing the Motor" on page 72*. To ensure adequate heat dissipation, at least 100 mm spacing between adjacent parts is recommended 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

Drives in Size A (rated Power: 0.2 kW to 0.4 kW): SV660PS1R6I, SV660PS2R8I

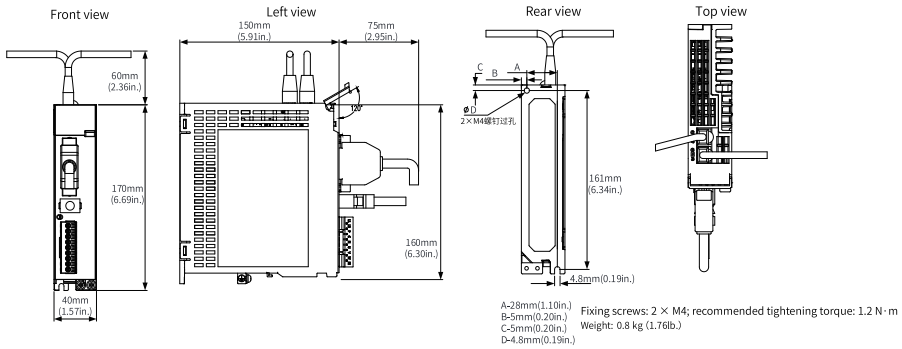


Figure 5-6 Dimensions of servo drives in size A

Drives in Size B (rated Power: 0.75 kW): SV660PS5R5I

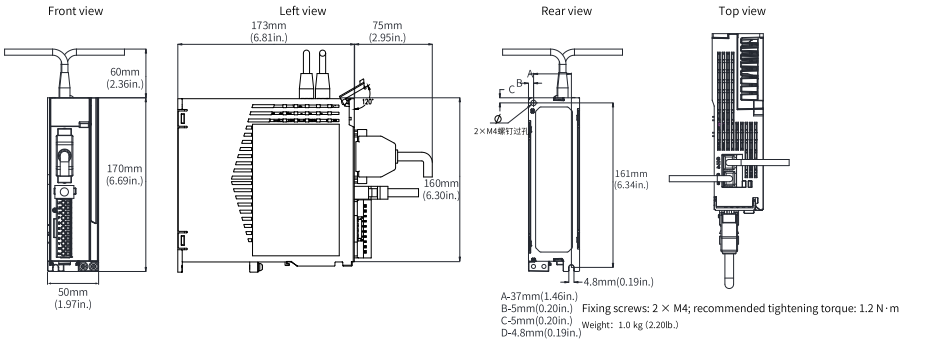


Figure 5-7 Dimensions of servo drives in size B

Servo drives in size C (rated power: 1.0 kW to 1.5 kW): SV660PS7R6I, SV660PT3R5I, and SV660PT5R4I

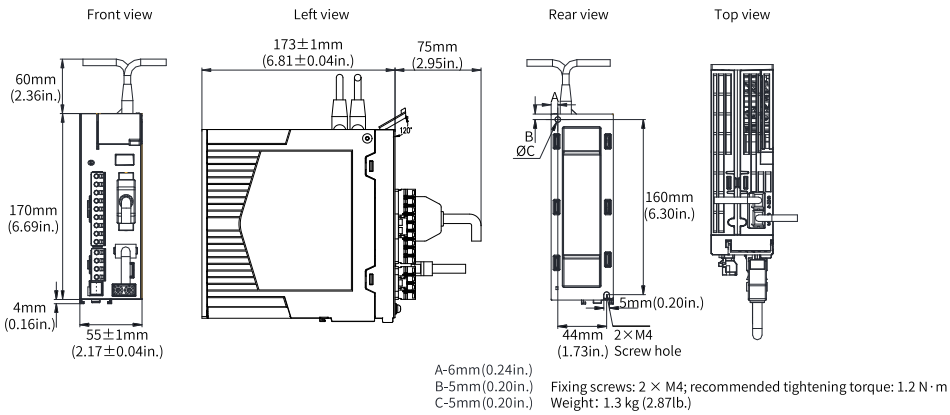


Figure 5-8 Dimension drawing of servo drives in Size C

Servo drives in size D (rated power: 1.5 kW to 3.0 kW): SV660PS012I, SV660PT8R4I, and SV660PT012I

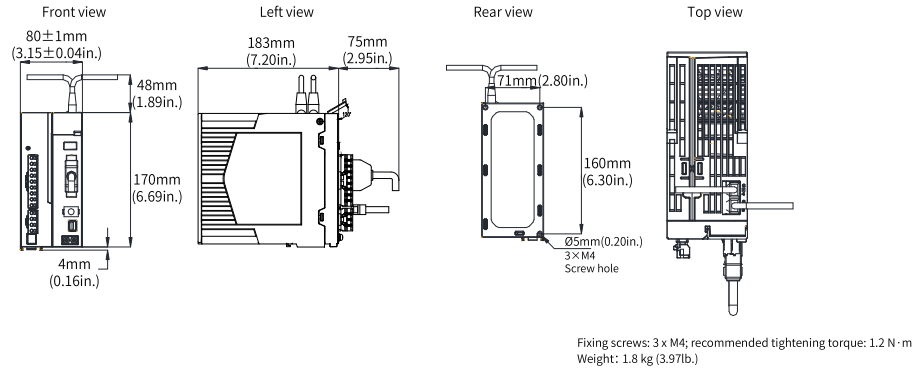


Figure 5-9 Dimension drawing of servo drives in Size D

Servo drives in size E (rated power: 5.0 kW to 7.5 kW): SV660PT017I, SV660PT021I, and SV660PT026I

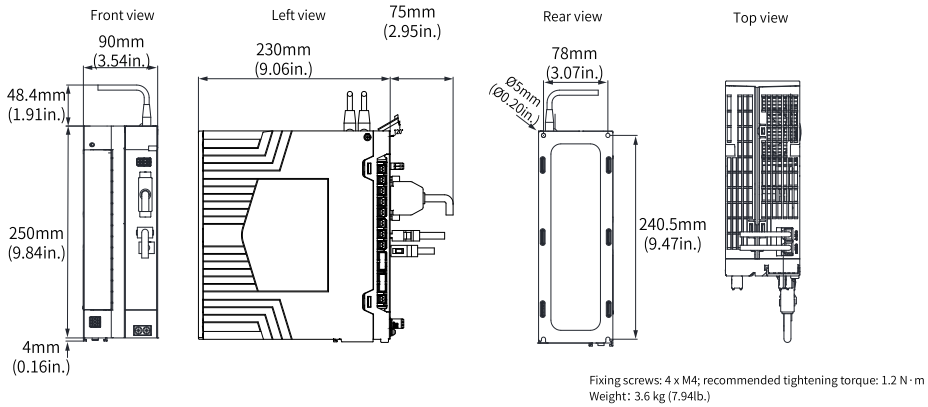


Figure 5-10 Dimension drawing of servo drives in Size E

5.3.5 Option Installation Requirements

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.

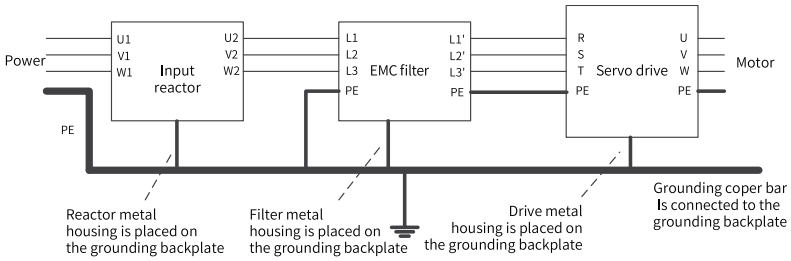


Figure 5-11 Installing the AC input reactor

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.

The following figure shows the connection of the EMC filter.

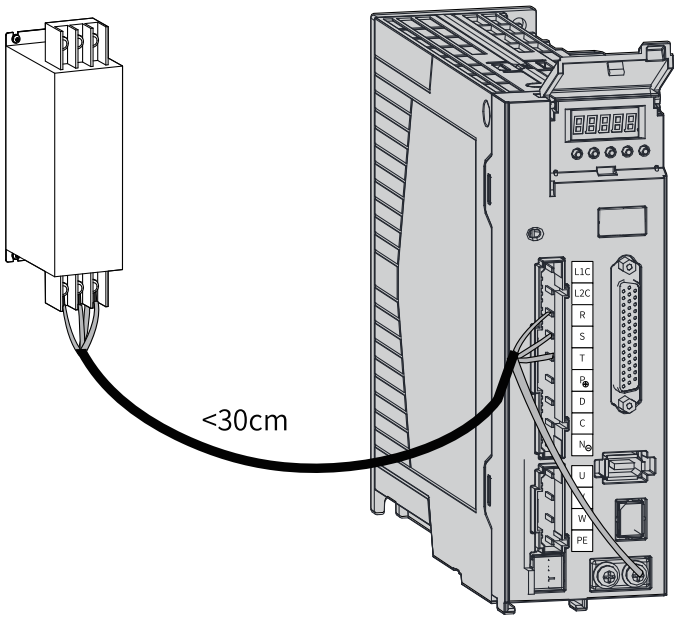


Figure 5-12 Installing the filter

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.

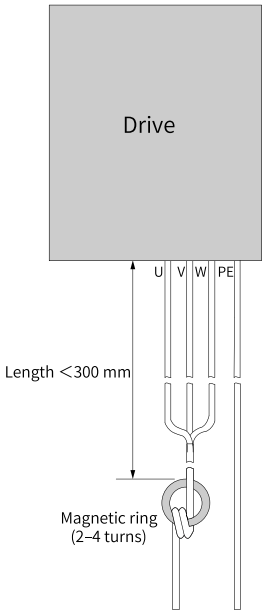


Figure 5-13 Installing the magnetic ring

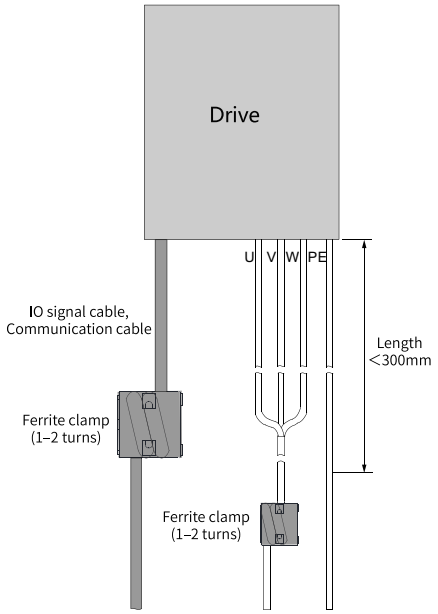


Figure 5-14 Installing the ferrite clamp

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, Storage, and Handling

5.4.1 Unpacking of the 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 64*. The deliverables include the product, cushion, carton box, and screw bag, as shown in *"Figure 5-15" on page 64* .
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

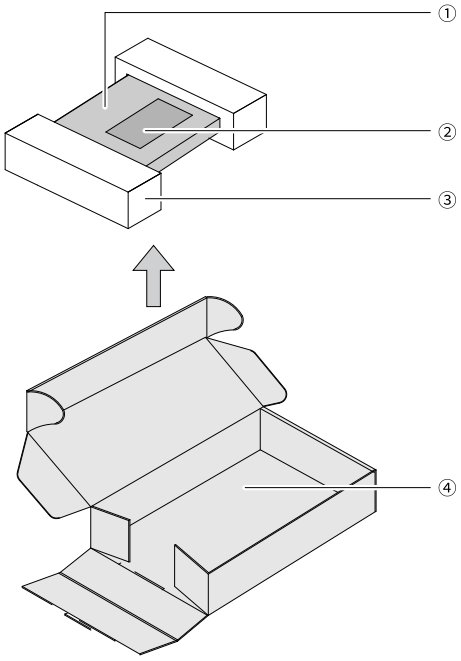


Figure 5-15 Packaging components

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

Table 5–4 Terminal accessory kit list

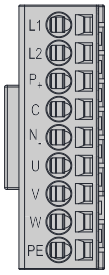
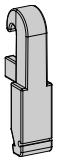
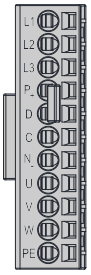
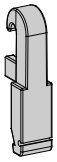
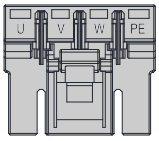
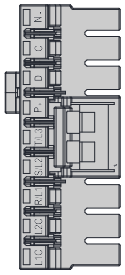
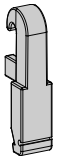
Material code	Diagram	Name	Quantity
98050331		F9A-5.0-09P-A-0419	1
		NFS-004	1
	-	Self-sealing bag	1
	-	QR code label	1
98050332		F9A-5.0-11P-A-0419	1
		NFS-004	2
	-	Self-sealing bag	1
	-	QR code label	1
98050333		F9A-7.5-04P-A-0416	1
		F9A-7.5-09P-A-0420	1
		NFS-004	2
	-	Self-sealing bag	1
	-	QR code label	1

Table 5–5 Material code of the accessory kit 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

Note

SV660 series servo drives share the same terminal accessory kit.

5.4.2 Unpacking, Storage, and Handling of the Motor

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.

Post-unpacking inspection

Check the following items upon unpacking.

Item	Remarks
Check whether the delivered product is consistent 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 delivered is in good condition. If there is any missing or damage, 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

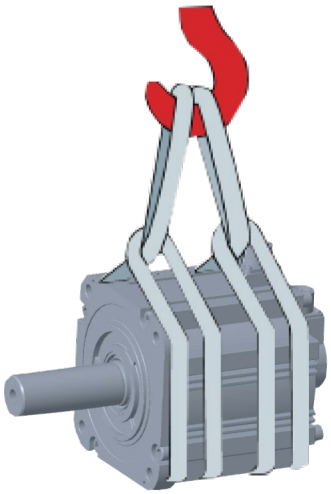


Figure 5-16 Hoisting and handling the motor with dedicated tools



Figure 5-17 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.



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 in temperatures between -20℃ to +60℃. 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 for more than six months must meet the following requirements.

Table 5–6 Storage environment requirements

Item	Description
Ambient temperature	-20℃ to +60℃
Maximum relative humidity	< 60% (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.

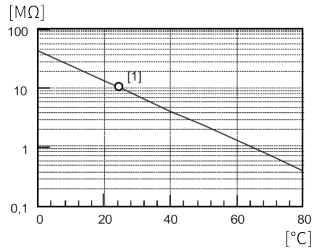


Figure 5-18 Curve of relationship between the insulation resistance and temperature

Note

- Dramatic temperature change;
- Direct sunlight;
- High temperature during storage;
- Put a desiccant into the package and avoid preceding conditions.

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.

The following figure describes the drain wire color of the battery box.

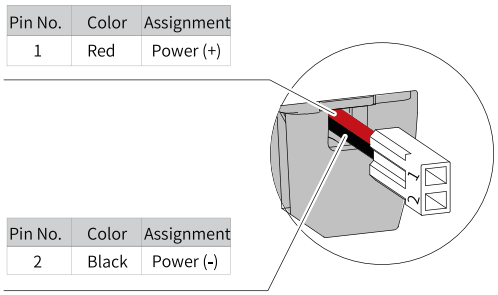


Figure 5-19 Drain wire colors of the battery box

The optional S6-C4A battery box contains the following items:

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

Installing the battery box

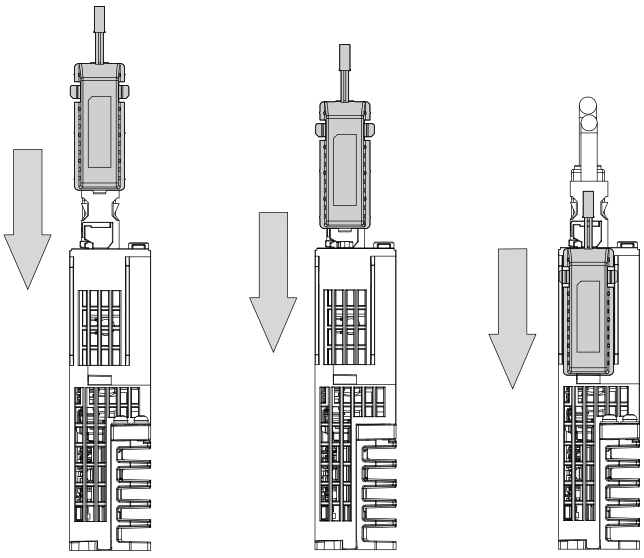
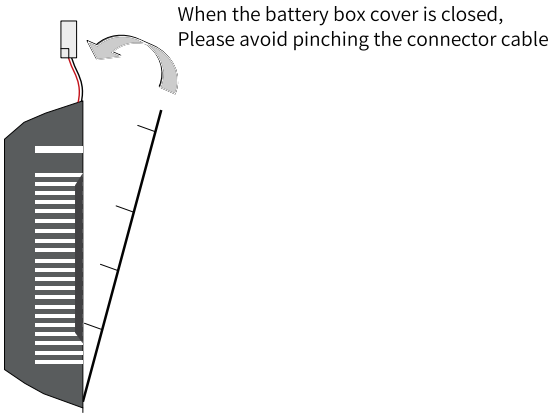


Figure 5-20 Installing the battery box (bottom view)

Removing the battery box

The battery may generate leakage liquid after long-term use. Replace it every two years. Remove the battery box based on the procedure shown in the preceding figure, but in the reverse order.

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



Improper use of the battery may result in liquid leakage which corrodes the components or leads to 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 70*) 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.

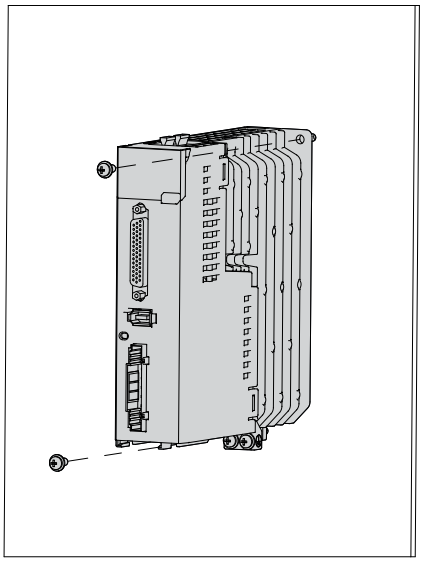


Figure 5-21 Backplate mounting diagram

Note

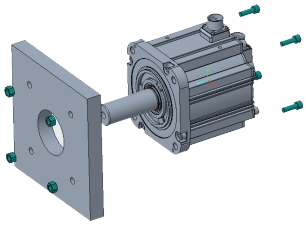
- Servo drives in sizes A, B, and C are secured by two screws, with one screw on the top and the other one at the bottom.
- Servo drives in size D are secured by three screws, with two screws on the top and another one at the bottom.
- Servo drives in size E are secured by four screws, with two screws on the top and the other two at the bottom.
- M4 screw, tightening torque 1.2 N·m.

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 73*.
- 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.	□

No.	Item	Compliance
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 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, solenoid and electromagnetic contactor coils.
   d. Do not share the power supply with an electric welder or an electric 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.

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 recommended 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.

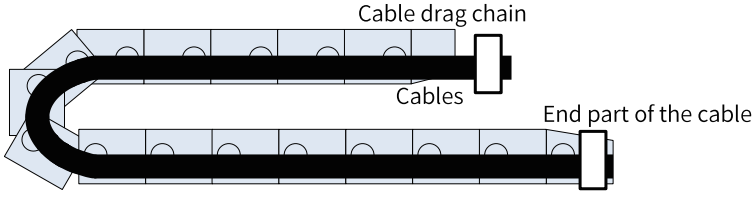


Figure 6-1 Cable drag chain

6.2 Electrical Wiring Diagram

6.2.1 Wiring diagram of the Position Control Mode

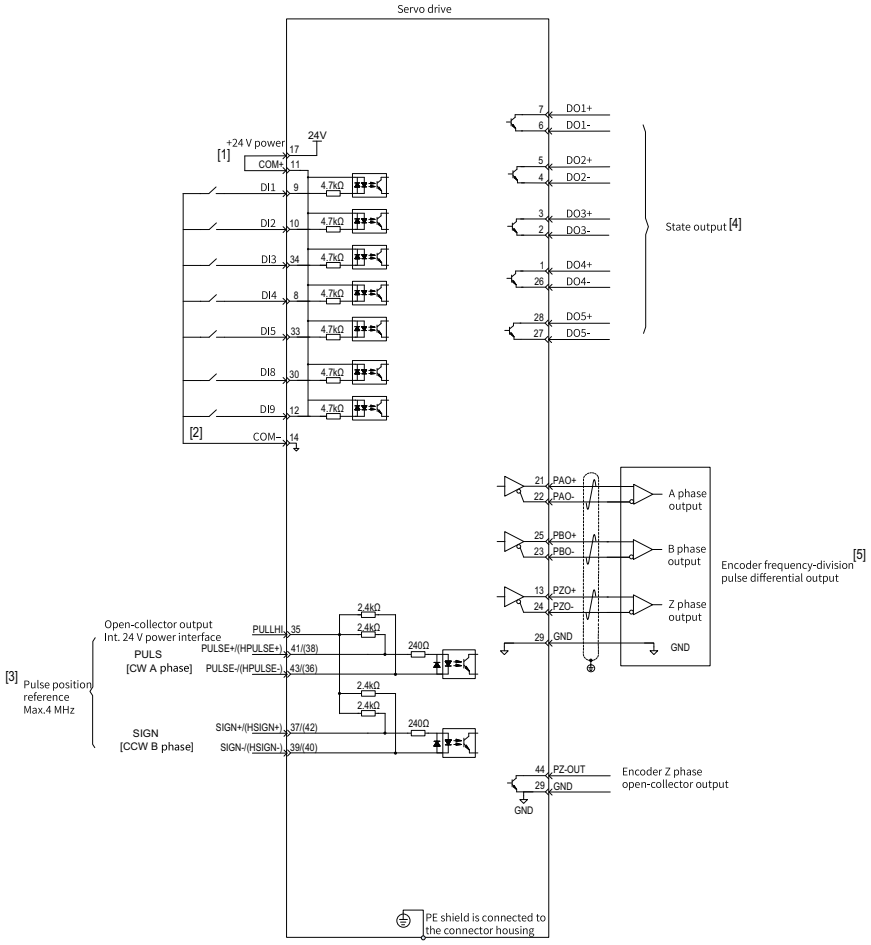


Figure 6-2 Wiring diagram of the Position Control Mode

Note

- [1] The range of the internal 24 V power supply is 20 V to 30 V, with maximum operating current being 150 mA (@25℃).
- [2] DI8 and DI9 are high-speed DIs that must be used according to their functions assigned.
- [3] Use the shielded twisted pairs for pulse terminals, with both ends of the shield connected to PE. Connect GND and signal GND of the host controller properly. The high-speed and low-speed pulse instruction inputs (differential input) share the same interface. The corresponding function code is set according to the frequency of the input pulse.
- [4] The DO power supply (voltage range: 5 V to 24 V) needs to be prepared by users. The DO terminals support 30 VDC voltage and 50 mA current to the maximum.
- [5] Use the shielded twisted pair cable as the frequency-division cable, with both ends of the shield connected to PE. Connect GND and signal GND of the host controller properly.

6.2.2 Wiring Diagram for Torque or Speed Control Mode

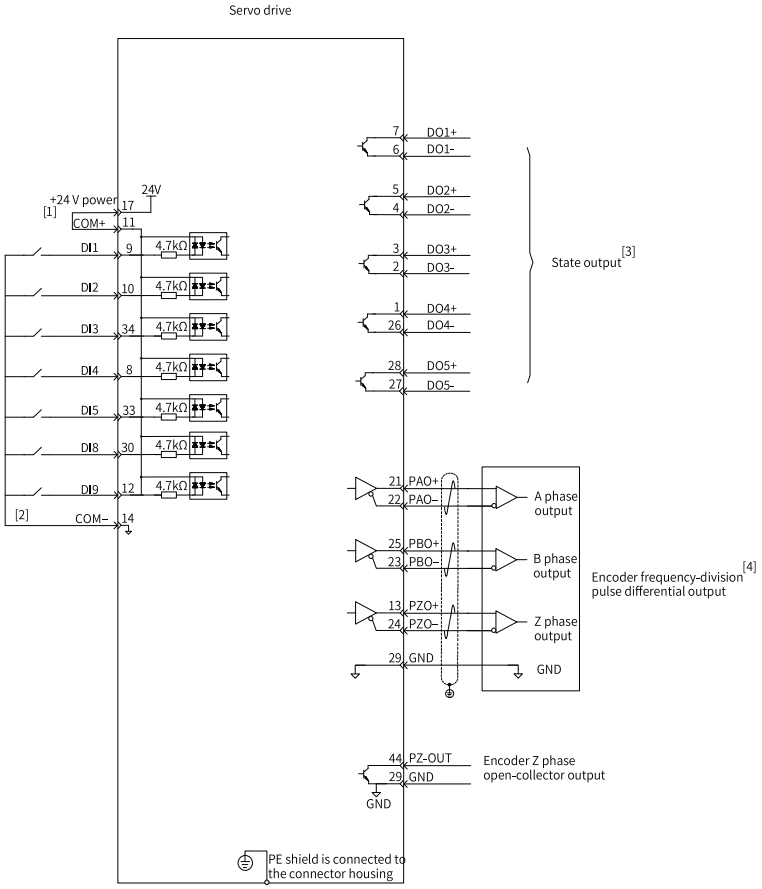


Figure 6-3 Wiring Diagram for Torque Control Mode

Note

- [1] The range of the internal 24 V power supply is 20 V to 30 V, with maximum operating current being 150 mA (@25℃).
- [2] DI8 and DI9 are high-speed DIs that must be used according to their functions assigned.
- [3] The DO power supply (voltage range: 5 V to 24 V) needs to be prepared by users. The DO terminals support 30 VDC voltage and 50 mA current to the maximum.
- [4] Use the shielded twisted pair cable as the frequency-division cable, with both ends of the shield connected to PE. Connect GND and signal GND of the host controller properly.

6.3 Introduction to Main Circuit Terminals

6.3.1 Terminal Layout

Size A (rated power: 0.2 kW to 0.4 kW): SV660PS1R6I, SV660PS2R8I

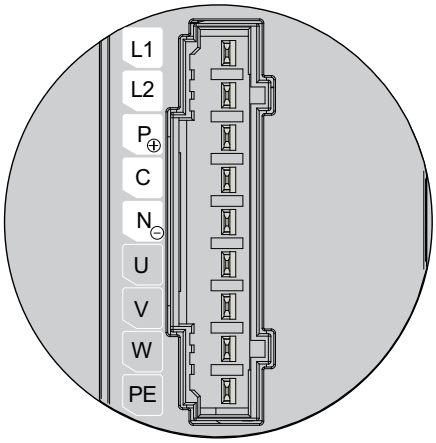


Figure 6-4 Main circuit terminal pins of drives in size A

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

No.	Name	Description
1	L1, L2 Power input terminals	See the nameplate for the rated voltage level.
2	P⊕ and N⊖ DC 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.
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.

Size B (rated power: 0.75 kW): SV660PS5R5I

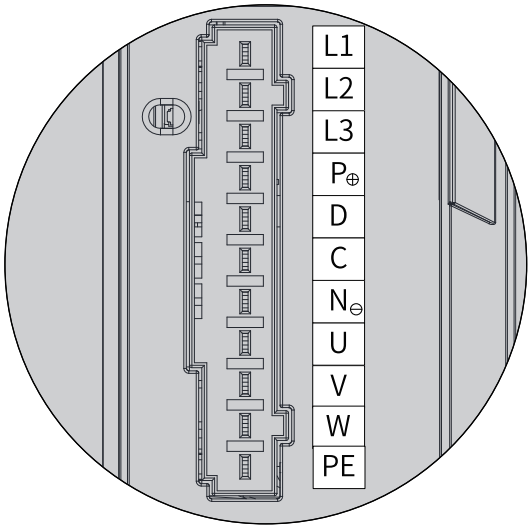


Figure 6-5 Pin assignment of main circuit terminal of drives in size B

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

No.	Name	Description
1	L1, L2, L3 Power input terminals	See the nameplate for the rated voltage level. S5R5 (750 W) drives support single-phase 220 V input only, with a 220 V power supply connected between terminals L1 and L2.
2	P⊕ and N⊖ DC bus terminals	Used by the common DC bus for multiple drives. Contact Inovance for technical support.
	P⊕, D, C Terminals for connecting external braking resistor	When an external braking resistor is required (first remove the jumper between P⊕, and D, and connect it to P⊕ and C. If external braking resistor is not required, short terminals P⊕ and D. Drives in size A are not equipped with built-in braking resistor or jumper bar between terminals P⊕ and D.
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.

Rated power (size C/D: 1.0 kW to 1.5 kW): SV660PS7R6I, SV660PS012I

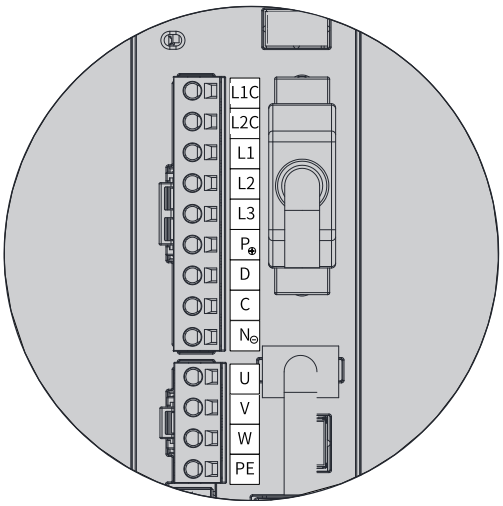


Figure 6-6 Main circuit terminal pin layout of servo drives in size C (SV660PS7R6I) and size D (SV660PS012I)

Table 6–3 Description of main circuit terminal pins of servo drives in size C (SV660PS7R6I) and size D (SV660PS012I)

No.	Name	Description
1	L1C, L2C Control circuit power input terminals	Used to provide 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. Note: The drive supports single-phase/three-phase 220 V input, with the 220 V power supply connected between L1 and L2.
3	P⊕ and N⊖ DC bus terminals	Used by the common DC bus for multiple drives. Contact Inovance for technical support.
	P⊕, D, C Terminals for connecting external braking resistor	When an external braking resistor is required (first remove the jumper between P⊕, and D, and connect it to P⊕ and C. If external braking resistor is not required, short terminals P⊕ and D. Drives in size A are not equipped with built-in braking resistor or jumper bar between terminals P⊕ and D.
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.

Servo drives in size C and size D (rated power: 1.0 kW to 3.0 kW): SV660PT3R5I, SV660PT5R4I, SV660PT8R4I, and SV660PT012I

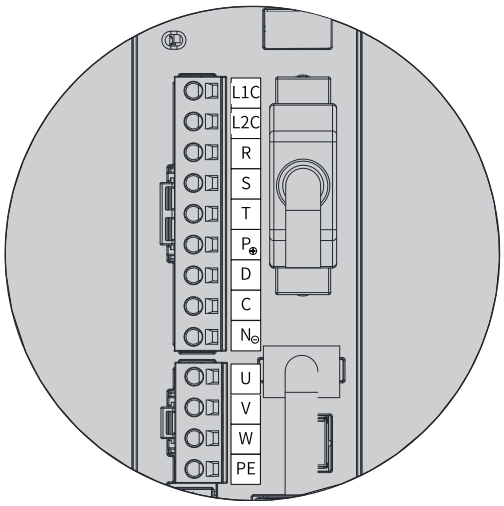


Figure 6-7 Main circuit terminal pin layout of servo drives in size C (SV660PT3R5I, SV660PT5R4I) and size D (SV660PT8R4I, SV660PT012I)

Table 6–4 Description of main circuit terminal pins of servo drives in size C (SV660PT3R5I, SV660PT5R4I) and size D (SV660PT8R4I, SV660PT012I)

No.	Name	Description
1	L1C, L2C Control circuit power input terminals	Used to provide 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⊕ and N⊖ DC bus terminals	Used by the common DC bus for multiple drives. Contact Inovance for technical support.
	P⊕, D, C Terminals for connecting external braking resistor	When an external braking resistor is required (first remove the jumper between P⊕, and D, and connect it to P⊕ and C. If external braking resistor is not required, short terminals P⊕ and D. Drives in size A are not equipped with built-in braking resistor or jumper bar between terminals P⊕ and D.
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.

Size E (rated power: 5.0 kW to 7.5 kW): SV660PT017I, SV660PT021I, SV660PT026I

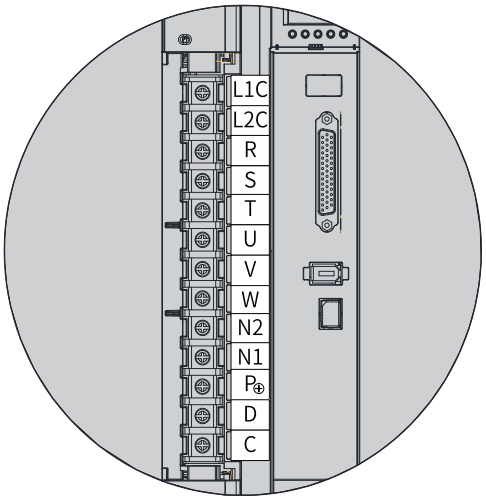


Figure 6-8 Pin assignment of main circuit terminal of drives in size E

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

No.	Name	Description
1	L1C, L2C Control circuit power input terminals	Used to provide 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, N1 Terminals for connecting external reactor	Terminals and are shorted by default. When the power high-order harmonics need to be suppressed, remove the jumper and connect a reactor between N1 and N2. Install a DC reactor between terminals N1 and N2.
5	P⊕, D, C Terminals for connecting external braking resistor	When an external braking resistor is required (first remove the jumper between P⊕, and D, and connect it to P⊕ and C. If external braking resistor is not required, short terminals P⊕ and D. Drives in size A are not equipped with built-in braking resistor or jumper bar between terminals P⊕ and D.

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.

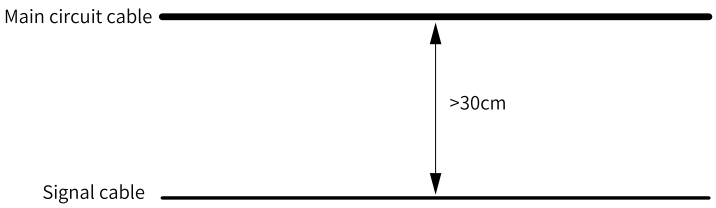


Figure 6-9 Cable layout

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 x Reduction coefficient of current-carrying density of the conductor x Current correction coefficient

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

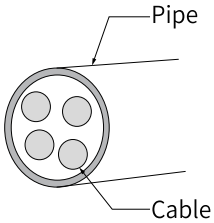


Table 6–6 Reduction coefficient of conductor current-carrying density

Number of cables in a duct	Current reduction coefficient
< 3	0.7
4	0.63
5 to 6	0.56
7 to 15	0.49

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.

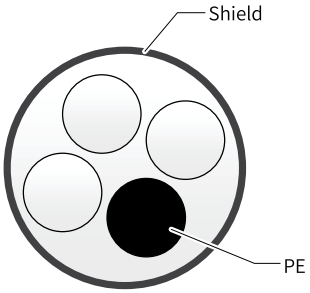


Figure 6-10 Diagram of four-conductor shielded cable

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, product damage may occur:

- Locations where static electricity may cause interference;
- Locations with strong electric or magnetic fields;
- Locations where radiation may occur

The shield of the motor power cable must be bonded to the grounding wire of the power cable to ensure reliable grounding, as shown in the figure below.

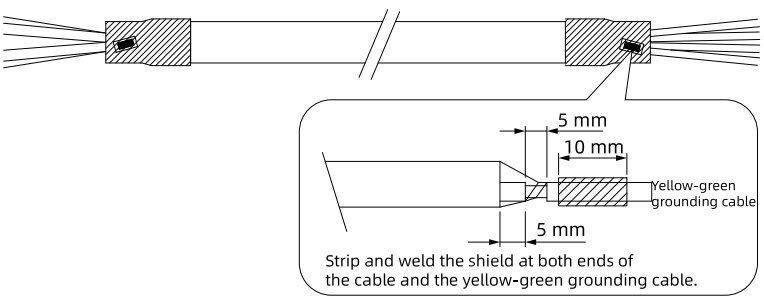


Figure 6-11 Wiring of the shield

6.3.3.2 Cable Sspecifications

Table 6–7 Recommended main circuit cables

Drive model SV660P series			L1C, L2C		L1, L2, L3/R, S, T		P ⊕, D, C, N ⊖, N2, N1		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 x 0.75	18	4 x 0.52	20	2 x 0.75	18	4 x 0.52	20	0.52	20
	S2R8	4	2 x 0.75	18	4 x 0.52	20	2 x 0.75	18	4 x 0.52	20	0.52	20
Size B	S5R5	7.9	2 x 0.75	18	4 x 0.52	20	2 x 0.75	18	4 x 0.52	20	0.52	20
Size C	S7R6	9.6	2 x 0.75	18	4 x 1.31	16	2 x 0.75	18	4 x 0.52	20	0.52	20
Size D	S012	12.8	2 x 0.75	18	4 x 1.31	16	2 x 0.75	18	4 x 1.31	16	1.31	16
Three-phase 220 V												
Size C	S7R6	5.1	2 x 0.75	18	4 x 0.52	20	2 x 0.75	18	4 x 0.52	20	0.52	20
Size D	S012	8	2 x 0.75	18	4 x 1.31	16	2 x 0.75	18	4 x 1.31	16	1.31	16
Three-phase 380 V												
Size C	T3R5	2.4	2 x 0.75	18	3 x 0.52	20	2 x 0.75	18	4 x 0.52	20	0.52	20
	T5R4	3.6	2 x 0.75	18	3 x 0.52	20	2 x 0.75	18	4 x 0.52	20	0.52	20
Size D	T8R4	5.6	2 x 0.75	18	3 x 0.52	20	2 x 0.75	18	4 x 0.52	20	0.52	20
	T012	8	2 x 0.75	18	3 x 1.31	16	2 x 0.75	18	4 x 1.31	16	1.31	16
Size E	T017	12	2 x 0.75	18	3 x 2.08	14	2 x 0.75	18	4 x 2.08	14	2.08	14
	T021	16	2 x 0.75	18	3 x 2.08	14	2 x 0.75	18	4 x 2.08	14	2.08	14
	T026	21	2 x 0.75	18	3 x 3.33	12	2 x 0.75	18	4 x 3.33	12	3.33	12

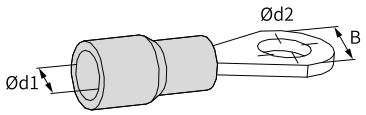
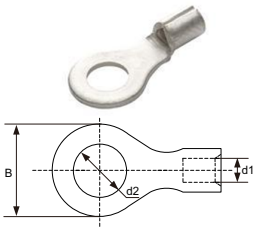
Table 6–8 Recommended cable specifications and models

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

Table 6–9 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 6–10 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 Example

6.3.4.1 Motor Wiring Instance

Terminal-type motor

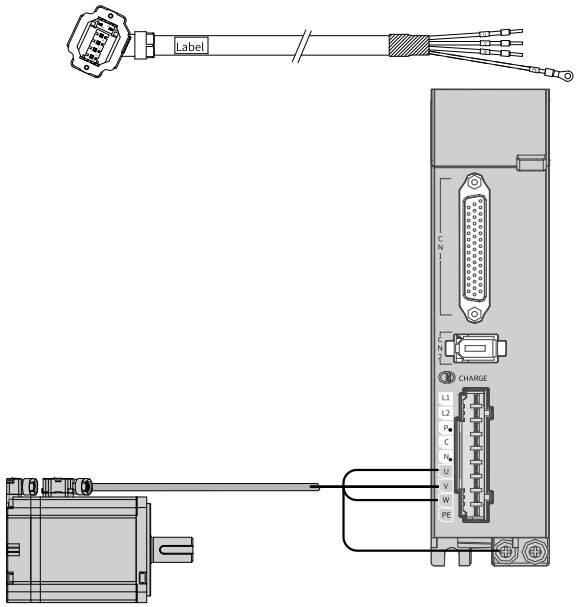


Figure 6-12 Wiring between the servo drive and servo motor

Applicable flying leads motors

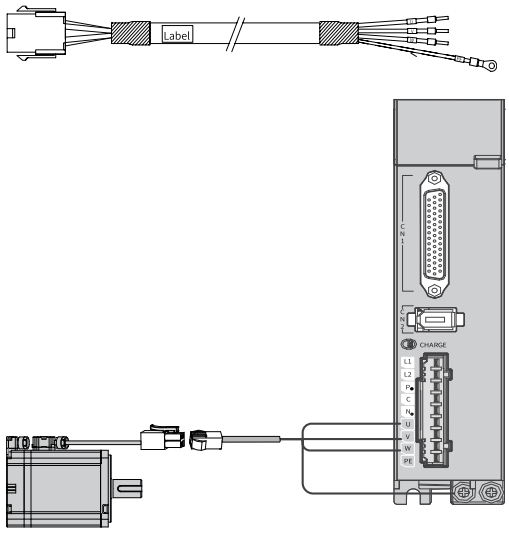


Figure 6-13 Wiring between the servo drive and servo motor

Note

- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.
- For motor power cable connectors, see section "Options".

6.3.4.2 Power Supply Wiring Instance

Single-phase 220 V

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

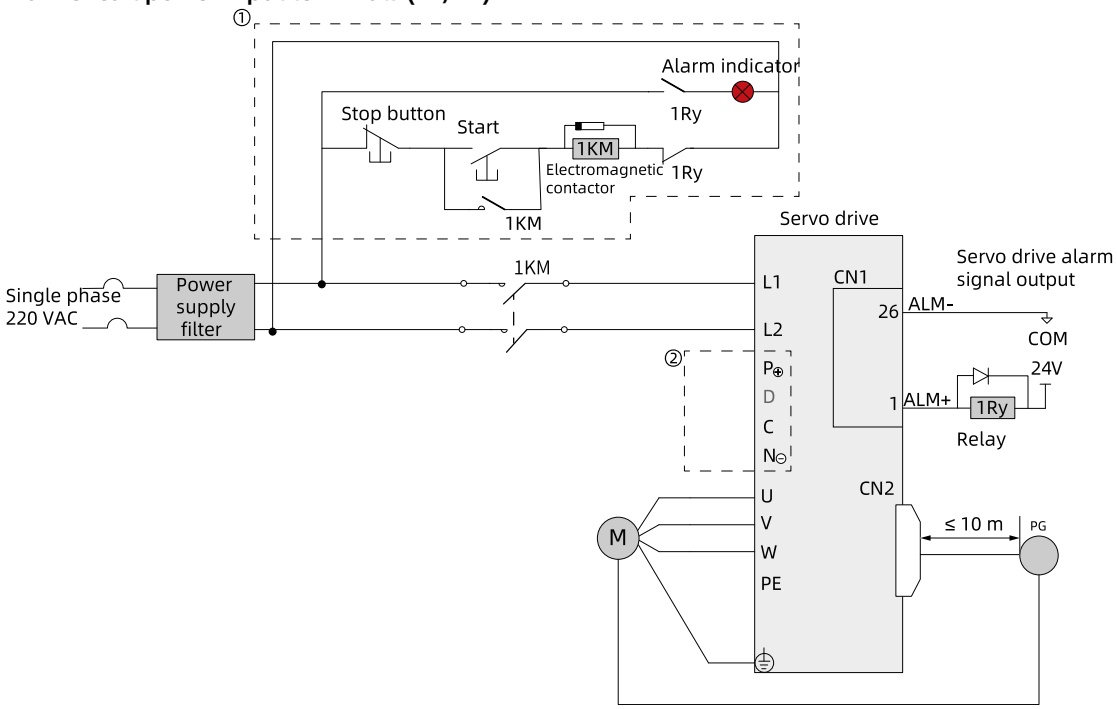


Figure 6-14 Main circuit wiring of single-phase 220 V models

Note

- 1KM: Electromagnetic contactor; 1Ry: Relay; 1D: Flywheel diode
- 1. Alarm protection circuit. The DO is set as alarm output (ALM+/-). When the servo drive alarms, the power supply is cut off automatically.
- 2. S1R6 and S2R8 do not have a built-in braking resistor and PD jumper. If you want to use a braking resistor, connect an external braking resistor between terminals P ⊕ and C.
- 3. For S5R5, S7R6 and S012, remove the jumper bar between terminals P ⊕ and D before connecting an external braking resistor between terminals P ⊕ and C. If no external braking resistor is required, keep the jumper between terminals P ⊕ and D.

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

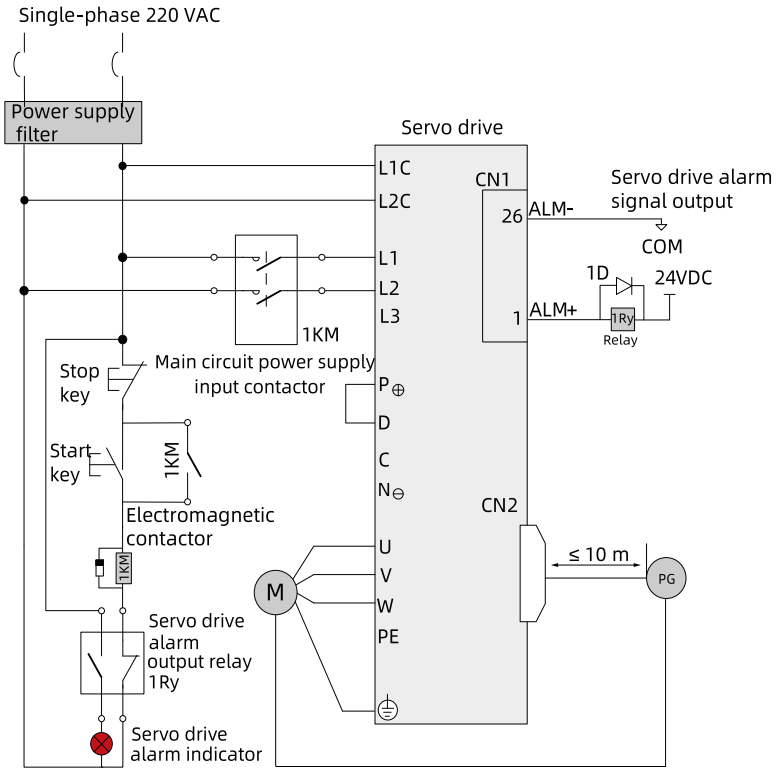


Figure 6-15 Main circuit wiring of single-phase 220 V models

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

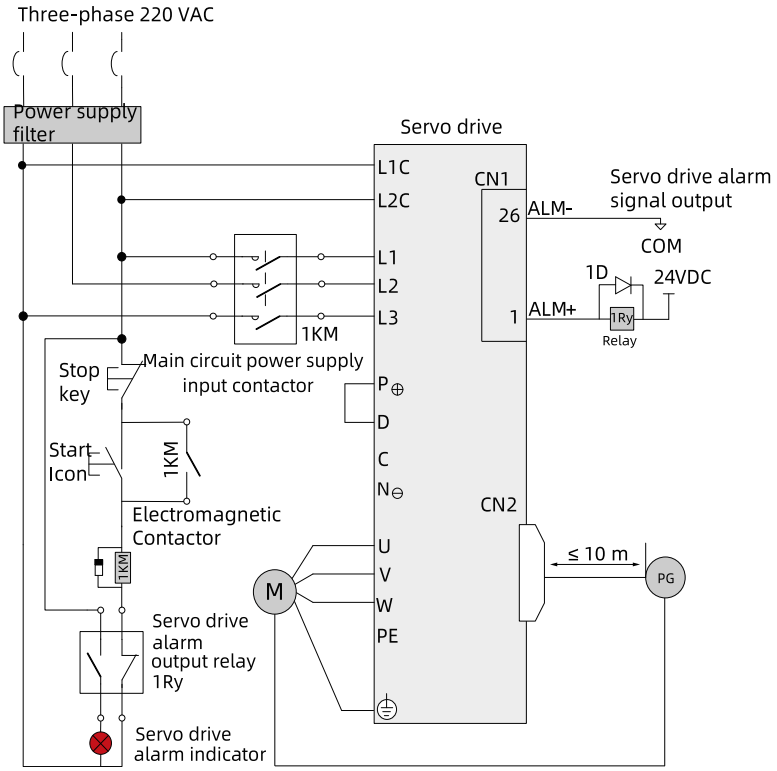


Figure 6-16 Main circuit wiring of three-phase 220 V models

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

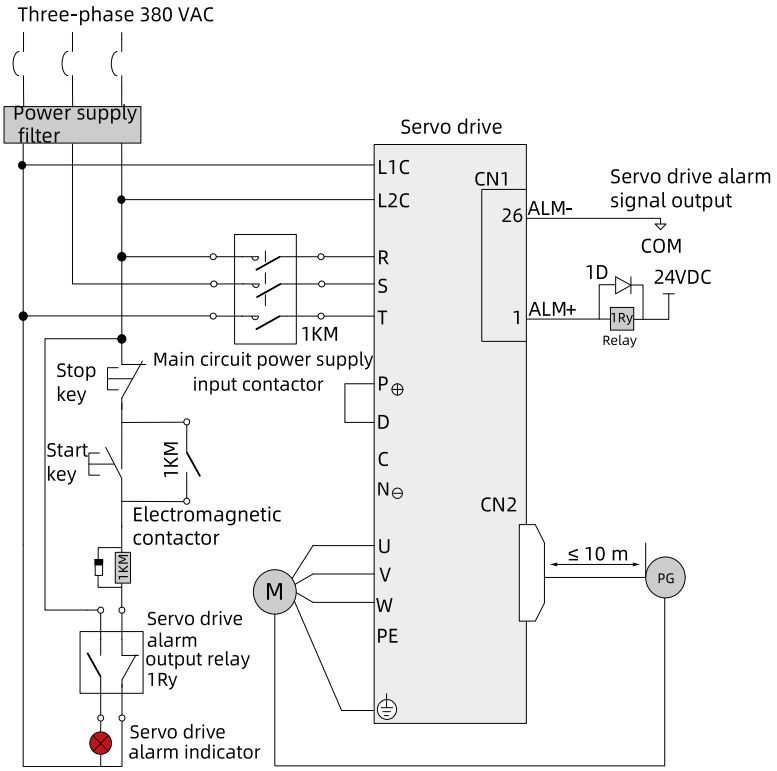


Figure 6-17 Main circuit wiring of three-phase 380 V models

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.

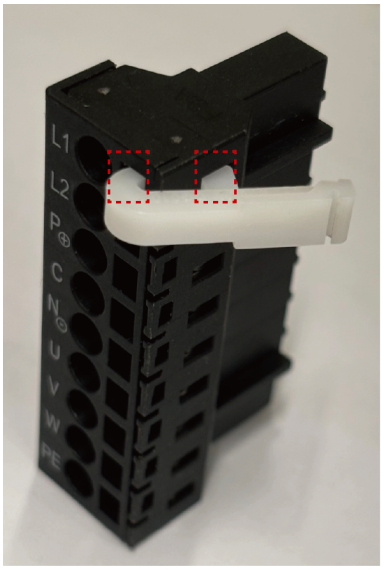
Installation procedure

Size A to size D

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

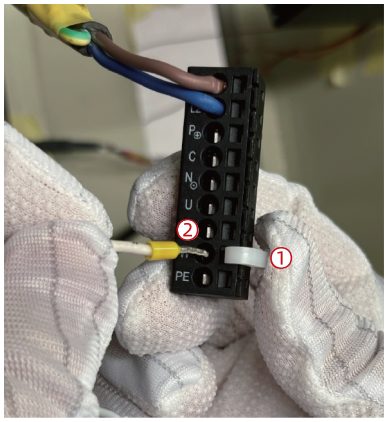


Step 2. Insert the plastic part into the terminal block, ensuring both ends are inserted into the holes.



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.



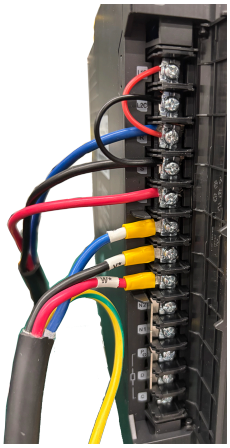
Step 4. Installing the terminal block: Align the terminal block with the servo silkscreen direction, it is installed in place when you hear a "click."



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

Size E

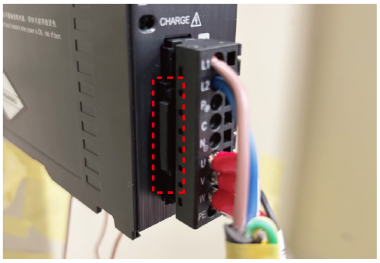
Remove the M5 screw, insert the corresponding cable, then tighten the M5 screw with a recommended tightening torque of 2.5 N·m.



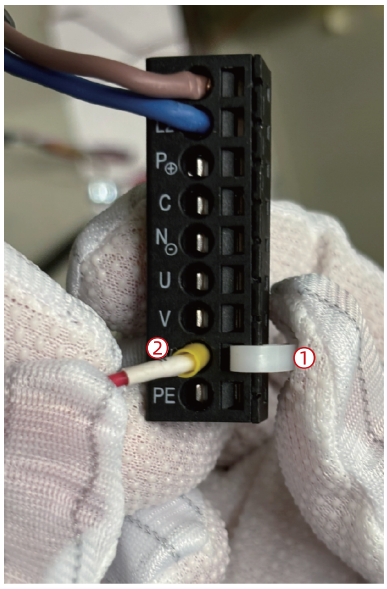
Removal procedure

Size A to size D

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

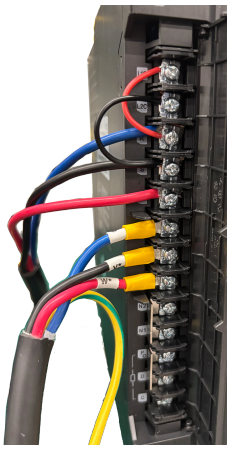


Step 2. Removal: Hold the plastic part's tail (①) with one hand, and pull the cable outward (②) with the other hand. Remove all cables in sequence.



Size E

Remove the M5 screw and take off the cable.



6.4 Introduction to Control Terminal CN1

6.4.1 Terminal Layout

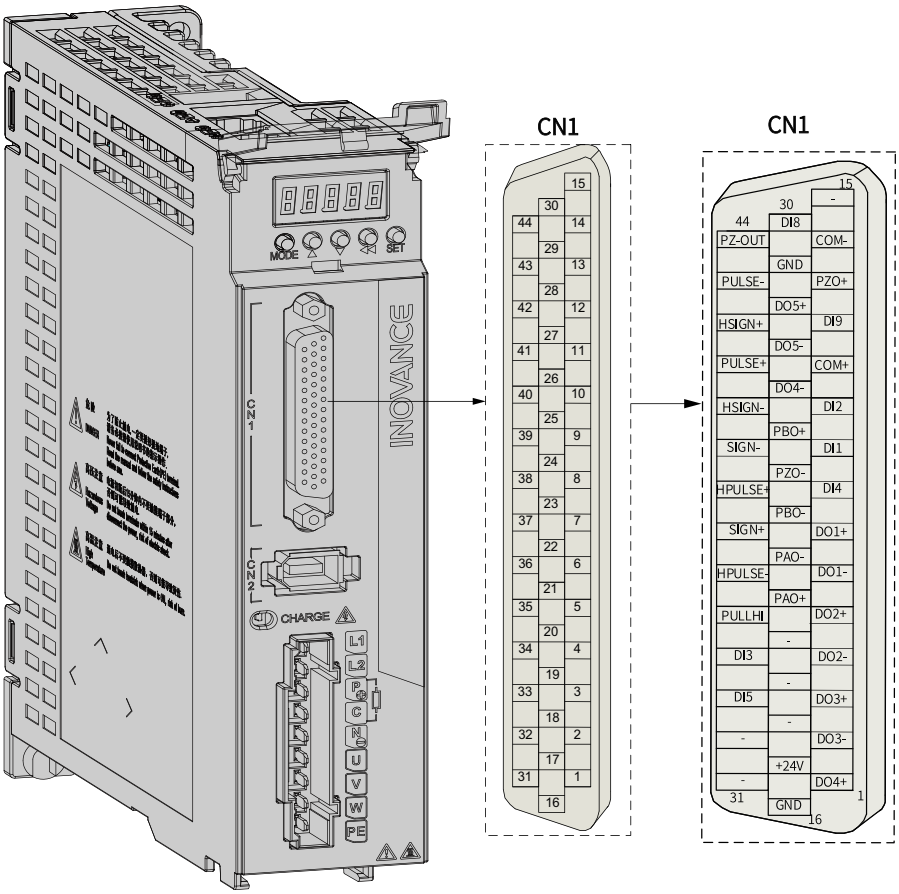


Figure 6-18 Control terminal pin layout of servo drives in sizes A and B

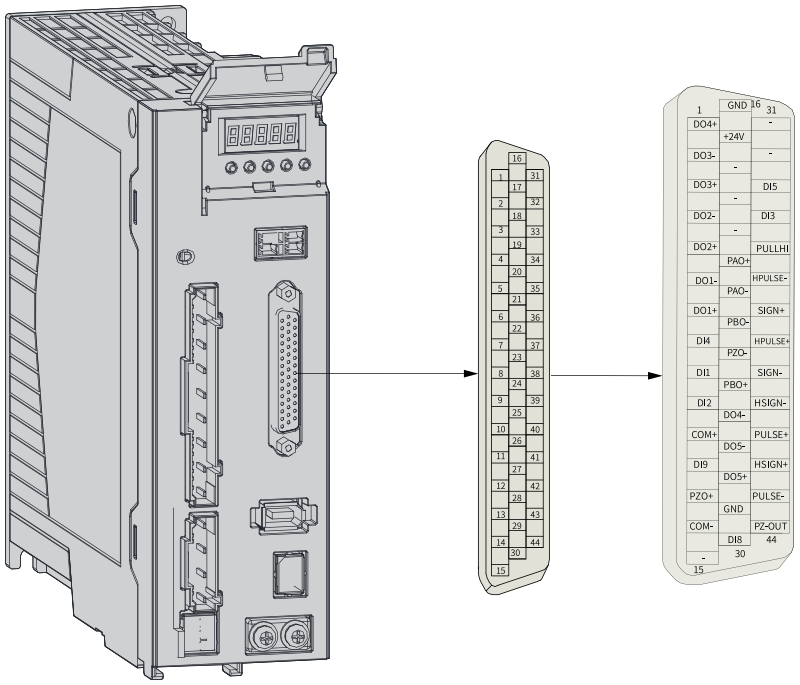


Figure 6-19 Control terminal pin layout of servo drives in sizes C, D, and E

Note

- CN1 terminal – connector housing on cable side: DB25P.
- Use shielded cables as signal cables and ground both ends of each shielded cable.

Table 6–11 Position reference input signals

Signal		Pin No.	Function	
Position reference	PULSE+	41	Low-speed pulse reference input mode: • Differential drive input • Open-collector	Pulse input form: • Direction + Pulse • A/B quadrature pulse • CW/CCW pulse
	PULSE–	43		
	SIGN+	37		
	SIGN–	39		
	PULLHI	35		
	HPULSE+	38	High-speed input pulse reference	
	HPULSE–	36		
	HSIGN+	42	High-speed position reference sign	
	HSIGN–	40		

Table 6–12 Description of DI/DO signals

Signal		Default function	Pin No.	Function
General	DI1	P-OT	9th	Positive overtravel switch.
	DI2	N-OT	10	Negative overtravel switch.
	DI3	INHIBIT	34	Position reference inhibited.
	DI4	ALM-RST	8	Alarm reset (edge-triggered).
	DI5	S-ON	33	Servo ON.
	DI8	HomeSwitch	30	Home switch.
	DI9	Reserved	12	-
	+24 V		17	Internal 24 V power supply; voltage range: 20 V to 30 V; maximum output current: 150 mA (@ 25℃)
	COM-		14	
	COM+		11	Common terminal of DI terminals
	DO1+	S-RDY+	7	Servo ready.
	DO1-	S-RDY-	6	
	DO2+	COIN+	5	Position reached
	DO2	COIN-	4	
	DO3+	BK+	3	Brake output
	DO3-	BK-	2	
	DO4+	ALM+	1	Fault output.
	DO4-	ALM-	26	
	DO5+	HomeAttain+	28	Home return completed
	DO5-	HomeAttain-	27	

Note

DI logic level standard: "0" < 3 V; "1" > 18 V.

When DO is used as EDM output, the leakage current is lower than 0.3 μA, and the EDM residual voltage is lower than 1.65 V.

Table 6–13 Encoder frequency-division output signals

Signal	Default function	Pin No.	Function	
General	PAO+	21	Phase A frequency-division output signal	Quadrature frequency-division pulse output signal of phases A and B
	PAO-	22		
	PBO+	25	Phase B frequency-division output signal	
	PBO-	23		
	PZO+	13	Phase Z frequency-division output signal	Home pulse output signal
	PZO-	24		
	PZ-OUT	44	Phase Z frequency-division output signal	Home pulse open collector output signal
	GND	29	Home pulse open collector output signal ground	
	GND	16	-	
	PE	Enclosure	-	

6.4.2 Wiring Precautions and Requirements

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

Caution

- When connecting DO terminals to relays, ensure the polarity of the flywheel diode is correct. Wrong polarity will result in equipment damage or signal output failure.
- Keep a distance of at least 30 cm between main circuit cables (RST/LN, UVW) and I/O signal cables/encoder cables. Otherwise 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, with both ends of the shielded cable grounded.

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.

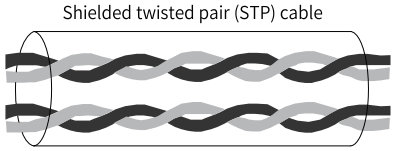


Figure 6-20 Diagram of shielded twisted pairs

Control terminal	Recommended connector Kit/ material code	Recommended cable specifications (AWG)
CN1	DB44	24-30

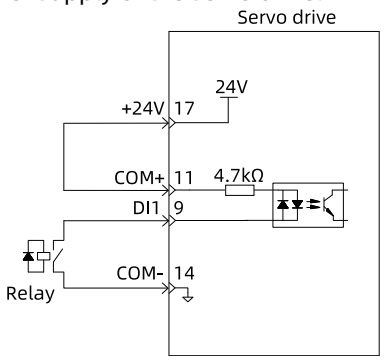
6.4.4 Wiring Example

6.4.4.1 DI/DO Signals

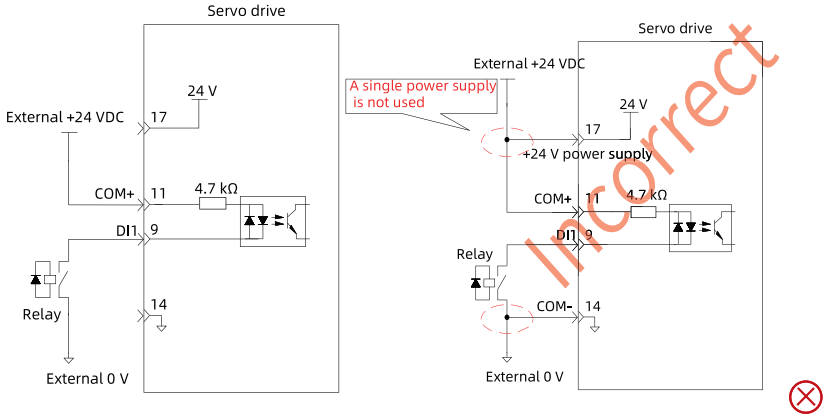
6.4.4.1.1 DI circuit

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

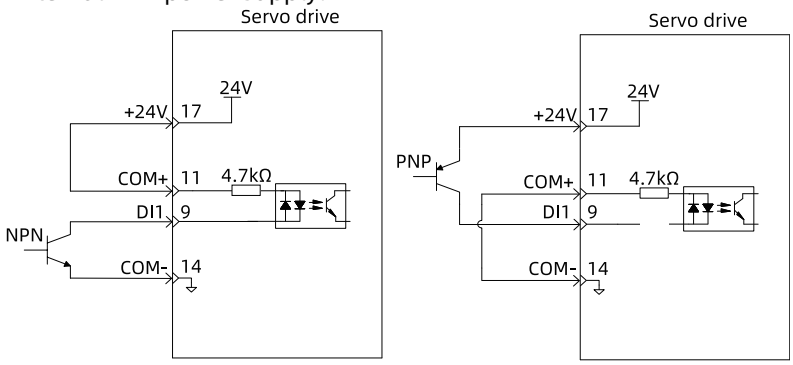
- When the host controller provides relay output, both internal and external power supplies for the drive are supported, as shown in the following figure.
  - For use of an internal 24 V power supply of the servo drive:



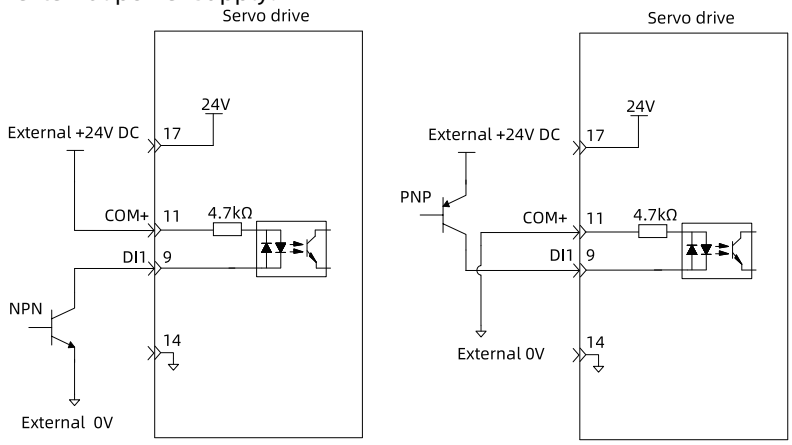
- For use of an external power supply:



- 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.

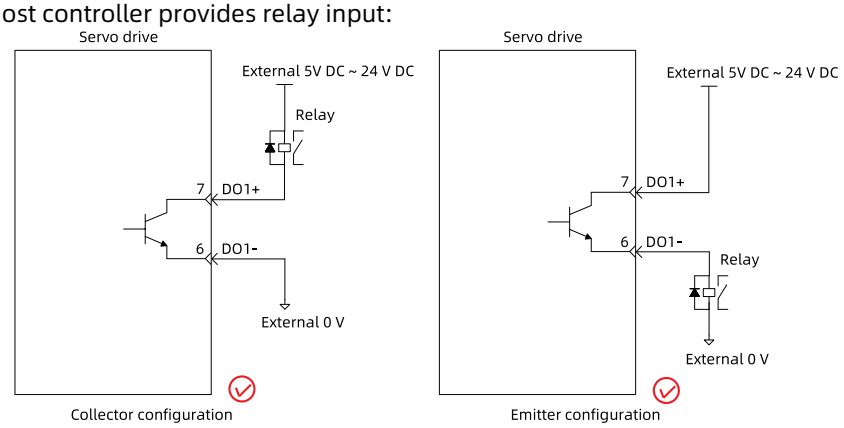
6.4.4.1.2 Digital output signal

Connect DO properly. No output can be generated if the DO is connected reversely.

This product has 5 DOs. For the interface circuits of DO1, DO2, DO4, and DO5, see *" Digital output signal" on page 102*; for the interface circuit of DO3, see *" Digital output signal (with internal current-limiting resistor)" on page 103*.

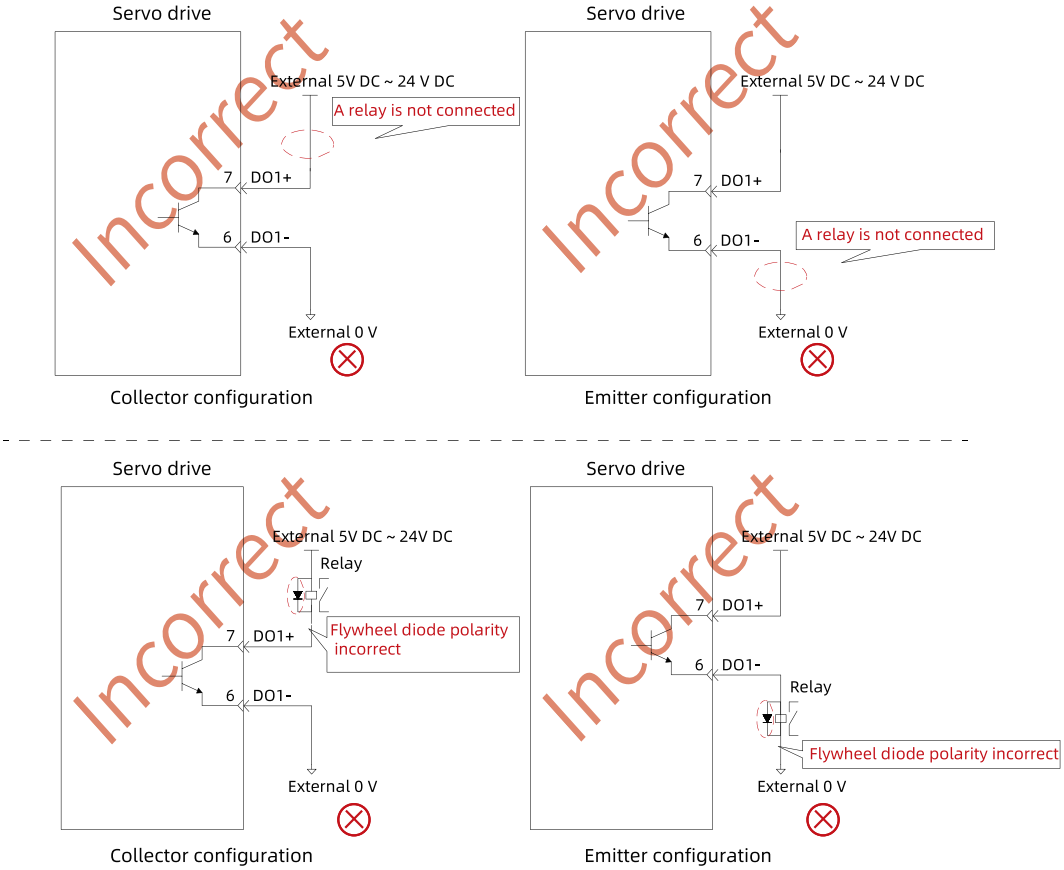
Digital output signal

- When the host controller provides relay input:

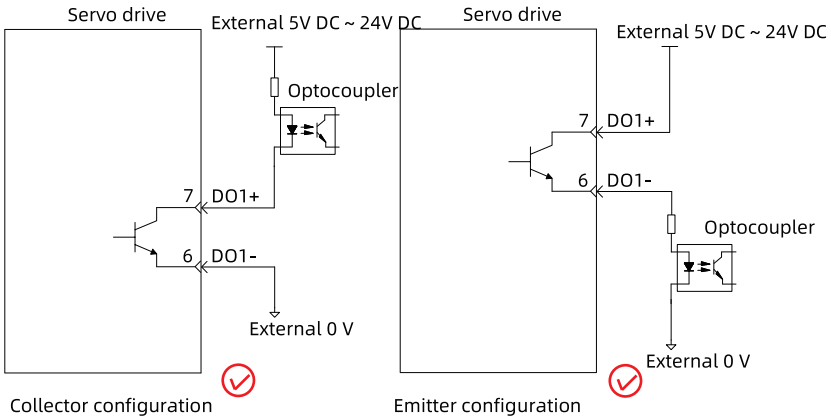


Note

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



- When the host controller provides optocoupler input:

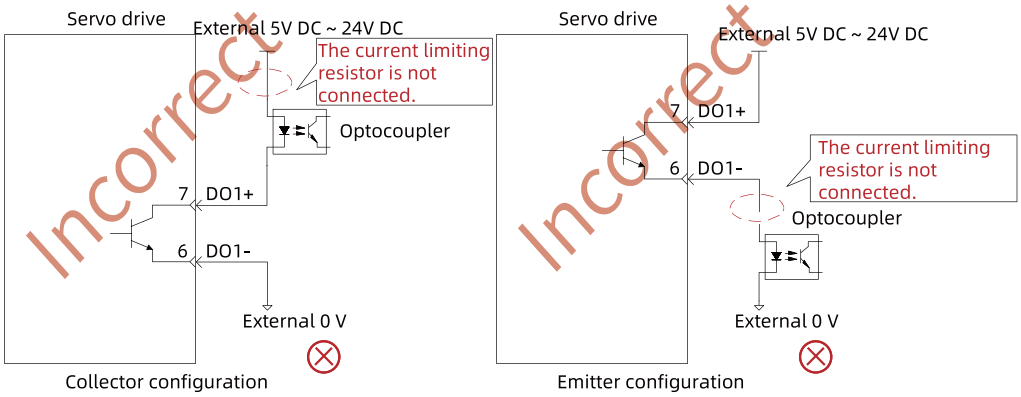


Note

- 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.

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

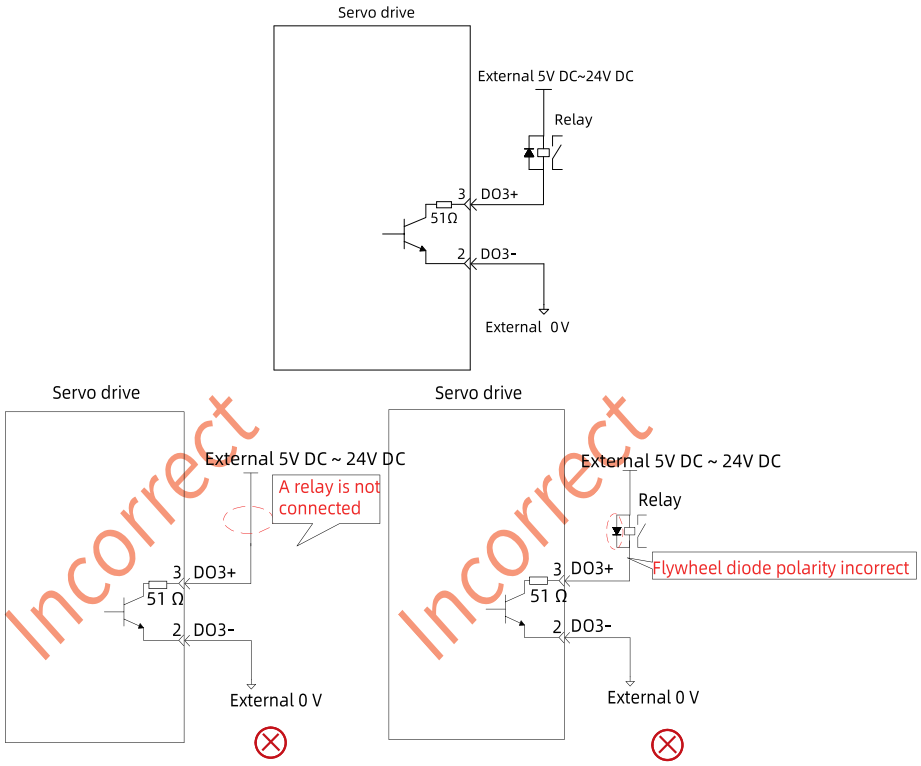
In the preceding formula, VF is the diode ON voltage drop on the primary side of the external coupler, which is 1.2 V generally. VIN is the external power input voltage of DO, which is generally within 30 V.



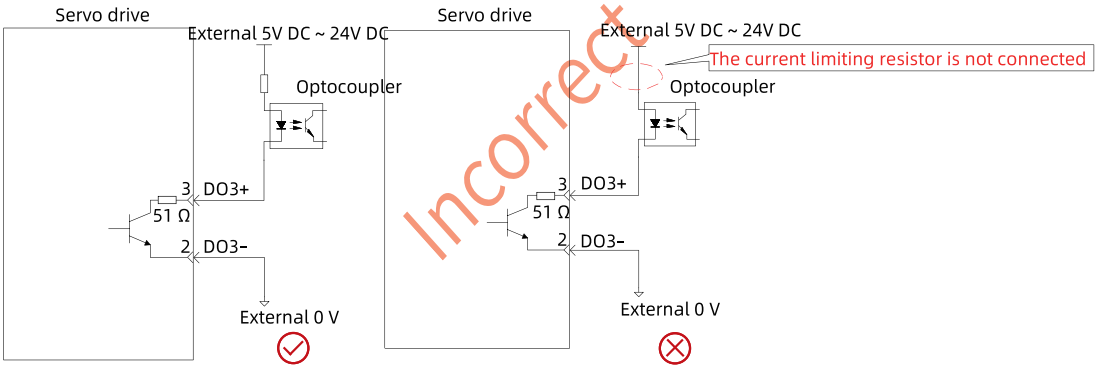
Digital output signal (with internal current-limiting resistor)

When an internal 51Ω current-limiting resistor is present, for external relay connection, the voltage division effect of the internal resistor must be considered. For optocoupler connection, the external resistor calculation requires subtraction of the internal current-limiting resistor value.

- When the host controller adopts relay input, a flywheel diode must be installed. Otherwise, the DO terminals may be damaged.
  The following figure shows the wiring.



- The wiring diagram is shown below 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 calculation formula for the external current-limiting resistor of DO3 is as follows.

$$\frac{VIN-VF-0.75}{5}-51 \geqslant R(K\Omega) \geqslant \frac{VIN-VF-0.75}{50}-51$$

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.

6.4.4.2 Encoder Frequency-Division Output Signals

For details about terminal layout, see *"Table 6-13 Encoder frequency-division output signals" on page 99*.

The encoder frequency-division output circuit outputs differential signals through the differential drive. Typically, this circuit provides feedback signals to the host controller in a position control system. Use a differential or optocoupler receiving circuit on the host controller side to receive feedback signals. The maximum output current is 20 mA.

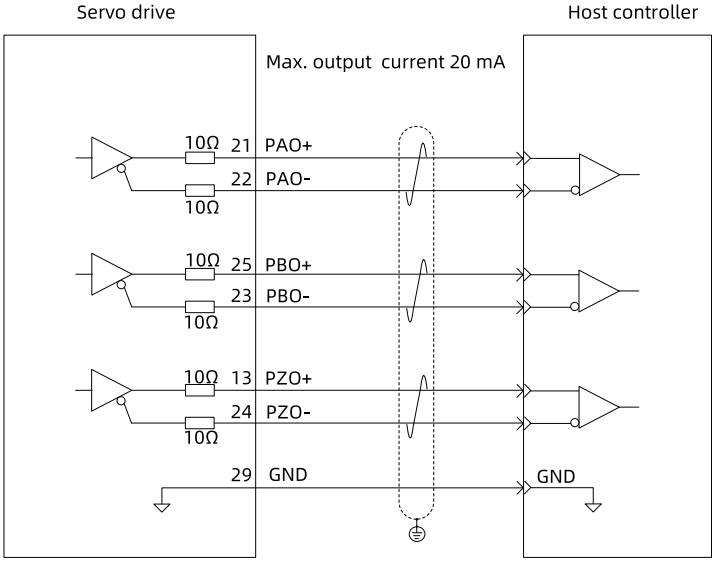


Figure 6-21 Differential receiving circuit

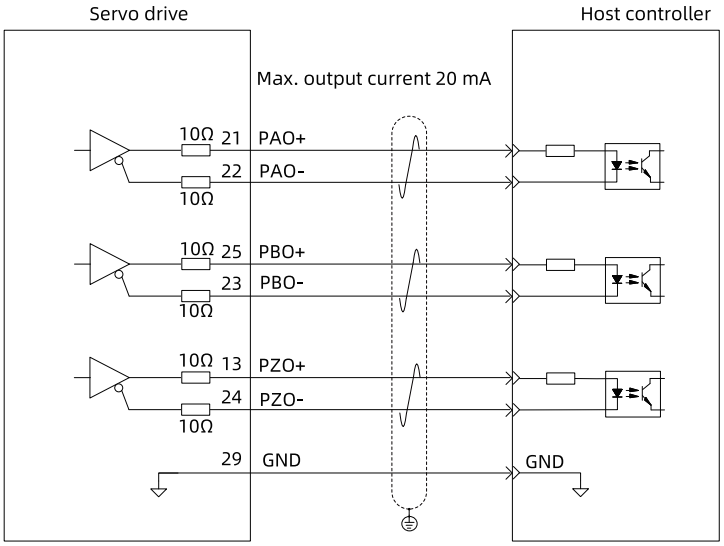
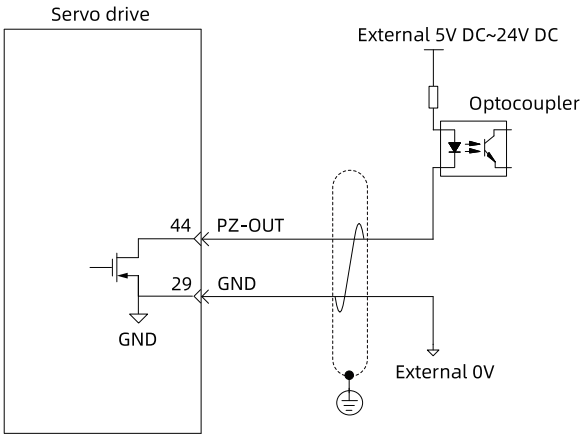


Figure 6-22 Optocoupler receiving circuit

The encoder phase Z frequency-division output circuit outputs open collector signals. Typically, this circuit provides feedback signals to the host controller in a position control system. An optocoupler circuit, a relay circuit, or a bus receiver circuit must be used in the host controller to receive feedback signals.



Caution

To reduce noise interference, use shielded twisted pairs to connect the 5V GND of the host controller to the GND of the servo drive.

6.4.4.3 Position Reference Input Signals

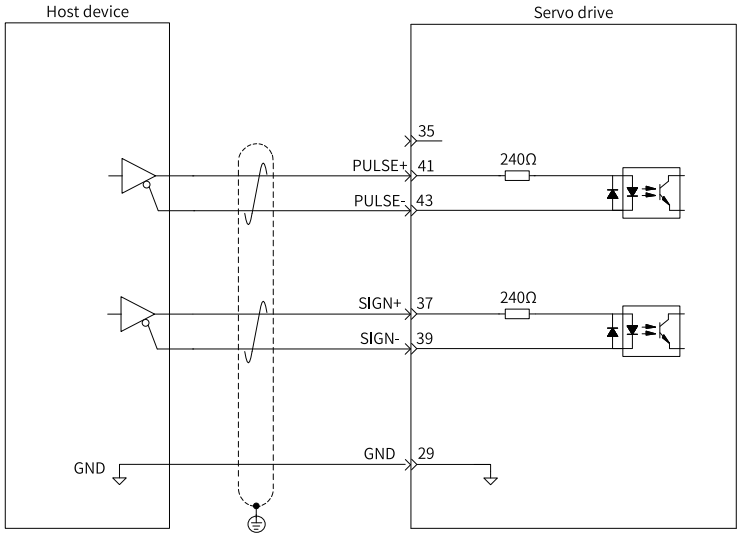
For the terminal layout of position reference input signals, see *"Table 6-11 Position reference input signals" on page 98*.

The pulse reference and symbol signal output circuit on the host controller side can either be differential drive output or OC output. The following table lists the maximum input frequency and minimum pulse width.

Table 6–14 Correspondence between pulse input frequency and pulse width

Pulse mode		Single-channel max. pulse frequency (pps)	Min. pulse width (μs)	Voltage (V)
Low speed	Differential	200k	2.5	> 3.0
	Open-collector	200k	2.5	24
High-speed differential		4 M	0.125	> 3.0

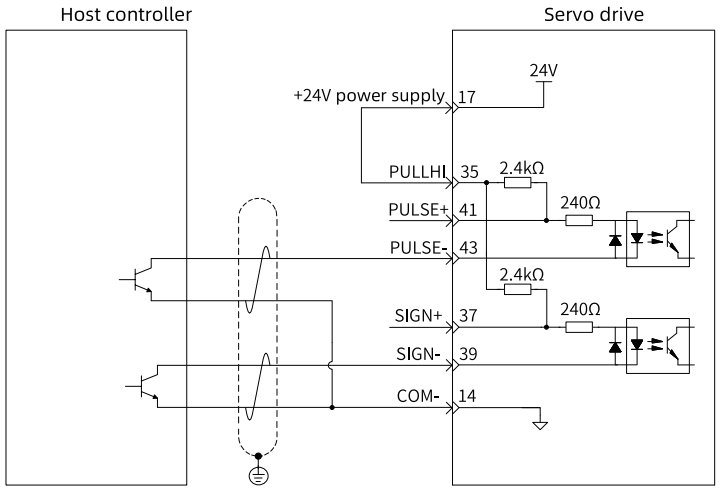
6.4.4.3.1 Differential mode



6.4.4.3.2 Open-collector mode

For use of an internal 24 V power supply of the servo drive:

NPN



PNP

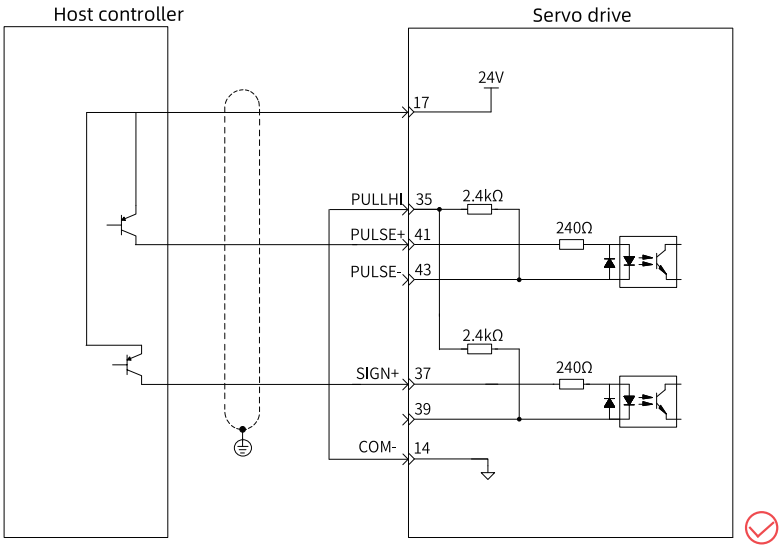


Figure 6-23 Correct: The internal 24 V power supply of the servo drive is used.

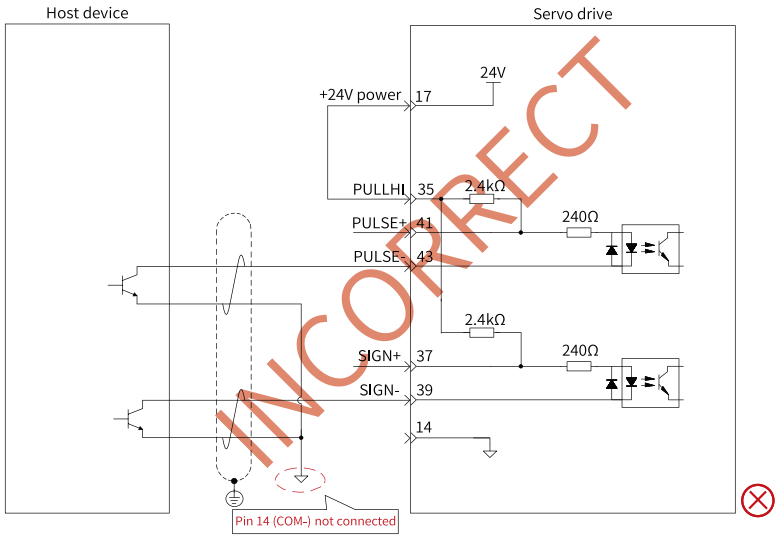
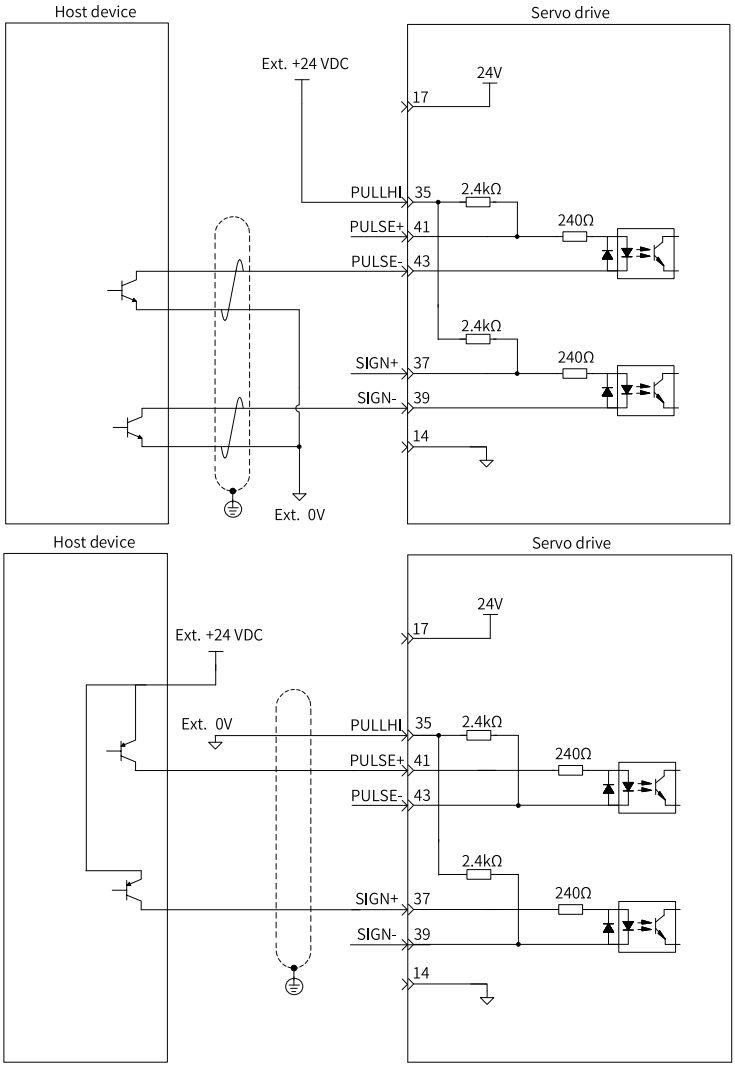


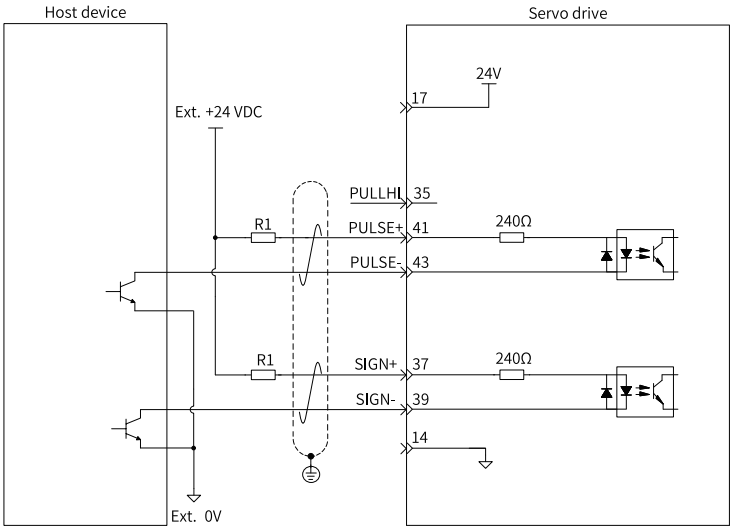
Figure 6-24 Wrong connection: Pin 14 (COM-) is not connected, which cannot form a closed-loop circuit.

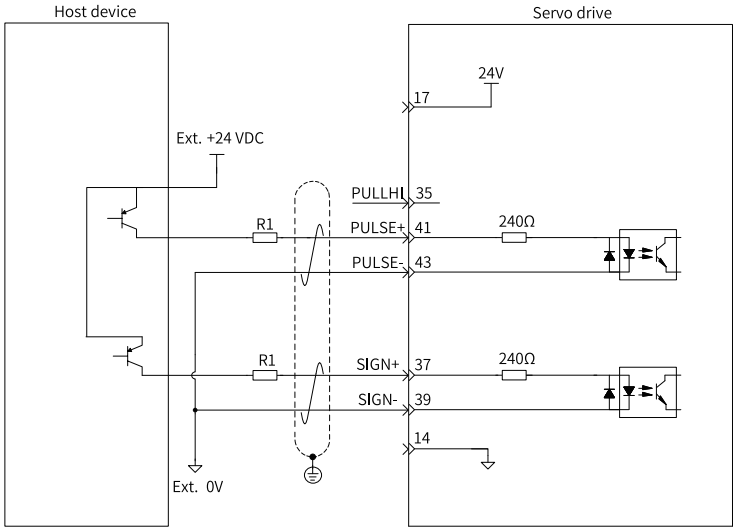
For use of an external power supply:

1. **Scheme 1: using the internal resistor of the servo drive (recommended)**



2. **Scheme 2: Using the external resistor**





Value of resistor R1 shall satisfy the following formula:

$$\frac{V_{CC} - 1.5}{R1 + 240} = 10\ mA$$

Table 6–15 Recommended resistance of R1

V_{CC} Voltage (V)	R1 (kΩ)	Power of R1 (W)
24	2.4	0.5
12	1.5	0.5

The following figures show examples of incorrect wiring.

- Incorrect wiring 1: The current limiting resistor is not connected, resulting in terminal burnout.

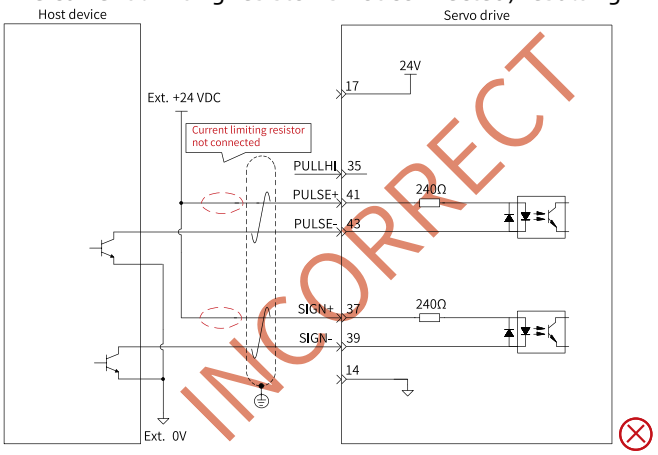


Figure 6-25 Incorrect wiring example 1: The current limiting resistor is not connected, resulting in terminal burnout.

Note

- A detection feature is added on SIGN+ and SIGN- to detect if SIGN+ is connected to 24 V, SIGN- is connected to external 0 V, but no current limit resistor is connected. When this case is detected, the drive issues an E991.1 warning.
- In this case, check the wiring and then test the drive. Otherwise, the port may be damaged.
- This feature cannot detect polarity reversal.

- Incorrect wiring 2: Multiple terminals share the same current-limit resistor, resulting in pulse receiving error.

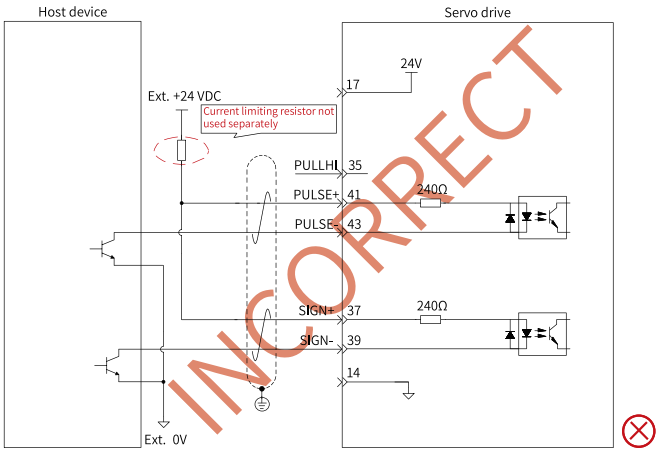


Figure 6-26 Incorrect wiring example 2: Multiple terminals share the same current limiting resistor, resulting in pulse receiving errors.

- Incorrect wiring 3: The SIGN port is not connected, preventing these two ports from receiving pulses.

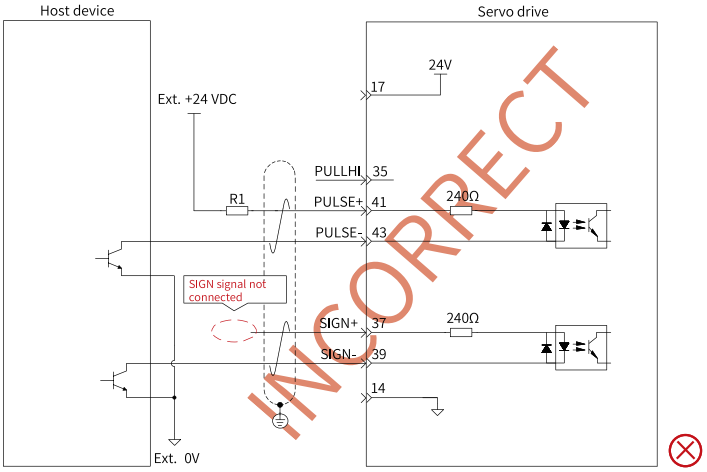


Figure 6-27 Incorrect wiring example 3: The SIGN port is not connected, preventing these two ports from receiving pulses.

- Incorrect wiring 4: Terminals are connected incorrectly, resulting in terminal burnout.

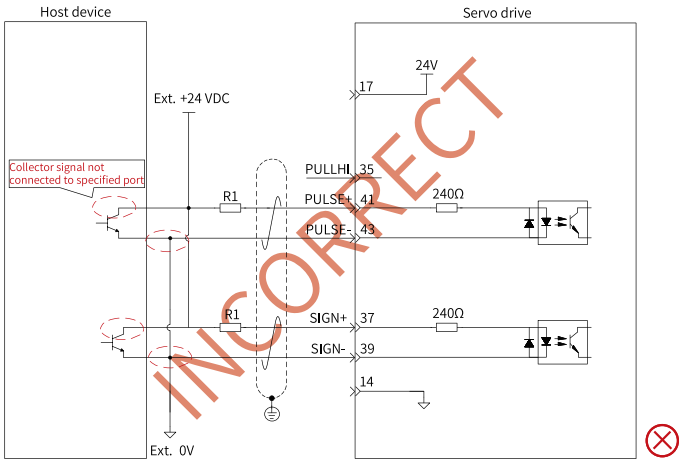


Figure 6-28 Incorrect wiring example 4: Terminals are connected incorrectly, resulting in terminal burnout.

- Incorrect wiring 5: Multiple terminals share the same current limiting resistor, resulting in pulse receiving error.

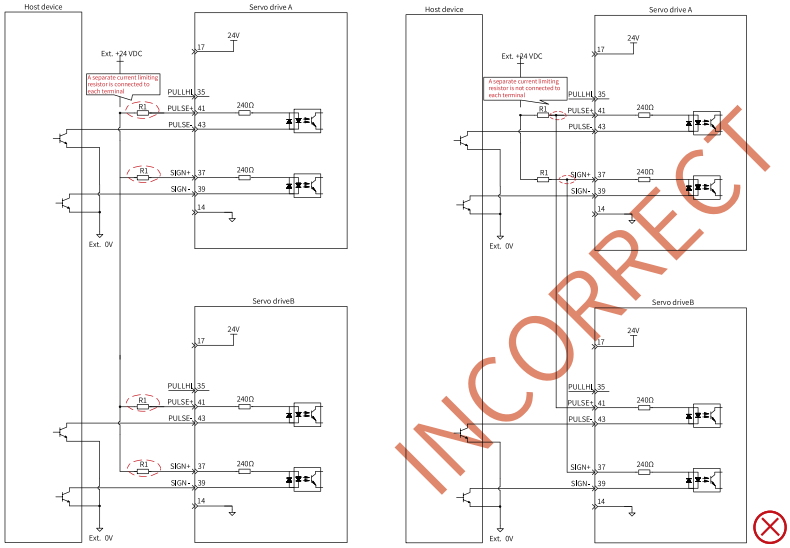
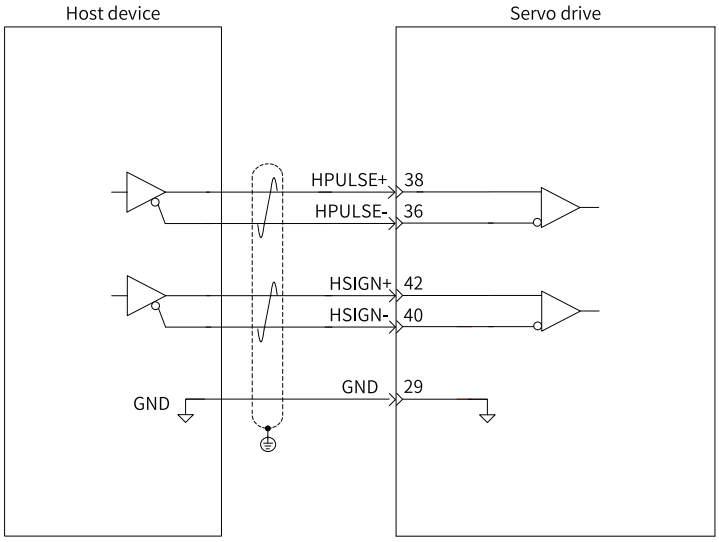


Figure 6-29 Incorrect wiring example 5: Multiple terminals share one current limiting resistor, resulting in a pulse receiving error.

6.4.4.3.3 High-speed pulse reference input

High-speed reference pulse and symbol signals at the host controller can only be output to the servo drive via differential drive output.



Note

- This is a 5 V system. Do not input 24 V power.
- A detection feature is added on HSIGN+ and HSIGN- to detect if HSIGN+ is connected to 24 V, HSIGN- is connected to external 0 V, but no current limit resistor is connected. When this case is detected, the drive issues an E991.1 warning.
- In this case, check the wiring and then test the drive. Otherwise, the port may be damaged.
- This feature cannot detect polarity reversal.

Caution

The differential input must be 5 V. Otherwise, unstable pulse input will occur on the servo drive, resulting in the following situations:

- Pulse loss during pulse input
- When inputting reference direction, the direction will reverse.
- Connect 5V GND of the host controller to the GND of the servo drive to reduce noise interference.

6.4.4.4 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.

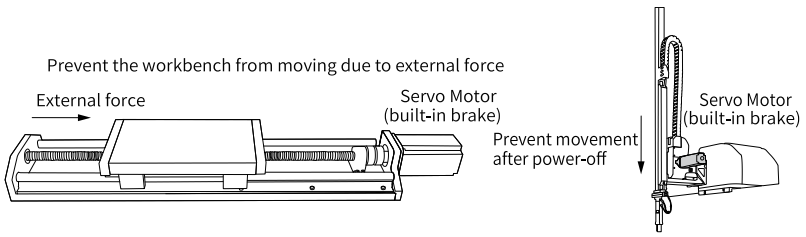


Figure 6-30 Application of the brake

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.

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.

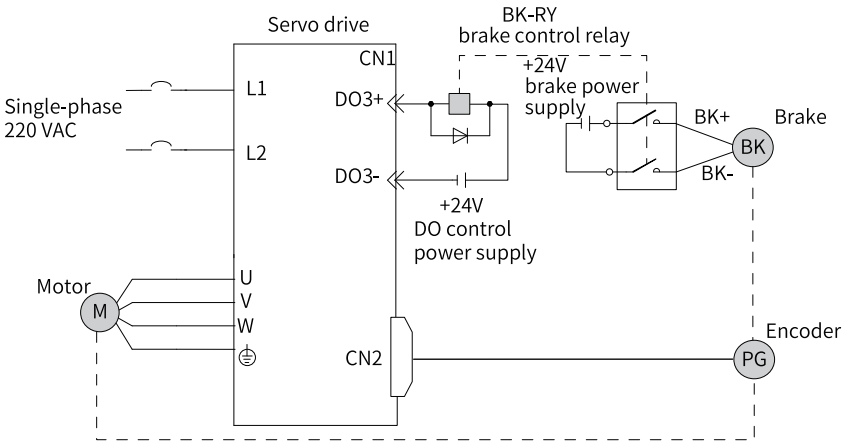


Figure 6-31 Wiring of the brake

Note

- Ensure that different power supplies are used for the brake and brake control signals to avoid electromagnetic interference to electronic devices.
- Install a flywheel diode to suppress the peak voltage generated by turning on/off the relay. Recommended diode model: 1N4001 Specifications: (1) Reverse voltage impedance ≥ 50 V; (2) Positive current ≥ 2 x Rated current of the relay coil
- Use cables with a cross-sectional area above 0.5 mm^2.

Pay attention to the following precautions during 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)	Supply voltage (VDC) ±10%	Coil resistance (Ω)±7%	Excitation current (A)	Release time (ms)	Apply 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

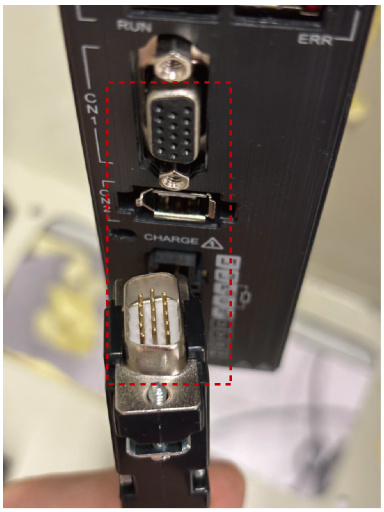
6.4.5 Wiring Procedure of Control Cables

Note

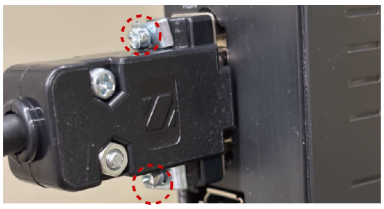
Terminals may vary in shape and wiring. The following installation procedure only describes wiring steps. Actual operations may vary.

Installation procedure

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

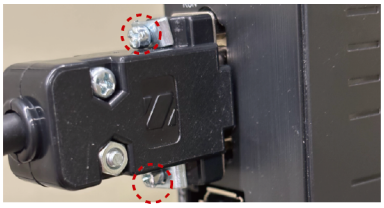


Step 2. After inserting the terminal properly, tighten the M3 screws at both ends of the cable terminal with a recommended tightening torque of 0.5 N·m.



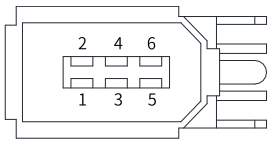
Removal procedure

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



6.5 Introduction to Encoder Terminal CN2

6.5.1 Terminal Layout



Encoder signal terminal CN2 (drive side)

Figure 6-32 Terminal pin layout of the encoder

Table 6–17 Description of encoder terminal pins

No.	Name	Remarks
1	+5 V	5 V power supply
2	GND	
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 Models

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 size (AWG)	Cable resistance per unit length (Ω/km)	Permissible cable length (m)
3P x 26	143	0 to 10
1P x 22 + 2P x 26	54.3	10 to 26.4
1P x 20+2P x 24	33.9	26.4 to 42.2
1P x 18+2P x 22	21.4	42.2 to 66.8
1P x 16+2P x 18	13.5	66.8 to 105.0

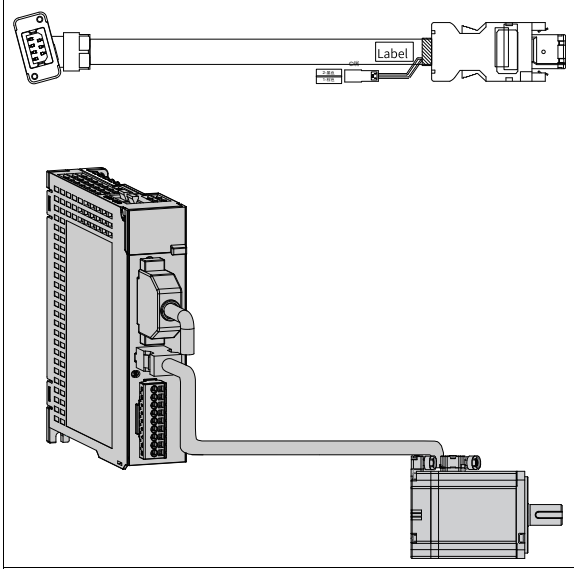
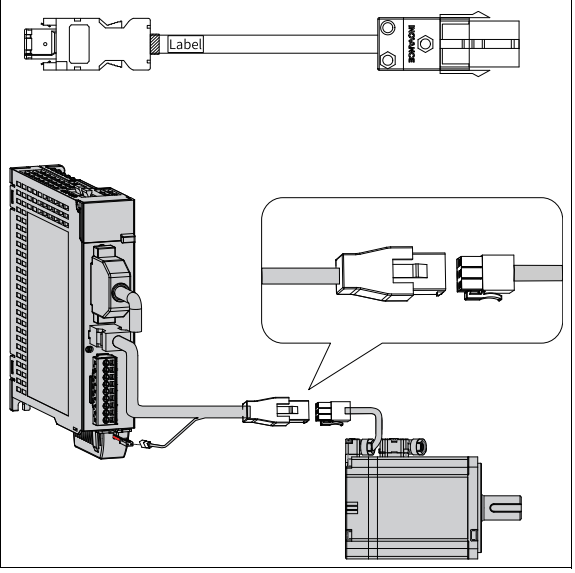
Note

- 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 Example

6.5.4.1 Connecting the Absolute Encoder

Table 6–19 Absolute encoder signal[1]Wiring example

terminal-type motors	Flying leads motors
	

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 70*.
- 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.

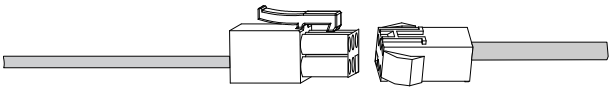


Figure 6-33 Power cable adapter scheme

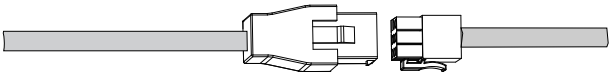


Figure 6-34 Encoder cable adapter scheme

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.

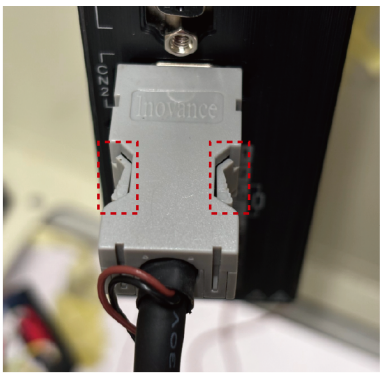
Installation procedure

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 Introduction to Communication Terminals CN3 and CN4

6.6.1 Terminal Layout

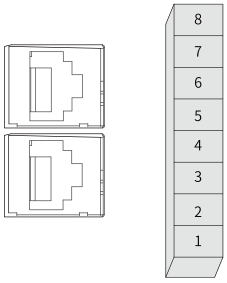


Figure 6-35 Communication terminal pin layout of the servo drive

Table 6–20 Description of communication terminal pins

Pin No.	Definition	Description
1	-	-
2	-	
3	-	
4	RS485+	Modbus communication terminal
5	RS485-	
6	RS232-TXD	RS232 transmitting end, connected to the receiving end of the host controller
7	RS232-RXD	RS232 receiving end, connected to the transmitting end of the host controller
8	GND	Signal reference ground
Enclosure	PE	Shield

6.6.2 Wiring Example

6.6.2.1 RS485 Communication Wiring Example

RS485 communication connection with PLC

The following figure shows the cable connection between the servo drive and the PLC during RS485 communication networking.



Figure 6-36 Diagram of the drive-to-PLC communication cable

Use a three-conductor shielded cable to connect the RS485 bus, with three conductors connected to 485+, 485-, and GND (GND represents non-isolated RS485 signal reference ground), respectively. Connect the twisted pairs to the RS485+ and RS485– terminals. Connect the third cable to the RS485 reference ground (GND). Connect the shield to the device ground (PE). Connect 120 Ω termination resistors only at the head and tail ends of the bus to prevent RS485 signal reflection.

Table 6–21 Pin connections of the cable used for CAN communication between the servo drive and PLC

RJ45 on the Drive (A)			PLC side (B)		
Communication type	Pin No.	Definition	Communication type	Pin No.	Definition
RS485	4	485+	RS485	4	485+
	5	485-		5	485-
	8	GND		8	GND
-	Enclosure	PE (shield)	-	Enclosure	PE (shield)

Wiring of multi-drive RS485 communication

The following figure shows the cable connection between multiple servo drives during RS485 communication networking.



Figure 6-37 Diagram of the multi-drive communication cable

Table 6–22 Pin connections of the cable used for multi-drive RS485 communication (pins in 485 group used only)

RJ45 on the Drive (A)			RJ45 on Drive Side (End B)		
Communication type	Pin No.	Definition	Communication type	Pin No.	Definition
RS485	4	485+	RS485	4	485+
	5	485-		5	485-
	8	GND		8	GND
-	Enclosure	PE (shield)	-	Enclosure	PE (shield)

In case of a large number of nodes, connect the RS485 communication using the daisy chain mode. Connect the RS485 signal reference grounds of all the nodes (up to 128 nodes) together.

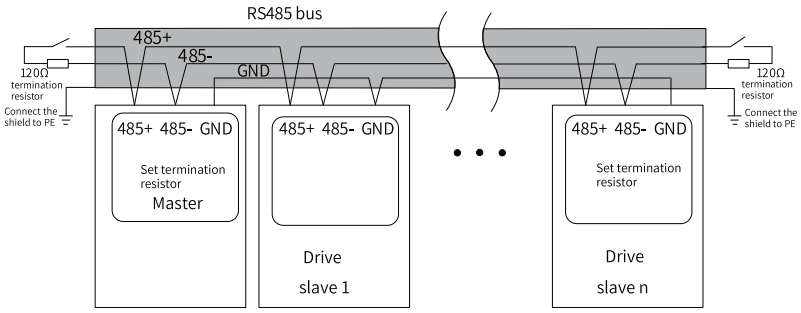


Figure 6-38 RS485 bus topology

Caution

- Set the termination resistor: Insert S6-L-T03-0.0 into the RJ45 connector.
- Do not connect theGND terminal of the host controller to the GND terminal of the servo drive. Failure to comply will damage the device.

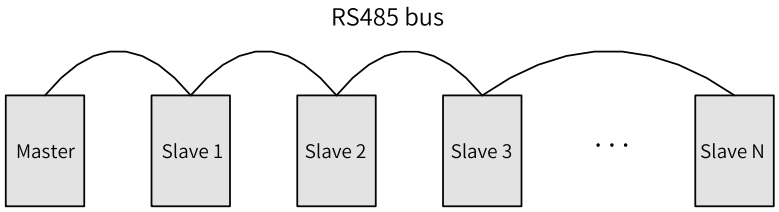


Figure 6-39 Daisy chain mode

The following table lists the maximum number of nodes and transmission distance supported by the Inovance standard RS485 circuit at different transmission rates.

Table 6–23 Transmission distance and number of nodes

No.	Transmission Rate (kbps)	Transmission Distance (m)	Number of nodes	Cable size (AWG)
1	115.2	100	128	26
2	19.2	1,000	128	26

6.6.2.2 RS232 Communication Wiring

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.



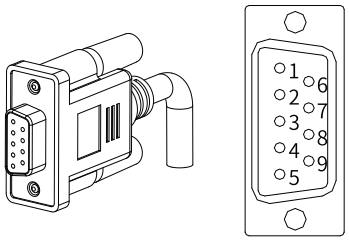
Figure 6-40 PC communication cable

Table 6–24 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 6–25 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	

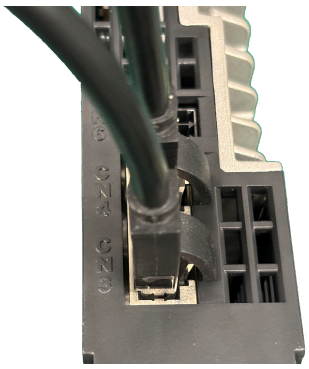
6.6.3 Wiring Procedure of Communication Cables

Note

Refer to the actual product for specific silk screen and terminal positions; this section only explains the wiring steps.

Installation procedure

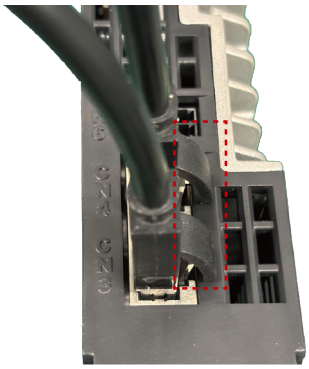
Ensure the network cable direction matches the network port direction. Insert the RJ45 connector into the bottom of the network port, and make sure the connector's clip snaps into the port's slot to ensure a reliable connection.



Removal Procedure

Press the port latch and pull the cable outward to remove it.

Note: Do not forcibly pull the cable. If the cable is difficult to remove, check whether the RJ45 connector latch is fully released.



6.6.4 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.

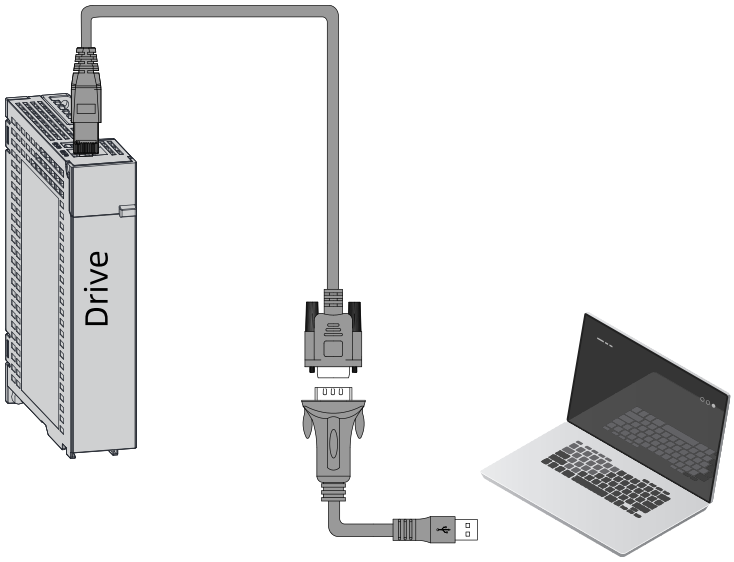


Figure 6-41 Serial-to-USB conversion

The recommended cable is as follows:
Z-TEK, model: ZE551A, 0.8-m USB extension cable, integrated circuit model: FT232

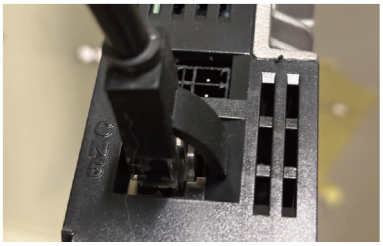
Installation procedure

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.

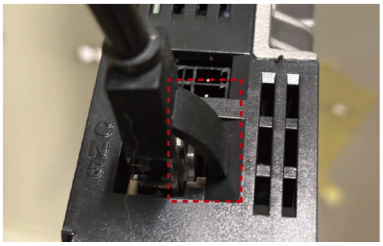


Step 3. Connect the network port to the servo.



Removal procedure

Press the side protrusion and pull the cable outward.



6.7 Grounding

6.7.1 Grounding Requirements (CE)

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

Caution

1. Measures against electrical shock: Ground the grounding terminal properly. The grounding method must comply with the electrical installation regulations in the applicable country/region.
2. 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.
3. 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.
4. 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.

Note

1. For multi-drive systems, ground the system according to specifications. Improper grounding may cause equipment malfunction.
2. 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.

6.7.2 Wiring Precautions and Requirements

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

- The protective grounding conductor must be a yellow-green cable comprised of copper conductors. Do not connect the protective grounding conductor to a switching device (such as a circuit breaker) in series.
- The grounding terminal must be grounded properly. Do not connect the grounding terminal to the power supply neutral (N) terminal.
- Install the device on a conductive metal surface. Ensure that the whole conductive bottom of the drive is bonded properly with the mounting surface.

6.7.3 Wiring Example

6.7.3.1 Single-Drive Grounding

For grounding of a single drive, see *" System Connection Diagram" on page 47*.

6.7.3.2 Multi-Drive Grounding

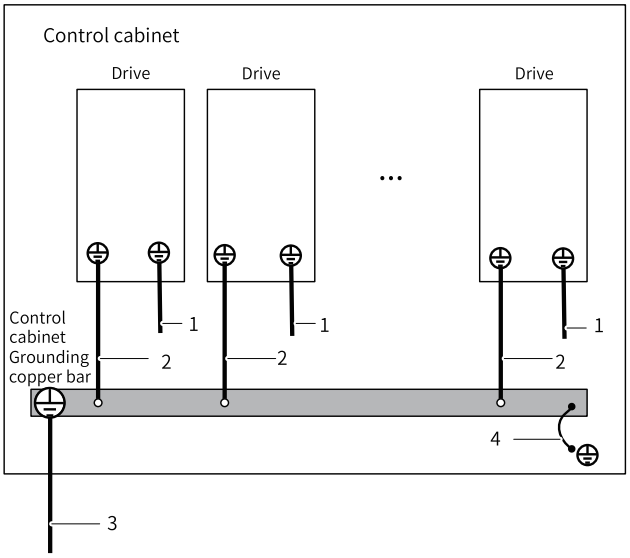


Figure 6-42 Multi-drive grounding

Table 6–26 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.

6.7.3.3 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 6–27 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.

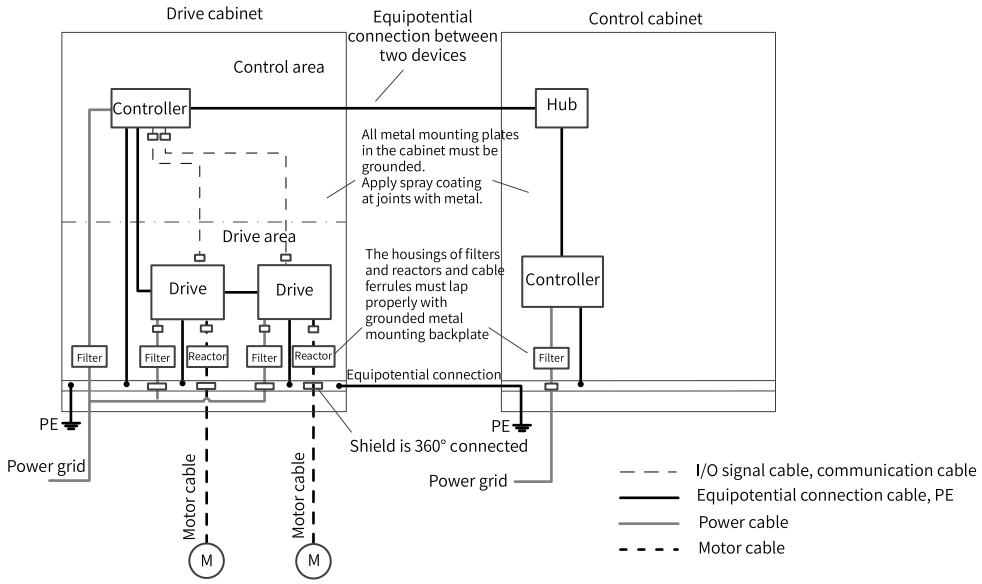


Figure 6-43 Recommended wiring for the control cabinet system

6.8 Option Wiring

6.8.1 Braking Resistor Wiring

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.

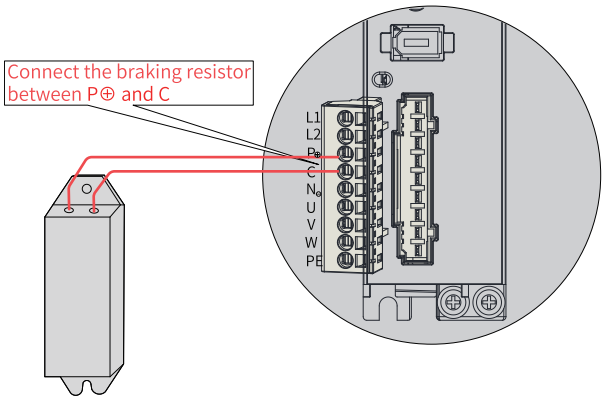


Figure 6-44 Connection of external braking resistor

For cables used for terminals P⊕ and C, see *"6.3.3.2 Cable Sspecifications" on page 87*.

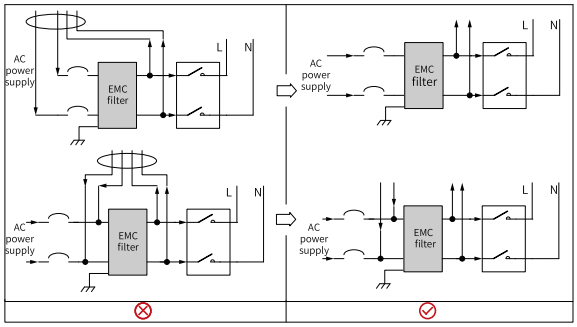
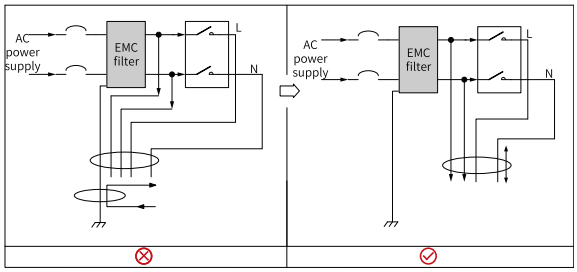
Caution

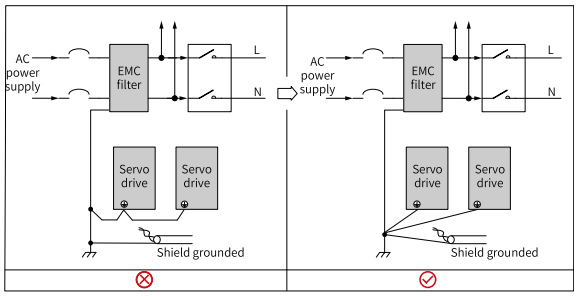
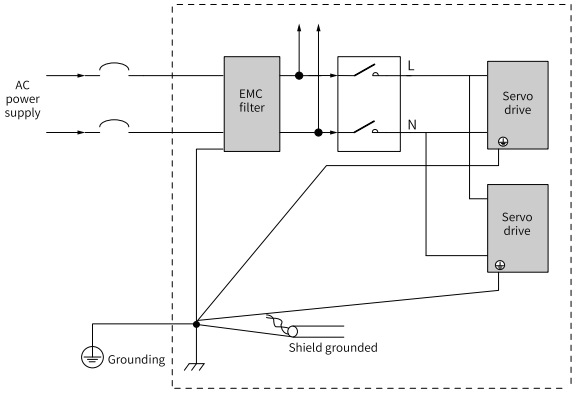
Observe the following precautions when connecting the braking resistor:

- 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 can damage the 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 Er.201 (Overcurrent) 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.

6.8.2 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 6-45 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 6-46 Separate routing of the grounding cable and output power cable

No.	Precautions	Wiring example
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 6-47 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 6-48 Grounding of the EMC filter

6.8.3 Surge Protection Device Wiring

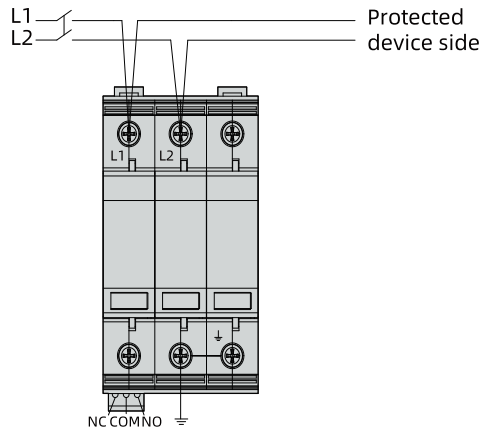
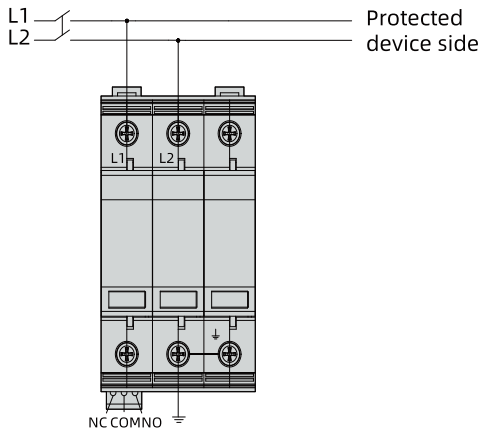
6.8.3.1 Wiring Precautions and Requirements

- 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.

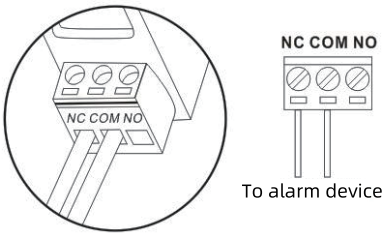
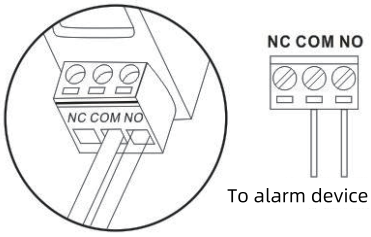
6.8.3.2 Wiring Example

Wiring method

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

V-shaped wiring (recommended)	Direct parallel wiring
 V-connection	 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 type	Indicator	NC-COM	NO-COM
Running	Green	Short circuit	Open circuit
Failure state	Red	Open circuit	Short circuit

6.9 Post-wiring Inspection

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

No.	Item	Compliance
1	The drive is grounded properly.	□
2	The power supply (input power) voltage matches the rated input voltage of the drive.	□

No.	Item	Compliance
3	The power supply (input power) is connected to L1/L2/L3 and secured with the specified tightening torque.	□
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.	□

6.10 Solutions to Common EMC Problems

6.10.1 Malfunction of Residual Current Device

If an RCD is needed, select the RCD according to the following requirements:

- Use a B-type residual current device (RCD) because the drive may generate DC leakage current in the protective conductor.
- For each drive, use an RCD with tripping current 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 one RCD is used, select an RCD with tripping current not lower than 300 mA.
- It is recommended to use Chint or Schneider RCDs.

When the residual current device malfunctions, perform troubleshooting according to the following table.

Table 6–28 Measures against current leakage

Malfunction of Residual Current Device	Possible cause	Solution
Malfunction of residual current device upon power-on	The interference resistance performance of the residual current device is poor.	• Use RCDs of recommended brands. • Use a 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.	
Malfunction of residual current device during operation	The interference resistance performance of the residual current device is poor.	• Use RCDs of recommended brands. • Use a 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 6-49 Magnetic ring on the input side" on page 132*. • 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 distributed capacitance to ground of the motor cable and motor is excessively high.	

Figure 6-49 Magnetic ring on the input side

6.10.2 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 62*.

6.10.3 Control Circuit Interference

6.10.3.1 High-speed Pulse Interference

Take corrective measures as described in the following table.

No.	Step
1	Used shielded twisted pair cables with both ends of the cable grounded (see *" Cable Specifications and Model Requirements" on page 100*).
2	Connect the motor enclosure to the PE terminal of the drive.
3	Connect the PE terminal of the drive to the PE terminal of the mains power supply.

No.	Step
4	Add an equipotential bonding grounding cable between the host controller and drive (see *"6.7.3.3 Grounding of the Control Cabinet System" on page 126*).
5	Separate signal cables from power cables with a distance of at least 30 cm.
6	Wind the signal cable around the ferrite clamp or magnetic ring by one or two turns (see *" Instructions for Installing Magnetic Ring and Ferrite Clamp" on page 62*).
7	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 62*).
8	Use a shielded power cable and properly ground its shield.

6.10.3.2 Common I/O Signal Interference

The drive generates strong interference during operation. Although EMC measures are taken, interference may still exist due to improper wiring or grounding during use. When the drive disturbs or is disturbed by other devices, adopt 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 100*.
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 *"6.7.3.3 Grounding of the Control Cabinet System" on page 126*).
4	Main circuit 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 62*).
6	Increase the filter capacitance for low-speed DIs. A capacitance up to 0.1 μF is recommended, as shown in *"Figure 6-50 I/O signal cables with capacitance increased" on page 133*.
7	Wind the signal cable around the magnetic ring or ferrite clamp by one or two turns (see *" Instructions for Installing Magnetic Ring and Ferrite Clamp" on page 62*).
8	Use shielded power cables and ground the shield properly.

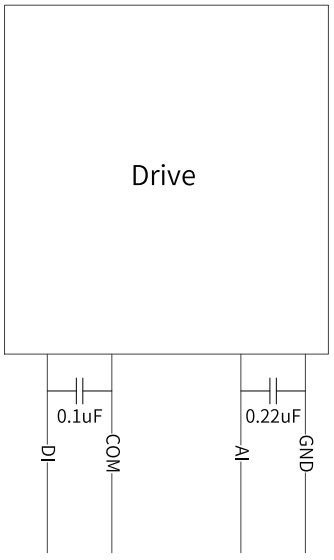


Figure 6-50 I/O signal cables with capacitance increased

6.10.4 Communication Interference

Take corrective measures as described in the following table.

Step	Solution
1	Install a 120 Ω termination resistor on each end of the bus.
2	Communication cables are recommended to use shielded twisted three-core cables, with the shield grounded at both ends.
3	Separate communication cables from power cables with a distance of at least 30 cm.
4	Adopt daisy chain mode for multi-node communication layout.
5	Add an equipotential bonding grounding cable between nodes during multi-node communication (see *"6.7.3.3 Grounding of the Control Cabinet System" on page 126*).
6	Install ferrite clamps on both sides of the communication cable or wind the magnetic ring by one or two turns (see *" Instructions for Installing Magnetic Ring and Ferrite Clamp" on page 62*).
7	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 62*).
8	Use a shielded power cable and properly ground its shield.

7 Commissioning Tools

7.1 Keypad

7.1.1 Components

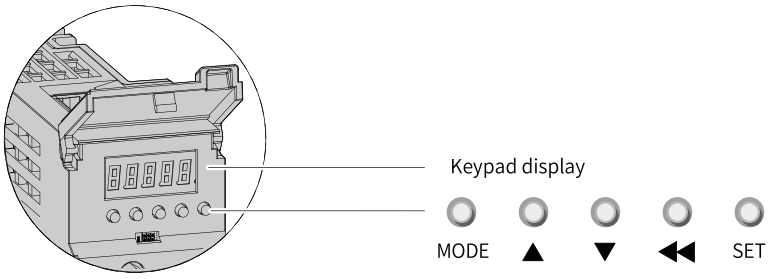


Figure 7-1 Appearance of the operation panel

The keypad, which consists of five 8-segment LEDs and five keys, is used for data display, parameter setting, user password setting, and general function execution. The following table takes parameter setting as an example to describe the general functions of the keys.

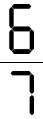
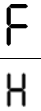
Table 7–1 Functions of keys

Name	Demonstration	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. Note: To switch between high-order and low-order bit values, hold down the SHIFT key.
SET	SET	Switch to the next-level menu. Execute commands such as storing parameter setpoints.

7.1.2 LED Display

Table 7–2 LED display and actual data

Display	Equivalent	Display	Equivalent	Display	Equivalent	Display	Equivalent
0	0	9	9	h	h	r	r
1	1	A	A	c	c	t	t

Display	Equivalent	Display	Equivalent	Display	Equivalent	Display	Equivalent
	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

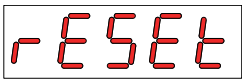
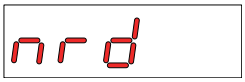
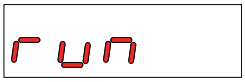
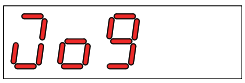
Display	Name	Applicable scenario	Description
	reset Servo drive initializing	Upon power-on	The servo drive is in the initialization or reset status. After initialization or reset is completed, the servo drive automatically switches to other status.
	nrd Servo not ready	The servo drive is initialized, but is not ready.	The servo drive is not ready to run because the main circuit is not powered on. For details, see**User Guide**.
	nrd.x Servo not ready		Meaning of x: For specific causes and troubleshooting methods, please refer to *"Table 7-3 Cause and troubleshooting for display of "x"" on page 137*. 1: Control power (L1C, L2C) undervoltage 2: Main circuit power input error 3: The bus power supply is in the undervoltage status. 4: Pre-charge resistor not bypassed 5: Encoder initialization not done 6: Short circuit to ground detection not done 7: There are other initialization items to be done.
	RDY Servo ready	The servo drive is ready to run.	The servo drive is ready to run and waits for the enabling signal from the host controller.
	Run Servo running	Servo ON (S-ON) signal is activated. (S-ON signal switched on)	The servo drive is running.
	Jog Jog	The servo drive is jogging.	See section Jogging for details.

Table 7–3 Cause and troubleshooting for display of "x"

nrd.x	Cause	Troubleshooting
nrd.1	Control power undervoltage. Control power (H0b.57) is less than the undervoltage threshold H01.17 (for 220V input, undervoltage threshold = H01.17 - 10; for 380V input, undervoltage threshold is 350V).	① Check whether 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.
nrd.2	Inputs of L1 to L3 are abnormal.	① Use a multimeter to check whether there is voltage input in L1 to L3. ② Use an oscilloscope to test whether phase loss occurs on L1 to L3.

nrd.x	Cause	Troubleshooting
nrd.3	The bus voltage (H0b.26) is lower than the undervoltage threshold H01.17 (undervoltage threshold for 220 V input: 200 V; undervoltage threshold for 380 V input: 380 V).	① Check if input L1 to L3 meet the input specifications. ② If yes, and H0b.26 is close to 0, the hardware circuit may be damaged.
nrd.4	Soft start failed.	Check whether the bus voltage (H0b.26) is in the normal range (220 V input : 235 V to 378 V; 380 V input: 451 V to 689 V).
nrd.5	Initialization of the encoder is not completed.	Contact the encoder manufacturer technical support engineers.
nrd.6	Short circuit to ground detection is not completed.	Check the value of H0b-57.
nrd.7	There are other initialization items to be done.	Contact Inovance technical personnel for troubleshooting.

7.1.3.2 Parameter Display

- Display of parameter groups

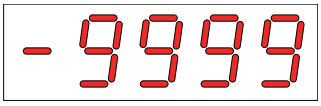
Display	Name	Content
HXX.YY	Parameter group	XX: Parameter group No. (Hexadecimal) YY: Offset within the parameter group (decimal)

For example, H02.00 is displayed as follows:

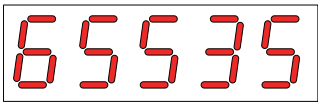
Display	Name	Content
	H02.00	02: Parameter group No. 00: Offset within the parameter group

- 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:

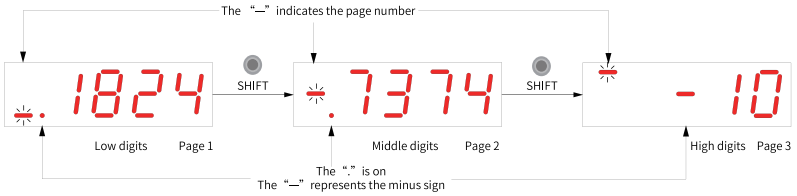


Figure 7-2 Display of "-1073741824"

For example, 1073741824 is displayed as follows:

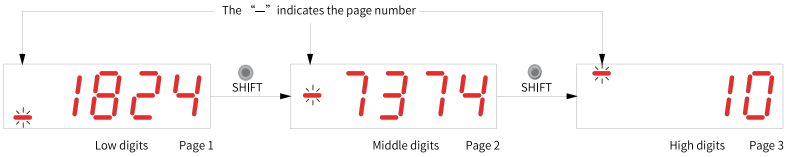
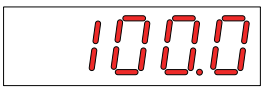
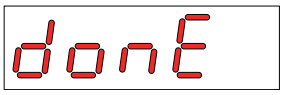
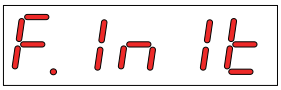
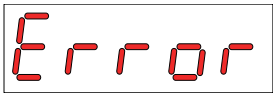


Figure 7-3 Display of "1073741824"

- 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 displays the current or history faults and warnings. For analysis and troubleshooting of faults and warnings, see the section Troubleshooting.
- When a single fault or warning occurs, the keypad displays the fault or warning code. When multiple faults or warnings occur, the keypad displays the fault code of the highest level.
- You can select the previous fault/warning to be viewed through H0b.33 and view the code of the selected fault/warning in H0b.34.
- You can clear the latest 10 faults or alarms saved in the servo drive by setting H02.31 to 2.

For example, E941.0 is displayed as follows:

Display	Name	Description
	E941.0 Current warning code	E: indicates that a fault or warning occurs in the servo drive 941.0: warning code

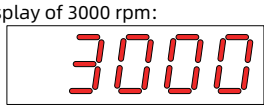
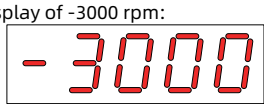
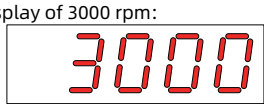
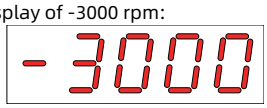
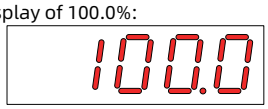
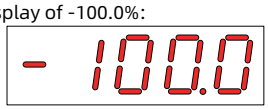
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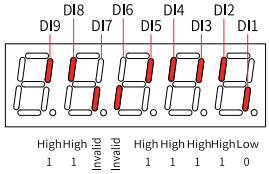
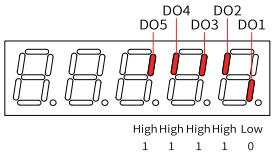
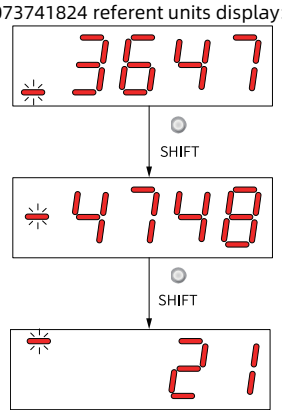
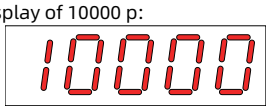
- If the panel displays "Hault/Fault", a system fault has occurred.
- The possible causes include program bugs, external interference like static electricity or electromagnetic interference, extreme operating temperature or radiation.
- In this case, record the values of H16.00–H16.27, and consult with our R&D engineers.

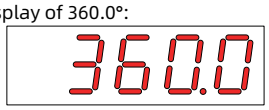
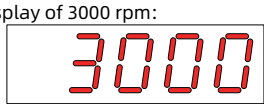
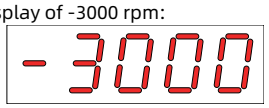
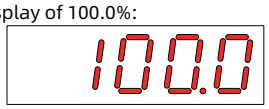
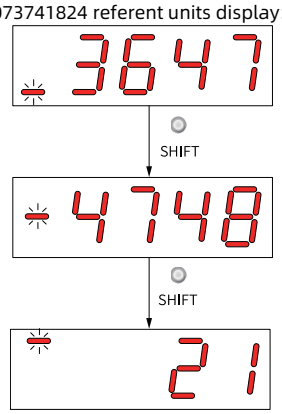
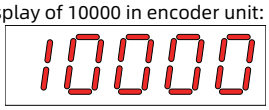
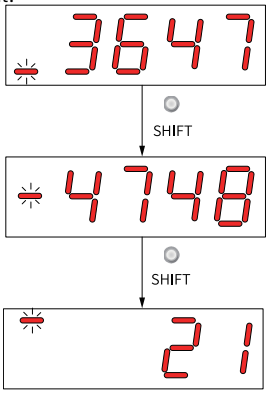
7.1.3.4 Monitored Value Display

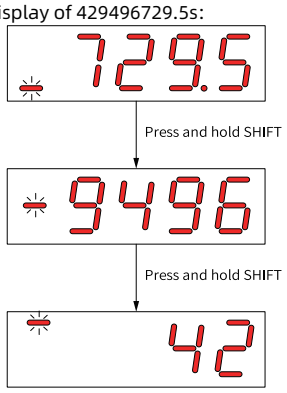
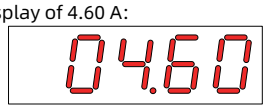
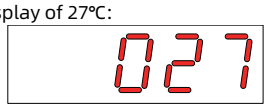
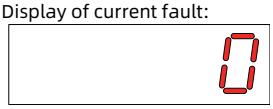
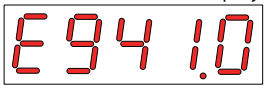
- Group H0b: The parameters in this group are used to monitor the running status of the servo drive. You can enable panel monitoring display by setting H02.32. The parameter group number displayed is H0b and the group offset is the value set by H02.32.
- When H02.32 is set to a valid group offset, the 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, when H02.32 is set to 00 and when the motor changes from the standstill state to rotation state, the display switches from "Status display mode" to "Parameter display mode", and the display displays the parameter value corresponding to H0b.00.

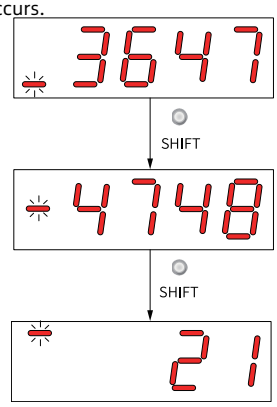
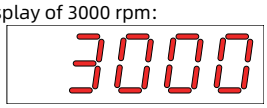
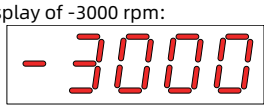
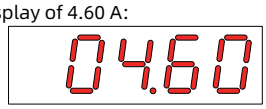
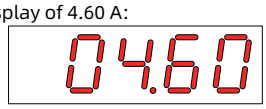
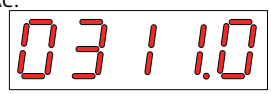
The following table illustrates the display of the monitored parameter H0b.00.

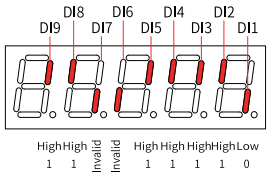
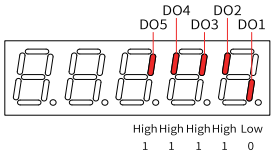
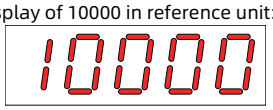
Parameter	Name	Unit	Description	Example
H0b.00	Actual motor speed	rpm	Displays the rounded-off value of the actual motor speed, which is accurate to 1 RPM.	Display of 3000 rpm:  Display of -3000 rpm: 
H0b.01	Speed reference	rpm	Displays the current speed reference of the servo drive.	Display of 3000 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%: 

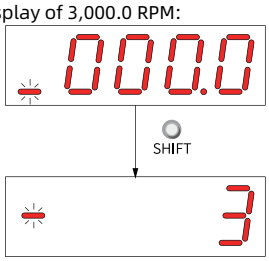
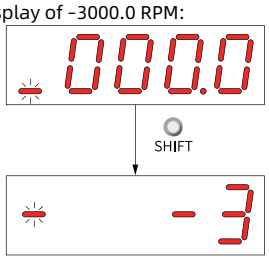
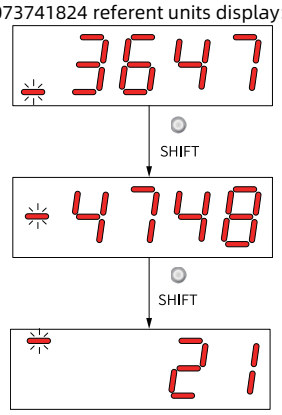
Parameter	Name	Unit	Description	Example
H0b.03	Monitored DI state	-	Displays the optocoupler status of DI1 to DI9: Upper LED segments turned on: The optocoupler is switched off (indicated by "1"). Lower LED segments turned on: The optocoupler is switched on (indicated by "0"). The value of H0b.03 read in the software tool is a decimal.	For example, if DI1 is low level, DI2 to DI9 are high level: the corresponding binary value is "110011110", and the value of H0b.03 read in the software tool is 414. The keypad display is as follows: 
H0b.05	Monitored DO state	-	Displays the optocoupler status of DO1 to DO5: Upper LED segments turned on: The optocoupler is switched off (indicated by "1"). Lower LED segments turned on: The optocoupler is switched on (indicated by "0"). H0b.05 value read by the software tool is a decimal.	For example, if DO1 is low level and DO2 to DO5 are high level: The binary value is "11110". and the value of H0b.05 read in the software tool is 30. The keypad display is as follows: 
H0b.07	Absolute position counter (displayed in 32-bit decimal)	Reference unit	Indicates the present absolute position of the motor (in reference unit).	1073741824 referent units display: 
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 x 4 - 1. (For example, the maximum value of H0b.09 for a 2500-PPR incremental encoder is 9999.) Maximum value of H0b.09 for an absolute encoder is 65535. $\text{Actual mechanical angle} = \frac{\text{H0b.09}}{\text{H0b.09 max. value}+1} \times 360.0\text{deg}$	Display of 10000 p: 

Parameter	Name	Unit	Description	Example
H0b.10	Rotation angle (electrical angle)	0.1°	Displays the current electrical angle of the motor.	Display of 360.0°: 
H0b.11	Speed corresponding to the 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%	Displays the ratio of the average load torque to the rated torque of the motor.	Display of 100.0%: 
H0b.13	Input position reference counter (displayed in 32-bit decimal)	Reference unit	Counts and displays the number of input position references.	1073741824 referent units display: 
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: 

Parameter	Name	Unit	Description	Example
H0b.19	Total power-on time (32-bit decimal)	0.1s	Counts and displays the total power-on time of the servo drive.	Display of 429496729.5s: 
H0b.24	Phase current effective value	0.01A	Displays the RMS value of the phase current of the servo motor.	Display of 4.60 A: 
H0b.26	Bus voltage	0.1 V	Displays the DC bus voltage of the main circuit.	Display of 311.0 V rectified from 220 VAC:  After 380 V AC 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: Latest fault 2: 2nd to last fault ... 9: 9th to last fault	0: Display of current fault: 
H0b.34	Fault code of the selected fault record	-	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, H0b.34 = E941.0, the current fault code is 941. Display: 

Parameter	Name	Unit	Description	Example
H0b.35	Time stamp upon displayed fault	s	Indicates the total servo operating time when the selected fault occurred. When no fault occurs, the value of H0b.35 is 0.	If H0b.34 = E941.0, H0b.35 = 107374182.4, the present fault code will be 941 and the total operating time of the servo drive is 107374182.4s when the fault occurs. 
H0b.37	Motor speed upon displayed fault	rpm	The linear motor speed when the selected fault occurred. When no fault occurs, the value of H0b.37 is 0.	Display of 3000 rpm:  Display of -3000 rpm: 
H0b.38	Motor phase U current upon displayed 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	Displays the RMS value of motor phase V winding current when the fault displayed in H0b.34 occurred. When no fault occurs, the value of H0b.39 is 0.	Display of 4.60 A: 
H0b.40	Bus voltage upon displayed fault	V	Indicates the DC bus voltage of the main circuit when the selected fault occurred. When no fault occurs, the value of H0b.40 is 0.	Display of 311.0 V rectified from 220 VAC:  After 380 V AC rectification, 537.0 V is displayed as follows: 

Parameter	Name	Unit	Description	Example
H0b.41	Input terminal state upon displayed 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 displayed fault	-	Indicates the high/low level state of the five DO terminals upon occurrence of the selected fault. The method for determining the DO level status is the same as that of H0b.05. When no fault occurs, all DOs are displayed as low level in H0b.42 (indicated by the decimal value 0).	Display when H0b.42 is 15: 
H0b.53	Position deviation counter (displayed in 32-bit decimal)	Reference unit	Position deviation = Sum of input position references (reference unit) - Sum of pulses fed back by the encoder (reference unit)	Display of 10000 in reference unit: 

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 3,000.0 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.	1073741824 referent units display: 

7.1.3.5 Display mode switchover

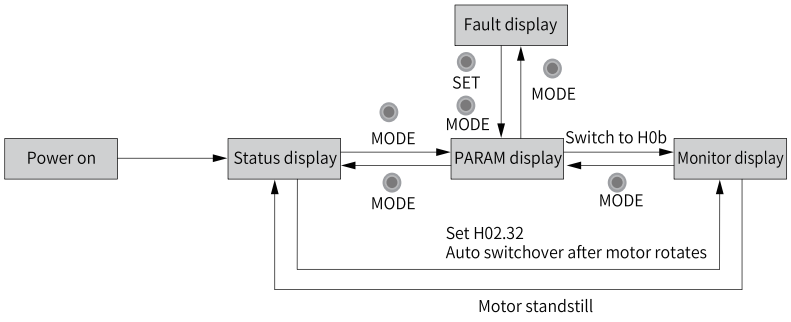


Figure 7-4 Switchover among different display modes

- After the power is on, the operation panel enters the state display mode.
- Press MODE to switch among different display modes based on the conditions shown in *"Figure 7-4 Switchover among different display modes" on page 146*.
- 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 operation panel 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 Example of Parameter Settings

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.

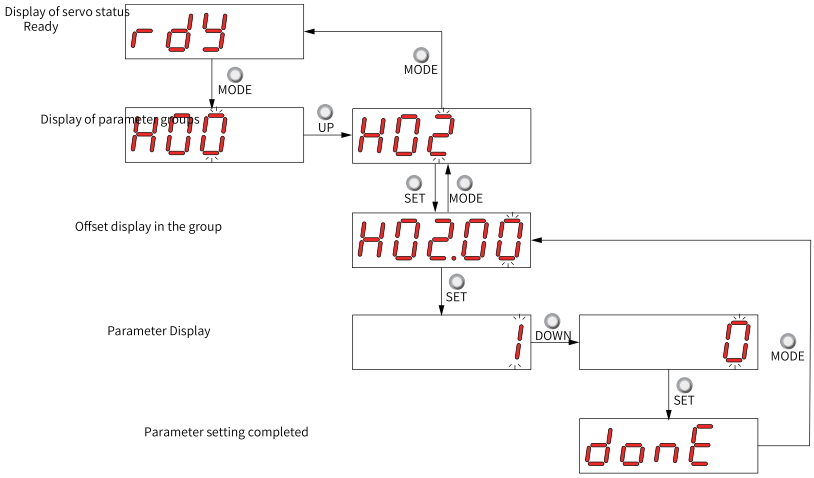


Figure 7-5 Parameter setting procedure

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 input

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

- **Procedure**

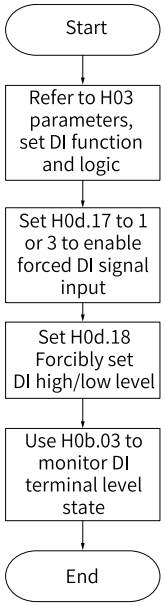


Figure 7-6 Procedure for setting forced DI function

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 operating panel. 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 and DI8 to DI9are inactive when the DI1 function is active. In this case, you can set H0d.18 to "19E" (110011110), and the panel monitored by H0b.03 shows that the DI1 is of low level, DI2 to DI5 and DI8 to DI9 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 "414".

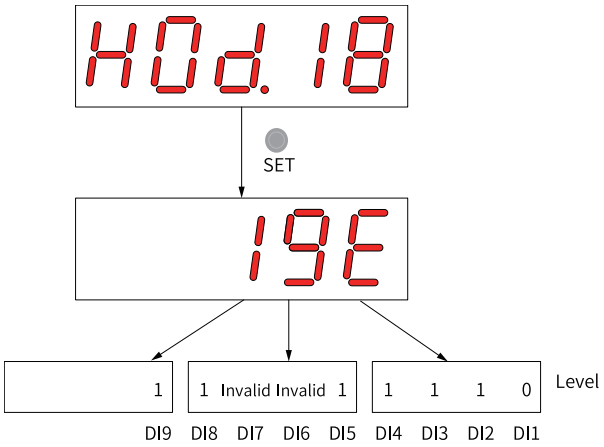


Figure 7-7 Meaning of the H0d.18 setpoint

You can monitor the DI level state through H0b.03, as shown below. The keypad display is as follows:

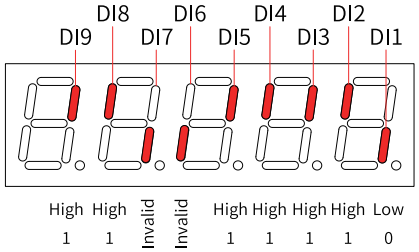


Figure 7-8 DI level states corresponding to H0b.03

Note

DI6 and DI7 terminals are not used, terminal functions are invalid.

Upper LED segment turned 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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.17	Forced DI/ DO selection	0x0D11	0 to 3	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: No action 1: Forced DI enabled, forced DO disabled 2: Forced DO enabled, forced DI disabled 3: Forced DI and DO enabled								
	Parameter description:								
	Defines whether to enable forced DI/DO.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.18	Forced DI level	0x0D12	0x0~0x1FF	-	0x1FF	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the level logic of the DI functions set in group H03 when forced DI is active (H0d.17 set to 1 or 3). H0d.18 is displayed in hex on the keypad. In the converted binary value, bit(n) = 1 indicates that the DI is active high. bit(n)=0 indicates that the level logic of the DI function is low level.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.03	Monitored DI states	0x0B03	0~65535	-	0	UInt16	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the level states of the nine DI terminals without filtering. Upper LED segments ON: optocoupler ON (indicated by "1") Lower LED segments ON: optocoupler OFF (indicated by "0")								

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

In applications where the servo motor drives the vertical axis, when the brake output signal (DO function 9: BK) is active, the brake will be released and the load may fall. Take protective measures on the machine to prevent the risk of falling.

- **Procedure**

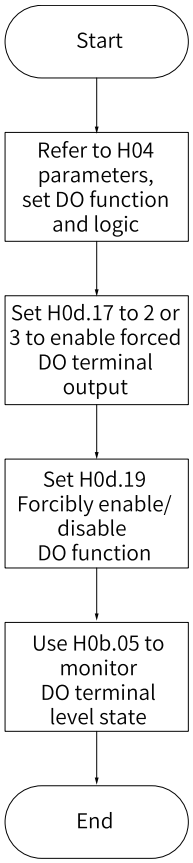


Figure 7-9 Procedure for setting forced DO signal output

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 is set to "active high", DO1 function is inactive when functions of DO2 to DO5 are active through setting H0d.19 to "1E"(11110), and the panel monitored by H0b.05 shows that DO2 to DO5 are of high level, and DO1 is of low level. If there is no fault in the DO function, the read value of H0b.05 matches the set value of H0d.19. The value read through InoDriverShop is a decimal "1E".

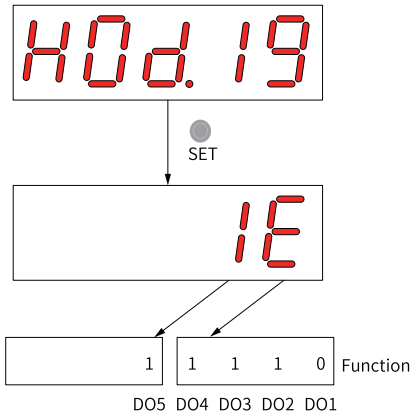


Figure 7-10 Setpoints of H0d.19

Monitoring the DO level status through H0b.05. The keypad display is as follows:

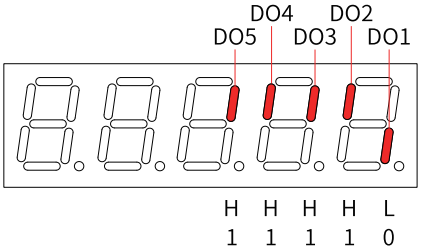


Figure 7-11 Display of H0b.05 when all DO are "active high"

- **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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.17	Forced DI/ DO selection	0x0D11	0 to 3	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: No action 1: Forced DI enabled, forced DO disabled 2: Forced DO enabled, forced DI disabled 3: Forced DI and DO enabled								
	Parameter description:								
	Defines whether to enable forced DI/DO.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.19	Forced DO setting	0x0D13	0x0~0x1F	-	0x0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines whether the DO functions assigned in group H04 are active when forced DO function is active (H0d.17= 2 or 3). The value of H0d.19 is displayed in hex on the keypad. When it is converted to a binary value, "bit(n) = 1" indicates that the DO is active, and "bit(n) = 0" indicates that the DO is inactive.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.05	Monitored DO states	0x0B05	0 to 65535	-	0	UInt16	Unmodifiable	Ordinary user	-
	Parameter description:								
	Displays the level status of five DOs without filtering. Upper LED segments ON: optocoupler ON (indicated by "1") Lower LED segments ON: optocoupler OFF (indicated by "0")								

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.

Setting the user password

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

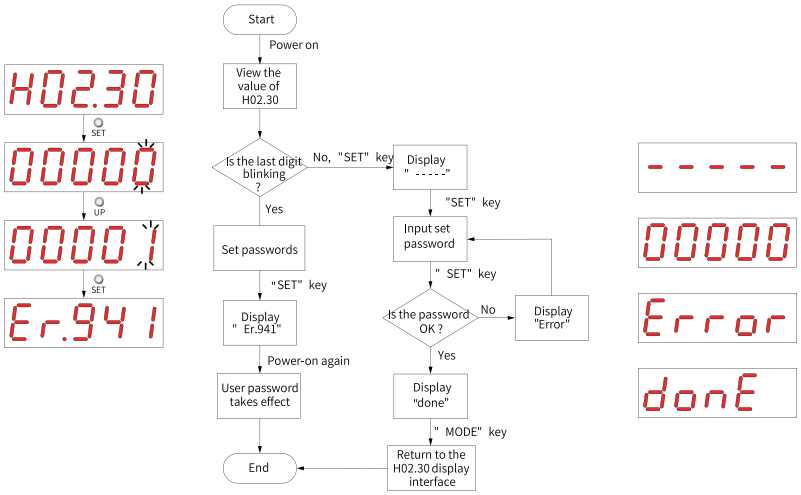


Figure 7-12 Procedure for setting the user password

Changing the user password

First enter the current password to enable parameter setting permissions. Enter H02.30 again, and then set a new password according to the method described in the preceding figure.

Note

If the last digit does not blink, password protection is enabled. If the last digit blinks, password is not set or the correct password has been entered.

Canceling the user password

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.30	User Password	0x021E	0 to 65535	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the user password.								

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

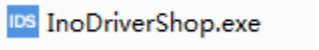
1. Access to the software

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

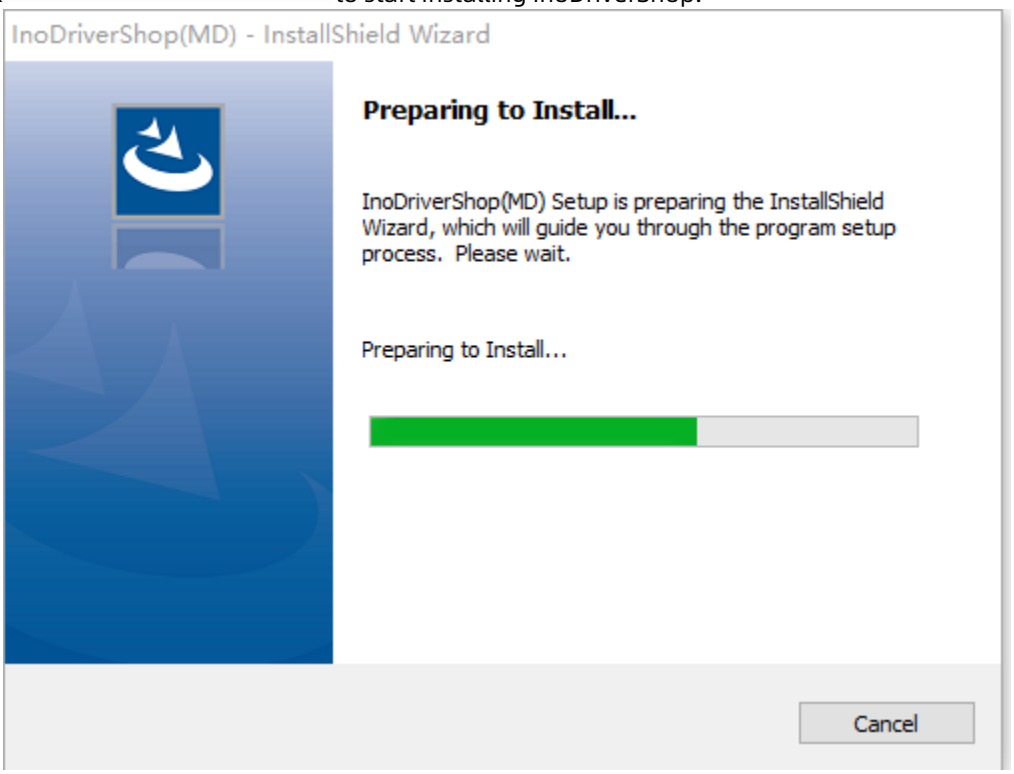
   b. Choose Support → Download, and then type in the keyword InoDriverShop and click "Search".

   c. Click "Download".

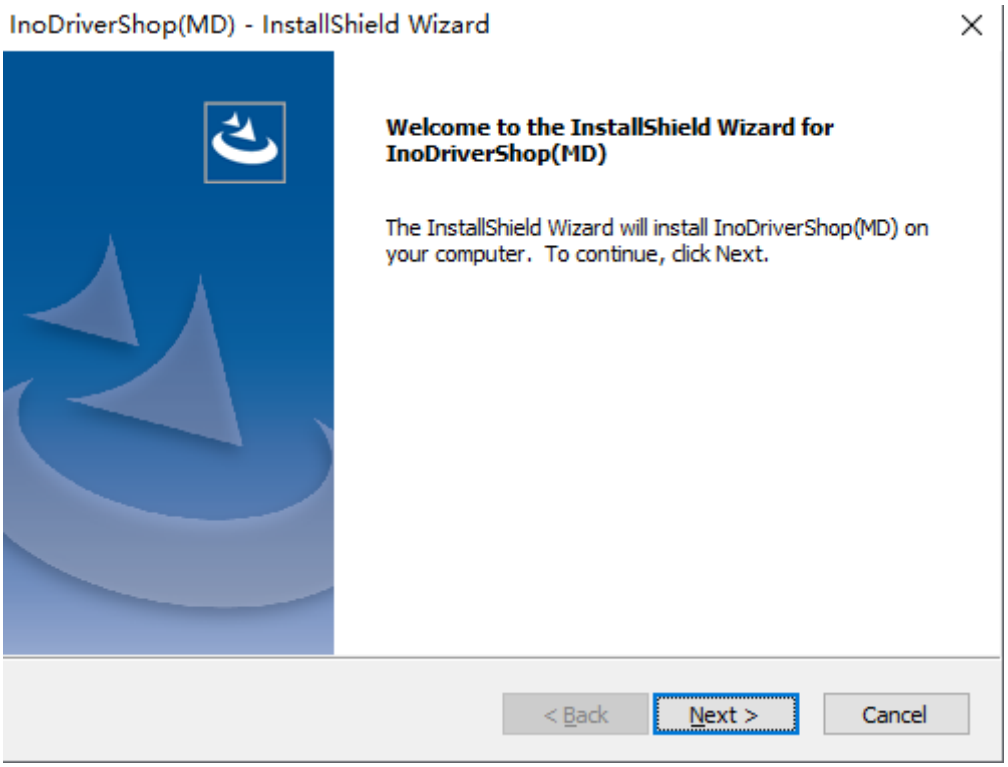
2. Unzip the package downloaded.

3. Click 

to start installing InoDriverShop.

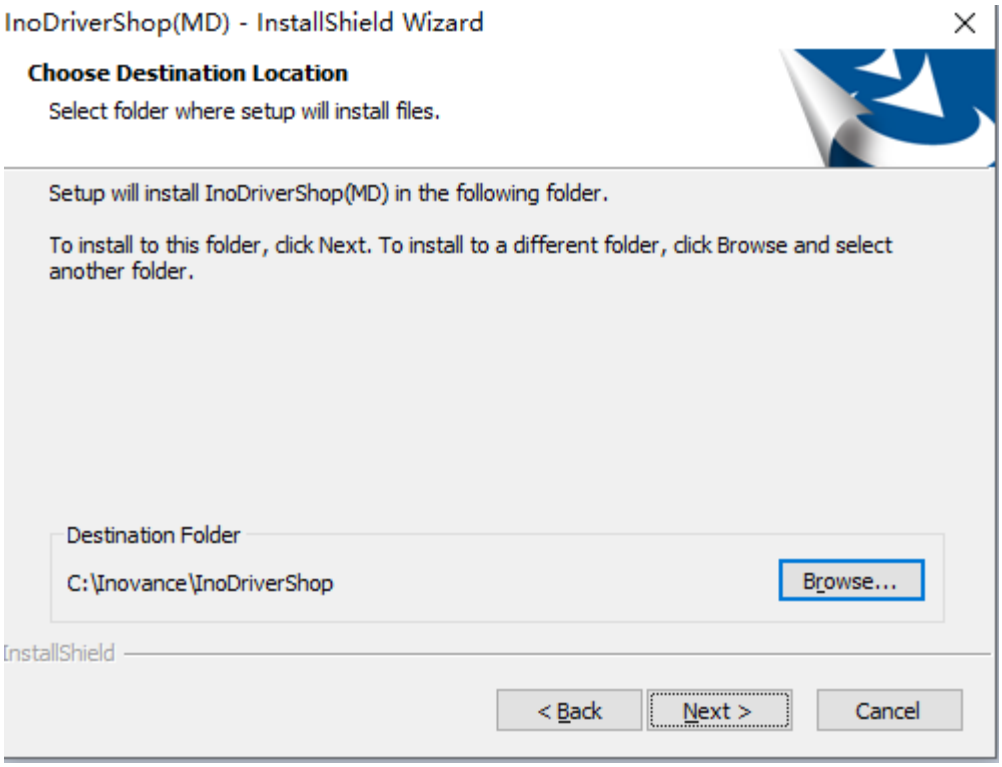


4. Click "Next".

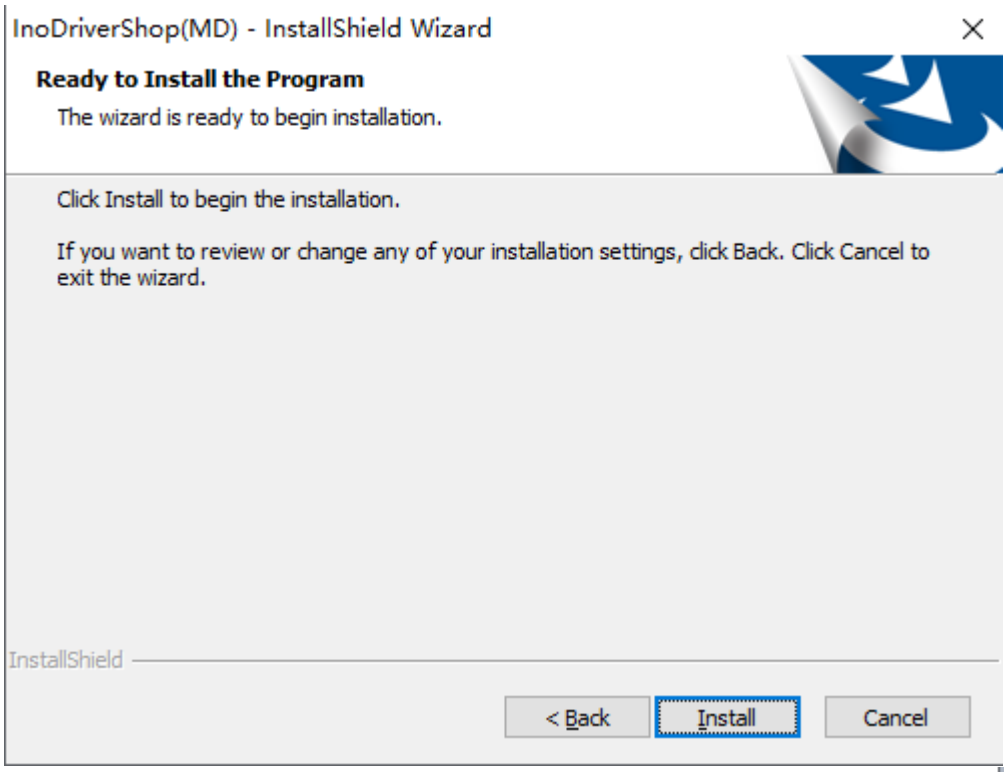


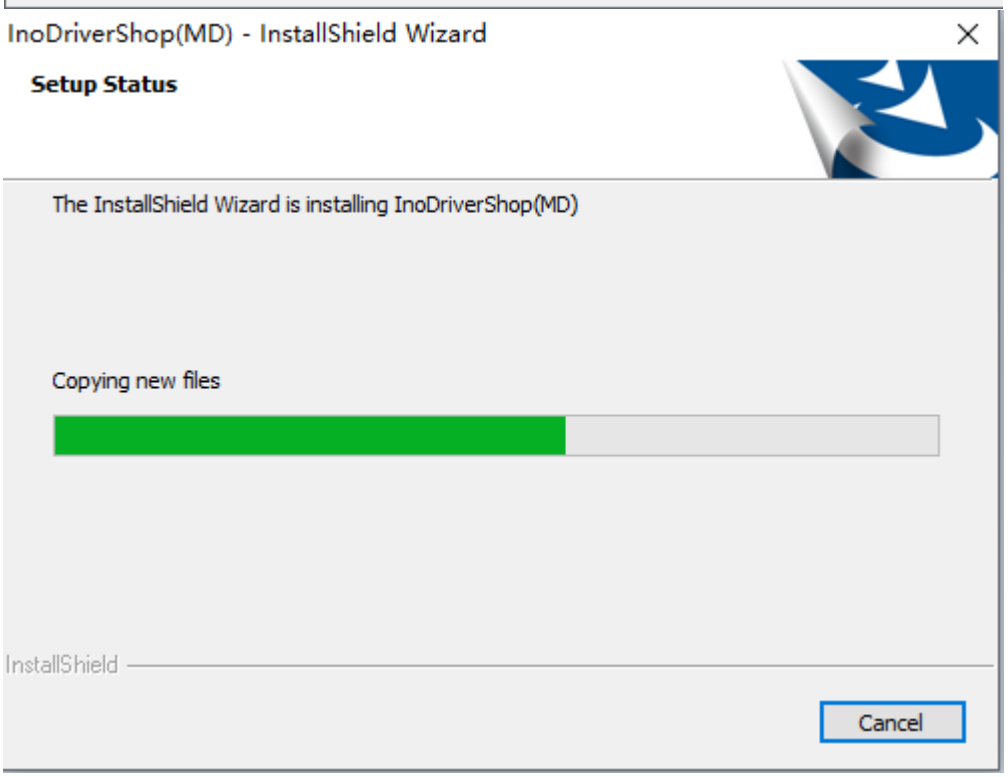
5. You can select the directory for installation as needed through the Browse button. The default directory for installation is "C:\Program Files\Inovance\InoDriverShop".
   In online upgrade, InoDriverShop will be upgraded directly in the original directory.

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

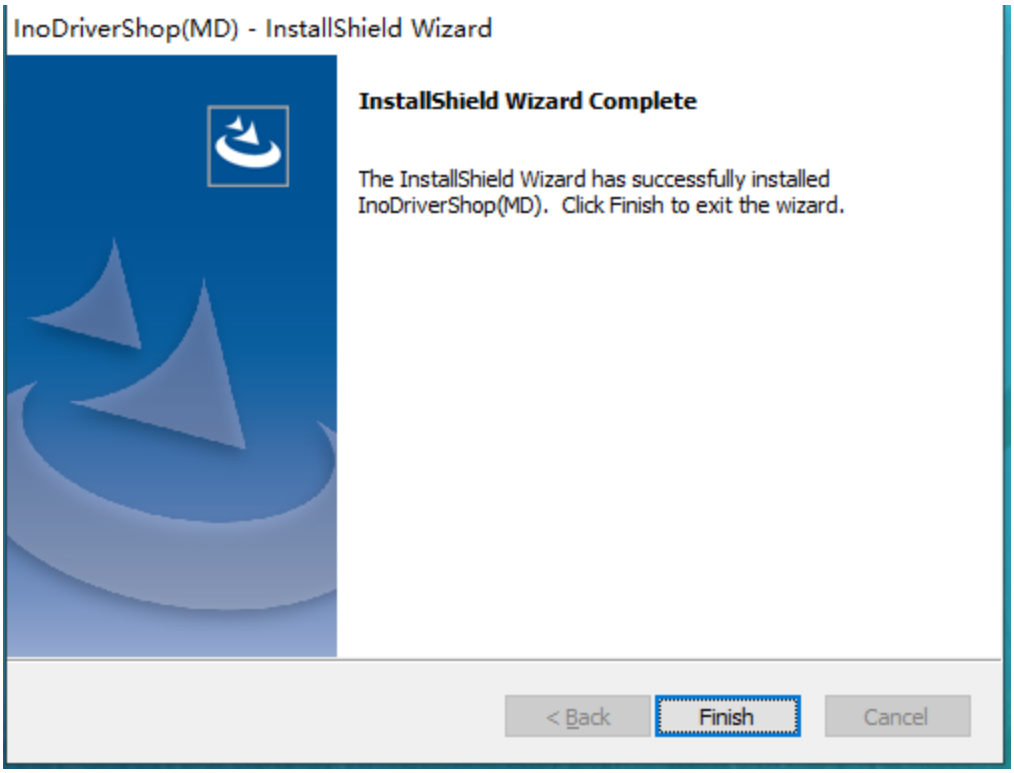


6. Click "Install" to start installation.





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



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



7.2.3 Connection

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.

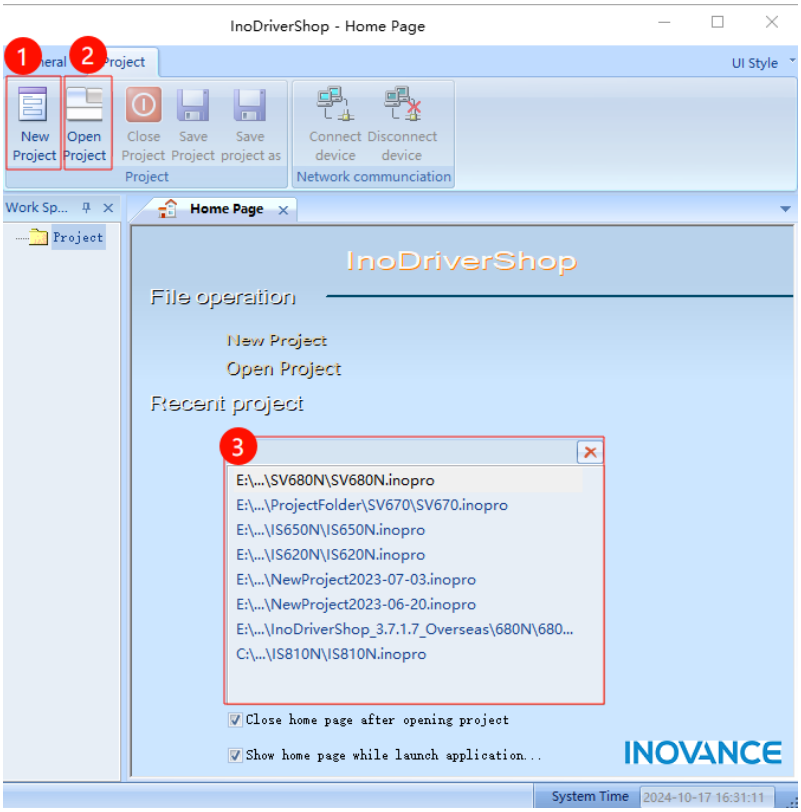


Figure 7-13 Start page

Note

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

b. Open the "Project Guide" page.

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



Figure 7-14 Project Guide page

c. Click "Next" to create a project.

- Create online device, as shown below. The device is automatically scanned. Select the device to be commissioned and click Finish.

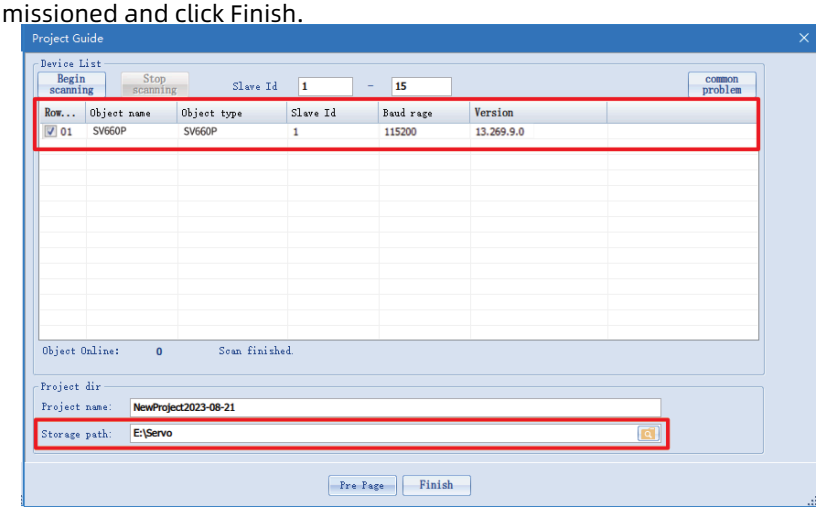


Figure 7-15 Scan page

- The following figure shows the wizard page for creating a project for an offline device. You can select the "Slave ID", "Object Type", and "Software Version" as needed and add different standard or customized devices. You can also designate the storage directory or create multiple offline devices.

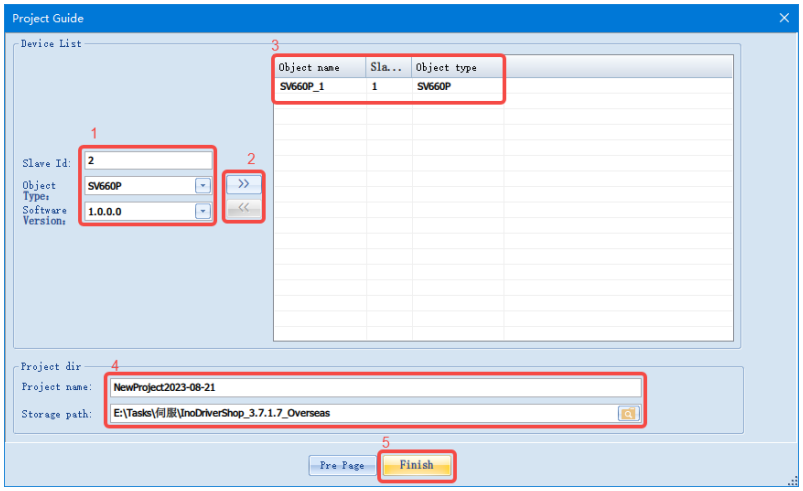


Figure 7-16 Project Guide page for offline device

Note

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

d. The project has been created.

After connection, the main page is shown as follows

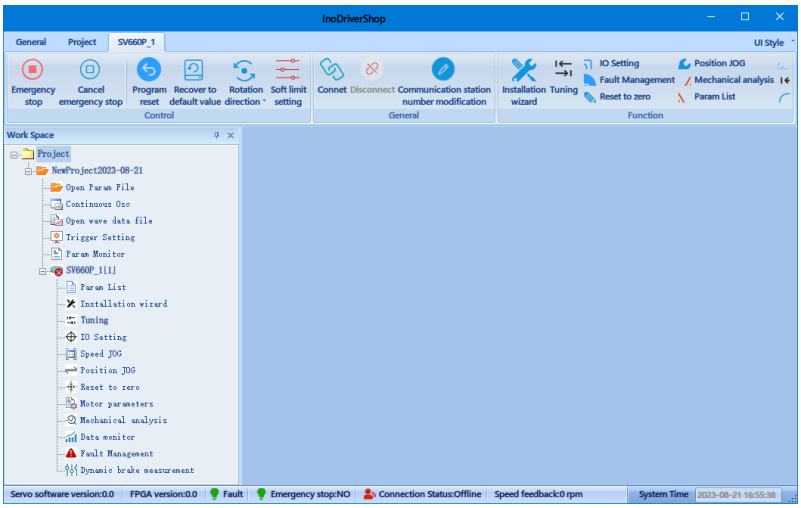
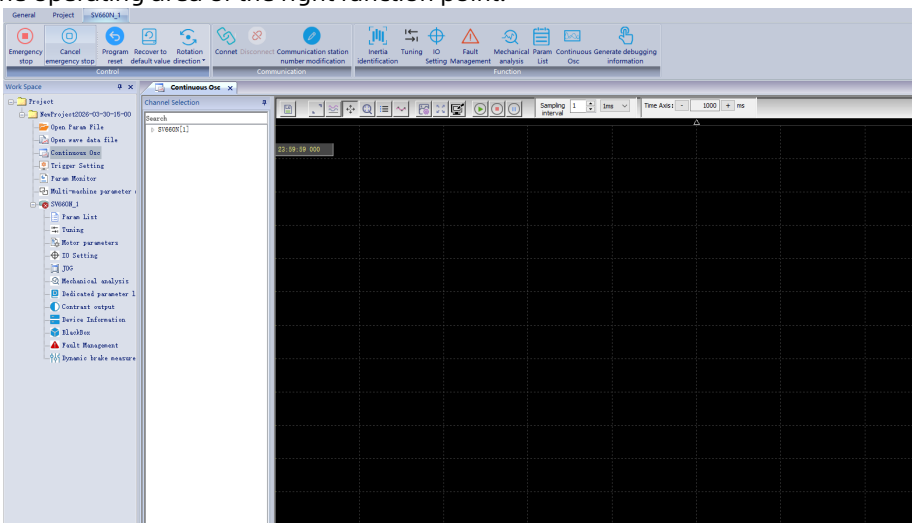


Figure 7-17 Main page

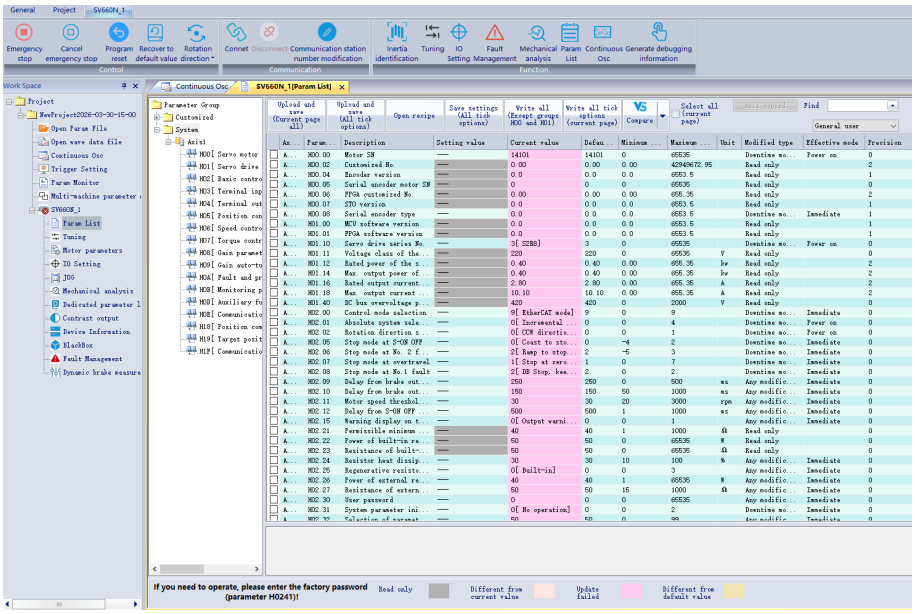
7.2.4 Description of Common Software Functions

InoDriverShop features the following functions:

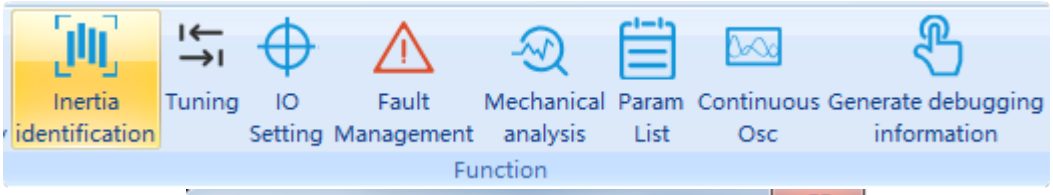
- Oscilloscope: Detects and saves the instantaneous data during operation. Double-click the continuous oscilloscope tree node in the workspace area to open the continuous oscilloscope view in the operating area of the right function point.

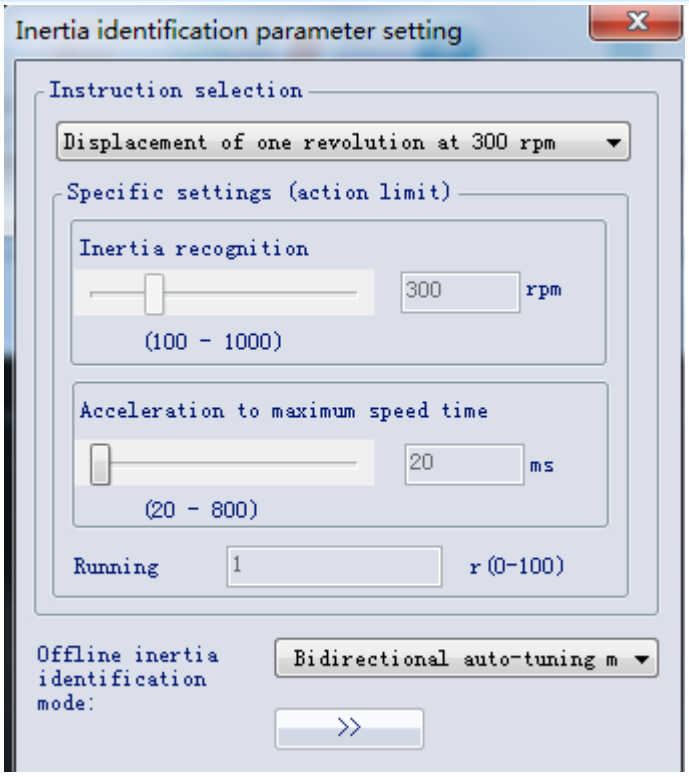


- Parameter management: Reads and downloads parameters in batches. Double-click the parameter list tree node in the workspace area to open the parameter list view in the operating area of the right function point. The current value of the parameter is displayed in the parameter list. You can edit the parameter value and write it to the drive as needed.

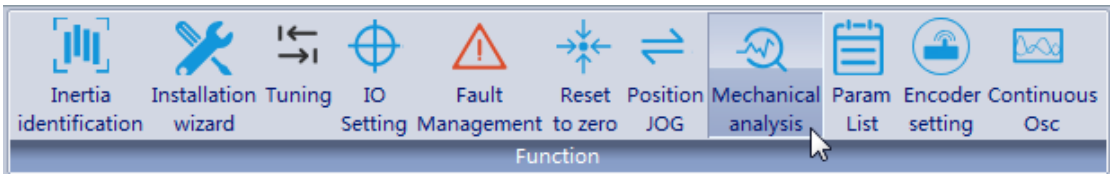


- Inertia auto-tuning: Performs auto-tuning on the load inertia ratio. Select the target axis of the drive to be operated through the drop-down list to configure the inertia auto-tuning parameters. After setting inertia auto-tuning parameters, click the bottom button to enter the inertia auto-tuning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

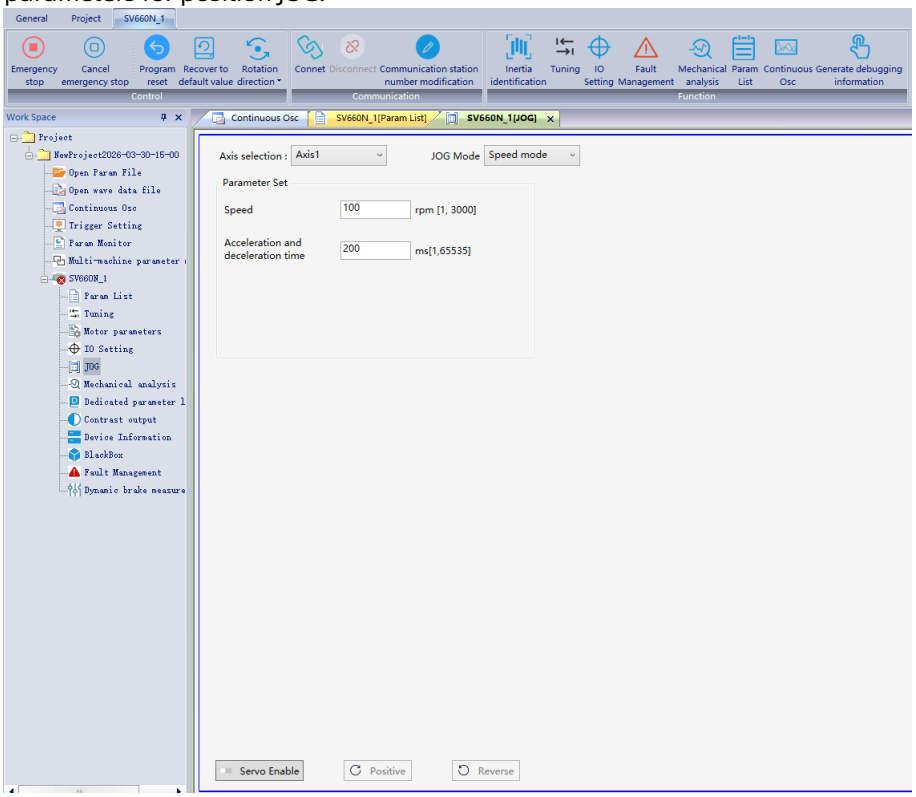




- Mechanical characteristic analysis: Analyzes the resonance frequency of the mechanical system.



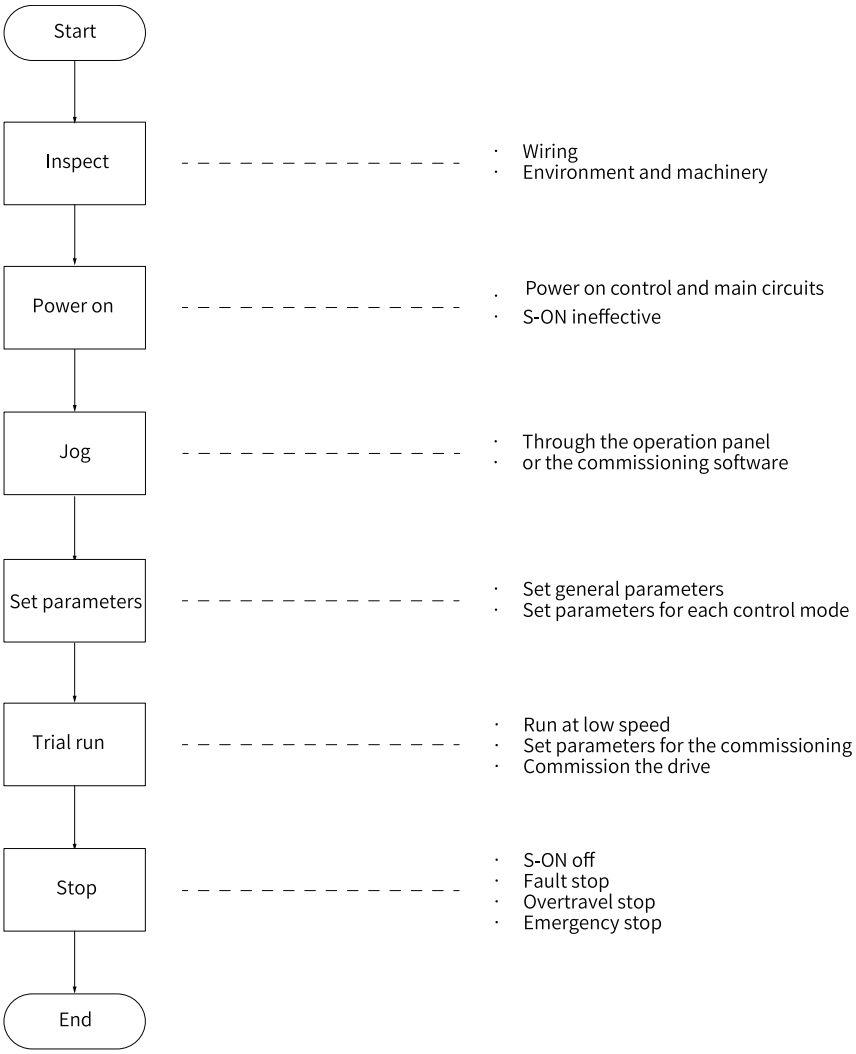
- Motion JOG: Generates position references to make the motor run. Select the target axis of the drive for the position JOG to be performed through the drop-down list, configure and enable function parameters for position JOG.



- Gain tuning: Adjusts the stiffness level and monitors the motion data.

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.	Content	Compliance
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.	Content	Compliance
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 insulated properly.	□
Environment and Mechanical Conditions		
1	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.	□
2	The drive and the external braking resistor are placed on incombustible objects.	□
3	The motor is installed properly. The motor shaft is connected to the machine properly.	□
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" → "nrd" → "rdy" in sequence, the servo drive is ready to run and waits for the S-ON signal.

Note

- If the servo drive panel displays continuously "nrd," refer to *"Table 7-3 Cause and troubleshooting for display of "x"" on page 137* to analyze and eliminate the fault cause.
- If the keypad displays other faults, rectify the fault according to section "Troubleshooting".

2. Turn off the servo ON signal.

Allocate a certain DI of the servo drive with function 1 (FunIN.1:S-ON, servo ON) and set the active logic of this DI. Then deactivate this DI through communication with the host controller or through an external switch.

Relevant function No.:

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

8.4 Jog

Caution

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.

Jogging through the keypad in speed control mode

- **Steps**

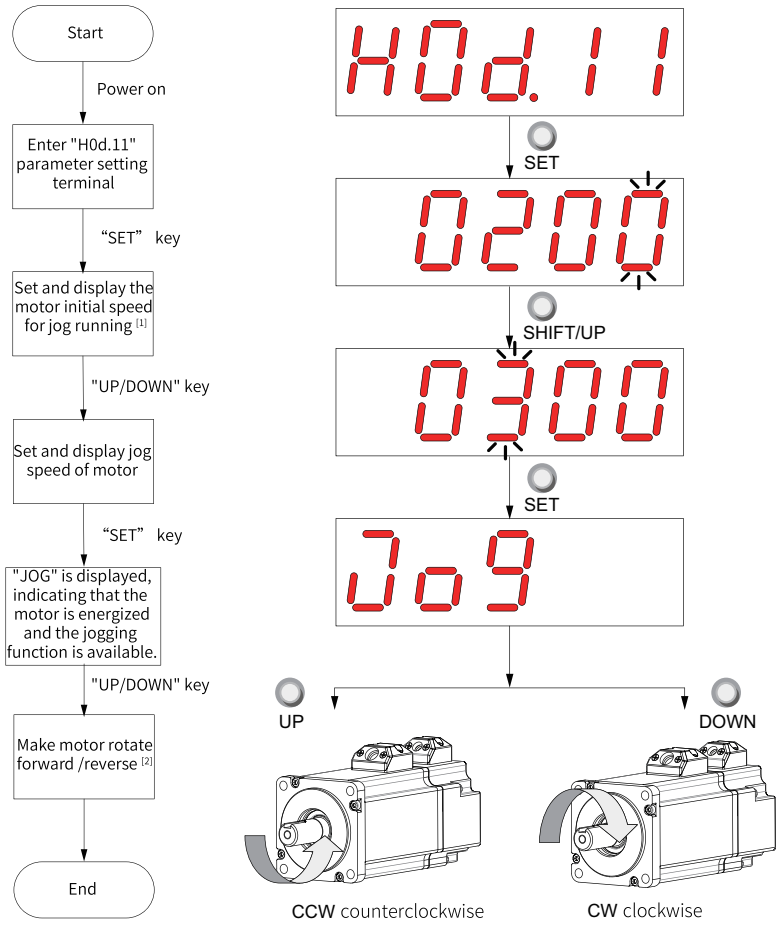


Figure 8-1 Procedure for triggering jog through keypad in speed control mode

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 speed jog mode by setting H0d.11 through the keypad. The keypad displays the default jog speed at this moment.
  2. After pressing the "SET" button, you can adjust the jog speed using the "UP/DOWN" buttons, then press the "SET" button again. The keypad displays "JOG".
  3. Press the UP/DOWN key to make the motor run forwardly or reversely.
  4. Press the MODE key to exit the jog mode and return to the previous menu. The setpoint of H06.04 returns to the default value.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.04	Jog speed setting value	0x0604	0 to 7000	rpm	100	UInt16	At once	Ordinary user	At once
	Parameter description:								
	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.

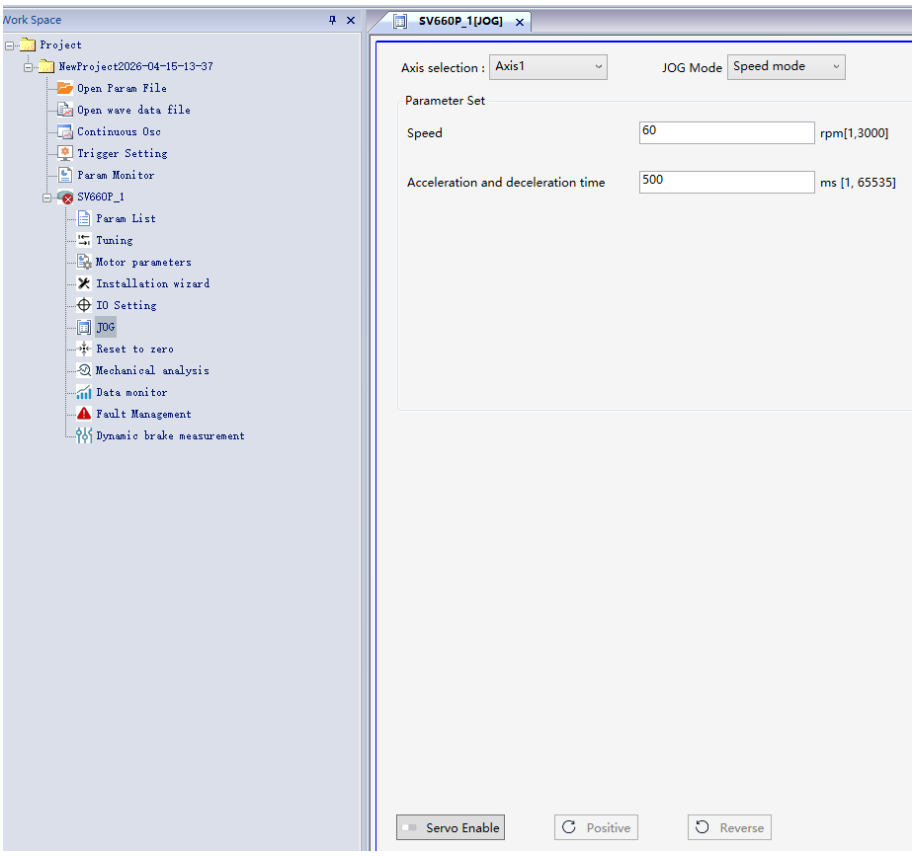


Figure 8-2 Jog page

8.5 Setting Parameters

8.5.1 Rotation Direction Selection

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

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

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

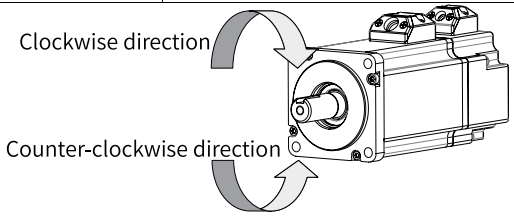
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H00.00	Motor SN	0x0000	0 to 65535	-	14101	UInt16	At stop	Ordinary user	Effective upon next power-on
	Parameter description:								
	14000: Inovance motor with 20-bit incremental encoder 14101: Inovance motor with 23-bit absolute encoder								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.02	Forward direction	0x0202	0–1	-	0	UInt16	At stop	Ordinary user	Effective upon next power-on

Parameter description:

Defines the forward direction of the motor when viewed from the motor shaft side.

Set value	Rotating 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 Selection of Output Pulse Phase

The output of the servo drive is phase A + phase B quadrature pulse.

The phase relationship between phase A and phase B pulses can be changed by setting H02.03 without changing the motor rotating direction.

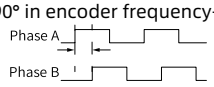
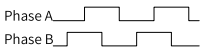
The change of H02.02 does not affect the pulse output form or the sign (+/–) of monitoring parameter values of the servo drive.

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.03	Output pulse phase	0x0203	0–1	-	0	UInt16	At stop	Ordinary user	Effective upon next power-on

Parameter description:

Defines the relationship between phase A and phase B on the condition that the motor direction of rotation remains unchanged when pulse output is enabled.

Set value	Output pulse phase	Remarks
0	CCW direction as the forward direction (phase A leads phase B)	Phase A leads phase B by 90° in encoder frequency-division output pulses. 
1	CW direction as the forward direction (Phase A lags phase B)	Phase A lags behind phase B by 90° in encoder frequency-division output pulses. 

8.5.3 Brake Settings

8.5.3.1 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.

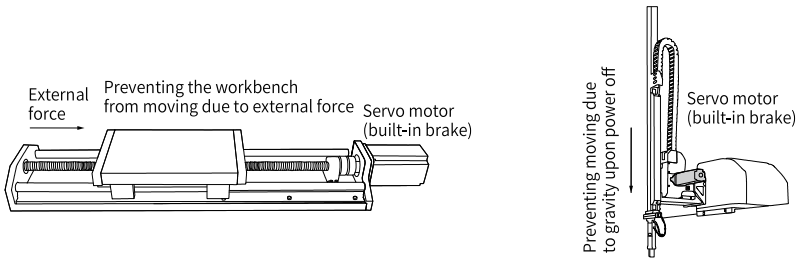


Figure 8-3 Application of the brake

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.

8.5.3.2 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.

8.5.3.3 Brake Time Sequence of Servo Drive

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 171*and *" b. Brake time sequence at motor rotating" on page 172*.

For the brake sequence in the fault state, see *" c. Brake time sequence in faulty state of servo drive" on page 174*.

Brake sequence for motor at standstill

When the servo ON signal is deactivated, and the current motor speed is lower than 20 rpm, the drive acts according to the brake sequence for the motor at standstill.

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.

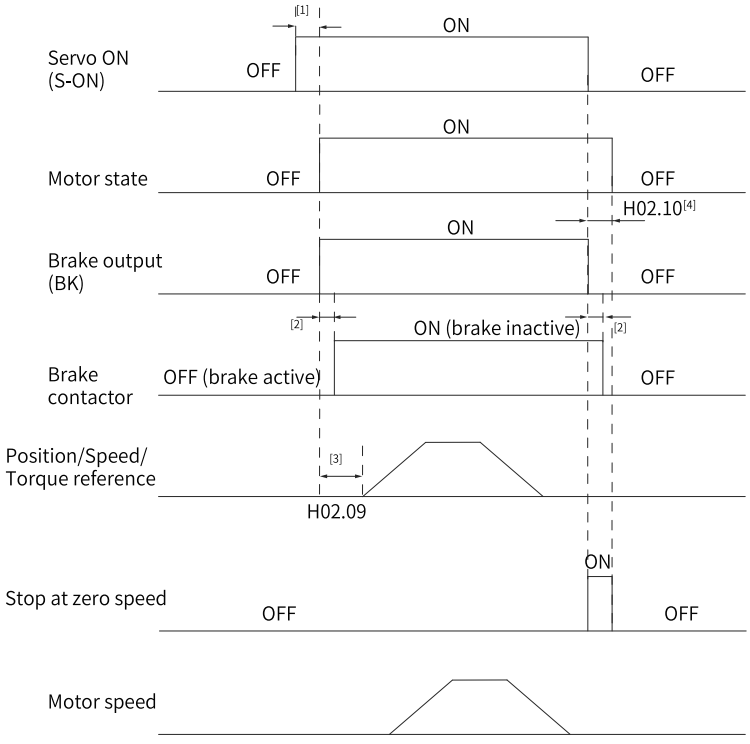


Figure 8-4 Brake sequence for motor at standstill

Note

- [1]: When the S-ON signal is activated, the brake (BK) output signal is set to "ON" at a delay of about 100 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 170*.
- [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".

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.09	Delay from brake output on to command received	0x0209	0–500	ms	250	UInt16	At once	Ordinary user	At once
	Parameter description:								
	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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.10	Delay from brake output OFF to motor de-energized in static state	0x020A	1 to 1000	ms	150	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the delay from the moment brake output is OFF to the moment when the motor at standstill enters the de-energized status.								

b. Brake time sequence at motor rotating

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

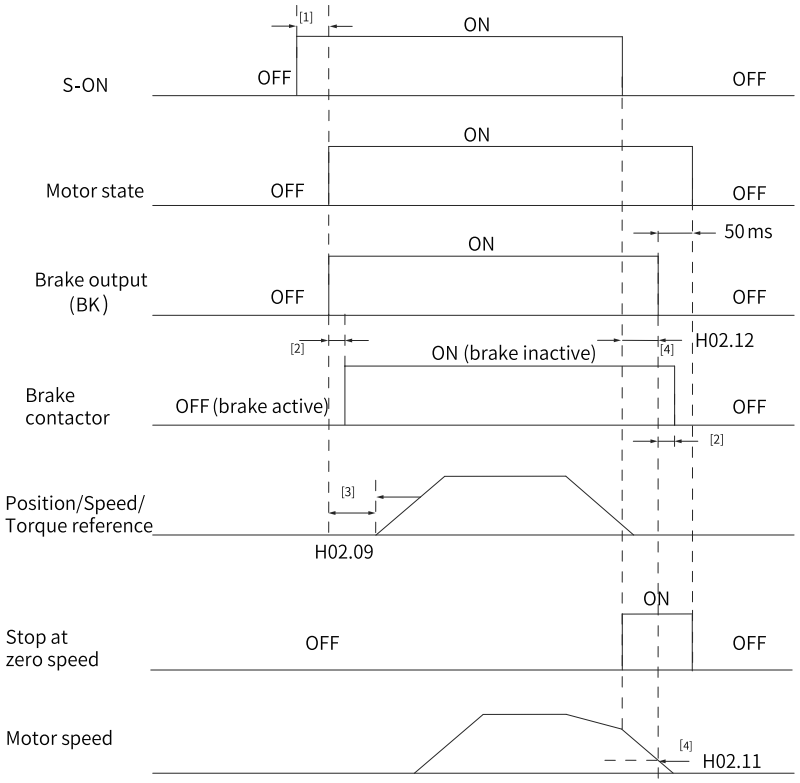


Figure 8-5 Brake time sequence in the rotating state of the motor

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 170*.
- [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".

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.11	Motor speed threshold at brake output off in rotating state	0x020B	0 to 3000	rpm	30	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the motor speed threshold when brake (BK) output is set to OFF in the rotating state.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.12	Delay from S-ON off to brake output off in the rotating state	0x020C	1 to 1000	ms	500	UInt16	At once	Ordinary user	At once
	Parameter description:								
	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.

8.6 Trial Run

Switch on the S-ON signal.

When the servo drive is ready to run, the operation panel 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	Compliance
1	At first-time running, set a appropriate reference to make the motor run at low speed and check the motor rotation is correct.	☐
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 "Adjustment".	☐

Power-on sequence diagram

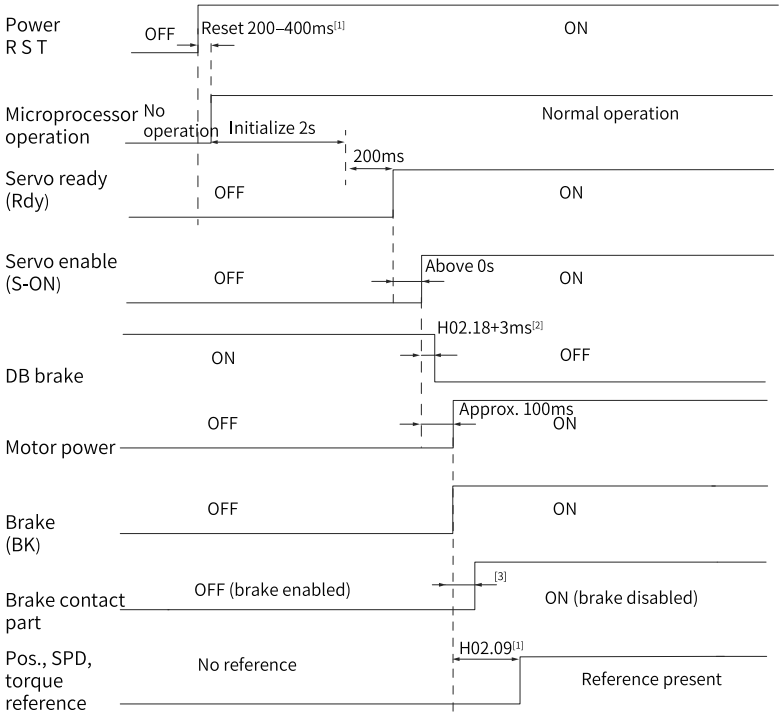


Figure 8-6 Power-on sequence diagram

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 the brake contactor actions, see *"Table 8-2 Brake specifications" on page 170*.
- [4] When FunOUT.9 (BK, brake output) is not used, H02.09 is invalid.

Sequence diagram for stop at alarm or fault

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

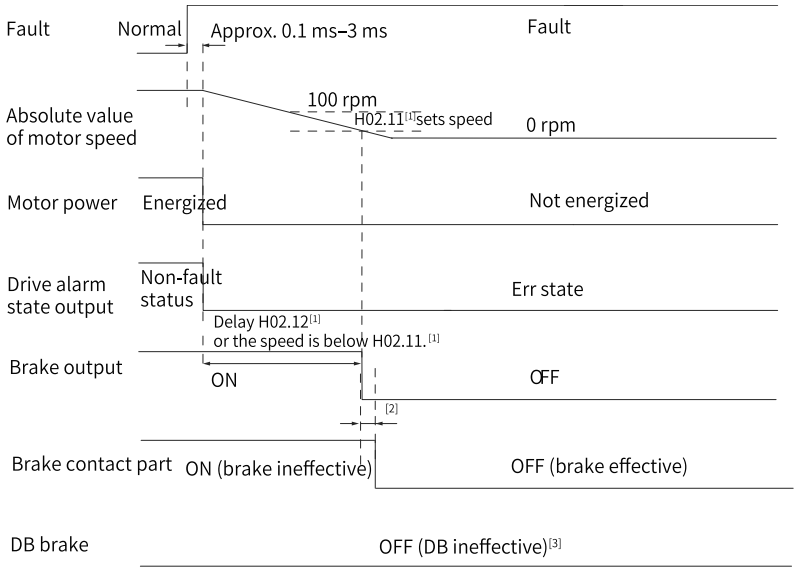


Figure 8-7 Sequence of "Coast to stop, keeping de-energized state" at No. 1 fault

Note

- [1] When FunOUT.9 (BK, brake output) is not used, H02.11 and H02.12 are invalid.
- [2] For delay of the brake contactor actions, see *"Table 8-2 Brake specifications" on page 170*.
- [3] The dynamic brake is delivered as standard.

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

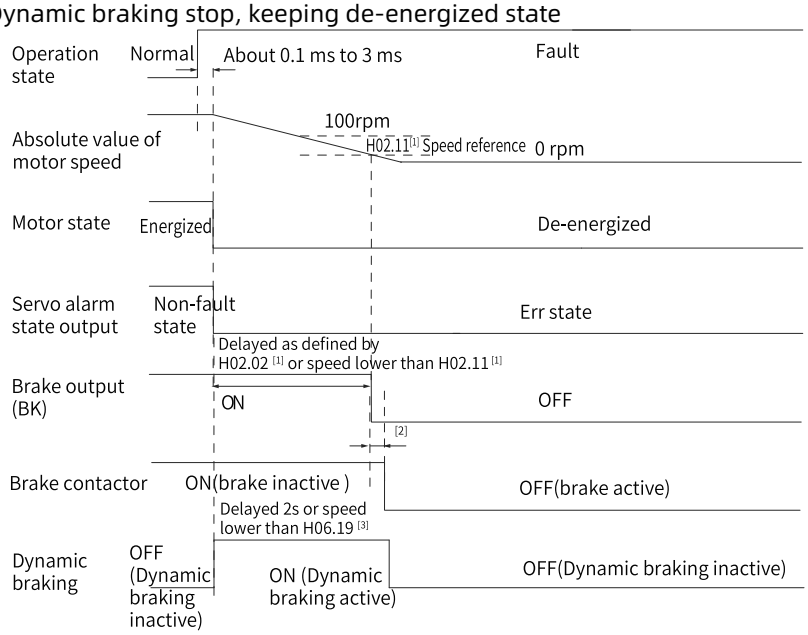


Figure 8-8 Sequence of "Dynamic braking stop, keeping de-energized state" at No. 1 fault

Note

- [1] When FunOUT.9 (BK, brake output) is not used, H02.11 and H02.12 are invalid.
- [2] For delay of the brake contactor actions, see *"Table 8-2 Brake specifications" on page 170*.
- [3] The dynamic brake is delivered as standard.

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

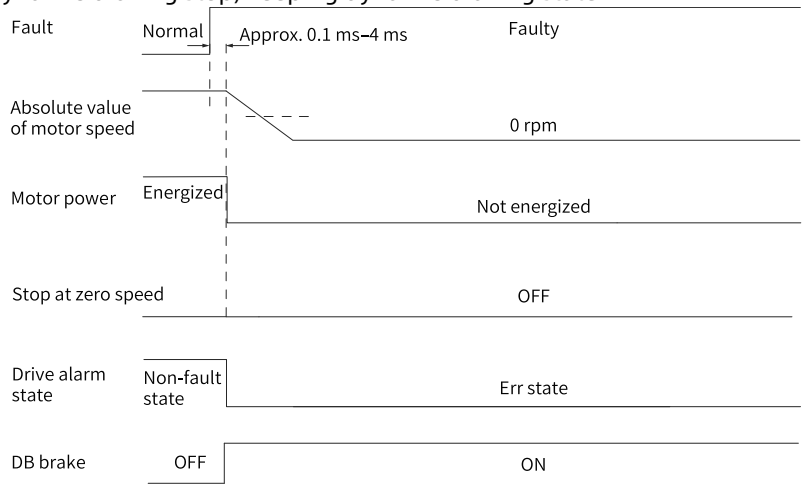


Figure 8-9 Sequence of "Dynamic braking stop, keeping dynamic braking state" at No. 1 fault

Note

- [1] When FunOUT.9 (BK, brake output) is not used, H02.11 and H02.12 are invalid.
- [2] For delay of the brake contactor actions, see *"Table 8-2 Brake specifications" on page 170*.
- [3] The dynamic brake is delivered as standard.

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

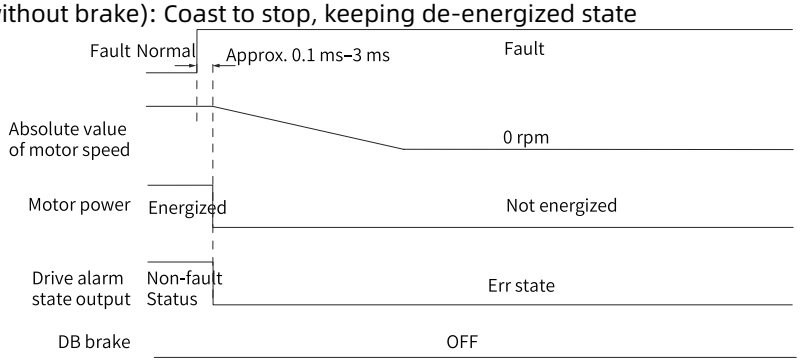


Figure 8-10 Sequence of "Coast to stop, keeping de-energized state" at No.2 fault

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

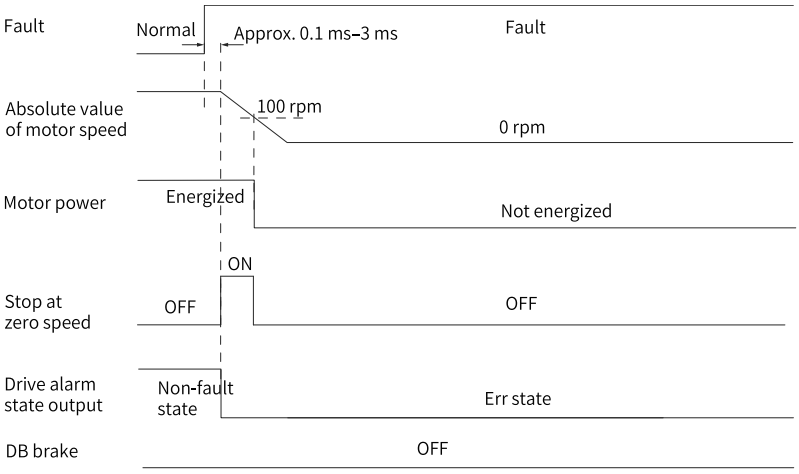


Figure 8-11 Sequence of "Stop at zero speed, keeping de-energized state" at No. 2 fault (without brake)

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

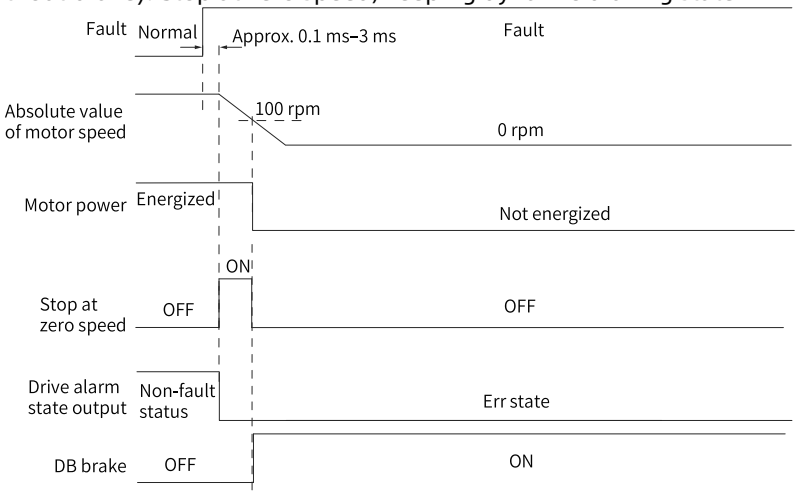


Figure 8-12 Sequence of "Stop at zero speed, keeping dynamic braking state" at No. 2 fault (without brake)

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

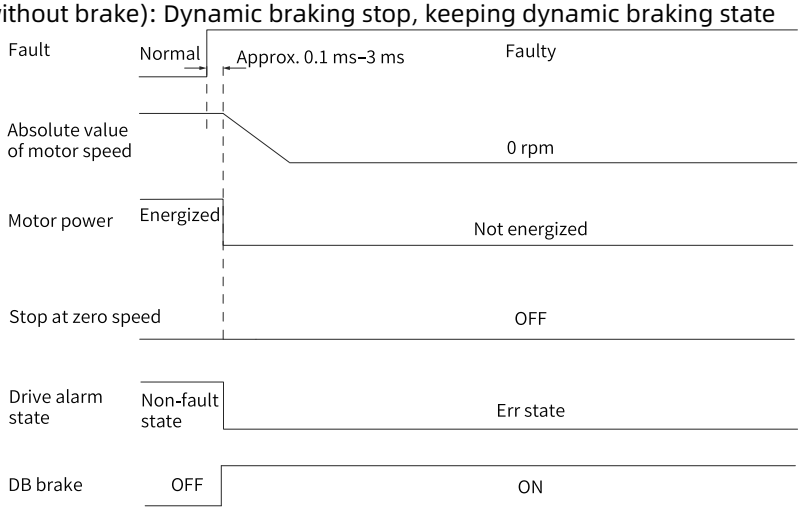


Figure 8-13 Sequence of "Dynamic braking stop, keeping dynamic braking state" at No. 2 fault (without brake)

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

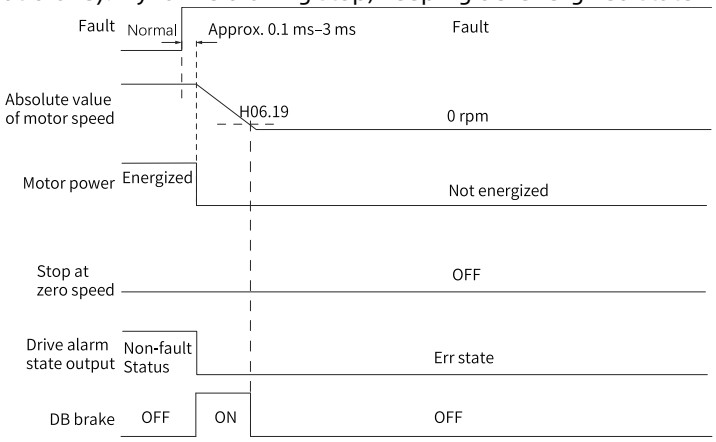


Figure 8-14 Sequence of "Dynamic braking stop, keeping de-energized state" at No. 2 fault (without brake)

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

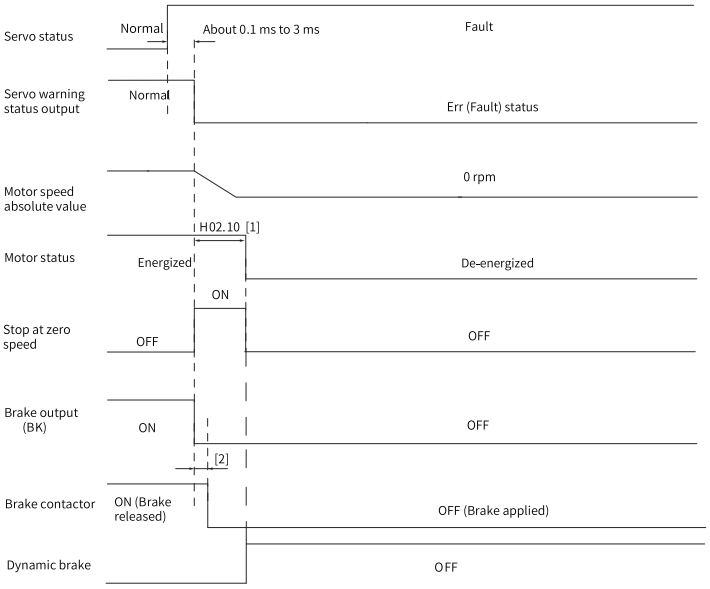


Figure 8-15 Sequence of "Stop at zero speed, keeping dynamic braking state" at No. 2 fault (with brake)

Note

- [1] When FunOUT.9 (BK, brake output) is not used, H02.10 is invalid.
- [2] For delay of the brake contactor actions, see *"Table 8-2 Brake specifications" on page 170*.

- When a No. 3 alarm occurs on the drive, such as E900.0 (DI emergency braking), E950.0 (Positive limit switch alarm), and E952.0 (Negative limit switch alarm), the drive stops according to *"Figure 8-16 Sequence for alarms that cause stop" on page 180*.
- Alarms that cause stop: Stop at zero speed, keeping position lock status

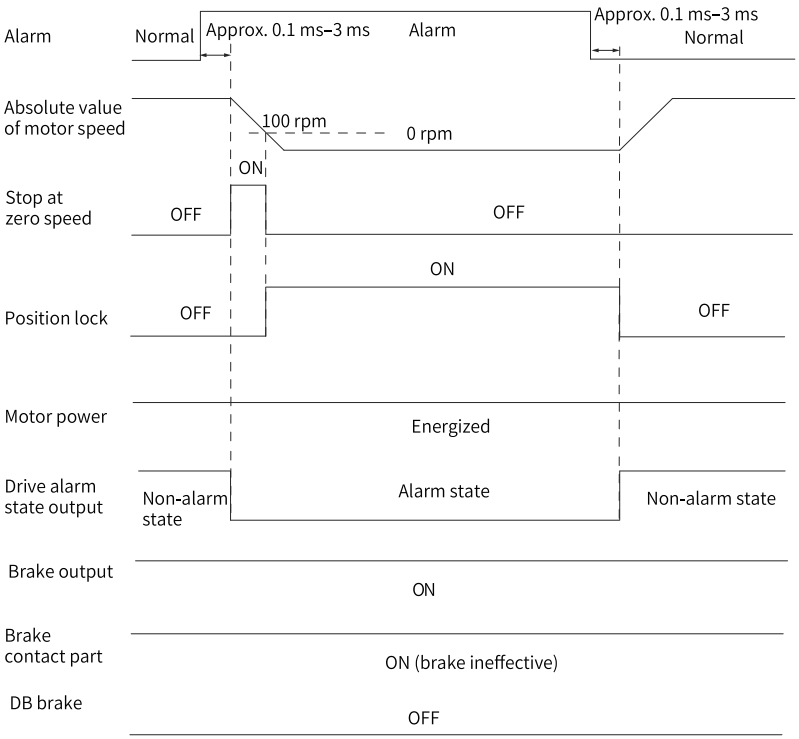


Figure 8-16 Sequence for alarms that cause stop

The other alarms do not affect the operation state of the drive. The sequence diagram for these alarms is shown in *"Figure 8-17 Sequence for alarms that do not cause stop" on page 180*.

- Warnings that do not cause stop

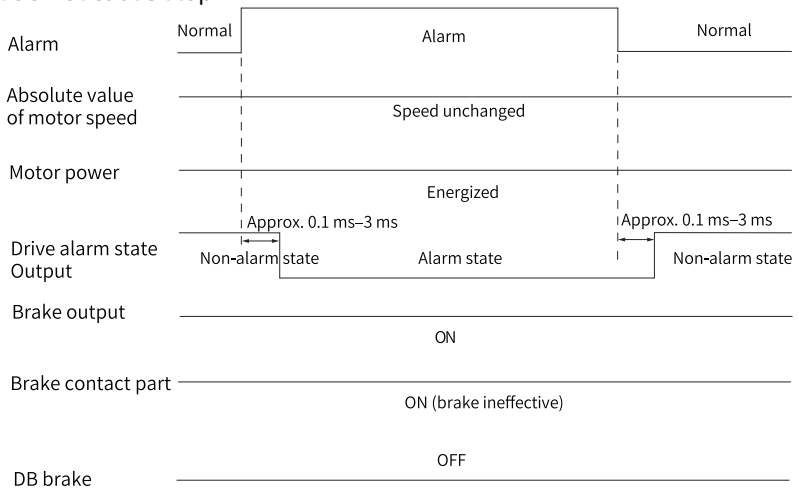


Figure 8-17 Sequence for alarms that do not cause stop

- Fault reset

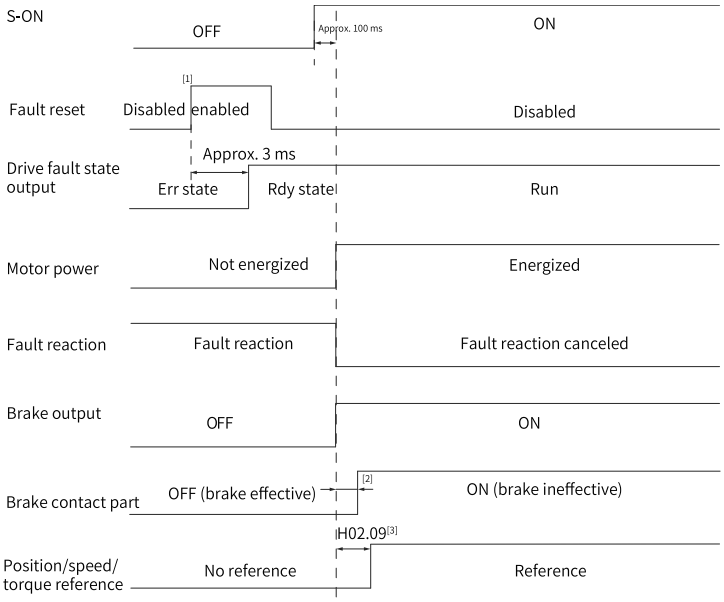


Figure 8-18 Sequence for fault reset

Note

- [1] The DI fault reset signal (FunIN.2: ALM-RST) is edge-triggered.
- [2] For delay of the brake contactor actions, see *"Table 8-2 Brake specifications" on page 170*.
- [3] When FunOUT.9 (BK, brake output) is not used, H02.09 is invalid.

8.7 Servo Drive Stop

There are three type of stops modes: coast to stop, stop at zero speed, and dynamic braking stop, along with three stop status: de-energized, dynamic braking, and position lock. The stop state is classified into the de-energized state, dynamic Braking state and the position lock state. See the following table for details.

Table 8–4 Comparison among different stop modes

Stop mode	Coast to stop	Stop at zero speed	Dynamic braking stop
Description	The servo motor is de-energized and decelerates to stop gradually. The deceleration time is affected by the friction inertia and mechanical.	The servo drive outputs the reverse braking torque and the motor decelerates to 0 quickly.	The three motor phases are short-circuited and the motor decelerates to 0 RPM under the influence of back EMF.
Feature	Smooth and slow deceleration with small mechanical shocks.	Quick deceleration with obvious mechanical shock.	Quick stop, with deceleration speed between coast to stop and stop at zero speed.

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 rotate freely after the motor stops rotating.

The stop causes can be divided into the following types: stop at S-ON OFF, stop at fault, stop at overtravel, and emergency stop.

Stop at S-ON OFF

Set a DI terminal with the S-ON function, and disable this terminal.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.05	Disable operation option code	0x0205	0 to 3	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Coast to stop, keeping de-energized state 1: Stop at zero speed, keeping de-energized state				2: Stop at zero speed, keeping dynamic braking state 3: Dynamic braking stop, keeping dynamic braking state				
	Parameter description:								
	Defines the deceleration mode of the motor for stopping rotating upon S-OFF and the motor state after stop.								

Stop at fault

The stop mode varies according to the fault type. For fault classification, see section Troubleshooting.

Note

When the brake is enabled, the following parameters are set forcibly:

- H02.05 = 2: Stop at zero speed, keeping dynamic braking state
- H02.06 = 2: Stop at zero speed, keeping dynamic braking state
- H02.07 = 1: Stop at zero speed, keeping position locking state
- H02.08=2: Dynamic braking stop, keeping de-energized state

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.06	Fault reaction option code	0x0206	0 to 4	-	2	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Coast to stop, keeping de-energized state 1: Stop at zero speed, keeping de-energized state 2: Stop at zero speed, keeping dynamic braking state				3: Dynamic braking stop, keeping dynamic braking state 4: Dynamic braking stop, keeping de-energized status				
	Parameter description:								
	Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when a No. 2 fault occurs.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.08	Stop mode at No.1 fault	0x0208	0 to 2	-	2	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Coast to stop, keeping de-energized state 1: DB stop, keeping de-energized state 2: DB stop, keeping DB state								
	Parameter description:								
	Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when a No. 1 fault occurs.								

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.

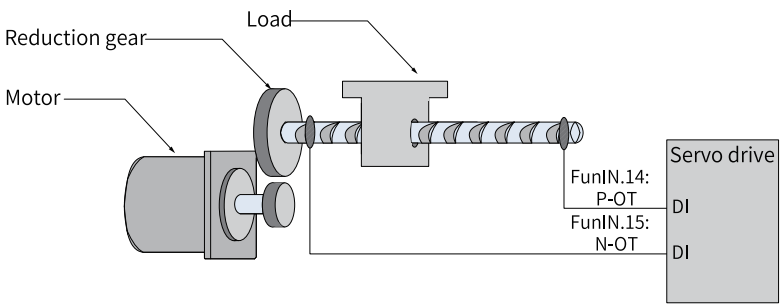


Figure 8-19 Installation of limit switches

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.07	Stop mode at limit switch signal	0x0207	0 to 2	-	1	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Coast to stop, keeping de-energized state 1: Stop at zero speed, keeping position lock state2: Stop at zero speed, keeping de-energized state								
	Parameter description:								
	Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when overtravel occurs.								

Emergency Stop

Two emergency stop modes are supported:

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

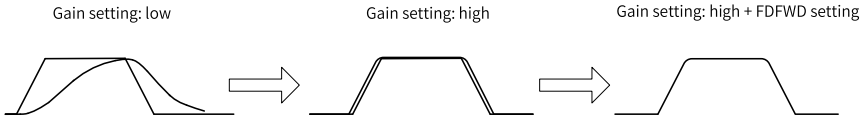
Code	Name	Function Name	Function
FunIN.34	Emergency stop	Braking	Inactive: Current operating state unaffected Active: Stop quickly and keeping position lock status, with E900.0 (DI emergency braking) reported.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.05	Emergency Stop	0x0D05	0–1	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	0: No action 1: Emergency stop								

9 Adjustment

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. To meet such requirements, gain tuning is required.



Position loop gain: 40.0Hz
Speed loop gain: 25.0Hz
SPD loop integral time const.: 50.00ms
Speed feedforward gain：0
Load inertia ratio: 30

Position loop gain: 80.0Hz
Speed loop gain: 50.0Hz
SPD loop integral time const.: 25.00ms
Speed feedforward gain：0
Load inertia ratio: 30

Position loop gain: 80.0Hz
Speed loop gain: 50.0Hz
SPD loop integral time const.: 25.00ms
Speed feedforward gain：50.0%
Load inertia ratio: 30

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. The values of these parameters must be balanced against each other during gain tuning.

Note

Before gain adjustment, perform jog running and ensure that the motor is under normal operation.

The following figure shows the general flowchart for gain tuning.

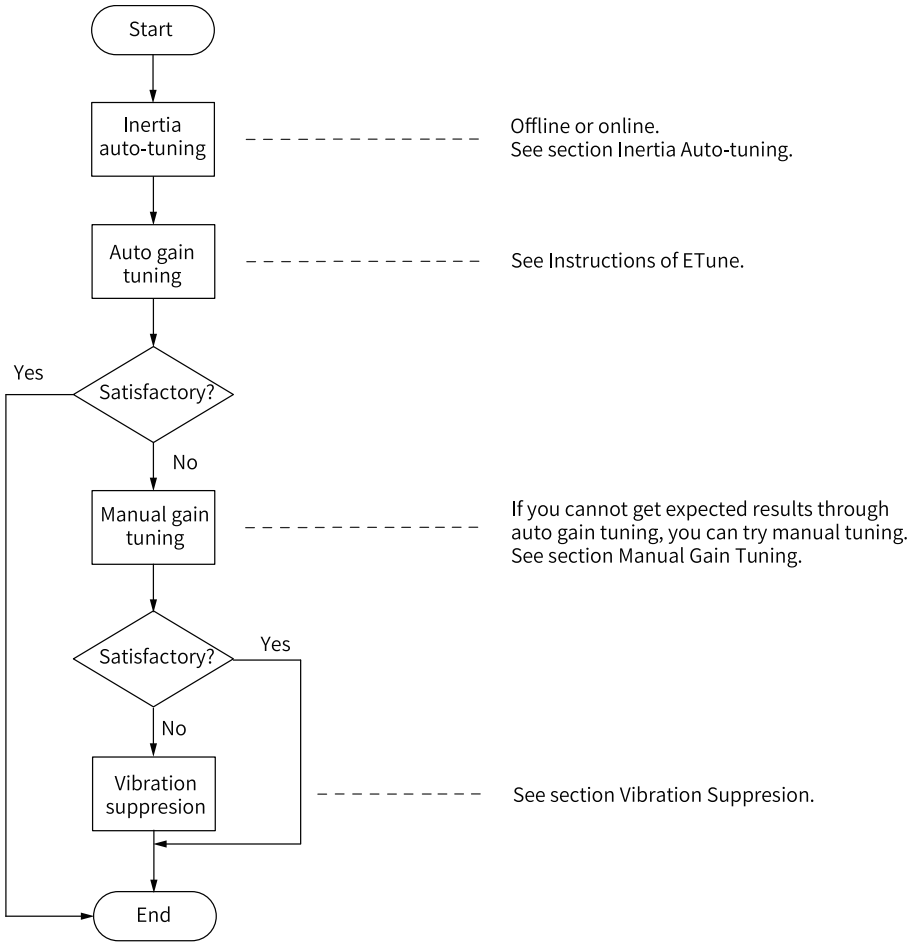


Figure 9-1 Gain tuning process

Table 9–1 Gain tuning process

Gain tuning process			Function	References
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 189*
		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 193*
2	Automatic gain tuning		The servo drive generates a group of gain parameters based on the correct inertia ratio.	*" ETune" on page 195*and *" STune" on page 200*

Gain tuning process			Function	References
3	Manual gain tuning	Basic gains	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 217*
		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 222*
		Reference filter	It filters the position, speed, and torque references.	*"9.4.3 Comparison of filters" on page 230*
		Feedforward gain	The feedforward function is enabled to improve the following performance.	*" Feedforward gain tuning" on page 230*
		Pseudoifferen-tial regulator	Adjusts the speed loop control mode to improve the anti-interference capability at low frequency range.	*"9.4.5 Pseudo Differential Feedforward Control" on page 234*
		Torque disturbance observer	Improves the resistance against torque disturbance.	*" Torque disturbance observer" on page 235*
		Model Tracking	The model tracking control can improve response and shorten the positioning time.	*"9.4.7 Model Tracking" on page 237*
		Speed Observer	Increases the gains while shortening the positioning time, and avoids high-frequency vibration.	*"9.4.8 Speed Observer" on page 241*
		Friction compensation	Reduces the impact of friction in mechanical transmission on the operational performance.	*"9.4.9 Friction Compensa-tion" on page 244*
4	Vibration suppression	Mechanical resonance	Enable the notch function to suppress the mechanical resonance.	*"9.6.2 Mechanical Resonance Suppression" on page 252*
		Low-frequency resonance	Activate the filter for suppressing low-frequency resonance.	*"9.6.3 Low-Frequency Resonance Suppression at the Mechanical End" on page 260*

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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.15	Load/Rotor inertia ratio	0x080F	0.00 to 120.00	-	2.00	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the ratio of the load inertia against the rotor (of the motor) inertia. When H08.15 is set to 0, it indicates the motor carries no load; if it is set to 1.00, it indicates the mechanical load inertia is the same as 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 (H09.03 set to a non-zero value) is used, this parameter is set automatically. To set this parameter manually, set H09.03 (Online inertia auto-tuning mode) to 0 (Disabled).								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.00	Speed loop gain	0x0800	0.1 to 2000.0	Hz	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the speed loop. 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 value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

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.

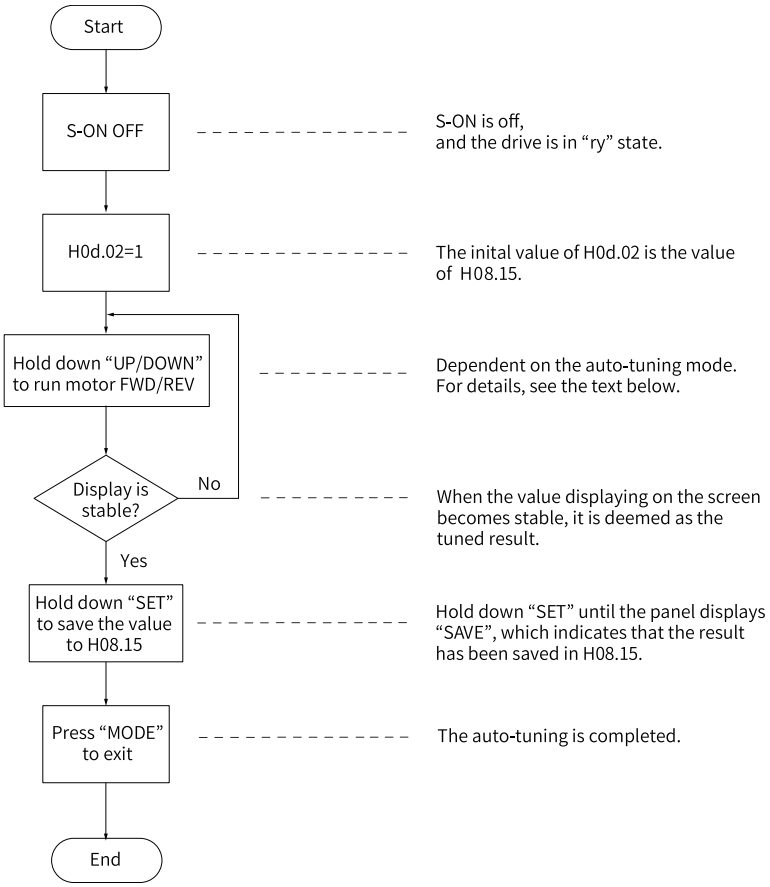


Figure 9-2 Offline inertia auto-tuning flowchart

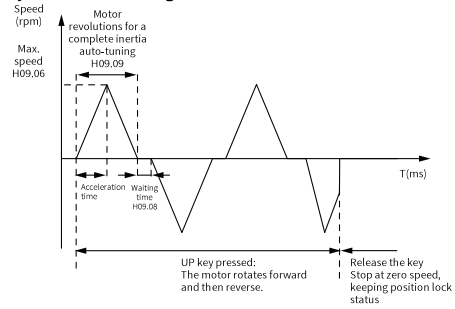
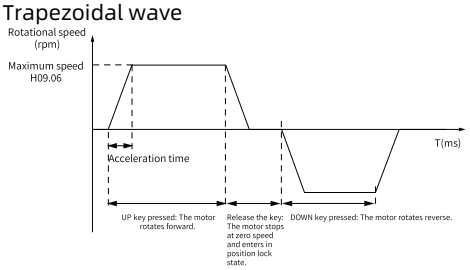
Flowchart description:

1. In the parameter configuration interface, set the auto-tuning mode (H09.05).
   - Mode 0: Positive/Negative triangular wave mode (initial inertia ratio H08.15 shall be set)
   - Mode 1: JOG mode (initial inertia ratio H08.15 shall be set)
   - Mode 2: Bidirectional auto-tuning mode (initial inertia ratio not required)
   - Mode 3: Unidirectional auto-tuning mode (initial inertia ratio not required)
2. If Mode 2/3 is set, skip this step; if Mode 0/1 is set, the inertia ratio H08.15 shall still be set, as the default value of H08.15 is 1.00. If the actual load inertia ratio > 30.00, motor response may become sluggish or auto-tuning may fail.
   The recommended preset value is 5.00.
   Increase H08.15 gradually until the value displayed on the operation panel changes with it.
3. 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.
4. Return to the operation page, and press the UP/DOWN keys to start offline auto-tuning. The UP/DOWN keys determine the motor running direction (forward/reverse). For applications allowing unidirectional operations only, set H09.05 to 3.
5. During auto-tuning, releasing the button will stop the device. Pressing UP/DOWN key again will restart the auto-tuning.

6. 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.
7. Hold down the "SET" key until the panel displays "SAVE", indicating that the auto-tuned values have been saved to H08.15.

The reference format differs between forward and reverse triangular wave mode (H09.05=0) and JOG mode (H09.05=1), as shown in the table below.

Table 9–2 Descriptions of two offline inertia auto-tuning modes

Item	Positive and Negative Triangular Wave Mode (H09.05 = 0)	Jog Mode (H09.05 = 1)
Reference form	Symmetric triangle wave 	Trapezoidal wave 
Maximum speed	H09.06	H09.06
Acceleration/ Deceleration time Time	H09.07	H09.07
Key descriptions	Hold down key UP: The motor rotates forward and then reverse. Hold down key DOWN: The motor rotates reverse and then forward. UP/DOWN key released: The motor stops at zero speed, keeping position lock state.	Press key UP: The motor rotates forward. Press key DOWN: The motor rotates reverse. UP/DOWN key released: The motor stops at zero speed, keeping position lock state.
Time interval	H09.08	Interval between two key operations
Motor revolutions	≤H09.09	Controlled manually
Applicable scenario	The motor travel is short.	The motor travel is long and can be manually controlled.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.05	Offline inertia auto-tuning mode	0x0905	0 to 3	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Positive/Negative triangular wave mode 1: JOG mode 2: Bidirectional auto-tuning mode 3: Unidirectional auto-tuning mode								
	Parameter description:								
	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".								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.06	Maximum speed for inertia auto-tuning	0x0906	100 to 1000	rpm	500	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	It sets the permissible maximum motor speed reference in offline inertia auto-tuning mode. During inertia auto-tuning, a larger motor speed causes a more accurate auto-tuning result. Use the default value of this parameter generally.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.07	Time constant of accelerating to max. speed for inertia auto-tuning	0x0907	20 to 800	ms	125	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.08	Interval after an inertia auto-tuning	0x0908	50 to 10000	ms	2500+	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	Defines the interval time between two consecutive speed references when H09.05 (Offline inertia auto-tuning mode) is set to 0 (Positive/Negative triangular wave mode).								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.09	Motor revolutions for an inertia auto-tuning	0x0909	0.00 to 655.35	-	1.00	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the motor revolutions per inertia auto-tuning when H09.05 (Offline inertia auto-tuning mode) is set to 0 (Positive/ Negative triangular wave mode). Note: When using the offline inertia auto-tuning function, 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 (Maximum speed for inertia auto-tuning) or H09.07 (Time constant of accelerating to max. speed during inertia auto-tuning) properly until the motor travel distance fulfills the requirement.								

9.2.2 Online Inertia Auto-tuning

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

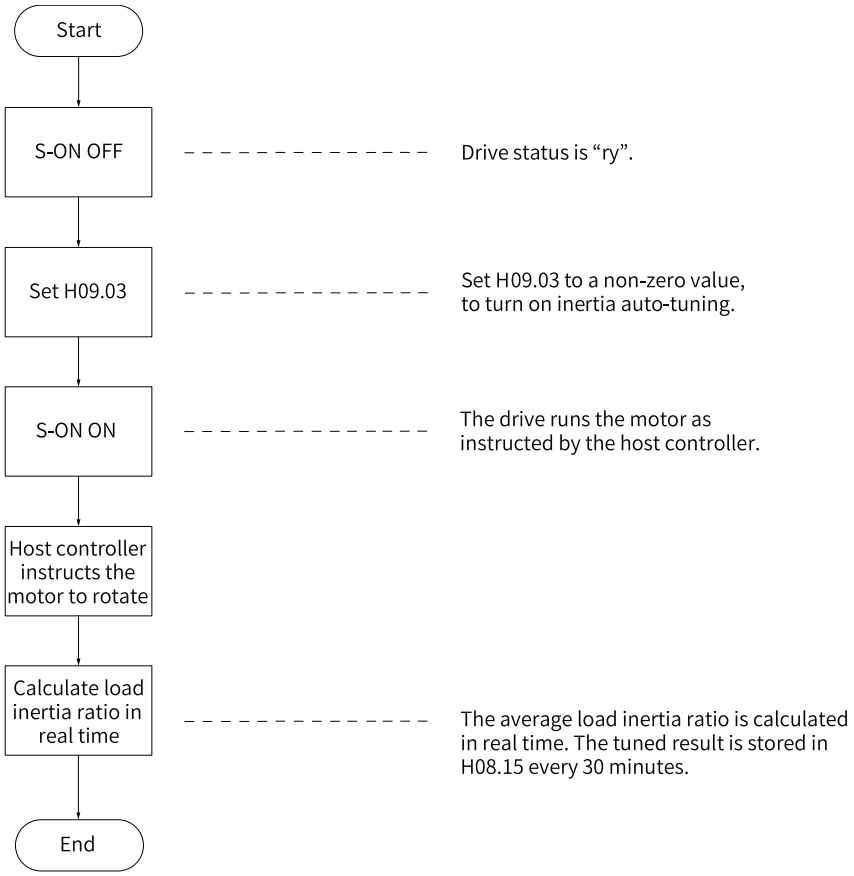


Figure 9-3 Online inertia auto-tuning flowchart

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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.03	Online inertia auto-tuning mode	0x0903	0 to 3	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Disabled 1: Enabled, inertia ratio changing slowly 2: Enabled, inertia ratio changing normally 3: Enabled, inertia ratio changing quickly								
	Parameter description:								
	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 Adjustment

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 Operation Flowchart

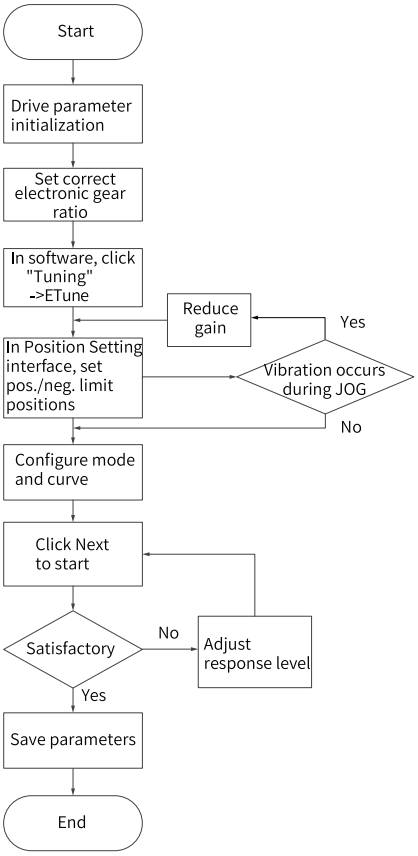
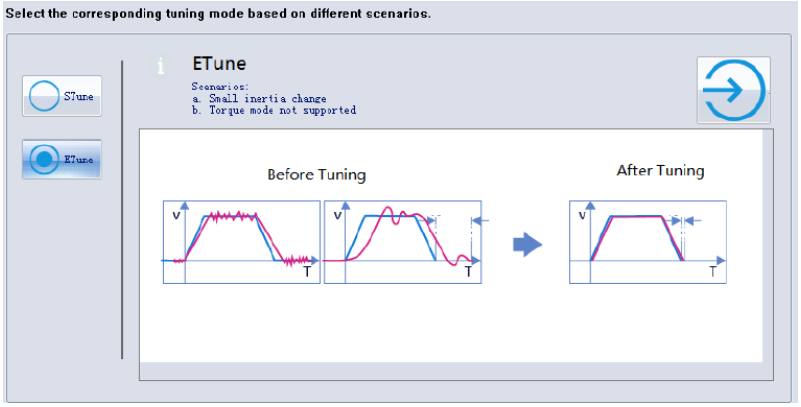


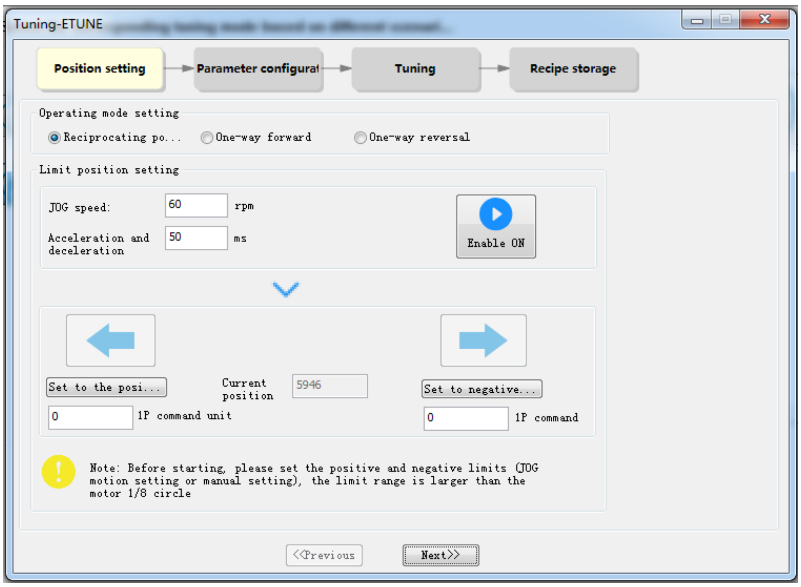
Figure 9-4 Operation flowchart

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 the "Reciprocating po..." mode, the motor keeps reciprocating within the positive and negative position limits.
- In the "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 the "One-way reverse" 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, designate 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. Then click "Enable OFF" to complete the limit setting. Then click "Enable OFF" to complete the limit setting. Then click "Enable OFF" to complete the limit setting. Then click "Enable OFF" to complete the limit setting.
- Directly enter the positive/negative limit positions in the white text box.

Note

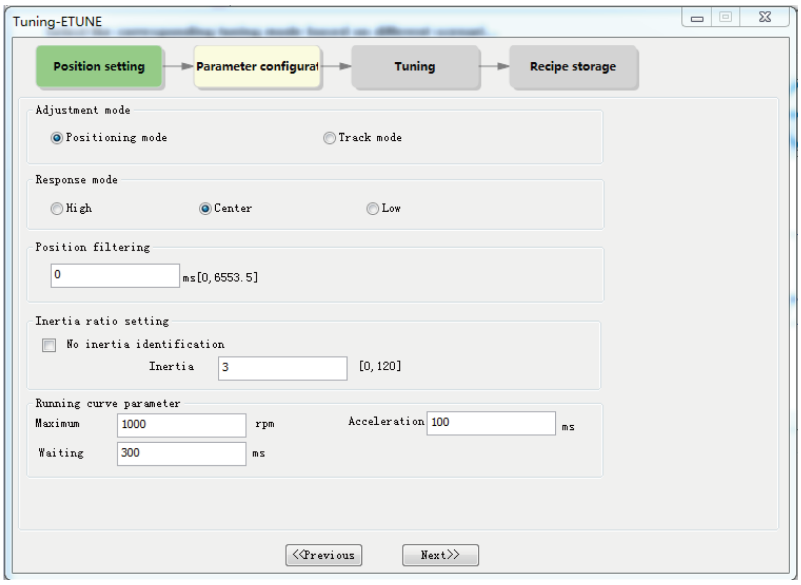
The difference between the positive and negative position limits must be larger than 1/8 of one revolution. The larger the value of the limit position, the better the adaptability of the auto-tuned parameters, but the longer will ETune adjustment take.

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

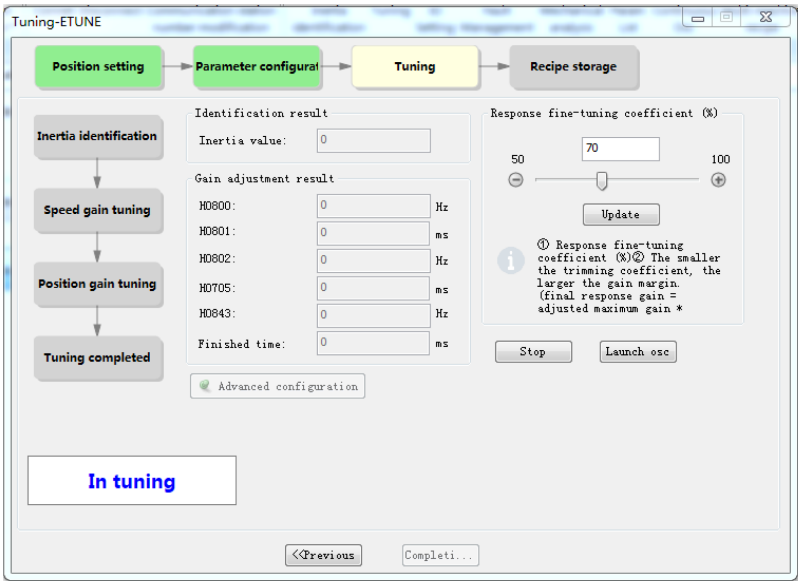
- The adjustment mode is divided into "Positioning mode" and "Track mode".
- Response mode and position filter time constant: Make corresponding adjustment according to the response performance needed and actual position reference noise.

- 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.

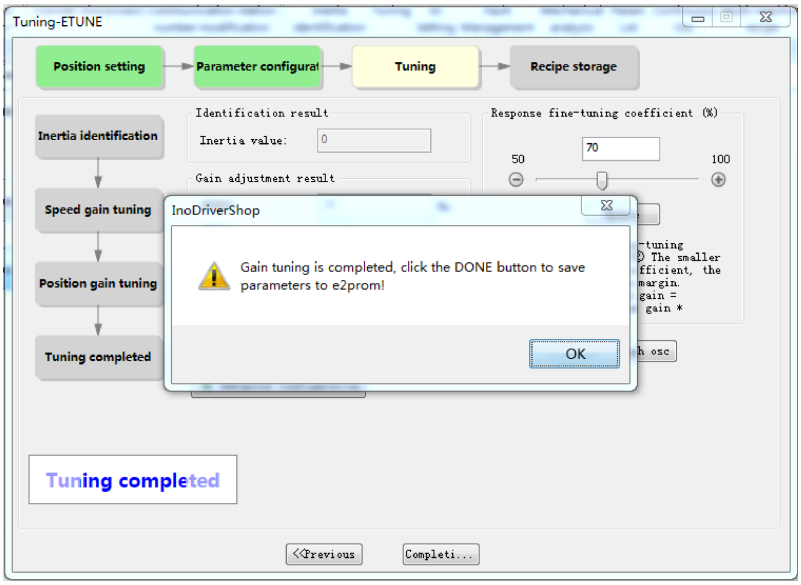


4. Click " **Next** " to enter the "Tuning" step.

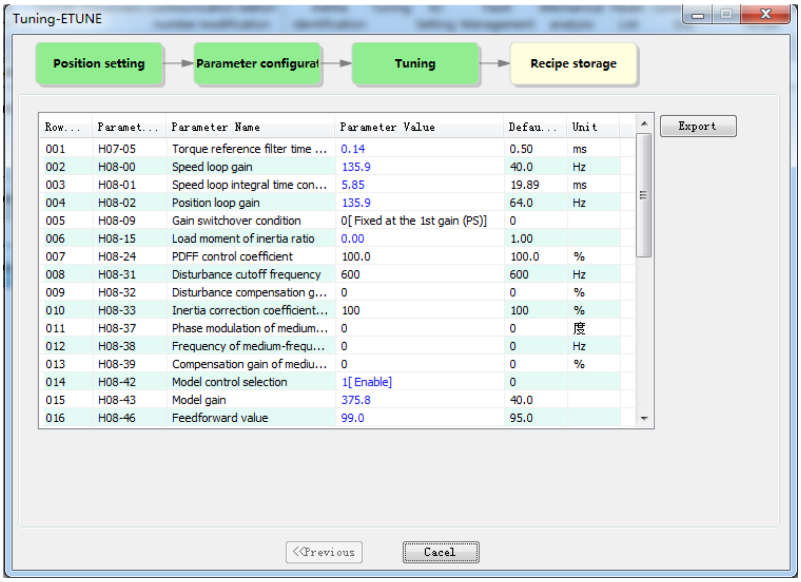
- If you choose to perform inertia auto-tuning, the drive starts inertia auto-tuning based on the set motion profile. After inertia auto-tuning is done, the drive starts gain auto-tuning.
- If you choose not to perform inertia auto-tuning in the previous step, the drive starts gain tuning directly after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



5. In the "Tuning" phase, modify the final 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 Troubleshooting

Fault symptom	Cause	Solution
E661.6: Gain auto-tuning failed	The drive vibrates during gain tuning.	Rule out mechanical causes and try to set the gain parameters manually.
E600.0: Angle auto-tuning failure	1. Vibration cannot be suppressed.	1. Enable the vibration suppression function manually and perform ETune again.
	2. The auto-tuned values fluctuate dramatically.	2. Increase the maximum operating speed and decrease the acceleration/ deceleration time. For the lead screws, shorten the travel distance.
	3. Mechanical couplings of the load are loose or the mechanism is eccentric.	3. Mechanical couplings of the load are loose or the mechanism is eccentric. Clear the mechanical faults.
	4. Interruption occurs due to a fault that occurs during auto-tuning.	4. Clear the fault and perform ETune again.
	5. Vibration of the large-inertia load cannot be suppressed.	5. Increase the acceleration/deceleration time first to ensure the motor current is not saturated.

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 9–3 Six STune modes

Mode (Value of H09.00)	Name	Applicable occasion
0	Inactive	The gains need to be adjusted manually.
1	Standard stiffness level mode	Gains are set automatically based on the set stiffness level.
2	Positioning mode	Gains are set automatically based on the set stiffness level. This mode is applicable to occasions requiring quick positioning.
3	Interpolation mode+Inertia auto-tuning	Gains are set automatically based on the set stiffness level. In this mode, inertia is auto-tuned and vibration is suppressed automatically. This mode is applicable to multi-axis interpolation.

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.00	Self-adjustment mode selection	0x0900	0 to 6	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Disabled, manual gain tuning required 1: Enabled, gain parameters tuned automatically based on the stiffness level 2: Positioning mode, gain parameters tuned automatically based on the stiffness level 3: Interpolation mode + Inertia auto-tuning 4: Standard mode + Inertia auto-tuning 6: Quick positioning mode + Inertia auto-tuning								
	Parameter description:								
	Defines different gain tuning modes. Related gain parameters can be set manually or automatically according to the rigidity meter.								

9.3.2.2 Operation Flowchart

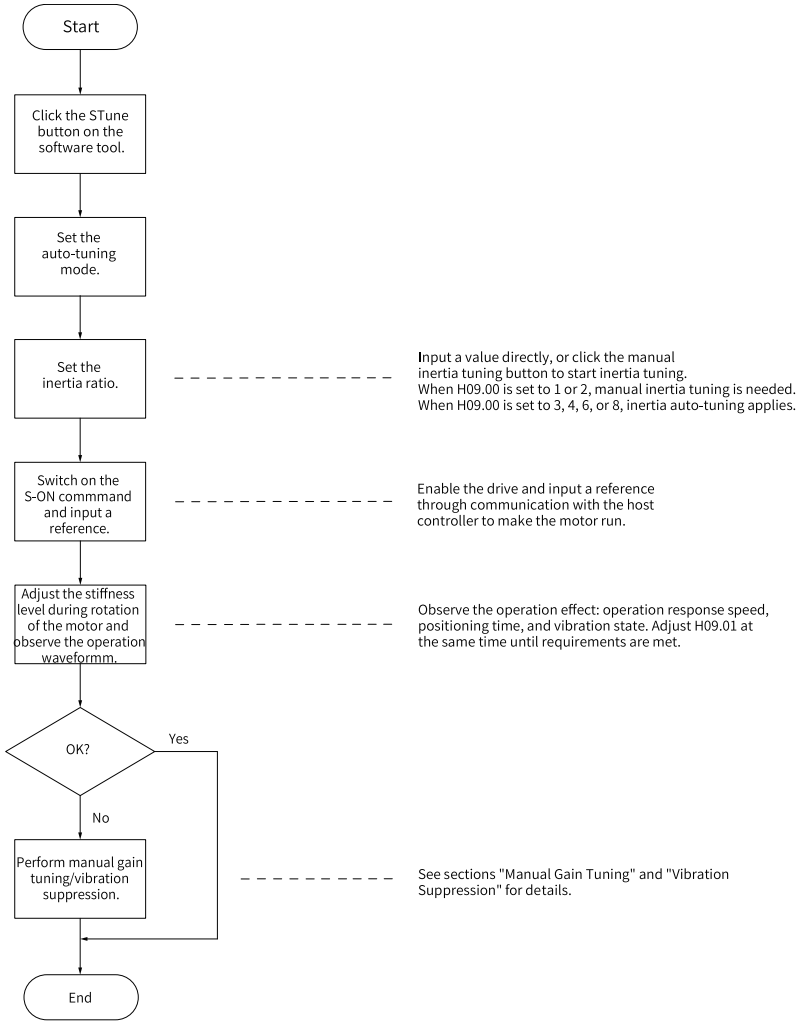


Figure 9-5 Operation flowchart

Process description

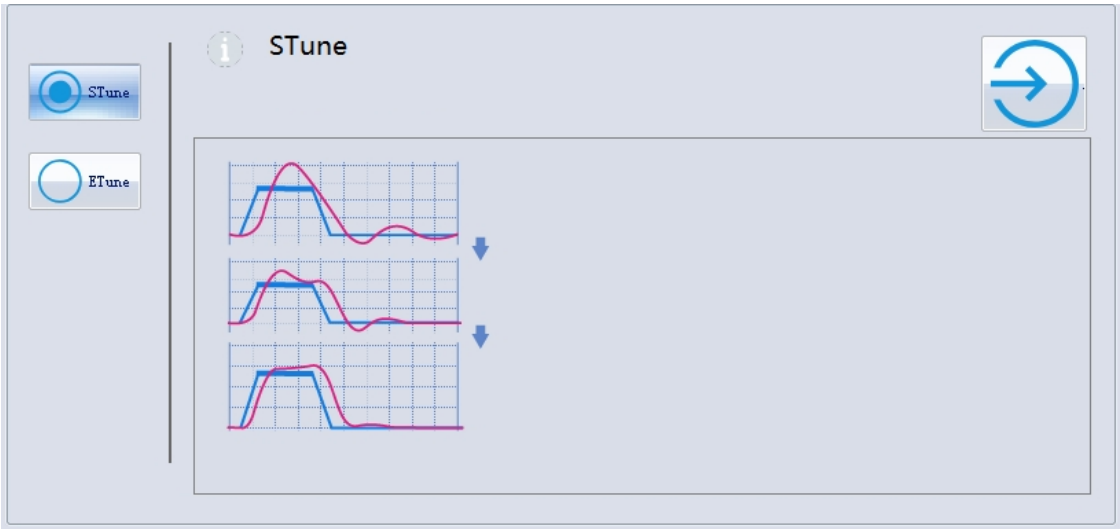
Quick setup method for modes 0/3/4/6:

Note

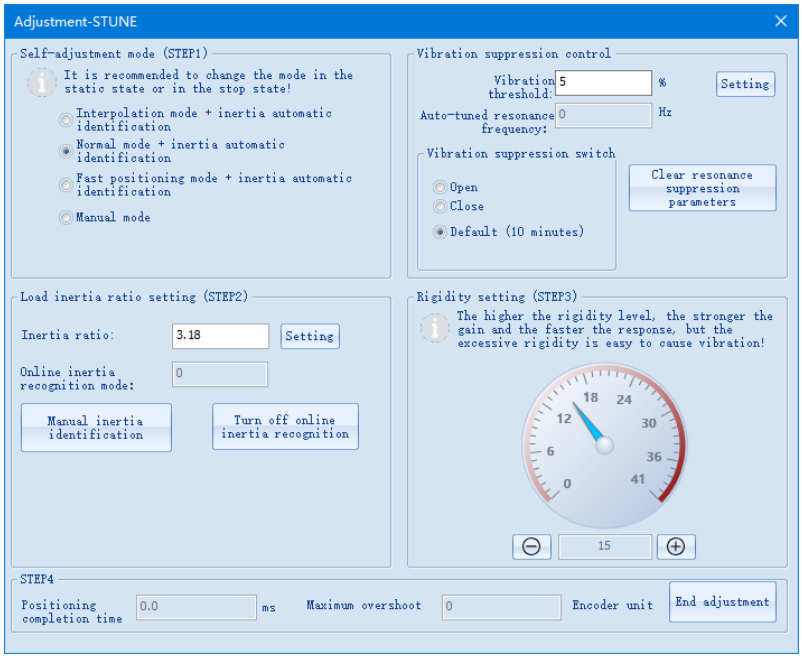
- Modes 3/4/6 are not applicable to situations with slow acceleration/deceleration, high vibration, or unstable mechanical couplings.
- If inertia auto-tuning is turned off automatically, switching to modes 3, 4, or 6 will not activate inertia auto-tuning again.

---

1. Click on the "Tuning" button in the top toolbar or "Usability adjustment" in the left workspace to enter the mode selection page. After selecting "STune", click the button at the upper right to proceed to the next step.



2. Select the auto-tuning mode. For modes 3/4/6, 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 3, 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 rapidly.
- 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.

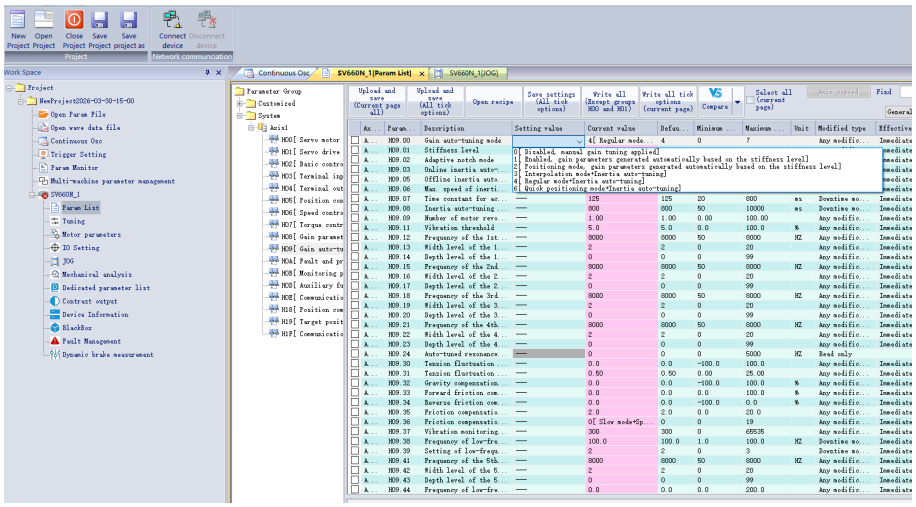
3. Gradually adjust the stiffness level during operation of the load. The current stiffness level value will be automatically written to the drive.
4. Keep monitoring the operation waveform after increasing the stiffness level (increase by one level at a time) until desired performance is achieved.
5. In STune modes 3, 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 3, 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 modes 3 and 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

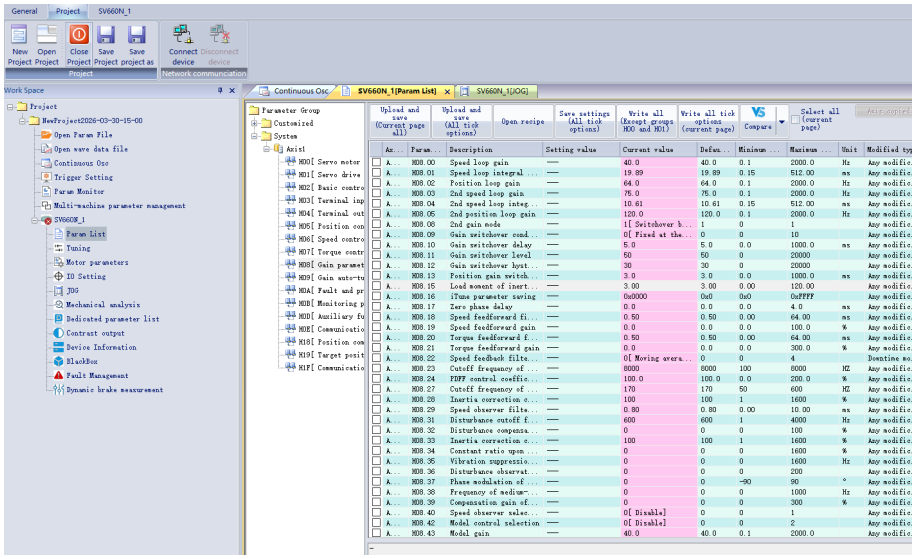
To ensure a stable operation in STune modes 3/4/6 with default parameter settings, gain parameters will be adjusted along with the inertia ratio when the inertia ratio is higher than 13:1. In multi-axis trajectories, responses may be inconsistent under the same stiffness level.

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 mechanical vibration occurs, decrease the stiffness level before performing inertia auto-tuning manually.



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	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.15	Load/Rotor inertia ratio	0x0900	0.00 to 120.00	-	2.00	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the ratio of the load inertia against the rotor (of the motor) inertia. When H08.15 is set to 0, it indicates the motor carries no load; if it is set to 1.00, it indicates the mechanical load inertia is the same as 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 (H09.03 set to a non-zero value) is used, this parameter is set automatically. To set this parameter manually, set H09.03 (Online inertia auto-tuning mode) to 0 (Disabled).								

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 9–4 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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.01	Stiffness level selection	0x0901	0 to 41	-	15	UInt16	At once	Ordinary user	At once
	Parameter description:								
	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.								

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).

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.00	Speed loop gain	0x0800	0.1 to 2000.0	Hz	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the speed loop. 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. If the position loop gain is increased in position control mode, the speed loop gain also needs to be increased.								
	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	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.01	Time constant of speed loop integration	0x0801	0.15 to 512.00	ms	19.89	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the integral time constant of the speed loop. 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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.02	Position loop gain	0x0802	0.0 to 2000.0	Hz	64.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the position loop. This parameter determines response of the position loop. A large position loop gain shortens the positioning time. Note that a very large setting 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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.05	Torque reference filter time constant 1	0x0705	0.00 to 30.00	ms	0.50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference filter time constant 1. Low-pass filter of torque reference helps to make torque reference more smooth and reduce 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.								

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).

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.03	Second speed loop gain	0x0803	0.1 to 2000.0	Hz	75.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the 2nd speed loop gain. This parameter determines response of the speed loop. The larger the setting is, the quicker response will be. Note that a very large setting may cause vibration. If the position loop gain is increased in position control mode, the speed loop gain also needs to be increased. 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".								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.04	Second speed loop integral time constant	0x0804	0.15 to 512.00	ms	10.61	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the 2nd speed loop integral time constant. The smaller the setting is, the better integration effect will be obtained and the deviation value at stop will approach 0 more quickly. There is no integral action when this parameter is set to 512.00.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.05	Second position loop gain	0x0805	0.0 to 2000.0	Hz	120.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the 2nd gain of the position loop. This parameter determines response of the position loop. A large position loop gain shortens the positioning time. But setting it too large may cause vibration.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.06	2nd time constant of torque reference filter	0x0706	0.00 to 30.00	ms	0.27	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference filter time constant 2. Low-pass filter of torque reference helps to make torque reference more smooth and reduce vibration. Note that an excessively high setpoint can reduce responsiveness.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.18	Time constant of speed feedforward filter	0x0812	0.00 to 64.00	ms	0.50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the time constant of speed feedforward filter. The larger the filter time constant, the smoother the speed feedforward, but the greater the delay.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.19	Speed feedforward gain	0x0813	0.0 to 100.0	%	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	In the position control mode, speed feedforward is the value of H08.19 multiplied by the speed feedforward signal, which is part of the speed reference. Increasing this parameter improves position reference response and reduces position deviation at fixed 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).								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.08	2nd gain mode setting	0x0808	0–1	-	1	UInt16	At once	Ordinary user	At once
	Values:								
	0: First gain fixed, P/PI switchover by DI 1: Switching between 1st and 2nd gain sets based on the condition defined by H08.09								
	Parameter description:								
	It sets switchover mode of the 2nd gain.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way

H08.09	Gain switchover condition	0x0809	0–10	-	0	UInt16	At once	Ordinary user	At once

Values:

0: Fixed to the 1st gain set (PS)
1: Switched through external DIs
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:

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

Table 9–5 Conditions for gain switchover

Set value	Gain Switchover Condition	Remarks
0	Fixed at 1st gain	The 1st gain is always used.
1	Switchover via DI	-
2	Torque reference being large	If the torque reference absolute value exceeds (Level + Time lag) [%] 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 – Time lag) [%] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the drive returns to the 1st gain set.
3	Speed reference being large	If the speed reference absolute value exceeds (Level + Time lag) [rpm] in the last 1st gain set, the drive switches to the 2nd gain set. If the absolute value of the speed reference is lower than (Level - Time lag) [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 being large	It is valid only in non-speed control mode. If the absolute value of the change rate of the speed reference exceeds (Level + Time lag) [10 rpm/s] in the last 1st gain set, the drive switches to the 2nd gain set. If the absolute value of the speed reference change rate is lower than (Level – Time lag) [10 rpm/s] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the drive returns to the 1st gain set. The drive always uses the 1st gain in speed control mode.
5	Speed reference high-speed/ low-speed thresholds	If the speed reference absolute value exceeds (Level - Time lag) [rpm] in the last 1st gain set, the drive starts switching to the 2nd gain set, with gains changed gradually. When the speed reference absolute value reaches (Level + Time lag) [rpm], the 2nd gain set applies. If the speed reference absolute value is lower than (Level + Time lag) [rpm] in the last 2nd gain set, the drive starts returning to the 1st gain set, with gains changed gradually. When the speed reference absolute value reaches (Level - Time lag) [rpm], the 1st gain set applies.

6	Position deviation being large	Active only in the position control mode If the position deviation absolute value exceeds (Level + Time lag) [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 - Time lag) [Encoder unit] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the drive returns to the 1st gain set. The 1st gain set applies in control modes other than position control.
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 uncompleted	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.
9th	Large actual motor speed	Active only in the position control mode If the absolute value of actual speed exceeds (Level + Time lag) [rpm] in the last 1st gain set, the drive switches to the 2nd gain set. If the absolute value of actual speed is lower than (Level - Time lag) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the drive returns to the 1st gain set. The 1st gain set applies in control modes other than position control.
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. If the position reference keeps being 0 within the delay defined by H08.10 in the last 2nd gain set, the 2nd gain set applies. When the position reference keeps being 0 after the time defined by H08.10 elapses, if the absolute value of actual speed does not reach (Level) [RPM], the servo drive switches to the 1st gain set (except the speed integral time constant which is fixed to H08.04 (2nd speed loop integral time constant)); If the absolute value of the actual speed is lower than (Level - Time lag) [rpm], the drive switches to the 1st gain set without any exception. The 1st gain set applies in control modes other than position control.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.10	Gain switchover delay	0x080A	0.0 to 1000.0	ms	5.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the delay when the drive switches from the 2nd gain set to the 1st gain set.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.11	Gain switchover level	0x080B	0 to 20000	-	50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the level for gain switchover. Gain switchover is affected by both the level and the dead time, as defined by H08.09. The unit of gain switchover level varies with the switchover condition.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.12	Gain switchover hysteresis	0x080C	0 to 20000	-	30	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the hysteresis for gain switchover. Gain switchover is affected by both the level and the dead time, as defined by H08.09. The unit of gain switchover hysteresis varies with the switchover condition.								

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).

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.37	Phase modulation for medium frequency suppression 2	0x0825	-90 to +90	°	0	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines the compensation phase of medium-frequency jitter suppression 2.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.38	Frequency for medium frequency suppression 2	0x0826	0 to 1000	Hz	0	UInt16	At once	Ordinary user	At once
	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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.39	Compensation gain for medium frequency suppression 2	0x0827	0 to 1500	%	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	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 be within the range of 40% to 55% in general cases. Setting this parameter to 0 negates the effect of medium-frequency jitter suppression 2.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.18	3rd notch frequency	0x0912	50 to 4000	Hz	4,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the center frequency of the 3rd notch, which is the mechanical resonance frequency. When H09.00 = 3/4/6, the third notch will be automatically set. In the torque control mode, setting the notch frequency to 4000 Hz deactivates the notch function.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.19	3rd notch width level	0x0913	0 to 20	-	2	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the width level of the 2nd notch. Use the default value of this parameter. When H09.00 = 3/4/6, the third notch will be automatically set. The notch width level indicates the ratio of the notch width to the notch center frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.20	3rd notch depth level	0x0914	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the depth level of the 1st notch. When H09.00 = 3/4/6, the third notch will be automatically set. The notch depth level indicates the ratio of input to output at center frequency. The larger the setting of this parameter is, the smaller the notch depth is and the weaker the suppression effect on mechanical resonance will be. Note that a very large setting may cause system instability. For use of the notch, see section "Vibration Suppression".								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.21	4th notch frequency	0x0915	50 to 4000	Hz	4,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the center frequency of the 4th notch, which is the mechanical resonance frequency. When H09.00 = 3/4/6, the fourth notch will be automatically set. In the torque control mode, setting the notch frequency to 4000 Hz deactivates the notch function.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.22	4th notch width level	0x0916	0 to 20	-	2	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the width level of the 2nd notch. Use the default value of this parameter. When H09.00 = 3/4/6, the fourth notch will be automatically set. The notch width level indicates the ratio of the notch width to the notch center frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.23	Depth level of the 4th notch	0x0917	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the depth level of the 1st notch. When H09.00 = 3/4/6, the fourth notch will be automatically set. The notch depth level indicates the ratio of input to output at 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".								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.58	STune resonance suppression reset selection	0x093A	0–1	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Disable 1: Enable								
	Parameter description:								
	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 Troubleshooting

Fault symptom	Cause	Solution
E661.6: Gain auto-tuning failed	The drive vibrates during gain tuning.	Rule out mechanical causes and try to set the gain parameters manually.

9.4 Manual Gain Adjustment

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 position loop, speed loop, and current loop from external to internal. The basic control diagram is shown in the following figure.

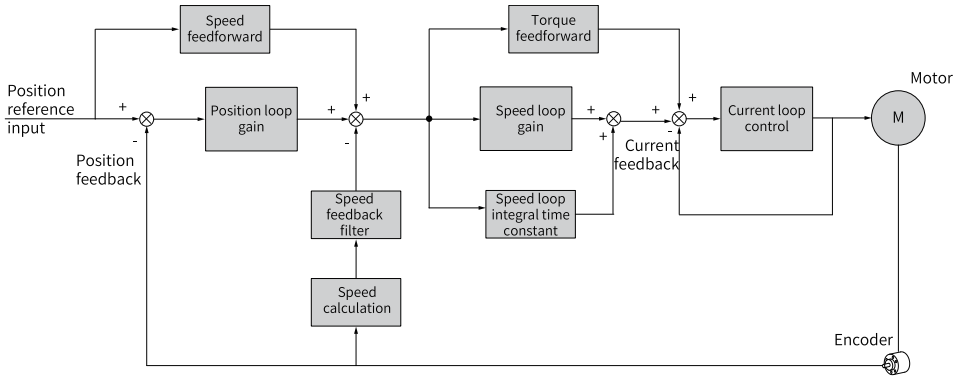


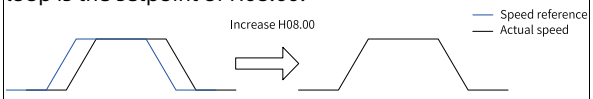
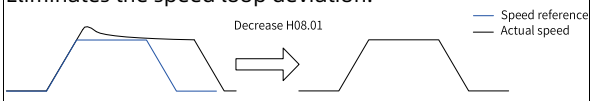
Figure 9-6 Basic control for manual gain tuning

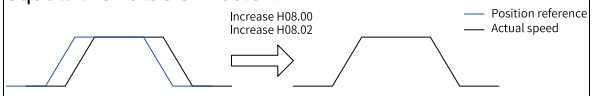
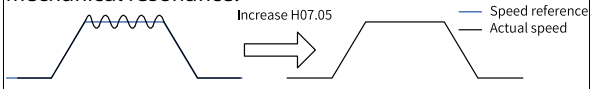
Note

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 adjustment. you only need to adjust the position loop gain, speed loop gain and other auxiliary gains. For gain tuning in the 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 adjust the basic gain parameters.

Step	Param.	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 set correctly, the maximum frequency that can be followed by the speed loop is the setpoint of H08.00.  **Note:** • Increasing the setpoint without incurring extra noise or vibration shortens the positioning time, stabilizes the speed, and improves the following behavior. • If noise occurs, decrease the setpoint. • If mechanical vibration occurs, enable mechanical resonance suppression. For details, see *"9.6.2 Mechanical Resonance Suppression" on page 252*.
2	H08.01	Speed loop integral time constant	**Parameter function:** Eliminates the speed loop deviation.  **Note:** • Set this parameter according to the following formula: 500 ≤ H08.00 x H08.01 ≤ 1000• For example, if H08.00 is set to 40.0 Hz, the speed loop integral time constant must meet the following requirement: 12.50 ms ≤ H08-01 ≤ 25.00 ms01 ≤ 25.00ms。 • 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	Param.	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.  **Note:** • To ensure system stability, the maximum follow frequency of the speed loop is 3 to 5 times of the maximum follow 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, the position loop gain 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.  **Note:** • Ensure that the cutoff frequency of the torque reference low-pass filter is higher than 4 x maximum following 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 *"9.6.2 Mechanical Resonance Suppression" on page 252*. 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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.05	Time constant of torque reference filter	0x0705	0.00 to 30.00	ms	0.50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	These parameters set the time constant of the torque reference filter. Low-pass filter of torque reference helps to make torque reference more smooth and reduce vibration. Note that an excessively high setpoint can reduce responsiveness. Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.00	Speed loop gain	0x0800	0.1 to 2000.0	Hz	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the speed loop. 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 value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies. 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	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.01	Time constant of speed loop integration	0x0801	0.15 to 512.00	ms	19.89	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the integral time constant of the speed loop. The smaller the setting is, the better integration effect will be obtained and the deviation value at stop will approach 0 more quickly. There is no integral action when this parameter is set to 512.00. Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.02	Position loop gain	0x0802	0.0 to 2000.0	Hz	64.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the position loop. This parameter determines response of the position loop. A large position loop gain shortens the positioning time. Note that a very large setting may cause vibration. Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies.								

9.4.2 Gain switchover

Gain switchover can be triggered by the internal state of the drive or an external DI. It is only effective in position and speed control modes. Gain switchover can achieve the following purposes.

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

H08.08 set to 0

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

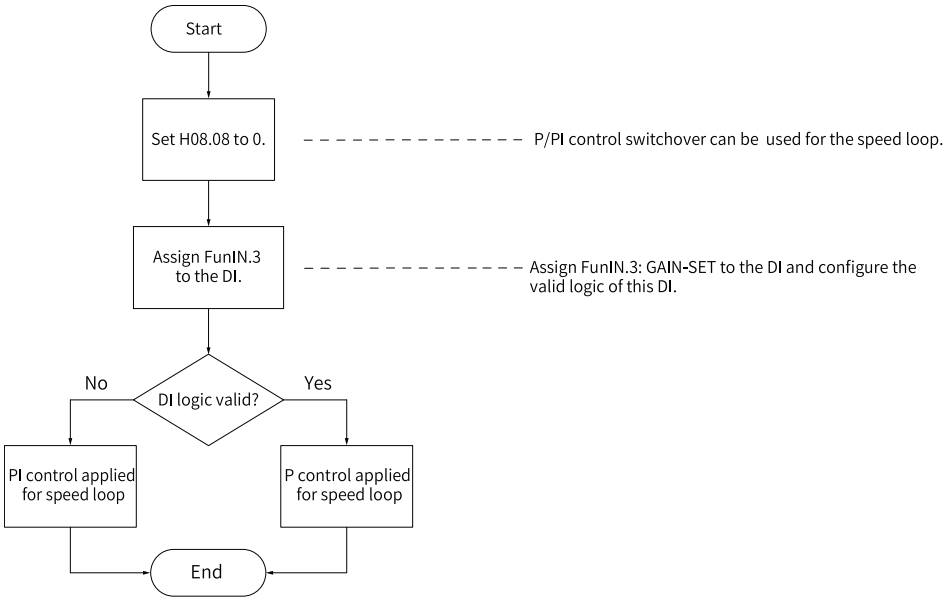


Figure 9-7 Gain switchover flowchart (H08.08 set to 0)

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.

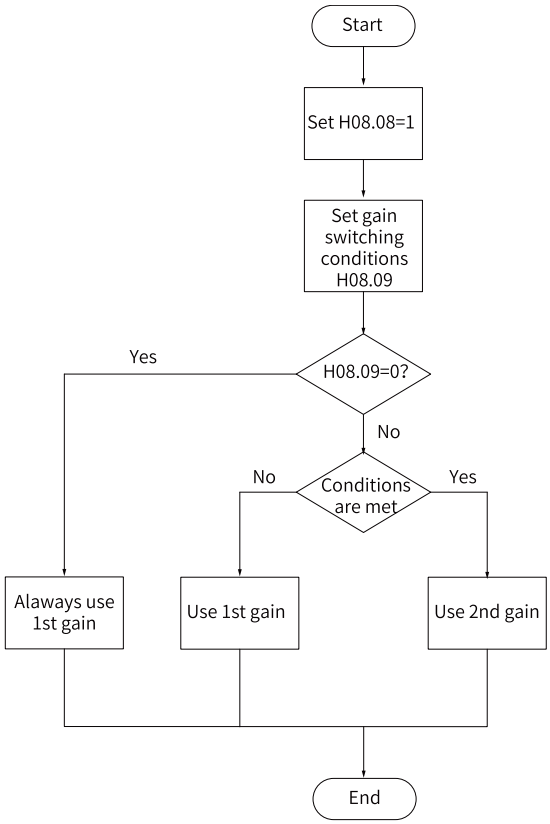
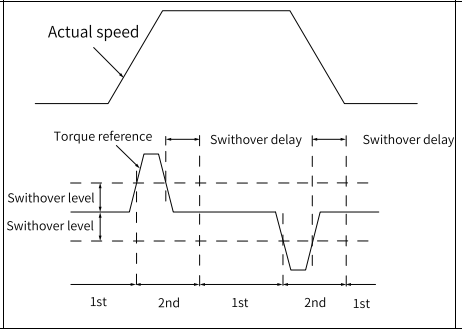
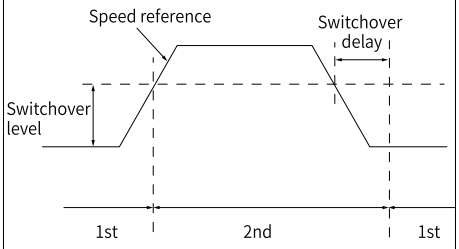
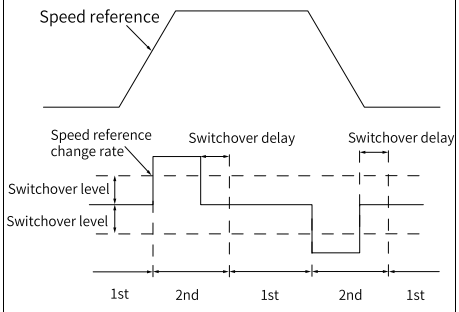
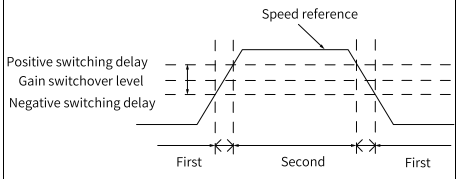
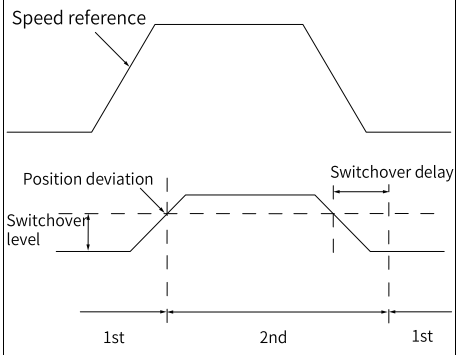
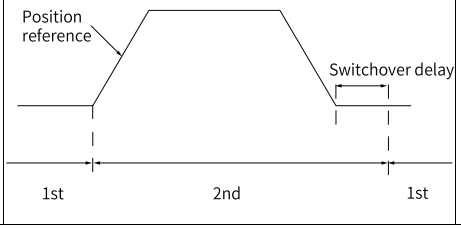


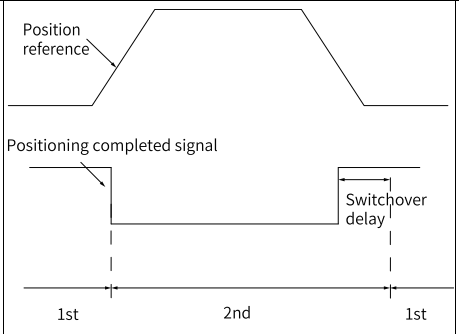
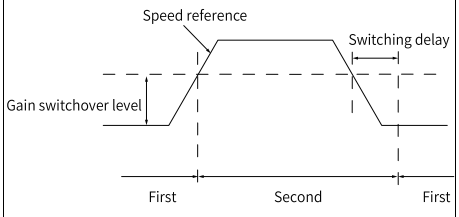
Figure 9-8 Gain switchover flowchart when H08.08 is set to 1

There are in total 11 gain switchover modes. The following table describes the diagrams and parameters of different modes.

Table 9–6 Gain switchover modes

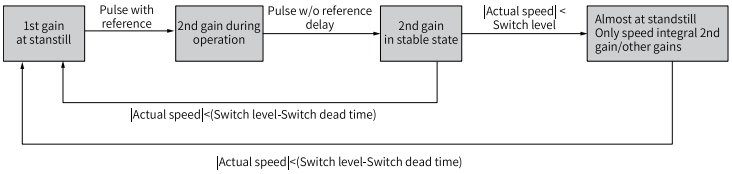
Gain switchover condition			Related parameter		
H08.09	Condition	Diagram	Delay time (H08.10)	Switchover level (H08.11)	Switchover hysteresis (H08.12)
0	Fixed at 1st gain	-	OFF	OFF	OFF
1	Switchover by external DI	-	OFF	OFF	OFF
2	Torque reference		ON	ON (%)	ON (%)

Gain switchover condition			Related parameter		
H08.09	Condition	Diagram	Delay time (H08.10)	Switchover level (H08.11)	Switchover hysteresis (H08.12)
3	Speed reference		ON	ON	ON
4	Speed reference change rate		ON	ON (10 rpm/s)	ON (10 rpm/s)
5	Speed reference high-speed/ low-speed thresholds		OFF	ON (rpm)	ON (rpm)
6	Position deviation		ON	ON (Encoder unit)	ON (Encoder unit)
7	Position reference		ON	OFF	OFF

Gain switchover condition			Related parameter		
H08.09	Condition	Diagram	Delay time (H08.10)	Switchover level (H08.11)	Switchover hysteresis (H08.12)
8	Positioning uncompleted		ON	OFF	OFF
9th	Actual speed		ON	ON (rpm)	ON (rpm)
10	Position reference available + Actual speed	See the following note for details.	ON	ON (rpm)	ON (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:



Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.08	2nd gain mode setting	0x0808	0-1	-	1	UInt16	At once	Ordinary user	At once
	Values:								
	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								
	Parameter description:								
	It sets switchover mode of the 2nd gain.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way

H08.09	Gain switchover condition	0x0809	0–10	-	0	UInt16	At once	Ordinary user	At once

Values:

0: Fixed to the 1st gain set (PS)
1: Switched through external DIs
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:

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

Table 9–7 Conditions for gain switchover

Set value	Gain Switchover Condition	Remarks
0	Fixed at 1st gain	The 1st gain is always used.
1	Switchover via DI	-
2	Torque reference being large	If the torque reference absolute value exceeds (Level + Time lag) [%] 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 – Time lag) [%] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the drive returns to the 1st gain set.
3	Speed reference being large	If the speed reference absolute value exceeds (Level + Time lag) [rpm] in the last 1st gain set, the drive switches to the 2nd gain set. If the absolute value of the speed reference is lower than (Level - Time lag) [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 being large	It is valid only in non-speed control mode. If the absolute value of the change rate of the speed reference exceeds (Level + Time lag) [10 rpm/s] in the last 1st gain set, the drive switches to the 2nd gain set. If the absolute value of the speed reference change rate is lower than (Level – Time lag) [10 rpm/s] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the drive returns to the 1st gain set. The drive always uses the 1st gain in speed control mode.
5	Speed reference high-speed/ low-speed thresholds	If the speed reference absolute value exceeds (Level - Time lag) [rpm] in the last 1st gain set, the drive starts switching to the 2nd gain set, with gains changed gradually. When the speed reference absolute value reaches (Level + Time lag) [rpm], the 2nd gain set applies. If the speed reference absolute value is lower than (Level + Time lag) [rpm] in the last 2nd gain set, the drive starts returning to the 1st gain set, with gains changed gradually. When the speed reference absolute value reaches (Level - Time lag) [rpm], the 1st gain set applies.

6	Position deviation being large	Active only in the position control mode If the position deviation absolute value exceeds (Level + Time lag) [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 - Time lag) [Encoder unit] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the drive returns to the 1st gain set. The 1st gain set applies in control modes other than position control.
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 uncompleted	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.
9th	Large actual motor speed	Active only in the position control mode If the absolute value of actual speed exceeds (Level + Time lag) [rpm] in the last 1st gain set, the drive switches to the 2nd gain set. If the absolute value of actual speed is lower than (Level - Time lag) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the drive returns to the 1st gain set. The 1st gain set applies in control modes other than position control.
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. If the position reference keeps being 0 within the delay defined by H08.10 in the last 2nd gain set, the 2nd gain set applies. When the position reference keeps being 0 after the time defined by H08.10 elapses, if the absolute value of actual speed does not reach (Level) [RPM], the servo drive switches to the 1st gain set (except the speed integral time constant which is fixed to H08.04 (2nd speed loop integral time constant)); If the absolute value of the actual speed is lower than (Level - Time lag) [rpm], the drive switches to the 1st gain set without any exception. The 1st gain set applies in control modes other than position control.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.10	Gain switchover delay	0x080A	0.0 to 1000.0	ms	5.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the delay when the servo drive returns from the 2nd gain to the 1st gain.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.11	Gain switchover level	0x080B	0 to 20000	-	50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the level for gain switchover. Gain switchover is affected by both the level and the dead time, as defined by H08.09. The unit of gain switchover level varies with the switchover condition.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.12	Gain switchover hysteresis	0x080C	0 to 20000	-	30	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the hysteresis for gain switchover. Gain switchover is affected by both the level and the hysteresis, as defined by H08.09. The unit of gain switchover hysteresis varies with the switchover condition. Note: Set H08.11 ≥ H08.12. If H08.11 is set to a value less than H08.12, the system will automatically set H08.11 = H08.12.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.13	Position gain switchover time	0x080D	0.0 to 1000.0	ms	3.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	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. If the set value of H08.05 is equal to or lower than H08.02, this parameter is invalid and the drive switches to the 2nd gain set immediately.								

9.4.3 Comparison of filters

Name	Function	Applicable scenario	Impact of excessive filtering
Pulse input terminal filter	Prevents interference to ensure the number of pulses received by the servo drive is accurate.	• The system wiring does not comply with specifications. • The ambient interference is strong.	The number of pulses received by the servo drive is smaller than those sent by the host controller.
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.	• The acceleration/ deceleration process is not performed on the position references sent from the host controller. • The pulse reference frequency is low. • The electronic gear ratio is larger than 10.	The response delay is prolonged.

9.4.4 Feedforward Gain Adjustment

Speed feedforward

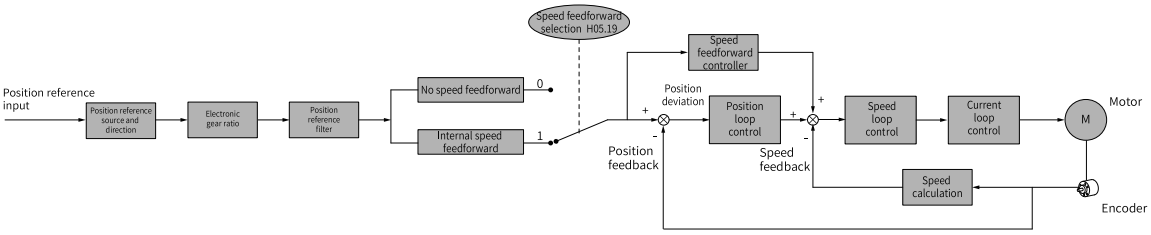


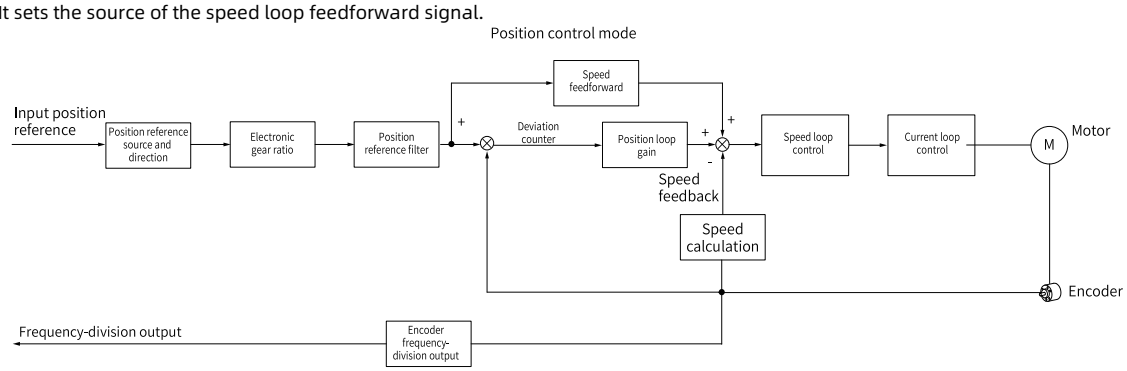
Figure 9-9 Block diagram of speed feedforward control

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).

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.19	Speed feedforward control selection	0x0513	0 to 3	-	1	UInt16	At stop	Ordinary user	At once
	Values:								
	0: No speed feedforward 1: Internal speed feedforward								
	Parameter description:								
	It sets the source of the speed loop feedforward signal. 								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.18	Time constant of speed feedforward filter	0x0812	0.00 to 64.00	ms	0.50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the time constant of speed feedforward filter. The larger the filter time constant, the smoother the speed feedforward, but the greater the delay.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.19	Speed feedforward gain	0x0813	0.0 to 100.0	%	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	In the position control mode, speed feedforward is the value of H08.19 multiplied by the speed feedforward signal, which is part of the speed reference. Increasing this parameter improves position reference response and reduces position deviation at fixed 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).								

Torque feedforward

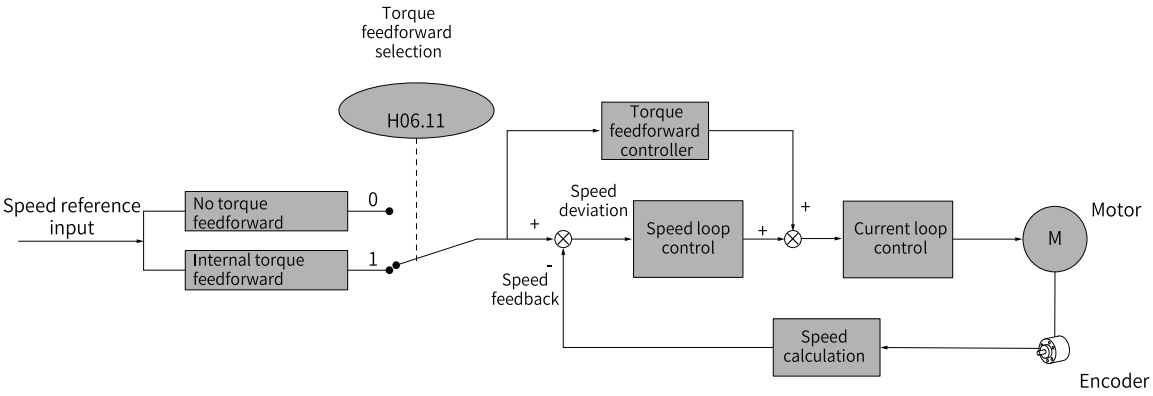


Figure 9-10 Block diagram of torque feedforward control

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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.11	Torque feedforward control	0x060B	0–1	-	1	UInt16	At once	Ordinary user	At once

Values:

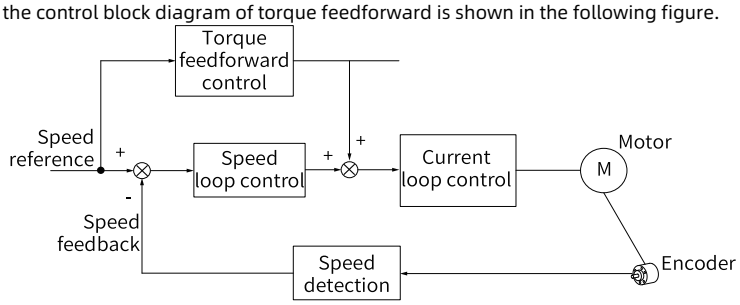
0: No torque feedforward
1: Internal torque feedforward

Parameter description:

Defines the source for torque feedforward control.
It sets whether to enable the internal torque feedforward function in 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.

Set value	Torque feedforward control	Remarks
0	None	-
1	Internal torque feedforward	The torque feedforward signal source is speed reference: • Output of speed controller in speed control mode • Speed reference set by user in speed control mode

In non-torque control, the control block diagram of torque feedforward is shown in the following figure.



Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.20	Time constant of torque feedforward filter	0x0814	0.00 to 64.00	ms	0.50	UInt16	At once	Ordinary user	At once

Parameter description:

It sets the time constant of torque feedforward filter.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.21	Torque feedforward gain	0x0815	0.0 to 200.0	%	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	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 this parameter improves response to changing speed references. Increasing this parameter improves position reference response and reduces position deviation at fixed speed. During parameter adjustment, 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. Note: For how to enable the torque feedforward function and select the torque feedforward signal, see H06.11 (Torque feedforward control).								

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.

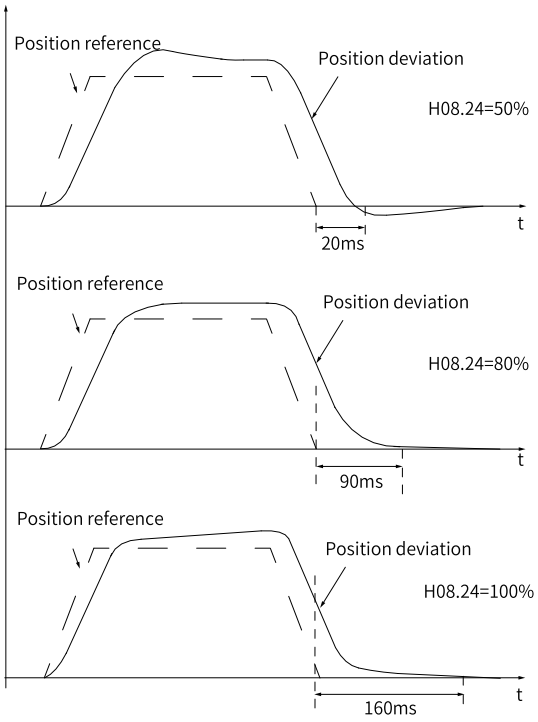


Figure 9-11 Example of pseudo differential feedforward control

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.

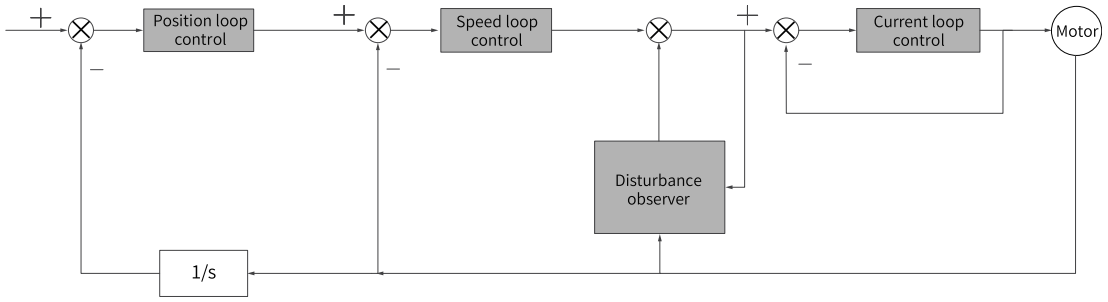
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.24	PDFF control coefficient	0x0818	0.0 to 1000.0	%	100.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the control mode of the speed loop. • When the parameter is set to 100.0, 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. 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

Disturbance observer 1

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 1.



Note:

1/s: Integral element

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.31	Disturbance cut-off frequency	0x081F	1 to 4000	Hz	600	UInt16	At once	Ordinary user	At once
	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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.32	Disturbance observation compensation coefficient	0x0820	0 to 100	%	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the compensation coefficient 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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.33	Disturbance inertia correction coefficient	0x0821	1 to 10000	%	100	UInt16	At once	Ordinary user	At once
	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.								

Disturbance observer 2

The disturbance observer 2 detects and estimates the external disturbance torque suffered by the system and compensates the torque reference accordingly, reducing the effect of external disturbance on the servo system and suppressing vibration.

The following figure shows the function block diagram for disturbance observer 2.

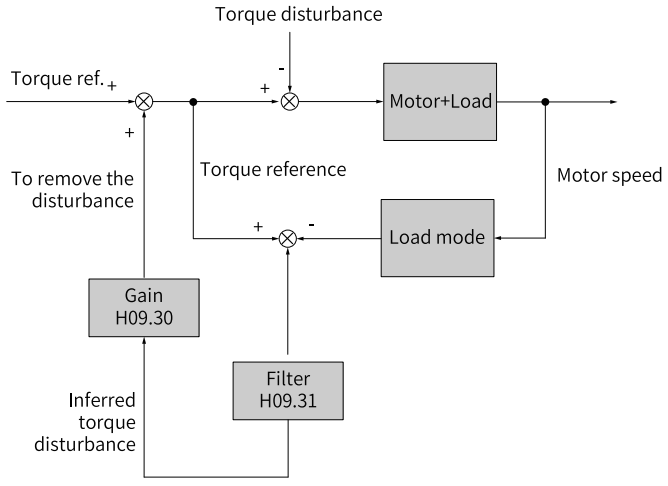


Figure 9-12 Block diagram for disturbance observation

Note:

Two parameters need to be set for the disturbance observer 2:

- H09.30 (Torque disturbance compensation gain): Increasing the value of H09.30 improves disturbance suppression but increases the noise.
- H09.31 (Filter time constant of torque disturbance observer): Increasing the value of H09.31 reduces the noise. Decreasing the value of H09.31 allows detection and estimation of the external disturbance torque featuring short delay, which improves the disturbance suppression capacity but increases the noise.

Set H09.31 to a larger value. Then, increase H09.30 gradually from 0 to a certain value at which the disturbance observer reaches the effect. Then, gradually decrease H09.31 gradually on the condition that the disturbance observer keeps valid. Adjust H09.30 and H09.31 repeatedly to find the balanced setting.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.30	Torque disturbance compensation gain	0x091E	-100.0 to +100.0	%	0.0	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque disturbance compensation gain.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.31	Time constant of torque disturbance observer filter	0x091F	0.00 to 25.00	ms	0.50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the filter time constant of torque disturbance observer.								

9.4.7 Model Tracking

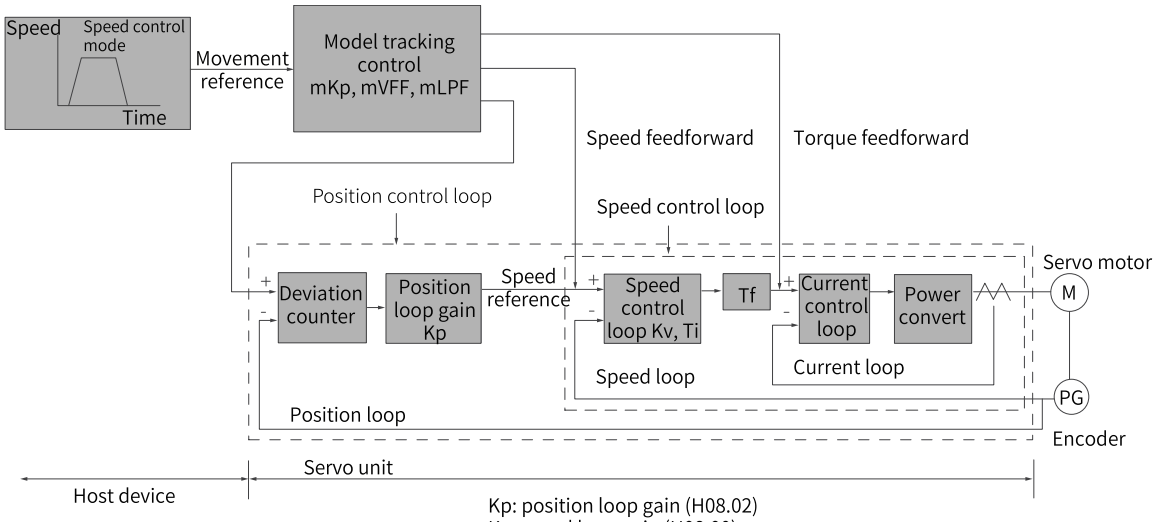
The model tracking control, which is only available in the position control mode, can be used to improve responsiveness and shorten the positioning time. It is only available in the position control mode.

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:

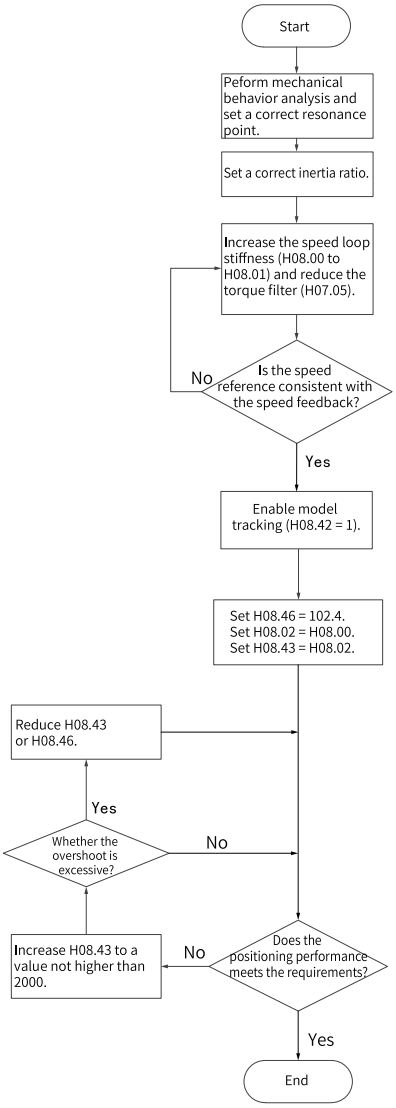
- The auto-tuned values cannot deliver desired performance.
- Improving the responsiveness takes priority over the auto-tuned or customized values.
- User-defined gain parameters or model tracking control parameters are needed.

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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.05	Time constant of torque reference filter	0x0705	0.00 to 30.00	ms	0.50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	These parameters set the time constant of the torque reference filter. Low-pass filter of torque reference helps to make torque reference more smooth and reduce vibration. Note that an excessively high setpoint can reduce responsiveness. Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.00	Speed loop gain	0x0800	0.1 to 2000.0	Hz	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the speed loop. 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 value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies. 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	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.01	Time constant of speed loop integration	0x0801	0.15 to 512.00	ms	19.89	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the integral time constant of the speed loop. The smaller the setting is, the better integration effect will be obtained and the deviation value at stop will approach 0 more quickly. There is no integral action when this parameter is set to 512.00. Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.02	Position loop gain	0x0802	0.0 to 2000.0	Hz	64.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the position loop. This parameter determines response of the position loop. A large position loop gain shortens the positioning time. Note that a very large setting may cause vibration. Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.42	Model control selection	0x082A	0–1	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Disable 1: Enable								
	Parameter description:								
	Used to enable model tracking control. Enabling this function improves response and reduces positioning time. It is only available in the position control mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.43	Model gain	0x082B	0.0 to 2000.0	-	40.0	UInt16	At once	Ordinary user	At once
	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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.46	Model feedfor ward	0x082E	0.0 to 102.4	-	95.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the speed feedforward gain for single inertia model control. If overshoot occurs, reduce the setpoint properly.								

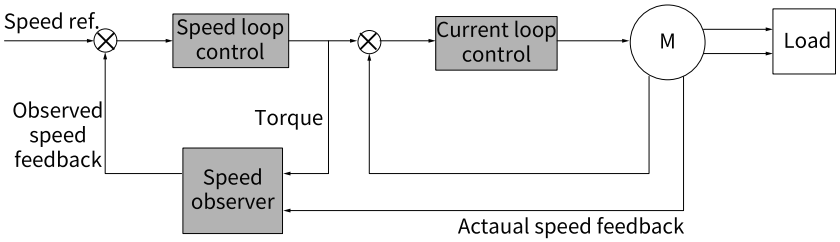
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.51	Model filter time 2	0x0833	0.00 to 655.35	ms	0.00	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the model filter time 2.								

9.4.8 Speed Observer

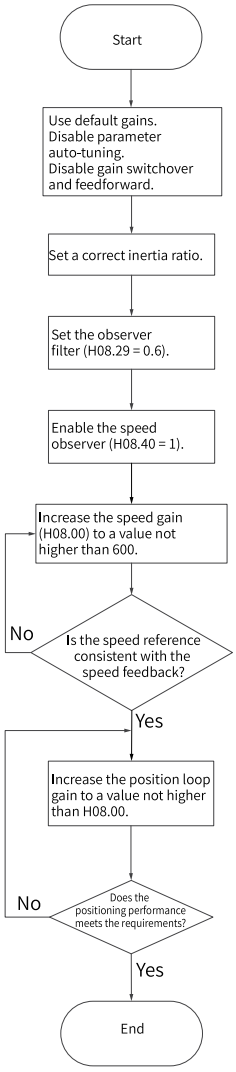
The speed observer is mainly applicable to scenarios with small variations in load characteristics and negligible inertia changes, which helps achieve rapid positioning.

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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.00	Speed loop gain	0x0800	0.1 to 2000.0	Hz	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the speed loop. 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 value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies. 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	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.27	Cutoff frequency of speed observer	0x081B	10 to 2000	Hz	170	UInt16	At once	Ordinary user	At once
	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 loud speed feedback noise.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.28	Speed inertia correction coefficient	0x081C	10 to 10000	%	100	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the speed observer inertia calibration coefficient. When the actual inertia ratio does match the value of H08.15, the correction factor = (actual inertia ratio + 1) / H08.15 x 100%;If H08.15 is set according to the actual inertia, there is no need to calibrate this coefficient.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.29	Speed observer filter time	0x081D	0.02 to 20.00	ms	0.80	UInt16	At once	Ordinary user	At once
	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. 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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.40	Speed observer	0x0828	0–1	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Disabled 1: Enabled								
	Parameter description:								
	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.								

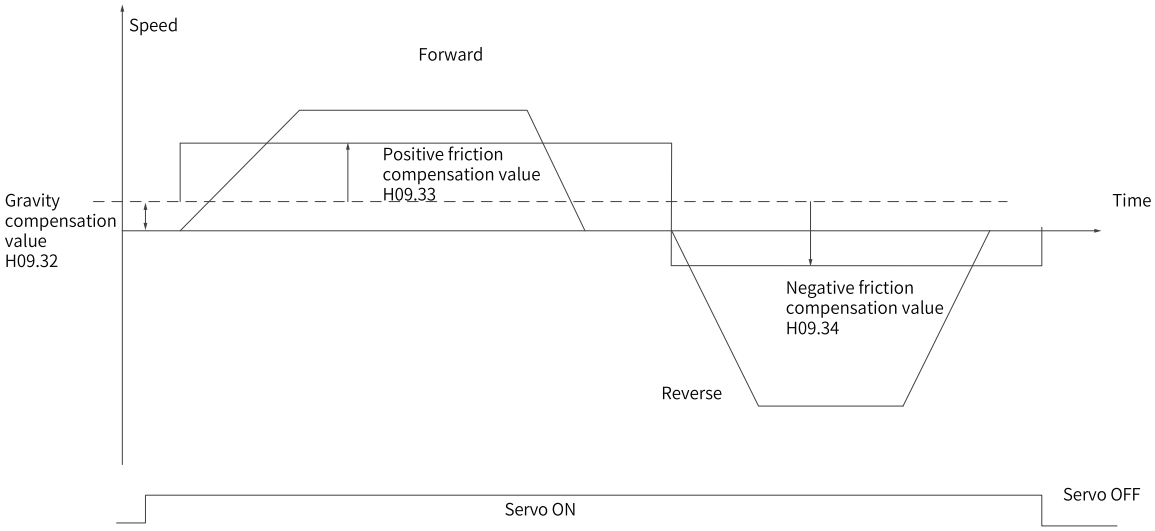
9.4.9 Friction Compensation

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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.32	Gravity compensation value	0x0920	-100.0 to +100.0	-	0.0	Int16	At once	Ordinary user	At once
	Parameter description:								
	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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.33	Positive friction compensation	0x0921	-100.0 to +100.0	%	0.0	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines the positive friction compensation value. See section "Friction Compensation" for details.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.34	Negative friction compensation	0x0922	-100.0 to +100.0	%	0.0	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines the negative friction compensation value. See section "Friction Compensation" for details.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.35	Friction compensation speed threshold	0x0923	0.1 to 30.0	rpm	2.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the friction compensation speed.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.36	Friction compensation speed	0x0924	0 to 2	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Speed reference 1: Model tracking speed 2: Speed feedback								
	Parameter description:								
	Defines the friction compensation speed source. 0: Slow mode + speed reference 1: Slow mode + model tracking speed 2: Slow mode + speed feedback								

9.5 Parameter Adjustment 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.

9.5.1 Parameter Tuning in Position Control Mode

1. Obtain the value of H08.15 (Load inertia ratio) through inertia auto-tuning.
2. Perform again auto-tuning to obtain the initial values of the 1st gain set (or 2nd gain set) and common gain set.
   Gain parameters in position control mode:

- 1st gain:

Parameter	Name	Function	Default value
H07.05	Time constant of torque reference filter	These parameters set the time constant of the torque reference filter.	0.79 ms
H08.00	Speed loop gain	Defines the speed loop proportional gain.	40.0 Hz
H08.01	Time constant of speed loop integration	It sets 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

- Parameters related to the 2nd gain set:

Parameter	Name	Function	Default value
H07.06	2nd time constant of torque reference filter	Defines the torque reference filter time constant.	0.79 ms
H08.03	2nd speed loop gain	Defines the speed loop proportional gain.	40.0 Hz
H08.04	2nd speed loop integral time constant	Defines the integral time constant of the speed loop.	20.00 ms
H08.05	2nd position loop gain	Defines the position loop proportional gain.	64.0 Hz
H08.08	2nd gain mode setting	Defines the mode of the 2nd gain set.	1
H08.09	Gain switchover condition	Defines the gain switchover condition.	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

Parameter	Name	Function	Default value
H08.18	Time constant of speed feedforward filter	Defines the speed feedforward filter time constant.	0.50 ms
H08.19	Speed feedforward gain	Defines the speed feedforward gain.	0.0%
H08.20	Time constant of torque feedforward filter	Defines the torque feedforward filter time constant.	0.50 ms
H08.21	Torque feedforward gain	Defines the torque feedforward gain.	0.0%
H08.22	Speed feedback filter option	Defines the speed feedback filter 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.	4000 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	Time constant of torque disturbance observer filter	Defines the filter time constant of torque disturbance observer.	0.5 ms
H09.38	Low-frequency resonance suppression frequency at the mechanical end	Sets the frequency of low-frequency resonance suppression at the mechanical end.	100.0 Hz
H09.39	Low-frequency resonance suppression at the mechanical end	Defines different low-frequency resonance suppression types at the mechanical end.	2

3. Manually fine-tune the following gains.

Parameter	Name	Function
H07.05	Time constant of torque reference filter	These parameters set the time constant of the torque reference filter.
H08.00	Speed loop gain	Defines the speed loop proportional gain.
H08.01	Time constant of speed loop integration	It sets the integral time constant of the speed loop.
H08.02	Position loop gain	Defines the position loop proportional gain.
H08.19	Speed feedforward gain	Defines the speed feedforward gain.

9.5.2 Parameter Tuning in Speed Control Mode

Parameter adjustment in the speed control mode is the same as that in the position control mode, except for the position loop gain (H08.02 and H08.05). For details, see *"9.5.1 Parameter Tuning in Position Control Mode" on page 246*.

9.5.3 Parameter Tuning in Torque Control Mode

Parameter tuning in torque control mode varies with the condition:

- If the actual speed reaches the speed limit, the adjustment method is the same as that described in *"9.5.2 Parameter Tuning in Speed Control Mode" on page 247*;
- If the actual speed does not reach the speed limit value, except for the position loop gain (H08.02, H08.05), the speed loop gain (H08.00, H08.03), and the speed loop integral time constant (H08.01, H08.04), the adjustment method is the same as *"9.5.2 Parameter Tuning in Speed Control Mode" on page 247*.

9.6 Vibration Suppression

The block diagram for vibration suppression is as follows.

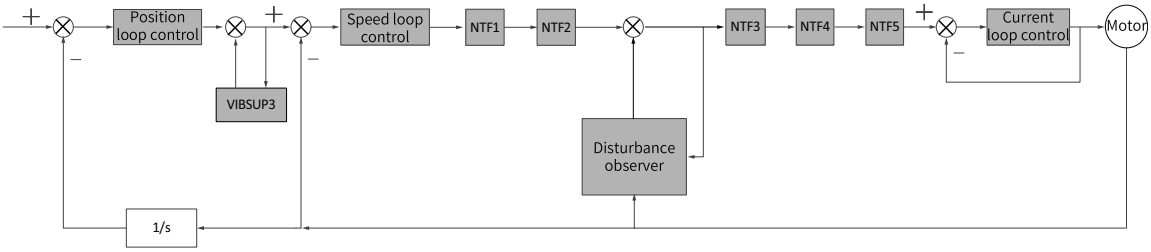


Diagram description:

- 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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.53	Medium- and low-frequency jitter suppression frequency 3	0x0835	0.0 to 600.0	Hz	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the medium- and low-frequency jitter suppression frequency 3. Set this parameter according to the actual resonant frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.54	Medium- and low-frequency jitter suppression compensation 3	0x0836	0 to 200	%	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the compensation gain for medium- and low-frequency jitter suppression 3. Full compensation applies when this parameter is set to 200%.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.56	Medium- and low-frequency jitter suppression phase modulation 3	0x0838	0 to 1600	-	100	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the medium- and low-frequency jitter suppression phase 3. This parameter can be adjusted according to the actual compensation effect.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.59	Medium- and low-frequency jitter suppression frequency 4	0x083B	0.0 to 600.0	Hz	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the jitter frequency for medium- and low-frequency jitter suppression 4. Set this parameter according to the actual resonant frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.60	Medium- and low-frequency jitter suppression compensation 4	0x083C	0 to 200	%	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the compensation gain for medium- and low-frequency jitter suppression 4. Full compensation applies when this parameter is set to 200%.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.61	Medium- and low-frequency jitter suppression phase modulation 4	0x083D	0 to 1600	-	100	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Adjust this parameter based on the actual compensation effect.								

9.6.1 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

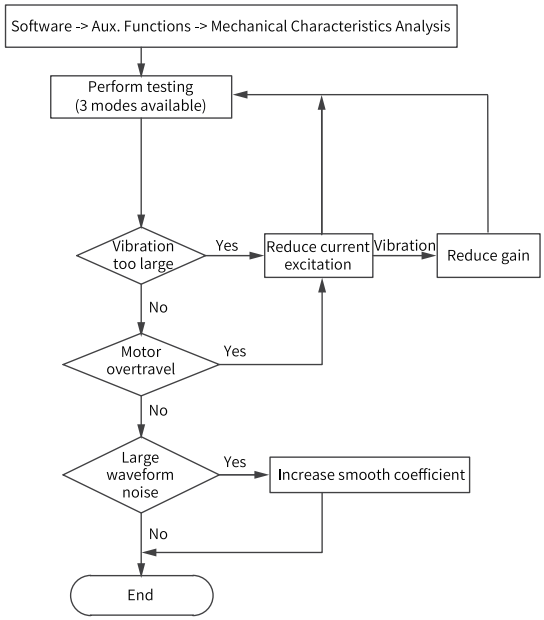


Figure 9-13 Operating procedure for mechanical characteristic analysis

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.

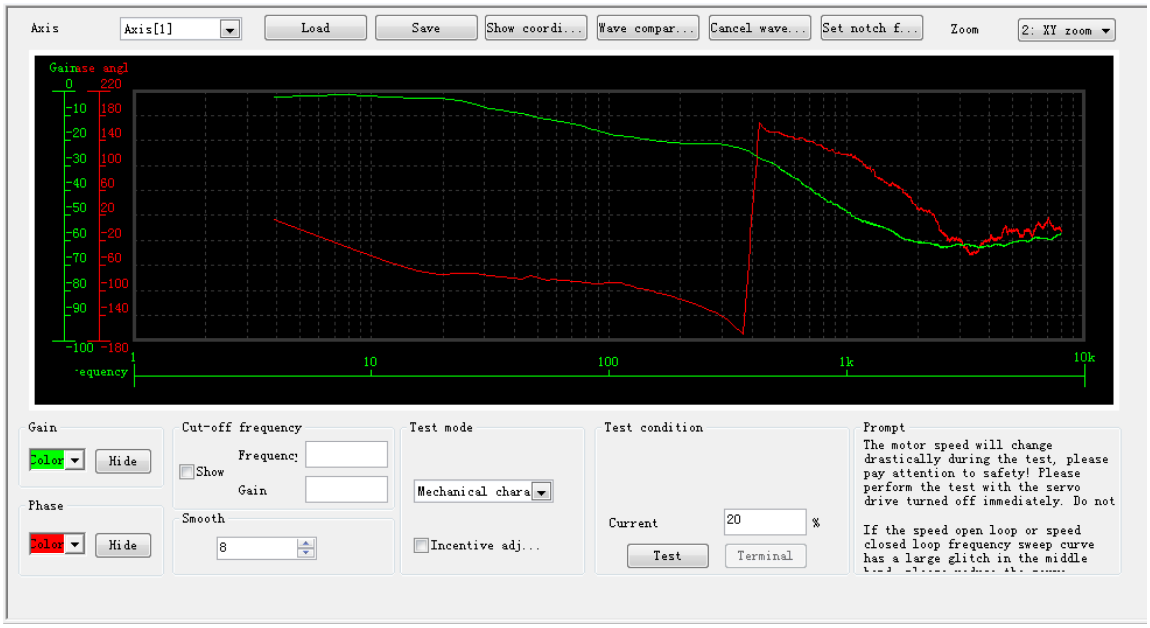


Figure 9-14 Example of the waveform obtained

9.6.2 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.

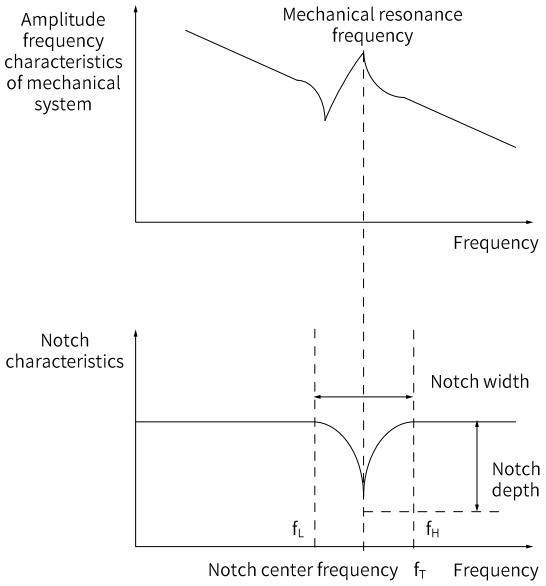


Figure 9-15 Operating principle of the notch

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 9–8 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.

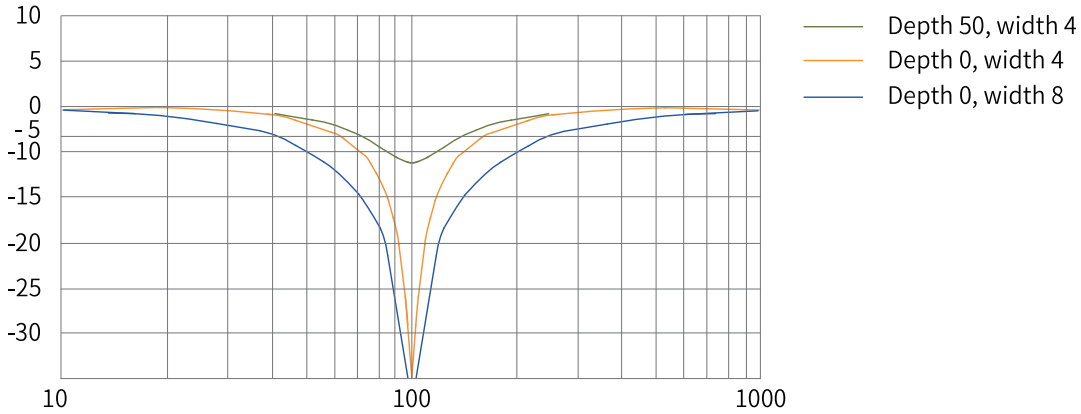


Figure 9-16 Notch frequency characteristics

Use of the notch

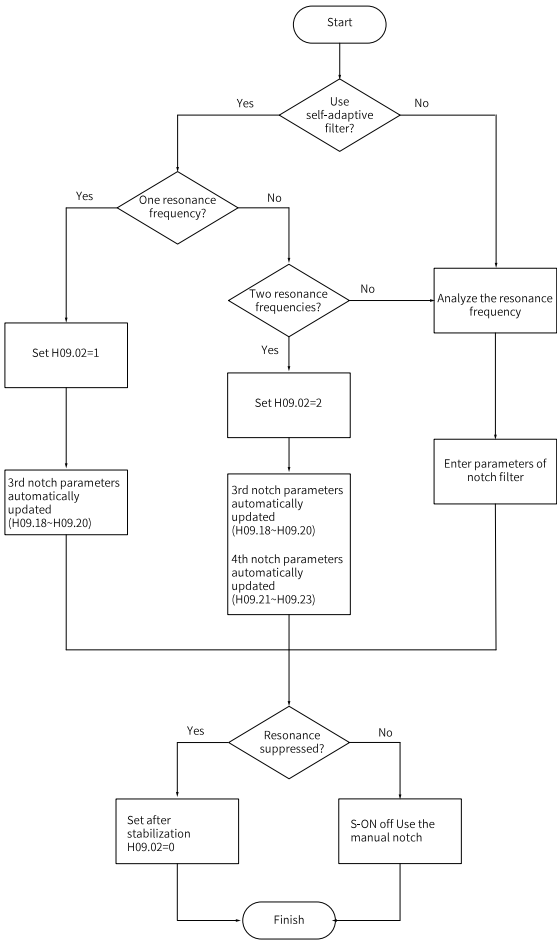


Figure 9-17 Flowchart for using the notch

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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.02	Working mode of self-adaptive notch	0x0902	0 to 4	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	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								
	Parameter description:								
	It sets the working mode of the adaptive notch.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.12	Group 1 notch frequency	0x090C	50 to 4000	Hz	4,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the center frequency of the 1st notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 4000 Hzdeactivates the notch function.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.13	Group 1 notch width level	0x090D	0 to 20	-	2	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the bandwidth level of the 1st notch. Use the default setpoint in general cases. The notch width level indicates the ratio of the notch width to the notch center frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.14	Group 1 notch depth level	0x090E	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the depth level of the 1st notch. The notch depth level indicates the ratio of input to output at 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".								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.15	2nd notch frequency	0x090F	50 to 4000	Hz	4,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the center frequency of the 2nd notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 4000 Hz deactivates the notch function.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.16	2nd notch width level	0x0910	0 to 20	-	2	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the bandwidth level of the 2nd notch. Use the default setpoint in general cases. The notch width level indicates the ratio of the notch width to the notch center frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.17	2nd notch depth level	0x0911	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the depth level of the 2nd notch. The notch depth level indicates the ratio of input to output at 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".								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.18	3rd notch frequency	0x0912	50 to 4000	Hz	4,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the center frequency of the 3rd notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 4000 Hzdeactivates the notch function.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.19	3rd notch width level	0x0913	0 to 20	-	2	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the bandwidth level of the 3rd notch. Use the default setpoint in general cases. The notch width level indicates the ratio of the notch width to the notch center frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.20	3rd notch depth level	0x0914	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the depth level of the 3rd notch. The notch depth level indicates the ratio of input to output at 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".								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.21	4th notch frequency	0x0915	50 to 4000	Hz	4,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the center frequency of the 4th notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 4000 Hzdeactivates the notch function.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.22	4th notch width level	0x0916	0 to 20	-	2	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the bandwidth level of the 4th notch. Use the default setpoint in general cases. The notch width level indicates the ratio of the notch width to the notch center frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.23	Depth level of the 4th notch	0x0917	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the depth level of the 4th notch. The notch depth level indicates the ratio of input to output at 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".								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.24	Obtained resonance frequency	0x0918	0 to 4000	-	0	UInt16	Unmodifiable	Ordinary user	-
	Parameter description:								
	When H09.02 (Adaptive notch mode) is set to 3, the current mechanical resonance frequency is displayed.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.41	Frequency of the 5th notch	0x0929	50 to 8000	Hz	4,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the center frequency of the 5th notch, which is the mechanical resonance frequency. In the torque control mode, setting the notch frequency to 4000 Hzdeactivates the notch function.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.42	Width level of the 5th notch	0x092A	0 to 20	-	2	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the bandwidth level of the 5th notch. Use the default setpoint in general cases. The notch width level indicates the ratio of the notch width to the notch center frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.43	Depth level of the 5th notch	0x092B	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the depth level of the 5th notch. The notch depth level indicates the ratio of input to output at 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".								

9.6.3 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.

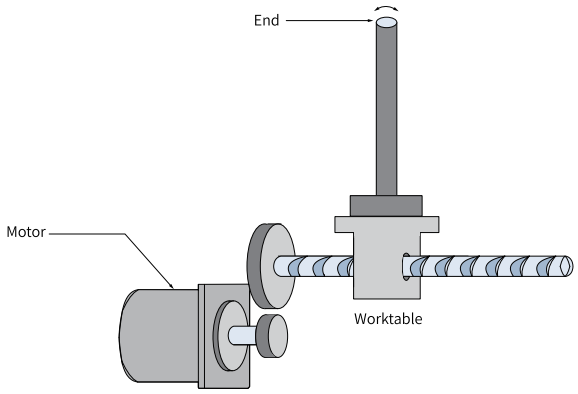


Figure 9-18 Low-frequency vibration at the mechanical end

Use of the filter

The low-frequency resonance suppression filter can effectively reduce such vibration.

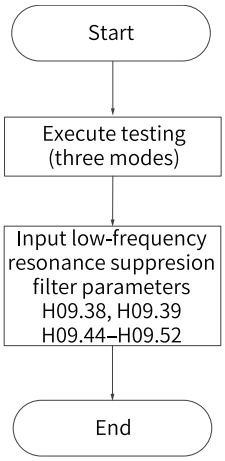


Figure 9-19 Flowchart for setting low-frequency resonance suppression filter

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.

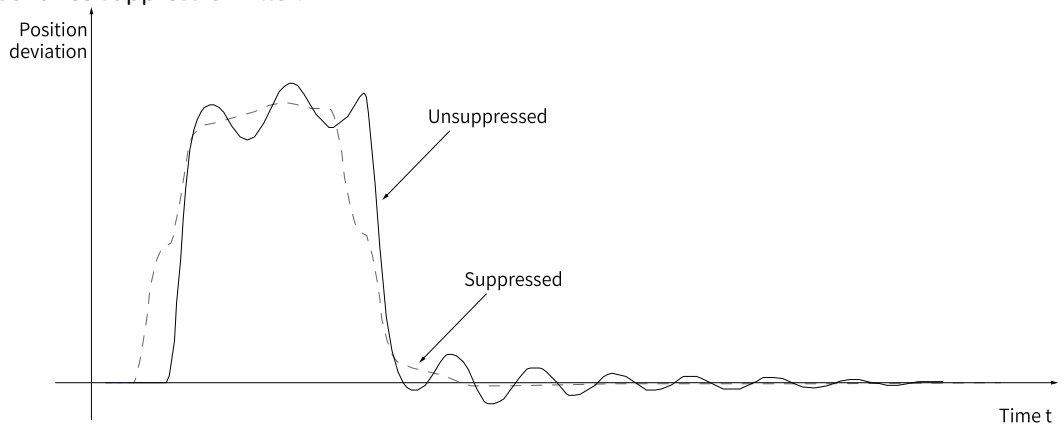


Figure 9-20 Low-frequency resonance suppression effect

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.04	Suppression mode of low-frequency resonance	0x0904	0–1	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Vibration frequency set manually 1: Vibration frequency set automatically								
	Parameter description:								
	It sets the mode of suppressing low-frequency resonance. When H09.04=0, manually set parameters of low-frequency resonance suppression filter (H09.38 and H09.39); When H09.04=1, automatically set parameters of low-frequency resonance suppression filter (H09.38 and H09.39).								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.38	Low-frequency resonance suppression frequency at the mechanical end	0x0926	1.0 to 100.0	Hz	100.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Set this parameter based on the actual jitter frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.39	Low-frequency resonance suppression at the mechanical end	0x0927	0 to 3	-	2	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines different low-frequency resonance suppression types at the mechanical end. Type 1 features the shortest delay.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.44	Frequency of low-frequency resonance suppression 1 at mechanical load end	0x092C	0.0 to 200.0	Hz	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Set this parameter based on the actual jitter frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.45	Responsiveness of low-frequency resonance suppression 1 at the end-effector	0x092D	0.01 to 10.00	-	1.00	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Sets the width of low-frequency resonance suppression 1 at mechanical load end. Use the default setpoint in general cases. Increasing this setpoint can reduce the delay time.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.47	Width of low-frequency resonance suppression 1 at mechanical load end	0x092F	0.00 to 2.00	-	1.00	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Sets the width of low-frequency resonance suppression 1 at mechanical load end. Use the default setpoint in general cases. Increasing this setpoint can increase the delay time.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.49	Frequency of low-frequency suppression 2 at the mechanical end	0x0931	0.0 to 200.0	Hz	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Set this parameter based on the actual jitter frequency.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.50	Response to low-frequency suppression 2 at the mechanical end	0x0932	0.01 to 10.00	-	1.00	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Use the default setpoint in general cases. Increasing this setpoint can reduce the delay time.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.52	Width of low-frequency suppression 2 at the mechanical end	0x0934	0.00 to 2.00	-	1.00	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Use the default setpoint in general cases. Increasing this setpoint can increase the delay time.								

10 Function Overview

Functions of the drive are listed below. See details in corresponding chapters.

Function	Description	References
Position control mode	Used to make the servo drive operate in the position control mode.	*" Position control mode" on page 267*
Speed control mode	Used to make the servo drive operate in the speed control mode.	*" Speed control mode" on page 338*
Torque control mode	Used to make the servo drive operate in the torque control mode.	*" Torque control mode" on page 362*
Position/Speed control switchover	Switchover between position control and speed control is implemented via external input signal.	*"11.5 Compound Control Mode" on page 380*
Position/Torque control switchover	Switchover between speed control and torque control is implemented via external input signal.	
Torque/Position control switchover	Switchover between torque control and position control is implemented via external input signal.	
Torque/Speed/ Position control switchover	Switchover between torque control, speed control and position control is implemented via external input signal.	
Torque Reference Filter	It suppresses possible mechanical resonance generated when the response speed of the servo drive is very high.	*"11.4.3 Torque Reference Filter" on page 368*
Electronic gear ratio	Decreasing or increasing the pulse input by: (0.001 x Encoder resolution/10000) to (4000 x Encoder resolution/10000).	*" Reference Frequency Division/ Multiplication (Electronic Gear Ratio)" on page 296*
Position first-order low-pass filter	It implements smooth acceleration/deceleration.	*"11.2.4 Position reference filter" on page 302*
Homing	Used to search for the mechanical home automatically to locate the relative position between the mechanical home and mechanical zero	*" Homing" on page 319*
Fixed length	Used to interrupt present position reference and execute the set displacement.	*"11.2.8 Interrupt Positioning" on page 315*
Zero Clamp	Used to keep the motor speed below a certain value in the speed control mode to lock the position.	*"11.3.4 Zero Clamp" on page 354*
Absolute Encoder System	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 Encoder System" on page 381*
Soft Limit Function	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.	*"12.2 Soft Limit Function" on page 391*
Software Reset	The software reset function comes into rescue when a restart of the servo drive in the non-operating state is not allowed because a No.1 non-resettable fault does not occur.	*"12.3 Software Reset" on page 392*

Function	Description	References
Motor protection	The servo drive provides the motor overload protection function to prevent the motor from being damaged due to over-temperature.	“ *Motor protection*” *on page 393*
Alarm history	The latest alarms are recorded, and the alarm history can be cleared.	“ *Fault Log*” *on page 656*
Alarm code output	A 3-digit alarm code is output when an alarm occurs.	“ *List of Warnings*” *on page 658* “ *List of Fault Codes*” *on page 659*

11 Basic Functions of the Servo Drive

11.1 Servo Mode

SV660P supports multiple control modes which can be selected by setting parameter H02.00 via the servo drive keypad or the Inovance drive commissioning platform.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.00	Control mode selection	0x0200	See "Values".	-	1	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Speed control mode 1: Position mode 2: Torque mode 3: Torque control mode <-> Speed control mode				4: Speed control mode <-> Position control mode 5: Torque control mode<->Position control mode 6: Torque control mode<->Speed control mode<->Position control mode				
	Parameter description:								
	Select a control mode								

11.2 Position control mode

11.2.1 Overview

11.2.1.1 Function Description

In position control mode, the servo drive controls the motor position based on position references. In 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 internal or external encoder.

Set H02.00 to 1 on the keypad or InoDriveShop platform to enable the position control mode. Set the drive parameters based on the mechanical structure and technical specifications.

Application scenarios

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.

11.2.1.2 Working Principle

Function Block Diagram

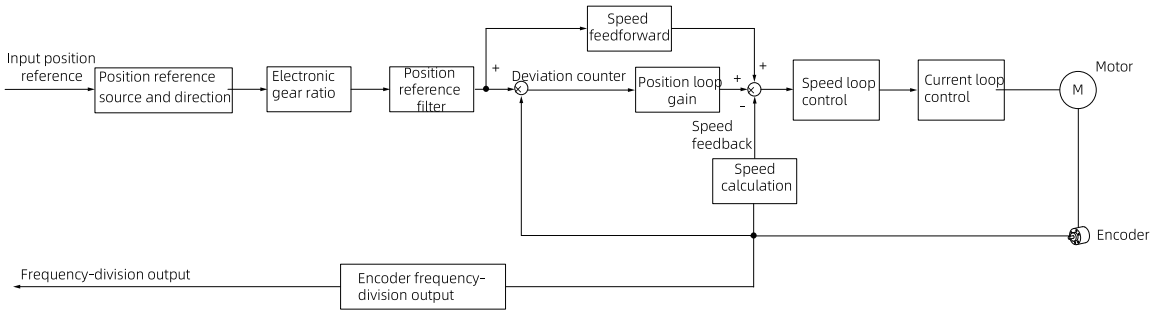


Figure 11-1 Position control diagram

Signal exchange between the drive and the host controller

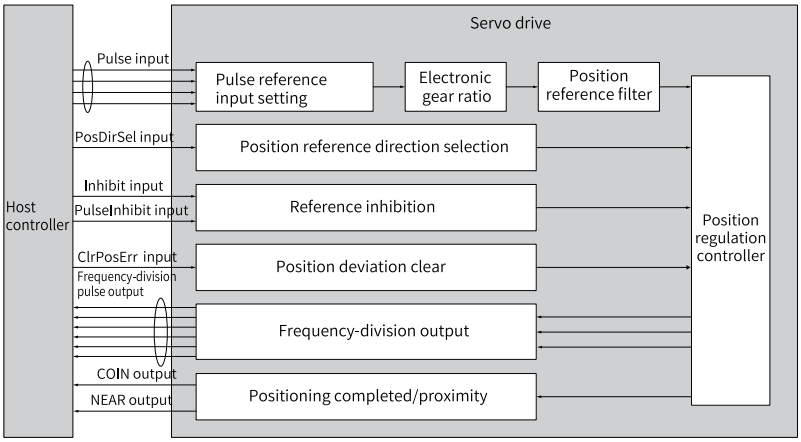


Figure 11-2 Signal exchange between the servo drive and the host controller

Parameter diagram

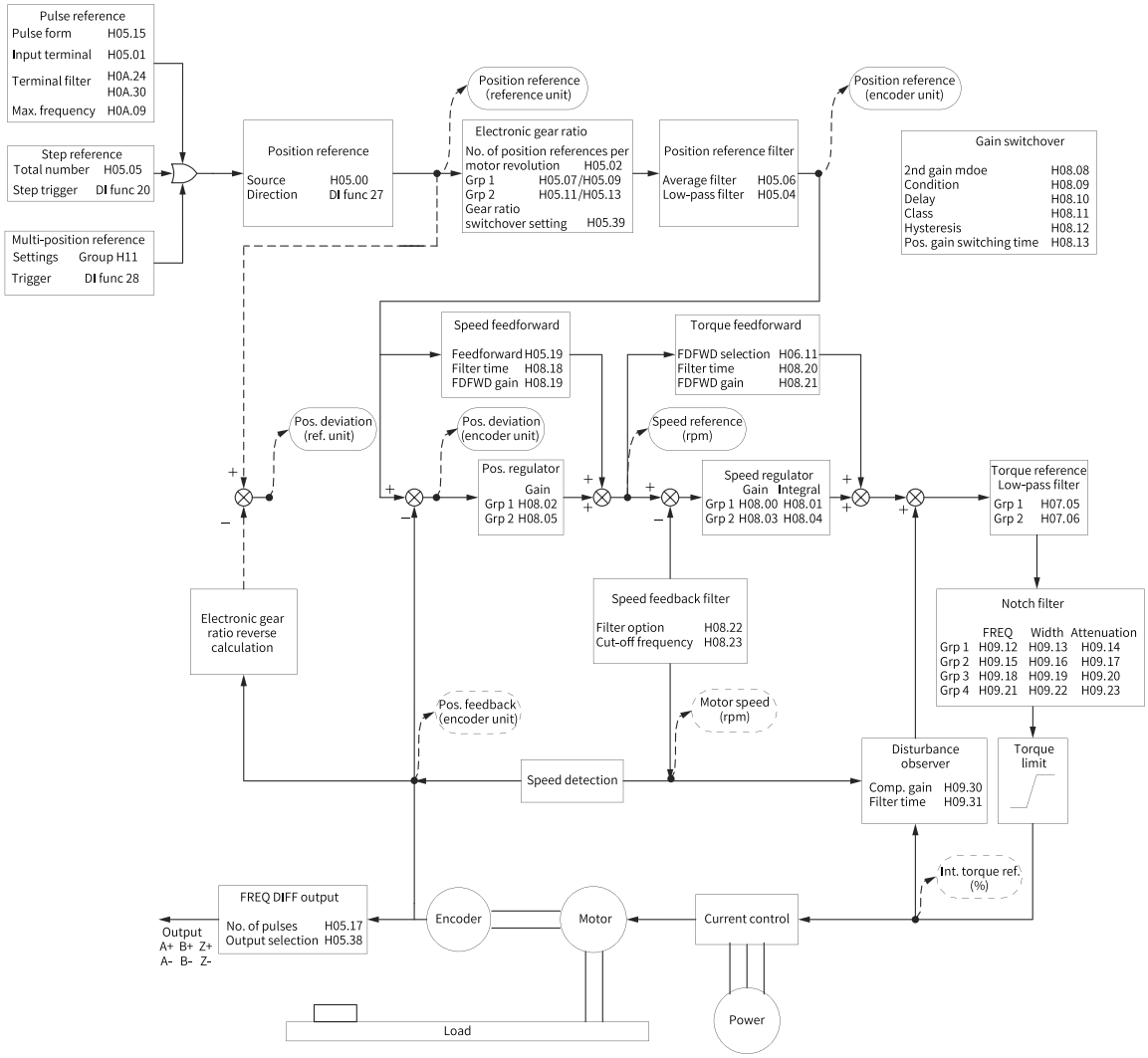


Figure 11-3 Block diagram of position control parameters

11.2.1.3 Control mode setting guide

Step	Name	Description	
1	Select the position control mode	Set H02.00 to 1.	
2	Defines the position reference source.	Sets the pulse reference as the source (H05.00 = 0)	*"Pulse reference input terminal" on page 273*
			"Pulse input terminal filter" on page 275
			"Pulse input format" on page 276
			"Pulse reference frequency" on page 278
		Sets the step reference as position reference source (H05.00 = 1)	*"Set the motor speed based on the electronic gear ratio." on page 279*
			"Set the target displacement." on page 279
			"Enable the step amount reference." on page 280
		Sets the multi-position reference as the position reference source (H05.00 = 2)	*"Setting the multi-position operation mode" on page 281*
			"Setting the multi-position operating curve" on page 291
			"Setting multi-position reference enable mode" on page 293
3	Set the position reference direction	*"11.2.2.2 Position reference direction" on page 293*	
4	Other function setting	Position reference inhibited	*"11.2.2.3 Position reference inhibited" on page 294*
		Reference Frequency Division/ Multiplication (Electronic Gear Ratio)	*"Reference Frequency Division/ Multiplication (Electronic Gear Ratio)" on page 296*
		Position reference filter	*"11.2.4 Position reference filter" on page 302*
		Position deviation clear	*"11.2.5 Position Deviation Clear" on page 304*
		Frequency-division output	*"11.2.6 Frequency-Division Output" on page 305*
		Motion control completed, internal reference completed, positioning completed, positioning almost completed	*"Motion control completed" on page 309*
		Interrupt positioning	*"11.2.8 Interrupt Positioning" on page 315*
		Homing	*"Homing" on page 319*

11.2.2 Position Reference Input Setting

The position reference input setting includes position reference source, direction, and inhibition.

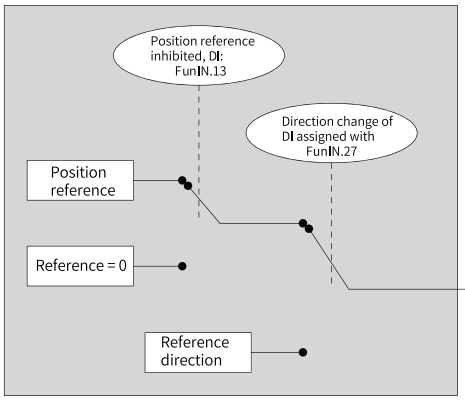


Figure 11-4 Block diagram of position reference input setting

11.2.2.1 Position reference source

In position control mode, set the position reference source in H05.00 first.

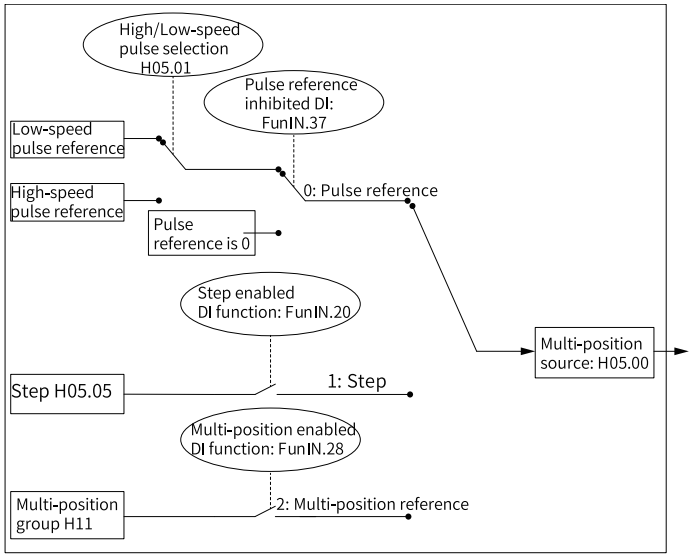


Figure 11-5 Setting the position reference source

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.00	Main position reference source	0x0500	See "Parameter Description"	-	0	UInt16	At once	Ordinary user	At once

Parameter description:

Defines the position reference source in the position control mode.

Set value	Reference source	Description
0	Pulse reference	The host controller or other pulse generators generate pulses, which are input to the servo drive through hardware terminals. The hardware terminal is selected in H05.01.
1	Step size	The step displacement is set in H05.05 (Step value). The step reference is sent by the DI terminal allocated with FunIN.20.
2	Multi-position reference	The running mode of the multi-position function is set by parameters in group H11. The multi-position reference is sent by the DI terminal allocated with FunIN.28.

11.2.2.1.1 Pulse Reference as Source (H05.00 = 0)

Perform the following operations to obtain the correct pulse reference form.

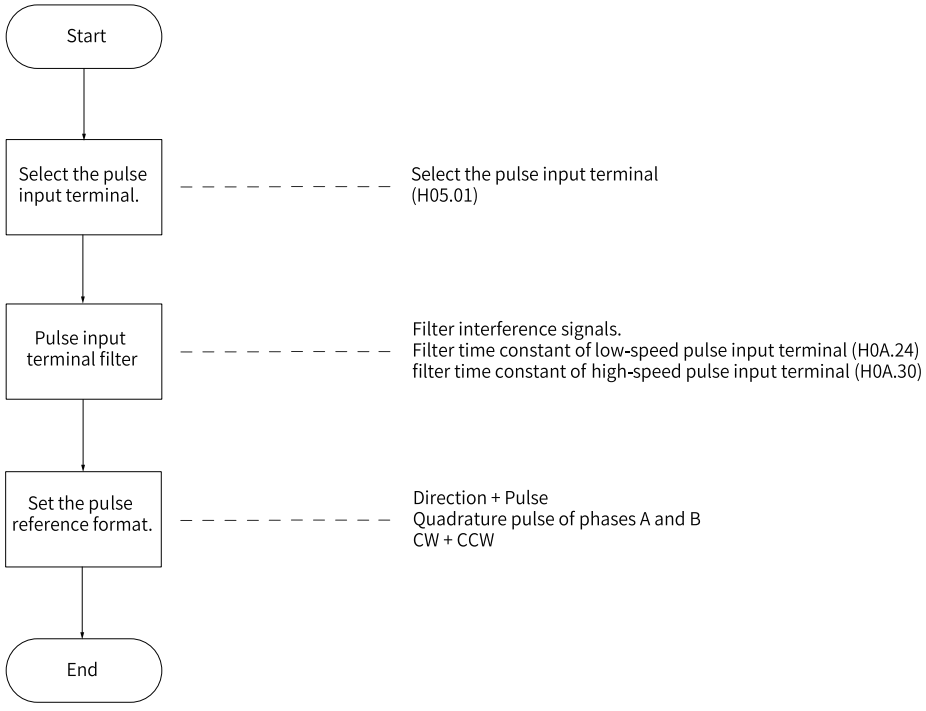
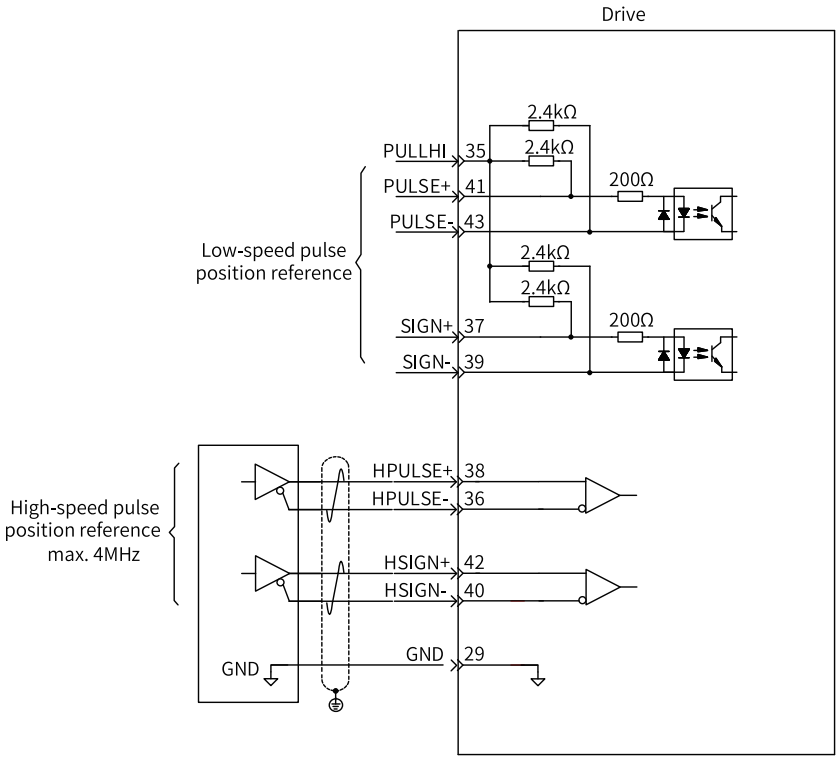


Figure 11-6 Flowchart for setting the pulse reference as the source

Pulse reference input terminals

The servo drive provides two pulse input terminals.



The low-speed pulse input terminals (PULSE+, PULSE-, SIGN+, SIGN-) receive differential input signals (maximum frequency up to 200 kpps) and open-collector input signals (maximum frequency up to 200 kpps).

The high-speed pulse input terminal (HPULSE+, HPULSE-, HSIGN+, HSIGN-) receives only differential input signal (maximum frequency 4 Mpps).

For detailed information about the interface circuit, see the "Wiring" section.

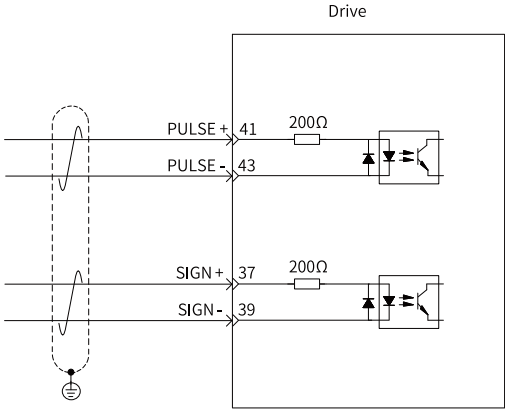
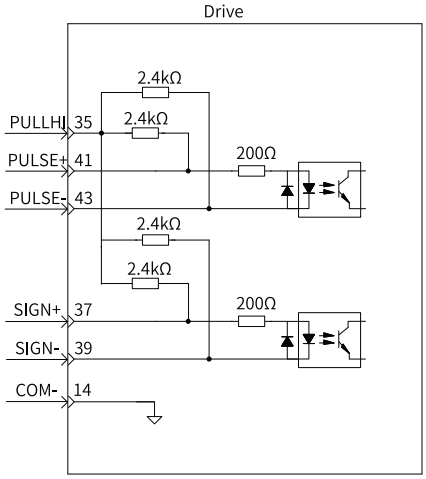
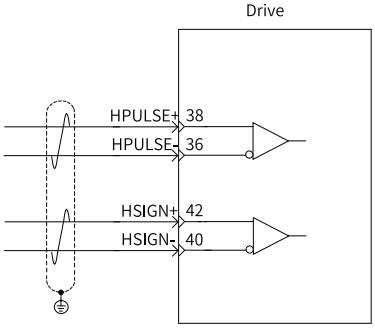
Table 11–1 Specifications of pulse input

Pulse type		Maximum input frequency	Voltage	Forward current
High-speed pulse	Differential signal	4 Mpps	5 V	< 25 mA
Low-speed pulse	Differential signal	200 kpps	5 V	< 15 mA
	Open-collector signal	200 kpps	24 V	< 15 mA

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.01	Position pulse reference input terminal selection	0x0501	See "Values".	-	0	UInt16	At stop	Ordinary user	At once

Values:

Used to select the physical input terminal based on the input pulse frequency when the pulse reference acts as the position reference source in the position control mode.

Set value	Input terminal	Description
0	Low speed	Differential input terminals: PULSE+, PULSE-, SIGN+, SIGN- Max. pulse frequency: 500 kpps 
		Open-collector input terminals: PULLHI, PULSE+, PULSE-, SIGN+, SIGN-, maximum pulse frequency: 200 kpps 
1	High speed	Differential input terminals: HPULSE+, HPULSE-, HSIGN+, HSIGN-, maximum pulse frequency: 4 Mpps 

Pulse input terminal filter

Set the filter time to filter the pulses from the low-speed/high-speed pulse input terminals to prevent motor malfunction due to interference on the servo drive.

If the filter time constant is t_F, and the minimum width of input signals is t_{min}, the input signal and filtered signal are as shown in the following figure. The filtered signal has a t_F delay over the input signal.

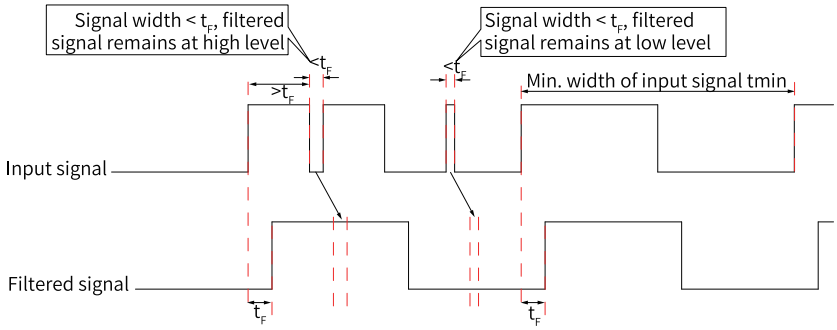


Figure 11-7 Example of signal filtering waveform

The filter time constant t_F must be equal to or smaller than (20% to 25%) t_{min}.

The recommended filter parameter setting based on the maximum frequency (minimum width) of input pulses is described in the following table.

Table 11–2 Recommended filter parameter setting

Pulse Input Terminal	Parameter	Maximum Frequency of Input Pulses	Recommended Filter Time Constant (25 ns)
Low-speed pulse input terminal	H0A.24	<167kpps	30
Low-speed pulse input terminal	H0A.24	167kpps~200kpps	20
High-speed pulse input	H0A.30	200kpps~1Mpps	5
High-speed pulse input	H0A.30	>1Mpps	3

For example, if the filter time constant is set to 30, the actual filter time is 30 x 25 = 750 ns.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.24	Filter time constant of low-speed pulse input terminal	0x0A18	0 to 255	-	30	UInt16	At stop	Ordinary user	Effective upon next power-on

Parameter description:

Defines the filter time constant of low-speed pulse input terminal which is enabled (H05.01 = 0) when the position reference source is pulse input (H05.00 = 0) in the position control mode.

When peak interference exists in the low-speed pulse input terminal, set this parameter to suppress peak interference and prevent motor malfunction due to interference signal inputted to the servo drive.

Maximum Frequency of Input Pulses	Recommended Filter Time Constant (25 ns)
<167kpps	30
167kpps~250kpps	20
250kpps~500kpps	10

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.30	Filter time constant of high-speed pulse input terminal	0x0A1E	0 to 255	ns	2	UInt16	At stop	Ordinary user	Effective upon next power-on

Parameter description:

Defines the filter time constant of high-speed pulse input terminal which is enabled (H05.01 = 1) when the position reference source is pulse reference (H05.00 = 0) in the position control mode.

When peak interference exists in the high-speed pulse input terminal, set this parameter to suppress peak interference and prevent motor malfunction due to interference signal inputted to the servo drive.

Maximum Frequency of Input Pulses	Recommended Filter Time Constant (Unit: ns)
500kpps~1Mpps	5
>1Mpps	3

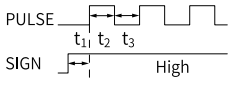
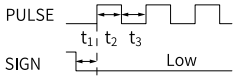
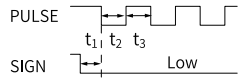
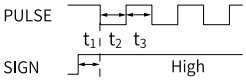
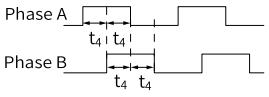
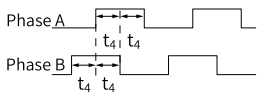
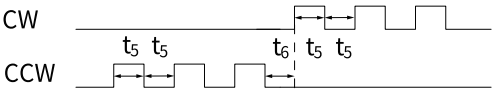
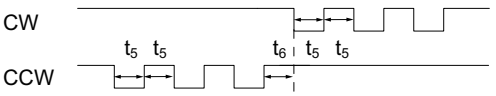
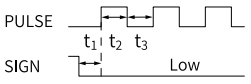
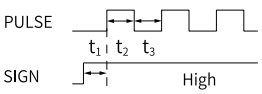
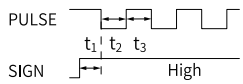
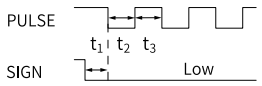
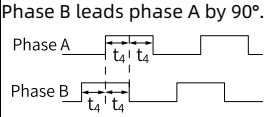
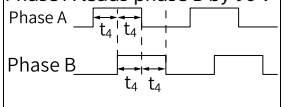
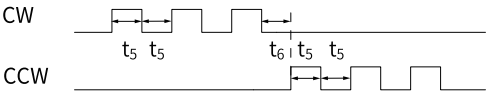
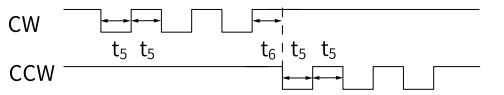
Pulse input format

The servo drive supports three pulse input formats:

- Direction + Pulse (positive or negative logic)
- 2: Phase A + phase B quadrature pulse, 4-frequency multiplication
- Forward pulse/Reverse pulse (CW+CCW)

Select a pulse reference form appropriate for the host controller or other pulse generators.

Table 11–3 Pulse forms

H02.02 Direction of rotation	H05.15 Reference form	Pulse format	Signal	Forward Pulse Diagram	Reverse Pulse Diagram
0	0	Pulse+ direction Positive Logic	PULSE SIGN		
	1	Pulse+ direction Negative Logic	PULSE SIGN		
	2	Phase A + phase B quadrature pulse 4-frequency multiplication	PULSE (phase A) SIGN (phase B)	Phase A leads phase B by 90°. 	Phase B leads phase A by 90°. 
	3	CW + CCW	PULSE (CW) SIGN (CCW)		
					
1	0	Pulse+ direction Positive Logic	PULSE SIGN		
	1	Pulse+ direction Negative Logic	PULSE SIGN		
	2	Phase A + phase B quadrature pulse 4-frequency multiplication	PULSE (phase A) SIGN (phase B)	Phase B leads phase A by 90°. 	Phase A leads phase B by 90°. 
	3	CW + CCW	PULSE (CW) SIGN (CCW)		
					

The following table describes the maximum frequencies and minimum time widths of position pulse references corresponding to different input terminals.

Table 11–4 Pulse reference specifications

Input terminal		Maximum frequency	Minimum time width (unit: μs)					
			t1	t2	t3	t4	t5	t6
High-speed pulse input		4 Mpps	0.125	0.125	0.125	0.25	0.125	0.125
Low-speed pulse input terminal	Differential input	200 kpps	2.5	2.5	2.5	5	2.5	2.5
	Collector input	200 kpps	2.5	2.5	2.5	5	2.5	2.5

The rising time and falling time of position pulses must be smaller than 0.1 us.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.15	Pulse input format	0x050F	See "Values".	-	0	UInt16	At stop	Ordinary user	Effective upon next power-on
	Values:								
	0: Direction+Pulse, positive logic 1: Direction+Pulse, negative logic 2: Phase A + phase B quadrature pulse, quadrature multiplication 3: CW+CCW								
	Parameter description:								
	Defines the input pulse form when the main position reference source is pulse input.								

Pulse reference frequency

Set the maximum position pulse frequency in H0A.09. If the actual input pulse frequency is higher than H0A.09, EB01.0 (excessive pulse increment) will occur.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.09	Maximum position pulse frequency	0x0A09	100 to 4000	kHz	4,000	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	Defines the maximum frequency of input pulses when the position reference source is pulse reference (H05.00 = 0) in the position control mode. When the actual pulse frequency exceeds H0A.09, the servo drive detects fault EB01.0.								

11.2.2.1.2 Step reference as position reference source (H05.00 = 1)

The drive supports step operation, which means the drive can operate at a fixed speed until the set displacement is reached.

Caution

When the servo drive is in the running state (servo enable is set to ON) and if the step reference is invalid, the motor is locked; conversely, if the step reference is valid, the motor rotates. After the H05.05 command is executed, if the step reference is no longer triggered, the motor will also be locked.

Setting process

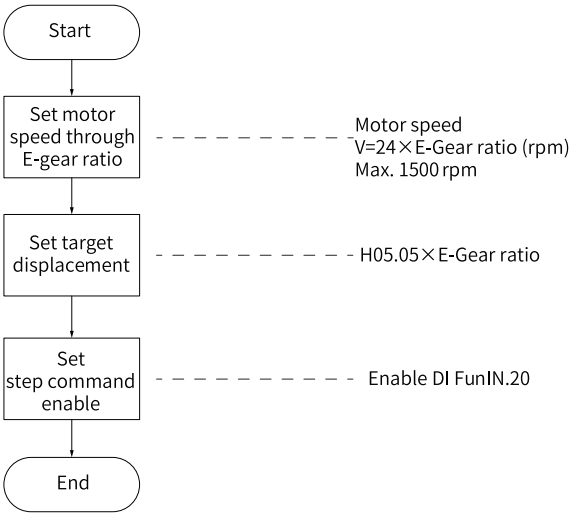


Figure 11-8 Flowchart of setting step reference as the source

Set the motor speed based on the electronic gear ratio.

Motor speed and electronic gear ratio

When the step reference is used as the position reference source, the set motor speed will be converted based on the following formula. The motor speed in this case cannot exceed 1500 rpm.

$$V_{motor}=24 \times \text{Electronic gear ratio (I}$$

Set the target displacement.

When the position reference source is step setting, the position reference sum (reference unit) is set in H05.05. Positive or negative of H05.05 value determines positive or negative of the motor speed.

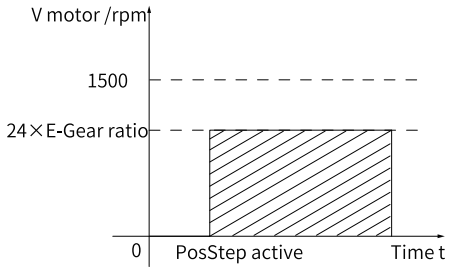


Figure 11-9 Motor operating curve (H05.00 = 1)

The hatched area in the preceding figure indicates the motor displacement: H05.05 x Electronic gear ratio (encoder unit).

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.05	Step size	0x0505	-9999~ +9999	Reference unit	50	Int16	At stop	Ordinary user	At once
	Parameter description:								
	Defines the position reference sum when the step reference acts as the main position reference source.								

Enable the step amount reference.

When using step setting as the position reference source, set a DI of the servo drive with function 20 (FunIN.20:PosStep, step reference), and set the DI terminal logic.

Relevant function No.:

Code	Name	Function Name	Function
FunIN.20	PosStep	Step reference	S-ON: Active: The position reference defined by H05.05 is input to the servo drive, driving the motor to run. Invalid: Servo motor in locked state

FunIN.20 (Step reference) is edge valid. After executing the step position reference, the servo motor enters the locked state. After FunIN.20 becomes valid again, the servo motor executes the position reference set in H05.05.

11.2.2.1.3 Multi-position reference as the position reference source (H05.00 = 2)

The servo drive supports multi-position operation. It stores 16 position references. The displacement, maximum running speed, and acceleration/deceleration time of each position can be set separately. The waiting time and switchover mode between positions can also be set according to the actual requirements.

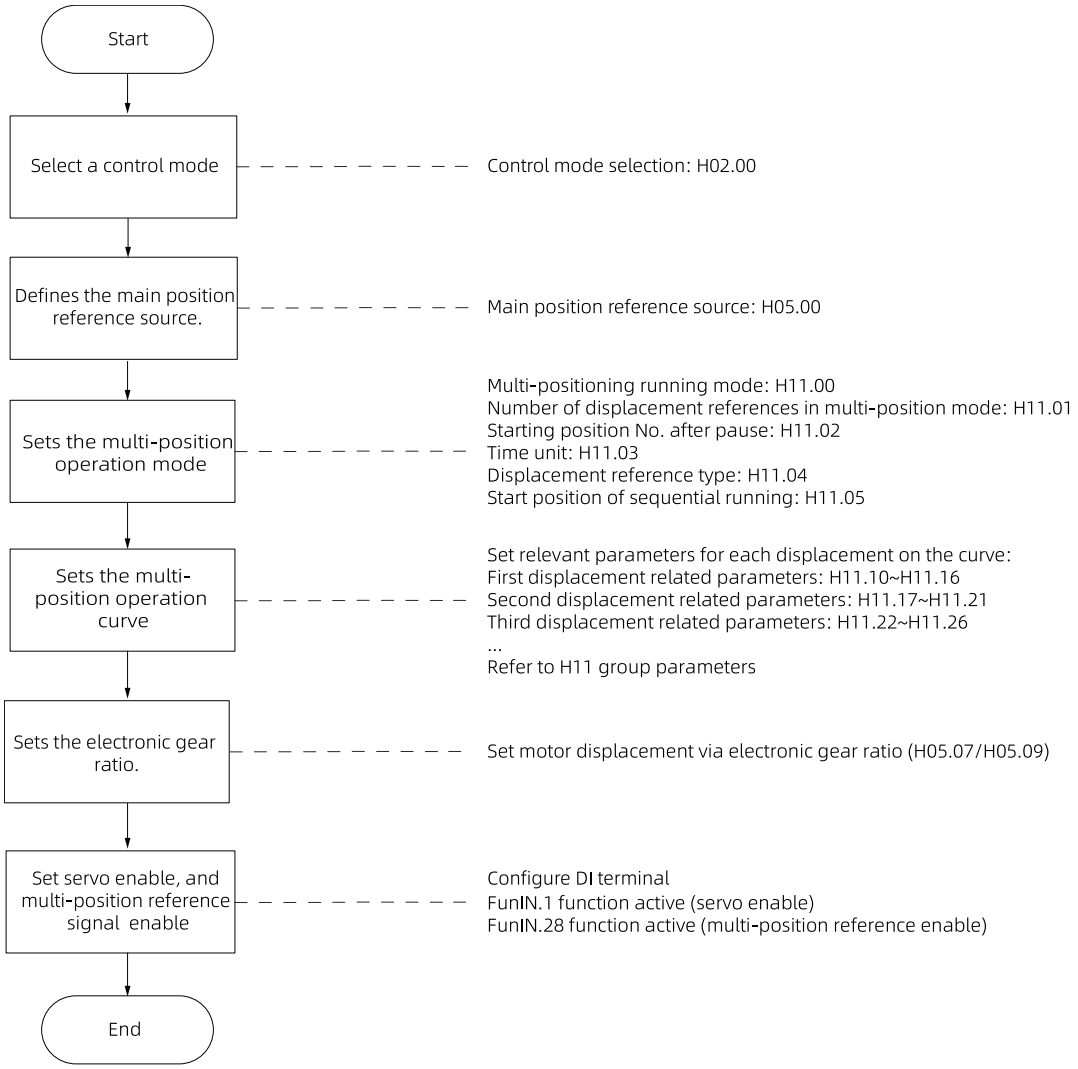
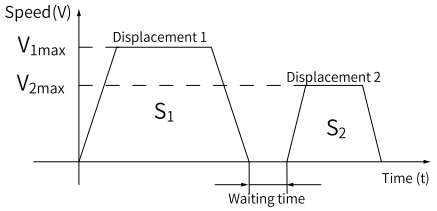


Figure 11-10 Flowchart for setting the multi-position reference as the source

Setting the multi-position operation mode

- **Individual operation (H11.00 = 0)**

Table 11–5 Description of individual operation

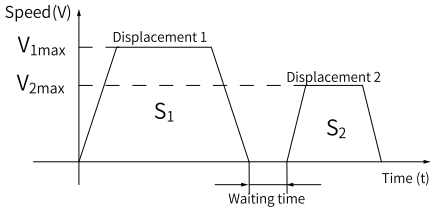
Mode description	Operation curve
• The drive stops after one cycle of operation. • The drive switches to the next displacement automatically. • The interval time between displacements can be set as needed. • The PoslnSen (multi-position reference enable) signal is level-triggered.	 V_{1max} , V_{2max} : maximum values of 1st and 2nd speeds. S_1 , S_2 : displacements of 1st and 2nd speeds. • The positioning completed signal is active after each position is reached. • If the PosInsen signal is switched off during operation, the drive abandons the unfinished displacement and stops. The COIN (positioning completed) signal is activated after the drive stops. • After the PoslnSen signal is enabled again, the drive executes the displacement defined by H11.02. • If the S-ON signal is switched off during operation, the motor stops as defined by H02.05 (Stop mode at S-ON OFF). The COIN (positioning completed) signal is deactivated after the motor stops. • When a certain displacement is in progress, the logic change of the DI assigned with FunIN.27 (PosDirSel) does not affect the operating direction in this displacement.

★Terms:

A complete operation cycle covers all the position references defined by H11.01.

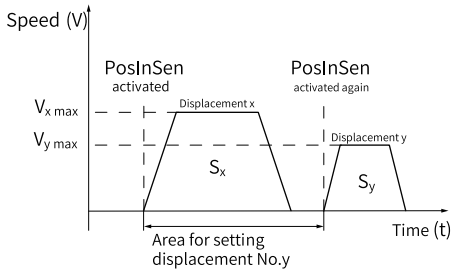
- **Cyclic operation (H11.00 = 1)**

Table 11–6 Descriptions of cyclic operation

Mode description	Operation curve
• The drive starts from displacement 1 again after each cycle of operation. • The drive switches to the next displacement automatically. • The interval time between displacements can be set as needed. • The cyclic operation mode is kept when the FunIN.28 (Multi-position reference enable) is active. • The PoslnSen (multi-position reference enable) signal is level-triggered.	 V_{1max} , V_{2max} : maximum values of 1st and 2nd speeds. S_1 , S_2 : displacements of 1st and 2nd speeds. • The positioning completed signal is active after each position is reached. • If the PosInsen signal is switched off during operation, the drive abandons the unfinished displacement and stops. The COIN (positioning completed) signal is activated after the drive stops. • After the PoslnSen signal is enabled again, the drive executes the displacement defined by H11.02. • If the S-ON signal is switched off during operation, the motor stops as defined by H02.05 (Stop mode at S-ON OFF). The COIN (positioning completed) signal is deactivated after the motor stops. • When a certain displacement is in progress, the logic change of the DI assigned with FunIN.27 (PosDirSel) does not affect the operating direction in this displacement.

- **DI-based operation (H11.00 = 2)**

Table 11–7 Descriptions of DI-based operation

Mode description	Operation curve
• When the servo drive runs the current position, you can set the next position No. After the position reference of the current number is completed, the servo motor stops. After the PoslnSen (position reference enable) signal is enabled again, the present displacement will be executed. • The speed No. is determined by the DI logic. • The interval time between displacements is determined by the command delay of the host controller. • The PoslnSen (multi-position reference enable) signal is edge-triggered.	 V_{xmax} , V_{ymax} : maximum values of xth and yth speeds. S_x , S_y : displacements of xth and yth speeds. • The positioning completed signal is active after each position is reached. • If the PosInsen (multi-position reference enable) signal is switched off during operation, the drive continues to execute the unfinished displacement and outputs the COIN (positioning completed) signal. • The displacements must be switched in the following sequence: 1. The displacement No. cannot be switched over before the xth displacement is completed. 2. When the xth displacement is in progress or completed, switch off the PoslnSen (multi-position reference enable) signal first, and then change the displacement No. from x to y (if x = y, the drive executes displacement x again). 3. After the xth displacement is completed, the servo drive executes the yth displacement if you set the multi-position reference enable signal to active. • If the S-ON signal is switched off during operation, the motor stops as defined by H02.05 (Stop mode at S-ON OFF). The COIN (positioning completed) signal is deactivated after the motor stops. • When a certain displacement is in progress, the logic change of the DI assigned with FunIN.27 (PosDirSel) does not affect the operating direction in this displacement.

In multi-position operation mode, assign four DIs with FunIN.6 to FunIN.9 respectively, and set the active logic of these DIs.

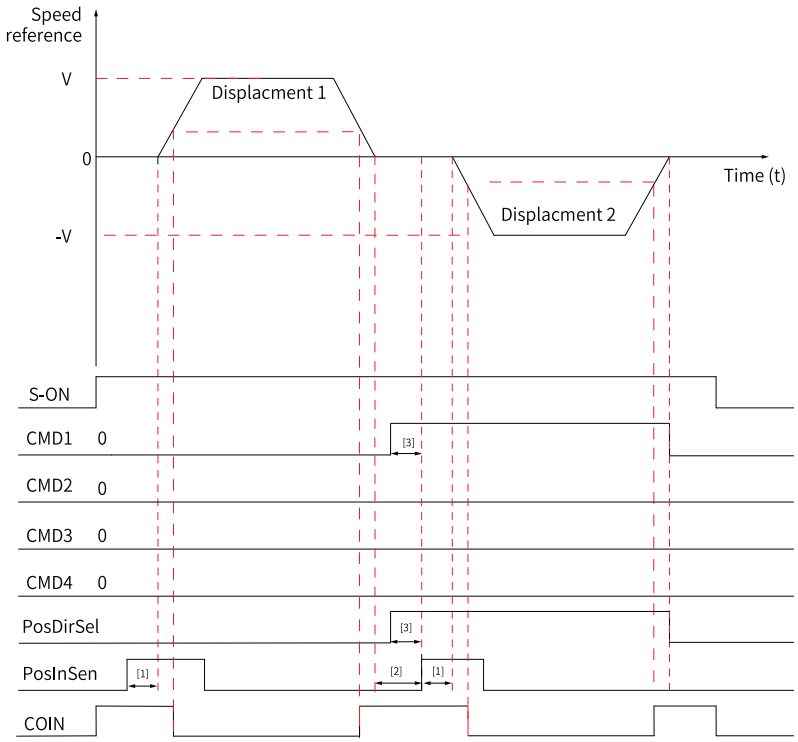


Figure 11-11 Multi-position sequence diagram

Note

- [1] The PosInSen signal is edge-triggered. The minimum signal widths required by the normal DI and high-speed DI are 3 ms and 0.25 ms respectively.
- [2] Area for switching the displacement No.: Refers to the interval that start from the moment the last position reference is done transmitting to the moment the next PosInSen (multi-position reference enable) signal is activated again.
- [3] When a normal DI is used, an effective signal width of 0.125 ms must be kept.

Relevant function No.:

Code	Name	Function Name	Function
FunIN.6	CMD1	Multi-reference switchover 1	The position No. is a 4-bit binary value, and the relationship between CMD1 to CMD4 and the position No. is listed in *"Table 11-8" on page 285*. The DI logic is level-triggered. The CMD value is 1 upon active level input or 0 upon inactive level input.
FunIN.7	CMD2	Multi-position reference switchover 2	
FunIN.8	CMD3	Multi-position reference switchover 3	
FunIN.9	CMD4	Multi-reference switchover 4	

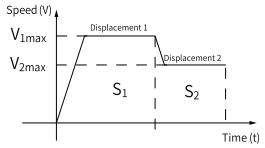
Table 11–8 Relationship between the displacement No. and CMD1 to CMD4

CMD4	CMD3	CMD2	CMD1	Speed No.
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	5
0	1	0	1	6

CMD4	CMD3	CMD2	CMD1	Speed No.
…				
1	1	1	1	16

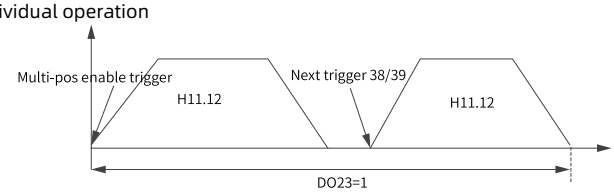
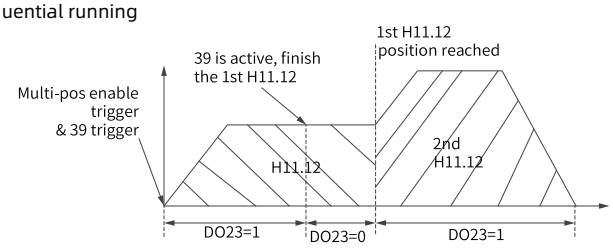
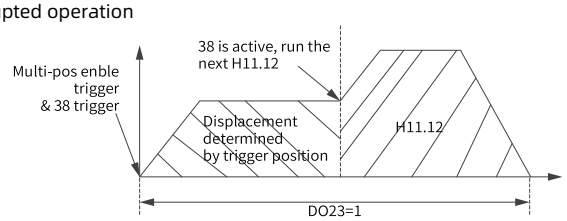
- **Sequential operation (H11.00 = 3)**

Table 11–9 Descriptions of sequential operation

Mode description	Operation curve
• The drive stops after one cycle of operation. • (H11.05 = 0 or H11.05 > H11.01). • The starting displacement after the first cycle of operation is defined by H11.05. • The drive switches to the next displacement automatically. • There is no interval time between displacements. • The PoslnSen (multi-position reference enable) signal is level-triggered.	 V_{1max} , V_{2max} : maximum values of 1st and 2nd speeds. S_1 , S_2 : displacements of 1st and 2nd speeds. • The positioning completed signal is active after each position is reached. • If the PosInsen signal is switched off during operation, the drive abandons the unfinished displacement and stops. The COIN (positioning completed) signal is activated after the drive stops. • After the PoslnSen signal is enabled again, the drive executes the displacement defined by H11.02. • If the S-ON signal is switched off during operation, the motor stops as defined by H02.05 (Stop mode at S-ON OFF). The COIN (positioning completed) signal is deactivated after the motor stops. • When a certain displacement is in progress, the logic change of the DI assigned with FunIN.27 (PosDirSel) does not affect the operating direction in this displacement.

- **Axis-controlled continuous operation (H11.00 = 5)**

Table 11–10 Description of axis-controlled continuous operation

Mode description	Operation curve
• The drives executes one displacement only. • The individual operation mode, sequential operation mode, and interrupted operation mode are included. • The PoslnSen (multi-position reference enable) signal is level-triggered.	• Individual operation  • The PoslnSen (multi-position reference enable) signal is triggered only once (FunIN.38/39 triggered later). The servo drive stops after executing the distance defined by H11.12 (Displacement 1). • Sequential running  • The PoslnSen (multi-position reference enable) signal is triggered only once. Write H11.12 again and activate FunIN.39 when the distance defined by the first H11.12 is still in progress.• After receiving the new distance (or speed), which is the second H11.12, the servo drive continues executing the first H11.12 until the distance defined by the first H11.12 is reached. Then it starts to execute the second H11.12 directly. The travel distance therefore is the sum of the first H11.12 and the second H11.12. • Interrupted operation  • The PoslnSen (Multi-position reference enable) signal is triggered only once. Write H11.12 (such as 1000000) again and activate FunIN.38 when the first H11.12 (such as 9000000) is still in progress. After receiving the new distance (or speed), which is the second H11.12, the servo drive stops executing the first H11.12 and turns to executing the second H11.12.

Relevant function No.:

Code	Name	Function Name	Function
FunIN.38	MultiBlockTrig	Write interrupt trigger signal	Active: Newly written command activated immediately Inactive: Newly written command not activated
FunIN.39	MultiBlockWr	Write non-interrupt trigger signal	Active: Newly written command activated after the current displacement is completed Inactive: Newly written command not activated
FunOUT.23	WrNextBlockEn	Next command input enable	Active: Next command input allowed Inactive: Next command input inhibited

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.00	Multi-position running mode	0x1100	See "Values".	-	1	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Individual operation (number of positions defined by H11.01) 1: Cyclic operation (number of positions defined by H11.01) 2: DI-based operation (selected through DI) 3: Sequential operation 5: Axis-controlled continuous operation								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.01	End position No. in displacement reference	0x1101	1 to 16	-	1	UInt16	At stop	Ordinary user	At once
	Values:								
	It sets the total number of positions. You can set different displacements, running speed, and acceleration/deceleration time for each position.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.02	Starting position No. after pause	0x1102	See "Parameter Description"	-	0	UInt16	At stop	Ordinary user	At once
	Parameter description:								

It sets the starting position No. when the multi-function running recovers after a pause. The function defined by H11.02 is valid only when H11.00 (Multi-position mode) is set to 0, 1, or 3.

Set value	Starting position No. after pause	Remarks
0	Complete the remaining distance	For example, if H11.01 = 16 and the servo drive pauses when running to the 2nd position, it starts running from the 3rd position after restoring the multi-position running.
1	Start running again from 1st position	For example, if H11.01 = 16 and the servo drive pauses when running to the 2nd position, it starts running from the 1st position after restoring the multi-position running.

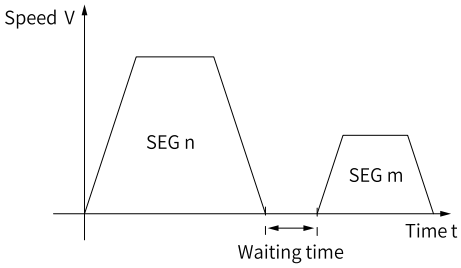
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.03	Waiting time unit	0x1103	See "Values".	-	0	UInt16	At stop	Ordinary user	At once

Values:

0: ms
1: s

Parameter description:

Sets the unit of the acceleration/deceleration time and waiting time during the multi-position running.

Set value	Waiting time unit	Remarks
0	ms	
1	s	

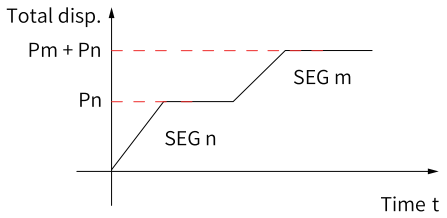
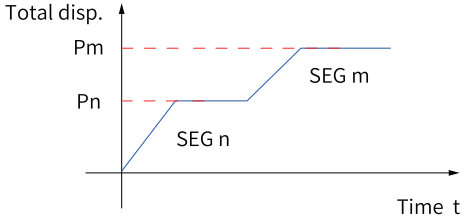
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.04	Displacement reference type	0x1104	See "Values".	-	0	UInt16	At once	Ordinary user	During shutdown

Values:

0: Relative displacement reference
1: Absolute displacement reference

Parameter description:

It sets the displacement reference type when the multi-position function is used.

Set value	Displacement Reference Type	Remarks
0	Relative displacement reference	 mth actual displacement: Pm
1	Absolute displacement reference	 mth actual displacement: Pm

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.05	Start position of sequential running	0x1105	0 to 16	-	0	UInt16	At stop	Ordinary user	At once

Parameter description:

Defines whether to perform cyclic operation and the starting displacement No. after the first cycle of operation in the sequential operation mode (H11.00 = 3).

Set value	Start position of sequential running	Remarks
0	Not cyclic	The servo drive runs positions set in H11.01 only once, and stops after the running is completed. Then, the motor becomes in locked state.
1 to 16	1 to 16	The drive operates cyclically, with the starting displacement No. defined by H11.05 after the first cycle of operation. The value of H11.05 should be lower than or equal to H11.01.

Setting the multi-position operating curve

The servo drive provides 16 position references, and the displacement, maximum running speed, and acceleration/deceleration time of each can be set. The following descriptions take the 1st position as an example.

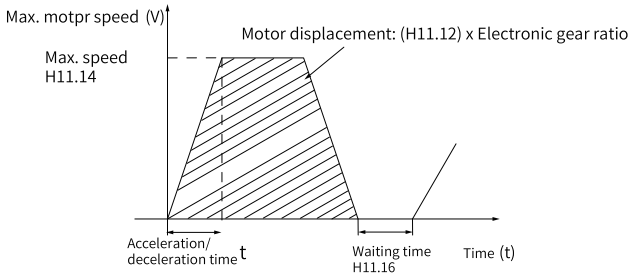


Figure 11-12 Motor operating curve in displacement 1

Actual time (t) taken to accelerate to H11.14:

$$t = \frac{(H11.14)}{1000} \times (H11.15)$$

For parameter settings of other 15 displacements, see Chapter "Parameter List".

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.12	1st displacement	0x110C	-1073741824 to +1073741824	Reference unit	10,000	Int32	At once	Ordinary user	At once
	Parameter description:								
	Defines displacement 1 (in reference unit) in multi-position operation.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.14	Maximum running speed of first displacement	0x110E	1 to 7000	rpm	200	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the maximum running speed of the 1st position in multi-position. The maximum running speed is the average running speed when the motor is not in acceleration/deceleration. If H11.12 is too small, the actual motor speed will be smaller than H11.14.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.15	Acceleration/ Deceleration time of 1st displacement	0x110F	0–65535	ms	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the time for the motor to change from 0 rpm 1000 rpm at a constant speed during displacement 1. Actual time needed for accelerating to H11.14 (Max. speed of displacement 1): t = (H11.14 x H11.15)/1000								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.16	Waiting time after 1st displacement	0x1110	0 to 10000	ms(s)	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the waiting time from completion of the 1st displacement to starting of the next displacement.								

Setting multi-position reference enable mode

When using multi-position reference as the position reference source, set a DI of the servo drive with function 28 (FunIN.28:PosInSen, multi-position reference enable), and set the DI terminal logic.

Relevant function No.:

Code	Name	Function Name	Function
FunIN.28	PosInSen	Multi-position reference signal enable	Active: The motor executes the multi-position reference. Invalid: Servo motor in locked state **Note:** • When H11.00 is set to 0, 1, or 3, the logic of the DI assigned with the PosInSen signal is level-triggered. • When H11.00 is set to 2, the logic of the DI assigned with the PosInSen signal is edge-triggered.

11.2.2.2 Position reference direction

A DI terminal is used to change the position reference direction and further the motor direction. Assign FunIN.27 (PosDirSel, position reference direction) to a DI of the drive, and set the active logic of this DI.

Relevant function No.:

Code	Name	Function Name	Function
FunIN.27	PosDirSel	Position reference direction	Inactive: Actual position reference direction same as the set direction Active: Actual position reference direction opposite to the set direction

The actual motor direction is related to the rotating direction in H02.02, positive/negative of the position reference, and position reference direction (FunIN.27).

Table 11–11 Motor direction of rotation

H02.02 setpoint	Sign of position reference	FunIN.27	Actual Motor Rotating Direction
0	+	OFF	CCW
0	+	ON	Clockwise
0	-	OFF	Clockwise

H02.02 setpoint	Sign of position reference	FunIN.27	Actual Motor Rotating Direction
0	-	ON	CCW
1	+	OFF	Clockwise
1	+	ON	CCW
1	-	OFF	CCW
1	-	ON	Clockwise

11.2.2.3 Position reference inhibited

The servo drive provides the position reference inhibited function (FunIN.13: Inhibit) and pulse input inhibited function (FunIN.37:PulseInhibit).

Position reference inhibited

When this function is enabled, the servo drive forces all position references to zero and does not respond to any internal or external position reference, and makes the motor enter the position lock state in position control mode. In this case, the drive can switch to other control modes to continue operating.

When position reference inhibition is activated, the input position reference counter (H0b.13) continues counting the position references in the position control mode, but the references counted in this case are not responded to by the servo drive after position reference inhibition is deactivated.

To use FunIN.13(Inhibit, position reference), assign FunIN.13 to a certain DI and set the active logic of this DI. It is recommended to use the high-speed DI (DI8 or DI9) terminal.

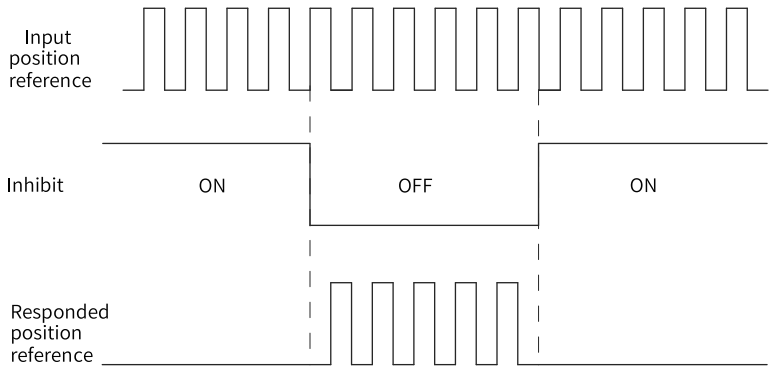


Figure 11-13 Waveform example for position reference inhibited

Relevant function No.:

Code	Name	Function Name	Function
FunIN.13	Inhibit	Position reference inhibited	Inactive: The drive responds to position references in position control mode. Active: The drive does not respond to any internal or external position references in position control mode.

Pulse reference inhibited

The servo drive sets all the pulse references to 0, which means it does not respond to any pulse references inputted from the pulse input terminal but it can respond to position references in other

forms in the position control mode. In this case, the drive can be switched to other control modes to continue operating.

When the pulse reference is inhibited in the position control mode and no other forms of position references are used, the input position reference counter (H0b.13) continues counting the pulse references inputted from the pulse input terminal, but the pulse references counted in this case are not responded to by the drive after the pulse reference is no longer inhibited.

If position references in other forms are used in the position control mode, the input position reference counter (H0b.13) continues counting the these position references, and these references will be executed.

To use this function, configure a DI terminal of the servo drive with function 37 (FunIN.37: PulseInhibit, pulse input inhibited), and set the terminal logic. It is recommended to use the high-speed DI (DI8 or DI9) terminal.

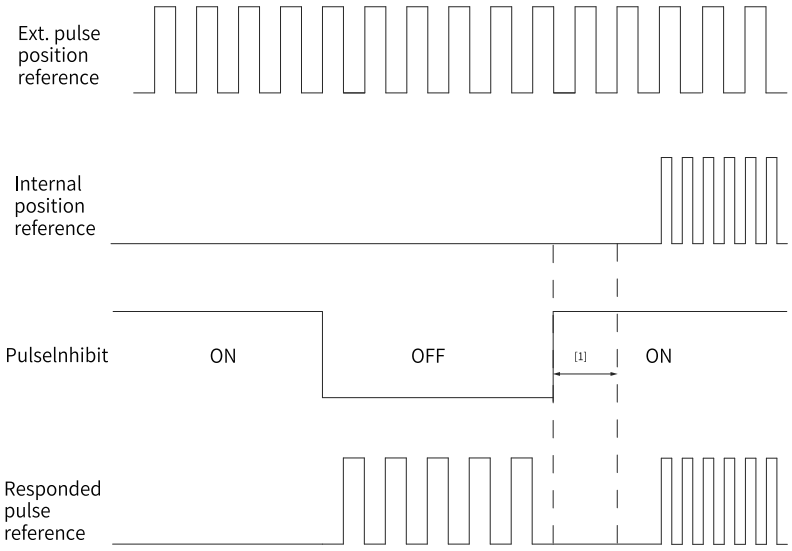


Figure 11-14 Waveform example for pulse reference inhibited

Note

[1] When DI is used, keep an interval of at least 0.5 ms from the moment the DI logic is deactivated to the moment the internal position reference is inputted.

Relevant function No.:

Code	Name	Function Name	Function
FunIN.37	PulseInhibit	Pulse reference inhibited	The position reference source is pulse reference (H05.00 = 0) in the position control mode: Inactive: The drive responds to pulse references. Active: The drive does not respond to pulse references.

11.2.3 Reference Frequency Division/Multiplication (Electronic Gear Ratio)

11.2.3.1 Function Description

In position control mode, the input position reference (reference unit) defines the load displacement, and the motor position reference (encoder unit) defines the motor displacement. The electronic gear ratio is used to establish a proportional relationship between the input position reference and motor position reference.

The electronic gear ratio, which allows frequency division (electronic gear ratio < 1) or frequency multiplication (electronic gear ratio > 1), can be used to set the actual displacement corresponding to the input position reference per reference unit, or used to increase the position reference frequency when the motor speed needed cannot be fulfilled due to limited pulse output frequency of the host controller or limited parameter value range.

★Terms:

- Reference unit: Refers to the minimum identifiable value input from the host controller to the servo drive.
- Encoder unit: the value of the input reference multiplied/divided by the electronic gear ratio.

11.2.3.2 Electronic Gear Ratio Setting

11.2.3.2.1 Procedure for setting the electronic gear ratio

The electronic gear ratio varies with the different mechanical structure. Set the electronic gear ratio according to the following flowchart.

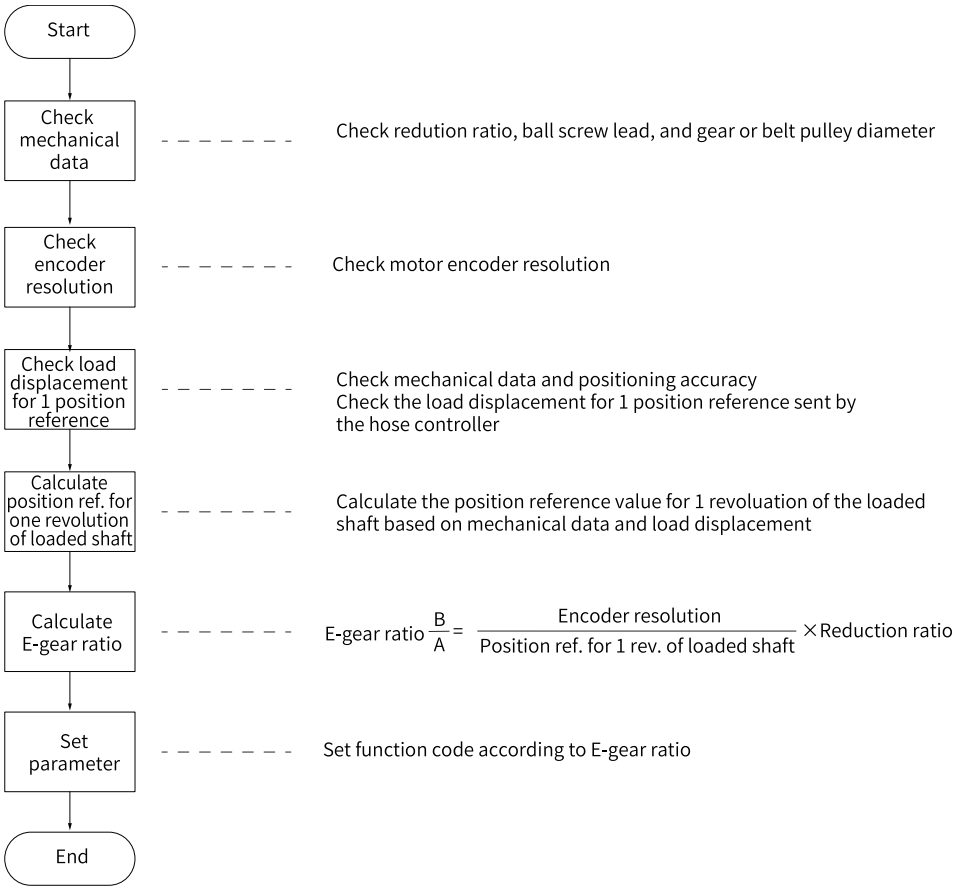


Figure 11-15 Procedure for setting the electronic gear ratio

See the following figure for how to set parameters.

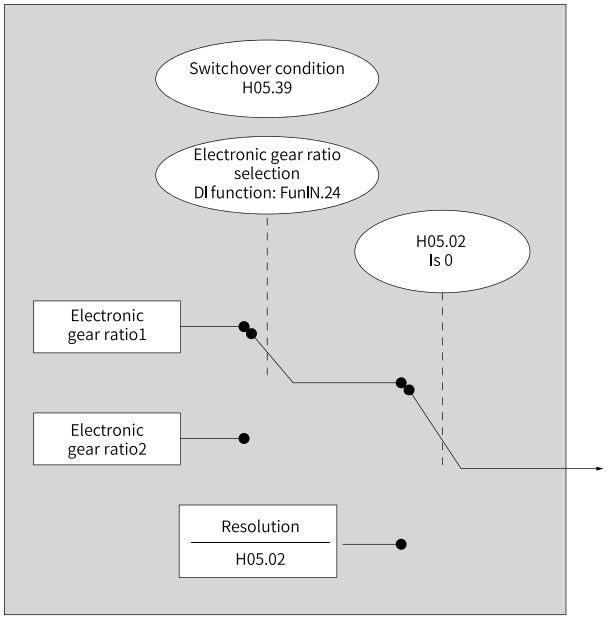


Figure 11-16 Procedure for setting the electronic gear ratio

Note

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{\text{Resolution}}{\text{H05.02}}$$

When H05.02 is not 0, electronic gear ratio 1 and electronic gear ratio 2 are invalid.

11.2.3.2.2 Setting the electronic gear ratio

The electronic gear ratio must be within the following range:

$$\frac{0.001 \times \text{Encoder resolution}}{10000} \leqslant \frac{B}{A} \leqslant \frac{4000 \times \text{Encoder resolution}}{10000}$$

Otherwise, EB03.0 (electronic gear ratio beyond the limit) will occur.

In cases where an operation error occurs due to an improper electronic gear ratio, it is recommended to reset the electronic gear ratio after the servo drive stops.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.02	Pulses per revolution	0x0502	0 to 1048576	P/Rev	0	UInt32	At stop	Ordinary user	At once
	Parameter description:								
	Sets the number of position references when the motor rotates one revolution.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.07	Electronic gear ratio 1 (numerator)	0x0507	1 to 1073741824	-	8388608	UInt32	At once	Ordinary user	At once
	Parameter description:								
	Defines the numerator of electronic gear ratio 1 for encoder unit conversion to user unit.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.09	Electronic gear ratio 1 (denominator)	0x0509	1 to 1073741824	-	10,000	UInt32	At once	Ordinary user	At once
	Parameter description:								
	Defines the denominator of electronic gear ratio 1 for encoder unit conversion to user unit.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.11	Electronic gear ratio 2 (numerator)	0x050B	1 to 1073741824	-	8388608	UInt32	At once	Ordinary user	At once
	Parameter description:								
	Defines the numerator of electronic gear ratio 2 for encoder unit conversion to user unit.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.13	Electronic gear ratio 2 (denominator)	0x050D	1 to 1073741824	-	10,000	UInt32	At once	Ordinary user	At once
	Parameter description:								
	Defines the denominator of electronic gear ratio 2 for encoder unit conversion to user unit.								

11.2.3.2.3 Calculating formula of the electronic gear ratio

The following figure shows the relationship between the position reference (reference unit), load displacement, and electronic gear ratio.

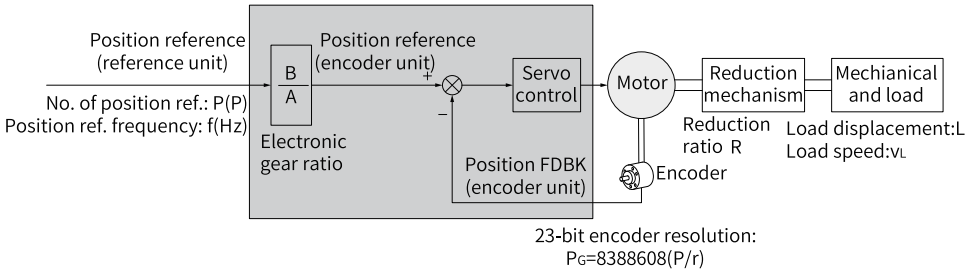


Figure 11-17 Relationship among the position reference (reference unit), load displacement, and electronic gear ratio

Take the load ball screw in linear movement as an example. P_B (mm) is the screw lead, P_G is the encoder resolution, and R is the reduction ratio of the reducer.

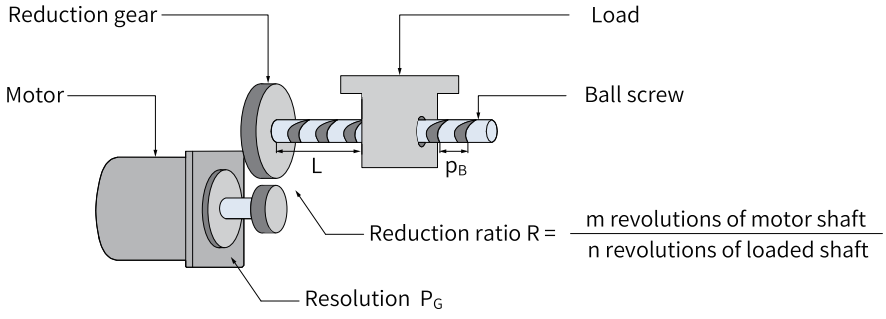


Figure 11-18 Ball screw

When the load displacement per pulse ΔL (mm) is known:

The load shaft rotates $\frac{\Delta L}{P_B}$ revolutions and the motor shaft rotates $\frac{\Delta L}{P_B} \times R$ revolutions when the mechanical displacement is ΔL. Then the following formula applies:

$$1 \times \frac{B}{A} = \frac{\Delta L}{P_B} \times R \times P_G$$

Therefore, the electronic gear ratio is:

$$\frac{B}{A} = \frac{\Delta L}{P_B} \times R \times P_G$$

The load displacement L(mm) and position reference sum P(P) are known.

The load shaft rotates $\frac{L}{P_B}$ revolutions and the motor shaft rotates $\frac{L}{P_B} \times R$ revolutions when the mechanical displacement is ΔL. Then the following formula applies:

$$P \times \frac{B}{A} = \frac{L}{P_B} \times R \times P_G$$

Therefore, the electronic gear ratio is:

$$\frac{B}{A} = \frac{L}{P_B} \times R \times P_G \times \frac{1}{P}$$

vL (mm/s) as load speed and f (Hz) as position reference frequency:

Load shaft rotating speed: $\frac{v_L}{P_B}$ (r/s)

Motor speed: $v_M = \frac{v_L}{P_B} \times R$ (r/s)

Relationship between position reference frequency, electronic gear ratio and motor speed:

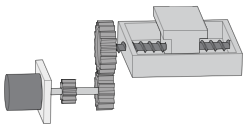
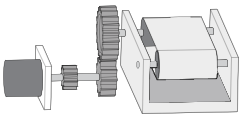
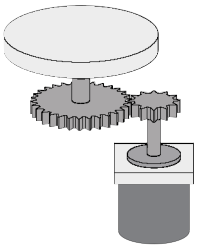
$$f \times \frac{B}{A} = v_M \times P_G$$

Therefore, the electronic gear ratio is:

$$\frac{B}{A} = \frac{v_M \times P_G}{f}$$

11.2.3.2.4 Electronic gear ratio setting example

Table 11–12 Electronic gear ratio setting example

Step	Name	Mechanical Structure		
		Ball Screw Transmission	Belt Pulley Transmission	Rotating Load
	-			
1	Mechanical parameters	Reduction ratio R: 1:1 Screw pitch: 0.01 m	Reduction ratio R: 5:1 Belt pulley diameter: 0.2 m (Belt pulley circumstance: 0.628 m)	Reduction ratio (R): 10/1 Load rotation angle when the load axis rotates one revolution: 360°
2	Encoder resolution	23 bit = 8388608 P/r	23 bit = 8388608 P/r	23 bit = 8388608 P/r
3	Load displacement corresponding to one position reference (reference unit)	0.0001 m	0.000005 m	0.01 degree
4	Position reference (reference unit) value required for the load axis to rotate one revolution	$\frac{0.01}{0.0001} = 100$	$\frac{0.628}{0.000005} = 125600$	$\frac{360}{0.01} = 36000$
5	Calculating	$\frac{B}{A} = \frac{8388608}{100} \times \frac{1}{1}$	$\frac{B}{A} = \frac{8388608}{125600} \times \frac{5}{1}$	$\frac{B}{A} = \frac{8388608}{36000} \times \frac{10}{1}$
6	Setting	H05.07 = 8388608 H05.09=100	H05.07=41943040 H05.09=125600	H05.07=83886080 H05.09=36000

11.2.3.3 Switching the electronic gear ratio

Caution

The motor speed may fluctuate significantly if the electronic gear ratio changes sharply in real time or electronic gear ratio 1 differs greatly from electronic gear ratio 2. In this case, set H05.04 (First-order low-pass filter time constant) properly to allow smooth switchover of the position reference.

- When H05.02 = 0, electronic gear ratio switchover is supported. Determine whether switchover is necessary based on the mechanical running conditions and set the switchover conditions.
- Only one electronic gear ratio is effective at any moment.
- The effective time of real-time change to the electronic gear ratio is also subject to the switchover condition (H05.39).

Assign FunIN.24 (GEAR_SEL, electronic gear ratio selection) to a certain DI and set the active logic of this DI.

Relevant function No.:

Code	Name	Function Name	Function
FunIN.24	GEAR_SEL	Electronic gear ratio selection	Inactive: Electronic gear ratio 1 used in position control mode Active: Electronic gear ratio 2 used in position control mode

See the following table for the electronic gear ratio used by the servo drive.

H05.02	H05.39	Level of the DI Assigned with FunIN.24	Electronic gear ratio
0	0	OFF	$\frac{H05.07}{H05.09}$
		ON	$\frac{H05.11}{H05.13}$
	1	OFF	$\frac{H05.07}{H05.09}$
		ON	$\frac{H05.11}{H05.13}$
1 to 1048576	-		-

The resolution of the serial encoder is 2^n(P/r), where "n" is the number of bits of the serial encoder.

For example, the resolution of a 23-bit serial encoder is 2^{23}PPR, which is 8388608 PPR.

11.2.4 Position reference filter

Function Description

Position reference filter serves to filter the position references (in encoder unit) multiplied or divided by the electronic gear ratio, which includes first-order low-pass filtering and moving average filtering. It involves the first-order filter and moving average filter.

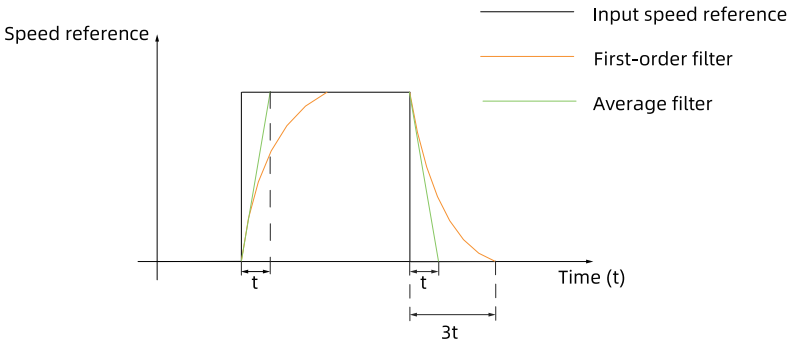


Figure 11-19 First-order filter and moving average filter for rectangular position references

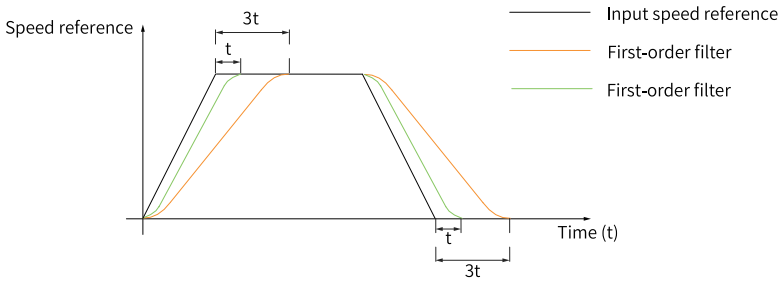


Figure 11-20 First-order filter and moving average filter for trapezoid position references

Application scenarios

It is applicable to the following scenarios:

- The acceleration/ deceleration process is not performed on the position references sent from the host controller.
- The pulse reference frequency is low.
- The electronic gear ratio is larger than 10.

Note:

An excessively high setpoint delays the response. Set a proper filter time constant based on actual conditions.

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.04	Time constant of first-order low-pass filter	0x0504	0.0 to 6553.5	ms	0.0	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	Defines the first-order low pass filter time constant of position references.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.06	Time constant of moving average filter	0x0506	0.0–28.0	ms	0.0	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	Defines the moving average filter time constant of position references.								

11.2.5 Position Deviation Clear

Function Description

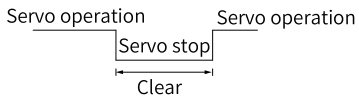
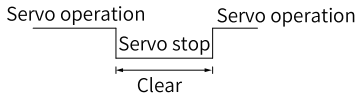
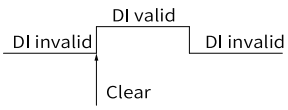
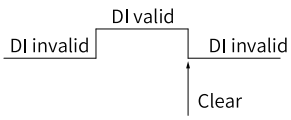
This function serves to clear the position deviation when the condition defined by H05.16 (Clear action selection) is met.

Note

Position deviation = Position reference sum – Position feedback sum

Setting value

Table 11–13 Position deviation clear

Set value	Clear Condition	Clear Time
H05.16=0	Clear the position deviation when the S-ON signal is switched off or when a fault occurs.	
H05.16=1	Clear the position deviation when the S-ON signal is switched off or when the servo drive stops upon a fault event.	
H05.16=2	Clear the position deviation cleared when the S-ON signal is switched off or when a fault occurs. Clear the position deviation when ClrPosErr signal is inputted through a DI when the servo drive is in the RUN state.	 (Rising edge-triggered)  (Falling edge-triggered)

When H05.16 = 2, set a DI terminal of the servo drive with function 35 (FunIN.35:ClrPosErr, position deviation cleared), and set the terminal logic.

Relevant function No.:

Code	Name	Function Name	Function
FunIN.35	ClrPosErr	Position deviation cleared	Active: Position deviation cleared Inactive: Position deviation not cleared

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.16	Clear action	0x0510	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Clear position deviation upon S-OFF or fault 1: Clear position deviation upon S-OFF or fault 2: Clear the position deviation when ClrPosErr signal is inputted through a DI when the servo drive is in the RUN state.								
	Parameter description:								
	Defines the condition for clearing the position deviation.								

11.2.6 Frequency-Division Output

Function Description

The frequency-division output function outputs the position reference pulses or encoder feedback position references as A/B phase quadrature pulses.

Working Principle

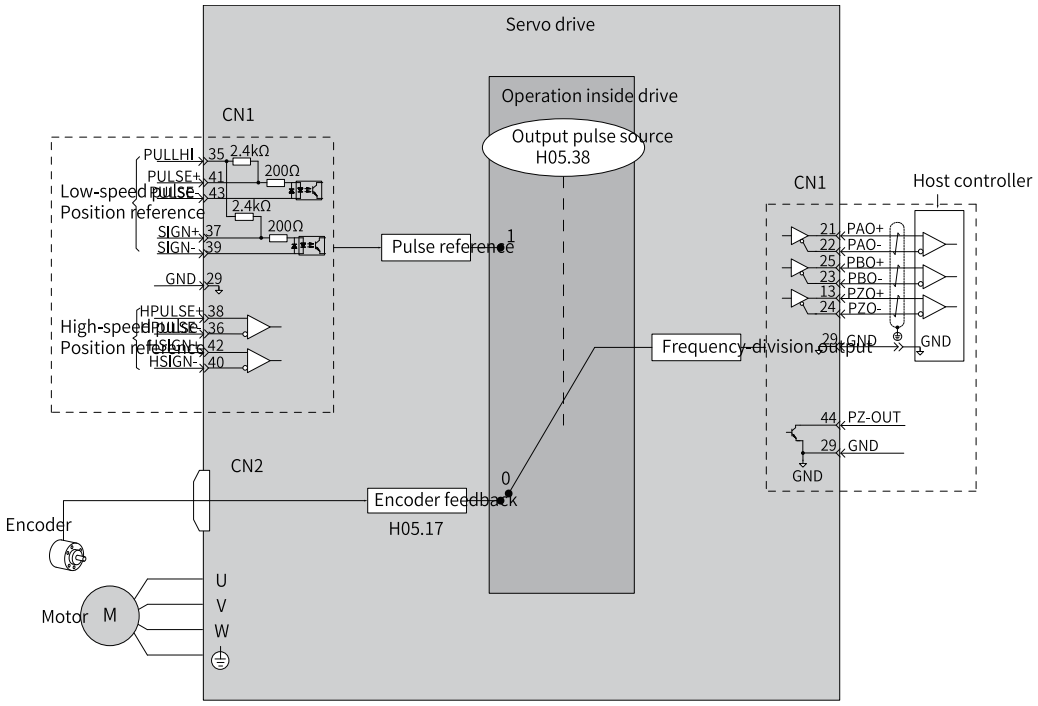


Figure 11-21 Schematic diagram of frequency-division output

It is recommended to use synchronous output (H05.38 = 1) of pulse references in case of synchronous tracing of multi-axis servo pulses. When the host controller is used for closed-loop feedback, it is recommended to use encoder frequency-division output (H05.38 = 0).

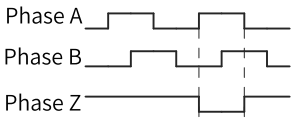
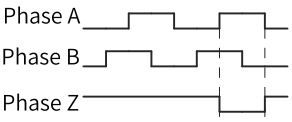
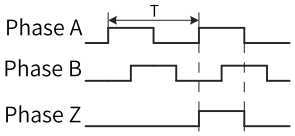
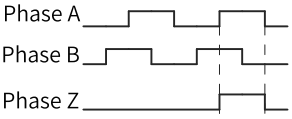
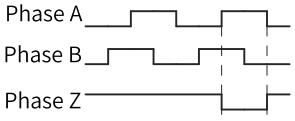
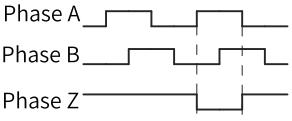
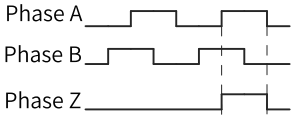
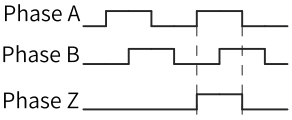
The servo drive provides one frequency-division terminal:

- Phase A pulses: PAO+ and PAO-, differential output, maximum output pulse frequency: 2 Mpps
- Phase B pulses: PBO+ and PBO-, differential output, maximum output pulse frequency: 2 Mpps
- Phase Z pulse: PZO+, PZO-, differential output, maximum output pulse frequency 2 Mpps
- PZ-OUT, GND, open-collector output, maximum output pulse frequency 100 kpps

When using the frequency-division output function, set the output pulse source (H05.38), phase (H02.03), resolution (H05.17), and phase Z pulse polarity (H05.41) according to requirements.

When the output source is encoder frequency-division pulse (H05.38 = 0), the phase A/B output pulses per motor revolution are determined by H05.17 (Encoder frequency-division pulses) and H05.61 (Encoder frequency-division pulses). The pulse width (T) of phase A/B is determined by the motor speed. The phase Z, whose width is also T, is synchronized with phase A. Z signal is output once per motor revolution.

Table 11–14 Pulse diagrams of encoder frequency-division (H05.38 = 0)

H02.03 (Output pulse phase)	H05.41 (Z pulse output polarity)	Pulse Output Diagram of Forward RUN	Pulse Output Diagram of Reverse RUN
0	0	 Phase A leads phase B by 90°.	 Phase B leads phase A by 90°.
	1	 Phase A leads phase B by 90°.	 Phase B leads phase A by 90°.
1	0	 Phase B leads phase A by 90°.	 Phase A leads phase B by 90°.
	1	 Phase B leads phase A by 90°.	 Phase A leads phase B by 90°.

Note:

In applications requiring high precision of Z signal frequency-division output, the effective change edge of Z signal is recommended.

H05.41 setpoint	Output polarity of Z pulse
0	Negative (low level upon active Z pulse)
1	Positive (high level upon active Z pulse)

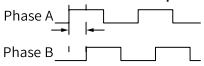
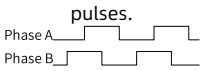
H05.41 is 0: Falling-edge triggered; H05.41 is 1: Rising-edge triggered

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.03	Output pulse phase	0x0203	See "Set value"	-	0	UInt16	At stop	Ordinary user	Effective upon next power-on

Parameter description:

Defines the relationship between phase A and phase B on the condition that the motor direction of rotation remains unchanged when pulse output is enabled.

Set value	Output pulse phase	Remarks
0	Phase A advancing phase B	Phase A leads phase B by 90° in encoder frequency-division output pulses. 
1	Phase A lagging phase B	Phase A lags behind phase B by 90° in encoder frequency-division output pulses. 

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.17	Encoder frequency-division pulses	0x0511	35 to 32767	P/Rev	2500	UInt16	At stop	Ordinary user	Effective upon next power-on

Parameter description:

It sets the number of pulses output by PAO or PBO per motor revolution.

Pulse output resolution = H05.17 x 4

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.38	Servo pulse output source	0x0526	0 to 2	-	0	UInt16	At stop	Ordinary user	Effective upon next power-on

Parameter description:

It sets the output source of the pulse output terminal.

Set value	Output source	Remarks
0	Encoder frequency-division output	The encoder feedback signal is outputted only after being divided by the value of H05.17 during rotation of the motor. Encoder frequency-division output mode is recommended when the host controller is used for closed-loop feedback.
1	Pulse reference synchronous output	The input pulse references are outputted synchronously only when H05.00 is set to 0. When pulses of the multi-axis servo is synchronously tracked, pulse synchronous output is suggested.
2	Frequency-division or synchronous output forbidden	The pulse output terminal has no output.

The pulse output terminals are as follows:

Signal	Output mode	Output port	Max. Pulse Frequency
A-phase signal	Differential output	PAO+, PAO-	2Mpps
B-phase signal	Differential output	PBO+, PBO-	2Mpps
Phase Z signal	Differential output	PZO+, PZO-	2Mpps
	Open collector output	PZ-OUT, GND	100kpps

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.41	Z pulse output polarity	0x0529	See "Values".	-	1	UInt16	At stop	Ordinary user	Effective upon next power-on

Values:

1: Negative (high level upon active Z pulse)

0: Positive (low level upon active Z pulse)

Parameter description:

It sets the output level when phase Z of the pulse output terminal is valid.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.61	Encoder frequency-division pulse output (32-bit)	0x053D	0 to 262143	P/Rev	0	UInt32	At stop	Ordinary user	Effective upon next power-on
	Parameter description:								
	Defines the number of pulses outputted by PAO or PBO per revolution of the motor when the capacity defined by H05.17 is insufficient. Pulse output resolution = H05.66 x 4								

11.2.7 Motion Control Completed, Internal Reference Completed, Positioning Completed, Positioning Almost Completed

Motion control completed

- **Function Description**
  "Motion control completed" refers to the completion of command transmission and positioning in position control mode. In this case, the servo drive outputs a McOK (motion control completed) signal, and the host controller, upon receiving the signal, acknowledges the motion control is done.
- **Working Principle**
  When using the internal position mode for control, the motion control completion signal is output after both the reference transmission and positioning are completed.

Internal command completed

- **Function Description**
  "Internal command completed" refers to the completion of command transmission. In this case, the internal multi-position reference is zero. The servo drive therefore outputs a CmdOk (Internal command completed) signal, and the host controller, upon receiving the signal, acknowledges that the internal command transmission is completed.
- **Working Principle**

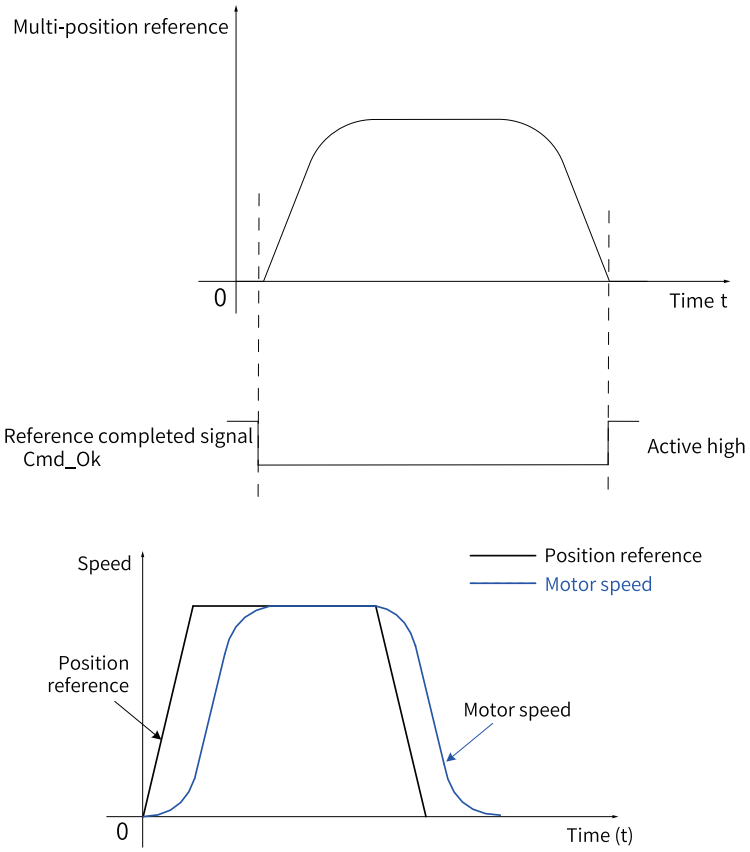


Figure 11-22 Function diagram

Positioning completed

- **Function Description**

  Positioning completed: When the position deviation meets the condition set in H05.20, the servo drive outputs the positioning completed signal (COIN); after receiving this signal, the host controller determines that positioning is completed. Meanwhile, the servo drive outputs positioning completed (COIN) signal, and the host controller, after receiving this signal, confirms the positioning is completed.

- **Working Principle**

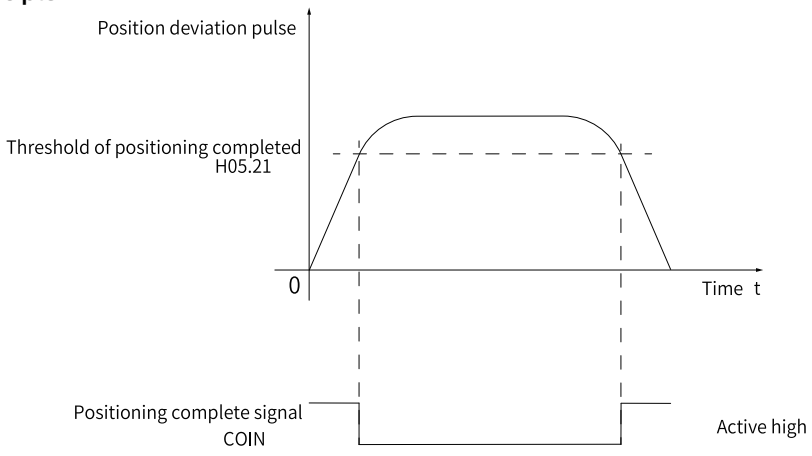


Figure 11-23 Function diagram

You can set the unit for positioning completed, positioning almost completed, and excessive position deviation through H0A.17. When position deviation meets the condition defined by H05.20, the servo drive outputs a NEAR signal to prepare for positioning completed.

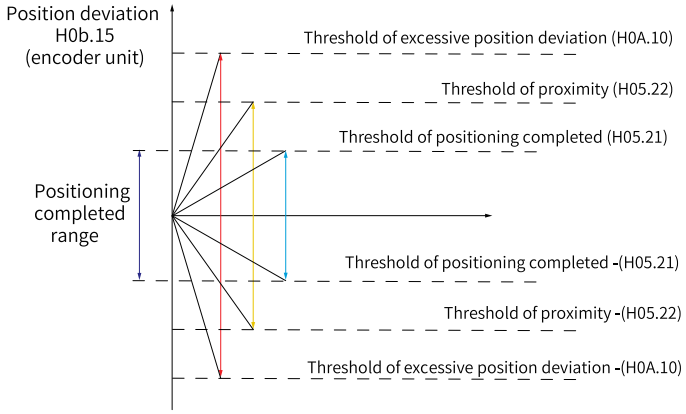


Figure 11-24 Signals related to position deviation

Before enabling the positioning almost completed function, set H05.20, H05.21, H05.22, H05.59, and H05.60 first. The schematic diagram for the window time (H05.59) and hold time (H05.60) of the positioning completed signal is as follows.

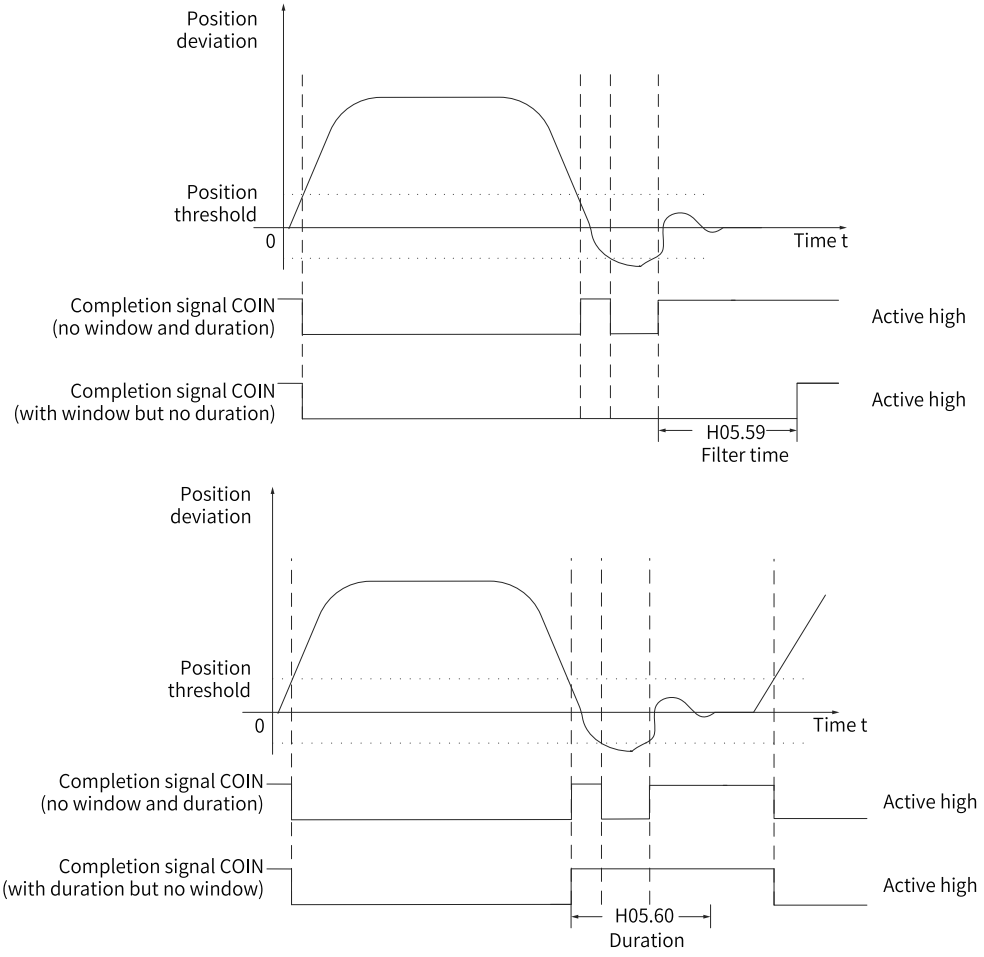


Figure 11-25 Schematic diagram for the window time (H05.59) and hold time (H05.60) of positioning completed signal

When the positioning completed signal (COIN) has a hold time of 0, it remains active until the next position reference is received.

Positioning almost completed

- **Function Description**
  Positioning almost completed: When the position deviation meets the condition set by users (H05.20), positioning in position control mode is almost completed. Meanwhile, the servo drive outputs a positioning almost completed (NEAR) signal, and the host controller, after receiving this signal, acknowledges that positioning is almost completed.
- **Working Principle**

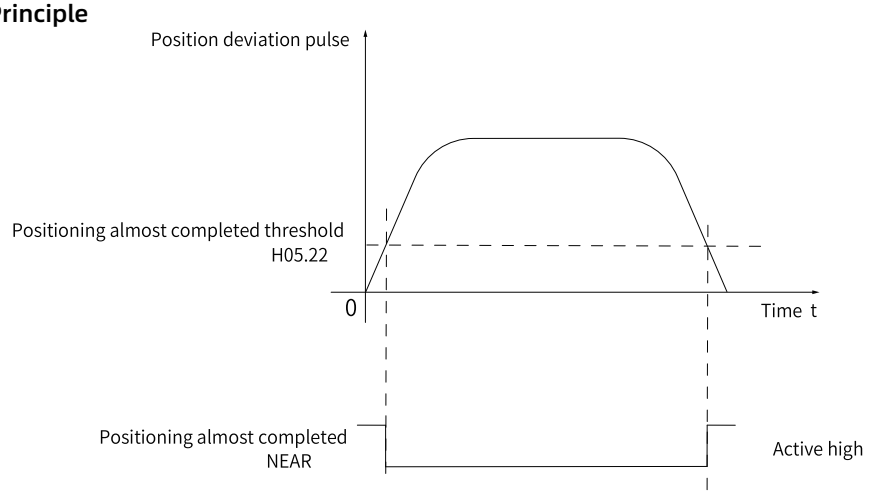


Figure 11-26 Function diagram

Related parameter

To apply motion control/internal command/positioning completion and the proximity function, allocate four DO terminals with FunOUT.24 (McOk, motion control completed), FunOUT.22 (CmdOk, internal command completed), FunOUT.5 (COIN, positioning completed), and FunOUT.6 (NEAR, proximity) respectively, and set the active logic of these terminals.

Code	Name	Function Name	Function
FunOut.5	COIN	Positioning completed	Active: The absolute position deviation meets the threshold defined by H05.21 in the position control mode, indicating positioning is done. Invalid: In the position control mode, the servo drive is performing positioning.
FunOut.6	NEAR	Positioning almost completed	Active: The absolute position deviation meets the condition defined by H05.22, indicating the servo drive is close to the target position. Invalid: In the position control mode, the servo drive is performing positioning.
FunOUT.22	CmdOk	Internal command completed	Active: The transmission of the multi-position reference or interrupt positioning reference is done in the position control mode. Inactive: The transmission of the multi-position reference or interrupt positioning reference is in progress in the position control mode.
FunOUT.24	McOk	Motion control completed	Active: The transmission of the multi-position reference or interrupt positioning reference and the positioning process are done in the position control mode. Inactive: The transmission of the multi-position reference or interrupt positioning reference or positioning is in progress in the position control mode.

Note:

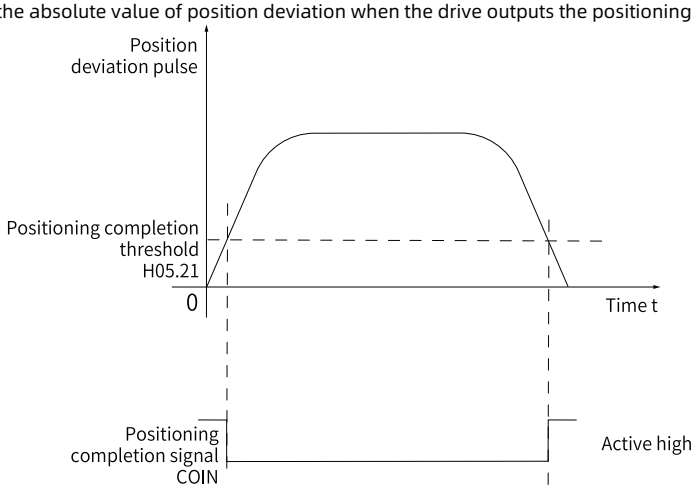
Caution

- Set H05.22 to a value higher than H05.21 in general cases.
- H05.21 only indicates the threshold of the absolute value of position deviation when positioning-completed is valid. It is unrelated to positioning accuracy.
- An excessively high speed feedforward gain (H08.19) or low-speed operation reduces the absolute position deviation. In this case, the COIN (positioning completed) signal may keep active if H05.21 is set to an excessively high value. To improve the positioning accuracy, decrease the value of H05.21.
- In cases where both the setting value of H05.21 and the position deviation are small, change the output condition of positioning completed signal by H05.20 (Output condition for positioning completed/near signal).
- When the S-ON signal is inactive, the positioning completed signal (COIN) and positioning near signal (NEAR) are invalid.
- The output of positioning approaching DO is not affected by H05.60 and H05.59, and do not need to detect the change of position reference from present to absent.

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.17	Reference/ Pulse selection	0x0A11	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Pulse unit 1: Reference unit								
	Parameter description:								
	Select whether the units for the positioning completion threshold (H05.21), positioning almost completion threshold (H05.22), and excessive position deviation threshold (H0A.10) are in encoder pulse units or input reference units.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.20	Reference/ Pulse selection	0x0A11	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Absolute position deviation lower than the setpoint of H05.21 1: Absolute position deviation lower than the setpoint of H05.21 and the filtered position reference is 0 2: Absolute position deviation lower than the setpoint of H05.21 and the unfiltered position reference is 0 3: Absolute position deviation kept lower than the setpoint of H05.21 within the time defined by H05.60 and the unfiltered position reference is 0								
	Parameter description:								
	Defines the condition for outputting positioning completed/proximity signal. In the 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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.21	Threshold of positioning completed	0x0515	1 to 65535	Encoder unit	5872	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of the absolute value of position deviation when the drive outputs the positioning completed signal. 								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.22	Positioning near threshold	0x0516	1 to 65535	Encoder unit	65535	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of the absolute value of position deviation when the drive outputs the proximity signal.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.59	Positioning window time	0x053B	0 to 30000	ms	0	UInt16	At once	Ordinary user	At once
	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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.60	Holding time of positioning completed	0x053C	0 to 30000	ms	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the holding time of an active positioning completed signal.								

11.2.8 Interrupt Positioning

Function Description

If interrupt positioning is triggered in position control mode, the servo drive halts current operation and turns to executing the pre-set fixed distance. To be specific, when the servo ON signal is active in position control mode and this function is enabled, the servo motor executes the position reference for position change on fly in the original direction (before the function is triggered).

When interrupt positioning is in progress, the servo drive does not respond to any other internal/ external position references (including another interrupt positioning command). In this case, the input position reference counter (H0b.13) counts the interrupt positioning reference only. After the running of this function is complete, the servo drive keeps shielding or responds to position references according to the setting of H05.29 (Interrupt positioning unlock), but discards the position references input in the running process.

After the running of this function is complete, the servo drive outputs the position change on fly completed signal (FunOUT.15:XintCoin) and positioning completed signal (FunOUT.5:COIN) signal simultaneously. After receiving the position change on fly completed signal, the host controller confirms that the running of this function is complete. The output of the position change on fly completed signal is irrelevant to the S-ON signal and DI9 terminal logic.

Interrupt positioning is effective only when the following conditions are met:

- Before this function is triggered, motor current speed ≥ 10 RPM or H05-26 and H05.24 ≠ 0
- The DI assigned with FunIN.33 (Interrupt positioning inhibited) is not used or the logic of this DI is inactive.

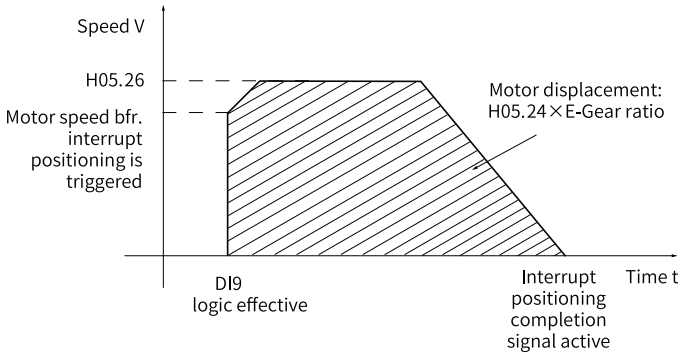


Figure 11-27 Motor operating curve during interrupt positioning

Table 11–15 Motor speed for interrupt positioning

H05.26 setpoint	Motor speed before function triggered	Interrupt Positioning	Constant speed for interruption fixed length
0	< 10	OFF	-
	≥ 10	ON	Motor speed before function triggered
1 to 6000	-	ON	H05.26

Procedure

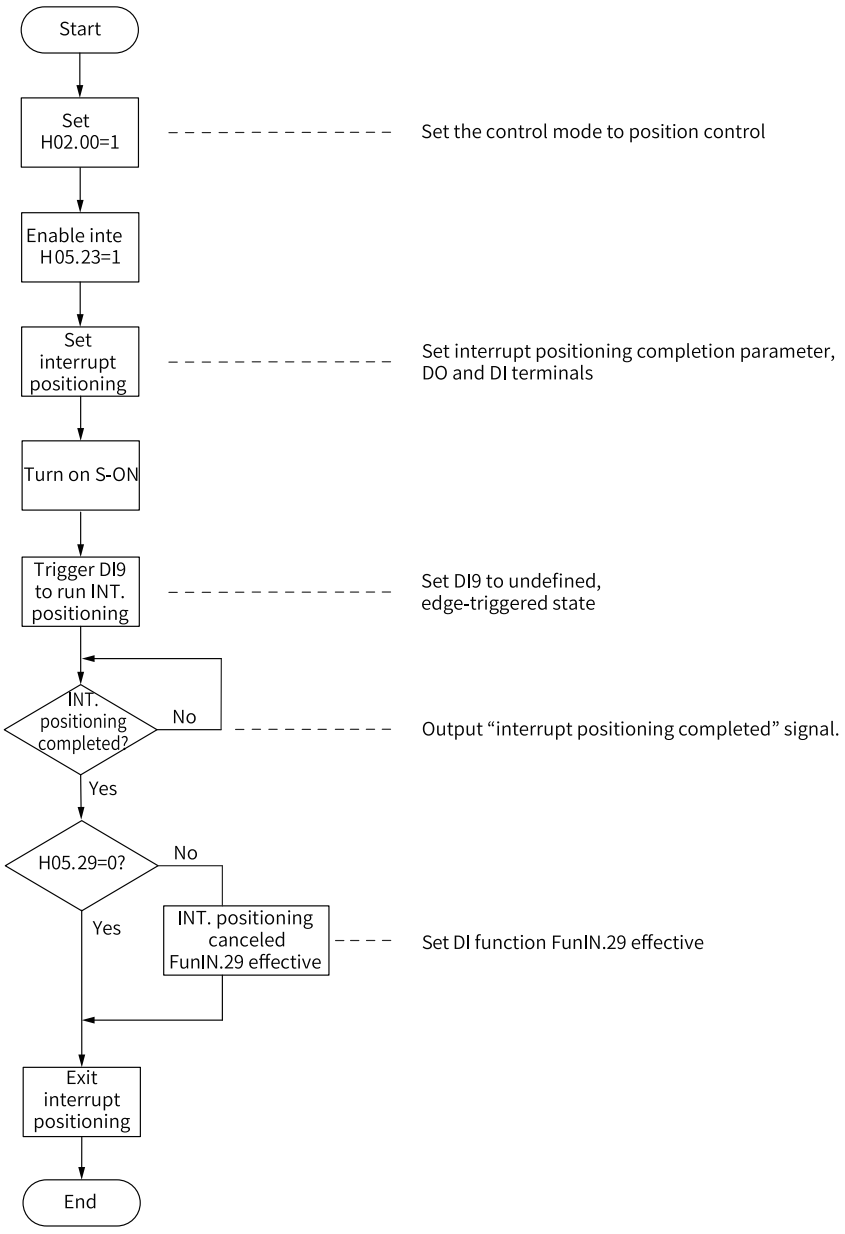


Figure 11-28 Flowchart of interrupt positioning signal

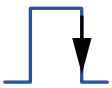
Relevant function No.:

Code	Name	Function Name	Function
FunIN.29	XintFree	Interrupt positioning clear	Active: The interrupt positioning state is cleared, which means the servo drive can respond to other position references. Inactive: The interrupt positioning state is locked, which means the servo drive cannot respond to other position references.
FunIN.33	XintInHibit	Interrupt positioning inhibited	Active: Interrupt positioning inhibited Inactive: Interrupt positioning allowed
FunOUT.15	XintCoin	Interrupt positioning completed	Active: Interrupt positioning completed in position control Inactive: Displacement in interrupt positioning not completed in position control

Note:

- The interrupt positioning signal cannot be triggered during homing.
- The moving average filter is inactive when interrupt positioning is in progress.
- During interrupt positioning, DI9 is used to trigger interrupt positioning only, which means no other functions can be assigned to DI9 through H03.18 (DI9 function selection) and no other DIs can trigger interrupt positioning. The logic of DI9 (H03.18) is "edge-triggered" .

Table 11–16 Active logic of DI9 during interrupt positioning

H03.19	Active logic of DI9	Waveform
0	Active low	
1	Active high	

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.23	Interruption fixed length	0x0517	See "Values".	-	0	UInt16	At stop	Ordinary user	Effective upon next power-on
	Values:								
	0: Disabled 1: Enabled								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.24	Displacement of interruption fixed length	0x0518	0 to 1073741824	Reference unit	10,000	UInt32	At once	Ordinary user	At once
	Parameter description:								
	Defines the position reference for interrupt positioning.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.26	Constant speed for interruption fixed length	0x051A	0 to 7000	rpm	200	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Set the maximum running speed when running in interrupt positioning mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.27	Acceleration/ Deceleration time of interruption fixed length	0x051B	0 to 1000	ms	10	UInt16	At once	Ordinary user	At once
	Values:								
	Defines the time for the motor to accelerate from 0 RPM to 1000 RPM or decelerate from 1000 RPM to 0 RPM for interrupt positioning. The actual motor acceleration time t during interrupt positioning is: $t = \frac{\lvert \text{H05.26-Motor speed before interrupt positioning} \rvert}{1000} \times (\text{H05.27})$								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.29	Interruption fixed length unlock	0x051D	See "Parameter Description"	-	1	UInt16	At once	Ordinary user	At once

Parameter description:

Sets whether to unlock the interrupt positioning signal.

Set value	Interrupt positioning cancel signal	Remarks
0	Disabled	After interrupt positioning is completed, the servo drive responds to the other position references directly.
1	Enable	• After interrupt positioning is completed, the servo drive does not directly respond to other position references. • The servo drive can respond to other position references only after the DI function 29 (FunIN.29: XintFree, interrupt positioning unlock) is enabled.

11.2.9 Homing

11.2.9.1 Function Description

Function Description

Homing function: When the S-ON signal is active in position control mode, the servo motor proactively searches for the zero position and completes positioning if the homing function is triggered.

Note

- Home (or mechanical home): Indicates the position of the home switch or Z signal depending on the value of H05.31 (Homing mode).
- Zero: positioning target point, expressed as home + offset (set in H05.36). When H05.36 (Mechanical home offset) is set to 0, the zero position coincides with the home.

During the homing operation, the servo drive shields the other position references (including the homing reference triggered again). After the homing operation is completed, the servo drive can respond to other position references.

This function includes homing and electrical homing.

- Home: After receiving the homing signal, the servo drive proactively locates the relative position between the motor shaft and the preset mechanical home reference point. It finds the home and then moves through the offset from the home reference point to the zero point. The homing mode usually applies in initial searching for the zero position.
- Electrical homing: After determining the absolute zero position through homing, the drive takes the current position as the start position to execute a relative displacement.

After the homing operation is completed (including home attaining and electric home attaining), the absolute motor position (H0b.07) is the same as the mechanical home offset (H05.36).

After the homing operation is completed, the servo drive outputs the home attaining completed signal (FunOUT.16: HomeAttain) or electric home attaining completed signal (FunOUT.17: ElecHomeAttain). After receiving this signal, the host controller confirms that the homing operation is completed. The HomeAttain or ElecHomeAttain signal is irrelevant to the operation mode or operation state of the servo drive.

Table 11–17 Comparison between homing and electrical homing

Mode	Homing Mode (H05.30)	Homing direction, deceleration point, home	Trigger signal	Total motor displacement
Homing	0	-	-	-
	1	Determined by H05.31	HomingStart signal	Determined by the mechanical home coordinate and offset displacement
	3		Servo ON	
	4		Servo ON	
	6	-	-	-
	8	-	-	-
Electrical homing	2	The homing direction is consistent with the motor displacement sign (+/-). The deceleration point or home signal is not needed.	HomingStart signal	(H05.36 - H0b.07) x Electronic gear ratio
	5		Servo ON	

Caution

- The homing trigger signal is shielded when interrupt positioning or multi-position reference is in progress.
- To use the homing function, ensure H11.00 is not set to 5 as the setpoint 5 indicates enhanced axis control mode, in which the homing function is shielded.
- Do not set H05.30=6 or H05.30=8 during motor operation upon receiving references; otherwise speed fluctuations will occur.

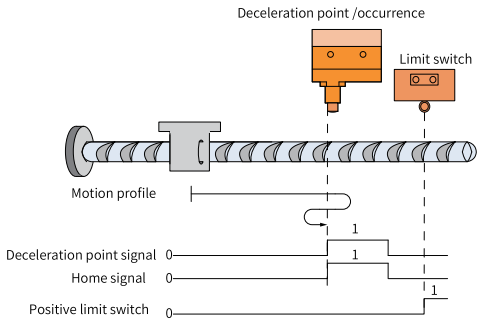
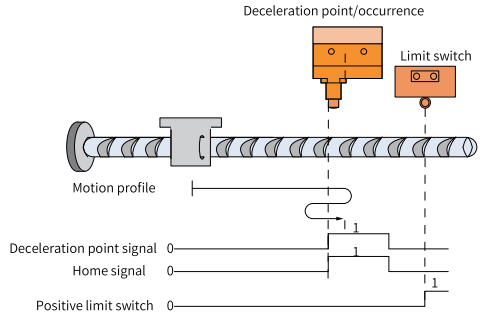
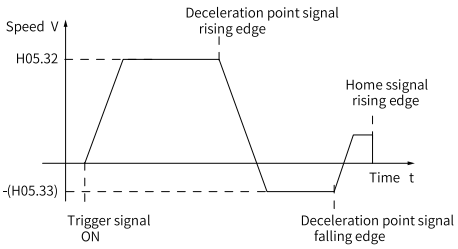
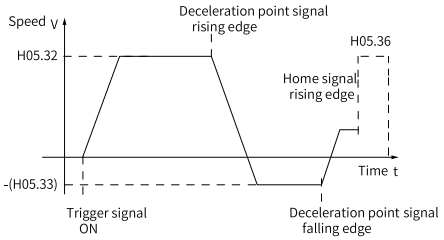
Note

Both the moving average filter and low-pass filter are invalid when the homing function is used.

Mechanical home and mechanical zero

The following takes "H05.30 = 0" as example to describe the difference between mechanical home and mechanical zero.

Table 11–18 Description of mechanical home and mechanical zero

Mechanical zero different from mechanical home reference point	Mechanical zero same as mechanical home reference point
If the home offset is present (H05.36 ≠ 0) and the mechanical home differs from the mechanical zero (H05.40 = 0 or 2), the motor stops immediately after reaching the rising edge of the home signal during acceleration or forward operation at constant speed. After stop, the motor absolute position (H0b.07) is changed to the setpoint of H05.36 (Mechanical home offset) forcibly.	If the home offset is present (H05.36 ≠ 0) and the mechanical home coincides with the mechanical zero (H05.40 = 1 or 3), the motor continues running after reaching the rising edge of the home switch signal during acceleration or forward operation at constant speed until the absolute position (H0b.07) reaches the setpoint of H05.36 (Mechanical home offset).
	
	

11.2.9.2 Homing

Note

- Do not set H05.30=6 or H05.30=8 during motor operation upon receiving references; otherwise speed fluctuations will occur.
- Set mechanical limit switches before enabling the homing function. For homing upon hit-and-stop, set the offset to a value within the travel range to prevent the machine from collision due to high-speed operation during homing.
- When the motor hits the limit switch during homing, the drive reports E950.0 (Forward overtravel) or E952.0 (Reverse overtravel), and the motor, if H05.40 is set to 0 or 1, stops in the stop mode defined by H02.07.

Homing Mode	Description
H05.31 = 0: Forward direction, deceleration point and home being home switch signal	*" H05.31 = 0: Forward direction, deceleration point and home being home switch signal" on page 322*
H05.31 = 2: Forward direction, deceleration point and home being motor Z signal	*" Mode 2: Forward homing, Z signal as the deceleration point and the home (H05.31 = 2)" on page 324*

Homing Mode	Description
H05.31 = 4: Forward direction, deceleration point being home switch signal and home being motor Z signal	"Mode 4: Forward homing, home switch as the deceleration point and Z signal as the home (H05.31 = 4)" on page 325
H05.31 = 6: Forward direction, deceleration point and home being forward limit switch signal	"Mode 6: Forward homing, positive limit switch as the deceleration point and the home (H05.31 = 6)" on page 327
Forward, positive limit switch as deceleration point and Z signal as home (H05.31 = 8)	"Mode 8: Forward homing, positive limit switch as the deceleration point and Z signal as the home (H05.31 = 8)" on page 328
H05.31 = 10: Forward homing, mechanical limit position as the deceleration point and the home (H05-31 = 10)	"Mode 10: Forward homing, forward mechanical limit as the deceleration point and the home (H05.31 = 10)" on page 329
Forward, mechanical limit position as deceleration point and Z signal as home (H05.31 = 12)	"Mode 12: Forward homing, forward mechanical limit as the deceleration point and Z signal at the home (H05.31 = 12)" on page 329
Forward single-turn homing (H05.31 = 14)	"Forward single-turn homing (H05.31 = 14)" on page 330
Reverse single-turn homing (H05.31 = 15)	"Reverse single-turn homing (H05.31 = 15)" on page 330
Single-turn nearby homing (H05.31 = 16)	"Single-turn nearby homing (H05.31 = 16)" on page 330

The other homing modes are the same as above, except the initial homing mode, which is contrary to the above.

H05.31 = 0: Forward direction, deceleration point and home being home switch signal

- The home switch (deceleration point) signal is inactive (0: inactive, 1: active) when the motor starts to run, and the forward limit switch is not sensed in the entire process.
  The running process is as follows:
  The servo motor searches for the deceleration point signal in forward direction at high speed set in H05.32.
  After reaching the rising edge of the deceleration point signal, the motor decelerates to -(H05.33) according to the time set in H05.34.
  The motor searches for the falling edge of the deceleration point signal in reverse direction at low speed of -(H05.33).
  After reaching the falling edge of the deceleration point signal, the motor then changes to forward direction, and searches for the rising edge of the home signal at the speed of H05.33.
  During forward acceleration or forward constant speed running, the motor stops immediately after reaching the rising edge of the home signal.

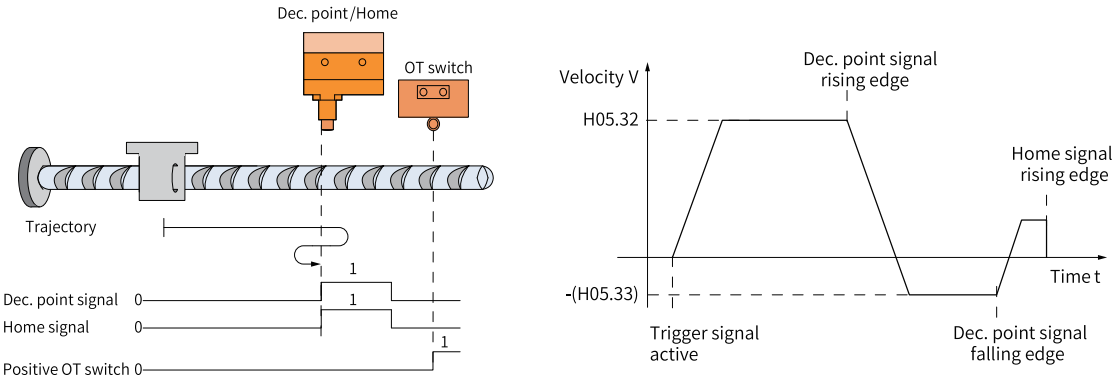


Figure 11-29 Motor running curve and speed in mode 0

- The home switch (deceleration point) signal is active when the motor starts running, with the positive limit switch not triggered in the whole process.
  The running process is as follows:
  The servo motor directly searches for the falling edge of the deceleration point signal in reverse direction at low speed of -(H05.33).
  After reaching the falling edge of the deceleration point signal, the motor changes to forward direction, and searches for the rising edge of the home signal at low speed of H05.33.
  During forward acceleration or forward constant speed running, the motor stops immediately after reaching the rising edge of the home signal.

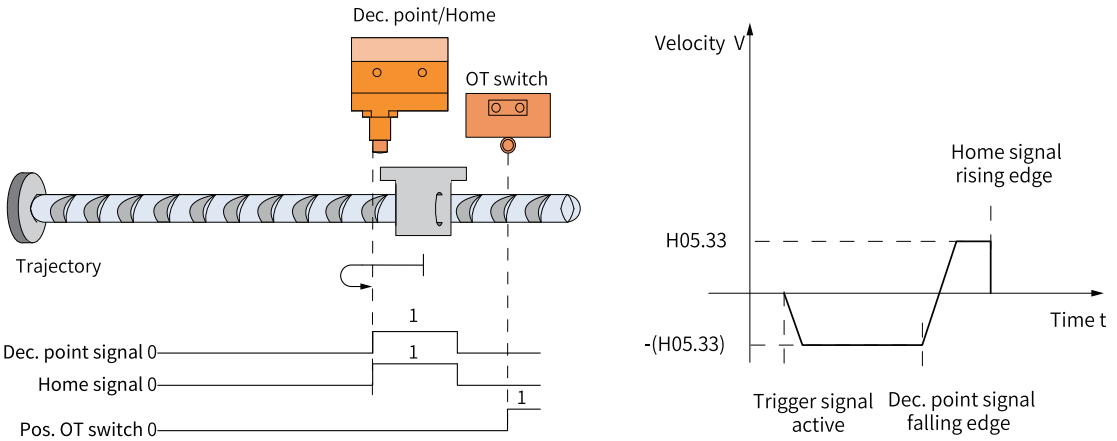


Figure 11-30 Motor running curve and speed in mode 0

- The home switch (deceleration point) signal is inactive when the motor starts to run, and the forward limit switch is triggered in the process.
  The motor starts searching for the deceleration point signal in the forward direction at a speed defined by H05.32. After reaching the positive limit switch, it changes to execute reverse homing (H05.40 = 2 or 3) or stops and waits for another homing trigger signal (H05.40 = 0 or 1). After receiving the signal, it starts searching for the falling edge of the deceleration point signal in the reverse direction at a speed defined by "-H05.32". After reaching this falling edge, it decelerates as defined by H05.34 and changes to search for the rising edge of the home signal in the forward direction as defined by H05.33. Finally, it stops immediately after reaching the rising edge of the home signal during forward acceleration or forward operation at a constant speed.

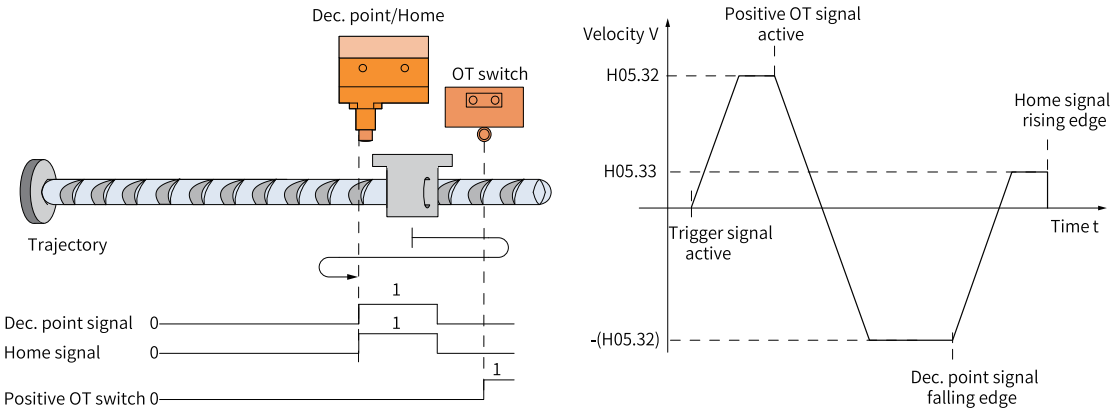


Figure 11-31 Motor running curve and speed in mode 0

Mode 2: Forward homing, Z signal as the deceleration point and the home (H05.31 = 2)

Caution

Note: In Modes 2 and 3 (H05.31 = 2 or 3) where the motor Z signal acts as the home and deceleration point, the actual stop position of the motor may not be on the rising edge on the same side of the motor Z signal. A deviation of ±1 pulse (in encoder unit) may be present in the stop position.

- The Z signal is inactive (0: inactive, 1: active) when the motor starts to run, and the forward limit switch is not sensed in the entire process.
  The running process is as follows:
  The servo motor searches for Z signal in forward direction at high speed of H05.32.
  After reaching the rising edge of Z signal, the motor then decelerates and changes to reverse direction according to the time set in H05.34, and accelerates to -(H05.33).
  During reverse acceleration or reverse constant speed running, the motor immediately stops after reaching motor Z signal rising edge of the other side.

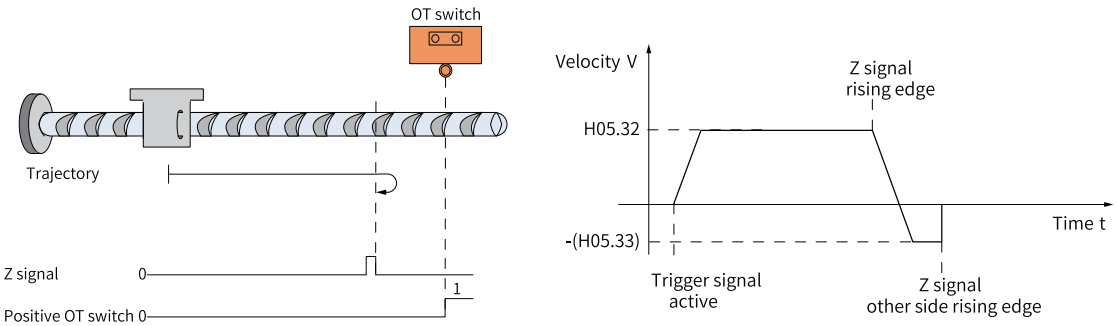


Figure 11-32 Motor operation curve and speed in mode 2

- The Z signal is active when the motor starts to run, and the forward limit switch is not triggered in the entire process.
  The running process is as follows: The servo motor directly searches for the falling edge of Z signal in forward direction at the speed defined by H05.33 (speed for low-speed home switch signal searching). After reaching the falling edge of Z signal, the motor changes to reverse direction, and searches for the rising edge of Z signal at the speed of -(H05.33). During reverse

acceleration or reverse constant speed running, the motor stops immediately after reaching the rising edge of Z signal.

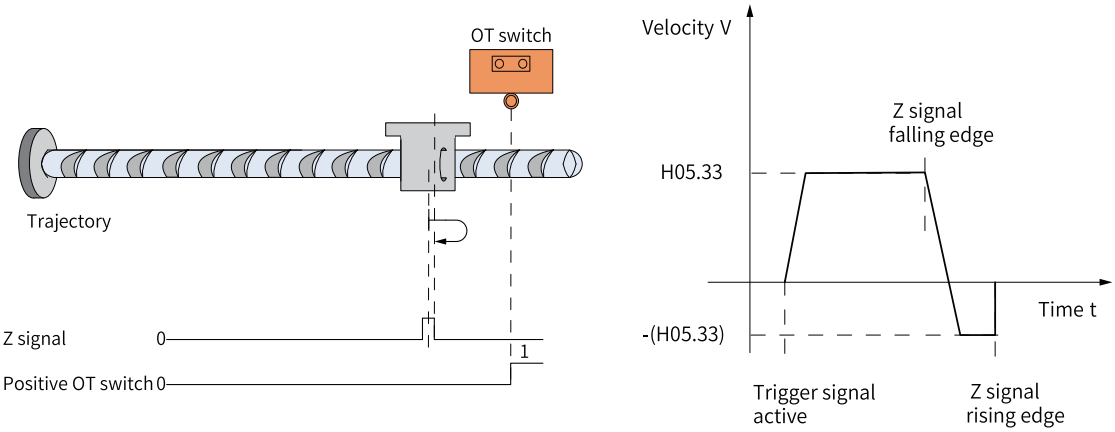


Figure 11-33 Motor operation curve and speed in mode 2

- The Z signal is inactive when the motor starts to run, and the forward limit switch is triggered in the process.
  The motor starts searching for the Z signal in the forward direction at the high speed defined by H05.32. After hitting the positive limit switch, the motor turns to executing reverse homing (H05.40 = 2 or 3) or stops and waits for another homing trigger signal (H05.40 = 0 or 1) sent from the host controller. After the signal is sent, the motor starts searching for the Z signal in the reverse direction at the speed defined by "-(H05.32)" until reaching the rising edge of the Z signal, where it decelerates as defined by H05.34 in the forward direction and turns to searching for the rising edge of the Z signal on the other side at the low speed defined by H05.33. During forward acceleration or forward operation at a constant speed, the motor stops immediately after reaching rising edge of the Z signal on the other side.

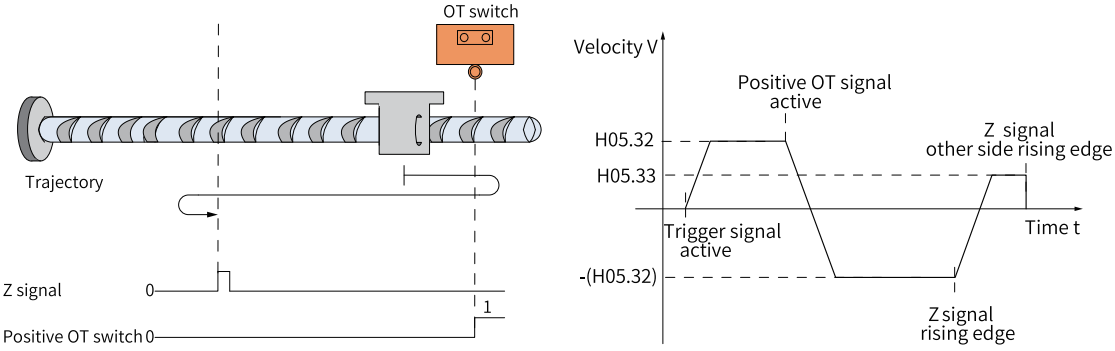


Figure 11-34 Motor operation curve and speed in mode 2

Mode 4: Forward homing, home switch as the deceleration point and Z signal as the home (H05.31 = 4)

- The home switch signal is inactive (0: inactive, 1: active) when the motor starts running, with the positive limit switch not triggered in the whole process.
  The running process is as follows:
  The servo motor searches for the home switch signal in forward direction at high speed of H05.32.
  After reaching the rising edge of the home switch signal, the motor then decelerates and

changes to reverse direction according to the time set in H05.34, and searches for the falling edge of the home switch signal at low speed of -(H05.33).

After reaching the falling edge of the home switch signal, the motor decelerates and restores to forward direction, and searches for the rising edge of the home switch signal at low speed of H05.33.

After reaching the rising edge of the home switch signal, the motor continues to run and immediately stops after reaching Z signal for the first time.

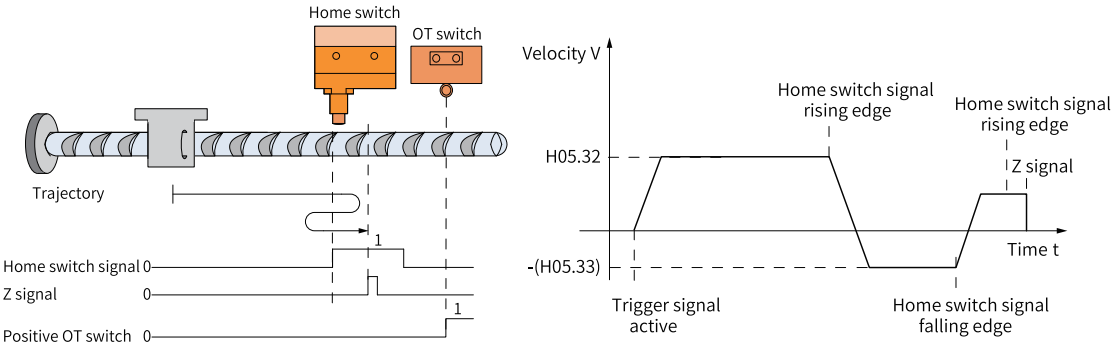


Figure 11-35 Motor running curve and speed in mode 4

- The home switch signal is active when the motor starts to run, and the forward limit switch is not triggered in the entire process.

  The running process is as follows:

  The servo motor directly searches for the falling edge of the home switch signal in reverse direction at low speed of -(H05.33).

  After reaching the falling edge of the home switch signal, the motor decelerates and restores to forward direction, and searches for the rising edge of the home switch signal at low speed of H05.33.

  After reaching the rising edge of the home switch signal, the motor continues to run in forward direction at low speed of H05.33, and stops immediately after reaching Z signal for the first time.

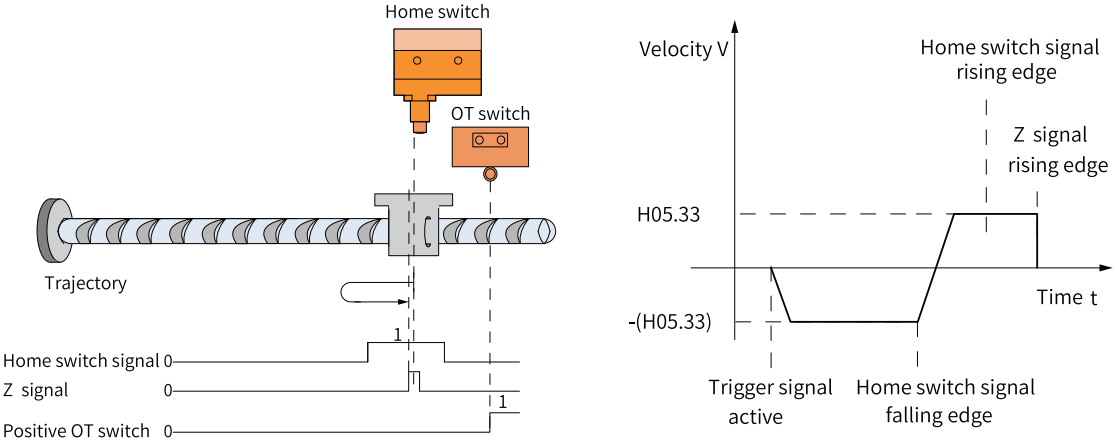


Figure 11-36 Motor running curve and speed in mode 4

- The home switch signal is inactive when the motor starts to run, and the forward limit switch is triggered in the process.

  The motor starts searching for the home switch in the forward direction at the high speed defined by H05.32. After hitting the positive limit switch, the motor executes reverse homing (H05.40 = 2

or 3) as defined by H05.40 or stops and waits for another homing trigger signal (H05.40 = 0 or 1) sent from the host controller. After this signal is sent, the motor starts searching for the deceleration point in the reverse direction at the high speed defined by "-(H05.32)" until reaching the falling edge of the home switch signal, where it decelerates gradually as defined by H05.34 and turns to searching for the rising edge of the home switch signal in the forward direction at the low speed defined by H05.33. After reaching the rising edge of the home switch signal, the motor continues running until it stops at the first Z signal.

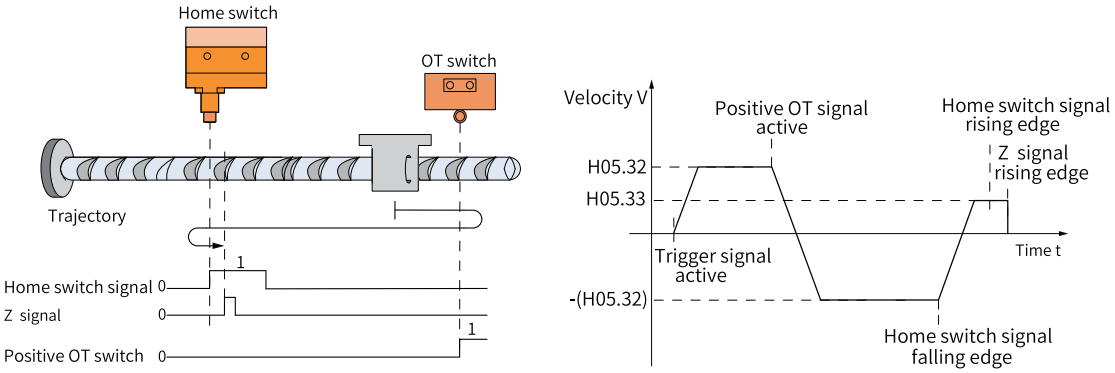


Figure 11-37 Motor running curve and speed in mode 4

Mode 6: Forward homing, positive limit switch as the deceleration point and the home (H05.31 = 6)

- The forward limit signal is inactive (0: inactive, 1: active) when the motor starts to run.
  The running process is as follows:
  The servo motor searches for the forward limit switch signal in forward direction at high speed of H05.32.
  After reaching the rising edge of the forward limit switch signal, the motor then decelerates and changes to reverse direction according to the time set in H05.34, and searches for the falling edge of the forward limit switch signal at low speed of -(H05.33).
  After reaching the falling edge of the forward limit switch signal, the motor decelerates and restores to forward direction, and searches for the rising edge of the forward limit switch signal at low speed of H05.33.
  During forward acceleration or forward constant speed running, the motor stops immediately after reaching the rising edge of the forward limit switch signal.

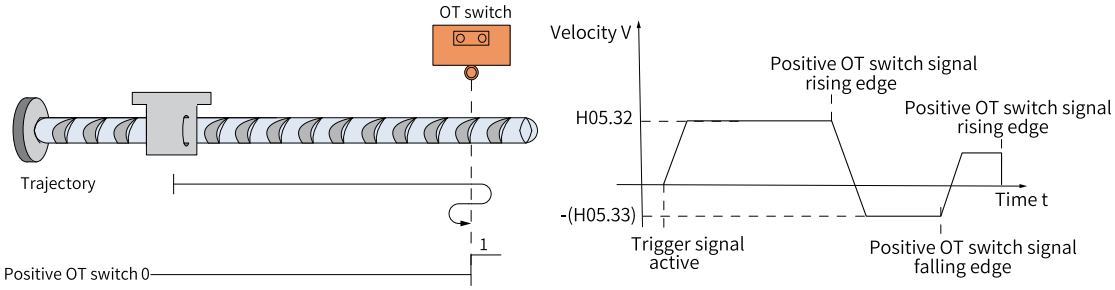


Figure 11-38 Motor running curve and speed in mode 6

- The forward limit switch signal is active when the motor starts to run.
  The running process is as follows:
  The servo motor directly searches for the falling edge of the forward limit switch signal in reverse

direction at low speed of -(H05.33).
After reaching the falling edge of the forward limit switch signal, the motor decelerates and changes to forward direction, and searches for the rising edge of the forward limit switch signal at low speed of H05.33.
During forward acceleration or forward constant speed running, the motor stops immediately after reaching the rising edge of the forward limit switch signal.

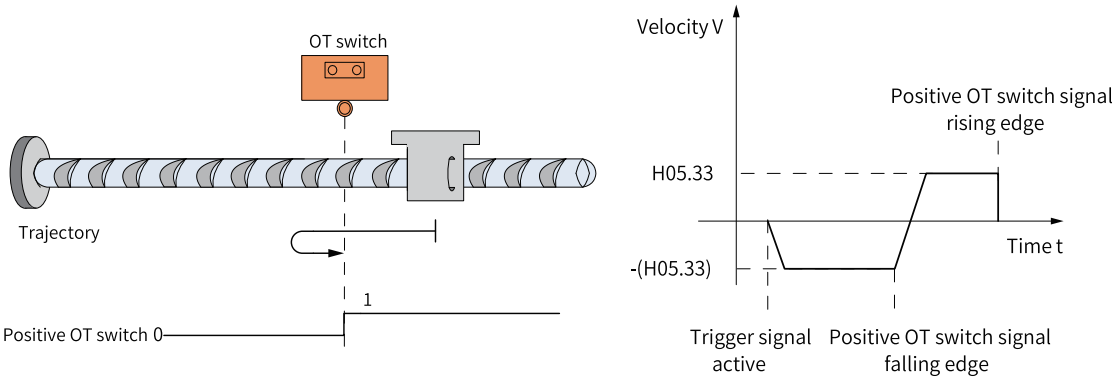


Figure 11-39 Motor running curve and speed in mode 6

Mode 8: Forward homing, positive limit switch as the deceleration point and Z signal as the home (H05.31 = 8)

- The forward limit signal is inactive (0: inactive, 1: active) when the motor starts to run.
  The motor starts searching for the positive limit switch in the forward direction at the high speed defined by H05.32. After reaching the rising edge of the positive limit switch signal, the motor decelerates gradually as defined by H05.34 and turns to searching for the falling edge of the positive limit switch signal in the reverse direction at the low speed defined by "-(H05.33)". After reaching this falling edge, the motor continues running until it stops upon reaching the Z signal for the first time.

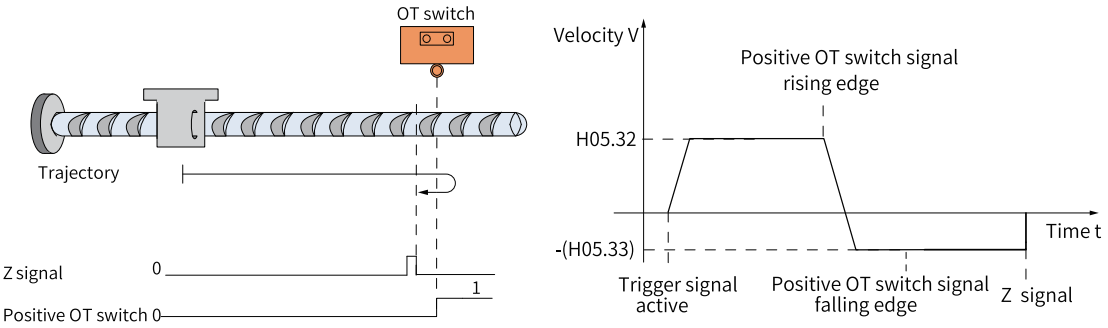


Figure 11-40 Motor running curve and speed in mode 8

- The forward limit switch signal is active when the motor starts to run.
  The motor starts searching for the falling edge of the positive limit switch signal in the reverse direction at a low speed defined by "-(H05.33)". After reaching the falling edge of the positive limit switch signal, the motor continues running until it stops at the first rising edge of the Z signal.

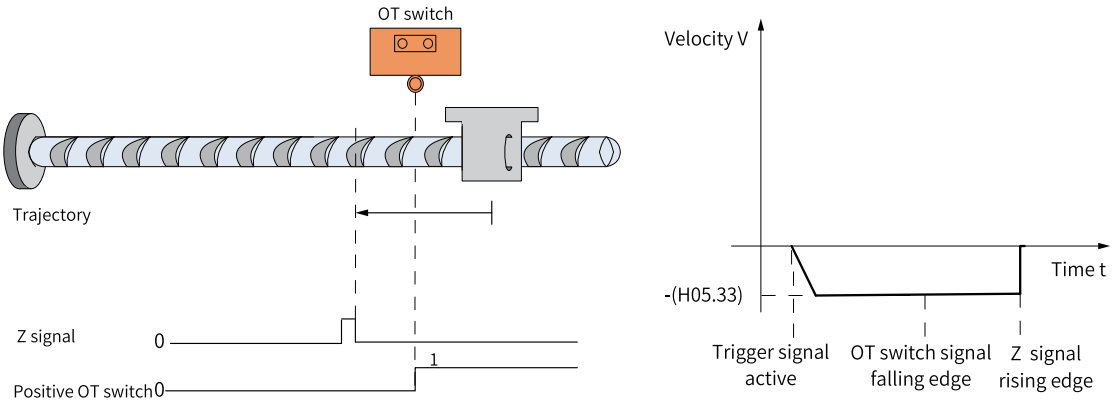


Figure 11-41 Motor running curve and speed in mode 8

Mode 10: Forward homing, forward mechanical limit as the deceleration point and the home (H05.31 = 10)

The motor starts running in the forward direction at the low speed defined by H05.33. After hitting the mechanical limit, the motor stops if the torque keeps reaching the upper limit (H05.58) and the speed keeps lower than H05.56 for a period of time.

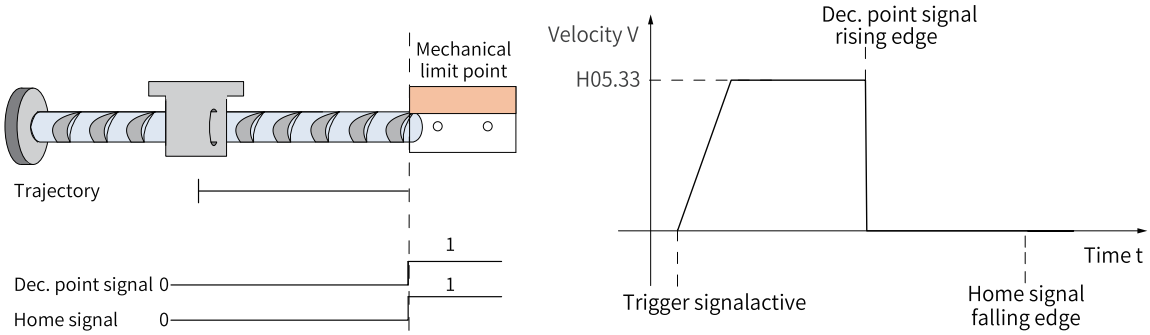


Figure 11-42 Motor running curve and speed in mode 10

Mode 12: Forward homing, forward mechanical limit as the deceleration point and Z signal at the home (H05.31 = 12)

The motor runs in the forward direction at the low speed defined by H05.33. After hitting the mechanical limit, the motor changes to run in the reverse direction at the speed defined by H05.33 if the torque keeps reaching the upper limit (H05.58) and the speed keeps lower than H05.56 for a period of time. Then the motor stops after reaching the rising edge of the Z signal for the first time.

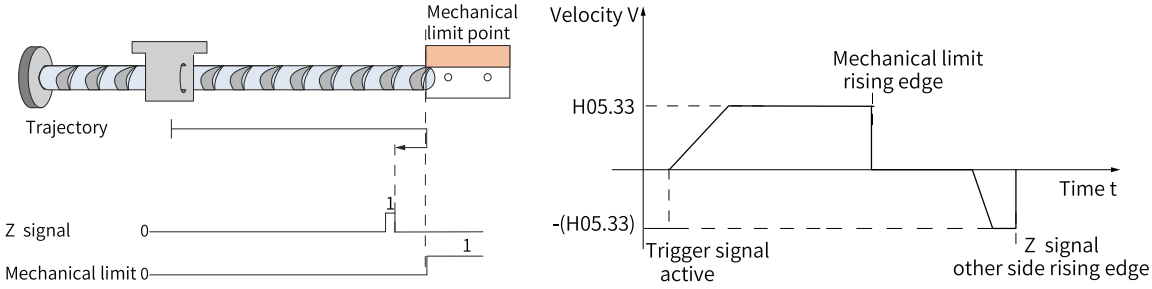


Figure 11-43 Motor running curve and speeds in mode 12

Forward single-turn homing (H05.31 = 14)

- When H05.31 = 14, the motor performs forward homing. After you set H05.36, the servo motor can be moved from the current absolute position (H0b.07) to the specified position (H05.36). Motor displacement = (H05.36–H0b.07) × Electronic gear ratio.
- If motor displacement is < 0, the actual motor displacement = (H05.36–H0b.07) x Electronic gear ratio + Encoder resolution. The motor stops immediately after the displacement command finishes.

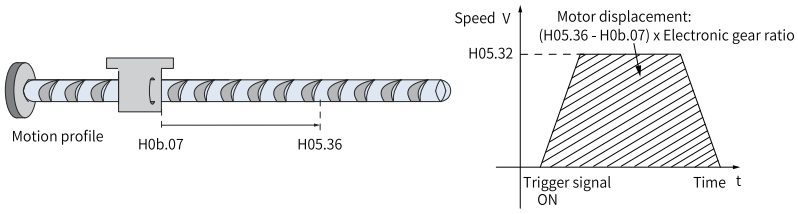


Figure 11-44 Motor running curve and speed in mode 14

Reverse single-turn homing (H05.31 = 15)

- When H05.31 = 15, the motor performs reverse homing. After you set H05.36, the servo motor can be moved from the current absolute position (H0b.07) to the specified position (H05.36). Motor displacement = (H05.36–H0b.07) × Electronic gear ratio.
- If motor displacement is > 0, the actual motor displacement = (H05.36–H0b.07) x Electronic gear ratio - Encoder resolution. The motor stops immediately after the displacement command finishes.

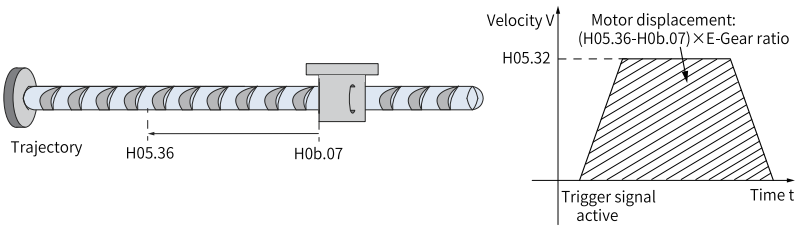


Figure 11-45 Motor running curve and speed in mode 15

Single-turn nearby homing (H05.31 = 16)

When H05.31 = 16, the motor performs nearby homing. The actual motor displacement is the distance from the current position to the specified position (H05.36). The direction of operation is determined by the distance. The motor stops immediately after the displacement command finishes.

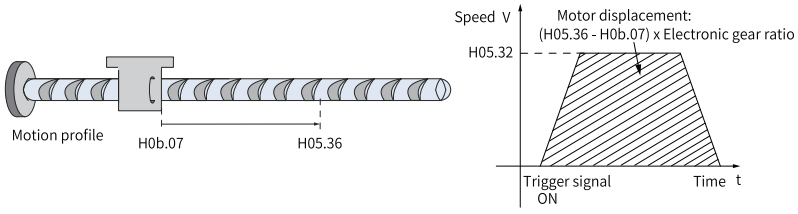


Figure 11-46 Motor running curve and speed in mode 16

Evaluation condition for torque homing: After the motor reaches the hard limit, and the torque feedback reaches the limit value defined in H05.58 (mechanical torque limit, in %), the first Z signal in the reverse direction is searched for and regarded as the home after the motor stops.

11.2.9.3 Electrical homing

Start electrical homing (H05.30 = 5)

The mechanical zero position is obtained after homing is done. In this case, you can make the motor move from current position (H0b.07) to the designated position (H05.36) by setting H05.36.

In the electrical homing mode, the motor runs at the speed defined by H05.32 in the direction defined by the sign (+/-) of the displacement value. The total displacement is determined by the difference between H05.36 and H0b.07. The motor stops immediately after the displacement reference is done executing.

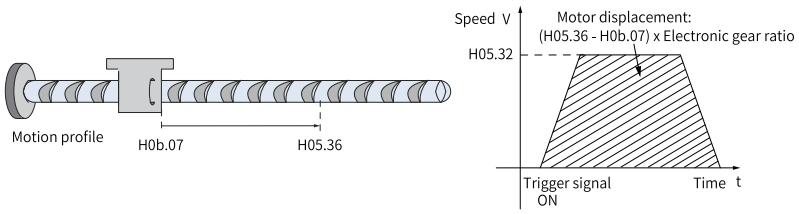


Figure 11-47 Motor running curve and speed in electrical homing

11.2.9.4 Sequence

H05.30 = 1 or 2

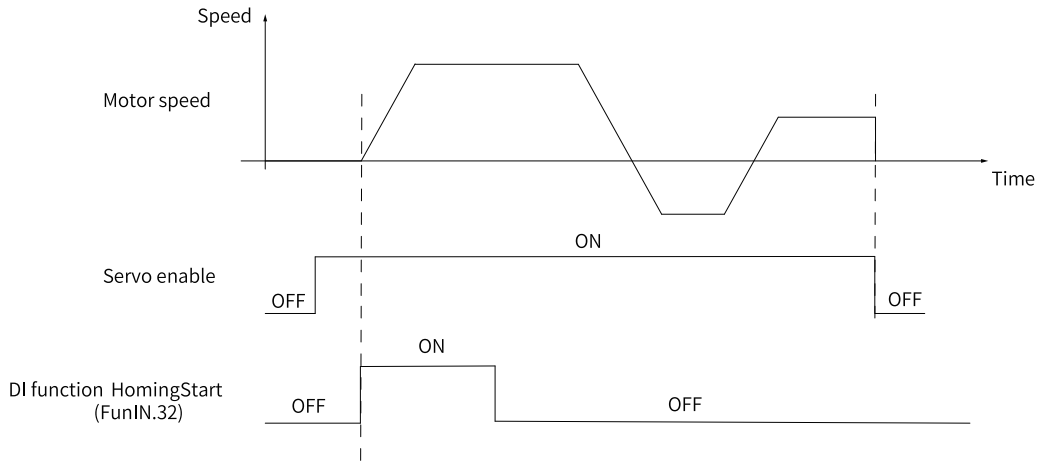


Figure 11-48 Sequence example

- Switch on the S-ON signal first and then the HomingStart signal.
- During homing, the S-ON signal remains active and the change of the HomingStart signal is shielded.
- During homing, the motor stops if the S-ON signal is switched off. To enable homing again, switch on the S-ON signal first and then the HomingStart signal.
- If E601.0 (Homing timeout) occurs, the motor stops, but the S-ON signal remains active. In this case, trigger the HomingStart signal again to reset E601.0, and execute homing again.

- The homing operation can be triggered repeatedly.

H05.30=3

- The homing operation is executed only when the S-ON signal is switched on for the first time after power-on.
- The motor stops when E601.0 (Homing timeout) occurs. To reset E601.0, deactivate the S-ON signal.
- The homing operation can only be triggered again at next power-on.

H05.30 = 4 or 5

- The homing operation is executed immediately after the S-ON signal is switched on upon power-on.
- If the S-ON signal is deactivated during homing, the motor stops immediately. To trigger homing again, activate the S-ON signal again.
- When E601.0 (Homing timeout) occurs, H05.30 is set to 0 and the motor stops. To reset E601.0, deactivate the S-ON signal. To perform homing again, reset H05.30. After homing is done, H05.30 is set to 0. To perform homing again, set H05.30 again.

H05.30=6

- To take the current position as the home and achieve home offset (H05.40 = 0 or 2, H05.36 ≠ 0), set H05.36 and H05.40 first, and then set H05.30 to 6. Failing to do so will cause H0b.07 to keep the previous value of H05.36 rather than the one set currently.
- After homing is done, H05.30 will be set to 0. To enable homing again, re-write H05.36 and set H05.30 to 6.

H05.30=8

- To take the DI-triggered position as the home, assign FunIN.41 to a DI first and set the current position as the home.
- To achieve home offset (H05.40 = 0 or 2, H05.36 ≠ 0), set H05.36 and H05.40 first, and then set H05.30 to 6. Failing to do so will cause H0b.07 to keep the previous value of H05.36 rather than the one set currently.

11.2.9.5 Related Parameters

Parameters related to homing mode

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.30	Control of home return	0x051E	See "Parameter Description"	-	0	UInt16	At once	Ordinary user	At once

Parameter description:

Defines the homing mode and the trigger signal source.

Set value	Trigger signal	Remarks	
		Mode of home return	Trigger signal
0	Disabled	The homing function is disabled.	-
1	Homing enabled through HomingStart signal input from DI	Homing	DI function FunIN.32 (HomingStart, homing enable)
2	Electrical homing enabled through HomingStart signal input from DI	Electrical homing	DI function FunIN.32 (HomingStart, homing enable)
3	Homing started immediately upon power-on	Homing	S-ON signal active for the first time after power-on again in the position mode
4	Homing started immediately	Homing	S-ON signal active in the position mode After homing is done, set H05.30 to 0.
5	Electrical homing started	Electrical homing	S-ON signal active in the position mode After homing is done, set H05.30 to 0.
6	Homing on current position	Homing	Not required After homing is done, set H05.30 to 0.
8	Current position as the home enabled through signal input from DI	Homing	DI signal FunIN.41 (current position as the home)

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.31	Mode of home return	0x051F	See "Values".	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Forward, home switch as deceleration point and home 1: Reverse, home switch as deceleration point and home 2: Forward, Z signal as deceleration point and home 3: Reverse, motor Z signal as deceleration point and home 4: Forward, home switch as deceleration point and Z signal as home 5: Reverse, home switch as deceleration point and Z signal as home 6: Forward, positive limit switch as deceleration point and home 7: Reverse, negative limit switch as deceleration point and home 8: Forward, positive limit switch as deceleration point and Z signal as home 9: Reverse, negative limit switch as deceleration point and Z signal as home 10: Forward, mechanical limit position as deceleration point and home 11: Reverse, mechanical limit position as deceleration point and home 12: Forward, mechanical limit position as deceleration point and Z signal as home 13: Reverse, mechanical limit position as deceleration point and Z signal as home 14: Forward single-turn homing 15: Reverse single-turn homing 16: Nearby single-turn homing								
	Parameter description:								
	Defines the default motor direction of rotation, deceleration point, and home during homing.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.40	Mechanical home offset and action upon active limit signal	0x0528	See "Values".	-	0	UInt16	At stop	Ordinary user	At once

Values:

0: H05.36 as the coordinate after homing, reverse homing applied after homing triggered again upon overtravel
1: H05.36 as the relative offset after homing, reverse homing applied after homing triggered again upon overtravel
2: H05.36 as the coordinate after homing, reverse homing applied automatically upon overtravel3: H05.36 as the relative offset after homing, reverse homing applied automatically upon overtravel

Parameter description:

Defines the offset relationship between the mechanical home and mechanical zero, as well as the action upon overtravel during homing.

Set value	Mechanical home offset and action upon active limit signal	Remarks	
		Mechanical home	Action upon Active Limit Signal
0	H05.36 as the coordinate after homing, reverse homing applied after homing triggered again on overtravel	The mechanical home differs from the mechanical zero point. After homing, the motor stops at the home position and the home coordinate is forced to the value of H05.36.	After the homing enable signal is sent again, the servo drive performs homing in the reverse direction.
1	H05.36 as the relative offset after homing, reverse homing triggered on hitting the limit	The mechanical home is the same as the mechanical zero. After positioning the mechanical home, the motor continues to move according to the setting of H05.36 and then stops.	After the homing enable signal is sent again, the servo drive performs homing in the reverse direction.
2	H05.36 as the coordinate after homing, reverse homing auto-applied on overtravel	The mechanical home differs from the mechanical zero point. After homing, the motor stops at the home position and the home coordinate is forced to the value of H05.36.	The servo drive automatically continuous to perform homing in the reverse direction.
3	H05.36 as the relative offset after homing, reverse homing auto-applied on overtravel	The mechanical home is the same as the mechanical zero. After positioning the mechanical home, the motor continues to move according to the setting of H05.36 and then stops.	The servo drive automatically continuous to perform homing in the reverse direction.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.59	Positioning window time	0x053B	0 to 30000	ms	0	UInt16	At once	Ordinary user	At once
	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.								

If the home signal is activated before the deceleration triggered by an active deceleration point signal is completed, the final positioning may be unstable. Take the displacement required by deceleration into account before setting the deceleration point and home signal input position. The acceleration/deceleration time during homing (H05.34) also affect the positioning stability.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.32	Speed of home switch signal at high-speed searching	0x0520	0 to 3000	rpm	100	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the motor speed for searching for the deceleration point signal during homing.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.33	Speed of low-speed homing	0x0521	0 to 1000	rpm	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the motor speed for searching for the home signal during homing.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.34	Acceleration/ Deceleration time during homing	0x0522	0 to 1000	ms	1,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the time for the motor to accelerate from 0 rpm to 1000 rpm at a constant speed during homing.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.35	Duration limit of homing	0x0523	0–65535	ms	10,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets maximum time for searching the home.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.36	Mechanical origin offset	0x0524	-1073741824 to +1073741824	Reference unit	0	Int32	At once	Ordinary user	At once
	Parameter description:								
	Defines the absolute position value of the motor after homing.								

11.2.9.6 Related parameters

Code	Name	Function Name	Function
FunIN.31	HomeSwitch	Home switch	Active: Current position as home Set the logic of the DI assigned with FunIN.31 to "active high" or "active low" based on the output of the host controller. See the following table.
FunIN.32	HomingStart	Homing enable	Active: Homing enabled (The HomingStart signal cannot be triggered repeatedly during homing.) Inactive: Homing inhibited
FunIN.41	HomingRecord	DI-triggered point as the home	The edge-triggered position is taken as the home.
FunOut.16	HomeAttain	Homing completed	Active: Homing completed in position control mode Inactive: Homing not completed
FunOut.17	ElecHomeAttain	Electrical homing completed	Active: Electrical homing completed in position control mode Inactive: Electrical homing not completed

DI logic set by HomeSwitch	Actual active level
0 (Low level)	Low level
1 (High level)	High level
3 (Rising edge)	High level
4 (Falling edge)	Low level
5 (Edge transition)	Low level

11.3 Speed Control Mode

11.3.1 Overview

11.3.1.1 Function Description

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.

Set H02.00 (Mode selection) to 0 (Speed mode) through the operating panel or Inovance servo commissioning software to enable the speed control mode.

Application scenarios

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.

11.3.1.2 Working Principle

Function Block Diagram

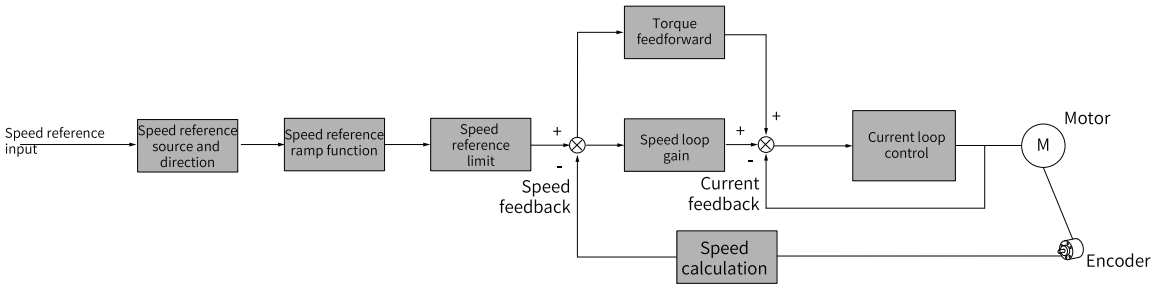


Figure 11-49 Block diagram of speed control

Signal exchange between the drive and the host controller

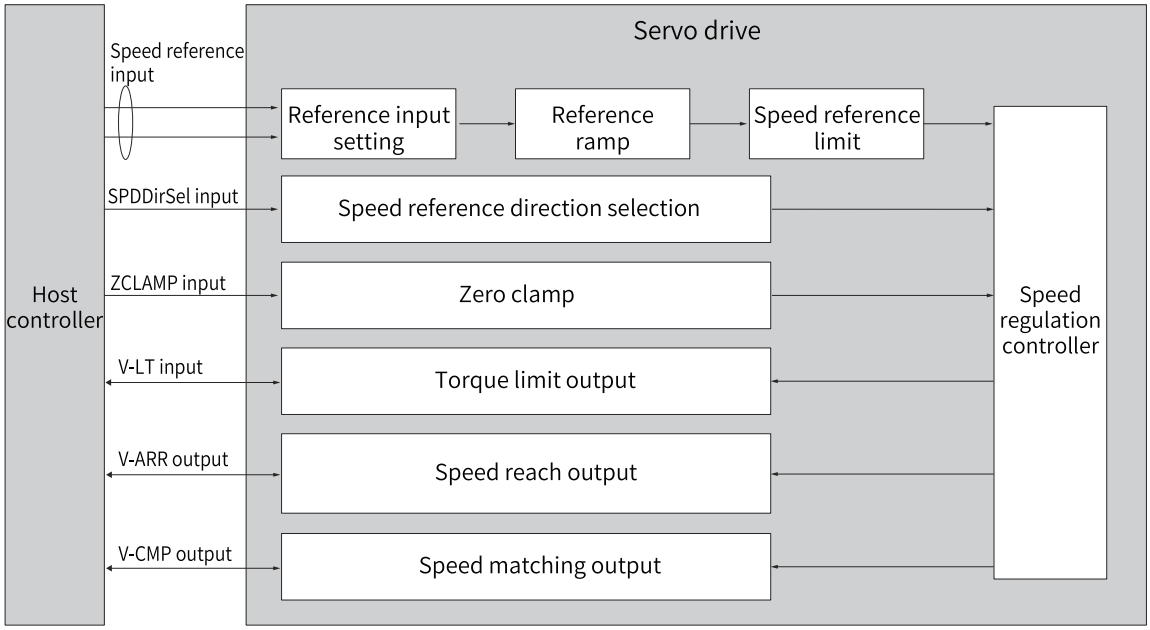


Figure 11-50 Signal exchange between the servo drive and the host controller

Parameter diagram

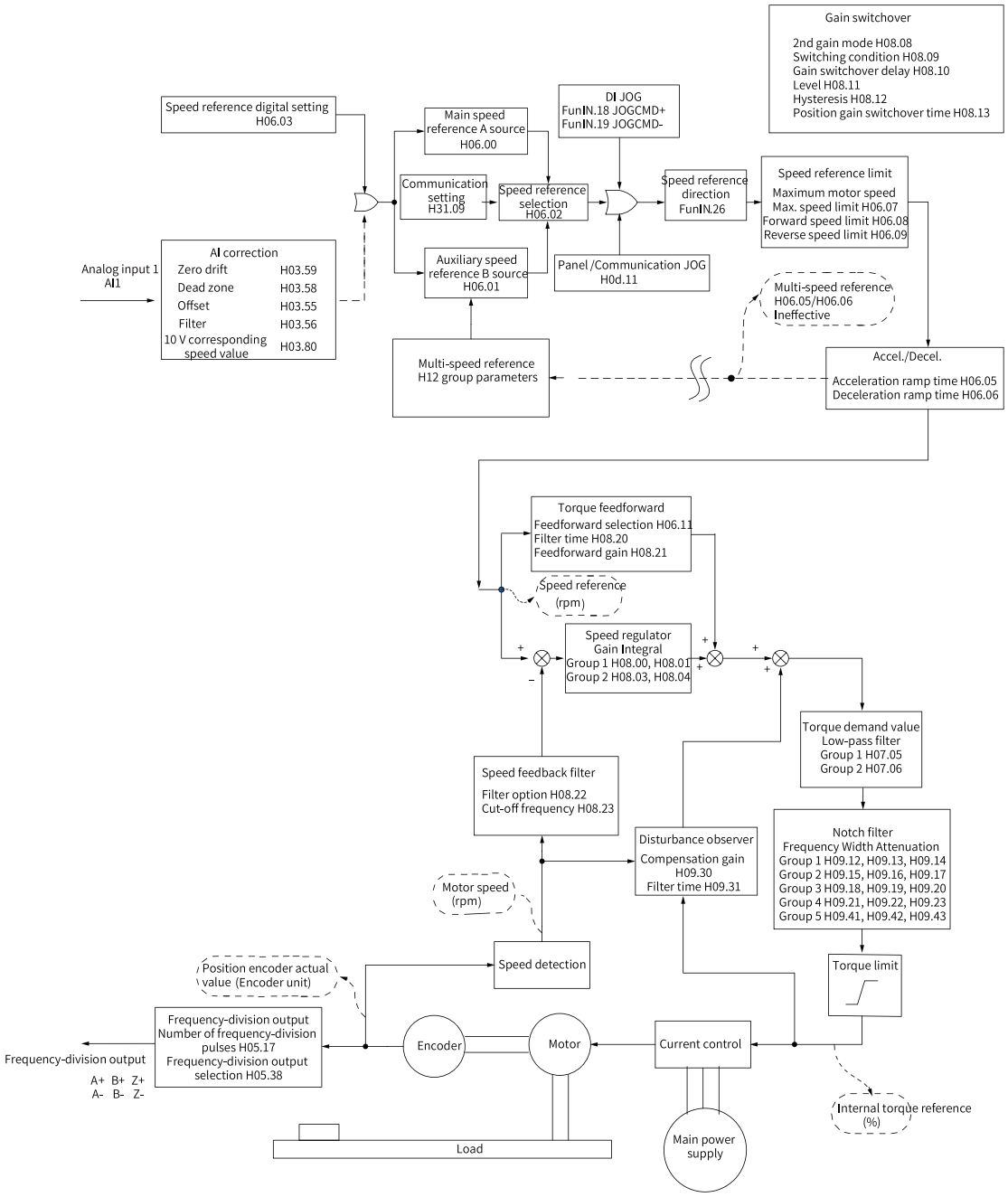


Figure 11-51 Block diagram of speed control mode parameters

11.3.1.3 Control mode setting guide

Step	Name	Description	
1	Select the speed control mode	Set H02.00 to 0.	
2	Defines the speed reference source.	Main speed command A source (H06.02=0)	
		Auxiliary speed command B source (H06.02=1)	*"Set multi-speed operation mode" on page 344*
			"Setting the multi-speed curve" on page 348
		Main speed command A source + Auxiliary speed command B source (H06.02=2)	
		Main command A source and auxiliary command B source switching (H06.02=3)	
		Communication setting (H06.02=4)	
3	Set the speed reference direction	*"11.3.2.2 Speed reference direction" on page 352*	
4	Other function setting	Ramp function setting	*"11.3.3 Ramp Function Setting" on page 353*
		Zero clamp	*"11.3.4 Zero Clamp" on page 354*
		Speed reference limit	*"11.3.5 Speed Reference Limit" on page 355*
		Speed-related DO	*"Speed-Related DO" on page 357*

11.3.2 Speed Reference Input Setting

Speed command input settings include: speed command source, speed command direction.

11.3.2.1 Speed reference source

Five speed reference sources are available in the speed control mode, which can be set in H06.02.

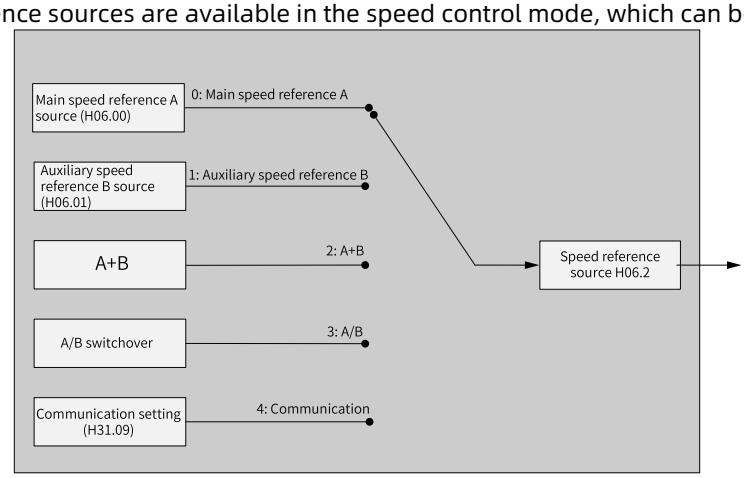


Figure 11-52 Speed reference source

<table>
<tr><th>Parameter</th><th>Name</th><th>Add.</th><th>Range</th><th>Unit</th><th>Default value</th><th>Data Format</th><th>Change Method</th><th>User Permissions</th><th>Effective Way</th></tr>
<tr><td>H06.02</td><td>Speed reference selection</td><td>0x0602</td><td>See "Parameter Description"</td><td>-</td><td>0</td><td>UInt16</td><td>At stop</td><td>Ordinary user</td><td>At once</td></tr>
<tr><td></td><td colspan="9">Parameter description:
Defines the source of speed references.
<table>
<tr><th>Set value</th><th>Control mode</th><th>Remarks</th></tr>
<tr><td>0</td><td>Main speed reference A source</td><td>The reference source is defined by H06.00.</td></tr>
<tr><td>1</td><td>Auxiliary speed command B source</td><td>The reference source is defined by H06.01.</td></tr>
<tr><td>2</td><td>A + B</td><td>The reference source is the product of A + B (H06.00 + H06.01).</td></tr>
<tr><td>3</td><td>Switched between A and B</td><td>The reference source is switched between A and B as defined by FunIN.4 (Cmd_SEL).
<table>
<tr><th>State of FunIN.4 (Cmd_ SEL)</th><th>Reference Source</th></tr>
<tr><td>OFF</td><td>Main speed reference A source</td></tr>
<tr><td>ON</td><td>Auxiliary speed command B source</td></tr>
</table></td></tr>
<tr><td>4</td><td>Communication setting</td><td>The speed reference is defined by operating on H31.09 through communication (unit: 0.001 RPM).</td></tr>
</table></td></tr>
</table>

11.3.2.1.1 Source of main speed reference A: H06.02=0

The main speed reference A is an internal speed reference that can be set through digital setting.

The speed reference is set in H06.03.

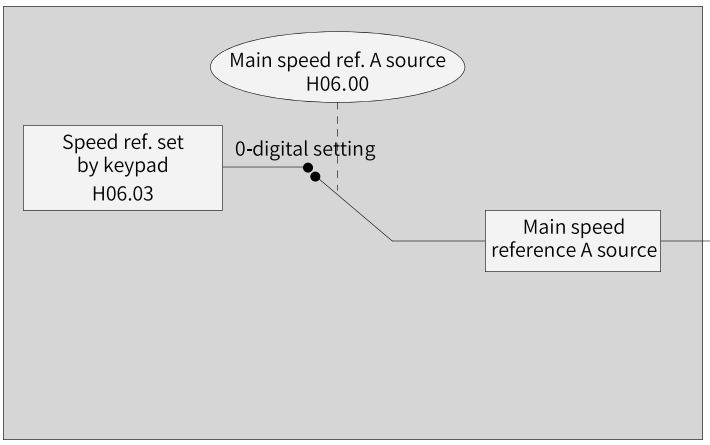


Figure 11-53 Source of main speed reference A

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.00	Main speed reference A source	0x0600	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Digital setting (H06.03)								
	Parameter description:								
	Defines the source of main speed reference A.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.03	Keypad setting value of speed reference	0x0603	-7000 to 7000	rpm	200	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines the speed reference value set through the keypad.								

11.3.2.1.2 Source of auxiliary speed reference B: H06.02=1

The auxiliary speed reference B sources include digital setting and multi-speed references. Both are internal speed references.

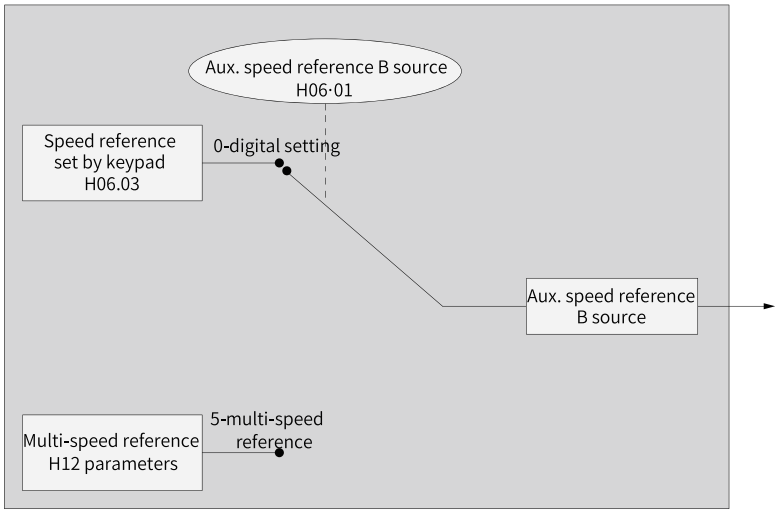


Figure 11-54 Source of auxiliary speed reference B

The digital setting method is the same as the main speed command A source. .

The servo drive supports multi-speed operation, in which 16 multi-speed references can be saved in the servo drive. The maximum operating speed, operating time, and acceleration/deceleration time (four groups) can be set separately for each multi-speed reference.

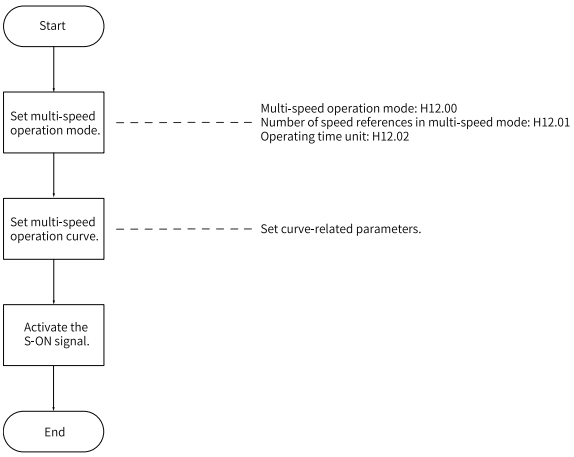


Figure 11-55 Multi-speed reference setting flowchart

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.01	Auxiliary speed command B source	0x0601	See "Values".	-	5	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Digital setting (H06.03) 5: Multi-speed reference								
	Parameter description:								
	Defines the source of auxiliary speed reference B.								

Set the multi-speed operation mode.

You can assign FunIN.5 (DIR-SEL) to an external DI to select the multi-speed operation direction.

Relevant function No.:

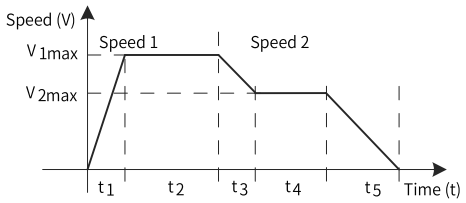
Code	Name	Function Name	Function
FunIN.5	DIR-SEL	Multi-reference direction	Inactive: Reference direction by default Active: Opposite to the reference direction

The following takes "H12.01 = 2" as an example to describe each mode.

- **Individual operation (H12.00 = 0)**
  Set H12.00 to 0 to select the individual operation mode.

Set H12.01 and H12.02 as needed. Then set the reference value, operating time, and acceleration/deceleration time of each speed. The drive executes multi-speed references in a sequence from speed 1 to speed N. After all the speeds are executed, the drive stops.

Table 11–19 Description of individual operation

Mode description	Operation curve
• The drive stops after one cycle of operation. • The drive switches to the next displacement automatically.	 • V_{1max} , V_{2max} : 1st and 2nd speeds • t_1 : actual acceleration/deceleration time of 1st speed • t_3 , T_5 : actual acceleration/deceleration time of 2nd speed • Operation time of a certain speed = Speed change time from previous speed reference switched over to the current speed reference + Average operation time (For example, the operating time of speed 1 is the sum of t_1 +t_2 , the second running time is t_3 +t_4 , and so on). • Do not set the operating time of a certain speed to 0. Otherwise, the drive skips this speed and switches to the next speed directly. • The speed reach signal is activated when the motor speed feedback reaches the maximum operating speed set for this speed. • If the servo ON signal becomes OFF during running of a certain speed, the servo motor stops according to the stop mode in H02.05.

★Terms:

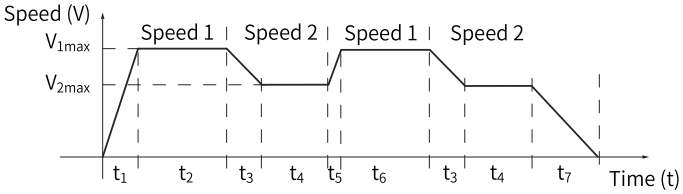
A complete operation cycle covers all the multi-speed references defined by H12.01.

- **Cyclic operation (H12.00 = 1)**

  Set H12.00 to 1 to select the cyclic operation mode.

  Set H12.01 and H12.02 based on the number of speeds and the operating time unit. Then set the reference value, operating time and acceleration/deceleration time for each speed. The drive executes the set speeds in a sequence from speed 1 to speed N (last speed). After all the speeds are executed, the drive jumps to speed 1 and repeats the preceding process.

Table 11–20 Descriptions of cyclic operation

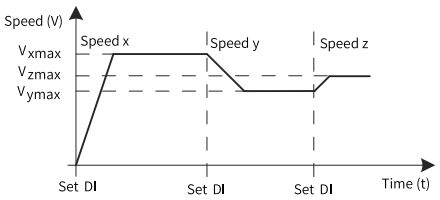
Mode description	Operation curve
• The drive starts from displacement 1 again after each cycle of operation. • The drive switches to the next displacement automatically. • The cyclic running state remains if the servo ON signal is active.	 • V_{1max}, V_{2max}: maximum values of 1st and 2nd speeds. • Running time of a certain speed = Speed change time from previous speed reference switched over to the current speed reference + Average running time (For example, the first running time is t_1+t_2, the second running time is t_3+t_4, and so on). • Do not set the operating time of a certain speed to 0. Otherwise, the drive skips this speed and switches to the next speed directly. • The speed reach signal is activated when the motor speed feedback reaches the maximum operating speed set for this speed. • If the servo ON signal becomes OFF during running of a certain speed, the servo motor stops according to the stop mode in H02.05.

- **DI-based operation (H12.00 = 2)**

  Set H12.00 to 2 to select DI-based operation.

  Set H12.01 and H12.02 based on the number of speeds to be executed and the operating time unit. Then set the reference value, operating time and acceleration/deceleration time for each speed. The drive executes the speed references according to ON/OFF combination of the external DIs (CMDx).

Table 11–21 Descriptions of DI-based operation

Mode description	Operation curve
• The drive operates continuously as long as the S-ON signal is active. • The speed No. is determined by the DI logic. • The interval time between displacements is determined by the command delay of the host controller. • The multi-speed reference is edge-triggered.	 • x and y: speed No. (The relationship between the speed No. and the DI logic is described below.) • The operation time is independent of the parameter setpoint. If the speed No. changes during operation, the drive switches to the new speed No. immediately. • The speed reach signal is activated when the motor speed feedback reaches the maximum operating speed set for this speed. • If the servo ON signal becomes OFF during running of a certain speed, the servo motor stops according to the stop mode in H02.05.

When the multi-speed operation mode is set to DI switching, you can execute the corresponding speed no. reference by configuring the combined DI terminal functions (FunIN.6 to FunIN.9 for multi-reference switchover) and determining the valid logic of the DI terminals. In addition, assign FunIN.5 (DIR-SEL, direction selection in DI-based multi-speed operation) to a certain DI to switch the speed reference direction.

Relevant function No.:

Code	Name	Function Name	Function
FunIN.5	DIR-SEL	Setting of multi-speed DI switchover running direction	Defines the speed reference direction in DI-based operation mode. Inactive: Reference direction Active: Opposite to the reference direction
FunIN.6	CMD1	Multi-reference switchover 1	The speed No. is a 4-bit binary value. The relationship between the speed no. and CMD1 to CMD4 is shown in *"Table 11-22" on page 347*. The DI logic is level-triggered. The CMD value is 1 upon active level input or 0 upon inactive level input.
FunIN.7	CMD2	Multi-position reference switchover 2	
FunIN.8	CMD3	Multi-position reference switchover 3	
FunIN.9	CMD4	Multi-reference switchover 4	

Table 11–22 Relationship between the speed No. and CMD1 to CMD4

CMD4	CMD3	CMD2	CMD1	Speed No.
0	0	0	0	1
0	0	0	1	2
…				
1	1	1	1	16

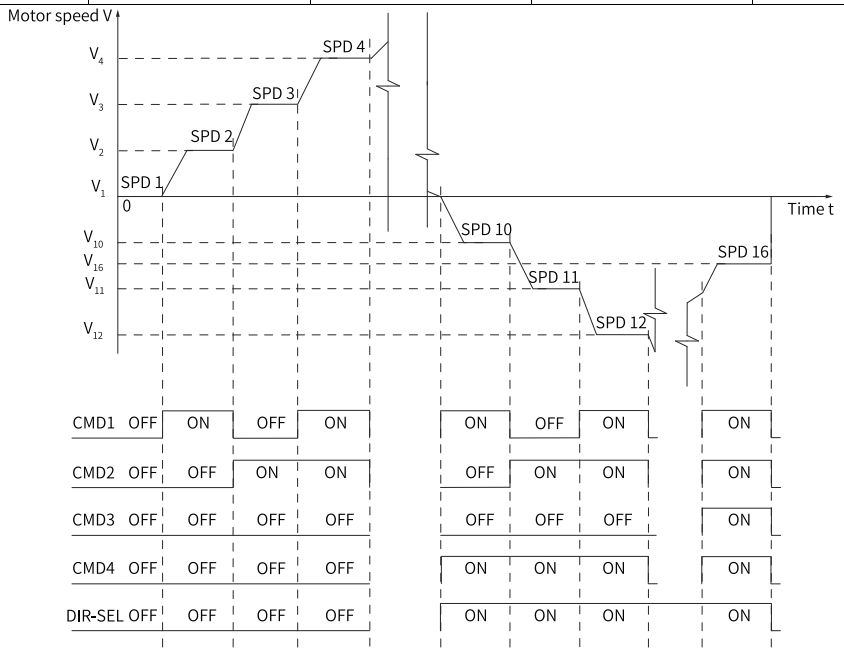


Figure 11-56 Example of multi-speed curve

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.00	Multi-speed running mode	0x1200	See "Values".	-	1	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Stop after running for one cycle (number of speeds defined by H12.01) 1: Cyclic operation (number of speeds defined by H12.01) 2: DI-based operation								
	Parameter description:								
	Defines the multi-speed operation mode when the speed reference source is multi-speed reference (H06.01 = 5, H06.02 = 1/2/3) in the speed control mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.01	End speed No. in speed reference	0x1201	1 to 16	-	16	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	It sets the total number of speed references. Different speed references, operating time, and acceleration/deceleration time (four groups optional) can be set for each speed. H12.00 is not 2: Speeds are switched automatically in a sequence from 1, 2...H12.01. H12.00 is 2: Assign four DIs (Hardware DI or VDI) with DI functions 6 to 9 (FunIN.6: CMD1 to FunIN.9: CMD4) and control the DI logic through the host controller to switch between different speeds.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.02	Running time unit	0x1202	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: sec 1: min								

Setting the multi-speed curve

For speed references in multi-speed operation mode, besides the reference value and operating time, four groups of acceleration/deceleration time options are also available. There is no acceleration/deceleration time by default.

The following describes the actual acceleration/deceleration time and the operating time in cases where H12.00 (Multi-speed operation mode) is set to 1 (Individual operation).

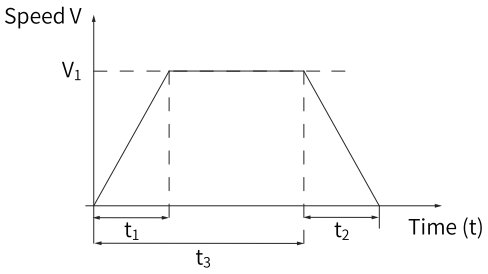


Figure 11-57 Example of multi-speed curve

As shown in the above figure, the velocity command for this segment is V_1, and the actual acceleration time t_1:

$$t_1 = \frac{V_1}{1000} \times \text{Acceleration time set for this speed}$$

Actual deceleration time t_2:

$$t_2 = \frac{V_1}{1000} \times \text{Deceleration time set for this speed}$$

Operation time = Time taken in switching from the last speed to present speed + Duration of constant-speed operation at present speed (as shown by t_3.

For the parameter settings of the other 15 displacements, see *" Parameter description" on page 408*.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.03	Acceleration time 1	0x1203	0-65535	ms	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.04	Deceleration time 1	0x1204	0-65535	ms	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.09	Acceleration time 4	0x1209	0–65535	ms	150	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.10	Deceleration time 4	0x120A	0–65535	ms	150	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.20	1st speed reference	0x1214	-7000 to +7000	rpm	0	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines speed reference 1 in multi-speed operation mode.								

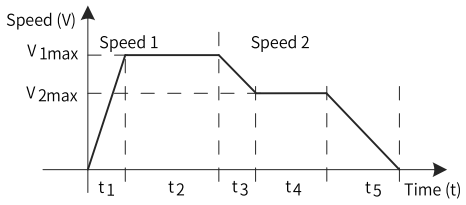
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.21	Running time of 1st speed reference	0x1215	0.0 to 6553.5	s(m)	5.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the running time of the 1st speed reference. If the running time is 0, the servo drive automatically ignores this speed reference.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.22	Acceleration/ Deceleration time of 1st speed reference	0x1216	See "Parameter Description"	-	0	UInt16	At once	Ordinary user	At once

Parameter description:

Sets the acceleration/deceleration time of the 1st speed reference.

Set value	Acceleration/Deceleration time	Remarks
0	Zero acceleration/deceleration time	Acceleration time: 0 Deceleration time: 0
1	Acceleration/Deceleration time 1	Acceleration time: H12.03 Deceleration time: H12.04
2	Acceleration/Deceleration time 2	Acceleration time: H12.05 Deceleration time: H12.06
3	Acceleration/Deceleration time 3	Acceleration time: H12.07 Deceleration time: H12.08
4	Acceleration/Deceleration time 4	Acceleration time: H12.09 Deceleration time: H12.10



- V_{1max} , V_{2max} : 1st and 2nd speeds
- t_1 : actual acceleration/deceleration time of 1st speed
- t_3 , T_5 : actual acceleration/deceleration time of 2nd speed
- Running time of a certain speed = Speed change time from previous speed reference switched over to the current speed reference + Average running time (For example, the first running time is t) $_1$ +t_2 , the second running time is t_3 +t_4 , and so on).
- Do not set the operating time of a certain speed to 0. Otherwise, the drive skips this speed and switches to the next speed directly.

Actual acceleration time t_1 :

$$t_1 = \frac{V_1}{1000} \times \text{Acceleration time set for this speed}$$

Actual deceleration time t_2 :

$$t_2 = \frac{V_1}{1000} \times \text{Deceleration time set for this speed}$$

11.3.2.1.3 Main speed reference A source + Auxiliary speed reference B source (H06.02=02)

The speed reference is defined by both H06.00 (Main speed reference A source) and H06.01 (Auxiliary speed reference B source).

11.3.2.1.4 Main reference A source and auxiliary reference B source switching (H06.02=3)

When setting H06.02 (speed reference source) to 3 (Switched between A and B), you need to assign FunIN.4 (DI-SEL) to the corresponding DI. The input signal of this DI determines which source (A or B) is active.

Relevant function No.:

Code	Name	Function Name	Description
FunIN.4	CMD-SEL	Main/Auxiliary reference switchover	Inactive: Current reference being A Active: Current reference being B

11.3.2.1.5 Communication setting (H06.02=4)

When H06.02 (Speed reference source) is set to 4 (Communication), the speed reference is the setpoint of H31.09. H31.09 is not displayed on the keypad, it can be set through communication only.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H31.09	Speed reference set via communication	0x3109	-9000000 to +9000000	rpm	0	Int32	At once	Ordinary user	At once
	Parameter description:								
	Sets the speed reference (accurate to 0.001 RPM) when the speed reference source is communication in the speed control mode. The setpoint of H31-09 is a 32-bit value, which is not displayed on the keypad. It can only be set through communication.								

11.3.2.2 Speed reference direction

A DI terminal with FunIN.26 (SPDDirSel, speed reference direction selection) is used to change the speed reference direction.

Relevant function No.:

Code	Name	Function Name	Description
FunIN.26	SPDDirSel	Speed reference direction	Inactive: Forward direction Invalid: Reverse direction

The actual motor direction is determined by the rotation direction specified in parameter H02.02, speed reference direction, and DI switchover of speed reference direction (FunIN.26).

Table 11–23 Actual motor rotation direction in the speed control mode

H02.02 setpoint	Positive/Negative of Speed Reference	FunIN.26	Actual Motor Rotating Direction
0	+	OFF	CCW
0	+	ON	Clockwise
0	-	OFF	Clockwise
0	-	ON	CCW
1	+	OFF	Clockwise
1	+	ON	CCW
1	-	OFF	CCW
1	-	ON	Clockwise

11.3.3 Ramp Function Setting

Function Description

The ramp function is used to smooth the acceleration rate of speed references through acceleration/deceleration time setting.

In speed control mode, a high acceleration rate easily leads to motor jerk or intense vibration. In this case, increasing the acceleration/deceleration time smooths the motor speed change, preventing mechanical damage caused by jerk or vibration.

Caution

- When the speed reference source is digital setting or jog speed, the acceleration time and deceleration time are set in H06.05 and H06.06.
- When the speed reference source is a multi-speed reference, the acceleration time and deceleration time are set in parameter group H12. For details, see *" Parameter description" on page 408*.

Working Principle

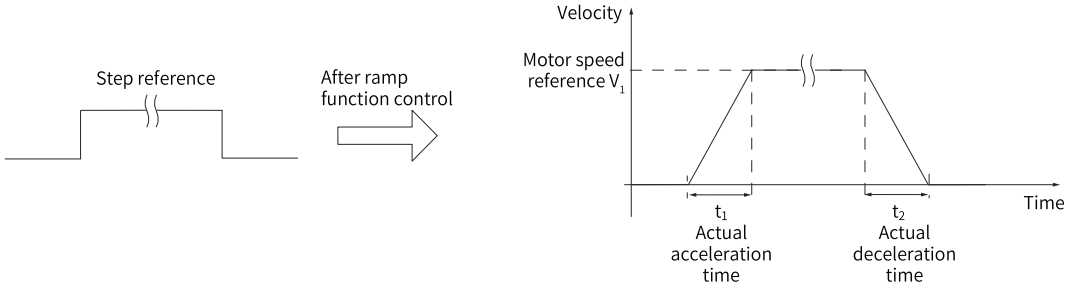


Figure 11-58 Ramp function definition

- 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 acceleration and deceleration time are as follows:

$$\text{Actual acceleration time } t_1 = \frac{\text{Speed reference}}{1000} \times \text{Acceleration ramp time of speed reference}$$

$$\text{Actual deceleration time } t_2 = \frac{\text{Speed reference}}{1000} \times \text{Deceleration ramp time of speed reference}$$

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.05	Acceleration ramp time constant of speed reference	0x0605	0–65535	ms	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the acceleration/deceleration ramp time of speed reference. The acceleration/ deceleration 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 acceleration and deceleration time are as follows: Actual acceleration time t1 = Speed reference/1000 x Speed reference acceleration ramp time Actual deceleration time t2 = Speed reference/1000 x Speed reference deceleration ramp time								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.06	Deceleration ramp time constant of speed reference	0x0606	0–65535	ms	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the acceleration/deceleration ramp time of speed reference. The acceleration/ deceleration time constant of multi-speed references are defined only by parameters in group H12.								

11.3.4 Zero Clamp

Function Description

In the speed control mode, if FunIN.12 (ZCLAMP) is enabled, and the speed reference amplitude is smaller than or equal to the value of H06.15, the motor enters zero position clamp state. In this case, a position loop is built inside the drive and the speed reference is invalid.

The motor is clamped within ±1 pulse of the position at which zero clamp is activated. Even if it rotates due to external force, it will return to the zero position and be clamped.j

When the speed reference amplitude is larger than the value of H06.15, the servo motor exits the zero speed clamp state and continues running according to the input speed reference. If the signal of the DI terminal with FunIN.12 (ZCLAMP) is inactive, the zero speed clamp function is disabled.

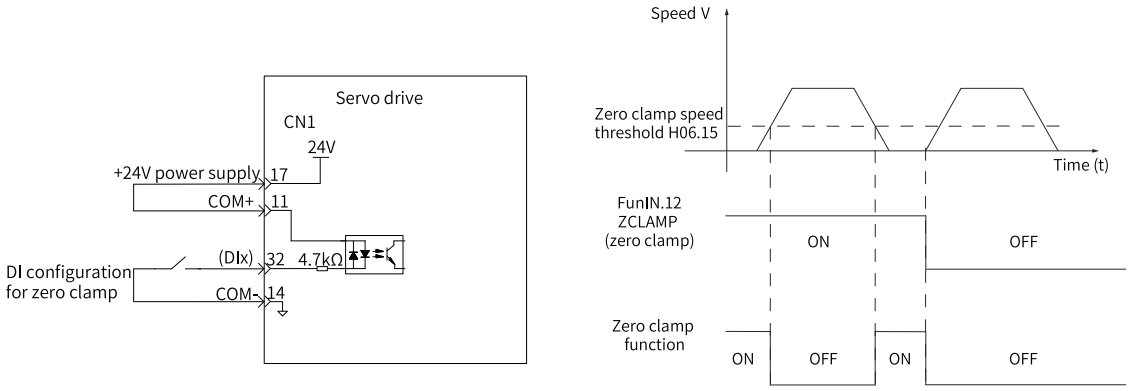


Figure 11-59 Wiring and waveform of zero clamp

Relevant function No.:

Code	Name	Function Name	Description
FunIN.12	ZCLAMP	Zero speed clamp	Invalid: Zero clamp disabled Valid: Zero clamp enabled

Application scenarios

- The zero speed clamp function is used in systems where the host controller does not construct the position loop in speed control mode.
- If servo motor oscillation occurs in zero speed clamp state, tune the position loop gain.

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.15	Zero clamp speed threshold	0x060F	0 to 7000	rpm	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the zero clamp speed threshold.								

11.3.5 Speed Reference Limit

Function Description

In speed control mode, the sources of speed reference limit include:

- H06.07 specifies speed limit of speed reference in both forward and reverse directions. If speed reference exceeds the setting of H06-07, the speed reference will be limited as this value.
- H06.08 specifies the forward speed limit. If forward speed reference exceeds the setting of H06-08, the reference will be limited as this value.
- H06.09 specifies the reverse speed limit. If reverse speed reference exceeds the setting of H06-09, the reference will be limited as this value.
- Maximum speed of the motor (default threshold): Depends on the motor model.

Application Example

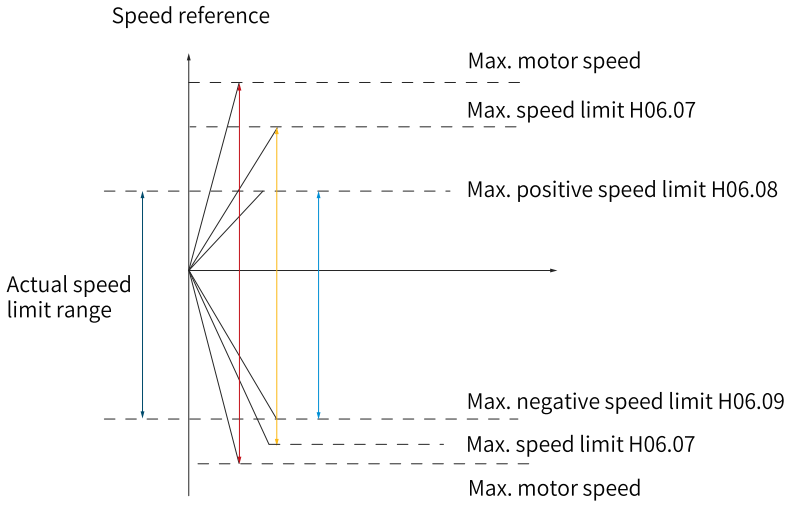


Figure 11-60 Example of speed reference limit

The actual motor speed limit meets the following requirements:

- |Forward speed limit| ≤ min {maximum motor speed, H06.07, H06.08}
- |Reverse speed limit| ≤ min {maximum speed of the motor, H06.07, H06.09}

Note:

The speed reference limit value shall be less than the over-speed fault threshold (H0A.08). When the motor actual speed exceeds the over-speed fault threshold, the servo drive will trigger a motor over-speed fault (E500.0).

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.07	Max. speed limit	0x0607	0 to 7000	rpm	6,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the maximum speed limit.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.08	Forward speed threshold	0x0608	0 to 7000	rpm	6,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the forward speed threshold.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.09	Reverse speed threshold	0x0609	0 to 7000	rpm	6,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the reverse speed threshold.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.08	Overspeed threshold	0x0A08	0 to 10000	rpm	0	UInt16	At once	Ordinary user	At once
	Parameter description:								

It sets the motor speed threshold at which the overspeed fault is detected.

Set value	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 10000	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.	

11.3.6 Speed-Related DO

Different DO signals are output to the host controller based on comparison between the speed feedback after filter and different thresholds. The corresponding filter time parameter is set by the speed DO filter time constant (H0A.27).

Motor rotation DO signal

When the absolute value of the filtered motor actual speed reaches the motor speed threshold (H06.16), the motor rotation occurred. In this case, the drive outputs the motor rotation signal (FunOUT.2: TGON) to acknowledge that the motor is rotating. When the absolute value of the actual motor speed after filter is smaller than the value of H06.16, the motor is considered not rotating.

Judgment on the motor rotation signal (FunOUT.2, TGON) is not affected by the operating state or control mode of the drive.

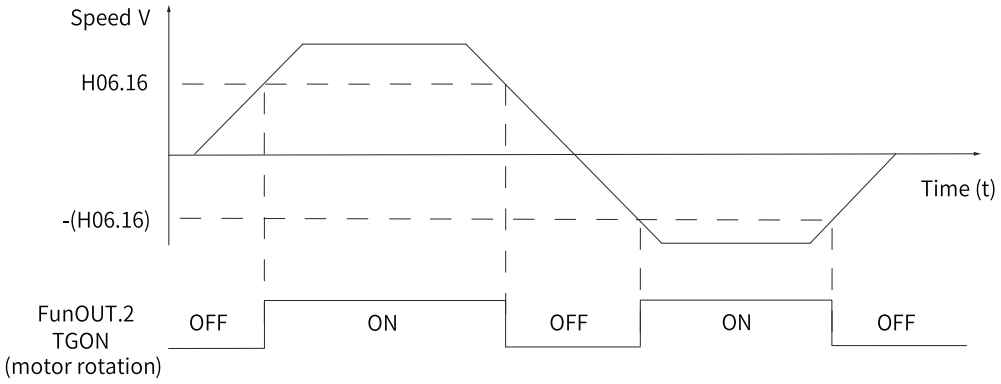


Figure 11-61 Waveform of motor rotation (TGON) signal

Note

In the preceding figure, ON indicates that the motor rotation DO signal is active. OFF indicates that the motor rotation DO signal is inactive.

To use the TGon signal, assign a DO with FunOUT.2 (TGon, motor rotation) and set the active logic of this DO.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.2	TGon	Motor rotation	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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.16	Motor rotation speed threshold	0x0610	0 to 1000	rpm	20	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of TGON (motor rotation) signal.								

Speed matching DO signal

In speed control, when the absolute value of the difference between the motor speed after filter and the speed reference satisfies the setting of H06.17, the actual motor speed is considered to reach the speed reference. At this moment, the servo drive outputs the speed matching signal (FunOUT.4: V-CMP). When the absolute value of the difference between the motor speed after filter and the speed reference exceeds the setting of H06-17, the speed matching signal is inactive.

If the drive is not in the operational state or the speed control mode, the speed matching signal (FunOUT.4: V-Cmp) is always inactive.

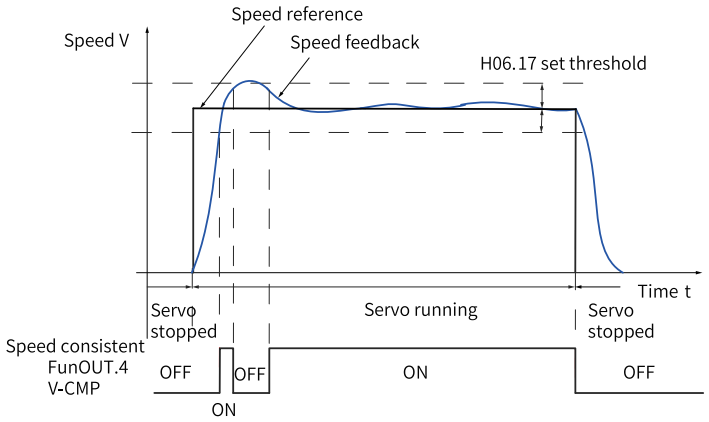


Figure 11-62 Waveform of speed matching (V-Cmp) signal

Note

In the preceding figure, "ON" indicates the the V-Cmp (speed matching) signal is active. "OFF" indicates the V-Cmp signal is inactive.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.4	V-Cmp	Speed match	Inactive: The absolute difference between the filtered actual motor speed and the speed reference is higher than the value of H06.17. Active: The absolute difference between the filtered actual motor speed and the speed reference is lower than or equal to the value of H06.17.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.17	Threshold of speed match signal	0x0611	0 to 100	rpm	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of speed matching signal.								

Speed reach DO signal

When the absolute value of the motor speed after filter exceeds the setting of H06.18, the motor speed is acknowledged to reach the desired value. At this moment, the servo drive outputs the speed reached signal (FunOUT.19: V-Arr). When the absolute value of the motor speed after filter is smaller than or equal to the setting of H06-18, the speed arrival signal is inactive.

Acknowledgment of the speed reach (FunOUT.19: V-Arr) signal is not affected by the operating state or control mode of the drive.

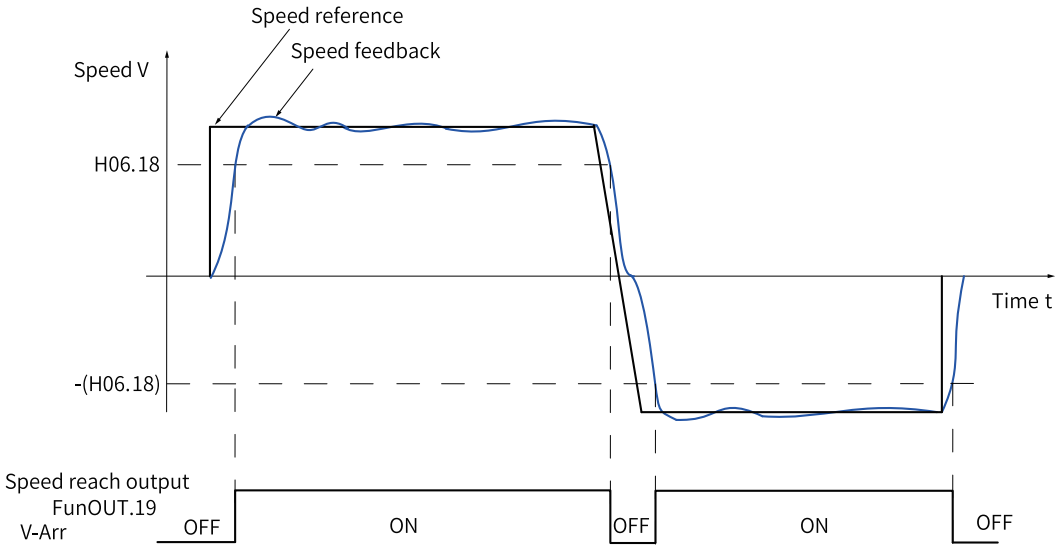


Figure 11-63 Waveform of the speed reach (V-Arr) signal

Note

In the preceding figure, ON indicates that the speed reached DO signal is active. OFF indicates that the speed reached DO signal is inactive.

To use the V-Arr signal, assign FunOUT.19 (V-Arr, speed reach) to a DO and set the active logic of this DO.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.19	V-Arr	Speed reach	Inactive: The absolute value of filtered motor speed feedback exceeds H06.18. Active: The absolute value of filtered motor speed feedback is lower than or equal to the value of H06.18.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.18	Threshold of speed reached signal	0x0612	10 to 7000	rpm	1,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of speed reached signal.								

Zero speed DO signal

When the absolute value of the motor speed after filter is smaller than the setting of H06.19, the motor speed is considered to be close to 0. At this moment, the servo drive outputs the zero speed signal (FunOUT.3: V-Zero). When the absolute value of the motor speed after filter is equal to or large than to the setting of H06-19, the zero speed signal is inactive.

Acknowledgment of the zero speed (FunOUT.3: V-Zero) signal is not affected by the operating state and control mode of the drive.

The interference in the speed feedback can be filtered by the speed feedback DO filter. You can set the corresponding filter time constant in H0A.27.

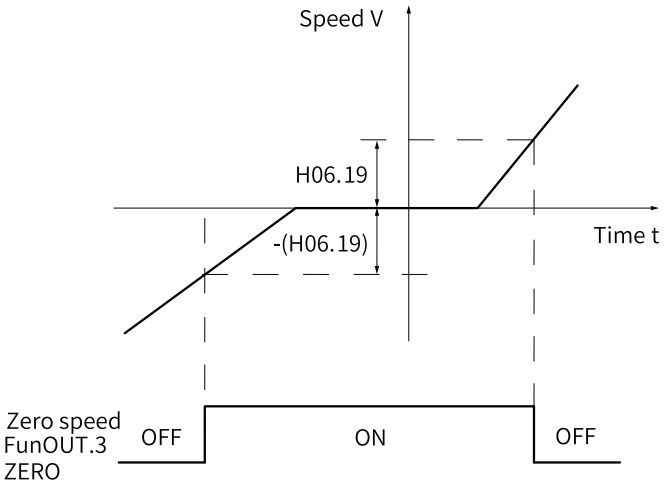


Figure 11-64 Waveform of the zero speed (V-Zero) signal

Note

In the preceding figure, "ON" indicates the V-Zero (zero speed) signal is active. "OFF" indicates the V-Zero (zero speed) signal is inactive.

Set a DO terminal of the servo drive with function 3 (FunOUT.3: ZERO, zero speed) and set the terminal logic.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.3	V-Zero	Zero speed signal	Inactive: The difference between motor speed feedback and the reference value is higher than the setpoint of H06.19. Active: The difference between motor speed feedback and the reference value is lower than or equal to the value of H06.19.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.19	Threshold of zero speed output signal	0x0613	1 to 7000	rpm	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of zero speed output signal.								

11.4 Torque control mode

11.4.1 Overview

11.4.1.1 Function Description

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.

Set H02.00 (Control mode selection) to 2 (Torque control mode) through the keypad or the Inovance software tool to make the drive operate in the torque control mode. Set the drive parameters based on the mechanical structure and technical specifications.

Application scenarios

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.

11.4.1.2 Working Principle

Function Block Diagram

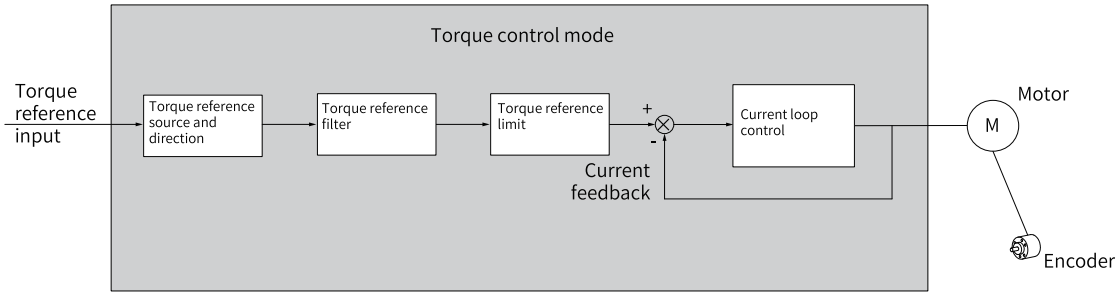


Figure 11-65 Torque control block diagram

Signal exchange between the drive and the host controller

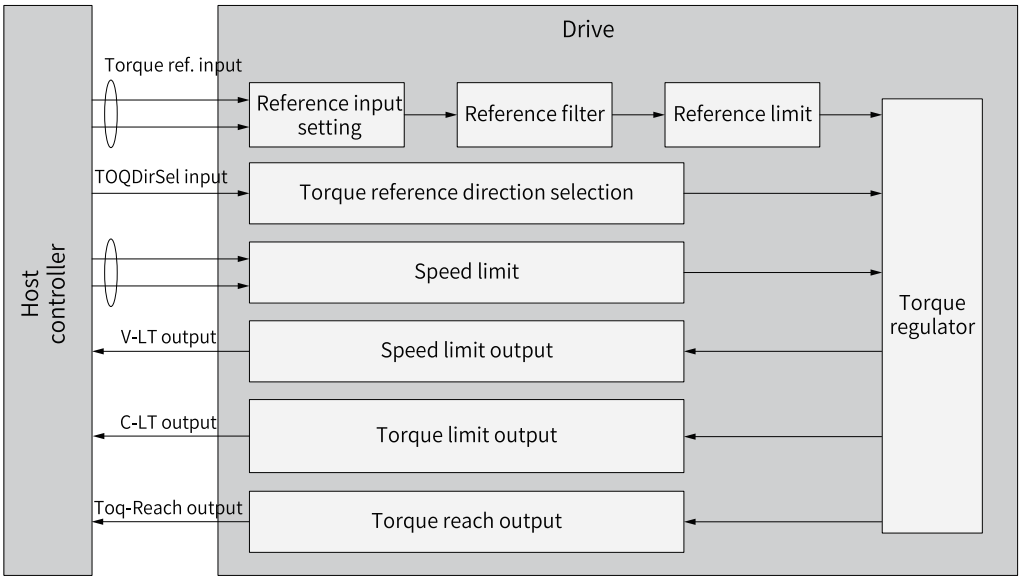


Figure 11-66 Signal exchange between the servo drive and the host controller

Parameter diagram

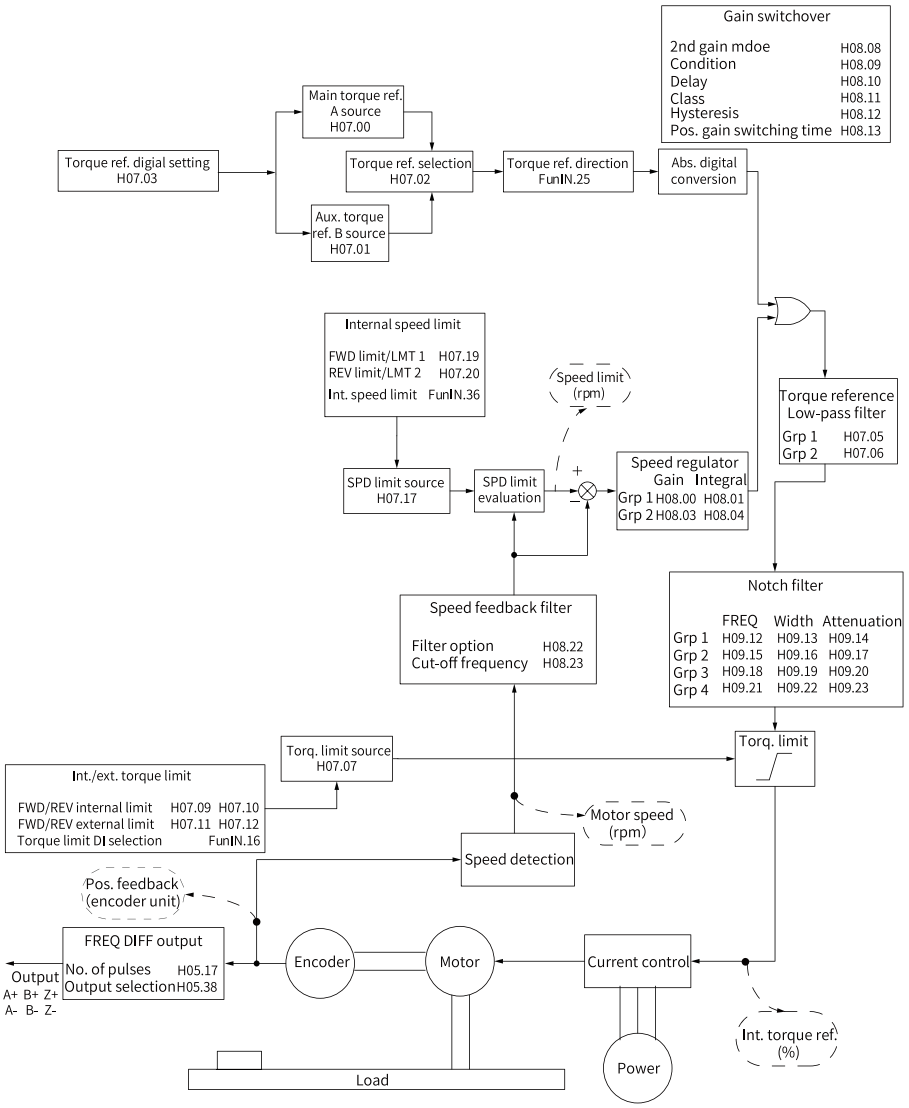


Figure 11-67 Block diagram of torque control parameters

11.4.1.3 Control mode setting guide

Step	Name	Description	
1	Select the reference control mode	Set H02.00 to 2.	
2	Defines the torque reference source.	Main torque command A source (H06.02=0)	*"11.4.2.1.1 Main torque command A source (H07.02=0)" on page 366*
		Communication setting (H07.02=4)	*"11.4.2.1.2 Communication setting (H07.02=4)" on page 367*
3	Torque reference direction	*"11.4.2.2 Torque reference direction" on page 367*	

Step	Name	Description	
4	Other function setting	Torque Reference Filter	*"11.4.3 Torque Reference Filter" on page 368*
		Torque Reference Limit	*" Torque Reference Limit" on page 369*
		Speed Limit in Torque Control	*" Speed Limit in Torque Control" on page 374*
		Torque Reach Output	*"11.4.6 Torque Reach Output" on page 378*

11.4.2 Torque Reference Input Setting

Torque reference input settings include: torque reference source, torque reference direction.

11.4.2.1 Torque reference source

Two torque reference sources are available in torque control mode, which can be set in H07.02.

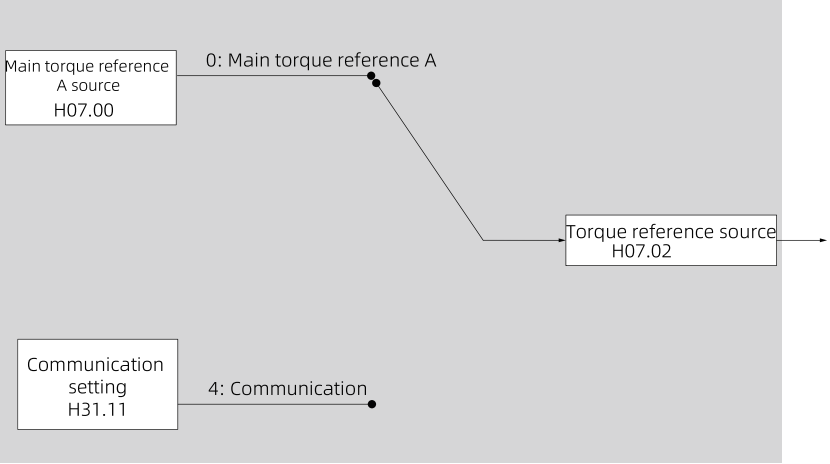


Figure 11-68 Selection of torque reference source

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.02	Torque reference source	0x0702	See "Values".	-	0	UInt16	At stop	Ordinary user	At once

Values:

0: Main torque command A source
4: Communication

Parameter description:

Defines the torque reference.

H07.02 setpoint	Control mode	Remarks
0	Sources of main torque reference A	The reference source is defined by H07.00.
4	Via communication	The torque reference is defined by operating on H31.11 through communication.

11.4.2.1.1 Main torque command A source (H07.02=0)

The main speed reference A is an internal speed reference that can be set through digital setting.

The speed reference is set in H07.03. The setpoint of H07.03 is the percentage of the torque reference to the rated torque of the motor.

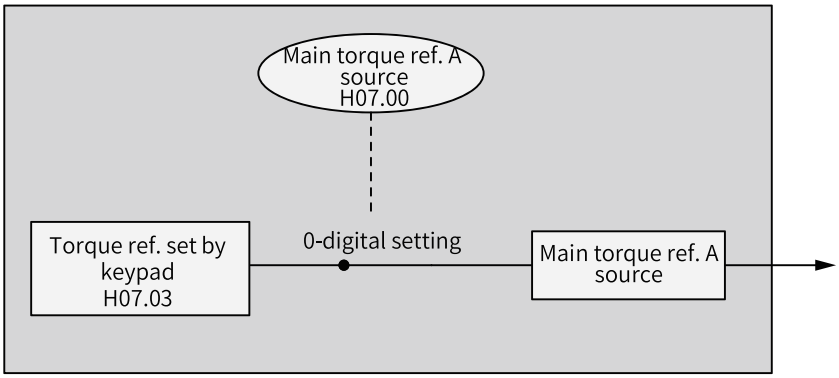


Figure 11-69 Description of main torque reference A sources

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.00	Torque reference source	0x0702	See "Parameter Description"	-	0	UInt16	At stop	Ordinary user	At once

Parameter description:

Defines main torque reference A.

Set value	Reference source	Instruction receiving method
0	Keypad (H07.03)	Torque reference A is set by H07.03.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.03	Keypad setting value of torque reference	0x0703	-400.0 to +400.0	%	0.0	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference value set through keypad.								

11.4.2.1.2 Communication setting (H07.02=4)

When H07.02 (Torque reference source) is set to 4 (Communication), the torque reference is the value of H31.11. H31.11 is not displayed on the keypad, it can be set through communication only.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H31.11	Torque reference set via communication	0x310B	-100000 to +100000	%	0	Int32	At once	Ordinary user	At once
	Parameter description:								
	Sets the torque reference (accurate to 0.001%) when the torque reference source is communication in the torque control mode. The setpoint 100.000% corresponds to the rated torque of the motor. The setpoint of H31.11 is a 32-bit value, which is not displayed on the keypad. It can only be set through communication.								

11.4.2.2 Torque reference direction

To switch the torque reference direction through the DI, assign FunIN.25 (TorDirSel, torque reference direction) to the corresponding DI. The input signal of this DI determines the torque reference direction.

Relevant function No.:

Code	Name	Function Name	Description
FunIN.25	ToqDirSel	Torque reference direction	Inactive: The actual torque reference direction is the same as the set direction. Active: The actual torque reference direction is opposite to the set direction.

The actual direction of rotation is related to the setting of H02.02 (Direction of rotation), the torque reference direction, and the logic of FunIN.25.

Table 11–24 Actual direction of rotation in torque control mode

H02.02 setpoint	Sign (+/-) of the torque reference value	FunIN.25	Actual Motor Rotating Direction
0	+	OFF	CCW
0	+	ON	Clockwise
0	-	OFF	Clockwise
0	-	ON	CCW
1	+	OFF	Clockwise
1	+	ON	CCW
1	-	OFF	CCW
1	-	ON	Clockwise

11.4.3 Torque Reference Filter

Function Description

The servo drive can perform low-pass filtering on the torque reference, making the reference smoother and reducing vibration.

Applicable control modes: position, speed, torque, and hybrid control modes.

The servo drive offers two low-pass filters for torque references, in which the low-pass filter 1 is used by default.

The servo drive switches to low-pass filter 2 when gain switchover is enabled (H08.08 = 1) and the condition defined by H08.09 (H08.09 ≠ 0) is met.

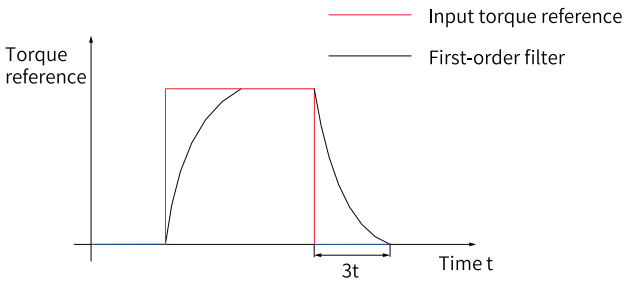


Figure 11-70 First-order filter for rectangular torque references

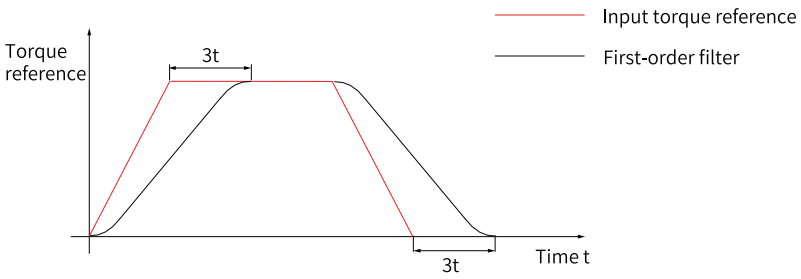


Figure 11-71 First-order filter for trapezoid torque references

Note

In the figure, the "t" in "3t" refers to the torque reference filter time constant. Pay attention to the responsiveness when you set the filter time constant because an excessively high setpoint decreases the responsiveness.

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.05	Time constant of torque reference filter	0x0705	0.00 to 30.00	ms	0.50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference filter time constant 1. Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.06	2nd time constant of torque reference filter	0x0706	0.00 to 30.00	ms	0.27	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference filter time constant 2.								

11.4.4 Torque Reference Limit

11.4.4.1 Function Description

The torque reference limit is used to protect the servo drive and the motor.

When the absolute value of the torque reference input from the host controller or output by the speed regulator is higher than the absolute value of the torque reference limit, the actual torque reference of the drive is limited to the torque reference limit. Otherwise, the torque reference input from the host controller or output by the speed regulator is used.

At any moment, only one torque limit value is effective, and both positive and negative torque limits do not exceed the maximum torque of the drive and motor, nor do they exceed ±300.0% of rated torque.

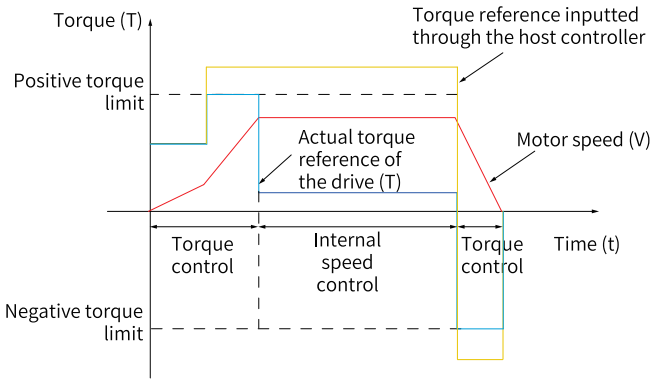


Figure 11-72 Torque reference and torque limit

Application Example

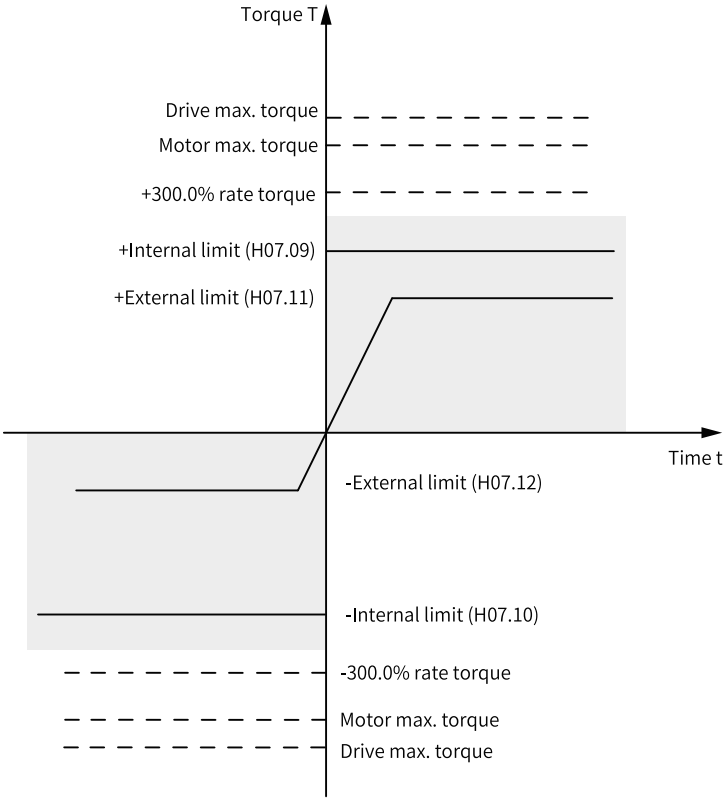


Figure 11-73 Torque limit example

11.4.4.2 Setting Torque Limit Source

You can set the torque limit source in H07.07.

After the torque limit is set, the servo drive torque reference is restricted to within the torque limit. After the torque reference reaches the limit, the motor runs according to the torque limit. The torque limit must be set according to the load conditions. If the setting is very small, it may cause longer acceleration/deceleration time of the motor, and the actual motor speed may not reach the required value at constant speed running.

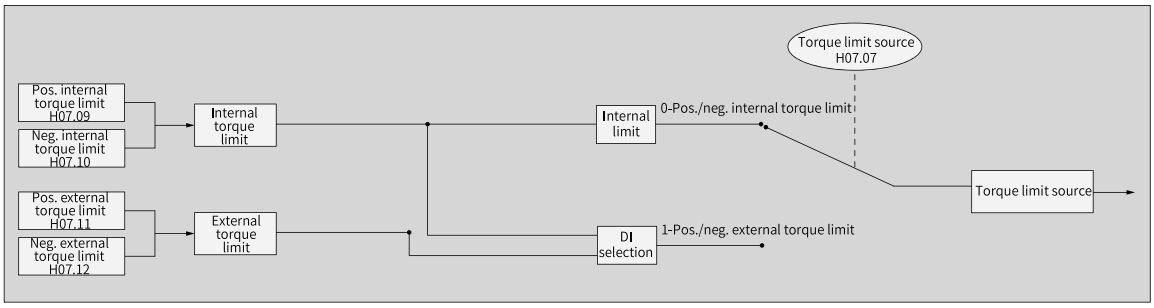


Figure 11-74 Torque limit source

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.07	Torque limit source	0x0707	See "Values".	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Forward/Reverse internal torque limit (default) 1: Forward/Reverse external torque limit (selected through P-CL and N-CL)								
	Parameter description:								
	Defines the torque limit source.								

11.4.4.2.1 Positive and negative internal torque limits (H07.07=0)

The torque reference limit is determined only by H07.09 and H07.10.

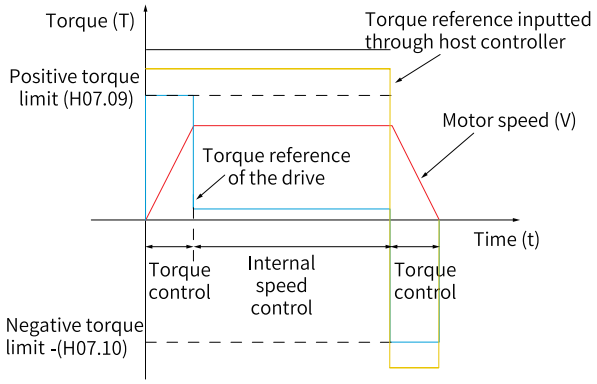


Figure 11-75 Torque limit curve (H07.07 = 0)

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.09	Internal forward torque limit	0x0709	0.0 to 400.0	%	350.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the positive internal torque limit.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.10	Internal reverse torque limit	0x070A	0.0 to 400.0	%	350.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the negative internal torque limit.								

11.4.4.2.2 Positive and negative external torque limits (H07.07=1)

The torque reference limit value is determined by the logic state of external DI signals. The positive torque limit is selected between H07.09 (Positive internal torque limit) and H07.11 (Positive external torque limit). The negative torque limit is selected between H07.10 (Negative internal torque limit) and H07.12 (Negative external torque limit).

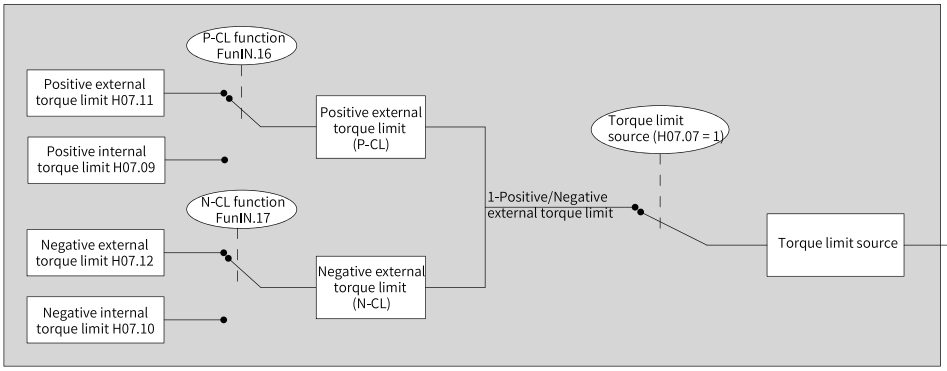
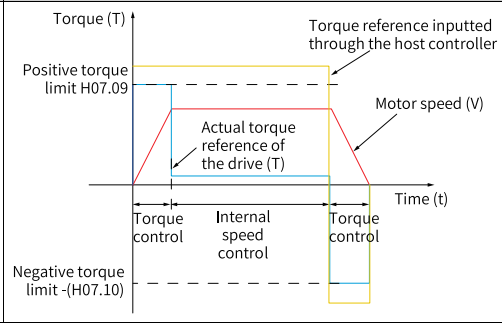
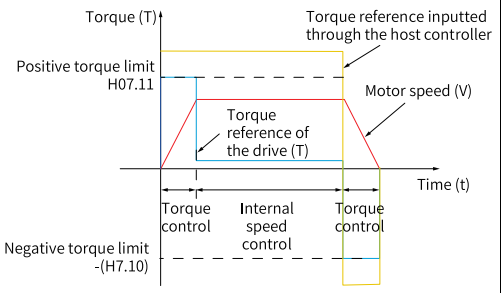
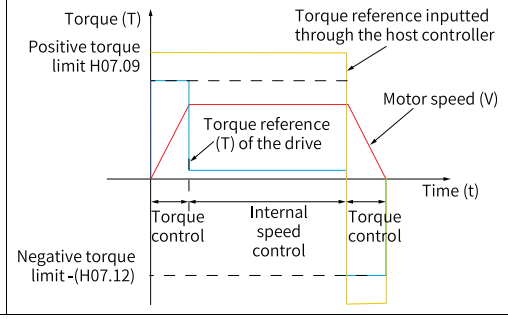
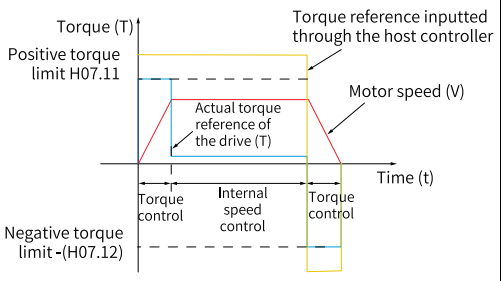


Figure 11-76 Torque limit source (H07.07 = 1)

Table 11–25 Description of H07.07 = 1

<table>
<tr><th colspan="2" rowspan="2">DI state</th><th colspan="2">P-CL</th></tr>
<tr><th>OFF</th><th>ON</th></tr>
<tr><td rowspan="2">N-CL</td><td>OFF</td><td>
</td><td>
</td></tr>
<tr><td>ON</td><td>
</td><td>
</td></tr>
</table>

Assign function 16 (FunIN.16: P-CL, external positive torque limit) and function 17 (FunIN.17: N-CL, external negative torque limit) to two DI terminals of the servo drive respectively and set the terminal logics.

Relevant function No.:

Code	Name	Function Name	Description
FunIN.16	P-CL	External positive torque limit	The torque limit source is switched based on H07.07 (Torque limit source). H07.07 = 1: Active: Positive external torque limit activated Inactive: Positive internal torque limit activated
FunIN.17	N-CL	External negative torque limit	The torque limit source is switched based on H07.07 (Torque limit source). H07.07 = 1: Active: Negative external torque limit activated Invalid: Internal reverse torque limit enabled

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.11	External positive torque limit	0x070B	0.0 to 400.0	%	350.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the positive external torque limit.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.12	External negative torque limit	0x070C	0.0 to 400.0	%	350.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the negative external torque limit.								

11.4.4.2.3 Setting torque limit DO signal

When the torque reference reaches the torque limit, the servo drive outputs the torque limit signal to the host controller. Set a DO terminal of the servo drive with function 7 (FunOUT.7: C-LT, torque limit) and set the terminal logic.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.7	C-LT	Torque limit signal	Active: The torque reference value reaches the torque limit and is limited by the torque limit. Inactive: The torque reference does not reach the torque limit.

11.4.5 Speed limit in Torque Control Mode

11.4.5.1 Function Description

In torque control mode, the motor accelerates continuously if the torque reference is higher than the load torque on the machine side, which may lead to overspeed and damage the machine. The motor speed needs to be limited to protect the machine.

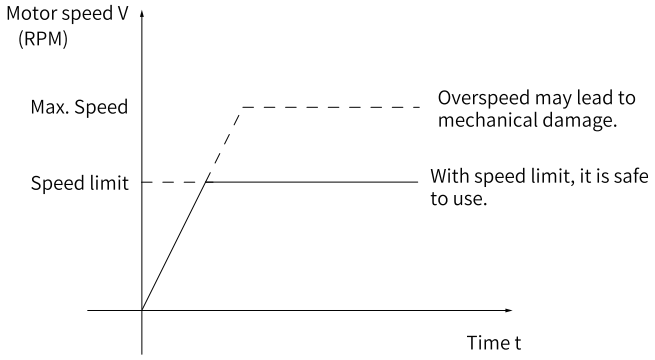


Figure 11-77 Speed limit in torque control mode

11.4.5.2 Setting Speed Limit Source

In the torque control mode, you can set the speed limit source in H07.17. After the speed limit is set, the actual motor speed is restricted to within the speed limit. After reaching the speed limit, the

motor keeps constant-speed running at the speed limit value. The speed limit must be set according to the load conditions.

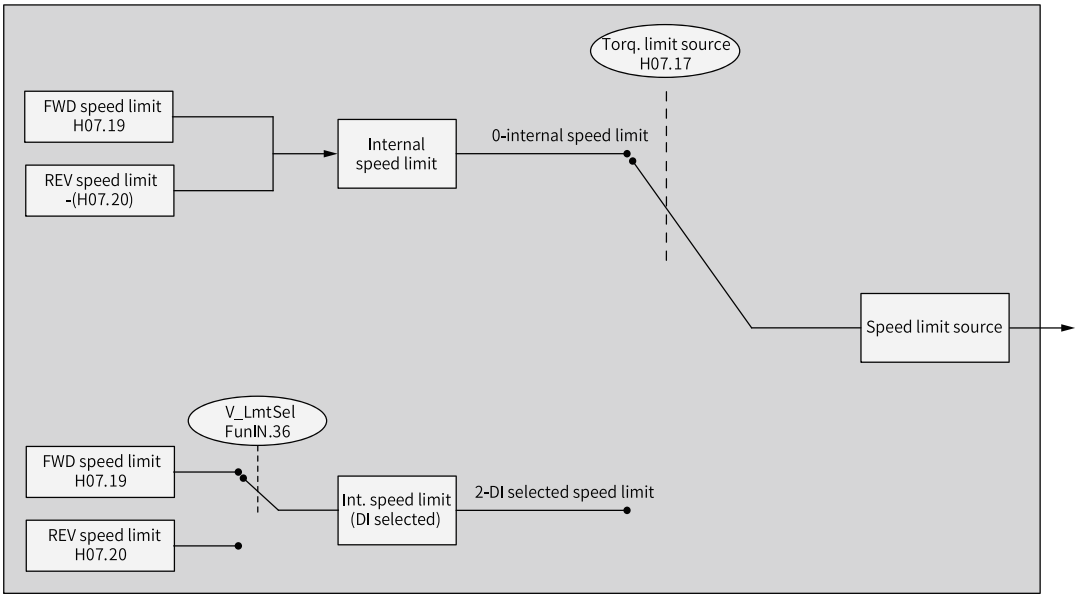


Figure 11-78 Speed limit source

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.17	Speed limit source	0x0711	See "Parameter Description"	-	0	UInt16	At once	Ordinary user	At once

Parameter description:

Defines the speed limit source.

Set value	Reference source	Description
0	Internal speed limit	The speed limit is defined by both H07.19 and H07.20.
1	-	-
2	H07.19 or H07.20 used as speed limit as defined by DI	DI (FunIN.36) inactive: H07.19 used as positive/negative speed limit DI (FunIN.36) active: H07.20 used as positive/negative speed limit

11.4.5.2.1 Internal speed limit (H07.17=0)

The speed limit is determined only by H07.19 and H07.20.

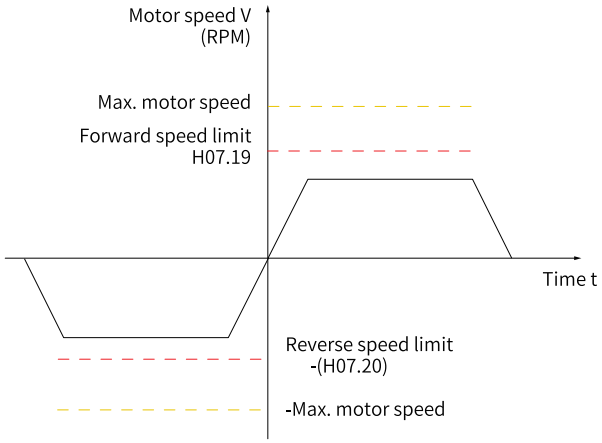


Figure 11-79 Speed limit curve (H07.17 = 0)

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.19	Positive speed limit/ Speed limit 1 in the torque control mode	0x0713	0 to 7000	rpm	3,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the positive speed limit in torque control.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.20	Reverse speed limit/ 2nd speed limit in torque control	0x0714	0 to 7000	rpm	3,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the negative speed limit in torque control.								

11.4.5.2.2 Speed limit selected via DI (H07.17=2)

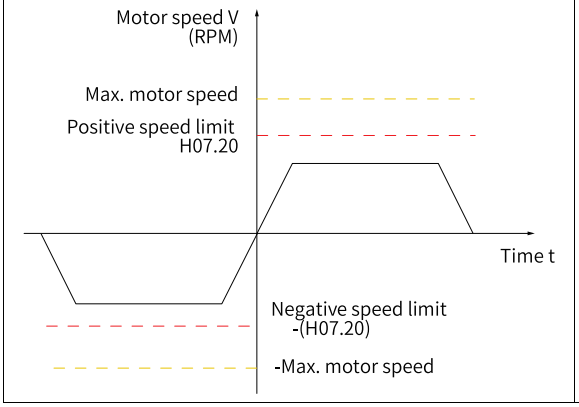
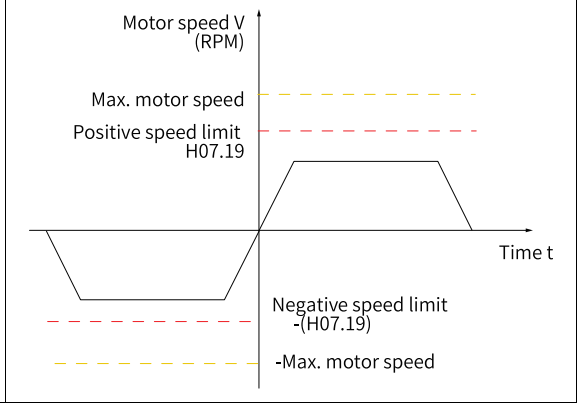
H07.19 or H07.20 is used as the speed limit based on the logic of the DI.

To use this function, set a DI terminal of the servo drive with function 36 (FunIN.36: V-LmtSel, internal speed limit source) and set the terminal logic.

Relevant function No.:

Code	Name	Function Name	Description
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

Table 11–26 Descriptions of speed limit

V_LmtSel	
ON	OFF
	

11.4.5.2.3 Setting the speed limit DO singnal

In the torque control mode, the servo drive outputs the V- LT (FunOUT.8: speed limit) signal to the host controller when the absolute value of the motor speed keeps exceeding the speed limit in the period defined by H07.40. If either of the preceding two conditions is not met, the speed limit signal will be deactivated.

The speed limit signal (FunOUT.8:V-LT) is judged only in the torque mode and servo running status.

Assign function 8 (FunOUT.8:V-LT) to a DO terminal of the servo drive and set the DO terminal logic.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.8	V-LT	Speed limit	Inactive: The motor speed does not reach the speed limit. Active: The motor speed reaches the speed limit and a speed loop is built based on this limit.

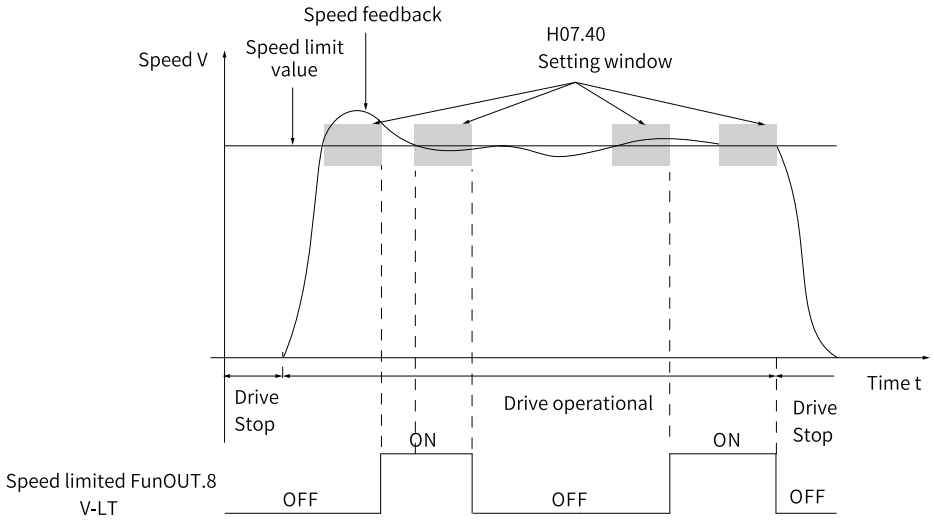


Figure 11-80 Example of speed limit DO waveform

11.4.6 Torque Reach Output

Function Description

The torque reach output is used to determine whether the actual torque reference reaches the set range. When the actual torque reference reaches the threshold, the servo drive outputs the related DO signal (FunOUT.18: ToqReach, torque reached) to the host controller.

To use the torque reached function, assign function 18 (FunOUT.18: ToqReach, torque reached) to a DO terminal of the servo drive and set the DO terminal logic.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.18	ToqReach	Torque reach	Active: The absolute value of the torque reference reaches the setpoint. Inactive: The absolute value of the torque reference is lower than the setpoint.

Application Example

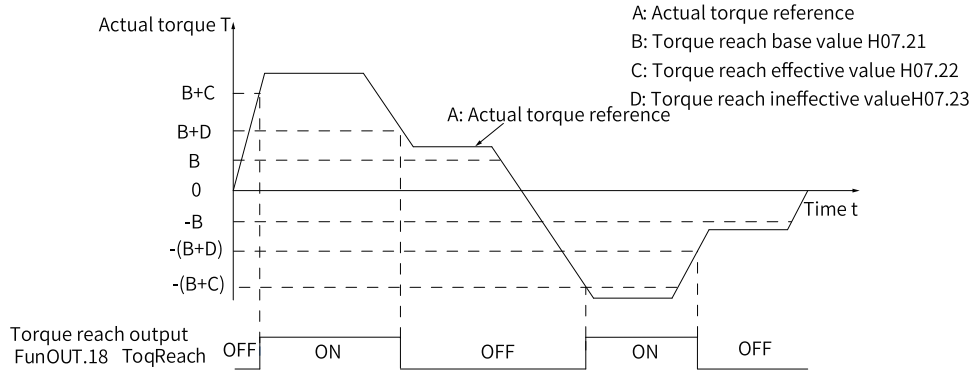


Figure 11-81 Example of TorReach signal waveform

C and D are the offset based on B.

The torque reach DO signal can be activated only when the actual torque reference meets the following condition: |A| ≥ B + C. Otherwise, the torque reached signal remains inactive.

The torque reach signal is deactivated only when the actual torque reference meets the following condition: |A| < B + D. Otherwise, the torque reached signal remains active.

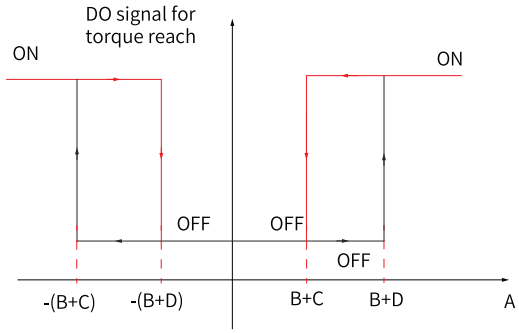


Figure 11-82 Description of torque reach output

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.21	Base value for torque reached	0x0715	0.0 to 300.0	%	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference of the base value for torque reach.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.22	Threshold of torque reached valid	0x0716	10.0 to 300.0	%	20.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference for valid torque reach.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.23	Threshold of torque reached invalid	0x0717	0.0 to 52.8	%	10.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of invalid torque reach.								

11.5 Compound Control Mode

In compound control mode, the control mode can be switched when the S-ON signal is switched on and the servo drive is in the "run" state. You can enable the compound control mode by setting H02.00 through the keypad or the software tool.

For details, see the following figure.

<table>
<tr><th>H02.00 setpoint</th><th>Control mode</th><th>Remarks</th></tr>
<tr><td>3</td><td>Torque control mode <->
Speed control mode</td><td>Allocate a DI with the function FunIN.10: M1_SEL (Mode switchover) and determine the terminal logic.
<table>
<tr><th>M1_SEL
Terminal Logic</th><th>Control mode</th></tr>
<tr><td>OFF</td><td>Torque control mode</td></tr>
<tr><td>ON</td><td>Speed control mode</td></tr>
</table></td></tr>
<tr><td>4</td><td>Speed control mode<-
>Position control mode</td><td>Allocate a DI with the function FunIN.10: M1_SEL (Mode switchover) and determine the terminal logic.
<table>
<tr><th>M1_SEL
Terminal Logic</th><th>Control mode</th></tr>
<tr><td>OFF</td><td>Speed control mode</td></tr>
<tr><td>ON</td><td>Position control mode</td></tr>
</table></td></tr>
<tr><td>5</td><td>Torque control mode<-
>Position control mode</td><td>Allocate a DI with the function FunIN.10: M1_SEL (Mode switchover) and determine the terminal logic.
<table>
<tr><th>M1_SEL
Terminal Logic</th><th>Control mode</th></tr>
<tr><td>OFF</td><td>Torque control mode</td></tr>
<tr><td>ON</td><td>Position control mode</td></tr>
</table></td></tr>
<tr><td>6</td><td>Torque control mode<-
>Speed control mode<-
>Position control mode</td><td>Allocate two DIs with the function FunIN.10: M1_SEL (Mode switchover) and FunIN.11: M2_SEL (Mode switchover) and determine the terminal logic.
<table>
<tr><th>M2_SEL
Terminal Logic</th><th>M1_SEL
Terminal Logic</th><th>Control mode</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Torque control mode</td></tr>
<tr><td>ON</td><td>OFF</td><td>Speed control mode</td></tr>
<tr><td>-</td><td>ON</td><td>Position control mode</td></tr>
</table></td></tr>
</table>

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 and absolute position rotation mode.

E731.0 (Encoder multi-turn position data loss) will occur upon initial power-on of the battery. Set H0d.20 to 1 to reset E731.0 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.

Application 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 system settings

To match the absolute encoder with the SV660P 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 number of encoder turns and the position of an encoder turn. In incremental position mode, the number of encoder turns is absent.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H00.00	Motor SN	0x0000	0 to 65535	-	14101	UInt16	At stop	Ordinary user	Effective upon next power-on
	Parameter description:								
	14000: Inovance motor with 20-bit incremental encoder 14101: Inovance motor with 23-bit absolute encoder								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H00.08	Serial encoder type	0x0008	0 to 65535	-	0	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	14100: Multi-turn absolute encoder Others: Single-turn absolute encoder								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.01	Absolute position detection system	0x0201	0 to 2	-	0	UInt16	At stop	Ordinary user	Effective upon next power-on
	Parameter description:								

Used to set the absolute position function.

Set value	Absolute system selection	Remarks
0	Incremental position 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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.70	Number of absolute encoder revolutions	0x0B46	0-65535	Rev	0	UInt16	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the number of absolute encoder turns.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.71	Position of absolute encoder within one turn	0x0B47	0 to 2147483647	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the single-turn position feedback of the 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.

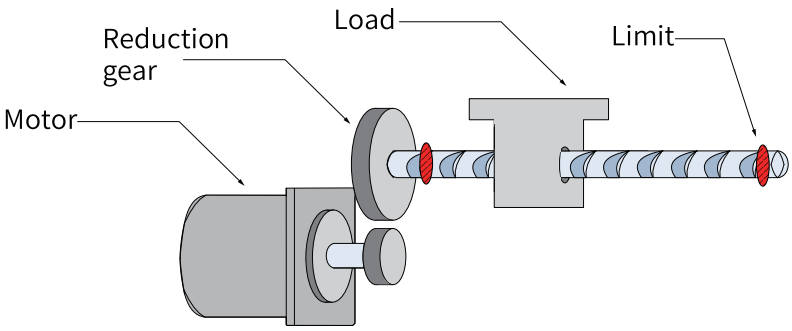


Figure 12-1 Application of the linear mode

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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.07	Absolute position counter	0x0B07	-2147483648 to +2147483647	Reference unit	0	Int32	Unmodifiable	Ordinary user	-
	Parameter description:								
	Indicates the current absolute position of the motor (in reference unit). This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.58	Mechanical absolute position (low 32 bits)	0x0B3A	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	Displays the low 32 low-order bit values (encoder unit) of the mechanical position feedback when the absolute encoder is used.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.60	Mechanical absolute position (high 32 bits)	0x0B3C	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	Displays the 32 high-order bit values (encoder unit) of the mechanical position feedback when the absolute encoder is used.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.77	Absolute position (low 32 bits) of absolute encoder	0x0B4D	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the low 32-bit data of the position feedback of the absolute encoder.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.79	Absolute position (high 32 bits) of absolute encoder	0x0B4F	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the high 32-bit data of the position feedback of the absolute encoder.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.36	Encoder multi-turn overflow fault selection	0x0A24	0–1	-	0	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	0: Disabled 1: Enabled Defines whether to hide the encoder multi-turn overflow fault (H0A.36=1) in the absolute position linear mode (H02.01 = 1).								

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.

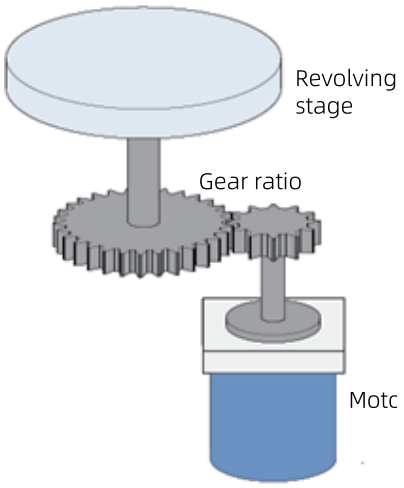


Figure 12-2 Rotating load

The servo drive calculates the absolute position upper limit of the machine based on H05.52 and H05.54 first. If H05.52 and H05.54 are 0, the servo drive turns to H05.50 and H05.51. Assume the encoder resolution R_E, $R_E = 2^{23}$, and assume the number of encoder pulses corresponding to one

load rotation is R_M, when H05.52 or H05.54 is not equal to 0, R_M = H05.54×2^{32}+ H05.52; when both H05.52 and H05.54 are 0, $R_M = R_E$.

If the electronic gear ratio is B/ A, then the following formula applies: H0b.07 (absolute position counter) = R_M / (B/A).

The following figure shows the relation between the single-turn position of the rotating load and the position of the rotary platen.

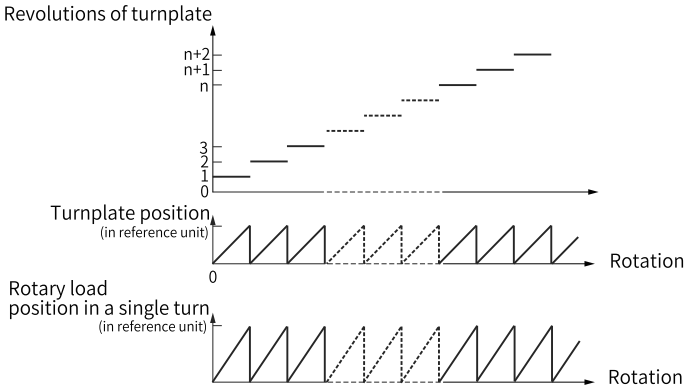


Figure 12-3 Relation between the single-turn position of the rotating load and the position of the rotating platen

The following figure shows the relation between the position fed back by the encoder and the single-turn position of the rotating load.

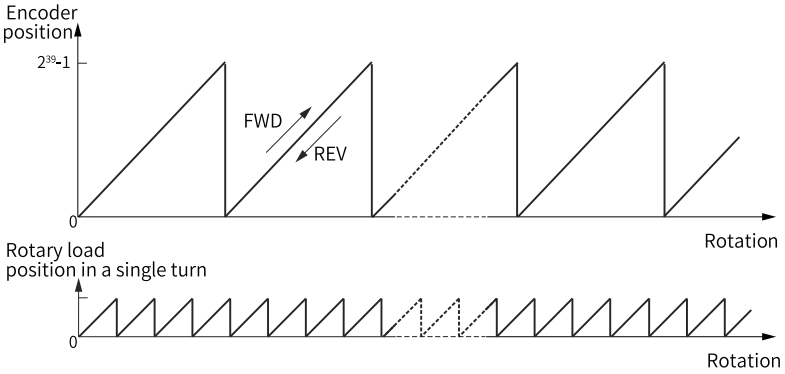


Figure 12-4 Relation between encoder feedback position and the rotating load single-turn position

The multi-turn data range is unlimited in the absolute position rotation mode. Therefore, E735.0 (encoder multi-turn counting overflow) is inactive.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.50	Mechanical gear ratio in absolute position rotation mode (numerator)	0x0532	1 to 65535	-	1	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	Defines the transmission ratio between the mechanical rotary load and the motor in the absolute position rotation mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.51	Mechanical gear ratio in absolute position rotation mode (denominator)	0x0533	1 to 65535	-	1	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	Defines the transmission ratio between the mechanical rotary load and the motor in the absolute position rotation mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.52	Pulses per revolution of the load in absolute position rotation mode (low 32 bits)	0x0534	0 to 4294967295	Encoder unit	0	UInt32	At stop	Ordinary user	At once
	Parameter description:								
	Defines the number of pulses per revolution of the rotary load in the absolute position rotation mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.54	Pulses per revolution of the load in absolute position rotation mode (high 32 bits)	0x0536	0 to 4294967295	Encoder unit	0	UInt32	At stop	Ordinary user	At once
	Parameter description:								
	Defines the number of pulses per revolution of the rotary load in the absolute position rotation mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.58	Torque threshold in homing upon hit-and-stop	0x053A	0 to 3000	%	1,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the maximum positive/negative torque limit during homing upon hit-and-stop.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.60	Holding time of positioning completed	0x053C	0 to 30000	ms	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the holding time of an active positioning completed signal.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.77	Absolute position (low 32 bits) of absolute encoder	0x0B4D	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the low 32-bit data of the position feedback of the absolute encoder.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.79	Absolute position (high 32 bits) of absolute encoder	0x0B4F	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the high 32-bit data of the position feedback of the absolute encoder.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.81	Load position within one turn in absolute position rotation mode (low 32 bits)	0x0B51	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.83	Load position within one turn in absolute position rotation mode (high 32 bits)	0x0B53	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.85	Load position within one turn in absolute position rotation mode	0x0B55	-2147483648 to +2147483647	Reference unit	0	Int32	Unmodifiable	Ordinary user	-
	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.								

12.1.5 Precautions for Use of the Battery Box

E731.0 (Encoder battery failure) will occur at initial power-on of the battery. Set H0d.20 (Absolute encoder reset function) to 1 to reset E731.0 before further operations.

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 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.
- 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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.20	Multi-turn absolute encoder reset	0x0D14	0 to 2	-	0	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	0: No action 1: Reset fault 2: Reset fault and multi-turn data You can reset the encoder fault or the multi-turn data fed back by the encoder through H0d.20.								

12.2 Soft Limit Function

Function Description

Software position limit is implemented through a comparison between the internal position feedback and the set limit value. If the set limit value is exceeded, the servo drive reports a warning and stops immediately. 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.40 (Software position limit) to 2 (Enabled after homing) first, and then perform homing upon power-on before applying software position limit.

Traditional hardware limit function:
This function is implemented by inputting the external sensor signal to the CN1 terminal of the servo drive.

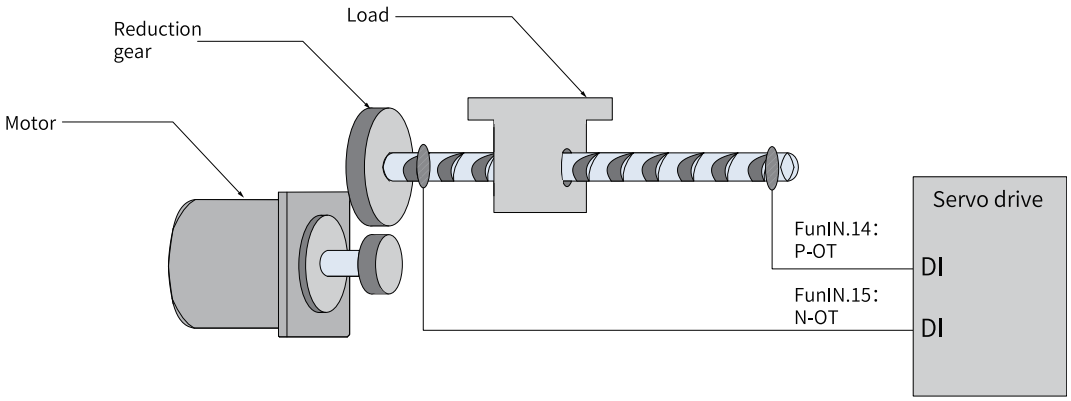


Figure 12-5 Installation diagram of limit switch

Table 12–1 The following table compares the traditional hardware limit function and soft limit function.

Traditional Hardware Limit Function		Soft Limit Function	
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.
	Suffered from the risk of mechanical slip.		Internal position comparison can prevent malfunction due to mechanical slip.
	Unable to sense or detect an overtravel fault after power-off.		

Note:

- When H0A.40 is set to 0, software position limit is disabled.
- When H0A.40 is set to 1, software position limit is enabled immediately upon power-on. When the absolute position counter (H0b.07) is larger than H0A.41, the servo drive reports E950.0 (Forward limit switch warning) and executes stop at forward limit. When the absolute position counter (H0b.07) is smaller than H0A.43, the servo drive reports warning E952.0 (Reverse limit switch warning) and executes stop at reverse limit.
- If H0A.40 is set to 2, soft limit is enabled after homing. When the value of the absolute position counter (H0b.07) is larger than the value of H0A.41 after homing, E950.0 (Forward overtravel

warning) occurs and the servo drive stops at forward overtravel. When the value of the absolute position counter (H0b.07) is smaller than the value of H0A-42 after homing, E952.0 (Reverse overtravel warning) occurs and the servo drive stops at reverse overtravel.

Related parameters

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.40	Software limit selection	0x0A28	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: No action 1: Activated immediately 2: Activated after homing completed								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.41	Forward position of software limit	0x0A29	-2147483648 to +2147483647	-	2147483647	Int32	At stop	Ordinary user	At once
	Parameter description:								
	When the absolute position counter (H0b.07) is larger than H0A.41, the servo drive reports E950.0 (Forward overtravel) and stops accordingly.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.43	Reverse position of software limit	0x0A2B	-2147483648 to +2147483647	-	-2147483648	Int32	At stop	Ordinary user	At once
	Parameter description:								
	When the absolute position counter (H0b.07) is smaller than H0A.43, the servo drive reports E952.0 (Reverse overtravel) and stops accordingly.								

12.3 Software Reset

Function Description

The software reset function comes into reset when a restart of the servo drive in the non-operating state is not allowed because a No.1 non-resettable fault does not occur.

Related parameters

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.00	Software reset	0x0D00	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: No action 1: Enable reset								
	Parameter description:								
	Programs in the drive are reset automatically (similar to the program reset upon power-on) after the software reset function is enabled, without the need for a power cycle.								

12.4 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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.04	Motor overload protection gain	0x0A04	50 to 300	%	100	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.26	Enable motor overload shielding	0x0A1A	See "Values".	-	3	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Show motor overload warning (E909.0) and fault (E620.0) 1: Hide motor overload warning (E909.0) and fault (E620.0)			2: No function 3: Enabled for new motors					
	Parameter description:								
	It sets whether to shield 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 SV680P series servo drive. Failure to comply will result in the risk of short circuit due to ageing of insulation.

Related parameters

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.32	Time threshold for locked rotor over-temperature protection	0x0A20	10 to 65535	ms	200	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the time duration of locked-rotor over-temperature (E630.0) before it is detected by the servo drive. H0A.32 can be used to adjust the sensitivity of motor stall over-temperature detection.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.33	Locked rotor over-temperature protection	0x0A21	See "Values".	-	1	UInt16	At once	Ordinary user	At once
	Values:								
	0: Disabled 1: Enable 2: Enabled for new over-temperature								
	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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.08	Overspeed threshold	0x0A08	0 to 10000	rpm	0	UInt16	At once	Ordinary user	At once

Parameter description:

It sets the motor speed threshold at which the overspeed fault is detected.

Set value	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 10000	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	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.12	Enable runaway protection function	0x0A0C	0–1	-	1	UInt16	At once	Ordinary user	At once

Values:

0: Disabled
1: Enabled

Parameter description:

Defines whether to enable runaway protection.

0: Hide the detection on E234.0 in applications where the motor drives a vertical axis or is driven by the load.
1: Enable runaway protection

13 Modbus RTU communication

13.1 Communication Introduction

13.1.1 Modbus Protocol

The Modbus protocol is a common language applied to electronic controllers. This protocol allows communication between the drives and between the drive and other devices such as the HMI and PLC. This protocol has become a general industry standard. Based on the Modbus protocol, control devices produced by different manufacturers can be connected to form an industrial network for centralized monitoring.

13.1.2 Modbus Communication Specifications

Item		Specification
Modbus slave device performance	Link layer protocol	RS485
	Application layer protocol	Modbus RTU, GBT 19582.2-2008, using custom command area
	Baud rate	115200 bps
	Duplex mode	Half-duplex
	Data format	8-N-1 (8 data bits, no parity check, 1 stop bit)

13.2 Communication data frame structure

Parameters of the servo drive are divided into 16-bit and 32-bit parameters based on the data length. You can read and write parameters through the Modbus RTU protocol.

The command codes for reading/writing parameters vary with the data length.

Operation	Command code
Reading 16-bit/32-bit parameters	0x03
Writing 16-bit parameters	0x06
Write 32-bit parameters	0x10

Command code for reading parameters: 0x03

Based on the Modbus RTU protocol, command code 0x03 is used to read both 16-bit and 32-bit parameters.

Request frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame
ADDR	Servo axis address: 1 to 247 **Note: 1 to 247 are decimal values and need to be converted to hexadecimal equivalents.**
CMD	Command code: 0x03

Value	Description
DATA[0]	Register start address (high 8 bits): parameter group number of the start register For example, for parameter H06.11, where 06 is the group number, DATA[0] is 0x06. **Note: In this example, 06 is a hexadecimal value and needs no conversion.**
DATA[1]	Register start address (low 8 bits): offset within the parameter group of the start register For example, for parameter H06.11, where 11 is the offset within the parameter group, DATA[1] is 0x0B. **Note: In this example, 11 is a decimal value and needs to be converted to its hexadecimal equivalent 0x0B.**
DATA[2]	High 8 bits of the number of parameters to be read (hexadecimal), N(H)
DATA[3]	Low 8 bits of the number of parameters to be read (hexadecimal), N(L)
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame

Response frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame
ADDR	Servo axis address, in hexadecimal.
CMD	Command code: 0x03
DATALENGTH	Number of parameter bytes, equal to twice the number of parameters to be read, that is, N x 2
DATA[0]	Data of the first register parameter (high 8 bits)
DATA[1]	Data of the first register parameter (low 8 bits)
DATA[…]	…
DATA[N x 2 – 2]	Data of the Nth register parameter (high 8 bits)
DATA[N*2-1]	Data of the Nth register parameter (low 8 bits)
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame

Based on the Modbus RTU protocol, command code 0x06 is used to write 16-bit parameters. Command code 0x10 is used to write 32-bit parameters.

Communication Cases

- To read two-word data with H02.02 as the start register from the drive whose servo axis address is 01:

  The master sends the following request frame:

01	03	02	02	00	02	CRCL	CRCH

  The slave returns the following response frame:

01	03	04	00	01	00	00	CRCL	CRCH

  The response frame means that the slave returns data of 2 word length (4 bytes), and the data content is 0x0001, 0x0000.

  If the slave response frame is as follows:

01	83	02	CRCL	CRCH

The response frame means that a communication error occurs, and the error code is 0x02. 0x83 indicates the error.

- To read parameter H05.07 (32-bit) from the drive whose servo axis address is 01:
  The master sends the following request frame:

01	03	05	07	00	02	CRCL	CRCH

The slave returns the following response frame:

01	03	04	00	01	00	00	CRCL	CRCH

The response frame indicates that the value of parameter H05.07 is 0x00000001.

Command code for writing 16-bit parameters: 0x06

Caution

Do not write 32-bit parameters with 0x06. Failure to comply can result in unexpected error.

Request frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame
ADDR	Servo axis address 1 to 247 **Note: 1 to 247 are decimal values and need to be converted to hexadecimal equivalents.**
CMD	Command code: 0x06
DATA[0]	Register start address (high 8 bits): parameter group number of the start register For example, to write data to parameter H06.11, where 06 is the group number, DATA[0] is 0x06. **Note: In this example, 06 is a hexadecimal value and needs no conversion.**
DATA[1]	Register start address (low 8 bits): offset within the parameter group of the start register For example, to write data to parameter H06.11, where 11 is the offset within the parameter group, DATA[1] is 0x0B. **Note: In this example, 11 is a decimal value and needs to be converted to its hexadecimal equivalent 0x0B.**
DATA[2]	High 8 bits of data to be written to the register (hexadecimal)
DATA[3]	Low 8 bits of data to be written to the register (hexadecimal)
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame

Response frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame
ADDR	Servo axis address, in hexadecimal.
CMD	Command code: 0x06

Value	Description
DATA[0]	Register start address (high 8 bits): parameter group number of the start register For example, to write data to parameter H06.11, where 06 is the group number, DATA[0] is 0x06. **Note: In this example, 06 is a hexadecimal value and needs no conversion.**
DATA[1]	Register start address (low 8 bits): offset within the parameter group of the start register For example, to write data to parameter H06.11, where 11 is the offset within the parameter group, DATA[1] is 0x0B. **Note: In this example, 11 is a decimal value and needs to be converted to its hexadecimal equivalent 0x0B.**
DATA[2]	High 8 bits of data to be written to the register (hexadecimal)
DATA[3]	Low 8 bits of data to be written to the register (hexadecimal)
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame

Communication Cases

To write data 0x0001 to parameter H02.02 in the drive whose servo axis address is 01:

The master sends the following request frame:

01	06	02	02	00	01	CRCL	CRCH

The slave returns the following response frame:

01	06	02	02	00	01	CRCL	CRCH

The response frame indicates that data 0x0001 has been written to parameter H02.02 in the drive whose servo axis address is 01.

If the slave response frame is as follows:

01	86	02	CRCL	CRCH

The response frame indicates that a communication error occurs, and the error code is 0x02. 0x86 indicates the error.

Command code for writing 32-bit parameters: 0x10

Caution

Do not write 16-bit parameters with 0x10. Failure to comply can result in unexpected error.

Request frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame
ADDR	Servo axis address 1 to 247 **Note: 1 to 247 are decimal values and need to be converted to hexadecimal equivalents.**

Value	Description
CMD	Command code: 0x10
DATA[0]	Register start address (high 8 bits): parameter group number of the start register For example, to write data to parameter H11.12, where 11 is the group number, DATA[0] is 0x11. **Note: In this example, "11" is a hexadecimal value that needs no conversion.**
DATA[1]	Register start address (low 8 bits): offset within the parameter group of the start register When writing parameter H11.12,**12 is the offset in the group**, which means DATA[1] = 0x0C. **Note: In this example, 12 is a decimal value and needs to be converted to its hexadecimal equivalent 0x0C.**
DATA[2]	High 8 bits of the number of parameters to which data will be written (hexadecimal), M(H) For example, to write data to parameter H05.07 alone, DATA[2] is 00, DATA[3] is 02, and M is H0002. **One 32-bit parameter is counted as two words.**
DATA[3]	Low 8 bits of the number of parameters to which data will be written (hexadecimal), M(L)
DATA[4]	Number of bytes corresponding to data to be written to the register, that is, M x 2 For example, to write data to parameter H05.07 alone, DATA[4] is H04.
DATA[5]	High 8 bits of data to be written to the start register (hexadecimal)
DATA[6]	Low 8 bits of data to be written to the start register (hexadecimal)
DATA[7]	High 8 bits of data to be written to Start register address + 1 (hexadecimal)
DATA[8]	Low 8 bits of data to be written to Start register address +1 (hexadecimal)
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame

Response frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame
ADDR	Servo axis address, in hexadecimal.
CMD	Command code: 0x10
DATA[0]	Register start address (high 8 bits): offset within the parameter group of the start register For example, to write data to parameter H11.12, DATA[0] is 0x11.
DATA[1]	Register start address (low 8 bits): offset within the parameter group of the start register For example, to write data to parameter H11.12, DATA[1] is 0x0C.
DATA[2]	High 8 bits of the number of parameters to which data will be written (hexadecimal), M(H)
DATA[3]	Low 8 bits of the number of parameters to which data will be written (hexadecimal), M(L)
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame

Error response frame

Error frame response format:

Value	
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame
ADDR	Servo axis address, in hexadecimal.
CMD	Command code: 0x80
DATA[0]...[3]	DATA error code
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame

Error codes:

Error code	Description
0x0001	Invalid command code
0x0002	Illegal data address
0x0003	Illegal data
0x0004	Slave device fault

32-bit parameter addressing

When Modbus commands are used to read/write 32-bit parameters, the communication address is determined by the address of the parameter with the smaller offset number. Two parameters are operated per operation. See the following examples.

Note

In the following examples, the servo axis address is 01 by default.

- The Modbus command for reading parameter H11.12 (1st displacement) is as follows.

01	03	11	0C	00	02	CRCL	CRCH

If the "1st displacement" is 0x40000000 (decimal equivalent: 1073741824), then the following response frames apply:

- When H0C.26 is set to 1 (Low 16 bits before high 16 bits), the response frame is as follows.

01	03	04	00	00	40	00	CRCL	CRCH

- H0C.26 = 0 (High 16 bits before low 16 bits), then the response frame is:

01	03	04	40	00	00	00	CRCL	CRCH

- For example, the Modbus command for writing 0x12345678 to H11.12 (1st displacement 1) is:
  - If H0C.26 = 1 (Low 16 bits before high 16 bits):

01	10	11	0C	00	02	04	56	78	12	34	CRCL	CRCH

  - If H0C.26 = 0 (High 16 bits before low 16 bits):

01	10	11	0C	00	02	04	12	34	56	78	CRCL	CRCH

CRC check

The host controller and servo drive must use the same CRC algorithm. Otherwise, a CRC error will occur. The SV660P series servo drive adopts 16-bit CRC with low bytes before high bytes. The polynomial used for checksum is: $X^{16}+ X^{15}+ X^{2}+ 1$ （0xA001）。

```
Uint16 COMM_CrcValueCalc(const Uint8 *data, Uint16 length)
{
  Uint16 crcValue = 0xffff;
  int16 i;
  while (length--)
  {
    crcValue ^= *data++;
    for (i = 0; i < 8; i++)
    {
      if (crcValue & 0x0001)
      {
        crcValue = (crcValue >> 1) ^ 0xA001;
      }
      else
      {
        crcValue = crcValue >> 1;
      }
    }
  }
  return (crcValue);
}
```

13.3 Communication Parameters

Parameter	Default Value	Description	Remarks
H0C.00	1	Servo axis address	-
H0C.02	5	Serial port baud rate	5: 57600 bps

Parameter	Default Value	Description	Remarks
H0C.03	0	Modbus communication data format	0: No check, 2 stop bits
H0C.26	1	Modbus communication data sequence	0: High bits before low bits 1: Low bits before high bits

13.4 Communication Configuration Examples

13.4.1 Modbus RTU Communication Configuration

13.4.1.1 Communication Overview

The following describes the Modbus RTU communication connection between Inovance H2U and SV660P series servo drive. The connection can be implemented through the configuration table or programming. The following case takes H06.03 (Write speed) and H0b.00 (Read speed) as examples.

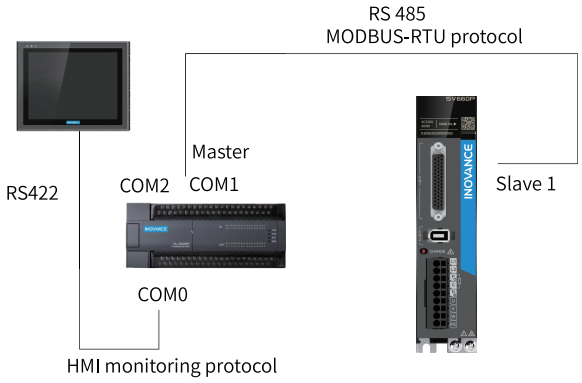


Figure 13-1 Schematic and wiring diagram

13.4.1.2 Wiring for Modbus RTU Communication Between Servo Drive and Different PLCs

Inovance H2U and SV660P

Product Name	Model	Quantity	Remarks
PLC	H2U-1616MT/MR	1	-
Inovance SV660P series servo drive and applicable motor	SV660PT012I MS1H3-*******	1 set	-

COM1 Terminal Layout on PLC Side		CN3/CN4 Terminal Layout on Drive Side	
Signal	Pin No.	Signal	Pin No.
RS485+	1	RS485+	4
RS485-	2	RS485-	5
-	-	PE (shield)	Enclosure

Siemens PLC and SV660P

Siemens S7200 PLC		CN3/CN4 Terminal Layout on Drive Side	
PLC PORT0-RS485	Pin No.	Signal	Pin No.
Data+	3	RS485+	4
Data–	8	RS485-	5
PE (shield)	Enclosure	PE (shield)	Enclosure

Mitsubishi FX3U and SV660P

Mitsubishi FX3U PLC		CN3/CN4 Terminal Layout on Drive Side	
FX3U-485-BD	Pin No.	Signal	Pin No.
SDA	Short	RS485+	4
RDA			
SDB	Short	RS485-	5
RDB			
SG	Enclosure	PE (shield)	Enclosure

Setting communication parameters through GX PLC software (initialization of communication port 1):

1. Communication port 1 parameter setting (RS485, 19200, 7, N, 1)
2. LD M8002
3. Initial ON
4. MOV H0C91 D8120
5. Communication port 1 setting
6. SET M8161
7. Communication format: 8-bit

Using two major references (See the user guide for FX3U communication.)

- RS D100 K8 D120 K8
  - D100: station No. being "?"
  - D120: starting address for data receiving (8 bytes)
- CRC D100 D106 K6
  - D100: station No. being "?"
  - D106: CRC checked address

Omron PLC and SV660P

Omron CP1L		CN3/CN4 Terminal Layout on Drive Side	
PLC PORT0-RS485	Pin No.	Signal	Pin No.
SDB+	-	RS485+	4
SDA–	-	RS485-	5
PE (shield)	Enclosure	PE (shield)	Enclosure

Note

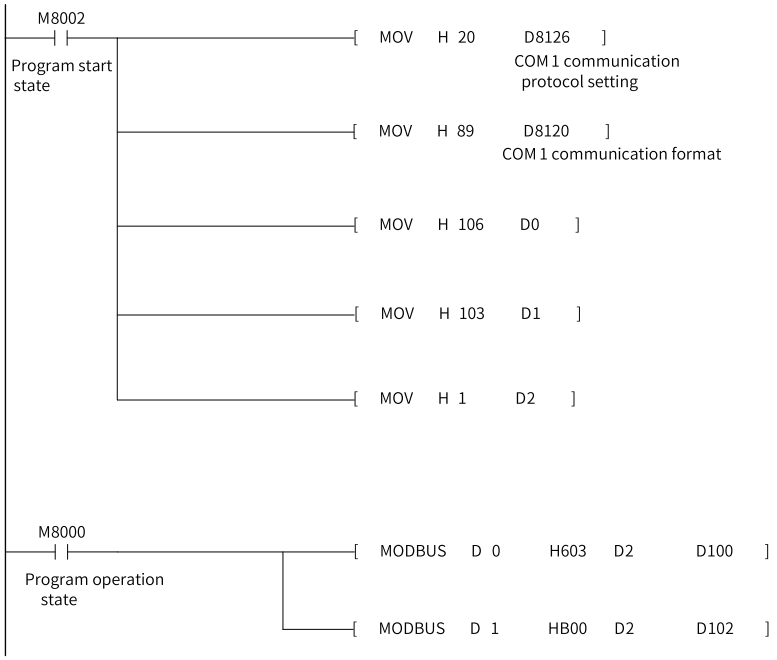
Set 2, 3, 5, and 6 on the DIP switch to ON, and others to OFF. The DIP switch is on the back of PLC communication card.

13.4.1.3 Servo parameter setting

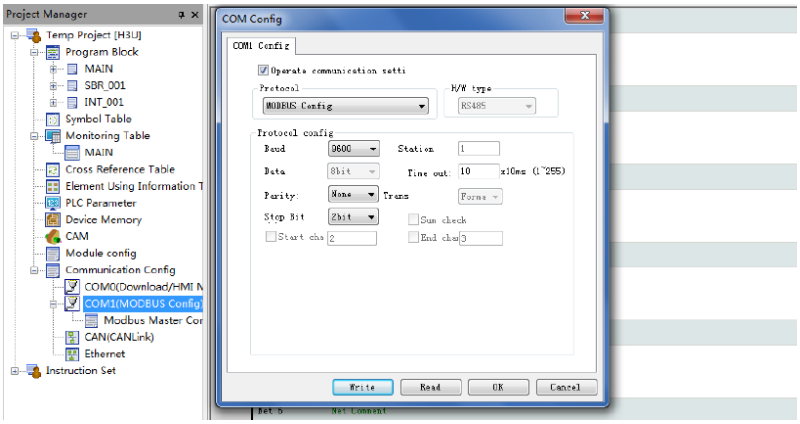
Parameter	Set Value	Description	Remarks
H0C.00	1	Servo axis address	-
H0C.02	5	Serial port baud rate	5: 57600 bps
H0C.26	0	Modbus communication data sequence	0: High 16 bits before low 16 bits 1: Low 16 bits before high 16 bits

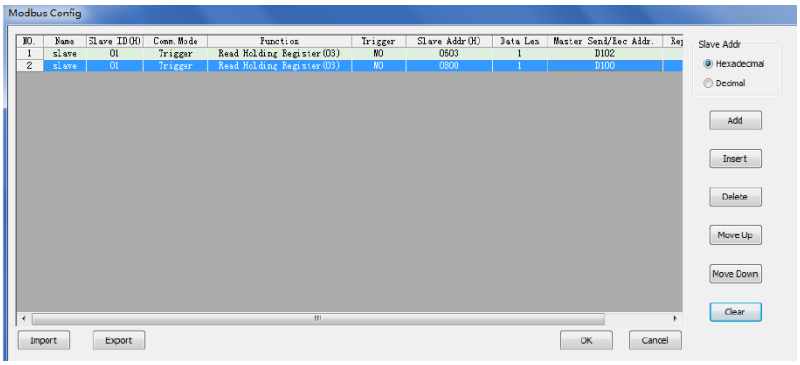
13.4.1.4 PLC Program Examples

Communication connection implemented through programming



Communication connection implemented through configuration table




Modbus Config
NO.
Name
Slave ID(H)
Comm.Mode
Function
Trigger
Slave Addr(H)
Data Len
Master Send/Rec Addr.
1
slave
01
Trigger
Read Holding Register(03)
NO
0603
1
D102
2
slave
01
Trigger
Read Holding Register(03)
NO
0800
1
D100
Slave Addr
Hexadecimal
Decimal
Add
Insert
Delete
Move Up
Move Down
Clear
Import
Export
OK
Cancel

14 Parameter Description

14.1 H00 Servo Motor Parameters

H00.00 **Motor SN**

Address:	0x0000	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	14101	Change:	At stop

Range:

0–65535

Parameter description

14000: Inovance motor with 20-bit incremental encoder

14101: Inovance motor with 23-bit absolute encoder

H00.02 **Customized motor SN**

Address:	0x0002	Effective mode:	-
Minimum:	0.00	Unit:	-
Maximum:	42949672.95	Data type	UInt32
Default:	0.00	Change:	Unmodifiable

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 SN**

Address:	0x0004	Effective mode:	-
Minimum:	0.0	Unit:	-
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0 to 6553.5

Parameter description

Saved in the encoder to differentiate the encoder software version.

H00.05 **Bus motor SN**

Address:	0x0005	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

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:	0x0006	Effective mode:	-
Minimum:	0.00	Unit:	-
Maximum:	42949672.95	Data type	UInt32
Default:	0.00	Change:	Unmodifiable

Range:

0.00 to 42949672.95

Parameter description

Used to differentiate the customized FPGA software version, which is not applicable to standard models.

H00.08 **Serial encoder type**

Address:	0x0008	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0–65535

Parameter description

14100: Multi-turn absolute encoder

Others: Single-turn absolute encoder

H00.09 **Motor voltage class**

Address:	0x0009	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	V
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: 220 V

1: 380 V

Parameter description

0: 220 V

1: 380 V

H00.10 **Rated power**

Address:	0x000A	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	kW
Maximum:	655.35	Data type:	UInt16
Default:	0.75	Change:	At stop

Range:

0.00 kW–655.35kW

Parameter description

Defines the rated motor power.

H00.11 **Rated current**

Address:	0x000B	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	A.

Maximum:	655.35	Data type:	UInt16
Default:	4.70	Change:	At stop

Range:

0.00 A to 655.35 A

Parameter description

Defines the rated motor current.

H00.12 Rated torque

Address:	0x000C	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	N·m
Maximum:	655.35	Data type:	UInt16
Default:	2.39	Change:	At stop

Range:

0.00 N·m to 655.35 N·m

Parameter description

Defines the rated motor torque.

H00.13 Maximum torque

Address:	0x000D	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	N·m
Maximum:	655.35	Data type:	UInt16
Default:	7.16	Change:	At stop

Range:

0.00 N·m to 655.35 N·m

Parameter description

Defines the maximum current/torque (DDR) of the motor.

H00.14 Rated speed

Address:	0x000E	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	rpm
Maximum:	65535	Data type:	UInt16
Default:	3,000	Change:	At stop

Range:

0rpm~65535rpm

Parameter description

Defines the rated motor speed.

H00.15 Maximum motor rotational speed

Address:	0x000F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	rpm
Maximum:	65535	Data type:	UInt16
Default:	6,000	Change:	At stop

Range:

0rpm~65535rpm

Parameter description

Defines the maximum motor speed.

H00.16 **Rotor inertia**

Address:	0x0010	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	kg·cm²
Maximum:	655.35	Data type:	UInt16
Default:	1.30	Change:	At stop

Range:

0.00kg·cm² to 655.35kg·cm²

Parameter description

Defines the motor moment of inertia.

H00.17 **Number of pole pairs of PMSM**

Address:	0x0011	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	4	Change:	At stop

Range:

0–65535

Parameter description

Defines the number of PMSM pole pairs.

H00.18 **Stator resistance**

Address:	0x0012	Effective mode:	Effective upon next power-on
Minimum:	0.000	Unit:	Ω
Maximum:	65.535	Data type:	UInt16
Default:	0.500	Change:	At stop

Range:

0.000 Ω to 65.535 Ω

Parameter description

Defines the motor stator resistance.

H00.19 **Stator inductance Lq**

Address:	0x0013	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	mH
Maximum:	655.35	Data type:	UInt16
Default:	3.27	Change:	At stop

Range:

0.00 mH to 655.35 mH

Parameter description

Defines motor stator inductance Lq.

H00.20 **Stator inductance Ld**

Address:	0x0014	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	mH
Maximum:	655.35	Data type:	UInt16
Default:	3.87	Change:	At stop

Range:

0.00 mH to 655.35 mH

Parameter description
Defines motor stator inductance Ld.

H00.21 **Line back EMF coefficient**

Address:	0x0015	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	mV/RPM
Maximum:	655.35	Data type:	UInt16
Default:	33.30	Change:	At stop

Range:
0.00 mV/rpm to 655.35 mV/rpm
Parameter description
Defines the motor back EMF coefficient.

H00.22 **Torque coefficient Kt**

Address:	0x0016	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	N·m/Arms
Maximum:	655.35	Data type:	UInt16
Default:	0.51	Change:	At stop

Range:
0.00 N·m/Arms to 655.35 N·m/Arms
Parameter description
Defines the motor torque coefficient Kt.

H00.23 **Electrical constant Te**

Address:	0x0017	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	ms
Maximum:	655.35	Data type:	UInt16
Default:	6.54	Change:	At stop

Range:
0.00 to 655.35
Parameter description
Defines the motor electrical constant Te.

H00.24 **Mechanical constant Tm**

Address:	0x0018	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	ms
Maximum:	655.35	Data type:	UInt16
Default:	0.24	Change:	At stop

Range:
0.00 to 655.35
Parameter description
Defines the motor mechanical constant Tm.

H00.28 **Position offset of absolute encoder**

Address:	0x001C	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	P/Rev
Maximum:	4294967295	Data type	UInt32

Default:	8192	Change:	At stop

Range:

0 PPR to 4294967295 PPR

Parameter description

Used to save the values obtained from angle auto-tuning.

H00.30 Encoder selection

Address:	0x001E	Effective mode:	Effective upon next power-on
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x13	Change:	At stop

Range:

0: Standard incremental encoder (UVW - ABZ)

1: Wire-saving encoder (ABZ (UVW))

2: Regular incremental encoder (ABZ, without UVW)

16: TAMAGAWA encoder

18: Nikon encoder

19: Inovance encoder

48: Grating scale

Parameter description

0: Standard incremental encoder (UVW - ABZ)

1: Wire-saving encoder (ABZ (UVW))

2: Regular incremental encoder (ABZ, without UVW)

16: TAMAGAWA encoder

18: Nikon encoder

19: Inovance encoder

48: Grating scale

H00.31 Encoder PPR

Address:	0x001F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	P/Rev
Maximum:	4294967295	Data type	UInt32
Default:	8388608	Change:	At stop

Range:

0 PPR to 4294967295 PPR

Parameter description

Defines the number of pulses fed back by the encoder per motor revolution.

H00.35 Motor SN stored by serial encoder

Address:	0x0023	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0–65535

Parameter description

Defines the serial encoder model.

H00.37 **Serial encoder function setting bit**

Address:	0x0025	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Defines the absolute encoder function setting bit.

14.2 H01 Servo Drive Parameters

H01.00 **MCU software version SN**

Address:	0x0100	Effective mode:	-
Minimum:	0.0	Unit:	-
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0 to 6553.5

Parameter description

Displays MCU software version (with one decimal place).

H01.01 **FPGA software version**

Address:	0x0101	Effective mode:	-
Minimum:	0.0	Unit:	-
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0 to 6553.5

Parameter description

Displays the FPGA software version (with one decimal place).

H01.02 **Servo drive series No.**

Address:	0x0102	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	3	Change:	At stop

Range:

0–65535

Parameter description

Displays the drive series (without decimal place).

H01.04 **Voltage class**

Address:	0x0104	Effective mode:	-
Minimum:	0	Unit:	V
Maximum:	65535	Data type:	UInt16

Default:	220	Change:	Unmodifiable

Range:

0 to 65535

Parameter description

Displays the voltage class of the servo drive.

H01.05 **Rated Power**

Address:	0x0105	Effective mode:	-
Minimum:	0.01	Unit:	kW
Maximum:	655.35	Data type:	UInt16
Default:	0.75	Change:	Unmodifiable

Range:

0.01 to 655.35

Parameter description

Displays the rated power of the drive (with two decimal places).

H01.06 **Max. output power**

Address:	0x0106	Effective mode:	-
Minimum:	0.01	Unit:	kW
Maximum:	655.35	Data type:	UInt16
Default:	0.75	Change:	Unmodifiable

Range:

0.01 to 655.35

Parameter description

Displays the maximum output power of the drive (with two decimal places).

H01.07 **Rated output current**

Address:	0x0107	Effective mode:	-
Minimum:	0.01	Unit:	A.
Maximum:	655.35	Data type:	UInt16
Default:	5.50	Change:	Unmodifiable

Range:

0.01 to 655.35

Parameter description

Displays the rated output current of the drive (with two decimal places).

H01.08 **Max. output current**

Address:	0x0108	Effective mode:	-
Minimum:	0.01	Unit:	A.
Maximum:	655.35	Data type:	UInt16
Default:	16.90	Change:	Unmodifiable

Range:

0.01 to 655.35

Parameter description

Displays the maximum output current of the drive (with two decimal places).

H01.10 **Carrier frequency**

Address:	0x010A	Effective mode:	Effective upon next power-on

Minimum:	4,000	Unit:	-
Maximum:	20000	Data type:	UInt16
Default:	8000	Change:	At stop

Range:

4000 to 20000

Parameter description

Displays the carrier frequency (without decimal place).

H01.11 **Current loop modulation frequency**

Address:	0x010B	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At stop

Range:

0 - Carrier frequency

1 - Two times the carrier frequency

Parameter description

Defines current loop modulation frequency.

H01.12 **Speed loop scheduling frequency-division coefficient**

Address:	0x010C	Effective mode:	Effective upon next power-on
Minimum:	1	Unit:	-
Maximum:	32	Data type:	UInt16
Default:	1	Change:	At stop

Range:

1 - Current loop modulation frequency/1

2 - Current loop modulation frequency/2

4 - Current loop modulation frequency/4

8 - Current loop modulation frequency/8

16 - Current loop modulation frequency/16

32 - Current loop modulation frequency/32

Parameter description

Defines speed loop scheduling frequency-division coefficient.

H01.13 **Position loop scheduling frequency-division coefficient**

Address:	0x010D	Effective mode:	Effective upon next power-on
Minimum:	2	Unit:	-
Maximum:	128	Data type:	UInt16
Default:	4	Change:	At stop

Range:

2 - Current loop modulation frequency/2

4 - Current loop modulation frequency/4

8 - Current loop modulation frequency/8

16 - Current loop modulation frequency/16

32 - Current loop modulation frequency/32

64 - Current loop modulation frequency/64

128 - Current loop modulation frequency/128

Parameter description

Defines position loop scheduling frequency-division coefficient.

H01.14 Dead zone time

Address:	0x010E	Effective mode:	Effective upon next power-on
Minimum:	0.01	Unit:	μs
Maximum:	20.00	Data type:	UInt16
Default:	2.00	Change:	At stop

Range:

0.01 μs to 20.00 μs

Parameter description

Displays the dead zone time (with two decimal places).

H01.15 DC bus overvoltage protective point

Address:	0x010F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	V
Maximum:	900	Data type:	UInt16
Default:	420	Change:	At stop

Range:

0 V~900V

Parameter description

Displays DC bus overvoltage protection threshold (without decimal place).

H01.16 DC bus voltage discharge point

Address:	0x0110	Effective mode:	At once
Minimum:	0	Unit:	V
Maximum:	900	Data type:	UInt16
Default:	380	Change:	At stop

Range:

0 V~900V

Parameter description

Displays DC bus voltage discharge threshold (without decimal place).

H01.17 DC bus voltage under pressure point

Address:	0x0111	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	V
Maximum:	900	Data type:	UInt16
Default:	200	Change:	At stop

Range:

0 V~900V

Parameter description

Displays DC bus undervoltage threshold (without decimal place).

H01.18 Servo drive overcurrent protection threshold

Address:	0x0112	Effective mode:	Effective upon next power-on
Minimum:	10	Unit:	%
Maximum:	100	Data type:	UInt16

Default:	100	Change:	At stop

Range:

10% to 100%

Parameter description

Displays the overcurrent protection threshold of the drive.

H01.19 Sampling coefficient of 7860

Address:	0x0113	Effective mode:	Effective upon next power-on
Minimum:	1	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	3200	Change:	At stop

Range:

1 to 65535

Parameter description

Displays the sampling factor of the drive.

H01.20 Dead zone compensation

Address:	0x0114	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	μs
Maximum:	20.00	Data type:	UInt16
Default:	2.00	Change mode:	At once

Range:

0.00 μs to 20.00 μs

Parameter description

Displays the dead zone compensation coefficient.

H01.21 Minimum switch-on time of bootstrap circuit

Address:	0x0115	Effective mode:	Effective upon next power-on
Minimum:	1.0	Unit:	μs
Maximum:	60.0	Data type:	UInt16
Default:	4.0	Change mode:	At once

Range:

1.0μs~60.0μs

Parameter description

Displays the minimum switch-ON time of the bootstrap circuit.

H01.22 D-axis back EMF constant

Address:	0x0116	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	6553.5	Data type:	UInt16
Default:	60.0	Change mode:	At once

Range:

0.0 to 6553.5

Parameter description

Displays the D-axis coupling voltage compensation coefficient.

H01.23 **Q-axis back EMF constant**

Address:	0x0117	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	6553.5	Data type:	UInt16
Default:	100.0	Change mode:	At once

Range:

0.0 to 6553.5

Parameter description

Displays Q-axis back EMF compensation coefficient.

H01.24 **D-axis current loop gain**

Address:	0x0118	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	1,000	Change mode:	At once

Range:

0–65535

Parameter description

Displays D-axis current loop gain (without decimal place).

H01.25 **D-axis current loop integral compensation factor**

Address:	0x0119	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	2.00	Change mode:	At once

Range:

0.00 to 655.35

Parameter description

Displays D-axis current loop integral compensation factor (with two decimal places).

H01.26 **Current sampling Sinc3 filter data extraction rate**

Address:	0x011A	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Extraction rate 32

1: Extraction rate 64

2: Extraction rate 128

3: Extraction rate 256

Parameter description

Display Sinc3 filter data extraction rate in current sampling (without decimal place).

H01.27 **Q-axis current loop gain**

Address:	0x011B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	1,000	Change mode:	At once

Range:
0–65535
Parameter description
Displays Q-axis current loop gain (without decimal place).

H01.28 **Q-axis current loop integral compensation factor**

Address:	0x011C	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Displays Q-axis current loop integral compensation factor (with two decimal places).

H01.29 **Control power voltage sampling coefficient**

Address:	0x011D	Effective mode:	At once
Minimum:	50.0	Unit:	-
Maximum:	150.0	Data type:	UInt16
Default:	100.0	Change:	At stop

Range:
50.0 to 150.0
Parameter description
Displays bus voltage gain tuning of control circuit (with one decimal place).

H01.30 **Bus voltage gain adjustment**

Address:	0x011E	Effective mode:	At once
Minimum:	50.0	Unit:	%
Maximum:	150.0	Data type:	UInt16
Default:	100.0	Change:	At stop

Range:
50.0 %~150.0%
Parameter description
Displays bus voltage gain tuning (with one decimal place).

H01.31 **FOC calculation time**

Address:	0x011F	Effective mode:	Effective upon next power-on
Minimum:	100	Unit:	μs
Maximum:	10,000	Data type:	UInt16
Default:	260	Change:	At once

Range:
100μs~10000μs
Parameter description
FOC calculation time

H01.32 **UV sampling relative gain**

Address:	0x0120	Effective mode:	Effective upon next power-on
Minimum:	1	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	32768	Change:	At stop

Range:
1 to 65535
Parameter description
Displays the relative gain of UV sampling (without decimal place).

H01.37 **Model identification version**

Address:	0x0125	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	0.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Displays the model parameter version.

H01.44 **Sinc3 filter data extraction rate in 2nd group of current sampling**

Address:	0x012C	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0: Extraction rate 32
1: Extraction rate 64
2: Extraction rate 128
3: Extraction rate 256
Parameter description
Displays Sinc3 filter data extraction rate in current sampling.
0: Extraction rate 32
1: Extraction rate 64
2: Extraction rate 128
3: Extraction rate 256

H01.45 **Phase U duty cycle obtained upon voltage injection**

Address:	0x012D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16

Default:	0	Change:	At stop

Range:

0–65535

Parameter description

Displays phase U duty cycle obtained upon voltage injection.

H01.47 MCU current reference processing time

Address:	0x012F	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	μs
Maximum:	60.00	Data type:	UInt16
Default:	38.00	Change:	At stop

Range:

0.00μs~60.00μs

Parameter description

Displays MCU current reference processing time.

H01.48 AD sampling delay

Address:	0x0130	Effective mode:	Effective upon next power-on
Minimum:	-40.00	Unit:	μs
Maximum:	40.00	Data type	Int16
Default:	1.00	Change:	At stop

Range:

-40.00 μs to +40.00 μs

Parameter description

Displays AD sampling delay.

H01.49 Serial encoder data dissemination delay

Address:	0x0131	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	μs
Maximum:	500.00	Data type:	UInt16
Default:	61.00	Change:	At stop

Range:

0.00 μs to 500.00 μs

Parameter description

Displays serial encoder data dissemination delay.

H01.52 D-axis proportional gain in performance priority mode

Address:	0x0134	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	2,000	Change mode:	At once

Range:

0–65535

Parameter description

Displays D-axis proportional gain in performance priority mode (without decimal place).

H01.53 **D-axis integral gain in performance priority mode**

Address:	0x0135	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	2.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Displays D-axis integral gain in performance priority mode (with two decimal places).

H01.54 **Q-axis proportional gain in performance priority mode**

Address:	0x0136	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	2,000	Change mode:	At once

Range:
0–65535
Parameter description
Displays Q-axis proportional gain in performance priority mode (without decimal place).

H01.55 **Q-axis integral gain in performance priority mode**

Address:	0x0137	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Displays Q-axis integral gain in performance priority mode (with two decimal places).

H01.56 **2nd group of proportional gain coefficient in performance priority mode**

Address:	0x0138	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	1000.0	Data type:	UInt16
Default:	102.4	Change mode:	At once

Range:
0.0 %~1000.0%
Parameter description
Displays the 2nd group of proportional gain coefficient in performance priority mode (with one decimal place).

H01.57 **3rd group of proportional gain coefficient in performance priority mode**

Address:	0x0139	Effective mode:	At once

Minimum:	0.0	Unit:	%
Maximum:	1000.0	Data type:	UInt16
Default:	102.4	Change mode:	At once

Range:
0.0 %~1000.0%
Parameter description
Displays the 3rd group of proportional gain coefficient in performance priority mode (with one decimal place).

H01.58 **1st gain switchover threshold in performance priority mode**

Address:	0x013A	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	1.0	Change mode:	At once

Range:
0.0% to 300.0%
Parameter description
Displays the 1st gain switchover threshold in performance priority mode (with one decimal place).

H01.59 **2nd gain switchover threshold in performance priority mode**

Address:	0x013B	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	2.0	Change mode:	At once

Range:
0.0% to 300.0%
Parameter description
Displays the 2nd gain switchover threshold in performance priority mode (with one decimal place).

H01.60 **3rd gain switchover threshold in performance priority mode**

Address:	0x013C	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	100.0	Change mode:	At once

Range:
0.0% to 300.0%
Parameter description
Displays the 3rd gain switchover threshold in performance priority mode (with one decimal place).

H01.61 **4th gain switchover threshold in performance priority mode**

Address:	0x013D	Effective mode:	At once

Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	200.0	Change mode:	At once

Range:
0.0% to 300.0%
Parameter description
Displays the 4th gain switchover threshold in performance priority mode (with one decimal place).

H01.62 **Phase U/V 7860 detection protection threshold**

Address:	0x013E	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	320	Data type:	UInt16
Default:	280	Change:	Unmodifiable

Range:
0 to 320
Parameter description
Displays the protection threshold of phase U/V overcurrent detection.

H01.63 **Serial encoder data transmission compensation time**

Address:	0x013F	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	-
Maximum:	10.00	Data type:	UInt16
Default:	0.00	Change:	At stop

Range:
0.00 to 10.00
Parameter description
Displays the data transmission compensation time of the serial encoder (with three decimal places).

14.3 H02 Basic Control Parameters

H02.00 **Control mode selection**

Address:	0x0200	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	6	Data type:	UInt16
Default:	1	Change:	At stop

Range:

0: Speed control mode
1: Position control mode 2: Torque control mode 3: Torque<->Speed control mode 4: Speed<->Position control mode 5: Torque<->Position control mode 6: Torque<->Speed<->Position compound mode

Parameter description

0: Speed control mode
1: Position control mode 2: Torque control mode 3: Torque<->Speed control mode 4: Speed<->Position control mode 5: Torque<->Position control mode 6: Torque<->Speed<->Position compound mode

<table>
<tr><th>Set value</th><th>Control mode</th><th>Remarks</th></tr>
<tr><td>0</td><td>Speed control mode</td><td>For speed mode parameter settings, see the "Basic Functions of the Servo Drive" section in the user guide.</td></tr>
<tr><td>1</td><td>Position control mode</td><td>For position mode parameter settings, see the "Basic Functions of the Servo Drive" section in the user guide.</td></tr>
<tr><td>2</td><td>Torque control mode</td><td>For torque mode parameter settings, see the "Basic Functions of the Servo Drive" section in the user guide.</td></tr>
<tr><td>3</td><td>3: Torque control mode <-> Speed control mode</td><td>Set a DI terminal for FunIN.10: M1_SEL (Mode switchover 1) and determine terminal logic.<table><tr><th>M1_SEL Terminal Logic</th><th>Control mode</th></tr><tr><td>OFF</td><td>Torque control mode</td></tr><tr><td>ON</td><td>Speed control mode</td></tr></table></td></tr>
<tr><td>4</td><td>Speed control mode<->Position control mode</td><td>Set a DI terminal for FunIN.10: M1_SEL (Mode switchover 1) and determine terminal logic.<table><tr><th>M1_SEL Terminal Logic</th><th>Control mode</th></tr><tr><td>OFF</td><td>Speed control mode</td></tr><tr><td>ON</td><td>Position control mode</td></tr></table></td></tr>
<tr><td>5</td><td>Torque control mode<->Position control mode</td><td>Set a DI terminal for FunIN.10: M1_SEL (Mode switchover 1) and determine terminal logic.<table><tr><th>M1_SEL Terminal Logic</th><th>Control mode</th></tr><tr><td>OFF</td><td>Torque control mode</td></tr><tr><td>ON</td><td>Position control mode</td></tr></table></td></tr>
<tr><td>6</td><td>Torque control mode<->Speed control mode<->Position control mode</td><td>Set two DI terminal for FunIN.10: M1_SEL (Mode switchover 1) and FunIN.11: M2_SEL (Mode switchover 2), respectively and determine terminal logic.<table><tr><th>M2_SEL Terminal Logic</th><th>M1_SEL Terminal Logic</th><th>Control mode</th></tr><tr><td>OFF</td><td>OFF</td><td>Torque control mode</td></tr><tr><td>ON</td><td>OFF</td><td>Speed control mode</td></tr><tr><td>-</td><td>ON</td><td>Position control mode</td></tr></table></td></tr>
</table>

H02.01 **Absolute position detection system**

Address:	0x0201	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Incremental position mode

1: Absolute position linear mode

2: Absolute position rotating mode

Parameter description

Used to set the absolute position function.

H02.02 **Forward direction**

Address:	0x0202	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

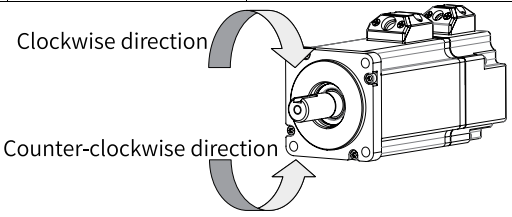
0: CCW direction as the forward direction

1: CW direction as the forward direction

Parameter description

Defines the forward direction of the motor when viewed from the motor shaft side.

Set value	Rotating 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.



H02.03 **Output pulse phase**

Address:	0x0203	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

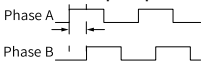
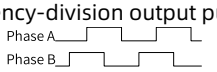
Range:

0: Phase A leads phase B

1: Phase A lags behind phase B

Parameter description

Defines the relationship between phase A and phase B on the condition that the motor direction of rotation remains unchanged when pulse output is enabled.

Set value	Output pulse phase	Remarks
0	Phase A advancing phase B	Phase A leads phase B by 90° in encoder frequency-division output pulses. 
1	Phase A lagging phase B	Phase A lags behind phase B by 90° in encoder frequency-division output pulses. 

H02.05 Disable operation option code

Address:	0x0205	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Coast to stop, keeping de-energized state

1: Stop at zero speed, keeping de-energized state

2: Stop at zero speed, keeping dynamic braking state

3: Dynamic braking stop, keeping dynamic braking state

Parameter description

Defines the deceleration mode of the motor for stopping rotating upon S-ON OFF and the motor status after stop.

H02.06 Fault reaction option code

Address:	0x0206	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	2	Change:	At stop

Range:

0: Coast to stop, keeping de-energized state

1: Stop at zero speed, keeping de-energized state

2: Stop at zero speed, keeping dynamic braking state

3: Dynamic braking stop, keeping dynamic braking state

4: Dynamic braking stop, keeping de-energized status

Parameter description

Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when a No. 2 fault occurs.

H02.07 Stop mode at limit switch signal

Address:	0x0207	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	1	Change:	At stop

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

Parameter description

Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when overtravel occurs.

H02.08 **Stop mode at No.1 fault**

Address:	0x0208	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	2	Change:	At stop

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 servo motor for stopping rotating and the servo motor status when a No. 1 fault occurs.

H02.09 **Delay from brake output on to command received**

Address:	0x0209	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	500	Data type:	UInt16
Default:	250	Change mode:	At once

Range:

0 to 500

Parameter description

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.

H02.10 **Delay from brake output OFF to motor de-energized in static state**

Address:	0x020A	Effective mode:	At once
Minimum:	1	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	150	Change mode:	At once

Range:

1 to 1000

Parameter description

Defines the delay from the moment brake output is OFF to the moment when the motor at standstill enters the de-energized status.

H02.11 **Motor speed threshold at brake output off in rotating state**

Address:	0x020B	Effective mode:	At once

Minimum:	0	Unit:	rpm
Maximum:	3,000	Data type:	UInt16
Default:	30	Change mode:	At once

Range:
0 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 in the rotating state**

Address:	0x020C	Effective mode:	At once
Minimum:	1	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	500	Change mode:	At once

Range:
1 to 1000
Parameter description
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.

H02.14 **Speed threshold for stop mode and stop status switchover**

Address:	0x020E	Effective mode:	At once
Minimum:	10	Unit:	rpm
Maximum:	100	Data type:	UInt16
Default:	10	Change:	At stop

Range:
10rpm~100rpm
Parameter description
Defines the speed threshold for stop mode and stop status switchover.

H02.15 **LED warning display selection**

Address:	0x020F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0: Alarm information output immediately
1: Alarm information not output
Parameter description
Defines whether to switch the keypad to the fault display mode when a No. 3 fault occurs.

H02.17 **Stop at zero speed upon main circuit power-off**

Address:	0x0211	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At stop

Range:

0: Disable

1: Enable

Parameter description

Defines the stop mode of the motor for stopping rotating upon main circuit power failure.

H02.18 S-ON filter time constant

Address:	0x0212	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	64	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0 ms~64ms

Parameter description

Defines the S-ON filter time constant.

H02.19 Brake release delay upon S-ON

Address:	0x0213	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0 ms to 1000 ms

Parameter description

Defines the delay time from servo ON to brake release.

H02.20 Energizing delay of DB relay coil

Address:	0x0214	Effective mode:	At once
Minimum:	10	Unit:	ms
Maximum:	30000	Data type:	UInt16
Default:	30	Change mode:	At once

Range:

10 to 30000

Parameter description

Defined based on hardware dynamic brake relay response time

H02.21 Smallest allowed dynamic braking resistor

Address:	0x0215	Effective mode:	-
Minimum:	1	Unit:	Ω
Maximum:	1,000	Data type:	UInt16
Default:	40	Change:	Unmodifiable

Range:

1 Ω~1000Ω

Parameter description

The permissible minimum resistance of the regenerative resistor is only related to the servo drive model.

H02.22 **Power of built-in regenerative resistor**

Address:	0x0216	Effective mode:	-
Minimum:	1	Unit:	W
Maximum:	65535	Data type:	UInt16
Default:	40	Change:	Unmodifiable

Range:

1W–65535W

Parameter description

The power of the built-in regenerative resistor is dependent on the drive model and cannot be modified.

H02.23 **Resistance of built-in regenerative resistor**

Address:	0x0217	Effective mode:	-
Minimum:	1	Unit:	Ω
Maximum:	1,000	Data type:	UInt16
Default:	50	Change:	Unmodifiable

Range:

1 Ω~1000Ω

Parameter description

The resistance of the built-in regenerative resistor is dependent on the drive model and cannot be modified.

Table 14–1 Specifications of the Braking Resistor

Servo drive model (SV660, SV630)	Specifications of built-in braking resistor		External regenerative resistor
	Resistance (Ω)	Power Pr (W)	Min. allowable resistance (Ω) (H02.21)
SV6*0PS1R6I	-	-	50
SV6*0PS2R8I	-	-	45
SV6*0PS5R5I	50	50	40
SV6*0PS7R6I	25	80	20
SV6*0PS012I			15
SV6*0PT3R5I	100	80	80
SV6*0PT5R4I	100	80	60
SV6*0PT8R4I	50	80	45
SV6*0PT012I			40
SV6*0PT017I	35	100	35
SV6*0PT021I			25
SV6*0PT026I			

H02.24 **Resistor heat dissipation coefficient**

Address:	0x0218	Effective mode:	At once
Minimum:	10	Unit:	-
Maximum:	100	Data type:	UInt16
Default:	30	Change:	At stop

Range:

10 to 100

Parameter description

Defines the heat dissipation coefficient of the braking resistor,

It sets the heat dissipation coefficient of the regenerative resistor, which is valid for both built-in and external ones.

Set H02.24 properly according to actual heat dissipation conditions of the resistor.

Recommendations:

Generally, the value of H02.24 cannot exceed 30% for natural cooling or 50% for forced air cooling.

H02.25 **Regenerative resistor type**

Address:	0x0219	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Built-in

1: External, natural ventilated

2: External, forced air cooling

3: Not needed

Parameter description

Defines the resistor type and the mode of absorbing and releasing the braking energy.

Set value	Defines the regenerative resistor type and the mode of absorbing and releasing the braking energy.	Remarks
0	Built-in	When the calculated value of the maximum braking energy is larger than the maximum braking energy absorbed by capacitors, and the calculated value of braking power is no larger than the built-in regenerative resistor power.
1	External, naturally ventilated	When the calculated value of the maximum braking energy is larger than the maximum braking energy absorbed by capacitors, and the calculated value of braking power is larger than the built-in regenerative resistor power.
2	External, forcible cooling	When the calculated value of the maximum braking energy is larger than the maximum braking energy absorbed by capacitors, and the calculated value of braking power is larger than the built-in regenerative resistor power.
3	No resistor, using only capacitor	When the calculated value of maximum braking energy is no larger than the maximum braking energy absorbed by capacitors.

H02.26 **Power of external braking resistor**

Address:	0x021A	Effective mode:	At once

Minimum:	1	Unit:	W
Maximum:	65535	Data type:	UInt16
Default:	40	Change:	At stop

Range:

1W–65535W

Parameter description

Defines the power of the external braking resistor.

H02.27 Resistance of external regenerative resistor

Address:	0x021B	Effective mode:	At once
Minimum:	1	Unit:	Ω
Maximum:	1,000	Data type:	UInt16
Default:	50	Change:	At stop

Range:

1 Ω~1000Ω

Parameter description

Defines the resistance of the external braking resistor.

H02.28 Minimum bus voltage of 220 V voltage class

Address:	0x021C	Effective mode:	Effective upon next power-on
Minimum:	190	Unit:	V
Maximum:	260	Data type:	UInt16
Default:	235	Change:	At stop

Range:

190 V~260V

Parameter description

Defines the minimum bus voltage of 220 V voltage class.

H02.30 User Password

Address:	0x021E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0–65535

Parameter description

Defines the user password.

H02.31 System parameter initialization

Address:	0x021F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No operation

1: Restore default settings

2: Clear fault records

Parameter description

Used to restore default values or clear fault log.

Set value	Stop mode	Remarks
0	No operation	-
1	Restore default setting	Restore parameters to default values except parameters in groups H00 and H01.
2	Clear fault records	Clear the latest 10 faults and warnings.

H02.32 Default keypad display

Address:	0x0220	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	50	Change:	At once

Range:

0 to 99

Parameter description

According to the setting, the keypad can switch to monitoring parameter display mode (parameters in group H0b) automatically. H02.32 is used to set the offset in group H0b.

Set value	Parameters in group H0b	Remarks
0	H0b.00	Motor speed is not zero, the keypad displays the setting of H0b.00 (Actual motor speed).
1	H0b.01	The keypad displays the setting of H0b.01 (speed reference).

H02.34 CAN software version

Address:	0x0222	Effective mode:	-
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	0.00	Change:	Unmodifiable

Range:

0.00 to 655.35

Parameter description

Displays the CAN software version.

H02.35 Keypad display refresh frequency

Address:	0x0223	Effective mode:	At once
Minimum:	0	Unit:	Hz
Maximum:	20	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 to 20

Parameter description

Defines the keypad data refresh frequency.

H02.37 **Bus voltage hold time**

Address:	0x0225	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	ms
Maximum:	3,000	Data type:	UInt16
Default:	150	Change mode:	At once

Range:

0 ms~3000ms

Parameter description

Used to set the hold time of bus voltage before the soft-start relay closes.

H02.41 **Manufacturer password**

Address:	0x0229	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0–65535

Parameter description

Enter the manufacturer password to enable the manufacturer protection parameters.

14.4 H03 Terminal Input Parameters

H03.00 **States of DI functions FunIN1 to 16**

Address:	0x0300	Effective mode:	Effective upon next power-on
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	At once

Range:

0: Corresponding to null
1: Corresponding to FunIN.1
2: Corresponding to FunIN.2
4: Corresponding to FunIN.3
8: Corresponding to FunIN.4
16: Corresponding to FunIN.5
32: Corresponding to FunIN.6
64: Corresponding to FunIN.7
128: Corresponding to FunIN.8
256: Corresponding to FunIN.9
512: Corresponding to FunIN.10
1024: Corresponding to FunIN.11
2048: Corresponding to FunIN.12
4096: Corresponding to FunIN.13
8192: Corresponding to FunIN.14
16384: Corresponding to FunIN.15
32768: Corresponding to FunIN.16

Parameter description

Used to enable a certain DI function (FunIN.1 to FunIN.16) to be activated immediately at next power-on.

H03.01 **States of DI functions FunIN17 to 32**

Address:	0x0301	Effective mode:	Effective upon next power-on
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	At once

Range:

0: Corresponding to null
1: Corresponding to FunIN.17
2: Corresponding to FunIN.18
4: Corresponding to FunIN.19
8: Corresponding to FunIN.20
16: Corresponding to FunIN.21
32: Corresponding to FunIN.22
64: Corresponding to FunIN.23
128: Corresponding to FunIN.24
256: Corresponding to FunIN.25
512: Corresponding to FunIN.26
1024: Corresponding to FunIN.27
2048: Corresponding to FunIN.28
4096: Corresponding to FunIN.29
8192: Corresponding to FunIN.30
16384: Corresponding to FunIN.31

Parameter description

Used to enable a certain DI function (FunIN.17 to FunIN.31) to be activated immediately at next power-on.

H03.02 **DI1 function selection**

Address:	0x0302	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	14	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI1.

H03.03 **DI1 logic selection**

Address:	0x0303	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

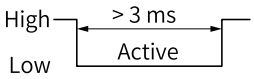
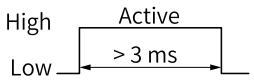
0: Active low

1: Active high

Parameter description

It sets the level logic of DI1 for enabling the DI1 function. DI1 to DI5 are standard DIs, and DI8 to DI9 are high-speed DIs.

Table 14–2 Signal logic of low-speed DI terminals

Set value	Terminal logic when DI function valid	Remarks
0	Low level	
1	High level	

H03.04 **DI2 terminal function selection**

Address:	0x0304	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	15	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI2.

H03.05 **DI2 terminal logic selection**

Address:	0x0305	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Low level active

1: High level active

Parameter description

Defines the level logic of DI2 when the function assigned to DI2 is active. DI1 to DI5 are standard DIs, and DI8 to DI9 are high-speed DIs.

H03.06 **DI3 terminal function selection**

Address:	0x0306	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	13	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI3.

H03.07 **DI3 terminal logic selection**

Address:	0x0307	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Low level active

1: High level active

Parameter description

It sets the level logic of DI3 for enabling the DI3 function. DI1 to DI5 are standard DIs, and DI8 to DI9 are high-speed DIs.

H03.08 **DI4 terminal function selection**

Address:	0x0308	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	2	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI4.

H03.09 **DI4 terminal logic selection**

Address:	0x0309	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Low level active

1: High level active

Parameter description

It sets the level logic of DI4 for enabling the DI4 function. DI1 to DI5 are standard DIs, and DI8 to DI9 are high-speed DIs.

H03.10 **DI5 terminal function selection**

Address:	0x030A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI5.

H03.11 **DI5 terminal logic selection**

Address:	0x030B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Low level active

1: High level active

Parameter description

It sets the level logic of DI5 for enabling the DI5 function. DI1 to DI5 are standard DIs, and DI8 to DI9 are high-speed DIs.

H03.16 **DI8 terminal function selection**

Address:	0x0310	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	31	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI8.

H03.17 **DI8 terminal logic selection**

Address:	0x0311	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

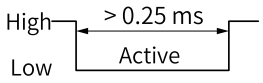
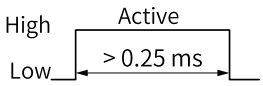
0: Active low

1: Active high

Parameter description

It sets the level logic of DI8 for enabling the DI8 function. DI8 and DI9 are high-speed DIs. The width of the input signal must be higher than 0.25 ms.

Table 14–3 Signal logic of high-speed DI terminals

Set value	Terminal logic when DI function valid	Remarks
0	Low level	
1	High level	

H03.18 **DI9 terminal function selection**

Address:	0x0312	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI9.

H03.19 **DI9 terminal logic selection**

Address:	0x0313	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Low level active

1: High level active

Parameter description

It sets the level logic of DI9 for enabling the DI9 function. DI8 and DI9 are high-speed DIs. The width of the input signal must be higher than 0.25 ms.

H03.34 **States of DI functions FunIN33 to 48**

Address:	0x0322	Effective mode:	Effective upon next power-on
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	At once

Range:

0: 0x0 - Corresponding to null

1: 0x1 - Corresponding to FunIN.33

2: 0x2 - Corresponding to FunIN.34

4: 0x4 - Corresponding to FunIN.35

8: 0x8 - Corresponding to FunIN.36

16: 0x10 - Corresponding to FunIN.37

32: 0x20 - Corresponding to FunIN.38

64: 0x40 - Corresponding to FunIN.39

128: 0x80 - Corresponding to FunIN.40

256: 0x100 - Corresponding to FunIN.41

512: 0x200 - Corresponding to FunIN.42

1024: 0x400 - Corresponding to FunIN.43

2048: 0x800 - Corresponding to FunIN.44

4096: 0x1000 - Corresponding to FunIN.45

8192: 0x2000 - Corresponding to FunIN.46

16384: 0x4000 - Corresponding to FunIN.47

Parameter description

Used to enable a certain DI function (FunIN.33 to FunIN.37) to be activated immediately at next power-on.

H03.35 **States of DI functions FunIN49 to 64**

Address:	0x0323	Effective mode:	Effective upon next power-on
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	At once

Range:

0: 0x0 - Corresponding to null
1: 0x1 - Corresponding to FunIN.49
2: 0x2 - Corresponding to FunIN.50
4: 0x4 - Corresponding to FunIN.51
8: 0x8 - Corresponding to FunIN.52
16: 0x10 - Corresponding to FunIN.53
32: 0x20 - Corresponding to FunIN.54
64: 0x40 - Corresponding to FunIN.55
128: 0x80 - Corresponding to FunIN.56
256: 0x100 - Corresponding to FunIN.57
512: 0x200 - Corresponding to FunIN.58
1024: 0x400 - Corresponding to FunIN.59
2048: 0x800 - Corresponding to FunIN.60
4096: 0x1000 - Corresponding to FunIN.61
8192: 0x2000 - Corresponding to FunIN.62
16384: 0x4000 - Corresponding to FunIN.63

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**

Address:	0x033C	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	At once

Range:

0.00 to 500.00

Parameter description

Defines the filter time of DI1. The DI function is active only after the active level is kept for the time defined by H03.60.

H03.61 **DI2 filter**

Address:	0x033D	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	At once

Range:

0.00 to 500.00

Parameter description

Defines the filter time of DI2. The DI function is active only after the active level is kept for the time defined by H03.61.

H03.62 **DI3 filter**

Address:	0x033E	Effective mode:	At once
Minimum:	0.00	Unit:	ms

Maximum:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	At once

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI3. The DI function is active only after the active level is kept for the time defined by H03.62.

H03.63 **DI4 filter**

Address:	0x033F	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	At once

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI4. The DI function is active only after the active level is kept for the time defined by H03.63.

H03.64 **DI5 filter**

Address:	0x0340	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	At once

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI5. The DI function is active only after the active level is kept for the time defined by H03.64.

H03.65 **DI8 filter 1**

Address:	0x0341	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	500.00	Data type:	UInt16
Default:	0.00	Change mode:	At once

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI8. The DI function is active only after the active level is kept for the time defined by H03.65.

H03.66 **DI9 filter 1**

Address:	0x0342	Effective mode:	At once
Minimum:	0.00	Unit:	ms

Maximum:	500.00	Data type:	UInt16
Default:	0.00	Change mode:	At once

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI9. The DI function is active only after the active level is kept for the time defined by H03.66.

14.5 H04 Terminal Output Parameters

H04.00 **DO1 terminal function selection**

Address:	0x0400	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	1	Change mode:	At once

Range:
0: No function
1: Servo ready
2: Motor rotation
3: Zero speed signal
4: Speed consistent
5: Positioning completed
6: Positioning near
7: Torque limit
8: Speed limit
9: Braking
10: Warning
11: Fault
12: Output 3-digit alarm code
13: Output 3-digit alarm code
14: Output 3-digit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reached
19: Speed reached
20: Angle auto-tuning output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed
26: Servo enabled to receive operating command
27: Fault or alarm

Parameter description

Defines the function of DO1.

H04.01 DO1 logic selection

Address:	0x0401	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

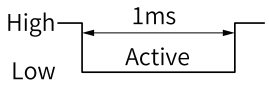
Range:

0: Output low (L) level when active (optocoupler ON)

1: Output high (H) level when active (optocoupler OFF)

Parameter description

Defines the level logic of DO1 when the function assigned to DO1 is active. DO1 to DO5 are low-speed DO terminals and their minimum output signal width is 1 ms.

Set value	DO1 Logic When DO1 Function Enabled	Transistor State	Remarks
0	Low level	ON	
1	High level	OFF	

H04.02 DO2 terminal function selection

Address:	0x0402	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	5	Change mode:	At once

Range:

0: No function
1: Servo ready
2: Motor rotation
3: Zero speed signal
4: Speed consistent
5: Positioning completed
6: Positioning near
7: Torque limit
8: Speed limit
9: Braking
10: Warning
11: Fault
12: Output 3-digit alarm code
13: Output 3-digit alarm code
14: Output 3-digit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reached
19: Speed reached
20: Angle auto-tuning output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed
26: Servo enabled to receive operating command
27: Fault or alarm

Parameter description

Defines the function of DO2.

H04.03 **DO2 logic selection**

Address:	0x0403	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Output low level (L) when active (optocoupler ON)
1: Output high level (H) when active (optocoupler OFF)

Parameter description

Defines the level logic of DO2 when the function assigned to DO2 is active. DO1 to DO5 are low-speed DO terminals and their minimum output signal width is 1 ms.

H04.04 **DO3 terminal function selection**

Address:	0x0404	Effective mode:	At once
Minimum:	0	Unit:	-

Maximum:	27	Data type:	UInt16
Default:	9th	Change mode:	At once

Range:

0: No function
1: Servo ready
2: Motor rotation
3: Zero speed signal
4: Speed consistent
5: Positioning completed
6: Positioning near
7: Torque limit
8: Speed limit
9: Braking
10: Warning
11: Fault
12: Output 3-digit alarm code
13: Output 3-digit alarm code
14: Output 3-digit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reached
19: Speed reached
20: Angle auto-tuning output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed
26: Servo enabled to receive operating command
27: Fault or alarm

Parameter description

Defines the function of DO3.

H04.05 **DO3 logic selection**

Address:	0x0405	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Output low level (L) when active (optocoupler ON)
1: Output high level (H) when active (optocoupler OFF)

Parameter description

Defines the level logic of DO3 when the function assigned to DO3 is active. DO1 to DO5 are low-speed DO terminals and their minimum output signal width is 1 ms.

H04.06 **DO4 terminal function selection**

Address:	0x0406	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	11	Change mode:	At once

Range:

0: No function
1: Servo ready
2: Motor rotation
3: Zero speed signal
4: Speed consistent
5: Positioning completed
6: Positioning near
7: Torque limit
8: Speed limit
9: Braking
10: Warning
11: Fault
12: Output 3-digit alarm code
13: Output 3-digit alarm code
14: Output 3-digit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reached
19: Speed reached
20: Angle auto-tuning output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed
26: Servo enabled to receive operating command
27: Fault or alarm

Parameter description

Defines the function of DO4.

H04.07 **DO4 logic selection**

Address:	0x0407	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Output low level (L) when active (optocoupler ON)
1: Output high level (H) when active (optocoupler OFF)

Parameter description

Defines the level logic of DO4 when the function assigned to DO2 is active. DO1 to DO5 are low-speed DO terminals and their minimum output signal width is 1 ms.

H04.08 **DO5 terminal function selection**

Address:	0x0408	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	16	Change mode:	At once

Range:

0: No function
1: Servo ready
2: Motor rotation
3: Zero speed signal
4: Speed consistent
5: Positioning completed
6: Positioning near
7: Torque limit
8: Speed limit
9: Braking
10: Warning
11: Fault
12: Output 3-digit alarm code
13: Output 3-digit alarm code
14: Output 3-digit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reached
19: Speed reached
20: Angle auto-tuning output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed
26: Servo enabled to receive operating command
27: Fault or alarm

Parameter description

Defines the function of DO5.

H04.09 **DO5 logic selection**

Address:	0x0409	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Output low level (L) when active (optocoupler ON)

1: Output high level (H) when active (optocoupler OFF)

Parameter description

Defines the level logic of DO5 when the function assigned to DO2 is active. DO1 to DO5 are low-speed DO terminals and their minimum output signal width is 1 ms.

H04.22 DO source

Address:	0x0416	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:

bit0: DO1

0: DO1 function output

1: bit0 of H31.04

bit1: DO2

0: DO2 function output

1: bit1 of H31.04

bit2: DO3

0: DO3 function output

1: bit2 of H31.04

bit3: DO4

0: DO4 function output

1: bit3 of H31.04

bit4: DO5

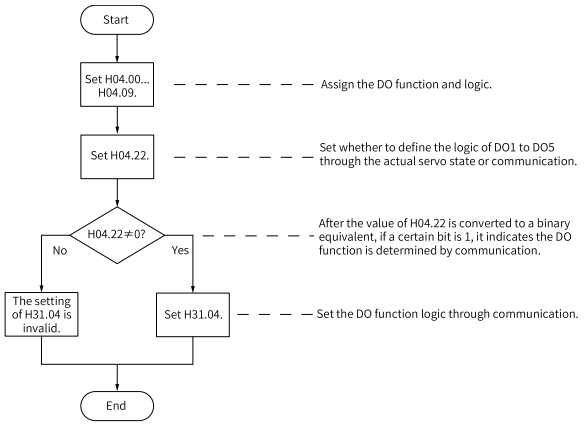
0: DO5 function output

1: bit4 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.

Value Range (Decimal)	Setpoint (binary)					DO logic	
	bit4	bit 3	bit2	bit1	bit0	Defined by the drive state	Defined by Communica-tion (H31.04)
	DO5	DO4	DO3	DO2	DO1		
0	0	0	0	0	0	DO1-DO5	None
1	0	0	0	0	1	DO2-DO5	DO1
…	…	…	…	…	…	…	…
31	1	1	1	1	1	None	DO1-DO5



14.6 H05 Position Control Parameters

H05.00 **Main position reference source**

Address:	0x0500	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Pulse reference

1: Step amount

2: Multi-position reference

Parameter description

Defines the position reference source in the position control mode.

Set value	Reference source	Description
0	Pulse reference	The host controller or other pulse generators generate pulses, which are input to the servo drive through hardware terminals. The hardware terminal is selected in H05.01.
1	Step size	The step displacement is set in H05.05 (step value). The step reference is sent by the DI set for function FunIN.20.
2	Multi-position reference	The running mode of the multi-position function is set in parameters in group H11. The multi-position reference is sent by the DI set for function FunIN.28.

H05.01 **Position pulse reference input terminal selection**

Address:	0x0501	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

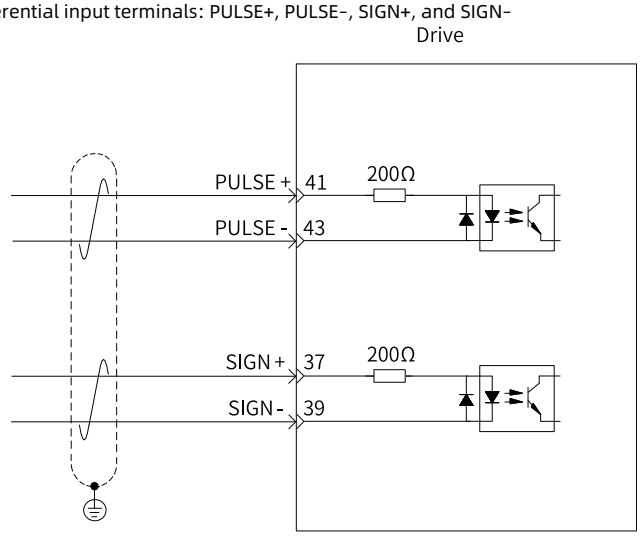
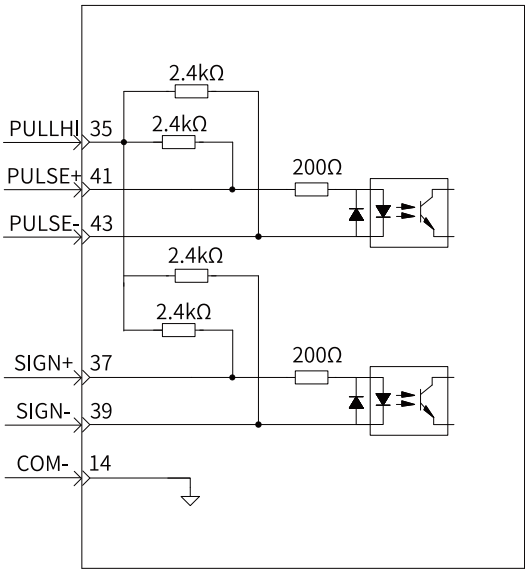
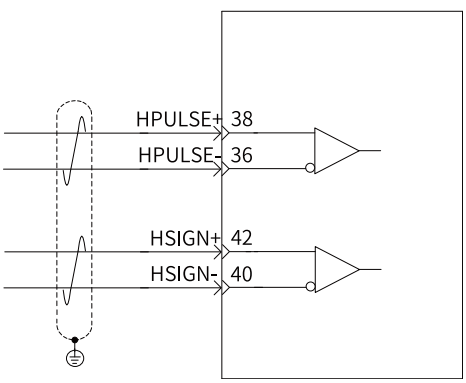
Range:

0: Low-speed

1: High-speed

Parameter description

Used to select the physical input terminal based on the input pulse frequency when the pulse reference acts as the position reference source in the position control mode.

Set value	Input terminal	Description
0	Low speed	Differential input terminals: PULSE+, PULSE–, SIGN+, and SIGN–  Max. pulse frequency: 500 kpps
		Open-collector input terminals: PULLHI, PULSE+, PULSE–, SIGN+, and SIGN–  Max. pulse frequency: 200 kbps
1	High speed	Differential input terminals: HPULSE+, HPULSE–, HSIGN+, and HSIGN–  Max. pulse frequency: $ Mbps.

H05.02 **Pulses per revolution**

Address:	0x0502	Effective mode:	At once
Minimum:	0	Unit:	P/Rev
Maximum:	1048576	Data type	UInt32
Default:	0	Change:	At stop

Range:

0 P/Rev–1048576 P/Rev

Parameter description

Sets the number of position references when the motor rotates one revolution.

H05.04 **Time constant of first-order low-pass filter**

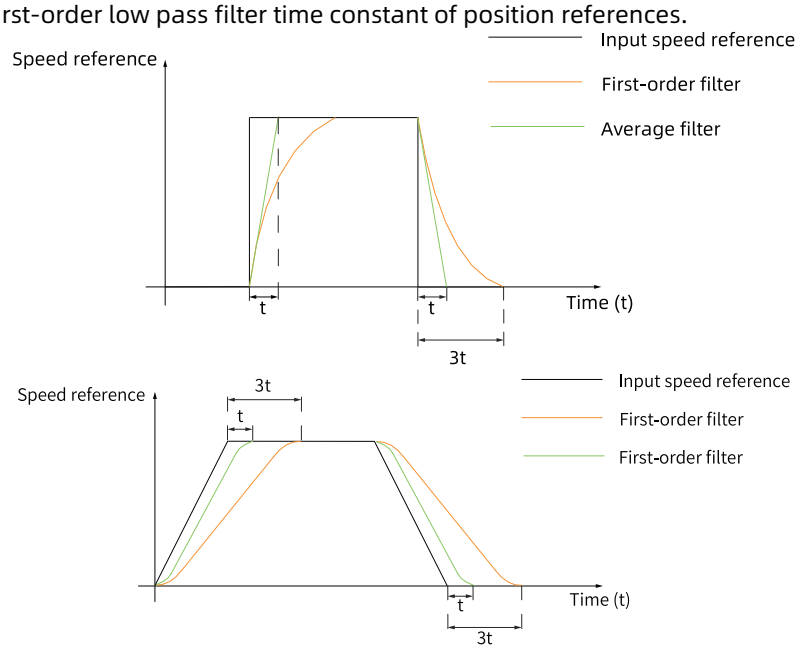
Address:	0x0504	Effective mode:	At once
Minimum:	0.0	Unit:	ms
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	At stop

Range:

0.0 ms to 6553.5ms

Parameter description

Defines the first-order low pass filter time constant of position references.



H05.05 **Step size**

Address:	0x0505	Effective mode:	At once
Minimum:	-9999	Unit:	Reference unit
Maximum:	9999	Data type	Int16
Default:	50	Change:	At stop

Range:

-9999 to +9999

Parameter description

Defines the position reference sum when the step reference acts as the main position reference source.

H05.06 **Time constant of moving average filter**

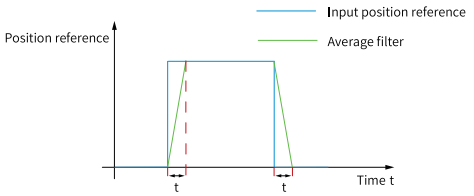
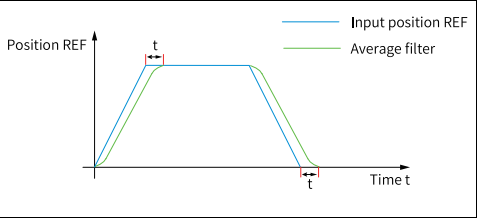
Address:	0x0506	Effective mode:	At once
Minimum:	0.0	Unit:	ms
Maximum:	128.0	Data type:	UInt16
Default:	0.0	Change:	At stop

Range:

0.0 to 128.0

Parameter description

Defines the moving average filter time constant of position references.

Position Reference Being Rectangular Wave	Position Reference Being Trapezoidal Wave
	

H05.07 **Electronic gear ratio 1 (numerator)**

Address:	0x0507	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	1073741824	Data type	UInt32
Default:	8388608	Change mode:	At once

Range:

1 to 1073741824

Parameter description

Defines the numerator of electronic gear ratio 1 for encoder unit conversion to user unit.

H05.09 **Electronic gear ratio 1 (denominator)**

Address:	0x0509	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	1073741824	Data type	UInt32
Default:	10,000	Change mode:	At once

Range:

1 to 1073741824

Parameter description

Defines the denominator of electronic gear ratio 1 for encoder unit conversion to user unit.

H05.11 **Electronic gear ratio 2 (numerator)**

Address:	0x050B	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	1073741824	Data type	UInt32
Default:	8388608	Change mode:	At once

Range:

1 to 1073741824

Parameter description

Defines the numerator of electronic gear ratio 2 for encoder unit conversion to user unit.

H05.13 Electronic gear ratio 2 (denominator)

Address:	0x050D	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	1073741824	Data type	UInt32
Default:	10,000	Change mode:	At once

Range:

1 to 1073741824

Parameter description

Defines the denominator of electronic gear ratio 2 for encoder unit conversion to user unit.

H05.15 Pulse input format

Address:	0x050F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Direction+Pulse, positive logic

1: Direction+Pulse, negative logic

2: Phase A + phase B quadrature pulse, quadrature multiplication

3: CW+CCW

Parameter description

Defines the input pulse form when the main position reference source is pulse input.

Table 14–4 Pulse forms

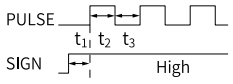
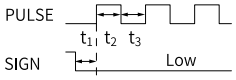
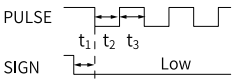
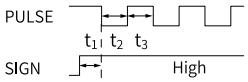
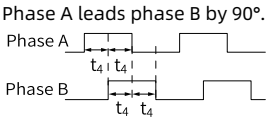
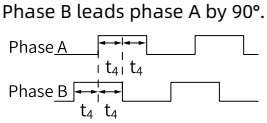
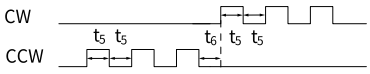
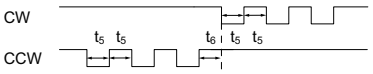
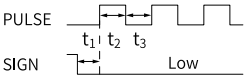
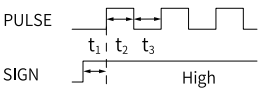
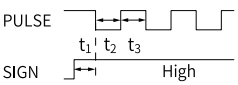
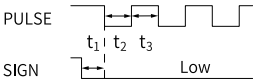
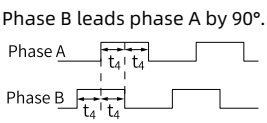
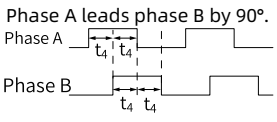
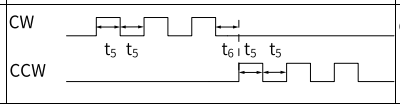
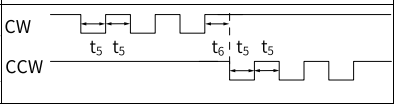
H02.02	H05.15	Pulse format	Signal	Forward Pulse Diagram	Reverse Pulse Diagram
0	0	Pulse+ direction Positive Logic	PULSE SIGN		
	1	Pulse+ direction Negative Logic	PULSE SIGN		
	2	Phase A + phase B quadrature pulse 4-frequency multiplication	PULSE (phase A) SIGN (phase B)		
	3	CW + CCW	PULSE (CW) SIGN (CCW)		
1	0	Pulse+ direction Positive Logic	PULSE SIGN		
	1	Pulse+ direction Negative Logic	PULSE SIGN		
	2	Phase A + phase B quadrature pulse 4-frequency multiplication	PULSE (phase A) SIGN (phase B)		
	3	CW + CCW	PULSE (CW) SIGN (CCW)		

Table 14–5 Pulse reference specifications

Input terminal		Maximum frequency	Min. Time Width (μs)					
			t1	t2	t3	t4	t5	t6
High-speed pulse input		4 Mpps	0.125	0.125	0.125	0.25	0.125	0.125
Low-speed pulse input terminal	Differential input	200 kpps	2.5	2.5	2.5	5	2.5	2.5
	Collector input	200 kpps	2.5	2.5	2.5	5	2.5	2.5

H05.16 **Clear action**

Address:	0x0510	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop
Range:			

0: Clear position deviation upon S-OFF and fault

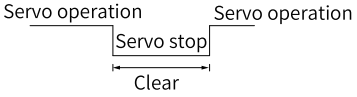
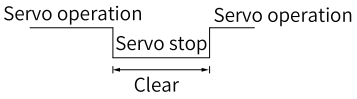
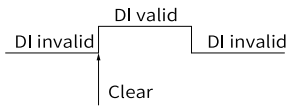
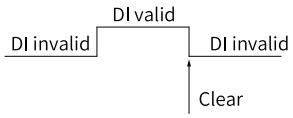
1: Clear position deviation pulses upon S-OFF and fault

2: Clear position deviation by ClrPosErr signal input from DI

Parameter description

Defines the condition for clearing the position deviation.

Table 14–6 Position deviation clear

Set value	Clear Condition	Clear Time
H05.16=0	Clear the position deviation when the S-ON signal is switched off or when a fault occurs.	
H05.16=1	Clear the position deviation when the S-ON signal is switched off or when the servo drive stops upon a fault event.	
H05.16=2	Clear the position deviation cleared when the S-ON signal is switched off or when a fault occurs. Clear the position deviation when ClrPosErr signal is inputted through a DI when the servo drive is in the RUN state.	 (Rising edge-triggered)  (Falling edge-triggered)

H05.17 **Encoder frequency-division pulses**

Address:	0x0511	Effective mode:	Effective upon next power-on
Minimum:	35	Unit:	P/Rev
Maximum:	32767	Data type:	UInt16
Default:	2500	Change:	At stop

Range:

35 P/Rev–32767 P/Rev

Parameter description

It sets the number of pulses output by PAO or PBO per motor revolution.

Pulse output resolution per revolution = (H05.17) x 4

H05.19 **Speed feedforward control selection**

Address:	0x0513	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	1	Change:	At stop

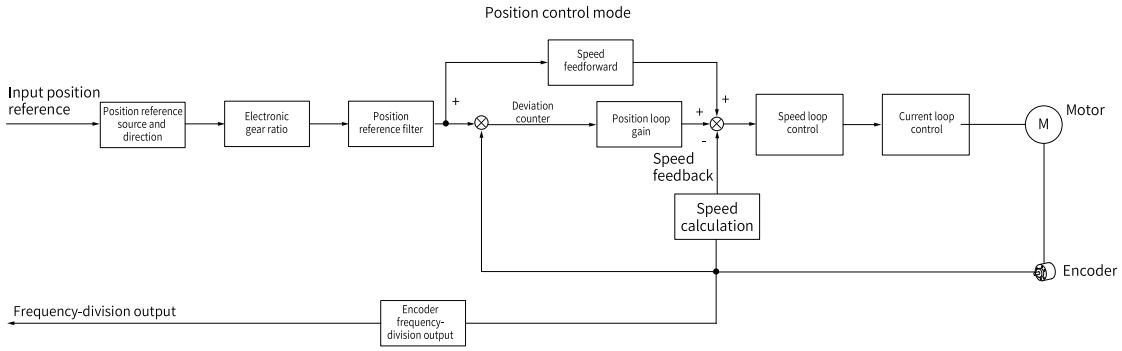
Range:

0: No speed feedforward

1: Internal speed feedforward

Parameter description

It sets the source of the speed loop feedforward signal.



H05.20 **Condition for positioning completed signal output**

Address:	0x0514	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Absolute position deviation lower than the setpoint of H05.21

1: Absolute position deviation lower than the setpoint of H05.21 and the filtered position reference is 0

2: Absolute position deviation lower than the setpoint of H05.21 and the unfiltered position reference is 0

3: Absolute position deviation kept lower than the setpoint of H05.21 within the time defined by H05.60 and the unfiltered position reference is 0

Parameter description

Defines the condition for outputting positioning completed/proximity signal. In the 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.

H05.21 **Threshold of positioning completed**

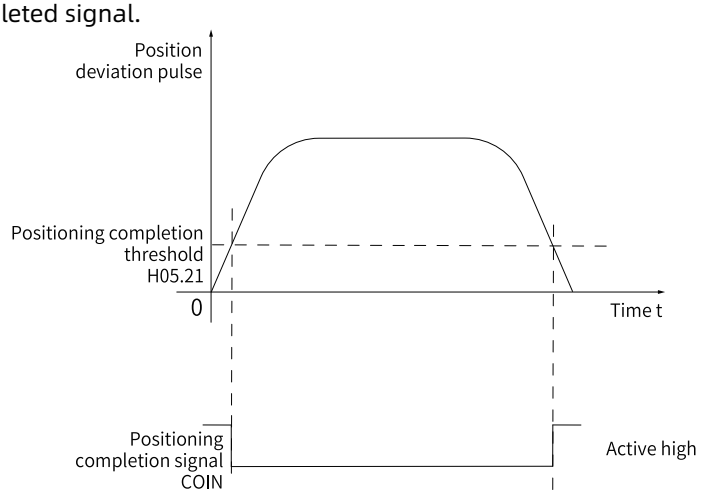
Address:	0x0515	Effective mode:	At once
Minimum:	1	Unit:	Encoder unit
Maximum:	65535	Data type:	UInt16
Default:	5872	Change mode:	At once

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:	0x0516	Effective mode:	At once
Minimum:	1	Unit:	Encoder unit
Maximum:	65535	Data type:	UInt16
Default:	65535	Change mode:	At once

Range:

1 to 65535

Parameter description

Defines the threshold of the absolute value of position deviation when the drive outputs the proximity signal.

H05.23 Interruption fixed length

Address:	0x0517	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Disabled

1: Enabled

Parameter description

0: Disabled

1: Enabled

H05.24 Displacement of interruption fixed length

Address:	0x0518	Effective mode:	At once
Minimum:	0	Unit:	Reference unit
Maximum:	1073741824	Data type	UInt32
Default:	10,000	Change mode:	At once

Range:

0 to 1073741824

Parameter description

Defines the position reference for interrupt positioning.

H05.26 Constant speed for interruption fixed length

Address:	0x051A	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change:	At once

Range:

0rpm~7000rpm

Parameter description

Defines the maximum speed during interrupt positioning.

Table 14–7 Motor speed for interrupt positioning

H05.26	Motor speed before function triggered	Interrupt Positioning	Constant speed for interruption fixed length
0	< 10	OFF	-
	≥ 10	ON	Motor speed before function triggered
1 to 7000	-	ON	H05.26

H05.27 Acceleration/Deceleration time of interruption fixed length

Address:	0x051B	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms to 1000 ms

Parameter description

Defines the time for the motor to accelerate from 0 RPM to 1000 RPM or decelerate from 1000 RPM to 0 RPM for interrupt positioning.

The actual motor acceleration time t during interrupt positioning is:

$$t = \frac{|\text{H05.26-Motor speed before interrupt positioning}|}{1000} \times (\text{H05.27})$$

H05.29 Interruption fixed length unlock

Address:	0x051D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At once

Range:

0: Disable

1: Enable

Parameter description

Sets whether to unlock the interrupt positioning signal.

Set value	Interrupt positioning cancel signal	Remarks
0	Disabled	After interrupt positioning is completed, the servo drive responds to the other position references directly.
1	Enable	• After interrupt positioning is completed, the servo drive does not directly respond to other position references. • After you enable the DI function 29 (FunIN.29: XintFree, unlock interrupt positioning), the servo drive can respond to other position references.

H05.30 Control of home return

Address:	0x051E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	8	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Disabled

1: Homing enabled through the HomingStart signal input from DI

2: Electrical homing enabled through the HomingStart signal input from DI

3: Homing started immediately upon power-on

4: Homing executed immediately

5: Electrical homing started

6: Current position as home

8: DI-triggered position as home

Parameter description

Defines the homing mode and the trigger signal source.

Set value	Trigger signal	Remarks	
		Mode of home return	Trigger signal
0	Disabled	The homing function is disabled.	
1	Homing enabled through HomingStart signal input from DI	Homing	DI function FunIN.32 (HomingStart, homing enable)
2	Electrical homing enabled through HomingStart signal input from DI	Electrical homing	DI function FunIN.32 (HomingStart, homing enable)
3	Homing started immediately upon power-on	Homing	S-ON signal active for the first time after power-on again in the position mode
4	Homing started immediately	Homing	S-ON signal active in the position mode After homing is done, set H05.30 to 0.
5	Electrical homing started	Electrical homing	S-ON signal active in the position mode After homing is done, set H05.30 to 0.
6	Homing on current position	Homing	Not required After homing is done, set H05.30 to 0.
8	Current position as the home enabled through signal input from DI	Homing	DI signal FunIN.41 (current position as the home)

H05.31 Mode of home return

Address:	0x051F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	16	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Forward homing, home switch as the deceleration point and the home
1: Reverse homing, home switch as the deceleration point and the home
2: Forward homing, Z signal as deceleration point and home
3: Reverse homing, Z signal as deceleration point and home
4: Forward homing, home switch as the deceleration point and motor Z signal as the home
5 - Reverse homing, home switch as the deceleration point and motor Z signal as the home
6: Forward homing, deceleration point and home being positive limit switch
7: Reverse homing, deceleration point and home being negative limit switch
8: Forward homing, deceleration point being positive limit switch and home being motor Z signal
9: Reverse homing, deceleration point being negative limit switch and home being motor Z signal
10: Forward homing, deceleration point and home being mechanical final limit position
11: Reverse homing, deceleration point and home being mechanical final limit position
12: Forward homing, deceleration point being mechanical final limit position and home being motor Z signal
13: Reverse homing, deceleration point being mechanical final limit position and home being motor Z signal
14: Forward single-turn homing
15: Reverse single-turn homing
16: Single-turn homing to the nearest reference point

Parameter description

Defines the default motor direction of rotation, deceleration point, and home during homing.

H05.32 **Speed of home switch signal at high-speed searching**

Address:	0x0520	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	3,000	Data type:	UInt16
Default:	100	Change mode:	At once

Range:

0 to 3000

Parameter description

Defines the motor speed for searching for the deceleration point signal during homing.

H05.33 **Speed of low-speed homing**

Address:	0x0521	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	1,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 rpm to 1000 rpm

Parameter description

Defines the motor speed for searching for the home signal during homing.

H05.34 **Acceleration/Deceleration time during homing**

Address:	0x0522	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	1,000	Change mode:	At once

Range:

0 ms to 1000 ms

Parameter description

Defines the time for the motor to accelerate from 0 rpm to 1000 rpm at a constant speed during homing.

H05.35 **Duration limit of homing**

Address:	0x0523	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10,000	Change mode:	At once

Range:

0ms~65535ms

Parameter description

It sets maximum time for searching the home.

H05.36 **Mechanical origin offset**

Address:	0x0524	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	0	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Defines the absolute position value of the motor after homing.

H05.38 **Servo pulse output source**

Address:	0x0526	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Encoder frequency division output

1: Pulse reference synchronous output

2: Frequency division or synchronous output inhibited

Parameter description

It sets the output source of the pulse output terminal.

Set value	Output source	Remarks
0	Encoder frequency-division output	The encoder feedback signal is outputted only after being divided by the value of H05.17 during rotation of the motor. Encoder frequency-division output mode is recommended when the host controller is used for closed-loop feedback.
1	Pulse reference synchronous output	The input pulse references are outputted synchronously only when H05.00 is set to 0. When pulses of the multi-axis servo is synchronously tracked, pulse synchronous output is suggested.
2	Frequency-division or synchronous output forbidden	The pulse output terminal has no output.

The pulse output terminals are as follows:

Signal	Output mode	Output port	Max. Pulse Frequency
A-phase signal	Differential output	PAO+, PAO-	2Mpps
B-phase signal	Differential output	PBO+, PBO-	2Mpps
Phase Z signal	Differential output	PZO+, PZO-	2Mpps
	Open collector output	PZ-OUT, GND	100kpps

H05.39 Electronic gear ratio switchover condition

Address:	0x0527	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Switchover after position reference is kept 0 for 2.5 ms

1: Switched in real time

Parameter description

Defines the electronic gear ratio switchover condition.

Set value	Switchover conditions	Remarks
0	Switching after the position pulse reference kept 0 for 2.5 ms	Allocate a DI terminal with the DI function 24 (FunIN.24: GEAR_SEL, electronic gear ratio switchover).
1	Switchover in real time	

H05.40 Mechanical home offset and action upon active limit signal

Address:	0x0528	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16

Default: 0 Change: At stop

Range:

0: H05.36 as the coordinate after homing, reverse homing applied after homing triggered again upon overtravel

1: H05.36 as the relative offset after homing, reverse homing applied after homing triggered again upon overtravel

2: H05.36 as the coordinate after homing, reverse homing applied automatically upon overtravel

3: H05.36 as the relative offset after homing, reverse homing applied automatically upon overtravel

Parameter description

Defines the offset relationship between the mechanical home and mechanical zero, as well as the action upon overtravel during homing.

Set value	Mechanical home offset and action upon active limit signal	Remarks	
		Mechanical home	Action upon Active Limit Signal
0	H05.36 as the coordinate after homing, reverse homing applied after homing triggered again on overtravel	The mechanical home differs from the mechanical zero point. After homing, the motor stops at the home position and the home coordinate is forced to the displacement defined by H05.36.	After the homing enable signal is sent again, the servo drive performs homing in the reverse direction.
1	H05.36 as the relative offset after homing, reverse homing triggered on hitting the limit	The mechanical home is the same as the mechanical zero. After positioning the mechanical home, the motor continues to move according to the setting of H05.36 and then stops.	After the homing enable signal is sent again, the servo drive performs homing in the reverse direction.
2	H05.36 as the coordinate after homing, reverse homing auto-applied on overtravel	The mechanical home differs from the mechanical zero point. After homing, the motor stops at the home position and the home coordinate is forced to the displacement defined by H05.36.	The servo drive automatically continuous to perform homing in the reverse direction.
3	H05.36 as the relative offset after homing, reverse homing auto-applied on overtravel	The mechanical home is the same as the mechanical zero. After positioning the mechanical home, the motor continues to move according to the setting of H05.36 and then stops.	The servo drive automatically continuous to perform homing in the reverse direction.

H05.41 **Z pulse output polarity**

Address:	0x0529	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At stop

Range:

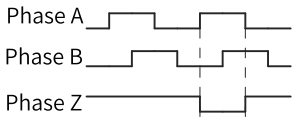
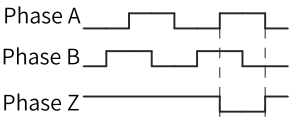
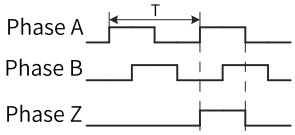
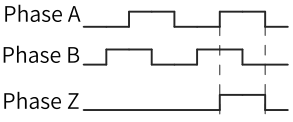
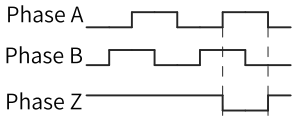
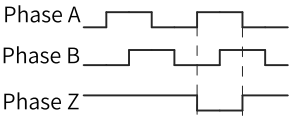
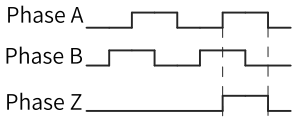
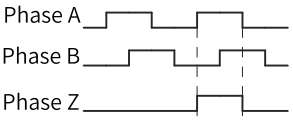
1: Negative (low level upon active Z pulse)

0: Positive (high level upon active Z pulse)

Parameter description

It sets the output level when phase Z of the pulse output terminal is valid.

Table 14–8 Pulse diagrams of encoder frequency-division (H05.38 = 0)

H02.03 (Output pulse phase)	H05.41 (Z pulse output polarity)	Pulse Output Diagram of Forward RUN	Pulse Output Diagram of Reverse RUN
0	0	 Phase A leads phase B by 90°.	 Phase B leads phase A by 90°.
	1	 Phase A leads phase B by 90°.	 Phase B leads phase A by 90°.
1	0	 Phase B leads phase A by 90°.	 Phase A leads phase B by 90°.
	1	 Phase B leads phase A by 90°.	 Phase A leads phase B by 90°.

In applications requiring high precision of Z signal frequency-division output, the effective change edge of Z signal is recommended.

H05.41 = 0: Triggered by falling-edge; H05.41 = 1: Triggered by rising-edge

H05.43 **Position pulse edge**

Address:	0x052B	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Valid at the falling edge

1: Active at rising edge

Parameter description

Defines the valid edge of pulse reference. When it is set to 0, the falling edge of the pulse is valid. When it is set to 1, the rising edge of the pulse is valid.

H05.44 Encoder multi-turn data offset

Address:	0x052C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0–65535

Parameter description

Defines the multi-turn position offset of the encoder.

H05.46 Position offset in absolute position linear mode (low 32 bits)

Address:	0x052E	Effective mode:	At once
Minimum:	-2147483648	Unit:	Encoder unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	At stop

Range:

-2147483648 to 2147483647

Parameter description

When H02.01 (Absolute system selection) is set to 1 (Absolute position linear mode), position offset in absolute position linear mode equals the difference between present encoder absolute position and mechanical position (encoder unit).

H05.48 Position offset in absolute position linear mode (high 32 bits)

Address:	0x0530	Effective mode:	At once
Minimum:	-2147483648	Unit:	Encoder unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	At stop

Range:

-2147483648 to 2147483647

Parameter description

When H02.01 (Absolute system selection) is set to 1 (Absolute position linear mode), position offset in absolute position linear mode equals the difference between present encoder absolute position and mechanical position (encoder unit).

H05.50 Mechanical gear ratio in absolute position rotation mode (numerator)

Address:	0x0532	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	1	Change:	At stop

Range:

1 to 65535

Parameter description

Defines the 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:	0x0533	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	1	Change:	At stop

Range:

1 to 65535

Parameter description

Defines the 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:	0x0534	Effective mode:	At once
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	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.

H05.54 Pulses per revolution of the load in absolute position rotation mode (high 32 bits)

Address:	0x0536	Effective mode:	At once
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	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.

H05.56 Speed threshold in homing upon hit-and-stop

Address:	0x0538	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	1,000	Data type:	UInt16
Default:	2	Change mode:	At once

Range:

0 rpm to 1000 rpm

Parameter description

Defines the speed threshold for judging whether the load reaches the mechanical position in touch-triggered homing.

H05.57 **Mechanical limit judgment times**

Address:	0x0539	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	20	Change mode:	At once

Range:
0–65535
Parameter description
Defines the threshold of mechanical limits during touch-triggered homing.

H05.58 **Torque threshold in homing upon hit-and-stop**

Address:	0x053A	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	3,000	Data type:	UInt16
Default:	1,000	Change mode:	At once

Range:
0 %~3000%
Parameter description
Defines the maximum positive/negative torque limit in touch-triggered homing.

H05.59 **Positioning window time**

Address:	0x053B	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	30000	Data type:	UInt16
Default:	0	Change mode:	At once

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 **Holding time of positioning completed**

Address:	0x053C	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	30000	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 30000
Parameter description
Defines the holding time of an active positioning completed signal.

H05.61 **Encoder frequency-division pulse output (32-bit)**

Address:	0x053D	Effective mode:	Effective upon next power-on

Minimum:	0	Unit:	P/Rev
Maximum:	262143	Data type	UInt32
Default:	0	Change:	At stop

Range:

0 P/Rev–262143 P/Rev

Parameter description

Defines the number of pulses outputted by PAO or PBO per revolution of the motor when the capacity defined by H05.17 is insufficient.

Pulse output resolution = H05.66 x 4

H05.63 Real time update of position reference source

Address:	0x053F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0–1

Parameter description

Used to set whether the position reference source is updated in real time.

H05.66 Homing time unit

Address:	0x0542	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: ms

1: 10 ms

2: 100 ms

Parameter description

Defines the homing time unit. The actual timeout is H05.35 x H05.66 (ms).

H05.67 Offset between zero point and single-turn absolute position

Address:	0x0543	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2147483647	Data type	UInt32
Default:	0	Change:	At stop

Range:

0 to 2147483647

Parameter description

Displays or defines the offset position relative to the home in the single-turn absolute mode (H0201 = 4).

H05.69 Auxiliary homing function

Address:	0x0545	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Disable

1: Enable single-turn homing

2: Record offset position

3: Start a new search for the Z signal (homing)

4: Clear offset position

Parameter description

Single-turn homing mode setting

0: Disable

1: Enable single-turn homing

2: Record offset position

3: Start a new search for the Z signal (homing)

4: Clear offset position

14.7 H06 Speed Control Parameters

H06.00 **Main speed reference A source**

Address:	0x0600	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	0	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Digital setting (H06.03)

Parameter description

Defines the source of main speed reference A.

0: Digital setting (H06.03)

Set value	Reference source	Instruction receiving method
0	Digital setting	The source of speed reference A is set by H06.03.

H06.01 **Auxiliary speed command B source**

Address:	0x0601	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	5	Data type:	UInt16
Default:	5	Change:	At stop

Range:

0: Digital setting (H06.03)

5: Multi-speed reference

Parameter description

Defines the source of auxiliary speed reference B.

Set value	Reference source	Instruction receiving method
0	Digital setting	The source of speed reference A is set by H06.03.
1	-	-
2	-	-
3	-	-
4	-	-
5	Multi-speed reference	The source of auxiliary speed reference B is determined by internal multi-speed references. For settings of multi-speed parameters, see parameters in group H12.

H06.02 Speed reference selection

Address:	0x0602	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Source of main speed reference A

1: Source of auxiliary speed reference B

2: Source of A + B

3: Switched between A and B4: Communication

Parameter description

Defines the source of speed references.

Set value	Control mode	Remarks
0	Main speed reference A source	The reference source is defined by H06.00.
1	Auxiliary speed command B source	The reference source is defined by H06.01.
2	A + B	The reference source is the product of A + B (H06.00 + H06.01).
3	Switched between A and B	The reference source is switched between A and B as defined by FunIN.4 (Cmd_SEL).
4	Via communication	The speed reference is defined by operating on H31.09 through communication (unit: 0.001 RPM).

State of FunIN.4 (Cmd_ SEL)	Reference Source
OFF	Main speed reference A source
ON	Auxiliary speed command B source

H06.03 Keypad setting value of speed reference

Address:	0x0603	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16

Default:	200	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Defines the speed reference value set through the keypad.

H06.04 **Jog speed setting value**

Address:	0x0604	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
0rpm~7000rpm
Parameter description
Defines the DI jog speed reference.

H06.05 **Acceleration ramp time constant of speed reference**

Address:	0x0605	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

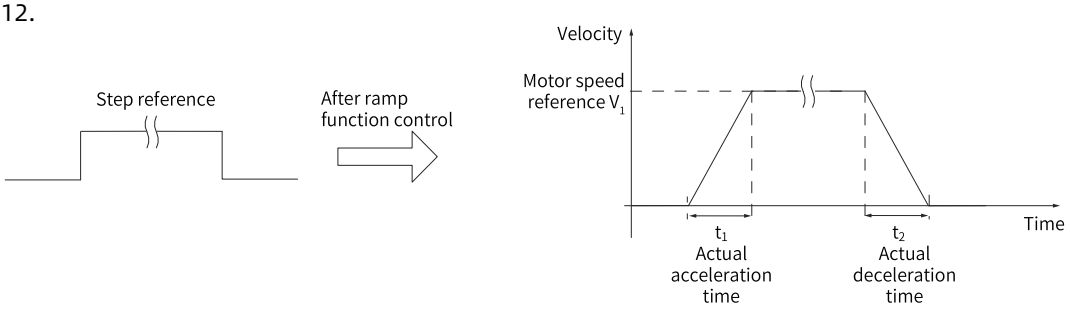
Range:
0ms~65535ms
Parameter description
Defines the acceleration/deceleration ramp time of speed reference. The acceleration/deceleration time constant of multi-speed references are defined only by parameters in group H12.
Parameter H06.05 defines the time for the speed reference to change from 0 RPM to 1000 RPM.
Parameter H06.06 defines the time for the speed reference to change from 1000 RPM to 0 RPM.
The formulas of calculating the actual acceleration and deceleration time are as follows:
Actual acceleration time t1 = Speed reference/1000 x Acceleration ramp time of speed reference
Actual deceleration time t2 = Speed reference/1000 x Deceleration ramp time of speed reference

H06.06 **Deceleration ramp time constant of speed reference**

Address:	0x0606	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0ms~65535ms
Parameter description

Defines the acceleration/deceleration ramp time of speed reference. The acceleration/deceleration time constant of multi-speed references are defined only by parameters in group H12.



Parameter H06.05 defines the time for the speed reference to change from 0 RPM to 1000 RPM.
Parameter H06.06 defines the time for the speed reference to change from 1000 RPM to 0 RPM.
The formulas of calculating the actual acceleration and deceleration time are as follows:

$$\text{Actual acceleration time } t_1 = \frac{\text{Speed reference}}{1000} \times \text{Speed reference acceleration ramp time}$$

$$\text{Actual deceleration time } t_2 = \frac{\text{Speed reference}}{1000} \times \text{Speed reference deceleration ramp time}$$

Actual acceleration time t1 = Speed reference/1000 x Acceleration ramp time of speed reference
Actual deceleration time t2 = Speed reference/1000 x Deceleration ramp time of speed reference

H06.07 **Max. speed limit**

Address:	0x0607	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	6,000	Change mode:	At once

Range:
0rpm~7000rpm
Parameter description
Defines the maximum speed limit.

H06.08 **Forward speed threshold**

Address:	0x0608	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	6,000	Change mode:	At once

Range:
0rpm~7000rpm
Parameter description
Defines the forward speed threshold.

H06.09 **Reverse speed threshold**

Address:	0x0609	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16

Default:	6,000	Change mode:	At once

Range:

0rpm~7000rpm

Parameter description

Defines the reverse speed threshold.

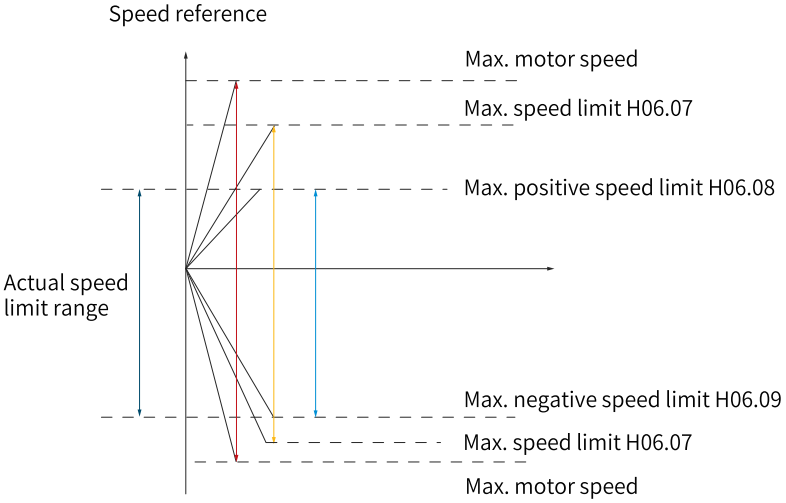


Figure 14-1 Example of speed reference limit

H06.11 **Torque feedforward control**

Address:	0x060B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At once

Range:

0: No torque feedforward

1: Internal torque feedforward

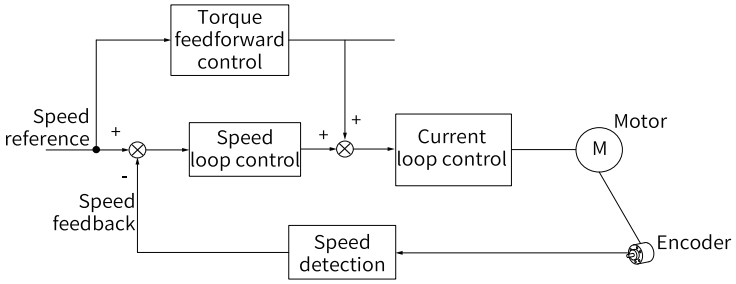
Parameter description

Defines the source for torque feedforward control.

It sets whether to enable the internal torque feedforward function in non-torque control mode. The torque feedforward function can improve the torque reference response and reduce the position deviation during fixed acceleration/deceleration.

Set value	Torque feedforward control	Remarks
0	None	-
1	Internal torque feedforward	The torque feedforward signal source is speed reference: • Output of speed controller in speed control mode • Speed reference set by user in speed control mode

In non-torque control, the control block diagram of torque feedforward is shown in the following figure.



H06.13 Speed smoothing time

Address:	0x060D	Effective mode:	At once
Minimum:	0	Unit:	μs
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 μs to 65535 μs
Parameter description
Defines the speed feedforward smoothing filter time.

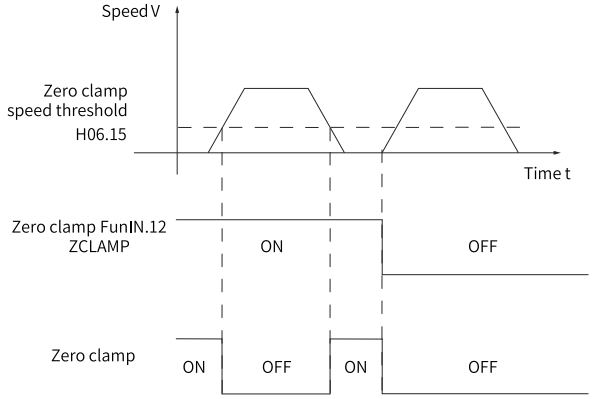
H06.15 Speed threshold for zero speed clamp

Address:	0x060F	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0rpm~7000rpm

Parameter description

Defines the zero clamp speed threshold.



H06.16 Motor rotation speed threshold

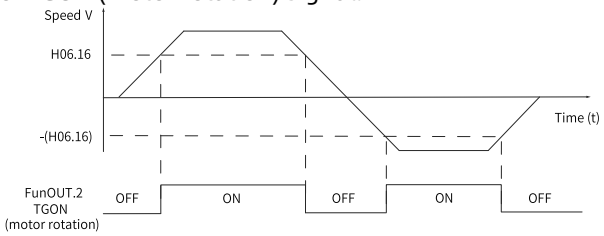
Address:	0x0610	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	1,000	Data type:	UInt16
Default:	20	Change mode:	At once

Range:

0 rpm to 1000 rpm

Parameter description

Defines the threshold of TGON (motor rotation) signal.



H06.17 Threshold of speed match signal

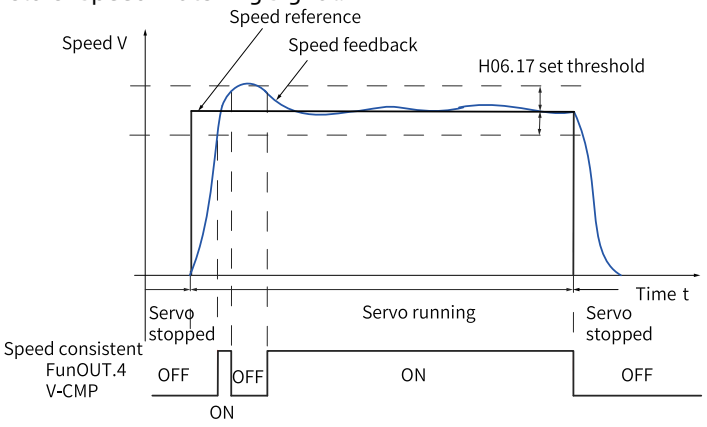
Address:	0x0611	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	100	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 RPM –100 RPM

Parameter description

Defines the threshold of speed matching signal.



H06.18 **Threshold of speed reached signal**

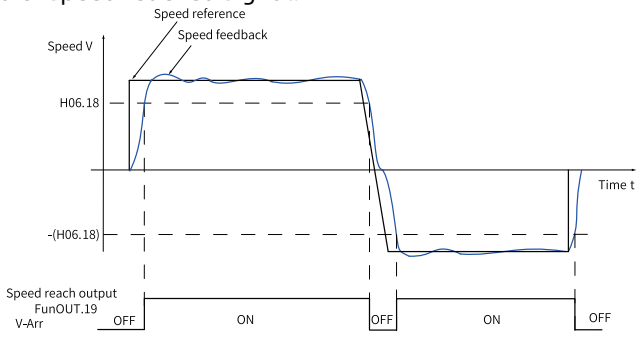
Address:	0x0612	Effective mode:	At once
Minimum:	10	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	1,000	Change mode:	At once

Range:

10rpm~7000rpm

Parameter description

Defines the threshold of speed reached signal.



H06.19 **Threshold of zero speed output signal**

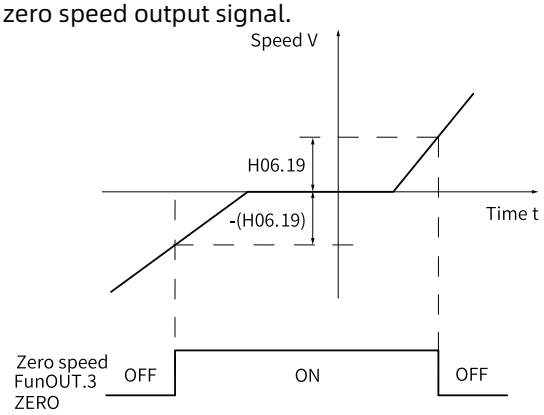
Address:	0x0613	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Defines the threshold of zero speed output signal.



H06.28 Cogging torque ripple compensation

Address:	0x061C	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: Disable

1: Enable

Parameter description

Used to enable the cogging torque fluctuation compensation function.

H06.31 SIN frequency

Address:	0x061F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	16000	Data type:	UInt16
Default:	50	Change mode:	At once

Range:

0 to 16000

Parameter description

Used to set the SIN frequency.

H06.32 SIN amptitude

Address:	0x0620	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	30000	Data type:	UInt16
Default:	30	Change mode:	At once

Range:

0 to 30000

Parameter description

Defines the sine reference amplitude.

H06.33 **Sine reference enable**

Address:	0x0621	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Disabled

1: Position reference sine

2: Speed reference sine3: Torque reference sine

Parameter description

Used to turn on the sine references.

H06.35 **SIN offset**

Address:	0x0623	Effective mode:	At once
Minimum:	-9900	Unit:	-
Maximum:	9900	Data type	Int16
Default:	0	Change mode:	At once

Range:

-9900 to 9900

Parameter description

Used to set the SIN command offset.

14.8 H07 Torque Control Parameters

H07.00 **Sources of main torque reference A**

Address:	0x0700	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	0	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: H07.03

Parameter description

Defines main torque reference A.

Set value	Reference source	Instruction receiving method
0	Keypad (H07.03)	Torque reference A is set by H07.03.

H07.01 **Sources of auxiliary torque reference B**

Address:	0x0701	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: H7.03

1: No function

2: No function

Parameter description

Defines auxiliary torque references.

Set value	Reference source	Instruction receiving method
0	Digital setting	The source of auxiliary torque reference B is set by H07.03.

H07.02 Torque reference source

Address:	0x0702	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Main torque command A source

4: Communication

Parameter description

Selects the torque reference.

Set value	Control mode	Remarks
0	Sources of main torque reference A	The reference source is defined by H07.00.
4	Via communication	The torque reference is defined by operating on H31.11 through communication.

H07.03 Keypad setting value of torque reference

Address:	0x0703	Effective mode:	At once
Minimum:	-400.0	Unit:	%
Maximum:	400.0	Data type	Int16
Default:	0.0	Change mode:	At once

Range:

-400.0 %~400.0%

Parameter description

Defines the torque reference value set through keypad.

H07.05 Time constant of torque reference filter

Address:	0x0705	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	30.00	Data type:	UInt16
Default:	0.50	Change mode:	At once

Range:

0.00 to 30.00

Parameter description

Defines the torque reference filter time constant 1.

H07.06 **2nd time constant of torque reference filter**

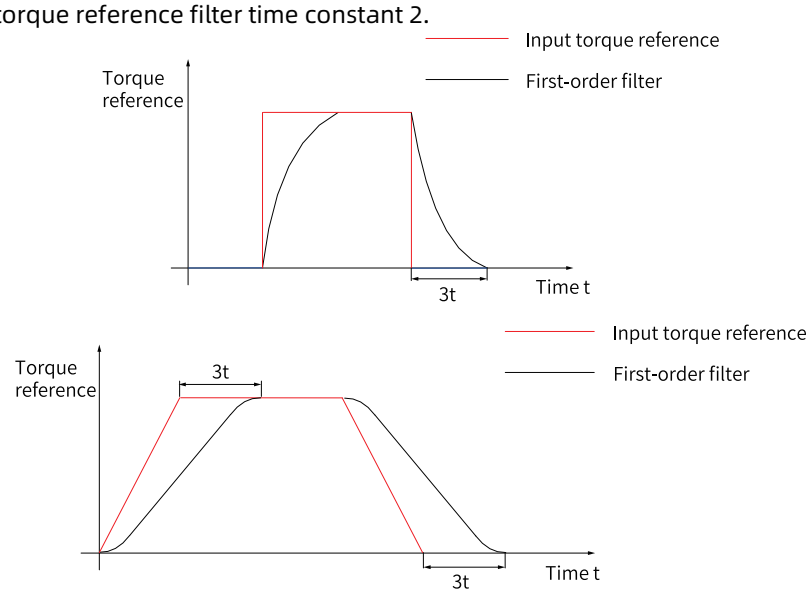
Address:	0x0706	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	30.00	Data type:	UInt16
Default:	0.27	Change mode:	At once

Range:

0.00 to 30.00

Parameter description

Defines the torque reference filter time constant 2.



Note

- The servo drive offers two low-pass filters for torque references, in which the low-pass filter 1 is used by default.
- The gain switchover function can be used In the position or speed control mode. Once certain conditions are satisfied, you can switch to low-pass filter 2.

H07.07 **Torque limit source**

Address:	0x0707	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Forward/Reverse internal torque limit (default)

1: Forward/Reverse external torque limit (selected through P-CL and N-CL)

Parameter description

Defines the torque limit source.

H07.09 **Internal forward torque limit**

Address:	0x0709	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	400.0	Data type:	UInt16

Default:	350.0	Change mode:	At once

Range:
0.0% to 400.0%
Parameter description
Defines the positive internal torque limit.

H07.10 **Internal reverse torque limit**

Address:	0x070A	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	At once

Range:
0.0% to 400.0%
Parameter description
Defines the negative internal torque limit.

H07.11 **External positive torque limit**

Address:	0x070B	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	At once

Range:
0.0% to 400.0%
Parameter description
Defines the positive external torque limit.

H07.12 **External negative torque limit**

Address:	0x070C	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	At once

Range:
0.0% to 400.0%
Parameter description
Defines the negative external torque limit.

H07.15 **Emergency stop torque**

Address:	0x070F	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	100.0	Change:	At stop

Range:
0.0% to 300.0%

Parameter description

Defines the emergency stop torque.

H07.17 Speed limit source

Address:	0x0711	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Internal speed limit (in torque control)

1: 0 (no action)

2: 1st or 2nd speed limit input selected by FunIN.36

Parameter description

Defines the speed limit source.

Set value	Reference source	Description
0	Internal speed limit	The speed limit is defined by both H07.19 and H07.20.
1	-	-
2	H07.19 or H07.20 used as speed limit as defined by DI	DI (FunIN.36) inactive: H07.19 used as positive/ negative speed limit DI (FunIN.36) active: H07.20 used as positive/ negative speed limit

H07.19 Positive speed limit/Speed limit 1 in the torque control mode

Address:	0x0713	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	3,000	Change mode:	At once

Range:

0rpm~7000rpm

Parameter description

Defines the positive speed limit in torque control.

H07.20 Reverse speed limit/2nd speed limit in torque control

Address:	0x0714	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	3,000	Change mode:	At once

Range:

0rpm~7000rpm

Parameter description

Defines the negative speed limit in torque control.

H07.21 Base value for torque reached

Address:	0x0715	Effective mode:	At once

Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:

0.0% to 300.0%

Parameter description

Defines the torque reference of the base value for torque reach.

H07.22 **Threshold of torque reached valid**

Address:	0x0716	Effective mode:	At once
Minimum:	10.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	20.0	Change mode:	At once

Range:

10.0 %~300.0%

Parameter description

Defines the torque reference for valid torque reach.

H07.23 **Threshold of torque reached invalid**

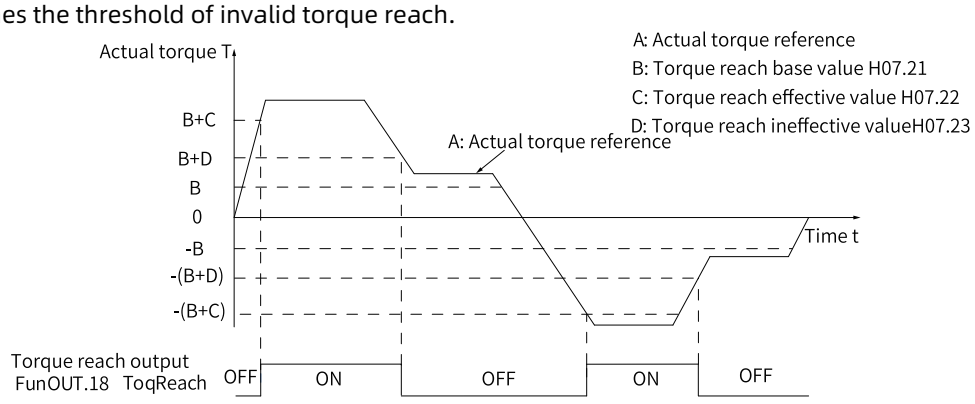
Address:	0x0717	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	52.8	Data type:	UInt16
Default:	10.0	Change mode:	At once

Range:

0.0 %~52.8%

Parameter description

Defines the threshold of invalid torque reach.



H07.24 **Field weakening depth**

Address:	0x0718	Effective mode:	At once
Minimum:	60	Unit:	%
Maximum:	120	Data type:	UInt16
Default:	115	Change mode:	At once

Range:

60 %~120%

Parameter description

Defines the flux weakening depth.

H07.25 Maximum permissible demagnetization current

Address:	0x0719	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	200	Data type:	UInt16
Default:	100	Change mode:	At once

Range:

0 %~200%

Parameter description

Defines the maximum permissible demagnetization current.

H07.26 Flux weakening selection

Address:	0x071A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: Disable

1: Enable

Parameter description

Used to disable or enable field weakening.

H07.27 Field weakening gain

Address:	0x071B	Effective mode:	At once
Minimum:	1	Unit:	Hz
Maximum:	1,000	Data type:	UInt16
Default:	30	Change mode:	At once

Range:

1 Hz~1000Hz

Parameter description

Defines the field weakening gain.

H07.40 Time duration of speed limit in torque control mode

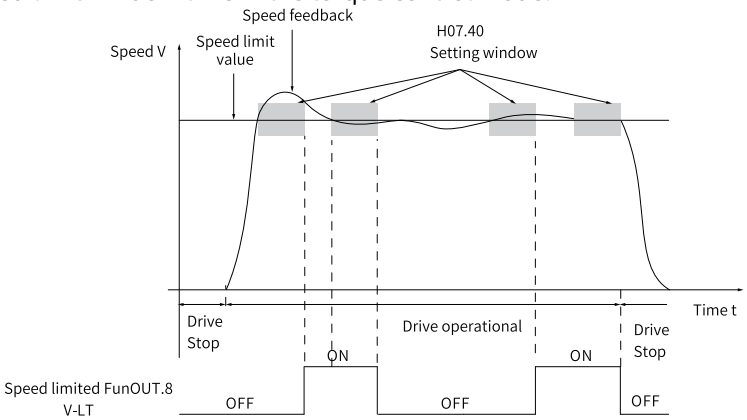
Address:	0x0728	Effective mode:	At once
Minimum:	0.5	Unit:	ms
Maximum:	30.0	Data type:	UInt16
Default:	1.0	Change mode:	At once

Range:

0.5 ms~30.0ms

Parameter description

Defines the speed limit window time in the torque control mode.



Note

In the preceding figure, ON indicates that the speed limit DO signal is valid. OFF indicates that the speed limit DO signal is invalid.

14.9 H08 Gain Parameters

H08.00 **Speed loop gain**

Address:	0x0800	Effective mode:	At once
Minimum:	0.1	Unit:	Hz
Maximum:	2000.0	Data type:	UInt16
Default:	40.0	Change mode:	At once

Range:

0.1 to 2000.0

Parameter description

Defines the responsiveness of the speed loop. The higher the setpoint, the faster the speed loop response is. Note that an excessively high setpoint may cause vibration.

If the position loop gain is increased in position control mode, the speed loop gain also needs to be increased.

H08.01 **Time constant of speed loop integration**

Address:	0x0801	Effective mode:	At once
Minimum:	0.15	Unit:	ms
Maximum:	512.00	Data type:	UInt16
Default:	19.89	Change mode:	At once

Range:

0.15 to 512.00

Parameter description

It sets the integral time constant of the speed loop.

The smaller the setting is, the better integration effect will be obtained and the deviation value at stop will approach 0 more quickly.

Note:
There is no integral action when H08.01 is set to 512.00.

H08.02 Position loop gain

Address:	0x0802	Effective mode:	At once
Minimum:	0.0	Unit:	Hz
Maximum:	2000.0	Data type:	UInt16
Default:	64.0	Change mode:	At once

Range:
0.0 Hz to 2000.0 Hz
Parameter description
It sets the proportional gain of the position loop.
This parameter determines response of the position loop. A large position loop gain shortens the positioning time. Note that a very large setting may cause vibration.
The 1st gains include H08.00 (Speed loop gain), H08.01 (Speed loop integral time constant), H08.02, and H07.05 (Filter time constant of torque reference).

H08.03 Second speed loop gain

Address:	0x0803	Effective mode:	At once
Minimum:	0.1	Unit:	Hz
Maximum:	2000.0	Data type:	UInt16
Default:	75.0	Change mode:	At once

Range:
0.1 to 2000.0
Parameter description
Defines the 2nd speed loop gain.

H08.04 Second speed loop integral time constant

Address:	0x0804	Effective mode:	At once
Minimum:	0.15	Unit:	ms
Maximum:	512.00	Data type:	UInt16
Default:	10.61	Change mode:	At once

Range:
0.15 to 512.00
Parameter description
Defines the 2nd speed loop integral time constant.

H08.05 Second position loop gain

Address:	0x0805	Effective mode:	At once
Minimum:	0.0	Unit:	Hz
Maximum:	2000.0	Data type:	UInt16
Default:	120.0	Change mode:	At once

Range:
0.0 Hz to 2000.0 Hz

Parameter description

They are the 2nd gain parameters of the position loop and speed loop. The 2nd gain parameters include H08.03 (Speed loop gain), H08.04 (Speed loop integral time constant), H08.05, and H07.06 (2nd torque reference filter time constant).

H08.08 2nd gain mode setting

Address:	0x0808	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At once

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

It sets switchover mode of the 2nd gain.

Set value	Meaning
0	Fixed at 1st gain. P/PI of speed control is switched through DI function 3 (FunIN.3: GAIN_SEL, gain switchover). • GAIN_SEL invalid: PI control • GAIN_SEL valid: P control
1	Switchover between the 1st gain and the 2nd gain, determined by H08.09. The 1st gain includes H08.00 (Speed loop gain), H08-01 (Speed loop integral time constant), H08.02 (Position loop gain), and H07.05 (Filter time constant of torque reference). The 2nd gain includes H08.03 (2nd speed loop gain), H08-04 (2nd speed loop integral time constant), H08.05 (2nd position loop gain), and H07.06 (Filter time constant of 2nd torque reference).

H08.09 Gain switchover condition

Address:	0x0809	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	10	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Fixed to the 1st gain (PS)

1: Switched by external DI (PS)

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 not completed (P)

9: Actual speed (P)

10: Position reference available+Actual speed (P)

Parameter description

Defines the gain switchover condition.

Set value	Gain Switchover Condition	Remarks
0	Fixed at 1st gain	The 1st gain is always used.
1	Switchover via DI	-
2	Torque reference being large	If the torque reference absolute value exceeds (Level + Dead time) [%] 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 - Dead time) [%] 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 being large	When the absolute value of the speed reference exceeds (level + hysteresis, RPM) in the 1st gain, the drive switches over to the 2nd gain. If the absolute value of the speed reference is lower than (level - Dead time) [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 being large	It is valid only in non-speed control mode. When the absolute value of the speed reference change rate exceeds (level + hysteresis, 10 RPM/s) in the 1st gain, the drive switches over to the 2nd gain. If 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 drive always uses the 1st gain in speed control mode.
5	Speed reference high-speed/ low-speed thresholds	When the absolute value of the speed reference exceeds (level - hysteresis, RPM) in the 1st gain, the drive starts to switch over to the 2nd gain and the gain changes gradually. When the absolute value of the speed reference exceeds (level + hysteresis, RPM), the drive completely switches over to the 2nd gain. When the absolute value of the speed reference is smaller than (level + hysteresis, RPM) in the 2nd gain, the drive starts to return to the 1st gain and the gain changes gradually. When the absolute value of the speed reference reaches (level - hysteresis, RPM), the drive completely returns to the 1st gain.
6	Position deviation being large	It is valid only in fully closed-loop position control mode. When the absolute value of the position deviation exceeds (level + hysteresis, encoder unit) in the 1st gain, the drive switches over to the 2nd gain. When the absolute value of the position deviation is lower than (Level - Dead time) [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 set. The drive always uses the 1st gain if not in position control or fully closed-loop control.
7	Position reference available	It is valid only in fully closed-loop 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 set. The drive always uses the 1st gain if not in position control or fully closed-loop control.
8	Positioning uncompleted	It is valid only in fully closed-loop position control mode. When positioning is not completed in the 1st gain, the drive switches to the 2nd gain. If positioning is not completed and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the servo drive returns to the 1st gain set. The drive always uses the 1st gain if not in position control or fully closed-loop control.

Set value	Gain Switchover Condition	Remarks
9th	Large actual motor speed	It is valid only in fully closed-loop position control mode. When the absolute value of the actual motor speed exceeds (level + hysteresis, RPM) in the 1st gain, the drive switches over to the 2nd gain. If the absolute value of actual speed is lower than (Level - Dead time) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the drive returns to the 1st gain set. The drive always uses the 1st gain if not in position control or fully closed-loop control.
10	Position reference available + Actual speed	It is valid only in fully closed-loop position control mode. When the position reference is not 0 in the 1st gain, the drive switches to the 2nd gain. If the position reference is 0 and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, 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 set; if the absolute value of actual speed does not reach (Level - Dead time) [rpm], the speed integral also returns to the setpoint of H08.01 (Speed loop integral time constant). The drive always uses the 1st gain if not in position control or fully closed-loop control.

H08.10 **Gain switchover delay**

Address:	0x080A	Effective mode:	At once
Minimum:	0.0	Unit:	ms
Maximum:	1000.0	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0 to 1000.0

Parameter description

It sets the delay when the servo drive returns from the 2nd gain to the 1st gain.

H08.11 **Gain switchover level**

Address:	0x080B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20000	Data type:	UInt16
Default:	50	Change mode:	At once

Range:

0 to 20000

Parameter description

It sets the level for gain switchover.

Gain switchover is affected by both the level and the dead time, as defined by H08.09. The unit of gain switchover level varies with the switchover condition.

H08.12 **Gain switchover hysteresis**

Address:	0x080C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20000	Data type:	UInt16

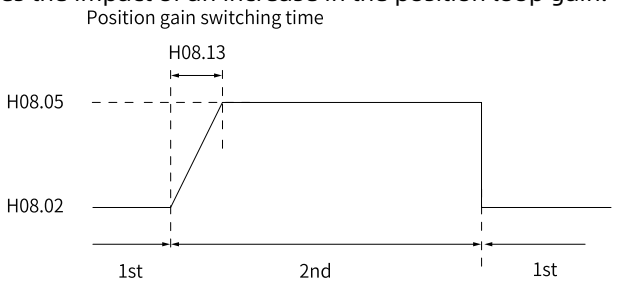
Default:	30	Change mode:	At once

Range:
0 to 20000
Parameter description
It sets the hysteresis for gain switchover.
Gain switchover is affected by both the level and the dead time, as defined by H08.09. The unit of gain switchover hysteresis varies with the switchover condition.
Note:
Set H08.11 to a value higher than or equal to H08.12. Otherwise, the drive forcibly sets H08.11 to the same value as H08.12.

H08.13 **Position gain switchover time**

Address:	0x080D	Effective mode:	At once
Minimum:	0.0	Unit:	ms
Maximum:	1000.0	Data type:	UInt16
Default:	3.0	Change mode:	At once

Range:
0.0 to 1000.0
Parameter description
In position control, if H08.05 (2nd position loop gain) is much higher than H08.02 (Position loop gain), set the time for switching from H08.02 to H08.05.
This parameter reduces the impact of an increase in the position loop gain.



H08.14 **Auto-tuned inertia value**

Address:	0x080E	Effective mode:	-
Minimum:	0.00	Unit:	-
Maximum:	120.00	Data type:	UInt16
Default:	1.00	Change:	Unmodifiable

Range:
0.00 to 120.00
Parameter description
Displays the auto-tuned inertia value.

H08.15 **Load/Rotor inertia ratio**

Address:	0x080F	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	120.00	Data type:	UInt16
Default:	2.00	Change mode:	At once

Range:
0.00 to 120.00
Parameter description
It sets the ratio of the load inertia against the rotor (of the motor) inertia.
When H08.15 is set to 0, it indicates the motor carries no load; if it is set to 1.00, it indicates the mechanical load inertia is the same as the motor moment of inertia.

H08.18 **Time constant of speed feedforward filter**

Address:	0x0812	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	64.00	Data type:	UInt16
Default:	0.50	Change mode:	At once

Range:
0.00 to 64.00
Parameter description
It sets the time constant of speed feedforward filter.

H08.19 **Speed feedforward gain**

Address:	0x0813	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	100.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:
0.0% to 100.0%
Parameter description
In position control and full closed-loop control modes, speed feedforward is the product of speed feedforward signal multiplied by H08.19 and is part of the speed reference.
Increasing this parameter improves position reference response and reduces position deviation at fixed 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).

H08.20 **Time constant of torque feedforward filter**

Address:	0x0814	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	64.00	Data type:	UInt16
Default:	0.50	Change mode:	At once

Range:
0.00 to 64.00
Parameter description
It sets the time constant of torque feedforward filter.

H08.21 **Torque feedforward gain**

Address:	0x0815	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	200.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:

0.0% to 200.0%

Parameter description

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 this parameter improves response to changing speed references.

Increasing this parameter improves position reference response and reduces position deviation at fixed speed.

During parameter adjustment, 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.

Note:

For how to enable the torque feedforward function and select the torque feedforward signal, see H06.11 (Torque feedforward control).

H08.22 **Speed feedback filter option**

Address:	0x0816	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Disable

1: Two times

2: Four times

3: Eight times

4: Sixteen times

Parameter description

It sets the times of carrying out moving average filter on speed feedback.

A larger filter times causes smaller speed feedback fluctuation and larger feedback delay.

H08.23 **Cutoff frequency of speed feedback low-pass filter**

Address:	0x0817	Effective mode:	At once
Minimum:	100	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change mode:	At once

Range:

100 Hz~4000Hz

Parameter description

It sets the cutoff frequency of first-order low-pass filter on speed feedback.

Note:

The lower the setpoint, the weaker the speed feedback fluctuation, and the longer the feedback delay can be.
If this parameter is set to 4000 Hz, there is no filter.

H08.24 **PDFF control coefficient**

Address:	0x0818	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	1000.0	Data type:	UInt16
Default:	100.0	Change mode:	At once

Range:
0.0 %~1000.0%
Parameter description
It sets the speed loop control mode.
When this parameter is set to 100.0, PI control (default mode) is used for speed loop, bringing rapid dynamic response.
When this parameter is set to 0.0, there is good integral effect on the speed loop, which eliminates low-frequency interference and slows dynamic response.
H08.24 can be used to keep a good responsivity of the speed loop, with anti-interference capacity in low-frequency bands improved and speed feedback overshoot unaffected.

H08.27 **Cutoff frequency of speed observer**

Address:	0x081B	Effective mode:	At once
Minimum:	10	Unit:	Hz
Maximum:	2,000	Data type:	UInt16
Default:	170	Change mode:	At once

Range:
10 Hz~2000Hz
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 loud speed feedback noise.

H08.28 **Speed inertia correction coefficient**

Address:	0x081C	Effective mode:	At once
Minimum:	10	Unit:	%
Maximum:	10,000	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
10 %~10000%
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:	0x081D	Effective mode:	At once

Minimum:	0.02	Unit:	ms
Maximum:	20.00	Data type:	UInt16
Default:	0.80	Change mode:	At once

Range:
0.02 ms~20.00ms
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 compensation gain**

Address:	0x081F	Effective mode:	At once
Minimum:	1	Unit:	%
Maximum:	1700	Data type:	UInt16
Default:	600	Change mode:	At once

Range:
1 %~1700%
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 observation compensation coefficient**

Address:	0x0820	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	100	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0% to 100%
Parameter description
Defines the compensation factor of the disturbance observer. The setpoint 100% indicates full compensation.

H08.33 **Disturbance inertia correction coefficient**

Address:	0x0821	Effective mode:	At once
Minimum:	1	Unit:	%
Maximum:	10,000	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
1 %~10000%
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.

H08.34 **Medium- and high-frequency jitter suppression phase modulation 1**

Address:	0x0822	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	1600	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 %~1600%

Parameter description

Defines the compensation phase of medium- and high-frequency jitter suppression 1.

H08.35 **Medium- and high-frequency jitter suppression frequency 1**

Address:	0x0823	Effective mode:	At once
Minimum:	0	Unit:	Hz
Maximum:	1,000	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 to 1000

Parameter description

Defines medium- and high-frequency jitter suppression frequency 1.

H08.36 **Medium- and high-frequency jitter suppression compensation 1**

Address:	0x0824	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	200	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 %~200%

Parameter description

Defines medium- and high-frequency jitter suppression compensation 1.

H08.37 **Phase modulation for medium frequency suppression 2**

Address:	0x0825	Effective mode:	At once
Minimum:	-90	Unit:	-
Maximum:	90	Data type	Int16
Default:	0	Change mode:	At once

Range:

-90–90

Parameter description

Defines the compensation phase of medium-frequency jitter suppression 2.

H08.38 **Frequency for medium frequency suppression 2**

Address:	0x0826	Effective mode:	At once
Minimum:	0	Unit:	Hz

Maximum:	1,000	Data type:	UInt16
Default:	0	Change mode:	At once

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:	0x0827	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	1500	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 %~1500%
Parameter description
Defines the compensation gain for medium-frequency jitter suppression 2. Set this parameter to be within the range of 40% to 55% in general cases. Setting this parameter to 0 negates the effect of medium-frequency jitter suppression 2.

H08.40 Speed observer

Address:	0x0828	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0: Disable
1: Enable
Parameter description
Sets the enable bit for speed observer.

H08.42 Model control selection

Address:	0x082A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0: Disable
1: Enable
Parameter description
Used to enable model tracking control.

H08.43 Model gain

Address:	0x082B	Effective mode:	At once

Minimum:	0.0	Unit:	-
Maximum:	2000.0	Data type:	UInt16
Default:	40.0	Change mode:	At once

Range:
0.0 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.

H08.45 **Feedforward position selection**

Address:	0x082D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:
0–1
Parameter description
Defines the feedforward position of single inertia model.
0: Add torque feedforward before filtering
1: Add torque feedforward after filtering

H08.46 **Model feedforward**

Address:	0x082E	Effective mode:	At once
Minimum:	0.0	Unit:	-
Maximum:	102.4	Data type:	UInt16
Default:	95.0	Change mode:	At once

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.

H08.51 **Model filter time 2**

Address:	0x0833	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	655.35	Data type:	UInt16
Default:	0.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Defines the model filter time 2.

H08.53 **Medium- and low-frequency jitter suppression frequency 3**

Address:	0x0835	Effective mode:	At once

Minimum:	0.0	Unit:	Hz
Maximum:	600.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:
0.0 Hz to 600.0 Hz
Parameter description
Defines the medium- and low-frequency jitter suppression frequency.

H08.54 **Medium- and low-frequency jitter suppression compensation 3**

Address:	0x0836	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	200	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 %~200%
Parameter description
Defines the medium- and low-frequency jitter suppression compensation.

H08.56 **Medium- and low-frequency jitter suppression phase modulation 3**

Address:	0x0838	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1600	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
0 to 1600
Parameter description
Defines the medium- and low-frequency jitter suppression phase.

H08.59 **Medium- and low-frequency jitter suppression frequency 4**

Address:	0x083B	Effective mode:	At once
Minimum:	0.0	Unit:	Hz
Maximum:	600.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:
0.0 Hz to 600.0 Hz
Parameter description
Defines the jitter frequency for medium- and low-frequency jitter suppression 4.

H08.60 **Medium- and low-frequency jitter suppression compensation 4**

Address:	0x083C	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	200	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 %~200%
Parameter description
Defines the compensation gain for medium- and low-frequency jitter suppression 4.

H08.61 **Medium- and low-frequency jitter suppression phase modulation 4**

Address:	0x083D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1600	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
0 to 1600
Parameter description
Adjust this parameter based on the actual compensation effect.

H08.62 **Position loop integral time constant**

Address:	0x083E	Effective mode:	At once
Minimum:	0.15	Unit:	ms
Maximum:	512.00	Data type:	UInt16
Default:	512.00	Change mode:	At once

Range:
0.15 to 512.00
Parameter description
Defines the position loop integral time constant.

H08.63 **2nd position loop integral time constant**

Address:	0x083F	Effective mode:	At once
Minimum:	0.15	Unit:	ms
Maximum:	512.00	Data type:	UInt16
Default:	512.00	Change mode:	At once

Range:
0.15 to 512.00
Parameter description
Defines the 2nd position loop integral time constant.

H08.64 **Speed observer feedback selection**

Address:	0x0840	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0–1
Parameter description
Defines the feedback source of speed observer.

14.10 H09 Gain Auto-tuning Parameters

H09.00 **Self-adjustment mode selection**

Address:	0x0900	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	7	Data type:	UInt16
Default:	0	Change:	At once

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 level3: Interpolation mode+Inertia auto-tuning

4: Standard mode+Inertia auto-tuning

6: Quick positioning mode+Inertia auto-tuning

Parameter description

Defines different gain tuning modes. Related gain parameters can be set manually or automatically according to the rigidity meter.

Set value	Meaning	Remarks
0	Disabled Gain parameters set manually	-
1	Standard stiffness level mode, gain parameters tuned automatically based on the stiffness level.	The 2nd gain does not follow the stiffness table to change automatically.
2	Positioning mode, gain parameters tuned automatically based on stiffness table	Changing automatically along with the stiffness table, the 2nd gain is always one level higher than the 1st gain, but does not exceed the highest stiffness level.
3	Interpolation mode + Inertia auto-tuning	In this mode, gain and inertia is auto-tuned and vibration is suppressed automatically according to the rigidity level. This mode is applicable to multi-axis interpolation.
4	Standerd mode + Inertia auto-tuning	The gain and inertia is auto-tuned and vibration is suppressed automatically according to the rigidity level.
6	Quick positioning mode + Inertia auto-tuning	In this mode, gain and inertia is auto-tuned and vibration is suppressed automatically according to the rigidity level. This mode is applicable to applications requiring quick positioning.

H09.01 **Stiffness level selection**

Address:	0x0901	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16

Default:	15	Change mode:	At once

Range:

0 to 41

Parameter description

It sets the stiffness level of the servo system. The higher the stiffness level is, the stronger gain and quicker response will be obtained. However, too strong stiffness will cause vibration.
The setpoint 0 indicates the lowest rigidity and 41 indicates the highest rigidity.

H09.02 Working mode of self-adaptive notch

Address:	0x0902	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

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

It sets the working mode of the adaptive notch.

Set value	Meaning
0	Parameters not updated
1	Only one notch (3rd notch) valid, parameters updated in real time
2	Both notches (3rd and 4th notches) valid, parameters updated in real time
3	Only detect resonance frequency (displayed in H09.24)
4	Clear 3rd and 4th notches, restore parameters to default setting

H09.03 Online inertia auto-tuning mode

Address:	0x0903	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Disabled

1: Enabled, changing slowly

2: Enabled, changing normally3: Enabled, changing quickly

Parameter description

It sets whether to enable online inertia auto-tuning and sets the inertia ratio update speed during online inertia auto-tuning.

Set value	Online inertia auto-tuning mode	Remarks
0	Online auto-tuning disabled	-
1	Enabled, changing slowly	Applicable to the scenario where the inertia ratio almost does not change.
2	Enabled, changing normally	Applicable to the scenario where the inertia ratio changes slowly.
3	Enabled, changing quickly	Applicable to the scenario where the inertia ratio changes quickly.

H09.04 **Suppression mode of low-frequency resonance**

Address:	0x0904	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Set vibration frequency manually

1: Identify vibration frequency

Parameter description

It sets the mode of suppressing low-frequency resonance.

When H09.04=0, manually set parameters of low-frequency resonance suppression filter (H09.38 and H09.39);

When H09.04=1, automatically set parameters of low-frequency resonance suppression filter (H09.38 and H09.39).

H09.05 **Offline inertia auto-tuning mode**

Address:	0x0905	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Positive/Negative triangular wave mode

1: JOG mode

2: Bidirectional auto-tuning mode

3: Unidirectional auto-tuning mode

Parameter description

Defines the offline inertia auto-tuning mode. The offline inertia auto-tuning function can be enabled through H0d.02.

Set value	Meaning	Remarks
0	Positive and negative triangular wave mode	Applicable to the scenario where the motor movement travel is short.
1	Jog mode	Applicable to the scenario where the motor movement travel is long.
2	0: Bidirectional auto-tuning.	No pre-set ratio of inertia is required, suitable for applications where the motor can rotate in both directions.
3	1: Unidirectional auto-tuning	No preset ratio of inertia is required, suitable for applications where the motor can only rotate in one direction.

H09.06 Maximum speed for inertia auto-tuning

Address:	0x0906	Effective mode:	At once
Minimum:	100	Unit:	rpm
Maximum:	1,000	Data type:	UInt16
Default:	500	Change:	At stop

Range:

100 to 1000

Parameter description

It sets the permissible maximum motor speed reference in offline inertia auto-tuning mode. During inertia auto-tuning, a larger motor speed causes a more accurate auto-tuning result. Use the default value of this parameter generally.

H09.07 Time constant of accelerating to max. speed for inertia auto-tuning

Address:	0x0907	Effective mode:	At once
Minimum:	20	Unit:	ms
Maximum:	2500+	Data type:	UInt16
Default:	125	Change:	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 (H09.06) during offline inertia auto-tuning.

H09.08 Interval after an inertia auto-tuning

Address:	0x0908	Effective mode:	At once
Minimum:	50	Unit:	ms
Maximum:	10,000	Data type:	UInt16
Default:	2500+	Change:	At stop

Range:

50 to 10000

Parameter description

Defines the interval time between two consecutive speed references when H09.05 (Offline inertia auto-tuning mode) is set to 1 (Positive/Negative triangular wave mode).

H09.09 **Motor revolutions for an inertia auto-tuning**

Address:	0x0909	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Defines the motor revolutions per inertia auto-tuning when H09.05 (Offline inertia auto-tuning mode) is set to 1 (Positive/Negative triangular wave mode).
Note:
When using the offline inertia auto-tuning function, 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 (Maximum speed for inertia auto-tuning) or H09.07 (Time constant of accelerating to max. speed during inertia auto-tuning) properly until the motor travel distance fulfills the requirement.

H09.11 **Vibration threshold setting**

Address:	0x090B	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	100.0	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:
0.0% to 100.0%
Parameter description
Defines the warning threshold for current feedback vibration.

H09.12 **Group 1 notch frequency**

Address:	0x090C	Effective mode:	At once
Minimum:	50	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change mode:	At once

Range:
50 Hz~4000Hz
Parameter description
It sets the center frequency of the 1st notch, that is, mechanical resonance frequency.
If the notch frequency is 4000 Hz in torque control mode, the notch function is disabled.

H09.13 **Group 1 notch width level**

Address:	0x090D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0 to 20

Parameter description
It sets the width level of the 2nd notch. Use the default value of this parameter.
The notch width level indicates the ratio of the notch width to the notch center frequency.

H09.14 Group 1 notch depth level

Address:	0x090E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 99
Parameter description
It sets the depth level of the 1st notch.
The notch depth level indicates the ratio of input to output at center frequency.
The larger the setting of this parameter is, the smaller the notch depth is and the weaker the suppression effect on mechanical resonance will be. Note that a very large setting may cause system instability.

H09.15 2nd notch frequency

Address:	0x090F	Effective mode:	At once
Minimum:	50	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change mode:	At once

Range:
50 Hz~4000Hz
Parameter description
Defines the frequency of the 2nd notch.

H09.16 2nd notch width level

Address:	0x0910	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0 to 20
Parameter description
Defines the width level of the 2nd notch.

H09.17 2nd notch depth level

Address:	0x0911	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 to 99

Parameter description

Defines the depth level of the 2nd notch.

H09.18 **3rd notch frequency**

Address:	0x0912	Effective mode:	At once
Minimum:	50	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change mode:	At once

Range:

50 Hz~4000Hz

Parameter description

Defines the frequency of the 3rd notch.

H09.19 **3rd notch width level**

Address:	0x0913	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20	Data type:	UInt16
Default:	2	Change mode:	At once

Range:

0 to 20

Parameter description

Defines the width level of the 3rd notch.

H09.20 **3rd notch depth level**

Address:	0x0914	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 to 99

Parameter description

Defines the depth level of the 3rd notch.

H09.21 **4th notch frequency**

Address:	0x0915	Effective mode:	At once
Minimum:	50	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change mode:	At once

Range:

50 Hz~4000Hz

Parameter description

Defines the frequency of the 4th notch.

H09.22 **4th notch width level**

Address:	0x0916	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0 to 20
Parameter description
Defines the width level of the 4th notch.

H09.23 **Depth level of the 4th notch**

Address:	0x0917	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 99
Parameter description
Defines the depth level of the 4th notch.

H09.24 **Obtained resonance frequency**

Address:	0x0918	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	4,000	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:
0 to 4000
Parameter description
When H09.02 (Adaptive notch mode) is set to 3, the current mechanical resonance frequency is displayed.

H09.30 **Torque disturbance compensation gain**

Address:	0x091E	Effective mode:	At once
Minimum:	-100.0	Unit:	%
Maximum:	100.0	Data type	Int16
Default:	0.0	Change mode:	At once

Range:
-100.0% to +100.0%
Parameter description
Defines the torque disturbance compensation gain.

H09.31 **Time constant of torque disturbance observer filter**

Address:	0x091F	Effective mode:	At once
Minimum:	0.00	Unit:	ms

Maximum:	25.00	Data type:	UInt16
Default:	0.50	Change mode:	At once

Range:
0.00 ms~25.00ms
Parameter description
Defines the filter time constant of torque disturbance observer.

H09.32 **Gravity compensation value**

Address:	0x0920	Effective mode:	At once
Minimum:	-100.0	Unit:	-
Maximum:	100.0	Data type	Int16
Default:	0.0	Change mode:	At once

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**

Address:	0x0921	Effective mode:	At once
Minimum:	-100.0	Unit:	%
Maximum:	100.0	Data type	Int16
Default:	0.0	Change mode:	At once

Range:
-100.0% to +100.0%
Parameter description
Defines the positive friction compensation value.

H09.34 **Negative friction compensation**

Address:	0x0922	Effective mode:	At once
Minimum:	-100.0	Unit:	%
Maximum:	100.0	Data type	Int16
Default:	0.0	Change mode:	At once

Range:
-100.0% to +100.0%
Parameter description
Defines the negative friction compensation value.

H09.35 **Friction compensation speed threshold**

Address:	0x0923	Effective mode:	At once
Minimum:	0.1	Unit:	rpm
Maximum:	30.0	Data type:	UInt16
Default:	2.0	Change mode:	At once

Range:
0.1 RPM to 30.0 RPM
Parameter description
Defines the friction compensation speed.

H09.36 **Friction compensation speed**

Address:	0x0924	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0x12	Data type:	UInt16
Default:	0x0	Change mode:	At once

Range:
0: Speed reference
1: Model tracking speed
2: Speed feedback
Parameter description
Friction compensation speed selection:
0: Slow speed mode + Speed reference
1: Slow speed mode + Model speed
2: Slow speed mode + Speed feedback

H09.38 **Low-frequency resonance suppression frequency at the mechanical end**

Address:	0x0926	Effective mode:	At once
Minimum:	1.0	Unit:	Hz
Maximum:	100.0	Data type:	UInt16
Default:	100.0	Change mode:	At once

Range:
1.0 Hz~100.0Hz
Parameter description
Set this parameter based on the actual jitter frequency.

H09.39 **Low-frequency resonance suppression at the mechanical end**

Address:	0x0927	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	2	Change mode:	At once

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 **Frequency of the 5th notch**

Address:	0x0929	Effective mode:	At once
Minimum:	50	Unit:	Hz
Maximum:	8000	Data type:	UInt16

Default:	4,000	Change mode:	At once

Range:
50 to 8000
Parameter description
Defines the frequency of the 5th notch.

H09.42 **Width level of the 5th notch**

Address:	0x092A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0 to 20
Parameter description
Defines the width level of the 5th notch.

H09.43 **Depth level of the 5th notch**

Address:	0x092B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 99
Parameter description
Defines the depth level of the 5th notch.

H09.44 **Frequency of low-frequency resonance suppression 1 at mechanical load end**

Address:	0x092C	Effective mode:	At once
Minimum:	0.0	Unit:	Hz
Maximum:	200.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:
0.0 Hz~200.0Hz
Parameter description
Set this parameter based on the actual jitter frequency.

H09.45 **Responsiveness of low-frequency resonance suppression 1 at the end-effector**

Address:	0x092D	Effective mode:	At once
Minimum:	0.01	Unit:	-
Maximum:	10.00	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.01 to 10.00

Parameter description

Use the default setpoint in general cases. Increasing this setpoint can reduce the delay time.

H09.47 **Width of low-frequency resonance suppression 1 at mechanical load end**

Address:	0x092F	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	2.00	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:

0.00 to 2.00

Parameter description

Use the default setpoint in general cases. Increasing this setpoint can increase the delay time.

H09.49 **Frequency of low-frequency suppression 2 at the mechanical end**

Address:	0x0931	Effective mode:	At once
Minimum:	0.0	Unit:	Hz
Maximum:	200.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:

0.0 Hz~200.0Hz

Parameter description

Set this parameter based on the actual jitter frequency.

H09.50 **Response to low-frequency suppression 2 at the mechanical end**

Address:	0x0932	Effective mode:	At once
Minimum:	0.01	Unit:	-
Maximum:	10.00	Data type:	UInt16
Default:	1.00	Change mode:	At once

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.

H09.52 **Width of low-frequency suppression 2 at the mechanical end**

Address:	0x0934	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	2.00	Data type:	UInt16
Default:	1.00	Change mode:	At once

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.

H09.57 **STune resonance suppression switchover frequency**

Address:	0x0939	Effective mode:	At once
Minimum:	0	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	850	Change mode:	At once

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:	0x093A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

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.

14.11 H0A Fault and Protection

H0A.00 **Power input phase loss protection**

Address:	0x0A00	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Enable phase loss fault and inhibit phase loss warning

1: Enable phase loss fault and warning

2: Disable phase loss fault and warning

Parameter description

Inovance provides servo drives of single-phase 220 V, three-phase 220 V, and three-phase 380 V. When the input voltage fluctuates violently or phase loss occurs, the servo drive flexibly selects the protection mode based on this setpoint.

Set value	Phase loss protection method	Remarks
0	Enable faults and inhibit warnings	If the main circuit input voltage is single phase for the drive with rated power of 1 kW and above (H01.02 ≥ 6), E420.0 occurs.
1	Enable faults and warnings	• If the main circuit input voltage is single phase for the drive with rated power of 1 kW and above (H01.02 ≥ 6), E420.0 occurs. • If the main circuit input voltage is single phase for the servo drive with 0.75 kW rated power (H01.02 = 5), E990.0 (Power input phase loss warning) occurs.
2	Inhibit faults and warnings	Er.420 and E990.0 will not be detected. In common bus mode, set H0A.00 to 2. Otherwise, the servo drive cannot enter "rdy" state after power-on. Note that power-off discharge and power-off retentive are not supported when H0A.00 is set to 2.

H0A.02 **Vibration alarm switch**

Address:	0x0A02	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Alarm

1: No alarm

Parameter description

Used to enable/disable the vibration runaway alarm function.

H0A.03 **Retentive at power failure**

Address:	0x0A03	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Disabled

1: Enabled

Parameter description

When this parameter is set to 1, the drive saves the value of H0b.17 (Pulse count value of the encoder) upon power failure, which can be viewed through the corresponding parameter at next power-on.

Set value	Function	Instruction receiving method
0	Disabled	The function of retentive at power failure is disabled.
1	Enable	The function of retentive at power failure is enabled. The servo drive automatically stores the encoder feedback pulse count (H0b.17) at power failure, which can be viewed in the corresponding function code after power-on again.

H0A.04 Motor overload protection gain

Address:	0x0A04	Effective mode:	At once
Minimum:	50	Unit:	%
Maximum:	300	Data type:	UInt16
Default:	100	Change:	At stop

Range:

50 %~300%

Parameter description

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.

The setting must be based on the actual heating condition, and take caution during use.

H0A.08 Overspeed threshold

Address:	0x0A08	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	10,000	Data type:	UInt16
Default:	0	Change:	At once

Range:

0 rpm to 10000 rpm

Parameter description

It sets the motor speed threshold at which the overspeed fault is detected.

Set value	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 10000	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.09 **Maximum position pulse frequency**

Address:	0x0A09	Effective mode:	At once
Minimum:	100	Unit:	kHz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change:	At stop

Range:

100 kHz~4000kHz

Parameter description

Defines the maximum frequency of input pulses when the position reference source is pulse reference (H05.00 = 0) in the position control mode.

When the actual pulse input frequency exceeds the value of H0A.09, the drive reports EB01.0 (Position reference input error).

H0A.10 **Threshold of position deviation excess**

Address:	0x0A0A	Effective mode:	At once
Minimum:	1	Unit:	Encoder unit
Maximum:	1073741824	Data type	UInt32
Default:	32767	Change mode:	At once

Range:

1 to 1073741824

Parameter description

It sets the threshold of the position deviation excess fault in the position control mode.

When the position deviation exceeds this threshold, the drive reports EB00.0 (Position deviation too large).

H0A.12 **Enable runaway protection function**

Address:	0x0A0C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: Disabled

1: Enabled

Parameter description

Defines whether to enable runaway protection.

0: Hide the detection on E234.0 in applications where the motor drives a vertical axis or is driven by the load.

1: Enable runaway protection

H0A.16 **Position deviation threshold for low-frequency resonance suppression**

Address:	0x0A10	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1,000	Data type:	UInt16
Default:	5	Change mode:	At once

Range:

0 to 1000

Parameter description

Defines the threshold of low-frequency resonance position deviation.

H0A.17 **Reference/Pulse selection**

Address:	0x0A11	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Pulse unit

1: Reference unit

Parameter description

Defines the unit for the position settings in H05.21, H05.22, and H0A.10.

H0A.18 **IGBT over-temperature threshold**

Address:	0x0A12	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	℃
Maximum:	100	Data type:	UInt16
Default:	90	Change:	At stop

Range:

0°C to 100°C

Parameter description

Defines the threshold for reporting E640.0 and E640.1.

H0A.19 **DI8 filter time**

Address:	0x0A13	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	255	Data type:	UInt16
Default:	80	Change:	At stop

Range:

0 to 255

Parameter description

Defines the filter time constant of DI8 (high-speed DI terminal). When peak interference exists on the external input signals, set H0A.19 to filter out the peak interference.

H0A.20 **DI9 filter time constant**

Address:	0x0A14	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	255	Data type:	UInt16
Default:	80	Change:	At stop

Range:

0 to 255

Parameter description

Defines the filter time constant of DI9 (high-speed DI terminal). When peak interference exists on the external input signals, set H0A.19 to filter out the peak interference.

H0A.22 **Sigma Delta filter time**

Address:	0x0A16	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0 to 3
Parameter description
Defines the Sigma_Delta filter time.

H0A.23 **Tz signal filter time**

Address:	0x0A17	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	31	Data type:	UInt16
Default:	15	Change:	At stop

Range:
0 to 31
Parameter description
Defines the TZ signal filter time.

H0A.24 **Filter time constant of low-speed pulse input terminal**

Address:	0x0A18	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	255	Data type:	UInt16
Default:	30	Change:	At stop

Range:
0 to 255
Parameter description
Defines the filter time constant of low-speed pulse input terminal which is enabled (H05.01 = 0) when the position reference source is pulse input (H05.00 = 0) in the position control mode. When peak interference exists in the low-speed pulse input terminal, set this parameter to suppress peak interference and prevent motor malfunction due to interference signal inputted to the servo drive.

Maximum Frequency of Input Pulses	Recommended filter value (25 ns)
< 167 kbps	30
167 k to 250 k	20
250 k to 500 k	10

H0A.25 **Filter time constant of speed feedback display value**

Address:	0x0A19	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	5,000	Data type:	UInt16
Default:	200	Change:	At stop

Range:
0ms~5000ms

Parameter description

It sets the low-pass filter time constant of speed signals for the speed feedback and position reference.

H0A.26 **Enable motor overload shielding**

Address:	0x0A1A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	3	Change:	At stop

Range:

0: Detect motor overload

1: Hide motor overload warning (Er.909) and motor overload fault (Er.620)

2: Meaningless

3: Enabled for new motors

Parameter description

It sets whether to shield motor overload detection.

H0A.27 **Filter time constant of speed DO**

Address:	0x0A1B	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	5,000	Data type:	UInt16
Default:	10	Change:	At stop

Range:

0ms~5000ms

Parameter description

Defines the moving average filter time constant of the speed information for speed feedback and position references.

H0A.28 **Filter time constant of quadrature encoder**

Address:	0x0A1C	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	ns
Maximum:	255	Data type:	UInt16
Default:	30	Change:	At stop

Range:

0 to 255

Parameter description

Used to suppress peak interference on feedback signals from the incremental quadrature encoder.

H0A.30 **Filter time constant of high-speed pulse input terminal**

Address:	0x0A1E	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	ns
Maximum:	255	Data type:	UInt16
Default:	2	Change:	At stop

Range:

0 to 255

Parameter description

Defines the filter time constant of high-speed pulse input terminal which is enabled (H05.01 = 1) when the position reference source is pulse reference (H05.00 = 0) in the position control mode. When peak interference exists in the high-speed pulse input terminal, set this parameter to suppress peak interference and prevent motor malfunction due to interference signal inputted to the servo drive.

Maximum Frequency of Input Pulses	Recommended Filter Time Constant (unit: ns)
500 k to 1 M	5
> 1 Mpps	3

H0A.32 **Time threshold for locked rotor over-temperature protection**

Address:	0x0A20	Effective mode:	At once
Minimum:	10	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

10ms~65535ms

Parameter description

Defines the over-temperature duration before E630.0 (Motor stall) is detected by the servo drive. H0A.32 can be used to adjust the sensitivity of motor stall over-temperature detection.

H0A.33 **Locked rotor over-temperature protection**

Address:	0x0A21	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: Enabled

1: Enable

2: New over-temperature protection enable

Parameter description

Defines whether to enable the detection for E630.0 (Motor stall overtemperature protection).

H0A.35 **Reading encoder EEPRROM upon power-on (for third-party encoders)**

Address:	0x0A23	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Enabled

1: Disabled

Parameter description

Used to set whether to inhibit the read-write operations in the ROM of Nikon, TAMAGAWA, and Endat2.2 encoders.
0: Disabled
1: Enabled

H0A.36 Encoder multi-turn overflow fault selection

Address:	0x0A24	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0: Disabled
1: Enabled

Parameter description
Defines whether to hide the encoder multi-turn overflow fault in the absolute position linear mode (H02.01 = 1).

H0A.38 IGBT over-temperature threshold

Address:	0x0A26	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	℃
Maximum:	175	Data type:	UInt16
Default:	135 m	Change:	At stop

Range:
0 ℃~175℃

Parameter description
Displays the IGBT overtemperature threshold.

H0A.39 IGBT over-temperature protection switch

Address:	0x0A27	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0: Disable
1: Enable

Parameter description
Used to enable IGBT overtemperature protection.

H0A.40 Software limit selection

Address:	0x0A28	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0: No action
1: Activated immediately
2: Activated after homing completed

Parameter description

0: No action

1: Activated immediately

2: Activated after homing completed

H0A.41 **Forward position of software limit**

Address:	0x0A29	Effective mode:	At once
Minimum:	-2147483648	Unit:	-
Maximum:	2147483647	Data type	Int32
Default:	2147483647	Change:	At stop

Range:

-2147483648 to 2147483647

Parameter description

When the absolute position counter value (H0b.07) is higher than H0A.41, the drive reports E950.0 (Forward overtravel) and stops accordinly.

H0A.43 **Reverse position of software limit**

Address:	0x0A2B	Effective mode:	At once
Minimum:	-2147483648	Unit:	-
Maximum:	2147483647	Data type	Int32
Default:	-2147483648	Change:	At stop

Range:

-2147483648 to 2147483647

Parameter description

When the absolute position counter value (H0b.07) is lower than H0A.43, the drive reports E952.0 (Reverse overtravel) and stops accordingly.

H0A.47 **Brake protection**

Address:	0x0A2F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Disable brake protection detection

1: Enable brake protection detection

Parameter description

When this parameter is set to 0, the brake protection detection function is disabled. When this parameter is set to 1, the function is enabled.

H0A.48 **Gravity load**

Address:	0x0A30	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3,000	Data type:	UInt16
Default:	300	Change mode:	At once

Range:

0 to 3000

Parameter description

Displays the gravity load.

H0A.49 **Bleeder wafer over-temperature threshold**

Address:	0x0A31	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	℃
Maximum:	175	Data type:	UInt16
Default:	115	Change:	At stop

Range:

0 ℃~175℃

Parameter description

Defines the temperature threshold for braking resistor overload.

H0A.50 **Torque reference display filter time**

Address:	0x0A32	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	5,000	Data type:	UInt16
Default:	200	Change:	At stop

Range:

0ms~5000ms

Parameter description

Defines the torque reference display filter time.

H0A.51 **Encoder fault tolerance count**

Address:	0x0A33	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	31	Data type:	UInt16
Default:	31	Change mode:	At once

Range:

0 to 31

Parameter description

When the number of communication failures between the encoder and the drive exceeds H0A.51, the communication between the encoder and the drive fails.

H0A.52 **Encoder overtemperature protection threshold**

Address:	0x0A34	Effective mode:	At once
Minimum:	0	Unit:	°
Maximum:	175	Data type:	UInt16
Default:	105	Change mode:	At once

Range:

0 °~175°

Parameter description

E760.0 is reported when the encoder temperature (H0b.66) exceeds H0A.52 + 15℃ for 100 ms, or E760.0 is reported after H0A.52 + 5℃ for 1000 ms. When H0A-52 is set to 0, 760 detection is disabled.

H0A.55 **Runaway current threshold**

Address:	0x0A37	Effective mode:	At once
Minimum:	100.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	200.0	Change mode:	At once

Range:
100.0 %~400.0%
Parameter description
Defines the current threshold for runaway protection detection.

H0A.57 **Runaway speed threshold**

Address:	0x0A39	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	1,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
1 rpm to 1000 rpm
Parameter description
Defines the overspeed threshold for runaway protection detection.

H0A.58 **Speed feedback filter time constant**

Address:	0x0A3A	Effective mode:	Effective upon next power-on
Minimum:	0.1	Unit:	ms
Maximum:	100.0	Data type:	UInt16
Default:	2.0	Change mode:	At once

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:	0x0A3B	Effective mode:	At once
Minimum:	10	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	30	Change mode:	At once

Range:
10 ms to 1000 ms
Parameter description
The runaway fault will be reported when runaway fault keeps active for a period longer than that defined by H0A.59.

H0A.61 **Phase loss detection time threshold**

Address:	0x0A3D	Effective mode:	At once

Minimum:	30	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	50	Change mode:	At once

Range:
30 ms~65535ms
Parameter description
Defines the phase loss detection time threshold.

H0A.85 **Wire breakage detection torque threshold**

Address:	0x0A55	Effective mode:	At once
Minimum:	4.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	5.0	Change:	At stop

Range:
4.0 %~400.0%
Parameter description
Defines the open circuit detection torque threshold.

H0A.86 **Wire breakage detection filter time**

Address:	0x0A56	Effective mode:	At once
Minimum:	5	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	30	Change:	At stop

Range:
5 to 1000
Parameter description
Defines the open circuit detection filter time.

14.12 H0B Display Parameters

H0b.00 **Actual motor speed**

Address:	0x0B00	Effective mode:	-
Minimum:	-32767	Unit:	rpm
Maximum:	32767	Data type	Int16
Default:	0	Change:	Unmodifiable

Range:
-32767rpm to 32767rpm
Parameter description
Indicates the actual motor speed after round-off, which is accurate to 1 RPM.
Set in H0A.25 (Filter time constant of speed feedback display) the filter time constant for H0b.00.

H0b.01 **Speed reference**

Address:	0x0B01	Effective mode:	-
Minimum:	-32767	Unit:	rpm
Maximum:	32767	Data type	Int16

Default: 0 Change: Unmodifiable

Range:

-32767rpm to 32767rpm

Parameter description

Indicates the present speed reference (accurate to 1 RPM) of the drive in the position and speed control modes.

H0b.02 Internal torque reference

Address: 0x0B02 Effective mode: -

Minimum: -3276.7 Unit: %

Maximum: 3276.7 Data type Int16

Default: 0.0 Change: Unmodifiable

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: 0x0B03 Effective mode: -

Minimum: 0 Unit: -

Maximum: 65535 Data type: UInt16

Default: 0 Change: Unmodifiable

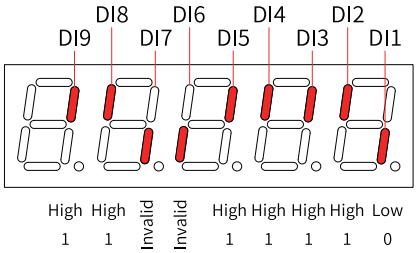
Range:

0–65535

Parameter description

It displays the level states of the 8 DI terminals without filtering.

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



H0b.05 Monitored DO states

Address: 0x0B05 Effective mode: -

Minimum: 0 Unit: -

Maximum: 65535 Data type: UInt16

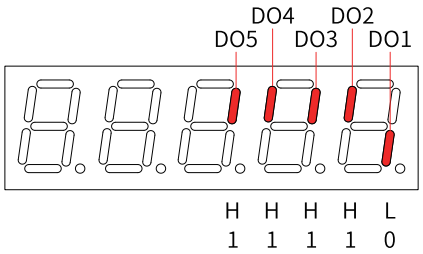
Default: 0 Change: Unmodifiable

Range:

0–65535

Parameter description

Displays the level status of five DOs without filtering.
Upper LED segments ON: high level (indicated by "1") Lower LED segments ON: low level (indicated by "0")



H0b.07 **Absolute position counter**

Address:	0x0B07	Effective mode:	-
Minimum:	-2147483648	Unit:	Reference unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:
-2147483648 to +2147483647
Parameter description
Displays current absolute position of the motor in reference unit.
This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.09 **Mechanical angle**

Address:	0x0B09	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:
0–65535
Parameter description
Displays the present mechanical angle (encoder unit) of the motor. The setpoint 0 indicates the mechanical angle is 0°.
Actual mechanical angle = 360° x H0b.09/(Maximum value of H0b.09 + 1)

Maximum value of H0b.09 for an absolute encoder is 65535.

H0b.10 **Electric angle**

Address:	0x0B0A	Effective mode:	-
Minimum:	0.0	Unit:	°
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:
0.0 to 6553.5
Parameter description
Indicates the present electrical angle of the motor, which is accurate to 0.1°.
The electrical angle variation range is ±360.0° during rotation. If the motor has four pairs of poles, each revolution generates four rounds of angle change from 0° to 359°. Similarly, if the motor has five pairs of poles, each revolution generates five rounds of angle change from 0° to 359°.

H0b.11 Speed corresponding to input position reference

Address:	0x0B0B	Effective mode:	-
Minimum:	-32767	Unit:	rpm
Maximum:	32767	Data type	Int16
Default:	0	Change:	Unmodifiable

Range:

-32767rpm to 32767rpm

Parameter description

It displays the speed corresponding to the position references within one position control period in the position control mode.

H0b.12 Average load ratio

Address:	0x0B0C	Effective mode:	-
Minimum:	0.0	Unit:	%
Maximum:	800.0	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

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 position reference counter

Address:	0x0B0D	Effective mode:	-
Minimum:	-2147483648	Unit:	Reference unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

–2147483648 to +2147483647

Parameter description

Used to count and display the number of position references not divided or multiplied by the electronic gear ratio during operation.

This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.15 Encoder position deviation counter

Address:	0x0B0F	Effective mode:	-
Minimum:	-2147483648	Unit:	Encoder unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

-2147483648 to 2147483647

Parameter description

It counts and displays the position deviation value after being divided or multiplied by the electronic gear ratio in the position control mode. The setting is 32-bit data, and the keypad display is a decimal.

H0b.17 **Feedback pulse counter**

Address:	0x0B11	Effective mode:	-
Minimum:	-2147483648	Unit:	Encoder unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

-2147483648 to 2147483647

Parameter description

It counts the position pulses fed back by the encoder in any mode.

This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.19 **Total power-on time**

Address:	0x0B13	Effective mode:	-
Minimum:	0.0	Unit:	s
Maximum:	429496729.5	Data type	UInt32
Default:	0.0	Change:	Unmodifiable

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.

Note:

If multiple times of power-on/off are performed in the servo drive within a short time, there may be one-hour deviation between the value of this parameter and the actual time.

H0b.24 **Phase current effective value**

Address:	0x0B18	Effective mode:	-
Minimum:	0.00	Unit:	A.
Maximum:	655.35	Data type:	UInt16
Default:	0.00	Change:	Unmodifiable

Range:

0.00 A to 655.35 A

Parameter description

It displays the phase current effective value of the servo motor, in unit of 0.01 A.

H0b.26 **Bus voltage**

Address:	0x0B1A	Effective mode:	-
Minimum:	0.0	Unit:	V
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0 V to 6553.5 V

Parameter description

It displays the DC bus voltage of the main circuit input voltage after rectification, in unit of 0.01 V.

H0b.27 **Module temperature**

Address:	0x0B1B	Effective mode:	-

Minimum:	-20	Unit:	℃
Maximum:	200	Data type	Int16
Default:	0	Change:	Unmodifiable

Range:

-20°C to +200°C

Parameter description

It displays the temperature of the modules inside the servo drive, which can be used as the reference of current servo drive temperature.

H0b.28 Absolute encoder fault information given by FPGA

Address:	0x0B1C	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the absolute encoder fault information given by FPGA

H0b.29 System status information given by FPGA

Address:	0x0B1D	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the axis status information given by FPGA.

H0b.30 System fault information given by FPGA

Address:	0x0B1E	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the axis fault information given by FPGA.

H0b.33 Fault record

Address:	0x0B21	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	19	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Present fault
1: Latest fault
2: 2nd to last fault
3: 3rd to last fault
4: 4th to last fault
5: 5th to last fault
6: 6th to last fault
7: 7th to last fault
8: 8th to last fault
9: 9th to last fault
10: 10th to last fault
11: 11th to last fault
12: 12th to last fault
13: 13th to last fault
14: 14th to last fault
15: 15th to last fault
16: 16th to last fault
17: 17th to last fault
18: 18th to last fault
19: 19th to last fault

Parameter description

Used to view the latest 20 faults of the drive.

H0b.34 Fault code of the selected fault record

Address:	0x0B22	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the fault code of the selected fault.

H0b.35 Time stamp upon displayed fault

Address:	0x0B23	Effective mode:	-
Minimum:	0	Unit:	s
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0.0s~4294967295s

Parameter description

Displays the time stamp of the selected fault.

H0b.37 Motor speed upon displayed fault

Address:	0x0B25	Effective mode:	-
Minimum:	-32767	Unit:	rpm
Maximum:	32767	Data type	Int16

Default:	0	Change:	Unmodifiable

Range:

-32767rpm to 32767rpm

Parameter description

Displays the motor speed upon occurrence of the selected fault.

H0b.38 Motor phase U current upon displayed fault

Address:	0x0B26	Effective mode:	-
Minimum:	-327.67	Unit:	A.
Maximum:	327.67	Data type	Int16
Default:	0.00	Change:	Unmodifiable

Range:

-327.67 A~327.67A

Parameter description

Displays the motor phase U current upon occurrence of the selected fault.

H0b.39 Motor phase V current upon displayed fault

Address:	0x0B27	Effective mode:	-
Minimum:	-327.67	Unit:	A.
Maximum:	327.67	Data type	Int16
Default:	0.00	Change:	Unmodifiable

Range:

-327.67 A~327.67A

Parameter description

Displays the motor phase V current upon occurrence of the selected fault.

H0b.40 Bus voltage upon displayed fault

Address:	0x0B28	Effective mode:	-
Minimum:	0.0	Unit:	V
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

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 displayed fault

Address:	0x0B29	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0-65535

Parameter description

Displays the input terminal state upon occurrence of the selected fault.

H0b.42 Output terminal state upon displayed fault

Address:	0x0B2A	Effective mode:	-

Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Displays the output terminal status upon occurrence of the selected fault.

H0b.43 Function code group number with abnormal parameter

Address:	0x0B2B	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the group number of the abnormal parameter.

H0b.44 Offset in function code group with abnormal parameter

Address:	0x0B2C	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Displays the offset within the group of the abnormal parameter.

H0b.45 Internal fault code

Address:	0x0B2D	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the master code + fault subcode of the current servo fault.

H0b.46 Absolute encoder fault information given by FPGA upon occurrence of the selected fault

Address:	0x0B2E	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

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 given by FPGA upon occurrence of the selected fault

Address:	0x0B2F	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the system status information given by FPGA upon occurrence of the selected fault.

H0b.48 System fault information given by FPGA upon occurrence of the selected fault

Address:	0x0B30	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the system fault information given by FPGA upon occurrence of the selected fault.

H0b.51 Internal fault code when the fault is selected

Address:	0x0B33	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the internal fault code upon occurrence of the selected fault.

H0b.52 Timeout fault flat bit given by FPGA upon occurrence of the selected fault

Address:	0x0B34	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the FPGA timeout fault standard bit upon occurrence of the selected fault.

H0b.53 Position deviation counter

Address:	0x0B35	Effective mode:	-
Minimum:	-2147483648	Unit:	Reference unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

–2147483648 to +2147483647

Parameter description

It displays the position deviation not processed by the electronic gear ration 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 speed

Address:	0x0B37	Effective mode:	-
Minimum:	-214748364.8	Unit:	rpm
Maximum:	214748364.7	Data type	Int32
Default:	0.0	Change:	Unmodifiable

Range:

-214748364.8rpm to 214748364.7rpm

Parameter description

Indicates the actual value of motor speed, which is accurate to 0.1 RPM.

This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0A.25 (Filter time constant of speed feedback display) can be used to set the filter time constant of the speed feedback.

H0b.58 Mechanical absolute position (low 32 bits)

Address:	0x0B3A	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 4294967295

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:	0x0B3C	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 4294967295

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:	0x0B3F	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	7	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

1: Control circuit power input error
2: Main circuit power input error
3: Bus undervoltage
4: Soft start failed
5: Encoder initialization not done
6: Short-circuit to ground failed
7: Others

Parameter description

Displays the reason for NotRdy state.

H0b.64 Real-time input position reference counter

Address:	0x0B40	Effective mode:	-
Minimum:	-2147483648	Unit:	Reference unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

-2147483648 to +2147483647

Parameter description

Displays the value of the pulse 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.

H0b.66 Encoder temperature

Address:	0x0B42	Effective mode:	-
Minimum:	-32768	Unit:	℃
Maximum:	32767	Data type	Int16
Default:	0	Change:	Unmodifiable

Range:

-32768 ℃~32767℃

Parameter description

Displays the encoder temperature.

H0b.70 Number of absolute encoder revolutions

Address:	0x0B46	Effective mode:	-
Minimum:	0	Unit:	Rev
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0 Rev to 65535 Rev

Parameter description

It displays the number of absolute encoder turns.

H0b.71 Position of absolute encoder within one turn

Address:	0x0B47	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	2147483647	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 2147483647

Parameter description

It displays the single-turn position feedback of the absolute encoder.

H0b.73 Single-turn offset position of absolute encoder

Address:	0x0B49	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	2147483647	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 2147483647

Parameter description

Displays the offset position of absolute encoder within one turn.

H0b.75 Load inertia ratio during online inertia auto-tuning

Address:	0x0B4B	Effective mode:	-
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	0.00	Change:	Unmodifiable

Range:

0.00 to 655.35

Parameter description

Displays the load inertia ratio upon online inertia auto-tuning.

H0b.76 External load during online inertia auto-tuning

Address:	0x0B4C	Effective mode:	-
Minimum:	-100.0	Unit:	-
Maximum:	100.0	Data type	Int16
Default:	0.0	Change:	Unmodifiable

Range:

-100.0 to 100.0

Parameter description

Displays the external load in online inertia auto-tuning.

H0b.77 Absolute position (low 32 bits) of absolute encoder

Address:	0x0B4D	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 4294967295

Parameter description

It displays the low 32-bit data of the position feedback of the absolute encoder.

H0b.79 Absolute position (high 32 bits) of absolute encoder

Address:	0x0B4F	Effective mode:	-
Minimum:	0	Unit:	Encoder unit

Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 4294967295

Parameter description

It displays the high 32-bit data of the position feedback of the absolute encoder.

H0b.81 Load position within one turn in absolute position rotation mode (low 32 bits)

Address:	0x0B51	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 4294967295

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 Load position within one turn in absolute position rotation mode (high 32 bits)

Address:	0x0B53	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 4294967295

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 Load position within one turn in absolute position rotation mode

Address:	0x0B55	Effective mode:	-
Minimum:	-2147483648	Unit:	Reference unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

–2147483648 to +2147483647

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.89 Low bits 0 to 15 of active state of DI function

Address:	0x0B59	Effective mode:	
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description
Displays the low bits 0 to 15 of active state of DI function.

H0b.90 **Low bits 16 to 31 of active state of DI function**

Address:	0x0B60	Effective mode:	
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:
0–65535
Parameter description
Displays the low bits 16 to 31 of active state of DI function.

H0b.91 **Low bits 32 to 47 of active state of DI function**

Address:	0x0B61	Effective mode:	
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:
0–65535
Parameter description
Displays the low bits 32 to 47 of active state of DI function.

H0b.92 **Low bits 48 to 63 of active state of DI function**

Address:	0x0B62	Effective mode:	
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:
0–65535
Parameter description
Displays the low bits 48 to 63 of active state of DI function.

14.13 H0C Communication Parameters

H0C.00 **Servo axis address**

Address:	0x0C00	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	247	Data type:	UInt16
Default:	1	Change:	At stop

Range:
1 to 247
Parameter description
Indicates the CAN slave node address. Ensure this parameter is consistent with the configuration of the host controller.

H0C.02 **Serial port baud rate**

Address:	0x0C02	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	7	Data type:	UInt16
Default:	5	Change mode:	At once

Range:

0: 2400 bps

1: 4800 bps

2: 9600 bps

3: 19200 bps

4: 38400 bps

5: 57600 bps

6: 115200 bps

Parameter description

Defines the serial port baud rate during RS485 communication between the drive and host controller.

0: 2400 bps

1: 4800 bps

2: 9600 bps

3: 19200 bps

4: 38400 bps

5: 57600 bps

6: 115200 bps

The data format set in the servo drive must be the same as that in the host controller. Otherwise, communication will fail.

H0C.03 **Modbus data format**

Address:	0x0C03	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: No check, 2 stop bits

1: Even parity, 1 stop bit

2: Odd parity, 1 stop bit

3: No check, 1 stop bits

Parameter description

Defines the data check mode between the drive and the host controller during RS485 communication.

0: No check, 2 stop bits

1: Even parity, 1 stop bit

2: Odd parity, 1 stop bit

3: No check, 1 stop bits

The data format set in the servo drive must be the same as that in the host controller. Otherwise, communication will fail.

H0C.08 **CAN communication rate**

Address:	0x0C08	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	8	Data type:	UInt16
Default:	5	Change:	At stop

Range:

0: 20 K

1: 50 °K

2: 100 °K

3: 125 °K

4: 250 °K

5: 500 °K

6: 1 M

7: 1 Mbps

Parameter description

Defines the communication rate between the drive and the host controller in the CANlink or CANopen mode. The communication rates of the servo drive and the host controller must be the same; otherwise, the communication fails. If H0C.08 is set to 6, the baud rate is 1 Mbps. 80% sampling points are used to match most PLCs with a 1M standard baud rate.

H0C.09 **Communication VDI**

Address:	0x0C09	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Disable

1: Enable

Parameter description

To use the VDI function:

1. Enable VDI through H0C.09.
2. Set the default level after power-on through H0C.10.
3. Set the DI function of the VDI terminal through parameters in group H17.
4. Set VDI output through H31.00.

H0C.10 **VDI default value after power-on**

Address:	0x0C0A	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0–65535

Parameter description

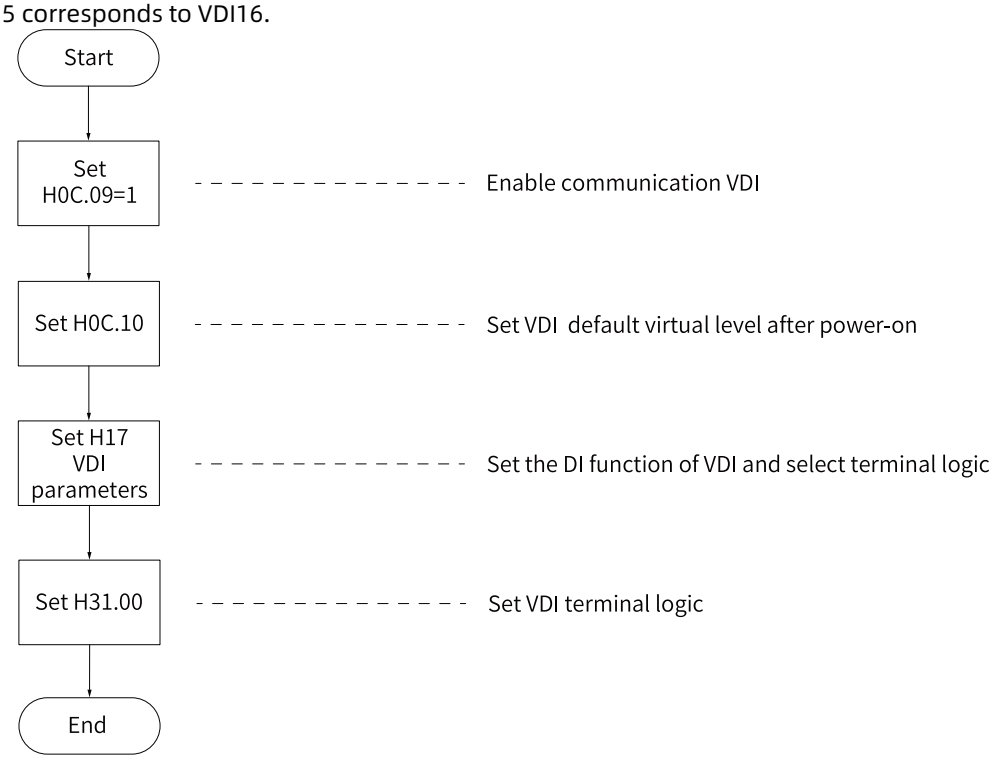
Configures the initial value of VDI upon power-on.

Bit 0 corresponds to VDI1.

Bit 1 corresponds to VDI2.

…

Bit 15 corresponds to VDI16.



H0C.11 **Communication VDO**

Address:	0x0C0B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Disable

1: Enable

Parameter description

To use the VDO function:

1. Enable VDO through H0C.11.

2. Set the default level after power-on through H0C.12.

3. Set the DO function of the VDO through parameters in group H17.

4: Read the output level of the VDO in H17.32.

H0C.12 **Default level of the VDO allocated with function 0**

Address:	0x0C0C	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

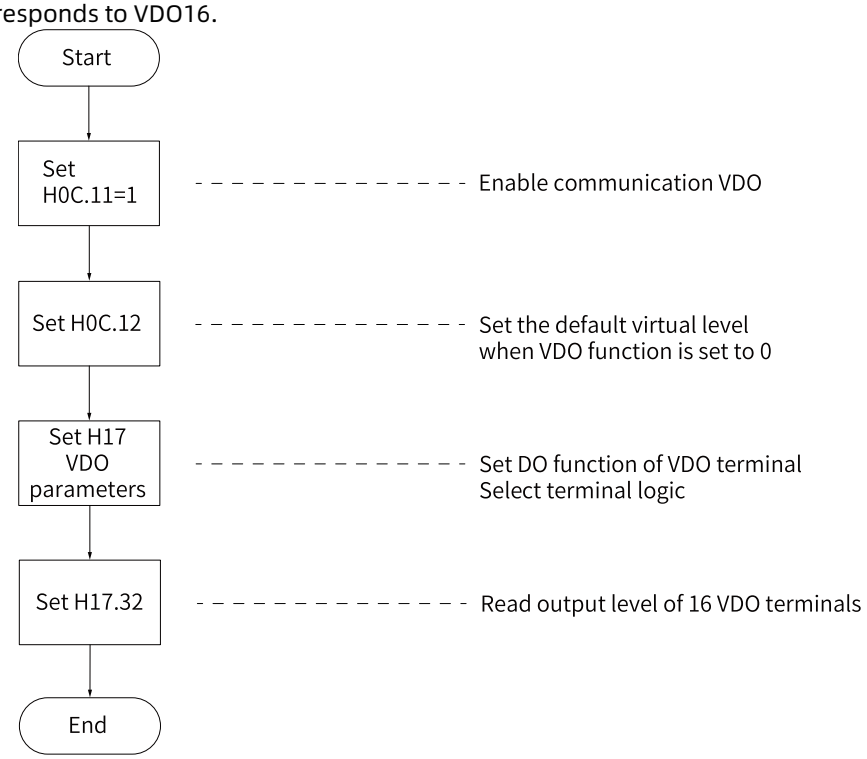
Configures the initial value of VDO upon power-on.

Bit 0 corresponds to VDO1.

Bit 1 corresponds to VDO2.

…

Bit 15 corresponds to VDO16.



H0C.13 **Writing the updated parameter values in the EEPROM**

Address:	0x0C0D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: No writing to EEPROM

1: Writing to EEPROM

Parameter description

Defines whether to save the parameters written via Modbus communication to EEPROM (InoDriverShop also communicates with servo drive via Modbus protocol).

H0C.14 **Modbus error** code

Address:	0x0C0E	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0: None

1: 0x0001 illegal parameter (command code)

2: 0x0002 command code data address

3: 0x0003 illegal data

4: 0x0004 slave station device fault

Parameter description

Displays the error code when a communication fault occurs.

H0C.16 **Update parameter values written through CAN communication to EEPROM**

Address:	0x0C10	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: No writing to EEPROM

1: Writing to EEPROM

Parameter description

Defines whether to save parameters written through CAN communication to EEPROM.

H0C.25 **Modbus response delay**

Address:	0x0C19	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	20	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0ms~20ms

Parameter description

It sets the delay from the moment when the slave receives a command from the host controller to the moment when the slave returns a response.

H0C.26 **Modbus communication data sequence**

Address:	0x0C1A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: High 16 bits before low 16 bits

1: Low 16 bits before high 16 bits

Parameter description

Defines the 32-bit data transmission format of Modbus communication.

H0C.30 **Modbus error frame format**

Address:	0x0C1E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: Previous protocol

1: New protocol (Standard protocol)

Parameter description

Defines the protocol for reporting communication errors.

H0C.31 **Modbus receiving selection**

Address:	0x0C1F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Enable receive interrupt

1: Current loop interrupt query

Parameter description

Defines the Modbus reception processing mode.

14.14 H0d Auxiliary Function Parameters

H0d.00 **Software reset**

Address:	0x0D00	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No action

1: Enable reset

Parameter description

Programs in the drive are reset automatically (similar to the program reset upon power-on) after the software reset function is enabled, without the need for a power cycle.

H0d.01 **Fault reset**

Address:	0x0D01	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No operation

1: Fault reset

Parameter description

When a No.1 or No.2 resettable fault occurs, you can enable the fault reset function in the non-operational state after rectifying the fault cause, stopping the keypad from displaying the fault and allowing the drive to enter the "rdy" state.
NO. 3 warnings can be reset directly regardless of the servo state.

Set value	Function	Remarks
0	No operation	-
1	Fault reset	• When a No.1 or No.2 resettable fault occurs, you can enable the fault reset function in the non-operational state after rectifying the fault cause, stopping the keypad from displaying the fault and allowing the drive to enter the "rdy" state. • NO. 3 warnings can be reset directly regardless of the servo state.

H0d.02 Inertia auto-tuning selection

Address:	0x0D02	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 65
Parameter description
Used to enable offline inertia auto-tuning through the keypad.

H0d.03 Initial angle auto-tuning

Address:	0x0D03	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0: No action
1: Enable
Parameter description
0: No action
1: Enable

H0d.04 Encoder ROM read/write

Address:	0x0D04	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0: No action
1: Read ROM
2: Write ROM

Parameter description

0: No action

1: Read ROM

2: Write ROM

H0d.05 **Emergency Stop**

Address:	0x0D05	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: No action

1: Emergency stop

Parameter description

0: No action

1: Emergency stop

H0d.06 **Current loop parameter auto-tuning**

Address:	0x0D06	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No action

1: Saving parameters during auto-tuning

2: Not saving parameters during auto-tuning

Parameter description

Current loop parameter auto-tuning

H0d.12 **Phase U/V current balance correction**

Address:	0x0D0C	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–1

Parameter description

Phase U/V current balance correction enable

H0d.17 **Forced DI/DO selection**

Address:	0x0D11	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: No action

1: Forced DI enabled, forced DO disabled

2: Forced DO enabled, forced DI disabled

3: Forced DI and DO enabled

Parameter description

Defines whether to enable forced DI/DO.

H0d.18 **Forced DI level**

Address:	0x0D12	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0x1FF	Data type:	UInt16
Default:	0x1FF	Change mode:	At once

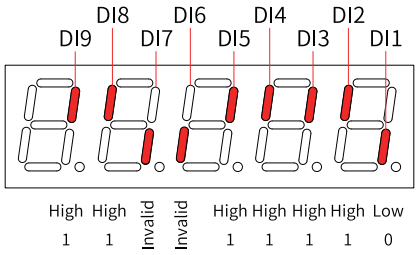
Range:

0x0~0x1FF

Parameter description

Defines the level logic of the DI functions set in group H03 when forced DI is active (H0d.17 set to 1 or 3).

H0d.18 is displayed in hex on the keypad. In the converted binary value, bit(n) = 1 indicates that the DI is active high. bit(n)=0 indicates that the level logic of the DI function is low level.



H0d.19 **Forced DO setting**

Address:	0x0D13	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0x1F	Data type:	UInt16
Default:	0x0	Change mode:	At once

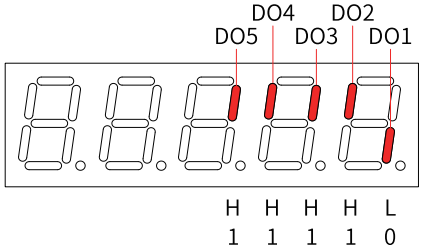
Range:

0x0~0x1F

Parameter description

Defines whether the DO functions assigned in group H04 are active when forced DO is active (H0d.17 set to 2 or 3).

The value of H0d.19 is displayed in hex on the keypad. When it is converted to a binary value, "bit (n) = 1" indicates that the DO is active, and "bit(n) = 0" indicates that the DO is inactive.



H0d.20 **Multi-turn absolute encoder reset**

Address:	0x0D14	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No action

1: Reset fault

2: Reset fault and multi-turn data

Parameter description

You can reset the encoder fault or the multi-turn data fed back by the encoder through H0d.20.

14.15 H11 Multi-Position Function Parameters

H11.00 **Multi-position running mode**

Address:	0x1100	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	5	Data type:	UInt16
Default:	1	Change:	At stop

Range:

0: Individual operation (number of positions defined by H11.01)

1: Cyclic operation (number of positions defined by H11.01)

2: DI-based operation (selected through DI)

3: Sequential operation

5: Axis-controlled continuous operation

Parameter description

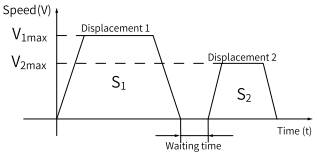
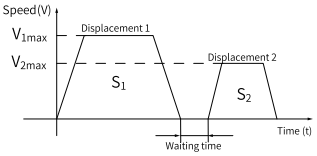
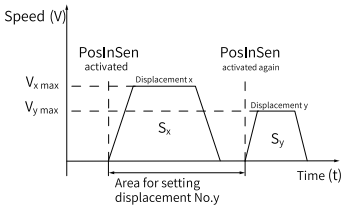
0: Individual operation (number of positions defined by H1101)

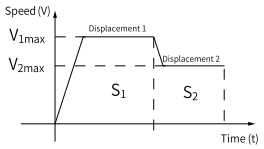
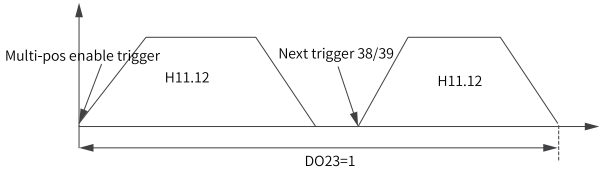
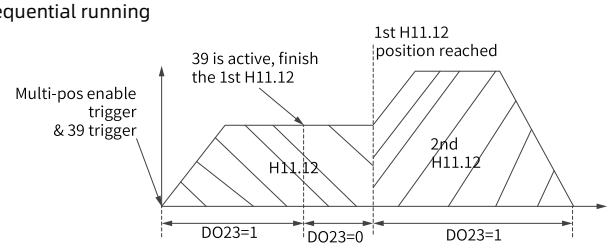
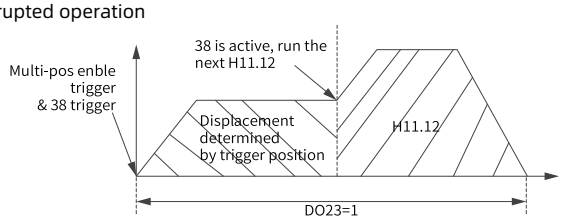
1: Cyclic operation (number of positions defined by H1101)

2: DI-based operation (selected through DI)

3: Sequential operation

5: Axis-controlled continuous operation

Set value	Operating mode	Remarks	Operation Curve
0	Stop after a single running	• The drive stops after one cycle of operation. • The drive switches to the next displacement automatically. • The interval time between displacements can be set as needed. • The PoslnSen (Multi-position reference enable) signal is level-triggered.	 V_{1max} , V_{2max}: maximum values of 1st and 2nd speeds S_1 and S_2 : displacement 1 and displacement 2
1	Cyclic running	• The drive starts from displacement 1 again after each cycle of operation. • The drive switches to the next displacement automatically. • The interval time between displacements can be set as needed. • The cyclic operation state remains active as long as the FunIN.28 (Multi-position reference enable) signal is active. • The PoslnSen (Multi-position reference enable) signal is level-triggered.	 V_{1max} , V_{2max}: maximum values of 1st and 2nd speeds S_1 and S_2 : displacement 1 and displacement 2
2	DI switchover	• When the servo drive runs the current position, you can set the next position No. After the position reference of the current number is completed, the servo motor stops. After the PoslnSen (position reference enable) signal is enabled again, the present displacement will be executed. • The speed No. is determined by the DI logic. • The interval time between displacements is determined by the command delay of the host controller. • The PoslnSen (Multi-position reference enable) signal is edge-triggered.	 V_{xmax} and V_{ymax} : maximum operating speeds in position x and position y S_x , S_y : displacements of xth and yth positions

Set value	Operating mode	Remarks	Operation Curve
3	Sequential running	• The drive stops after one cycle of operation. • (H11.05 = 0 or H11.05 > H11.01). • The starting displacement after the first cycle of operation is defined by H11.05. • The drive switches to the next displacement automatically. • There is no interval time between displacements. • The PoslnSen (Multi-position reference enable) signal is level-triggered.	 V_{1max} , V_{2max}: maximum values of 1st and 2nd speeds S_1 and S_2 : displacement 1 and displacement 2
5	Axis-controlled continuous operation	• The drives executes one displacement only. • The individual operation mode, sequential operation mode, and interrupted operation mode are included. • The PoslnSen (Multi-position reference enable) signal is level-triggered.	• Individual operation  • The PoslnSen (multi-position reference enable) signal is triggered only once (FunIN.38/39 triggered later). The servo drive stops after executing the distance defined by H11.12 (Displacement 1). • Sequential running  • The PoslnSen (multi-position reference enable) signal is triggered only once. Write H11.12 again and activate FunIN.39 when the distance defined by the first H11.12 is still in progress.• After receiving the new distance (or speed), which is the second H11.12, the servo drive continues executing the first H11.12 until the distance defined by the first H11.12 is reached. Then it starts to execute the second H11.12 directly. The travel distance therefore is the sum of the first H11.12 and the second H11.12. • Interrupted operation  • The PoslnSen (Multi-position reference enable) signal is triggered only once. Write H11.12 (such as 1000000) again and activate FunIN.38 when the first H11.12 (such as 9000000) is still in progress. After receiving the new distance (or speed), which is the second H11.12, the servo drive stops executing the first H11.12 and turns to executing the second H11.12.

H11.01 **End position No. in displacement reference**

Address: 0x1101 Effective mode: At once

Minimum:	1	Unit:	-
Maximum:	16	Data type:	UInt16
Default:	1	Change:	At stop

Range:

1 to 16

Parameter description

It sets the total number of positions. You can set different displacements, running speed, and acceleration/deceleration time for each position.

FunIN.9	FunIN.8	FunIN.7	FunIN.6	Speed No.
CMD4	CMD3	CMD2	CMD1	
0	0	0	0	1
0	0	0	1	2
...				
1	1	1	1	16

H11.02 **Starting position No. after pause**

Address:	0x1102	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Continue to execute the unexecuted displacements

1: Start from displacement 1

Parameter description

It sets the starting position No. when the multi-function running recovers after a pause. The function defined by H11.02 is valid only when H11.00 (Multi-position mode) is set to 0, 1, or 3.

Set value	Starting position No. after pause	Remarks
0	Complete the remaining distance	For example, if H11.01 = 16 and the servo drive pauses when running to the 2nd position, it starts running from the 3rd position after restoring the multi-position running.
1	Start running again from 1st position	For example, if H11.01 = 16 and the servo drive pauses when running to the 2nd position, it starts running from the 1st position after restoring the multi-position running.

H11.03 **Waiting time unit**

Address:	0x1103	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

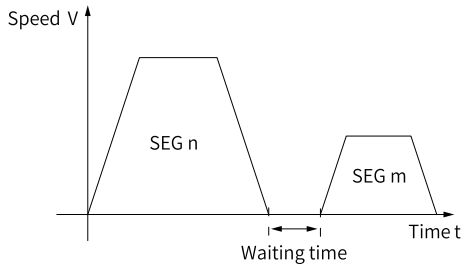
Range:

0: ms

1: s

Parameter description

Sets the unit of the acceleration/deceleration time and waiting time during the multi-position running.

Set value	Waiting time unit	Remarks
0	ms	
1	s	

H11.04 Displacement reference type

Address:	0x1104	Effective mode:	During shutdown
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

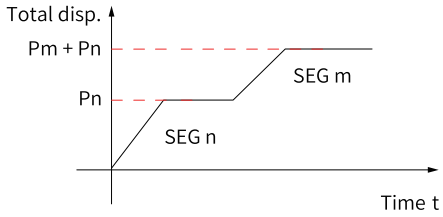
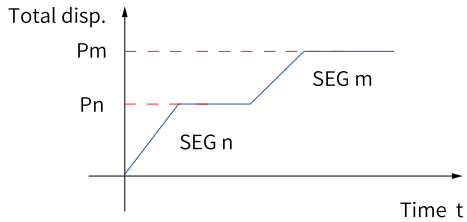
Range:

0: Relative displacement reference

1: Absolute displacement reference

Parameter description

It sets the displacement reference type when the multi-position function is used.

Set value	Displacement Reference Type	Remarks
0	Relative displacement reference	 mth actual displacement: Pm
1	Absolute displacement reference	 mth actual displacement: Pm

H11.05 Start position of sequential running

Address:	0x1105	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	16	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0 to 16

Parameter description

Defines whether to perform cyclic operation and the starting displacement No. after the first cycle of operation in the sequential operation mode (H11.00 = 3).

Set value	Start position of sequential running	Remarks
0	Not cyclic	The servo drive runs positions set in H11.01 only once, and stops after the running is completed. Then, the motor becomes in locked state.
1 to 16	1 to 16	The drive operates cyclically, with the starting displacement No. defined by H11.05 after the first cycle of operation. The value of H11.05 should be lower than or equal to H11.01.

H11.09 Deceleration upon axis control OFF

Address:	0x1109	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	65535	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Defines the deceleration rate upon axis control OFF.

H11.10 Start speed of the 1st displacement

Address:	0x110A	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0rpm~7000rpm

Parameter description

Defines the starting speed of displacement 1.

H11.11 Stop speed of the 1st displacement

Address:	0x110B	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0rpm~7000rpm

Parameter description

Defines the stop speed of displacement 1.

H11.12 **1st displacement**

Address:	0x110C	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Sets the 1st displacement in multi-position operation (in reference unit).

H11.14 **Maximum running speed of first displacement**

Address:	0x110E	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

It sets the maximum running speed of the 1st position in multi-position. The maximum speed is the average operating speed when the motor is not in the acceleration/deceleration process. If H11.12 is set to a too low value, the actual motor speed will be lower than H11.14.

H11.15 **Acceleration/Deceleration time of 1st displacement**

Address:	0x110F	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Defines the time for the motor to change from 0 rpm 1000 rpm at a constant speed during displacement 1. Actual time needed for accelerating to H11.14 (Max. speed of displacement 1): t = (H11.14 x H11.15)/1000

H11.16 **Waiting time after 1st displacement**

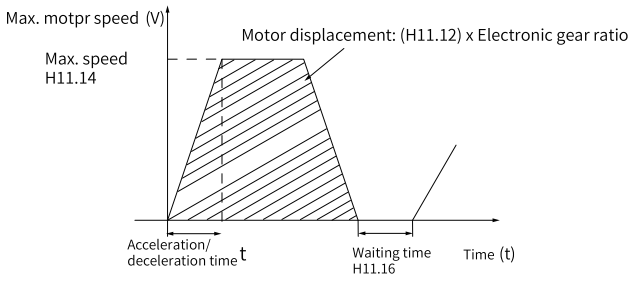
Address:	0x1110	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

It sets the waiting time from completion of the 1st displacement to starting of the next displacement.



H11.17 2nd displacement

Address:	0x1111	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.19 Maximum running speed of 2nd displacement

Address:	0x1113	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.20 Acceleration/Deceleration time of 2nd displacement

Address:	0x1114	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.21 Waiting time after 2nd displacement

Address:	0x1115	Effective mode:	At once
Minimum:	0	Unit:	ms(s)

Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.22 **3rd displacement**

Address:	0x1116	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.24 **Max. running speed of 3rd displacement**

Address:	0x1118	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.25 **Acceleration/Deceleration time of 3rd displacement**

Address:	0x1119	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.26 **Waiting time after 3rd displacement**

Address:	0x111A	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.27 **4th displacement**

Address:	0x111B	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.29 **Max. running speed of 4th displacement**

Address:	0x111D	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.30 **Acceleration/Deceleration time of 4th displacement**

Address:	0x111E	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.31 **Waiting time after 4th displacement**

Address:	0x111F	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.32 **5th displacement**

Address:	0x1120	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.34 **Max. running speed of 5th displacement**

Address:	0x1122	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.35 **Acceleration/Deceleration time of 5th displacement**

Address:	0x1123	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.36 **Waiting time after 5th displacement**

Address:	0x1124	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.37 **6th displacement**

Address:	0x1125	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit

Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.39 **Max. running speed of 6th displacement**

Address:	0x1127	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.40 **Acceleration/Deceleration time of 6th displacement**

Address:	0x1128	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.41 **Waiting time after 6th displacement**

Address:	0x1129	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.42 **7th displacement**

Address:	0x112A	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.44 Max. running speed of 7th displacement

Address:	0x112C	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.45 Acceleration/Deceleration time of 7th displacement

Address:	0x112D	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.46 Waiting time after 7th displacement

Address:	0x112E	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.47 8th displacement

Address:	0x112F	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.49 **Max. running speed of 8th displacement**

Address:	0x1131	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.50 **Acceleration/Deceleration time of 8th displacement**

Address:	0x1132	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.51 **Waiting time after 8th displacement**

Address:	0x1133	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.52 **9th displacement**

Address:	0x1134	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.54 **Max. running speed of 9th displacement**

Address:	0x1136	Effective mode:	At once
Minimum:	1	Unit:	rpm

Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.55 **Acceleration/Deceleration time of 9th displacement**

Address:	0x1137	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.56 **Waiting time after 9th displacement**

Address:	0x1138	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.57 **10th displacement**

Address:	0x1139	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.59 **Max. running speed of 10th displacement**

Address:	0x113B	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.60 Acceleration/Deceleration time of 10th displacement

Address:	0x113C	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.61 Waiting time after 10th displacement

Address:	0x113D	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.62 11th displacement

Address:	0x113E	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.64 Max. running speed of 11th displacement

Address:	0x1140	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.65 **Acceleration/Deceleration time of 11th displacement**

Address:	0x1141	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.66 **Waiting time after 11th displacement**

Address:	0x1142	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.67 **12th displacement**

Address:	0x1143	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.69 **Max. running speed of 12th displacement**

Address:	0x1145	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.70 **Acceleration/Deceleration time of 12th displacement**

Address:	0x1146	Effective mode:	At once
Minimum:	0	Unit:	ms

Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.71 **Waiting time after 12th displacement**

Address:	0x1147	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.72 **13th displacement**

Address:	0x1148	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.74 **Max. running speed of 13th displacement**

Address:	0x114A	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.75 **Acceleration/Deceleration time of 13th displacement**

Address:	0x114B	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.76 Waiting time after 13th displacement

Address:	0x114C	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.77 14th displacement

Address:	0x114D	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.79 Max. running speed of 14th displacement

Address:	0x114F	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.80 Acceleration/Deceleration time of 14th displacement

Address:	0x1150	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.81 **Waiting time after 14th displacement**

Address:	0x1151	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.82 **15th displacement**

Address:	0x1152	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.84 **Max. running speed of 15th displacement**

Address:	0x1154	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.85 **Acceleration/Deceleration time of 15th displacement**

Address:	0x1155	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.86 **Waiting time after 15th displacement**

Address:	0x1156	Effective mode:	At once
Minimum:	0	Unit:	ms(s)

Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.87 **16th displacement**

Address:	0x1157	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.89 **Max. running speed of 16th displacement**

Address:	0x1159	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.90 **Acceleration/Deceleration time of 16th displacement**

Address:	0x115A	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.91 **Waiting time after 16th displacement**

Address:	0x115B	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

14.16 H12 Multi-Speed Operation References

H12.00 **Multi-speed running mode**

Address:	0x1200	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	1	Change:	At stop

Range:

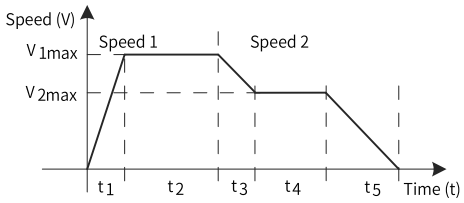
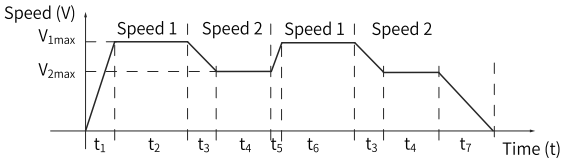
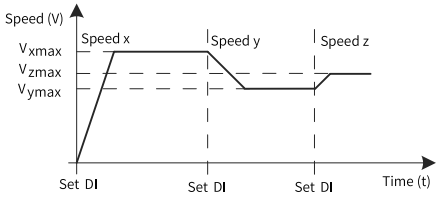
0: Individual operation (number of speeds defined by H12.01)

1: Cyclic operation (number of speeds defined by H12.01)

2: Switchover by DI

Parameter description

Defines the multi-speed operation mode when the speed reference source is multi-speed reference (H06.01 = 5, H06.02 = 1/2/3) in the speed control mode.

Set value	Operating mode	Remarks	Operation Curve
0	Stop after a single running	The servo drive stops at one round of running. The drive switches to the next displacement automatically.	 V 1max and V 2max : reference values of speed 1 and speed 2 t 1 : actual acceleration/deceleration time of speed 1 t 3 , t 5: actual acceleration/deceleration time of 2nd speed
1	Cyclic running	The servo drive repeats from the 1st speed after each round of running. The servo drive automatically switches to the next speed with a larger No. The cyclic running state remains if the servo ON signal is active.	 V 1max , V 2max: maximum values of 1st and 2nd speeds
2	Switchover by DI	The servo drive continues running when the servo ON signal is active. The speed No. is determined by the DI terminal logic. The running time of each speed reference is determined by the time interval for speed No. switchover. The speed reference direction can be switched over through FunIN.5 (DlR-SEL).	 x and y: speed No. (The relationship between the speed No. and the DI logic is described below.) V x and V y : speed references for speeds x and y The speed No. determined by DI does not change, which means the speed reference operates continuously regardless of the reference operating time.

H12.01 **End speed No. in speed reference**

Address:	0x1201	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	16	Data type:	UInt16
Default:	16	Change:	At stop

Range:
1 to 16

Parameter description

It sets the total number of speed references. Different speed references, operating time, and acceleration/deceleration time (four groups optional) can be set for each speed.

FunIN.9	FunIN.8	FunIN.7	FunIN.6	Speed No.
CMD4	CMD3	CMD2	CMD1	
0	0	0	0	1
0	0	0	1	2
...				
1	1	1	1	16

H12.02 **Running time unit**

Address:	0x1202	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: sec

1: min

Parameter description

0: sec

1: min

H12.03 **Acceleration time 1**

Address:	0x1203	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.

H12.04 **Deceleration time 1**

Address:	0x1204	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.

H12.05 **Acceleration time 2**

Address:	0x1205	Effective mode:	At once

Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	50	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.

H12.06 **Deceleration time 2**

Address:	0x1206	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	50	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.

H12.07 **Acceleration time 3**

Address:	0x1207	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.

H12.08 **Deceleration time 3**

Address:	0x1208	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.

H12.09 **Acceleration time 4**

Address:	0x1209	Effective mode:	At once

Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	150	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.

H12.10 **Deceleration time 4**

Address:	0x120A	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	150	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.

H12.20 **1st speed reference**

Address:	0x1214	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	0	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Defines speed reference 1 in multi-speed operation mode.

H12.21 **Running time of 1st speed reference**

Address:	0x1215	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
It sets the running time of the 1st speed reference. If the running time is 0, the servo drive automatically ignores this speed reference.

H12.22 **Acceleration/Deceleration time of 1st speed reference**

Address:	0x1216	Effective mode:	At once
Minimum:	0	Unit:	-

Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/deceleration time 1

2: Acceleration/deceleration time 2

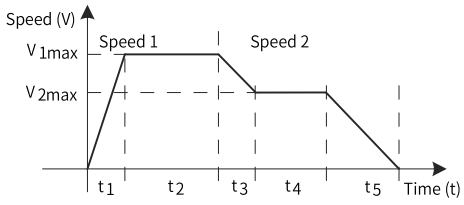
3: Acceleration/deceleration time 3

4: Acceleration/deceleration time 4

Parameter description

Sets the acceleration/deceleration time of the 1st speed reference.

Set value	Acceleration/Deceleration time	Remarks
0	Zero acceleration/ deceleration time	Acceleration time: 0 Deceleration time: 0
1	Acceleration/Deceleration time 1	Acceleration time: H12.03 Deceleration time: H12.04
2	Acceleration/Deceleration time 2	Acceleration time: H12.05 Deceleration time: H12.06
3	Acceleration/Deceleration time 3	Acceleration time: H12.07 Deceleration time: H12.08
4	Acceleration/Deceleration time 4	Acceleration time: H12.09 Deceleration time: H12.10



- V_{1max} , V_{2max} : 1st and 2nd speeds
- t_1 : actual acceleration/deceleration time of 1st speed
- t_3 , T_5 : actual acceleration/deceleration time of 2nd speed
- Running time of a certain speed = Speed change time from previous speed reference switched over to the current speed reference + Average running time (For example, the first running time is $t)_1 + t_2$, the second running time is $t_3 + t_4$, and so on).
- Do not set the operating time of a certain speed to 0. Otherwise, the drive skips this speed and switches to the next speed directly.

Actual acceleration time t_1 :

$$t_1 = \frac{V_1}{1000} \times \text{Acceleration time set for this speed}$$

Actual deceleration time t_2 :

$$t_2 = \frac{V_1}{1000} \times \text{Deceleration time set for this speed}$$

H12.23 2nd speed reference

Address:	0x1217	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16

Default:	100	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.24 **Running time of the 2nd speed reference**

Address:	0x1218	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.25 **Acc./dec. time of speed 2**

Address:	0x1219	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0: Zero acceleration/deceleration time
1: Acceleration/Deceleration time 1
2. Acceleration/Deceleration time selection 2
3. Acceleration/Deceleration time selection 3
4. Acceleration/Deceleration time selection 4
Parameter description
Same as the acceleration/deceleration time of speed 1

H12.26 **3rd speed reference**

Address:	0x121A	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	300	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.27 **Running time of the 3rd speed reference**

Address:	0x121B	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16

Default:	5.0	Change mode:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.28 **Acceleration/deceleration time of speed 3**

Address:	0x121C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0: Zero acceleration/deceleration time
1: Acceleration/Deceleration time 1
2. Acceleration/Deceleration time selection 2
3. Acceleration/Deceleration time selection 3
4. Acceleration/Deceleration time selection 4
Parameter description
Same as the acceleration/deceleration time of speed 1

H12.29 **4th speed reference**

Address:	0x121D	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	500	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.30 **Running time of the 4th speed reference**

Address:	0x121E	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.31 **Acceleration/deceleration time of speed 4**

Address:	0x121F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16

Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.32 **5th speed reference**

Address:	0x1220	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	700	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.33 **Running time of the 5th speed reference**

Address:	0x1221	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.34 **Acceleration/deceleration time of speed 5**

Address:	0x1222	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.35 **6th speed reference**

Address:	0x1223	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	900	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.36 **Running time of the 6th speed reference**

Address:	0x1224	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.37 **Acceleration/deceleration time of speed 6**

Address:	0x1225	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.38 **7th speed reference**

Address:	0x1226	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	600	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.39 **Running time of the 7th speed reference**

Address:	0x1227	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.40 **Acceleration/deceleration time of speed 7**

Address:	0x1228	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.41 **8th speed reference**

Address:	0x1229	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	300	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.42 **Running time of the 8th speed reference**

Address:	0x122A	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.43 **Acceleration/deceleration time of speed 8**

Address:	0x122B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.44 **9th speed reference**

Address:	0x122C	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	100	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.45 **Running time of the 9th speed reference**

Address:	0x122D	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.46 **Acceleration/deceleration time of speed 9**

Address:	0x122E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.47 **10th speed reference**

Address:	0x122F	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	-100	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.48 **Running time of the 10th speed reference**

Address:	0x1230	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.49 **Acceleration/deceleration time of speed 10**

Address:	0x1231	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.50 **11th speed reference**

Address:	0x1232	Effective mode:	At once

Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	-300	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.51 **Running time of the 11th speed reference**

Address:	0x1233	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.52 **Acceleration/deceleration time of speed 11**

Address:	0x1234	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:
0: Zero acceleration/deceleration time
1: Acceleration/deceleration time 1
2: Acceleration/deceleration time 2
3: Acceleration/deceleration time 3
4: Acceleration/deceleration time 4
Parameter description
Same as the acceleration/deceleration time of speed 1

H12.53 **12th speed reference**

Address:	0x1235	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type:	Int16
Default:	-500	Change:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.54 **Running time of the 12th speed reference**

Address:	0x1236	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.55 **Acceleration/deceleration time of speed 12**

Address:	0x1237	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/deceleration time 1

2: Acceleration/deceleration time 2

3: Acceleration/deceleration time 3

4: Acceleration/deceleration time 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.56 **13th speed reference**

Address:	0x1238	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type:	Int16
Default:	-700	Change:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.57 **Running time of the 13th speed reference**

Address:	0x1239	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.58 **Acceleration/deceleration time of speed 13**

Address:	0x123A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/deceleration time 1

2: Acceleration/deceleration time 2

3: Acceleration/deceleration time 3

4: Acceleration/deceleration time 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.59 **14th speed reference**

Address:	0x123B	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type:	Int16
Default:	-900	Change:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.60 **Running time of the 14th speed reference**

Address:	0x123C	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.61 **Acceleration/deceleration time of speed 14**

Address:	0x123D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/deceleration time 1

2: Acceleration/deceleration time 2

3: Acceleration/deceleration time 3

4: Acceleration/deceleration time 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.62 **15th speed reference**

Address:	0x123E	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type:	Int16
Default:	-600	Change:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.63 **Running time of the 15th speed reference**

Address:	0x123F	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.64 **Acceleration/deceleration time of speed 15**

Address:	0x1240	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:
0: Zero acceleration/deceleration time
1: Acceleration/deceleration time 1
2: Acceleration/deceleration time 2
3: Acceleration/deceleration time 3
4: Acceleration/deceleration time 4
Parameter description
Same as the acceleration/deceleration time of speed 1

H12.65 **16th speed reference**

Address:	0x1241	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type:	Int16
Default:	-300	Change:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.66 **Running time of the 16th speed reference**

Address:	0x1242	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.67 **Acceleration/deceleration time of speed 16**

Address:	0x1243	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/deceleration time 1

2: Acceleration/deceleration time 2

3: Acceleration/deceleration time 3

4: Acceleration/deceleration time 4

Parameter description

Same as the acceleration/deceleration time of speed 1

14.17 H17 VDO/VDI settings

H17.00 **VDI1 function selection**

Address:	0x1700	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the VDI1 function.

H17.01 **VDI1 logic selection**

Address:	0x1701	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

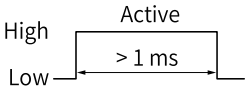
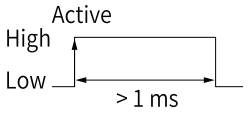
Range:

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 of VDI1.

Set value	VDI1 logic upon active DI function	Remarks
0	0: Active when 1 is written	
1	Active when written value changes from 0 to 1	

H17.02 **VDI2 function selection**

Address:	0x1702	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.03 **VDI2 logic selection**

Address:	0x1703	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.04 **VDI3 function selection**

Address:	0x1704	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.05 **VDI3 logic selection**

Address:	0x1705	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.06 **VDI4 function selection**

Address:	0x1706	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.07 **VDI4 logic selection**

Address:	0x1707	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.08 **VDI5 function selection**

Address:	0x1708	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.09 **VDI5 logic selection**

Address:	0x1709	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.10 **VDI6 function selection**

Address:	0x170A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.11 **VDI6 logic selection**

Address:	0x170B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.12 **VDI7 function selection**

Address:	0x170C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.13 **VDI7 logic selection**

Address:	0x170D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.14 **VDI8 function selection**

Address:	0x170E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.15 **VDI8 logic selection**

Address:	0x170F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.16 **VDI9 function selection**

Address:	0x1710	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.17 **VDI9 logic selection**

Address:	0x1711	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.18 **VDI10 function selection**

Address:	0x1712	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.19 **VDI10 logic selection**

Address:	0x1713	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.20 **VDI11 function selection**

Address:	0x1714	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.21 **VDI11 logic selection**

Address:	0x1715	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.22 **VDI12 function selection**

Address:	0x1716	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.23 **VDI12 logic selection**

Address:	0x1717	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.24 **VDI13 function selection**

Address:	0x1718	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.25 **VDI13 logic selection**

Address:	0x1719	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.26 **VDI14 function selection**

Address:	0x171A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.27 **VDI14 logic selection**

Address:	0x171B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.28 **VDI15 function selection**

Address:	0x171C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.29 **VDI15 logic selection**

Address:	0x171D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.30 **VDI16 function selection**

Address:	0x171E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.31 **VDI16 logic selection**

Address:	0x171F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.32 **VDO virtual level**

Address:	0x1720	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

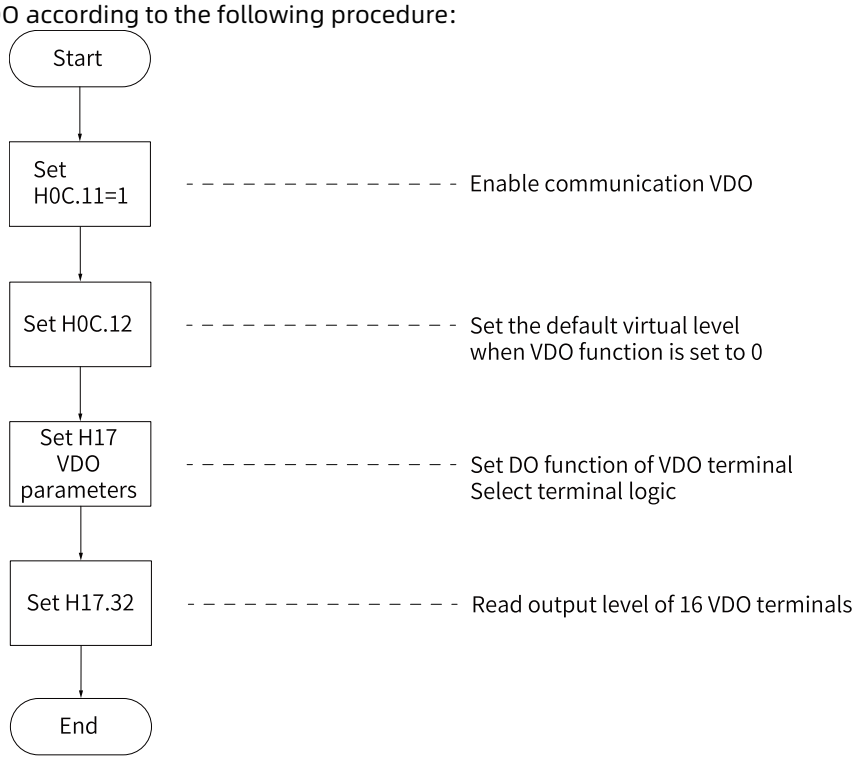
Range:

0x0 to 0xFFFF

Parameter description

It sets the default virtual level of the VDO allocated with function 0 (invalid).

Use the VDO according to the following procedure:



H17.33 **VDO1 function selection**

Address:	0x1721	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Defines the function of VDO1.

H17.34 **VDO1 logic level**

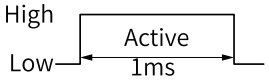
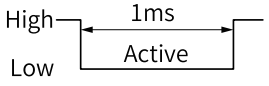
Address:	0x1722	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Defines the active level of VDO1.

Set value	VDO1 terminal logic	Remarks
0	Output 1 when function valid	
1	Output 0 when function valid	

H17.35 **VDO2 function selection**

Address:	0x1723	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment

1: Servo ready

2: Motor rotation

3: Zero speed

4: Speed matching

5: Positioning completed

6: Positioning almost completed

7: Torque limited

8: Speed limited

9: Brake

10: Alarm

11: Fault

12: Output 3-bit alarm code

13: Output 3-bit alarm code

14: Output 3-bit alarm code

15: Interrupt positioning completed

16: Homing completed

17: Electrical homing completed

18: Torque reach

19: Speed reach

22: Internal command completed

23: Writing next command allowed

24: Internal motion completed

Parameter description

Same as H17.33

H17.36 **VDO2 logic level**

Address:	0x1724	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x1725	Effective mode:	At once
Minimum:	0	Unit:	-

Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment

1: Servo ready

2: Motor rotation

3: Zero speed

4: Speed matching

5: Positioning completed

6: Positioning almost completed

7: Torque limited

8: Speed limited

9: Brake

10: Alarm

11: Fault

12: Output 3-bit alarm code

13: Output 3-bit alarm code

14: Output 3-bit alarm code

15: Interrupt positioning completed

16: Homing completed

17: Electrical homing completed

18: Torque reach

19: Speed reach

22: Internal command completed

23: Writing next command allowed

24: Internal motion completed

Parameter description

Same as H17.33

H17.38 VDO3 logic level

Address:	0x1726	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x1727	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.40 **VDO4 logic level**

Address:	0x1728	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x1729	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.42 **VDO5 logic level**

Address:	0x172A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x172B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description
Same as H17.33

H17.44 **VDO6 logic level**

Address:	0x172C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x172D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.46 **VDO7 logic level**

Address:	0x172E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x172F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.48 VDO8 logic level

Address:	0x1730	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x1731	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.50 **VDO9 logic level**

Address:	0x1732	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x1733	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.52 VDO10 logic level

Address:	0x1734	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x1735	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.54 **VDO11 logic level**

Address:	0x1736	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x1737	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.56 **VDO12 logic level**

Address:	0x1738	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x1739	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.58 **VDO13 logic level**

Address:	0x173A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x173B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.60 **VDO14 logic level**

Address:	0x173C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x173D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.62 **VDO15 logic level**

Address:	0x173E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

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:	0x173F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.64 **VDO16 logic level**

Address:	0x1740	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

14.18 H1b [Motor storage property]

H1b.14 **Bit01 of motor SN**

Address:	0x1B0E	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Displays bit01 of motor SN code.

H1b.15 Bit23 of motor SN

Address:	0x1B0F	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Displays bit23 of motor SN code.

H1b.16 Bit45 of motor SN

Address:	0x1B10	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Displays bit45 of motor SN code.

H1b.17 Bit67 of motor SN

Address:	0x1B11	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Displays bit67 of motor SN code.

H1b.18 Bit89 of motor SN

Address:	0x1B12	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Displays bit89 of motor SN code.

H1b.19 Bit11 of motor SN

Address:	0x1B13	Effective mode:	At once
Minimum:	0x0	Unit:	-

Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:
0x0 to 0xFFFF
Parameter description
Displays bit11 of motor SN code.

H1b.20 Bit13 of motor SN

Address:	0x1B14	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:
0x0 to 0xFFFF
Parameter description
Displays bit13 of motor SN code.

H1b.21 Bit15 of motor SN

Address:	0x1B15	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:
0x0 to 0xFFFF
Parameter description
Displays bit15 of motor SN code.

H1b.47 Motor storage property mask word 1

Address:	0x1B2F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0–65535
Parameter description
Defines the motor property mask word 1.

H1b.48 Motor storage property mask word 2

Address:	0x1B30	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0–65535
Parameter description
Defines the motor property mask word 2.

14.19 H30 Servo status variables read through communication

H30.00 **Servo state read by communication**

Address:	0x3000	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

The value of H30.00 is a hexadecimal, which is not displayed on the keypad and must be converted to a binary equivalent when it is being read through communication.

Bit	Servo Status	Remarks
0	Servo ready	It determines whether the servo main circuit DC bus voltage is ready and the servo drive is ready for running. 0: Servo drive not ready 1: Servo ready
1 to 11	Reserved	-
12 to 13	Servo running state	It determines the servo running state. 00: Servo drive not ready (main circuit DC bus voltage not set up correctly) 01: Servo drive ready (main circuit DC bus voltage set up correctly, servo drive is ready for running) 10: Servo drive running (S-ON active) 11: Servo drive fault (a level 1 or level 2 fault occurs)
14 to 15	Reserved	-

H30.01 **DO function state 1 read via communication**

Address:	0x3001	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

The state of DO function 1 to DO function 16 are read through communication based on the DO function list. H30.01 is a hexadecimal, which is not displayed on the keypad and must be converted to a binary equivalent when it is being read through communication.

Bit	DO Functions	Remarks
0	DO function 1 (FunOUT.1:S-RDY, servo ready)	0: Servo drive not ready 1: Servo ready
...		
15	DO function 16 (FunOUT.16: HomeAttain, homing output)	0: Homing not completed 1: Homing completed

H30.02 **DO function state 2 read via communication**

Address:	0x3002	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

bit0 corresponds to DO function 17.
bit1 corresponds to DO function 18.
bit2 corresponds to DO function 19.
…
By analogy

Bit	DO Functions	Remarks
0	DO function 17 (FunOUT.17: ElecHomeAttain, electric homing output)	0: Electrical homing not completed 1: Electrical homing completed
…		
9th	DO function 27 (FunOUT.27: AlmAndWarn, fault or alarm output signal)	0: Fault or alarm output invalid 1: Fault or alarm output valid

H30.03 **Input pulse reference sampling read via communication**

Address:	0x3003	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Indicates the number of pulses at the pulse input terminal read through communication within an individual control cycle when the position reference source is pulse input (H05.00 = 0) or handwheel input. This parameter is irrelevant to the servo running mode and running status.

H30.04 **DI status read through communication**

Address:	0x3004	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Indicates the state of DI1 to DI9. The value 1 represents the corresponding DI is switched on and the value 0 represents the corresponding DI not switched on.
For example:
When DI9 is switched on while DI1 to DI8 are not, H30.04 = 256 (binary: 100 000 000).
When DI8 and DI9 are switched on while DI1 to DI7 are not, H30.04 = 384 (binary: 110 000 000).
When DI9, DI8 and DI3 are switched on while DI4 to DI7 or DI2 to DI1 are not, H30.04 = 388 (binary: 110 000 100).

14.20 H31 Related variables set through communication

H31.00 **VDI virtual level set via communication**

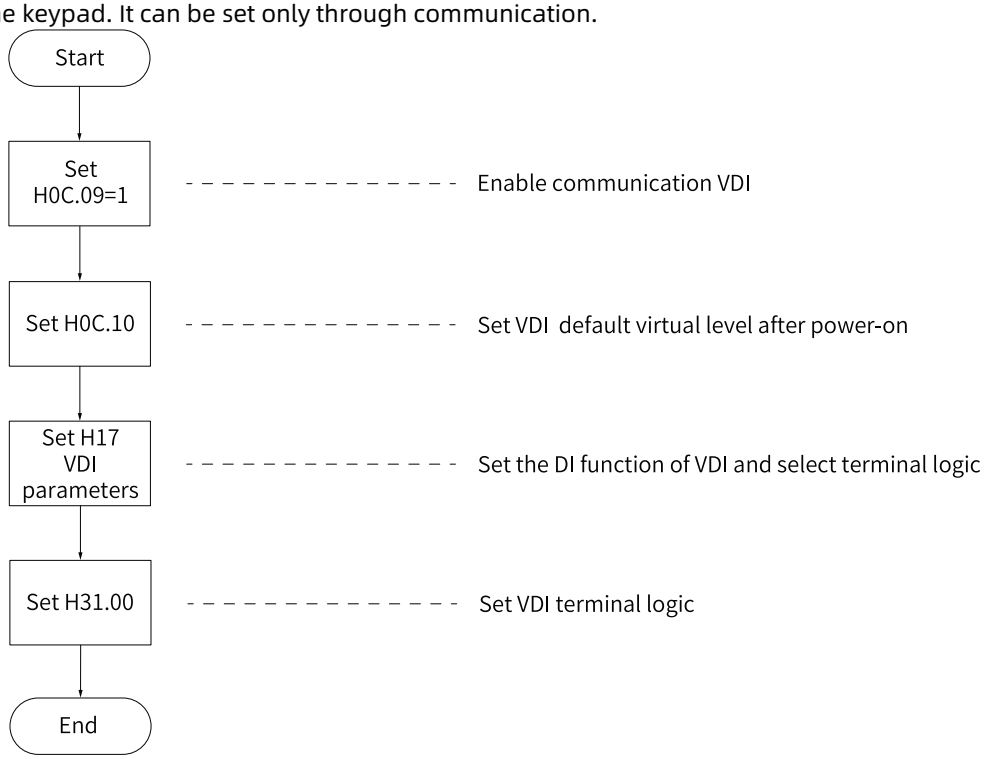
Address:	0x3100	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0–65535

Parameter description

Defines the DI function levels of VDI1 to VDI6. H31.00 is a decimal value, which is not displayed on the keypad. It can be set only through communication.



H31.04 **DO state set via communication**

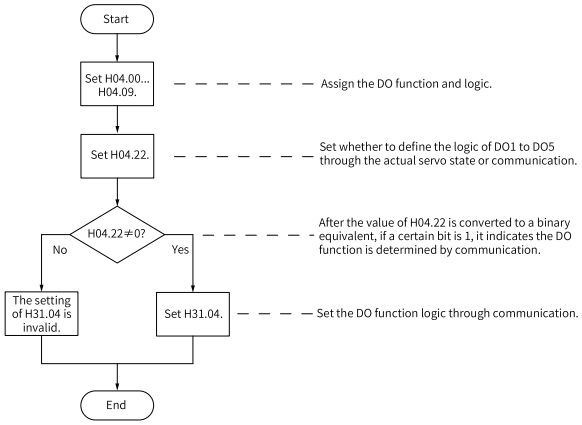
Address:	0x3104	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0–65535

Parameter description

If DO function is used, the DO state will be set through communication based on the setting of H04.22 (DO source). H31.04 is a decimal value, which is not displayed on the keypad. It can be set only through communication.



H31.09 **Speed reference set via communication**

Address:	0x3109	Effective mode:	At once
Minimum:	-9000000	Unit:	rpm
Maximum:	9000000	Data type	Int32
Default:	0	Change mode:	At once

Range:

-9000000 rpm to +9000000 rpm

Parameter description

Sets the speed reference (accurate to 0.001 RPM) when the speed reference source is communication in the speed control mode. The setpoint of H31-09 is a 32-bit value, which is not displayed on the keypad. It can only be set through communication.

H31.11 **Torque reference set via communication**

Address:	0x310B	Effective mode:	At once
Minimum:	-100000	Unit:	%
Maximum:	100000	Data type	Int32
Default:	0	Change mode:	At once

Range:

-100000 %~100000%

Parameter description

Sets the torque reference (accurate to 0.001%) when the torque reference source is communication in the torque control mode.

The setpoint 100.000% corresponds to the rated torque of the motor.

The setpoint of H31.11 is a 32-bit value, which is not displayed on the keypad. It can only be set through communication.

15 Troubleshooting

15.1 Fault and alarm levels

Fault and alarm levels

Faults and alarms of the driver are classified into three levels according to severity, from highest to lowest: level 1 fault, level 2 fault, and level 3 alarm. Level 1 faults are further divided into non-resettable faults and resettable faults. See the following table for details.

- No. 1 non-resettable faults
- No. 1 resettable faults
- No. 2 resettable faults
- No. 3 resettable alarms

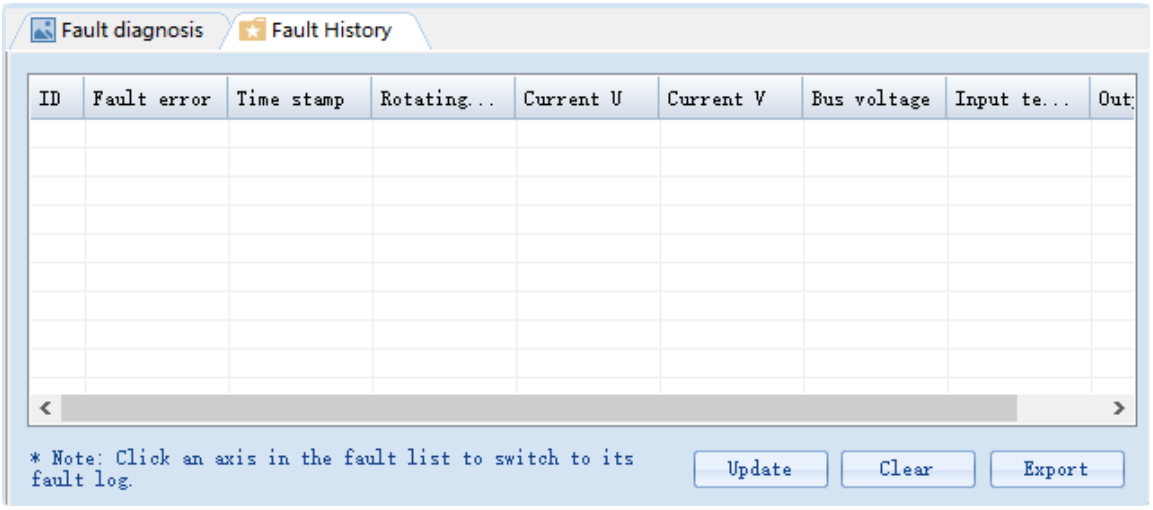
Note

"Resettable" means the keypad stops displaying the fault/alarm once a "Reset signal" is input.

Fault Log

The servo drive can record the latest 10[1]faults and alarms, as well as the status parameters upon fault/alarm. However, duplicate faults or alarms are not recorded by default. The fault log must be cleared before the same fault or alarm can be recorded again.

After a fault or alarm is reset, it still exists in the fault log. To remove the fault/alarm log 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

Note

[1]: To show 20 fault records: The MCU software version is required to be 6.3 and above, and the commissioning software must be the latest.

15.2 Fault Reset

You can set H0d.01 to 1 (Fault reset) to stop the keypad from displaying the fault. To reset a fault/warning:

- 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 or activate the DI assigned with DI function 2.

☆ Related parameters:

Parameter	Name	Value range	Unit	Default setting	Setting Mode	Effective time	Mode
H0d.01	Fault reset	0: No action 1: Fault reset	-	0	At stop	Immedi-ately	-

Relevant function No.:

Code	Name	Function Name	Function
FunIN.2	ALM-RST	Fault/Alarm reset signal	This DI function is edge-triggered, which means it is inactive upon continuous high/low level. The servo drive can continue to work after alarms of certain types are reset. If this function is allocated to a low-speed DI and the logic is set to level valid, the servo drive forcibly changes it to edge logic internally. The valid level change must last for more than 3 ms. Otherwise, the fault reset function is inactive. Do not assign this function to a high-speed DI. Otherwise, this function is inactive. • Inactive, fault/alarm not reset • Active, fault/alarm reset



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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.01	Fault reset	0x0D01	0–1	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: No action 1: Fault reset								
	Parameter description:								
	Defines whether to enable fault reset. After fault reset, the keypad stops displaying the fault only, but parameter change 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. Note: This parameter is non-retentive upon power failure as it is not saved to EERPOM.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.34	Fault code of the selected fault record	0x0B22	0x0 to 0xFFFF	-	0x0	UInt16	Unmodifiable	Ordinary user	-
	Parameter description:								
	Displays the fault code corresponding to the fault set by H0b.33.								

15.3 List of Alarm Codes

Table 15–1 Resettable warnings

Fault code	Fault name	Fault level	Resettable	Error code (603Fh)	Auxiliary code (203Fh)
E108.0	Storage parameter write error	3	Yes	0x5530	0x01080108
E108.1	Storage parameter read error	3	Yes	0x5530	0x01080108
E110.0	Frequency-division pulse output setting error	3	Yes	0x6320	0x01100110
E121.0	Invalid S-ON command	3	Yes	0x5441	0x01210121
E122.0	Multi-turn absolute encoder setting error	3	Yes	0x0122	0x01220122
E510.0	Frequency division pulse output overspeed	3	Supported	0x0510	0x05100510
E600.0	Inertia auto-tuning failure	3	Yes	0x0600	0x06000600
E601.0	Homing alarm	3	Yes	0x0601	0x06010601
E730.0	Encoder battery alarm	3	Yes	0x7305	0x07300730
E900.0	DI emergency braking	3	Yes	0x5442	0x09000900
E908.0	Check code error for model identification	3	Yes	0x0908	0x09080908
E909.0	Motor overload alarm	3	Yes	0x3230	0x09090909
E920.0	Braking resistor overload	3	Yes	0x3210	0x09200920

Fault code	Fault name	Fault level	Resettable	Error code (603Fh)	Auxiliary code (203Fh)
E922.0	Resistance of the external braking resistor excessively low	3	Yes	0x6320	0x09220922
E924.0	Braking transistor overtemperature	3	Yes	0x0924	0x09240924
E941.0	Modified parameters activated at next power-on	3	Yes	0x6320	0x09410941
E942.0	Parameter storage too frequent	3	Yes	0x7600	0x09420942
E950.0	Forward overtravel	3	Yes	0x5443	0x09500950
E952.0	Reverse overtravel	3	Yes	0x5444	0x09520952
E980.0	Encoder algorithm error	3	Yes	0x7305	0x09800980
EA40.0	Parameter auto-tuning failure	3	Yes	0x0A40	0x0A400A40
EA41.0	Torque fluctuation compensation failure	3	Yes	0x0A41	0x0A410A41

15.4 List of Fault Codes

Fault code	Fault name	Fault level	Resettable	Error code (603Fh)	Auxiliary code (203Fh)
E101.0	Abnormal parameters in groups H02 and above	1	No	0x6320	0x01010101
E101.1	Group H00/H01 parameter error	1	No	0x6320	0x01010101
E101.2	Address error in read/write operation after the number of parameters changes	1	No	0x6320	0x01010101
E102.0	FPGA communication establishment error	1	No	0x7500	0x01020102
E102.1	FPGA initialization start error	1	No	0x7500	0x01020102
E102.8	Software versions of MCU and FPGA mismatch	1	No	0x7500	0x01020102
E104.1	MCU running timeout (MCU breakdown)	1	No	0x7500	0x01040104
E104.2	FPGA operation timeout (FPGA crashed)	1	No	0x7500	0x01040104
E104.4	MCU reference update timeout	1	No	0x7500	0x01040104
E120.0	Unknown encoder type	1	No	0x7122	0x01200120
E120.1	Unknown motor model	1	No	0x7122	0x01200120
E120.2	Unknown drive model	1	No	0x7122	0x01200120
E120.7	Model check error	1	No	0x7122	0x01200120
E122.1	DI function allocation error	2	Yes	0x0122	0x01220122
E122.4	VDI function assignment error	2	Yes	0x0122	0x01220122
E122.5	DI and VDI assigned with the same function	2	Yes	0x0122	0x01220122
E136.0	Encoder ROM motor parameter verification error	1	No	0x7305	0x01360136

Fault code	Fault name	Fault level	Resettable	Error code (603Fh)	Auxiliary code (203Fh)
E136.1	Encoder ROM motor parameter read error	1	No	0x7305	0x01360136
E136.2	Torque fluctuation compensation data verification error	1	No	0x7305	0x01360136
E201.0	Phase-P overcurrent	1	No	0x2312	0x02010201
E201.1	Phase-U overcurrent	1	No	0x2312	0x02010201
E201.2	Phase-V overcurrent	1	No	0x2312	0x02010201
E201.4	Phase-N overcurrent	1	No	0x2312	0x02010201
E207.0	D-/Q-axis current overflow	1	Yes	0x0207	0x02070207
E208.2	Encoder communication timeout	1	Yes	0x0208	0x02080208
E208.4	FPGA current loop operation timeout	1	Yes	0x0208	0x02080208
E210.0	Output ground fault	1	No	0x2330	0x02100210
E210.1	Output short-circuited to ground (new)	1	No	0x2330	0x02100210
E234.0	Runaway	1	No	0x0234	0x02340234
E321.0	Dynamic brake resistor overload	1	Yes	0x0321	0x03210321
E400.0	Main circuit overvoltage	1	Yes	0x3210	0x04000400
E410.0	Main circuit undervoltage	1	Yes	0x3220	0x04100410
E420.0	Main circuit phase loss	2	Yes	0x3130	0x04200420
E430.0	Control power supply undervoltage	2	Yes	0x3120	0x04300430
E500.0	Motor overspeed	1	Yes	0x8400	0x05000500
E602.0	Angle auto-tuning failure	1	Yes	0x0602	0x06020602
E602.2	U/V/W phase sequence reversed	1	Yes	0x0602	0x06020602
E605.0	Speed too fast upon S-ON	1	Supported	0x0605	0x06050605
E620.0	Motor overload	1	Yes	0x3230	0x06200620
E625.0	Brake abnormality enabled	1	Yes	0x0625	0x06250625
E626.0	Brake abnormality disabled	1	Yes	0x0626	0x06260626
E630.0	Motor stall overtemperature protection	1	Yes	0x7121	0x06300630
E640.0	IGBT junction temperature excessively high	1	Yes	0x0640	0x06400640
E640.1	Flywheel diode junction temperature excessively high	1	Yes	0x0640	0x06400640
E650.0	Heatsink temperature excessively high	1	Yes	0x4210	0x06500650
E660.0	Motor over-temperature	1	Yes	0x0660	0x06600660
E661.6	Gain auto-adjustment failed	2	Yes	0x0661	0x06610661
E668.0	The homing method does not match the current encoder.	2	Yes	0x0668	0x06680668
E731.0	Encoder multi-turn position data loss	2	Yes	0x7305	0x07310731
E733.0	Encoder multi-turn counting error	2	Yes	0x7305	0x07330733

Fault code	Fault name	Fault level	Resettable	Error code (603Fh)	Auxiliary code (203Fh)
E735.0	Encoder multi-turn counting overflow	2	Yes	0x7305	0x07350735
E740.0	Absolute encoder communication timeout	1	No	0x7305	0x07400740
E740.2	Absolute encoder error	1	No	0x7305	0x07400740
E740.3	Absolute encoder single-turn calculation error	1	No	0x7305	0x07400740
E740.6	Encoder write error	1	No	0x7305	0x07400740
E760.0	Encoder over-temperature	2	Yes	0x4210	0x07600760
E939.0	Motor power cable disconnected	1	Yes	0x3331	0x09390939
E994.0	CANlink station number conflict	2	Yes	0x0994	0x09940994
EA33.0	Encoder read/write verification error	1	No	0x7305	0x0A330A33
EA34.0	Encoder communication check abnormal	1	No	0x7305	0x0A340A34
EB00.0	Excessive position deviation	2	Supported	0x8611	0x0B000B00
EB00.1	Position deviation overflow	2	Supported	0x8611	0x0B000B00
EB01.0	The position reference increment is too large.	2	Yes	0x0B01	0x0B010B01
EB03.0	Electronic gear ratio beyond the limit - H05.02	2	Yes	0x6320	0x0B030B03
EB03.1	Electronic gear ratio beyond the limit - Electronic gear ratio 1	2	Yes	0x6320	0x0B030B03
EB03.2	Electronic gear ratio beyond the limit - Electronic gear ratio 2	2	Yes	0x6320	0x0B030B03
ED03.0	CANlink disconnected	2	Yes	0x0D03	0x0D030D03

15.5 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 off and on the drive again and check whether the modification is saved.	If the modification is not saved and the fault persists after the drive is restarted repeatedly, 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.	Modify a certain parameter, power off and on the servo drive again and check whether the modified value can be read.	If the modified value cannot be read and the fault persists after the servo drive is powered off and on repeatedly, replace the drive.

E110.0: Frequency-division pulse output setting error

Cause:

The number of frequency-division pulses (after quadrature multiplication) exceeds the motor resolution.

Troubleshooting:

Cause	Verification method	Solution
The number of frequency-division pulses (after quadrature multiplication) exceeds the motor resolution.	Check the setpoint of H05.17.	Adjust the value of H05.17 based on the motor resolution.

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
The external S-ON signal is active when servo drive is enabled internally.	Check whether auxiliary functions (H0d.02, H0d.03, and H0d.12) are used and whether DI function 1 (FunIN.1: S-ON signal) is active.	Deactivate the DI assigned with FunIN.1 (both hardware DI and virtual DI).

E122.0: Multi-turn absolute encoder setting error

Cause:

The motor does not match in the absolute position mode or the motor SN is set incorrectly.

Troubleshooting:

Cause	Verification method	Solution
The motor does not match the absolute position mode or the motor code is set incorrectly.	1. Check the motor nameplate to see whether the motor is configured with a multi-turn absolute encoder. 2. Check whether the H00.00 (Motor code) is set properly.	Reset H00.00 (motor code) according to the motor nameplate or use a suitable motor.

E510.0: Frequency division pulse output overspeed

Cause:

The single-channel output pulse frequency exceeds the frequency upper limit allowed by the hardware (4 MHz) when pulse output is used (H05.38 = 0/1/2).

Troubleshooting:

Cause	Verification method	Solution
The MCU detects excessive pulse increment fed back by FPGA.	1. When H05.38 is set to 0 (encoder frequency-division output) or 2 (secondary encoder frequency-division output), check whether the output pulse frequency corresponding to the motor speed upon fault exceeds the limit. Output pulse frequency (Hz) = Motor speed (rpm)/60 x H05.17 2. The input pulse frequency exceeds 2 MHz or interference exists in the pulse input pins when H05.38 is set to 1 (Reference pulse synchronous output). Low-speed pulse input pins: open-collector input terminals: PULLHI, PULSE+, PULSE-, SIGN+, SIGN-; maximum pulse frequency: 200 kpps. High-speed pulse input pins: differential input terminals: HPULSE+, HPULSE-, HSIGN+, HSIGN, maximum pulse frequency: 8 Mpps	1. Decrease the value of H05.17 (encoder frequency-division pulses) to allow the output pulse frequency, within the speed range required by the machine, to drop below the frequency upper limit allowed by the hardware. 2. Decrease the input pulse frequency to a value within the frequency upper limit allowed by hardware. In this case, if you do not modify the electronic gear ratio, the motor speed will decrease. If the input pulse frequency is high but is still within the frequency upper limit allowed by the hardware, take anti-interference measures (use STP cable for pulse input and set pin filter parameter H0A.24 or H0A.30). This is to prevent false alarms caused by interference pulses superimposed to actual pulse references.

E600.0: Angle auto-tuning failure

Cause:

Vibration cannot be suppressed. You can set notch parameters (H09.12...H09.23) manually to suppress vibration.
The auto-tuned values fluctuate dramatically. Increase the maximum operating speed, reduce the acceleration/deceleration time, and shorten the stroke of the lead screw during ETune operation.
Mechanical couplings of the load are loose, or the mechanism is eccentric. Clear the 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 a large inertia. In this case, increase the acceleration/deceleration time to ensure that the motor current is unsaturated.

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. Perform internal inspection to check whether the torque jitters upon stop (not FFT). 2. If the current inertia value is <5x the previous value, check if the change exceeds 3x the previous value. If the current inertia value is ≥5x the previous value, check if the change exceeds 0.5x the previous value.	1. Clear and reset the alarm. Clear the alarm and perform auto-tuning again. 2. For vibration that cannot be suppressed, enable vibration suppression function. 3. Ensure mechanical couplings are connected securely. 4. Increase the maximum operating speed, reduce the acceleration/deceleration time, and shorten the stroke of the lead screw during ETune operation.

E601.0: Homing alarm

Cause:

Homing timeout warning.

Troubleshooting:

Cause	Verification method	Solution
1. The home switch is faulty.	1. There is only high-speed searching and no low-speed searching during the homing operation. 2. After high-speed searching of homing, the drive keeps reverse low-speed searching.	If a hardware DI is used, check whether the corresponding DI function is allocated 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 (monitored DI status) 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 is excessively low.	Increase the value of H05.35.
3. The speed for homing ON/OFF signal at high speed is excessively low.	Based on the distance between the start position of homing and the home switch, check whether the value of H05.32 is excessively low, resulting in a prolonged homing process.	Increase the value of H05.32.

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.	Replace the battery with a new one that provides matching voltage.

E900.0: DI emergency braking

Cause:

The logic of the DI terminal (including the hardware DI and virtual DI) assigned with DI function 34 (FunIN.34: EmergencyStop) is valid.

Troubleshooting:

Cause	Verification method	Solution
The DI function 34 (FunIN.34: Emergency stop) is triggered.	Check whether the logic of DI assigned with FunIN.34: Emergency stop is activated.	Check the operation mode and clear the DI braking signal without affecting the safety performance.

E908.0: Model identification check code failure

Cause:

Model identification check code error.

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 restart. 2. Check whether parameters can be saved to EEPROM. Note: For software versions 6.3 and later, E908.0 is replaced by E120.7.	Set 1.H01.36 to 0 to disable model identification temporarily. 2. If you confirm that the drive is faulty, contact the technical personnel of the manufacturer. Note: For software versions 6.3 and later, E908.0 is replaced by E120.7.

E909.0: Motor overload warning

Cause:

Accumulative motor heat exceeds the overload protective warning 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.	1. Connect the cables according to the correct wiring diagram. 2. It is recommended to use the cables provided by Inovance. 3. When self-made 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.	1. Confirm the overload characteristics of the drive or motor. 2. Check whether the average load rate (H0b.12) keeps exceeding 100.0%.	1. Use a servo drive of higher capacity and a matching servo motor. 2. You can also reduce the load and increase the acceleration/ deceleration time.
3. Acceleration/deceleration is frequent or the load inertia is high.	1. Check the mechanical inertia ratio or perform inertia auto-tuning. View the value of H08.15 (Load moment of inertia ratio). 2. Check the single-shot operation cycle when the motor runs cyclically.	Increase the acceleration/ deceleration time.

Cause	Verification method	Solution
4. The gain is improper, or the stiffness is excessively high.	Check whether the motor vibrates and generates unusual noise during operation.	Adjust the gains.
5. The servo drive model or motor model is set improperly.	View the model of the motor equipped with a serial-type encoder in H00.05 and the servo drive model in H01.02.	Read the servo drive nameplate and set the servo drive model (H01.02) and motor model properly.
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 and confirm whether the load has increased or the brake is releasing normally.
7. The servo drive is faulty.	Power off and on the servo drive.	If the fault persists after restart, replace the servo drive.

E920.0: braking resistor overload

Cause:

The accumulative heat of the regenerative resistor exceeds the setting value.

Troubleshooting:

Cause	Verification method	Solution
1. The cable of the external braking resistor is in poor connection, connected loosely or disconnected.	1. Remove the external regenerative resistor and measure whether its resistance is "∞" (infinite). 2. Measure the resistance between P⊕ and C is "∞" (infinite).	Use a new external braking resistor. If the resistance measured is the same as the nominal value, connect the resistor between P and C. Connect the external braking resistor between P and C with a new cable.
2. When you use a built-in regenerative resistor, the cable between power terminal P⊕ and D may disconnect.	Measure if the resistance of the resistor between P⊕ and C is "∞" (infinite).	Use suitable cables to connect P⊕ and D directly.

Cause	Verification method	Solution
3. H02.25 is set improperly when an external braking resistor is used. 4. The resistance of the external braking resistor used is excessively high. 5. The value of H02.27 is higher than the resistance of the external braking resistor used.	1. View the value of H02-25. 2. Measure the resistance of the resistor between P ⊕ and C. Compare the result with the value of H02.25; 3. Check whether the value of H02.27 is greater than the resistance of the resistor between P ⊕ and C.	1. Set H02.25 according to section "Wiring and Settings of Braking Resistor". Set H02.25 to 1 (External resistor, natural cooling) Set H02.25 to 2 (external resistor, fan cooling) 2. Select a resistor of proper resistance based on the braking resistor specifications. 3. Set H02.27 according to the resistance of the external braking resistor used.
6. 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 specifications on the left.
7. The load moment of inertia ratio is excessively high. 8. 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. 9. The capacity of the drive or braking resistor is not sufficient.	1. Perform inertia auto-tuning or calculate total mechanical inertia according to mechanical parameters. Check whether the actual load inertia ratio exceeds 30. 2. View the motor speed curve during cyclic operation and check whether the motor is in the deceleration status for a long time. 3. View the motor speed curve in a single cycle and calculate whether the maximum braking energy can be absorbed completely.	Select an external braking resistor with large capacity and set H02.26 (Power of the external braking resistor) to a value consistent with the actual value. Select a drive with large capacity. Reduce the load if allowed. Increase the acceleration/ deceleration time if allowed. Increase the motor operation cycle if allowed.
10. The servo drive is faulty.	-	Replace the servo drive.

E922.0: Resistance of the external braking resistor excessively low

Cause:

The value of H02.27 (resistance of external braking resistor) is lower than the value of H02.21 (permissible min. 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.	Measure if the resistance of the resistor between P ⊕ and C is smaller than H02.21.	If yes, replace with an external regenerative resistor that matches the servo drive, then set H02.27 according to the resistance of the resistor used. Finally, connect the new resistor between P ⊕ and C. If not, set H02.27 to a value consistent with the resistance of the external braking resistor used.

E924.0: Braking transistor overtemperature

Cause:

Estimated temperature of the braking transistor is too high.

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.	Check whether abrupt acceleration/deceleration or repeated direction switchover occurs for a long period of time.	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 restart is needed.

Troubleshooting:

Cause	Verification method	Solution
The parameters modified are those whose "Effective time" is "Next power-on".	Check whether parameters modified are designed to be activated at next power-on.	Power off and on again.

E942.0: Frequent parameter storage

Cause:

The number of parameters modified at a time exceeds 200.

Troubleshooting:

Cause	Verification method	Solution
A massive number of parameters are modified and saved to EEPROM (H0C.13 = 1) at a brief interval.	Check whether parameters are modified through the host controller at a brief interval.	Check the operation mode. For parameters that need not be saved in EEPROM, set H0C.13 to 0 before the host controller performs the write operation.

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
1. The logic of the DI assigned with FunIN.14 (P-OT function 14, positive limit switch) is active.	1. Check whether a certain DI in group H03 is assigned with FunIN.14. 2. Check whether the logic of DI corresponding to the bit of H0b.03 (Monitored DI status) is active.	Check the operation mode. Send a reverse run command or rotate the motor to deactivate the DI function 14 without affecting the safety performance.
2. The servo position feedback reaches the positive software position limit.	Check whether the position feedback (H0b.17) is close to the value of H0A.41. Check whether the software position limit is set in H0A.40.	Ensure the servo drive references are proper, allowing the load travel range to be within the software position limit.

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
1. The logic of the DI assigned with FunIN.15 is active.	Check whether a certain DI in group H03 is assigned with FunIN.15. 2. Check whether the logic of DI corresponding to the bit of H0b.03 (Monitored DI status) is active.	Check the operation mode. On the prerequisite of safety, send a forward run command or rotate the motor to deactivate the logic of DI assigned with FunIN.15.
2. The position feedback of the servo drive reaches the negative software position limit.	1. Check whether the value of H0b.17 (Position feedback) is close to that of H0A.43 (Reverse overtravel). 2. Check whether the software position limit is set in H0A.40.	Use proper servo drive references to ensure the load travel range is within the software position limit.

E980.0: Encoder algorithm error

Cause:

An encoder algorithm error occurs.

Troubleshooting:

Cause	Verification method	Solution
1. An encoder internal fault occurs.	If the fault persists after the servo drive is powered off and on several times, the encoder is faulty.	Replace the servo motor.
2. The frequency-division output frequency is excessive, leading to calculation overflow.	Check whether E510.0 alarm occurred and set H05.17 to a value until E510.0 is not reported.	Set H05.17 properly or decrease the maximum operating speed.

EA40: Parameter auto-tuning failure

Cause:

Parameter auto-tuning failed during the phase current vector auto-tuning process.

Troubleshooting:

Cause	Verification method	Solution
In phase current vector auto-tuning, parameter auto-tuning through voltage injection fails when dynamic scanning of duty cycle is enabled, or parameter auto-tuning through voltage pulse injection fails.	Power off and on the drive again.	Replace the drive.

EA41.0: Torque fluctuation compensation failure

Cause:

The torque compensation fails.

Troubleshooting:

Cause	Verification method	Solution
The torque compensation fails.	Power off and on the drive again.	1. Disable the torque fluctuation compensation function by setting H0d.23=0 and H06.26=0. 2. Do not trigger emergency stop or external faults during auto-tuning of cogging torque fluctuation. 3. If the torque fluctuation compensation value fails, try again.

15.6 Description of Fault Codes

15.6.1 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 are outside the valid value range, which generally occurs after software update.

Troubleshooting:

Cause	Verification method	Solution
1. The control power voltage drops instantaneously.	1. Check whether the control circuit (L1C, L2C) is in the process of power-off or instantaneous power failure occurs. 2. Measure whether the voltage input of the control cable on the non-drive side during operation is within the following specifications: 220 V servo drive: Effective value: 220 V to 240 V Allowable deviation: 10% to +10% (198 V to 264 V) 380 V servo drive: Effective value: 380 V to 440 V Allowable deviation: 10% to +10% (342 V to 484 V)	1. Restore system parameters to default (H02.31 = 1) and write parameters again. 2. Enlarge the power capacity or replace with a power supply of higher capacity, restore system parameters to default values (H02.31 = 1) and write parameters again.
2. Instantaneous power failure occurs during parameter storage.	Check whether instantaneous power failure occurs during parameter storage.	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. Check whether instantaneous power failure occurs during parameter storage. 2. Check whether parameters are updated frequently through the host controller. 3. Read H0b.43 and H0b.44 to get parameter group that the abnormal parameter belongs to.	1. If the drive is faulty, replace the drive. 2. Change the way of writing and write parameters again. 3. Power on the system, restore default setting (H02.31 = 1) and write parameters again.
4. The software is upgraded.	Check whether parameter values in group H02 and above is outside the valid value range due to software update.	Reset the servo drive model and servo motor model, and restore system parameters to default (H02.31 = 1).
5. The servo drive is faulty.	Restart the power supply and restore parameters to default settings. If the fault persists, the drive is faulty.	Replace the servo 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 are outside the valid value range, which generally occurs after software update.

Troubleshooting:

Cause	Verification method	Solution
The drive detects whether parameter values in groups H00 and H01 are outside the valid value range during initialization upon power-on. If yes, the keypad displays E101.1. Motor parameters in group H00 are read from the encoder. Drive parameters in group H01 are mapped based on the drive model defined by H01.02.	Check which parameter in groups H00 and H01 is outside the valid value range. Check whether this parameter range is abnormal. Read H0b.43 and H0b.44 and obtain the abnormal parameter group number.	Replace the motor or servo 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
The total number of parameters changes after software update, leading to an address error in read/write operation.	Read the values of H0b.43 and H0b.44 and obtain the abnormal parameter group number.	1. Change the abnormal parameter value to a value within the specified range. 2. Restore default values.

E102.0: FPGA communication establishment error

Cause:

The communication between MCU and FPGA cannot be established.

Troubleshooting:

Cause	Verification method	Solution
The communication between MCU and FPGA cannot be established.	Check whether the fault persists after the drive is powered off and on repeatedly.	Replace the servo drive.

E102.1: FPGA initialization startup error

Cause:

The FPGA is faulty.

Troubleshooting:

Cause	Verification method	Solution
FPGA cannot start.	Check whether the fault persists after the drive is powered off and on repeatedly.	Replace the servo drive.

E102.8: FPGA and MCU versions mismatch

Cause:

FPGA and MCU software versions do not match.

Troubleshooting:

Cause	Verification method	Solution
The software version of MCU does not match that of FPGA.	1. Check whether the MCU version (H01.00) is 9xx.x (the fourth digit displayed on the keypad is 9). 2. Check whether the FPGA version (H01.01) is 9xx.x (the fourth digit displayed on the keypad is 9).	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 FPGA is faulty. 2. The communication handshake between FPGA and HOST is abnormal. 3. Access timeout occurs between the HOST and the coprocessor.	Check whether the fault persists after the drive is powered off and on repeatedly.	Replace the servo 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.	Check whether the fault persists after the drive is powered off and on repeatedly.	Replace the servo drive.

E104.4: MCU reference update timeout

Cause:

Take the moment when interrupt 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 system reports that the encoder communication time is set improperly, or the command calculation time is excessively long.	Check whether the fault persists after the drive is powered off and on repeatedly.	1. Disable unnecessary functions, such as notch, speed observer, filtering, etc. 2. Replace the servo 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
The product (motor or servo drive) code does not exist.	1. Read the nameplates of the servo drive and motor to check whether SV660 series servo drive and 23-bit encoder are used. Meanwhile, check whether H00.00 (Motor code) is set to 14101. 2. Check the servo drive code (H01.02) to see whether this servo drive code exists.	1. If the motor code does not exist, set H00.00 to 14101 when the SV660 series servo drive and 23-bit encoder are used. 2. If the drive code is absent, set the servo drive model correctly according to the 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.	Rectify the value of H00.00.

E120.2: Unknown drive model

Cause:

The servo drive detects the servo drive model defined by H01.02 during initialization upon power-on. If the servo drive model does not exist, E120.2 occurs.

Troubleshooting:

Cause	Verification method	Solution
H01.02 is incorrect	Check the value of H01.02.	Replace the drive.

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 parameters are lost or not programmed.	Program the model parameters again.

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. The same function is assigned to different DIs.	Check whether parameters in groups H03 (H03.02, and H03.04 to H03.20) and H17 (H17.00, and H17.02 to H17.30) are assigned with the same non-zero DI function No.	Assign different DI function numbers to parameters in groups H03 or H17, and then restart the control circuit to activate the assignment, or switch off the S-ON signal and send a RESET signal to activate the assignment.
2. The DI function No. exceeds the maximum number allowed for DI functions.	Check whether the MCU program is updated.	Restore system parameters to default values (H02.31 = 1) and restart the servo drive.

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
1. The same function is assigned to different VDIs	Check whether parameters in groups H03 (H03.02, and H03.04 to H03.20) and H17 (H17.00, and H17.02 to H17.30) are assigned with the same non-zero DI function No.	Assign different DI function numbers to parameters in groups H03 or H17, and then restart the control circuit to activate the assignment, or switch off the S-ON signal and send a RESET signal to activate the assignment.
2. The VDI function No. exceeds the maximum number allowed for VDI functions.	Check whether the MCU program is updated.	Restore system parameters to default values (H02.31 = 1) and restart the servo drive.

E122.5: DI and VDI assigned with the same function

Cause:

The same function is assigned repeatedly to DI and VDI. 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 groups H03 and H17 are repetitive.	Change any repetitive number.

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
1. The servo drive model does not match the motor model.	View the servo drive and servo motor nameplates to check whether the SV660 series servo drive and servo motor are used.	Replace the servo drive and motor.
2. A parameter check error occurs or no parameter is saved in the serial incremental encoder ROM.	1. Check whether the encoder cable provided by Inovance is used. For cable specifications, see "Matching Cables". The cable must be connected reliably without scratching, breaking or poor contact. 2. Check whether signals PS+, PS-, +5V, and GND on both ends of the encoder cable are consistent. For signal assignment, see Chapter "Wiring" in the hardware guide.	1. Use the encoder cable provided by Inovance. Ensure motor terminals are connected securely and servo drive screws are tightened properly. Use a new encoder cable if necessary. 2. Route encoder cables and power cables (R/S/T, U/V/W) through different routes.
3. The drive is faulty.	The fault persists after the servo drive is restarted.	Replace the servo drive.
4. The motor is faulty.	The fault persists after the servo drive is powered on again.	Replace the motor.

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.	1. Check the encoder wiring. 2. Check whether on-site vibration is too large, which loosens the encoder cable and even damages the encoder.	1. Connect the encoder cables according to the correct wiring diagram. 2. Re-connect the encoder cables and ensure the encoder terminals are connected securely.
2. The servo drive is faulty.	The fault persists after the servo drive is restarted.	Replace the servo drive.

E136.2: Torque fluctuation compensation data verification error

Cause:

Check whether the torque fluctuation compensation data in the motor ROM is read successfully.

Troubleshooting:

Cause	Verification method	Solution
When the R/W switch for saving the value of H06.22 (Auto-tuned torque fluctuation) to the encoder is set to 1 and motor torque fluctuation compensation is enabled, the first two check words saved in the motor ROM will be read. If these two check words differ from those set by the flash, E136.2 can be reported.	The fault persists after the servo drive is powered on again.	1. Check encoder wiring; set H06.22 to 1, then power on again. 2. Replace the servo 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 Inovance commissioning software.	1. The motor parameters are set improperly, modify the motor parameters. 2. Modify current loop parameter values. 3. Improper speed loop parameters cause vibration. 4. The drive is abnormal, replace the drive.
2. The encoder cable is aged, corroded, or connected improperly or loosely.	1. Check whether the encoder cable provided by Inovance is used. 2. Check whether the cable is aged, corroded, or connected loosely. 3. Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.17h (Electrical angle) changes as motor shaft rotates.	Re-solder, tighten, or replace the encoder cable.
3. The drive is faulty.	1. Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.17 (Electrical angle) changes as motor shaft rotates. 2. Disconnect the motor and restart the drive to check whether the fault can be cleared. 3. Check whether resistance of the external regenerative resistor is too small or the regenerative resistor is short-circuited (between terminals P, ⊕ and C).	1. Replace with a braking resistor of proper resistance and model. Perform wiring again. 2. Replace the servo 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).	1. Use a braking resistor with correct resistance and model. 2. Reconnect the wiring.

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 drive power cables and motor cables are connected properly, measure whether the insulation resistance between the drive U/V/W side and the PE cable is at MΩ level.	Replace the motor if the insulation is degraded.
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 drive power cables and motor cables are connected properly, measure whether the insulation resistance between the drive U/V/W side and the PE cable is at MΩ level.	Replace the motor if the insulation is degraded.
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 Inovance commissioning software.	Carry out 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 aged, corroded, or connected loosely.	Re-solder, tighten, or replace the encoder cable.
3. Overcurrent occurs on the braking resistor.	Check whether resistance of the external regenerative resistor is too small or the regenerative resistor is short-circuited (between terminals P, ⊕ and C).	Replace with a braking resistor of proper resistance. Perform wiring again.
4. Overcurrent is caused by the superposition of the braking current and phase current.	Check whether the drive accelerates abruptly during braking. Check whether the voltage feedback exceeds the braking threshold through the Inovance drive software tool and whether the torque reference increases abruptly.	Increase the acceleration/ deceleration time.
5. The servo drive is faulty.	Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.17 (Electrical angle) changes as motor shaft rotates. Disconnect the motor cables and check whether the fault is cleared at next power-on.	Replace the servo drive.

E207.0: D/Q shaft current overflow

Cause:

The D/Q axis current overflows, which is often caused by U/V phase current errors.

Troubleshooting:

Cause	Verification method	Solution
This fault is reported when the D/1 axis current overflow flag is set to 1 in the fault register sent by the FPGA to the MCU, which is often caused by phase U/V errors.	The fault persists after the servo drive is powered off and on again.	Replace the servo drive.

E208.2: MCU did not update torque command in time

Cause:

Timeout caused by failure of MCU to timely update torque instruction

Troubleshooting:

Cause	Verification method	Solution
Timeout caused by failure of MCU to timely update torque instruction	H0b.45 (Internal fault code) = 2208	Change the value of H01.47.

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 some unnecessary functions to reduce the operating load 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 H01.07.
3. Overcurrent occurs on phase P and phase N of drives in size 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 servo drive power cables (U/V/W) are short-circuited to ground (PE).	Connect the cables again or replace the servo 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 servo drive.
4. The motor speed is too high during grounding detection.	Check whether the motor is rotating upon power-on.	Reduce the motor speed.

E210.1: Output short-circuit to ground (new)

Cause:

During short circuit to ground detection, the bus voltage exceeds the discharge threshold.

Troubleshooting:

Cause	Verification method	Solution
The servo drive power cables (U/V/W) are short-circuited to ground.	Disconnect the motor cables, and measure whether the servo drive power cables (U/V/W) are short-circuited to ground (PE).	Connect the cables again or replace the servo drive power cables.

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 incorrectly.	Check whether the servo drive power cables are connected in the correct sequence at both ends.	Connect the U/V/W cables according to the correct sequence.
2. The initial phase of the motor rotor detected is incorrect due to interference at power-on.	The U/V/W phase sequence is correct, but E234.0 occurs when the servo drive is enabled.	Power off and on again.
3. The encoder type is set incorrectly, or the wiring is incorrect.	View the servo drive and motor nameplates to check whether the devices used are Inovance SV660 series servo drive and servo motor equipped with 23-bit encoder.	Replace with a mutually-matching servo drive and motor. For use of SV660 series servo drive and servo motor equipped with 23-bit encoder, set H00.00 to 14101. Correct the motor model, encoder type, and encoder wiring.
4. The encoder cable is aged or corroded, or connected incorrectly or loosely.	1. Check whether the encoder cable provided by Inovance is used and whether the cable is aging, corroded, or connected loosely. 2. Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.10 (Electrical angle) changes as motor shaft rotates.	Re-solder, tighten, or replace the encoder cable.
5. The gravity load is excessive in a vertical axis application.	Check whether the load of the vertical axis is too heavy. Adjust brake parameters H02.09 to H02.12 to check whether the fault can be cleared.	Reduce the load on the vertical axis or increase the stiffness level. You can also mask this fault if it does not affect safety performance and normal use.
6. 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.

E321.0: Dynamic brake resistor overload

Cause:

Dynamic regenerative resistor overload.

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:

$P_{\oplus}$ and $N_{\ominus}$ exceeds the threshold:

for 220 V servo drive, normal value: 310 V; overvoltage threshold: 420 V.

380 V servo drive: Normal value: 540 V Undervoltage threshold: 760 V

Troubleshooting:

Cause	Verification method	Solution
1. The main circuit input voltage is too high.	Check the input power supply specifications of the drive and measure whether the input voltage of the main circuit cable (RST) on the drive side meets the following specifications: 220 V servo drive: Effective value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) 380 V servo drive: Effective value: 380 V to 440 V Allowable deviation: -10% to +10% (342 V to 484 V)	Replace or adjust the power supply according to the specified range.
2. The power supply is unstable or affected by the lightning strike.	Check whether the power supply is unstable, affected by lightning, or complies with the preceding range.	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.	1. If you use built-in brake resistor (H02.25=0), check if $P_{\oplus}$ and D are reliably connected by a wire. If so, measure the resistance value between C and D; 2. If using an external brake resistor (H02.25=1/2), measure the resistance of the resistor between $P_{\oplus}$ and C. For details, See table "Specifications of the braking resistor" in the user guide.	1. If the resistance is "∞" (infinite), the braking resistor is disconnected internally. If you have already used a built-in brake resistor, change H02.25 to 1/2, and remove the wire between $P_{\oplus}$ and D. The resistance value can be the same as the built-in braking resistor, and the resistor power must not be less than the built-in braking resistor; 3. If you use an external regenerative resistor, remove it and connect a new resistor between $P_{\oplus}$ and C. 4. 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 too large, and energy absorption during braking is insufficient.	Measure if the resistance of the resistor between $P_{\oplus}$ and C, and compare the measured value with the recommended value.	1. Connect a new external regenerative resistor of the recommended resistance between $P_{\oplus}$ and C. 2. 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.	Check the acceleration/ deceleration time in operation. Measure the DC bus voltage between P ⊕ and N ⊖ and see if the voltage exceeds the fault value while in the deceleration segment.	After confirming 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 the value of parameter H0b.26 (bus voltage value) is within the following range: for 220V servo drive: H0b.26 > 420V; for 380V servo drive: H0b.26 > 760V. Measure the bus voltage between P ⊕ and N ⊖ is normal and less than the value of H0b.26.	Check whether the power supply input is normal.
7. The servo drive is faulty.	Check whether the fault persists after powering off the drive several times and re-connecting the main circuit power supply.	Replace the servo drive.

E410.0: Main circuit undervoltage

Cause:

P ⊕ and N ⊖ is lower than the threshold.

For 220 V servo drive, the normal value is 310 V and undervoltage threshold is 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. 220 V drive: Effective value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) All three phases need to be measured.	Increase the power supply capacity or ensure that the input voltage is stable.
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 capacity of the power supply.

Cause	Verification method	Solution
4. A three-phase servo drive is connected to a single-phase power supply, leading to phase loss.	Check the wiring of the main circuit.	Replace the cables and connect the main circuit cables properly (three-phase: R/S/T).
5. The servo drive is faulty.	Check whether the value of H0b.26 (Bus voltage) is within the following range: 220 V drive: H0b.26 < 200 V 380 V drive: H0b.26 < 380 V The fault persists after the main circuit (R/S/T) is restarted several times.	Replace the drive.

E420.0: Main circuit phase loss

Cause:

Main circuit PL signal detection error.

Troubleshooting:

Cause	Verification method	Solution
1. The three-phase power cables are wired improperly.	Check whether R/S/T cables on the drive side and non-drive side are in good condition and connected properly.	Replace the cables and connect the main circuit cables properly.
2. A single-phase power supply is used for a three-phase drive. 3. The three-phase power supply is unbalanced or the voltages of the three phases are excessively 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: 220 V servo drive: Effective value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) 380 V servo drive: Effective value: 380 V to 440 V Allowable deviation: -10% to +10% (342 V to 484 V) All the three phases need to be measured.	1. Servo drives of 0.75 kW (H01.02 = 5) can be supplied by single-phase power supplies. 2. If the input voltage complies with the specifications, set H0A.00 (Power input phase loss protection) to 2 to inhibit phase loss faults and warnings. 3. If the input voltage does not satisfy the specifications, replace or adjust the power capacity.

E430.0: Control circuit power supply undervoltage

Cause:

Undervoltage occurred on the control power supply of servo drives in size C/D/E.

Troubleshooting:

Cause	Verification method	Solution
1. The control circuit power supply of servo drives in size C/D/E are unstable or fails.	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: 220 V servo drive: Effective value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) 380 V servo drive: Effective value: 380 V to 440 V Allowable deviation: -10% to +10% (342 V to 484 V) All the three phases need to be measured.	Increase the power capacity.
2. The control circuit power supply of servo drives in size C/D/E is in poor contact.	Check whether control circuit cables are connected properly and whether the voltage of control circuit cables (L1C, L2C) on the servo 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 servo drive power cables are connected in the correct sequence at both ends.	Connect the U/V/W cables according to the correct sequence.
2. H0A.08 is set improperly.	1. Check whether the overspeed fault threshold is lower than the maximum motor speed required for operation 2. Overspeed threshold = 1.2 x maximum motor speed (H0A.08 = 0). 3. Overspeed fault threshold = H0A.08 (H0A.08 ≠ 0 and H0A.08 < 1.2 x max. motor speed)	Reset the overspeed threshold according to the actual mechanical requirement.

Cause	Verification method	Solution
3. The input reference is higher than the overspeed threshold.	1. Whether the motor speed corresponding to the input reference exceeds the overspeed fault threshold. Position control mode: View the gear ratio H05.07/H05.09 to determine the increment of the position reference corresponding to an individual synchronization cycle and convert it to speed information 2. Speed control mode: View the gear ratio H05.07/H05.09 and the target speed and speed limit (H06.06 to H06.09). 3. In torque control mode, view the speed limit defined by H07.17 and check the corresponding speed limit.	1. Position control mode: Decrease the position reference increment for an individual synchronization cycle. The host controller should cover the position ramp when generating references or reduce the target speed, or increase the acceleration/deceleration ramp, or reduce the gear ratio based on actual applications. 2. Speed mode: Reduce the target speed, speed limit, and gear ratio. 3. Torque control mode: Set the speed limit to a value below the overspeed threshold.
4. The motor speed overshoots.	Check whether the speed feedback exceeds the overspeed threshold through the software tool.	Adjust the gain or mechanical operation conditions.
5. The servo drive is faulty.	The fault persists after the servo drive is powered off and on again.	Replace the servo drive.

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 wiring of the encoder.

E602.2: U/V/W phase sequence reversed

Cause:

An incorrect U/V/W phase sequence is detected during angle auto-tuning.

Troubleshooting:

Cause	Verification method	Solution
A wrong U/V/W phase sequence is detected in angle auto-tuning.	Check whether U/V/W phases are wired correctly.	Exchange the cables of any two phases and start 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 switched on.	Check whether the drive is enabled when the motor is being driven.	Switch on the drive when the motor is 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 between the servo drive, servo motor and the encoder according to the correct "wiring diagram".	1. Connect the cables according to the correct wiring diagram. 2. It is recommended to use the cables provided by Inovance. 3. When self-made 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.	Check the overload characteristics of the servo drive or servo motor. Check whether the average load rate (H0b.12) of the drive keeps exceeding 100.0%.	1. Use a servo drive of higher capacity and a matching servo motor. 2. You can also reduce the load and increase the acceleration/ deceleration time.
3. Acceleration/deceleration is frequent, or the load inertia is high.	1. Calculate the mechanical inertia ratio or perform inertia auto-tuning. Check the value of H08.00 (Load inertia ratio). 2. Check the single-shot operation cycle when the motor runs cyclically.	Increase the acceleration/ deceleration time for 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.	Re-adjust the gain, such as the speed loop gain (H0800).
5. The servo drive model or motor model is set improperly.	View the motor model in H00.00 and the drive model in H01.02.	Read the servo drive nameplate and set the servo drive model (H01.02) and motor model properly.

Cause	Verification method	Solution
6. Locked-rotor occurs due to mechanical factors, resulting in very heavy load during running.	Check the reference and motor speed (H0b.00) through the software tool or keypad: References in the position control mode: H0b.13 (Input position reference counter) References in the speed control mode: H0b.01 (Speed reference) References in the torque control mode: H0b.02 (Internal torque reference) Check whether the operation command is not 0, but the motor speed is 0 in the corresponding mode.	1. Eliminate mechanical factors. 2. Check whether the brake can be released properly. 3. Check if the motor connection mechanism is normal.
7. The drive is faulty.	The fault persists after the drive is powered off and on again.	Replace the drive.

E625.0: Brake abnormality enabled

Cause:

The brake fails when it is released.

Troubleshooting:

Cause	Verification method	Solution
The brake fails when it is released.	Check if the motor shaft end is held by the brake when the brake release signal is active.	1. Check the wiring of the brake. Use a 24 VDC power supply to power up BK+ and BK- separately, and check whether the brake can be released properly 2. Replace the motor.

E626.0: brake abnormality disabled

Cause:

The brake failed to apply.

Troubleshooting:

Cause	Verification method	Solution
The brake fails when it is applied.	Check if the motor shaft end is not held tightly by the brake when the braking signal is active.	1. Check the wiring of the brake. Use a 24 VDC power supply to power up BK+ and BK- separately, and check whether the brake can be released properly 2. Replace the motor.

E630.0: Motor stall overtemperature protection

Cause:

The actual motor speed is lower than 10rpm but the torque reference reaches the limit, and such status lasts for the time defined by H0A.32.

Troubleshooting:

Cause	Verification method	Solution
1. U/V/W output phase loss, wire breakage or incorrect phase sequence occurs on the servo drive.	Perform motor trial run without load and check cable connections and the phase sequence.	Re-connect the cables according to the wiring diagram or replace the cables.
2. The motor parameters (especially the number of pole pairs) are set improperly and motor angle auto-tuning is not performed.	1. View parameters in group H00 to check whether the number of pole pairs are set properly. 2. Perform angle auto-tuning on the motor several times and check whether the value of H00.28 is consistent during angle auto-tuning.	Correct motor parameters, such as H00.17 (Number of motor pole pairs).
3. The references set through communication are disturbed.	Check whether jitter occurs on the references sent from the host controller and whether communication is disturbed.	Check whether the communication between the host controller and the servo drive is being disturbed.
4. The motor is stalled due to mechanical factors.	Check the operation reference and motor speed (H0b.00) through the software tool or keypad: References in the position control mode: H0b.13 (Input position reference counter) References in the speed control mode: H0b.01 (Speed reference) References in the torque control mode: H0b.02 (Internal torque reference) Check whether the operation command is not 0, but the motor speed is 0 in the corresponding mode. Check the current feedback (torque reference) waveform.	Check whether any mechanical part gets stuck or eccentric.

E640.0: IGBT junction temperature excessively high

Cause:

The IGBT temperature reaches the fault threshold defined by H0A.18.

Troubleshooting:

Cause	Verification method	Solution
1. The ambient temperature is excessively high. 2. The drive is restarted repeatedly to reset the overload fault.	Measure the ambient temperature and view the fault records (set H0b.33 and view H0b.34) to check whether an overload fault/alarm is reported (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0).	Improve the cooling conditions of the drive to lower down the ambient temperature. Change the fault reset method. After overload occurs, wait 30s and then perform the reset operation. Increase the capacities of the servo drive and servo motor. Increase the acceleration/deceleration time and reduce the load.
3. The fan is damaged.	Check whether the fan works properly during operation.	Replace the servo drive.

Cause	Verification method	Solution
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 installation requirements.
5. The servo drive is faulty.	The fault persists upon restart five minutes after power-off.	Replace the servo drive.

E640.1: Flywheel diode junction temperature excessively high

Cause:

The temperature of the flywheel diode reaches the fault threshold defined by H0A.18.

Troubleshooting:

Cause	Verification method	Solution
1. The ambient temperature is excessively high. 2. The drive is restarted repeatedly to reset the overload fault.	Measure the ambient temperature and view the fault records (set H0b.33 and view H0b.34) to check whether an overload fault/alarm is reported (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0).	Improve the cooling conditions of the drive to lower down the ambient temperature. Change the fault reset method. After overload occurs, wait 30s and then perform the reset operation. Increase the capacities of the servo drive and servo motor. Increase the acceleration/deceleration time and reduce the load.
3. The fan is damaged.	Check whether the fan works properly during operation.	Replace the servo 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 installation requirements.
5. The servo drive is faulty.	The fault persists upon restart five minutes after power-off.	Replace the servo 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 excessively high. 2. The drive is restarted repeatedly to reset the overload fault.	Measure the ambient temperature and view the fault records (set H0b.33 and view H0b.34) to check whether an overload fault/alarm is reported (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0).	Improve the cooling conditions of the drive to lower down the ambient temperature. Change the fault reset method. After overload occurs, wait 30s and then perform the reset operation. Increase the capacities of the servo drive and servo motor. Increase the acceleration/deceleration time and reduce the load.
3. The fan is damaged.	Check whether the fan works properly during operation.	Replace the servo drive.

Cause	Verification method	Solution
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 installation requirements.
5. The servo drive is faulty.	The fault persists upon restart five minutes after power-off.	Replace the servo drive.

E660.0: Motor over-temperature

Cause:

The temperature of the air-cooled motor is too high.

Troubleshooting:

Cause	Verification method	Solution
The temperature of the air-cooled motor is excessively high (above 130°C).	1. Measure whether the temperature of the air-cooled motor is too high (exceeding 130° C). 2. Wiring error.	1. Cool the motor down. 2. Check whether the wiring is normal.

E661.6: Gain auto-tuning failed

Cause:

Excessive resonance occurs and gain auto-tuning fails.

Troubleshooting:

Cause	Verification method	Solution
The drive vibrates during gain tuning.	Check whether unusual noise or vibration occurs during operation.	Rule out mechanical causes and try to set the gain parameters manually.

E668.0: Homing mode does not match the current encoder

Cause:

The homing method does not match the current encoder.

Troubleshooting:

Cause	Verification method	Solution
The homing method does not match the current encoder.	Check whether the following conditions exist in the servo parameters: 1. When H05.69 is set to 1 or H05.69 is set to 3, this fault is reported when H02.01 is not set to 0 or H00.00 is not set to 14101. 2. During electrical homing, this fault is reported when H05.69 is set to 1 but the value of homing mode is lower than 14. 2. During electrical homing, this fault is reported when H05.69 is not set to 1 but the value of homing mode is between 13 and 17. 4. This fault is reported when the value of homing mode is between 13 and 17 in the regular homing mode, or the value of homing mode is lower than 2 or set to 6, 7, 10, or 11 when H05.69 is set to 3.	Change the homing mode (H05.31).

E731.0: Encoder multi-turn position data lost

Cause:

The encoder multi-turn position data is lost.

Troubleshooting:

Cause	Verification method	Solution
1. The battery is not connected during power-off.	Check whether the battery is connected during power-off.	Set H0d.20 to 1 and restart the power supply to clear the fault.
2. The encoder battery voltage is lower than 2.9 V.	Measure the battery voltage.	Replace the battery with a new one that provides matching voltage.
3. The encoder is disturbed by strong magnetic field.	Check whether the encoder is in environment with strong magnetic field.	Remove the magnetic field source and set H0d.20 to 1.

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 to 2 to clear the fault, but E733.0 persists after restart.	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 number of forward revolutions exceeds 32767 or the number of reverse revolutions exceeds 32768.	Check whether the value of H0b.70 (Number of absolute encoder revolutions) is 32767 or 32768 when the servo drive works in the absolute linear mode (H02.01 = 1).	Set H0d.20 to 2 to power on again. Perform homing if necessary.

E740.0: Absolute encoder communication timeout

Cause:

Communication timeout occurs on the absolute encoder.

Troubleshooting:

Cause	Verification method	Solution
The communication between the servo drive and the encoder times out.	Check the wiring of the encoder and power on the servo drive again.	1. Check whether the encoder version (H00.04) is set properly. 2. Check the servo drive software version (H01.00). 3. Check the encoder wiring. 4. Replace the servo motor.

E740.2: Absolute encoder error

Cause:

A communication error occurs on the RX side of the encoder.

Troubleshooting:

Cause	Verification method	Solution
An error occurs in communication between the servo drive and the encoder.	Check whether the value of H0b.28 is not 0.	1. Ensure the motor model is set correctly. 2. Check whether the encoder cable is connected properly. 3. Ensure the servo drive and motor are grounded properly. You can wind the encoder cable on a magnetic ring to reduce interference. Note: For software versions earlier than 6.3, E740.4 fault is present, which can be rectified in the same way as E740.2. For software versions later than 6.3, E740.4 is replaced by E740.2.

E740.3: Absolute encoder single-turn calculation error

Cause:

An internal fault occurs on the encoder.

Troubleshooting:

Cause	Verification method	Solution
An internal fault occurs on the encoder.	Check whether bit8 of H0b.28 is 1.	1. Check whether the encoder version (H00.04) is set properly. 2. Check the condition of the encoder cable. 3. Replace the motor.

E740.6: Encoder write fault

Cause:

The attempt to write the encoder data fails.

Troubleshooting:

Cause	Verification method	Solution
The position offset fails to be written to the encoder after angle auto-tuning.	Use a new encoder cable. If the fault no longer occurs after replacement, it indicates that the original encoder cable is damaged. Keep the motor in a certain position, power on the system several times and observe the change of H0b.10 (Electrical angle). The electrical angle deviation should be within ±30° when the motor position does not change.	Use a new encoder cable. If the fault persists after the encoder cable is replaced, the encoder may be faulty. In this case, replace the servo 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 temperature or motor temperature using a thermometric label to determine whether the measured temperature exceeds the temperature threshold defined by H0b.66. When H0A.52 is set to 0, E760.0 can be ignored.	Switch off the S-ON signal to wait for the encoder to cool down. Check whether the encoder cable is susceptible to interference.

E939.0: Motor power cable disconnected

Cause:

Motor three phase cable breakage.

Troubleshooting:

Cause	Verification method	Solution
The three-phase motor power cables are disconnected.	Check the wiring of U/V/W power cables.	1. If the power cables are disconnected or in poor contact, re-connect the power cables. 2. Replace the servo 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 breaks or becomes loose.	Check the wiring.	Check whether the encoder cables are connected incorrectly, disconnected, or in poor contact. If the motor cables and encoder cables are bundled together, separate them.
2. The attempt to read/write serial incremental encoder parameters failed.	If the fault persists after the servo drive is powered off and on repeatedly, the encoder is faulty.	Replace the servo motor.

EA34.0: Encoder communication check abnormal

Cause:

Encoder UVW Hall signal abnormal

Troubleshooting:

Cause	Verification method	Solution
Encoder UVW Hall signal abnormal, encoder UVW phase logic error, incorrect UVW phase information read at power-up	If the fault persists after the power supply is restarted several times, the encoder or the drive is faulty.	Replace the faulty servo drive or 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. U/V/W output phase loss or incorrect phase sequence occurs on the servo drive.	Perform a no-load trial run on the motor and check the wiring.	Re-connect the cables according to the wiring diagram or replace the cables.
2. The servo drive U/V/W output cables or encoder cables are disconnected.	Check the wiring.	Connect the cables again. The servo drive power cables (U/V/W) must be connected in the correct order at both ends. If necessary, replace all cables and ensure a reliable connection.

Cause	Verification method	Solution
3. The motor rotor is stalled due to mechanical factors.	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 but the motor speed is 0 in the corresponding mode.	Rule out mechanical factors. For example, check whether the motor brake is released.
4. The servo drive gains are excessively low.	Check the position loop gain and speed loop gain of the drive. First gain set: H08.00 to H08.02 2nd gain set: H08.03 to H08.05	Adjust the gain values manually or perform gain auto-tuning.
5. The value of H0A.10 is insufficient for the operating conditions.	Check whether the setting of H0A.10 is too small.	Increase the setpoint 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. U/V/W output phase loss or incorrect phase sequence occurs on the servo drive.	Perform a no-load trial run on the motor and check the wiring.	Re-connect the cables according to the wiring diagram or replace the cables.
2. The servo drive U/V/W output cables or encoder cables are disconnected.	Check the wiring.	Connect the cables again. The servo drive power cables (U/V/W) must be connected in the correct order at both ends. If necessary, replace all cables and ensure a reliable connection.

Cause	Verification method	Solution
3. The motor rotor is stalled due to mechanical factors.	Check the reference and motor speed (H0b.00) through the software tool or keypad: References in the position control mode: H0b.13 (Input position reference counter) References in the speed control mode: H0b.01 (Speed reference) References in the torque control mode: H0b.02 (Internal torque reference) Check whether the operation command is not 0, but the motor speed is 0 in the corresponding mode.	Rule out mechanical factors. For example, check whether the motor brake is released.
4. The servo drive gains are excessively low.	Check the position loop gain and speed loop gain of the drive. First gain set: H08.00 to H08.02 2nd gain set: H08.03 to H08.05	Adjust the gain values manually or perform gain auto-tuning.
5. The value of H0A.10 is insufficient for the operating conditions.	Check whether the setting of H0A.10 is too small.	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.

EB01.0: Position reference increment too large

Cause:

The pulse reference increment exceeds the excessive reference threshold three times consecutively.

Troubleshooting:

Cause	Verification method	Solution
The pulse reference increment exceeds the excessive reference threshold three times consecutively.	Check whether the pulse reference input frequency exceeds H0A.09. Note: Maximum pulse input frequency: When H05.15 is set to 2 (Quadrature relationship of phase A + phase B): if H05.01 is set to 0 (low speed), the maximum low-speed input pulse is the minimum value between 4×240kHz and 4×H0A.09; if H05.01 is set to 1 (high speed), the maximum input pulse is the minimum value between 16000kHz and 4×H0A.09. When H05.15 is set to non-2: if H05.01 is set to 0 (low speed), the maximum input pulse is the minimum value between 240kHz and H0A.09; if H05.01 is set to 1 (high speed), the maximum input pulse is the minimum value between 4000kHz and H0A.09.	1. Increase the value of H0A.09. 2. Reduce the baud rate of pulse input.

EB03.0: Electronic gear ratio beyond the limit - H05.02

Cause:

The electronic gear ratio (H05.02) exceeds the limit: (0.001 to 4000 x Encoder resolution/10000).

Troubleshooting:

Cause	Verification method	Solution
The electronic gear ratio converted by H05.02 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 x Encoder resolution÷10000.	Change 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 x 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 electronic gear ratio 1 is within the range of 0.001 to 4000 x Encoder resolution/10000.	Change the values of electronic gear ratio 1 (H05.07/H05.09).

EB03.2: Electronic gear ratio 2 beyond the limit

Cause:

The electronic gear ratio 2 exceeds the limit: (0.001 to 4000 x Encoder resolution/10000).

Troubleshooting:

Cause	Verification method	Solution
The electronic gear ratio 2 exceeds the maximum gear ratio or is lower than the minimum gear ratio.	Check if the group 2 electronic gear ratio is within the range of 0.001–4000 × Encoder resolution÷10000.	Change the values of H05.11/ H05.13.

ED03.0: CANLink communication failure

Cause:

The master is offline.

Troubleshooting:

Cause	Verification method	Solution
The master is offline.	1. Increase the heartbeat threshold of the master station. 2. Check the wiring.	Capture frames to ensure that the master station is online.

15.6.2 Internal fault

When any one of the following fault occurs, contact Inovance for technical support.

- E602.0: Angle auto-tuning failure
- E220.0: Phase sequence fault
- EA40.0: Parameter auto-tuning failure
- E111.0: Internal parameter fault

15.7 Troubleshooting During Startup

Position control mode

- **Fault diagnosis**

Startup process	Fault symptom	Cause	Verification method
Connection of control power (L1C, L2C) Main power supply (L1, L2) (L1, L2, L3) (R/S/T terminals)	The LED display is OFF or does not display "rdy".	1. The control power voltage is abnormal.	After CN1, CN2, CN3, and CN4 are disconnected, the fault persists. Measure the AC voltage between L1C and L2C.
		2. The main power supply voltage is abnormal.	• For single-phase 220 V models, measure the AC voltage between L1 and L2. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 235 V, the keypad displays "nrd". • For three-phase 220 V/380 V models, measure the AC voltage among L1, L2, L3/R, S, T. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 451 V, the keypad displays "nrd".
		3. The programming terminal is short-circuited.	Check whether the programming terminal is short-circuited.
		4. The servo drive is faulty.	-
	The keypad displays "Exxx.x".	For details, see *"15.6.1 Troubleshooting Faults" on page 670* and *"Troubleshooting Alarms" on page 661* Rectify the fault.	
	After the faults are rectified, the operating panel displays "rdy".		
Activation of S-ON signal (S-ON signal switched on)	The keypad displays "Exxx.x".	For details, see *"15.6.1 Troubleshooting Faults" on page 670* and *"Troubleshooting Alarms" on page 661* Rectify the fault.	
	The shaft of the servo motor is in free operation state.	1. The S-ON signal is inactive.	Set the operating panel to servo status display and check whether the operating panel displays "rdy" rather than "run". • Check whether any parameter in groups H03 and H17 is set to the S-ON signal (DI function 1: S-ON). If yes, check whether the logic of the corresponding terminal is valid. If not, allocate the function to a terminal and make the corresponding terminal logic valid. See the parameter settings for group H03 and group H17. • If the keypad keeps displaying "rdy" even though the S-ON signal has been assigned to a DI through parameters in group H03 or H17 and the corresponding DI logic is active, check whether the DI is connected correctly according to Chapter "Wiring" in the user guide.
		2. An improper control mode is selected.	Check whether H02.00 (Control mode selection) is set to 1 (Position control mode). If it is set to 2 (Torque control mode), the motor shaft will be in the free running state because the default torque reference is 0.
	After the faults are rectified, the operating panel displays "run".		

Startup process	Fault symptom	Cause	Verification method
Input position reference	The servo motor does not rotate.	The value of the input position reference counter (H0b.13) is 0.	• The high/low-speed pulse input terminal is wired incorrectly. When H05.00 (Position reference source) is set to 0, check whether the high/low-speed pulse input terminal is connected correctly according to section "Description of Terminals". Additionally, check whether the setting of H05.01 (Pulse reference input terminal selection) is matched. • No position reference is inputted. • Check whether FunIN.13 (Inhibit, position reference inhibited) or FunIN.37 (PulseInhibit, pulse reference inhibited) is used. • When H05.00 (Position reference source) is set to 0 (pulse input), the host controller or other pulse generator does not output pulses. Check whether there are pulses into high/low-speed pulse input terminals with an oscilloscope. See section Terminals for details. • When H05.00 (Position reference source) is set to 1 (Step reference), check whether H05.05 (Step reference) is 0. If not, check whether FunIN.20 (PosStep, step reference enabled) is assigned to a DI and whether the logic of this DI is active. • When H05.00 (Position reference source) is set to 2 (Multi-position reference), check whether parameters in group H11 are set correctly. If yes, check whether FunIN.28 (PosInSen, internal multi-position enable) is assigned to a DI and whether the logic of this DI is active. • If interrupt positioning is used, check whether H05.29 (Interrupt positioning cancellation) is set to 1 (Enabled). If yes, check whether FunIN.29 (XintFree, interrupt positioning cancellation) is used.
Input position reference	The servo motor rotates in reverse direction.	The value of the input position reference counter (H0b.13) is a negative number.	• When H05.00 (Position reference source) is set to 0 (Pulse reference), check whether the setting of H05.15 (Pulse reference form) is consistent with the actual input pulses. If not, H05.15 is set improperly or terminals are wired incorrectly. • When H05.00 (Position reference source) is set to 1 (Step reference), check whether the value of H05.05 (Step reference) is positive or negative. • When H05.00 (Position reference source) is set to 2 (Multi-position reference), check the sign (+/-) of each displacement reference value in parameter group H11. • Check whether FunIN.27 (PosDirSel, position reference direction selection) is assigned to a DI and whether the logic of this DI is active. • Check whether H02.02 is set correctly.
	After the faults are rectified, the servo motor can rotate.		
Unstable rotation during low-speed operation	Motor speed is not steady.	The gain is set improperly.	Perform automatic gain adjustment.
	Side-to-side vibrations occur on the motor shaft.	The load moment of inertia ratio (H08.15) is too large.	If the drive can operate securely, perform inertia auto-tuning and automatic gain adjustment again.
	After preceding faults are removed, the servo motor can operate normally.		
Normal running	Inaccurate localization	Unsatisfactory position deviation is generated.	Confirm position reference counter (H0b.13), feedback pulse counter (H0b.17) and mechanical stop position according to the following steps.

- **Procedure for checking the causes of inaccurate positioning**

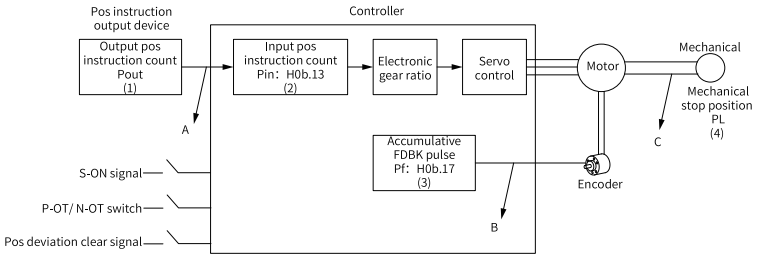


Figure 15-1 Schematic diagram for positioning control

- When localization is inaccurate, check the four signals in the preceding figure.
  - Count of output position references (Pout) of the position reference output device (host controller or internal parameters of the drive)
  - Count of input position references (Pin) received by the servo controller, corresponding to H0b.13
  - Accumulative feedback pulses from the built-in encoder of the servo motor, corresponding to H0b.17
  - Mechanical stop position PL
- There are three causes resulting in inaccurate localization, corresponding to A, B, and C in the preceding figure.
  - A: The count of input position references is incorrect because the cable connecting the position reference output device (host controller to be specific) and the servo drive is affected by noise.
  - B: Input position reference is interrupted during motor operation.
    Cause: Servo ON signal (S-ON) is set to OFF, the positive/negative limit switch signal (P-OT or N-OT) is ON and the position deviation clearing signal (ClrPosErr) is ON.
  - C: Mechanical position slides between the machine and servo motor.
- In ideal state (no position deviation), the following relationships hold:
  - Pout = Pin, meaning count of output position references = count of input position references
  - Pin x electronic gear ratio = Pf, meaning count of input position references x electronic gear ratio = accumulative feedback pulses
  - Pf x △L = PL, meaning accumulative feedback pulses x load displacement per position reference = mechanical stop position
- When inaccurate localization occurs, perform the following checks:
  - Pout ≠ Pin
    Cause: A

    To solve issue B, do as follows:

    1. Check if twisted pair shielded cables are connected to pulse input terminals (For low or high speed pulse input terminals, see section "Description of Terminals").
    2. If the open-collector input mode for low-speed pulse input terminals is used, change to the differential input mode.
    3. Route pulse input terminals and the main circuit terminals (L1, L2/R, S, T/U, V, W) through different routes.

4. If low-speed pulse input terminals are used, increase the filter time constant of low-speed pulse input pins (H0A.24). If high-speed pulse input terminals are used, increase the filter time constant of the high-speed pulse input pins (H0A.30).

- Pin x electronic gear ratio ≠ Pf:
  Cause: B

  To solve issue B, do as follows:

  1. Check whether a fault occurs during operation, causing the servo drive to stop before executing all the commands.
  2. If the fault is caused by an active position deviation clear signal (ClrPosErr), check whether the position deviation clear mode (H05.16) is proper.

- Pf x △L ≠ PL
  Cause: C

  To rectify cause C, check mechanical connections and find the sliding position.

Speed control mode

Startup process	Fault symptom	Cause	Verification method
Connection of control power (L1C, L2C) Main power supply (L1, L2) (L1, L2, L3) (R/S/T terminals)	The LED display is OFF or does not display "rdy".	1. The control power voltage is abnormal.	After CN1, CN2, CN3, and CN4 are disconnected, the fault persists. Measure the AC voltage between L1C and L2C.
		2. The input voltage is abnormal.	• For single-phase 220 V models, measure the AC voltage between L1 and L2. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 235 V, the keypad displays "nrd". • For three-phase 220 V/380 V models, measure the AC voltage among L1, L2, L3/R, S, T. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 451 V, the keypad displays "nrd".
		3. The programming terminal is short-circuited.	Check whether the programming terminal is short-circuited.
		4. The servo drive is faulty.	-
	The keypad displays "Exxx.x".	For details, see *"15.6.1 Troubleshooting Faults" on page 670*and *" Troubleshooting Alarms" on page 661*Rectify the fault.	
	After the faults are rectified, the operating panel displays "rdy".		
Activation of S-ON signal (S-ON signal switched on)	The keypad displays "Exxx.x".	For details, see *"15.6.1 Troubleshooting Faults" on page 670*and *" Troubleshooting Alarms" on page 661*Rectify the fault.	
	The shaft of the servo motor is in free operation state.	1. The S-ON signal is inactive.	Set the operating panel to servo status display and check whether the operating panel displays "rdy" rather than "run". • Check whether any parameter in groups H03 and H17 is set to the S-ON signal (DI function 1: S-ON). If yes, check whether the logic of the corresponding terminal is valid. If not, allocate the function to a terminal and make the corresponding terminal logic valid. See the parameter settings for group H03 and group H17. • If the keypad keeps displaying "rdy" even though the S-ON signal has been assigned to a DI through parameters in group H03 or H17 and the corresponding DI logic is active, check whether the DI is connected correctly according to section Description of Terminals.
		2. An improper control mode is selected.	Check whether H02.00 is set to 0. If it is set to 2 (torque control mode), the motor shaft is in free operating status because the default torque reference is 0.
	After the faults are rectified, the operating panel displays "run".		
Input of speed reference	The servo motor does not rotate or the motor speed is abnormal.	The speed reference (H0b.01) is 0.	• The speed reference source is incorrect. Check whether H06.02 is set correctly. • The speed reference is not specified or is abnormal. • When digital setting is used to set the speed reference, check whether H06-03 is set correctly. • When multi-speed is used to set the speed reference, check whether the parameters in group H12 are set correctly. • When communication is used to set the speed reference, check whether H31.09 is set correctly. • When jog speed reference is used to set the speed reference, check whether H06.04 is set correctly, whether DI functions are set to 18 and 19, and whether the logic of corresponding DI is valid. • Check whether the acceleration time and deceleration time (H06.05 and H06.06) are set correctly. • Check whether the DI function 12 (zero clamp) is enabled incorrectly and whether the logic of corresponding DI is valid.

Startup process	Fault symptom	Cause	Verification method
Input of speed reference	The servo motor rotates in reverse direction.	Speed reference (H0b.01) is negative.	• When digital setting is used to set the speed reference, check whether H06.03 is less than 0. • When multi-speed is used to set the speed reference, check whether speed references in group H12 are positive or negative. • When serial communication is used to set the speed reference, check whether H31.09 is less than 0. • When jog speed reference is used to set the speed reference, check the value of H06.04 and whether the valid logic of DI functions 18 and 19 matches the predicted rotating direction. • Check whether DI function 26 (FunIN.26: SpdDirSel, speed reference direction) has been configured and whether the logic of corresponding DI is valid. • Check whether H02.02 is set correctly.
	After the faults are rectified, the servo motor can rotate.		
Unstable rotation during low-speed operation	Motor speed is not steady.	The gain is set improperly.	Perform automatic gain adjustment.
	Side-to-side vibrations occur on the motor shaft.	The load moment of inertia ratio (H08-15) is too large.	If the servo motor can run safely, perform inertia auto-tuning again. Perform automatic gain adjustment.

Torque control mode

Startup process	Fault symptom	Cause	Verification method
Switch on the control power supply (L1C, L2C) Main power supply (L1, L2) (L1, L2, L3) (R/S/T terminals)	The LED display is OFF or does not display "rdy".	1. The control power voltage is abnormal.	After CN1, CN2, CN3, and CN4 are disconnected, the fault persists. Measure the AC voltage between L1C and L2C.
		2. The main power supply voltage is abnormal.	• For single-phase 220 V models, measure the AC voltage between L1 and L2. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 235 V, the keypad displays "nrd". • For three-phase 220 V/380 V models, measure the AC voltage among L1, L2, L3/R, S, T. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 451 V, the keypad displays "nrd".
		3. The programming terminal is short-circuited.	Check whether the programming terminal is short-circuited.
		4. The servo drive is faulty.	-
	The keypad displays "Exxx.x".	For details, see "15.6.1 Troubleshooting Faults" on page 670 and " Troubleshooting Alarms" on page 661 Rectify the fault.	
	After the faults are rectified, the operating panel displays "rdy".		
Activation of S-ON signal (S-ON signal switched on)	The keypad displays "Exxx.x".	For details, see "15.6.1 Troubleshooting Faults" on page 670 and " Troubleshooting Alarms" on page 661 Rectify the fault.	
	The shaft of the servo motor is in free operation state.	The S-ON signal is inactive.	• Set the operating panel to servo status display and check whether the operating panel displays "rdy" rather than "run". • Check whether any parameter in groups H03 and H17 is set to the S-ON signal (DI function 1: S-ON). If yes, check whether the logic of the corresponding terminal is valid. If not, allocate the function to a terminal and make the corresponding terminal logic valid. See the parameter settings for group H03 and group H17. • If the keypad keeps displaying "rdy" even though the S-ON signal has been assigned to a DI through parameters in group H03 or H17 and the corresponding DI logic is active, check whether the DI is connected correctly according to section Description of Terminals.
	After the faults are rectified, the operating panel displays "run".		
Input torque reference	The servo motor does not rotate.	The internal torque reference (H0b.02) is 0.	The torque reference source is set incorrectly. Check whether H07.02 is set correctly. No torque reference is specified. • In digital setting mode, check whether H07.03 is set to 0. • In communication setting mode, check whether H31.11 is set to 0.
	The servo motor rotates in reverse direction.	The value of internal torque reference (H0b.02) is a negative number.	• In digital setting mode, check whether H07.03 is set to a value smaller than 0. • In communication setting mode, check whether H31.11 is set to a value smaller than 0. • Check that DI function 25 (FunIN.25: ToqDirSel, torque reference direction setting) is set properly and that the corresponding terminal logic is valid. • Check whether H02.02 is set correctly.
	After the faults are rectified, the servo motor can rotate.		

Startup process	Fault symptom	Cause	Verification method
Unstable rotation during low-speed operation	Motor speed is not steady.	The gain is set improperly.	Perform automatic gain adjustment.
	Side-to-side vibrations occur on the motor shaft.	The load moment of inertia ratio (H08.15) is too large.	If the servo motor can run safely, perform inertia auto-tuning again. Perform automatic gain adjustment.

15.8 Solutions to Common Problems

15.8.1 Fault symptom

- It is recommended to perform troubleshooting according to the sequence numbers from lowest to highest.
- If a drive needs to be replaced on-site and returned, record the fault cause identified on site and return it together with the drive.

15.8.2 No Display on the Keypad

Fault symptom

There is no display on the LED of the drive after the main circuit power supply (L1, L2) is powered on.

Troubleshooting

No.	Possible cause	Detection method/Solution		Remarks
1	The external device is short-circuited.	After removing the CN1, CN2, and network port terminals, keep only the main circuit power supply terminals and check whether the display is normal.	Check whether the peripheral device is short-circuited.	-
2	The main circuit power supply is abnormal.	Check whether the power supply of input terminals L1/L2 is normal.	The voltage of a 220 V drive is 180 VAC to 264 VAC. When the input power supply does not meet requirements, rectify or replace the power supply.	"*Detailed detection methods and solutions*" *on page 707*
3	The drive is damaged.	Replace the drive and perform a cross-test.	Contact Inovance service personnel.	-

Detailed detection methods and solutions

Set the multimeter to the voltage (AC) range and measure the voltage across L1 and L2.

When the voltage between L1 and L2 cannot be measured, it is recommended to measure the voltage at the starting point of the power supply cable (typically the distribution cabinet).

Voltage of the input power supply for S2R8 model: 180 VAC to 264 VAC.

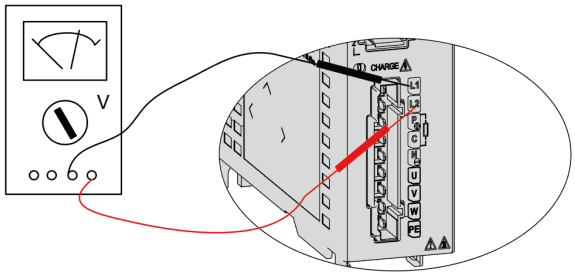


Figure 15-2 Input voltage detection instance

15.8.3 Smoke or Damage upon Power-on

If any one of the following fault symptoms occurs, power off immediately and perform the following troubleshooting process.

Fault symptom

Tripping occurs upon power-on, or the bus capacitor is damaged, leading to smoke or leakage liquid in the drive.

Troubleshooting

No.	Possible cause	Detection method/Solution		Remarks
1	Cables are wired improperly.	A 220 V drive is connected to a 380 V power supply.	Replace the power supply voltage.	-
2	The main circuit power supply is abnormal.	Check whether the power supply of input terminals L1/L2 is normal.	The voltage of a 220 V drive is 180 VAC to 264 VAC. When the input power supply does not meet requirements, rectify or replace the power supply.	"*Detailed detection methods and solutions*" *on page 708*
3	The drive is damaged.	If the input power supply voltage is normal, replace the drive and perform a cross-testing.	Contact Inovance service personnel.	-

Detailed detection methods and solutions

Set the multimeter to the voltage (AC) range and measure the voltage across L1 and L2.

Voltage of the input power supply for S2R8 model: 180 VAC to 264 VAC.

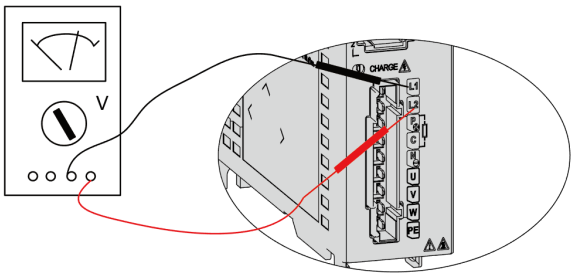


Figure 15-3 Input voltage detection instance

15.8.4 Motor Stall

Fault symptom

The motor shaft does not rotate with an operation command after the drive is enabled.

Troubleshooting

No.	Possible cause	Detection method		Solution
1	The emergency stop function of the drive is triggered.	Check whether the emergency stop button has been pressed.		Release the emergency stop button.
2	The power cable or encoder cable is faulty.	Check whether the encoder terminal and power cable terminal are connected properly.		Re-connect the cables properly.
		Replace the cable and perform cross-verification to check whether the cable is disconnected.		Replace the cable.
3	The drive does not receive the commands.	Trigger jog through the keypad or software tool.	The motor rotates after jog.	1 .Trigger the jog function through the keypad or software tool. During jog, check whether the motor operates properly. If yes, check whether external references or references sent from the host controller are normal. 2 .Check whether certain functions of the drive can cause operation failure of the motor, such as low torque limit, emergency stop enable, references inconsistent with setting, or improper wiring of CN1. See wiring of CN1 in section "Wiring Instance".
			The motor does not rotate when jog is triggered.	The drive can report an alarm when the motor does not rotate upon receiving a reference. Check the alarm information displayed by the drive. Check the position or speed reference through the software tool. If the reference is not zero and the motor does not rotate, the drive reports an alarm, such as E939, E610, and E630. See the solutions for the fault code or replace the drive for cross-verification.

No.	Possible cause		Detection method	Solution
4	The motor is abnormal.	The motor is damaged internally.	Check whether the motor is damaged. If yes, replace the motor, and perform cross-testing.	Contact Inovance service personnel to replace the motor.
		The motor brake is not released.	Check whether the brake is not connected to the power supply.	Connect the brake to a 24 V power supply. After the brake is released, you can rotate the motor shaft manually. See section "Brake Wiring Instance" for correct wiring of the brake.
5	The load is stalled.		Check whether the load is stalled, leading to motor stall.	Rectify the fault For stall-related solutions, see E630.0 in section "Troubleshooting".

15.8.5 Failure To Connect Software Tool

Fault symptom

The PC cannot detect the serial port.

Troubleshooting

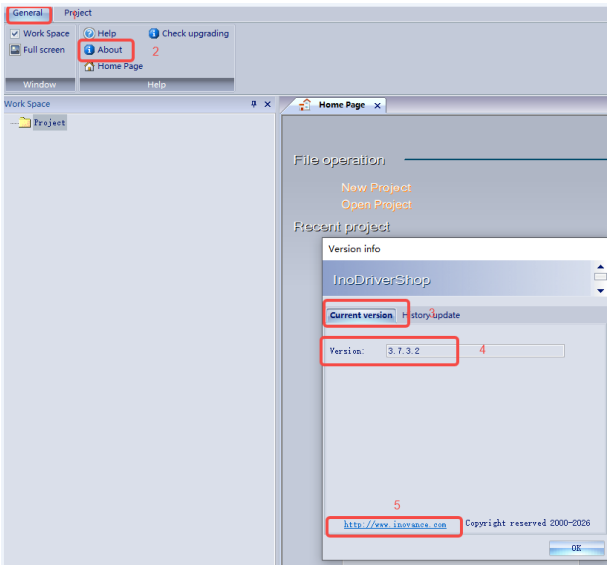
No.	Possible cause	Detection method/Solution		Remarks
1	The version of the software tool is outdated.	Check whether it is the latest version.	Update the software tool to the latest version on the official website.	"①" on page 710
2	The COM terminal is set improperly.	Open the software tool and check whether the COM port setting is correct in the connection serial port.	Re-select the correct COM port.	"②" on page 711
3	The communication parameters are set improperly.	Open the software tool and check whether the baud rate and other settings are correct.	Set the correct node address, baud rate, and parity bit according to H0E.00, H0E.80, and H0E.81.	
4	The serial port (COM port) is occupied by another software.	Open the software tool and check whether the serial port (COM port) is occupied.	Close other software occupying the COM port and reconnect the software.	
5	The communication cable is improper.	The communication cable is incompatible.	Please select the correct cable.	"③" on page 712
		The communication cable is faulty.	Perform a cross-test and replace the cable.	-
6	The drive is faulty.	Replace the drive and perform a cross-test.	Contact Inovance service personnel.	-

Detailed detection methods and solutions

①

Check whether it is the latest version.

Follow steps 1 to 4 in the figure below to confirm the current version, open the link in step 5, and compare it with the latest version on the official website.

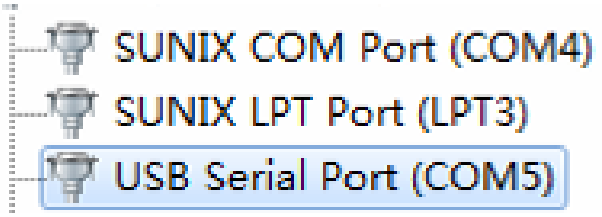


②

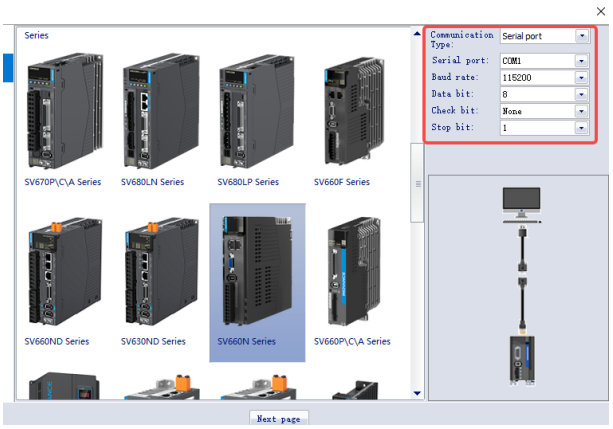
Confirm the serial port and related parameter settings.

Open the software tool, select "Connect serial port" from the "Start" menu, and in the pop-up dialog box, select the correct COM port, station number, and baud rate.

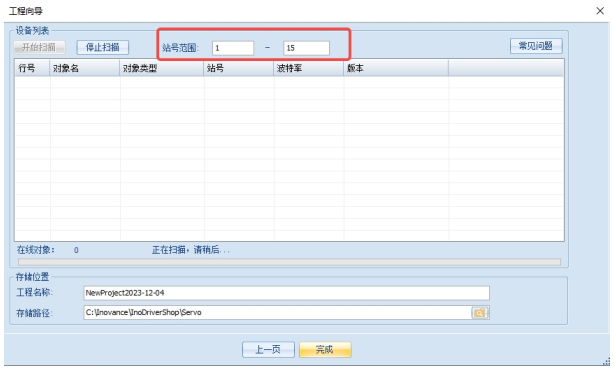
1. Find the corresponding port.



2. Select the correct COM port and baud rate.



3. Ensure the value of H0E.00 is within the "Station number range," and to minimize the scanning time, set the value of H0E.00 as low as possible.
   The default value of H0E.00 is 1.



③

Select the correct communication cable.

Communication cable model: S6-L-T00-3.0; Servo drive-to-PC communication cable

15.8.6 Parameters cannot be modified.

Fault symptom

- When manually changing parameters via the keypad, the parameters do not change with the increase (△) or decrease (▽) keys.
- When modifying parameters via the software tool, after writing the selected parameter, the drive parameter is not updated.

Troubleshooting

No.	Fault type	Possible cause	Detection method/Solution		Remarks
1	Parameters cannot be modified via keypad/ software tool.	Some parameters cannot be modified when the drive is enabled.	Check whether the drive is enabled.	Turn off the S-ON signal and modify parameters again.	"①" on page 712
		The user password (H02.30) is enabled.	Check that the password is entered correctly.	If the password is forgotten, contact the equipment manufacturer and enter the correct password.	-
2	The drive is faulty.	An internal fault occurs on the drive.	Replace the drive and perform a cross-test.	Contact Inovance service personnel.	-

Detailed detection methods and solutions

①

The following describes parameter setting methods.

Parameter setting methods are divided into "During running" and "At stop". Parameters set in stop state must be changed after the S-ON signal is turned off. Determine the parameter setting method through the user guide first and then modify parameters through the keypad.

See section "Status Display" for servo status display.

15.8.7 Tripping upon Power-on

Fault symptom

When the drive is powered on, the air switch on the power supply circuit trips.

Troubleshooting

No.	Possible cause		Detection method	Solution
1	The rated current of the air switch is excessively low.		See the input power supply specifications of the drive to check whether the rated current of the air switch is excessively low.	Select a circuit breaker of the correct specification. For detailed circuit breaker selection, see section "Electrical Peripherals".
2	The drive is wired improperly.	The input power supply terminal/PN of the main circuit/control circuit is short-circuited.	Check whether the input cables of the main circuit/control circuit are short-circuited, or whether the braking resistor is connected to PN by mistake.	Perform wiring again based on the terminal assignment. For information regarding main circuit terminals, see section "Power Wiring Instance".
3		The power cable is faulty.	After ensuring the cables are normal, replace the cables and perform a cross-test.	Contact the equipment supplier.
4	The drive is faulty.		Replace the drive and perform a cross-test.	Contact the equipment supplier.

15.8.8 The host controller cannot receive the DO signal output from the drive.

Fault symptom

After setting the DO function, the host controller cannot receive the DO signal output from the drive.

Troubleshooting

No.	Possible cause		Detection method/Solution		Remarks
1	The DO terminal does not generate output.	Check the status of the DO bit through H0b.05.	Not changed. Check whether parameters in group H04 are configured improperly.	Reconfigure parameters in group H04.	See detailed detection methods and solutions in: "*The DO terminal does not generate output.*" on page 714
			Changed. Check whether the DO wiring is correct.	Perform wiring properly.	
		The DO terminals are wired improperly.	Check whether the wiring is proper.	Perform wiring properly.	
2	The DO signals are disturbed.		The DO signal cable and power cable are routed in parallel or routed close to each other.	Route the DO signal cable and power cable through different routes. Check the DO wiring. Do not route the signal cable and power cable in parallel or route them close to each other.	See detailed detection methods and solutions in: "*The DO signals are disturbed.*" on page 715
3	The load exceeds the load capacity of the DO.		When using an external power supply, the resistance of the current-limiting resistor is excessively high.	Check whether the resistance of the current-limiting resistor value is excessively high.	See detailed detection methods and solutions in: "*The load exceeds the load capacity of the DO. When an external power supply is used, supply voltage is unstable or excessively low.*" on page 715
4	When using an external power supply, the power supply voltage is unstable or excessively low.		Check whether the power supply voltage is stable or excessively low.	Adjust the resistance of the current-limiting resistor to ensure the current does not exceed 50 mA. Alternatively, you can use the internal 24 V power supply.	
5	The DO terminals are abnormal.		Replace the DO terminal and perform cross-verification.	If the DO terminal works properly, continue using it. If it does not generate output, replace the drive.	-

Detailed detection methods and solutions

The DO terminal does not generate output.

- You can check the DO level status through H0b.05. For detailed instructions, see section "Forced DI/DO Setting".
- For correct wiring of DO, see section "DO Signals".

The DO signals are disturbed.

Route the DO cables and main circuit cables (R/S/T, U/V/W) or other power cables through different routes with a distance of at least 30 cm. Failure to comply can disturb I/O signals.

The load exceeds the load capacity of the DO. When an external power supply is used, supply voltage is unstable or excessively low.

Check the resistance of the current-limiting resistor.

Ensure that the DO loop current does not exceed 50 mA.

- The following formula is used to calculate the external current-limiting resistor for DO1 and DO2.

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

- The calculation formula for the external current-limiting resistor of DO3 is as follows.

$$\frac{\text{VIN-VF-0.75}}{5} - 51 \geqslant \text{R(K}\Omega\text{)} \geqslant \frac{\text{VIN-VF-0.75}}{50} - 51$$

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.

Note

Common causes of DO errors are as follows:

- If the upstream device provides relay input, the flywheel diode is not connected, or the polarity of the flywheel diode connected is incorrect.
- If the upstream device provides relay input, but the relay impedance is excessively low (a resistor needs to be connected in series), the drive DO output optocoupler current can exceed 50 mA. The maximum allowable voltage of the drive DO circuit is 30 VDC. The maximum current is DC 50 mA.
- The DO is not integrated with a current-limiting resistor. You need to select an appropriate current-limiting resistor based on the DO load and pull-up voltage. Also, note that the number of DIs that can be driven simultaneously is determined according to the DO driving capability and the internal impedance of the downstream DI (DIs of all drives and PLCs are integrated with current-limiting resistors).

15.8.9 Tripping/Leakage Current of Residual Current Device

Fault symptom

The residual current device trips when the drive is powered on or during operation.

Troubleshooting

No.	Fault symptom	Possible cause	Detection method/Solution	Remarks
1	The residual current device trips immediately upon power-on.	The interference resistance performance of the residual current device is poor.	• Use RCDs of recommended brands. • Use a RCD with a higher tripping current. • Move the unbalanced load to the upstream side of the residual current device. • Disconnect the filter grounding terminal to reduce the ground capacitance of the input end.	"*Recommended residual current device model*" *on page 716*
2		The tripping current of the residual current device is excessively low.		
		An unbalanced load is connected on the downstream of the residual current device.		
		Excessive ground capacitance exists in the upstream of the drive.		
3	Residual current device trips during operation.	The interference resistance performance of the residual current device is poor.	• Use RCDs of recommended brands. • Use a RCD with a higher tripping current. • Install a simple filter on the input side of the drive, and wind the L/N cables around the magnetic ring near the residual current device. • Reduce the carrier frequency without compromising the performance. • Use shorter motor cables.	"*Recommended residual current device model*" *on page 716* "*Selection of the EMC Filter*" *on page 717* "*Leakage current test*" *on page 717*
		The tripping current of the residual current device is excessively low.		
4		An unbalanced load is connected on the downstream of the residual current device.		
		The ground distributed capacitance of the motor cable or motor is excessively high.		

Detailed detection methods and solutions

Recommended residual current device model

- 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.
- Use Chint or Schneider RCDs (recommended).

Selection of the EMC Filter

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

Use CE-compliant filters that comply with the emission requirements in Category C2 of EN 61800-3. Properly ground the filter. Keep the cable connecting the filter and the controller shorter than 30 cm.

For EMC-related model selection, see the EMC filter section in section "Electrical Peripherals".

Leakage current test



It is recommended to prioritize power input cables when using a magnetic ring. Never wind the PE line around a magnetic ring.

Use a multimeter to detect the current value (mA, AC) between the PE terminal of the drive and PE wire of the power supply cable for leakage current detection.

For magnetic ring and ferrite clamp selection, see section "Electrical Peripherals" in the user guide. For how to install the magnetic ring and ferrite clamp, see section "Instructions for Installing the Magnetic Ring and Ferrite Clamp" in the user guide.

15.8.10 Brake Release Failure

Fault symptom

After the drive is enabled, the brake cannot be released, which may cause excessive drive load rate or motor stall.

Troubleshooting

No.	Possible cause	Detection method	Solution
1	The motor brake is wired improperly.	See section "Wiring of the Brake" in the user guide.	-
2	The DO is faulty.	For details, see *"15.8.8 The host controller cannot receive the DO signal output from the drive." on page 713*	-

No.	Possible cause	Detection method	Solution
3	The brake relay is faulty.	Check whether the relay acts. After supplying 24 V power directly to the relay coil, if you hear the relay engage, it indicates the relay acts properly.	Replace the relay.
4	The brake winding is faulty.	Check whether the motor brake winding is faulty, replace the motor, and perform cross-verification.	Replace the servo motor.

15.8.11 Panel Display Error

Fault symptom

LED display errors occur, include missing segments, extra segments, garbled characters, "RESET" displayed continuously, flashes continuously in Run mode, and five horizontal lines displayed.

Troubleshooting

No.	Fault symptom	Possible cause	Detection method/Solution	
1	The LED displays extra or missing segments.	The drive is abnormal.	Power off and restart the drive. If the fault persists, replace the drive.	
2	The LED continuously displays garbled characters or displays Fault.			
3	The LED continuously displays RESET, either constantly lit or flashing.			
5	The panel flashes continuously in the Run mode.	The speed or other parameters are displayed by default as set by the drive.	Check the setting of H02.32.	The default value 50 is displayed by default as defined by H02.32.
6	Five horizontal lines are displayed.	The user password was inadvertently set by the customer.	Check whether a new password is set in H02.30.	Try setting a password in H02.30 or directly restore default setting.

15.8.12 "88888" Displayed upon Power-on

Fault symptom

"88888" is displayed upon power-on.

Troubleshooting

No.	Possible cause	Detection method/Solution	
1	The drive is abnormal.	Power off and on the drive again.	If the fault persists, contact Inovance service personnel.

16 Maintenance

16.1 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.

16.2 Maintenance Interval

Electrical and electronic parts inside the servo drive 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.

Target	Type	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 interval is for reference only. If any device/component works improperly before the replacement interval expires, replace it immediately.
	Cooling fan	5 years (ambient temperature: 30°C; load rate: 80%; uptime per day: 20 hours; standard environment [1])	
	Control circuit aluminum electrolytic capacitor	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 1000 operations (rated motor speed at an interval of 5 min and inertia ratio of 20/1)	
	Dynamic braking resistor		
Motor	Bearing	22,000 h to 40,000 h	The standard replacement interval is for reference only. If any device/component works improperly before the replacement interval expires, replace it immediately.
	Fan	30,000 h to 40,000 h	
	Encoder	22,000 h to 40,000 h	
	Encoder battery	22,000 h to 40,000 h	
	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 20000 hours, whichever comes first.	Perform maintenance based on the related maintenance guide of the equipment.

Note

[1]: See " *Installation Environment Requirements" on page 55* for the standard environment.

16.3 Routine Maintenance

16.3.1 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 16–1 Routine checklist

No.	Routine Checklist	Compliance
1	The ambient temperature and humidity are normal. There is no dust or unwanted objects in the motor.	☐
2	There is no unusual 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 vent.	☐
6	There is no intrusion of unwanted object on the load end.	☐

Routine Cleaning List

Table 16–2 Routine cleaning list

No.	Routine Cleaning List	Compliance
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.

16.3.2 Regular Checklist

Table 16–3 Regular checklist

No.	Item	Compliance
1	Check that the screws used to fix the couplings between equipments 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).

16.4 Parts Replacement

16.4.1 Replace the servo drive.

Caution

- 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.

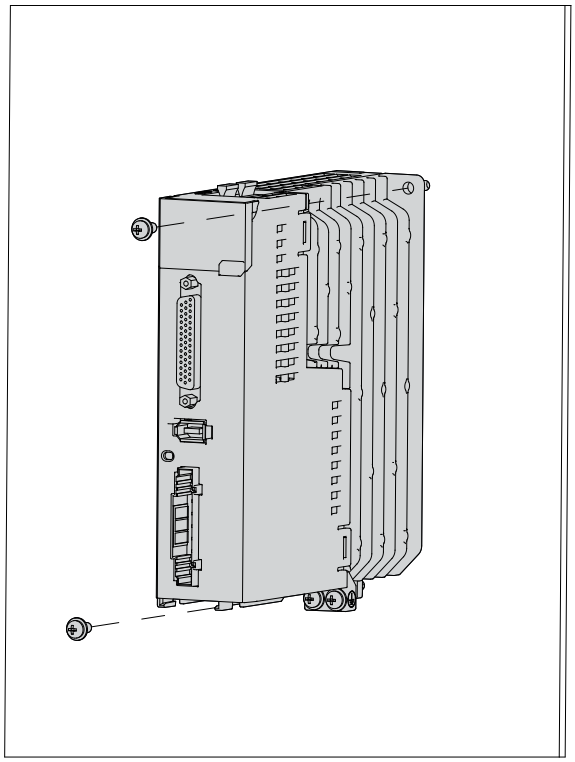
Note:

Servo drives in sizes A and C are secured by two screws, with one screw on the top and the other one at the bottom.

- Drives in size D are secured by three screws, with two screws on the top and 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 according to the checklist. For details about mechanical installation and the post-installation checklist, see *" Mechanical installation" on page 69*.
6. Re-connect the cables and check the items according to the post-inspection checklist. For details about electrical installation and the post-wiring checklist, see *" Wiring" on page 76* .
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 135* and *" Commissioning and Operation" on page 163*.

16.4.2 Replacing the Motor Feather Key

Caution

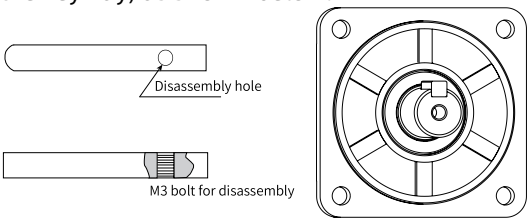
- Observe all the requirements presented in this chapter. Failure to comply may result in equipment fault or damage.
- Violent disassembly is not allowed. Take enough care during disassembly to prevent personal injury.

Standard MS1 series motors in frame sizes 60, 80, and 130 adopt C-type flat key that carries the disassembly hole. 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		
MS1 motor	Dimensions of the flat key (unit: mm)	Disassembly bolt (inner hexagon bolt)
60	C-type flat key: C5 x 5 x 16.5	M3 x 10 and above
Frame size 80	C-type flat key: C6 x 6 x 25	M3 x 15 and above
Frame size 100	C-type flat key: C8 x 7 x 35	M3 x 20 and above
Frame size 130	C-type flat key: C8 x 7 x 35	M3 x 20 and above
Frame size 180	C-type flat key: C10 x 8 x 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 bolt clockwise until A-A end of the flat key is completely detached from the keyway, as shown below.



17 Servo Drive Technical Data

17.1 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
	Surge current (A)	17.0	17.0	17.0	11.3	11.3
Control circuit	Control circuit power supply	No separate power supply required [4]			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	
	Min. resistance of external resistor (Ω)	40	40	40	20	15
	Max. braking energy absorbed by capacitor (J)	7.86	15.72	22.39	32.39	32.39
	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		Fan-cooled		
Overvoltage category		OCIII				
Max. input inrush current (A)		18.65	18.65	18.65	12.44	12.44
3τ (ms) (3 x 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
	Surge current (A)	11.3	11.3
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	
	Min. resistance of external resistor (Ω)	20	15
	Max. braking energy absorbed by capacitor (J)	32.39	32.39
	Braking resistor	Built-in braking resistor (external braking resistor supported)	
Cooling method		Fan-cooled	
Overvoltage category		OCIII	
Max. input inrush current (A)		12.44	12.44
3τ (ms) (3 x 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
	Surge current (A)	20.7	20.7	20.7	20.7	20.7	20.7	20.7
Control circuit	Control circuit power supply	Single-phase 380 VAC–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
	Min. resistance of external resistor (Ω)	80	60	45	40	35	25	25
	Max. braking energy absorbed by capacitor (J)	28.18	34.22	50.32	50.32	100.64	100.64	100.64
	Braking resistor	Built-in braking resistor (external braking resistor supported)						

Item	Size C		Size D		Size E		
Cooling method	Fan-cooled						
Overvoltage category	OCIII						
Max. input inrush current (A)	24.89	24.89	24.89	24.89	24.89	24.89	24.89
3τ (ms) (3 x 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]: 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.

17.2 Technical Specifications

Item				Description
Basic 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 in absence of the battery
	Conditions for use	Operating/Storage temperature[1]		0°C to 55°C (average load ratio not exceeding 80% in ambient temperatures between 45°C to 55°C) (non freezing) /–20°C to +70°C
		Use/Storage humidity		Below 90%RH (without condensation)
		Vibration resistance		4.9 m/s^2
		Impact resistance		19.6 m/s^2
		IP rating		IP20
		Pollution degree		PD2
		Altitude		The maximum altitude is 2000 m. 1000 m and below: Derating is not needed. For altitude above 1000 m, derate 1% for every additional 100 m. For altitude above 2000m, contact Inovance.
Speed/ Torque control mode	Performance	Load change ratio		Below 0.5% at 0–100% load (under rated speed)
		Voltage change ratio		0.5% at rated voltage ± 10% (under rated speed)
		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.)
		Soft startup time setting		0s to 65s (Acceleration and deceleration can be set separately.)
	Input signal	Speed reference input	Global Variable	Speed 0 to 15 selectable through DI signal combination
		Torque reference input	Global Variable	-

Item				Description
Position control mode	Performance	Feedforward compensation		0% to 100.0% (resolution: 0.1%)
		Timing window		1–65535 in encoder unit
	Input signal	Pulse reference	Input pulse forms	Four forms: Direction+Pulse, positive logic; Direction+Pulse, negative logic; phase A + phase B quadrature pulse; and CW/CCW pulse
			Input forms	Differential input; open collector
			Input pulse frequency	Differential input: single: 4 Mpps, quadrature: 8 Mpps, pulse width ≥ 0.125 μs Open collector: max. single pulse frequency: 200 Kpps, pulse width must not be less than 2.5 μs
		Power supply for built-in open collector[3]		+24 V (built-in 2.4 kΩ resistor)
		Multi-position reference selection		Position 0 to position 15 selectable through DI signal combination (Other terminals can be assigned with this function.)
	Position output	Output forms		Phase A, phase B: differential output
				Phase Z: differential output or open collector output
		Frequency division ratio		Any frequency division
Input/ Output signal	DI signal	DI signal function assignment		7 DIs
				DI1 to DI5: Max. input frequency is 1 kHz (decreasing when current limit resistance is greater than 2.4 kΩ); DI8 to DI9: signal input hardware delay is less than 1 ms (current limit resistance is 2.4 kΩ)
				The DI functions are as follows: Servo enable, alarm reset, gain switching, reference switching, Mode switching, zero clamp enable, position reference inhibit, pulse reference inhibit, Forward overtravel, reverse overtravel, speed limit, torque limit, Forward and reverse jog, step enable, hand wheel switching, electronic gear selection, reference direction setting, home switch, homing enable, current position as home, emergency stop, multi-position, interrupt positioning, axis control command, position deviation clearing, positioning and command completion signal clearing
	DO signal	Output signal function assignment		5 DOs; with-load capacity: 50 mA; voltage range: 5 V to 30 V
				The DO function is as follows: Servo ready, motor rotation signal, zero speed signal, speed consistent, speed attained, torque attained, positioning completed, positioning proximity, torque limit, speed limit, braking, warning output, fault output, warning or fault output, interrupt positioning completed, homing completed, electrical homing completed, enable completed, internal command completed, allow to write next command, and internal motion completed

Item			Description
Built-in functions	Overtravel prevention		The drive stops immediately when P-OT or N-OT signal is active.
	Electronic gear ratio		0.001 ≤ B/A ≤ 3355443.2
	Protection functions		Including protections against overcurrent, overvoltage, undervoltage, overload, main circuit detection error, heatsink overheat, power phase loss, overspeed, encoder error, CPU error, parameter error, and other errors.
	LED display		Main circuit CHARGE indicator, 5-digit LED display
	Vibration suppression		5 notches (including two adaptive notches) available, 50 Hz to 8000 Hz
	Usability functions		One-key parameter tuning, adaptive parameter tuning, speed observer, and model tracking
	Communication function	Background commissioning	RJ45 Modbus
		Multi-station communication	RS485
		Number of multi-station communication axes	When using Modbus communication, the maximum number of stations is 32
		Axis address setting	No physical knob, set through the software
		Function	Including status display, user parameter setting, monitored value display, fault tracing display, JOG and auto-tuning, and communication and motion control command setting
	Other functions		Gain adjustment, alarm logging, JOG operation

Note

- [1] The environment where the servo drive is installed must be within the specified temperature range. When it is installed inside a control cabinet, the temperature inside the cabinet must also be within this range.
- The internal open collector power supply is not electrically insulated from the control circuit in the servo drive.
- The main circuit of the servo drive supports single-phase 220 V power supplies without derating.

17.3 Communication Specifications

Item		Specification
Modbus RTU slave device performance	Link layer protocol	RS485
	Application layer protocol	Modbus RTU, GBT 19582.2-2008, using custom command area
	Baud rate	115200 bps
	Duplex mode	Half-duplex
	Data format	8-N-1 (8 data bits, no parity check, 1 stop bit)

17.4 Dynamic Brake Characteristics

Calculating the approximate dynamic braking distance

The initial speed and load inertia, the dynamic braking distance can be estimated according to the motor model. The approximate value of the dynamic braking distance can be calculated by the following formula.

Maximum braking distance s (turn) is:

$$s = \frac{V_0}{60}(t_e + (\tau_1 + \tau_2 V_0^2)(1 + \frac{J_L}{J_M}))$$

The coefficient is as follows:

$$\tau_1 = \frac{2R_s J}{3p_n^2 \Psi_f^2} = \frac{10000\pi^2 R_s J}{9K_e^2}$$

$$\tau_2 = \frac{\pi^2 L_d^2 J}{4050 R_s \Psi_f^2} = \frac{100 L_d^2 \pi^4 P_n^2 J}{243 R_s K_e^2}$$

$$\Psi_f = \frac{\sqrt{6} K_e}{100\pi P_n}$$

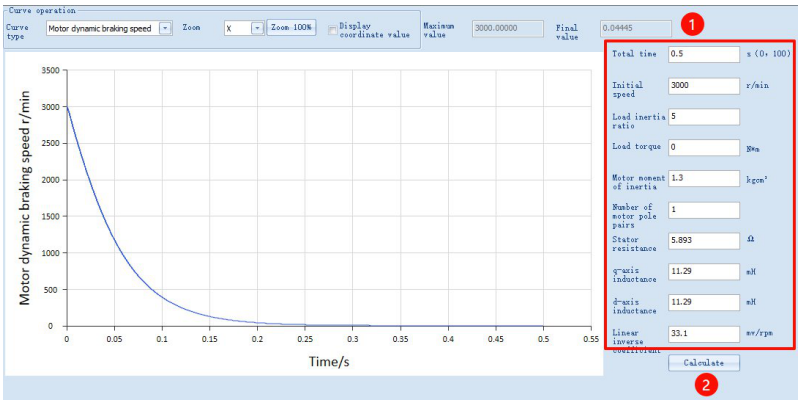
- V_0: Maximum feedback speed
- t_e: Dynamic brake program and relay delay
- J_L: Load moment of inertia
- J_M: Motor moment of inertia
- P_n: Number of motor pole pairs
- R_s: Stator resistance (Ω)
- K_e: Kelvin, unit of thermodynamic temperature
- L_q, L_d: q-axis inductance (mH), d-axis inductance (mH)

Calculating accurate dynamic braking distance

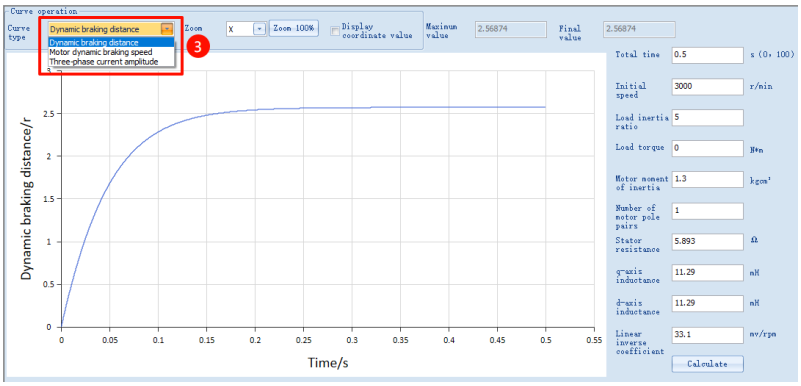
Use InoDriverShop for calculating accurate dynamic braking distance.

See detailed procedure below.

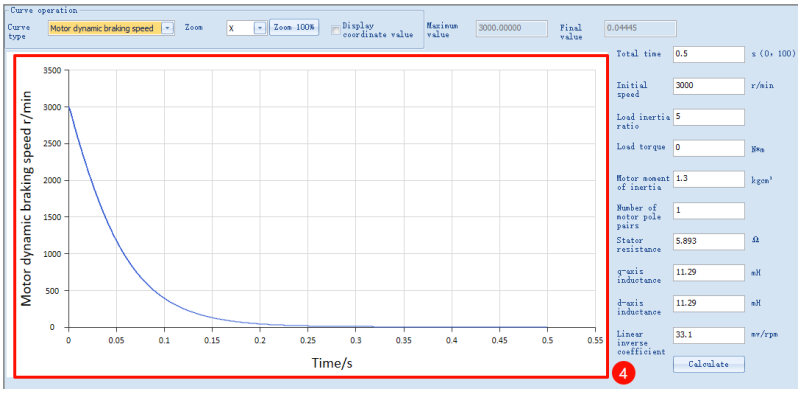
1. Set the corresponding parameters at ① according to actual motor, load, and operation parameters. The time range of the x-coordinate of the calculation chart can be adjusted by setting the total time.
2. After parameter setting is done, click "Calculate" at ② to generate dynamic braking measurement curve.



3. This function provides three dynamic braking calculation curves: dynamic braking distance-time curve (relationship between braking distance and time during dynamic braking), dynamic braking speed-time curve (relationship between motor speed and time during dynamic braking), and three-phase current amplitude-time curve (relationship between three-phase current amplitude and time during dynamic braking). You can select the curve type at ③ based on the curve needed.



4. After the curve type is selected, the curve is automatically generated at ④.



Application scenarios

To trigger dynamic braking at a motor speed of 3000 rpm and estimate how long can the motor stop (speed reduced to 0 rpm), do as follows. Set parameters at ① based on actual motor parameters. After calculation at ②, select "Dynamic motor braking speed" at ③ and a "Dynamic braking speed-time curve" will be generated automatically at ④.

17.5 Load Moment of Inertia

The load moment of inertia represents the ratio of load inertia to the rotor inertia. The higher the load inertia ratio, the weaker the responsiveness can be. An excessively high inertia ratio can result in unstable operation. The permissible 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 occur. In case of such alarms, take one of the following measures:

- Reduce the torque limit values.
- 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.

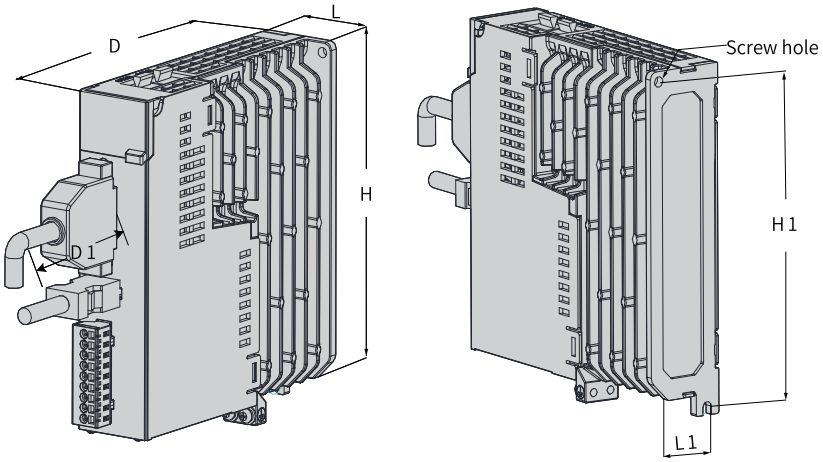
Table 17–1 Permissible load moment of inertia

Motor speed (rpm)	Drive model SV660 series											
	Size A		Size B	Size C			Size D			Size E		
	S1R6	S2R8	S5R5	S7R6	T3R5	T5R4	S012	T8R4	T012	T017	T021	T026
1500	x 20											
3000	x 20									x 10		
4500	x 20									x 5		
6000	x 20									x 5		Not supported
7000	x 20			Not supported								

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.

17.6 Product Dimensions

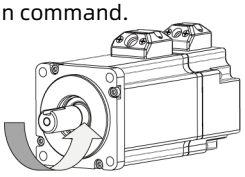


Size	L	H	D	L1	H1	D1	Tapped hole	Tightening Torque	Weight
	Unit: mm (in.)							Unit: (N·m)	Unit: kg (lb.)
A.	40 (1.57)	170 (6.69)	150 (5.91)	28 (1.10)	161 (6.34)	75 (2.95)	2 x M4	0.6 to 1.2	0.8 (1.76)
B	50 (1.97)	170 (6.69)	173 (6.81)	37 (1.46)	161 (6.34)	75 (2.95)	2 x M4	0.6 to 1.2	1.0 (2.20)
C	56 (2.20)	170 (6.69)	174 (6.85)	44 (1.73)	160 (6.30)	75 (2.95)	2 x M4	0.6 to 1.2	1.2 (2.65)
D	81 (3.19)	170 (6.69)	183 (7.20)	71 (2.80)	160 (6.30)	75 (2.95)	3xM4	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)

18 Motor Technical Specifications

18.1 Common Data

18.1.1 Mechanical Characteristics

Item	Description
Duty type	S1 (Continuous duty)
Vibration level [1]	V15
Insulation resistance	500 VDC, above 10 MΩ
Excitation mode	Permanent magnetic
Installation method	Flange type
Heat resistance level	Class F (155°C)
Insulation voltage	1500 VAC, 1 minute (220 V class) 1800 VAC, 1 minute (class 380 V)
IP rating of the enclosure	IP67 (excluding shaft opening and flying leads type motor connectors)
Direction of rotation	Rotates counterclockwise (CCW) when viewed from the shaft extension side with the 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 altitude	1000 m
	Altitude-based derating	• 1000 m and below: no derating. • Derating is required only for altitudes above 1000 m. An isolation transformer must be installed on the power supply side for altitudes above 2000 m. For details, see *"18.1.3 Derating Characteristics" on page 740*.
	Installation location	• Free from corrosive or explosive gases • Well ventilated and with minimum amount of dust, waste and moisture. • Convenient for inspection and cleanup. • Away sources that may generate strong magnetic fields. • Away from heating sources such as a heating stove. • Use the motor with oil seal in places with grinding fluid, oil mist, iron powders, or cuttings. • The oil seal is only dust-proof. It cannot withstand the intrusion of oil for a long term. If a directly connected reducer that requires long-term oil seal is used, contact Inovance for 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) • Humidity: 20% RH to 80% RH (without condensation)
Shock resistance [3] [5]	Shock acceleration (taking flange side as standard)	490 m/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.

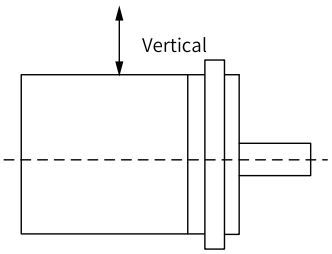


Figure 18-1 Shock applied on the motor

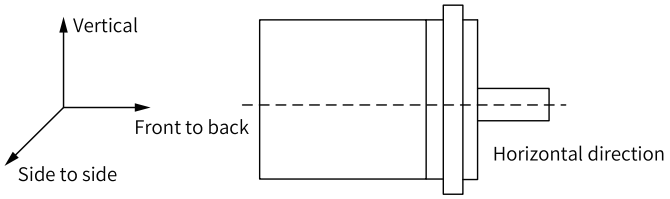


Figure 18-2 Vibration applied on the motor

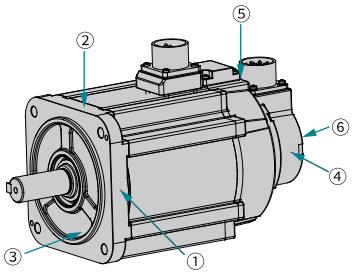


Figure 18-3 Max. allowable vibration limit of the motor

Direction	Measuring point	Limit value (10 Hz to 2000 Hz)
Radial	①②	49 m/s^2
	④⑤	49 m/s^2
Axial	③	24.5 m/s^2
	⑥	24.5 m/s^2

Note

The preceding vibration/shock standards cannot be applied for a long term. For long-term application, contact Inovance.

18.1.2 Overload Characteristics

The drive is compliant with NEC and CEC requirements and equipped with protective functions against overload and over-temperature.

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 motors with different load capacities, set the motor overload protection gain based on the overload threshold of the motor. Use the default gains in general conditions. However, when one of the following condition occurs, change the gains based on the temperature rise condition of the motor:

- 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.

Motor overload protection curve is as follows:

- **MS1H1/H4 (frame size 40/60/80)**

Load ratio (%)	Operation 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

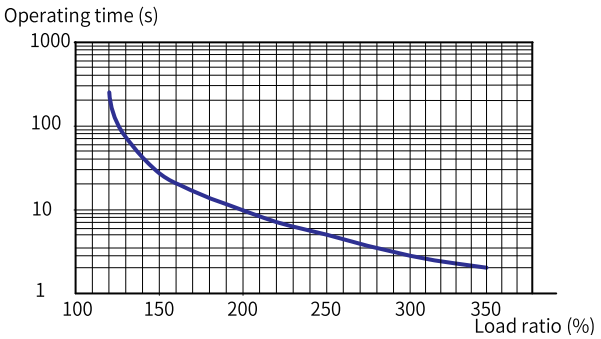


Figure 18-4 MS1H1/H4 (frame size 40/60/80) series motor overload curve

Note

The maximum torque of H1 and H4 models is the rated torque x 3.5.

- **MS1H2/MS1H3**

Load ratio (%)	Operation 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
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260	11
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275	9
280	8
285	7
290	6
295	5
300	5

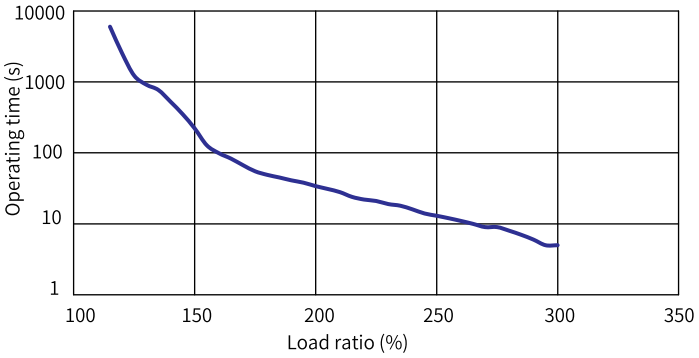


Figure 18-5 Overload curve of MS1H2 and MS1H3 series motors

Note

- The maximum torque of H2 models is the rated torque x 3.
- The maximum torque of H3 models is the rated torque x 2.5.

18.1.3 Derating Characteristics

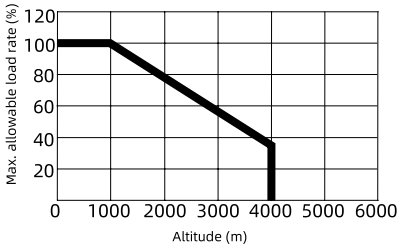
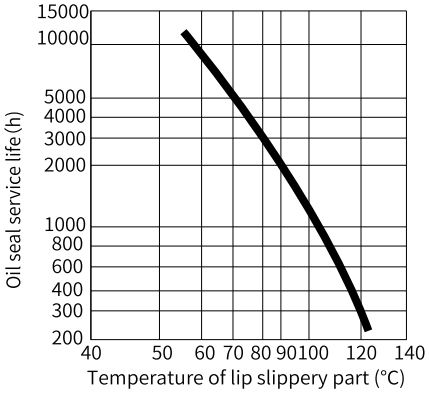


Figure 18-6 Altitude-based derating curve

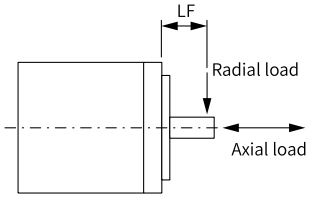
18.1.4 Temperature Curve of the Oil Seal



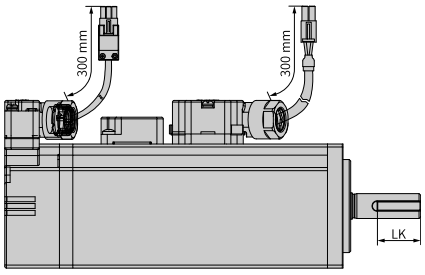
18.2 Selection Data (MS1-R Series Servo Motor)

18.2.1 Model Description

- Description of torque-speed characteristics curves:
  - Technical data and torque/speed characteristic values in the following tables are applicable to motors working with Inovance servo drives with the armature coil temperature being 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 (mm) (aluminum)
  - MS1H2-10C to 25C: 400 × 400 × 20 (mm) (steel)
  - MS1H2-30C to 50C: 400 × 400 × 20 (steel)
  - MS1H3-85B to 18C: 400 × 400 × 20 (steel)
  - MS1H3-29C to 55C: 550 × 550 × 30 (mm) (aluminum)
  - MS1H3-75C: 700 × 700 × 30 (mm) (aluminum)
- Radial and axial loads of the motor:



- Dimensions of flying leads type motors
  Flying leads type motors with frame size 80 and smaller (model ended with "-S") provide a drain wire of about 300 mm in length, as shown in the following figure.



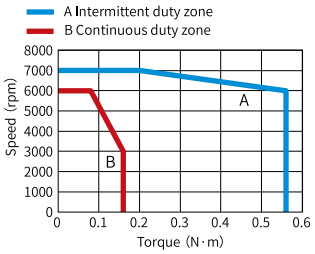
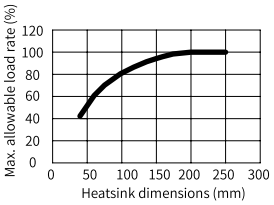
- As shown in the preceding figure, the product is marked with an LK value in the dimension diagram in the section of each model. LK indicates the length of the shaft key.
- MS1H3 (130-flange and 180-flange) comes with a key slot. When the operating speed is above 3000 rpm, the motor must run with the 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.

18.2.2 Low Inertia and Small Capacity (MS1H1)

18.2.2.1 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 ($kg·cm^2$)	Motor without brake	0.018 ± 10%	
	Motor with brake	0.0208 ± 10%	

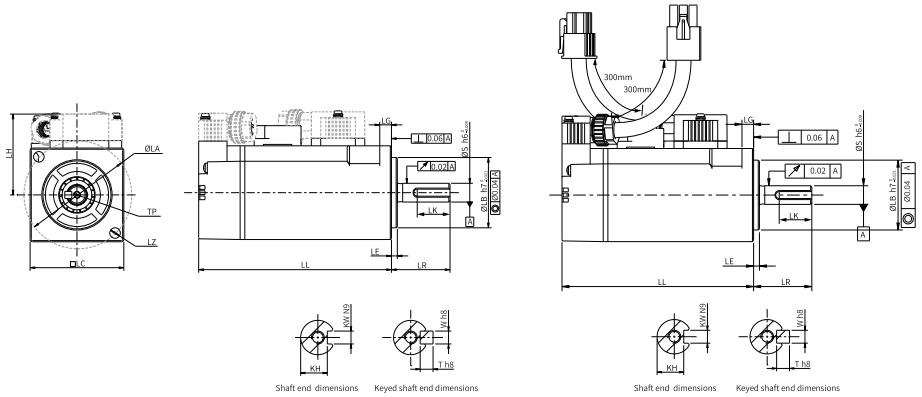
Electrical specifications of the brake

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 load

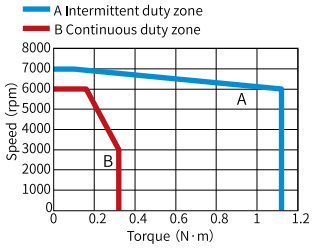
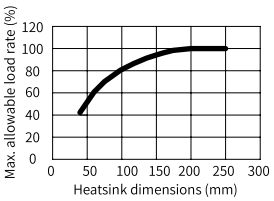
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

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)

18.2.2.2 MS1H1-10B30CB-A33*R

Motor specifications			Torque-speed characteristics
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		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%	

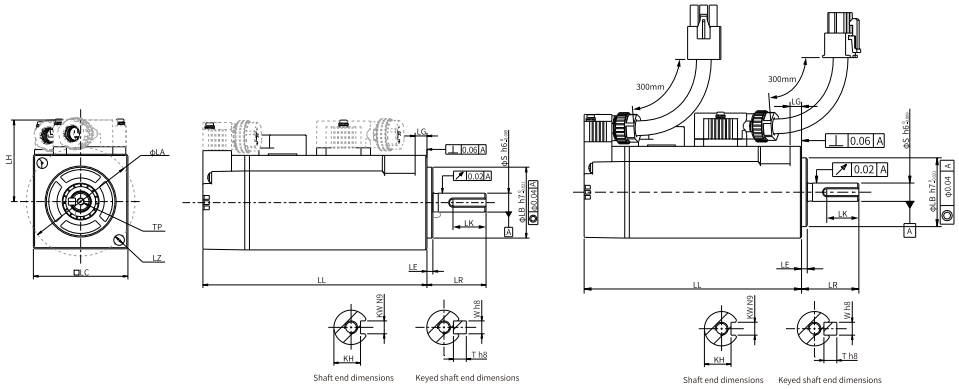
Electrical specifications of the brake

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 load

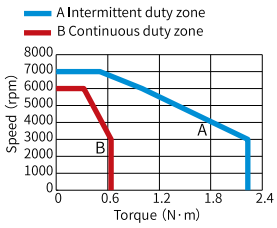
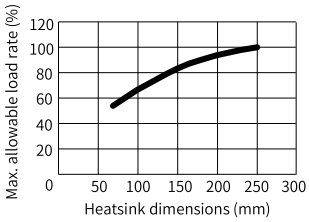
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
20	≤ 78	≤ 54

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)

18.2.2.3 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·cm²)	Motor without brake	0.094 ± 10%	
	Motor with brake	0.106 ± 10%	

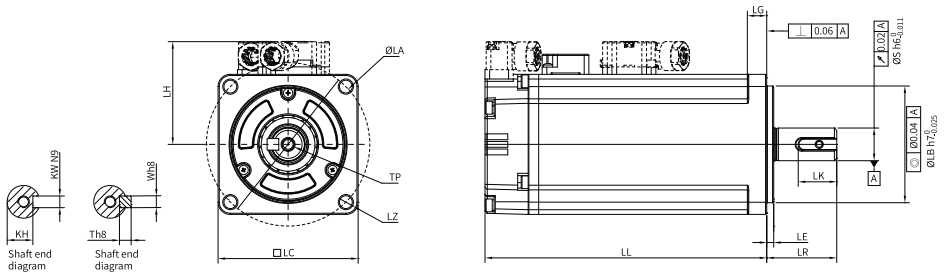
Electrical specifications of the brake

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

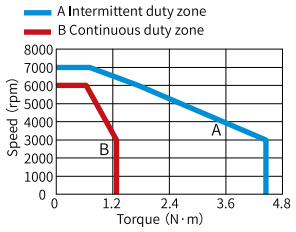
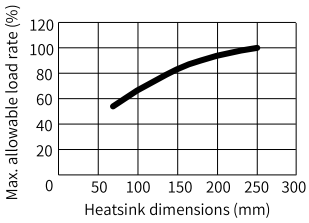
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

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)

18.2.2.4 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%	

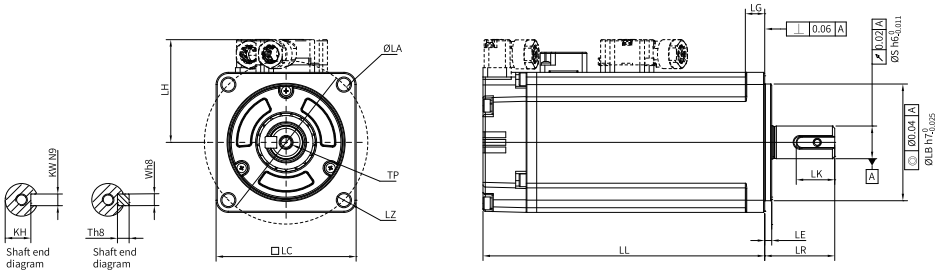
Electrical specifications of the brake

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

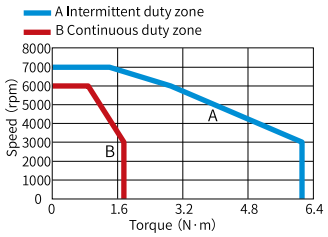
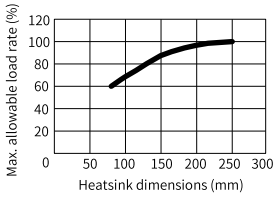
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

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)

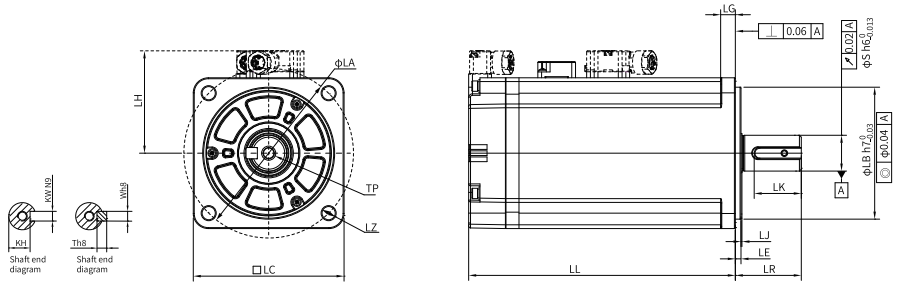
18.2.2.5 MS1H1-55B30CB-A33*R

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·cm^2)	Motor without brake	0.55 ± 10%	
	Motor with brake	-	

Allowable load

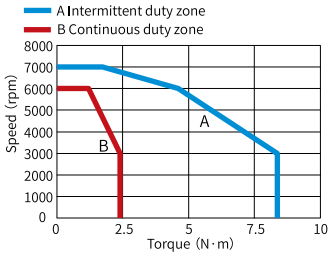
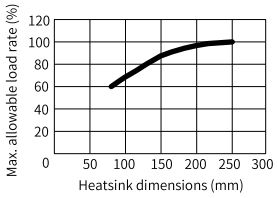
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

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

18.2.2.6 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%	

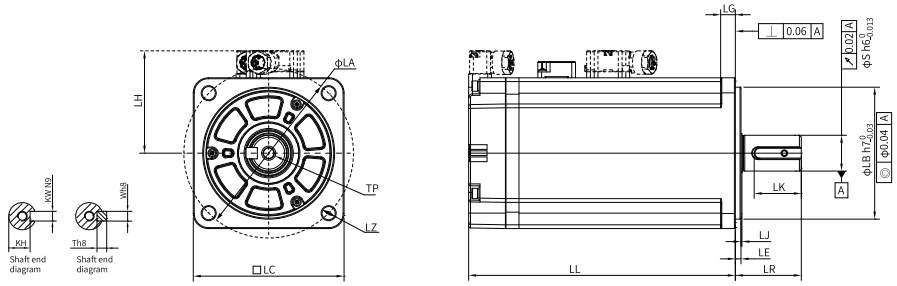
Electrical specifications of the brake

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

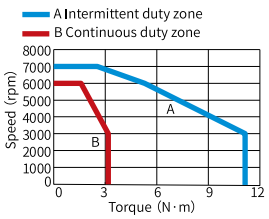
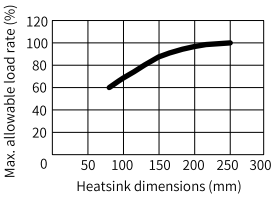
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

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)

18.2.2.7 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%	

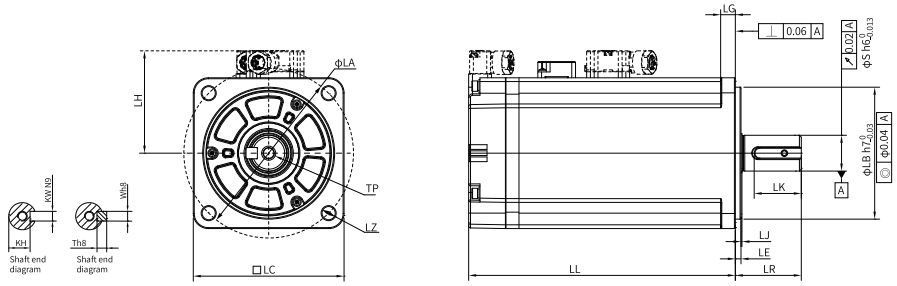
Electrical specifications of the brake

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

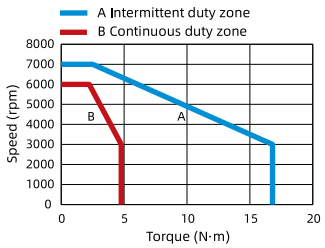
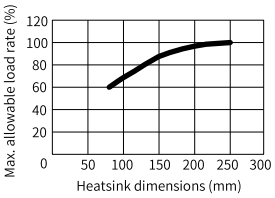
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

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)

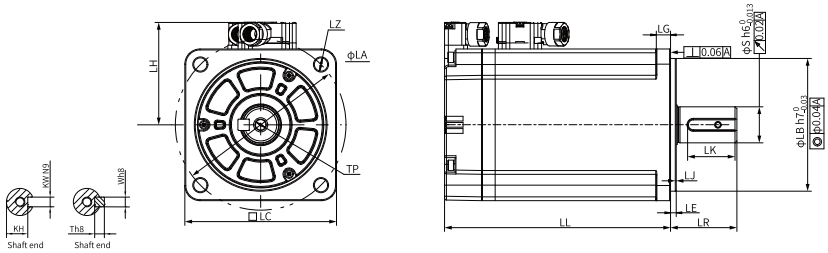
18.2.2.8 MS1H1-15C30CB-A33*R

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

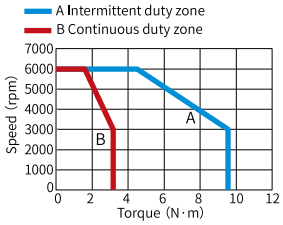
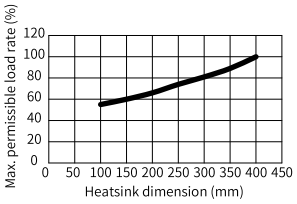
Product dimensions (mm)



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

18.2.3 Low Inertia and Medium Capacity (MS1H2)

18.2.3.1 MS1H2-10C30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, 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 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%	

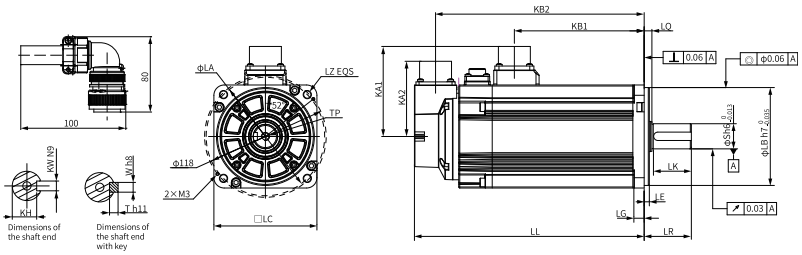
Electrical specifications of the brake

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 load

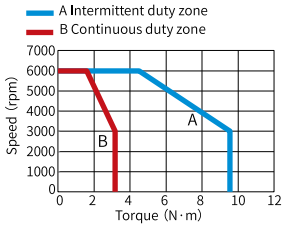
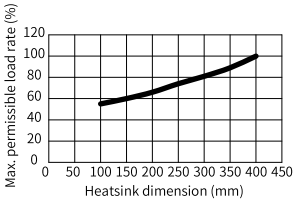
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.2.3.2 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·cm²)	Motor without brake	1.78 ± 10%	
	Motor with brake	2.6 ± 10%	

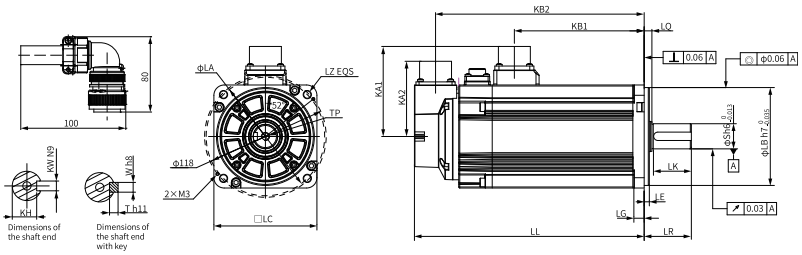
Electrical specifications of the brake

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

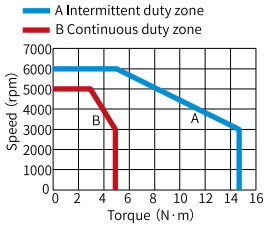
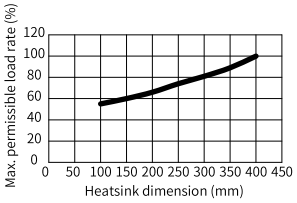
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.2.3.3 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·cm^2)	Motor without brake	2.35 ± 10%	
	Motor with brake	3.17 ± 10%	

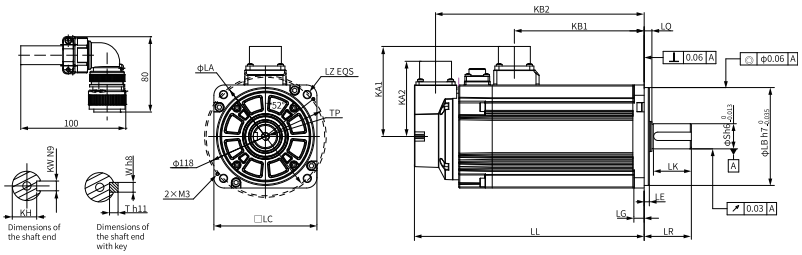
Electrical specifications of the brake

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

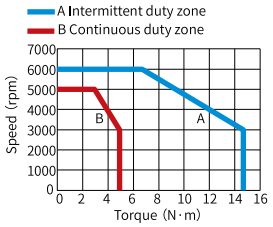
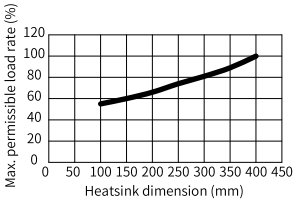
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.2.3.4 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%	

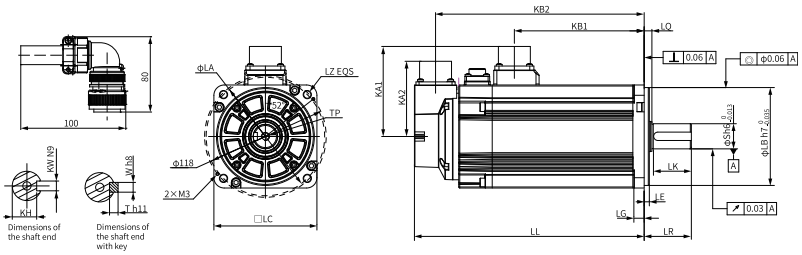
Electrical specifications of the brake

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)

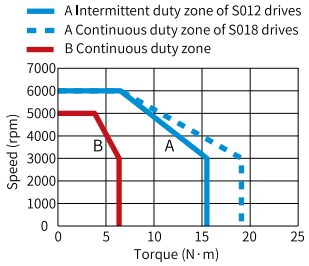


LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
100	161 (189)	45 ± 1	115	4 × ϕ7	88	92	73	140.5 (168.5)	10	5 ± 0.3
LQ	LB		S	TP	LK	KH	kW	W	T	Weight (kg)
7.5 ± 0.75	95		24	M8 × 16	350 -0.62	200 -0.2	8	8	7	4.65 (5.75)

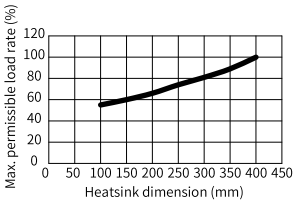
18.2.3.5 MS1H2-20C30CB-A33*R

Motor specifications		
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	
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%

Torque-speed characteristics



Heatsink-based derating curve



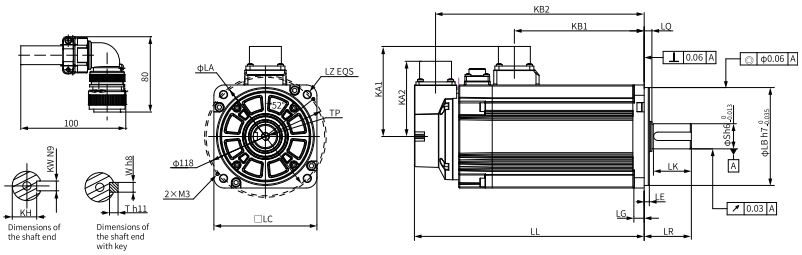
Electrical specifications of the brake

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 (°)
8	24	17.6	32.73	0.73	≤ 100	≤ 40	≤ 1

Allowable load

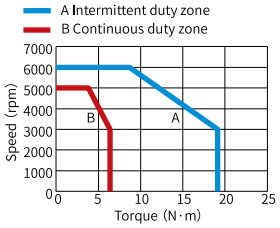
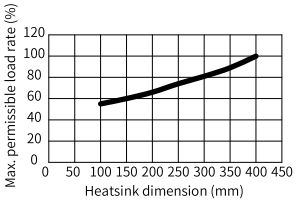
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.2.3.6 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%	

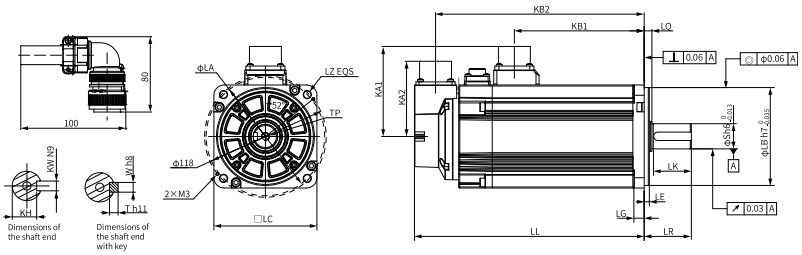
Electrical specifications of the brake

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

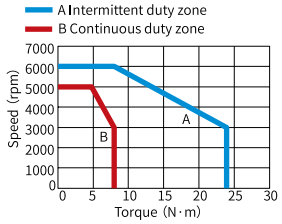
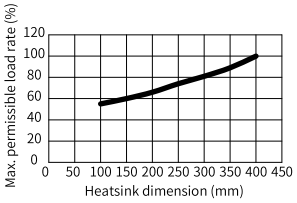
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.2.3.7 MS1H2-25C30CB-A33*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·cm²)	Motor without brake	3.49 ± 10%	
	Motor with brake	4.3 ± 10%	

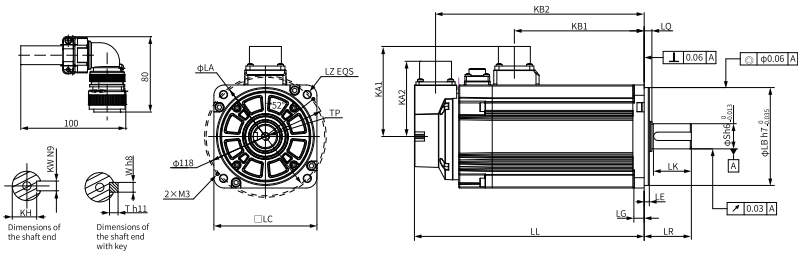
Electrical specifications of the brake

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

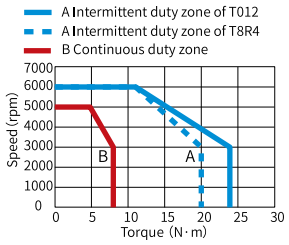
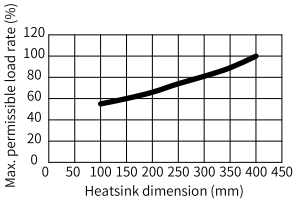
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.2.3.8 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%	

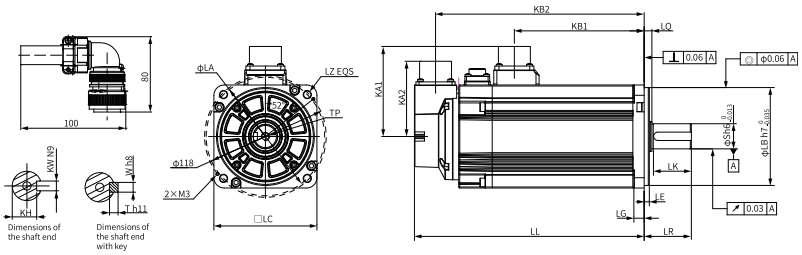
Electrical specifications of the brake

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

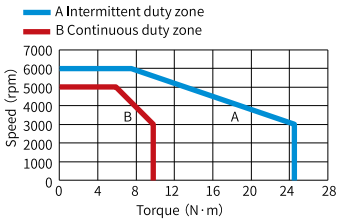
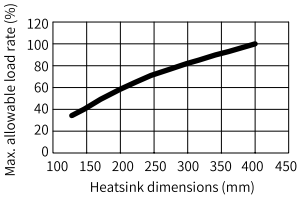
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.2.3.9 MS1H2-30C30CB-A33*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·cm²)	Motor without brake	6.4 ± 10%	
	Motor with brake	9.38 ± 10%	

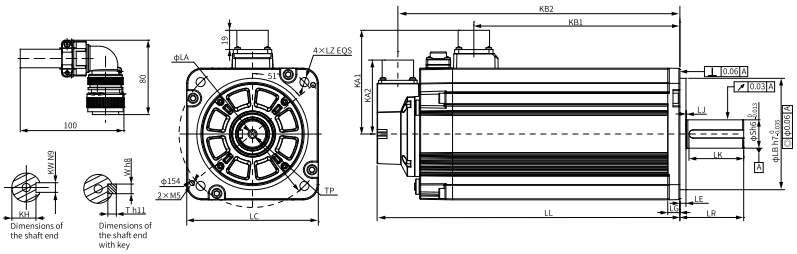
Electrical specifications of the brake

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

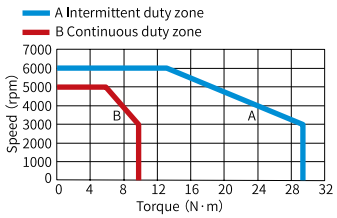
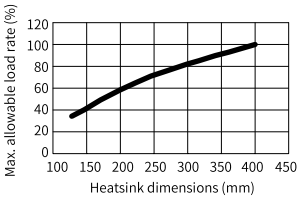
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

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)

18.2.3.10 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%	

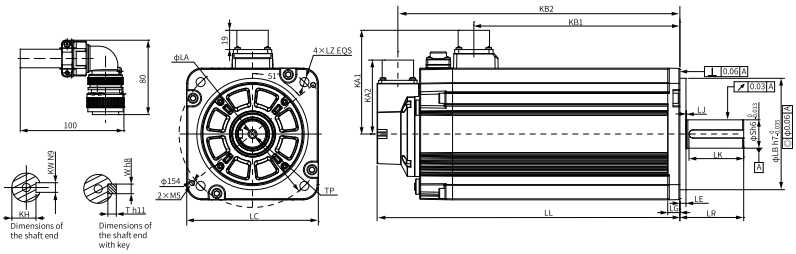
Electrical specifications of the brake

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

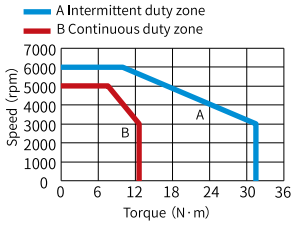
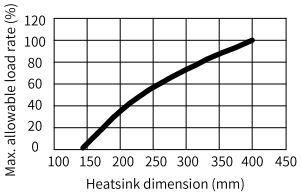
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

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)

18.2.3.11 MS1H2-40C30CB-A33*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·cm²)	Motor without brake	9 ± 10%	
	Motor with brake	11.98 ± 10%	

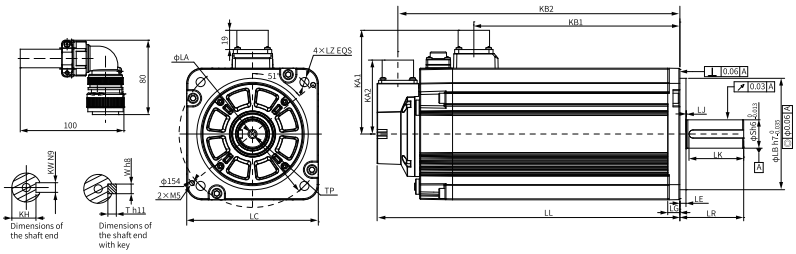
Electrical specifications of the brake

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

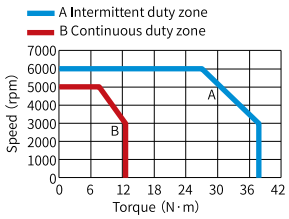
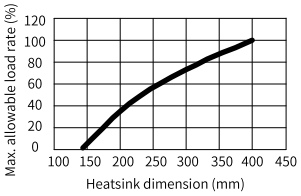
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

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)

18.2.3.12 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%	

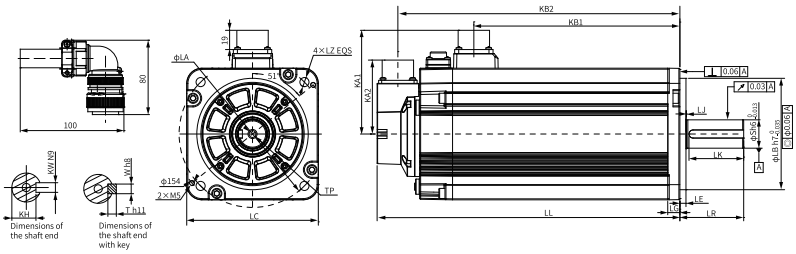
Electrical specifications of the brake

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

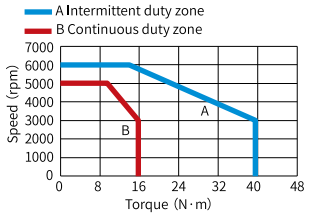
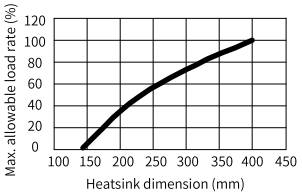
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

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)

18.2.3.13 MS1H2-50C30CB-A33*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·cm²)	Motor without brake	11.6 ± 10%	
	Motor with brake	14.58 ± 10%	

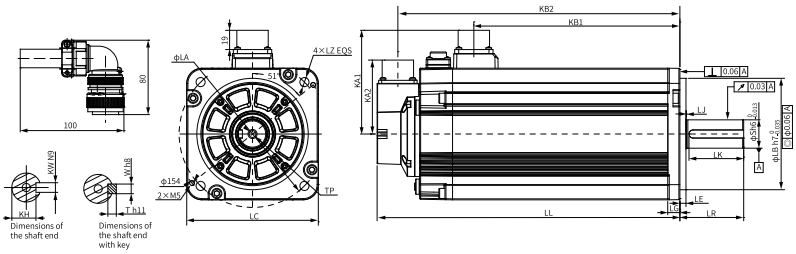
Electrical specifications of the brake

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

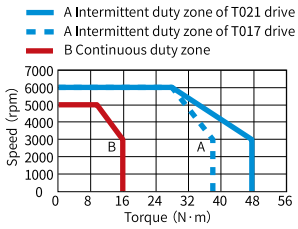
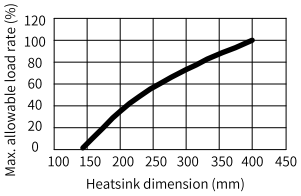
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

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)

18.2.3.14 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·cm²)	Motor without brake	11.6 ± 10%	
	Motor with brake	14.58 ± 10%	

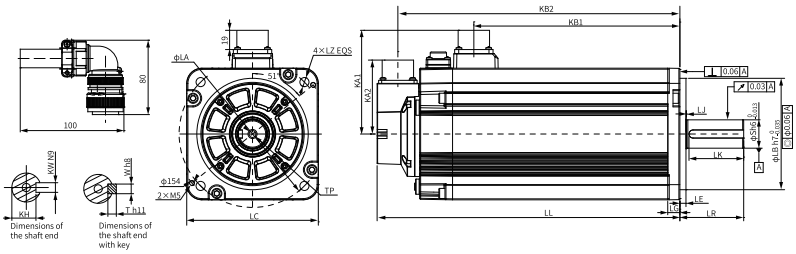
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Exciting current (A)	Response time (ms)	Response 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

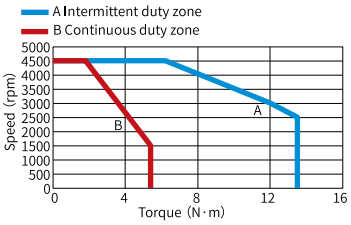
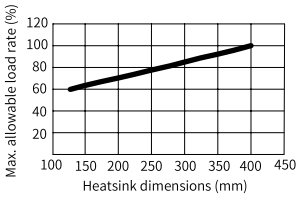
Dimensions (mm)



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)

18.2.4 Medium Inertia and Medium Capacity (MS1H3)

18.2.4.1 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%	

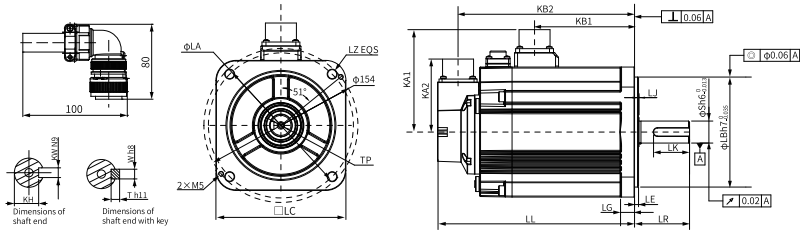
Electrical specifications of the brake

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

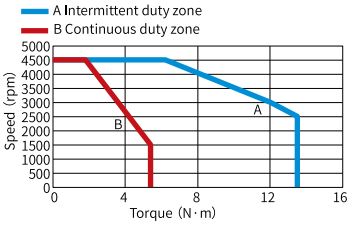
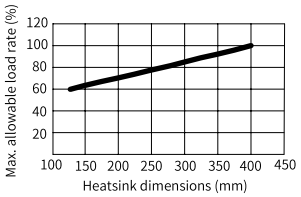
Dimensions (mm)



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 -0.62	180 -0.2	8	8	7	5.8 (7.7)

18.2.4.2 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·cm²)	Motor without brake	13.56 ± 10%	
	Motor with brake	15.8 ± 10%	

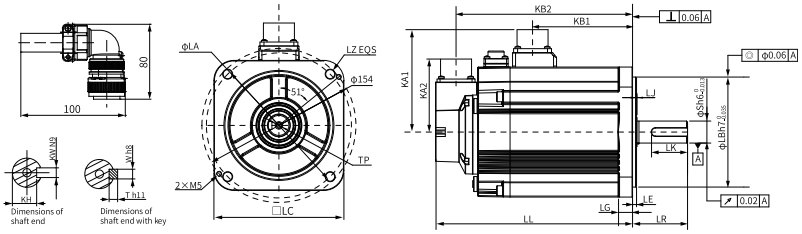
Electrical specifications of the brake

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

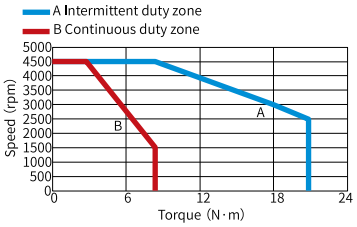
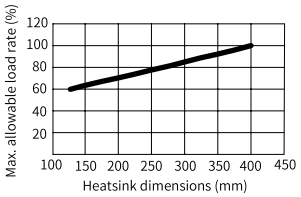
Dimensions (mm)



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)

18.2.4.3 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%	

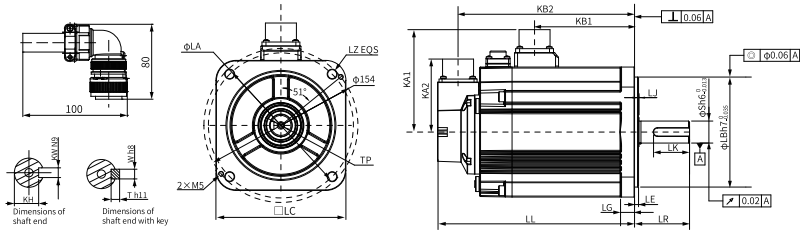
Electrical specifications of the brake

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

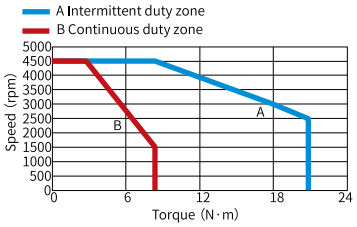
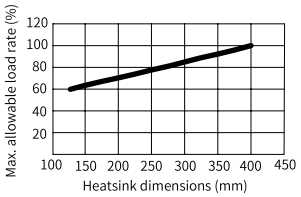
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

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)

18.2.4.4 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%	

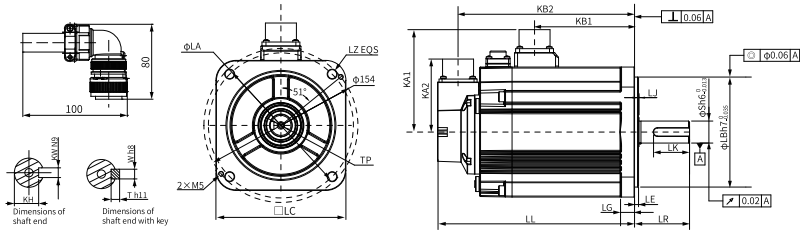
Electrical specifications of the brake

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

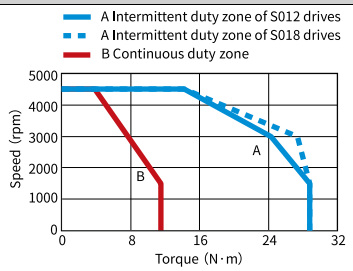
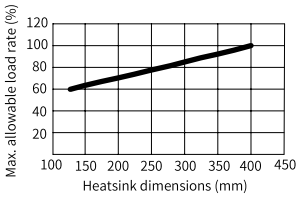
Dimensions (mm)



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)

18.2.4.5 MS1H3-18C15CB-A33*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·cm²)	Motor without brake	24.9 ± 10%	
	Motor with brake	27.2 ± 10%	

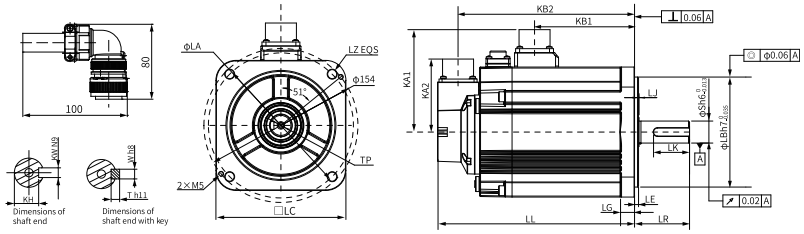
Electrical specifications of the brake

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

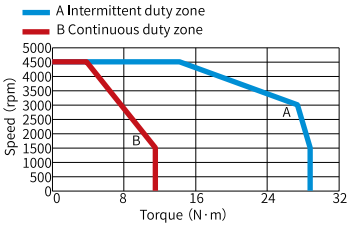
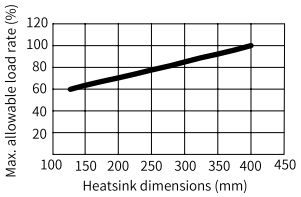
Dimensions (mm)



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)

18.2.4.6 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·cm^2)	Motor without brake	24.9 ± 10%	
	Motor with brake	27.2 ± 10%	

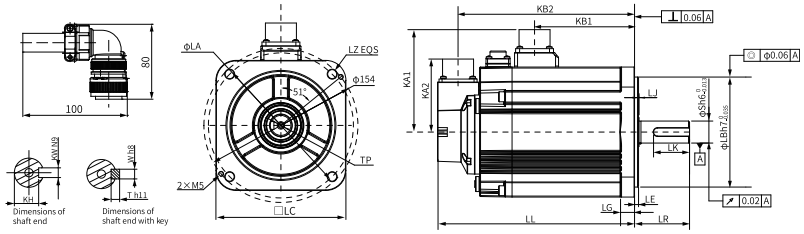
Electrical specifications of the brake

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

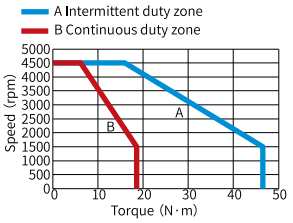
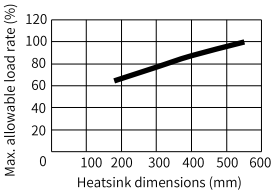
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
55	≤ 686	≤ 196

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 $^{0}_{-0.62}$	180 $^{0}_{-0.2}$	8	8	7	8.5 (10.3)

18.2.4.7 MS1H3-29C15CB-A33*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%	

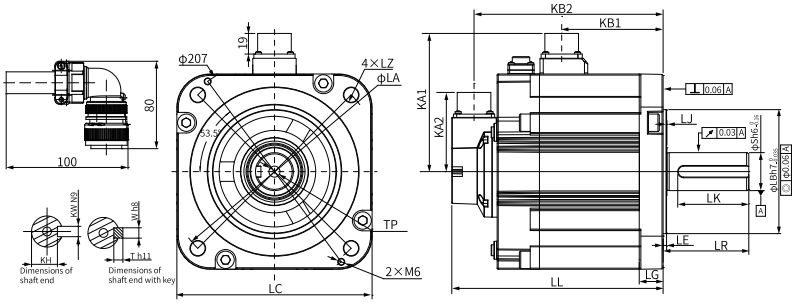
Electrical specifications of the brake

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

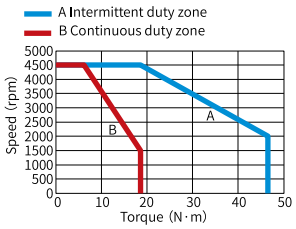
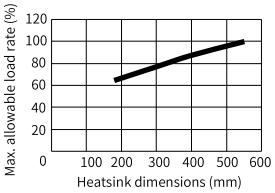
Dimensions (mm)



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)

18.2.4.8 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%	

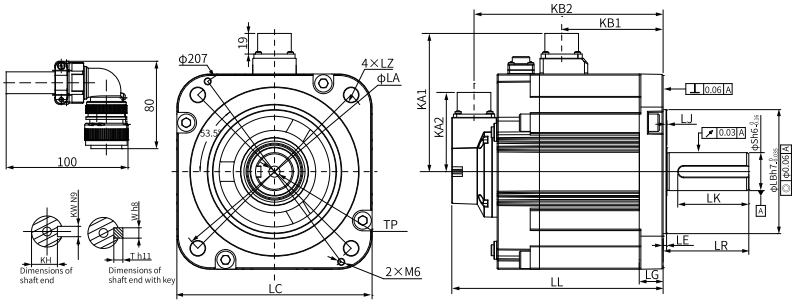
Electrical specifications of the brake

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

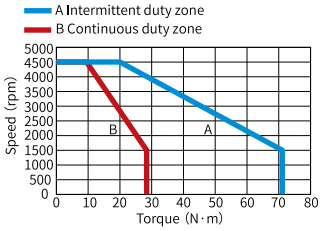
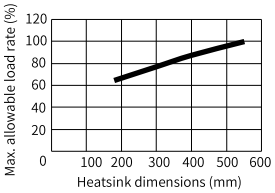
Dimensions (mm)



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)

18.2.4.9 MS1H3-44C15CB-A33*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%	

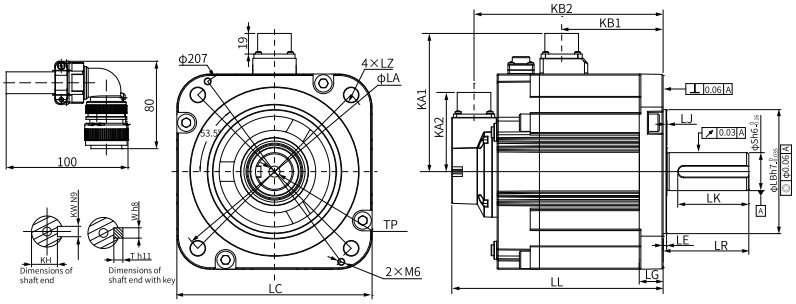
Electrical specifications of the brake

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

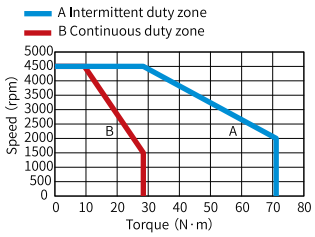
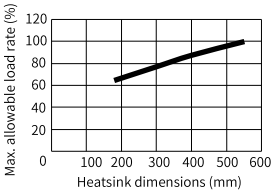
Dimensions (mm)



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)

18.2.4.10 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%	

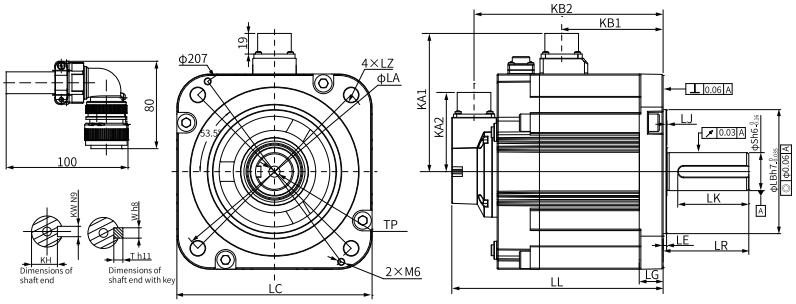
Electrical specifications of the brake

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

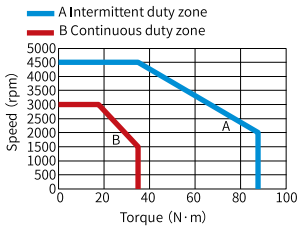
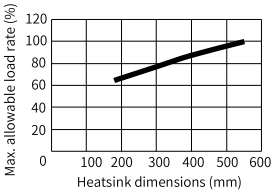
Dimensions (mm)



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)

18.2.4.11 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%	

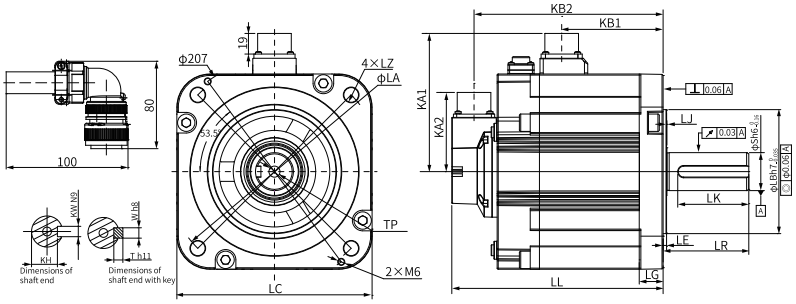
Electrical specifications of the brake

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

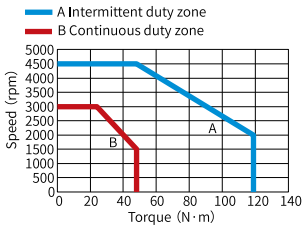
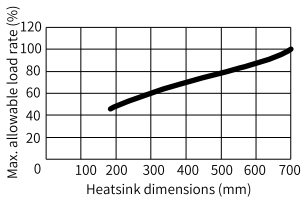
Dimensions (mm)



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)

18.2.4.12 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%	

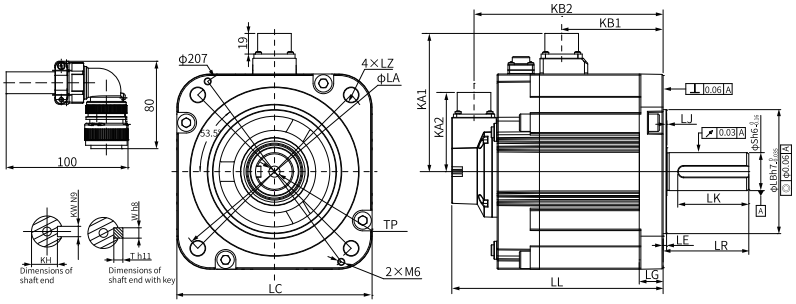
Electrical specifications of the brake

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)

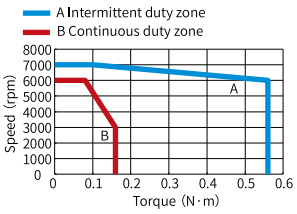
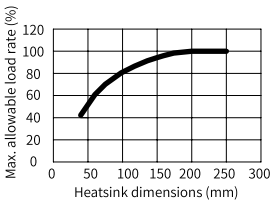


LC	LL	LR	LA	LZ	KA1	KB1	KA2	KB2	LG	LE
180	255 (288.8)	113 ± 1	200	4 × ϕ13.5	127.4	187.5	73	234.5 (268.5)	20.5	3.2 ± 0.3

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)

18.2.5 Medium Inertia and Small Capacity (MS1H4)

18.2.5.1 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·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)	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)

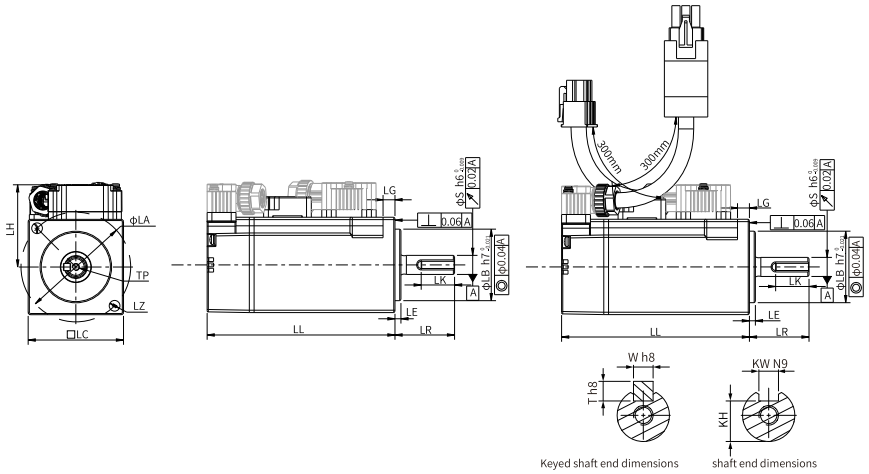


Figure 18-7 MS1H4-05B30CB-A330R and MS1H4-05B30CB-A332R

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)

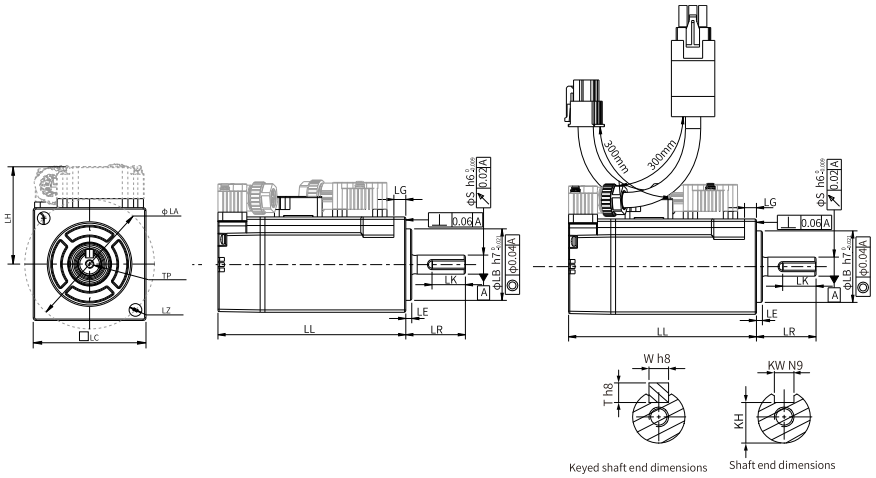
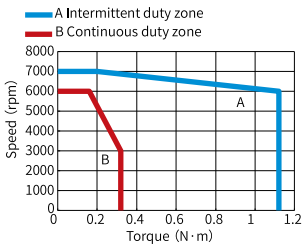
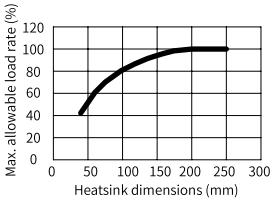


Figure 18-8 MS1H4-05B30CB-A331R and MS1H4-05B30CB-A334R

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)

18.2.5.2 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)

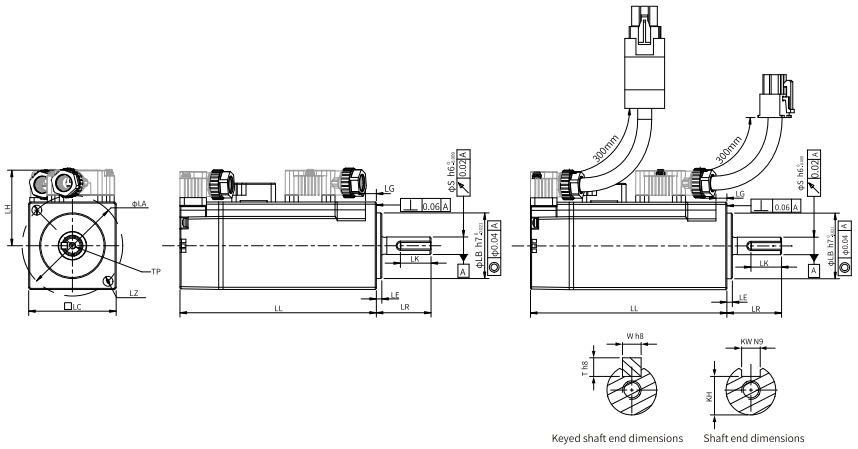


Figure 18-9 MS1H4-10B30CB-A330R and MS1H4-10B30CB-A332R

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)

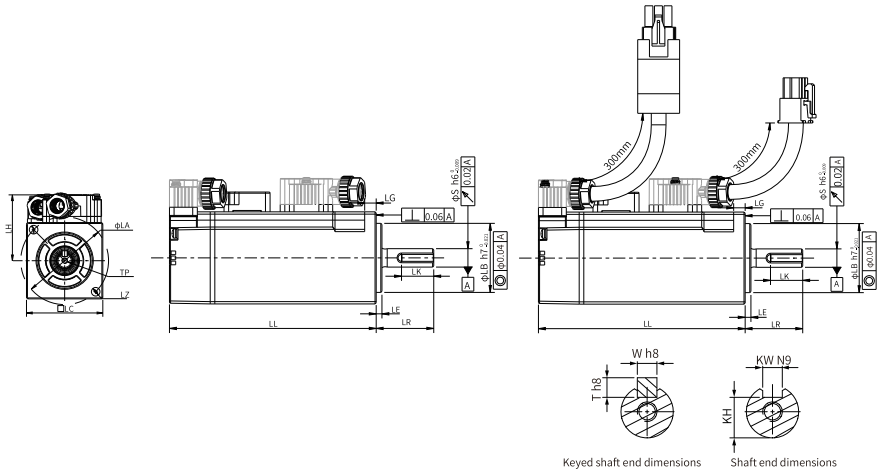
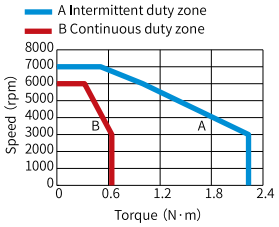
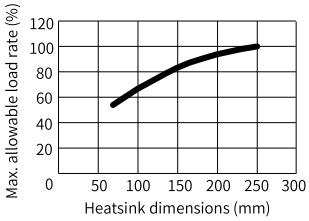


Figure 18-10 MS1H4-10B30CB-A331R and MS1H4-10B30CB-A334R

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)

18.2.5.3 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%	

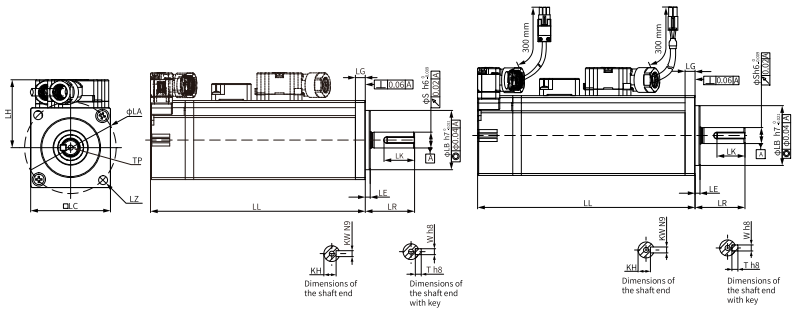
Electrical specifications of the brake

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

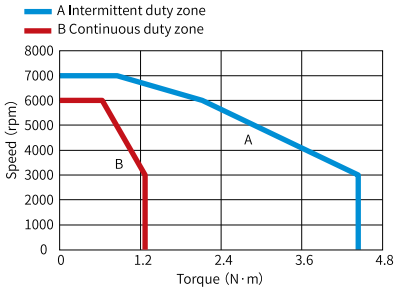
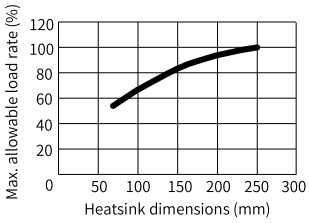
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

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)

18.2.5.4 MS1H4-40B30CB-A33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	60		
Inertia, capacity	Medium inertia, low 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%	

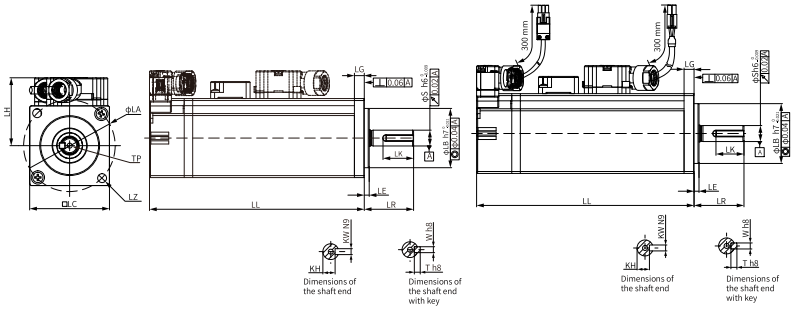
Electrical specifications of the brake

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 load

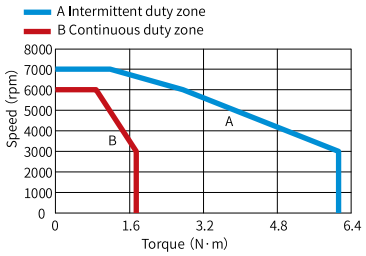
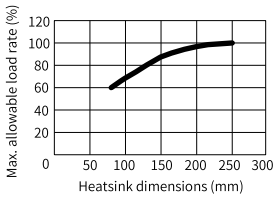
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	
60	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	16.50 $_{-0.53}$	110 $_{-}^{0.1}$	5	5	5	1.11 (1.48)

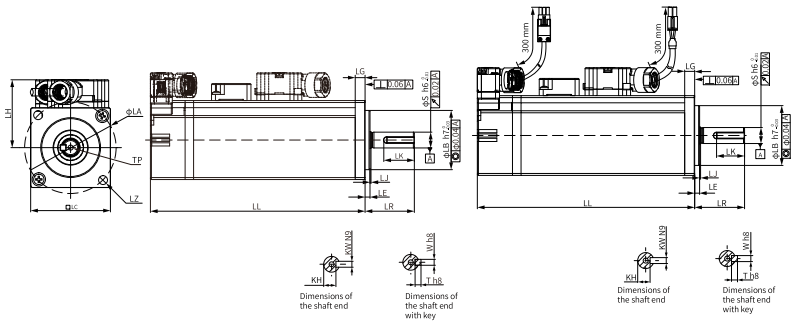
18.2.5.5 MS1H4-55B30CB-A33*R

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

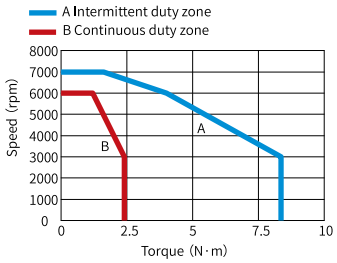
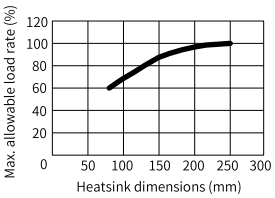
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

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

18.2.5.6 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%	

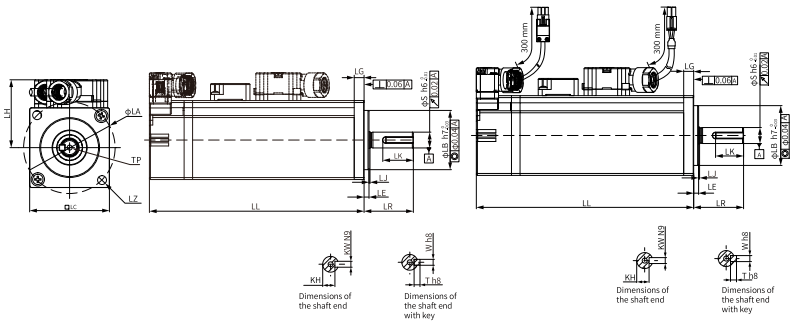
Electrical specifications of the brake

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

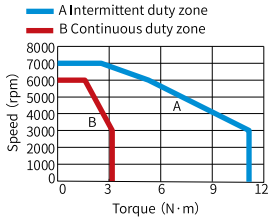
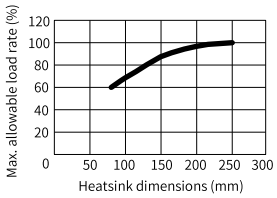
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

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)

18.2.5.7 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%	

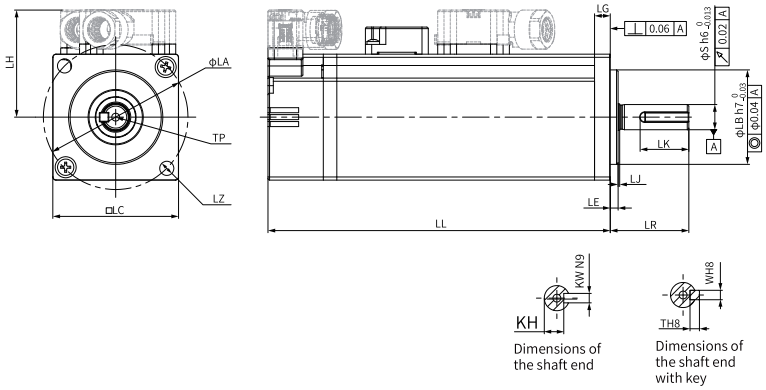
Electrical specifications of the brake

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)

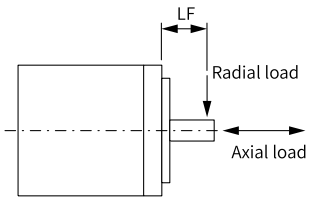


LC	LL	LR	LA	LZ	LH	LG	LE	LJ
80	118.7 (153.2)	35 ± 0.5	90	4 × ϕ7	54	7.5	3 ± 0.5	0.5 ± 0.35
LB	S	TP	LK	KH	kW	W	T	Weight (kg)
70	19	M6 × 20	250 -0.62	15.50 -0.1	6	6	6	2.55 (2.9)

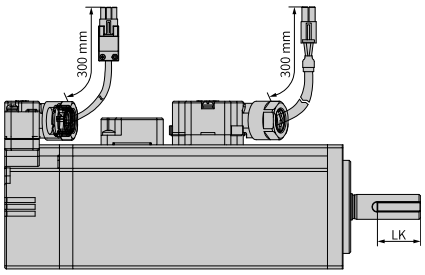
18.3 Selection Data (MS1-R Series Servo Motor with Battery-Free Encoder)

18.3.1 Model Description

- Description of torque-speed characteristics curves:
  - Technical data and torque/speed characteristic values in the following tables are applicable to motors working with Inovance servo drives with the armature coil temperature being 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 (mm) (aluminum)
  - MS1H2-10C to 25C: 400 × 400 × 20 (mm) (steel)
  - MS1H2-30C to 50C: 400 × 400 × 20 (mm) (steel)
  - MS1H3-85B to 18C: 400 × 400 × 20 (mm) (steel)
  - MS1H3-29C to 55C: 550 × 550 × 30 (mm) (aluminum)
  - MS1H3-75C: 700 × 700 × 30 (mm) (aluminum)
- Radial and axial loads of the motor:



- Dimensions of flying leads type motors
  Flying leads type motors with frame size 60/80 (model ended with "-S") provide a drain wire of about 300 mm in length, as shown in the following figure.



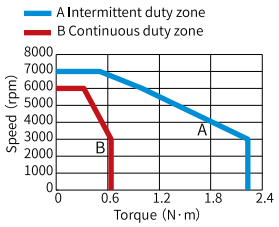
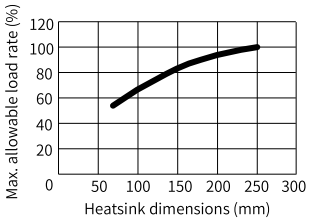
- As shown in the preceding figure, the product is marked with an LK value in the dimension diagram in the section of each model. LK indicates the length of the shaft key.
- The MS1H3 (130-flange and 180-flange) model comes with a keyway. When the operating speed is above 3,000 RPM, the motor must run with the keyway. If you need to run the motor without the keyway at a speed higher than 3,000 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.

18.3.2 Low Inertia and Small Capacity (MS1H1)

18.3.2.1 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 ($kg \cdot cm^2$)	Motor without brake	0.094 ± 10%	
	Motor with brake	0.106 ± 10%	

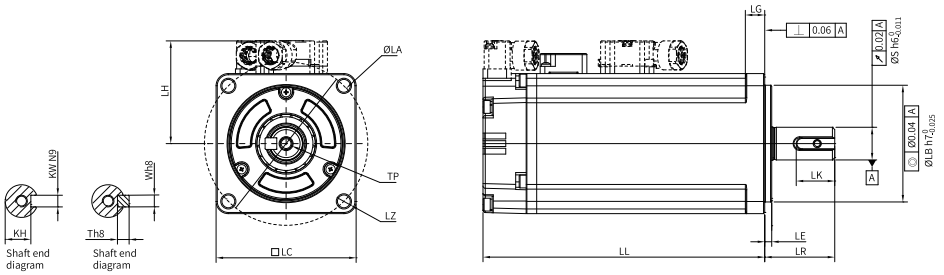
Electrical specifications of the brake

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

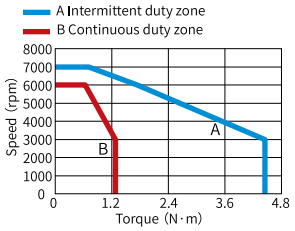
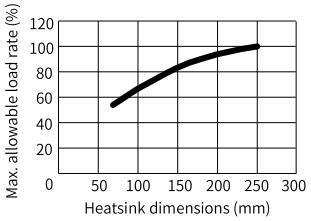
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

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 $^{-0.1}_{-0.1}$	5	5	5	0.80 (1.17)

18.3.2.2 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%	

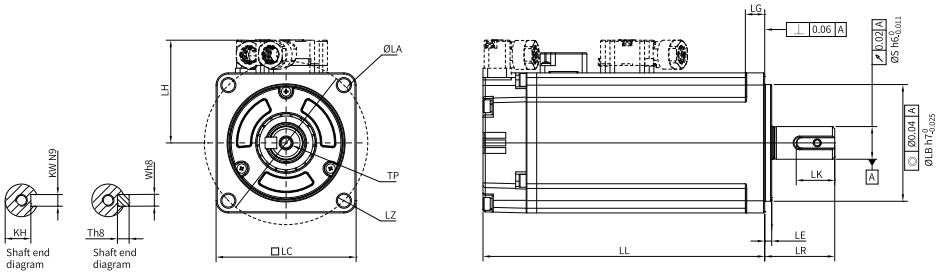
Electrical specifications of the brake

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

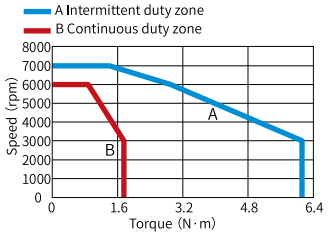
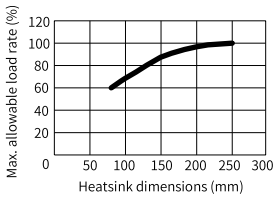
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

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)

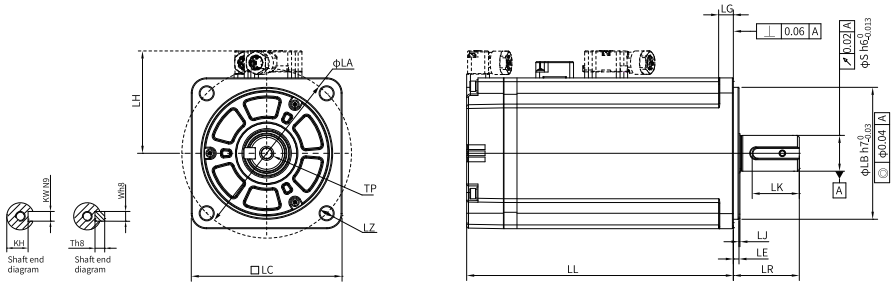
18.3.2.3 MS1H1-55B30CB-V331R

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

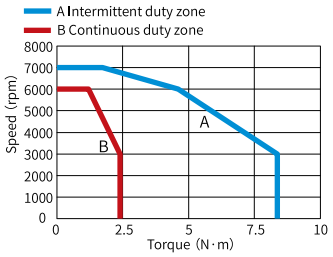
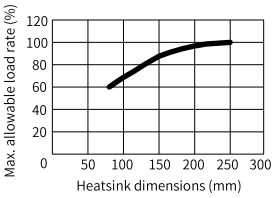
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

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

18.3.2.4 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%	

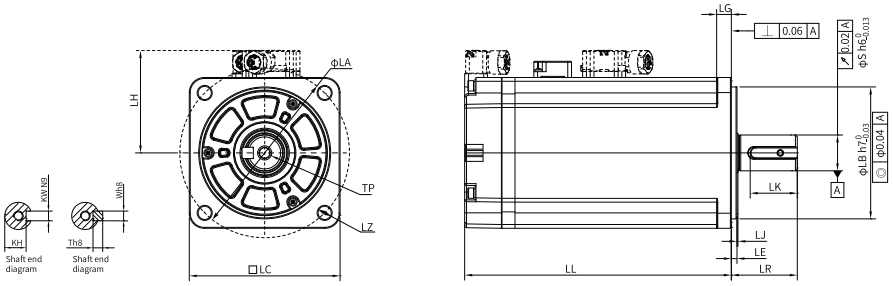
Electrical specifications of the brake

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

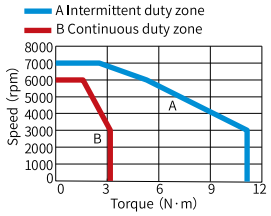
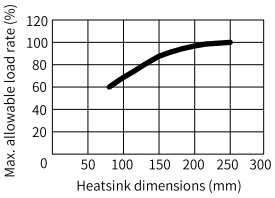
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

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)

18.3.2.5 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 ($kg·cm^2$)	Motor without brake	0.82 ± 10%	
	Motor with brake	0.87 ± 10%	

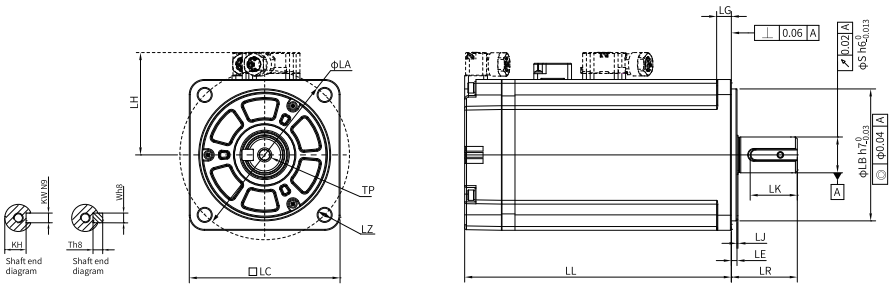
Electrical specifications of the brake

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

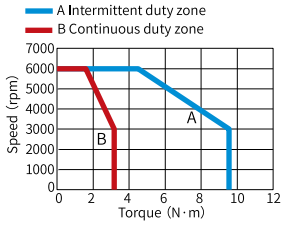
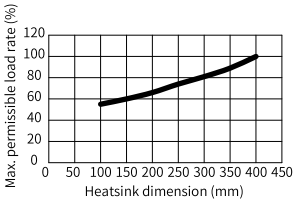
Dimensions (mm)



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)

18.3.3 Low Inertia and Medium Capacity (MS1H2)

18.3.3.1 MS1H2-10C30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	100		
Inertia, 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 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%	

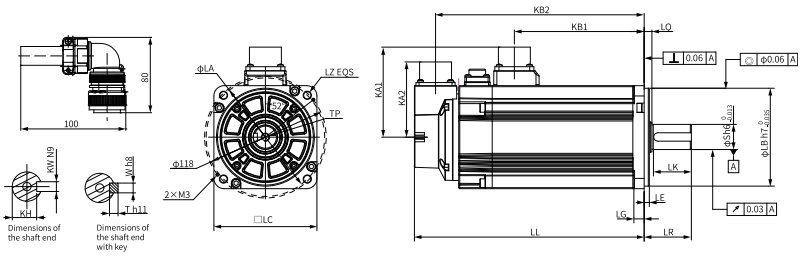
Electrical specifications of the brake

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 load

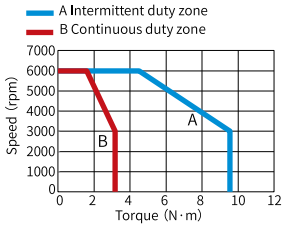
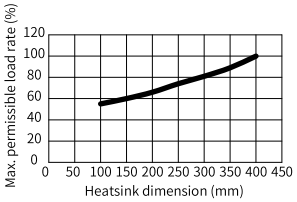
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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 $^{0}_{-0.62}$	200 $^{0}_{-0.2}$	8	8	7	3.85 (4.9)

18.3.3.2 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%	

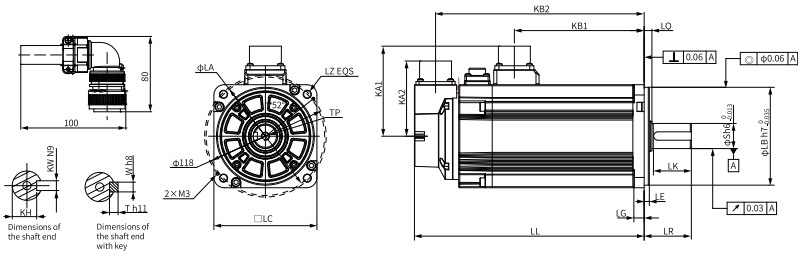
Electrical specifications of the brake

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

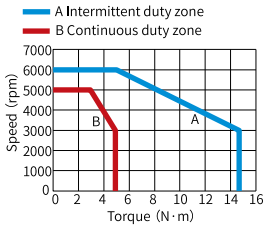
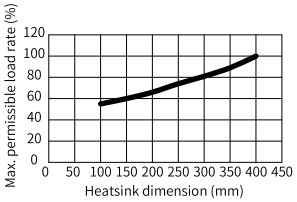
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.3.3.3 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%	

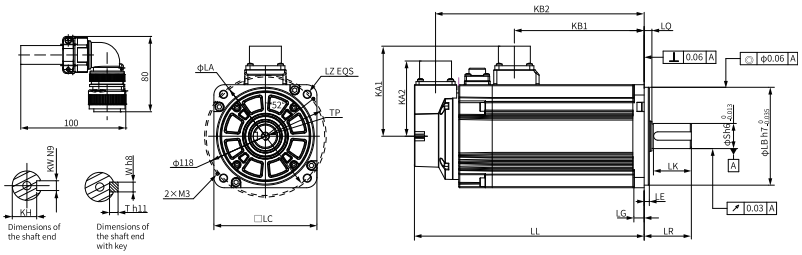
Electrical specifications of the brake

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

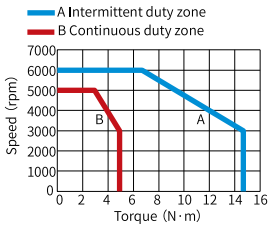
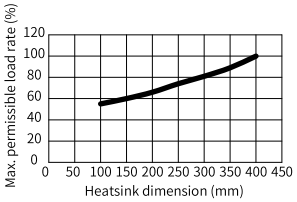
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.3.3.4 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%	

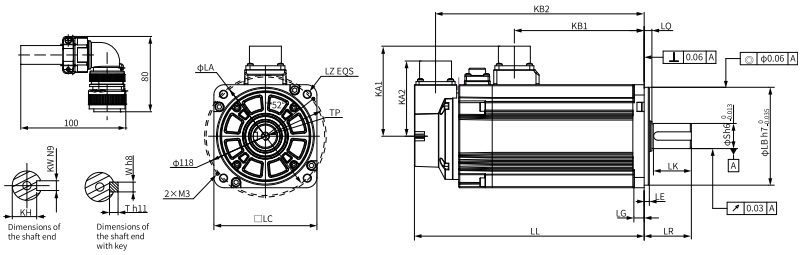
Electrical specifications of the brake

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

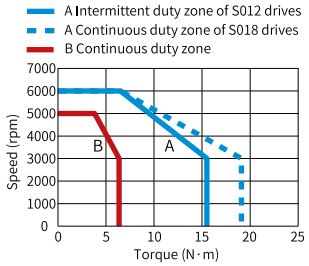
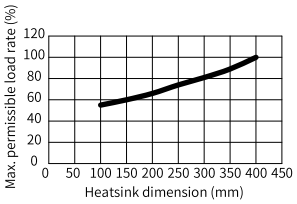
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.3.3.5 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 ($kg·cm^2$)	Motor without brake	2.92 ± 10%	
	Motor with brake	3.74 ± 10%	

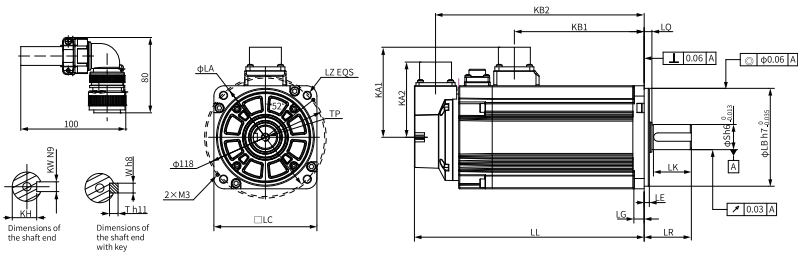
Electrical specifications of the brake

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

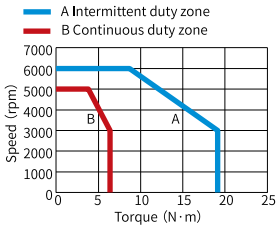
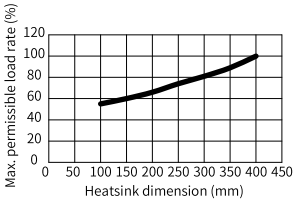
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.3.3.6 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%	

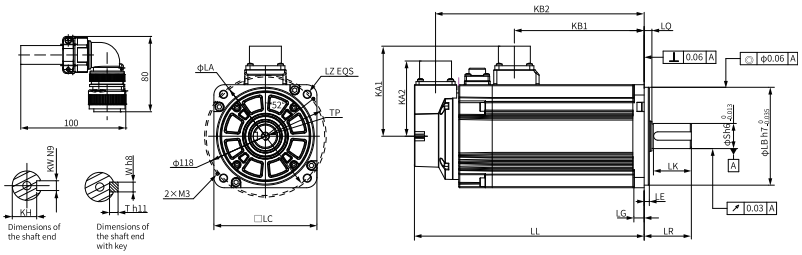
Electrical specifications of the brake

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

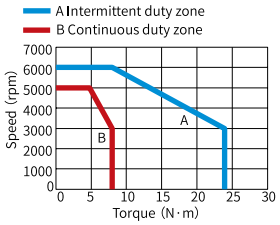
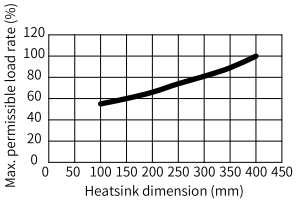
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.3.3.7 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%	

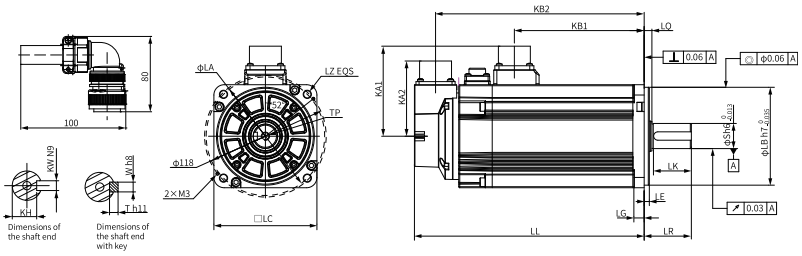
Electrical specifications of the brake

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

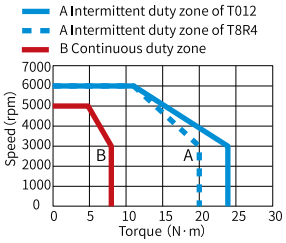
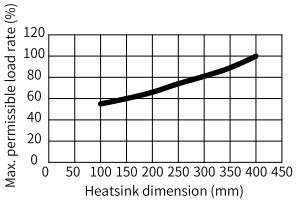
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.3.3.8 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%	

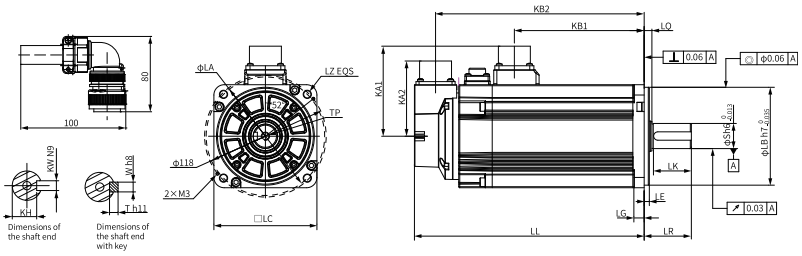
Electrical specifications of the brake

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

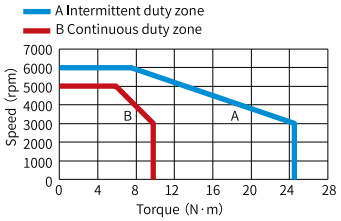
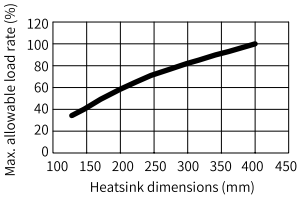
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
45	≤ 686	≤ 196

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)

18.3.3.9 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%	

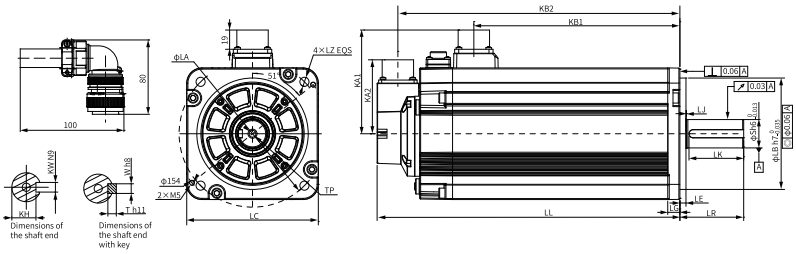
Electrical specifications of the brake

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

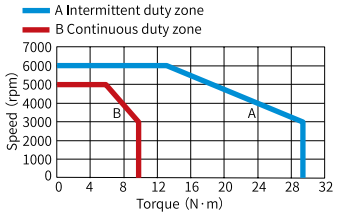
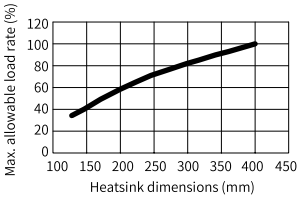
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

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)

18.3.3.10 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%	

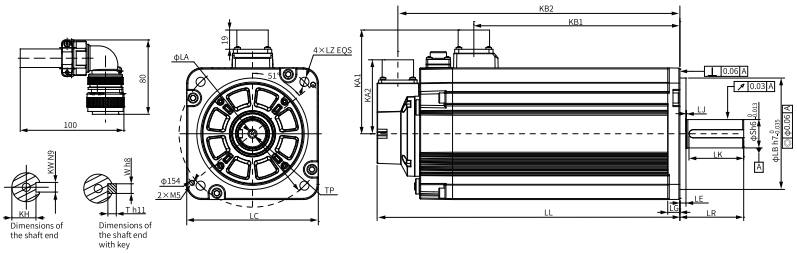
Electrical specifications of the brake

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

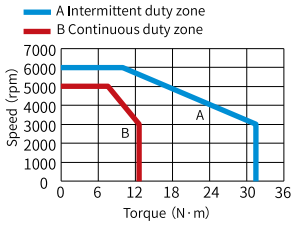
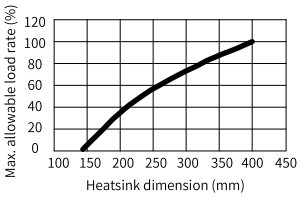
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

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 $^{0.62}_{-}$	240 $^{0.2}_{-}$	8	8	7	10.0 (11.9)

18.3.3.11 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 ($kg \cdot cm^2$)	Motor without brake	9 ± 10%	
	Motor with brake	11.98 ± 10%	

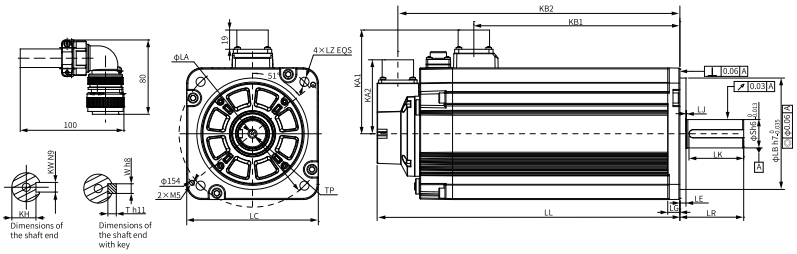
Electrical specifications of the brake

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

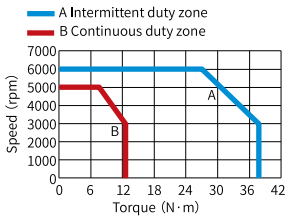
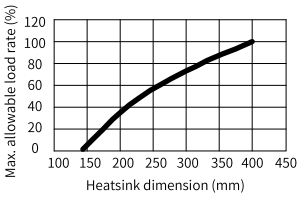
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

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)

18.3.3.12 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%	

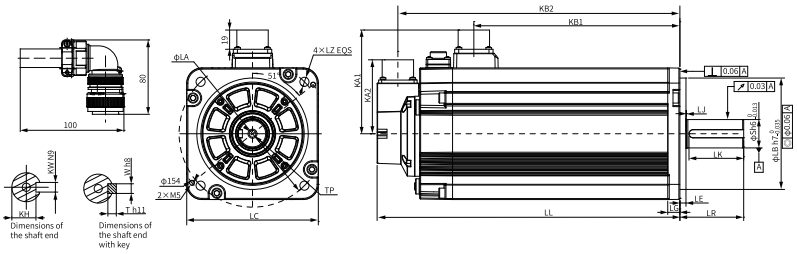
Electrical specifications of the brake

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

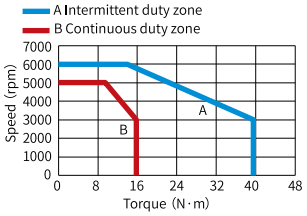
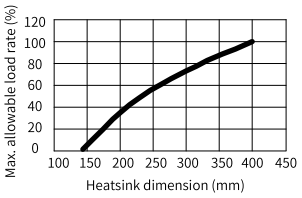
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

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)

18.3.3.13 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 ($kg·cm^2$)	Motor without brake	11.6 ± 10%	
	Motor with brake	14.58 ± 10%	

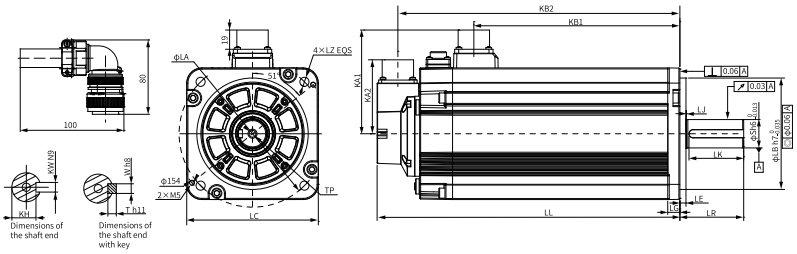
Electrical specifications of the brake

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

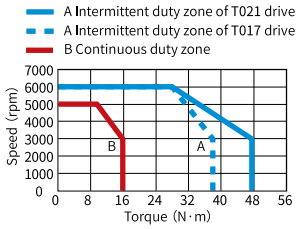
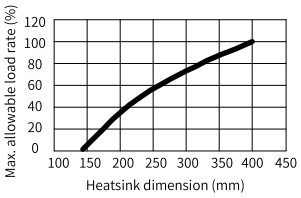
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
63	≤ 1176	≤ 392

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)

18.3.3.14 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%	

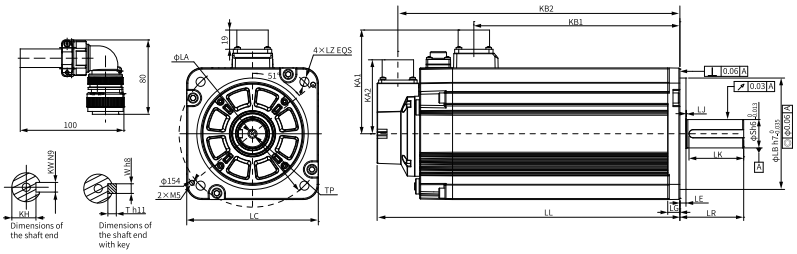
Electrical specifications of the brake

Holding torque (N·m)	Power supply voltage (VDC) ± 10%	Rated power (W)	Coil resistance (Ω) ± 10%	Exciting current (A)	Response time (ms)	Response 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

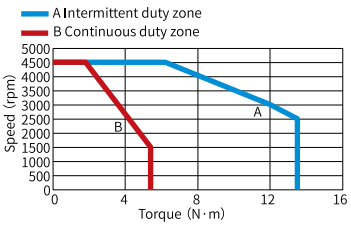
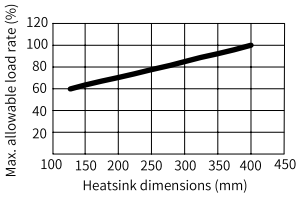
Dimensions (mm)



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)

18.3.4 Medium Inertia and Medium Capacity (MS1H3)

18.3.4.1 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 ($kg \cdot cm^2$)	Motor without brake	13.56 ± 10%	
	Motor with brake	15.8 ± 10%	

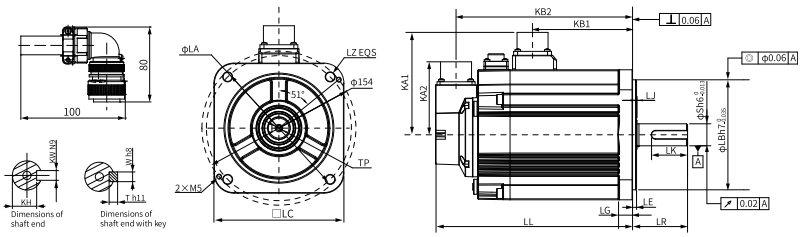
Electrical specifications of the brake

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

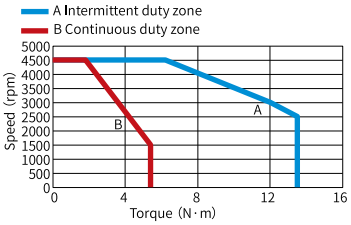
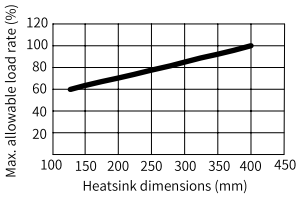
Dimensions (mm)



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)

18.3.4.2 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%	

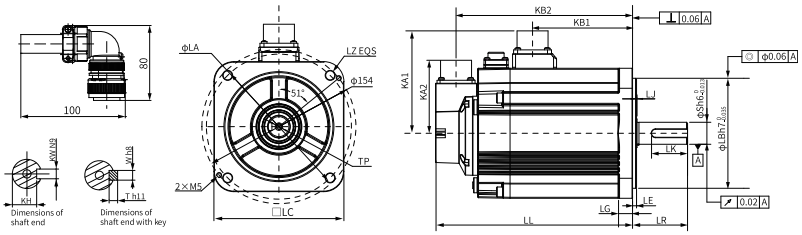
Electrical specifications of the brake

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

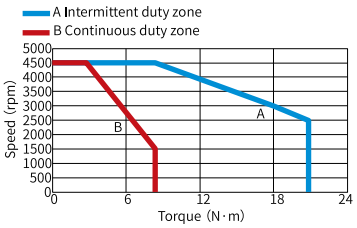
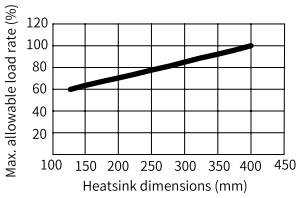
Dimensions (mm)



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)

18.3.4.3 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%	

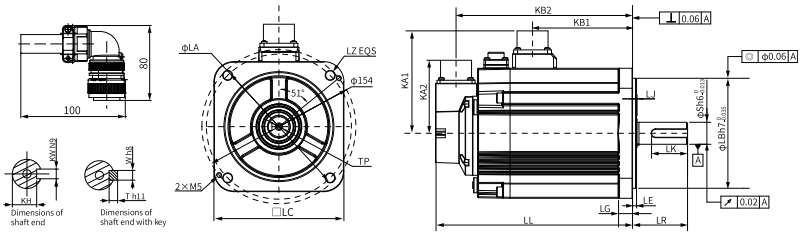
Electrical specifications of the brake

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

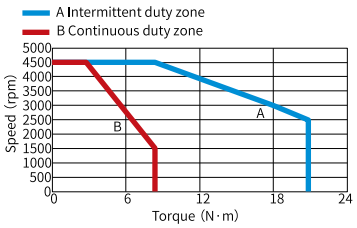
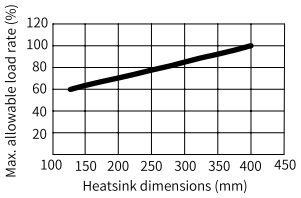
Dimensions (mm)



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)

18.3.4.4 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%	

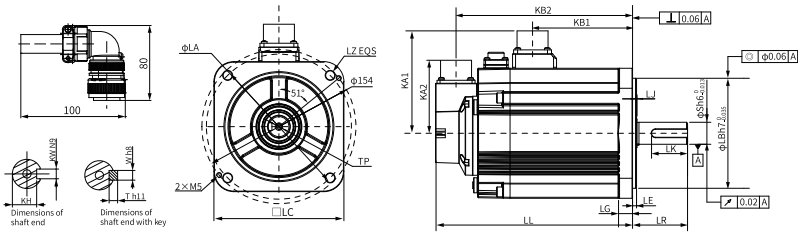
Electrical specifications of the brake

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

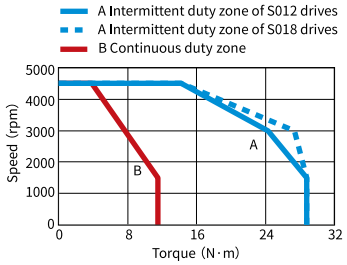
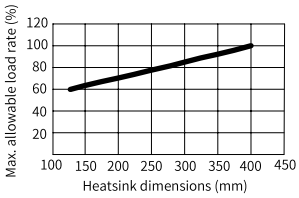
Dimensions (mm)



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)

18.3.4.5 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 ($kg \cdot cm^2$)	Motor without brake	24.9 ± 10%	
	Motor with brake	27.2 ± 10%	

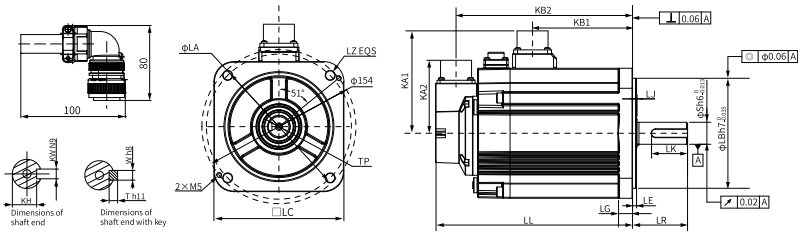
Electrical specifications of the brake

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

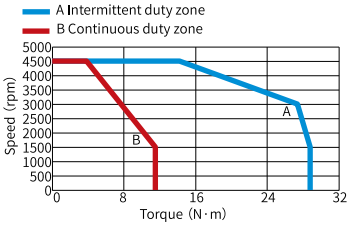
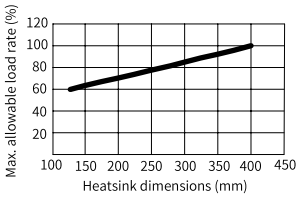
Dimensions (mm)



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)

18.3.4.6 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 ($kg·cm^2$)	Motor without brake	24.9 ± 10%	
	Motor with brake	27.2 ± 10%	

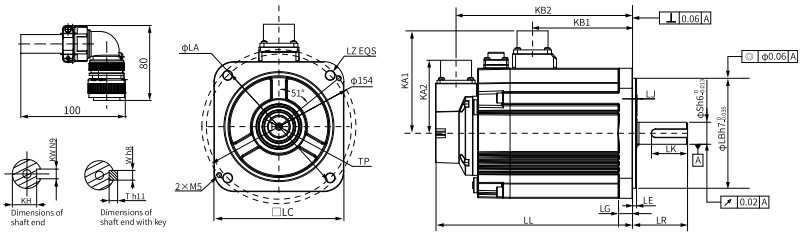
Electrical specifications of the brake

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

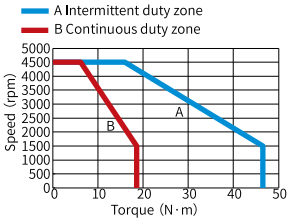
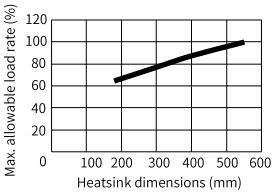
Dimensions (mm)



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)

18.3.4.7 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%	

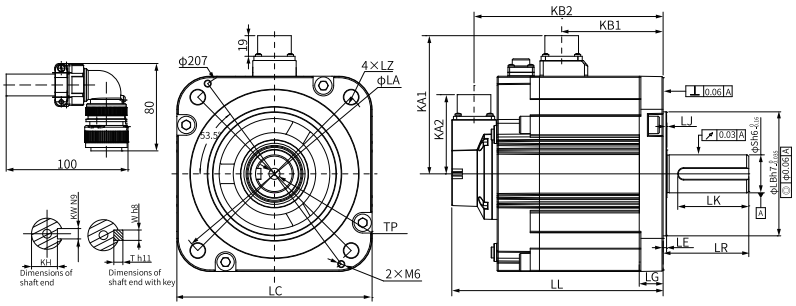
Electrical specifications of the brake

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

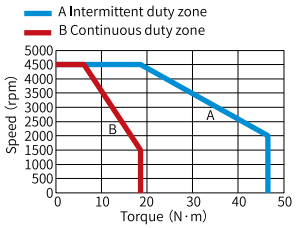
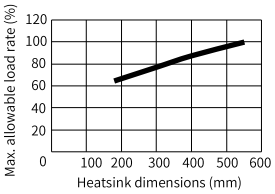
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
79	≤ 1470	≤ 490

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)

18.3.4.8 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%	

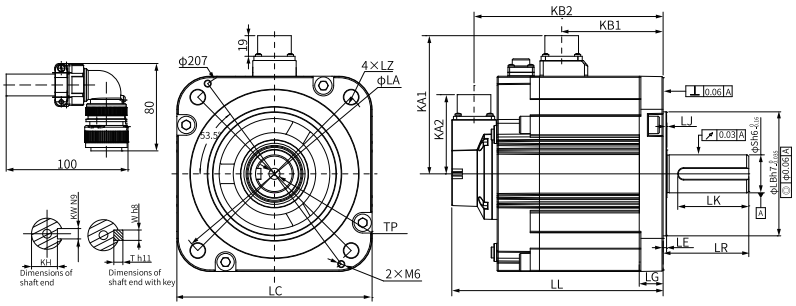
Electrical specifications of the brake

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

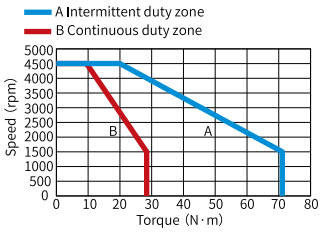
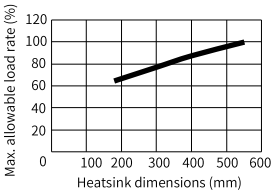
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
79	≤ 1470	≤ 490

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)

18.3.4.9 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%	

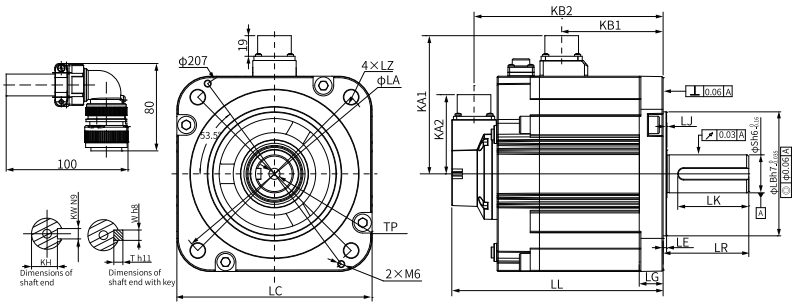
Electrical specifications of the brake

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

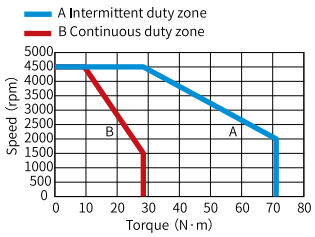
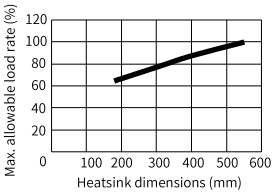
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
79	≤ 1470	≤ 490

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)

18.3.4.10 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%	

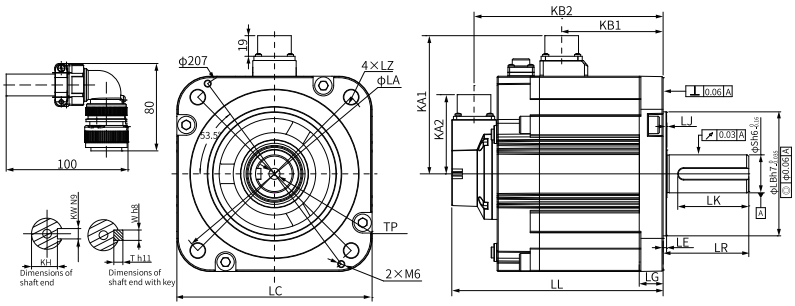
Electrical specifications of the brake

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

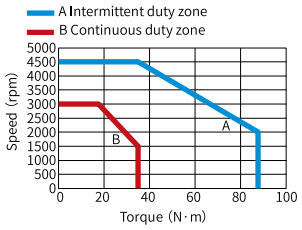
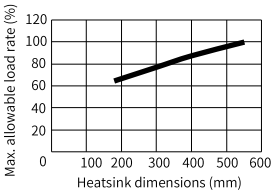
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
79	≤ 1470	≤ 490

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)

18.3.4.11 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%	

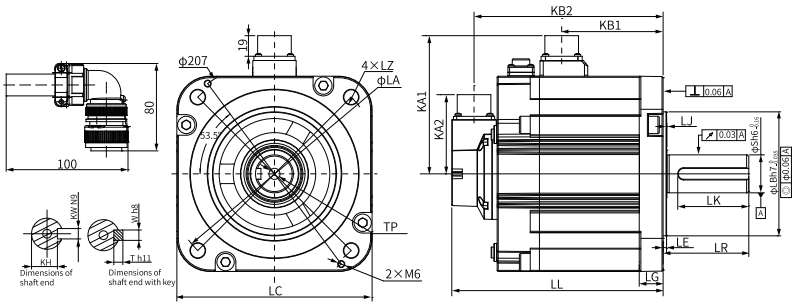
Electrical specifications of the brake

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

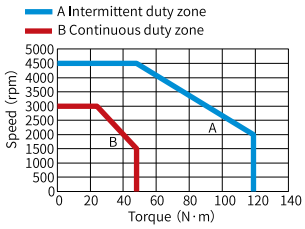
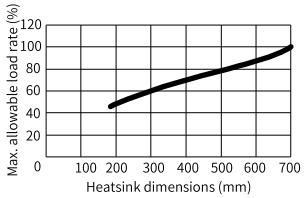
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
113	≤ 1764	≤ 588

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)

18.3.4.12 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%	

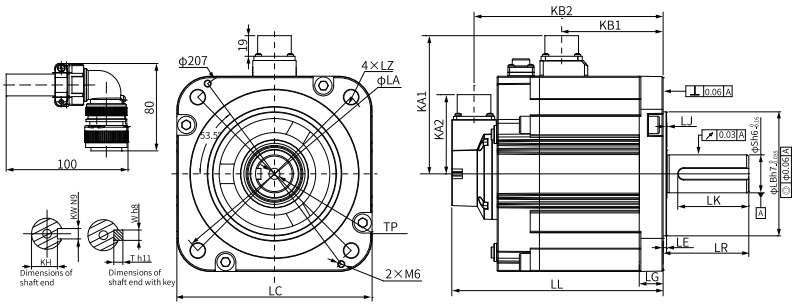
Electrical specifications of the brake

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

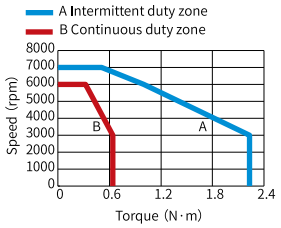
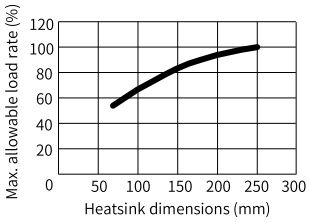
Dimensions (mm)



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)

18.3.5 Medium Inertia and Small Capacity (MS1H4)

18.3.5.1 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%	

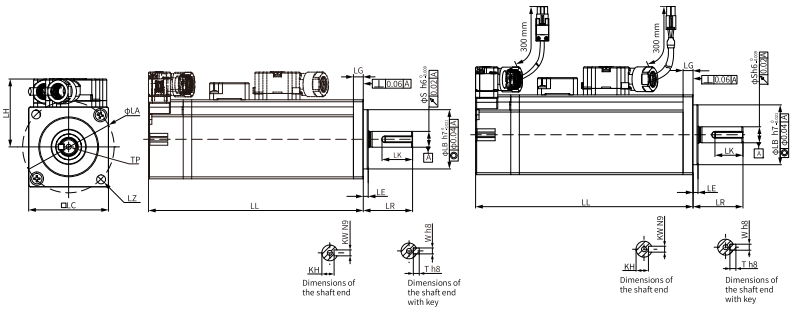
Electrical specifications of the brake

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

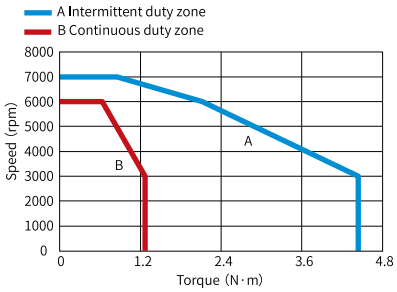
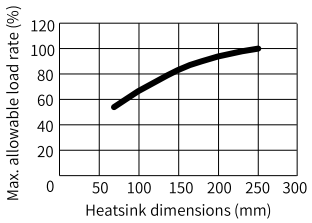
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

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	$16.50^{\ 0}_{-0.53}$	$110^{\ 0.1}_{-}$	5	5	5	0.78 (1.16)

18.3.5.2 MS1H4-40B30CB-V33*R

Motor specifications			Torque-speed characteristics
Frame size (mm)	60		
Inertia, capacity	Medium inertia, low 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%	

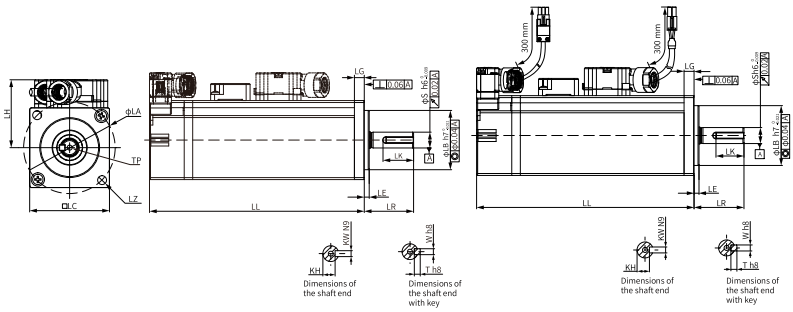
Electrical specifications of the brake

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 load

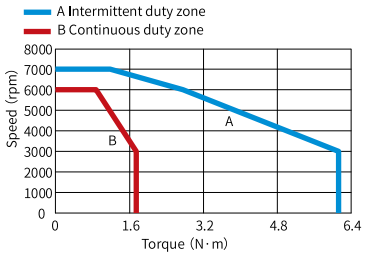
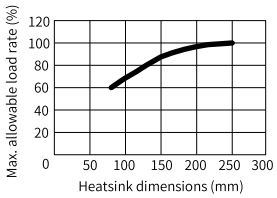
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
25	≤ 245	≤ 74

Dimensions (mm)



LC	LL	LR	LA	LZ	LH	LG	LE	
60	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	16.50 $_{-0.53}$	110 $_{-}^{0.1}$	5	5	5	1.11 (1.48)

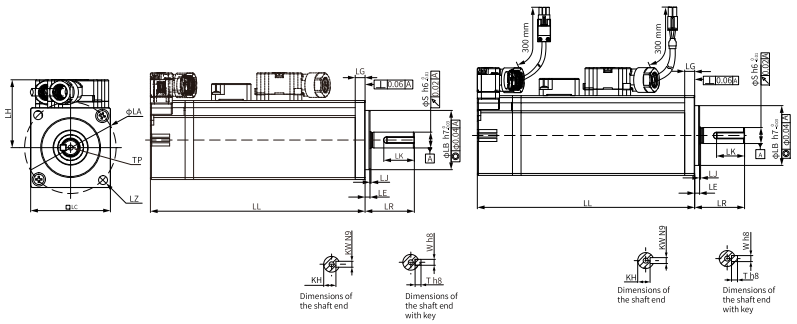
18.3.5.3 MS1H4-55B30CB-V331R

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·cm^2)	Motor without brake	1.12 ± 10%	
	Motor with brake	-	

Allowable load

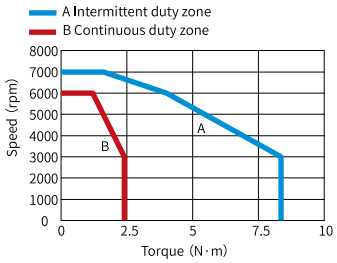
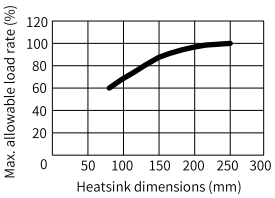
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

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

18.3.5.4 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%	

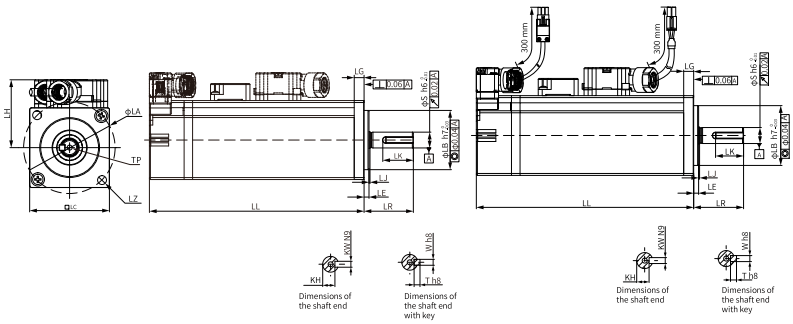
Electrical specifications of the brake

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

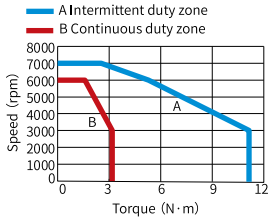
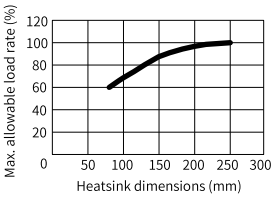
LF (mm)	Allowable radial load (N)	Allowable axial load (N)
35	≤ 392	≤ 147

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)

18.3.5.5 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 ($kg·cm^2$)	Motor without brake	1.87 ± 10%	
	Motor with brake	1.97 ± 10%	

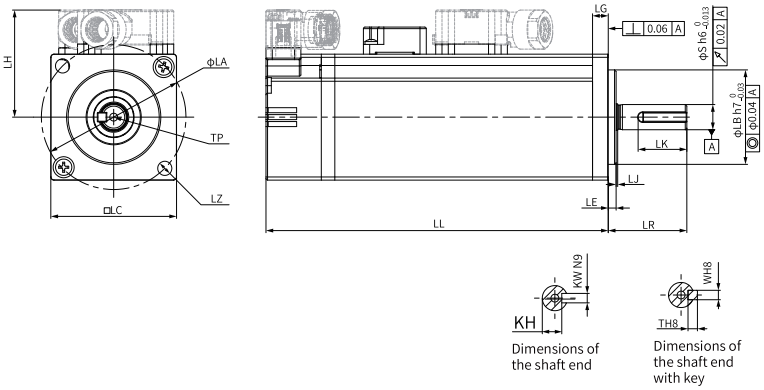
Electrical specifications of the brake

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 Options

19.1 Cables

19.1.1 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

19.1.2 Cable Type

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 to prevent excessive stress on cables.

Recommended bending radius ≥ 5D (D: cable diameter)

Flexible cables

Flexible cables can move along with cable carriers without a high risk of abrasion.

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

Inovance oil-resistant cables are suitable for machine tools, cutting fluids, cutting oils and other scenarios.

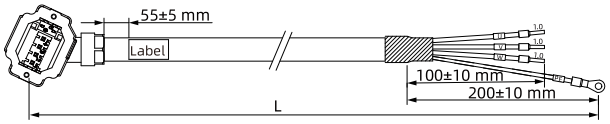
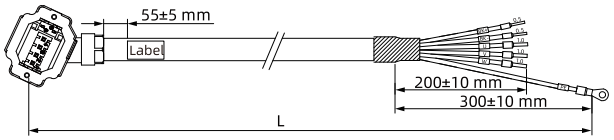
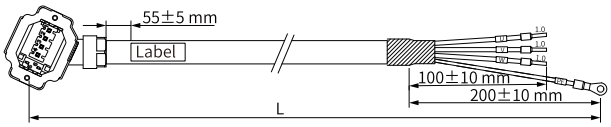
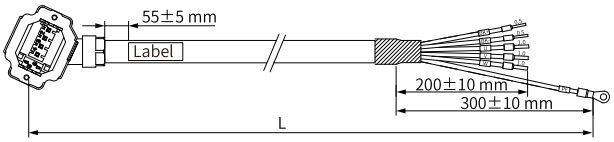
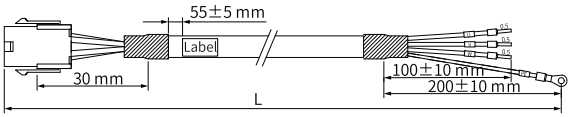
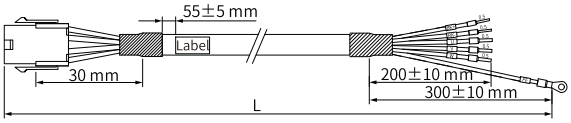
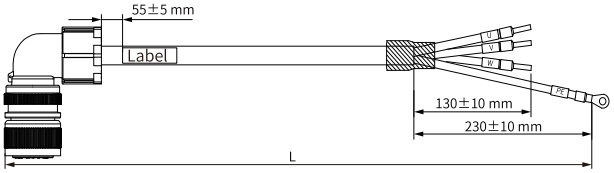
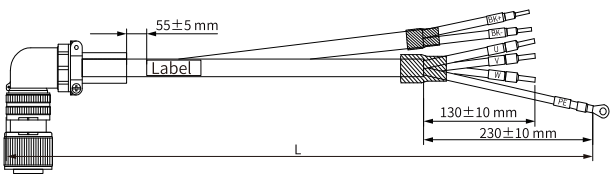
More information

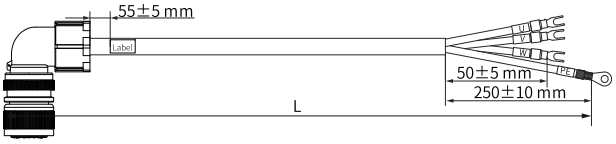
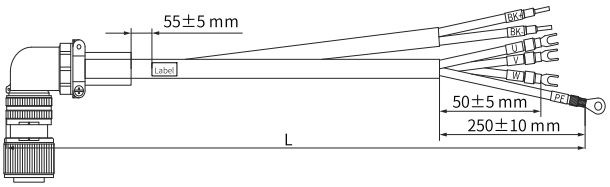
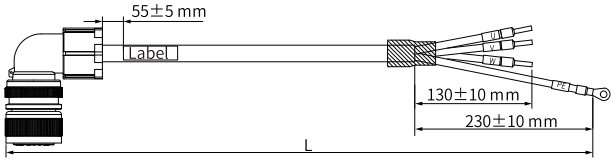
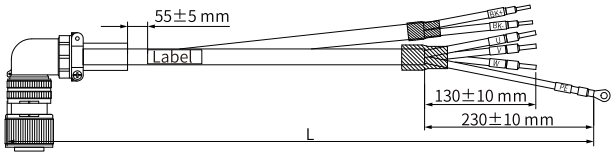
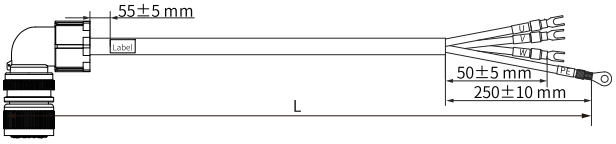
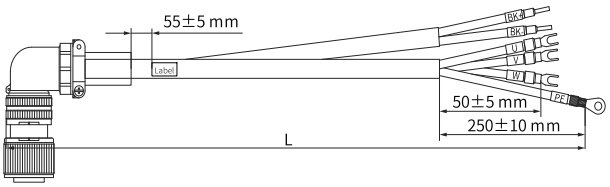
Terminal-type motor power cables and encoder cables must be connected with special equipment and tools. Therefore, purchase the cables through channels authorized by Inovance.

For more cable information, see cable specifications and models of the related servo drive.

19.1.3 Applicable Cable Selection

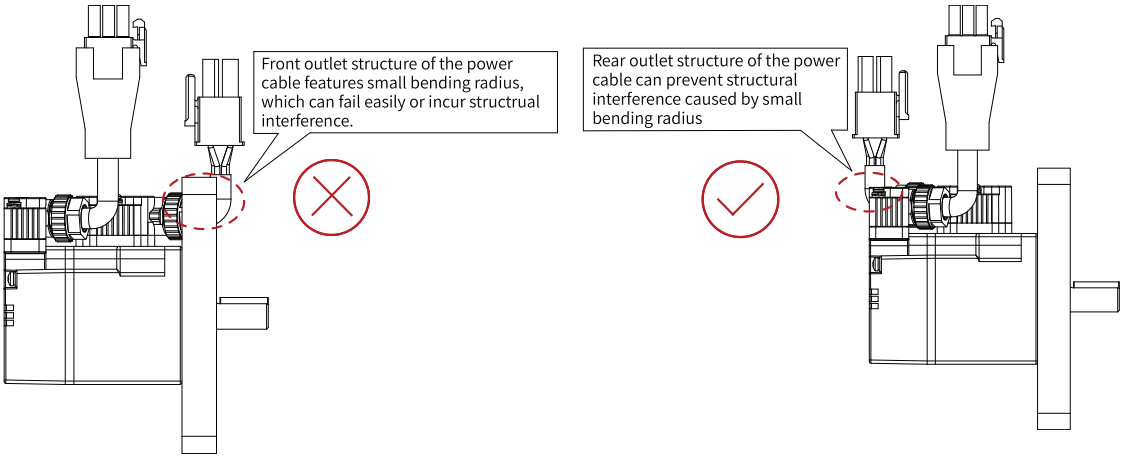
Power cable

Motor model	Name		Cable model	Cable length (mm)	Drawing
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	
		With 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	
		With 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	
	With 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	
	With brake		S6-L-B111-3.0	3100	
			S6-L-B111-5.0	5100	
			S6-L-B111-10.0	10100	

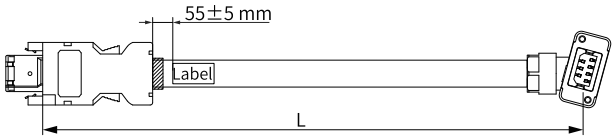
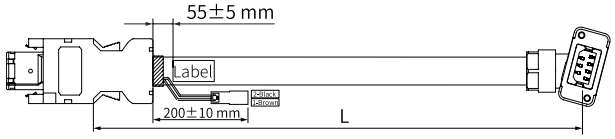
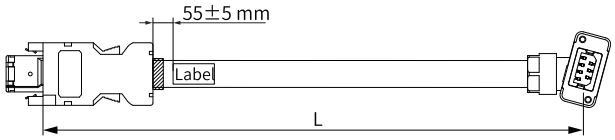
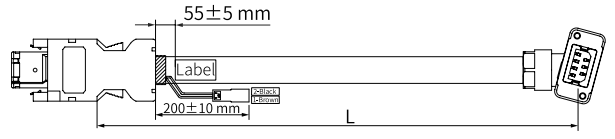
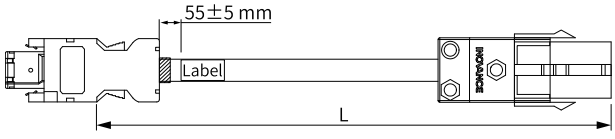
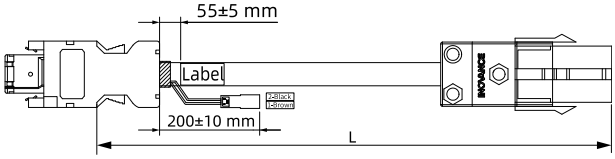
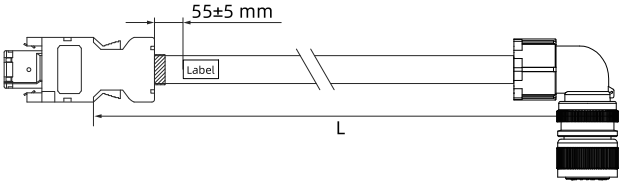
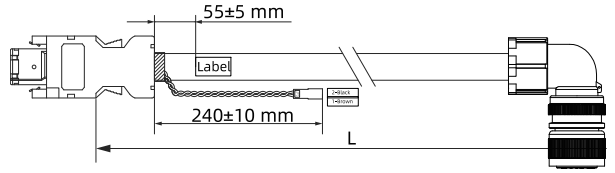
Motor model	Name	Cable model	Cable length (mm)	Drawing
MS1H2 motors rated 4 kW/5 kW	Without brake	S6-L-M011-3.0	3000	
		S6-L-M011-5.0	5000	
		S6-L-M011-10.0	10000	
	With brake	S6-L-B011-3.0	3000	
		S6-L-B011-5.0	5000	
		S6-L-B011-10.0	10000	
MS1H3 motors rated 2.9 kW	Without brake	S6-L-M112-3.0	3100	
		S6-L-M112-5.0	5100	
		S6-L-M112-10.0	10100	
	With 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 or above	Without brake	S6-L-M022-3.0	3000	
		S6-L-M022-5.0	5000	
		S6-L-M022-10.0	10000	
	With brake	S6-L-B022-3.0	3000	
		S6-L-B022-5.0	5000	
		S6-L-B022-10.0	10000	

Note

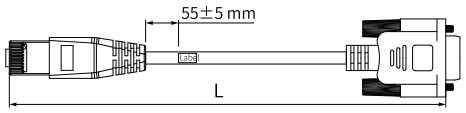
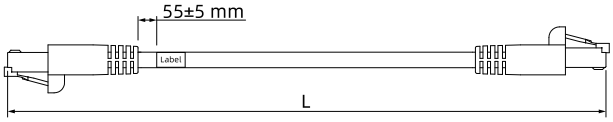
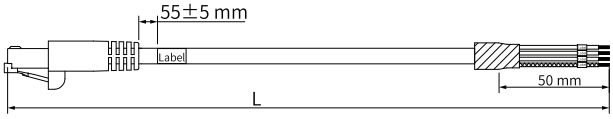
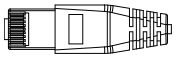
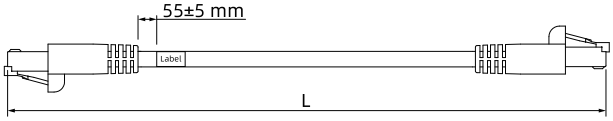
- For 50 W terminal-type models, use rear outlet for power cables.
- For 100 W models, if the mounting flange face is internally stepped type, only terminal-type models can be used, which are equipped with power cables with rear outlet.


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

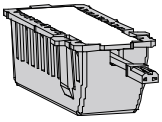
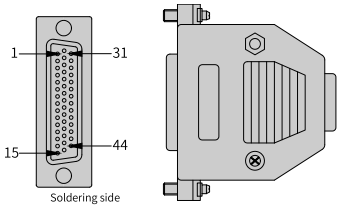
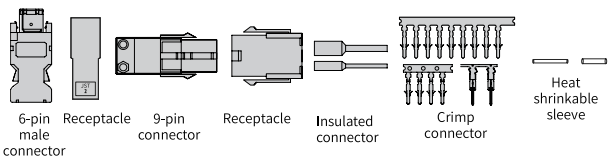
Encoder cable

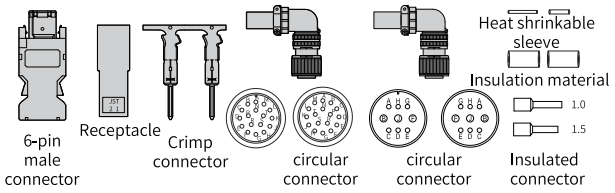
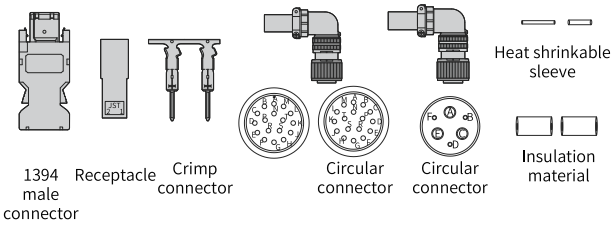
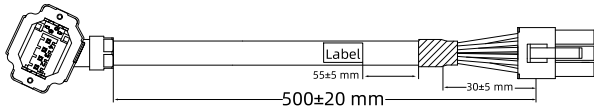
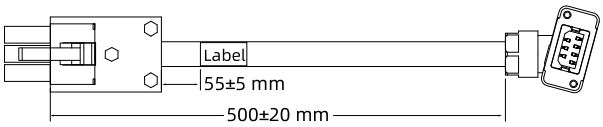
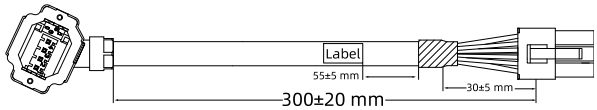
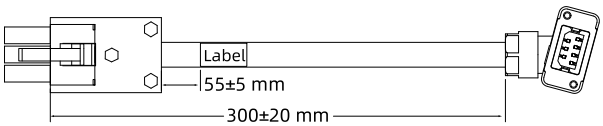
Motor model	Name		Cable model	Cable length (mm)	Drawing
MS1H1/ MS1H4 terminal-type motor	Front outlet	Single-turn absolute	S6-L-P114-3.0	3000	
			S6-L-P114-5.0	5000	
			S6-L-P114-10.0	10000	
		Multi-turn absolute	S6-L-P124-3.0	3000	
			S6-L-P124-5.0	5000	
			S6-L-P124-10.0	10000	
	Rear outlet	Single-turn absolute	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	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 motor		Single-turn absolute	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

Name	Cable model	Cable length (mm)	Drawing
Drive to PC communication cable	S6-L-T00-3.0	3000	
Multi-drive communication cable (CAN & RS485)	S6-L-T01-0.3	300	
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	

19.1.4 Connector Kits

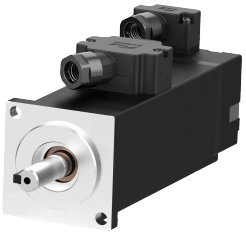
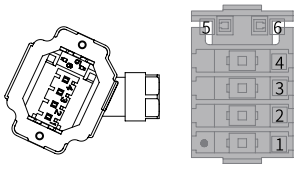
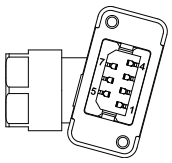
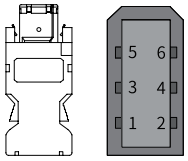
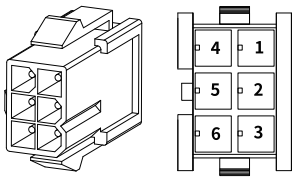
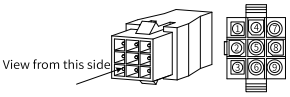
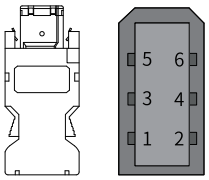
Name	Model	Drawing
Battery kit	S6-C4A	
CN1 terminal (DB44)	S6-C8	
MS1H1/MS1H4 flying leads motor connector	S6-C26	

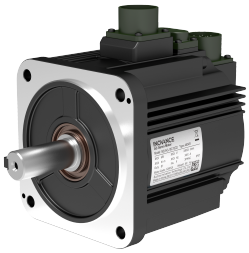
Name	Model	Drawing
MS1H2/MS1H3 (1.8 kW and below) motor connector	S6-C29	
MS1H3 motor (2.9 kW and above) connector	S6-C39	
Flying leads at motor side with power below 750 W - 500 mm	S6-C23	 
Flying leads at motor side with power below 750 W - 300 mm	S6-C24	 

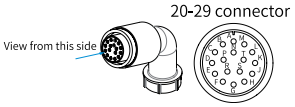
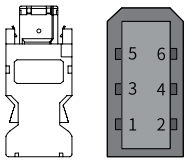
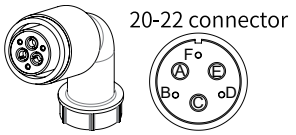
Note

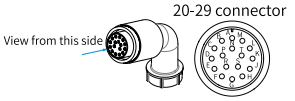
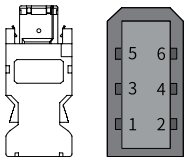
The battery-less encoder does not need the battery kit. Connecting the battery-less encoder to the battery box can damage the encoder.

19.1.5 Description of Cable Terminals

<table>
<tr><th>Name</th><th>Motor diagram</th><th colspan="3">Power cable 6-pin connector</th><th colspan="3">7-pin connector of the encoder on the motor side</th><th colspan="3">6-pin male on the drive side</th></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>+5 V</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>+5 V</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>+5 V</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>+5 V</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>8</td><td>GND</td><td>Orange</td></tr>
<tr><td>7</td><td>Shield</td><td>-</td></tr>
</table>

<table>
<tr><td rowspan="8">Assignment of terminals on the motor side (frame sizes 100/130)</td><td rowspan="8"></td><td colspan="3">Power cable connector</td><td colspan="3">Encoder cable connector</td><td colspan="3">6-pin male on the drive side</td></tr>
<tr><td colspan="3">

MIL-DTL-5015 series 3108E20-18S aviation connector</td><td colspan="3">
</td><td colspan="3">
</td></tr>
<tr><td>Pin No.</td><td>Pin No.</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>B</td><td>U</td><td>Blue</td><td>A</td><td>PS+</td><td>Blue</td><td>1</td><td>+5 V</td><td>Red</td></tr>
<tr><td>I</td><td>V</td><td>Black</td><td>B</td><td>PS-</td><td>Purple</td><td>2</td><td>GND</td><td>Orange</td></tr>
<tr><td>F</td><td>W</td><td>Red</td><td>E</td><td>Battery (+)</td><td>Brown</td><td>5</td><td>PS+</td><td>Blue</td></tr>
<tr><td>G</td><td>PE</td><td>Yellow/ Green</td><td>F</td><td>Battery (-)</td><td>Black</td><td>6</td><td>PS-</td><td>Purple</td></tr>
<tr><td>C</td><td rowspan="2">Brake (polarity insensitive)</td><td>Red</td><td>G</td><td>+5 V</td><td>Red</td><td rowspan="2">Enclosure</td><td rowspan="2">PE</td><td rowspan="2">-</td></tr>
<tr><td>E</td><td>Black</td><td>H</td><td>GND</td><td>Orange</td></tr>
<tr><td></td><td></td><td></td><td>J</td><td>Shield</td><td>-</td></tr>
<tr><td rowspan="8">Assignment of terminals on the motor side (frame size 180)</td><td rowspan="8"></td><td colspan="3">Power cable connector</td><td colspan="3">Encoder cable connector</td><td colspan="3">6-pin male on the drive side</td></tr>
<tr><td colspan="3">

MIL-DTL-5015 series 3108E20-22S aviation connector</td><td colspan="3">
</td><td colspan="3">
</td></tr>
<tr><td>Pin No.</td><td>Pin No.</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>A</td><td>U</td><td>Blue</td><td>A</td><td>PS+</td><td>Blue</td><td>1</td><td>+5 V</td><td>Red</td></tr>
<tr><td>C</td><td>V</td><td>Black</td><td>B</td><td>PS-</td><td>Purple</td><td>2</td><td>GND</td><td>Orange</td></tr>
<tr><td>E</td><td>W</td><td>Red</td><td>E</td><td>Battery (+)</td><td>Brown</td><td>5</td><td>PS+</td><td>Blue</td></tr>
<tr><td>F</td><td>PE</td><td>Yellow/ Green</td><td>F</td><td>Battery (-)</td><td>Black</td><td>6</td><td>PS-</td><td>Purple</td></tr>
<tr><td>B</td><td rowspan="2">Brake (polarity insensitive)</td><td>Red</td><td>G</td><td>+5 V</td><td>Red</td><td rowspan="2">Enclosure</td><td rowspan="2">PE</td><td rowspan="2">-</td></tr>
<tr><td>D</td><td>Black</td><td>H</td><td>GND</td><td>Orange</td></tr>
<tr><td></td><td></td><td></td><td>J</td><td>Shield</td><td>-</td></tr>
</table>

19.1.6 Cables

19.1.6.1 Power Cable Specifications

Table 19–1 Specifications of motor output cables

MS1H1/H4 05B–10C (Applicable to 0.05–1 kW)			
Cable type	Regular cable	Flexible cable	Oil-resistant shielded flexible 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℃) 4Ex20AWG+2Cx24AWG	UL2517 (rated temperature: 105℃) 4Ex20AWG+2Cx24AWG	UL2517 (rated temperature: 105℃) 4Ex20AWG+2Cx24AWG
	Power cable: 20AWG (0.52 mm^2) Outer diameter of insulation: ϕ 1.7 mm	Power cable: 20AWG (0.52 mm^2) Outer diameter of insulation: ϕ 1.7 mm	Power cable: 20AWG (0.52 mm^2) Outer diameter of insulation: ϕ 1.7 mm
	Brake cable: 24AWG (0.205 mm^2) Outer diameter of insulation: ϕ 1.1 mm	Brake cable: 24AWG (0.205 mm^2) Outer diameter of insulation: ϕ 1.1 mm	Brake cable: 24AWG (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" of the model number with cable length.			

Table 19–2 Specifications of motor output cables

MS1H2 10C–50C (Applicable to 1–5 kW)/MS1H3 85B–18C (Applicable to 0.85–1.8 kW)			
Cable type	Regular cable	Flexible cable	Oil-resistant shielded flexible 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℃) 4Ex16AWG, 2Cx18AWG	UL2586 (rated temperature: 105℃) 4Ex16AWG, 2Cx18AWG	UL2586 (rated temperature: 105℃) 4Ex16AWG, 2Cx18AWG
	Power cable: 16AWG (1.31 mm^2) Outer diameter of insulation: ϕ 3.1 mm	Power cable: 16AWG (1.31 mm^2) Outer diameter of insulation: ϕ 3.25 mm	Power cable: 16AWG (1.31 mm^2) Outer diameter of insulation: ϕ 3.25 mm
	Brake cable: 18AWG (0.823 mm^2) Outer diameter of insulation: ϕ 2.0 mm	Brake cable: 18AWG (0.823 mm^2) Outer diameter of insulation: ϕ 2.15 mm	Brake cable: 18AWG (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)

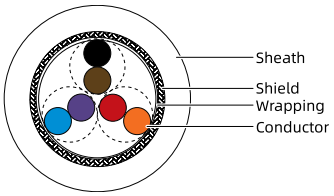
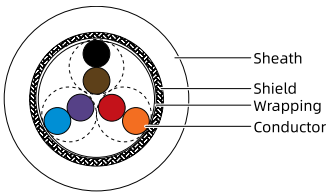
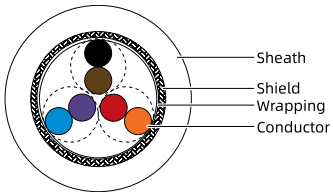
MS1H2 10C-50C (Applicable to 1-5 kW)/MS1H3 85B-18C (Applicable to 0.85-1.8 kW)			
Internal structure and conductor colors			
Fill in "X.X" of the model number with cable length.			

Table 19–3 Specifications of motor output cables

MS1H3 29C-75C (Applicable to 2.9-7.5 kW)			
Cable type	Regular cable	Flexible cable	Oil-resistant shielded flexible 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℃) 4Ex12AWG, 2Cx18AWG	UL2586 (rated temperature: 105℃) 4Ex12AWG, 2Cx18AWG	UL2586 (rated temperature: 105℃) 4Ex12AWG, 2Cx18AWG
	Power cable: 12AWG (3.31 mm^2) Outer diameter of insulation: ϕ 4.1 mm	Power cable: 12AWG (3.31 mm^2) Outer diameter of insulation: ϕ 4.2 mm	Power cable: 12AWG (3.31 mm^2) Outer diameter of insulation: ϕ 4.2 mm
	Brake cable: 18AWG (0.823 mm^2) Outer diameter of insulation: ϕ 2.0 mm	Brake cable: 18AWG (0.823 mm^2) Outer diameter of insulation: ϕ 2.15 mm	Brake cable: 18AWG (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" of the model number with cable length.			

19.1.6.2 Encoder Cable Specifications

Cable type	Regular cable	Flexible cable	Oil-resistant shielded flexible 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) 3Px26AWG	UL2517 (Rated temperature: 105°C) 3Px26AWG	UL2517 (Rated temperature: 105°C) 3Px26AWG
	Power cable: 26AWG (0.12 mm^2); OD of insulation: ϕ0.5 mm	Power cable: 26AWG (0.12 mm^2); OD of insulation: ϕ0.5 mm	Power cable: 26AWG (0.12 mm^2); OD of insulation: ϕ0.5 mm
Sheath outer diameter	5.8±0.2		6.0±0.2

Internal structure and conductor colors			
Fill in "X.X" of the model number with cable length.			

19.2 Peripheral Electrical Components

19.2.1 List of Peripheral Electrical Components

Type	Name	Installation position	Applicable model	Description
Peripheral Electrical Component	Fuse and Circuit Breaker	Input side of the drive	All models	To comply with standards EN 61800-5-1 and UL61800-5-1, install a fuse/circuit breaker on the input side of the drive to prevent accidents caused by internal short circuit.
	Electromagnetic contactor	Input side of the drive		-
	AC input reactor	Input side of the drive		Used to eliminate the high harmonics of the input side effectively and improve the power factor on the input side.
	EMC filter	Input side of the drive		Reduces the conduction and radiation interference generated by the drive to external devices.
	Magnetic ring and ferrite clamp	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.

19.2.2 Fuse (CE)

To prevent accidents caused by short circuit, install a fuse on the input side of the drive.

Table 19–4 Recommended fuse

Size	Servo drive		Fuse
	Model	Continuous input current of main circuit (A)	Rated current (A)
Single-phase 220 V			
A	SV660PS1R6I	2.3	5
	SV660PS2R8I	4	12
B	SV660PS5R5I	7.9	12
C	SV660PS7R6I	9.6	15
D	SV660PS012I	12.8	20

Size	Servo drive		Fuse
	Model	Continuous input current of main circuit (A)	Rated current (A)
Three-phase 220 V			
C	SV660PS7R6I	5.1	12
D	SV660PS012I	8	15
Three-phase 400 V			
C	SV660PT3R5I	2.4	5
	SV660PT5R4I	3.6	10
D	SV660PT8R4I	5.6	15
	SV660PT012I	8	15
E	SV660PT017I	12	20
	SV660PT021I	16	25
	SV660PT026I	21	30

Note

The recommended values in the preceding table are based on the following conditions:

- The ambient temperature of the device is 35°C without forced air cooling.
- The altitude is 2000 m.
- A single product is installed.
- The current-carrying density of the conductor is 1.3 A/mm².

If the conditions vary, select the model according to actual conditions.

19.2.3 Circuit Breaker (CE)

Table 19–5 Recommended circuit breaker model

Size	Servo drive		Recommended circuit breaker
	Model	Continuous input current of main circuit (A)	Current (A)
Single-phase 220 V			
A	SV660PS1R6I	2.3	4
	SV660PS2R8I	4	6
B	SV660PS5R5I	7.9	16
C	SV660PS7R6I	9.6	16
D	SV660PS012I	12.8	20
Three-phase 220 V			
C	SV660PS7R6I	5.1	10
D	SV660PS012I	8	16
Three-phase 380 V			
C	SV660PT3R5I	2.4	4
	SV660PT5R4I	3.6	6
D	SV660PT8R4I	5.6	10
	SV660PT012I	8	16
E	SV660PT017I	12	16
	SV660PT021I	16	25
	SV660PT026I	21	32

Note

The recommended values in the preceding table are based on the following conditions:

- The ambient temperature of the device is 35°C without forced air cooling.
- The altitude is 2000 m.
- A single product is installed.
- The current-carrying density of the conductor is 1.3 A/mm².

If the conditions vary, select the model according to actual conditions.

19.2.4 Electromagnetic Contactor

Table 19–6 Recommended electromagnetic contactor model

Size	Drive model	Rated input current (A)	Recommended contactor		
			Manufacturer	Current (A)	Model
Single-phase 220 V					
A	SV660PS1R6I	2.3	Schneider	9	LC1 D09
	SV660PS2R8I	4		9	LC1 D09
B	SV660PS5R5I	7.9		9	LC1 D09
C	SV660PS7R6I	9.6		12	LC1 D12
D	SV660PS012I	12.8		18	LC1 D18
Three-phase 220 V					
C	SV660PS7R6I	5.1	Schneider	9	LC1 D09
D	SV660PS012I	8		9	LC1 D09
Three-phase 380 V					
C	SV660PT3R5I	2.4	Schneider	9	LC1 D09
	SV660PT5R4I	3.6		9	LC1 D09
D	SV660PT8R4I	5.6		9	LC1 D09
	SV660PT012I	8		9	LC1 D09
E	SV660PT017I	12		12	LC1 D12
	SV660PT021I	16		18	LC1 D18
	SV660PT026I	21		25	LC1 D25

19.2.5 AC Input Reactor

Model selection

The optional AC input reactor is mainly used to reduce harmonics in the input current. In applications where harmonics need to be suppressed, install an external reactor. The following table lists the recommended manufacturers and models of input reactors.

Table 19–7 AC input reactor model selection

Size	Drive model	Rated input current (A)	Applicable reactor	Inductance (mH)
Three-phase 220 V				
C	SV660PS7R6I	5.1	MD-ACL-10-5-4T	5
D	SV660PS012I	8	MD-ACL-10-5-4T	5
Three-phase 380 V				
C	SV660PT3R5I	2.4	MD-ACL-10-5-4T	5
	SV660PT5R4I	3.6	MD-ACL-10-5-4T	5

Size	Drive model	Rated input current (A)	Applicable reactor	Inductance (mH)
D	SV660PT8R4I	5.6	MD-ACL-10-5-4T	5
	SV660PT012I	8	MD-ACL-10-5-4T	5
E	SV660PT017I	12	MD-ACL-15-3-4T	3
	SV660PT021I	16	MD-ACL-40-1.45-4T	1.45
	SV660PT026I	21	MD-ACL-40-1.45-4T	1.45

Dimensions

- Inovance input reactor:

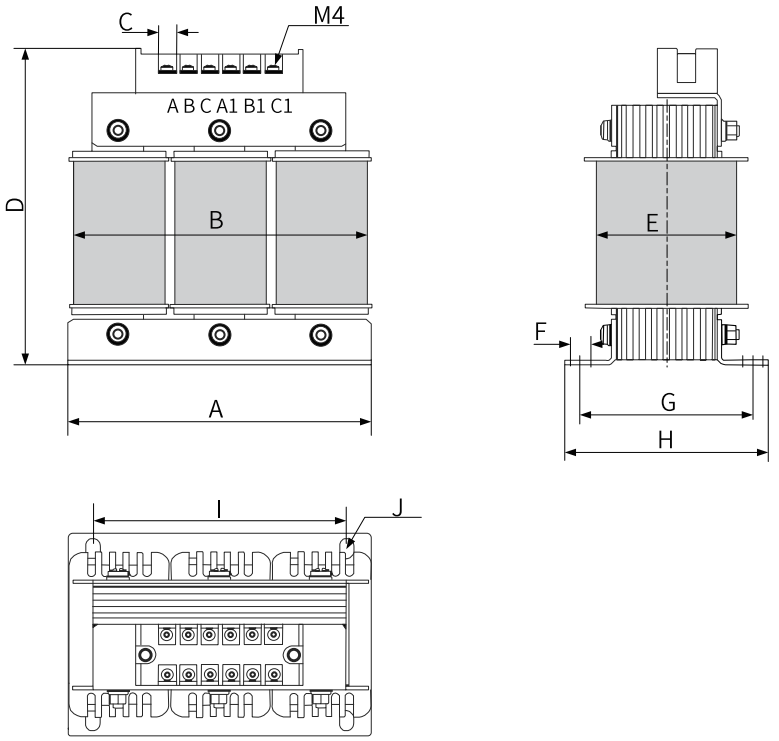


Figure 19-1 Dimensions of 10 A to 15 A AC input reactors

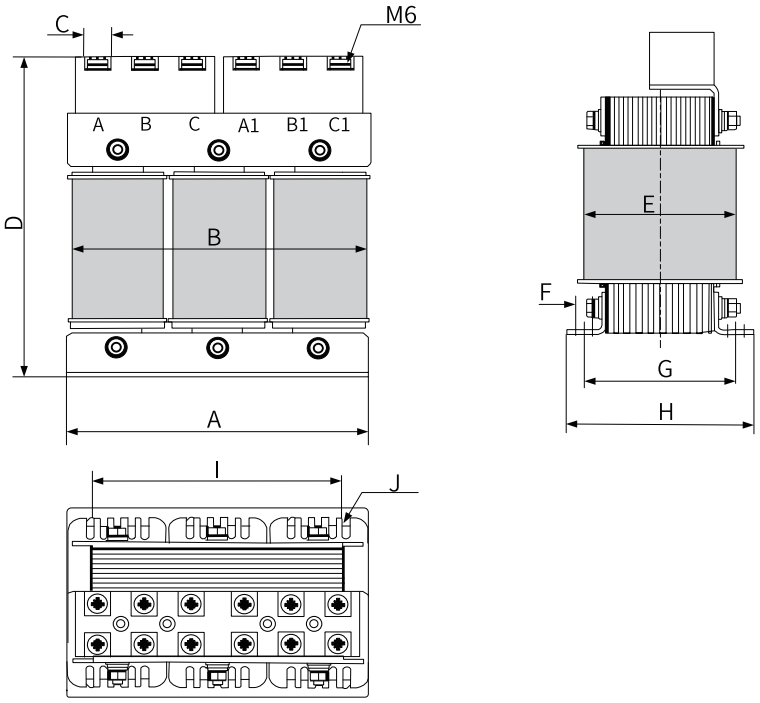


Figure 19-2 Dimensions of 40 A (1.45 mH) AC input reactors

Table 19–8 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 x 10
MD-ACL-15-3-4T	150±2	155	8	160	80	10	85± 2	100± 2	125± 1	Φ7 x 10
MD-ACL-40-1.45-4T	180± 2	185	16	200	105	10	95± 2	117± 2	150± 1	Φ7 x 10

19.2.6 EMC Filter

Model selection

To comply with EN IEC 61800-3 requirements in terms of radiated and conducted emission, install an EMC filter listed in the following table. You can select FN 2090 and FN 3287 series EMC filters manufactured by Schaffner. Select the EMC filter according to the rated input current of the drive, as shown in the following table.

Table 19–9 Standard EMC filter model and appearance

Filter model		Appearance
Schaffner	FN 2090 series	
	FN 3287 series	

Table 19–10 Filter model selection (Schaffner)

Size	Drive model	Rated input current (A)	Applicable filter
Single-phase 220 V			
A	SV660PS1R6I	2.3	FN 2090-03-06
	SV660PS2R8I	4	FN 2090-04-06
B	SV660PS5R5I	7.9	FN 2090-8-06
C	SV660PS7R6I	9.6	FN 2090-10-06
D	SV660PS012I	12.8	FN 2090-16-06
Three-phase 220 V			
C	SV660PS7R6I	5.1	FN 3258-7-44
D	SV660PS012I	8	FN 3258-16-44
Three-phase 380 V			
C	SV660PT3R5I	2.4	FN 3258-7-44
	SV660PT5R4I	3.6	FN 3258-7-44
D	SV660PT8R4I	5.6	FN 3258-7-44
	SV660PT012I	8	FN 3258-16-44
E	SV660PT017I	12	FN 3258-16-44
	SV660PT021I	16	FN 3258-16-44
	SV660PT026I	21	FN 3258-30-44

Dimensions

- Dimensions of Schaffner FN 2090 series filters

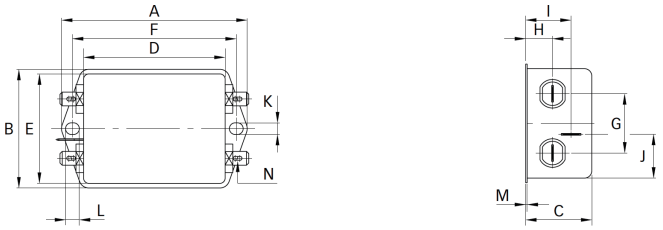


Figure 19-3 Dimensions of FN 2090 series filters (unit: mm)

Table 19–11 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

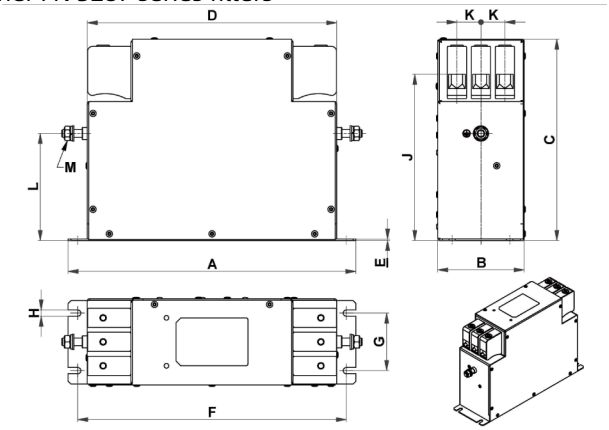


Figure 19-4 Dimension drawing of FN 3287 series filters (unit: mm)

Table 19–12 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

19.2.7 Magnetic Ring and Magnetic Buckle

The magnetic ring is to be installed on the input or output side of the drive. Install the magnetic ring as close to the drive as possible. Installing a magnetic ring at the input side can suppress noise in the input power system of the drive. Installing a magnetic ring at the output side can reduce the bearing current and interference that escapes to the outside.

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. For details, see "Dimensions" on page 75. *“ Dimensions” on page 843*.
- Ferrite magnetic buckle: provides good interference suppression in frequency bands above 1 MHz, applicable to low-power servo drives and signal cables, low-cost and easy to install.

Magnetic Ring and Ferrite Clamp		Manufacturer	Appearance
Magnetic ring	DY644020H	DAYOU-TECH	
	DY805020H	DAYOU-TECH	
Ferrite clamp	DYR-130-B	Dongyang	

Dimensions

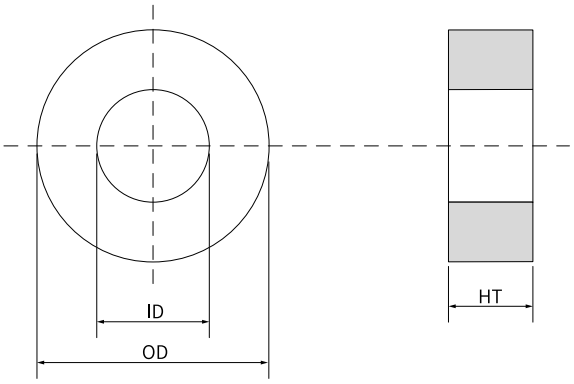


Figure 19-5 Dimensions of the magnetic ring

Table 19–13 Dimensions of the magnetic ring

Magnetic Ring Model	Dimension (OD x ID x HT) (mm)
DY644020H	64 x 40 x 20
DY805020H	80 x 50 x 20

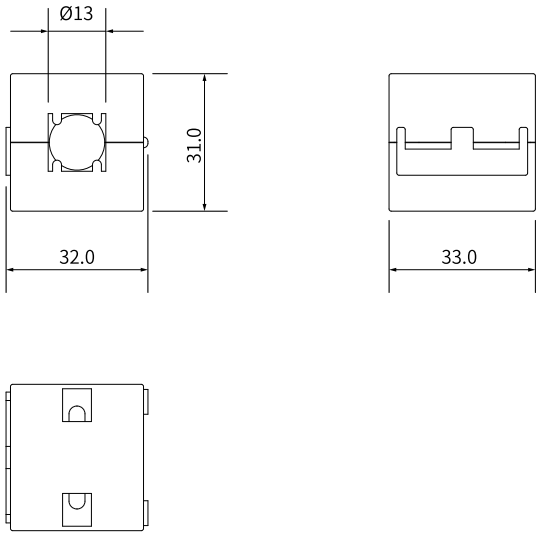


Figure 19-6 Dimensions of magnetic buckle

Table 19–14 Dimensions of the magnetic buckle

Model	Dimension (Width x Outer diameter x Inner diameter) (mm)
DYR-130-B	32 x 31 x 13

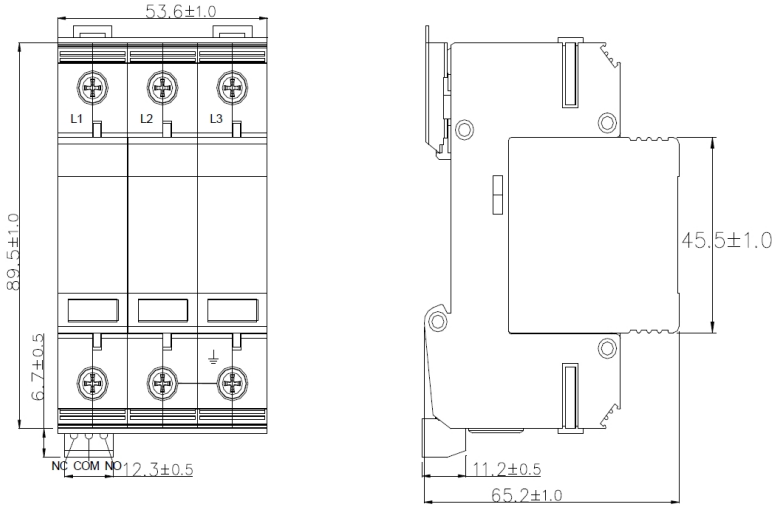
19.2.8 Surge Protection Device

Model selection

Table 19–15 Recommended surge protection device

Recommended surge protection device	
Manufacturer	Model
RainbowallY	RPM-40/3P

Dimensions



19.2.9 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

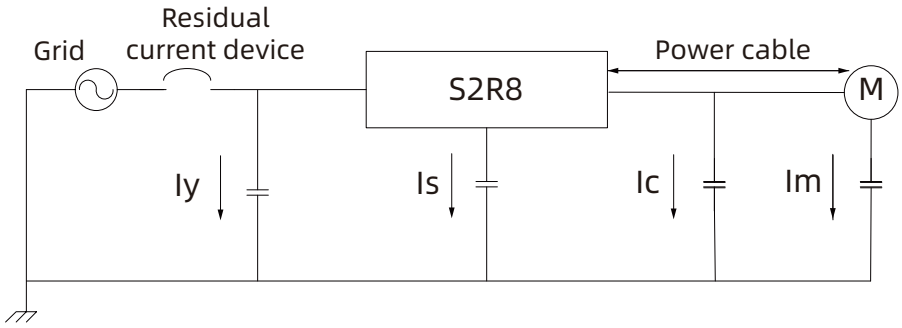


Figure 19-7 Leakage current of the drive

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-T33*R	0.5

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)
SV660PS1R6I SV660PS2R8I	0.32
SV660PS5R5I SV660PS7R6I SV660PS012I	0.52
SV660PT3R5I SV660PT5R4I SV660PT8R4I SV660PT012I SV660PT017I	0.48
SV660PT021I SV660PT026I	0.64

Selection instance

The following takes SV660PS2R8I servo drive and MS1H4-40B30CB-T331R 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 845*.

Ic = 0.1 x 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 845*.

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 846*.

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 x 1.15 mA. When three servo drives are connected in parallel, select a residual current device with a rated sensitivity current greater than 2 x (3 x 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.

19.3 Braking Resistor

Specifications of the braking resistor

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. Specifications of the braking resistor are as follows.

Table 19–16 Specifications of the braking resistor

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)	
SV660PS1R6I	-	-	-	40
SV660PS2R8I	-	-	-	40
SV660PS5R5I	50	50	25	40
SV660PS7R6I	25	80	40	20
SV660PS012I				15
SV660PT3R5I	100	80	40	80
SV660PT5R4I	100	80	40	60
SV660PT8R4I	50	80	40	45
SV660PT012I				40
SV660PT017I	35	100	50	35
SV660PT021I				25
SV660PT026I				

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 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.

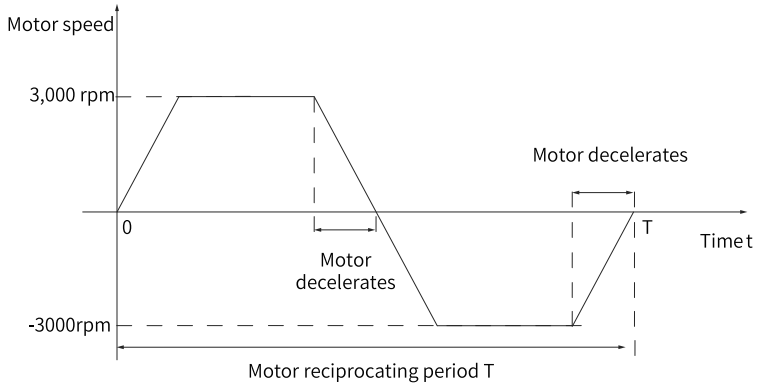


Figure 19-8 Example of motor speed curve (without external load torque)

- **External load torque applied, motor in generating state**

  When the motor direction of rotation is the same with the shaft direction of rotation, the motor outputs energy to the outside. In some applications where the motor direction of rotation is opposite to the shaft direction of rotation, the motor is in the generating state and feeds the electric energy back to the servo drive.

  When the load is in the generating state continuously, it is recommended to adopt the common DC bus mode.

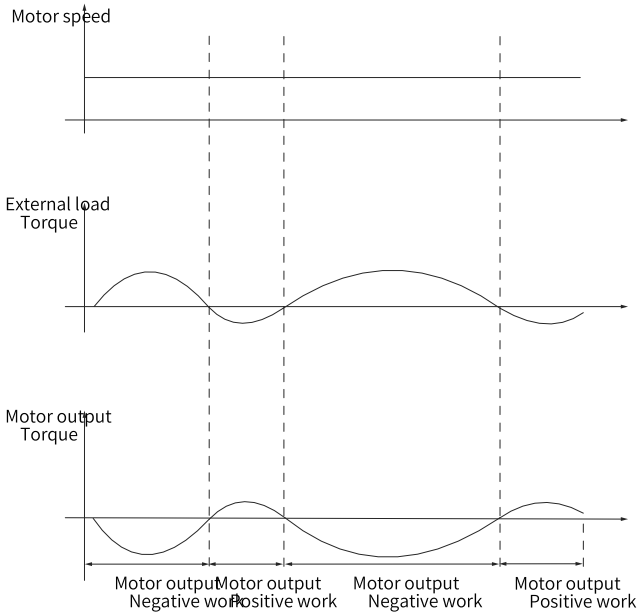


Figure 19-9 Example of the curve with external load torque

Among them, $P = FV = T/R \times 2\pi \times R \times V_1$.

For example, take the H1 series 400 W motor (rated torque 2.39 N·m) as an example. When 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 19-16 Specifications of the braking resistor" on page 847*.

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
SV660PS1R6I	13.15	The input voltage of the main circuit power supply is 220 VAC.
SV660PS2R8I	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 19–17 220 V motor energy data

Capacity (kW)	Servo Motor Model MS1H*-*******-*****	Rotor Inertia J (kg·m ^{2})	EO Generated During Decelerating from Rated Speed to a Standstill E O (J)	Max. Braking Energy Absorbed by Capacitor E C (J)
0.05	MS1H1-05B30CB-A330Z MS1H1-05B30CB-A332Z	0.026 X 10 $^{-4}$ (0.028 x 10 $^{-4}$)	0.13 (0.14)	7.86
0.1	MS1H1-10B30CB-A330Z MS1H1-10B30CB-A332Z	0.041 x 10 $^{-4}$ (0.043 x 10 $^{-4}$)	0.20 (0.21)	
0.2	MS1H1-20B30CB-A331R MS1H1-20B30CB-A334R	0.0938 x 10 $^{-4}$ (0.106 x 10 $^{-4}$)	0.46 (0.52)	
0.4	MS1H1-40B30CB-A331R MS1H1-40B30CB-A334R	0.145 x 10 $^{-4}$ (0.157 x 10 $^{-4}$)	0.72 (0.78)	15.72
0.55	MS1H1-55B30CB-A331R	0.55 x 10 $^{-4}$	2.72	22.39
0.75	MS1H1-75B30CB-A331R MS1H1-75B30CB-A334R	0.68 x 10 $^{-4}$ (0.71 x 10 $^{-4}$)	3.36 (3.51)	22.39
1	MS1H1-10C30CB-A331R MS1H1-10C30CB-A334R	0.82 x 10 $^{-4}$ (0.87 x 10 $^{-4}$)	4.05 (4.30)	32.39
1	MS1H2-10C30CB-A331R MS1H2-10C30CB-A334R	1.78 x 10 $^{-4}$ (2.6 x 10 $^{-4}$)	8.80 (12.86)	32.39

Capacity (kW)	Servo Motor Model MS1H*-*******-*****	Rotor Inertia J (kg·m ^{2})	EO Generated During Decelerating from Rated Speed to a Standstill E O (J)	Max. Braking Energy Absorbed by Capacitor E C (J)
1.5	MS1H2-15C30CB-A331R MS1H2-15C30CB-A334R	2.35 x 10 $^{-4}$ (3.17 x 10 $^{-4}$)	11.6 (15.68)	32.39
2.0	MS1H2-20C30CB-A331R MS1H2-20C30CB-A334R	2.92 x 10 $^{-4}$ (3.74 x 10 $^{-4}$)	14.44 (18.49)	32.39
0.85	MS1H3-85B15CB-A331R MS1H3-85B15CB-A334R	13.56 x 10 $^{-4}$ (15.8 x 10 $^{-4}$)	16.45 (17.3)	32.39
1.3	MS1H3-13C15CB-A331R MS1H3-13C15CB-A334R	19.25 x 10 $^{-4}$ (21.5 x 10 $^{-4}$)	22 (22.86)	32.39
0.1	MS1H4-10B30CB-A330Z MS1H4-10B30CB-A332Z	0.102 x 10 $^{-4}$ (0.104 x 10 $^{-4}$)	0.50 (0.51)	7.86
0.2	MS1H4-20B30CB-A331R MS1H4-20B30CB-A334R	0.22 x 10 $^{-4}$ (0.23 x 10 $^{-4}$)	1.09 (1.14)	7.86
0.4	MS1H4-40B30CB-A331R MS1H4-40B30CB-A334R	0.43 x 10 $^{-4}$ (0.44 x 10 $^{-4}$)	2.13 (2.18)	15.72
0.55	MS1H4-55B30CB-A331R	1.12 x 10 $^{-4}$	5.54	22.39
0.75	MS1H4-75B30CB-A331R MS1H4-75B30CB-A334R	1.46 x 10 $^{-4}$ (1.51 x 10 $^{-4}$)	7.22 (7.47)	22.39
1.0	MS1H4-10C30CBA331R MS1H4-10C30CBA334R	1.87 x 10 $^{-4}$ (1.97 x 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 19–18 380 V motor energy data

Capacity (kW)	Servo Motor Model MS1H*-*******-*****	Rotor Inertia J (kg·m ^{2})	Braking Energy E O Generated During Decelerating from Rated Speed to a Standstill (J)	Max. Braking Energy Absorbed by Capacitor E C (J)
1.0	MS1H2-10C30CD-A331R MS1H2-10C30CD-A334R	1.78 x 10 $^{-4}$ (2.6 x 10 $^{-4}$)	8.8 (12.86)	28.18
1.5	MS1H2-15C30CD-A331R MS1H2-15C30CD-A334R	2.35 x 10 $^{-4}$ (3.17 x 10 $^{-4}$)	11.62 (15.68)	34.22
2.0	MS1H2-20C30CD-A331R MS1H2-20C30CD-A334R	2.92 x 10 $^{-4}$ (3.74 x 10 $^{-4}$)	14.44 (18.49)	50.32
2.5	MS1H2-25C30CD-A331R MS1H2-25C30CD-A334R	3.49 x 10 $^{-4}$ (4.3 x 10 $^{-4}$)	17.26 (21.26)	50.32
3.0	MS1H2-30C30CD-A331R MS1H2-30C30CD-A334R	6.4 x 10 $^{-4}$ (9.38 x 10 $^{-4}$)	31.65 (46.38)	50.32

Capacity (kW)	Servo Motor Model MS1H*-*******-*****	Rotor Inertia J (kg·m ^{2})	Braking Energy E_O Generated During Decelerating from Rated Speed to a Standstill (J)	Max. Braking Energy Absorbed by Capacitor E_C (J)
4.0	MS1H2-40C30CD-A331R MS1H2-40C30CD-A334R	9 x 10 $^{-4}$ (11.98 x 10 $^{-4}$)	44.51 (59.24)	82.53
5.0	MS1H2-50C30CD-A331R MS1H2-50C30CD-A334R	11.6 x 10 $^{-4}$ (14.58 x 10 $^{-4}$)	57.36 (72.10)	100.64
0.85	MS1H3-85B15CD-A331R MS1H3-85B15CD-A334R	13.56 x 10 $^{-4}$ (15.8 x 10 $^{-4}$)	16.76 (19.53)	28.18
1.3	MS1H3-13C15CD-A331R MS1H3-13C15CD-A334R	19.25 x 10 $^{-4}$ (21.5 x 10 $^{-4}$)	23.8 (26.58)	34.22
1.8	MS1H3-18C15CD-A331R MS1H3-18C15CD-A334R	24.9 x 10 $^{-4}$ (27.2 x 10 $^{-4}$)	30.78 (33.63)	50.32
2.9	MS1H3-29C15CD-A331R MS1H3-29C15CD-A334R	44.7 x 10 $^{-4}$ (52.35 x 10 $^{-4}$)	55.26 (64.72)	50.32
4.4	MS1H3-44C15CD-A331R MS1H3-44C15CD-A334R	64.9 x 10 $^{-4}$ (72.55 x 10 $^{-4}$)	80.23 (89.69)	82.53
5.5	MS1H3-55C15CD-A331R MS1H3-55C15CD-A334R	86.9 x 10 $^{-4}$ (94.55 x 10 $^{-4}$)	107.43 (116.89)	100.64
7.5	MS1H3-75C15CD-A331R MS1H3-75C15CD-A334R	127.5 x 10 $^{-4}$ (135.15 x 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.

Braking resistor selection

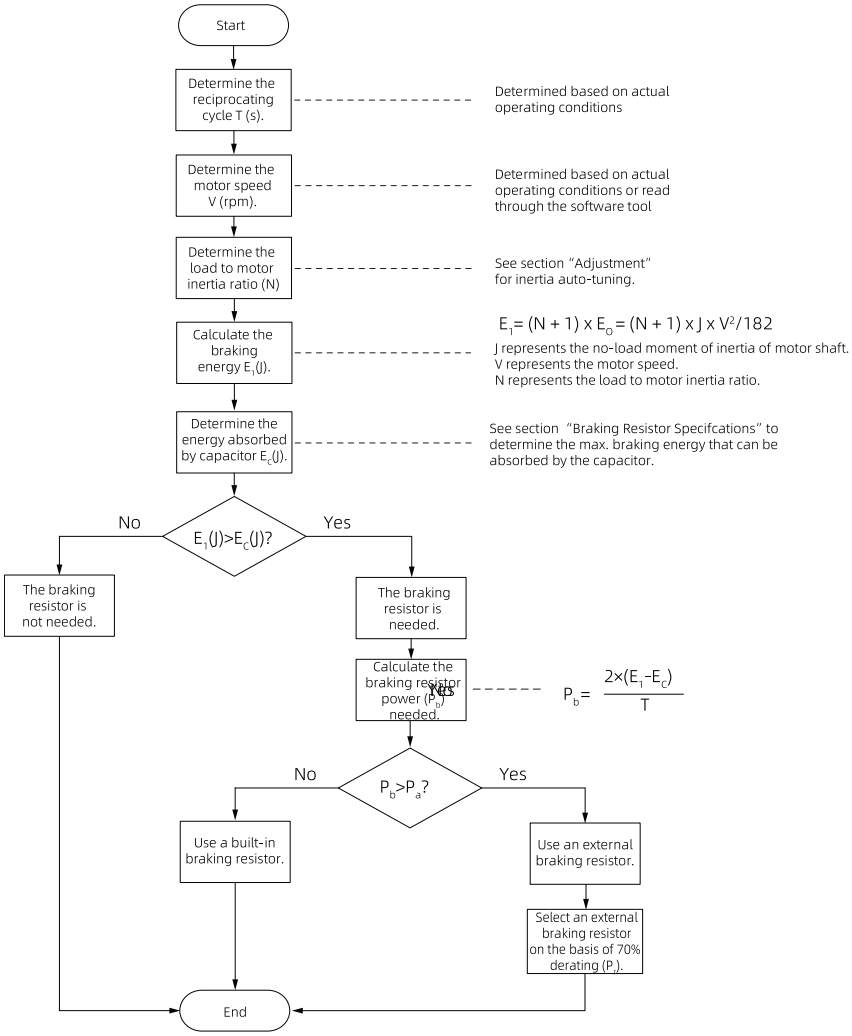


Figure 19-10 Flowchart for selecting the braking resistor

Table 19–19 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 "Adjustment".
Rotor inertia (J)	kg·m^2	For the specific rotor inertia of MS1 series motors, see *"Table 19-17 220 V motor energy data" on page 849*
Braking energy E_1	J	$E_1 = (N + 1) \times J \times V^2/182$
Energy absorbed by capacitor E_c	J	For the maximum braking energy absorbed by capacitor, see *"Table 19-17 220 V motor energy data" on page 849*
Power of braking resistor (P_b)	W	$P_b = 2 \times (E_1 - E_C)/T$
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 19-16 Specifications of the braking resistor" on page 847*

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 19-17 220 V motor energy data" on page 849* 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 19-16 Specifications of the braking resistor" on page 847*.

Application example:

Take the MS1H1 series 400 W model as an example. Assume that the reciprocating motion cycle T = 2s, rated peed = 3000 rpm, inertia ratio = 4, then the required braking resistor power is:

$$P_b = \frac{2 \times [E_1 - E_C]}{T}$$

The braking energy is generated during decelerating from no-load rated speed to a standstill, so $E_1 = (N + 1) \times E_0$, and the following formula applies:

$$P_b = \frac{2 \times [(N+1) \times E_0 - E_C]}{T} = \frac{2 \times [(4+1) \times 0.72 - 15.72]}{2} = -12.12W$$

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 30:1 and other conditions are the same, the required braking resistor power is as follows.

$$P_b = \frac{2 \times [(N+1) \times E_0 - E_C]}{T} = \frac{2 \times [(30+1) \times 0.72 - 15.72]}{2} = 6.6W$$

$P_b > 0$ W so an external braking resistor is required. The recommended power of the external braking resistor is $P_b/(1 - 70\%) = 22$ 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 $E_1 < E_C$, the braking resistor is not 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, $P_r = P_b/(1 - 70\%)$, 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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.21	Smallest allowed dynamic braking resistor	0x0215	1 to 1000	Ω	40	UInt16	Unmodifiable	Ordinary user	-
	Parameter description:								
	The permissible minimum resistance of the regenerative resistor is only related to the servo drive model.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.24	Resistor heat dissipation coefficient	0x0218	10 to 100	-	30	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	It sets the heat dissipation coefficient of the regenerative resistor, which is valid for both built-in and external ones. 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.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.25	Regenerative resistor type	0x0219	0 to 3	-	0	UInt16	At stop	Ordinary user	At once

Values:

0: Built-in
1: External, natural ventilated
2: External, forced air cooling
3: Not needed

Parameter description:

It sets the mode of absorbing and releasing the braking energy.

Set value	Defines the regenerative resistor type and the mode of absorbing and releasing the braking energy.	Remarks
0	Built-in	When the calculated value of the maximum braking energy is larger than the maximum braking energy absorbed by capacitors, and the calculated value of braking power is no larger than the built-in regenerative resistor power.
1	External, naturally ventilated	When the calculated value of the maximum braking energy is larger than the maximum braking energy absorbed by capacitors, and the calculated value of braking power is larger than the built-in regenerative resistor power.
2	External, forcible cooling	When the calculated value of the maximum braking energy is larger than the maximum braking energy absorbed by capacitors, and the calculated value of braking power is larger than the built-in regenerative resistor power.
3	No resistor, using only capacitor	When the calculated value of maximum braking energy is no larger than the maximum braking energy absorbed by capacitors.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.26	Power of external braking resistor	0x021A	1 to 65535	W	40	UInt16	At stop	Ordinary user	At once

Parameter description:

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.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.27	Resistance of external regenera tive resistor	0x021B	1 to 1000	Ω	50	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	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.								

19.4 Absolute Encoder Batteries

Model selection

Select an appropriate battery according to the following table.

Table 19–20 Description of the absolute encoder battery

Specification	Item	Rating			Condition
		Min. value	Typical Value	Max. value	
Output specification: 3.6 V 2700 mAh	External battery voltage (V)	3.2	3.6	3.8	In the standby mode[1]
	Circuit fault voltage (V)	-	2.6	-	In the standby mode
	Battery alarm voltage (V)	2.85	3	3.15	-
	Current consumed by the circuit (μA)	-	2	-	In the normal operation mode[2]
		-	10	-	In the standby mode, the axis is at a standstill.
		-	300	-	In standby mode, the axis keeps operating.
	Battery ambient temperature (℃)	0	-	40	Same as the motor
	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, E740 (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%. Keep the battery case away from corrosive substances, fire sources, and heating sources.

20 Certification and Standard Requirements

20.1 CE Certification



Figure 20-1 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.

20.1.1 Requirements for Compliance with EMC

This drive, which is applicable to the First environment and Second environment, complies with EMC Directive 2014/30/EU and standard EN IEC 61800-3.

As required by EMC Directive 2014/30/EU and standard EN IEC 61800-3, install an EMC filter on the input side of the drive and use shielded cables on the output side. Ensure the filter is grounded properly and the shield of the output cable is grounded 360 degrees.



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 application environment.

- Category C1: 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 with rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment.
- Category C4 equipment: PDS with rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

20.1.2 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 drive in a place with overvoltage category III and pollution degree 1 or 2 as specified by IEC 60664-1.

Installation environment

For requirements of the installation environment, see *" Installation Environment of the Drive" on page 55*.

Installation protection requirements

The drive must be installed in a fireproof cabinet with doors that provide effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations and relevant IEC standards.

Drives (IP20) intended to be installed inside the cabinet must be installed in a structure that prevents intrusion of unwanted objects from the top and the front.

Wiring requirements of main circuit

For detailed information, see section "Wiring Precautions and Requirements" for wiring requirements of main circuit terminals.

Requirements for protective devices

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

For recommended fuse and circuit breaker models, see the selection table for the fuse and circuit breaker.

20.2 UL/cUL



Figure 20-2 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:

SV660P 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

Warning: It is not allowed to connect output terminals (such as $P_{\oplus}$, C, and $N_{\ominus}$) in the field.

- Terminals $P_{\oplus}$, C, and $N_{\ominus}$ 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).

21 Appendix

21.1 Accessories and Spare Parts

21.1.1 Terminal Accessory Kit

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

Table 21–1 Material code of the accessory kit for each model

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

Note

SV660 series servo drives share the same terminal accessory kit.

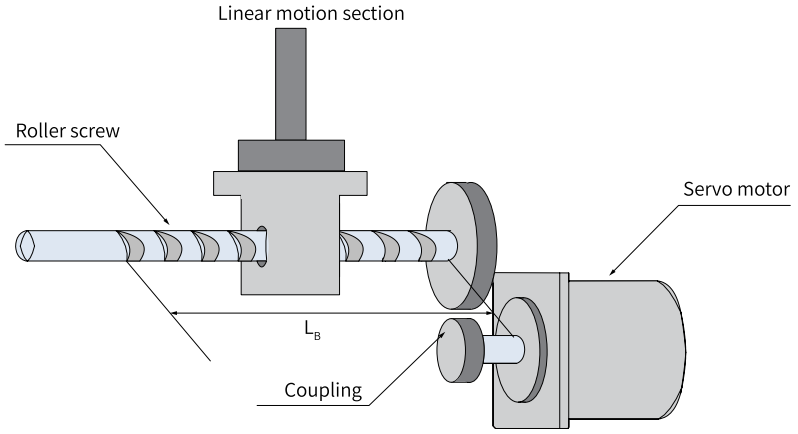
21.1.2 Recommended Terminal Blocks

Table 21–2 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	

21.2 Motor Sizing

21.2.1 Capacity Selection Example for Position Control



Load speed V_L =15 m/min

Linear motion section mass (m) = 80 kg

Roller screw length L_B =0.8m

Roller screw diameter d_B =0.016m

Roller screw pitch P_B = 0.005 m

Coupling mass m_c = 0.3 kg

Coupling outer diameter d_c = 0.03 m

Number of feeding operations (n) = 40/min

Feeding distance (L) = 0.25 m

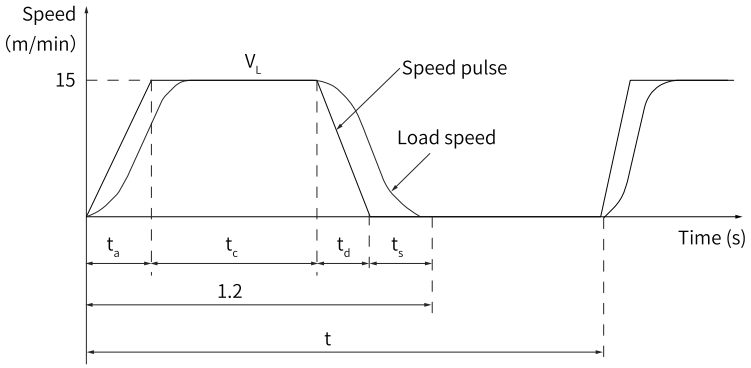
Feeding time t_m =1.2s or less

Electrical stopping precision (δ) = ±0.01 mm

Friction coefficient (μ) = 0.2

Mechanical efficiency (η) = 0.9 (90%)

1. **Speed diagram**



$$t = \frac{60}{n} = \frac{60}{40} = 1.5(s)$$

$$T_a = t_d,\ t_s = 0.1(s)$$

$$Ta = t_m - t_s - \frac{60L}{V_L} = 1.2 - 0.1 - \frac{60 \times 0.25}{15} = 0.1(s)$$

$$t_c = 1.2 - 0.1 - 0.1 \times 2 = 0.9(s)$$

2. **Speed**

- Load shaft speed

$$n_L = \frac{V_L}{P_B} = \frac{15}{0.005} = 3000\ (\text{rpm})$$

- Motor shaft speed

  As the coupling is directly connected, the gear ratio (1/R) is 1:1.

$$n_M = n_L \times R = 3000 \times 1 = 3000\ (\text{RPM})$$

3. **Load torque**

$$T_L = \frac{9.8\ \mu \times m \times P_B}{2\pi R \times \eta} = \frac{9.8 \times 0.2 \times 80 \times 0.005}{2\pi \times 1 \times 0.9} = 0.139\ (\text{N}\cdot\text{m})$$

4. **Load moment of inertia**

- Linear motion section

$$J_{LI} = m \times \left(\frac{P_B}{2\pi R}\right)^2 = 80 \times \left(\frac{0.005}{2\pi \times 1}\right)^2 = 0.507 \times 10^{-4}\ (\text{kg}\cdot\text{m}^2)$$

- Roller screw

$$J_B = \frac{\pi}{32} P \times L_B \times d_B^4 = \frac{\pi}{32} \times 7.87 \times 10^3 \times 0.8 \times (0.016)^4 = 0.405 \times 10^{-4}(\text{kg}\cdot\text{m}^2)$$

- Coupling

$$J_C = \frac{1}{8} m_c \times d_c^4 = \frac{1}{8} \times 0.3 \times (0.03)^2 = 0.338 \times 10^{-4}(\text{kg}\cdot\text{m}^2)$$

5. **Load moving power**

$$P_O = \frac{2\pi \times n_M \times T_L}{60} = \frac{2\pi \times 3000 \times 0.139}{60} = 43.7\ (\text{W})$$

6. **Load acceleration power**

$$P_a = \left(\frac{2\pi}{60} \times n_m\right)^2 \frac{J_L}{t_a} = \left(\frac{2\pi}{60} \times n_m\right)^2 \times \frac{J_{LI} + J_B + J_C}{t_a}$$

$$= \left(\frac{2\pi}{60} \times 3000\right)^2 \times \frac{1.25 \times 10^{-4}}{0.1} = 123.4\ (\text{W})$$

7. **Provisional settings of the servo motor**

- Selection condition

  $T_L \leq$ motor rated torque

  $P_a + P_o =$ (1 to 2) x Rated output of the motor

  $n_M \leq$ motor rated speed

  $J_L \leq$ Allowable load moment of inertia of the servo unit

  Perform the following provisional selections according to preceding conditions:

  Servo motor: MS1H1-20B30CB-A330R

  Servo drive: SV670PS1R6I

- Specifications of the servo motor and servo drive

Rated output: 200 (W)

Rated speed: 3000 (RPM)

Rated torque: 0.64 (N·m)

Maximum instantaneous torque: 1.95 (N·m)

Motor rotor moment of inertia: 0.082×10^{-4} ($kg \cdot m^2$)

Permissible load inertia of mechanism: 1.64×10^{-4} ($kg \cdot m^2$)

Number of encoder pulses: 67108864 (P/R)

8. **Verification of the servo motor selected provisionally**

Verify the start torque required

$$T_p = \frac{2\pi \times n_M \times (J_M + J_L)}{60 \times t_a} + T_L = \frac{2\pi \times 3000 \times (0.082 + 1.25) \times 10^{-4}}{60 \times 0.1} + 0.139$$

$= 0.557\ (N \cdot m) <$ Max. instantaneous torque...Satisfactory

Verify the braking torque required

$$T_s = \frac{2\pi \times n_M \times (J_M + J_L)}{60 \times t_a} - T_L = \frac{2\pi \times 3000 \times (0.082 + 1.25) \times 10^{-4}}{60 \times 0.1} - 0.139$$

$= 0.279(N \cdot m) <$ Max. instantaneous torque...Satisfactory

Verify the effective torque value

$$T_{rms} = \sqrt{\frac{T_p^2 \times t_a + T_L^2 \times t_c + T_s^2 \times t_d}{t}}$$

$$= \sqrt{\frac{(0.557)^2 \times 0.1 + (0.139)^2 \times 0.9 + (0.279)^2 \times 0.1}{1.5}}$$

$= 0.19\ (N \cdot m) <$ Rated torque...Satisfactory

The servo motor and servo drive selected provisionally are applicable in terms of capacity. The following analyzes position control.

9. **Electronic gear ratio (B/A)**

The electrical stopping precision (δ) is ±0.01 mm, so the position detection unit (△L) is 0.01 mm/pulse.

$$\frac{P_B}{\Delta L} \times \frac{B}{A} = \frac{5}{0.01} \times \frac{B}{A} = 67108864$$

$$\frac{B}{A} = \frac{67108864 \times 0.01}{5} = \frac{67108864}{500}$$

10. **Reference pulse frequency**

$$v_s = \frac{1000 \times V_L}{60 \times \Delta L} = \frac{1000 \times 15}{60 \times 0.01} = 25000\ (pps)$$

11. **Offset counter droop pulse**

- Set position loop gain K_p=30(l/s)

$$\varepsilon = \frac{V_s}{K_p} = \frac{25000}{30} = 833\ (pulse)$$

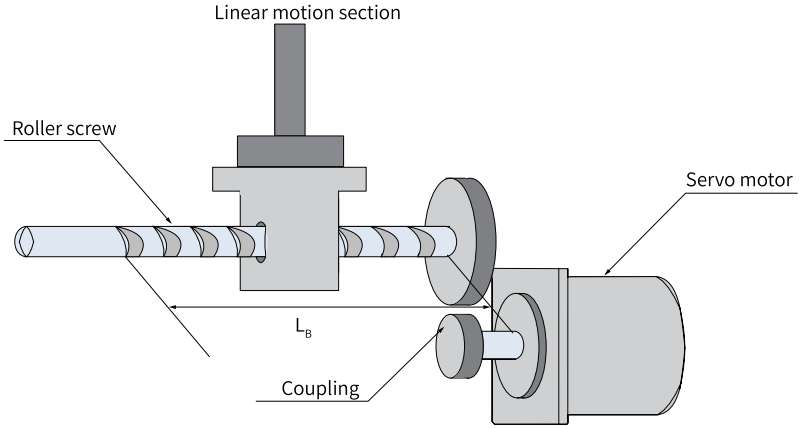
- Electrical stopping precision

$$\pm\Delta\varepsilon = \pm\frac{\varepsilon}{(\text{Servo drive control range}) \times \frac{n_M}{n_R}} = \pm\frac{833}{5000 \times \frac{3000}{3000}}$$

$$= \pm 0.17 < \pm 1\,(\text{pulse}) \pm 0.01\,(\text{mm/pulse})$$

The servo motor and servo drive selected provisionally are applicable for position control.

21.2.2 Capacity Selection Example for Speed Control



Load speed V_L =15 m/min

Linear motion section mass (m) = 80 kg

Roller screw length L_B =0.8m

Roller screw diameter d_B =0.04m

Roller screw pitch P_B = 0.01 m

Coupling mass m_c = 1 kg

Coupling outer diameter d_c = 0.06 m

Number of feeding operations (n) = 40/min

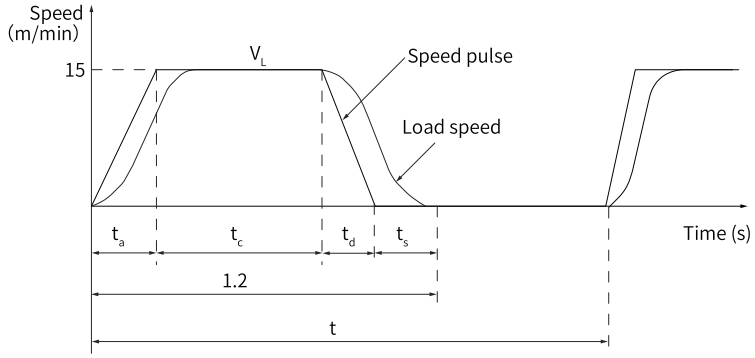
Feeding distance (L) = 0.25 m

Feeding time t_m =1.2s or less

Friction coefficient (μ) = 0.2

Mechanical efficiency (η) = 0.9 (90%)

1. **Speed diagram**



$$t = \frac{60}{n} = \frac{60}{40} = 1.5(s)$$

Set $t_a = t_d$

$$t_a = t_m - t_s - \frac{60 \times L}{V_L} = 1.2 - 0.1 - \frac{60 \times 0.25}{15} = 0.1(s)$$

$$t_C = 1.2 - 0.1 - 0.1 \times 2 = 0.9(s)$$

2. **Speed**

- Load shaft speed

$$n_L = \frac{V_L}{P_B} = \frac{15}{0.01} = 1500\ (rpm)$$

- Motor shaft speed

  As the coupling is directly connected, the gear ratio (1/R) is 1:1.

$$n_M = n_L \times R = 1500 \times 1 = 1500\ (RPM)$$

3. **Load torque**

$$T_L = \frac{9.8 \mu \times m \times P_B}{2\pi \times R \times \eta} = \frac{9.8 \times 0.2 \times 80 \times 0.01}{2\pi \times 1 \times 0.9} = 0.277\ (N \cdot m)$$

4. **Load moment of inertia**

- Linear motion section

$$J_{LI} = m \times \left(\frac{P_B}{2\pi R}\right)^2 = 80 \times \left(\frac{0.01}{2\pi \times 1}\right)^2 = 2.02 \times 10^{-4}\ (kg \cdot m^2)$$

- Roller screw

$$J_B = \frac{\pi}{32} P \times L_B \times d_B^4 = \frac{\pi}{32} \times 7.87 \times 10^3 \times 1.4 \times (0.04)^4 = 27.7 \times 10^{-4}\ (kg \cdot m^2)$$

- Coupling

$$J_C = \frac{1}{8} m_c \times d_c^4 = \frac{1}{8} \times 1 \times (0.06)^2 = 4.5 \times 10^{-4}\ (kg \cdot m^2)$$

5. **Load moving power**

$$P_O = \frac{2\pi \times n_M \times T_L}{60} = \frac{2\pi \times 1500 \times 0.277}{60} = 43.6\ (W)$$

6. **Load acceleration power**

$$P_a = \left(\frac{2\pi}{60} \times n_m\right)^2 \times \frac{J_L}{t_a} = \left(\frac{2\pi}{60} \times n_m\right)^2 \times \frac{J_C + J_B + J_{LI}}{t_a}$$

$$= \left(\frac{2\pi}{60} \times 1500\right)^2 \times \frac{34.22 \times 10^{-4}}{0.1} = 844\ (W)$$

7. **Provisional settings of the servo motor**

- Selection condition

  $T_L \leq$ motor rated torque

  $P_a + P_o =$ (1 to 2) x Rated output of the motor

  $n_M \leq$ motor rated speed

  $J_L \leq$ Allowable load moment of inertia of the servo unit

  Perform the following provisional selections according to preceding conditions:

Servo motor: MS1H4-75B30CB-A331R

Servo drive: SV670PS5R5I

- Specifications of the servo motor and servo drive

Rated output: 750 (W)

Rated speed: 3000 (RPM)

Rated torque: 2.39 (N·m)

Maximum instantaneous torque: 8.365 (N·m)

Motor rotor moment of inertia: 1.38×10^{-4}(kg·m²)

Permissible load inertia of mechanism: 69.58×10^{-4}(kg·m²)

8. **Verification of the servo motor selected provisionally**

Verify the start torque required

$$T_p = \frac{2\pi \times n_M \times (J_M + J_L)}{60 \times t_a} + T_L = \frac{2\pi \times 1500 \times (1.38 + 34.22) \times 10^{-4}}{60 \times 0.1} + 0.277$$

$$= 5.87\ (N \cdot m) < \text{Max. instantaneous torque...Satisfactory}$$

Verify the braking torque required

$$T_s = \frac{2\pi \times n_M \times (J_M + J_L)}{60 \times t_a} - T_L = \frac{2\pi \times 1500 \times (1.38 + 34.22) \times 10^{-4}}{60 \times 0.1} - 0.277$$

$$= 5.32\ (N \cdot m) < \text{Max. instantaneous torque...Satisfactory}$$

Verify the effective torque value

$$T_{rms} = \sqrt{\frac{T_p^2 \times t_a + T_L^2 \times t_c + T_s^2 \times t_d}{t}}$$

$$= \sqrt{\frac{(5.87)^2 \times 0.1 + (0.277)^2 \times 0.9 + (5.32)^2 \times 0.1}{1.5}}$$

$$= 2.06(N \cdot m) < \text{Rated torque...Satisfactory}$$

9. **Selection result**

The servo motor and servo drive selected provisionally are applicable for speed control. The torque diagram is as follows.

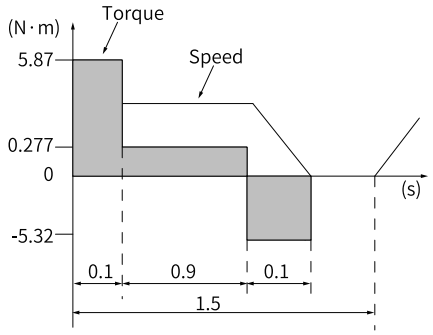


Figure 21-1 Torque diagram

21.3 DI/DO Function Assignment

Code	Name	Function Name	Description	Remarks
Description of DI signals				
FunIN.1	S-ON	Servo ON	Disabled: Servo motor disabled Enabled: Servo motor enabled	The corresponding terminal logic must be level-triggered. The change of the corresponding DI/VDI or terminal logic is activated at next power-on.
FunIN.2	ALM-RST	Fault and warning reset	Inactive: Disabled Active: Enabled	"Edge-triggered" will be applied even if "level-triggered" is selected. To reset No. 1 and No. 2 resettable faults, switch off the S-ON signal first. The servo drive can continue to work after alarms of certain types are reset.
FunIN.3	GAIN-SEL	Gain Switchover	• H08.09 = 1: • Inactive: Speed control loop being PI control • Invalid: Speed control loop being P control • H08.09 = 2: • Inactive: Fixed to the 1st group of gains • Valid: Fixed at 2nd gain	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.4	CMD-SEL	Main/Auxiliary reference switchover	Inactive: Current reference being A Valid: Current reference being B	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.5	DIR-SEL	Setting of multi-speed DI switchover running direction	Inactive: Reference direction by default Valid: Reverse reference direction	The corresponding terminal logic is recommended to be level-triggered.
FunIN.6	CMD1	Multi-position reference switchover 1	Used to select one from the 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.7	CMD2	Multi-position reference switchover 2	Used to select one from the 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.8	CMD3	Multi-position reference switchover 3	Used to select one from the 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.9	CMD4	Multi-position reference switchover 4	Used to select one from the 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.10	M1-SEL	Mode switchover 1	Perform switchover between speed control, position control, and torque control based on the selected control mode (values 3, 4, 5 of H02-00).	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.11	M2-SEL	Mode switchover 2	Perform switchover between speed control, position control, and torque control based on the selected control mode (values 6 of H02-00).	It is recommended that the logic of the corresponding terminal be set to level valid.

Code	Name	Function Name	Description	Remarks
FunIN.12	ZCLAMP	Zero speed clamp	Valid: Zero clamp enabled Invalid: Zero clamp disabled	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.13	INHIBIT	Position reference inhibited	Active: Pulse reference input inhibited Invalid: Pulse reference input allowed	The function is upgraded from pulse inhibited to position reference inhibited. Position references include internal and external position references. The logic of the corresponding terminal needs to be set to level valid.
FunIN.14	P-OT	Positive limit switch	Enabled: Forward drive inhibited Disabled: Forward drive permitted	Overtravel prevention applies when the machine moves beyond the limit. It is recommended that the corresponding terminal logic is level-triggered.
FunIN.15	N-OT	Negative limit switch	Overtravel prevention applies when the load moves beyond the limit. Active: Reverse drive inhibited Inactive: Reverse drive allowed	The corresponding terminal logic is recommended to be level-triggered.
FunIN.16	P-CL	External positive torque limit	The torque limit source is switched based on H07.07 (Torque limit source). H07.07 = 1: Active: Positive external torque limit activated Inactive: Positive internal torque limit activated	The corresponding terminal logic is recommended to be level-triggered.
FunIN.17	N-CL	External negative torque limit	The torque limit source is switched based on H07.07 (Torque limit source). H07.07 = 1: Active: Negative external torque limit activated Inactive: Negative internal torque limit activated	The corresponding terminal logic is recommended to be level-triggered.
FunIN.18	JOGCMD+	Forward jog	Active: Input based on command Inactive: Command input stopped	The corresponding terminal logic is recommended to be level-triggered.
FunIN.19	JOGCMD-	Reverse jog	Active: Input in reverse to the command Inactive: Command input stopped	The corresponding terminal logic is recommended to be level-triggered.
FunIN.20	POSSTEP	Step reference	Active: Execute step reference set in H05-05, servo motor running Invalid: Reference being zero, in positioning state	It is recommended that the logic of the corresponding terminal be set to level valid.

Code	Name	Function Name	Description	Remarks
FunIN.21	HX1	Handwheel multiplying factor signal 1	HX1 active, HX2 inactive: X10. HX1 inactive, HX2 active: x 100. Other: X1.	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.22	HX2	Handwheel multiplying factor signal 2		
FunIN.23	HX_EN	Handwheel enable signal	Inactive: Execute position control as defined by H05-00. Invalid: Receive pulse signal from the handwheel for position control in position control mode	The corresponding terminal logic is recommended to be level-triggered.
FunIN.24	GEAR_SEL	Electronic gear ratio switchover	Inactive: Electronic gear ratio 1 Valid: Electronic gear ratio 2	The corresponding terminal logic is recommended to be level-triggered.
FunIN.25	TOQDirSel	Torque reference direction	Inactive: Forward. Invalid: Reverse direction	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.26	SPDDirSel	Speed reference direction	Inactive: Forward. Invalid: Reverse direction	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.27	POSDirSel	Position reference direction	Inactive: Actual position reference direction same as the set direction Active: Actual position reference direction opposite to the set direction	The corresponding terminal logic is recommended to be level-triggered.
FunIN.28	PosInSen	Multi-position reference signal enable	Disabled: The reference is ineffective. Enabled: The reference is enabled.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.29	XintFree	Interrupt positioning clear	Inactive: Disabled Active: Enabled	The corresponding terminal logic is recommended to be level-triggered.
FunIN.31	HomeSwitch	Home switch	Inactive: The switch is not triggered Enabled: The switch is 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 active), the servo drive forcibly changes it to 1 (active high). If the logic is set to 3 (falling edge active), the servo drive forcibly changes it to 0 (active low). If the logic is set to 4 (both rising edge and falling edge active), the servo drive forcibly changes it to 0 (low level active).
FunIN.32	HomingStart	Homing enable	Inactive: Disabled Active: Enabled	It is recommended that the logic of the corresponding terminal be set to level valid.

Code	Name	Function Name	Description	Remarks
FunIN.33	XintInhibit	Interrupt positioning inhibited	Active: Interrupt positioning inhibited. Invalid: Interruption fixed length allowed	The logic of the corresponding terminal needs to be set to level valid. • If the logic is set to 2 (rising edge active), the servo drive forcibly changes it to 1 (active high). • If the logic is set to 3 (Active falling edge), the servo drive forcibly changes it to 0 (Active low). • If the logic is set to 4 (both rising edge and falling edge active), the servo drive forcibly changes it to 0 (low level active).
FunIN.34	Emergence Stop	Emergency Stop	Enabled: Position lock is applied after stop at zero speed. Invalid: Not affect currnt running state	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.35	ClrPosErr	Position deviation cleared	Valid: Position deviation cleared Invalid: Not clear	It is recommended that this function be allocated to DI8 or DI9.
FunIN.36	V_LmtSel	Internal speed limit source	Inactive: H07.19 used as positive/ negative internal speed limit Active: H07.20 used as positive/ negative internal speed limit	The corresponding terminal logic is recommended to be level-triggered.
FunIN.37	PulseInhibit	Pulse reference inhibited	The position reference source is pulse reference (H05.00 = 0) in the position control mode: Inactive: Respond to pulse references Active: Not respond to pulse references	The corresponding terminal logic is recommended to be level-triggered.
FunIN.38	MultiBlockTrig	Axis control command write interrupted	When the position reference source is multi-position reference (H05.00 = 2) in the position control mode: Inactive: Not write commands Active: Write command and generate interrupt	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.39	MultiBlockWr	Axis control command write not interrupted	When the position reference source is multi-position reference (H05.00 = 2) in the position control mode: Inactive: Not write commands Active: Command written and interrupt not generated	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.40	ClrCmdOkAndArrOk	Command cleared and positioning completed	Inactive: Command not cleared and positioning completed Active: Command cleared and positioning completed	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.41	HomeRecord	Present position as the home	Invalid: Not triggered Active: Triggered	It is recommended that the logic of the corresponding terminal be set to level valid.

Code	Name	Function Name	Description	Remarks
Description of DO signals				
FunOUT.1	S-RDY	Servo ready	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 output	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: Difference between motor speed feedback and reference value larger than H06.19 (Threshold of zero speed output signal) Active: The difference between the motor speed feedback and the reference value is within the threshold defined by H06.19.	-
FunOUT.4	V-CMP	Speed match	In the 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: Valid: Motor torque limited Invalid: Motor torque not limited	-
FunOUT.8	V-LT	Torque limit	Confirming rotational speed limit in torque control: Valid: Motor speed limited Invalid: Motor rotational speed not limited	-
FunOUT.9	BK	Brake output	Brake output: Valid: Brake released Invalid: Brake applied	-
FunOUT.10	WARN	Warning output	The warning output is active (conducted). (ON)	-
FunOUT.11	ALM	Fault output	This signal is valid when a fault occurs.	-
FunOUT.12	ALMO1	3-digit fault code output	A 3-digit fault code is output.	-

Code	Name	Function Name	Description	Remarks
FunOUT.13	ALMO2	3-digit fault code output	A 3-digit fault code is output.	-
FunOUT.14	ALMO3	3-digit fault code output	A 3-digit fault code is output.	-
FunOUT.15	Xintcoin	Interruption fixed length completed	Active: Interrupt positioning completed Invalid: Interruption fixed length not completed	-
FunOUT.17	ElecHome Attain	Electrical home return output	Electric home return state: Active: Electrical homing completed Invalid: Not return to electrical home position	-
FunOUT.18	ToqReach	Torque Reach 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	Valid: Speed feedback reaches the set value. Invalid: Speed feedback smaller than the setting	-
FunOUT.20	AngIntRdy	Angle auto-tuning output	Active: Angle auto-tuning completed Inactive: Angle auto-tuning not completed	-
FunOUT.21	DB	Dynamic braking output	Active: Dynamic brake relay opened Inactive: Dynamic braking relay closed	-
FunOUT.22	CmdOk	Internal reference output	Active: Internal reference completed Inactive: Internal reference not completed	-
FunOUT.23	WrNextBlockEn	Write next block enabled	Active: Writing the next segment allowed. Inactive: Writing the next segment inhibited.	-
FunOUT.24	McOk	Motion control output	Active: Motion control done Inactive: Motion control not done	-
FunOUT.26	RefAllow	Servo enabled to receive command	Valid - Enable allowed to receive command. Invalid - Enable not allowed to receive command.	-
FunOUT.27	AlmAndWarn	Fault or alarm valid output signal	Valid - Fault or alarm output is valid. Invalid - Fault or alarm output is invalid.	-

21.4 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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