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# SV630P Series Servo Drive

## User Guide

Industrial Automation

Intelligent Elevator

New Energy Vehicle

Industrial Robot

Rail Transit

Data code 19012296C00

# Preface

## Introduction

Thank you for purchasing the SV630P series servo drive developed by Inovance.

It is an economical AC servo drive product, offering a power range from 0.05 kW to 7.5 kW. It comes with Modbus communication interfaces to work with the host controller for a networked operation of multiple servo drives. The servo drive supports adaptive stiffness level setting, inertia auto-tuning, and vibration suppression for easy use. It works together with Inovance ISMH series small/medium-inertia high-response servo motor configured with a 18-bit incremental encoder, making the running stable and quiet and the positioning control more accurate. 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 user guide presents product information and instructions for installation, wiring, commissioning, and troubleshooting. Read and understand this user guide before first-time use. In case of any question about functions or performance, do not hesitate to contact the technical support personnel of Inovance.

## More documents

| Name | Data Code | Description |
|---|---|---|
| SV630P Series Servo Drive User Guide | 19012296 | Provides information on selection, installation, commissioning, function, troubleshooting and parameters of the equipment. |

## Revision History

| Date | Version | Description |
|---|---|---|
| 2023-03 | C00 | • Optimized H0b.33 and H0b.63.<br>• Optimized the detailed description of H02.00 and H05.26.<br>• Updated information on faults according to the latest fault list. |
| 2023-02 | B08 | • Updated the motor model table.<br>• Updated the motor models in the energy data table.<br>• Minor corrections. |

| Date | Version | Description |
|---|---|---|
| 2023-01 | B07 | • Added warranty information in the preface.<br>• Change the name of the magnetic clamp to DYR-130-B.<br>• Unified the naming rule of the fault code to Er.xxx.<br>• Changed "General Specifications" to "Product Specifications".<br>• Modified motor selection instructions.<br>• Deleted information on AI.<br>• Changed the MS1-Z motor to MS1-R motor.<br>• Added voltage data in the content related to correspondence between pulse input frequency and pulse width.<br>• Added description of high and low speed pulse reference input.<br>• Changed the resistance at the pulse interface to 200 Ω.<br>• Added a hexadecimal value for the parameters in the detailed description of parameters.<br>• Updated the list of parameters and description of parameters.<br>• Updated information on faults.<br>• Modified the description of fault logging. |
| 2022-09 | B06 | • Added a section on homing.<br>• Minor corrections. |
| 2022-07 | B05 | • Added information on port damage due to absence of a current limiting resistor.<br>• Added information on the -PS model.<br>• Updated the list of parameters and description of parameters.<br>• Added fault E991.1. |
| 2022-01 | B04 | • Modified Safety Instructions.<br>• Improved the table "Cable specifications and recommended models" in section 3.3.2. |
| 2021-12 | B03 | • Improved the table in section 1.1.3.<br>• Modified the numbering and component names in section 1.2.2.<br>• Transposed sections 2.2.3 and 2.2.4.<br>• Added load inertia ratio range recommendations and adjusted the reference level of rigidity to the STune operating instructions.<br>• Added safety precautions for the encoder.<br>• Changed the default value of H0A-30 to 2.<br>• Changed the range of H09-32 to -1000–1000.<br>• Changed the default value of H00-31 to 262144.<br>• Changed the default value of H09-37 to 300.<br>• Changed the type of the power line breakage fault to No. 2 recoverable. |
| 2021-08 | B02 | • Updated the model number and nameplate of the motor.<br>• Changed the default value of H0A-30 to 2.<br>• Added more recommended cable lug models. |
| 2021-03 | B01 | Added section 7 Modbus Communication. |

| Date | Version | Description |
|---|---|---|
| 2021-02 | B00 | • Added technical specifications of the drive and motor.<br>• Added information on components, servo motor selection, and cables for the servo drives above 1.8 kW.<br>• Updated the system wiring diagram.<br>• Improved sections Wiring of Power Cables and Wiring of Encoder Cables.<br>• Added section Wiring and Setup of the Braking Resistor. |
| 2020-11 | A04 | Minor corrections. |
| 2020-08 | A03 | Removed the customer service phone. |
| 2020-03 | A02 | • Removed the M3 motor model.<br>• Modified the motor model number and nameplate in section 1.<br>• Deleted the 55B30CB motor model.<br>• Modified the category of Er.430. |
| 2020-03 | A01 | • Added information on large power.<br>• Modified the description of drive terminals.<br>• Removed the S6R6 motor model.<br>• Modified the precautions of main circuit wiring in section 3.2.5.<br>• Modified the descriptions of FunIN.2, FunIN.28, FunIN.29, FunIN.32, FunIN.35, and FunIN.36.<br>• Added description for H03-60 to H03-64.<br>• Modified information on Er.130 and Er.640. |
| 2019-07 | A00 | First release. |

## Access to the Guide

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

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

## Warranty

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

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

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

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

For details, see the Product Warranty Card.

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# General Safety Instructions

## Safety Precautions

- This section explains the safety precautions that need to be observed to use this product correctly. Before using this product, please read the instruction manual and correctly understand the relevant information of safety precautions. Failure to comply with the safety precautions may result in death, serious injury, or equipment damage.
- "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
- Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper use.

## Safety Levels and Definitions

| | |
|---|---|
| DANGER | Indicates that failure to comply with the notice will result in death or severe personal injuries. |
| WARNING | Indicates that failure to comply with the notice may result in death or severe personal injuries. |
| CAUTION | 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 selection guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions. Install the covers or protective guards as specified, and use the equipment in accordance with the instructions described in the user guide.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.

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

| |
|---|
| CAUTION<br>• Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.<br>• Unpack the package by following the unpacking sequence. Do not strike the package violently.<br>• Check whether there is damage, rust, or injuries on the surface of the equipment and equipment accessories before unpacking.<br>• Check whether the package contents are consistent with the packing list before unpacking. |
| **Storage and Transportation** |
| WARNING<br>• Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage.<br>• 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.<br>• Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.<br>• When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage. |
| CAUTION<br>• Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.<br>• 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.<br>• Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.<br>• Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.<br>• Avoid storing the equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.<br>• Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.<br>• Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment. |
| **Installation** |
| DANGER<br>• The equipment can be operated by well-trained and qualified professionals only. Non-professionals are not allowed. |

**WARNING**

- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire.
- Do not retrofit the equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing 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.

**CAUTION**

- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.
- Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

**Wiring**

**DANGER**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Before wiring, cut off power connections with all equipment. Residual voltage exists after power cut-off. Therefore, wait at least the time designated on the equipment warning label before further operations. Measure the DC voltage of the main circuit and make sure it is below the safe voltage, otherwise there will be the danger of electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply will result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply will result in an electric shock.

WARNING

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

CAUTION

- During wiring, follow the proper electrostatic discharge (ESD) procedure, and wear an antistatic wrist strap. Failure to comply will damage the equipment or the internal circuits of the equipment.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

**Power-on**

DANGER

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

WARNING

- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before power-on, make sure that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may resulting in a fire. 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**

DANGER

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

WARNING

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

| Maintenance |
| --- |
| DANGER<br>• Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.<br>• Do not maintain the equipment with power ON. Failure to comply will result in an electric shock.<br>• Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.<br>• 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. |
| WARNING<br>• Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record. |
| **Repair** |
| DANGER<br>• Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.<br>• Do not repair the equipment with power ON. Failure to comply will result in an electric shock.<br>• 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. |
| WARNING<br>• Submit the repair request according to the warranty agreement.<br>• When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injuries or equipment damage.<br>• When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.<br>• Replace quick-wear parts of the equipment according to the replacement instructions.<br>• Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage.<br>• After the equipment is replaced, check the wiring and set parameters again. |
| **Disposal** |
| WARNING<br>• Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death.<br>• Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution. |

## Additional Precautions

### Cautions for the dynamic brake

- Dynamic braking can only be used for emergency stop in case of failure and sudden power failure. Do not trigger failure or power failure frequently.

- Ensure that the dynamic braking function has an operation interval of more than 5 minutes at high speed, otherwise the internal dynamic braking circuit may be damaged.
- Dynamic braking is common in rotating mechanical structures. For example, when a motor has stopped running, it keeps rotating due to the inertia of its load. In this case, this motor is in the regenerative state and short-circuit current passes through the dynamic brake. If this situation continues, the drive, and even the motor, may be burned.

## Safety Label

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. See the following table for descriptions of the safety labels.

| Safety Label | Description |
|---|---|
|  | • Never fail to connect Protective Earth (PE) terminal. Read the manual and follow the safety instructions before use.<br>• Do not touch terminals within 15 minutes after disconnecting the power supply to prevent the risk of electric shock.<br>• Do not touch the heatsink with power ON to prevent the risk of burn. |

# 1 Selection Table

## 1.1 Selection

| Servo motor | | | | Servo drive SV630****I | | | |
|---|---|---|---|---|---|---|---|
| Motor without brake | Motor with brake | Flange Size | Capacity (kW) | Voltage Class | Size | Recommended Drive Model | No. |
| Ratings of MS1H1 ( $n_N$=3000rpm, $n_{max}$ =6000rpm) series motors | | | | | | | |
| MS1H1-05B30CB-T330Z | MS1H1-05B30CB-T332Z | 40 | 0.05 | Single-phase 220 V | A | S1R6 | 00002 |
| MS1H1-10B30CB-T330Z | MS1H1-10B30CB-T332Z | 40 | 0.1 | | | | |
| MS1H1-20B30CB-T331R | MS1H1-20B30CB-T334R | 60 | 0.2 | | | | |
| MS1H1-40B30CB- T331R | MS1H1-40B30CB- T334R | 60 | 0.4 | Single-phase 220 V | | S2R8 | 00003 |
| MS1H1-55B30CB- T331R | - | 80 | 0.55 | Single-phase 220 V | B | S5R5 | 00005 |
| MS1H1-75B30CB- T331R | MS1H1-75B30CB- T334R | 80 | 0.75 | Single-phase 220 V | | S5R5 | 00005 |
| MS1H1-10C30CB- T331R | MS1H1-10C30CB- T334R | 80 | 1.0 | Single-phase/Three-phase 220 V | C | S7R6 | 00006 |
| Ratings of MS1H2 ( $n_N$=3000rpm, $n_{max}$ =6000rpm/5000rpm) series motors | | | | | | | |
| MS1H2-10C30CB-T331R | MS1H2-10C30CB-T334R | 100 | 1.0 | Single-phase/Three-phase 220 V | C | S7R6 | 00006 |
| MS1H2-10C30CD-T331R | MS1H2-10C30CD-T334R | 100 | 1.0 | Three-phase 380 V | | T3R5 | 10001 |
| MS1H2-15C30CB-T331R | MS1H2-15C30CB-T334R | 100 | 1.5 | Single-phase/Three-phase 220 V | D | S012 | 00007 |
| MS1H2-15C30CD-T331R | MS1H2-15C30CD-T334R | 100 | 1.5 | Three-phase 380 V | C | T5R4 | 10002 |
| MS1H2-20C30CB-T331R | MS1H2-20C30CB-T334R | 100 | 2.0 | Single-phase/Three-phase 220 V | D | S012 | 00007 |
| MS1H2-20C30CD-T331R | MS1H2-20C30CD-T334R | 100 | 2.0 | Three-phase 380 V | D | T8R4 | 10003 |
| MS1H2-25C30CD-T331R | MS1H2-25C30CD-T334R | 100 | 2.5 | Three-phase 380 V | D | T8R4 | 10003 |
| MS1H2-30C30CD-T331R | MS1H2-30C30CD-T334R | 130 | 3.0 | Three-phase 380 V | D | T012 | 10004 |
| MS1H2-40C30CD-T331R | MS1H2-40C30CD-T334R | 130 | 4.0 | Three-phase 380 V | E | T017 | 10005 |
| MS1H2-50C30CD-T331R | MS1H2-50C30CD-T334R | 130 | 5.0 | Three-phase 380 V | | T021 | 10006 |
| Ratings of MS1H3 ( $n_N$=1500rpm, $n_{max}$ =3000rpm) series motors | | | | | | | |
| MS1H3-85B15CB-T331R | MS1H3-85B15CB-T334R | 130 | 0.85 | Single-phase/Three-phase 220 V | C | S7R6 | 00006 |
| MS1H3-85B15CD-T331R | MS1H3-85B15CD-T334R | 130 | 0.85 | Three-phase 380 V | | T3R5 | 10001 |
| MS1H3-13C15CB-T331R | MS1H3-13C15CB-T334R | 130 | 1.3 | Single-phase/Three-phase 220 V | D | S012 | 00007 |
| MS1H3-13C15CD-T331R | MS1H3-13C15CD-T334R | 130 | 1.3 | Three-phase 380 V | C | T5R4 | 10002 |
| MS1H3-18C15CD-T331R | MS1H3-18C15CD-T334R | 130 | 1.8 | Three-phase 380 V | D | T8R4 | 10003 |

| Servo motor | | | | Servo drive SV630****I | | | |
|---|---|---|---|---|---|---|---|
| Motor without brake | Motor with brake | Flange Size | Capacity (kW) | Voltage Class | Size | Recommended Drive Model | No. |
| MS1H3-29C15CD-T331R | MS1H3-29C15CD-T334R | 180 | 2.9 | Three-phase 380 V | D | T012 | 10004 |
| MS1H3-44C15CD-T331R | MS1H3-44C15CD-T334R | 180 | 4.4 | Three-phase 380 V | E | T017 | 10005 |
| MS1H3-55C15CD-T331R | MS1H3-55C15CD-T334R | 180 | 5.5 | Three-phase 380 V | | T021 | 10006 |
| MS1H3-75C15CD-T331R | MS1H3-75C15CD-T334R | 180 | 7.5 | Three-phase 380 V | | T026 | 10007 |
| MS1H4 ( $n_N$=3000rpm, $n_{max}$ =6000rpm) ratings | | | | | | | |
| MS1H4-10B30CB-T330Z | MS1H4-10B30CB-T332Z | 40 | 0.1 | Single-phase 220 V | A | S1R6 | 00002 |
| MS1H4-20B30CB-T331R | MS1H4-20B30CB-T334R | 60 | 0.2 | | | | |
| MS1H4-40B30CB-T331R | MS1H4-40B30CB-T334R | 60 | 0.4 | Single-phase 220 V | | S2R8 | 00003 |
| MS1H4-55B30CB-T331R | - | 80 | 0.55 | Single-phase 220 V | B | S5R5 | 00005 |
| MS1H4-75B30CB-T331R | MS1H4-75B30CB-T334R | 80 | 0.75 | Single-phase 220 V | | S5R5 | 00005 |
| MS1H4-10C30CB-T331R | MS1H4-10C30CB-T334R | 80 | 1.0 | Single-phase/Three-phase 220 V | C | S7R6 | 00006 |

### *Note*

- Servo motors match different series of servo drives, and the maximum speed and maximum torque output of the motor vary slightly. See the selection table for details.
- For servo motors designed to work with 18-bit encoders, the height of the encoder aviation connector increases by 1 mm.

## 1.2 Models of MS1-R Series Motors and MS1-Z Series Motors

| Flange Size | Models without brake | | Models with Brake | |
|---|---|---|---|---|
| | MS1-Z series motor model | MS1-R series motor model | MS1-Z series motor model | MS1-R series motor model |
| 60 | MS1H1-20B30CB-A331Z | MS1H4-20B30CB-A331R | MS1H1-20B30CB-A334Z | MS1H4-20B30CB-A334R |
| | MS1H1-40B30CB-A331Z | MS1H4-40B30CB-A331R | MS1H1-40B30CB-A334Z | MS1H4-40B30CB-A334R |
| | MS1H4-40B30CB-A331Z | MS1H4-40B30CB-A331R | MS1H4-40B30CB-A334Z | MS1H4-40B30CB-A334R |
| | MS1H1-20B30CB-A331Z-S | MS1H4-20B30CB-A331R-S | MS1H1-20B30CB-A334Z-S | MS1H4-20B30CB-A334R-S |
| | MS1H1-40B30CB-A331Z-S | MS1H4-40B30CB-A331R-S | MS1H1-40B30CB-A334Z-S | MS1H4-40B30CB-A334R-S |
| | MS1H4-40B30CB-A331Z-S | MS1H4-40B30CB-A331R-S | MS1H4-40B30CB-A334Z-S | MS1H4-40B30CB-A334R-S |
| | MS1H1-20B30CB-T331Z | MS1H4-20B30CB-T331R | MS1H1-20B30CB-T334Z | MS1H4-20B30CB-T334R |
| | MS1H1-40B30CB-T331Z | MS1H4-40B30CB-T331R | MS1H1-40B30CB-T334Z | MS1H4-40B30CB-T334R |
| | MS1H4-40B30CB-T331Z | MS1H4-40B30CB-T331R | MS1H4-40B30CB-T334Z | MS1H4-40B30CB-T334R |
| | MS1H1-20B30CB-T331Z X6 | MS1H4-20B30CB-T331R | MS1H1-20B30CB-T334Z X6 | MS1H4-20B30CB-T334R |
| | MS1H1-40B30CB-T331Z X6 | MS1H4-40B30CB-T331R | MS1H1-40B30CB-T334Z X6 | MS1H4-40B30CB-T334R |
| | MS1H4-40B30CB-T331Z X6 | MS1H4-40B30CB-T331R | MS1H4-40B30CB-T334Z X6 | MS1H4-40B30CB-T334R |
| | - | MS1H4-20B30CB-T331R-S | - | MS1H4-20B30CB-T334R-S |
| | - | MS1H4-40B30CB-T331R-S | - | MS1H4-40B30CB-T334R-S |

## *Note*

- The R version of the H4 inertia model is used to replace the Z version of the H1 and H4 inertia models.
- The H1 model, ultra-small inertia type motor added to the flange size 60 and 80 of R version, is mainly used for fast point-to-point motion control applications.

| Flange Size | Models without brake | | Models with Brake | |
|---|---|---|---|---|
| | MS1-Z series motor model | MS1-R series motor model | MS1-Z series motor model | MS1-R series motor model |
| 80 | MS1H1-55B30CB-A331Z | MS1H4-55B30CB-A331R | MS1H1-75B30CB-A334Z | MS1H4-75B30CB-A334R |
| | MS1H1-75B30CB-A331Z | MS1H4-75B30CB-A331R | MS1H4-75B30CB-A334Z | MS1H4-75B30CB-A334R |
| | MS1H4-75B30CB-A331Z | MS1H4-75B30CB-A331R | MS1H1-75B30CB-A334Z-S | MS1H4-75B30CB-A334R-S |
| | MS1H1-10C30CB-A331Z | MS1H4-10C30CB-A331R | MS1H4-75B30CB-A334Z-S | MS1H4-75B30CB-A334R-S |
| | MS1H1-55B30CB-A331Z-S | MS1H4-55B30CB-A331R-S | MS1H1-75B30CB-T334Z | MS1H4-75B30CB-T334R |
| | MS1H1-75B30CB-A331Z-S | MS1H4-75B30CB-A331R-S | MS1H4-75B30CB-T334Z | MS1H4-75B30CB-T334R |
| | MS1H4-75B30CB-A331Z-S | MS1H4-75B30CB-A331R-S | MS1H1-75B30CB-T334Z X6 | MS1H4-75B30CB-T334R |
| | MS1H1-10C30CB-A331Z-S | MS1H4-10C30CB-A331R-S | MS1H4-75B30CB-T334Z X6 | MS1H4-75B30CB-T334R |
| | MS1H1-55B30CB-T331Z | MS1H4-55B30CB-T331R | - | MS1H4-10C30CB-A334R |
| | MS1H1-75B30CB-T331Z | MS1H4-75B30CB-T331R | - | MS1H4-10C30CB-A334R-S |
| | MS1H4-75B30CB-T331Z | MS1H4-75B30CB-T331R | - | MS1H4-10C30CB-T334R |
| | MS1H1-10C30CB-T331Z | MS1H4-10C30CB-T331R | - | MS1H4-75B30CB-T334R-S |
| | MS1H1-55B30CB-T331Z X6 | MS1H4-55B30CB-T331R | - | MS1H4-10C30CB-T334R-S |
| | MS1H1-75B30CB-T331Z X6 | MS1H4-75B30CB-T331R | - | - |
| | MS1H4-75B30CB-T331Z X6 | MS1H4-75B30CB-T331R | - | - |
| | MS1H1-10C30CB-T331Z X6 | MS1H4-10C30CB-T331R | - | - |
| | - | MS1H4-55B30CB-T331R-S | - | - |
| | - | MS1H4-75B30CB-T331R-S | - | - |
| | - | MS1H4-10C30CB-T331R-S | - | - |

## *Note*

- The R version of the H4 inertia model is used to replace the Z version of the H1 and H4 inertia models.
- The H1 model, ultra-small inertia type motor added to the flange size 60 and 80 of R version, is mainly used for fast point-to-point motion control applications.

| Flange Size | Models without brake | | Models with Brake | |
|---|---|---|---|---|
| | MS1-Z series motor model | MS1-R series motor model | MS1-Z series motor model | MS1-R series motor model |
| 100 | MS1H2-10C30CB-A331Z | MS1H2-10C30CB-A331R | MS1H2-10C30CB-A334Z | MS1H2-10C30CB-A334R |
| | MS1H2-10C30CD-A331Z | MS1H2-10C30CD-A331R | MS1H2-10C30CD-A334Z | MS1H2-10C30CD-A334R |
| | MS1H2-15C30CB-A331Z | MS1H2-15C30CB-A331R | MS1H2-15C30CD-A334Z | MS1H2-15C30CD-A334R |
| | MS1H2-15C30CD-A331Z | MS1H2-15C30CD-A331R | MS1H2-15C30CB-A334Z | MS1H2-15C30CB-A334R |
| | MS1H2-20C30CD-A331Z | MS1H2-20C30CD-A331R | MS1H2-20C30CD-A334Z-S4 | MS1H2-20C30CD-A334R |
| | MS1H2-25C30CD-A331Z | MS1H2-25C30CD-A331R | MS1H2-25C30CD-A334Z-S4 | MS1H2-25C30CD-A334R |
| | MS1H2-10C30CB-T331Z | MS1H2-10C30CB-T331R | MS1H2-10C30CB-T334Z | MS1H2-10C30CB-T334R |
| | MS1H2-10C30CD-T331Z | MS1H2-10C30CD-T331R | MS1H2-10C30CD-T334Z | MS1H2-10C30CD-T334R |
| | MS1H2-15C30CB-T331Z | MS1H2-15C30CB-T331R | MS1H2-15C30CD-T334Z | MS1H2-15C30CD-T334R |
| | MS1H2-15C30CD-T331Z | MS1H2-15C30CD-T331R | MS1H2-15C30CB-T334Z | MS1H2-15C30CB-T334R |
| | MS1H2-20C30CD-T331Z | MS1H2-20C30CD-T331R | MS1H2-20C30CD-T334Z-S4 | MS1H2-20C30CD-T334R |
| | MS1H2-25C30CD-T331Z | MS1H2-25C30CD-T331R | MS1H2-25C30CD-T334Z-S4 | MS1H2-25C30CD-T334R |
| 130 | MS1H2-30C30CD-A331Z | MS1H2-30C30CD-A331R | MS1H2-30C30CD-A334Z-S4 | MS1H2-30C30CD-A334R |
| | MS1H2-40C30CD-A331Z | MS1H2-40C30CD-A331R | MS1H2-40C30CD-A334Z-S4 | MS1H2-40C30CD-A334R |
| | MS1H2-50C30CD-A331Z | MS1H2-50C30CD-A331R | MS1H2-50C30CD-A334Z-S4 | MS1H2-50C30CD-A334R |
| | MS1H2-30C30CD-T331Z | MS1H2-30C30CD-T331R | MS1H2-30C30CD-T334Z-S4 | MS1H2-30C30CD-T334R |
| | MS1H2-40C30CD-T331Z | MS1H2-40C30CD-T331R | MS1H2-40C30CD-T334Z-S4 | MS1H2-40C30CD-T334R |
| | MS1H2-50C30CD-T331Z | MS1H2-50C30CD-T331R | MS1H2-50C30CD-T334Z-S4 | MS1H2-50C30CD-T334R |
| 130 | MS1H3-85B15CB-A331Z | MS1H3-85B15CB-A331R | MS1H3-85B15CB-A334Z | MS1H3-85B15CB-A334R |
| | MS1H3-85B15CD-A331Z | MS1H3-85B15CD-A331R | MS1H3-85B15CD-A334Z | MS1H3-85B15CD-A334R |
| | MS1H3-13C15CB-A331Z | MS1H3-13C15CB-A331R | MS1H3-13C15CB-A334Z | MS1H3-13C15CB-A334R |
| | MS1H3-13C15CD-A331Z | MS1H3-13C15CD-A331R | MS1H3-13C15CD-A334Z | MS1H3-13C15CD-A334R |
| | MS1H3-18C15CD-A331Z | MS1H3-18C15CD-A331R | MS1H3-18C15CD-A334Z | MS1H3-18C15CD-A334R |
| | MS1H3-85B15CB-T331Z X6 | MS1H3-85B15CB-T331R | MS1H3-85B15CB-T334Z X6 | MS1H3-85B15CB-T334R |
| | MS1H3-85B15CD-T331Z X6 | MS1H3-85B15CD-T331R | MS1H3-85B15CD-T334Z X6 | MS1H3-85B15CD-T334R |
| | MS1H3-13C15CB-T331Z X6 | MS1H3-13C15CB-T331R | MS1H3-13C15CB-T334Z X6 | MS1H3-13C15CB-T334R |
| | MS1H3-13C15CD-T331Z X6 | MS1H3-13C15CD-T331R | MS1H3-13C15CD-T331Z X6 | MS1H3-13C15CD-T331R |
| | MS1H3-18C15CD-T331Z X6 | MS1H3-18C15CD-T331R | MS1H3-13C15CD-T334Z X6 | MS1H3-13C15CD-T334R |
| | MS1H3-85B15CB-T331Z | MS1H3-85B15CB-T331R | MS1H3-18C15CD-T334Z X6 | MS1H3-18C15CD-T334R |
| | MS1H3-85B15CD-T331Z | MS1H3-85B15CD-T331R | MS1H3-85B15CB-T334Z | MS1H3-85B15CB-T334R |
| | MS1H3-85B15CD-T334Z | MS1H3-85B15CD-T334R | MS1H3-85B15CD-T334Z | MS1H3-85B15CD-T334R |
| | MS1H3-13C15CB-T331Z | MS1H3-13C15CB-T331R | MS1H3-13C15CB-T334Z | MS1H3-13C15CB-T334R |
| | MS1H3-13C15CD-T331Z | MS1H3-13C15CD-T331R | MS1H3-13C15CD-T334Z | MS1H3-13C15CD-T334R |
| | MS1H3-18C15CD-T331Z | MS1H3-18C15CD-T331R | MS1H3-18C15CD-T334Z | MS1H3-18C15CD-T334R |

| Flange Size | Models without brake | | Models with Brake | |
|---|---|---|---|---|
| | MS1-Z series motor model | MS1-R series motor model | MS1-Z series motor model | MS1-R series motor model |
| 180 | MS1H3-29C15CD-A331Z | MS1H3-29C15CD-A331R | MS1H3-29C15CD-A334Z | MS1H3-29C15CD-A334R |
| | MS1H3-44C15CD-A331Z | MS1H3-44C15CD-A331R | MS1H3-44C15CD-A334Z | MS1H3-44C15CD-A334R |
| | MS1H3-55C15CD-A331Z | MS1H3-55C15CD-A331R | MS1H3-55C15CD-A334Z | MS1H3-55C15CD-A334R |
| | MS1H3-75C15CD-A331Z | MS1H3-75C15CD-A331R | MS1H3-75C15CD-A334Z | MS1H3-75C15CD-A334R |
| | MS1H3-29C15CD-T331Z | MS1H3-29C15CD-T331R | MS1H3-29C15CD-T334Z | MS1H3-29C15CD-T334R |
| | MS1H3-44C15CD-T331Z | MS1H3-44C15CD-T331R | MS1H3-44C15CD-T334Z | MS1H3-44C15CD-T334R |
| | MS1H3-55C15CD-T331Z | MS1H3-55C15CD-T331R | MS1H3-55C15CD-T334Z | MS1H3-55C15CD-T334R |
| | MS1H3-75C15CD-T331Z | MS1H3-75C15CD-T331R | MS1H3-75C15CD-T334Z | MS1H3-75C15CD-T334R |

# 2 SV630P Series

## 2.1 Product Information

### 2.1.1 Description of the Model and Nameplate

**Description of the Model**

SV630 P S 2R8 I - FH
① ② ③ ④ ⑤ ⑥

| ① **Product series** | ④ **Rated output current** | | ⑤ **Installation Mode** |
|---|---|---|---|
| SV660: SV660 series servo drive<br>SV630: SV630 series servo drive<br>SV635: SV635 series servo drive | | | I: Base plate-mounted |
| ② **Product type**<br>P: Pulse type<br>A: CANlink type<br>C: CANopen type | S: 220 V | 1R6: 1.6 A<br>2R8: 2.8A<br>5R5: 5.5A<br>7R6: 7.6A<br>012: 11.6A | ⑥ **Non-standard features**<br>Blank: standard<br>FH: High protection |
| ③ **Voltage class**<br>S: 220 V<br>T: 380 V | T: 380 V | 3R5: 3.5A<br>5R4: 5.4A<br>8R4: 8.4A<br>012: 11.9A<br>017: 16.5A<br>021: 20.8A<br>026: 25.7A | |

## Nameplate

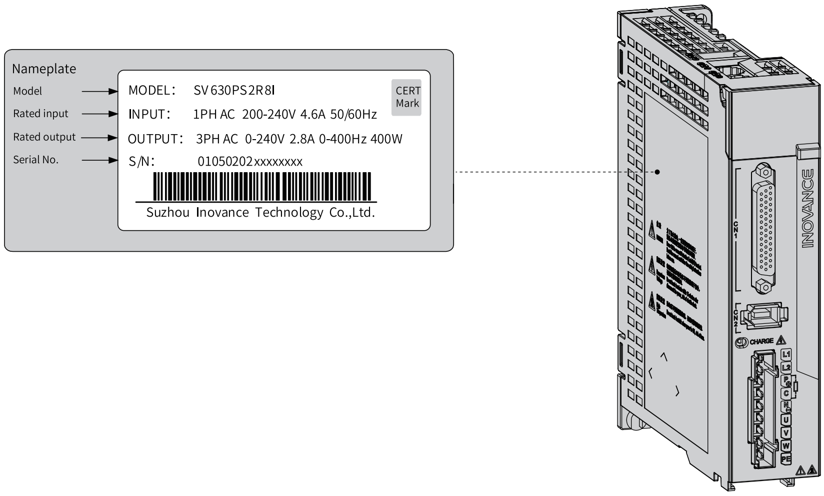



Figure 2-1 Nameplate

## Encryption of the production serial number

01050202 4 P 7 00001

① ② ③ ④ ⑤

| | | |
|---|---|---|
| ① **Internal code**<br>Material code | ③ **Year**<br>9: 2009<br>A: 2010<br>...<br>N: 2021<br>P: 2022<br>...<br>Note: I/L/O/Q is not used. | ⑤ **Lot number**<br>00001: 1st in current month<br>00002: 2nd in current month<br>00003: 3rd in current month<br>...<br>Range: 00001 to 99999 |
| ② **Manufacturer code**<br>4: Suzhou Inovance | ④ **Month**<br>1: January<br>2: February<br>...<br>A: October<br>B: November<br>C: December | |

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

## 2.1.2 Components

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

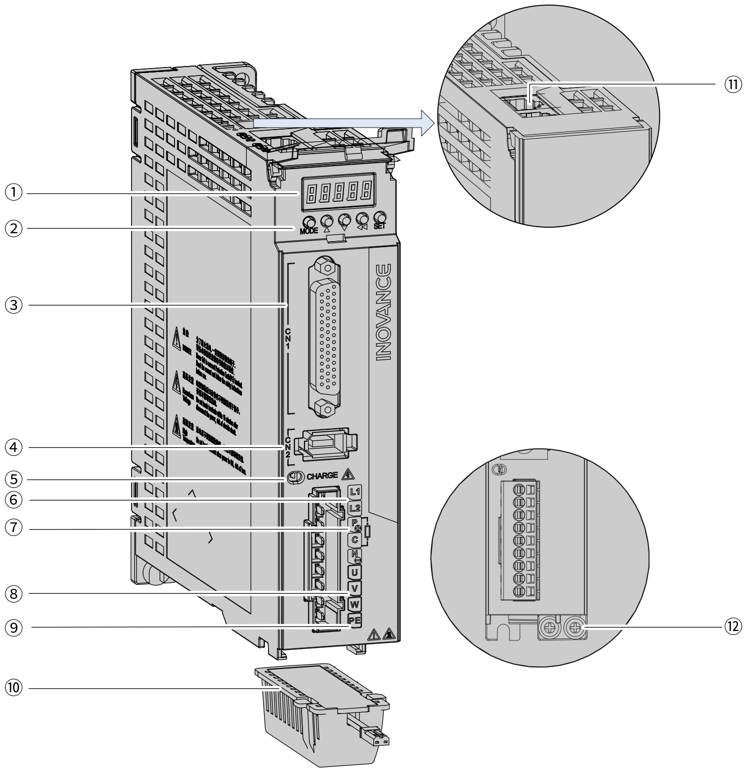



Figure 2-2 Components (SV630PS1R6I, SV630PS2R8I)

Table 2–1 Description of components (SV630PS1R6I, SV630PS2R8I)

| No. | Name | Description |
|---|---|---|
| ① | 5-digit LED display | The 5-digit 8-segment LED display is used to show servo system’s running state and parameter setting. |
| ② | Keys | MODE: Used to switch parameters in sequence.<br>△: Used to increase the value of the blinking bit.<br>▽: Used to decrease the value of the blinking bit.<br>◁: Used to shift the blinking bit leftwards.<br>(Hold down: Turning to the next page when the displayed number exceeds five digits)<br>SET: Used to save modifications and enter the next menu. |
| ③ | CN1 (control terminal) | Used by reference input signals and other I/O signals. |
| ④ | CN2 (terminal for connecting the encoder) | Connected to the motor encoder terminal. |
| ⑤ | CHARGE (bus voltage indicator) | Indicates the electric charge is present in the bus capacitor. When the indicator turns on, charges possibly still exist in the internal capacitor of the servo unit, even if the power supply of the main circuit is OFF.<br>To prevent electric shock, do not touch the power supply terminals when this indicator lights up. |
| ⑥ | L1, L2 (power input terminals) | See the nameplate for the rated voltage class. |

| No. | Name | Description |
|---|---|---|
| ⑦ | P⊕ and N⊖ (servo bus terminals) | Used by the common DC bus for multiple servo drives. |
| | P⊕, C (terminals for connecting external regenerative resistor) | If an external regenerative resistor is needed, connect it between terminals P⊕ and C. |
| ⑧ | U, V, W (terminals for connecting the servo motor) | Connected to U, V, and W phases of the servo motor. |
| ⑨ | Motor grounding terminal | Connected to the grounding terminal of the motor for grounding purpose. |
| ⑩ | Battery location | Used to hold the battery box of the absolute encoder. |
| 11 | CN3, CN4 (communication terminals) | Connected to RS232 and RS485 host controllers in parallel. |
| 12 | Servo drive grounding terminal | Connected to the grounding terminal of the power supply for grounding purpose. |

***Note***

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

### 2.1.2.2 Servo Drives in Size B (Rated Power: 0.75 kW)

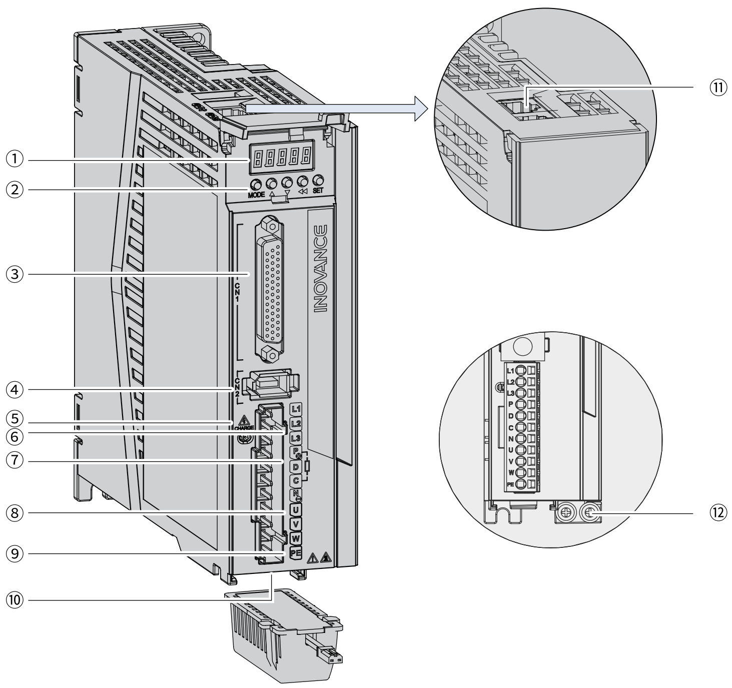



Figure 2-3 Components (SV630PS5R5I)

Table 2–2 Description of components (SV630PS5R5I)

| No. | Name | Description |
|---|---|---|
| ① | 5-digit LED display | The 5-digit 8-segment LED display is used to show servo system's running state and parameter setting. |
| ② | Keys | MODE: Used to switch parameters in sequence.<br>△: Used to increase the value of the blinking bit.<br>▽: Used to decrease the value of the blinking bit.<br>◁: Used to shift the blinking bit leftwards.<br>(Hold down: Turning to the next page when the displayed number exceeds five digits)<br>SET: Used to save modifications and enter the next menu. |
| ③ | CN1 (control terminal) | Used by reference input signals and other I/O signals. |
| ④ | CN2 (terminal for connecting the encoder) | Connected to the motor encoder terminal. |
| ⑤ | CHARGE (bus voltage indicator) | Indicates the electric charge is present in the bus capacitor. When the indicator turns on, charges possibly still exist in the internal capacitor of the servo unit, even if the power supply of the main circuit is OFF.<br>To prevent electric shock, do not touch the power supply terminals when this indicator lights up. |
| ⑥ | L1, L2, L3 (power input terminals) | See the nameplate for the rated voltage class.<br>Note: S5R5 (0.75kW) models support single-phase 220 V input only, with a 220 V power supply connected between terminals L1 and L2. |
| ⑦ | P⊕ and N⊖ (servo bus terminals) | Used by the common DC bus for multiple servo drives. |
| | P⊕, D, C (terminals for connecting external regenerative resistor) | Remove the jumper bar between terminals P⊕ and D before connecting an external regenerative resistor between terminals P⊕ and C. |
| ⑧ | U, V, W (terminals for connecting the servo motor) | Connected to U, V, and W phases of the servo motor. |
| ⑨ | Motor grounding terminal | Connected to the grounding terminal of the motor for grounding purpose. |
| ⑩ | Battery location | Used to hold the battery box of the absolute encoder. |
| 11 | CN3, CN4 (communication terminals) | Connected to RS232 and RS485 host controllers in parallel. |
| 12 | Servo drive grounding terminal | Connected to the grounding terminal of the power supply for grounding purpose. |

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

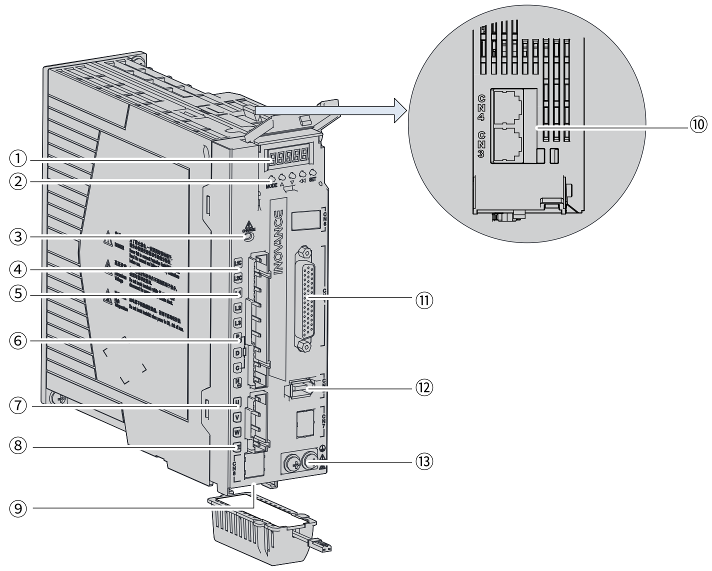



Figure 2-4 Components (SIZE C:SV630PS7R6I/SIZE D:SV630PS012I)

Table 2–3 Description of Components (SIZE C:SV630PS7R6I/SIZE D:SV630PS012I)

| No. | Name | Description |
|---|---|---|
| ① | 5-digit LED display | The 5-digit 8-segment LED display is used to show servo system' s running state and parameter setting. |
| ② | Keys | MODE: Used to switch parameters in sequence.<br>△: Used to increase the value of the blinking bit.<br>▽: Used to decrease the value of the blinking bit.<br>◁: Used to shift the blinking bit leftwards.<br>(Hold down: Turning to the next page when the displayed number exceeds five digits)<br>SET: Used to save modifications and enter the next menu. |
| ③ | CHARGE (bus voltage indicator) | Indicates the electric charge is present in the bus capacitor. When the indicator turns on, charges possibly still exist in the internal capacitor of the servo unit, even if the power supply of the main circuit is OFF.<br>To prevent electric shock, do not touch the power supply terminals when this indicator lights up. |
| ④ | L1C, L2C (control circuit power input terminals) | See the nameplate for the rated voltage class. |
| ⑤ | L1, L2, L3 (main circuit power input terminals) | Used as the power input terminals for a three-phase 220V servo drive. See the nameplate for the rated voltage class. |
| ⑥ | P⊕, D, C (terminals for connecting external regenerative resistor) | Remove the jumper bar between terminals P⊕ and D before connecting an external regenerative resistor between terminals P⊕ and C. |
| | P⊕ and N⊖ (servo bus terminals) | Used by the common DC bus for multiple servo drives. |
| ⑦ | U, V, W (terminals for connecting the servo motor) | Connected to U, V, and W phases of the servo motor. |
| ⑧ | Motor grounding terminal | Connected to the grounding terminal of the motor for grounding purpose. |
| ⑨ | Battery location | Used to hold the battery box of the absolute encoder. |

| No. | Name | Description |
|---|---|---|
| ⑩ | CN3, CN4 (communication terminals) | Connected to RS232 and RS485 host controllers in parallel. |
| 11 | CN1 (control terminal) | Used by reference input signals and other I/O signals. |
| 12 | CN2 (terminal for connecting the encoder) | Connected to the motor encoder terminal. |
| 13 | Servo drive grounding terminal | Connected to the grounding terminal of the 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.
- No derating is required when a single-phase power supply is used for models S7R6 and S012.

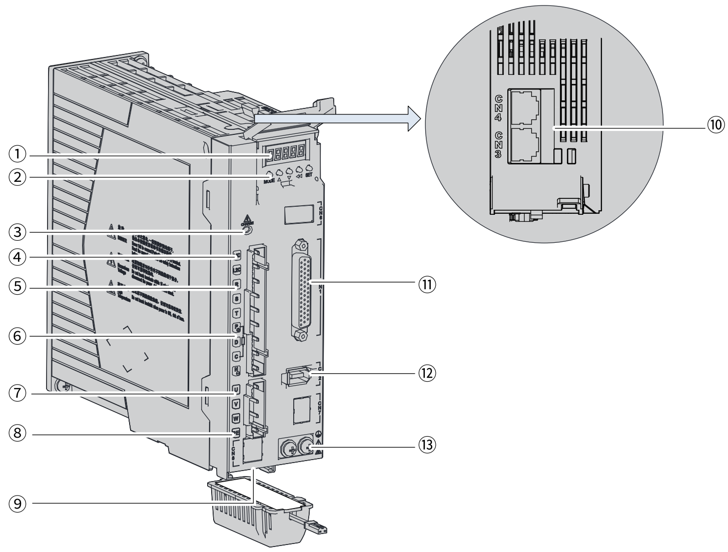



Figure 2-5 Components of servo drives in size C and size D (size C: SV630PT3R5I and SV630PT5R4I; size D: SV630PT8R4I and SV630PT012I)

Table 2–4 Description of components (Size C: SV630PT3R5I and SV630PT5R4I; size D: SV630PT8R4I and SV630PT012I)

| No. | Name | Description |
|---|---|---|
| ① | 5-digit LED display | The 5-digit 8-segment LED display is used to show servo system’s running state and parameter setting. |
| ② | Keys | MODE: Used to switch parameters in sequence.<br>△: Used to increase the value of the blinking bit.<br>▽: Used to decrease the value of the blinking bit.<br>◁: Used to shift the blinking bit leftwards.<br>(Hold down: Turning to the next page when the displayed number exceeds five digits)<br>SET: Used to save modifications and enter the next menu. |

| No. | Name | Description |
|---|---|---|
| ③ | CHARGE (bus voltage indicator) | Indicates the electric charge is present in the bus capacitor. When the indicator turns on, charges possibly still exist in the internal capacitor of the servo unit, even if the power supply of the main circuit is OFF.<br>To prevent electric shock, do not touch the power supply terminals when this indicator lights up. |
| ④ | L1C, L2C (control circuit power input terminals) | See the nameplate for the rated voltage class. |
| 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 resistor) | Remove the jumper bar between terminals P⊕ and D before connecting an external regenerative resistor between terminals P⊕ and C. |
| | P⊕ and N⊖ (servo bus terminals) | Used by the common DC bus for multiple servo drives. |
| ⑦ | U, V, W (terminals for connecting the servo motor) | Connected to U, V, and W phases of the servo motor. |
| ⑧ | Motor grounding terminal | Connected to the grounding terminal of the motor for grounding purpose. |
| ⑨ | Battery 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 by reference input signals and other I/O signals. |
| 12 | CN2 (terminal for connecting the encoder) | Connected to the motor encoder terminal. |
| 13 | Servo drive grounding terminal | Connected to the grounding terminal of the power supply for grounding purpose. |

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

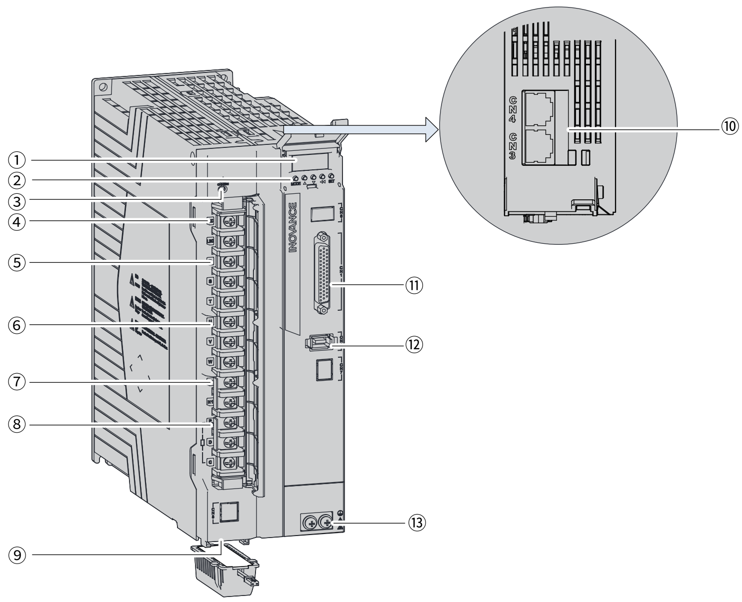
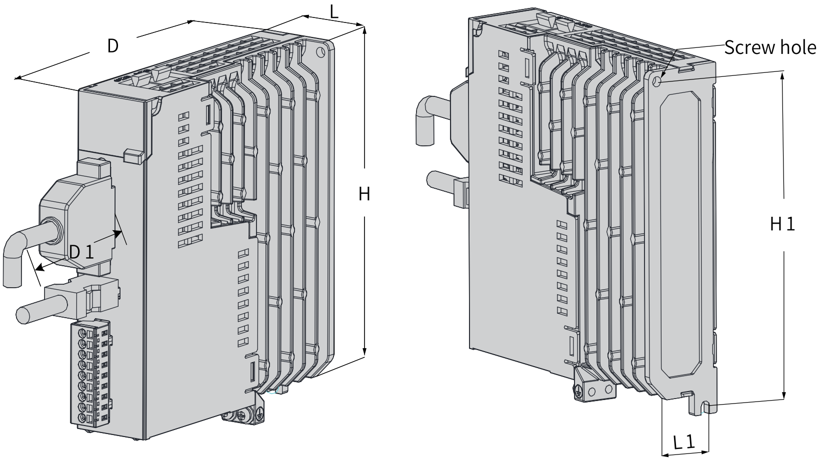



Figure 2-6 Components of servo drives in size E (SV630PT017I, SV630PT021I, SV630PT026I)

Table 2–5 Components (SV630PT017I, SV630PT021I, SV630PT026I)

| No. | Name | Description |
|---|---|---|
| ① | 5-digit LED display | The 5-digit 8-segment LED display is used to show servo system’s running state and parameter setting. |
| ② | Keys | MODE: Used to switch parameters in sequence.<br>△: Used to increase the value of the blinking bit.<br>▽: Used to decrease the value of the blinking bit.<br>◁: Used to shift the blinking bit leftwards.<br>(Hold down: Turning to the next page when the displayed number exceeds five digits)<br>SET: Used to save modifications and enter the next menu. |
| ③ | CHARGE (bus voltage indicator) | Indicates the electric charge is present in the bus capacitor. When the indicator turns on, charges possibly still exist in the internal capacitor of the servo unit, even if the power supply of the main circuit is OFF.<br>To prevent electric shock, do not touch the power supply terminals when this indicator lights up. |
| ④ | L1C, L2C (control circuit power input terminals) | See the nameplate for the rated voltage class. |
| 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) | Connected to U, V, and W phases of the servo motor. |
| ⑦ | N2, N1 (terminals for connecting external reactor) | Terminals N1 and N2 are jumpered by default. To suppress harmonics in the power supply, remove the jumper between terminals N1 and N2 first and connect an external DC reactor between terminals N1 and N2. |
| ⑧ | P⊕, D, C (terminals for connecting external regenerative resistor) | Remove the jumper bar between terminals P⊕ and D before connecting an external regenerative resistor between terminals P⊕ and C. |
| ⑨ | Battery 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 by reference input signals and other I/O signals. |
| 12 | CN2 (terminal for connecting the encoder) | Connected to the motor encoder terminal. |
| 13 | Servo drive grounding terminal | Connected to the grounding terminal of the power supply for grounding purpose. |

### 2.1.3 Product Dimensions




| Size | L | H | D | L1 | H1 | D1 | Screw Hole | Tightening Torque | Mass |
|---|---|---|---|---|---|---|---|---|---|
| | 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-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-M4 | 0.6 to 1.2 | 1.0 (2.20) |
| C | 55±1 (2.17±0.04) | 170 (6.69) | 173±1 (6.81±0.04) | 44 (1.73) | 160 (6.30) | 75 (2.95) | 2-M4 | 0.6 to 1.2 | 1.3 (2.87) |
| D | 80±1 (3.15±0.04) | 170 (6.69) | 183 (7.20) | 71 (2.80) | 160 (6.30) | 75 (2.95) | 3-M4 | 0.6 to 1.2 | 1.8 (3.97) |
| E | 90 (3.54) | 250 (9.84) | 230 (9.06) | 78 (3.07) | 240.5 (9.47) | 75 (2.95) | 4-M4 | 0.6 to 1.2 | 3.6 (7.94) |

## 2.2 Product Specifications

### 2.2.1 Electrical Specifications

- Single-phase 220 V drive

| Item | Size A | | Size B | Size C | Size D |
|---|---|---|---|---|---|
| Servo 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 |

| Item | | Size A | | Size B | Size C | Size D |
|---|---|---|---|---|---|---|
| Max. output current (Arms) | | 5.8 | 10.1 | 16.9 | 23.0 | 32.0 |
| Main circuit | Continuous input current (Arms) | 2.3 | 4.0 | 7.9 | 9.6 | 12.8 |
| | Main circuit power supply | Single-phase 200 VAC–240 VAC, -10% to +10%, 50 Hz/60 Hz | | | | |
| | Energy Loss (W)[1] | 10.21 | 23.8 | 38.2 | 47.32 | 69.84 |
| Control circuit | Control circuit power supply | Powered up by the bus, sharing the same power supply and rectification part with the main circuit | | | | |
| | Energy Loss (W)[1] | 16 | | | | |
| Braking resistor | Resistance (Ω) | - | - | 50 | 25 | |
| | Resistor power (W) | - | - | 50 | 80 | |
| | Min resistance of external resistor (Ω) | 40 | 45 | 40 | 20 | 15 |
| | Max. braking energy absorbed by capacitor (J) | 9.3 | 26.29 | 22.41 | 26.70 | 26.70 |
| | Braking resistor | All models in the series support built-in and external braking resistors. But Size A does not come with a built-in braking resistor as standard | | | | |
| Cooling method | | Self-cooling | | Air cooling | | |
| Overvoltage class | | III | | | | |

- Three-phase 220V drive

| Item | | Size C | Size D |
|---|---|---|---|
| Servo 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 |
| Main circuit | Continuous input current (Arms) | 5.1 | 8.0 |
| | Main circuit power supply | 3-phase 200 VAC–240 VAC, -10% to +10%, 50 Hz/60 Hz | |
| | Energy Loss (W)[1] | 47.32 | 69.84 |
| Control circuit | Control circuit power supply | Single-phase 200 VAC–240 VAC, -10% to +10%, 50 Hz/60 Hz | |
| | Energy Loss (W)[1] | 16 | |
| Braking resistor | Resistance (Ω) | 25 | |
| | Resistor power (W) | 80 | |
| | Min resistance of external resistor (Ω) | 20 | 15 |
| | Max. braking energy absorbed by capacitor (J) | 26.70 | 26.70 |
| | Braking resistor | Built-in and external resistor is supported | |
| Cooling mode | | Air cooling | |
| Overvoltage class | | III | |

- Three-phase 380 V drive

| Item | | Size C | | Size D | | Size E | | |
|---|---|---|---|---|---|---|---|---|
| Servo 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 | 41.25 | 52.12 | 64.25 |
| Main circuit | Continuous input current (Arms) | 2.4 | 3.6 | 5.6 | 8.0 | 12.0 | 16.0 | 21.0 |
| | Main circuit power supply | 3-phase 380 VAC–440 VAC, -10% to +10%, 50 Hz/60 Hz | | | | | | |
| | Energy Loss (W)[1] | 39.5 | 63.25 | 94.82 | 135.47 | 187.62 | 228.28 | 258.63 |
| Control circuit | Control circuit power supply | Single-phase 380 VAC–440 VAC, -10% to +10%, 50 Hz/60 Hz | | | | | | |
| | Energy Loss (W)[1] | 16 | | | | | | |
| Braking resistor | Resistance (Ω) | 100 | 100 | 50 | 50 | 35 | 35 | 35 |
| | Resistor 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) | 34.28 | 34.28 | 50.41 | 50.41 | 82.67 | 100.82 | 100.82 |
| | Braking resistor | Built-in and external resistor is supported | | | | | | |
| Cooling mode | | Air cooling | | | | | | |
| Overvoltage class | | III | | | | | | |

***Note***

- [1] Main circuit energy loss refers to the energy loss under rated output current of the servo drive.
- Select the external regenerative resistor according to actual operating conditions.

## 2.2.2 Technical Specifications

| Item | | | | Description |
|---|---|---|---|---|
| General Specifications | Control mode | | | IGBT PWM control, sine wave current drive mode |
| | | | | 220 V, 380 V: single/three-phase full pulse rectification |
| | Encoder feedback | | | 18-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 |
| | | Operating/Storage humidity | | Below 90%RH (without condensation) |
| | | Vibration resistance | | 4.9m/s$^2$ |
| | | Impact resistance | | 19.6 m/s$^2$ |
| | | IP rating | | IP20 |
| | | Pollution degree | | PD2 |
| | | Altitude | | Max. 2000m<br>For altitudes not higher than 1000 m, derating is not required<br>For altitude above 1000 m, derate 1% for every additional 100 m. For altitude above 2000m, contact Inovance. |
| Speed torque control mode | Performance | Speed change ratio [2] | 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) |
| | | | Temperature change ratio | Below 0.5% at 25 ± 25°C (under rated speed). |
| | | Speed control range | | 1:6000 (Under the rated torque load, the servo drive keeps 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 | DI signal | Speed 0 to 15 selectable through DI signal combination |
| | | Torque reference | DI signal | - |

| Item | | | | Description |
|---|---|---|---|---|
| Position control mode | Performance | Feedforward compensation | | 0% to 100.0% (resolution: 0.1%) |
| | | Timing window | | 1–65535 encoder unit |
| | Input signal | Pulse reference | Input pulse form | Three forms: direction+pulse, phase A + phase B quadrature pulse, CW/ CCW pulse |
| | | | Input form | Differential input; open collector |
| | | | Input pulse frequency | Differential input: single: 4 Mpps, quadrature: 8 Mpps, pulse width ⩾ 0.125 us<br>Open collector: max. single pulse frequency: 200 Kpps, pulse width must not be less than 2.5 us |
| | | 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 mode | | 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 |
| | Digital output signal | Output signal function selection | | 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 | Stop at limit switch | | The servo drive stops immediately when P-OT or N-OT is active |
| | Electronic gear ratio | | $0.001 \leqslant B/A \leqslant 104857.6$ |
| | Protection | | Including protections against overcurrent, overvoltage, undervoltage, overload, main circuit detection error, heatsink overheat, power phase loss, overspeed, encoder error, CPU error, and parameter error |
| | LED display | | Main circuit CHARGE indicator, 5-digit LED display |
| | Vibration Suppression | | 5 notches (including two adaptive notches) available, 50 Hz to 8000Hz |
| | Usability functions | | One-key parameter tuning, adaptive parameter tuning, speed observer, and model tracking |
| | Communication | Software commissioning | RJ45 Modbus |
| | | Multi-station communication | RS485 |
| | | Number of multi-station communication axes | Up to 32 for RS485 |
| | | 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, speed/torque reference signal observation, and communication and motion control command setting |
| | Others | | Gain tuning, alarm log, JOG |

## Note

- [1] Install the servo drive within the allowable ambient temperature range. When it is installed inside a control cabinet, the temperature inside the cabinet must also be within this range.
- [2] The speed change ratio is defined by the following formula: Speed change ratio = (No-load speed - Full-load speed) ÷ Rated speed x 100%.
- The voltage change and temperature change may result in amplifier deviation, which causes the calculated resistance value to change. Such changes is reflected by the speed change. Speed changes caused by the voltage change and the temperature change will be indicated respectively by a percentage to the rated speed.
- [3] The internal open collector power supply is not electrically insulated from the control circuit in the servo drive.

## 2.2.3 Dynamic Brake Characteristics

According to the motor model, initial speed and load inertia, the dynamic braking distance can be estimated. The approximate value of the dynamic braking distance can be calculated by the following formula. For the accurate value, please use the dynamic braking calculation function provided by our software.

Maximum braking distance s (turn) is:

$$s=\frac{V_0}{60}\left(t_e+(\tau_1+\tau_2 V_0^2)\left(1+\frac{J_L}{J_M}\right)\right)$$

The coefficient is as follows:

$$\tau_1=\frac{2R_s J}{3p_n^2\Psi_f^2}=\frac{10000\pi^2 R_s J}{9K_e^2}$$

$$\tau_2=\frac{\pi^2 L_d^{\,2} J}{4050 R_s \Psi_f^{\,2}}=\frac{100 L_d^{\,2}\pi^4 P_n^{\,2} J}{243 R_s K_e^{\,2}}$$

$$\Psi_f=\frac{\sqrt{6}K_e}{100\pi P_n}$$

- $V_0$: Maximum feedback speed
- $t_e$: Dynamic brake program and relay delay
- $J_L$: Load moment of inertia
- $J_M$: Motor moment of inertia
- $P_n$: Number of motor pole pairs
- $R_s$: Stator resistance (Ω)
- $L_q$, $L_d$: q-axis inductance (mH), d-axis inductance (mH).

## 2.2.4 Load Moment of Inertia

The load moment of inertia represents the inertia of the load. The larger the load moment of inertia is, the weaker the responsiveness is. An excessively high inertia may result in unstable motion. The allowable load moment of inertia of the motor is restricted. This value is provided strictly as a guideline and varies with the motor driving conditions.

An overvoltage warning may occur during deceleration if the load moment of inertia exceeds the allowable value. For servo drives with a built-in regenerative resistor, an overload alarm my be present. 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

- Check the drive selection guide for the built-in brake.
- Even you use a built-in resistor, the energy generated in some conditions will exceed the allowable capacity loss (W) of the resistor. In this case, an external braking resistor is required.

# 3 MS1-R Series Motor

## 3.1 Product Information

### 3.1.1 Description of the Model and Nameplate

**Model Description**

MS1 H1 - 75B 30C B A3 3 1 R - *
① ② ③ ④ ⑤ ⑥ ⑦⑧⑨ ⑩

| | | |
|---|---|---|
| ① **MS1 series servo motor** | ② **Inertia and capacity**<br>H1: low inertia, small capacity<br>H2: low inertia, medium capacity<br>H3: medium inertia, medium capacity<br>H4: medium inertia, small capacity | ③ **Rated power (W)**<br>One letter and two digits<br>B: x 10<br>C: x 100<br>Example: 75B: 750 W |
| ④ **Rated speed (rpm)**<br>One letter and two digits<br>B: x 10<br>C: x 100<br>Example: 30C: 3,000 rpm | ⑤ **Voltage class (V)**<br>B: 220<br>D: 380 | ⑥ **Encoder type**<br>One letter and one digit<br>A6: 26-bit multi-turn absolute encoder<br>S6: 26-bit multi-turn absolute encoder of functional safety type<br>A3: 23-bit multi-turn absolute encoder<br>T3: 18-bit multi-turn absolute encoder |
| ⑦ **Shaft connection mode**<br>3: Solid shaft with key and threaded hole | ⑧ **Brake, reducer, oil seal[1]**<br>0: Without oil seal + without brake<br>1: With oil seal + without brake<br>2: Without oil seal + with brake<br>4: With oil seal + with brake | ⑨ **Series**<br>R: R version<br>⑩ **Non-standard functions**<br>_: Standard<br>S: Flying leads type<br>-**: Other non-standard function |

***Note***

- [1] The standard configuration of the motor in flange size 40 does not include the oil seal. Motors of other models carry the oil seal as standard.

## Nameplate description

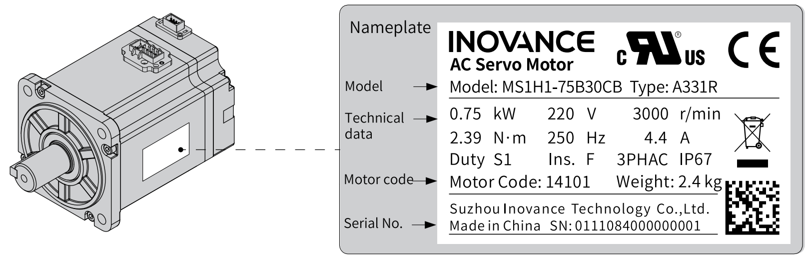



Figure 3-1 Description of the model and nameplate

## 3.1.2 Components

## Motor (Flange sizes 40&60&80)

- **Servo motors with terminal box**

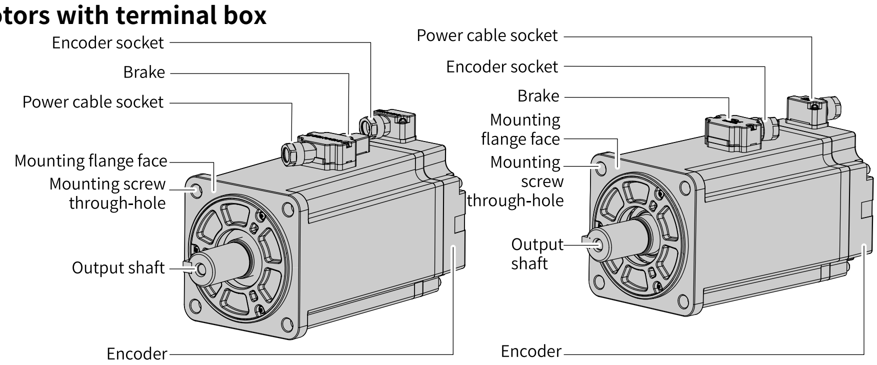



Figure 3-2 Components of motors with terminal box (left: front outlet; right: rear outlet)

- **Servo motors with flying leads**

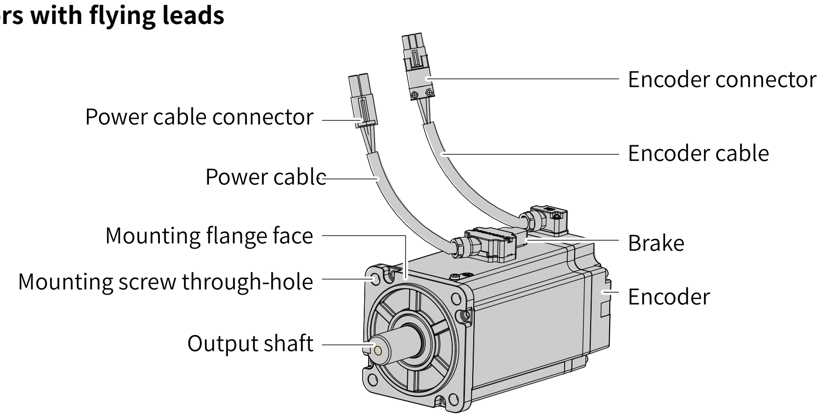



Figure 3-3 Components of motors with flying leads

## Motor (Flange sizes 100&130&180)

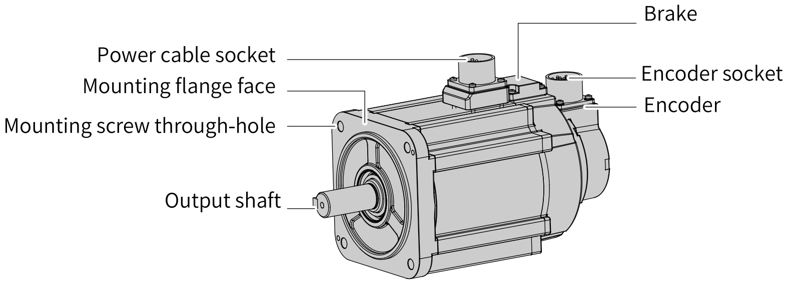



Figure 3-4 Components of servo motors in flange sizes 100/130/180

### 3.1.3 Motor Models

| Motor type | | Rated Output Capacity (kW) | Rated speed (max. speed) (RPM) | Encoder | IP rating of the enclosure |
|---|---|---|---|---|---|
| Low inertia, small capacity | MS1H1  | 0.05, 0.1, 0.2, 0.4, 0.55, 0.75, 1.0 | 3000 (6000) | T3: 18-bit multi-turn absolute encoder | IP67 |
| Low inertia, medium capacity | MS1H2  | 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0 | 3000 (6000) | T3: 18-bit multi-turn absolute encoder | IP67 |
| Medium inertia, medium capacity | MS1H3  | 0.85, 1.3, 1.8, 2.9, 4.4, 5.5, 7.5 | 1500 (3000) | T3: 18-bit multi-turn absolute encoder | IP67 |
| Medium inertia, small capacity | MS1H4  | 0.1, 0.2, 0.4, 0.55, 0.75, 1.0 | 3000 (6000) | T3: 18-bit multi-turn absolute encoder | IP67 |

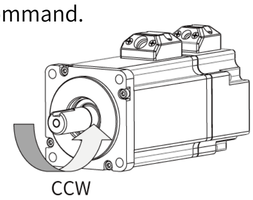
***Note***

40机座MS1-R系列伺服电机规划中，敬请期待！

## 3.2 Product Specifications

### 3.2.1 Mechanical Characteristics

| Item | Description |
|---|---|
| Duty type | S1(Continuous duty) |
| Vibration level[1] | V15 |

| Item | | Description |
|---|---|---|
| Insulation resistance | | 500 VDC, above 10 MΩ |
| Excitation mode | | Permanent magnetic |
| Installation method | | Flange type |
| Heat resistance level | | F |
| Insulation voltage | | 1500 VAC, 1 min (220 V class)<br>1800 VAC, 1 min (380 V class) |
| IP rating of the enclosure | | IP67 (excluding shaft opening and flying leads type motor connectors) |
| Direction of rotation | | Rotates counterclockwise when viewed from the shaft extension side with the forward run command.<br> |
| Operating conditions | Ambient temperature | 0°C to 40°C (non-freezing) (Derate based on the derating curve for temperatures above 40°C.) |
| | Ambient humidity | 20%–80% (no condensation) |
| | Installation location | • Free from corrosive or explosive gases<br>• Well ventilated and with minimum amount of dust, waste and moisture<br>• Convenient for inspection and cleanup<br>• Derating required only for altitudes above 1000 m *"3.2.3 Derating Characteristics" on page 46*<br>• Away from sources that may generate strong magnetic field<br>• Away from heating sources such as a heating stove<br>• Use the motor with oil seal in places with grinding fluid, oil mist, iron powders or cuttings.<br>• The oil seal is only dust-proof. It cannot withstand the intrusion of oil in a long term.<br>• No applicable to vacuum environment<br>• Not applicable to inching condition, which may result in stuck<br>• The motor with brake may generate a pattering sound.<br>• Coupler type and installation alignment requirements<br>• The system should avoid continuous operation at natural frequency. Exceeding the allowable vibration value may damage the system. |
| | Storage environment | Observe the following requirements for keeping a de-energized motor.<br>• Temperature: -20°C to +60°C (non-freezing)<br>• Humidity: 20% to 80% RH (no condensation) |
| Shock resistance [2] | Shock acceleration (taking flange side as standard) | 490 m/s$^2$ |
| | Times of shock | 2 |
| Vibration resistance[3] | Vibration acceleration (taking flange side as standard) | 49 m/s$^2$ |

***Note***

- [1]Vibration level V15 indicates that the vibration amplitude is less than 15 µm when a single servo motor rotates at rated values.
- [2] 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.
- [3] For a servo motor shaft mounted horizontally, the vibration resistance level in the up/down, left/right, and front/rear directions is shown in the preceding table.
- The strength of the vibration that the servo motor can withstand depends on the application. Check the vibration acceleration rate applied to the servo motor through the actual product.

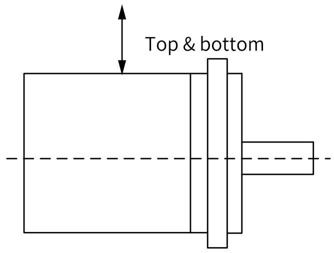



Figure 3-5 Shock applied on the motor

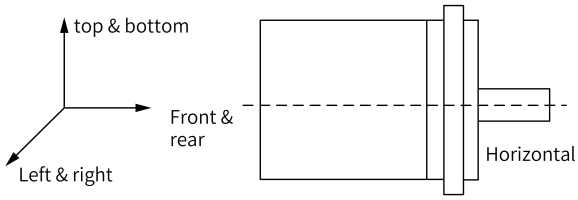



Figure 3-6 Vibration applied on the motor

## 3.2.2 Overload Characteristics

The equipment is compliant with NEC and CEC requirements and equipped with protective functions against overload and overtemperature.

For effective protection of different load motors, set the motor overload protection gain according to the motor overload capacity. 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.
- The thermal overload protection only occurs during continuous operation. In this case, power off the drive to check the motor temperature.

The motor overload protection curve is shown in the following figure.

- **MS1H1/MS1H4**

| Load ratio (%) | Operating time (s) |
|---|---|
| 120 | 230 |
| 130 | 80 |
| 140 | 40 |
| 150 | 30 |
| 160 | 20 |

| Load ratio (%) | Operating time (s) |
|---|---|
| 170 | 17 |
| 180 | 15 |
| 190 | 12 |
| 200 | 10 |
| 210 | 8.5 |
| 220 | 7 |
| 230 | 6 |
| 240 | 5.5 |
| 250 | 5 |
| 300 | 3 |
| 350 | 2 |

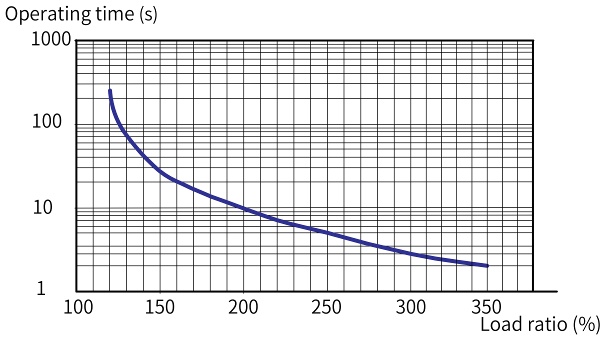



Figure 3-7 MS1H1 and MS1H4 series motor overload curves

## *Note*

The maximum torque of MS1H1 and MS1H4 models is 3.5 times the rated torque.

- **MS1H2/MS1H3**

| Load ratio (%) | Operating time (s) |
|---|---|
| 115 | 6000 |
| 121.4 | 2000 |
| 127.8 | 1000 |
| 134.2 | 800 |
| 140.6 | 500 |
| 147 | 300 |
| 153.4 | 150 |
| 159.8 | 100 |
| 166.2 | 80 |
| 172.6 | 60 |
| 179.0 | 50 |
| 185.4 | 45 |
| 191.8 | 40 |
| 198.2 | 36 |
| 204.6 | 32 |
| 211.0 | 28 |
| 217.4 | 23 |
| 223.8 | 22 |
| 230.2 | 19 |
| 236.6 | 18 |
| 243.0 | 15 |

| Load ratio (%) | Operating time (s) |
|---|---|
| 249.4 | 14 |
| 255.8 | 13 |
| 262.2 | 11 |
| 268.6 | 10 |
| 275.0 | 9 |
| 281.4 | 8 |
| 287.8 | 7 |
| 294.2 | 6 |

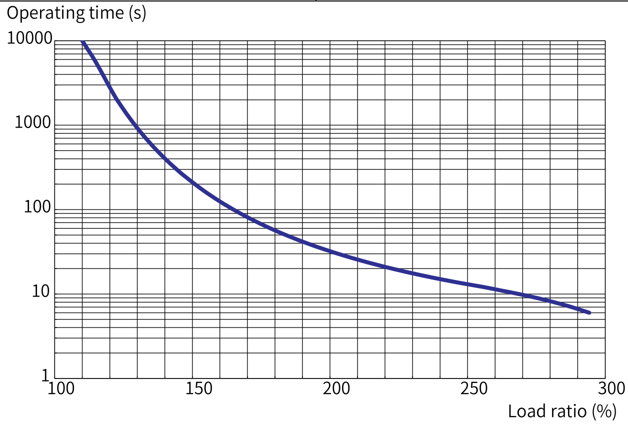


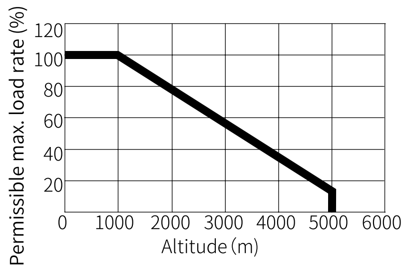

Figure 3-8 MS1H2 and MS1H3 series motor overload curves

***Note***

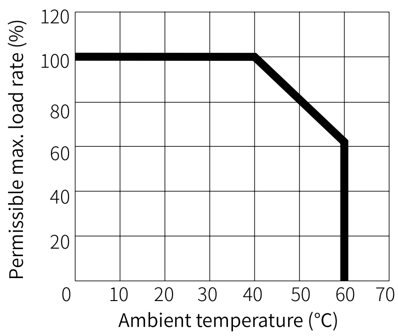
- The maximum torque of H2 models is three times the rated torque.
- The maximum torque of H3 models is 2.5 times the rated torque.

## 3.2.3 Derating Characteristics

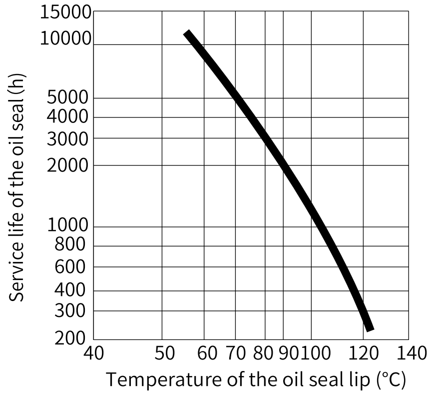
- **Altitude-based derating curve**




- **Temperature-based derating curve**

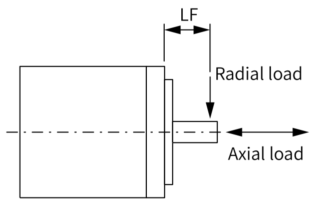


### 3.2.4 Temperature Curve of the Oil Seal



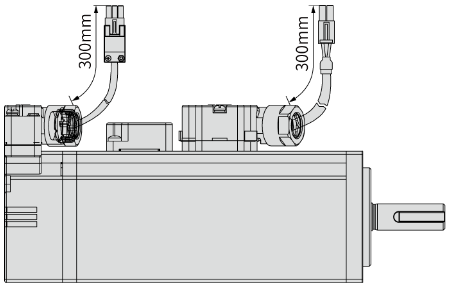

## 3.3 Selection Instructions

- Description of the torque-speed characteristics curve:
  - Technical data and torque/speed characteristic values in the following tables are applicable to motors working with Inovance servo drives with the 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.
  - Short-time working area: refers to a series of states in which the motor can run in a short time when the actual torque is greater than the rated torque.
- The characteristic parameter values are obtained in cases where the motor is installed with the following heatsink:
  - MS1H1/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

  The 40/60/80-flange flying leads type motor (with "-S") provides a drain wire of about 300 mm long, as shown in the following figure.



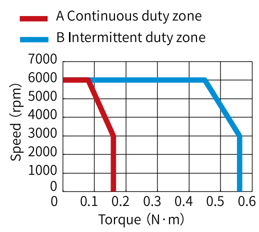

- MS1H3 (130-flange and 180-flange) comes with a key slot. When the operating speed is above 3000 rpm, the motor must run with the key. If you need to run the motor without the key, you can ask for customization from Inovance.

***Note***

- The data in the () is the value of the servo motor with the brake.
- The motor with oil seal must be derated by 10% during use.
- It is recommended that the cross sectional area of brake cables is above 0.5 mm$^2$.
- The brake must not share the power supply with other electrical devices. This is to prevent a malfunction of the brake due to a drop in the voltage or current when other electrical devices work in tandem.
- The holding brake cannot be used for braking purpose.
- 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.
- The MS1–R series motor encoder is T3 (18-bit single-turn absolute encoder) KA2 = 74 mm.
- The tightening tension for terminal screws must be between **0.19 N·m to 0.21 N·m**, exceeding of which may damage the terminal.

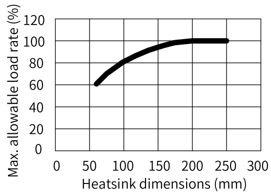
# 3.4 Low Inertia and Small Capacity (MS1H1)

## 3.4.1 MS1H1-05B30CB-T33*Z

| Motor specifications | | Torque-Speed characteristics |
|---|---|---|
| Flange size (mm) | 40 |  |
| Inertia, capacity | Low inertia, small capacity | |
| Rated power (kW) | 0.05 | |
| Rated voltage | 220 | |
| Rated torque (N·m) | 0.16 | |
| Maximum torque (N·m) | 0.56 | |
| Rated current (Arms) | 1.3 | Heatsink-based derating curve |

| Motor specifications | | |
|---|---|---|
| Maximum current (Arms) | 4.70 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 0.15 | |
| Rotor moment of inertia (kg·$cm^2$) | Motor without brake | 0.026 |
| | Motor with brake | 0.028 |

Torque-Speed characteristics



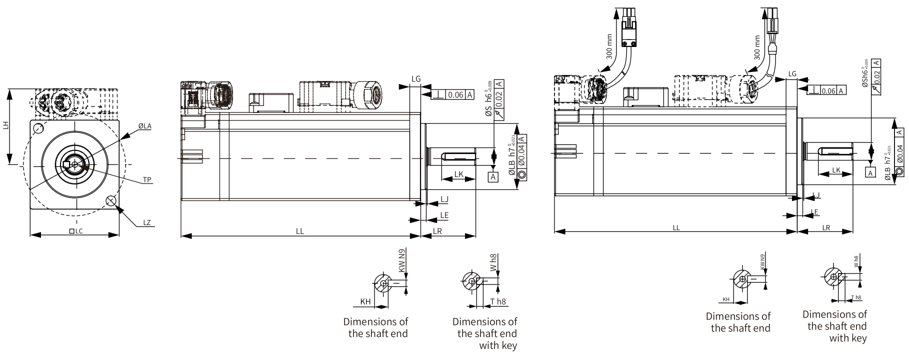

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC) ±10% | Rated power (W) | Coil resistance (Ω)(±7%) | Exciting current (A) | Apply time (ms) | Release time (ms) | Backlash (°) |
|---|---|---|---|---|---|---|---|
| 0.32 | 24 | 6.1 | 94.4 | 0.25 | ⩽ 40 | ⩽ 20 | ⩽ 1.5 |

## Allowable load

| LF (mm) | Allowable radial load (N) | Allowable axial load (N) |
|---|---|---|
| 20 | 78 | 54 |

## Dimensions (mm)

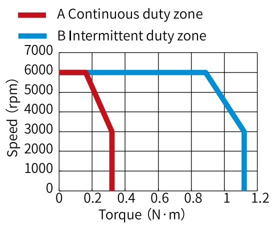



| LL | LC | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 65.4 (96) | 40 | 25±0.3 | 46 | 2-Ø4.5 | 34.3 | 5 | 2.5±0.5 | 0.5±0.35 |
| S | LB | TP | LK | KH | KW | W | T | Weight (kg) |
| 8 | $Ø30h7^{0}_{-0.021}$ | M3x6 | 15.5 | $6.2^{0}_{-0.1}$ | 3 | 3 | 3 | 0.39 (0.50) |

## 3.4.2 MS1H1-10B30CB-T33*Z

| Motor specifications | |
|---|---|
| Flange size (mm) | 40 |
| Inertia, capacity | Low inertia, small capacity |
| Rated power (kW) | 0.1 |
| Rated voltage | 220 |
| Rated torque (N·m) | 0.32 |
| Maximum torque (N·m) | 1.12 |
| Rated current (Arms) | 1.3 |

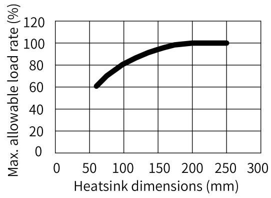
Torque-Speed characteristics




Heatsink-based derating curve

| Motor specifications | | |
|---|---|---|
| Maximum current (Arms) | 4.70 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 0.26 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 0.041 |
| | Motor with brake | 0.043 |

Torque-Speed characteristics



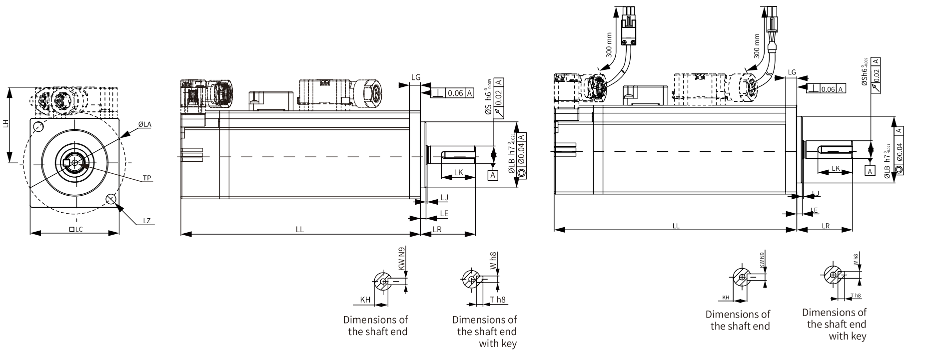

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC) ±10% | Rated power (W) | Coil resistance (Ω)(±7%) | Exciting current (A) | Apply time (ms) | Release time (ms) | Backlash (°) |
|---|---|---|---|---|---|---|---|
| 0.32 | 24 | 6.1 | 94.4 | 0.25 | ⩽ 40 | ⩽ 20 | ⩽ 1.5 |

## Allowable load

| LF (mm) | Allowable radial load (N) | Allowable axial load (N) |
|---|---|---|
| 20 | 78 | 54 |

## Dimensions (mm)



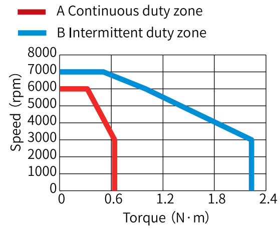

| LL | LC | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 78.4 (110) | 40 | 25±0.3 | 46 | 2-Ø4.5 | 34.3 | 5 | 2.5±0.5 | 0.5±0.35 |

| S | LB | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|
| 8 | Ø30h7$^{0}_{-0.021}$ | M3x6 | 15.5 | 6.2$^{0}_{-0.1}$ | 3 | 3 | 3 | 0.45 (0.64) |

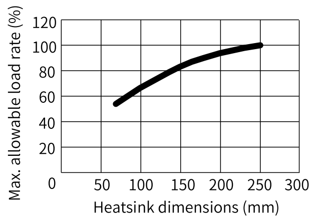
## 3.4.3 MS1H1-20B30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 1.5 | |
| Maximum current (Arms) | 5.8 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 7000 | |
| Torque coefficient (N·m/Arms) | 0.46 | |
| Rotor moment of inertia (kg·cm²) | Motor without brake | 0.094 |
| | Motor with brake | 0.106 |

Torque-Speed characteristics




Heatsink-based derating curve



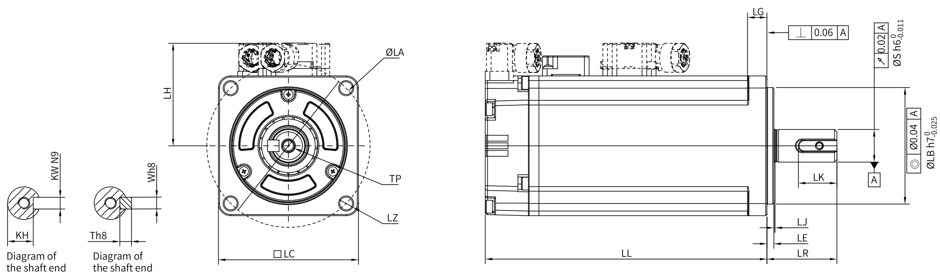

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

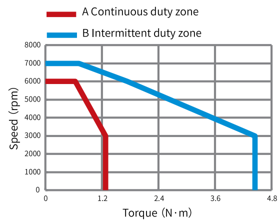



| LC | LL | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 60 | 75.5 (103) | 30±0.5 | 70 | 4- Ø 5.5 | 44 | 8.0 | 3±0.5 | 0.5±0.35 |
| **LB** | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| $Ø50h7^{0}_{-0.025}$ | 14 | M5x8 | 16.5 | $11^{0}_{-0.1}$ | 5 | 5 | 5 | 0.80 (1.17) |

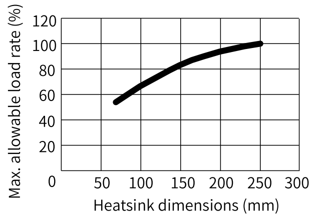
## 3.4.4 MS1H1-40B30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 2.5 | |
| Maximum current (Arms) | 9.8 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 7000 | |
| Torque coefficient (N·m/Arms) | 0.53 | |
| Rotor moment of inertia (kg·$cm^2$) | Motor without brake | 0.145 |
| | Motor with brake | 0.157 |

Torque-Speed characteristics




Heatsink-based derating curve



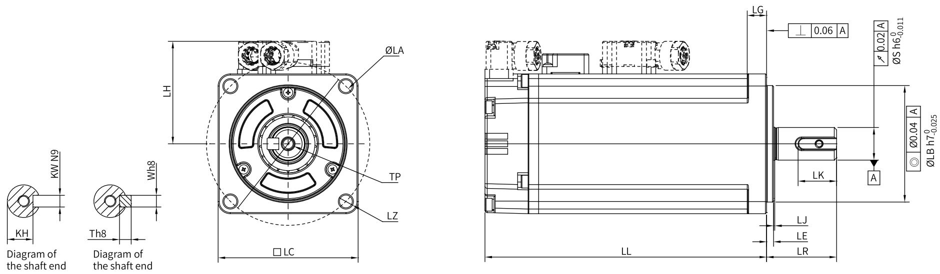

### Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

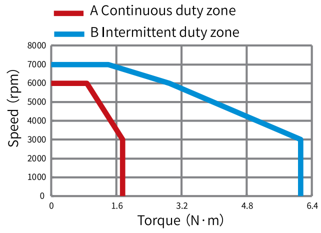



| LC | LL | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 60 | 93<br>(121) | 30 ± 0.5 | 70 | 4- Ø 5.5 | 44 | 8.0 | 3 ± 0.5 | 0.5±0.35 |
| **LB** | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| Ø50h7$^{0}_{-0.025}$ | 14 | M5x8 | 16.5 | 11$^{0}_{-0.1}$ | 5 | 5 | 5 | 1.11<br>(1.48) |

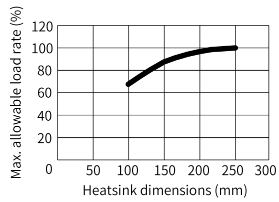
## 3.4.5 MS1H1-55B30CB-T331R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 3.9 | |
| Maximum current (Arms) | 15 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 7000 | |
| Torque coefficient (N·m/Arms) | 0.49 | |
| Rotor moment of inertia (kg·cm²) | Motor without brake | 0.55 |
| | Motor with brake | - |

Torque-Speed characteristics



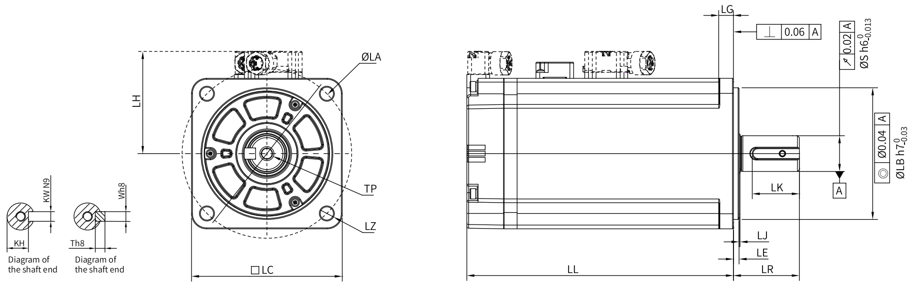

Heatsink-based derating curve




## Allowable load

| LF (mm) | Allowable radial load (N) | Allowable axial load (N) |
|---|---|---|
| 35 | 392 | 147 |

## Dimensions (mm)

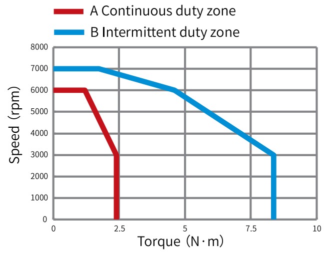



| LC | LL | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 80 | 96.7 | 25±0.5 | 90 | 4- Ø 7 | 54 | 7.5 | 3±0.5 | 0.5±0.35 |
| LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
| Ø70h7$^{0}_{-0.03}$ | 19 | M6 x 20 | 26 | 15.5$^{0}_{-0.1}$ | 6 | 6 | 6 | 1.88 |

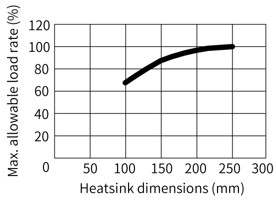
## 3.4.6 MS1H1-75B30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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) | 8.37 | |
| Rated current (Arms) | 4.4 | |
| Maximum current (Arms) | 16.9 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 7000 | |
| Torque coefficient (N·m/Arms) | 0.58 | |
| Rotor moment of inertia (kg·cm²) | Motor without brake | 0.68 |
| | Motor with brake | 0.71 |

Torque-Speed characteristics




Heatsink-based derating curve



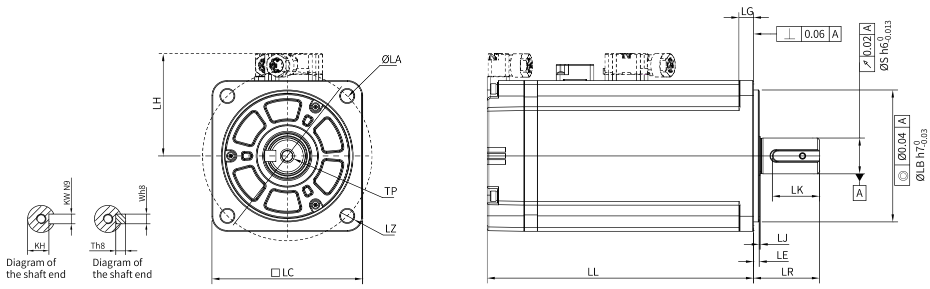

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

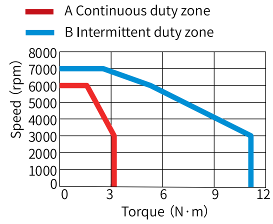



| LC | LL | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 80 | 107.3 (141.5) | 25±0.5 | 90 | 4- Ø 7 | 54 | 7.5 | 3±0.5 | 0.5±0.35 |
| **LB** | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| Ø70h7$^{0}_{-0.03}$ | 19 | M6 × 20 | 26 | 15.5$^{0}_{-0.1}$ | 6 | 6 | 6 | 2.22 (2.88) |

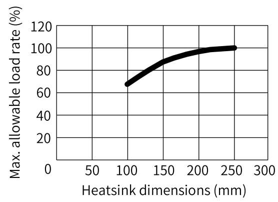
## 3.4.7 MS1H1-10C30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 6.2 | |
| Maximum current (Arms) | 24 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 7000 | |
| Torque coefficient (N·m/Arms) | 0.46 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 0.82 |
| | Motor with brake | 0.87 |

Torque-Speed characteristics




Heatsink-based derating curve



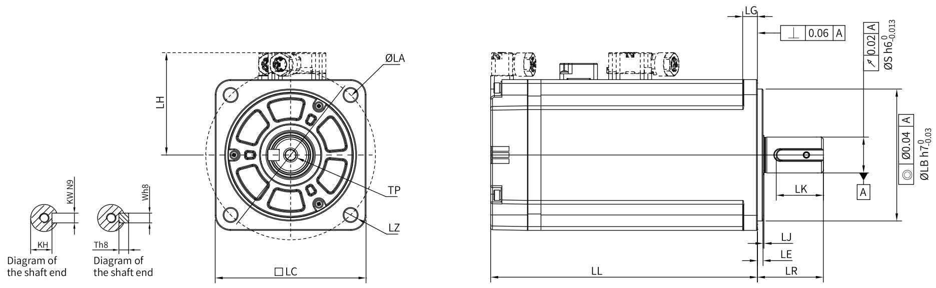

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



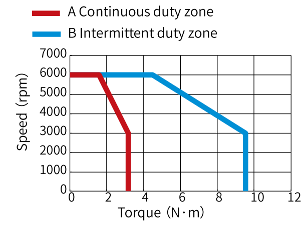

| LC | LL | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 80 | 119.2<br>(153.4) | 25±0.5 | 90 | 4- Ø 7 | 54 | 7.5 | 3 ± 0.5 | 0.5±0.35 |
| **LB** | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| Ø 70h7$^{0}_{-0.03}$ | 19 | M6 × 20 | 26 | 15.5$^{0}_{-0.1}$ | 6 | 6 | 6 | 2.61<br>(3.27) |

# 3.5 Low Inertia and Medium Capacity (MS1H2)

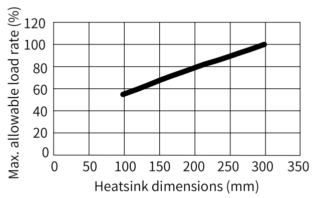
## 3.5.1 MS1H2-10C30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 (Arms) | 6.4 | |
| Maximum current (Arms) | 23 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 0.54 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 1.78 |
| | Motor with brake | 2.6 |

Torque-Speed characteristics




Heatsink-based derating curve



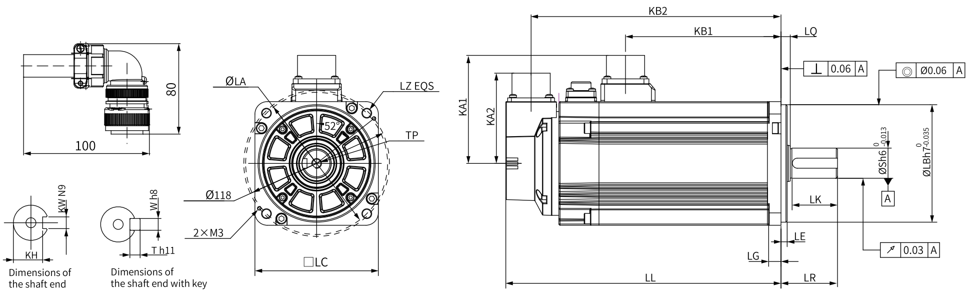

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



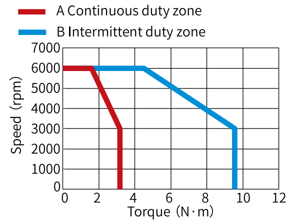

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 144 (172) | 45±1 | 115 | 4-Ø7 | 88 | 75 | 74 | 123.5 (151.5) | 10 | 5±0.3 |

| LQ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 7.5±0.75 | Ø95h7$^{0}_{-0.035}$ | 24 | M8x16 | 36 | $20^{0}_{-0.2}$ | 8 | 8 | 7 | 3.85 (4.9) |

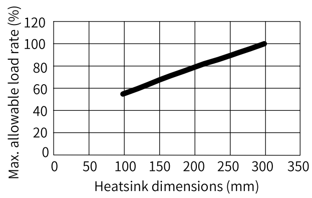
## 3.5.2 MS1H2-10C30CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 3.3 | |
| Maximum current (Arms) | 11 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 1.07 | |
| Rotor moment of inertia (kg·cm²) | Motor without brake | 1.78 |
| | Motor with brake | 2.6 |

Torque-Speed characteristics




Heatsink-based derating curve



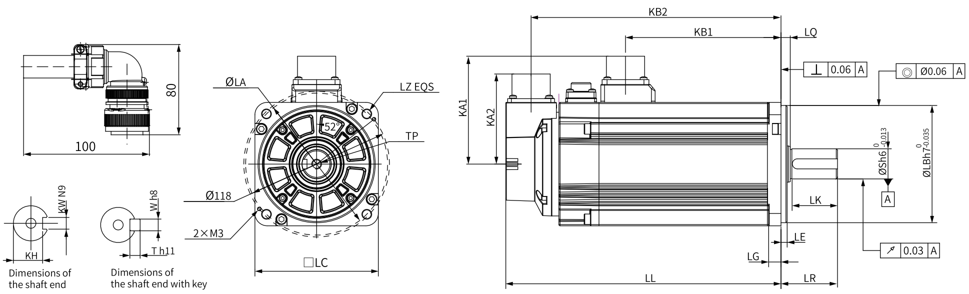

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



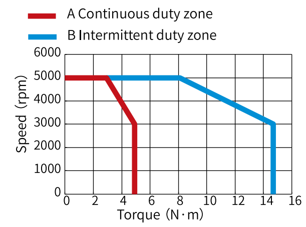

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 144 (172) | 45±1 | 115 | 4-Ø7 | 88 | 75 | 74 | 123.5 (151.5) | 10 | 5±0.3 |

| LQ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 7.5±0.75 | Ø95h7$^{0}_{-0.035}$ | 24 | M8x16 | 36 | 20$^{0}_{-0.2}$ | 8 | 8 | 7 | 3.85 (4.9) |

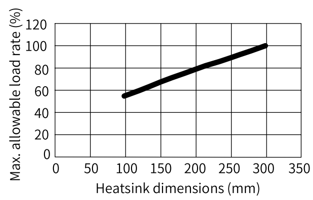
## 3.5.3 MS1H2-15C30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 8.6 | |
| Maximum current (Arms) | 32 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 5000 | |
| Torque coefficient (N·m/Arms) | 0.62 | |
| Rotor moment of inertia (kg·cm²) | Motor without brake | 2.35 |
| | Motor with brake | 3.17 |

Torque-Speed characteristics




Heatsink-based derating curve



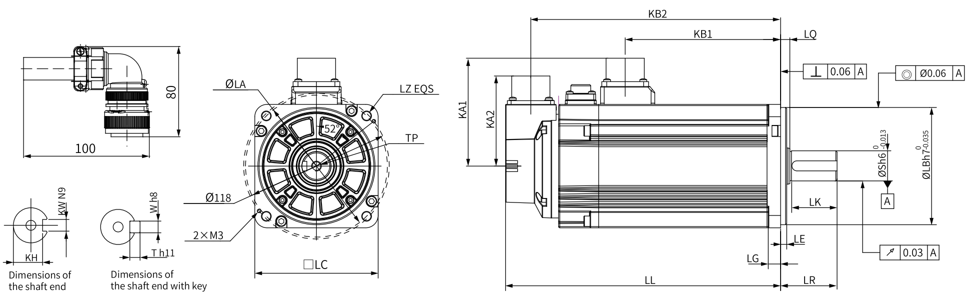

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

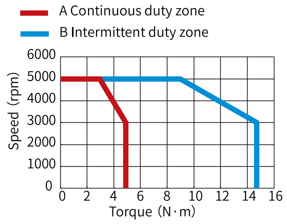



| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 161 (189) | 45±1 | 115 | 4-Ø7 | 88 | 92 | 74 | 140.5 (168.5) | 10 | 5±0.3 |
| LQ | LB | | S | TP | LK | KH | KW | W | T | Weight (kg) |
| 7.5±0.75 | Ø95h7$^{0}_{-0.035}$ | | 24 | M8x16 | 36 | 20$^{0}_{-0.2}$ | 8 | 8 | 7 | 4.65 (5.75) |

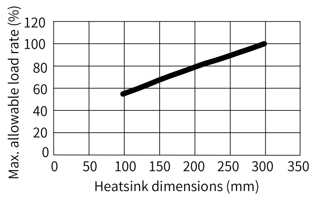
## 3.5.4 MS1H2-15C30CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 4.2 | |
| Maximum current (Arms) | 14 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 5000 | |
| Torque coefficient (N·m/Arms) | 1.28 | |
| Rotor moment of inertia (kg·$cm^2$) | Motor without brake | 2.35 |
| | Motor with brake | 3.17 |

Torque-Speed characteristics




Heatsink-based derating curve



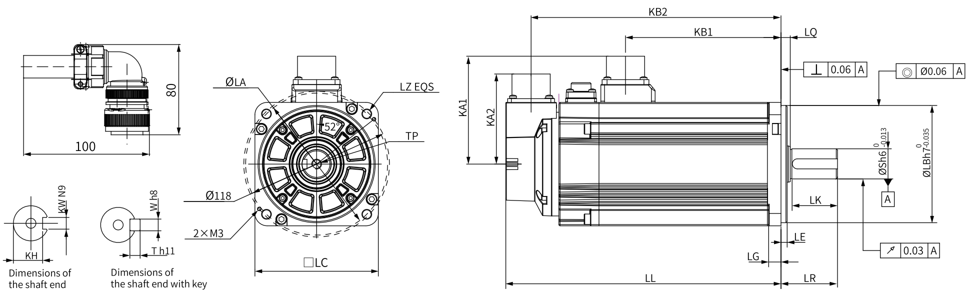

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

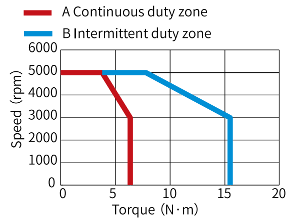



| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 161<br>(189) | 45±1 | 115 | 4-Ø7 | 88 | 92 | 74 | 140.5<br>(168.5) | 10 | 5±0.3 |
| **LQ** | **LB** | | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| 7.5±0.75 | Ø95h7$^{0}_{-0.035}$ | | 24 | M8x16 | 36 | 20$^{0}_{-0.2}$ | 8 | 8 | 7 | 4.65<br>(5.75) |

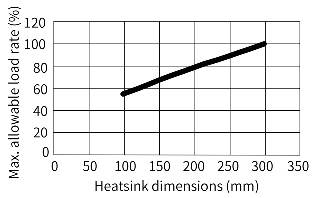
## 3.5.5 MS1H2-20C30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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) | 15.5 | |
| Rated current (Arms) | 11.3 | |
| Maximum current (Arms) | 32 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 5000 | |
| Torque coefficient (N·m/Arms) | 0.60 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 2.92 |
| | Motor with brake | 3.74 |

Torque-Speed characteristics




Heatsink-based derating curve



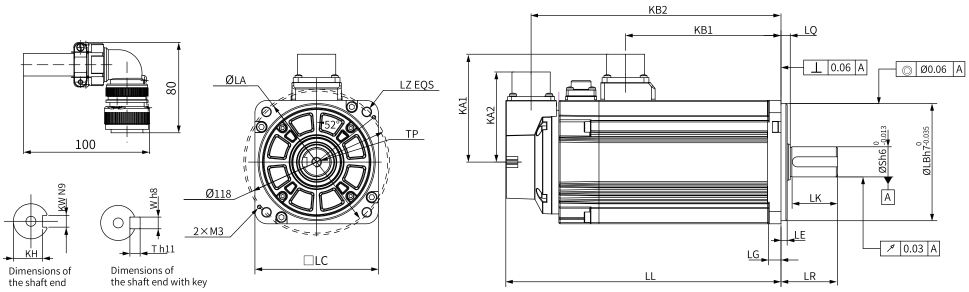

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

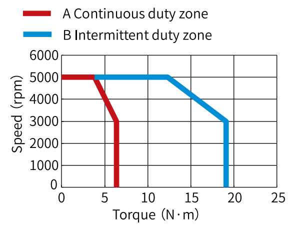



| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 177 (205) | 45±1 | 115 | 4-Ø7 | 88 | 108 | 74 | 156.5 (184.5) | 10 | 5±0.3 |
| **LJ** | **LB** | | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| 7.5±0.75 | Ø95h7$^{0}_{-0.035}$ | | 24 | M8x16 | 36 | 20$^{0}_{-0.2}$ | 8 | 8 | 7 | 5.5 (6.55) |

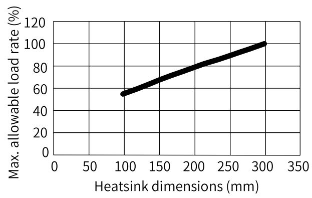
## 3.5.6 MS1H2-20C30CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 5.6 | |
| Maximum current (Arms) | 20 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 5000 | |
| Torque coefficient (N·m/Arms) | 1.19 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 2.92 |
| | Motor with brake | 3.74 |

Torque-Speed characteristics




Heatsink-based derating curve



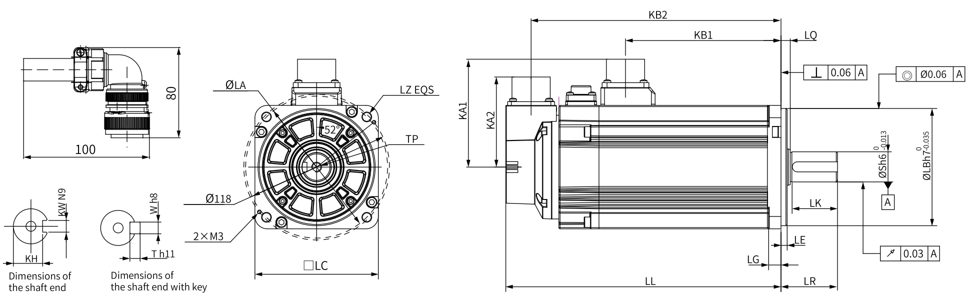

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



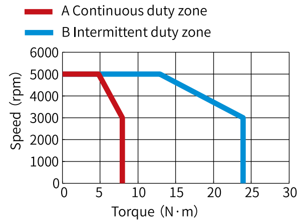

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 177 (205) | 45±1 | 115 | 4-Ø7 | 88 | 108 | 74 | 156.5 (184.5) | 10 | 5±0.3 |

| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 7.5±0.75 | Ø95h7$^{0}_{-0.035}$ | 24 | M8x16 | 36 | 20$^{0}_{-0.2}$ | 8 | 8 | 7 | 5.5 (6.55) |

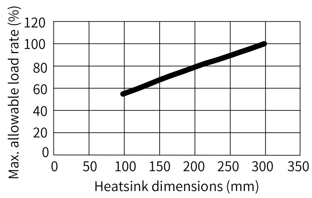
## 3.5.7 MS1H2-25C30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 14.7 | |
| Maximum current (Arms) | 53 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 5000 | |
| Torque coefficient (N·m/Arms) | 0.60 | |
| Rotor moment of inertia (kg·cm²) | Motor without brake | 3.49 |
| | Motor with brake | 4.3 |

Torque-Speed characteristics




Heatsink-based derating curve



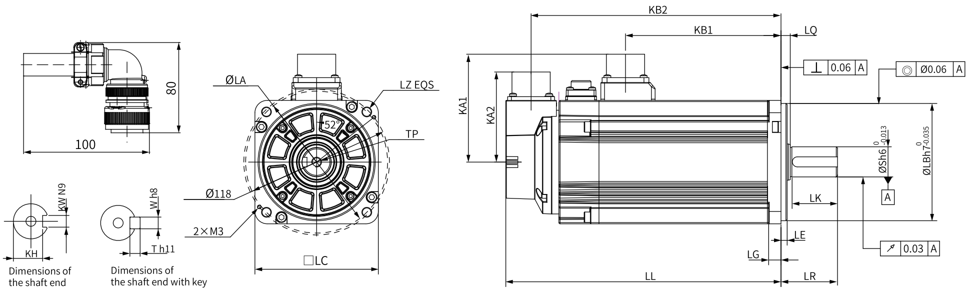

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

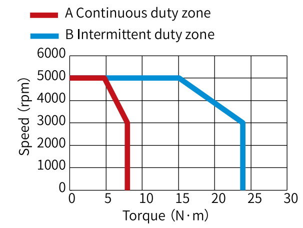



| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 [Note] | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 195 (223) | 45±1 | 115 | 4-Ø7 | 88 | 126 | 73 | 174.5 (202.5) | 10 | 5±0.3 |
| **LQ** | **LB** | | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| 7.5±0.75 | Ø95h7$^{0}_{-0.035}$ | | 24 | M8x16 | 36 | 20$^{0}_{-0.2}$ | 8 | 8 | 7 | 6.3 (7.35) |

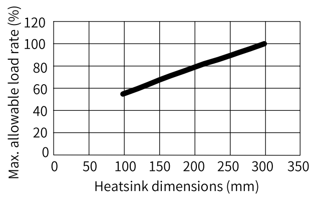
## 3.5.8 MS1H2-25C30CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 7.2 | |
| Maximum current (Arms) | 26 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 5000 | |
| Torque coefficient (N·m/Arms) | 1.18 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 3.49 |
| | Motor with brake | 4.3 |

Torque-Speed characteristics




Heatsink-based derating curve



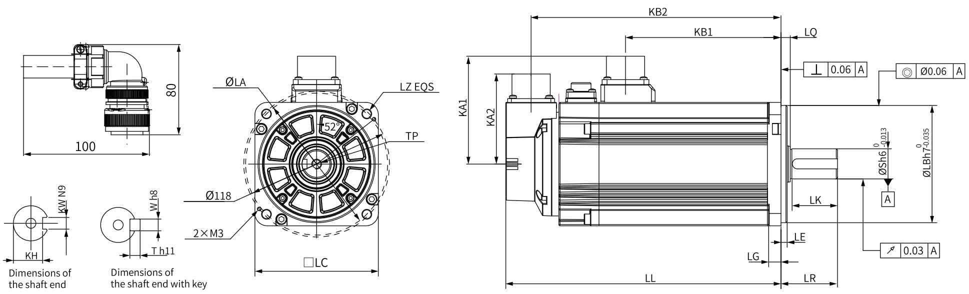

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



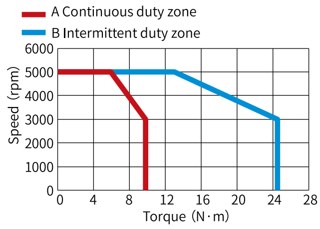

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 195 (223) | 45±1 | 115 | 4-Ø7 | 88 | 126 | 74 | 174.5 (202.5) | 10 | 5±0.3 |

| LQ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 7.5±0.75 | Ø95h7$^{0}_{-0.035}$ | 24 | M8x16 | 36 | 20$^{0}_{-0.2}$ | 8 | 8 | 7 | 6.3 (7.35) |

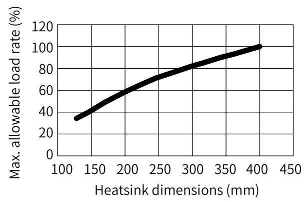
### 3.5.9 MS1H2-30C30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 16.6 | |
| Maximum current (Arms) | 55 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 5000 | |
| Torque coefficient (N·m/Arms) | 0.67 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 6.4 |
| | Motor with brake | 9.38 |

Torque-Speed characteristics




Heatsink-based derating curve



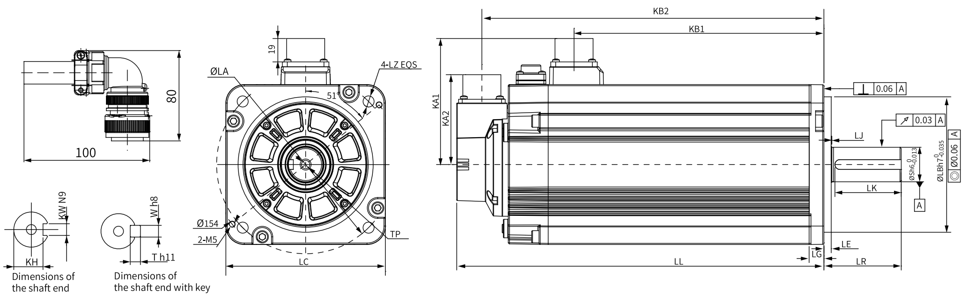

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

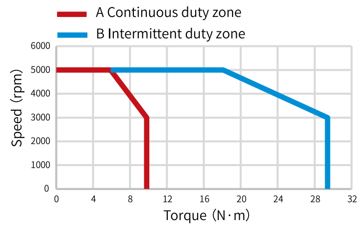



| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 [Note] | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 198 (223) | 63±1 | 145 | 4-Ø9 | 102.4 | 127.5 | 73 | 177.5 (202.5) | 12 | 6±0.3 |
| **LJ** | **LB** | | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| 0.5±0.75 | Ø110h7$^{0}_{-0.035}$ | | 28 | M8 × 20 | 54 | 24$^{0}_{-0.2}$ | 8 | 8 | 7 | 10.0 (11.9) |

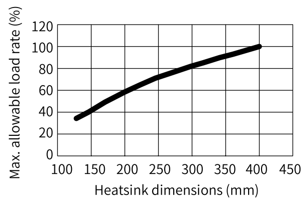
## 3.5.10 MS1H2-30C30CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 8.9 | |
| Maximum current (Arms) | 29 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 1.25 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 6.4 |
| | Motor with brake | 9.38 |

Torque-Speed characteristics




Heatsink-based derating curve



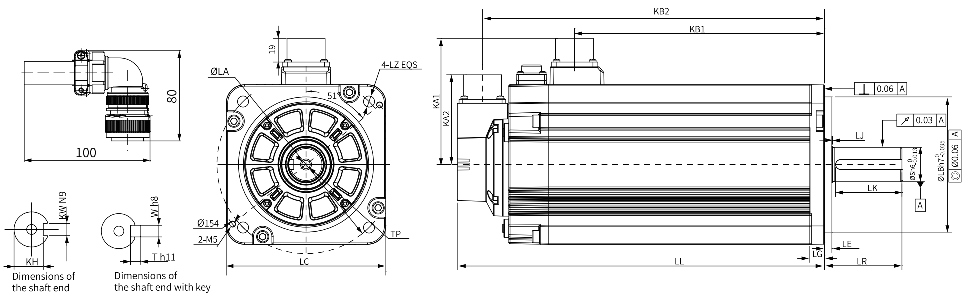

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



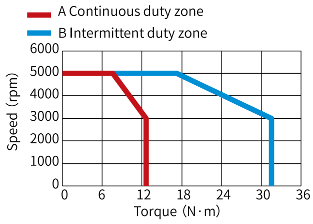

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 198 (223) | 63±1 | 145 | 4-Ø9 | 102.4 | 127.5 | 74 | 177.5 (202.5) | 12 | 6±0.3 |

| LJ | LB | | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | Ø110h7$^{0}_{-0.035}$ | | 28 | M8 × 20 | 54 | 24$^{0}_{-0.2}$ | 8 | 8 | 7 | 10.0 (11.9) |

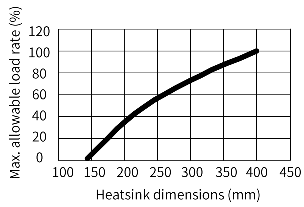
## 3.5.11 MS1H2-40C30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 22 | |
| Maximum current (Arms) | 67.5 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 5000 | |
| Torque coefficient (N·m/Arms) | 0.65 | |
| Rotor moment of inertia (kg·cm²) | Motor without brake | 9 |
| | Motor with brake | 11.98 |

Torque-Speed characteristics




Heatsink-based derating curve



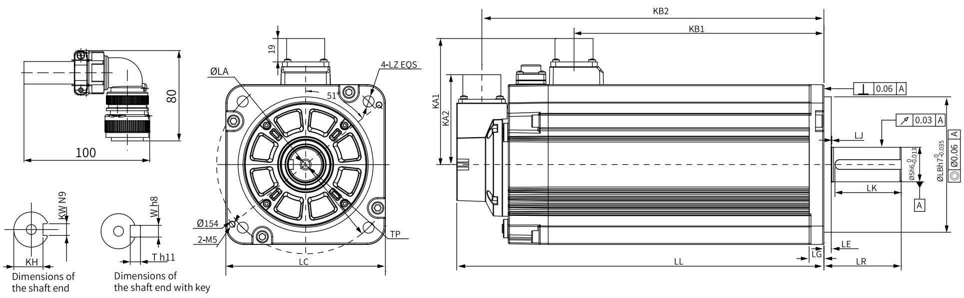

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

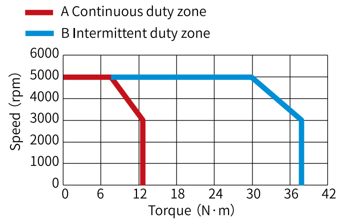



| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 [Note] | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 236 (261) | 63±1 | 145 | 4-Ø9 | 102.4 | 165.5 | 73 | 215.5 (240.5) | 12 | 6±0.3 |
| **LJ** | **LB** | | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| 0.5±0.75 | Ø110h7$^{0}_{-0.035}$ | | 28 | M8 × 20 | 54 | 24$^{0}_{-0.2}$ | 8 | 8 | 7 | 13.2 (15.1) |

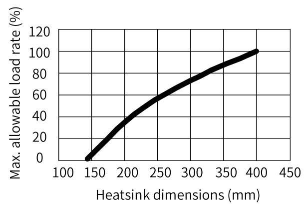
## 3.5.12 MS1H2-40C30CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 13.5 | |
| Maximum current (Arms) | 42.5 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 5000 | |
| Torque coefficient (N·m/Arms) | 1.06 | |
| Rotor moment of inertia (kg·cm²) | Motor without brake | 9 |
| | Motor with brake | 11.98 |

Torque-Speed characteristics




Heatsink-based derating curve



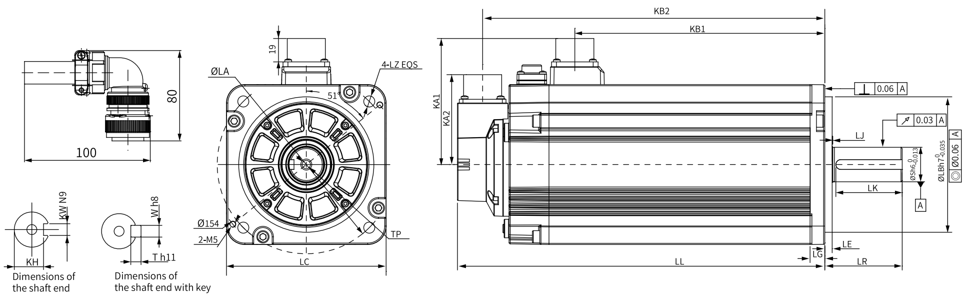

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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 |

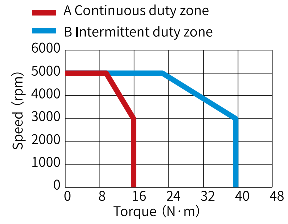
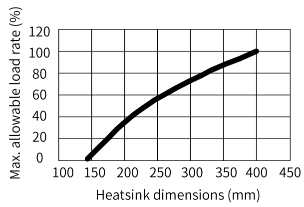
## Dimensions (mm)




| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 236 (261) | 63±1 | 145 | 4-Ø9 | 102.4 | 165.5 | 74 | 215.5 (240.5) | 12 | 6±0.3 |

| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | Ø110h7$^{0}_{-0.035}$ | 28 | M8 × 20 | 54 | 24$^{0}_{-0.2}$ | 8 | 8 | 7 | 13.2 (15.1) |

## 3.5.13 MS1H2-50C30CB-T33*R

| Motor specifications | | | Torque-Speed characteristics |
|---|---|---|---|
| Flange 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 current (Arms) | 22 | | Heatsink-based derating curve |
| Maximum current (Arms) | 67.5 | |  |
| Rated speed (rpm) | 3000 | | |
| Maximum speed (rpm) | 5000 | | |
| Torque coefficient (N·m/Arms) | 0.81 | | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 11.6 | |
| | Motor with brake | 14.58 | |

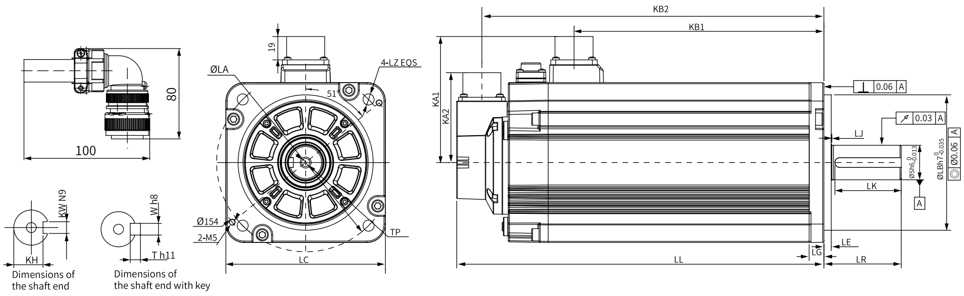
## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



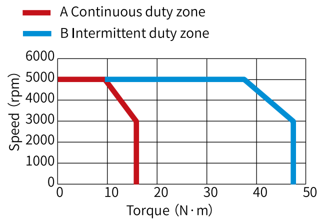

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 [Note] | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 274 (299) | 63±1 | 145 | 4-Ø9 | 102.4 | 203.5 | 73 | 253.5 (278.5) | 12 | 6±0.3 |

| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | Ø110h7$^{0}_{-0.035}$ | 28 | M8 × 20 | 54 | 24$^{0}_{-0.2}$ | 8 | 8 | 7 | 16.35 (18.25) |

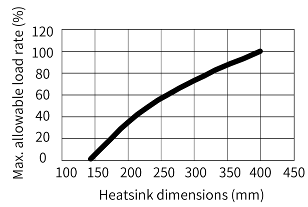
## 3.5.14 MS1H2-50C30CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 17 | |
| Maximum current (Arms) | 52.5 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 5000 | |
| Torque coefficient (N·m/Arms) | 1.04 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 11.6 |
| | Motor with brake | 14.58 |

Torque-Speed characteristics




Heatsink-based derating curve



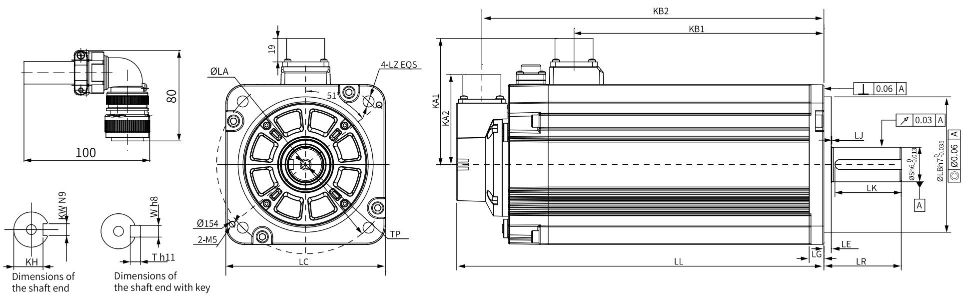

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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-Ø9 | 102.4 | 203.5 | 74 | 253.5 (278.5) | 12 | 6±0.3 |

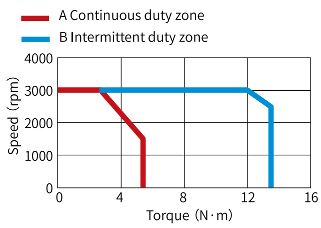
| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | $Ø110h7^{0}_{-0.035}$ | 28 | M8 × 20 | 54 | $24^{0}_{-0.2}$ | 8 | 8 | 7 | 16.35 (18.25) |

# 3.6 Medium Inertia and Medium Capacity (MS1H3)

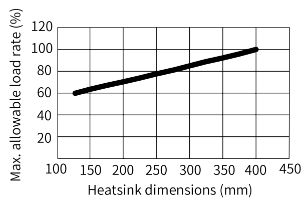
## 3.6.1 MS1H3-85B15CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 6.6 | |
| Maximum current (Arms) | 17.2 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 0.93 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 13.56 |
| | Motor with brake | 15.8 |

Torque-Speed characteristics




Heatsink-based derating curve



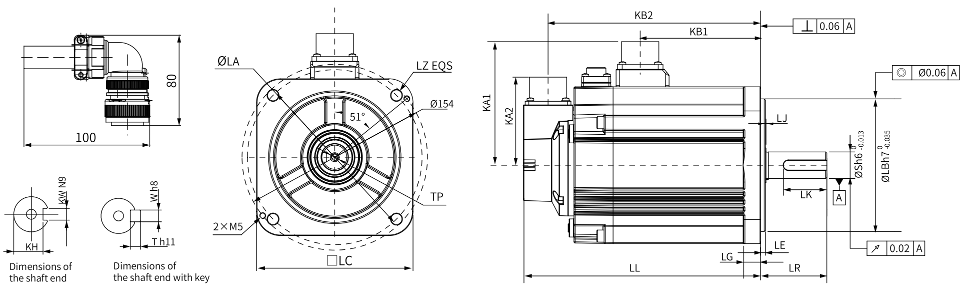

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

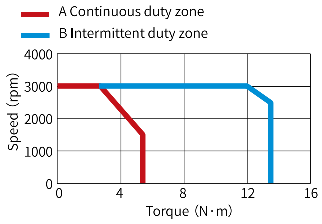



| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 142 (167) | 55±1 | 145 | 4-Ø9 | 103 | 70 | 74 | 121.5 (146.5) | 14 | 4 |
| LJ | LB | | S | TP | LK | KH | KW | W | T | Weight (kg) |
| 0.5±0.75 | Ø110h7$^{0}_{-0.035}$ | | 22 | M6 × 20 | 36 | 18$^{0}_{-0.2}$ | 8 | 8 | 7 | 5.8 (7.7) |

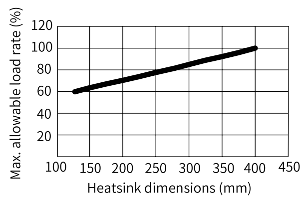
## 3.6.2 MS1H3-85B15CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 3.5 | |
| Maximum current (Arms) | 8.5 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 1.84 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 13.56 |
| | Motor with brake | 15.8 |

Torque-Speed characteristics




Heatsink-based derating curve



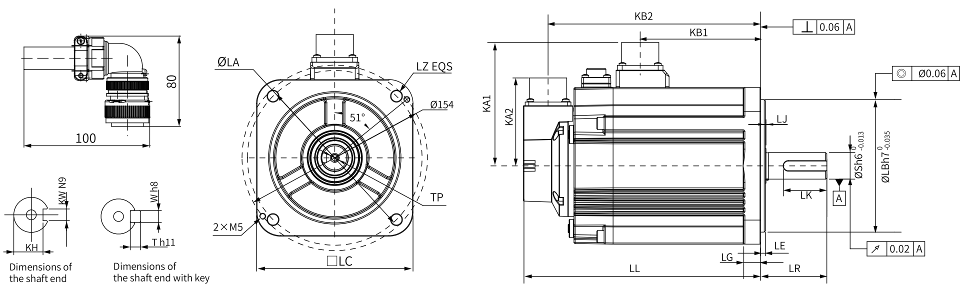

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



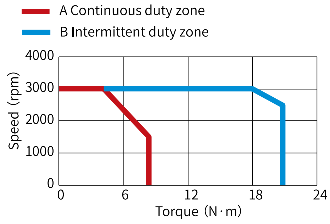

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 142<br>(167) | 55±1 | 145 | 4-Ø9 | 103 | 70 | 74 | 121.5<br>(146.5) | 14 | 4 |

| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | Ø110h7$^{0}_{-0.035}$ | 22 | M6 × 20 | 36 | 18$^{0}_{-0.2}$ | 8 | 8 | 7 | 5.8<br>(7.7) |

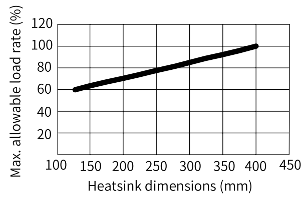
## 3.6.3 MS1H3-13C15CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 10.5 | |
| Maximum current (Arms) | 27.3 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 0.89 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 19.25 |
| | Motor with brake | 21.5 |

Torque-Speed characteristics




Heatsink-based derating curve



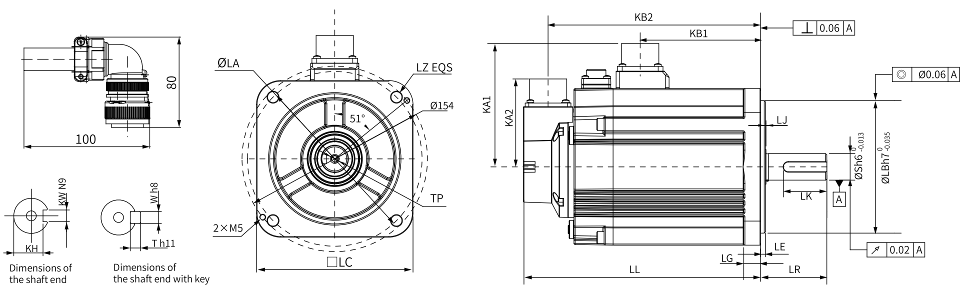

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



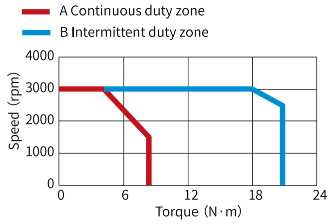

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 157<br>(182) | 55±1 | 145 | 4-Ø9 | 103 | 85 | 74 | 136.5<br>(161.5) | 14 | 4 |

| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | Ø110h7$^{0}_{-0.035}$ | 22 | M6 × 20 | 36 | 18$^{0}_{-0.2}$ | 8 | 8 | 7 | 7.1<br>(8.9) |

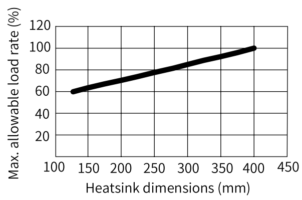
## 3.6.4 MS1H3-13C15CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 5.1 | |
| Maximum current (Arms) | 12.6 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 1.85 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 19.25 |
| | Motor with brake | 21.5 |

Torque-Speed characteristics




Heatsink-based derating curve



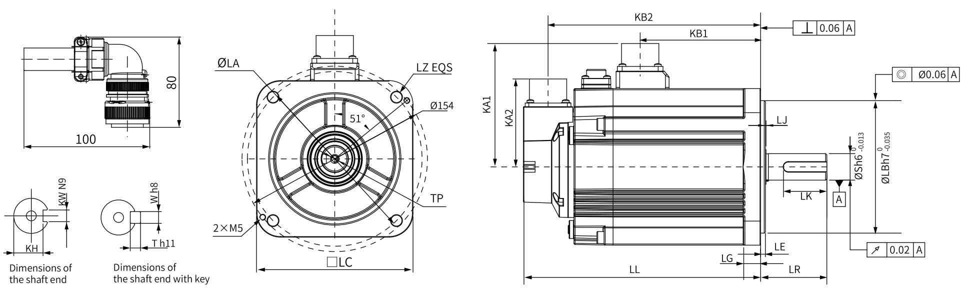

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



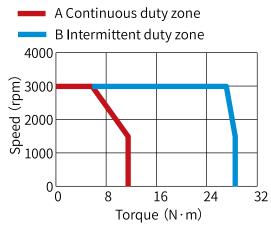

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 157 (182) | 55±1 | 145 | 4-Ø9 | 103 | 85 | 74 | 136.5 (161.5) | 14 | 4 |

| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | Ø110h7$^{0}_{-0.035}$ | 22 | M6 × 20 | 36 | 18$^{0}_{-0.2}$ | 8 | 8 | 7 | 7.1 (8.9) |

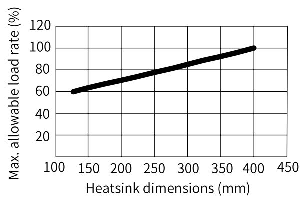
## 3.6.5 MS1H3-18C15CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 11.9 | |
| Maximum current (Arms) | 32.2 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 1.05 | |
| Rotor moment of inertia (kg·cm[2]) | Motor without brake | 24.9 |
| | Motor with brake | 27.2 |

Torque-Speed characteristics




Heatsink-based derating curve



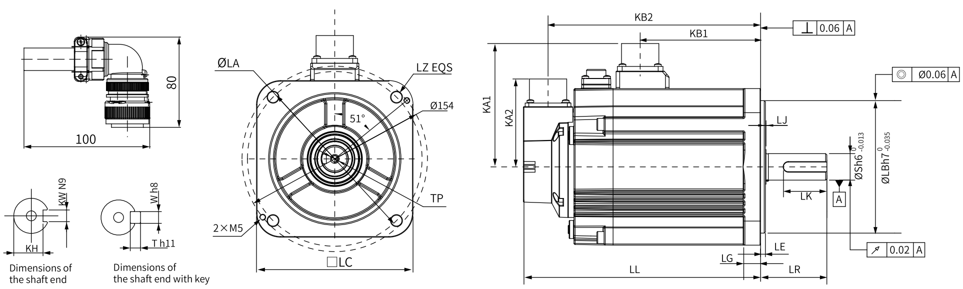

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



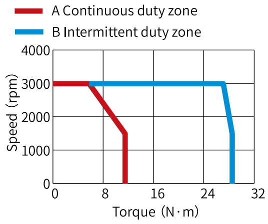
| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 172 (197) | 55±1 | 145 | 4-Ø9 | 103 | 100 | 74 | 151.5 (176.5) | 14 | 4 |

| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | $Ø110h7^{0}_{-0.035}$ | 22 | M6 × 20 | 36 | $18^{0}_{-0.2}$ | 8 | 8 | 7 | 8.5 (10.3) |

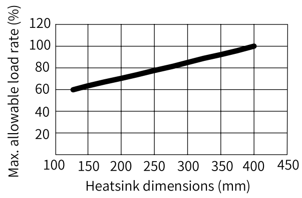
### 3.6.6 MS1H3-18C15CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 6.75 | |
| Maximum current (Arms) | 17.7 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 1.87 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 24.9 |
| | Motor with brake | 27.2 |

Torque-Speed characteristics




Heatsink-based derating curve



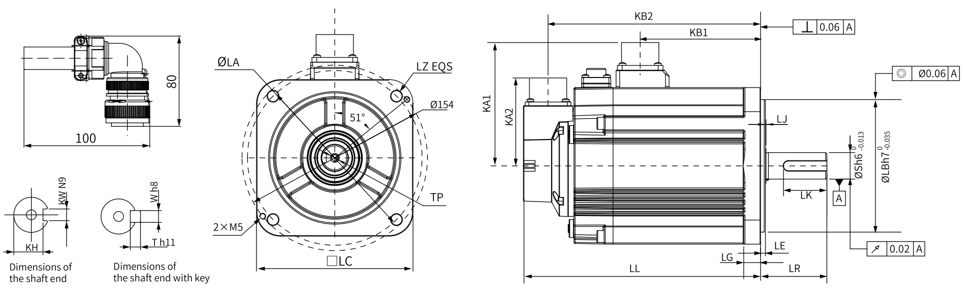

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



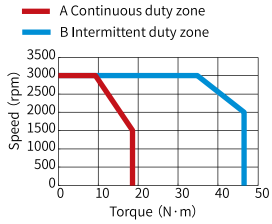

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 130 | 172 (197) | 55±1 | 145 | 4-Ø9 | 103 | 100 | 74 | 151.5 (176.5) | 14 | 4 |

| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | Ø110h7$^{0}_{-0.035}$ | 22 | M6 × 20 | 36 | 18$^{0}_{-0.2}$ | 8 | 8 | 7 | 8.5 (10.3) |

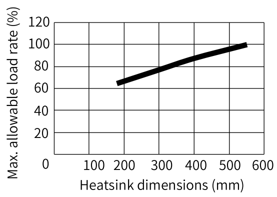
## 3.6.7 MS1H3-29C15CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 18 | |
| Maximum current (Arms) | 52.5 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 1.16 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 44.7 |
| | Motor with brake | 52.35 |

Torque-Speed characteristics




Heatsink-based derating curve



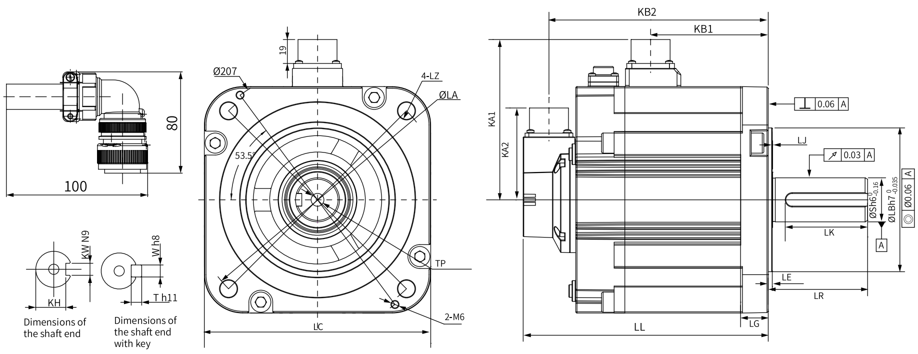

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

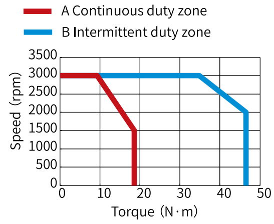



| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 [Note] | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 180 | 161 (194.8) | 79±1 | 200 | 4-Ø13.5 | 127.4 | 93.5 | 73 | 140.5 (174.3) | 22 | 3.2±0.3 |
| **LJ** | **LB** | | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| 0.5±0.75 | Ø114.3h7$^{0}_{-0.035}$ | | 35 | M12x25 | 65 | 30$^{0}_{-0.2}$ | 10 | 10 | 8 | 13.8 (17.9) |

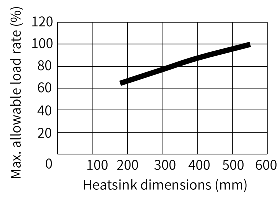
## 3.6.8 MS1H3-29C15CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | | 10.5 |
| Maximum current (Arms) | | 29.75 |
| Rated speed (rpm) | | 1500 |
| Maximum speed (rpm) | | 3000 |
| Torque coefficient (N·m/Arms) | | 1.94 |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 44.7 |
| | Motor with brake | 52.35 |

Torque-Speed characteristics




Heatsink-based derating curve



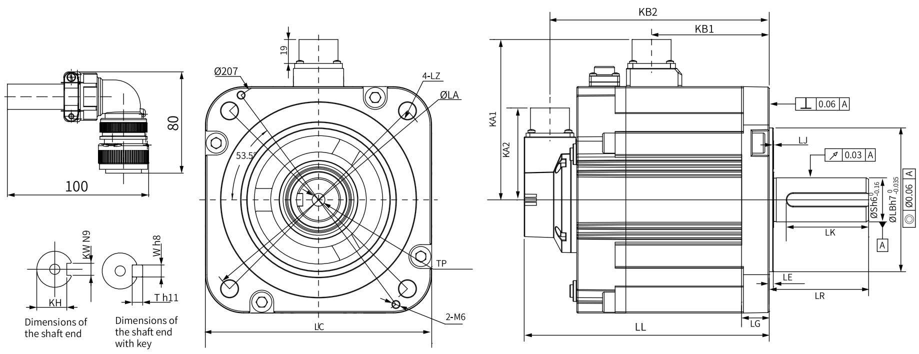

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

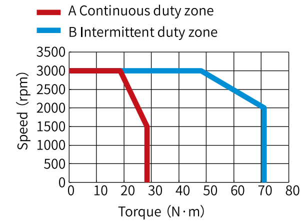



| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 180 | 161<br>(194.8) | 79±1 | 200 | 4-Ø13.5 | 127.4 | 93.5 | 74 | 140.5<br>(174.3) | 22 | 3.2±0.3 |
| **LJ** | **LB** | | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| 0.5±0.75 | Ø114.3h7$^{0}_{-0.035}$ | | 35 | M12x25 | 65 | 30$^{0}_{-0.2}$ | 10 | 10 | 8 | 13.8<br>(17.9) |

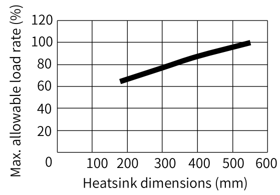
## 3.6.9 MS1H3-44C15CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 25.5 | |
| Maximum current (Arms) | 67 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 1.25 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 64.9 |
| | Motor with brake | 72.55 |

Torque-Speed characteristics




Heatsink-based derating curve



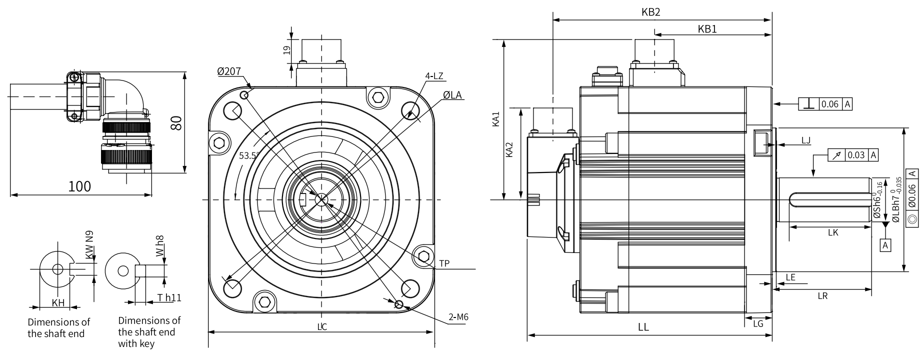

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



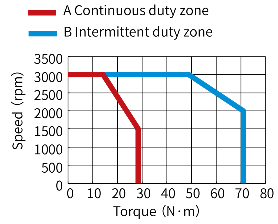

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 [Note] | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 180 | 184.5<br>(218.3) | 79±1 | 200 | 4-Ø13.5 | 127.4 | 117 | 73 | 164<br>(197.8) | 22 | 3.2±0.3 |

| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | Ø114.3h7$^{0}_{-0.035}$ | 35 | M12x25 | 65 | 30$^{0}_{-0.2}$ | 10 | 10 | 8 | 17.4<br>(21.9) |

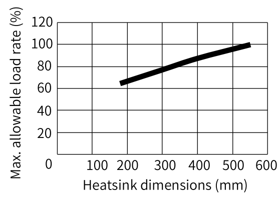
## 3.6.10 MS1H3-44C15CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 16 | |
| Maximum current (Arms) | 42 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 1.96 | |
| Rotor moment of inertia ($kg \cdot cm^2$) | Motor without brake | 64.9 |
| | Motor with brake | 72.55 |

Torque-Speed characteristics




Heatsink-based derating curve



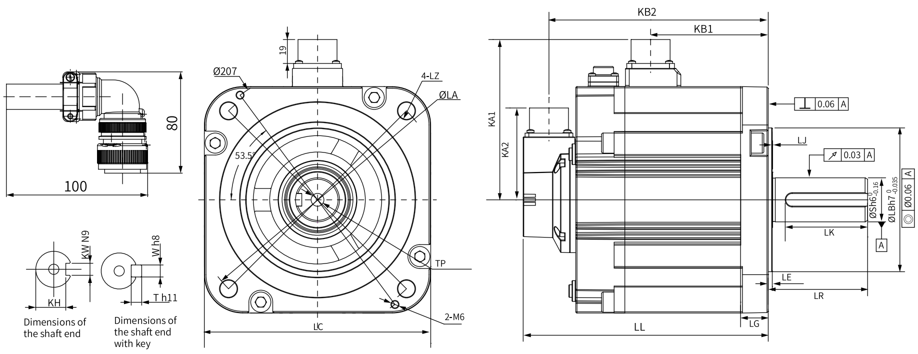

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



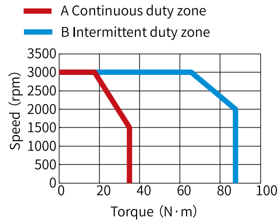

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 180 | 184.5 (218.3) | 79±1 | 200 | 4-Ø13.5 | 127.4 | 117 | 74 | 164 (197.8) | 22 | 3.2±0.3 |

| LJ | LB | | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | Ø114.3h7$^{0}_{-0.035}$ | | 35 | M12x25 | 65 | 30$^{0}_{-0.2}$ | 10 | 10 | 8 | 17.4 (21.6) |

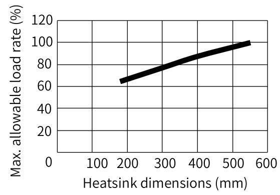
## 3.6.11 MS1H3-55C15CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 20.7 | |
| Maximum current (Arms) | 52 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 1.92 | |
| Rotor moment of inertia (kg·$cm^2$) | Motor without brake | 86.9 |
| | Motor with brake | 94.55 |

Torque-Speed characteristics




Heatsink-based derating curve



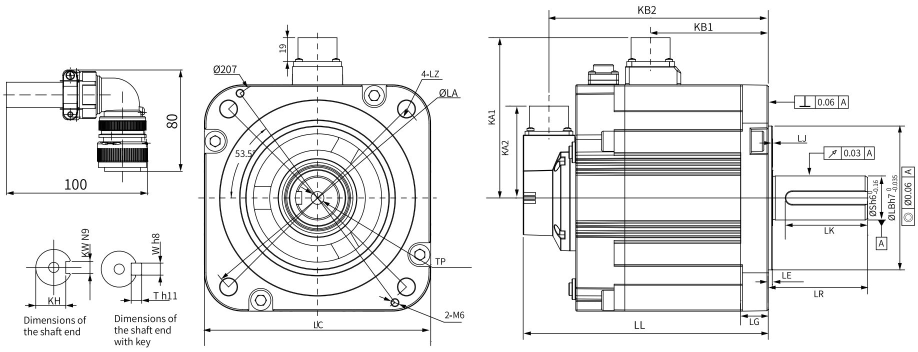

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)



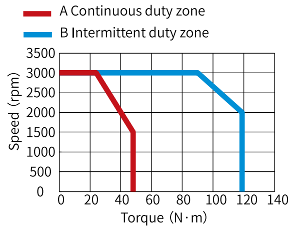

| LC | LL | LR | LA | LZ | KA1 | KB1 | KA2 | KB2 | LG | LE |
|---|---|---|---|---|---|---|---|---|---|---|
| 180 | 208 (241.8) | 113±1 | 200 | 4-Ø13.5 | 127.4 | 140.5 | 74 | 187.5 (221.3) | 22 | 3.2±0.3 |

| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | Ø114.3h7$^{0}_{-0.035}$ | 42 | M16x32 | 97 | 37$^{0}_{-0.2}$ | 12 | 12 | 8 | 21.7 (25.9) |

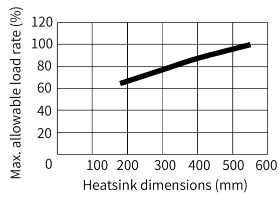
## 3.6.12 MS1H3-75C15CD-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 25 | |
| Maximum current (Arms) | 65 | |
| Rated speed (rpm) | 1500 | |
| Maximum speed (rpm) | 3000 | |
| Torque coefficient (N·m/Arms) | 2.13 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 127.5 |
| | Motor with brake | 135.15 |

Torque-Speed characteristics




Heatsink-based derating curve



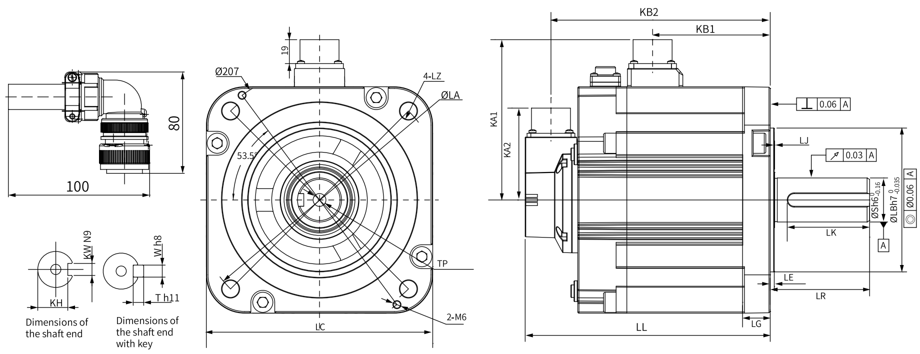

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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-Ø13.5 | 127.4 | 187.5 | 74 | 234.5 (234.5) | 22 | 3.2±0.3 |

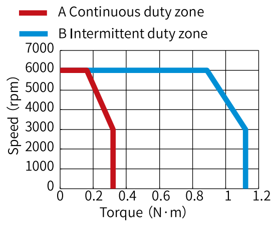
| LJ | LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| 0.5±0.75 | $Ø114.3h7^{0}_{-0.035}$ | 42 | M16x32 | 97 | $37^{0}_{-0.2}$ | 12 | 12 | 8 | 29 (33.2) |

# 3.7 Medium Inertia and Small Capacity (MS1H4)

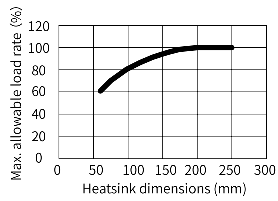
## 3.7.1 MS1H4-10B30CB-T33*Z

| Motor specifications | | |
|---|---|---|
| Flange size (mm) | 40 | |
| Inertia, capacity | Low inertia, small capacity | |
| Rated output (kW) | 0.1 | |
| Voltage (V) | 220 | |
| Rated torque (N·m) | 0.32 | |
| Maximum torque (N·m) | 1.12 | |
| Rated current (Arms) | 1.3 | |
| Maximum current (Arms) | 4.70 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 0.26 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 0.102 |
| | Motor with brake | 0.104 |

Torque-Speed characteristics




Heatsink-based derating curve



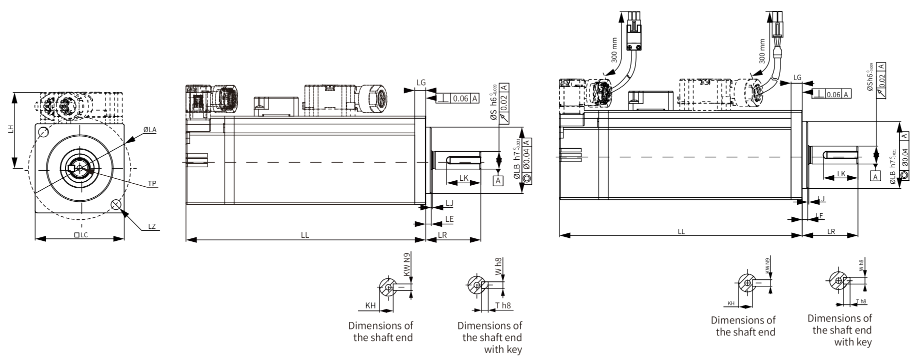

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting current (A) | Apply time (ms) | Release time (ms) | Backlash (°) |
|---|---|---|---|---|---|---|---|
| 0.32 | 24 | 6.1 | 94.4 | 0.25 | ⩽ 40 | ⩽ 20 | ⩽ 1.5 |

## Allowable load

| LF (mm) | Allowable radial load (N) | Allowable axial load (N) |
|---|---|---|
| 20 | 78 | 54 |

## Dimensions (mm)

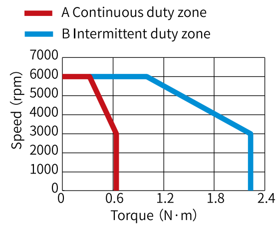



| LL | LC | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 91 (121.5) | 40 | 25±0.5 | 46 | 2-Ø4.5 | 34.3 | 5 | 2.5±0.5 | 0.5±0.35 |
| S | LB | TP | LK | KH | kW | W | T | Weight (kg) |
| 8 | Ø30h7$^{0}_{-0.021}$ | M3x6 | 15.5 | 6.2 $^{0}_{-0.1}$ | 3 | 3 | 3 | 0.45 (0.64) |

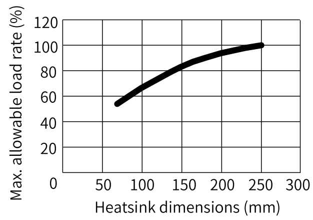
## 3.7.2 MS1H4-20B30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 1.3 | |
| Maximum current (Arms) | 5.3 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 0.46 | |
| Rotor moment of inertia (kg·cm²) | Motor without brake | 0.22 |
| | Motor with brake | 0.23 |

Torque-Speed characteristics




Heatsink-based derating curve



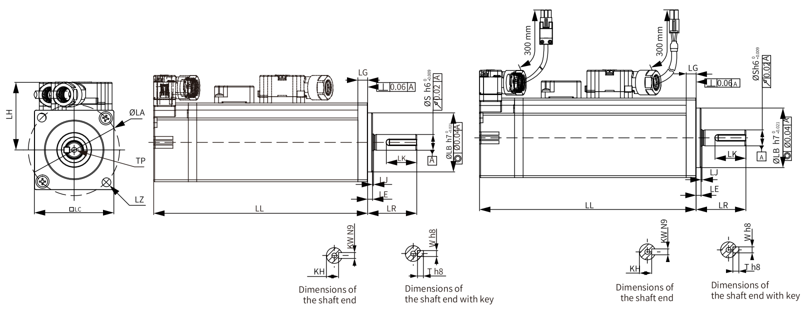

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

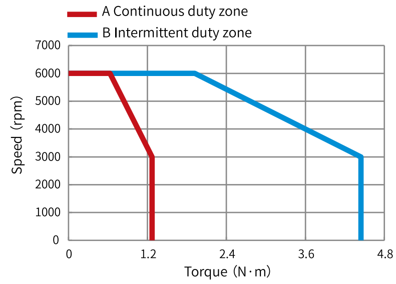



| LC | LL | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 60 | 73.5 (101.1) | 30±0.5 | 70 | 4-Ø5.5 | 44 | 8.0 | 3±0.5 | 0.5±0.35 |
| **LB** | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| Ø50h7$^{0}_{-0.025}$ | 14 | M5x8 | 16.5 | 11$^{0}_{-0.1}$ | 5 | 5 | 5 | 0.78 (1.16) |

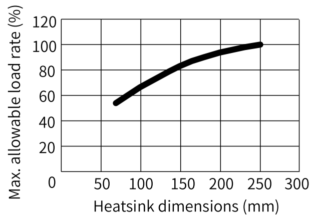
## 3.7.3 MS1H4-40B30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 2.4 | |
| Maximum current (Arms) | 9.2 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 0.53 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 0.43 |
| | Motor with brake | 0.44 |

Torque-Speed characteristics




Heatsink-based derating curve



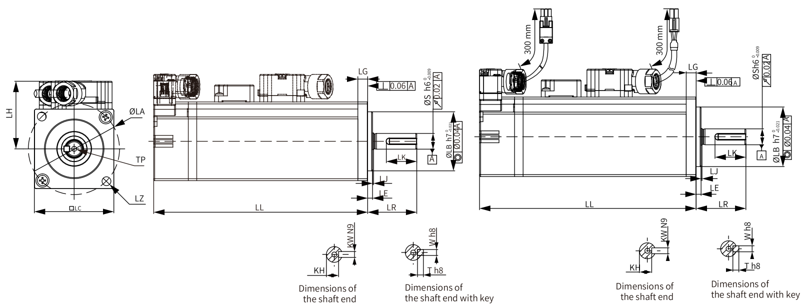

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

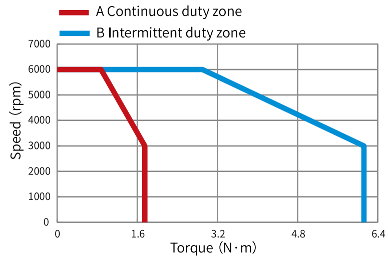



| LC | LL | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 60 | 92 (119.8) | 30±0.5 | 70 | 4-Ø5.5 | 44 | 8.0 | 3±0.5 | 0.5±0.35 |
| **LB** | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| Ø50h7$^{0}_{-0.025}$ | 14 | M5x8 | 16.5 | $11^{0}_{-0.1}$ | 5 | 5 | 5 | 1.11 (1.48) |

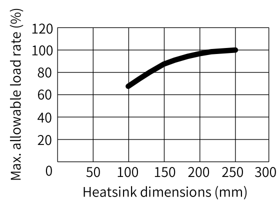
## 3.7.4 MS1H4-55B30CB-T331R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 3.3 | |
| Maximum current (Arms) | 13.2 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 0.49 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 1.12 |
| | Motor with brake | - |

Torque-Speed characteristics



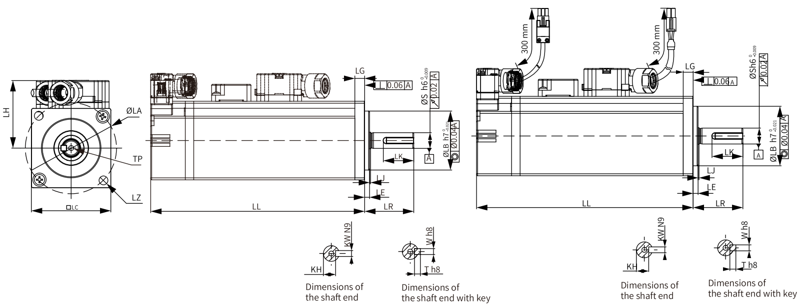

Heatsink-based derating curve




## Allowable load

| LF (mm) | Allowable radial load (N) | Allowable axial load (N) |
|---|---|---|
| 35 | 392 | 147 |

## Dimensions (mm)

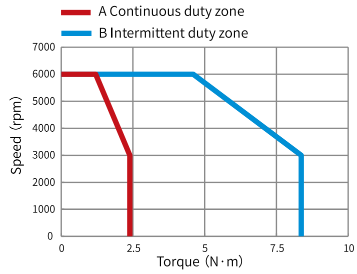



| LC | LL | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 80 | 96.7 | 25±0.5 | 90 | 4- Ø 7 | 54 | 7.5 | 3±0.5 | 0.5±0.35 |
| LB | S | TP | LK | KH | KW | W | T | Weight (kg) |
| Ø70h7$^{0}_{-0.03}$ | 19 | M6 x 20 | 26 | 15.5$^{0}_{-0.1}$ | 6 | 6 | 6 | 1.85 |

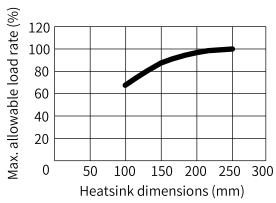
## 3.7.5 MS1H4-75B30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange size (mm) | 80 | |
| Inertia, capacity | Medium inertia, low capacity | |
| Rated power (kW) | 0.75 | |
| Voltage (V) | 220 | |
| Rated torque (N·m) | 2.39 | |
| Maximum torque (N·m) | 8.37 | |
| Rated current (Arms) | 4.4 | |
| Maximum current (Arms) | 16.9 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 0.58 | |
| Rotor moment of inertia (kg·cm$^2$) | Motor without brake | 1.46 |
| | Motor with brake | 1.51 |

Torque-Speed characteristics




Heatsink-based derating curve



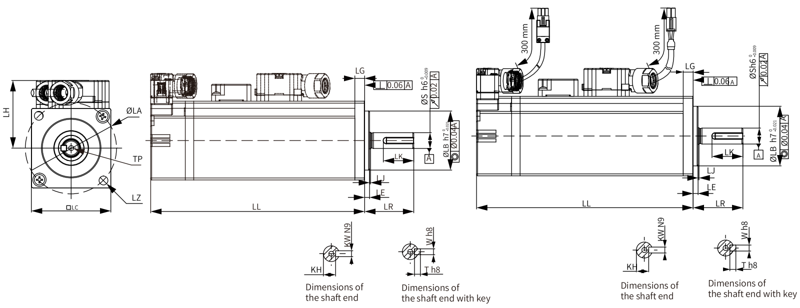

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)

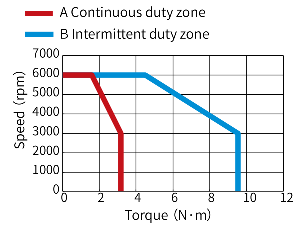



| LC | LL | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 80 | 107.3<br>(140.5) | 25±0.5 | 90 | 4-Ø7 | 54 | 7.5 | 3±0.5 | 0.5±0.35 |
| **LB** | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| Ø70h7$^{0}_{-0.03}$ | 19 | M6 × 20 | 26 | 15.5$^{0}_{-0.1}$ | 6 | 6 | 6 | 2.18<br>(2.82) |

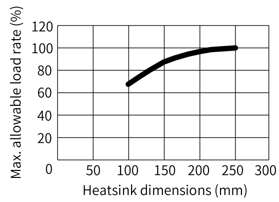
## 3.7.6 MS1H4-10C30CB-T33*R

| Motor specifications | | |
|---|---|---|
| Flange 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 current (Arms) | 6.5 | |
| Maximum current (Arms) | 24 | |
| Rated speed (rpm) | 3000 | |
| Maximum speed (rpm) | 6000 | |
| Torque coefficient (N·m/Arms) | 0.46 | |
| Rotor moment of inertia (kg·cm²) | Motor without brake | 1.87 |
| | Motor with brake | 1.97 |

Torque-Speed characteristics




Heatsink-based derating curve



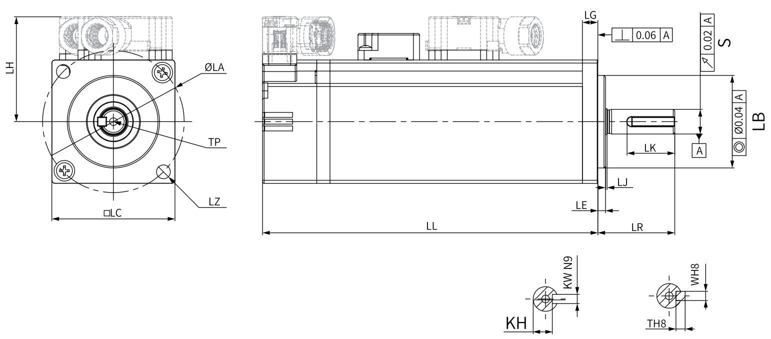

## Electrical specifications of the motor with brake

| Holding torque (N·m) | Supply voltage (VDC)±10% | Rated power (W) | Coil resistance (Ω) (±7%) | Exciting 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)




Dimensions of the shaft end

Dimensions of the shaft end with key

| LC | LL | LR | LA | LZ | LH | LG | LE | LJ |
|---|---|---|---|---|---|---|---|---|
| 80 | 118.7 (153.2) | 25±0.5 | 90 | 4-Ø7 | 54 | 7.5 | 3 ± 0.5 | 0.5±0.35 |
| **LB** | **S** | **TP** | **LK** | **KH** | **KW** | **W** | **T** | **Weight (kg)** |
| Ø70h7$^{0}_{-0.03}$ | 19 | M6 x 20 | 26 | 15.5$^{0}_{-0.1}$ | 6 | 6 | 6 | 2.55 (2.9) |

# 4 Options

## 4.1 List of options

| Type | Name | Installation Position | Applicable AC Drive Model | Description |
|---|---|---|---|---|
| Peripheral Electrical Components | Fuse and circuit breaker | Input side of the servo drive | All | To comply with EN 61800-5-1 standards, install a fuse/circuit breaker on the input side of the servo drive to prevent accidents caused by short circuit in the internal circuit. |
| | AC input reactor | Input side of the servo drive | | It is used to eliminate the higher harmonics of the input side effectively and improve the power factor of the input side. |
| | EMC filter | Input side of the servo drive | | It is used to reduce external conduction and radiation interference of the drive. |
| | Magnetic ring and ferrite clamp | Output side of the drive | | Reduces interferences to the outside and the bearing current. |
| | | Signal cable | | Improves the anti-interference performance of signals. |

## 4.2 Cables

### 4.2.1 Cable Type

#### Regular cables

Do not bend or move regular cables during use. Bending or moving regular cables may damage the cables and lead to a series of cable-related faults such as poor contact. Secure regular cables by binding them with ties or similar. During binding, reserve certain bending radius for the cables to prevent stress.

#### Flexible cables

Flexible cables can move along with the drag chain without a high risk of abrasion.

***Note***

- Do not twist or wind the cables in the drag chain.
- Ensure cables can move freely within the bending radius. Relative movement must be allowed between cables or between cables and the guiding device.
- Cables in the drag chain can be fixed or bundled through the two unmovable ends of the drag chain.

#### Oil-resistant cables

Oil-resistant cables apply to applications requiring shielded power cables, such as machine tools, cutting fluids, and cutting compounds.

### More information

Cables of MS1–R series motors are the same as MS1–Z series motors.

Power cables and encoder cables for terminal-type motors must be installed with specialized devices and jigs. Order the finished cables from distributors authorized by Inovance.

For more cable information, see "Cable Specifications and Models" in the hardware manual for the servo drive.

## 4.2.2 Model Description

### Power cable

S6-L-M 0 0 0 - 3.0 – T
① ②③④ ⑤ ⑥

| | | |
|---|---|---|
| ① **Cable type**<br>S6-L-B/M: Motion control power cable<br>B: With brake<br>M: Without brake | ③ **Cross sectional area (mm²)**<br>0: Flange size 25/40/60/80<br>1: Flange size 100/130/180<br>2: Flange size 180 (motors of 4.4 kW and above) | ⑤ **Cable length (m)**<br>3.0: 3 m<br>5.0: 5 m<br>10.0: 10 m |
| ② **Connector type at drive side**<br>0: U-shaped cable lug<br>1: Pin-shaped cable lug | ④ **Connector type at motor side**<br>0: 6-core plastic connector<br>1: 9-core aviation connector<br>2: 6-core aviation connector<br>7: SDC-06T series aviation connector (front outlet)<br>8: SDC-06T series aviation connector (rear outlet) | ⑥ **Special requirements**<br>T: Drag chain<br>TS: Shielded flexible cable |

### Model of encoder cables

S6-L-P 0 0 0 - 3.0 - T
① ②③④ ⑤ ⑥

| | | |
|---|---|---|
| ① **Cable type**<br>S6-L-P: Motion control encoder cable | ③ **Encoder**<br>1: Communication-type incremental encoder<br>2: Communication-type multi-turn absolute encoder | ⑤ **Cable length (m)**<br>3.0: 3 m<br>5.0: 5 m<br>10.0: 10 m |
| ② **Connector type at drive side**<br>0: DB9<br>1: USB | ④ **Connector type at motor side**<br>0: 9-core plastic connector<br>1: 9-core aviation connector<br>4: SDC-06T series aviation connector (front outlet)<br>5: SDC-06T series aviation connector (rear outlet) | ⑥ **Special requirements**<br>T: Drag chain<br>TS: Shielded flexible cable |

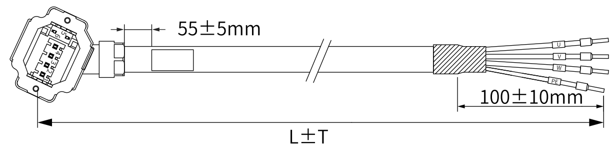
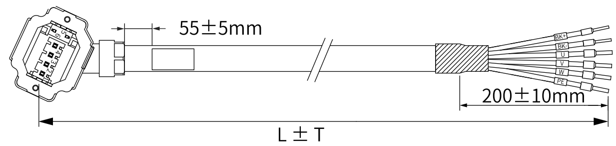
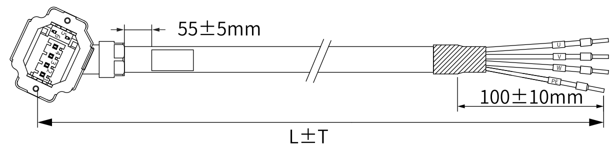
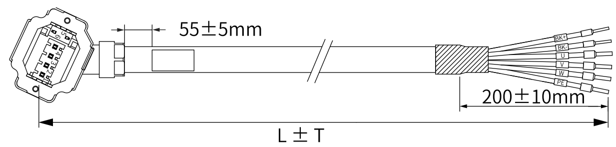
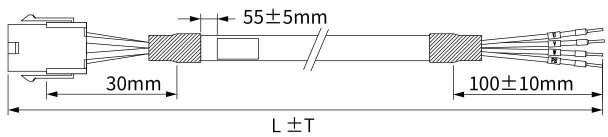
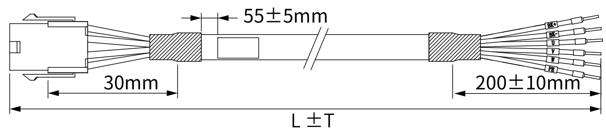
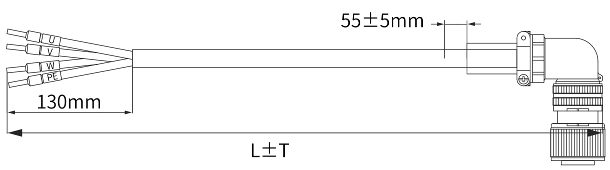
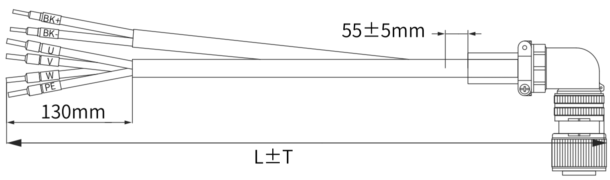
## Model of communication cables

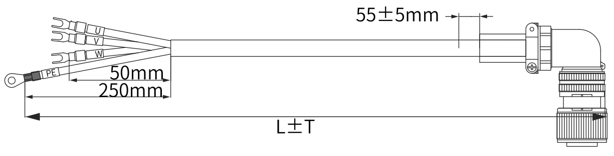
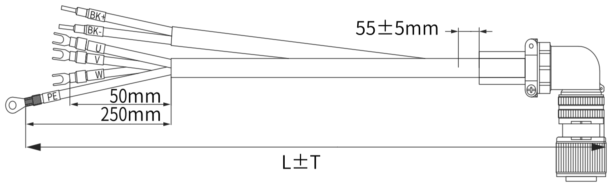
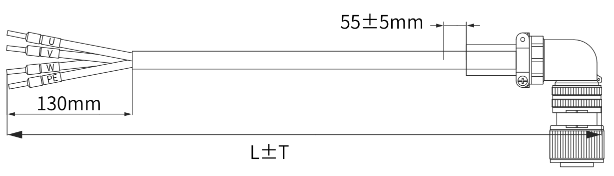
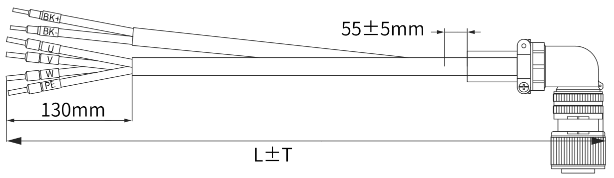
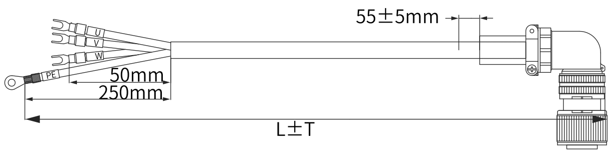
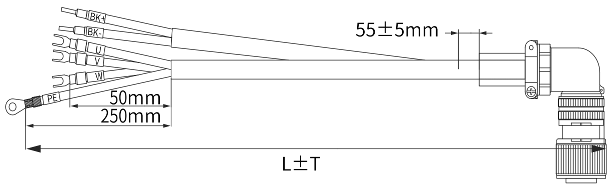
S6N-L-T 00 - 3.0
① ② ③

| ① Cable type | ② Cable type | ③ Cable length (m) |
|---|---|---|
| S6-L-T: Motion control communication cable<br>S6N-L-T: IS620F motion control encoder cable (only for servo drive PC communication cable) | 00: Servo drive to PC communication cable<br>01: Servo drive communication cable (CAN&RS485)<br>02: Servo drive to PLC communication cable<br>03: Servo drive termination resistor cable<br>04: Servo drive communication cable (EtherCAT) | 3.0: 3 m<br>5.0: 5 m<br>10.0: 10 m |

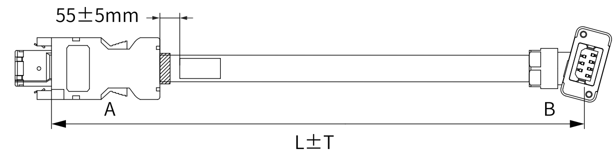
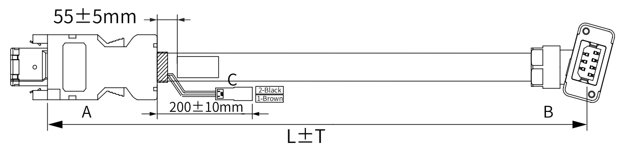
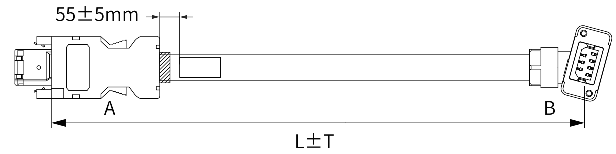
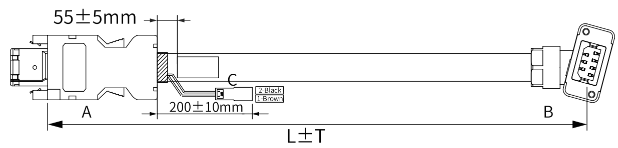
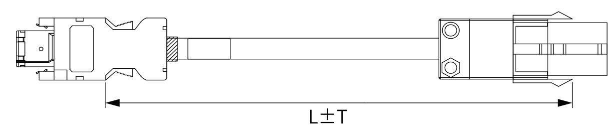
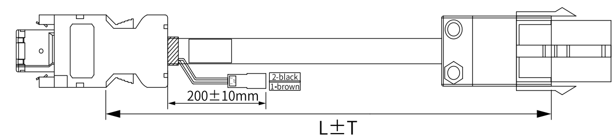
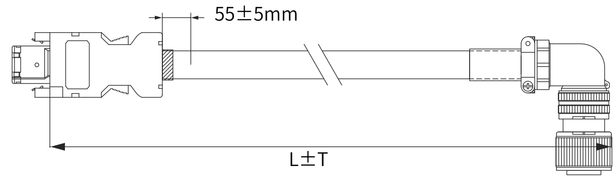
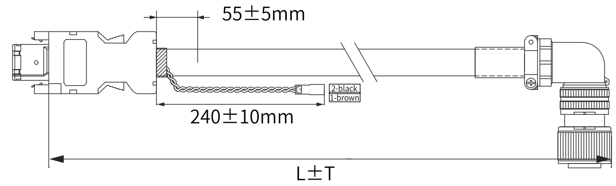
## 4.2.3 Cable Selection

### Power cable

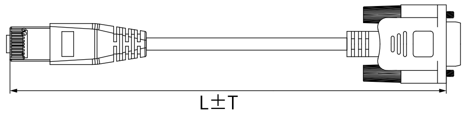
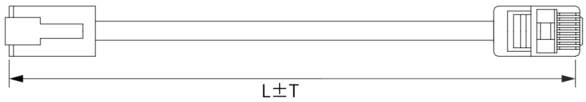
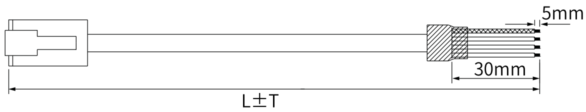
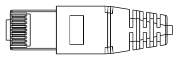
| Motor Model | Cable Name | | Cable Model | L Cable Length (mm) | Tolerance (T) (mm) | Illustration |
|---|---|---|---|---|---|---|
| MS1H1/ MS1H4 terminal-type motor | Front outlet | Power cable for motor without brake | S6-L-M107-3.0 | 3000 | (-30.30) |   |
| | | | S6-L-M107-5.0 | 5000 | (-30.50) | |
| | | | S6-L-M107-10.0 | 10000 | (-30.80) | |
| | | Brake | S6-L-B107-3.0 | 3000 | (-30.30) |   |
| | | | S6-L-B107-5.0 | 5000 | (-30.50) | |
| | | | S6-L-B107-10.0 | 10000 | (-30.80) | |
| | Rear outlet | Power cable for motor without brake | S6-L-M108-3.0 | 3000 | (-30.30) |   |
| | | | S6-L-M108-5.0 | 5000 | (-30.50) | |
| | | | S6-L-M108-10.0 | 10000 | (-30.80) | |
| | | Brake | S6-L-B108-3.0 | 3000 | (-30.30) |   |
| | | | S6-L-B108-5.0 | 5000 | (-30.50) | |
| | | | S6-L-B108-10.0 | 10000 | (-30.80) | |
| MS1H1/ MS1H4 lead-type (-S) motor | Power cable for motor without brake | | S6-L-M100-3.0 | 3000 | (-30.30) |   |
| | | | S6-L-M100-5.0 | 5000 | (-30.50) | |
| | | | S6-L-M100-10.0 | 10000 | (-30.80) | |
| | Brake | | S6-L-B100-3.0 | 3000 | (-30.30) |   |
| | | | S6-L-B100-5.0 | 5000 | (-30.50) | |
| | | | S6-L-B100-10.0 | 10000 | (-30.80) | |
| MS1H2 motor rated 3 kW or below/ MS1H3 motor rated 1.8 kW or below | Power cable for motor without brake | | S6-L-M111-3.0 | 3000 | (-30.30) |   |
| | | | S6-L-M111-5.0 | 5000 | (-30.50) | |
| | | | S6-L-M111-10.0 | 10000 | (-30.80) | |
| | Brake | | S6-L-B111-3.0 | 3000 | (-30.30) |   |
| | | | S6-L-B111-5.0 | 5000 | (-30.50) | |
| | | | S6-L-B111-10.0 | 10000 | (-30.80) | |

| Motor Model | Cable Name | Cable Model | L Cable Length (mm) | Tolerance (T) (mm) | Illustration |
|---|---|---|---|---|---|
| MS1H2 motor rated 4 kW/5 kW | Power cable for motor without brake | S6-L-M011-3.0 | 3000 | (-30.30) |   |
| | | S6-L-M011-5.0 | 5000 | (-30.50) | |
| | | S6-L-M011-10.0 | 10000 | (-30.80) | |
| | Brake | S6-L-B011-3.0 | 3000 | (-30.30) |   |
| | | S6-L-B011-5.0 | 5000 | (-30.50) | |
| | | S6-L-B011-10.0 | 10000 | (-30.80) | |
| MS1H3 motor rated 2.9 kW | Power cable for motor without brake | S6-L-M112-3.0 | 3000 | (-30.30) |   |
| | | S6-L-M112-5.0 | 5000 | (-30.50) | |
| | | S6-L-M112-10.0 | 10000 | (-30.80) | |
| | Brake | S6-L-B112-3.0 | 3000 | (-30.30) |   |
| | | S6-L-B112-5.0 | 5000 | (-30.50) | |
| | | S6-L-B112-10.0 | 10000 | (-30.80) | |
| MS1H3 motor rated 4.4 kW or above | Power cable for motor without brake | S6-L-M022-3.0 | 3000 | (-30.30) |   |
| | | S6-L-M022-5.0 | 5000 | (-30.50) | |
| | | S6-L-M022-10.0 | 10000 | (-30.80) | |
| | Brake | S6-L-B022-3.0 | 3000 | (-30.30) |   |
| | | S6-L-B022-5.0 | 5000 | (-30.50) | |
| | | S6-L-B022-10.0 | 10000 | (-30.80) | |

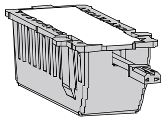
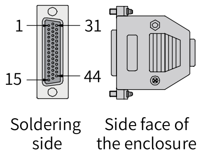
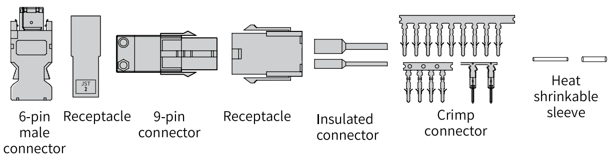
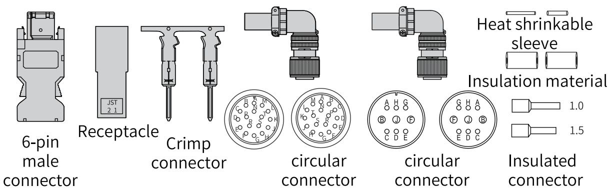
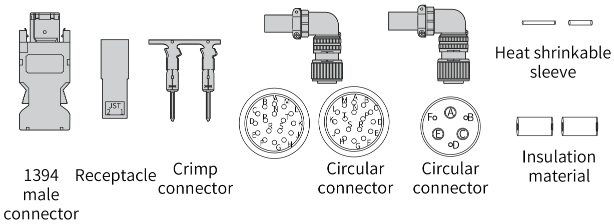
## Encoder cable

| Motor Model | Cable Name | | Cable Model | L Cable Length (mm) | Tolerance (T) (mm) | Illustration |
|---|---|---|---|---|---|---|
| MS1H1/ MS1H4 terminal-type motor | Front outlet | Single-turn absolute encoder cable | S6-L-P114-3.0 | 3000 | (-30.30) |  |
| | | | S6-L-P114-5.0 | 5000 | (-30.50) | |
| | | | S6-L-P114-10.0 | 10000 | (-30.80) | |
| | | Multi-turn absolute encoder cable | S6-L-P124-3.0 | 3000 | (-30.30) |  |
| | | | S6-L-P124-5.0 | 5000 | (-30.50) | |
| | | | S6-L-P124-10.0 | 10000 | (-30.80) | |
| | Rear outlet | Single-turn absolute encoder cable | S6-L-P115-3.0 | 3000 | (-30.30) |  |
| | | | S6-L-P115-5.0 | 5000 | (-30.50) | |
| | | | S6-L-P115-10.0 | 10000 | (-30.80) | |
| | | Multi-turn absolute encoder cable | S6-L-P125-3.0 | 3000 | (-30.30) |  |
| | | | S6-L-P125-5.0 | 5000 | (-30.50) | |
| | | | S6-L-P125-10.0 | 10000 | (-30.80) | |
| MS1H1/MS1H4 lead-type (-S) motor | | Single-turn absolute encoder cable | S6-L-P110-3.0 | 3000 | (-30.30) |  |
| | | | S6-L-P110-5.0 | 5000 | (-30.50) | |
| | | | S6-L-P110-10.0 | 10000 | (-30.80) | |
| | | Multi-turn absolute encoder cable | S6-L-P120-3.0 | 3000 | (-30.30) |  |
| | | | S6-L-P120-5.0 | 5000 | (-30.50) | |
| | | | S6-L-P120-10.0 | 10000 | (-30.80) | |
| MS1H2/MS1H3 motor | | Single-turn absolute encoder cable | S6-L-P111-3.0 | 3000 | (-30.30) |  |
| | | | S6-L-P111-5.0 | 5000 | (-30.50) | |
| | | | S6-L-P111-10.0 | 10000 | (-30.80) | |
| | | Multi-turn absolute encoder cable | S6-L-P121-3.0 | 3000 | (-30.30) |  |
| | | | S6-L-P121-5.0 | 5000 | (-30.50) | |
| | | | S6-L-P121-10.0 | 10000 | (-30.80) | |

## Communication cables

| Cable Name | Cable Model | Cable Length (mm) | Tolerance (T) (mm) | Illustration |
|---|---|---|---|---|
| Drive-PC communication cable | S6-L-T00-3.0 | 3000 | (-30.30) |  |
| Multi-drive communication cable | S6-L-T01-0.3 | 300 | (-10.10) |  |
| Servo drive to host controller communication cable | S6-L-T02-2.0 | 2000 | (-20.20) |  |
| Servo drive termination resistor connector | S6-L-T03-0.0 | - | - |  |

## Connector Kit

| Name | Model | Outline Drawing |
|---|---|---|
| Battery kit | S6-C4A |  |
| CN1 terminal (DB44) | S6-C8 |  |
| MS1H1 lead-type (-S) motor connector | S6-C26 |  |
| MS1H2/MS1H3 motor connector (1.8 kW and below) | S6-C29 |  |
| MS1H3 motor connector (2.9 kW and above) | S6-C39 |  |

# 4.3 Electrical Peripherals

## 4.3.1 Fuse

To prevent accidents caused by short circuit, install a fuse on the input side of the drive.

Table 4–1 List of recommended fuses

| Size | Drive Model SV630P****I | Rated Input Current (A) | Recommended Fuse | | |
|---|---|---|---|---|---|
| | | | Manufacturer | Rated Current (A) | Model |
| Single-phase 220 V | | | | | |
| A | S1R6 | 2.3 | Bussmann | 15 | FWP-15B |
| | S2R8 | 4 | | 20 | FWP-20B |
| B | S5R5 | 7.9 | | 35 | FWP-35C |
| C | S7R6 | 9.6 | | 40 | FWP-40C |
| D | S012 | 12.8 | | 40 | FWP-40C |
| Three-phase 220 V | | | | | |
| C | S7R6 | 5.1 | Bussmann | 50 | FWP-50C |
| D | S012 | 8 | | 50 | FWP-50C |
| Three-phase 380 V | | | | | |
| C | T3R5 | 2.4 | Bussmann | 15 | FWP-15B |
| | T5R4 | 3.6 | | 20 | FWP-20B |
| D | T8R4 | 5.6 | | 20 | FWP-20B |
| | T012 | 8 | | 50 | FWP-50C |
| E | T017 | 12 | | 50 | FWP-50C |
| | T021 | 16 | | 70 | FWP-70C |
| | T026 | 21 | | 125 | FWP-125C |

## 4.3.2 Electromagnetic Contactor

Table 4–2 Recommended electromagnetic contactor models

| Size | Drive Model SV630P****I | Rated Input Current | Recommended Contactor | | |
|---|---|---|---|---|---|
| | | | Manufacturer | Current (A) | Model |
| Single-phase 220 V | | | | | |
| A | S1R6 | 2.3 | Schneider | 9 | LC1 D09 |
| | S2R8 | 4 | | 9 | LC1 D09 |
| B | S5R5 | 7.9 | | 9 | LC1 D09 |
| C | S7R6 | 9.6 | | 12 | LC1 D12 |
| D | S012 | 12.8 | | 18 | LC1 D18 |
| Three-phase 220 V | | | | | |
| C | S7R6 | 5.1 | Schneider | 9 | LC1 D09 |
| D | S012 | 8 | | 9 | LC1 D09 |
| Three-phase 380 V | | | | | |
| C | T3R5 | 2.4 | Schneider | 9 | LC1 D09 |
| | T5R4 | 3.6 | | 9 | LC1 D09 |
| D | T8R4 | 5.6 | | 9 | LC1 D09 |
| | T012 | 8 | | 9 | LC1 D09 |
| E | T017 | 12 | | 12 | LC1 D12 |
| | T021 | 16 | | 18 | LC1 D18 |
| | T026 | 21 | | 25 | LC1 D25 |

### 4.3.3 Breaker

Table 4–3 Recommended circuit breaker models

| Size | Drive Model SV630P****I | Rated Input Current (A) | Recommended Circuit Breaker | | |
|---|---|---|---|---|---|
| | | | Manufacturer | Current (A) | Model |
| Single-phase 220 V | | | | | |
| A | S1R6 | 2.3 | Schneider | 4 | OSMC32N2C4 |
| | S2R8 | 4 | | 6 | OSMC32N2C6 |
| B | S5R5 | 7.9 | | 16 | OSMC32N2C16 |
| C | S7R6 | 9.6 | | 16 | OSMC32N2C16 |
| D | S012 | 12.8 | | 20 | OSMC32N2C20 |
| Three-phase 220 V | | | | | |
| C | S7R6 | 5.1 | Schneider | 10 | OSMC32N3C10 |
| D | S012 | 8 | | 16 | OSMC32N3C16 |
| Three-phase 380 V | | | | | |
| C | T3R5 | 2.4 | Schneider | 4 | OSMC32N3C4 |
| | T5R4 | 3.6 | | 6 | OSMC32N3C6 |
| D | T8R4 | 5.6 | | 10 | OSMC32N3C10 |
| | T012 | 8 | | 16 | OSMC32N3C16 |
| E | T017 | 12 | | 20 | OSMC32N3C20 |
| | T021 | 16 | | 25 | OSMC32N3C25 |
| | T026 | 21 | | 32 | OSMC32N3C32 |

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

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

### 4.3.4 AC input reactor

#### Selection

An AC input reactor is optional and mainly used to reduce harmonics in the input current. Install an external reactor as needed in actual applications. The following table lists the recommended manufacturers and models of input reactors.

Table 4–4 AC input reactor model selection

| Size | Drive Model SV630P****I | Rated Input Current | Applicable Reactor | Inductance (mH) |
|---|---|---|---|---|
| Three-phase 220 V | | | | |
| C | S7R6 | 5.1 | MD-ACL-10-5-4T | 5 |
| D | S012 | 8 | MD-ACL-10-5-4T | 5 |
| Three-phase 380 V | | | | |
| C | T3R5 | 2.4 | MD-ACL-10-5-4T | 5 |
| | T5R4 | 3.6 | MD-ACL-10-5-4T | 5 |

| Size | Drive Model SV630P****I | Rated Input Current | Applicable Reactor | Inductance (mH) |
|---|---|---|---|---|
| D | T8R4 | 5.6 | MD-ACL-10-5-4T | 5 |
| | T012 | 8 | MD-ACL-10-5-4T | 5 |
| E | T017 | 12 | MD-ACL-15-3-4T | 3 |
| | T021 | 16 | MD-ACL-40-1.45-4T | 1.45 |
| | T026 | 21 | MD-ACL-40-1.45-4T | 1.45 |

## Dimensions

- Inovance input reactors

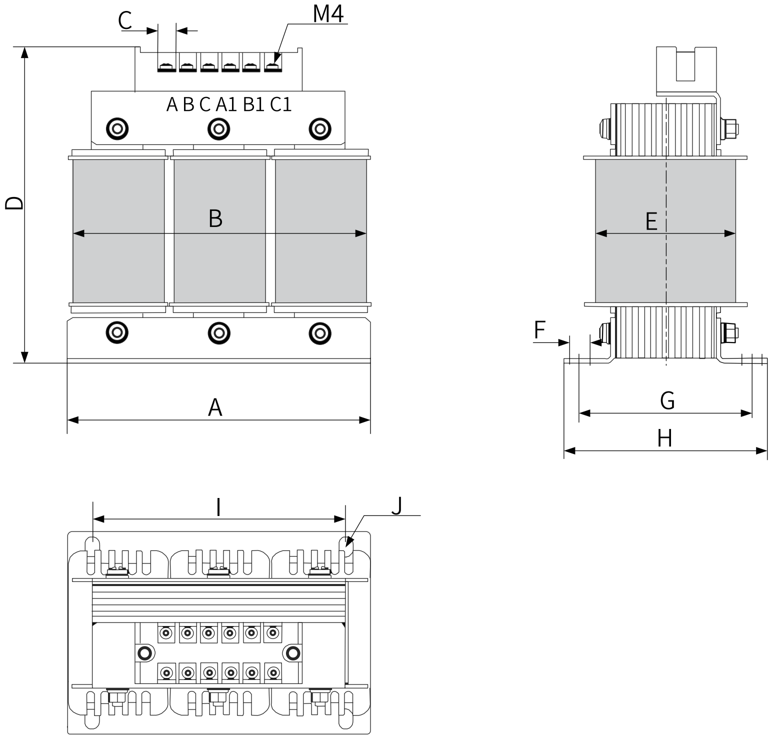



Figure 4-1 Dimensions of 10 A to 15 A AC input reactors

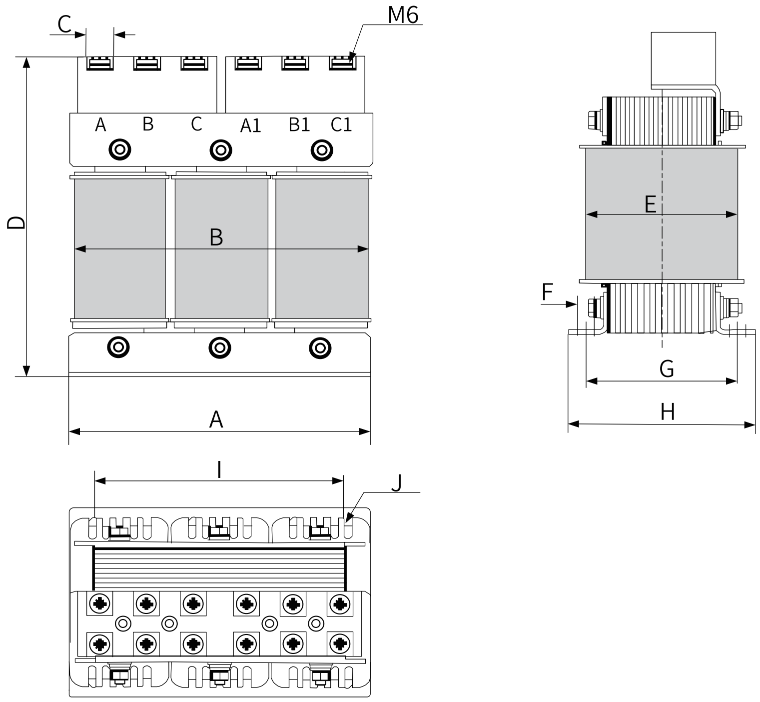



Figure 4-2 Dimensions of 40 A (1.45 mH) AC input reactors

Table 4–5 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 |

### 4.3.5 EMC filter

#### 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. EMC filter options are FN2090 and FN 3258 series EMC filters manufactured by Schaffner. Select the EMC filter according to the rated input current of the servo drive, as shown in the following table.

Table 4–6 Standard EMC filter model and appearance

| Filter Model | | Appearance |
|---|---|---|
| Schaffner | FN 2090 series |  |
| | FN3258 series |  |

Table 4–7 Filter model selection (Schaffner)

| Size | Servo drive model SV630P****I | Rated Input Current | Applicable Filter |
|---|---|---|---|
| Single-phase 220 V | | | |
| A | S1R6 | 2.3 | FN 2090-3-06 |
| | S2R8 | 4 | FN 2090-4-06 |
| B | S5R5 | 7.9 | FN 2090-8-06 |
| C | S7R6 | 9.6 | FN 2090-10-06 |
| D | S012 | 12.8 | FN 2090-16-06 |
| Three-phase 220 V | | | |
| C | S7R6 | 5.1 | FN 3258-7-44 |
| D | S012 | 8 | FN 3258-16-44 |
| Three-phase 380 V | | | |
| C | T3R5 | 2.4 | FN 3258-7-44 |
| | T5R4 | 3.6 | FN 3258-7-44 |
| D | T8R4 | 5.6 | FN 3258-7-44 |
| | T012 | 8 | FN 3258-16-44 |
| E | T017 | 12 | FN 3258-16-44 |
| | T021 | 16 | FN 3258-16-44 |
| | T026 | 21 | FN 3258-30-44 |

## Dimensions

- Dimensions of Schaffner FN 2090 series filters

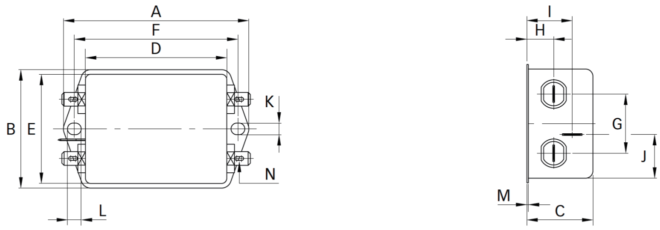



Figure 4-3 Dimensions of FN 2090 series filters (unit: mm)

Table 4–8 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 x 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 x 0.8 |

- Dimensions of Schaffner FN 3287 series filters

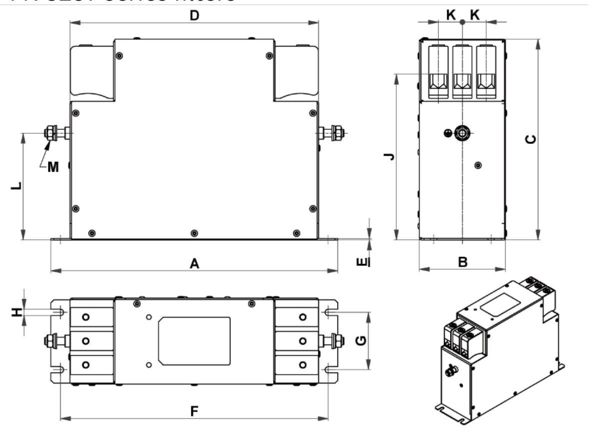



Figure 4-4 Dimension drawing of FN 3287 series filters (unit: mm)

Table 4–9 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 |

## 4.3.6 Magnetic Ring and Magnetic Buckle

The magnetic ring is intended to be installed on the input or output side of the drive. Install the magnetic ring as close to the drive as possible. Installing the magnetic ring on the input side suppresses the noise in the input power supply system of the drive. When it is installed on the output side, it can reduce the interference generated by the drive to external devices and the bearing current.

In applications with leakage current and signal cable interference, install a magnetic ring or a ferrite clamp.

## Selection

- Amorphous magnetic ring: featuring a high permeability within 1 MHz and excellent anti-interference performance, but not as low-cost as the ferrite clamp. See for details. *" Dimensions" on page 101*
- Ferrite clamp: featuring a good interference suppression performance within a frequency band above 1MHz, applicable to low-power servo drives and signal cables, low-cost and easy to install

| Magnetic ring and ferrite clamp | | Appearance |
|---|---|---|
| Magnetic ring | DY644020H |  |
| | DY805020H |  |
| ferrite clamp | DYR-130-B |  |

## Dimensions

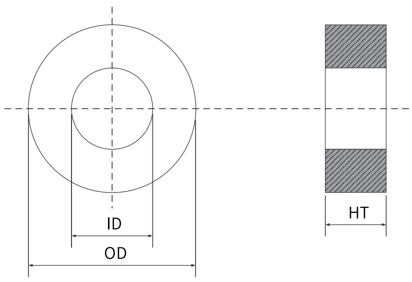



Figure 4-5 Dimensions of the magnetic ring

Table 4–10 Dimensions of the magnetic ring

| Model | Size (OD×ID×HT) (mm) |
|---|---|
| DY644020H | 64 × 40× 20 |
| DY805020H | 80 × 50× 20 |

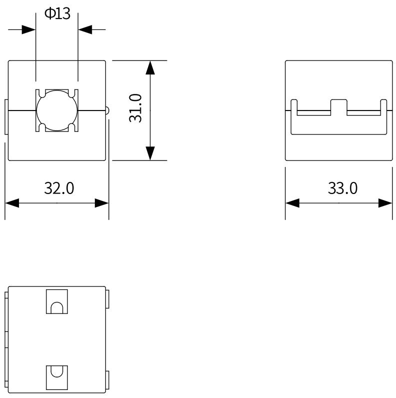



Figure 4-6 Dimensions of the ferrite clamp

Table 4–11 Dimensions of the ferrite clamp

| Model | Size (Length × OD × ID) (mm) |
|---|---|
| DYR-130-B | 32.0 × 31× 13 |

# 4.4 Absolute Encoder Batteries

## Model selection

Select an appropriate battery according to the following table.

Table 4–12 Description of the absolute encoder battery

| Battery Specifications | Item | Rated Values | | | Condition |
|---|---|---|---|---|---|
| | | Min. Value | Typical Value | Max. Value | |
| Output: 3.6 V, 2500 mAh | External battery voltage (V) | 3.2 | 3.6 | 5 | In standby state[1] |
| | Circuit fault voltage (V) | - | 2.6 | - | In standby state |
| | Battery alarm voltage (V) | 2.85 | 3 | 3.15 | - |
| | Current consumed by the circuit (uA) | - | 2 | - | In normal operation[2] |
| | | - | 10 | - | In standby state, shaft at standstill |
| | | - | 80 | - | In standby state, shaft rotating |
| | Ambient temperature (°C) | 0 | - | 40 | Same as the motor. |
| | Storage temperature (°C) | -20 | - | 60 | |

The preceding values are obtained under an ambient temperature of 20°C.

### *Note*

- [1]: The "standby state" means the encoder counts the multi-turn data by using the power from the external battery when the servo 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. Power on the servo drive after connecting the absolute encoder properly. The encoder starts data transceiving after a short delay of about 5s upon power-on. The motor speed must be lower than or equal to 10 rpm during transition from the standby state to the normal operation state (upon power-on). Otherwise, Er.740 (Encoder fault) may occur. In this case, you need to power off and on the servo drive again.

## Design life of the battery

The following calculation only covers the current consumed by the encoder.

Assume that the drive works normally for T1 in a day, the motor rotates for T2 after the drive is powered off, and the motor stops rotating for T3 after power-off [unit: hour (H)].

Example:

Table 4–13 Design life of the absolute encoder battery

| Item | Schedule 1 | Schedule 2 |
|---|---|---|
| Working Days in Different Operating Conditions in 1 Year | 313 | 52 |
| T1 (h) | 8 | 0 |
| T2 (h) | 0.1 | 0 |
| T3 (h) | 15.9 | 24 |

Capacity consumed in 1 year = (8 h × 2 uA + 0.1 h × 80 uA + 15.9 h × 10 uA) x 313 + (0 h × 2 uA + 0 h × 80 uA +24 h × 10 uA) x 52 ≈ 70 mAh

Design life = Battery capacity ÷ Capacity consumed in 1 year = 2600 mAh ÷ 70 mAh = 37.1 years

# 5 Installation

Read through the safety instructions in Chapter "Fundamental Safety Instructions". Failure to comply may result in serious consequence.

Caution

- Observe the installation direction described in this chapter. Failure to comply may result in equipment fault or damage.
- Do not install or operate damaged or defective equipment. Failure to comply can result in personal injury.
- Do not install the equipment in environments exposed to water splashes or corrosive gases. Failure to comply can result in equipment fault.
- Do not install the equipment near inflammable gases or combustible objects. Failure to comply can result in a fire or electric shock.
- Install the equipment inside a fire-proof cabinet that provides electrical protection. Failure to comply may result in a fire.
- Ensure the specified clearance is reserved among the servo drive, the interior surface of the control cabinet, and other machines. Failure to comply can result in a fire or equipment fault.
- 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 strong shock. Failure to comply may result in equipment damage.
- Do not block the air inlet/outlet of the equipment or allow unwanted objects to fall into the equipment. Failure to comply may result in a fire or equipment fault.

## 5.1 Installation of the Servo Drive

### 5.1.1 Unpacking Inspection

Check the following items upon unpacking.

| Item | Description |
|---|---|
| Check whether the delivered product is consistent with your order. | Check whether the servo drive model and specifications comply with your order.<br>See the dimensions of the packing box in *"Table 5–1" on page 104*. The deliverables include the product, cushion, carton box, and screw bag, as shown in *"Figure 5–1" on page 105* . |
| 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 5–1 Dimensions of the outer packing box

| SIZE | Servo Drive Model SV630****I | Outer Width (mm) | Outer Height (mm) | Outer Depth (mm) | Weight (kg) |
|---|---|---|---|---|---|
| A | S1R6, S2R8 | 250.0 | 90.0 | 195 | 0.96 |
| B | S5R5 | 225.0 | 90 | 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 |

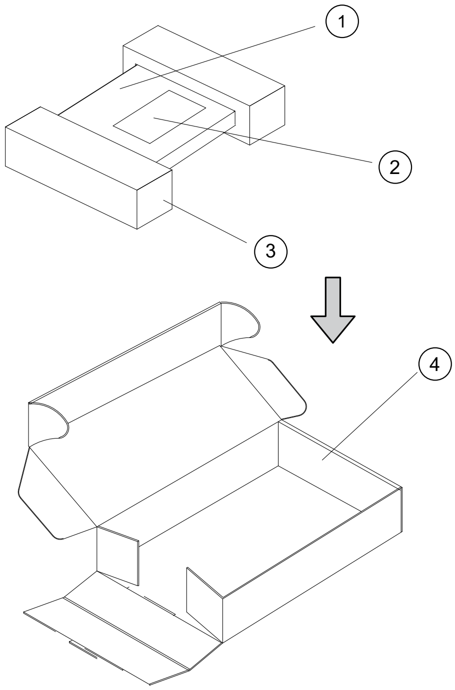



Figure 5-1 Contents inside the packing box

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

### 5.1.2 Installation Environment

Table 5–2 Environment requirements

| Item | Requirement |
|---|---|
| Installation location | Indoors |
| Grid overvoltage | Overvoltage Class III (OVC III). |
| Altitude | The maximum altitude is 2000 m.<br>• For altitudes not higher than 1000 m, derating is not required.<br>• Derating is required for altitudes above 1000 m (derate 1% for every additional 100 m).<br>• For altitudes above 2000 m, contact Inovance. |
| Temperature | • Mounting/Operating temperature: 0°C to 55°C For temperatures between 0°C to 45°C, derating is not required. For temperatures above 45°C, derate 2% for every additional 1°C.<br>• Storage/Transportation temperature: -20°C to +70°C.<br>• To improve the reliability of the machine, use the servo drive in environments without dramatic temperature change.<br>• When installing the servo drive into an enclosed environment such as a control cabinet, use a cooling fan or air conditioner to keep the temperature of the inlet air below 45°C. Failure to comply will result in overheat or fire.<br>• Install the servo drive on the surface of an incombustible object and leave sufficient surrounding space for heat dissipation.<br>• Take measures to prevent the servo drive from being frozen. |
| Ambient humidity | Below 90% RH (no condensation) |

| Item | Requirement |
|---|---|
| Storage humidity | Below 90% RH (no condensation) |
| Vibration | Below 4.9m/s$^2$<br>• During transportation with packing box: compliant with EN 60721-3-2 Class 2M3.<br>• During installation without packing box: compliant with ISTA 1H. |
| Shock | Below 19.6m/s$^2$ |
| IP rating | IP20. |
| Environment | Pollution Degree 2 and below<br>Install the servo drive in a place that meets the following requirements:<br>• Free from direct sunlight, dust, corrosive gas, explosive and inflammable gas, oil mist, vapor, water drop, and salty element<br>• Insusceptible to vibration (away from equipment that may generate strong vibration, such as a punch press)<br>• Free from unwanted objects such as metal powder, oil, and water inside the servo drive<br>• Free from radioactive substances, combustible materials, harmful gases and liquids, and salt corrosion<br>• Away from combustible materials such as wood<br>• Do not use the equipment in vacuum. |

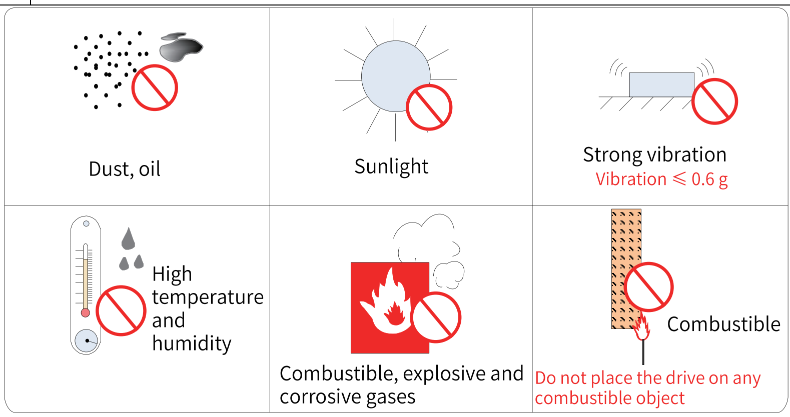



Figure 5-2 Environment requirements

## 5.1.3 Installation Clearance

Servo drives in different power ratings require different installation clearances. When installing multiple servo drives side by side, it is recommended to reserve a clearance of at least 10 mm (0.39 in.) between every two servo drives and a clearance of at least 50 mm (1.97 in.) above and below each servo drive for heat dissipation.

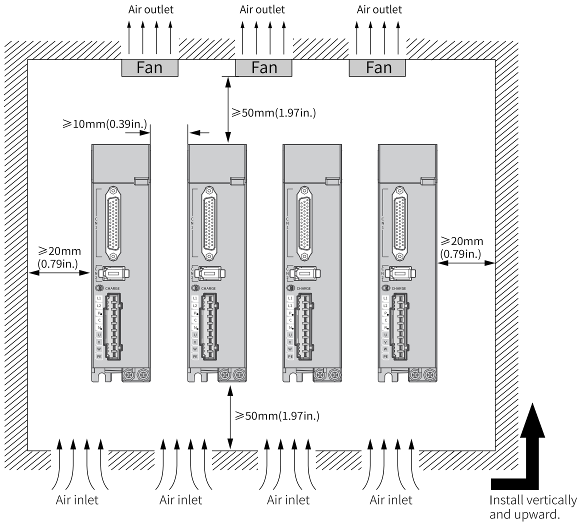



Figure 5-3 Clearance for side-by-side installation

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 rate to 75%.

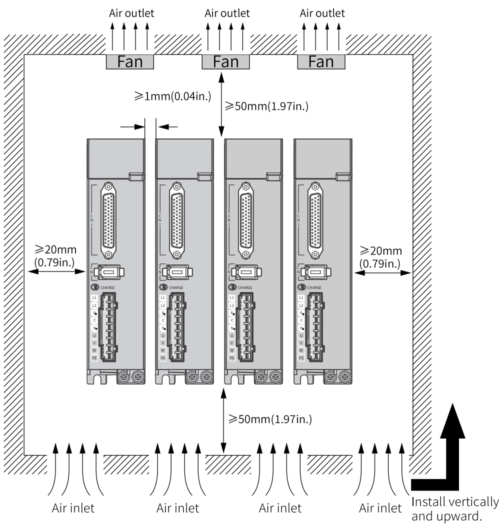



Figure 5-4 Clearance for compact installation

Servo drives in sizes C and D (rated power: 1.0 kW to 3 kW) support zero-clearance installation between every two servo drives, without derating.

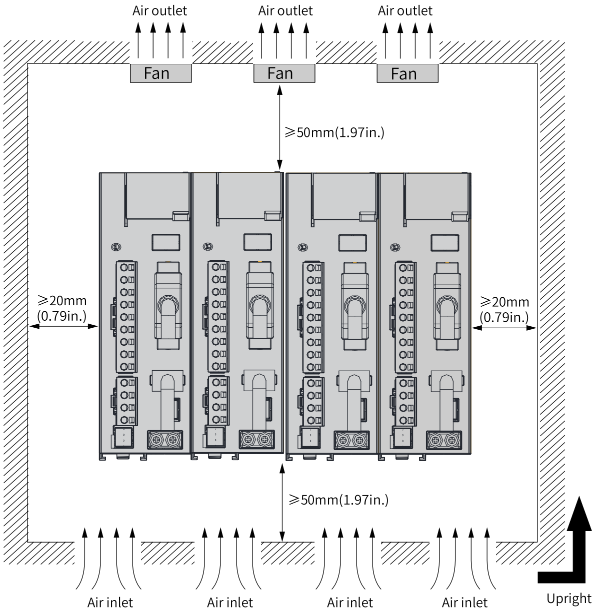



Figure 5-5 Zero-clearance installation

## 5.1.4 Installation Dimensions

### Drives in Size A (rated Power: 0.2 kW to 0.4 kW): SV630PS1R6I, SV630PS2R8I

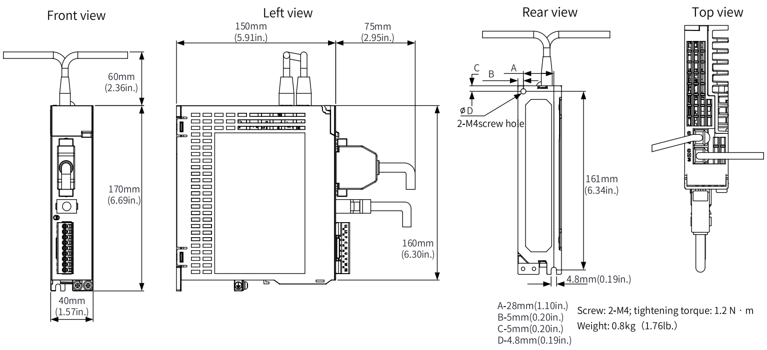



Figure 5-6 Dimension drawing of servo drives in size A

### Drives in Size B (rated Power: 0.75 kW: SV630PS5R5I

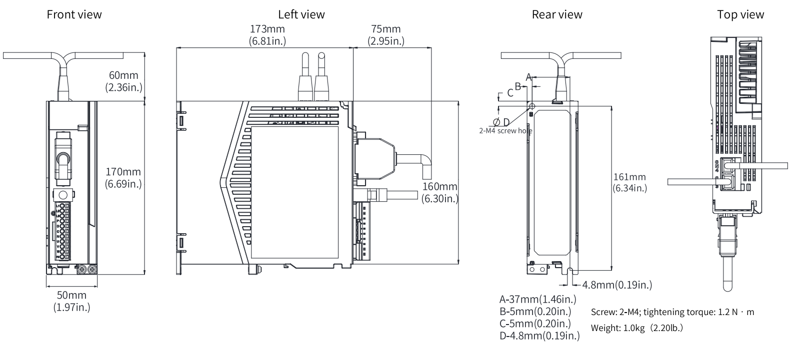



Figure 5-7 Dimension drawing of servo drives in size B

## Servo drives in size C (rated power: 1.0 kW to 1.5 kW): SV630PS7R6I, SV630PT3R5I, and SV630PT5R4I

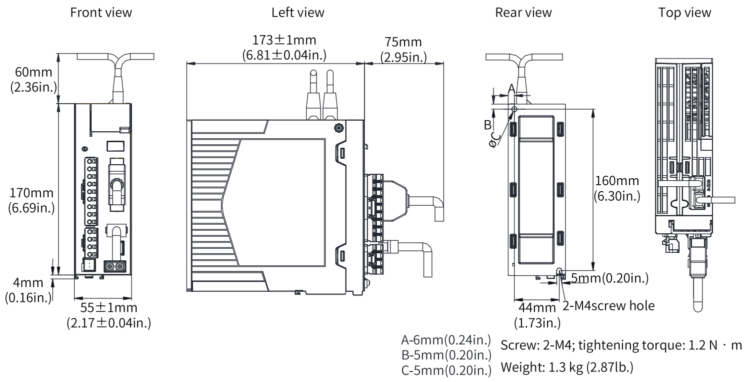



Figure 5-8 Dimension drawing of servo drives in size C

## Servo drives in size D (rated power: 1.5 kW to 3.0 kW): SV630PS012I, SV630PT8R4I, and SV630PT012I

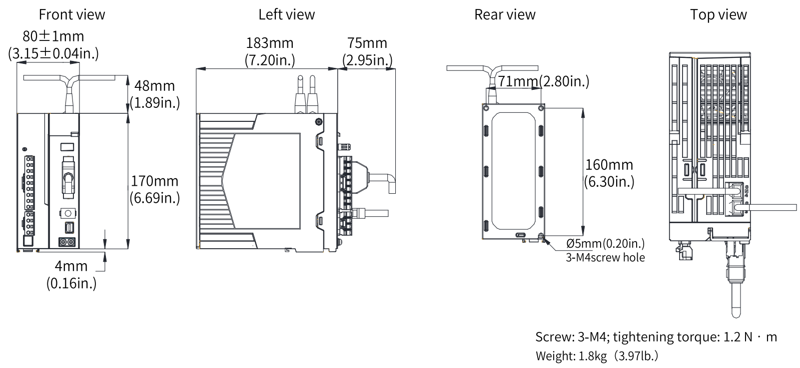



Figure 5-9 Dimension drawing of servo drives in size D

## Servo drives in size E (rated power: 5.0 kW to 7.5 kW): SV630PT017I, SV630PT021I, and SV630PT026I

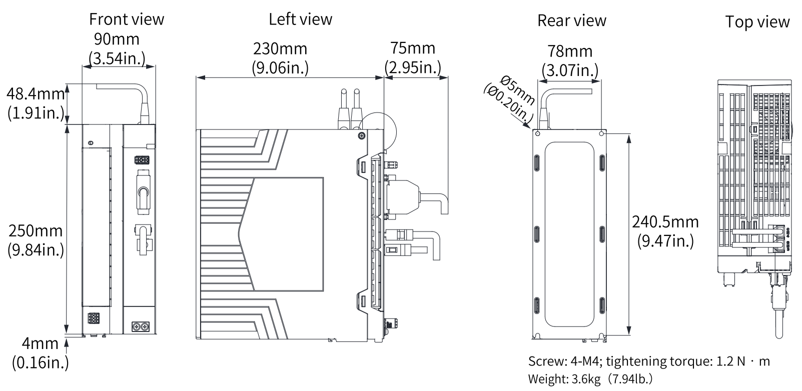
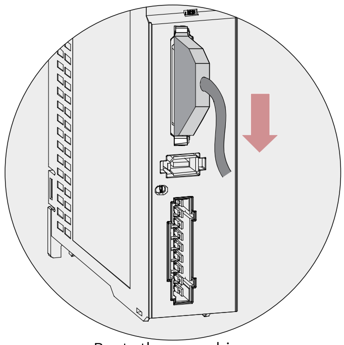
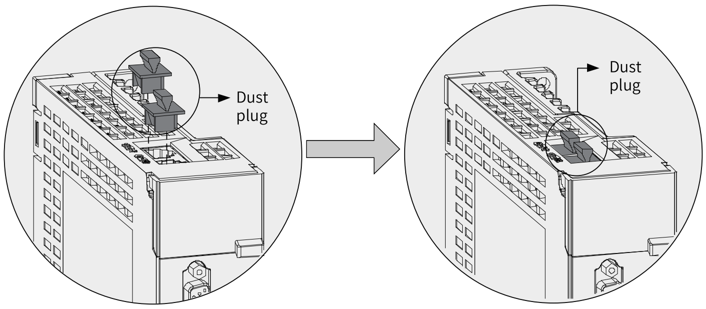



Figure 5-10 Dimension drawing of servo drives in size E

### 5.1.5 Installation Precautions

Table 5–3 Installation Precautions

| Item | Description |
|---|---|
| Installation Method | • Install the servo drive vertically and upward to facilitate heat dissipation. For installation of multiple servo drives inside the cabinet, install them side by side. For dual-row installation, install an air guide plate.<br>• Make sure the servo drive is installed vertically to the wall. Cool the servo drive down with natural convection or a cooling fan. Secure the servo drive to the mounting surface through two to four mounting holes (the number of mounting holes depends on the capacity of the servo drive).<br>• Install the servo drive vertically to the wall, with its front (actual mounting face) facing the operator.<br>• The mounting bracket (if needed) must be made of incombustible materials. |
| Cooling | As shown in *"5.1.3 Installation Clearance" on page 106*, reserve sufficient space around the servo drive to ensure a good heat dissipation through the cooling fan or natural convection. Take the heat dissipated by other devices inside the cabinet into consideration. Install a cooling fan to the upper part of the servo drive to avoid excessive temperature rise in a certain area, keeping an even temperature inside the control cabinet. |
| Grounding | Ground the grounding terminal properly. Failure to comply may result in electric shock or malfunction due to interference. |

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

## 5.1.6 Installation Instructions

The servo drive supports backplate mounting only.

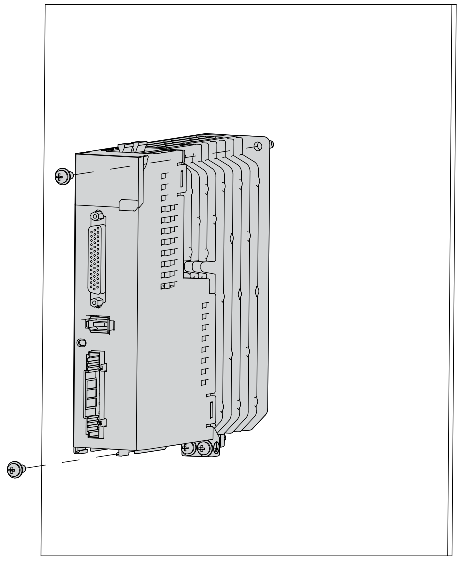


Figure 5-11 Backplate mounting

***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.

## 5.2 Installation of Optional Parts

### 5.2.1 Instructions for Installing the Fuse and Circuit Breaker

Caution

To prevent electric shock, when the fuse is blown or the circuit breaker trips, wait for at least the time designated on the warning label before powering on the drive or operating peripheral devices. Failure to comply can result in death, severe personal injury, or equipment damage.

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

### 5.2.2 Instructions for Installing the AC Input Reactor

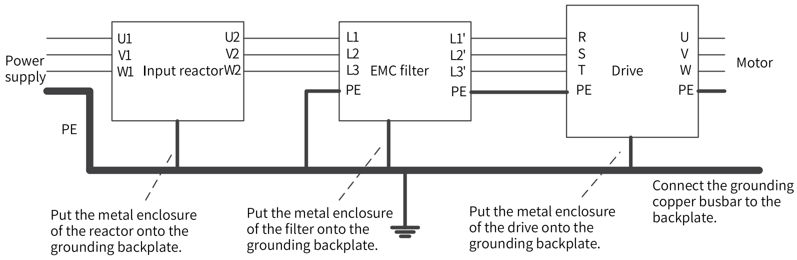



Figure 5-12 Installing the AC input reactor

### 5.2.3 Instructions for Installing the EMC Filter

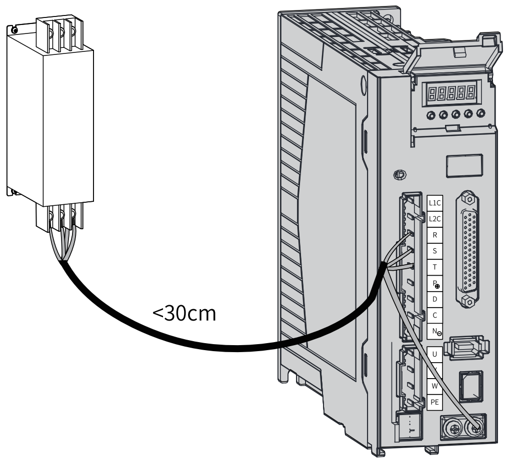



Figure 5-13 Installing the AC input reactor

### 5.2.4 Installation of the Magnetic Ring and Ferrite Clamp

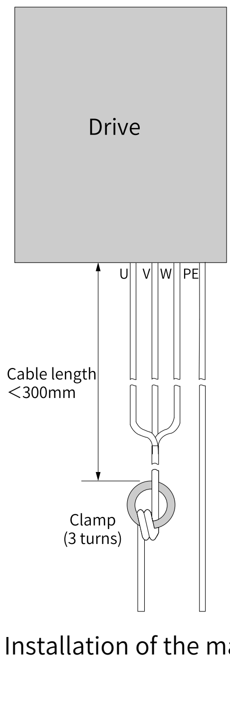



Figure 5-14 Installation of the magnetic ring

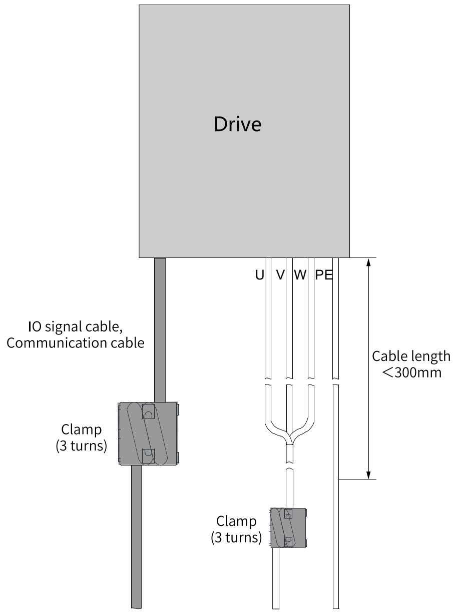



Figure 5-15 Installation of the ferrite clamp

# 6 System Wiring Diagram

## 6.1 System Wiring

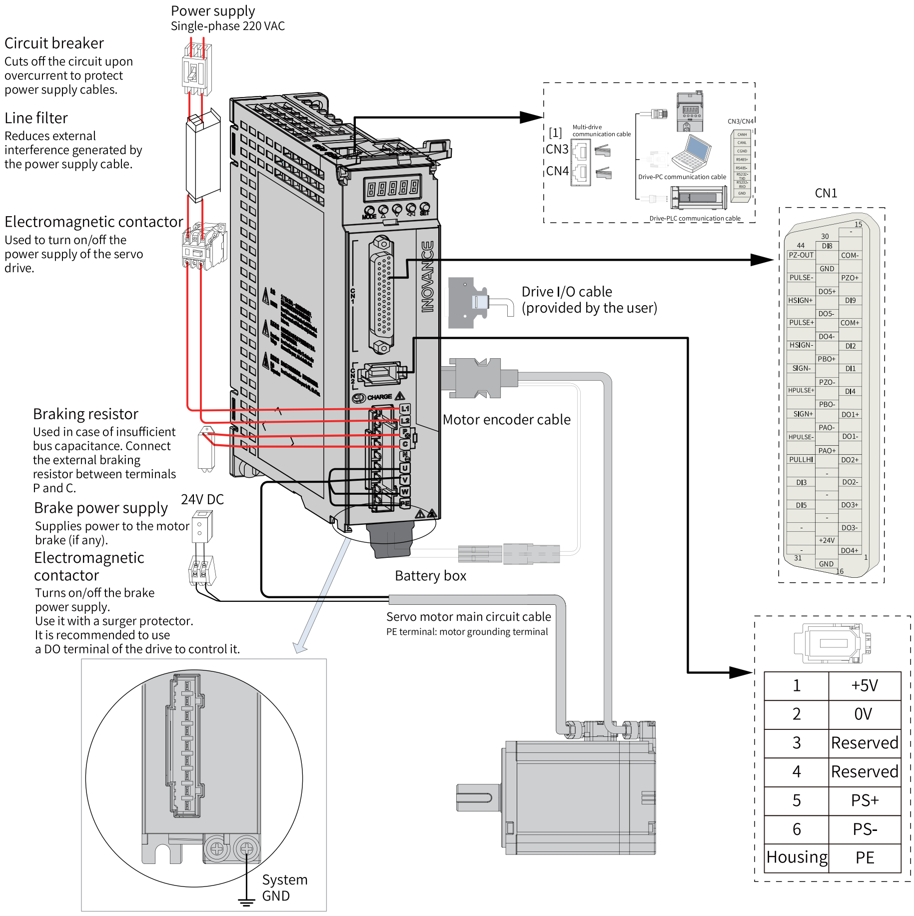



Figure 6-1 Wiring example of a single-phase 220 V system

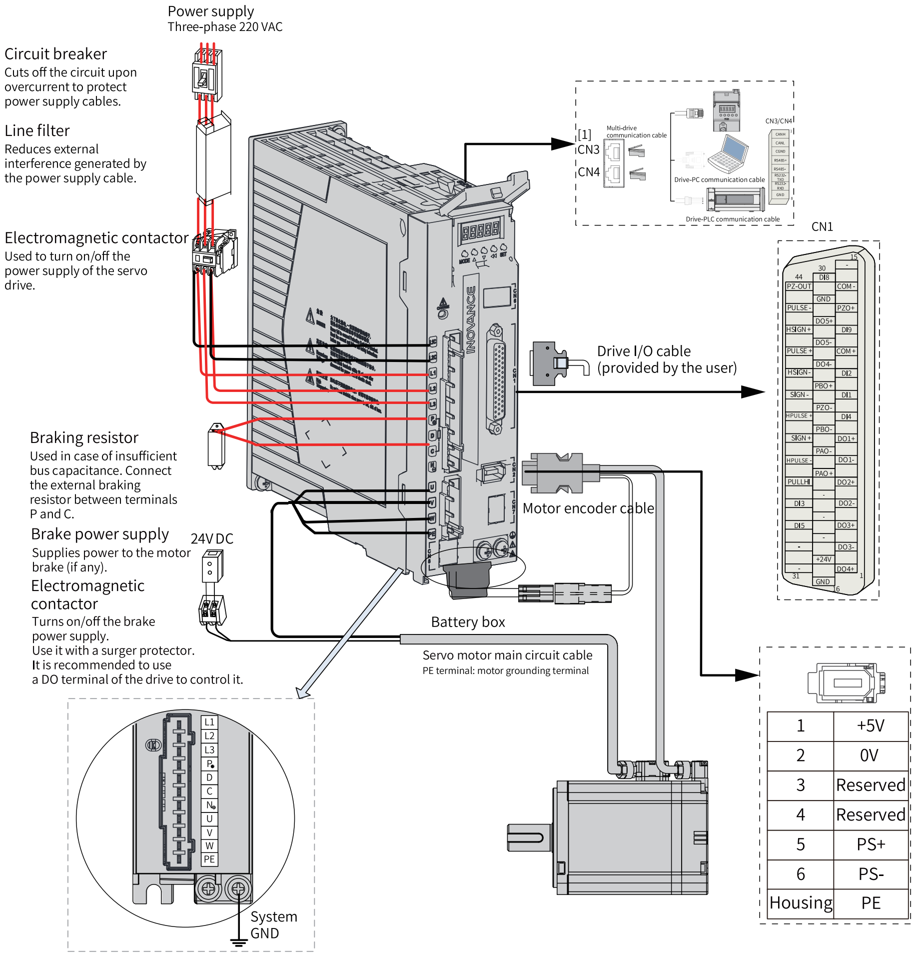



Figure 6-2 Wiring example of a three-phase 220V system

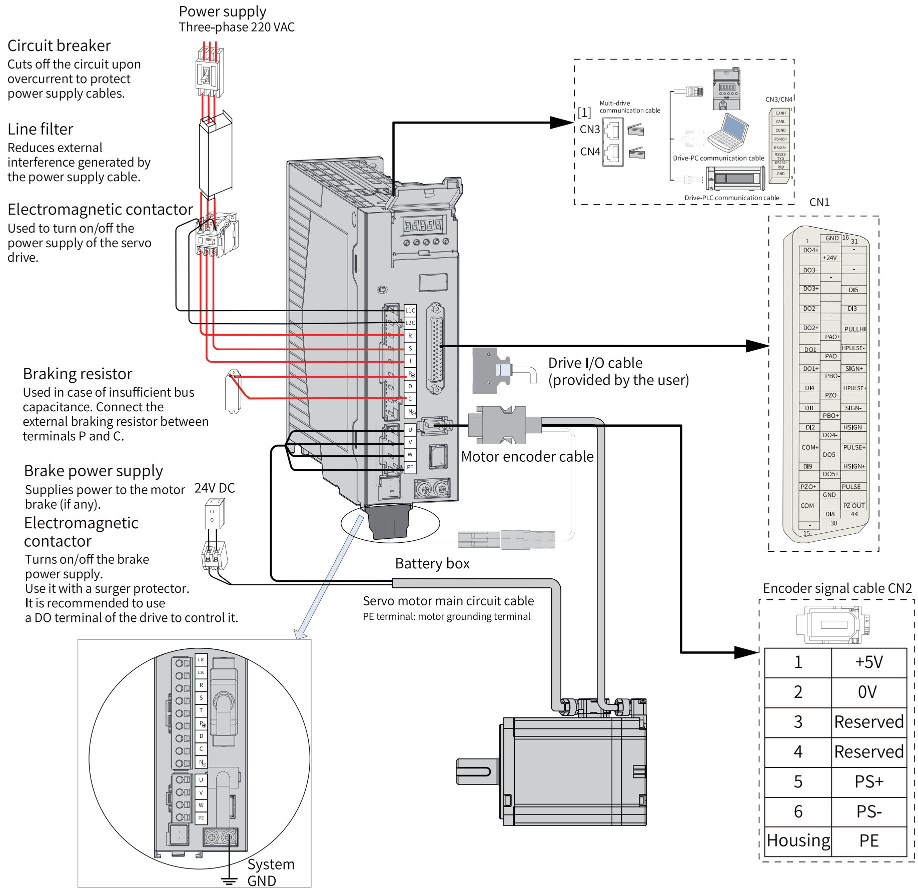



Figure 6-3 Wiring example of a three-phase 380 V system

***Note***

[1] CN3 and CN4 communication terminals can be used interchangeably. Their pin assignments are exactly the same.

## 6.2 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 start or stop the motor by using the electromagnetic contactor. As a high-inductance device, the motor may generate high voltages instantaneously, which may break down the contactor.
- When connecting an external power supply to the control circuit or a 24 VDC power supply, pay attention to the power capacity as insufficient power capacity will lead to insufficient supply current, resulting in failure of the servo drive or the brake. This is especially true when the power supply is used to power up multiple servo drives or brakes. The brake must be powered up by a 24 VDC power supply that matches the motor model and meets the brake power requirements.

## *Note*

- The built-in regenerative resistor or jumper bar is not available in models S1R6 and S2R8. If an external regenerative resistor is needed for these models, connect it between terminals P⊕ and C.
- Remove the jumper between P⊕ and D before using the external regenerative resistor. Failure to comply will result in overcurrent and damage the braking transistor.
- Do not connect the external regenerative resistor to the positive or negative pole of the bus directly. Failure to comply will damage the servo drive and result in a fire.
- Do not select any resistor lower than the minimum allowed resistance value. Failure to comply will result in E201.0 (Hardware overcurrent) or damage the servo drive.
- Make sure parameters H02.25 (Regenerative resistor setting), H02.26 (Power of external regenerative resistor) and H02.27 (Resistance of external regenerative resistor) are set properly before operating the servo drive.
- Install the external regenerative resistor on an incombustible object such as a metal.

# 7 电气接线图

## 7.1 Wiring diagram of the Position Control Mode

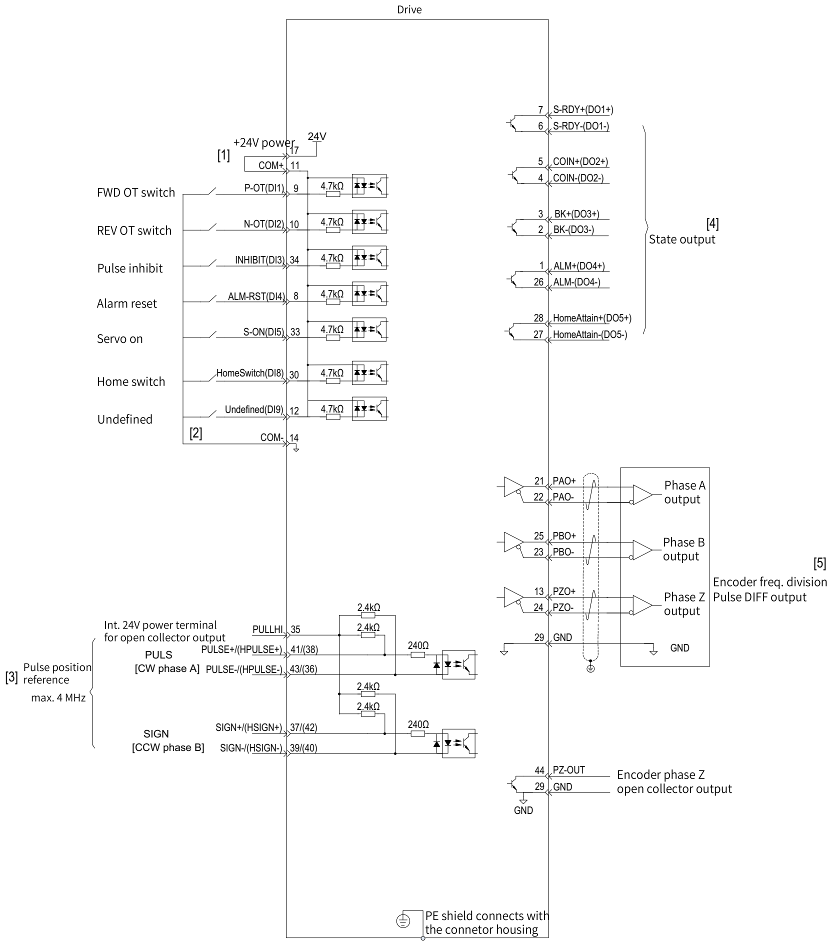


Figure 7-1 Wiring diagram of the Position Control Mode

### *Note*

- [1] The range of the internal +24 V power supply is 20 V to 28 V, with maximum operating current being 200 mA.
- [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 a maximum voltage of 30 VDC and a maximum current of 50 mA.
- [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.

# 7.2 Wiring Diagram for Torque Control Mode

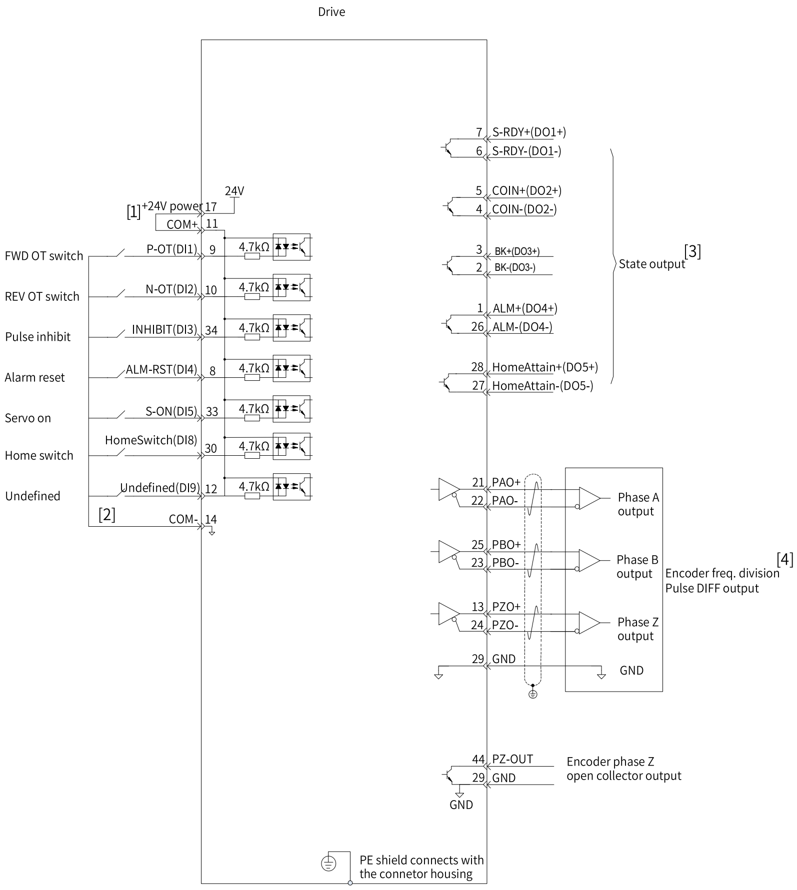



Figure 7-2 Wiring Diagram for Torque Control Mode

## *Note*

- [1] The range of the internal +24 V power supply is 20 V to 28 V, with maximum operating current being 200 mA.
- [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 a maximum voltage of 30 VDC and a maximum current of 50 mA.
- [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.

# 8 Wiring Terminals

## 8.1 Wiring Precautions

Warning

Read through the safety instructions in Chapter "Fundamental Safety Instructions". Failure to comply may result in serious consequences.

- Do not use the power from IT system for the servo drive. Use the power from TN/TT system for the drive. Failure to comply may result in an electric shock.
- Connect an electromagnetic contactor between the input power supply and the main circuit power supply of the drive (L1, L2 for single-phase; L1, L2, L3/R, S, T for three-phase) to form a structure allowing independent power cutoff on the power supply side of the drive. This is to prevent fire accident caused by continuous high current generated upon fault.
- Check that the input power supply of the drive is within the specified voltage range. Failure to comply may result in faults.
- Do not connect the output terminals U, V, and W of the drive to a three-phase power supply. Failure to comply may result in physical injury or a fire.
- Do not connect the motor terminals U, V, and W to a mains power supply. Failure to comply may result in physical injury or a fire.
- Use the ALM (fault) signal to cut off the main circuit power supply. A faulty braking transistor may overheat the regenerative resistor and lead to a fire.
- Connect the PE terminal of the drive to the PE terminal of the control cabinet. Failure to comply may result in an electric shock.
- Ground the entire system properly. Failure to comply may result in equipment malfunction.
- After the power supply is cut off, residual voltage is still present in the internal capacitor of the drive, wait for at least 15 min before further operations. Failure to comply may result in an electric shock.

**Caution**

- The specification and installation of external cables must comply with applicable local regulations.
- Observe the following requirements when the servo drive is used on a vertical axis.
  - Set the safety device properly to prevent the workpiece from falling upon warning or overtravel.
  - Ensure the positive/negative polarity of the 24 V power supply is correct. Otherwise, the axis may fall and cause personal injury or equipment damage.
- Observe the following requirements during wiring of the power supply and main circuit:
  - When the main circuit terminal is a connector, remove the connector from the servo drive before wiring.
  - Insert one cable into one cable terminal of the connector. Do not insert multiple cables into one cable terminal.
  - When inserting cables, take enough care to prevent the cable conductor burrs from being short circuited to the neighboring cable.
  - Insulate the connecting part of the power supply terminals to prevent electric shock.
  - Do not connect a 220 V servo drive to a 380 V power supply directly.
  - Install safety devices such as a circuit breaker to prevent short circuit in external circuits. Failure to comply may result in a fire.
  - Cut off the main circuit power supply and switch off the S-ON signal after an alarm signal is detected.
  - After all cables are connected, it is recommended to tie them at the point 10cm–20cm away from the connector end.
- Connect the servo drive to the motor directly. Do not use an electromagnetic contactor during wiring. Failure to comply may result in equipment fault.
- Do not put heavy objects onto cables or pull cables with excessive force. Failure to comply may result in cable damage, leading to an electric shock.
- 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 and I/O signal cables/encoder cables. Failure to comply may result in equipment malfunction.
- 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.
- The maximum wiring lengths of the I/O signal cable and the encoder cable are 3 m and 10 m respectively.
- Use a power supply filter to reduce the electromagnetic interference on electronic devices surrounding the servo drive.
- Take proper shielding measures in the following locations to prevent equipment damage:
  - Locations with interference caused by static electricity
  - Locations with strong electric field or magnetic field
  - Locations with radioactive rays

## Size A (rated power: 0.2 kW–0.4 kW): SV630PS1R6I, SV630PS2R8I

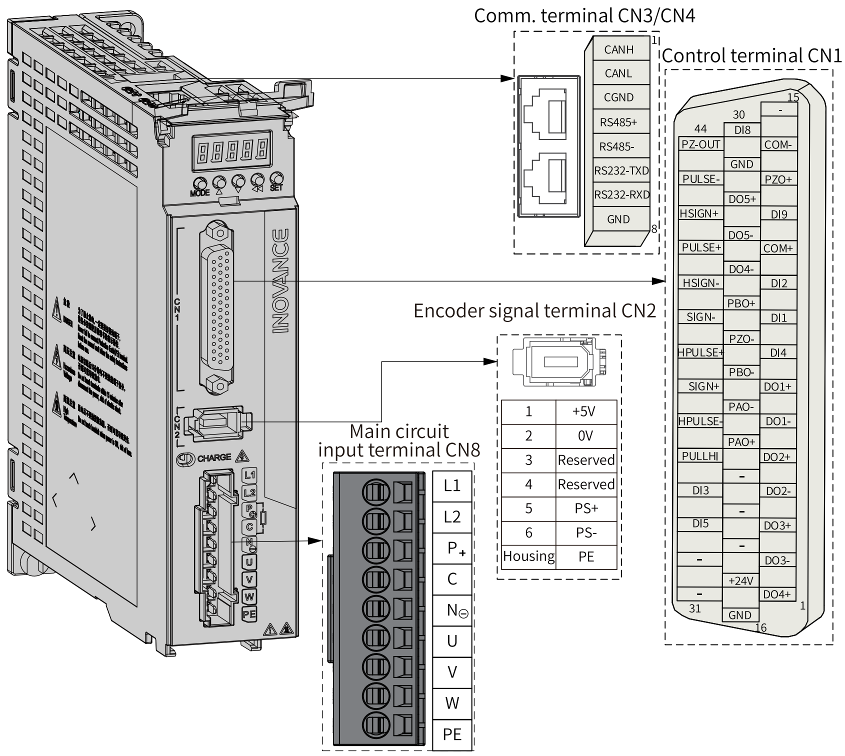



Figure 8-1 Terminal pin layout of servo drives in size A

## Rated power: (SIZE B: 0.75 kW): SV630PS5R5I

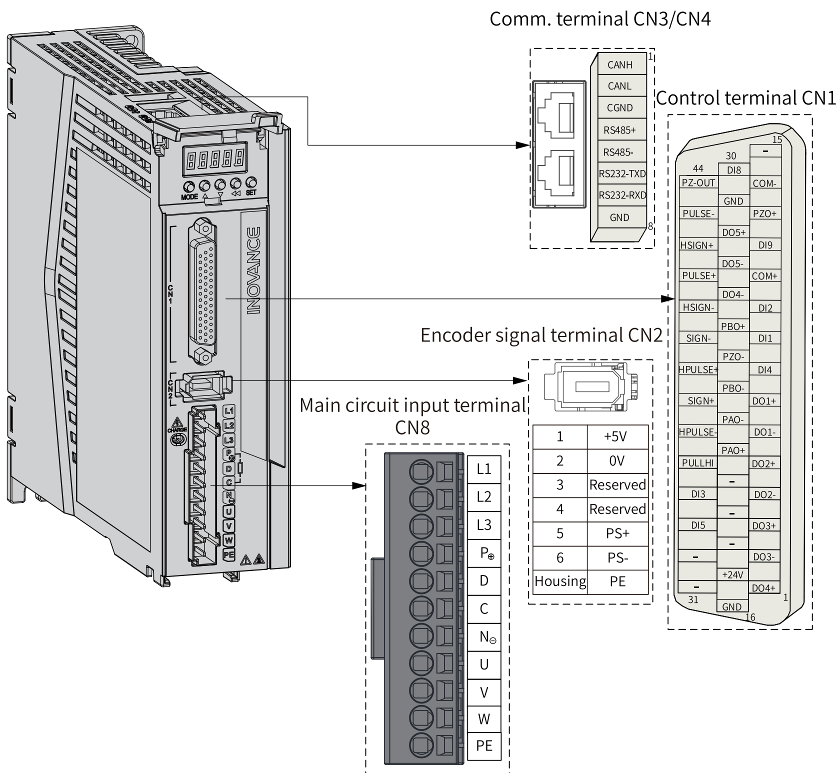



Figure 8-2 Terminal pin layout of servo drives in size B

## Servo drives in size C and size D (rated power: 1.0 kW to 1.5 kW): size C: SV630PS7R6I; size D: SV630PS012I

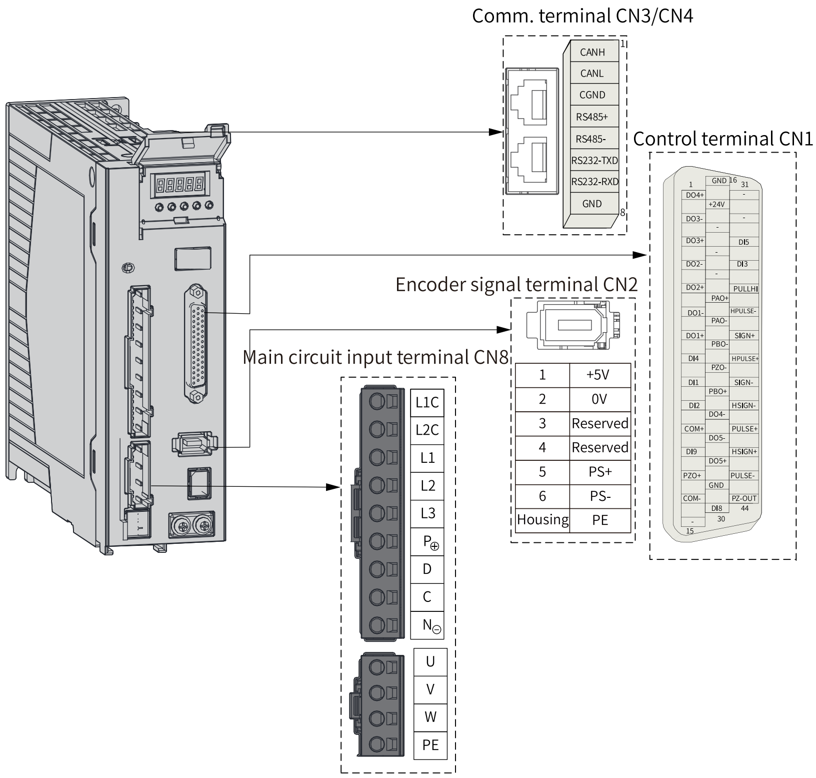



Figure 8-3 Terminal pin layout of servo drives in size C (SV630PS7R6I) and size D (SV630PS012I)

## Servo drives in size C and size D (rated power: 1.0 kW to 3.0 kW): size C: SV630PT3R5I and SV630PT5R4I; size D: SV630PT8R4I and SV630PT012I

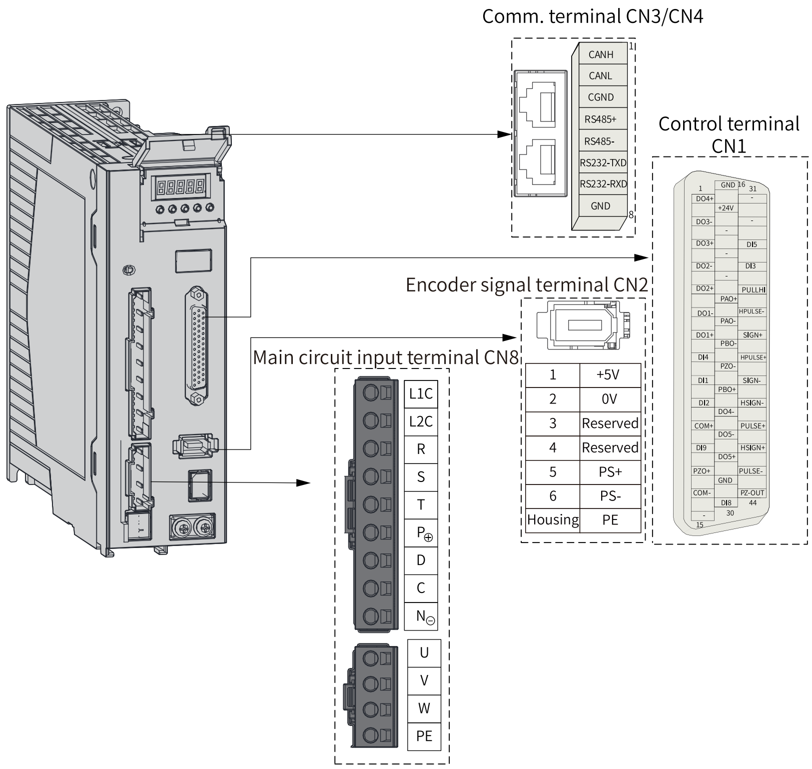



Figure 8-4 Terminal pin layout of servo drives in size C (SV630PT3R5I, SV630PT5R4I) and size D (SV630PT8R4I, SV630PT012I)

**Size E (rated power: 5.0 kW to 7.5 kW): SV630PT017I, SV630PT021I, and SV630PT026I**

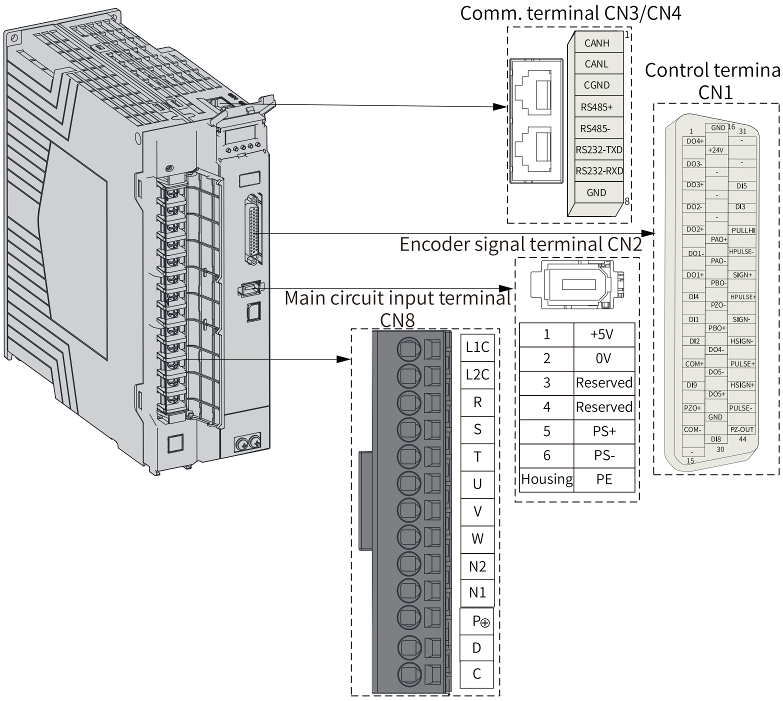



Figure 8-5 Terminal pin layout of servo drives in size E

# 8.2 Main Circuit Terminals

## 8.2.1 Wiring Precautions

- Do not connect the input power supply cables to the output terminals U, V, and W. Failure to comply will damage the servo drive.
- When cables are bundled in a duct, take current reduction ratio into consideration because of the poor cooling condition.
- 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.
- The bending radius of a cable must be more than 10 times its outer diameter to prevent the internal conductor from breaking due to long-time bending.
- Do not bundle power cables and signal cables together or route them through the same duct. Power cables and signal cables must be separated by at least 30 cm to prevent interference.
- High voltage may be still present in the servo drive after the power supply is switched off. Do not touch the power supply terminals within 15 minutes after power-off.
- Do not switch on/off the power supply frequently. If the power supply is switched on or off frequently within 1s, E740.0/E136.0/E430.0 may occur (see section Troubleshooting). In this case, power on the servo drive again after waiting for the specified ON/OFF interval. If frequent ON/OFF operation is needed, the time interval between ON and OFF must be at least 1 min.

The servo drive carries a capacitor in the power supply part, and this capacitor will be charged with a high current for 0.2s upon power-on. Turning on/off the power supply frequently affects the performance of main circuit components inside the servo drive.

- Use a grounding cable with the same cross-sectional area as the main circuit cable. If the cross-sectional area of the main circuit cable is less than 1.6 mm2, use a grounding cable with a cross-sectional area of 2.0 mm2.
- Do not power on the servo drive if terminal screws or cables are loose. Failure to comply may lead to a fire.

### 8.2.2 Main Circuit Wiring Requirements

Servo drive power input cables and motor cables may generate strong electromagnetic interference. To prevent the electromagnetic interference incurred by long-distance parallel routing and coupling between disturbing cables and control cables, keep a clearance of at least 30 cm between main circuit cables and signal cables. Main circuit cables include the RST cable, UVW cable, DC bus, and braking cable. 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.

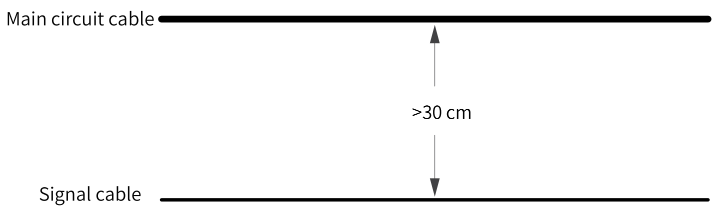



Figure 8-6 Cable layout

**Wiring requirements**

The wiring mode compliant with the Low Voltage Directive is supported.

- Terminals P⊕, C, and NΘ are used to connect optional parts. 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.
- Prevent foreign objects from entering the wiring area 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 a torque screwdriver, torque ratchet, or torque wrench to tighten terminal screws.
- When using an electric screwdriver to tighten terminal screws, set the electric screwdriver to low speed to prevent damage to the terminal screws.
- Tighten the terminal screws with an angle not greater than 5°. Failure to comply may damage the terminal screws.

## 8.2.3 Recommended Cable Specifications and Models

Table 8–1 Input/Output current specifications of the servo drive

| Drive model SV630P****I | | Rated input current (A) | Rated output current (A) | Maximum Output Current (A) |
|---|---|---|---|---|
| Single-phase 220V | | | | |
| Size A | S1R6 | 2.3 | 1.6 | 5.8 |
| | S2R8 | 4 | 2.8 | 10.1 |
| Size B | S5R5 | 7.9 | 5.5 | 16.9 |
| Size C | S7R6 | 9.6 | 7.6 | 23 |
| Size D | S012 | 12.8 | 11.6 | 32 |
| Three-phase 220V | | | | |
| Size C | S7R6 | 5.1 | 7.6 | 23 |
| Size D | S012 | 8 | 11.6 | 32 |
| Three-phase 380 V | | | | |
| Size C | T3R5 | 2.4 | 3.5 | 11 |
| | T5R4 | 3.6 | 5.4 | 14 |
| Size D | T8R4 | 5.6 | 8.4 | 20 |
| | T012 | 8 | 11.9 | 29.75 |
| Size E | T017 | 12 | 16.5 | 41.25 |
| | T021 | 16 | 20.8 | 52.12 |
| | T026 | 21 | 25.7 | 64.25 |

Table 8–2 Recommended main circuit cables

| Drive model SV630P****I | | | L1C, L2C | | L1, L2, L3/R, S, T | | P⊕, D, C, NΘ, N2, N1 | | U, V, W, PE | | Grounding terminal | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | Model | Rated input current (A) | ($mm^2$) | AWG | ($mm^2$) | AWG | ($mm^2$) | AWG | ($mm^2$) | AWG | ($mm^2$) | AWG |
| Single-phase 220V | | | | | | | | | | | | |
| Size A | S1R6 | 2.3 | 2 x 0.82 | 18 | 3 x 1.31 | 16 | 2 x 1.31 | 16 | 3 x 1.31 | 16 | 2.08 | 14 |
| | S2R8 | 4 | 2 x 0.82 | 18 | 3 x 1.31 | 16 | 2 x 1.31 | 16 | 3 x 1.31 | 16 | 2.08 | 14 |
| Size B | S5R5 | 7.9 | 2 x 0.82 | 18 | 3 x 1.31 | 16 | 2 x 1.31 | 16 | 3 x 1.31 | 16 | 2.08 | 14 |
| Size C | S7R6 | 9.6 | 2 x 0.82 | 18 | 3 x 1.31 | 16 | 2 x 1.31 | 16 | 3 × 1.31[1] | 16 | 2.08 | 14 |
| | | | 2 x 0.82 | | 3 x 1.31 | | 2 x 1.31 | | 3 × 2.08[2] | 14 | | 14 |
| Size D | S012 | 12.8 | 2 x 0.82 | 18 | 3 x 2.08 | 14 | 2 x 2.08 | 14 | 3 x 2.08 | 14 | 2.08 | 14 |
| Three-phase 220V | | | | | | | | | | | | |
| Size C | S7R6 | 5.1 | 2 x 0.82 | 18 | 3 x 1.31 | 16 | 2 x 1.31 | 16 | 3 × 1.31[1] | 16 | 1.31[1] | 16 |
| | | | | | | | | | 3 × 2.08[2] | 14 | 2.08[2] | 14 |
| Size D | S012 | 8 | 2 x 0.82 | 18 | 3 x 2.08 | 14 | 2 x 2.08 | 14 | 3 x 2.08 | 14 | 2.08 | 14 |
| Three-phase 380 V | | | | | | | | | | | | |
| Size C | T3R5 | 2.4 | 2 x 0.82 | 18 | 3 x 1.31 | 16 | 2 x 1.31 | 16 | 3 x 1.31 | 16 | 2.08 | 14 |
| | T5R4 | 3.6 | 2 x 0.82 | 18 | 3 x 1.31 | 16 | 2 x 1.31 | 16 | 3 x 1.31 | 16 | 2.08 | 14 |

| Drive model SV630P****I | | | L1C, L2C | | L1, L2, L3/R, S, T | | P⊕, D, C, NΘ, N2, N1 | | U, V, W, PE | | Grounding terminal | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | Model | Rated input current (A) | ($mm^2$) | AWG | ($mm^2$) | AWG | ($mm^2$) | AWG | ($mm^2$) | AWG | ($mm^2$) | AWG |
| Size D | T8R4 | 5.6 | 2 x 0.82 | 18 | 3 x 1.31 | 16 | 2 x 1.31 | 16 | 3 x 1.31 | 16 | 2.08 | 14 |
| | T012 | 8 | 2 x 0.82 | 18 | 3 x 2.08 | 14 | 2 x 2.08 | 14 | 3 x 2.08 | 14 | 2.08 | 14 |
| Size E | T017 | 12 | 2 x 0.82 | 18 | 3 x 5.27 | 10 | 2 x 5.27 | 10 | 3 × 3.33[3] | 12 | 3.33[3] | 12 |
| | | | | | | | | | 3 × 5.27[4] | 10 | 5.27[4] | 10 |
| | T021 | 16 | 2 x 0.82 | 18 | 3 x 5.27 | 10 | 2 x 5.27 | 10 | 3 x 5.27 | 10 | 5.27 | 10 |
| | T026 | 21 | 2 x 0.82 | 18 | 3 x 5.27 | 10 | 2 x 5.27 | 10 | 3 x 5.27 | 10 | 5.27 | 10 |

## *Note*

- [1]: For MS1H1-10C30CB motors.
- [2]: For MS1H2-10C30CB/MS1H3-85B15CB motors.
- [3]: For MS1H2-40C30CD/MS1H2-50C30CD motors.
- [4]: For MS1H3-44C15CD motors.

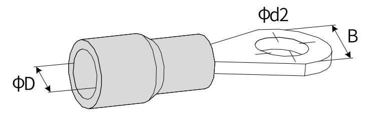
Table 8–3 Recommended Cable Specifications and Models

| Cable Type | Cable Size | OD (mm) |
|---|---|---|
| Power cable | 4×12AWG | 12.2±0.4 |
| | 4×14AWG | 10.5±0.3 |
| | 4×16AWG | 9.5±0.4 |
| | 4×18AWG | 7.8±0.2 |
| | 4×20AWG | 6.5±0.2 |
| Power cable shield | 4×12AWG | 12.9±0.4 |
| | 4×14AWG | 11.2±0.4 |
| | 4×16AWG | 10.1±0.4 |
| | 4×18AWG | 8.3±0.2 |
| | 4×20AWG | 6.5±0.2 |
| Power cable + brake cable | 4 × 20AWG + 2 × 24AWG | 6.5±0.2 |
| Brake cable | 2×18AWG | 5.8±0.2 |
| | 2×20AWG | 5.0±0.2 |

## Table 8–4 Main circuit cable lug and tightening torque

| Servo drive model SV630P****I | | | Recommended PVC Cable Model (at 40°C) | | | |
|---|---|---|---|---|---|---|
| SIZE | Model | Rated Input Current (A) | U, V, W, PE Cable Lug | Brake Cable Lug | Grounding Cable Lug | Tightening Torque (N·m) |
| Single-phase 220V | | | | | | |
| Size A | S1R6 | 2.3 | GTVE10008 | GTVE05008 | TVR2-4 | - |
| | S2R8 | 4 | | | TVR2-4 | - |
| Size B | S5R5 | 7.9 | | | TVR2-4 | - |
| Size C | S7R6 | 9.6 | | | TVR2-4 | - |
| Size D | S012 | 12.8 | GTVE15008 | GTVE10008 | TVR2-4 | - |
| Three-phase 220V | | | | | | |
| Size C | S7R6 | 5.1 | GTVE10008 | GTVE05008 | TVR2-4 | - |
| Size D | S012 | 8 | GTVE15008 | GTVE10008 | TVR2-4 | - |
| Three-phase 380 V | | | | | | |
| Size C | T3R5 | 2.4 | GTVE10008 | GTVE05008 | TVR2-4 | - |
| | T5R4 | 3.6 | | | TVR2-4 | - |
| Size D | T8R4 | 5.6 | | | TVR2-4 | - |
| | T012 | 8 | GTVE15008 | GTVE10008 | TVR2-4 | - |
| Size E | T017 | 12 | TVS1.25-4 | GTVE10008 | TVR1.25-4 | 1.36 |
| | T021 | 16 | TVS2-4 | GTVE10008 | TNR2-4 | 1.36 |
| | T026 | 21 | TVS3.5-4 | GTVE10008 | TNR3.5-4 | 1.36 |

## Table 8–5 TVR2-4 cable lug

| Lug Model | | D (mm) | d2 (mm) | B (mm) | Dimension Drawing |
|---|---|---|---|---|---|
| TVR | 2-4 | 4.5 | 4.3 | 8.5 |  |

## Table 8–6 Recommended terminal blocks

| Servo drive model SV630P****I | | 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 | |

| Servo drive model SV630P****I | | Terminal Block |
|---|---|---|
| Size E | T017 | - |
| | T021 | |
| | T026 | |

Table 8–7 Specifications of motor output cables

| MS1H1/H4 05B–10C (applicable to 0.05 kW–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°C)<br>4Ex20AWG+2Cx24AWG | UL2517 (rated temperature: 105°C)<br>4Ex20AWG+2Cx24AWG | UL2517 (rated temperature: 105°C)<br>4Ex20AWG+2Cx24AWG |
| | Power cable: 20AWG (0.52 $mm^2$); OD of insulation: 1.7 mm | Power cable: 20AWG (0.52 $mm^2$); OD of insulation: 1.7 mm | Power cable: 20AWG (0.52 $mm^2$); OD of insulation: 1.7 mm |
| | Brake cable: 24AWG (0.205 $mm^2$); OD of insulation: 1.1 mm | Brake cable: 24AWG (0.205 $mm^2$); OD of insulation: 1.1 mm | Brake cable: 24AWG (0.205 $mm^2$); OD of insulation: 1.1 mm |
| Sheath diameter | 6.5±0.2 mm | | |
| Internal structure and conductor colors |  |  |  |
| Fill in "X.X" in the model number with cable length. | | | |

Table 8–8 Specifications of motor output cables

| MS1H2 10C–50C (Applicable to 1 kW–5 kW)/MS1H3 85B–18C (Applicable to 850 W–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°C)<br>4Ex16AWG+2Cx18AWG | UL2586 (rated temperature: 105°C)<br>4Ex16AWG+2Cx18AWG | UL2586 (rated temperature: 105°C)<br>4Ex16AWG+2Cx18AWG |
| | Power cable: 16AWG (1.31 $mm^2$) OD of insulation: 3.1 mm | Power cable: 16AWG (1.31 $mm^2$) OD of insulation: 3.25 mm | Power cable: 16AWG (1.31 $mm^2$) OD of insulation: 3.25 mm |
| | Brake cable: 18AWG (0.823 $mm^2$) OD of insulation: 2.0 mm | Brake cable: 18AWG (0.823 $mm^2$) OD of insulation: 2.15 mm | Brake cable: 18AWG (0.823 $mm^2$) OD of insulation: 2.15 mm |
| Sheath diameter | 9.5±0.3 mm (main circuit) | 10.0±0.3 mm (main circuit) | 10.5±0.3 mm (main circuit) |

| MS1H2 10C–50C (Applicable to 1 kW–5 kW)/MS1H3 85B–18C (Applicable to 850 W–1.8 kW) | | | |
|---|---|---|---|
| Internal structure and conductor colors |  |  |  |
| Fill in "X.X" in the model number with cable length. | | | |

Table 8–9 Specifications of motor output cables

| MS1H3 29C–75C (Applicable to 2.9 kW–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°C) 4Ex12AWG+2Cx18AWG | UL2586 (rated temperature: 105°C) 4Ex12AWG+2Cx18AWG | UL2586 (rated temperature: 105°C) 4Ex12AWG+2Cx18AWG |
| | Power cable: 12AWG (3.31 mm$^2$) OD of insulation: 4.1 mm | Power cable: 12AWG (3.31 mm$^2$) OD of insulation: 4.2 mm | Power cable: 12AWG (3.31 mm$^2$) OD of insulation: 4.2 mm |
| | Brake cable: 18AWG (0.823 mm$^2$) OD of insulation: 2.0 mm | Brake cable: 18AWG (0.823 mm$^2$) OD of insulation: 2.15 mm | Brake cable: 18AWG (0.823 mm$^2$) OD of insulation: 2.15 mm |
| Sheath diameter | 12.2±0.4 mm (main circuit) | 12.5±0.4 mm (main circuit) | 13.2±0.4 mm (main circuit) |
| Internal structure and conductor colors |  |  |  |
| Fill in "X.X" in the model number with cable length. | | | |

**Cable selection**

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

Shielded cables are divided into three-conductor shielded cables and four-conductor shielded cables, as shown in the following figure.

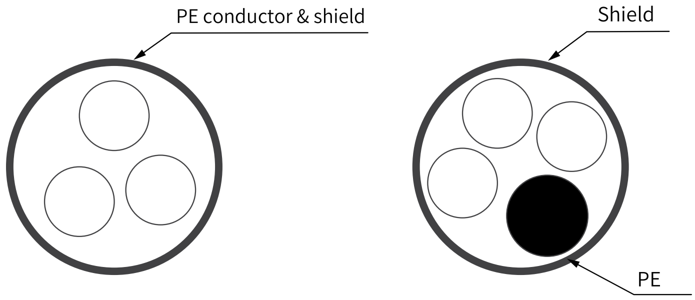



Figure 8-7 Recommended power cable

If the conductivity of the three-conductor cable shield is insufficient, add an extra PE cable. Or use a four-core shielded cable, with one core being the PE wire. The shield of the shielded cable is comprised of coaxial cooper braids to suppress radio frequency interference. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than 90%.

Observe national or regional regulations when selecting cable dimensions. The IEC cable must meet the following requirements:

- EN 60204-1 and IEC 60364-5-52 standards
- Use PVC insulated cables with copper conductors.
- Ambient temperature: 40°C; cable surface temperature: 70°C. Contact the manufacturer if the ambient temperature exceeds 40°C).

***Note***

If the recommended cable specifications for peripheral devices or optional parts exceed the applicable cable specification range, contact Inovance.

## 8.2.4 Main circuit terminal layout

### Size A (rated power: 0.2 kW–0.4 kW): SV630PS1R6I, SV630PS2R8I

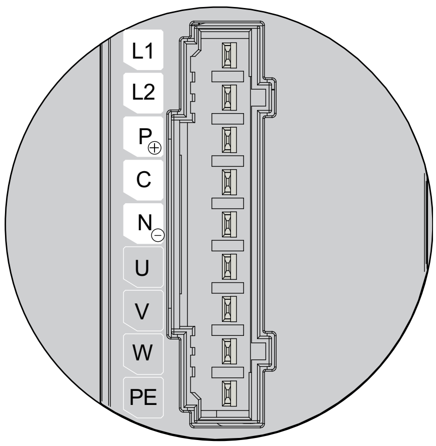



Figure 8-8 Main circuit terminal pins of size A drive

Table 8–10 Description of main circuit terminal pins of servo drives in size A

| No. | Parameter Name | Description |
|---|---|---|
| 1 | L1, L2<br>(power input terminals) | See the nameplate for the rated voltage class. |
| 2 | P⊕, NΘ<br>(DC bus terminals) | Used by the common DC bus for multiple servo drives. |
| | P⊕, C<br>Terminals for connecting external braking resistor | If an external regenerative resistor is needed, connect it between terminals P⊕ and C. |
| 3 | U, V, W<br>(terminals for connecting the servo motor) | Connected to U, V, and W phases of the servo motor. |
| 4 | Motor grounding terminal | Connected to the grounding terminal of the motor for grounding purpose. |

## Rated power: (SIZE B: 0.75 kW): SV630PS5R5I

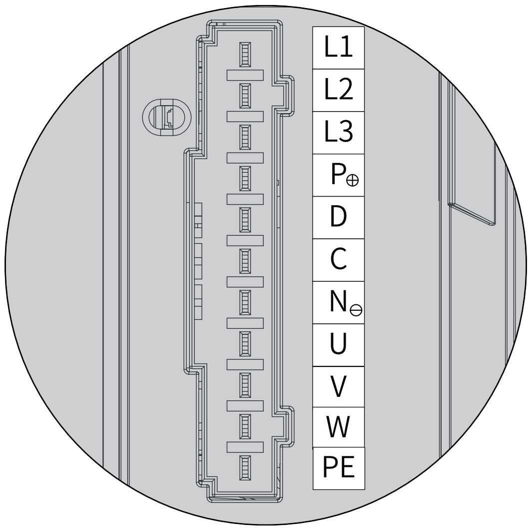



Figure 8-9 Pin assignment of main circuit terminal of servo drives in SIZE B

Table 8–11 Description of main circuit terminal pins of servo drives in SIZE B

| No. | Parameter Name | Description |
|---|---|---|
| 1 | L1, L2, L3<br>(power input terminals) | See the nameplate for the rated voltage class.<br>Note: S5R5 (750W) models support single-phase 220 V input only, with a 220 V power supply connected between terminals L1 and L2. |
| 2 | P⊕, NΘ<br>(DC bus terminals) | Used by the common DC bus for multiple servo drives. |
| | P⊕, D, C<br>Terminals for connecting external braking resistor | If an external regenerative resistor is needed, connect it between terminals P⊕ and C. Servo drives in size B are equipped with the built-in regenerative resistor, with terminals P⊕ and D jumpered by default. |

| No. | Parameter Name | Description |
|---|---|---|
| 3 | U, V, W<br>(terminals for connecting the servo motor) | Connected to U, V, and W phases of the servo motor. |
| 4 | Motor grounding terminal | Connected to the grounding terminal of the motor for grounding purpose. |

## Rated power (SIZE C/SIZE D: 1.0kW–1.5kW): SV630PS7R6I, SV630PS012I

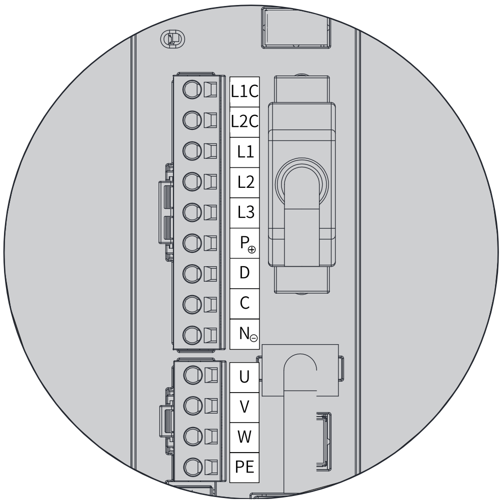



Figure 8-10 Main circuit terminal pin layout of servo drives in size C (SV630PS7R6I) and size D (SV630PS012I)

Table 8–12 Description of main circuit terminal pins of servo drives in size C (SV630PS7R6I) and size D (SV630PS012I)

| No. | Parameter Name | Description |
|---|---|---|
| 1 | L1C, L2C<br>Control circuit power input terminals | See the nameplate for the rated voltage class. |
| 2 | L1, L2, L3<br>Main circuit power input terminals | See the nameplate for the rated voltage class. |
| 3 | P⊕, NΘ<br>(DC bus terminals) | Used by the common DC bus for multiple servo drives. |
| | P⊕, D, C<br>Terminals for connecting external braking resistor | If an external regenerative resistor is needed, connect it between terminals P⊕ and C. SIZE C and SIZE D use a built-in regenerative resistor, with terminals P⊕ and D jumped. |
| 4 | U, V, W<br>(terminals for connecting the servo motor) | Connected to U, V, and W phases of the servo motor. |
| 5 | Motor grounding terminal | Connected to the grounding terminal of the motor for grounding purpose. |

## Servo drives in size C and size D (rated power: 1.0 kW to 3.0 kW): SV630PT3R5I, SV630PT5R4I, SV630PT8R4I, and SV630PT012I

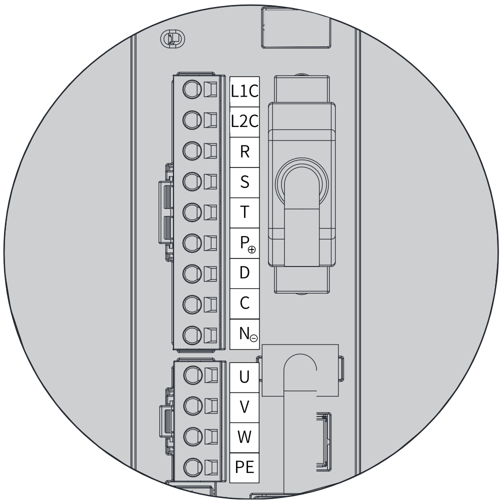



Figure 8-11 Main circuit terminal pin layout of servo drives in size C (SV630PT3R5I, SV630PT5R4I) and size D (SV630PT8R4I, SV630PT012I)

Table 8–13 Description of main circuit terminal pins of servo drives in size C (SV630PT3R5I, SV630PT5R4I) and size D (SV630PT8R4I, SV630PT012I)

| No. | Parameter Name | Description |
|---|---|---|
| 1 | L1C, L2C<br>Control circuit power input terminals | See the nameplate for the rated voltage class. |
| 2 | R, S, and T<br>Main circuit power input terminals | See the nameplate for the rated voltage class. |
| 3 | P⊕, NΘ<br>(DC bus terminals) | Used by the common DC bus for multiple servo drives. |
|  | P⊕, D, C<br>Terminals for connecting external braking resistor | If an external regenerative resistor is needed, connect it between terminals P⊕ and C. SIZE C and SIZE D use a built-in regenerative resistor, with terminals P⊕ and D jumped. |
| 4 | U, V, W<br>(terminals for connecting the servo motor) | Connected to U, V, and W phases of the servo motor. |
| 5 | Motor grounding terminal | Connected to the grounding terminal of the motor for grounding purpose. |

### Size E (rated power: 5.0 kW to 7.5 kW): SV630PT017I, SV630PT021I, and SV630PT026I

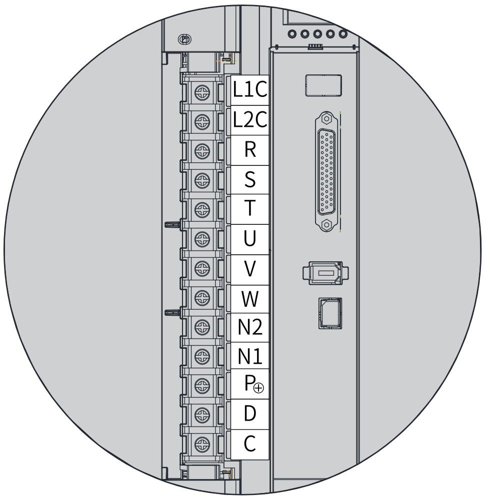



Figure 8-12 Pin assignment of main circuit terminal of servo drives in size E

Table 8–14 Description of main circuit terminal pins of servo drives in size E

| No. | Parameter Name | Description |
|---|---|---|
| 1 | L1C, L2C<br>Control circuit power input terminals | See the nameplate for the rated voltage class. |
| 2 | R, S, and T<br>Main circuit power input terminals | See the nameplate for the rated voltage class. |
| 3 | U, V, W<br>(terminals for connecting the servo motor) | Connected to U, V, and W phases of the servo motor. |
| 4 | N2, N1<br>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.<br>Install a DC reactor between terminals N1 and N2. |
| 5 | P⊕, D, C<br>Terminals for connecting external braking resistor | If an external regenerative resistor is needed, connect it between terminals P⊕ and C. SIZE E use a built-in regenerative resistor, with terminals P⊕ and D jumped. |

## 8.2.5 Connecting the Motor (UVW)

Keep the lead wire of the motor cable shield as short as possible, with its width (b in the following figure) not shorter than 1/5 of its length (a in the following figure).

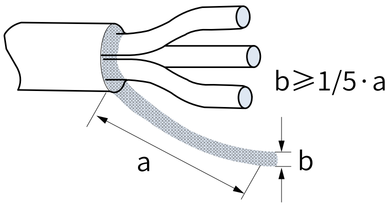



Figure 8-13 Lead-out of the motor cable shield

- The following figure shows the wiring diagram for a terminal-type motor.

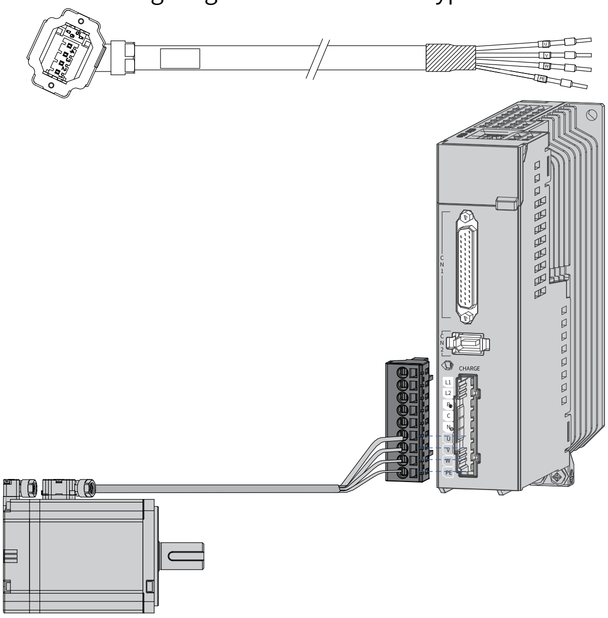
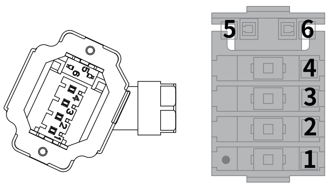


Figure 8-14 Wiring between the servo drive and terminal-type motor

Table 8–15 Description of the power cable connector (motor side)

| Flange Size [1] | Illustration | Pin | | |
|---|---|---|---|---|
| | | Pin No. | Signal Name | Color |
| Terminal-type:<br>40<br>60<br>80 | <br>Black 6-pin connector | 1 | PE | Yellow/Green |
| | | 2 | W | Red |
| | | 3 | V | Black |
| | | 4 | U | White |
| | | 5 | Brake (polarity insensitive) | Brown |
| | | 6 | | Blue |

## *Note*

- [1] The flange size refers to the width of the mounting flange (in mm).
- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.

- The connection diagram for a flying leads type motor is shown in the following figure.

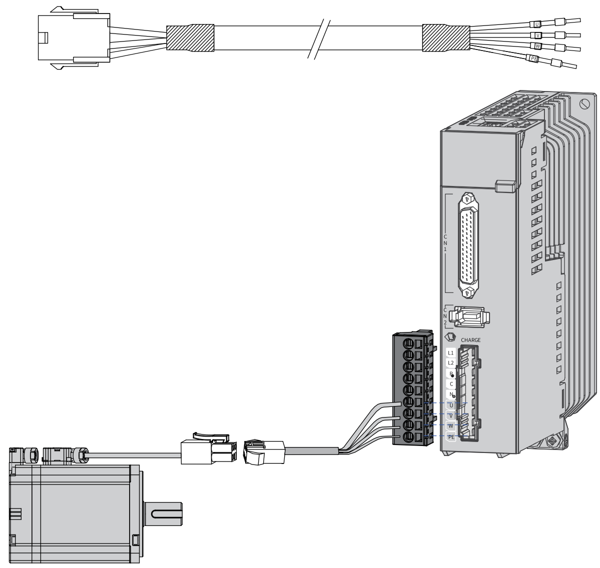
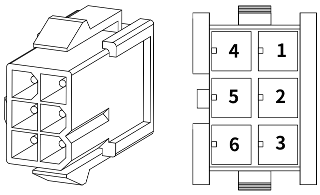


Figure 8-15 Wiring between the servo drive and terminal-type motor

Table 8–16 Description of the power cable connector (motor side)

| Flange Size [1] | Illustration | Pin | | |
|---|---|---|---|---|
| | | Pin No. | Signal Name | Color |
| Flying leads type:<br>40<br>60<br>80 |   Black 6-pin connector<br>Recommendation: Plastic housing: MOLEX-50361736 Terminal: MOLEX-39000061 | 1 | U | White |
| | | 2 | V | Black |
| | | 4 | W | Red |
| | | 5 | PE | Yellow/Green |
| | | 3 | Brake (polarity insensitive) | Brown |
| | | 6 | | Blue |

---

***Note***

- [1]: The flange size refers to the width of the mounting flange.
- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.

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- The following table describes the connector for high-power motor power cables.

Table 8–17 Description of the power cable connector (motor side)

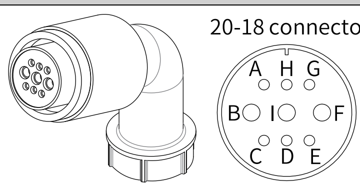
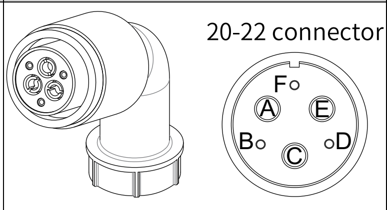
| Flange Size [1] | Illustration | Pin | | |
|---|---|---|---|---|
| | | Pin No. | Signal Name | Color |
| 100<br>130 | 20-18 connector   MIL-DTL-5015 series 3108E20-18S military-spec connector | B | U | Blue |
| | | I | V | Black |
| | | F | W | Red |
| | | G | PE | Yellow/Green |
| | | C | Brake (polarity insensitive) | Red |
| | | E | | Black |

Table 8–18 Description of the power cable connector (motor side)

| Flange Size [1] | Illustration | Pin | | |
|---|---|---|---|---|
| | | Pin No. | Signal Name | Color |
| 180 |  MIL-DTL-5015 series 3108E20-22S military-spec connector | A | U | Blue |
| | | C | V | Black |
| | | E | W | Red |
| | | F | PE | Yellow/Green |
| | | B | Brake (polarity insensitive) | Red |
| | | D | | Black |

## *Note*

- [1]: The flange size refers to the width of the mounting flange.
- Power cable colors are subject to the actual product. All cable colors mentioned in this guide refer to Inovance cable colors.

## 8.2.6 Wiring of External EMC Filter

Install the filter near the input terminals of the drive. The cable between the filter and the drive must be shorter than 30 cm. Connect the grounding terminal of the filter together with the grounding terminal of the drive. Ensure the filter and the drive are installed onto the same conductive mounting surface that is connected to the main grounding of the control cabinet.

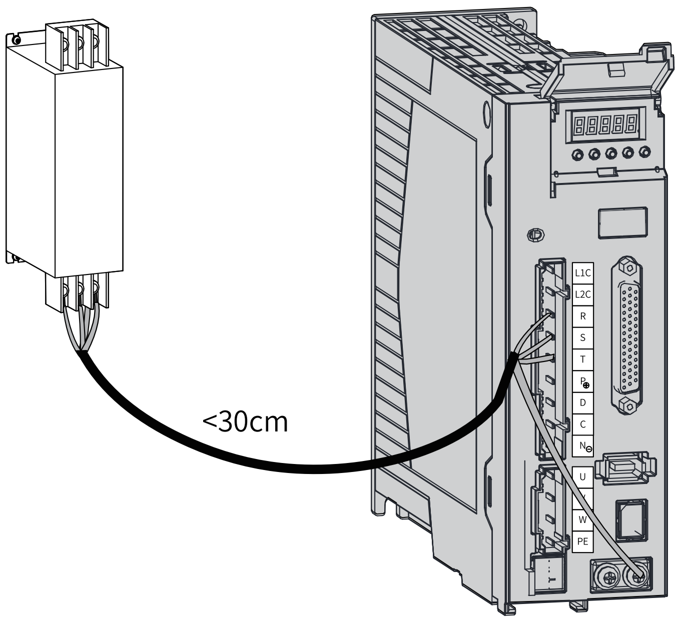



Figure 8-16 Installing the filter

## 8.2.7 Wiring of the Power Supply

- Single-phase 220 V models: SV630PS1R6I, SV630PS2R8I, SV630PS5R5I, SV630PS7R6I and SV630PS012I

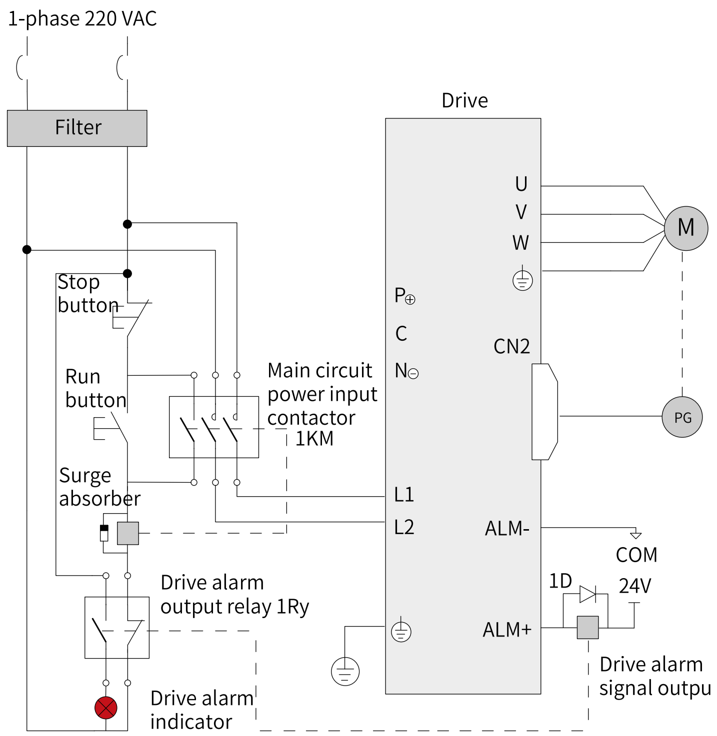



Figure 8-17 Main circuit wiring

## *Note*

- 1KM: Electromagnetic contactor; 1Ry: Relay; 1D: Flywheel diode
- DO is set as alarm output (ALM+/-). When the servo drive alarms, the power supply will be cut off automatically. SV630PS1R6I and SV630PS2R8I are not configured with built-in regenerative resistors, if the regenerative resistor is needed, connect an external regenerative resistor between P⊕ and C.

- Three-phase 220 V models: SV630PS7R6I, SV630PS012I

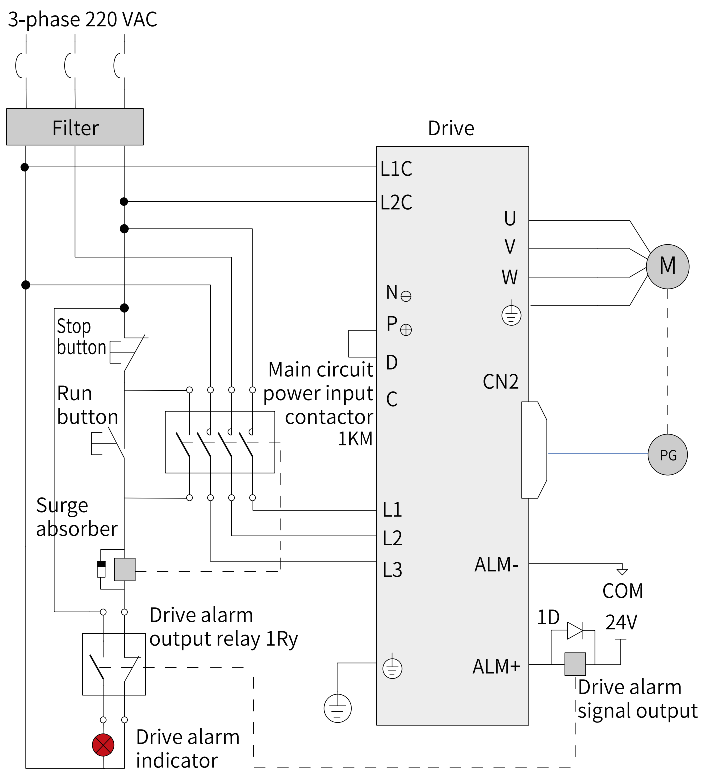



Figure 8-18 Main circuit wiring of three-phase 220 V models

## 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 models: SV630PT3R5I, SV630PT5R4I, SV630PT8R4I, SV630PT012I, SV630PT021I, SV630PT026I

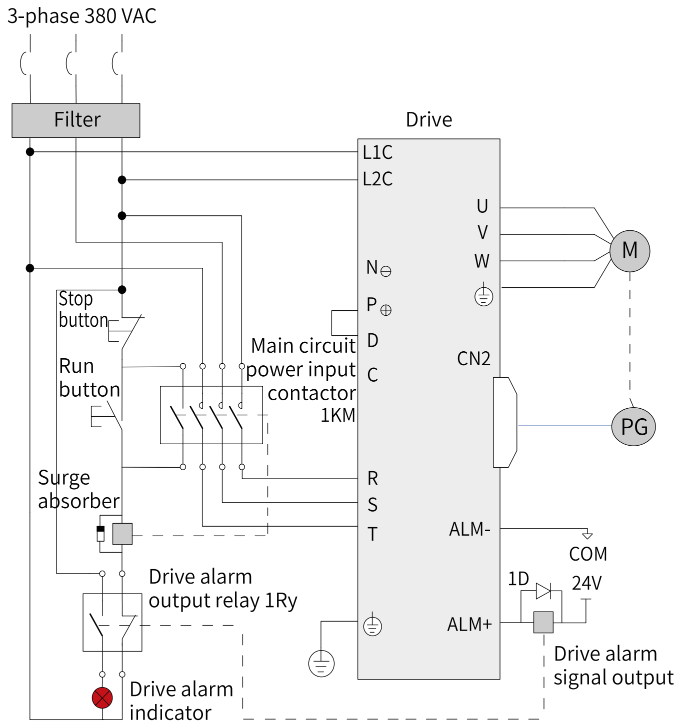



Figure 8-19 Main circuit wiring of three-phase 380V models

## *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.

## 8.2.8 Grounding and Wiring

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

**Warning**

- To prevent electric shocks, ground the grounding terminal properly. Observe related national or regional regulations during grounding.
- To prevent electric shocks, ensure the protective grounding conductor complies with technical specifications and local safety standards. Keep the length of the grounding cable as short as possible. As the leakage current of the equipment may exceed 3.5 mA, it is recommended to use a copper protective grounding conductor with a cross-sectional area of at least 10 $mm^2$, or use two protective grounding conductors with the same specification.
- The dimensions of the grounding cable must comply with the electrical device technical standards. Keep the length of the grounding cable as short as possible. Failure to comply will lead to unstable potential in the grounding terminals away from the grounding point due to leakage current, resulting in an electric shock.

Caution

- For use of multiple servo drives, observe all the grounding instructions for the drive. Improper grounding of the device will lead to malfunction of the drive and the device.
- Do not share the same grounding cable with other devices (such as welding machines or high-current electrical devices). Improper grounding of the device will lead to drive or device faults caused by electrical interference.
- For use of multiple servo drives, observe all the grounding instructions for the drive. Improper grounding of the device will lead to malfunction of the drive and the device.
- For drives equipped with optional VDR and insulation resistor grounding screws, remove the grounding screw before voltage resistance test. Failure to comply may cause the drive to fail the test.

## Grounding requirements

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

- 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 serial.
- Ground the grounding terminal properly. Improper grounding will lead to device malfunction or damage.
- Do not connect the grounding terminal to the N terminal of the neutral wire of the power supply.
- It is recommended to install the drive to a conductive metal surface. Ensure the whole conductive bottom of the drive is connected properly to the mounting face.
- Tighten the grounding screw with specified tightening torque to prevent the protective grounding conductor from being secured improperly.

## Single-drive grounding

Installation of an individual drive:

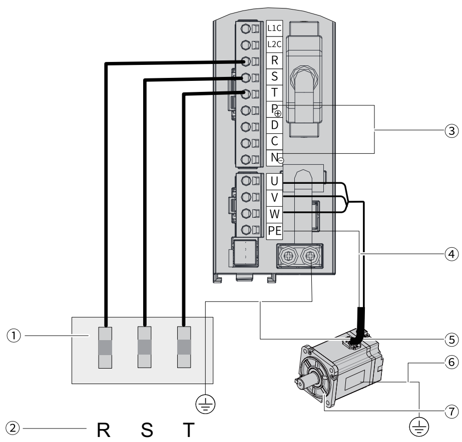



Table 8–19 Single-drive grounding

| No. | Description |
| --- | --- |
| ① | Input protection (fuse or circuit breaker) Connect the lower end of the fuse to the filter. |
| ② | Input power supply |
| ③ | Do not ground the DC bus terminal or the regenerative resistor terminal. |
| ④ | Connect the output PE terminal of the servo drive to the motor output cable shield. |

| No. | Description |
| --- | --- |
| ⑤ | Connect the PE cable on the input power supply side to the input PE terminal of the servo drive. |
| ⑥ | Ground the motor enclosure. |
| ⑦ | Three-phase motor |

***Note***

The main circuit terminal layout varies with different models and is subject to the physical product.

## Multi-drive grounding

Side-by-side installation of multiple drives:

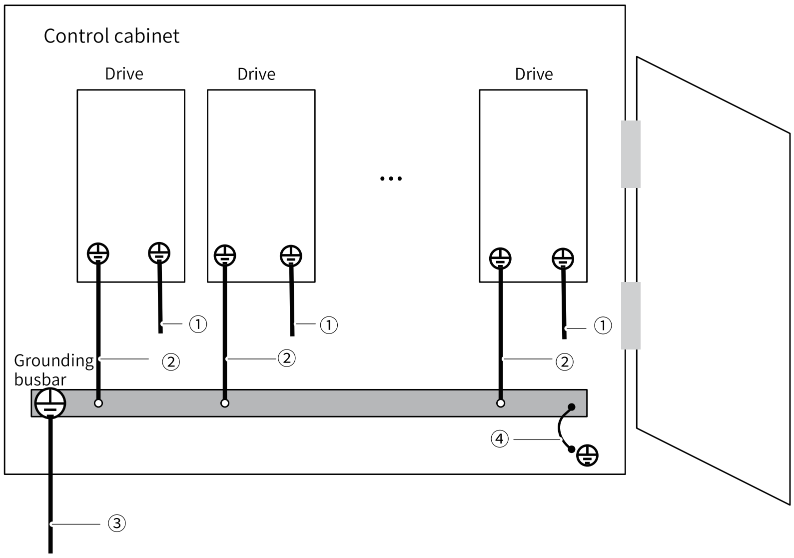



Table 8–20 Description for grounding of multiple drives installed side by side

| No. | 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 servo 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. |

## Grounding 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 8–21 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 PE 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 (such as RS485) and signal cables drawn from the control cabinet. |
| 6 | Place the power input filter in a position near the input interface of the control cabinet. |
| 7 | Apply spray coating to each grounding point in the control cabinet. |

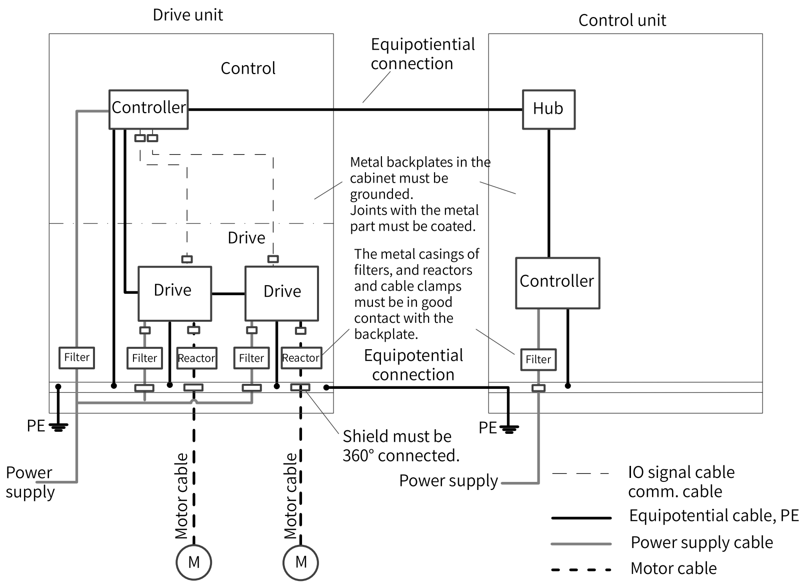



Figure 8-20 Recommended wiring for the control cabinet system

# 8.3 Description of Control Terminal (CN1)

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

## I/O signal cable selection

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 pairs for digital signals.

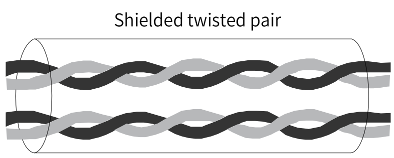



Figure 8-21 Diagram of shielded twisted pairs

## Control Cable Specifications

Table 8–22 Recommended Control Cable Specifications

| Control terminal | Connector Kit/Material No. | AWG |
|---|---|---|
| CN1 | DB44 | 24 to 30 |

## I/O signal layout

I/O signals include DI/DO signals and relay output signals.

Observe the following requirement during control circuit wiring:

Route the control circuit cables and main circuit cables or other power cables through different routes with a distance of at least 30 cm. Failure to comply may result in disturbed I/O signals.

## 8.3.1 Terminal Layout

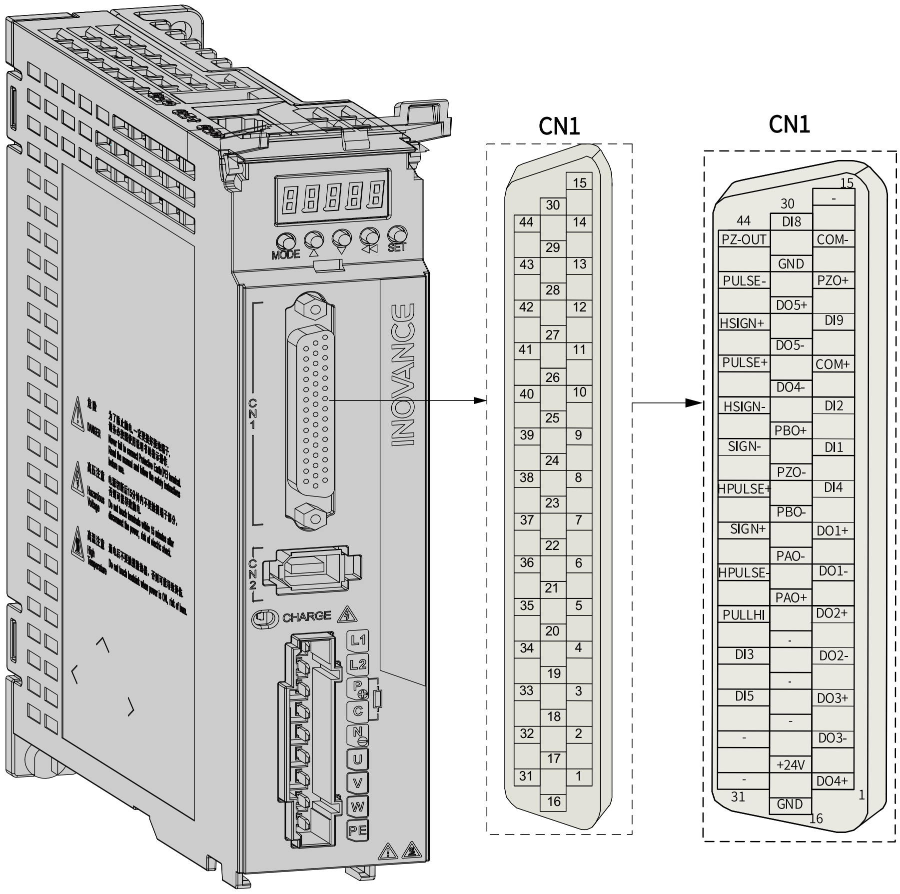



Figure 8-22 Control terminal pin layout of servo drives in sizes A and B

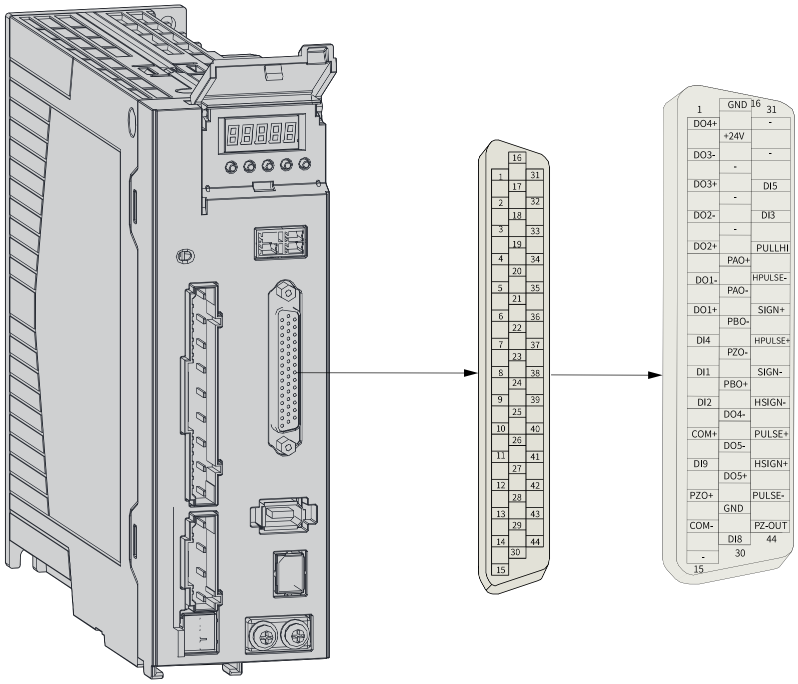



Figure 8-23 Control terminal pin layout of servo drives in sizes C, D, and E

## *Note*

- CN1: Plastic housing of plug on cable side: DB25P (manufacturer: SZTDK), black housing. Core: HDB44P male solder (manufacturer: SZTDK).
- Use shielded cables as signal cables, with both ends of the shielded cable grounded.

Table 8–23 Position Reference Input Signals

| Signal Name | | Pin No. | Function | |
|---|---|---|---|---|
| Position reference | PULSE+ | 41 | Low-speed pulse reference input mode:<br>• Differential drive input<br>• Open-collector | Pulse input form:<br>• Direction+Pulse<br>• Quadrature pulse of phases A and B<br>• 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 8–24 Description of DI/DO signals

| Signal Name | | Default Function | Pin No. | Function |
|---|---|---|---|---|
| General | DI1 | P-OT | 9 | Positive limit switch |
| | DI2 | N-OT | 10 | Negative limit switch |
| | DI3 | INHIBIT | 34 | Pulse input forbidden |
| | DI4 | ALM-RST | 8 | Alarm reset (edge-triggered) |
| | DI5 | S-ON | 33 | Servo ON |
| | DI8 | HomeSwitch | 30 | Home switch |
| | DI9 | Reserved | 12 | - |
| | +24V | | 17 | Internal 24 V power supply, voltage range: 20 to 28 V, maximum output current: 200 mA |
| | 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 | Homing completed |
| | DO5- | HomeAttain– | 27 | |

Table 8–25 Encoder frequency-division output signals

| Signal Name | Default Function | Pin No. | Function | |
|---|---|---|---|---|
| General | PAO+ | 21 | Phase A frequency-division output signal | Quadrature frequency-division pulse output signals 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 | Housing | - | |

## 8.3.2 Position Reference Input Signals

For descriptions of position reference input signals, see *"Table 8–23" on page 148*.

The reference pulses and signs on the host controller side can be outputted through the differential drive or open-collector. The following table lists the maximum input frequency and minimum pulse width.

Table 8–26 Correspondence between pulse input frequency and pulse width

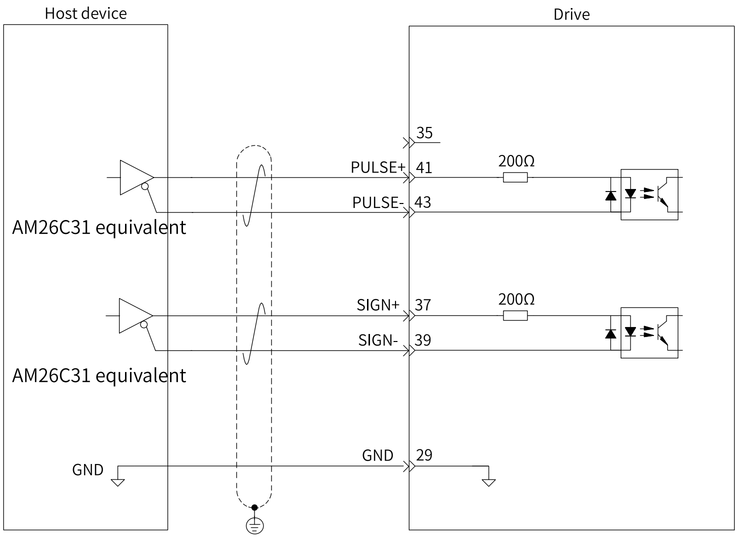
| Pulse Mode | | Max. Frequency (pps) | Minimum Pulse Width (us) | Voltage (V) |
|---|---|---|---|---|
| Low speed | Differential | 200k | 2.5 | > 3.0 |
| | Open-collector | 200k | 2.5 | 24 |
| High-speed differential | | 4M | 0.125 | > 3.0 |

## Note

- You can either use high-speed pulses or low-speed pulses, but not both of them together.
- If the output pulse width of the host controller is smaller than the minimum pulse width, a pulse receiving error will occur on the drive.
- The symbol represents shielded twisted pairs.

## Low-speed pulse reference input

- Differential mode




## Note

This is a 5 V system. Do not input 24 V power.

- Open-collector mode

  ① For use of the internal 24 V power supply of the servo drive:

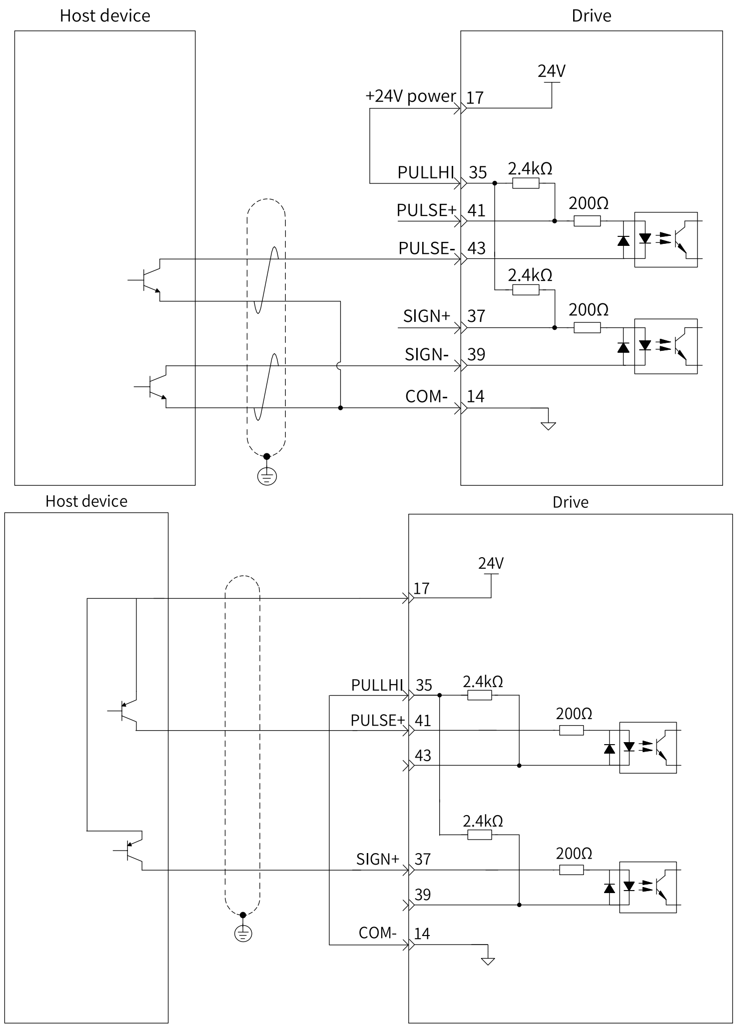



Figure 8-24 Correct: The internal 24 V power supply of the servo drive is used.

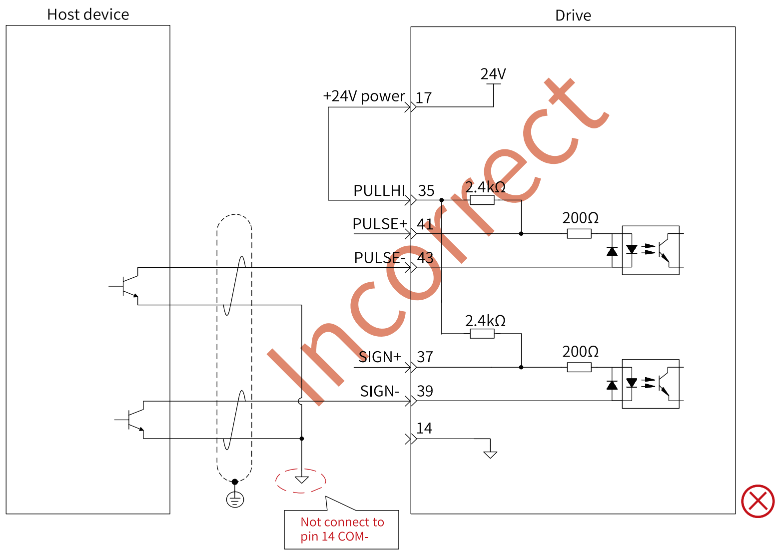
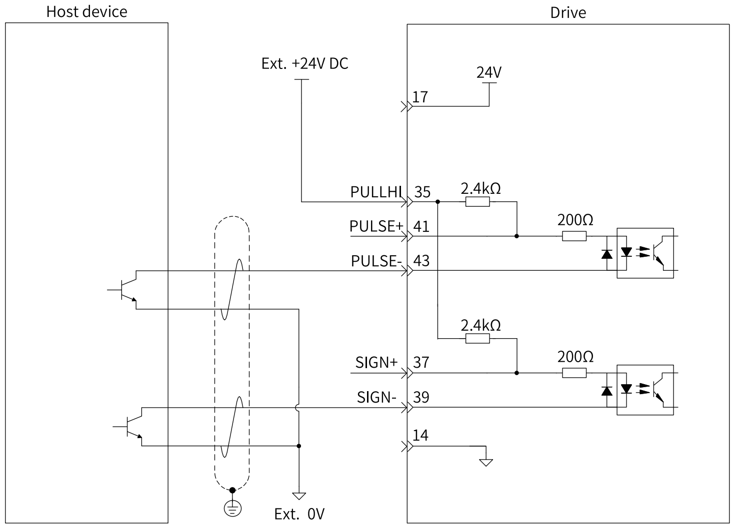
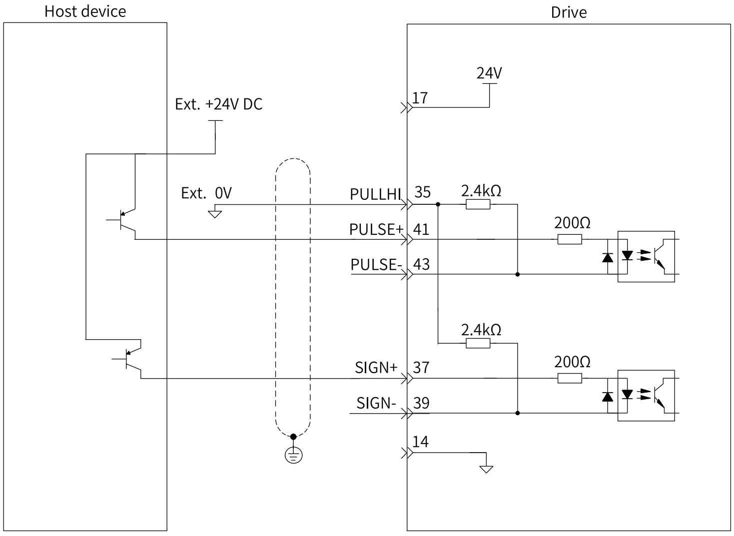



Figure 8-25 Incorrect: Pin 14 (COM–) is not connected, leading to failure in forming a closed-loop circuit.

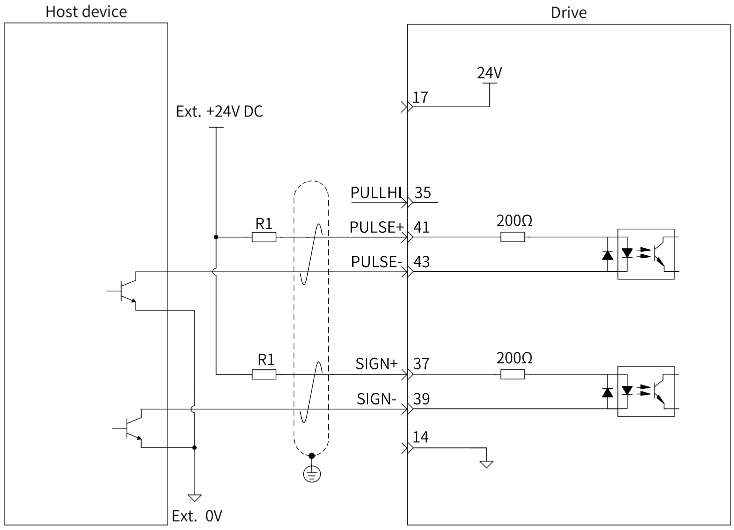
When the external power supply is used:

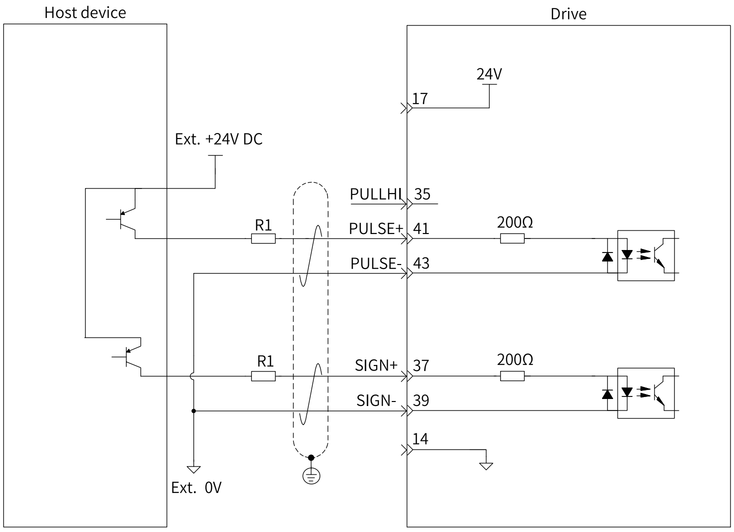
- Scheme 1: Using the built-in resistor (recommended)




- Scheme 2: Using the external resistor






Select resistor R1 based on the following formula.

$$\frac{V_{cc} - 1.5}{R1 + 200} = 10\ \text{mA}$$

Table 8–27 Recommended resistance of R1

| $V_{CC}$ Voltage (V) | R1 Resistance (kΩ) | R1 Power (W) |
|---|---|---|
| 24 | 2.4 | 0.5 |
| 12 | 1.5 | 0.5 |

- The following figures show examples of improper wiring.
- 1: The current limiting resistor is not connected, resulting in terminal burnout.

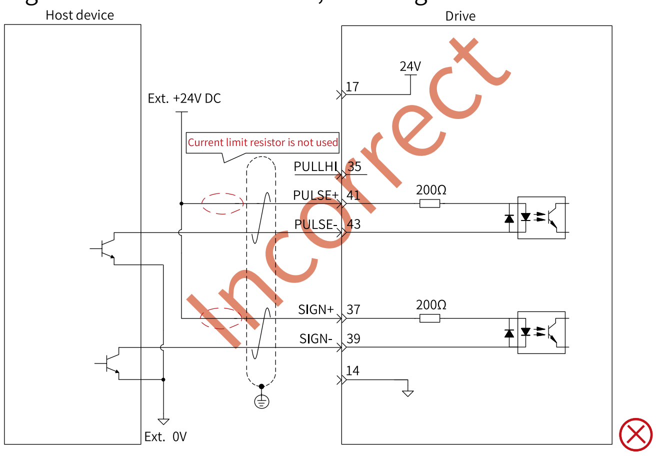



Figure 8-26 Incorrect wiring example 1: The current limiting resistor is not connected, resulting in terminal burnout.

## Note

- Some models comes with a detection feature 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.

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

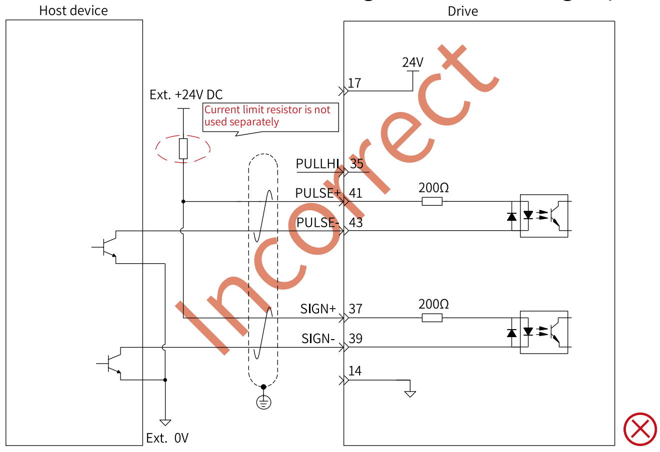



Figure 8-27 Incorrect wiring example 2: Multiple terminals share the same current limiting resistor, resulting in pulse receiving error.

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

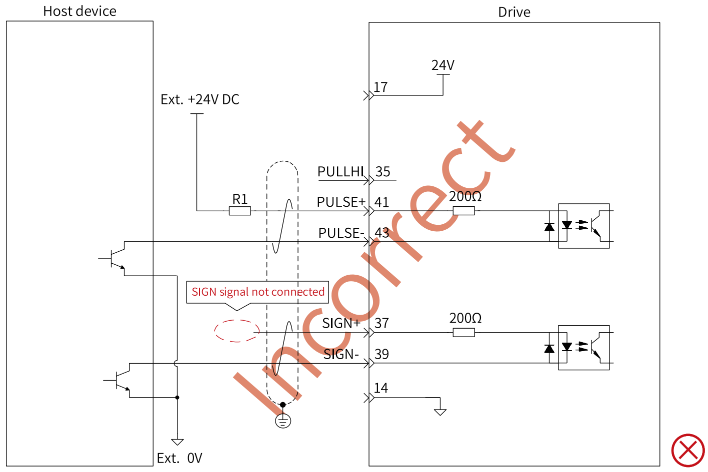



Figure 8-28 Incorrect wiring example 3: The SIGN port is not connected, preventing these two ports from receiving pulses.

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

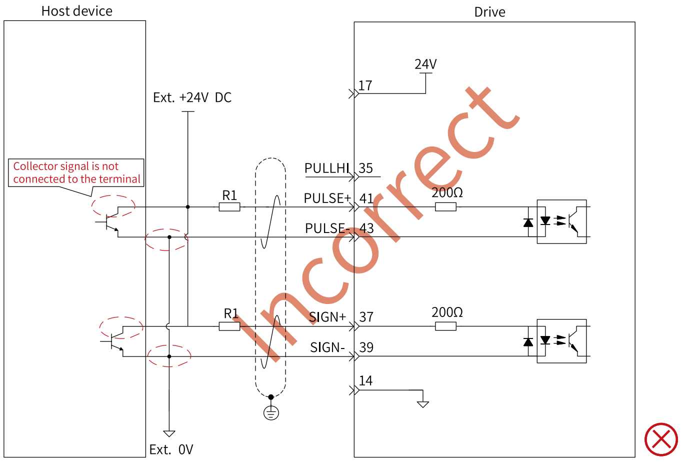



Figure 8-29 Incorrect wiring example 4: Terminals are connected incorrectly, resulting in terminal burnout.

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

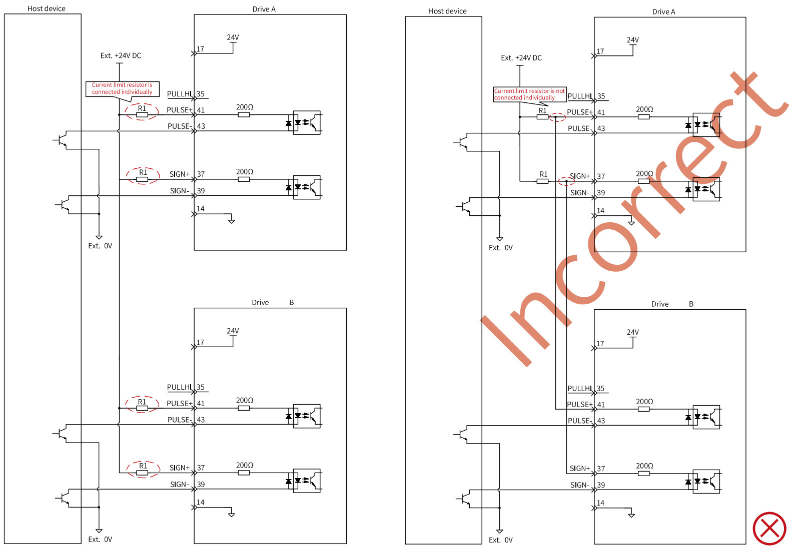
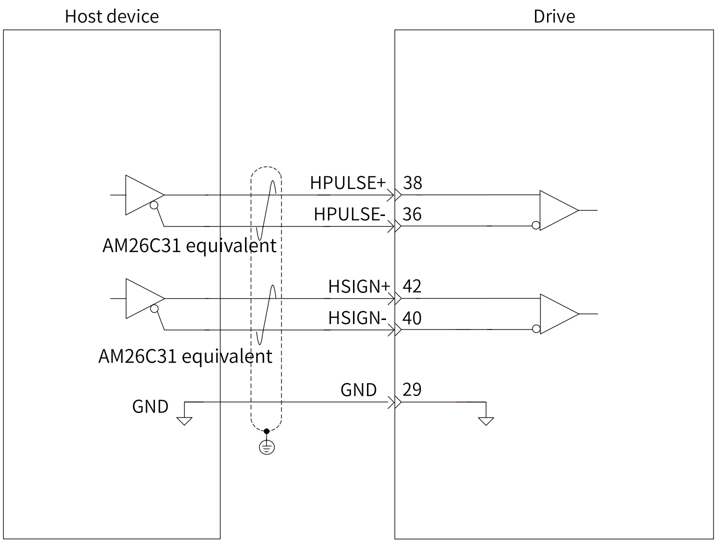



Figure 8-30 Incorrect wiring example 5: Multiple terminals share one current limiting resistor, resulting in a pulse receiving error.

## High-speed pulse reference input

High-speed reference pulses and signs on the host controller side can be outputted to the servo drive through the differential drive only.




## *Note*

- This is a 5 V system. Do not input 24 V power.
- Some models comes with a detection feature 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
- Reference inverted during reference direction input
- Connect 5 V GND of the host controller to the GND of the servo drive to reduce noise interference.

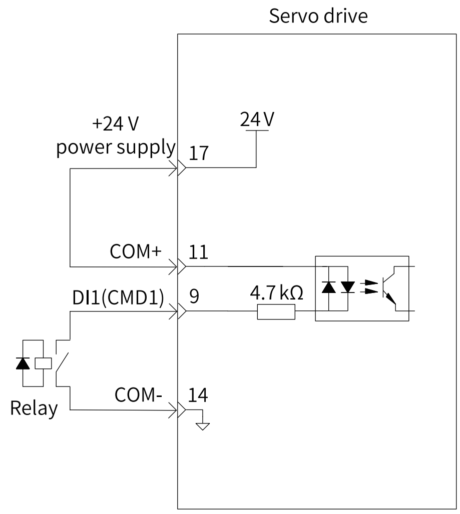
## 8.3.3 DI/DO Signals

For description of DI/DO signals, see *"Table 8–24" on page 149*.

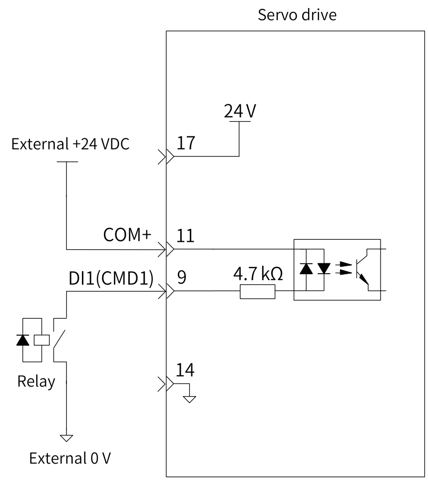
### DI circuit

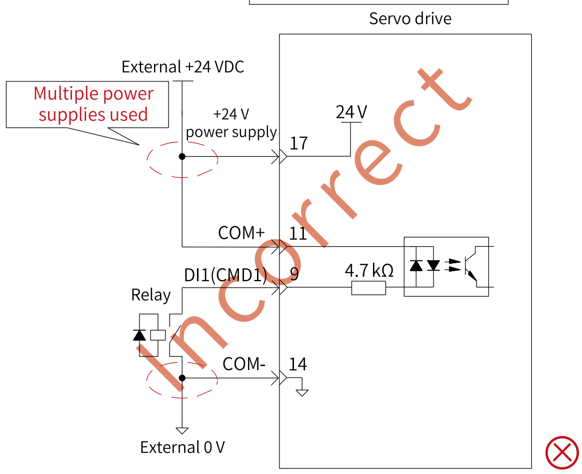
The circuits for DI1–DI5, DI8, and DI9 are the same. The following description takes DI1 circuit as an example.

- The host controller provides relay output:
  - When you use the internal 24 V power supply:

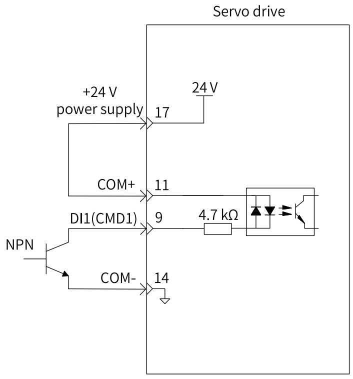


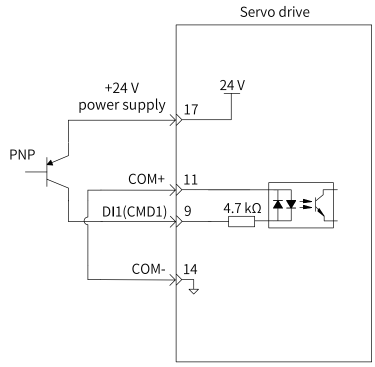

- When you use an external power supply:



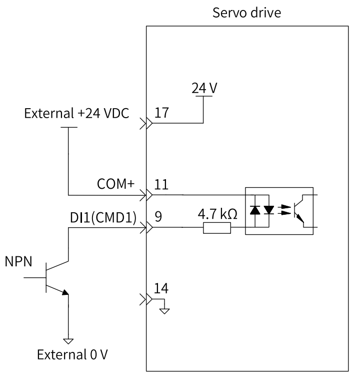



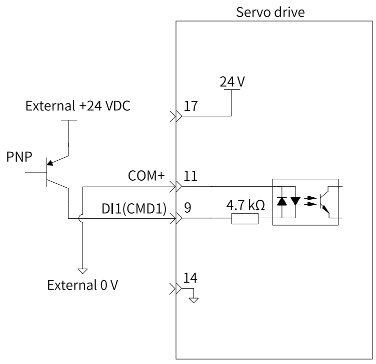

- The host controller provides open-collector output.
  - When you use the internal 24 V power supply:




- When you use an external power supply:

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## *Note*

PNP and NPN input cannot be used together in the same circuit.

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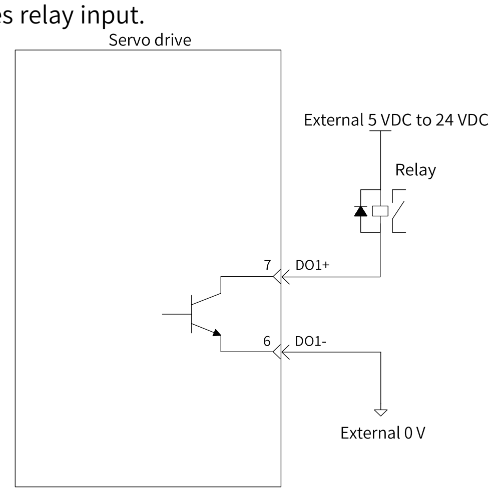
## DO circuit

The circuits for DO1 to DO5 are the same. The following description takes DO1 circuit as an example.

- The host controller provides relay input.

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## *Note*

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

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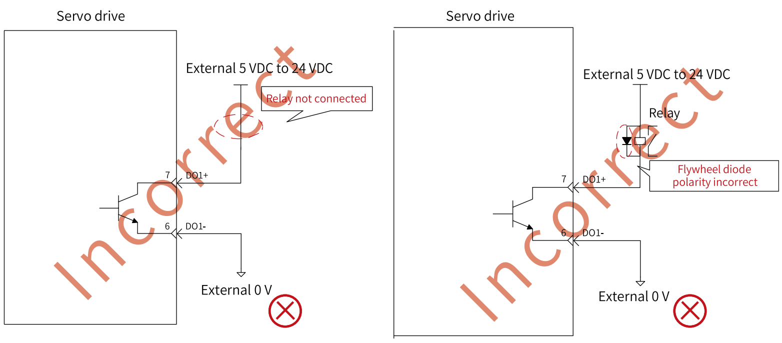
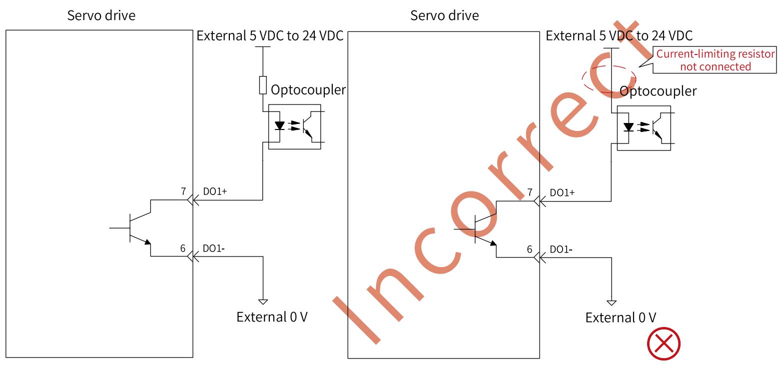



- The host controller provides optocoupler input:

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***Note***

The maximum permissible voltage and current capacity of the optocoupler output circuit inside the servo drive are as follows:

- Maximum voltage: 30 VDC
- Maximum current: DC 50 mA

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## 8.3.4 Encoder Frequency-Division Output Signals

For details on encoder frequency-division output signals, see *"Table 8–25 Encoder frequency-division output signals" on page 149*.

Encoder frequency-division output circuit outputs differential signals via 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.

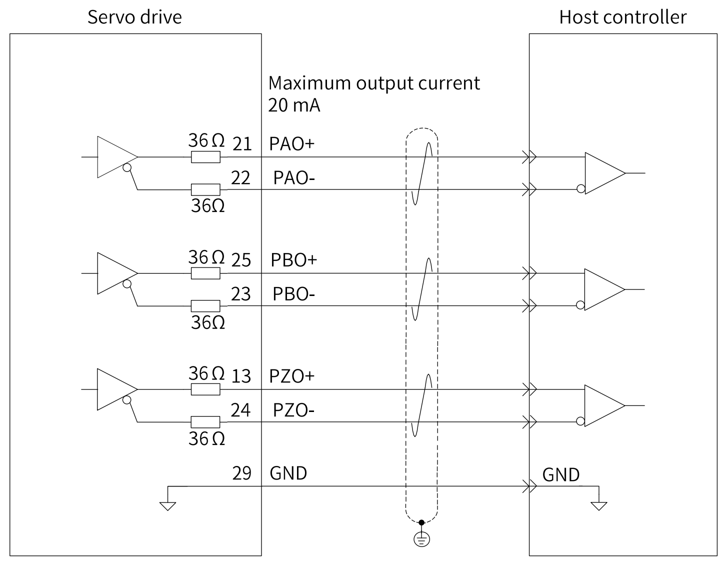



Figure 8-31 Differential receiving circuit

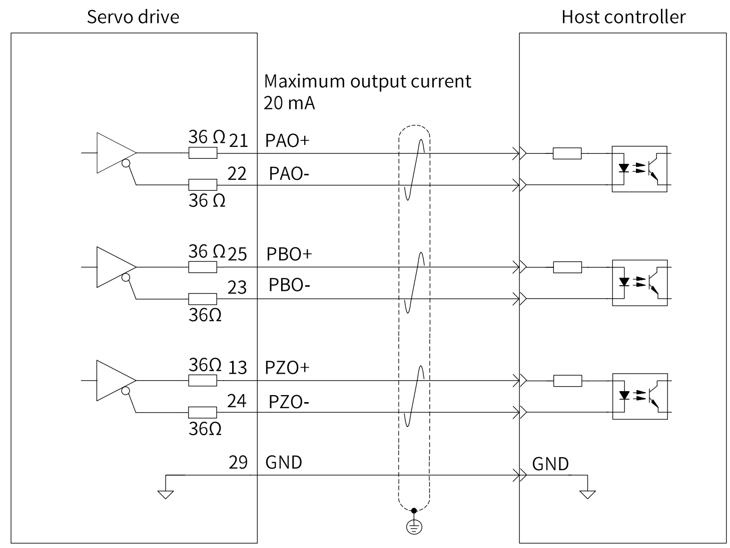
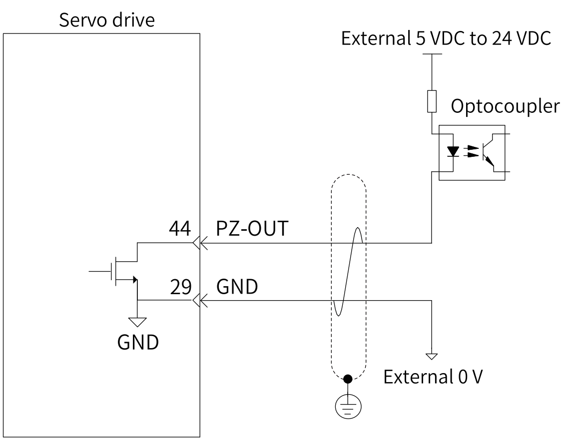



Figure 8-32 Optocoupler receiving circuit

Encoder phase Z output circuit outputs OC signals. Typically, this circuit provides feedback signals to the host controller in a position control system. An optocoupler circuit, relay circuit, or bus receiver circuit shall 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.

## 8.3.5 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.

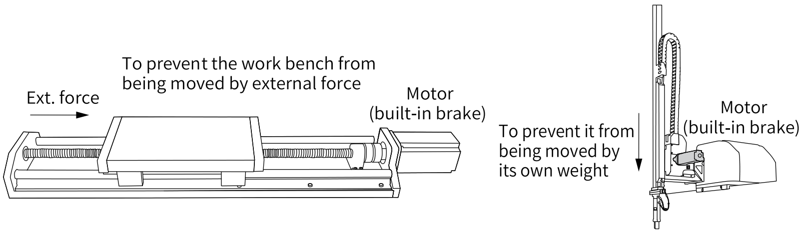



Figure 8-33 Application of the brake

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.
- Switch off the S-ON signal after the motor stops.
- When the motor with brake runs, the brake may generate a click sound, which does not affect its function.
- When brake coils are energized (the brake is released), flux leakage may occur on the shaft end. Pay special attention when using magnetic sensors around the motor.

The connection of brake input signals is polarity-insensitive. Users need to prepare a 24 V power supply. The following figure shows the standard wiring of the brake signals (BK) and the brake power supply.

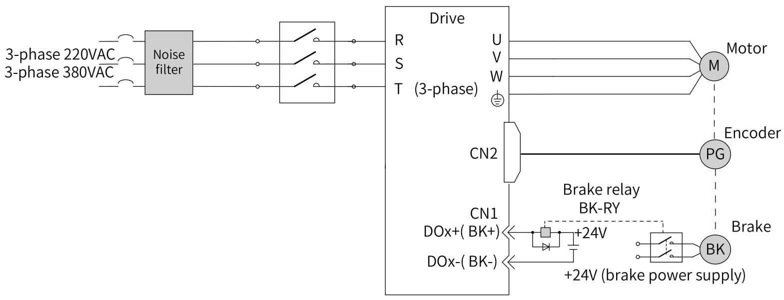



Figure 8-34 Wiring of the brake

**Pay attention to the following precautions during wiring:**

When deciding the length of the motor brake cable, take the voltage drop caused by cable resistance into consideration. The input voltage must be at least 21.6 V to enable the brake to work properly. The following table lists brake specifications of Inovance MS1 series servo motors.

Table 8–28 Brake specifications

| Motor Model | Holding Torque (N·m) | Supply Voltage (VDC) ±10% | Coil Resistance (Ω)±7% | Exciting 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 |

***Note***

- The brake cannot share the same power supply with other electrical devices. This is to prevent malfunction of the brake due to voltage or current drop caused by other working devices.
- Use cables with a cross-sectional area above 0.5 $mm^2$.

# 8.4 Encoder Terminal CN2

## 8.4.1 Terminal Layout

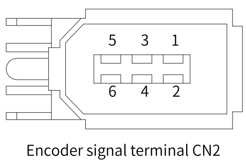



Figure 8-35 Encoder terminal pin layout

Table 8–29 Description of encoder terminal pins

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

## 8.4.2 Connecting the Absolute Encoder

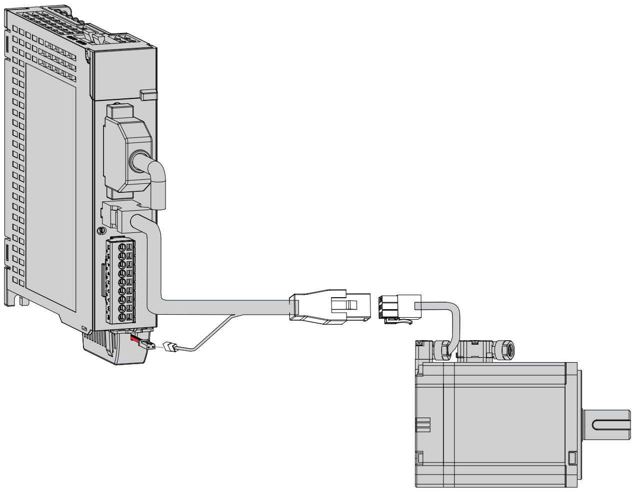


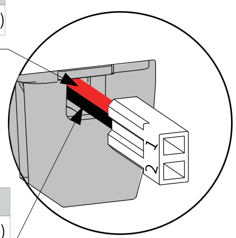
Figure 8-36 Signal wiring example of the absolute encoder[1]

### *Note*

- [1]: The figure shows encoder cable wiring.
- The encoder cable color is subject to the color of the actual product. Cable colors mentioned in this guide all refer to Inovance cables.

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

| Pin No. | Color | Assignment |
|---|---|---|
| 1 | Red | Power supply (+) |



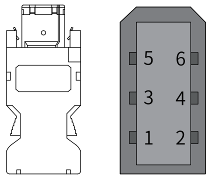
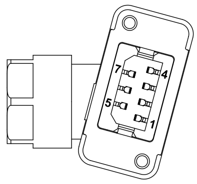
| Pin No. | Color | Assignment |
|---|---|---|
| 2 | Black | Power supply (–) |

Figure 8-37 Lead wire color of the battery box

### *Note*

- Keep the battery in environments within the required ambient temperature range and ensure the battery is in reliable contact and carries sufficient power capacity. Otherwise, encoder data loss may occur.
- Model of the battery box (battery included): S6-C4A

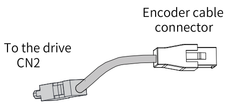
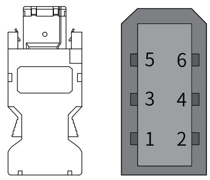
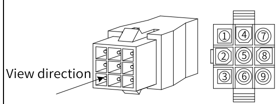
Table 8–30 Terminal-type motor encoder cable connector

| Motor Frame Size[1] | Illustration | | Pin | | | |
|---|---|---|---|---|---|---|
| | | | Pin No. | Signal Name | Color | Type |
| Terminal-type: 40 60 80 | Servo drive side |  6-pin male (right side as the connecting side) | 1 | +5V | Red | Twisted pair |
| | | | 2 | GND | Orange | |
| | | | 5 | PS+ | Blue | Twisted pair |
| | | | 6 | PS- | Purple | |
| | | | Enclosure | PE | - | - |
| | Motor side |  7-pin connector | 1 | PS+ | Blue | Twisted pair |
| | | | 2 | PS- | Purple | |
| | | | 3 | DC+ | Brown | Twisted pair |
| | | | 4 | DC- | Black | |
| | | | 5 | +5V | Red | Twisted pair |
| | | | 6 | GND | Orange | |
| | | | 7 | PE | - | - |

## Note

[1] The flange size refers to the width of the mounting flange.

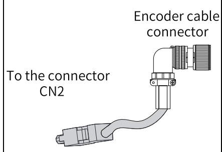
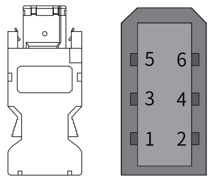
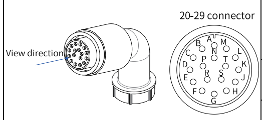
Table 8–31 Flying leads type motor encoder cable connector (9-pin)

| Motor Frame Size[1] | Illustration | | | Pin | | | |
|---|---|---|---|---|---|---|---|
| | | | | Pin No. | Signal Name | Color | Type |
| Flying leads type: 40 60 80 |  | Servo drive side |  6-pin male (right side as the connecting side) | 1 | +5V | Red | Twisted pair |
| | | | | 2 | GND | Orange | |
| | | | | 5 | PS+ | Blue | Twisted pair |
| | | | | 6 | PS- | Purple | |
| | | | | Enclo-sure | PE | - | - |
| | | Motor side |  9-pin connector<br>Recommended: Plastic enclosure: AMP 172161-1;<br>terminal: AMP 770835-1 | 1 | Battery (+) | Brown | Twisted pair |
| | | | | 4 | Battery (-) | Black | |
| | | | | 3 | PS+ | Blue | |
| | | | | 6 | PS- | Purple | |
| | | | | 9 | +5V | Red | - |
| | | | | 8 | GND | Orange | |
| | | | | 7 | Shield | - | |

## Note

[1] The flange size refers to the width of the mounting flange.

Table 8–32 Absolute encoder cable connector (MIL-DTL-5015 series 3108E20-29S aviation connector)

| Motor Frame Size[1] | Illustration | | | Pin | | | |
|---|---|---|---|---|---|---|---|
| | | | | Pin No. | Signal Name | Color | Type |
| 100<br>130<br>180 | <br> | Servo drive side | <br><br>6-pin male (right side as the connecting side) | 1 | +5V | Red | Twisted pair |
| | | | | 2 | GND | Orange | |
| | | | | 5 | PS+ | Blue | Twisted pair |
| | | | | 6 | PS- | Purple | |
| | | | | Enclosure | PE | - | - |
| | | Motor side | <br> | A | PS+ | Blue | Twisted pair |
| | | | | B | PS- | Purple | |
| | | | | E | Battery (+) | Brown | - |
| | | | | F | Battery (-) | Black | |
| | | | | G | +5V | Red | - |
| | | | | H | GND | Orange | |
| | | | | J | Shield | - | |

***Note***

[1] The flange size refers to the width of the mounting flange (in mm).

## 8.4.3 Installing Absolute Encoder Battery Box

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

- One plastic case.
- One battery (3.6 V, 2,600 mAh).
- Terminal block and crimping terminal.

## Installing the battery box

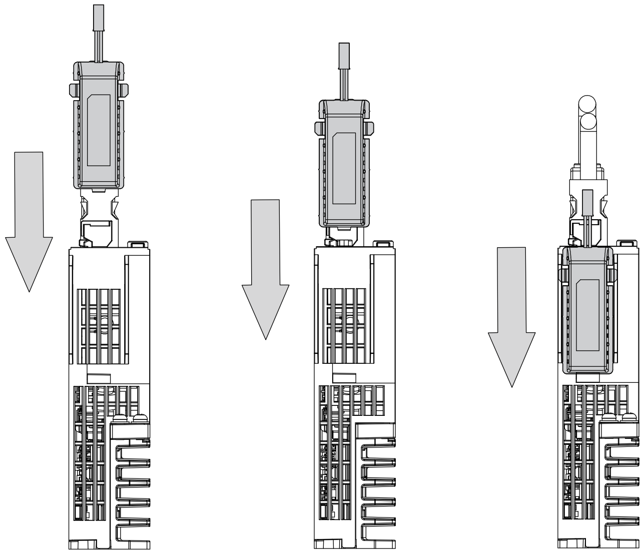
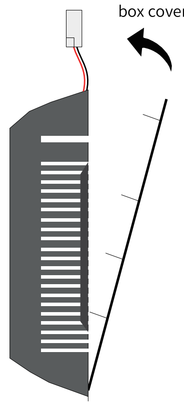


Figure 8-38 Installing the battery box (bottom view)

## Removing the battery box

The battery may generate leakage liquid after long-term use. Replace it every two years. Remove the battery box in steps 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.
- 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. It is recommended to replace the battery every 2 years.
- Do not disassemble the battery because the internal electrolyte may spread out and result in personal injury.
- Do not throw a battery into the fire. Failure to comply may result in an explosion.
- Do not short-circuit the battery or strip off the battery case. Prevent terminals (+) and (-) of the battery from coming into contact with the metal. Contact with the metal can result in a high current, not only weakening the battery power, but also incurring the risk of explosion due to severe heating.
- This battery is not rechargeable.
- Dispose of the retired battery according to local regulations.

## 8.4.4 Encoder Cable Specifications

- Ground the shielded layers on both the servo drive side and the motor side. Otherwise, the servo drive will report a false alarm.
- Do not connect cables to the "reserved" terminals.
- 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 UL2464 standard) with length no longer than 10 m as the encoder cable.

***Note***

It is recommended to use 22AWG to 26AWG cables and a matching terminal AMP170359-1 for 10B, 20B, 40B, and 75B series motors. If a longer cable is required, increase the cable diameter properly. See *"Table 8–33 Recommended cables" on page 167* for details.

Table 8–33 Recommended cables

| Cable Size | Cable Size ($mm^2$) | Ω/km | Allowable Length (m) | OD (mm) |
|---|---|---|---|---|
| 3P×26AWG | 0.13 | 143 | 10.0 | 6.0±0.2 |
| 3P×25AWG | 0.16 | 89.4 | 16.0 | 6.2±0.2 |
| 3P×24AWG | 0.2 | 79.6 | 18.0 | 6.5±0.2 |
| 3P×23AWG | 0.26 | 68.5 | 20.9 | 6.8±0.2 |
| 3P×22AWG | 0.32 | 54.3 | 26.4 | 7.0±0.2 |
| 3P×21AWG | 0.41 | 42.7 | 33.5 | 7.3±0.2 |
| 3P×20AWG | 0.52 | 33.9 | 42.2 | 7.6±0.3 |
| 3P×19AWG | 0.57 | 26.9 | 53.2 | 8.5±0.3 |
| 3P×18AWG | 0.81 | 21.4 | 66.8 | 8.8±0.3 |
| 3P×17AWG | 1.03 | 16.3 | 87.7 | 9.7±0.3 |
| 3P×16AWG | 1.31 | 13.5 | 105.0 | 11.4±0.3 |

***Note***

If the cables of above 16AWG are required, contact the sales personnel of Inovance.

# 8.5 Communication Terminals CN3 and CN4

## Terminal Layout

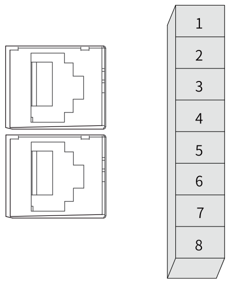



Figure 8-39 Communication Terminal pin layout of the servo drive

Table 8–34 Description of communication terminal pins

| Pin No. | Description | Description |
|---|---|---|
| 1 | CANH | CAN communication port |
| 2 | CANL | |
| 3 | CGND | CAN communication ground |
| 4 | RS485+ | RS485 communication port |
| 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 | Ground |
| Enclosure | PE | Shield |

## Terminal descriptions

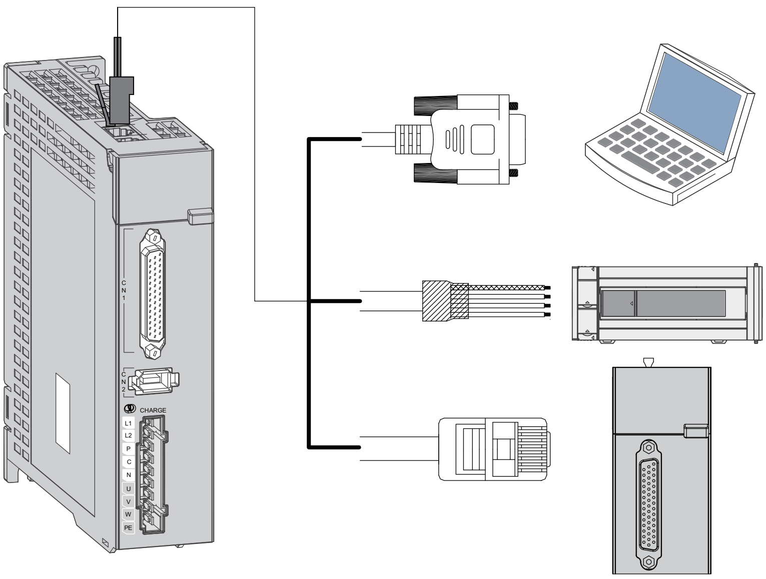


Figure 8-40 Wiring of communication cables

CN3 and CN4 are identical communication terminals connected in parallel internally.

CN3 and CN4 in the drive are used for communication with the PC, PLC, and other drives. For pin assignment of CN3/CN4, see *"Figure 8–39 Communication Terminal pin layout of the servo drive" on page 168*.

## RS485 communication with PLC

The following figure shows the cable used for 485 communication between the servo drive and PLC.

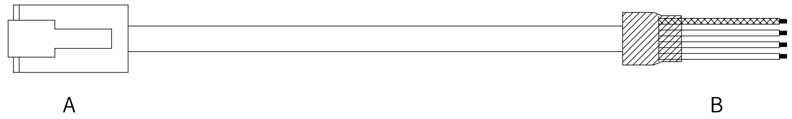



Figure 8-41 Outline drawing of cable used for CAN communication between the servo drive and PLC

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 circuit) respectively. Connect RS485+ and RS485- with two conductors twisted together and connect the remaining conductor to the RS485 reference ground (GND). Connect the shield to the device ground (PE). Connect a 120Ω termination resistor on each end of the bus to prevent RS485 signal reflection.

Table 8–35 Pin connection relation of the cable used for CAN communication between the servo drive and PLC

| RJ45 on the Drive Side (A) | | | PLC Side (B) | | |
|---|---|---|---|---|---|
| Communication Type | Pin No. | Description | Communication Type | Pin No. | Description |
| RS485 | 4 | 485+ | RS485 | 4 | 485+ |
| | 5 | 485- | | 5 | 485- |
| | 8 | GND | | 8 | GND |
| - | Enclosure | PE (shield layer) | - | Enclosure | PE (shield layer) |

## Wiring of multi-drive RS485 communication

The following figure shows the cable used for multi-drive RS485 communication.

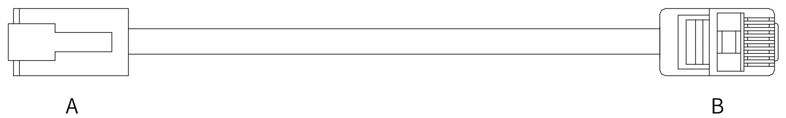



Figure 8-42 Outline drawing of the cable used for multi-drive RS485 communication

Table 8–36 Pin connection relation of the cable used for multi-drive RS485 communication (pins in 485 group used only)

| RJ45 on the Drive Side (A) | | | RJ45 on the Drive Side (B) | | |
|---|---|---|---|---|---|
| Communication Type | Pin No. | Description | Communication Type | Pin No. | Description |
| RS485 | 4 | 485+ | RS485 | 4 | 485+ |
| | 5 | 485- | | 5 | 485- |
| | 8 | GND | | 8 | GND |
| - | Enclosure | PE (shield layer) | - | Enclosure | PE (shield layer) |

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

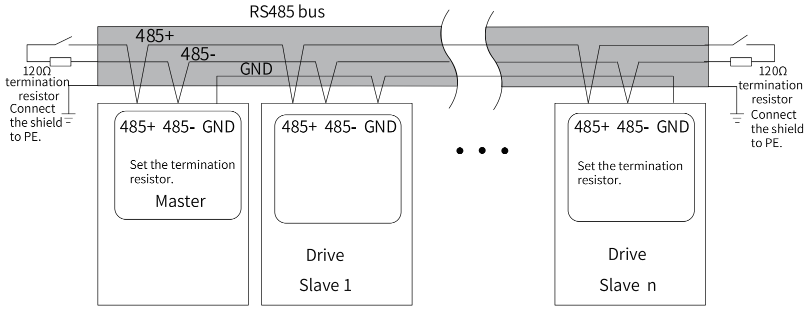



Figure 8-43 RS485 bus topology

**Caution**

Do not connect ⏚ (GND) terminal to the CGND terminal of the drive. Failure to comply may damage the machine.

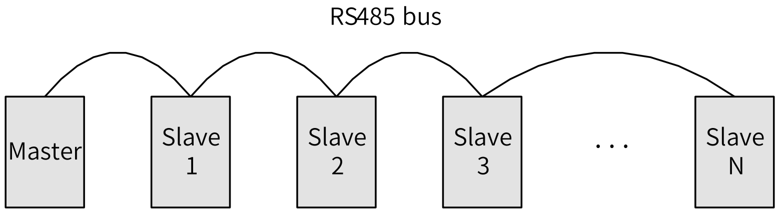



Figure 8-44 Daisy chain mode

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

Table 8–37 Transmission distance and number of nodes

| No. | Transmission Rate (kbps) | Transmission Distance (m) | Number of Nodes | Cross Sectional Area |
|---|---|---|---|---|
| 1 | 115.2 | 100 | 128 | AWG26 |
| 2 | 19.2 | 1000 | 128 | AWG26 |

## RS232 communication with PC

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.

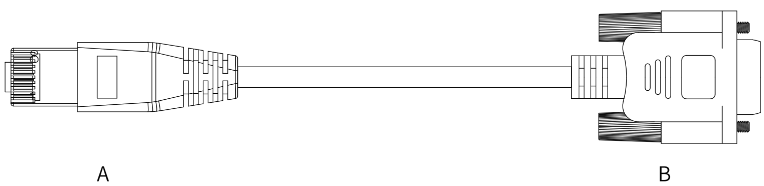


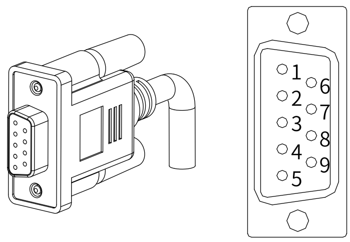

Figure 8-45 Outline drawing of the PC communication cable

Table 8–38 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 layer) | Enclosure | PE (shield layer) | Enclosure |

Pin assignment of DB9 terminal on the PC side is shown in the following table.

Table 8–39 Pin definition of DB9 terminal on the PC side ("B" in the preceding figure)

| Pin No. | Description | Description | Terminal Pin Layout |
|---|---|---|---|
| 2 | PC-RXD | PC receiving end |  |
| 3 | PC-TXD | PC transmitting end | |
| 5 | GND | Ground | |
| Enclosure | PE | Shield | |

If the host controller supports USB interface only, use the serial-to-USB cable.

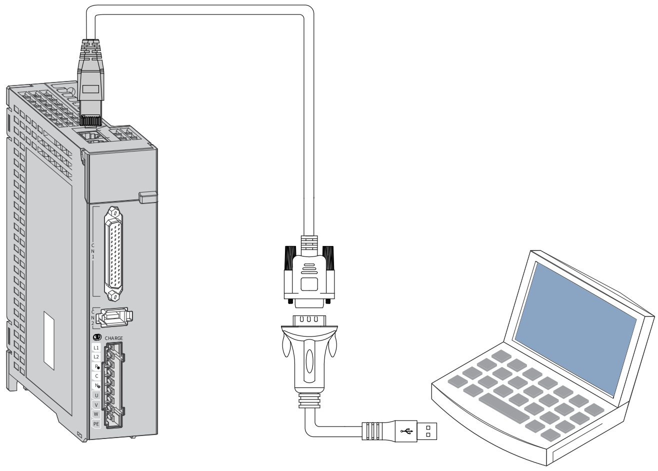


Figure 8-46 Outline drawing of the PC communication cable

Recommendations: Manufacture: Z-TEK Model: ZE551A, equipped with a 0.8 m USB extension cable
Chip model: FT232

# 8.6 Wiring and Setting of the Regenerative Resistor

## Connecting the regenerative resistor

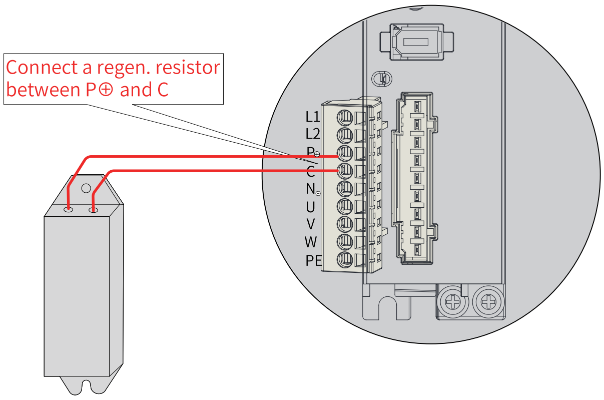



Figure 8-47 Wiring of external regenerative resistor

For cables used for terminals P⊕ and C, see *"8.2.3 Recommended Cable Specifications and Models" on page 128*.

**Caution**

Observe the following precautions when connecting the external regenerative resistor:

- The built-in regenerative resistor or jumper bar is not available in models S1R6 and S2R8. If an external regenerative resistor is needed for these models, connect it between terminals P⊕ and C.
- Remove the jumper between terminals P⊕ and D before using the external regenerative resistor. Failure to comply will result in overcurrent and damage the braking transistor.
- Do not connect the external regenerative resistor to the positive or negative pole of the bus directly. Failure to comply will damage the servo drive and result in a fire.
- Select a resistor with resistance higher than or equal to the minimum permissible value. Failure to comply will result in Er.201 (Overcurrent) or damage the servo drive.
- Make sure parameters H02.25 (Regenerative resistor setting), H02.26 (Power of external regenerative resistor) and H02.27 (Resistance of external regenerative resistor) are set properly before operating the servo drive.
- Install the external regenerative resistor on an incombustible object such as a metal.

# 9 Commissioning Tool

## 9.1 Operating Panel

### 9.1.1 Display Panel Components

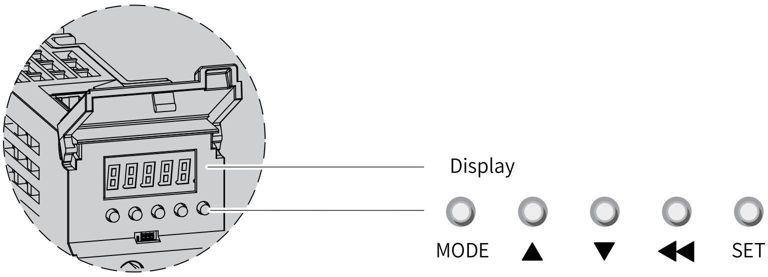



Figure 9-1 Magnified view of the keypad

The operation panel of the SV630 Series servo drive consists of an LED (5-digit, 8-segment) and five buttons. The keypad is used for value 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 9–1 Descriptions of keys

| Parameter Name | Illustration | Description |
|---|---|---|
| MODE | MODE | Switches among different modes.<br>Returns to the previous menu. |
| UP | ▲ | Increases the value of the blinking digit for the LED. |
| DOWN | ▼ | Decreases the value of the blinking digit for the LED. |
| SHIFT | ◀◀ | Shifts the blinking digit for the LED.<br>You can view the high digits of the number consisting of more than 5 digits. |
| SET | SET | Switches to the lower-level menu.<br>Executes commands such as storing parameter setting value. |

### 9.1.2 Panel Display

The operating panel can display the running status, parameter, faults, and monitoring 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.

## Display mode switchover

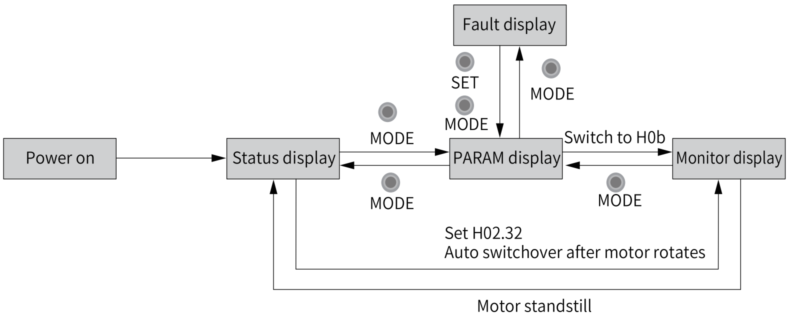
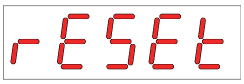
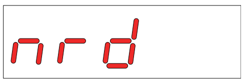
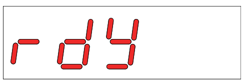
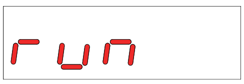
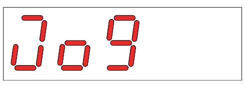



Figure 9-2 Switchover among different display modes

- The keypad enters status display immediately upon power-on.
- Press MODE to switch among different display modes based on the conditions shown in *"Figure 9–2" on page 174* .
- In status display, set H02.32 to select the parameter to be monitored. When the motor rotates, the keypad automatically switches to monitored value display. After the motor stops, the keypad automatically returns to status display.
- In the parameter display mode, after you select the parameter to be monitored in group H0b, the keypad switches to monitored value display.
- Once a fault occurs, the keypad switches to fault display immediately, with all the five LEDs blinking. Press SET to stop the LEDs from blinking, and then press MODE to switch to parameter display.

## Status display

| Display | Parameter Name | Applicable Occasion | Meaning |
|---|---|---|---|
|  | Reset<br>Servo drive initializing | Upon power-on | The servo drive is in the initialization or reset status.<br>After initialization or reset is done, the servo drive automatically switches to other status. |
|  | Nrd<br>Servo not ready | Initialization done, but servo drive not ready. | The servo drive is not ready to run because the main circuit is not powered on. For details, see Chapter "Troubleshooting". |
|  | Rdy<br>Ready | Servo drive ready | The servo drive is ready to run and waits for the enabling signal from the host controller. |
|  | Run<br>Running | Servo ON (S-ON) signal activated<br>(S-ON signal switched on) | The servo drive is running. |
|  | Jog<br>Jog | Servo drive in jog status | See *"10.4 Jog" on page 194* for details. |

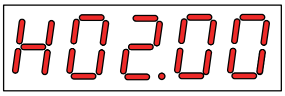
## Parameter Display

Parameters are divided into 19 groups based on their functions. A parameter can be located quickly based on the parameter group it belongs to. For details on parameters, see Chapter "Parameter List".

- Display of parameter groups

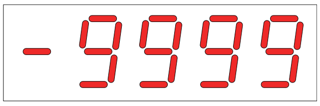
| Display | Parameter Name | Description |
|---|---|---|
| HXX.YY | Parameter group | XX: parameter group No. (decimal)<br>YY: offset within the parameter group (hexadecimal) |

For example, "H02.00" is displayed as follows.

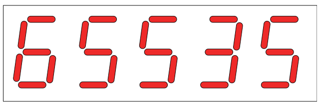
| Display | Parameter Name | Description |
|---|---|---|
|  | H02.00 | 02: Parameter group No.<br>00: Offset within the parameter group |

- Display of negative numbers and numbers with different lengths
  - Signed number with 4 digits and below or unsigned number with 5 digits and below
    Such numbers are displayed in a single page (five digits). For signed numbers, the highest bit "-" represents the negative symbol.

    For example, "-9999" is displayed as follows:



For example, "65535" is displayed as follows:



  - Signed number with more than 4 digits or unsigned number with more than 5 digits
    Such numbers are displayed from low to high bits in several pages (5 digits per page): current page + values on current 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:

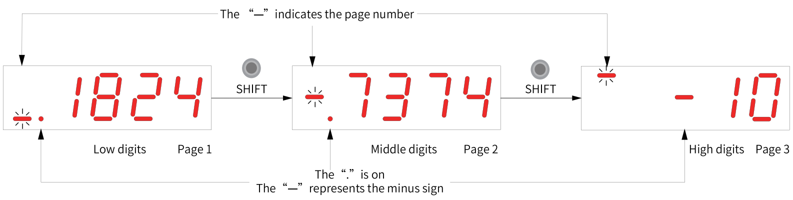



Figure 9-3 Display of "-1073741824"

Example: "1073741824" is displayed as follows:

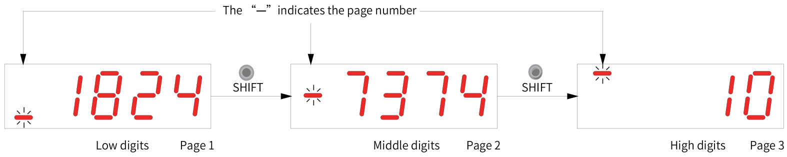
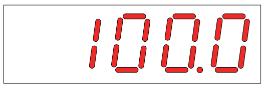


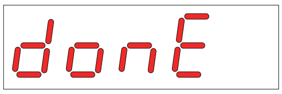
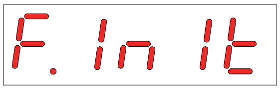
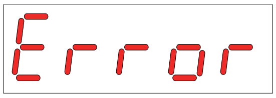

Figure 9-4 Display of "1073741824"

- Display of the decimal point

  The segment "." of the ones indicates the decimal point, which does not blink.

| Display | Parameter Name | Description |
|---|---|---|
|   | Decimal point | 100.0 |

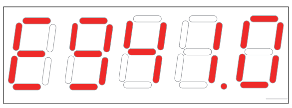
- Display of parameter setting status

| Display | Parameter Name | Applicable Occasion | Meaning |
|---|---|---|---|
|   | Done<br>Parameter setting completed | The parameter is set successfully. | The parameter is set and saved to the servo drive (Done). The servo drive can execute other operations. |
|   | F.InIt<br>(Restored to default settings) | Parameter initialization is in progress (H02.31 = 1). | The servo drive is in the process of parameter initialization. After parameter initialization is done, switch on the control power supply again. |
|   | Error<br>(wrong password) | 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. |

## Fault Display

- The keypad can be used to display present or previous fault and warning codes. For analysis and solutions to the faults and warnings, see Chapter "Troubleshooting".
- When a fault or warning occurs, the operating panel displays the corresponding fault or error code immediately. When multiple faults or errors occur, the keypad displays the fault or error code of the highest fault level.
- 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 warnings saved in the servo drive by setting H02.31 to 2.

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

| Display | Parameter Name | Description |
|---|---|---|
|   | E941.0<br>Warning code | E: A fault or warning occurs on the servo drive.<br>941.0: Warning code |

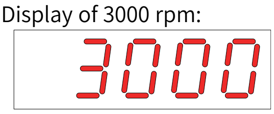
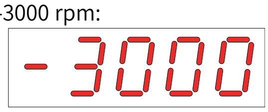
### *Note*

- If the panel displays Hault/Fault, a system fault has occurred.
- The possible causes include bugs of the program, 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.

## Monitored value display

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

The following table describes the monitoring parameters in H0b.00.

| Param. | Parameter Name | Unit | Meaning | Example |
|---|---|---|---|---|
| H0b.00 | Motor speed actual value | RPM | Displays the actual value of the motor speed after round-off, which can be accurate to 1 rpm. | Display of 3000 rpm:  -3000 rpm:  |

### *Note*

For details of parameter group H0b, see *"19.6 Display of Monitoring Parameters" on page 700*.

# 9.1.3 Parameter Settings

## Example of parameter settings

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.

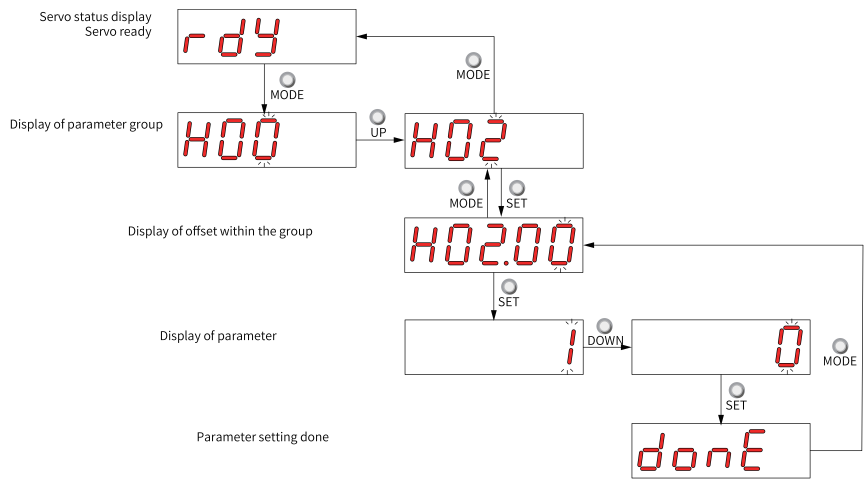



Figure 9-5 Example of parameter setting

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

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

## Forced DI/DO signals

You can assign different functions to DI/DOs by setting parameters in groups H03 and H04 through the keypad (or host controller), so that the host controller can control the servo functions through DI signals or use the DO signals outputted by the servo drive.

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

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

### Forced DI signal input

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

1. Operating process

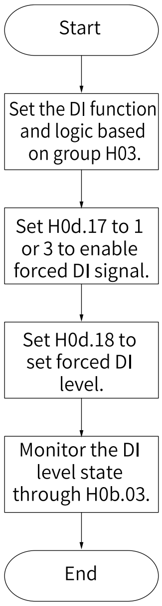



Figure 9-6 Procedure for setting forced DI function

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

## Note

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

2. Example:

To activate the DI function assigned to DI1 and deactivate DI functions assigned to DI2...DI9 (DI to DI9 are active low), set as follows:

As the value "1" indicates high level and the value "0" indicates low level, the corresponding binary value and hexadecimal value are "110011110" and "19E" respectively. Therefore, set H0d.18 to "19E" through the keypad.

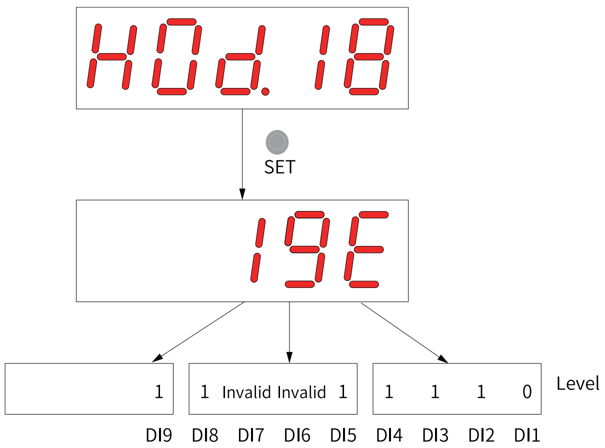



Figure 9-7 Meaning of the H0d.18 setpoint

Monitoring the DI level status through H0b.03:

If the DI function is normal, the display value of H0b.03 is always the same as that of H0d.18.

In this case, the DI1 is active low, DI2 to DI9 are active high and the value of H0b.03 read by the software tool is 414 (in decimal). See the following figure.

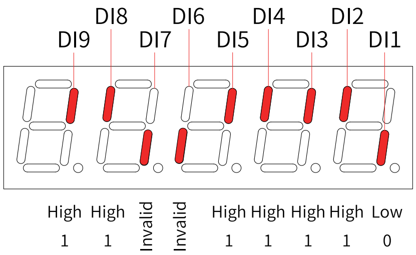



Figure 9-8 DI level status corresponding to H0b.03

## *Note*

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

3. 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 (No operation) to return to the normal DI mode.

**Forced DO function**

After this function is enabled, all DO signal levels are controlled by H0d.19 (Forced DO value), regardless of the internal DO status of the servo drive.

## Caution

In applications where the servo motor is used for vertical movement, if the brake output signal (FunOUT.9: BK, brake output) is active, the brake will be released and the load may fall. Take protective measures on the machine to prevent the risk of falling.

1. Operating process

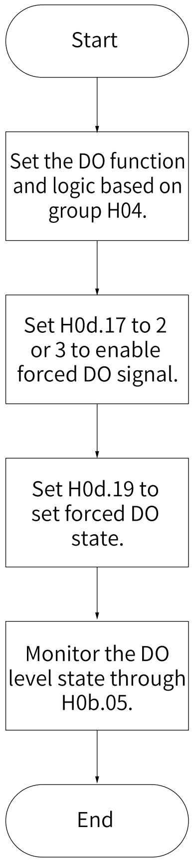



Figure 9-9 Procedure for setting forced DO function

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

The DO logic is defined by parameters in group H04. H0b.05 is used to monitor the DO level status. The keypad displays the level, and the value of H0b.05 (monitored DO signal) read in the software tool is decimal.

2. Example:
To activate the DO function assigned to DO1 and deactivate DO functions assigned to DO2 and DO5, set as follows:

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

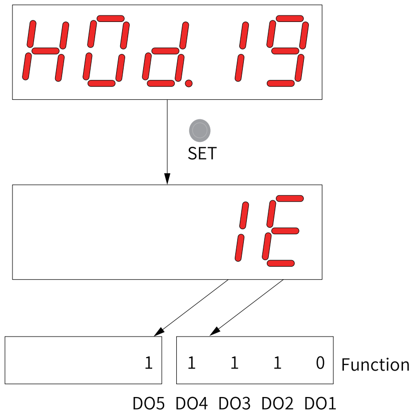



Figure 9-10 Meaning of the H0d.19 setpoint

Monitoring the DO level status through H0b.05:

If the logic of all the three DO terminals are "active at low level", the DO1 terminal is high level and DO2 to DO5 terminals are low level, and the corresponding binary number is "00001". In this case, the value of H0b.05 (Monitored DO signal) read by the software tool is 1 (decimal). See the following figure.

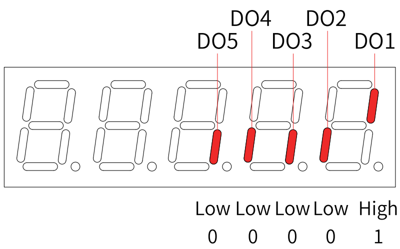



Figure 9-11 Display H0b.05 when all DO are "active low"

If the logic of all the 5 DO terminals are "active high", the DO1 terminal is low level and DO2 to DO5 terminals are high level, and the corresponding binary number is "11110". In this case, the value of H0b.05 (Monitored DO signal) read by the software tool is 30 (decimal). See the following figure.

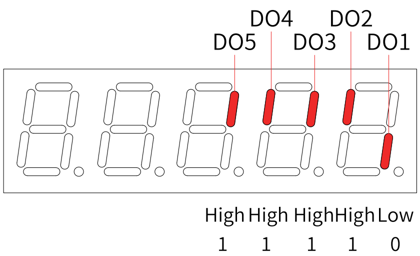



Figure 9-12 Display H0b.05 when all DO are "active high"

3. Exit
The forced DO signal is not retentive upon power-off. Normal DO functions are restored after restart, or you can set H0d.17 to 0 to return to the normal DO mode.

## User password

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

- Setting the user password

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

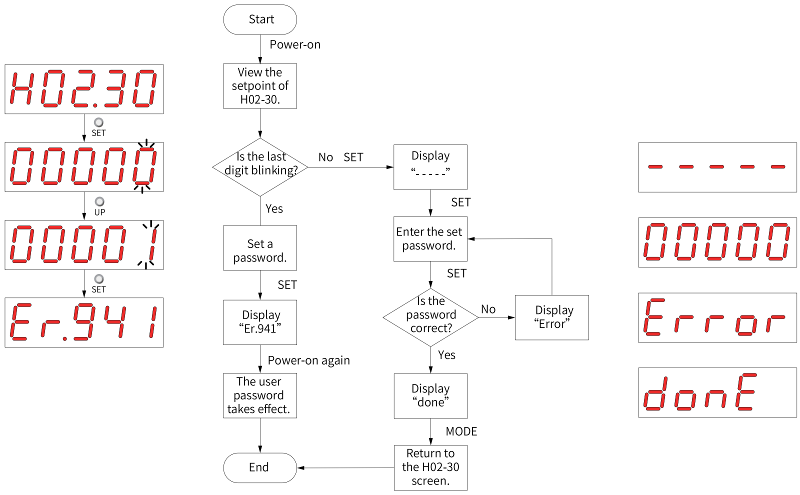



Figure 9-13 Procedure for setting the user password

To change the user password, input current password first to authorize the access to parameter setting. Next, enter H02.30 again to set a new password based on the procedure shown in the preceding figure.

***Note***

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

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

# 9.2 Commissioning Software

## 9.2.1 Overview

The software tool InoDriverShop can be downloaded from http://www.inovance.com.

Use a Type-C communication cable for communication between SV630 series servo drives 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 help document of InoDriverShop.

## 9.2.2 To install the fan, do as follows:

1. Software

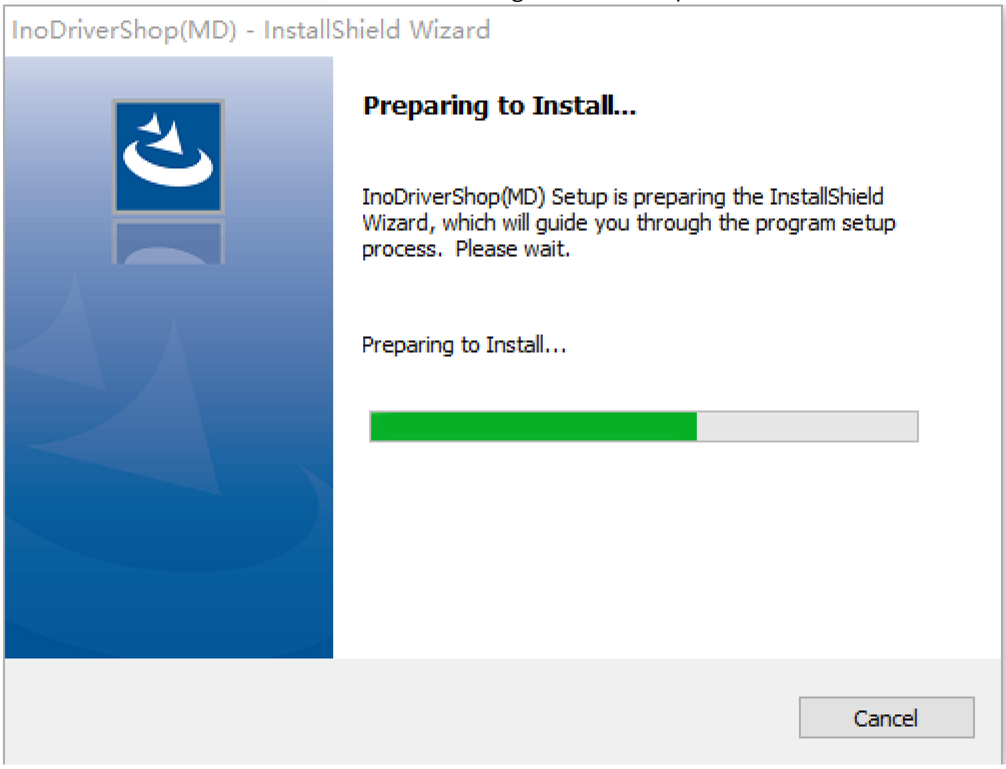
   a. Visit the official website of Inovance as shown below.
   http://www.inovance.com

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

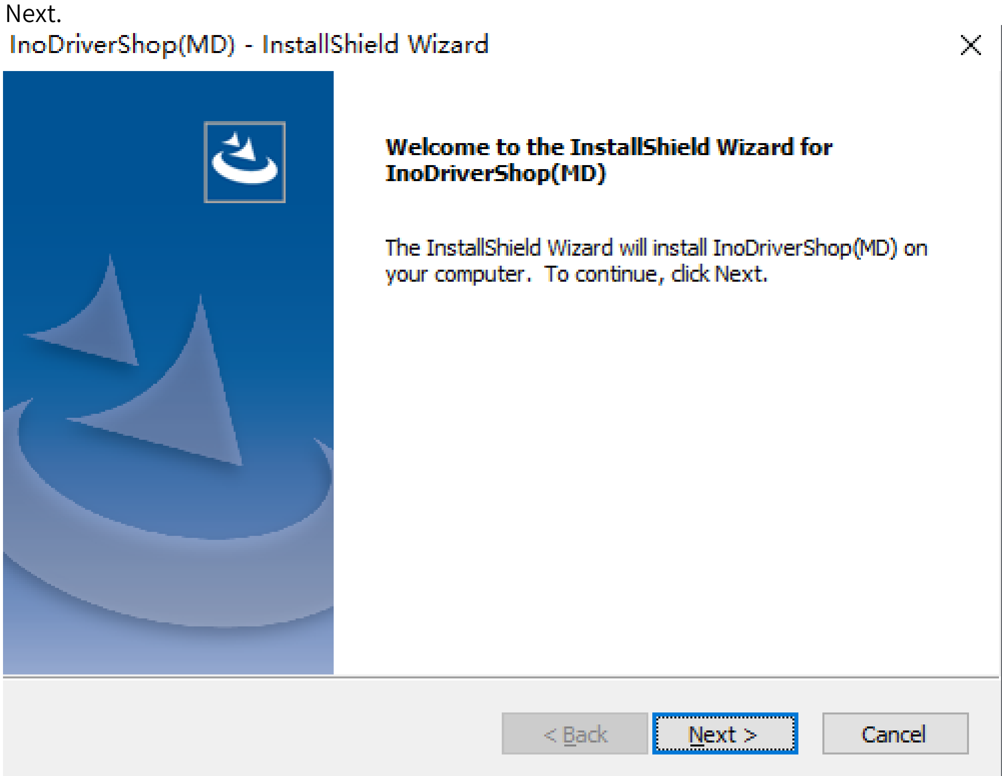
c. Click Download.

2. Unzip the package downloaded.

3. Click InoDriverShop.exe to start installing InoDriverShop.

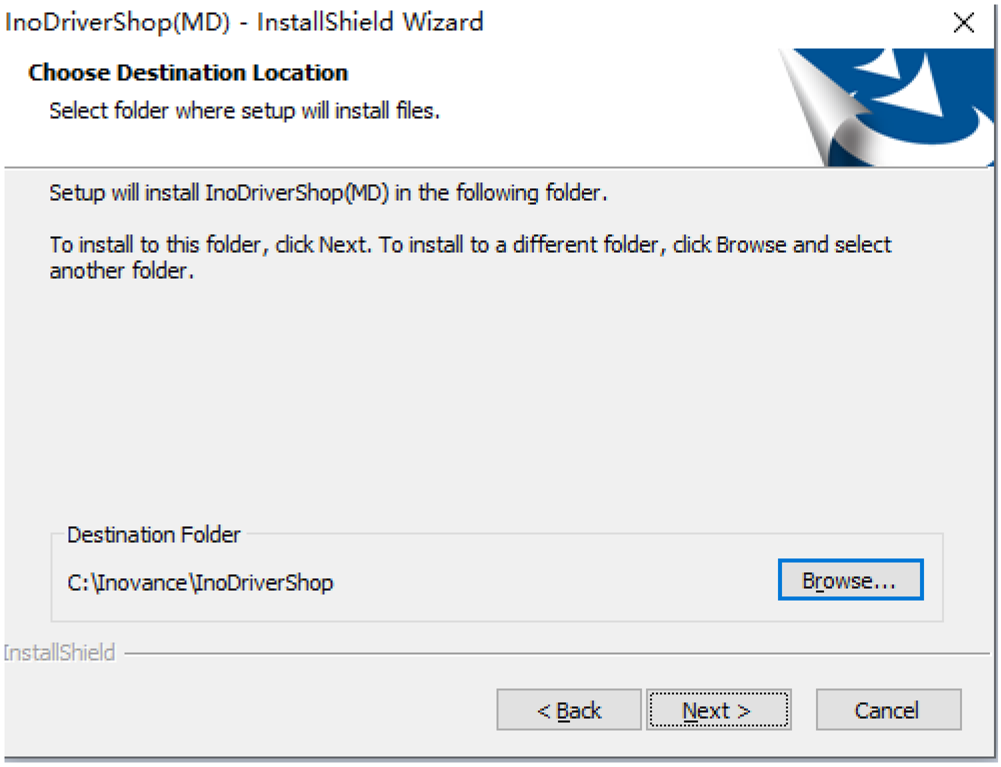



4. Click Next.

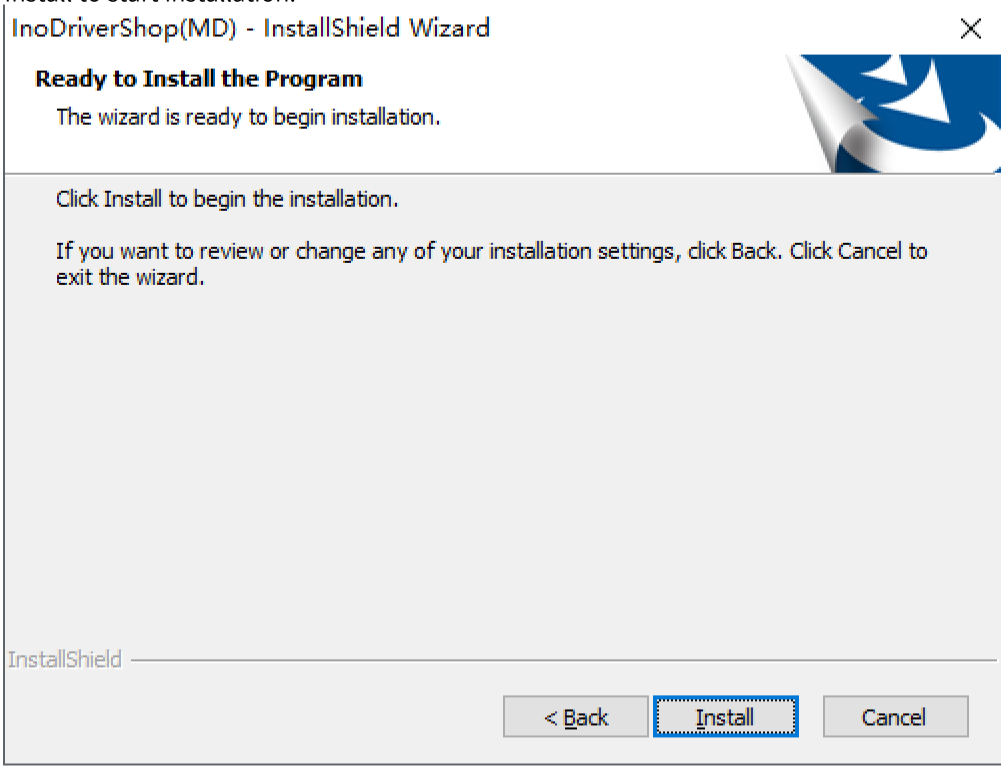


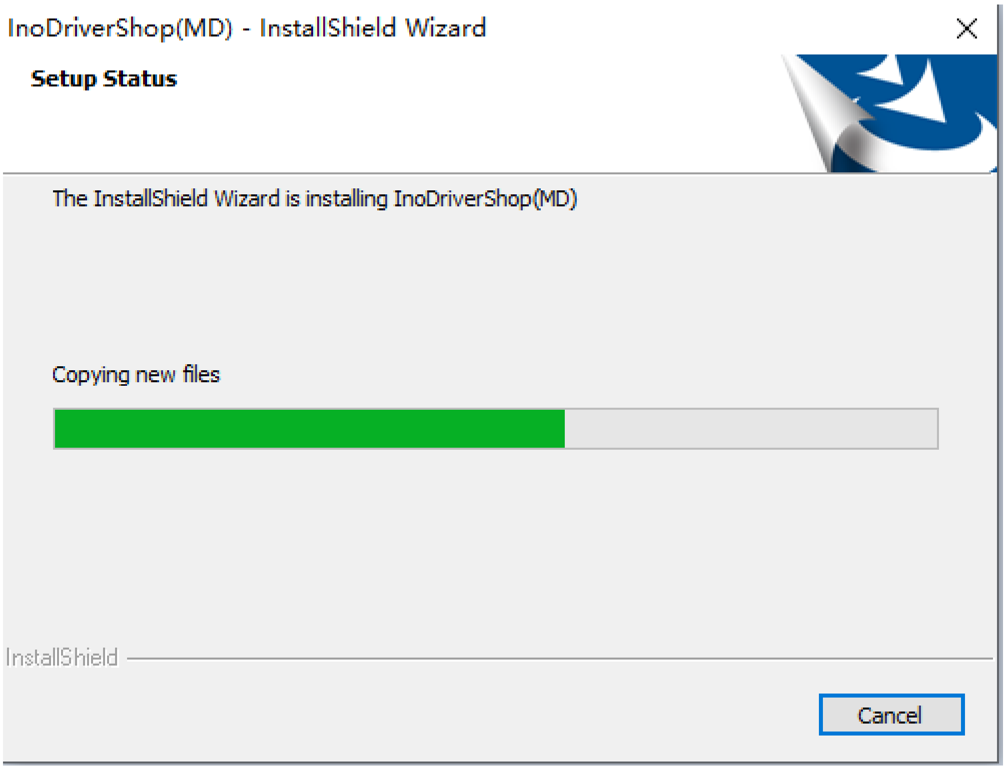

5. You can select the directory for installation as needed through the Browse button. The default directory for installation is "C:\Program Files\Inovance\InoDriverShop".
In online upgrade, InoDriverShop will be upgraded directly in the original directory.

After selecting the directory for installation, click Next.

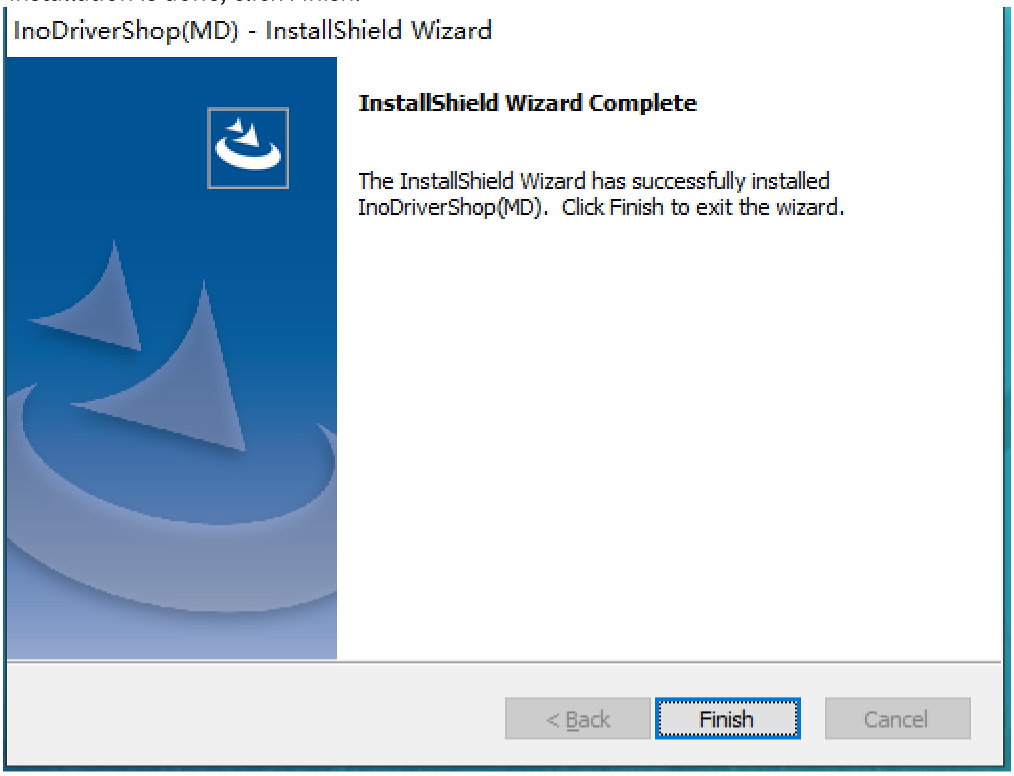



6. Click Install to start installation.

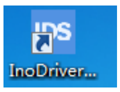





7. After installation is done, click Finish.




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



## 9.2.3 Connection

1. Start InoDriverShop.

- Double-click 

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

2. Create a project.

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

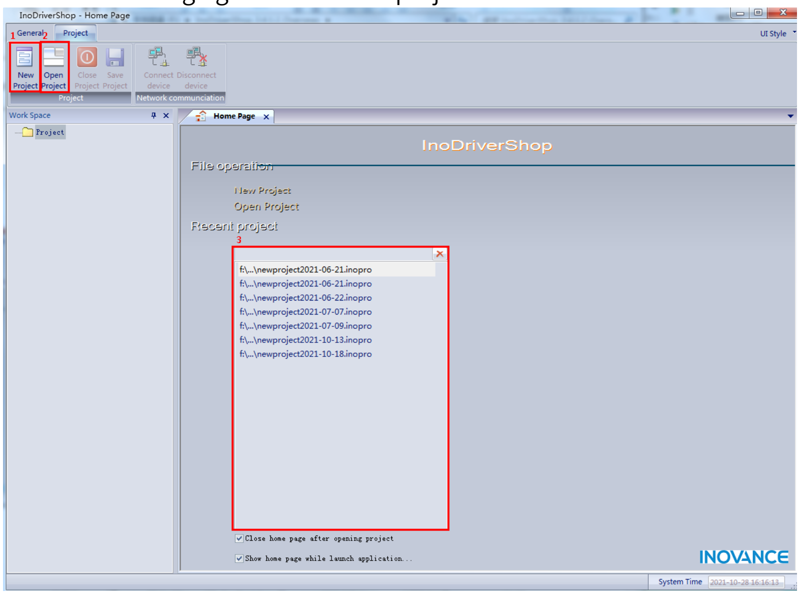



Figure 9-14 Start interface

---

### *Note*

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

---

b. Open the Project Guide interface.

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


Figure 9-15 Project Guide interface

c. Click Next page to create a project.

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

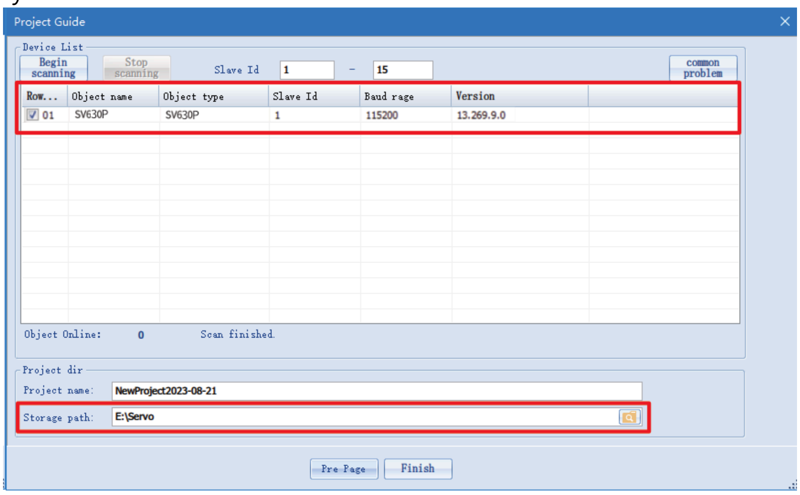



Figure 9-16 Scan interface

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

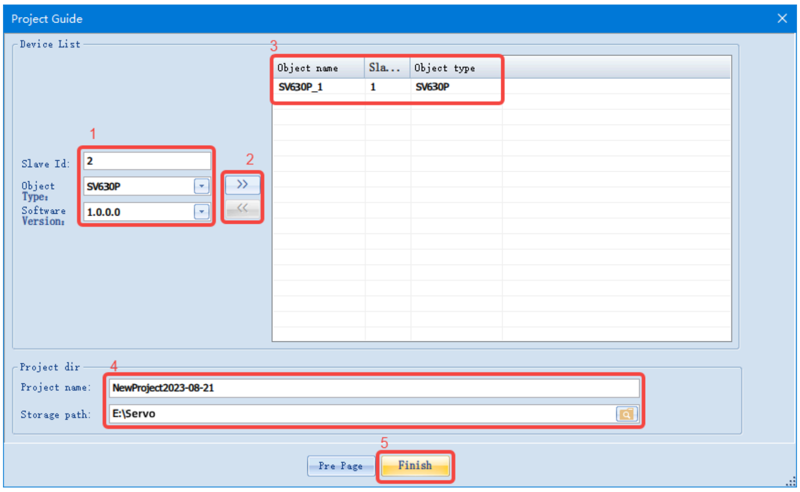



Figure 9-17 Project Guide interface for offline device

## *Note*

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

d. The project has been created.

3. The main interface is shown as follows.

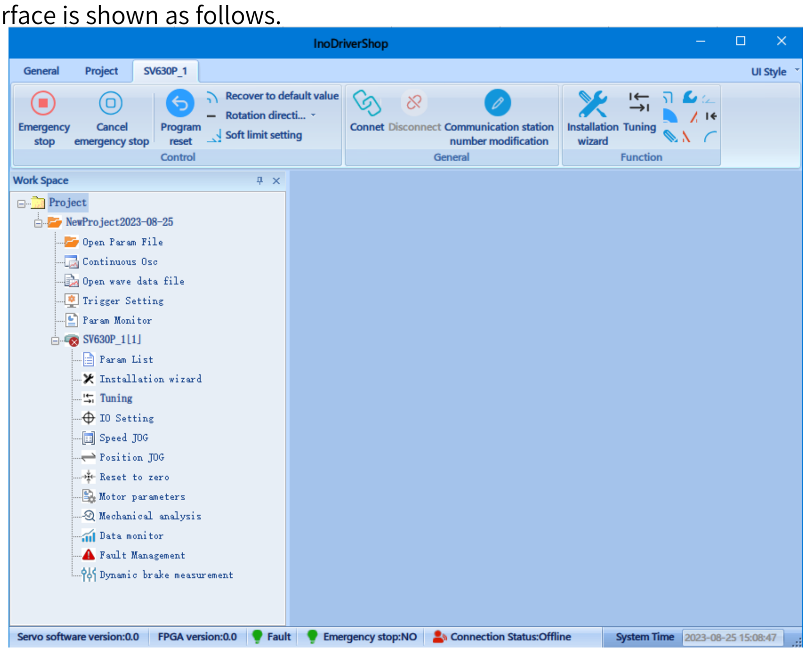
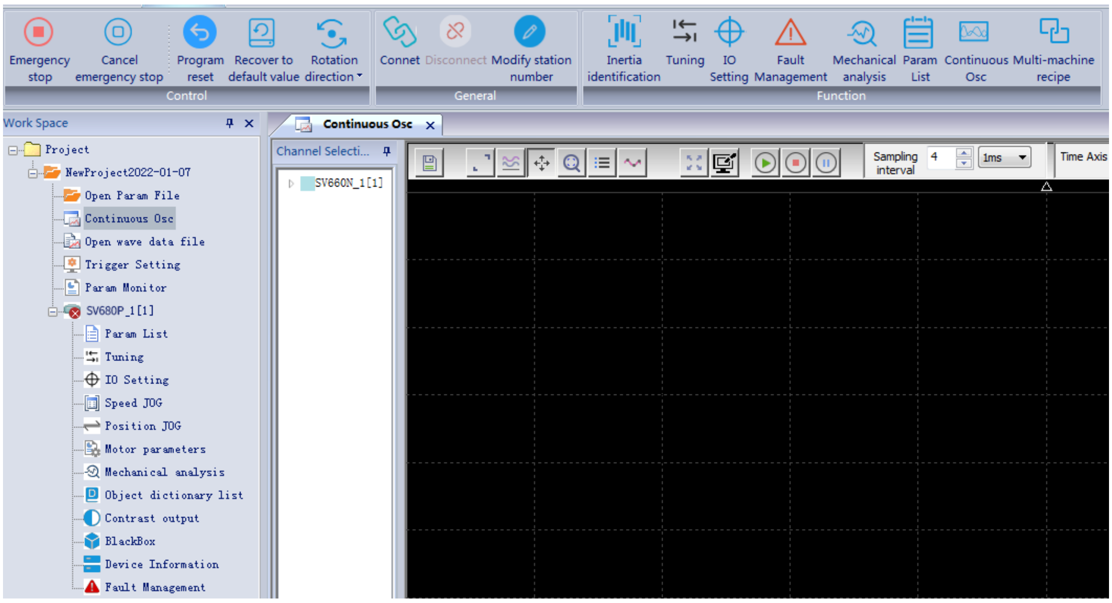



Figure 9-18 Main interface

## 9.2.4 Introduction to the Software Tool

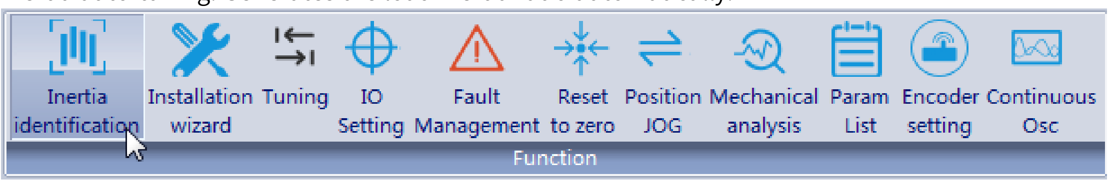
InoDriverShop features the following functions:

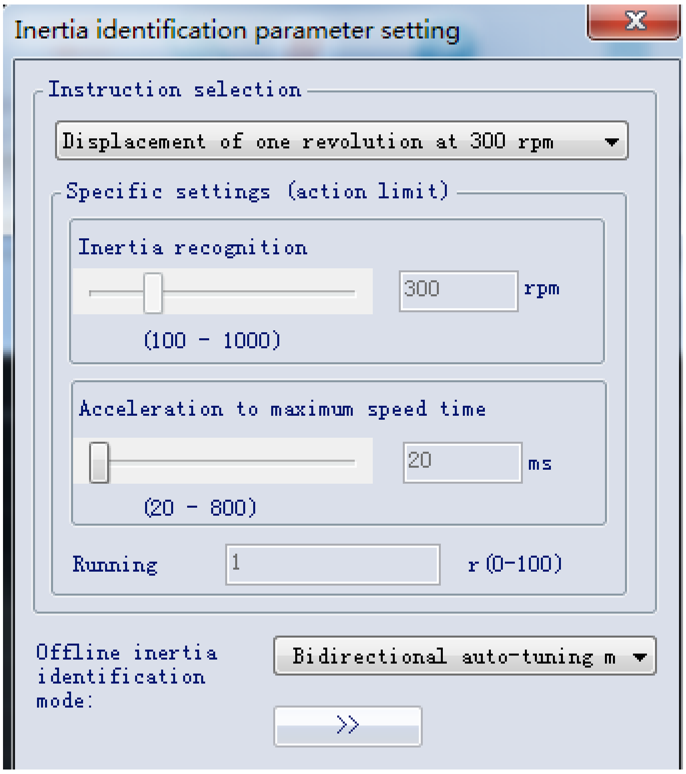
- Oscilloscope: Detects and saves the instantaneous data during operation.



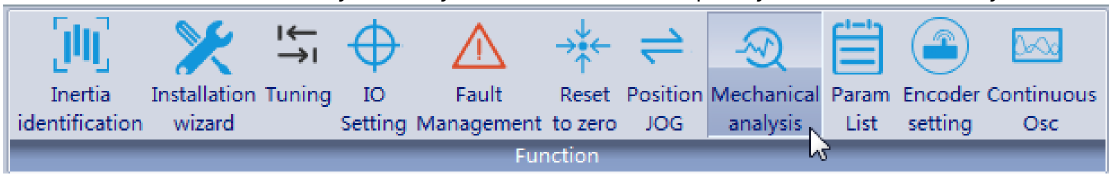

- Parameter management: Reads and downloads parameters in batches.

- Inertia auto-tuning: Generates the load inertia ratio automatically.

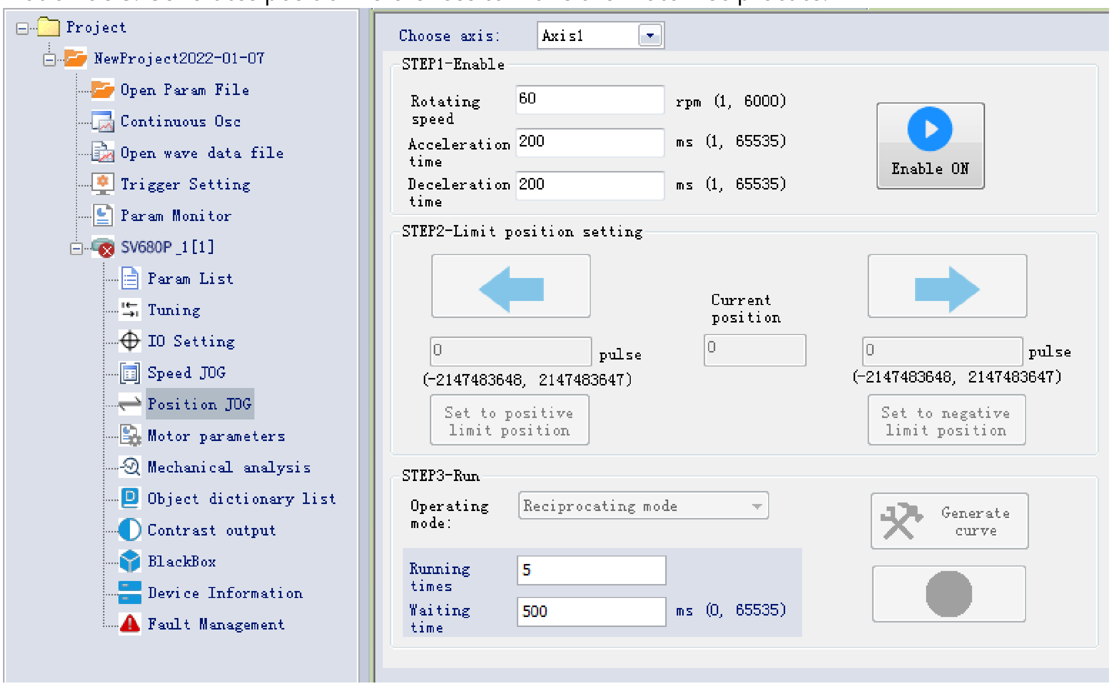





- Mechanical characteristic analysis: Analyzes the resonance frequency of the mechanical system.




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




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

# 10 Commissioning and Operation

## 10.1 Commissioning Flowchart

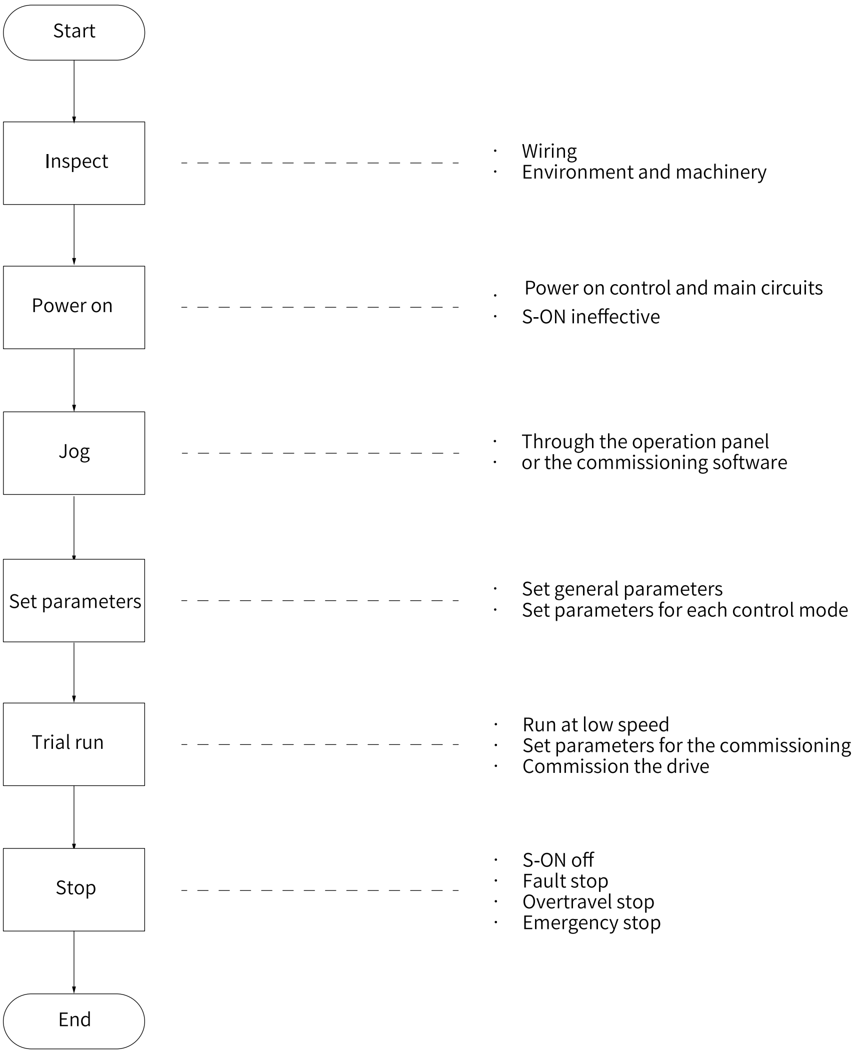



Figure 10-1 Commissioning flowchart of the drive

## 10.2 Inspection Before Commissioning

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

Table 10–1 Checklist

| Log | No. | Description |
|---|---|---|
| Wiring | | |
| □ | 1 | The power input terminals (L1, L2/L1, L2, L3/L1C, L2C/R, S, T) of the servo drive are connected properly. |
| □ | 2 | The main circuit cables (U, V, W) of the motor are connected to the U/V/W terminals of the drive correctly. |
| □ | 3 | No short circuit exists in the power input terminals (L1, L2/L1, L2, L3/R, S, T) or main circuit output terminals (U, V, W) of the servo drive. |

| Log | No. | Description |
|---|---|---|
| ☐ | 4 | The signal cables of the servo drive are connected correctly. The external signal cables such as the brake cable and the overtravel protection cable are connected reliably. |
| ☐ | 5 | The servo drive and servo motor are grounded properly. |
| ☐ | 6 | The stress suffered by the cable is within the specified range. |
| ☐ | 7 | All the wiring terminals are insulated properly. |
| Environment and Mechanical Conditions | | |
| ☐ | 1 | There are no unwanted objects (such as cable terminals and metal chippings) that may cause short circuit of the signal cable and power cable inside or outside the servo drive. |
| ☐ | 2 | The servo drive and the external regenerative resistor are placed on incombustible objects. |
| ☐ | 3 | The servo motor is installed properly. The motor shaft is connected to the machine securely. |
| ☐ | 4 | The servo motor and the connected machine are in good condition and ready to run. |

## 10.3 Power-on

- Switching on the input power supply
  - The power input terminals for a single-phase 220 V power supply are L1 and L2.
  - The power input terminals for a three-phase power supply are L1, L2, L3/L1C, L2C (control circuit power input terminals)/R, S, T (main circuit power input terminals).

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

***Note***

- If the keypad keeps displaying "Nrd", rectify the fault according to section "Troubleshooting".
- If the keypad displays other faults, rectify the fault according to section "Troubleshooting".

- 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. Then, it can be disabled through the host controller or an external switch.

  ☆ Related parameters:

| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.1 | S-ON | Servo ON | Inactive: Servo motor de-energized<br>Active: Servo motor energized |

# 10.4 Jog

**Caution**

To use the jog function, deactivate the S-ON signal first.

The jog function can be used in trial run to check whether the motor rotates properly, without abnormal vibration or noise generated during rotation. You can activate the jogging function through the keypad, two pre-configured external DIs, or the software tool. The motor takes the value saved in H06.04 as the jog speed.

## Jogging through the keypad

- Commissioning Steps

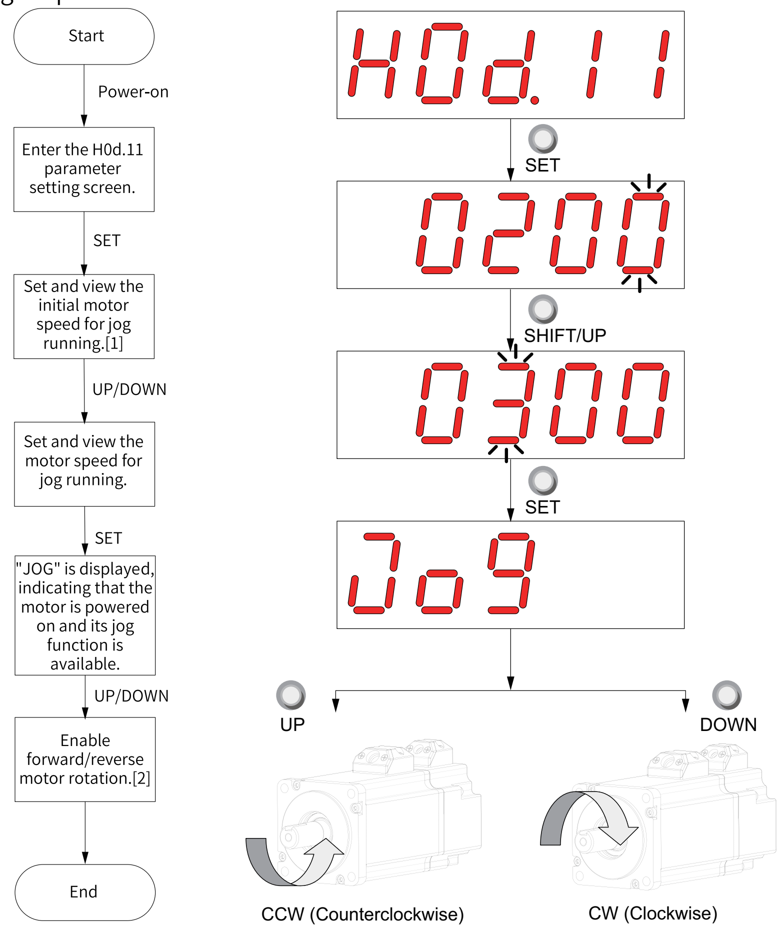



Figure 10-2 Procedure for setting the jog function

***Note***

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

- Procedure:

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

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

   The keypad displays "JOG".
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 upper-level menu.

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

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.04 | 2006-05h | Jog speed setpoint | 0 RPM to 6000 RPM | 100 | RPM | Real-time | " H06_en.04" on page 438 |

- Exiting the jog running
  Press the MODE key to exit from jog and return to the previous menu.

## Jogging through the DI

### *Note*

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

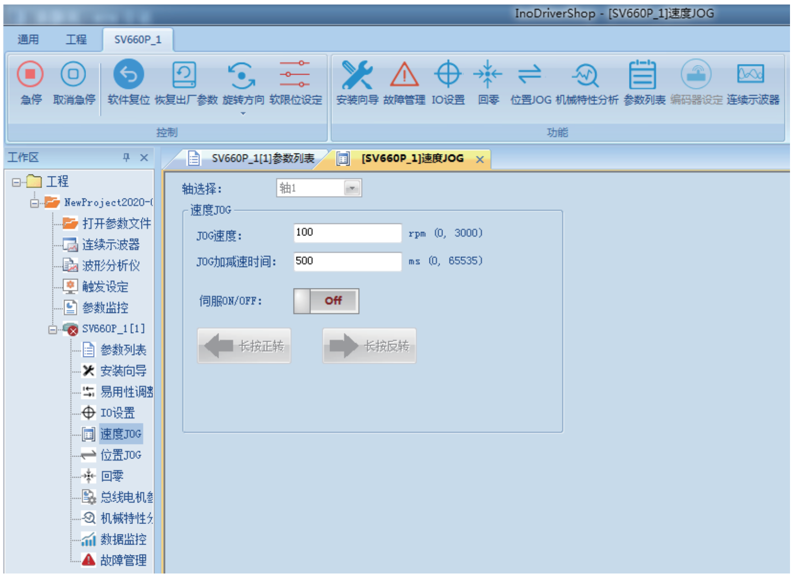
☆ Related parameters:

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

## Jogging through the software tool

Enter the jog interface of the software tool first, and then set the jog speed through H06.04. After clicking the S-ON button in the interface, you can perform forward or reverse jog through the forward/ reverse button in the interface.

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




# 10.5 Setting Parameters

## Rotation direction selection

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

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.02 | 2002-03h | Forward direction | 0: Counterclockwise (CCW) as forward direction<br>1: Clockwise (CW) as forward direction | 0 | - | At stop | " H02_en.02" on page 393 |

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.

## Selection of output pulse phase

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

The relation between phase A and phase B pulses can be changed directly through H02.03.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.03 | 2002-04h | Output pulse phase | 0: Phase A leads phase B<br>1: Phase A lags behind phase B | 0 | - | At stop | " H02_en.03" on page 394 |

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.

## Brake setting

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

**Caution**

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

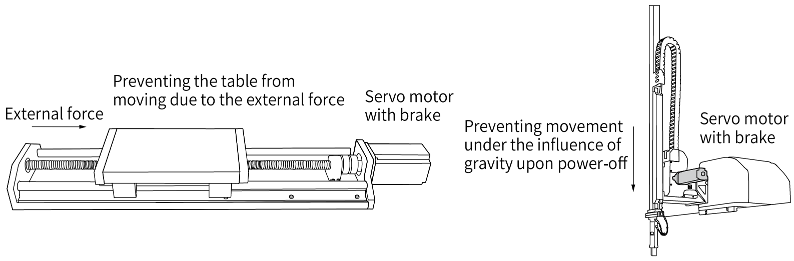



Figure 10-3 Application of the brake

Table 10–2 Brake specifications

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

## *Note*

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

- Brake software setting

  For the servo motor with brake, assign FunOUT.9 (BK, brake output) to a certain DO, and set the active logic of this DO.

  ☆ Related parameters:

| Code | Parameter Name | Function Name | 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.<br>Active: The brake power supply is switched on and the brake is released. In this case, the motor can rotate. |

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

- Brake sequence in normal state

  The brake sequence in the normal state is further divided into the following two types:

  - Standstill: The actual motor speed is lower than 20 RPM.
  - Rotating: The motor speed is equal to or higher than 20 RPM.

- Brake sequence for motor at standstill

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

## 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.

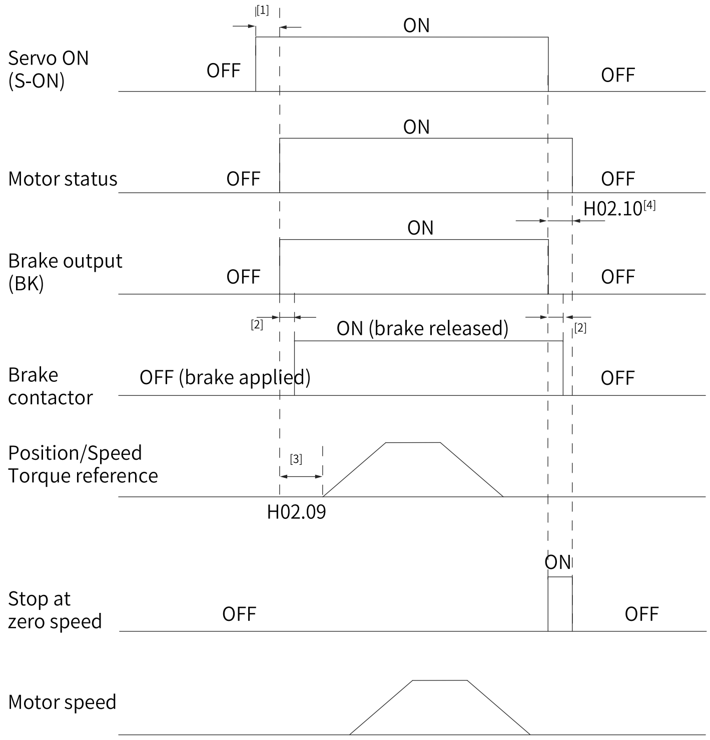



Figure 10-4 Brake sequence for motor at standstill

## Note

- [1]: When the S-ON signal is switched on, the brake output is set to "ON" at a delay of about 100 ms, with motor being energized at the same time.
- [2]: For delay of brake contactor actions, see *"Table 10–2" on page 197*.
- [3]: The interval time, starting from the moment when brake output is set to "ON" to the moment when a command is input, must be higher than the setpoint of H02.09.
- [4]: When the S-ON signal is switched off with motor at standstill (motor speed lower than 20 rpm), the brake output is set to "OFF". You can set in H02.10 the delay of the motor in entering the de-energized state after the brake output is set to "OFF".

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.09 | 2002-0Ah | Delay from brake output ON to command received | 0ms to 500ms | 250 | ms | Real-time | *"H02_en.09" on page 396* |
| H02.10 | 2002-0Bh | Delay from brake output OFF to motor de-energized in the standstill state | 1ms to 1000ms | 150 | ms | Real-time | *"H02_en.10" on page 396* |

- Brake sequence for motor in the rotation state

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

Caution

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

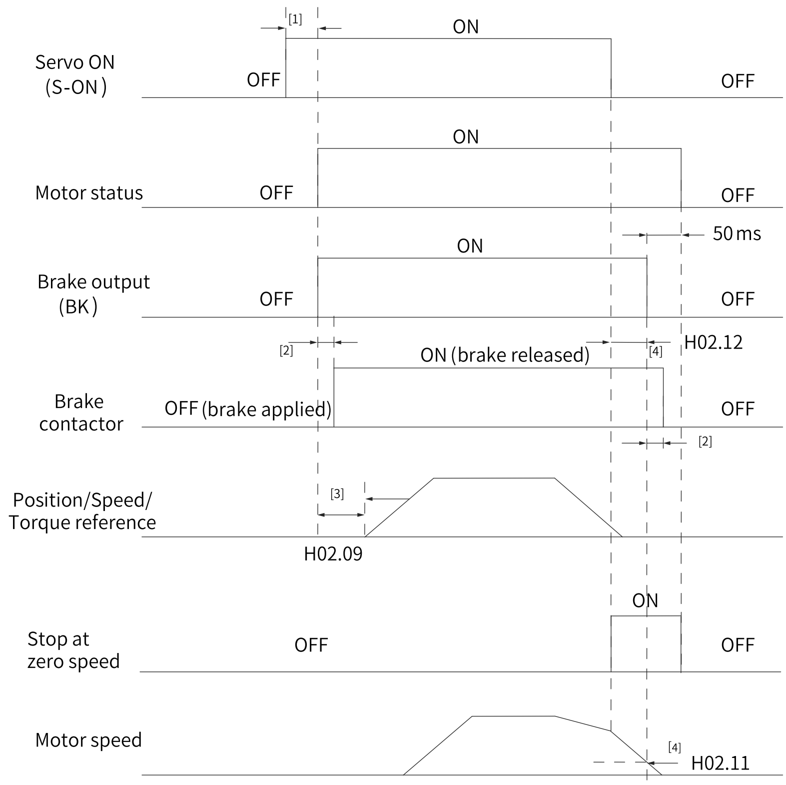



Figure 10-5 Brake sequence for a rotating motor

## Note

- [1]: When the S-ON signal is switched on, the brake output is set to "ON" at a delay of about 100 ms, with motor being energized at the same time.
- [2]: For delay of brake contactor actions, see *"Table 10–2" on page 197*.
- [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".

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.11 | 2002-0Ch | Motor speed threshold at brake output OFF in rotation state | 0 RPM to 3000 RPM | 30 | RPM | Real-time | " H02_en.11" on page 396 |
| H02.12 | 2002-0Dh | Delay from S-ON OFF to brake output OFF in rotation state | 1ms to 1000ms | 500 | ms | Real-time | " H02_en.12" on page 396 |

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

    In this case, the servo motor stops at zero speed first. When the motor speed actual value is lower than 20 RPM, the brake output changes to "OFF" immediately but the motor is still energized within the time defined by H02.10, which is the same as the brake time sequence for the motor at standstill.

## Braking settings

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 regenerative resistor. Otherwise, the servo drive will be damaged. The regenerative resistor can be a built-in or an external one. The internal and built-in regenerative resistors must not be used together. Specifications of the regenerative resistor are as follows.

Table 10–3 Specifications of the regenerative resistor

| Servo Drive Model | Specifications of Built-in Regenerative Resistor | | | External regenerative resistor Min. Allowable Resistance (Ω) (H02.21) |
|---|---|---|---|---|
| | Resistance (Ω) | Power (Pr) (W) | Processing Power (Pa) (W) | |
| SV630PS1R6I | - | - | - | 50 |
| SV630PS2R8I | - | - | - | 45 |
| SV630PS5R5I | 50 | 50 | 25 | 40 |
| SV630PS7R6I | 25 | 80 | 40 | 20 |
| SV630PS012I | | | | 15 |
| SV630PT3R5I | 100 | 80 | 40 | 80 |
| SV630PT5R4I | 100 | 80 | 40 | 60 |
| SV630PT8R4I | 50 | 80 | 40 | 45 |
| SV630PT012I | | | | 40 |
| SV630PT017I | 35 | 100 | 50 | 35 |
| SV630PT021I | | | | 25 |
| SV630PT026I | | | | |

## Note

The built-in regenerative resistor is not available in S2R8 models. For these models, you can install an external regenerative 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 regenerative resistor starts consuming the excessive energy fed back by the motor. The following figure shows the motor speed curve in no-load operation from 3000 rpm to a standstill.

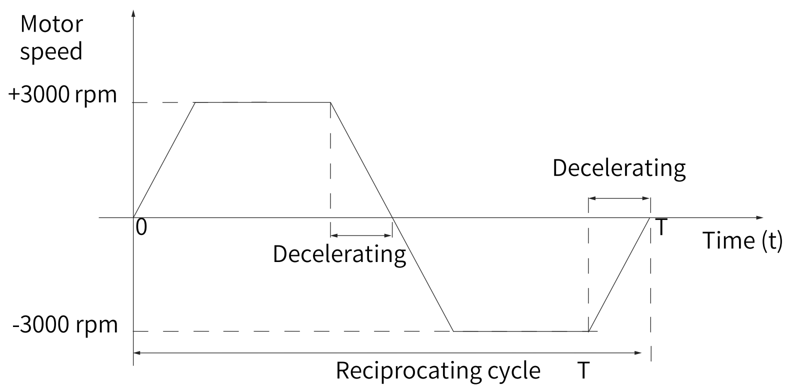



Figure 10-6 Example of motor speed curve (without external load torque)

- Energy calculation
  The built-in braking resistor is not available in SV630PS1R6I and SV630PS2R8I models. For the energy that can be charged by a capacitor, see *"8.6 Wiring and Setting of the Regenerative Resistor" on page 172*. An external regenerative resistor is needed when the rotational energy of the motor and the load exceeds the values listed in the following table.

| Drive Model | Regenerative Energy Can Be Absorbed | Remarks |
|---|---|---|
| SV630PS1R6I | 13.15 | The input voltage of the main circuit power supply is 220 VAC. |
| SV630PS2R8I | 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.

| Capacity (kW) | Servo Motor Model MS1H*-*******-***** | Rotor Inertia J ($10^{-4}$ kgm $^{2}$) | EO Generated During Decelerating from Rated Speed to a Standstill (J) | Max. Braking Energy Absorbed by Capacitor $E_C$ (J) |
|---|---|---|---|---|
| 0.05 | MS1H1-05B30CB-T330Z<br>MS1H1-05B30CB-T332Z | 0.026<br>(0.028) | 0.13<br>(0.14) | 7.86 |
| 0.1 | MS1H1-10B30CB-T330Z<br>MS1H1-10B30CB-T332Z | 0.041<br>(0.043) | 0.20<br>(0.21) | |
| 0.2 | MS1H1-20B30CB-T331R<br>MS1H1-20B30CB-T334R | 0.0938<br>(0.106) | 0.46<br>(0.52) | |
| 0.4 | MS1H1-40B30CB-T331R<br>MS1H1-40B30CB-T334R | 0.145<br>(0.157) | 0.72<br>(0.78) | 15.72 |
| 0.55 | MS1H1-55B30CB-T331R | 0.55 | 2.72 | 22.39 |
| 0.75 | MS1H1-75B30CB-T331R<br>MS1H1-75B30CB-T334R | 0.68<br>(0.71) | 3.36<br>(3.51) | 22.39 |
| 1 | MS1H1-10C30CB-T331R<br>MS1H1-10C30CB-T334R | 0.82<br>(0.87) | 4.05<br>(4.30) | 32.39 |
| 1 | MS1H2-10C30CB-T331R<br>MS1H2-10C30CB-T334R | 1.78<br>(2.6) | 8.80<br>(12.86) | 32.39 |
| 1.5 | MS1H2-15C30CB-T331R<br>MS1H2-15C30CB-T334R | 2.35<br>(3.17) | 11.6<br>(15.68) | 32.39 |
| 2.0 | MS1H2-20C30CB-T331R<br>MS1H2-20C30CB-T334R | 2.92<br>(3.74) | 14.44<br>(18.49) | 32.39 |
| 0.85 | MS1H3-85B15CB-T331R<br>MS1H3-85B15CB-T334R | 13.56<br>(15.8) | 16.45<br>(17.3) | 32.39 |
| 1.3 | MS1H3-13C15CB-T331R<br>MS1H3-13C15CB-T334R | 19.25<br>(21.5) | 22<br>(22.86) | 32.39 |
| 0.1 | MS1H4-10B30CB-T330Z<br>MS1H4-10B30CB-T332Z | 0.102<br>(0.104) | 0.50<br>(0.51) | 7.86 |
| 0.2 | MS1H4-20B30CB-T331R<br>MS1H4-20B30CB-T334R | 0.22<br>(0.23) | 1.09<br>(1.14) | 7.86 |
| 0.4 | MS1H4-40B30CB-T331R<br>MS1H4-40B30CB-T334R | 0.43<br>(0.44) | 2.13<br>(2.18) | 15.72 |
| 0.55 | MS1H4-55B30CB-T331R | 1.12 | 5.54 | 22.39 |

| Capacity (kW) | Servo Motor Model MS1H*-*******-***** | Rotor Inertia J ($10^{-4}$ kgm $^2$) | EO Generated During Decelerating from Rated Speed to a Standstill (J) | Max. Braking Energy Absorbed by Capacitor $E_C$ (J) |
|---|---|---|---|---|
| 0.75 | MS1H4-75B30CB-T331R<br>MS1H4-75B30CB-T334R | 1.46<br>(1.51) | 7.22<br>(7.47) | 22.39 |
| 1.0 | MS1H4-10C30CB-T331R<br>MS1H4-10C30CB-T334R | 1.87<br>(1.97) | 9.25<br>(9.74) | 32.39 |

- The following table shows the energy generated by a 380V motor in decelerating from the rated speed to a standstill during no-load operation.

| - Capacity (kW) | Servo Motor Model MS1H*-*******-***** | Rotor Inertia J ($10^{-4}$ kgm $^2$) | 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-T331R<br>MS1H2-10C30CD-T334R | 1.78<br>(2.6) | 8.8<br>(12.86) | 28.18 |
| 1.5 | MS1H2-15C30CD-T331R<br>MS1H2-15C30CD-T334R | 2.35<br>(3.17) | 11.62<br>(15.68) | 34.22 |
| 2.0 | MS1H2-20C30CD-T331R<br>MS1H2-20C30CD-T334R | 2.92<br>(3.74) | 14.44<br>(18.49) | 50.32 |
| 2.5 | MS1H2-25C30CD-T331R<br>MS1H2-25C30CD-T334R | 3.49<br>(4.3) | 17.26<br>(21.26) | 50.32 |
| 3.0 | MS1H2-30C30CD-T331R<br>MS1H2-30C30CD-T334R | 6.4<br>(9.38) | 31.65<br>(46.38) | 50.32 |
| 4.0 | MS1H2-40C30CD-T331R<br>MS1H2-40C30CD-T334R | 9<br>(11.98) | 44.51<br>(59.24) | 82.53 |
| 5.0 | MS1H2-50C30CD-T331R<br>MS1H2-50C30CD-T334R | 11.6<br>(14.58) | 57.36<br>(72.10) | 100.64 |
| 0.85 | MS1H3-85B15CD-T331R<br>MS1H3-85B15CD-T334R | 13.56<br>(15.8) | 16.76<br>(19.53) | 28.18 |
| 1.3 | MS1H3-13C15CD-T331R<br>MS1H3-13C15CD-T334R | 19.25<br>(21.5) | 23.8<br>(26.58) | 34.22 |
| 1.8 | MS1H3-18C15CD-T331R<br>MS1H3-18C15CD-T334R | 24.9<br>(27.2) | 30.78<br>(33.63) | 50.32 |
| 2.9 | MS1H3-29C15CD-T331R<br>MS1H3-29C15CD-T334R | 44.7<br>(52.35) | 55.26<br>(64.72) | 50.32 |
| 4.4 | MS1H3-44C15CD-T331R<br>MS1H3-44C15CD-T334R | 64.9<br>(72.55) | 80.23<br>(89.69) | 82.53 |
| 5.5 | MS1H3-55C15CD-T331R<br>MS1H3-55C15CD-T334R | 86.9<br>(94.55) | 107.43<br>(116.89) | 100.64 |
| 7.5 | MS1H3-75C15CD-T331R<br>MS1H3-75C15CD-T334R | 127.5<br>(135.15) | 157.62<br>(167.08) | 100.64 |

## Note

Values inside the parentheses "()" are for the motor with a brake.

## Note

If the total braking time T is known, you can determine whether an external regenerative resistor is needed and the power required using the following flowchart and formula.

- Regenerative resistor selection

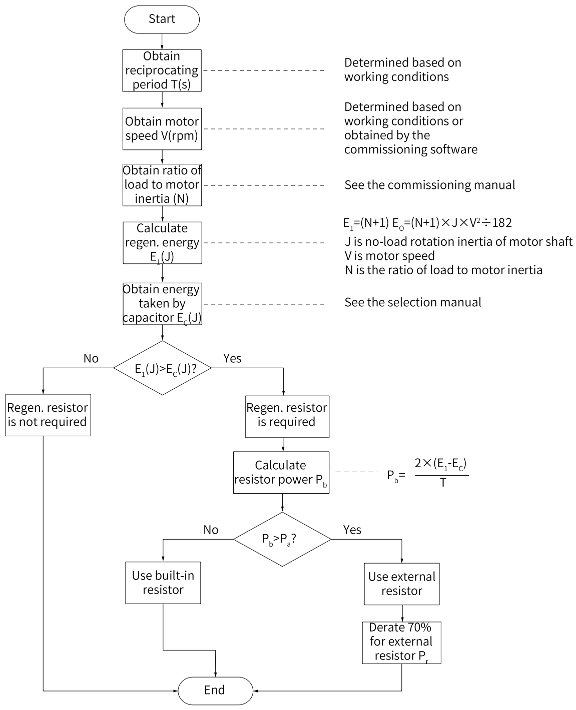



Figure 10-7 Flowchart for selecting the regenerative resistor

## Note

- Take the process in which the motor decelerates from 3000 RPM to 0 RPM as an example. Assume that the load inertia is (N x Motor inertia), then the braking energy is (N + 1) x $E_O$ when the motor decelerates from 3000 RPM to 0 RPM. The energy consumed by the braking resistor is (N + 1) x $E_O$ - $E_C$ ($E_C$ represents the energy absorbed by the capacitor). Suppose the reciprocating cycle is T, then the power of the regenerative resistor needed is 2 x [(N + 1) x $E_O$ - $E_C$]/T. for the $E_O$ and $E_C$ values of a specific motor, see the Braking Energy Data in *"Braking settings" on page 201*.
- Determine whether to use the regenerative resistor according to the preceding figure and select a built-in or an external regenerative resistor as needed. Then, set H02.25 accordingly.
- The resistor with aluminum case is recommended.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.25 | 2002-1Ah | Regenerative resistor type | 0: Built-in<br>1: External, natural ventilated<br>2: External, forced air cooling<br>3: Not needed | 0 | - | At stop | " H02_en.25" on page 399 |

Take the H1 series 750 W model as an example. Assume that the reciprocating cycle (T) is 2s, the maximum speed is 3000 RPM, and the load inertia is (4 x Motor inertia), then the required power of the braking resistor is as follows:

$$P_b = \frac{2\times[(N+1)\times E_o - E_c]}{T} = \frac{2\times[(4+1)\times 6.8-22.4]}{2} = 11.6W$$

The calculated result is smaller than the processing capacity (Pa = 40 W) of the built-in regenerative resistor, so a built-in regenerative resistor is enough.

If the inertia ratio in the preceding example is changed to 10 x motor inertia, and other conditions remain the same, the power of the regenerative resistor required will be as follows:

$$P_b = \frac{2\times[(N+1)\times E_o - E_c]}{T} = \frac{2\times[(10+1)\times 6.8-22.4]}{2} = 52.4W$$

The calculated result is larger than the processing capacity (Pa = 40 W) of the built-in regenerative resistor, so an external regenerative resistor is needed. so an external braking resistor is required. The recommended power of the external regenerative resistor is Pb/(1 – 70%) = 174.67W.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.21 | 2002-16h | Min. permissible resistance of braking resistor | 0Ω to 65535Ω | 40 | Ω | Unchangeable | " H02_en.21" on page 398 |
| H02.24 | 2002-19h | Resistor heat dissipation coefficient | 10 to 100 | 30 | - | At stop | " H02_en.24" on page 399 |
| H02.25 | 2002-1Ah | Regenerative resistor type | 0: Built-in<br>1: External, natural ventilated<br>2: External, forced air cooling<br>3: Not needed | 0 | - | At stop | " H02_en.25" on page 399 |
| H02.26 | 2002-1Bh | Power of external braking resistor | 1W to 65535W | 40 | W | At stop | " H02_en.26" on page 400 |
| H02.27 | 2002-1Ch | Resistance of external regenerative resistor | 1Ω to 1000Ω | 50 | Ω | At stop | " H02_en.27" on page 400 |

- Using an external regenerative 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 regenerative resistor with 70% derated, that is, $P_r = P_b/(1 – 70\%)$, and ensure the resistance of the regenerative resistor is higher than the minimum permissible resistance allowed by the servo drive. Remove the jumper bar between terminals P⊕ and D, and connect the external regenerative resistor between terminals P⊕ and C.

For the wiring diagram and lead wire specifications of the external regenerative resistor, see *"8.6 Wiring and Setting of the Regenerative Resistor" on page 172*. Set H02.25 to 1 or 2 based on the cooling mode of the braking resistor.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.21 | 2002-16h | Min. permissible resistance of braking resistor | 0Ω to 65535Ω | 40 | Ω | Unchangeable | *"H02_en.21" on page 398* |
| H02.26 | 2002-1Bh | Power of external braking resistor | 1W to 65535W | 40 | W | At stop | *"H02_en.26" on page 400* |
| H02.27 | 2002-1Ch | Resistance of external regenerative resistor | 1Ω to 1000Ω | 50 | Ω | At stop | *"H02_en.27" on page 400* |

**Caution**

- Set the power (H02.26) and resistance (H02.27) of the external regenerative resistor.
- Ensure the resistance of the external regenerative resistor is higher than or equal to the permissible minimum resistance.
- When the regenerative resistor is used at its rated power rather than the processing power (average value) in environments within the specified temperature range, the temperature of the resistor will rise to above 120°C under continuous braking. To ensure safety, cool the resistor down through forced air cooling, or use the resistor with thermal switch. For the load characteristics of the regenerative resistor, consult with the manufacturer.

Set the heat dissipation coefficient based on the heat dissipation condition of the external regenerative resistor.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.24 | 2002-19h | Resistor heat dissipation coefficient | 10 to 100 | 30 | - | At stop | *"H02_en.24" on page 399* |

***Note***

Higher resistor heat dissipation coefficient indicates higher braking efficiency.

- Using the built-in braking resistor

  When $P_b < P_a$ and $E_1 > E_C$, use the built-in regenerative resistor. In this case, set H02.25 to 0.

  When using the built-in regenerative resistor, connect terminals P⊕ and D with a jumper bar.

- Regenerative resistor not needed

When $E_1 < E_C$, the regenerative resistor is not needed because the braking energy can be absorbed by the bus capacitor. In this case, set H02.25 to 3.

- 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.

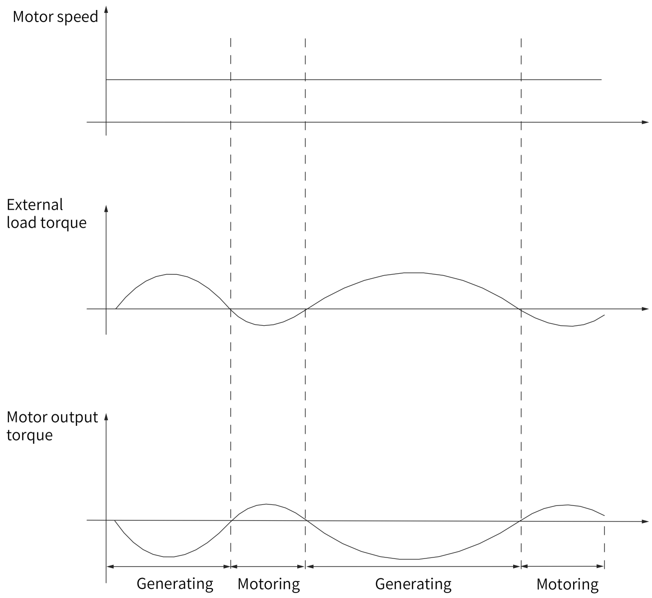



Figure 10-8 Example of the curve with external load torque

Take H1 series 0.75kW models (rated torque: 2.39 N·m) as an example. When the external load torque is 60% of the rated torque and the motor speed reaches 1500 rpm, the power fed back to the drive is (60% x 2.39) x (1500 x 2π/60) = 225 W. As the regenerative resistor needs to be derated by 70%, the power of the external regenerative resistor is 225/(1 – 70%) = 0.75kW, with resistance being 50 Ω.

## 10.6 Trial Run

Switch on the S-ON signal.

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

| Log | No. | Description |
|---|---|---|
| □ | 1 | During initial operation, set a proper command to make the motor run at low speed and check whether the motor rotates properly. |
| □ | 2 | Observe whether the motor rotating direction is correct. If the direction of rotation is opposite to the expected direction, check the reference signal input and the reference direction setting signal. |

| Log | No. | Description |
|---|---|---|
| ☐ | 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 preceding conditions, adjust related parameters to make the motor operate as desired. |
| ☐ | 5 | Adjust the drive according to section "Adjustment". |

## Power-on sequence diagram

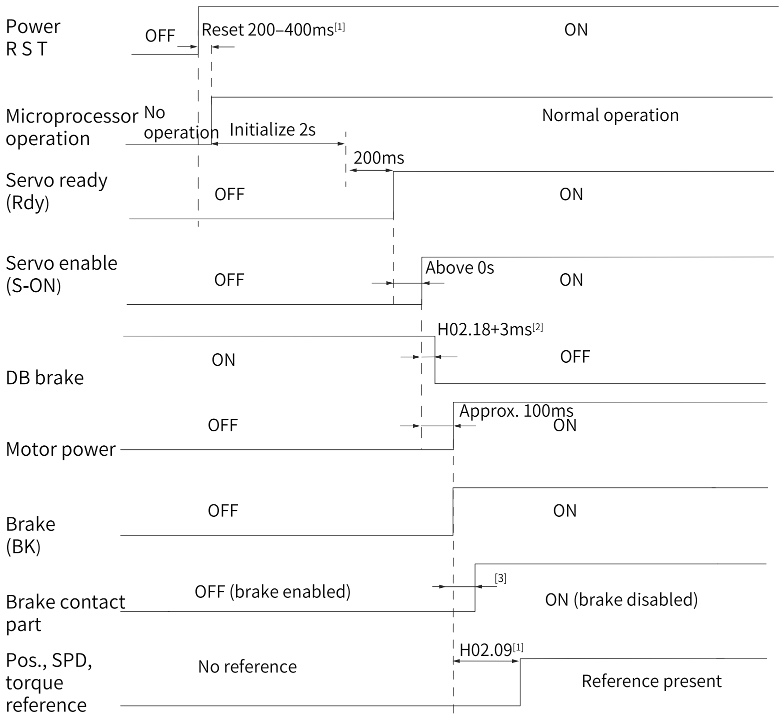



Figure 10-9 Power-on sequence diagram

### *Note*

- [1] The reset time is determined by the setup time of the +5V power supply of the microprocessor.
- [2] The dynamic brake is included in the standard configuration.
- [3] For the delay of brake contactor actions, see for details. *"Table 10–2" on page 197*
- [4] When FunOUT.9 (BK, brake output) is not used, H02.09 is invalid.

## Sequence diagram for stop at warning or fault

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

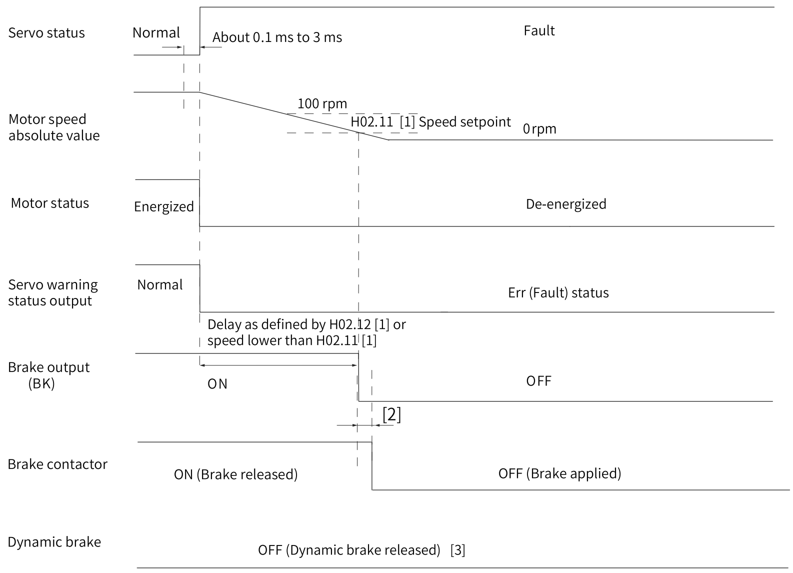



Figure 10-10 Sequence of "Coast to stop, keeping de-energized state" at No. 1 fault

## Note

- [1] When FunOUT.9 (BK, brake output) is not used, H02.11 and H02.12 are invalid.
- [2] For the delay of brake contactor actions, see for details. *“Table 10–2” on page 197*
- [3] The dynamic brake is included in the standard configuration.

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

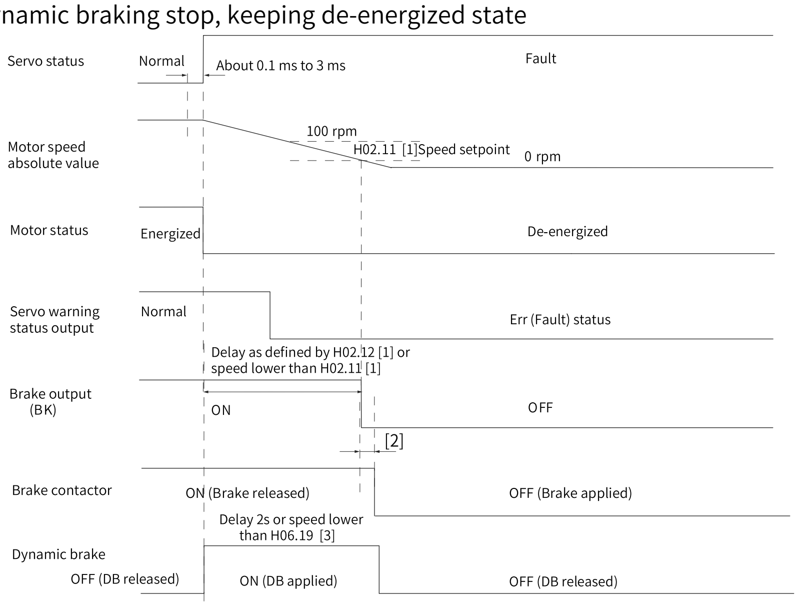



Figure 10-11 Sequence of "Dynamic braking stop, keeping de-energized state" at No. 1 fault

## Note

- [1] When FunOUT.9 (BK, brake output) is not used, H02.11 and H02.12 are invalid.
- [2] For the delay of brake contactor actions, see for details. *“Table 10–2” on page 197*
- [3] The dynamic brake is included in the standard configuration.

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

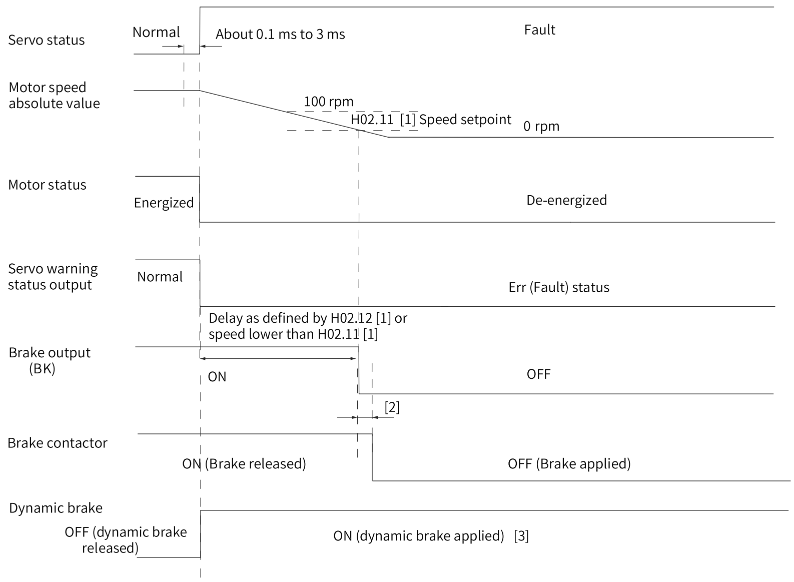



Figure 10-12 Sequence of "Dynamic braking stop, keeping dynamic braking state" at No. 1 fault

## Note

- [1] When FunOUT.9 (BK, brake output) is not used, H02.11 and H02.12 are invalid.
- [2] For the delay of brake contactor actions, see for details. *“Table 10–2” on page 197*
- [3] The dynamic brake is included in the standard configuration.

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

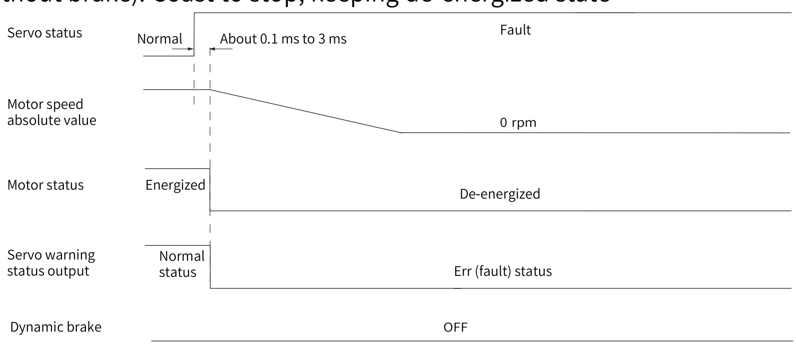



Figure 10-13 Sequence of "Coast to stop, keeping de-energized state" at No. 2 fault

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

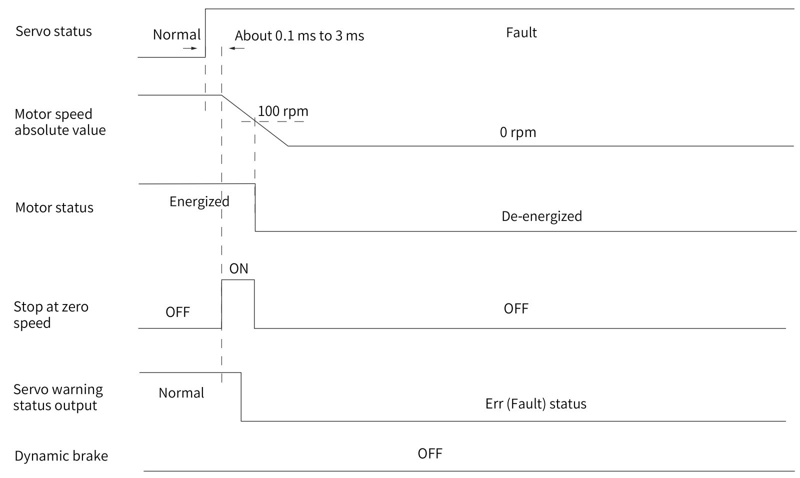



Figure 10-14 Sequence of "Stop at zero speed, keeping de-energized state" at No. 2 fault (without brake)

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

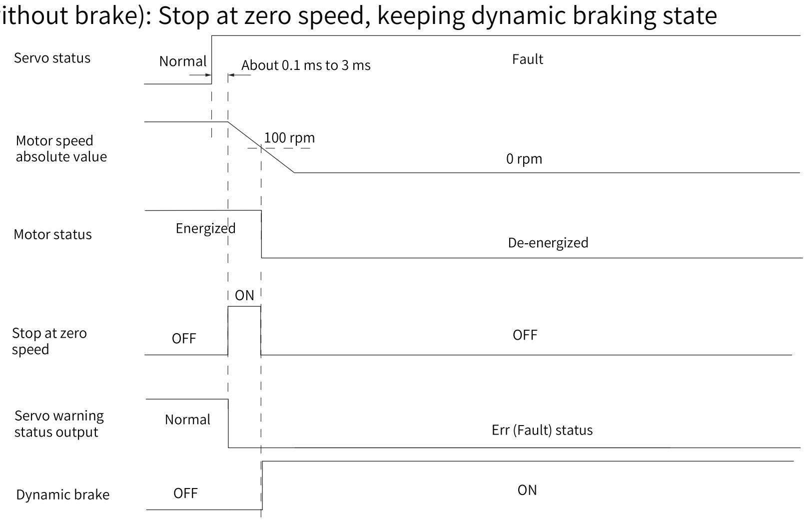



Figure 10-15 Sequence of "Stop at zero speed, keeping dynamic braking state" at No. 2 fault (without brake)

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

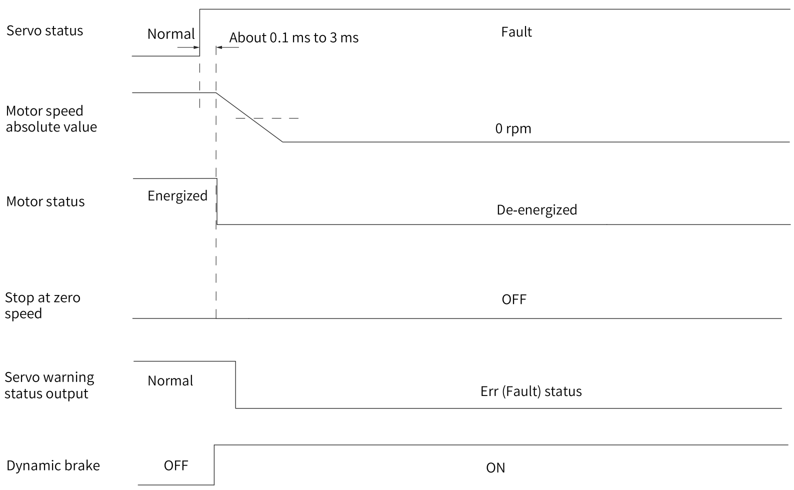



Figure 10-16 Sequence of "Dynamic braking stop, keeping dynamic braking state" at No. 2 fault (without brake)

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

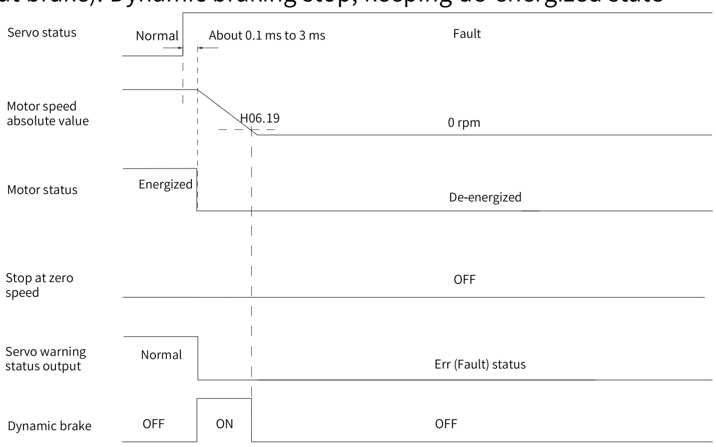



Figure 10-17 Sequence of "Dynamic braking stop, keeping de-energized state" at No. 2 fault (without brake)

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

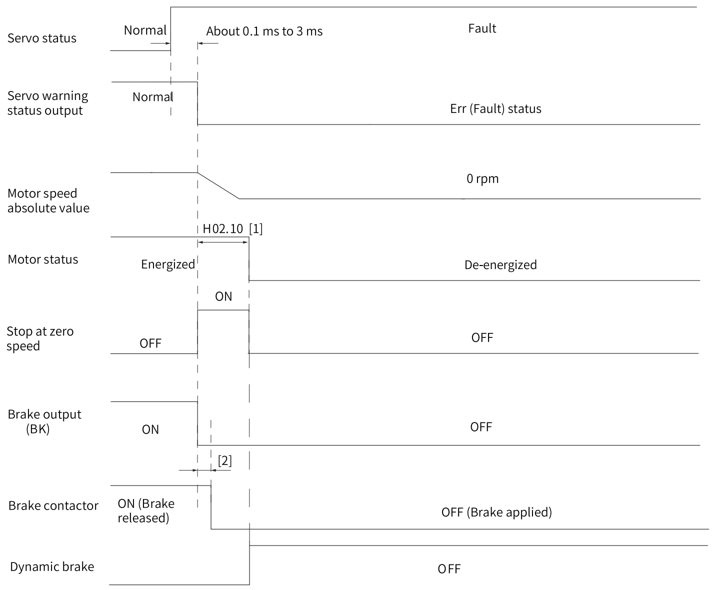



Figure 10-18 Sequence of "Stop at zero speed, keeping dynamic braking state" at No. 2 fault (with brake)

## *Note*

- [1] When FunOUT.9 (BK, brake output) is not used, H02.10 is invalid.
- [2] For the delay of brake contactor actions, see for details. *"Table 10–2" on page 197*

- When a No. 3 warning occurs on the servo drive, such as E900.0 (DI emergency braking), E950.0 (Positive limit switch warning), and E952.0 (Negative limit switch warning), the servo drive stops according to *"Figure 10–19 Sequence for warnings that cause stop" on page 215*.
- Warnings that cause stop: Stop at zero speed, keeping position lock status

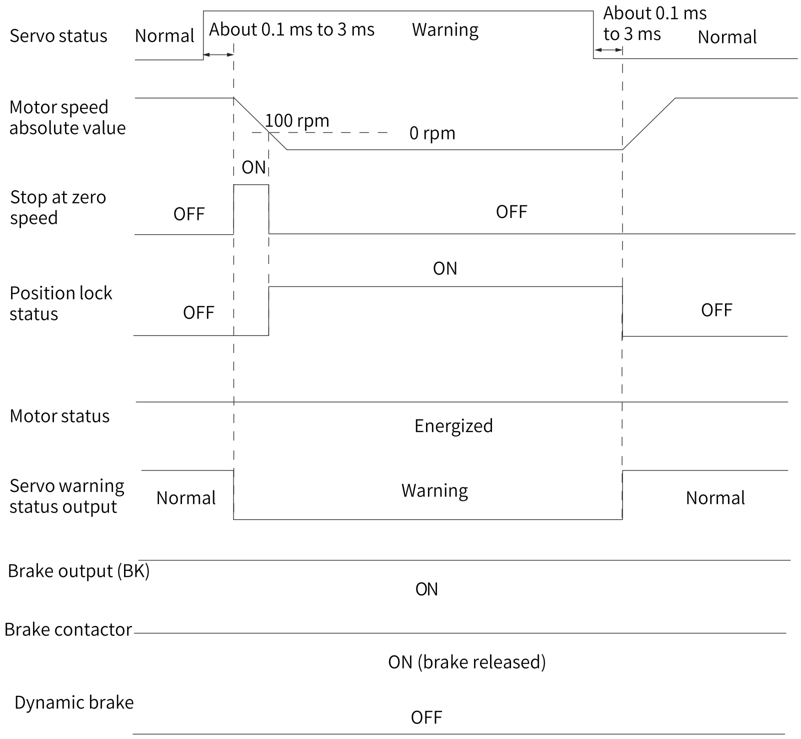



Figure 10-19 Sequence for warnings that cause stop

The other warnings do not affect the operation state of the drive. The sequence diagram for these warnings is shown in *"Figure 10–20 Sequence for warnings that do not cause stop" on page 215*.

- Warnings that do not cause stop

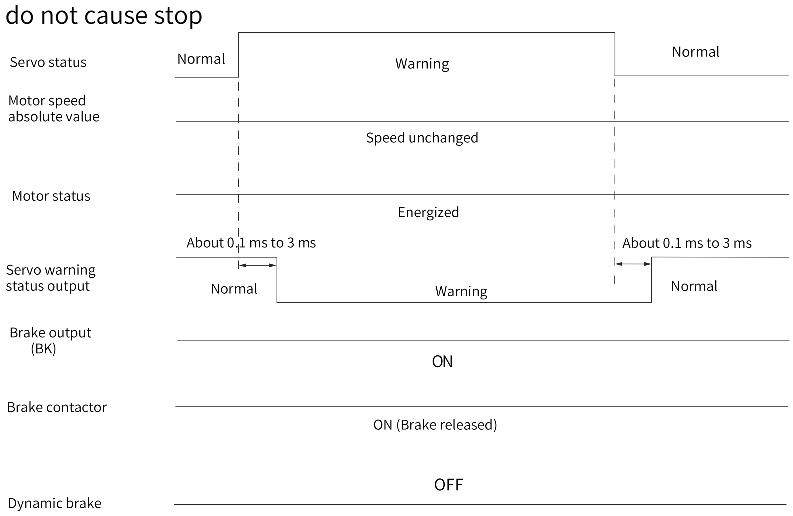



Figure 10-20 Sequence for warnings that do not cause stop

- Fault reset

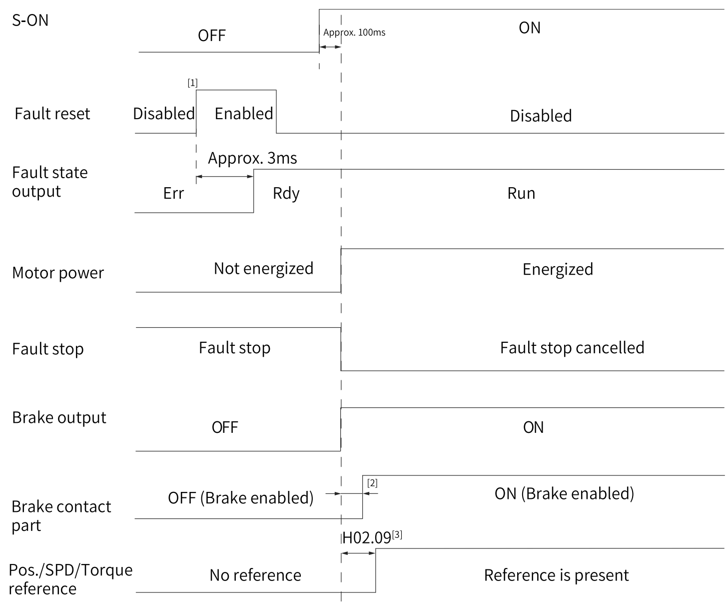



Figure 10-21 Sequence for fault reset

***Note***

- [1] The DI signal used for fault reset (FunIN.2: ALM-RST) is edge triggered.
- [2] For the delay of brake contactor actions, see for details. *"Table 10–2" on page 197*
- [3] When FunOUT.9 (BK, brake output) is not used, H02.09 is invalid.

## 10.7 Servo OFF

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 10–4 Comparison of three stop modes

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

Table 10–5 Comparison of three stop status

| De-energized | Position Lock | Dynamic Braking |
|---|---|---|
| The motor is de-energized and the motor shaft can be rotated freely after the motor stops rotating. | The motor shaft is locked and cannot be rotated freely after the motor stops rotating. | The motor shaft is braked after the motor stops rotating. The shaft can be rotated slowly under a large external force. |

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

## Stop at S-ON OFF

Assign the S-ON function to a certain DI and deactivate the logic of this DI.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.05 | 2002-06h | Stop mode at S-OFF | 0: Coast to stop, keeping de-energized state<br>1: Stop at zero speed, keeping de-energized state<br>2: Stop at zero speed, keeping dynamic braking state<br>3: Dynamic braking stop, keeping dynamic braking state | 0 | - | At stop | " H02_en.05" on page 394 |

## Fault reaction

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

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.06 | 2002-07h | Stop mode at No.2 fault | 0: Coast to stop, keeping de-energized state<br>1: Stop at zero speed, keeping de-energized state<br>2: Stop at zero speed, keeping dynamic braking state<br>3: Dynamic braking stop, keeping DB state<br>4: DB stops, keeping operation state | 2 | - | At stop | " H02_en.06" on page 395 |
| H02.08 | 2002-09h | Stop mode at No.1 fault | 0: Coast to stop, keeping de-energized state1: DB stop, keeping de-energized state2: DB stop, keeping DB state | 2 | - | At stop | " H02_en.08" on page 395 |

### *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

## Stop at overtravel

★ Definition of terms:

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

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.07 | 2002-08h | Stop mode at overtravel | 0: Coast to stop, keeping de-energized state<br>1: Stop at zero speed, keeping position lock state<br>2: Stop at zero speed, keeping de-energized state | 1 | - | At stop | " H02_en.07" on page 395 |

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

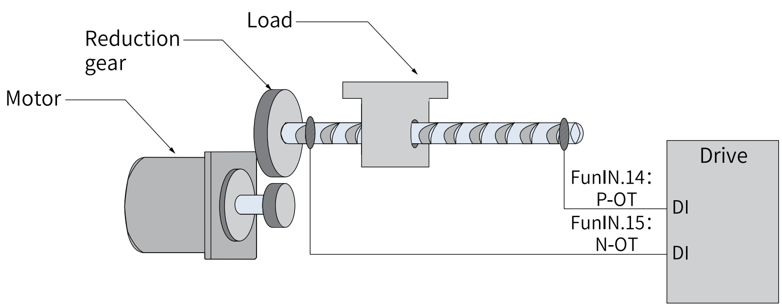



Figure 10-22 Installation of limit switches

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

☆ Related parameters:

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

## Emergency stop

The servo drive supports two emergency stop modes:

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

☆ Related parameters:

| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.34 | Emergency-Stop | Braking | Inactive: Current operating state unaffected<br>Active: Stop quickly as defined by H02.18, keeping position lock status, with E900.0 (DI emergency braking) reported. |

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0d.05 | 200d-06h | Emergency stop | 0: No operation<br>1: Emergency stop | 0 | - | Real-time | " H0d_en.05" on page 507 |

# 11 Adjustment

## 11.1 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. Gain adjustment needs to be performed to meet such requirement.

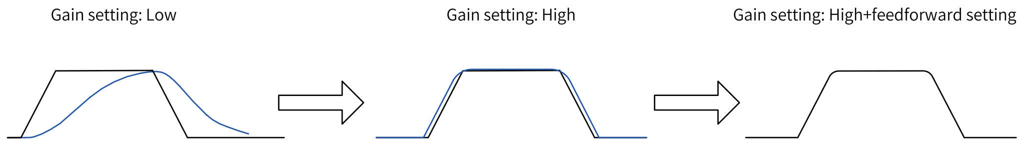



Figure 11-1 Example of gain tuning

| | | |
|---|---|---|
| Position loop gain: 40.0 Hz | Position loop gain: 200.0Hz | Position loop gain: 200.0Hz |
| Speed loop gain: 200.0 Hz | Speed loop gain: 25.0Hz | Speed loop gain: 25.0Hz |
| Speed loop integral time constant: 100.00 ms | Speed loop integral time constant: 50.00ms | Speed loop integral time constant: 50.00ms |
| Speed feedforward gain: 0 | Speed feedforward gain: 0 | Speed feedforward gain: 50.0% |
| Load inertia ratio: 30 | Load inertia ratio: 30 | Load inertia ratio: 30 |

The gain is defined by a combination of multiple parameters that affect each other. Such parameters include 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 tuning, perform a trial run through jogging to ensure the motor operates properly.

The following figure shows the general flowchart for gain tuning.

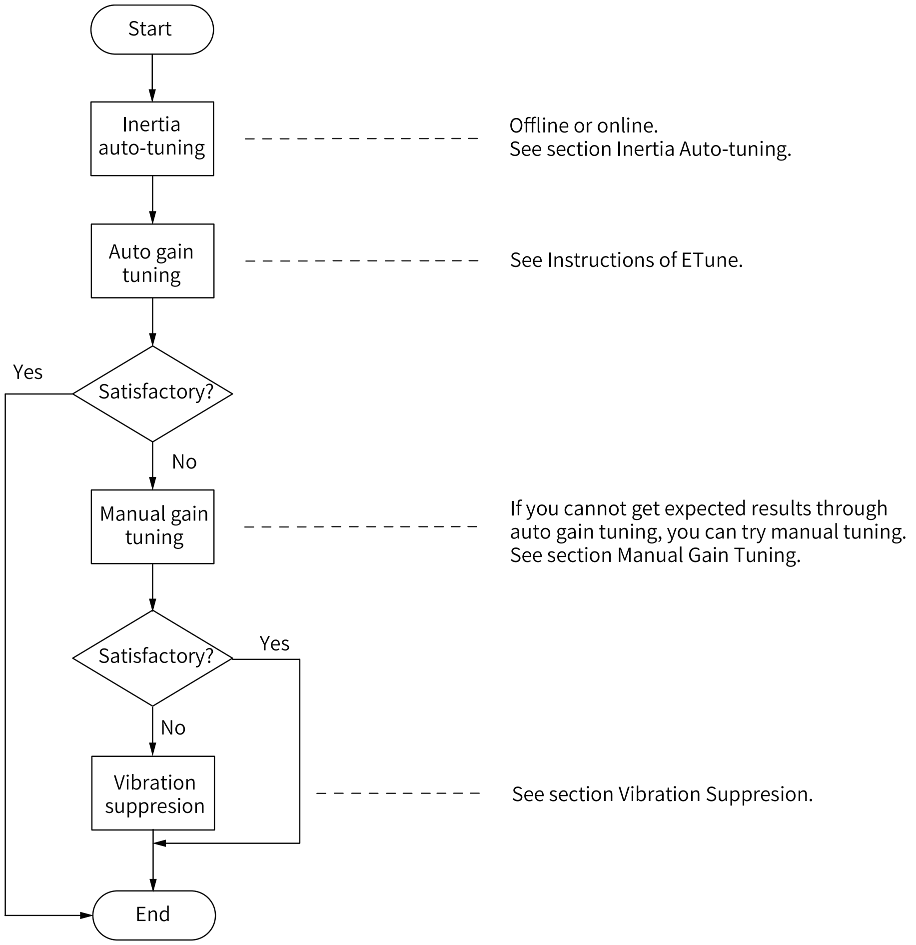



Figure 11-2 Steps

Table 11–1 Description of gain tuning

| Steps | | | Function | Reference |
|---|---|---|---|---|
| 1 | Inertia Identification | Offline | The servo drive calculates the load inertia ratio automatically through inertia auto-tuning. | *"11.2.1 Offline Inertia Identification" on page 223* |
| | | Online | The host controller sends a command to make the motor rotate, and the servo drive calculates the load inertia ratio in real time. | *"11.2.2 Online Inertia Auto-tuning" on page 225* |
| 2 | Auto Gain Tuning | | The servo drive generates a group of gain parameters based on the correct inertia ratio. | *"11.3.1 ETune" on page 227*and *"11.3.2 STune" on page 232* |

| Steps | | | Function | Reference |
|---|---|---|---|---|
| 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. | *"11.4.1 Basic Parameters" on page 236* |
| | | Reference filter | Smoothens the position, speed, and torque references. | *"11.4.3 Comparison of Filters" on page 244* |
| | | Feedforward gain | Improves the follow-up behavior. | *"11.4.4 Feedforward gain" on page 244* |
| | | Pseudo differential regulator | Adjusts the speed loop control mode to improve the anti-interference capability at low frequency range. | *"11.4.5 PDFF Control" on page 246* |
| | | Torque disturbance observer | Improves the resistance against torque disturbance. | *"11.4.6 Torque disturbance observer" on page 247* |
| 4 | Vibration suppression | Mechanical resonance | Suppresses mechanical resonance through the notch. | *"11.6.1 Mechanical Resonance Suppression" on page 258* |
| | | Low-frequency resonance | Activate the filter used to suppress low-frequency resonance. | *"11.6.2 Low-Frequency Resonance Suppression at the Mechanical End" on page 262* |

## 11.2 Inertia Identification

The load inertia ratio (H08.15) is calculated through the following formula:

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

The inertia ratio is an important parameter of the servo system, and quick commissioning can be implemented with the correct setting of this parameter.

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 Identification
  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***

- The following requirements must be met to ensure correct calculation of the inertia ratio:
  - The actual maximum speed of the motor is higher than 150 rpm.
  - The acceleration rate during acceleration/deceleration of the motor is higher than 3000 rpm/s.
  - The load torque is stable without dramatic changes.
  - The actual inertia ratio does not exceed 120.
- If the actual inertia ratio is large 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 fail in case of a large backlash of the transmission mechanism.

### 11.2.1 Offline Inertia Identification

The following two methods for offline inertia auto-tuning are available: Method 1: H09.05 = 0 or 1: The setpoint of H08.15 is taken as the initial inertia ratio for inertia auto-tuning. Method 2: H09.05 = 2 or 3: No initial inertia ratio is required for inertia auto-tuning.

#### Method 1

Set H09.05 (Offline inertia auto-tuning mode) to 0 or 1 , switch to "H0d.02" in the parameter display mode, and press the SET key to enable offline inertia auto-tuning.

Check the following before performing offline inertia auto-tuning:

- The motor must meet the following requirements:
  - A travel distance of more than one revolutions in the forward/reverse direction is available between the mechanical limit switches.
    Ensure limit switches are installed to the machine and a travel distance as described above is reserved to prevent overtravel during inertia auto-tuning.
  - The required number of revolutions (H09.09) is fulfilled.
    View the values of H09.06 (Maximum speed of inertia auto-tuning), H09.07 (Time constant for accelerating to the maximum speed during inertia auto-tuning), and H09.09 (Number of revolutions per inertia auto-tuning) to ensure the travel distance that starts from the stop position is larger than the value of H09.09. Otherwise, decrease the value of H09.06 or H09.07 until this requirement is met.
- Estimate the value of H08.15 (Load rotational inertia ratio).
  If the default value of H08.15 (1.00) is used but the actual inertia ratio is 30.00, the motor may run very slowly, resulting in auto-tuning failure. To solve this problem, take the following measures:
  - Set H08.15 to a large value first.
    It is recommended to set H08-15 to a large value first, such as 5.00. Then increase the value of H08-15 gradually until the display value on the keypad changes with it.
  - Increase the stiffness level (H09.01) properly so that the actual motor speed can reach H09.06 (Maximum speed of inertia auto-tuning).

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

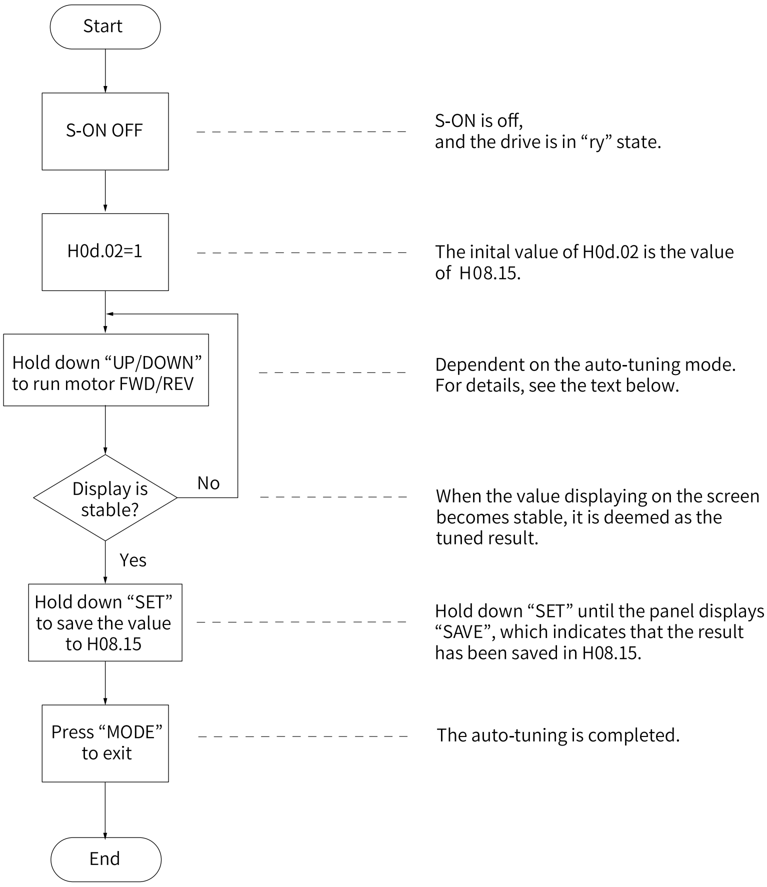
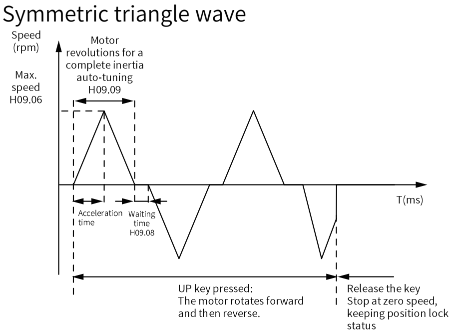
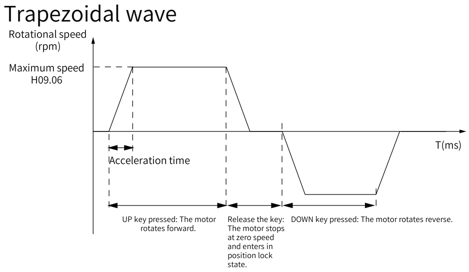



Figure 11-3 Offline inertia auto-tuning flowchart

Offline inertia auto-tuning is divided into two modes: positive/negative triangle wave mode and jog mode. The command forms for these two modes are different, as shown below.

Table 11–2 Descriptions of two offline inertia auto-tuning modes

| Item | Positive and Negative Triangular Wave Mode (H09.05 = 0) | Jog mode (H09.05 = 1) |
|---|---|---|
| Command form | Symmetric triangle wave<br> | Trapezoidal wave<br> |
| Max. speed | H09.06 | H09.06 |
| Acceleration/ Deceleration time<br>Time | H09.07 | H09.07 |

| Item | Positive and Negative Triangular Wave Mode (H09.05 = 0) | Jog mode (H09.05 = 1) |
|---|---|---|
| Key description | UP key held down: The motor rotates forwardly and then reversely.<br>DOWN key held down: The motor rotates reversely and then forwardly.<br>UP/DOWN key released: The motor stops at zero speed, keeping position lock state. | UP key pressed: The motor rotates forwardly.<br>DOWN key pressed: The motor rotates reversely.<br>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 Occasion | Applications where the motor travel is short | Applications where the motor travel is long and manual control is allowed |

## Method 2:

Set H9.05 to 2 or 3 and perform inertia auto-tuning based on the same flowchart for Method 1. To make the motor stop at zero speed, release the UP/DOWN key. Pressing the UP/DOWN key again starts a new inertia auto-tuning. The initial direction of operation is determined by the UP/DOWN key. For applications allowing unidirectional operations only, set H09-05 to 3. The running direction at start is determined by the UP/DOWN key. For applications requiring unidirectional movement, set H09.05 to 3.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.05 | 2009-06h | Offline inertia auto-tuning mode | 0: Positive/Negative triangular wave mode<br>1: JOG mode<br>2: Bidirectional auto-tuning mode<br>3: Unidirectional auto-tuning mode | 0 | - | At stop | *"H09_en.05" on page 469* |
| H09.06 | 2009-07h | Max. speed of inertia auto-tuning | 100 RPM to 1000 RPM | 500 | RPM | At stop | *"H09_en.06" on page 469* |
| H09.07 | 2009-08h | Time constant for accelerating to max. speed during inertia auto-tuning | 20ms to 800ms | 125 | ms | At stop | *"H09_en.07" on page 470* |
| H09.08 | 2009-09h | Interval time after an individual inertia auto-tuning | 50ms to 10000ms | 800 | ms | At stop | *"H09_en.08" on page 470* |
| H09.09 | 2009-0Ah | Motor revolutions for an inertia auto-tuning | 0.00 to 100.00 | 1.00 | - | Real-time | *"H09_en.09" on page 470* |

## 11.2.2 Online Inertia Auto-tuning

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

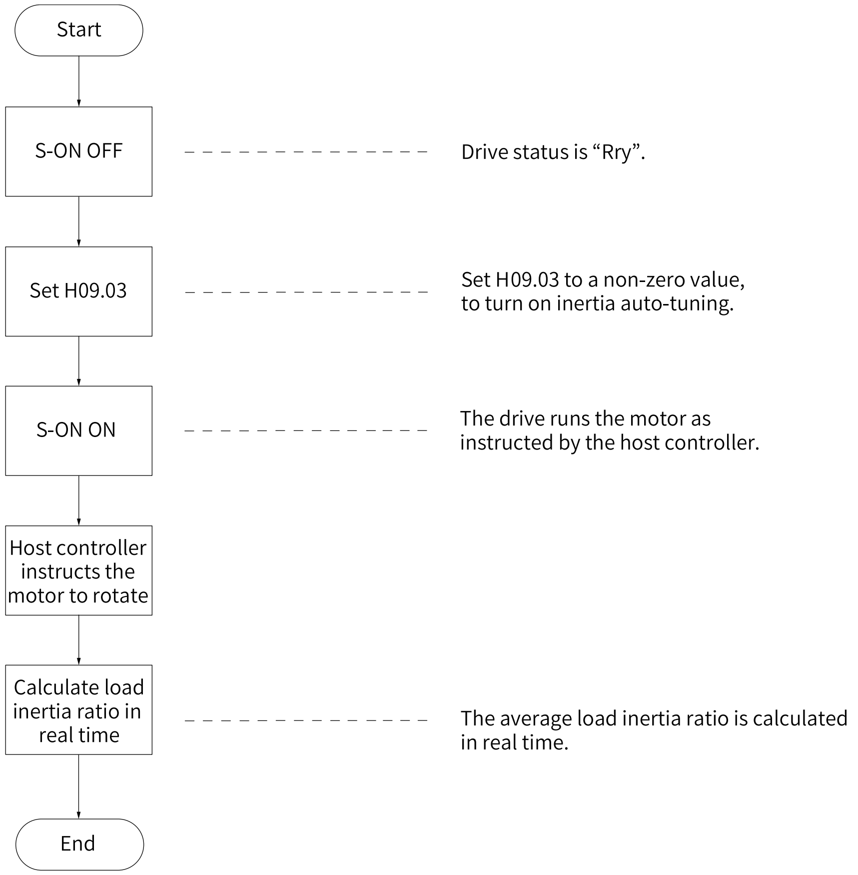



Figure 11-4 Online inertia auto-tuning flowchart

## Note

H09.03 defines the real-time updating speed of the load inertia ratio (H08.15).

- H09.03 = 1: Applicable to the scenario where the actual inertia ratio rarely changes, such as machine tool and wood carving machine.
- H09.03 = 2: suitable for applications where the actual inertia ratio changes slowly
- H09.03 = 3: Applicable to cases where the actual inertia ratio changes rapidly, such as handling manipulators.

☆Related parameter

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.03 | 2009-04h | Online inertia auto-tuning mode | 0: Disabled<br>1: Enabled, changing slowly<br>2: Enabled, changing normally<br>3: Enabled, changing quickly | 0 | - | Real-time | “H09_en.03” on page 468 |

# 11.3 Auto Gain Tuning

## 11.3.1 ETune

### Overview

ETune is a wizard-type auto-adjustment function used to guide users to set corresponding curve trajectories and response parameters. After the curve trajectories and response parameters are set, the servo drive performs auto-tuning automatically to generate the optimal gain parameters. The auto-tuned parameters can be saved and exported as a recipe for use in other devices of the same model.

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

### Description of ITune operation

- **Operation flowchart**

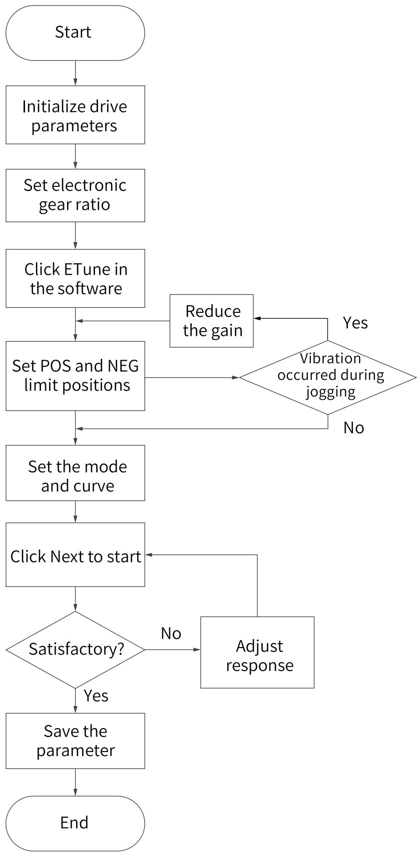
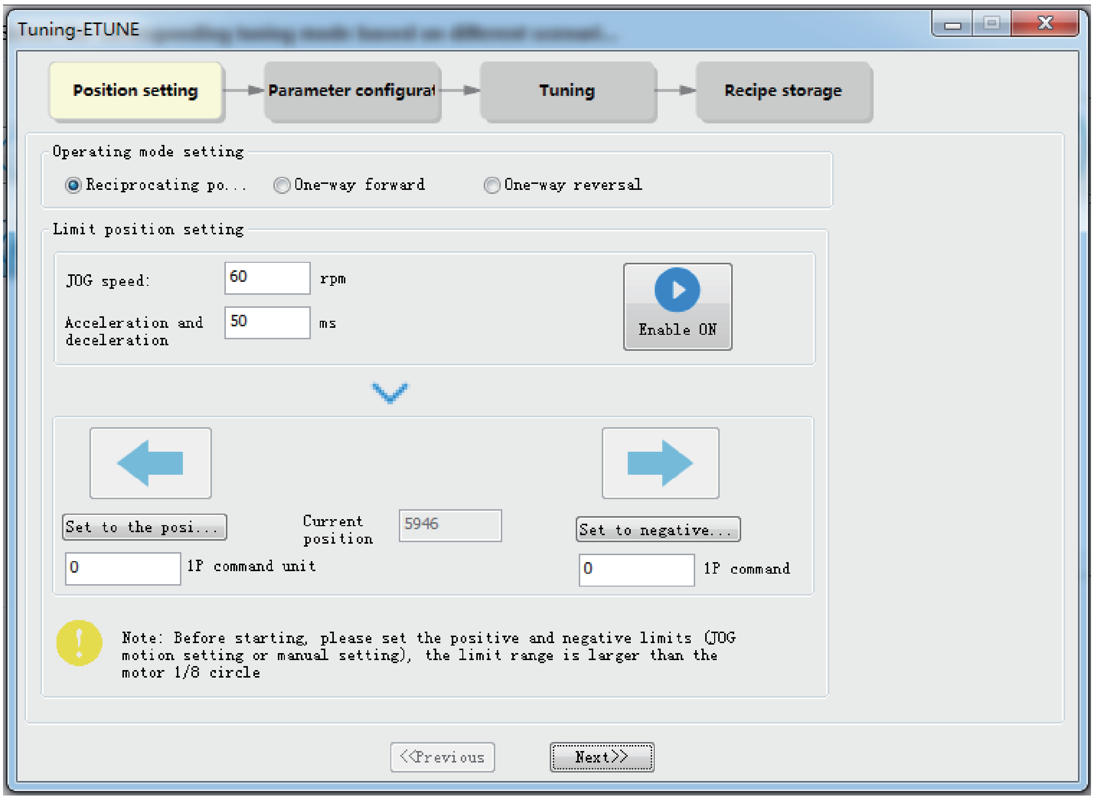



Figure 11-5 Operation flowchart

- **Detailed Description**

1. Click Tuning in the software tool, and select ETUNE.




2. Select any of the following three operation modes based on the operating direction allowed by the machine.

- 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 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 reverse direction.

3. 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.

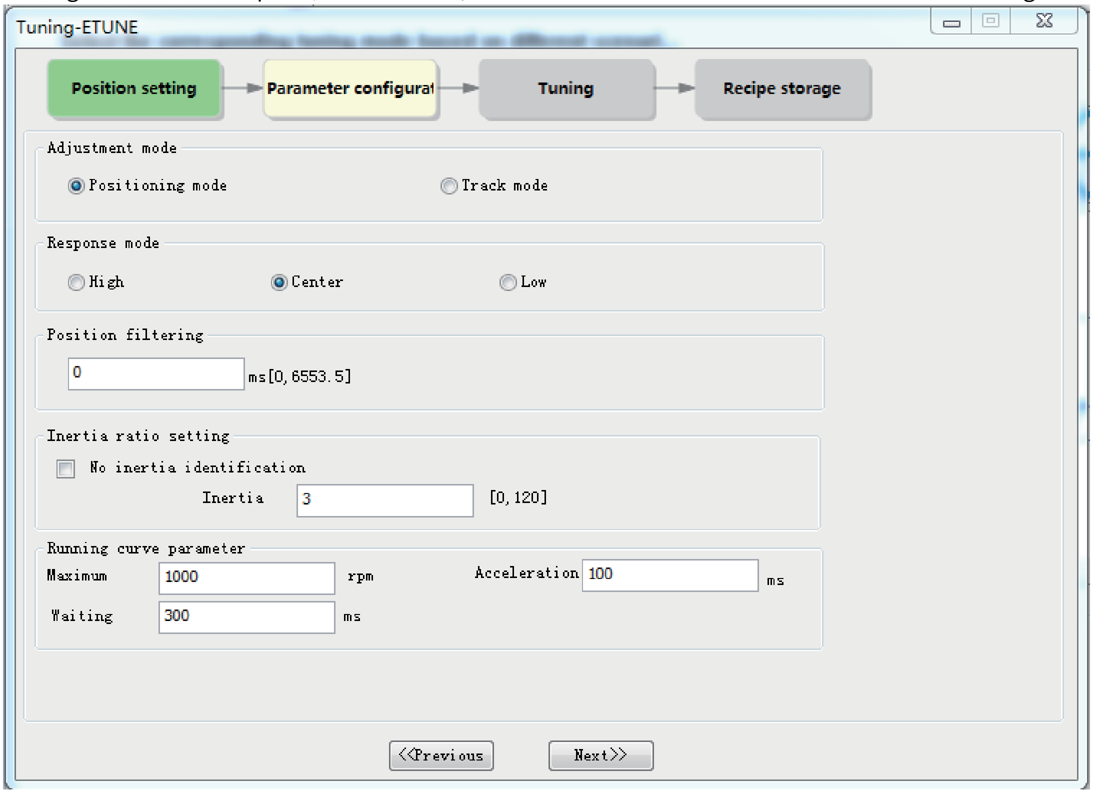
- Method 1: click Enable ON in JOG, and click the left arrow to make the motor move to the positive limit. Next, click **Set to the posi...**. Follow the same procedure for setting the negative position limit, and click Enable OFF (the Enable ON button changes to Enable OFF after a click).
- Method 2: Enter the positive and negative limits directly.

## *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.

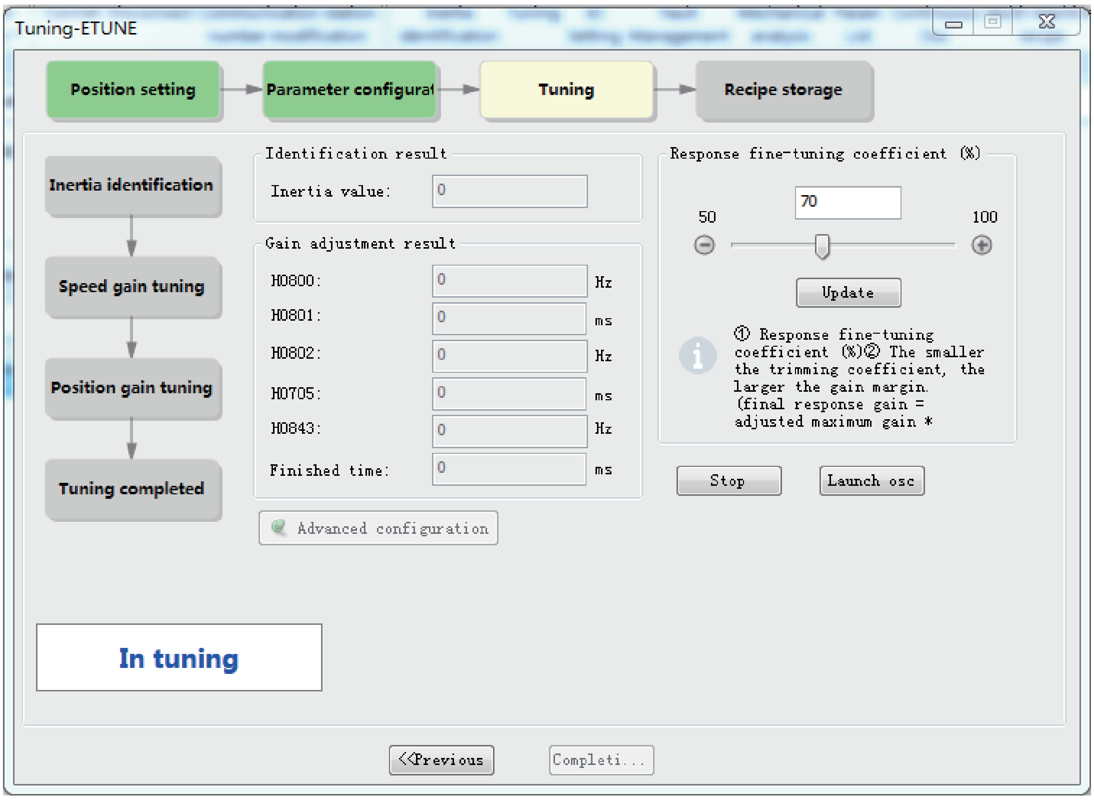
4. Click Next to switch to the mode parameter setting interface. The adjustment mode is divided into Positioning mode and Track mode.

   Auto-tuning of the inertia ratio is optional. If you choose not to perform inertia auto-tuning, set the correct inertia ratio (the inertia ratio can be modified directly). You can adjust the response level and position filter time constant based on the responsiveness needed and the position reference noise generated during operation. Then configure the motion profile by setting the maximum speed, acceleration/deceleration time and interval time for auto-tuning.

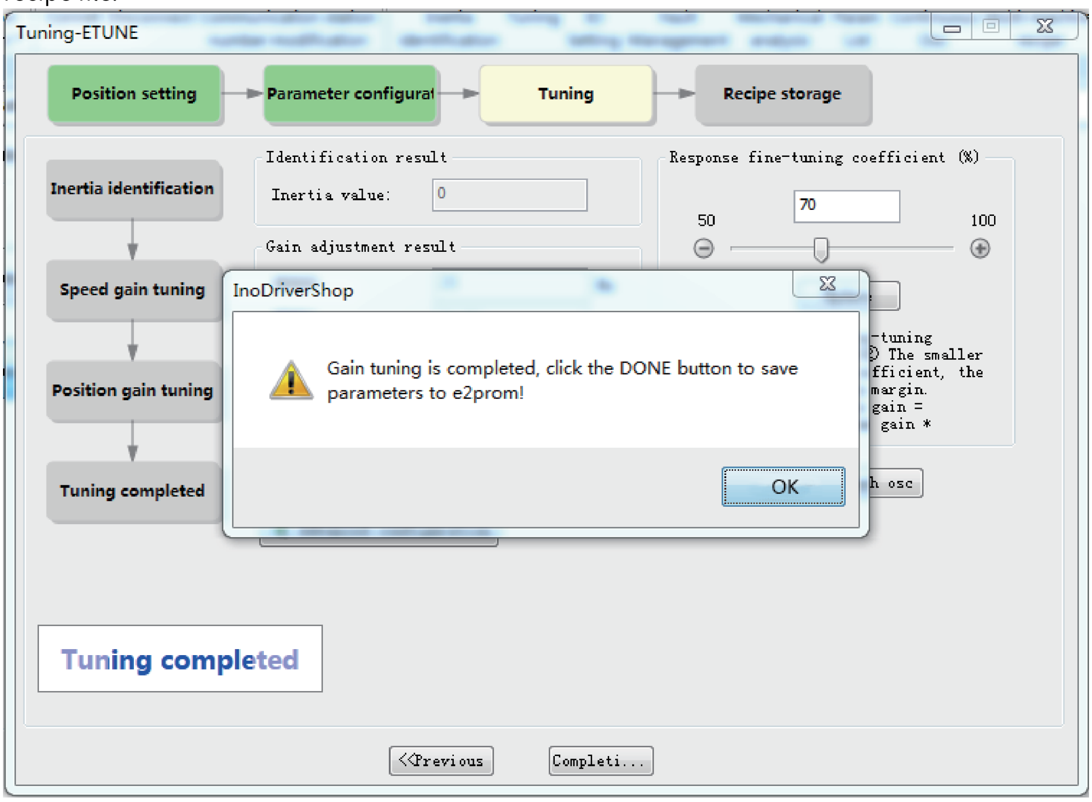


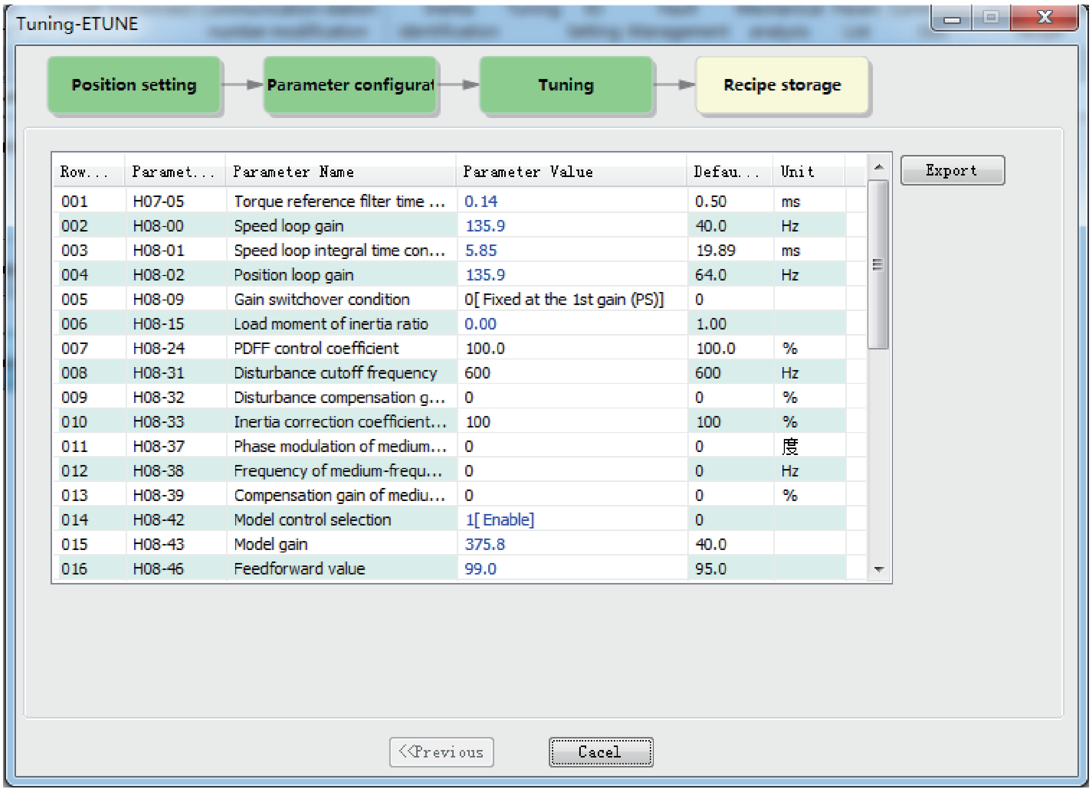

5. Click the " start " button to start auto-tuning.

- 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 on the start page, the drive starts gain auto-tuning directly after start.




6. During gain auto-tuning, if you modify the Response fine-tuning coefficient and click "Apply", gain auto-tuning will be continued based on the fine-tuning coefficient entered. After gain auto-tuning is done, you can click "Done" to save parameters to E2PROM and export parameters 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 | |

## Precautions

- Before gain tuning, set an electronic gear ratio that fits the actual application.
- You can adjust the maximum speed and acceleration/deceleration time of the motion profile based on actual conditions. The acceleration/deceleration time can be increased properly because positioning will be quickened 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 too long.

## Solutions to Common Faults

| Fault | Cause | Solution |
|---|---|---|
| E662: ETune failure | 1. Vibration cannot be suppressed. | 1. Enable the vibration suppression function manually. |
| | 2. The positioning overshoot is too large. | 2. Check whether the positioning threshold is too low. Increase the acceleration/deceleration time and reduce the response level. |
| | 3. The reference is disturbed by noise. | 3. Modify the electronic gear ratio to improve the reference resolution or increase the reference filter time constant in the "Parameter configuration" interface. |
| | 4. The current fluctuates. | 4. Check whether the current of the machine fluctuates regularly. |
| E600: Inertia 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. Rectify the mechanical fault. |
| | 4. Interruption occurs due to a fault that occurs during auto-tuning. | 4. Clear the fault and perform ETune again. |
| | 5. The position reference filter time is set to an excessively high value. | Decrease the values of H05.04–H05.06 and perform ETune again. |

## 11.3.2 STune

### Overview

STune performs gain auto-tuning based on the set stiffness level to fulfill the needs for rapidity and stability.

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

**Caution**

Ensure that the correct load inertia ratio has been obtained before enabling automatic gain adjustment.

### Description of ITune operation

- **Operation flowchart**

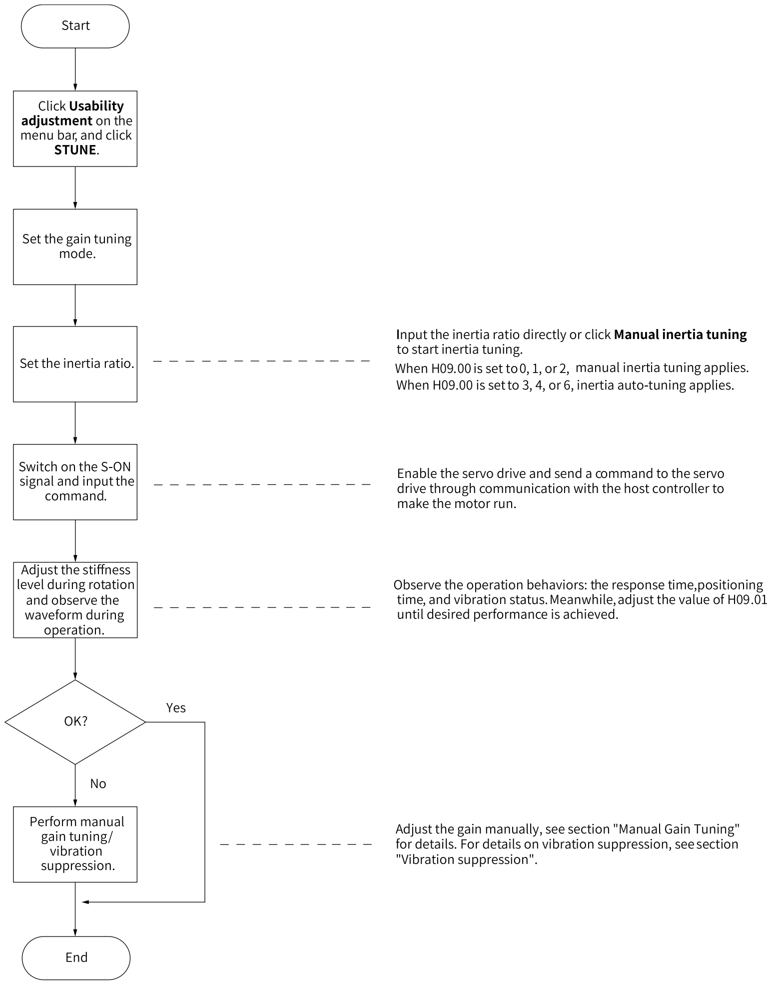



Figure 11-6 Operation flowchart

- **Detailed Description**

You can set the gain auto-tuning mode through the keypad or the software tool.

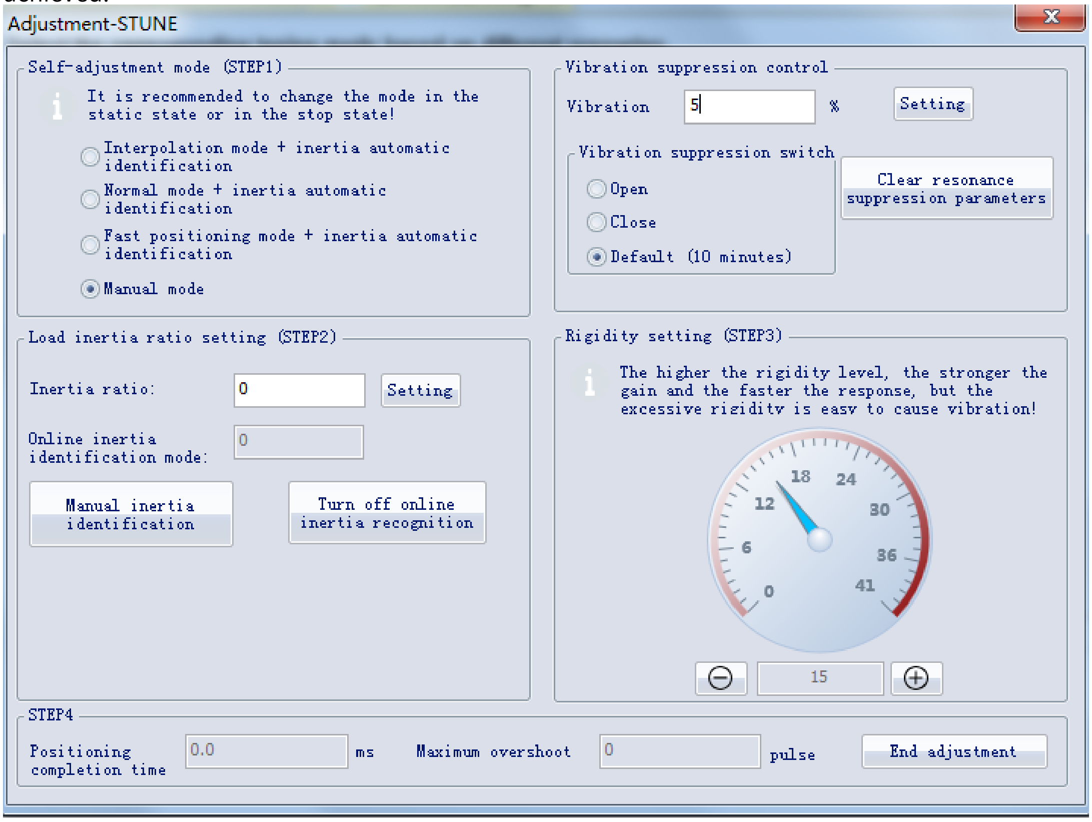
1. Select the gain auto-tuning mode.

  - In modes 0, 1 and 2 shown in the following table, you need to set the inertia ratio before stiffness tuning. If the inertia is unknown, adjust the inertia manually. If vibration occurs on the machine, decrease the stiffness level before adjusting the inertia manually.
  - In modes 3, 4, and 6 shown in the following table, you can perform adjustment through the wizard-type interface directly, without the need for setting an inertia ratio.

| Mode | Parameter Name | Function |
|---|---|---|
| 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 | Parameter Name | Function |
|---|---|---|
| 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. |
| 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. |

2. Adjust the stiffness level gradually during operation of the load. The present stiffness level value will be written to the drive automatically. Keep monitoring the operating waveform after increasing the stiffness level (increase by one level at a time) until desired performance is achieved.




## Precautions

### Load inertia ratio range

- In scenarios requiring high response, the inertia ratio must be lower than 500% and should not exceed 1000%.
  - For belt pulley or gear rack requiring not high rigidity and accuracy, the inertia ratio should not exceed 1000%.
  - For lead screw or cardan shaft requiring high rigidity and accuracy, the inertia ratio should not exceed 500%.
  - In scenarios where high positioning accuracy or response is required, the inertia ratio should not exceed 200%.
- In scenarios requiring a certain accuracy and dynamic response, the inertia ratio should not exceed 3000%.

- When the inertia ratio exceeds 3000%, it is hard to adjust and the trajectory control cannot be performed. It is only applicable to mechanisms for point-to-point control and rotary motion but the acceleration/deceleration time should be large.

**Rigidity meter setting**

The setting range of H09.01 (Stiffness level selection) is 0–41. The level 0 indicates the weakest stiffness and lowest gain and level 41 indicates the strongest stiffness and highest gain.

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

Table 11–3 Reference of stiffness levels

| 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-connected motors |

The following five gain auto-tuning modes are available.

Caution

- If H09.00 is set to 3, 4, or 6, the servo drive will suppress the vibration and perform inertia auto-tuning automatically within 5 min (or other time defined by H09-37) after power-on or stiffness level setting, and then the servo drive exits from automatic adjustment.
- Do not set H09.00 to 3, 4, or 6 in applications with slow acceleration/deceleration, large vibration, and unstable mechanical couplings.

- Standard rigidity meter mode (H09.00 set to 1)
  The 1st gain parameters (H08.00 to H08.02 and H07.05) are automatically updated and saved based on the rigidity level set in H09.01.

Table 11–4 Parameters updated automatically in the standard mode

| Param. | Parameter Name |
|---|---|
| H08.00 | Speed loop gain |
| H08.01 | Speed loop integral time constant |
| H08.02 | Position loop gain |
| H07.05 | Filter time constant of torque reference |

- Positioning mode (H09.00 = 2)
  On the basis of *"Table 11–4" on page 235*, the 2nd gain set (H08.03...H08.05, H07.06) are also updated and saved automatically according to the stiffness level defined by H09.01. The position loop gain in the 2nd gain set has a higher stiffness level than that in the 1st gain set.

Table 11–5 Parameters updated automatically in the positioning mode

| Param. | Parameter Name | Description |
|---|---|---|
| H08.03 | 2nd speed loop gain | - |
| H08.04 | 2nd speed loop integral time constant | If H08.04 is set to remain at 512.00 ms, the 2nd speed loop integral action is invalid and only proportional control is used in the speed loop. |

| Param. | Parameter Name | Description |
|---|---|---|
| H08.05 | 2nd position loop gain | - |
| H07.06 | 2nd torque reference filter time constant | - |

Values of speed feedforward parameters are fixed.

Table 11–6 Parameters with fixed values in the positioning mode

| Param. | Parameter Name | Value |
|---|---|---|
| H08.19 | Speed feedforward gain | 30.0% |
| H08.18 | Speed feedforward filter time constant | 0.50ms |

Values of gain switchover parameters are fixed.

Gain switchover is activated automatically in the positioning mode.

| Param. | Parameter Name | Value | Description |
|---|---|---|---|
| H08.08 | 2nd gain mode setting | 1 | Switchover between the 1st gain set (H08.00...H08.02, H07.05) and 2nd gain set (H08.03...H08.05, H07.06) is active in the positioning mode.<br>In other modes, the original setting is used. |
| H08.09 | Gain switchover condition | 10 | In positioning mode, the gain switchover condition is that H08.09 is set to 10.<br>In other modes, the original setting is used. |
| H08.10 | Gain switchover delay | 5.0ms | In positioning mode, the gain switchover delay is 5.0 ms.<br>In other modes, the original setting is used. |
| H08.11 | Gain switchover level | 50 | In the positioning mode, the gain switchover level is 50.<br>In other modes, the original setting is used. |
| H08.12 | Gain switchover hysteresis | 30 | In the positioning mode, the gain switchover dead time is 30.<br>In other modes, the original setting is used. |

Caution

In automatic gain adjustment mode, the parameters automatically updated along with H09-01 (Stiffness level) and those with fixed values cannot be modified. To modify these parameters, set H09-00 to 0 to exit automatic adjustment mode.

# 11.4 Manual Gain Tuning

## 11.4.1 Basic Parameters

When gain auto-tuning cannot fulfill the application needs, perform manual gain tuning. to achieve better result.

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.

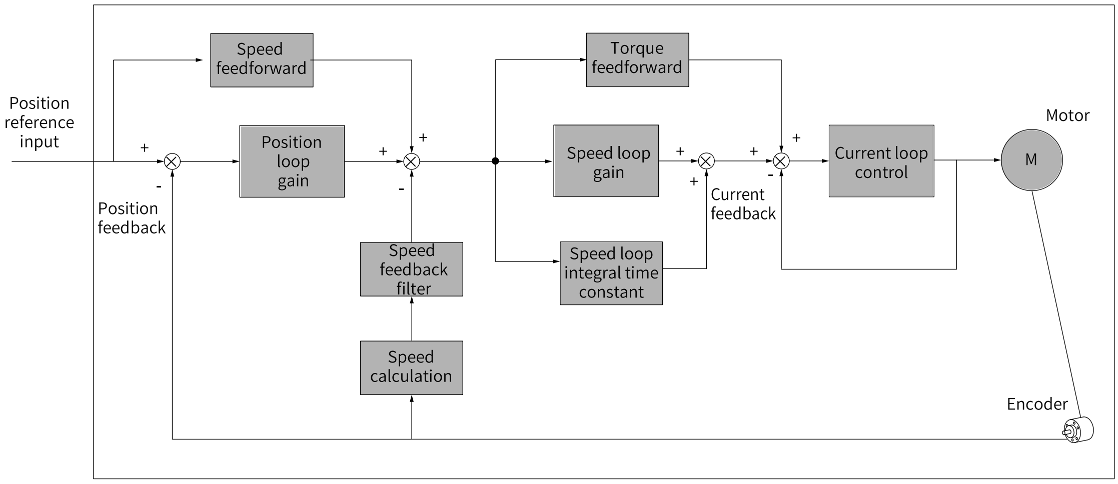



Figure 11-7 Basic control for manual gain tuning

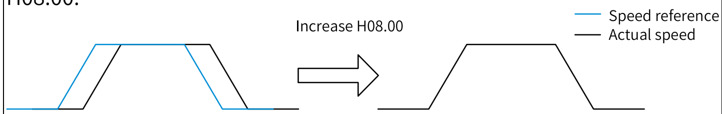
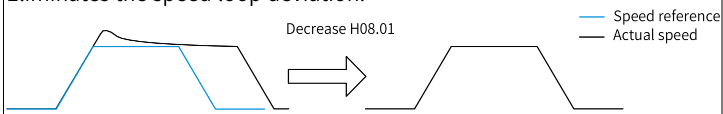
## *Note*

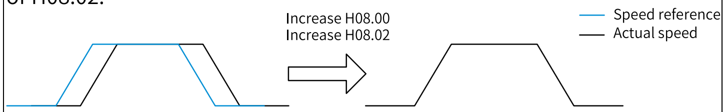
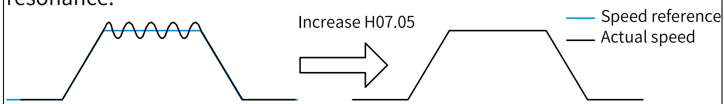
The response level of the inner loop must be higher than that of the outer loop. If it is not observed, the system may be unstable.

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.

Table 11–7 Adjustment of gain parameters

| Step | Param. | Parameter Name | Description |
| --- | --- | --- | --- |
| 1 | H08.00 | Speed loop gain | Function: Determines the maximum frequency of a variable speed reference that can be followed by the speed loop.<br>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.<br><br><br>Note:<br>• Increasing the setpoint without incurring extra noise or vibration shortens the positioning time, stabilizes the speed, and improves the follow-up behavior.<br>• If noise occurs, decrease the setpoint.<br>• If mechanical vibration occurs, enable mechanical resonance suppression. For details, see " Vibration suppression" on page 257. |
| 2 | H08.01 | Speed loop integral time constant | Function:<br>Eliminates the speed loop deviation.<br><br><br>Note:<br>Set H08.01 according to the following formula: 500 ⩽ H08.00 x H08.01 ⩽ 1000<br>For example, if H08.00 is set to 40.0 Hz, the setpoint of H08.01 must meet the following requirement: 12.50 ms ⩽ H08.01 ⩽ 25.00 ms<br>Decreasing the setpoint strengthens the integral action and shortens the positioning time, but an excessively low setpoint may easily lead to mechanical vibration.<br>An excessively high setpoint prevents the speed loop deviation from being cleared.<br>When H08.01 is set to 512.00 ms, the integral is invalid. |

| Step | Param. | Parameter Name | Description |
|---|---|---|---|
| 3 | H08.02 | Position loop gain | Function:<br>It sets the position reference maximum frequency followed by the position loop.<br>The maximum follow-up frequency of the position loop equals the value of H08.02.<br><br><br>Note:<br>To ensure system stability, the maximum follow-up frequency of the speed loop must be 3 to 5 times higher than that of the position loop.<br>$$3 \leqslant \frac{2\times\pi\times H08.00}{H08.02} \leqslant 5$$<br>For example, when H08.00 is set to 40.0 Hz, H08.02 must meet the following requirement:<br>50.2 Hz ⩽ H08.02 ⩽ 83.7 Hz<br>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.<br>An excessively high setpoint may easily lead to system instability and oscillation. |
| 4 | H07.05 | Torque reference filter time constant | Function:<br>Eliminates the high-frequency noise and suppresses mechanical resonance.<br><br><br>Note:<br>Ensure the cutoff frequency of the torque reference low-pass filter is 4 times higher than the maximum follow-up frequency of the speed loop, as shown in the following formula:<br>$$\frac{1000}{2\times\pi\times H07.05} \geqslant (H08.00)\times 4$$<br>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.<br>If vibration occurs after H08.00 is increased, adjust H07.05 to suppress the vibration. For details, see *"Vibration suppression" on page 257*.<br>An excessively high setpoint weakens the responsiveness of the current loop.<br>To suppress vibration upon stop, increase the setpoint of H08.00 and decrease the setpoint of H07.05.<br>If strong vibration occurs upon stop, decrease the setpoint of H07.05. |

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.05 | 2007-06h | Torque reference filter time constant | 0.00ms to 30.00ms | 0.50 | ms | Real-time | "H07_en.05" on page 448 |
| H08.00 | 2008-01h | Speed loop gain | 0.1Hz to 2000.0Hz | 40.0 | Hz | Real-time | "H08_en.00" on page 453 |
| H08.01 | 2008-02h | Speed loop integral time constant | 0.15ms to 512.00ms | 19.89 | ms | Real-time | "H08_en.01" on page 454 |
| H08.02 | 2008-03h | Position loop gain | 0.0Hz to 2000.0Hz | 64.0 | Hz | Real-time | "H08_en.02" on page 454 |

## 11.4.2 Gain Switchover

Gain switchover, which is active in the position control and speed control modes only, It is only effective in position and speed control modes. achieve the following purposes:

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

### H08.08 = 0

When H08.08 is set to 0, the 1st gain (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.

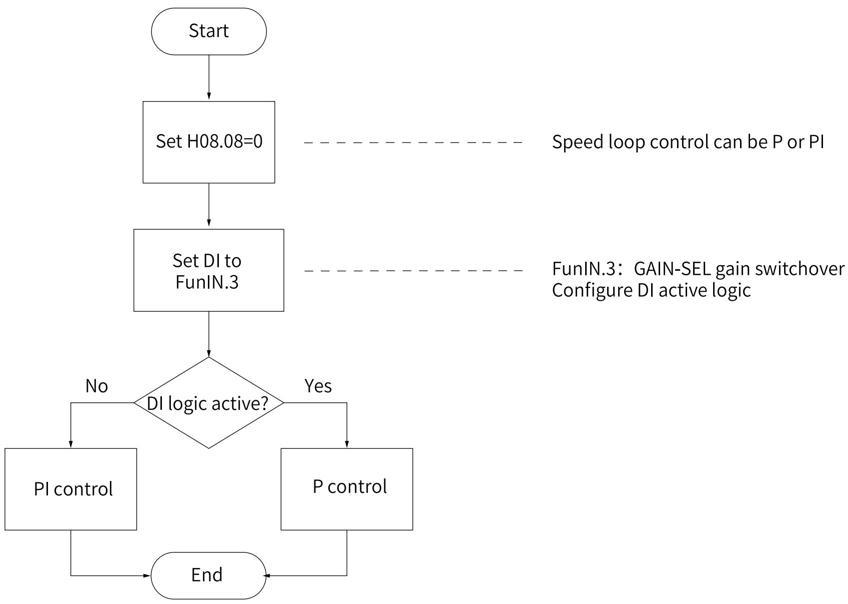



Figure 11-8 Gain switchover flowchart when H08.08 is set to 0

## 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.

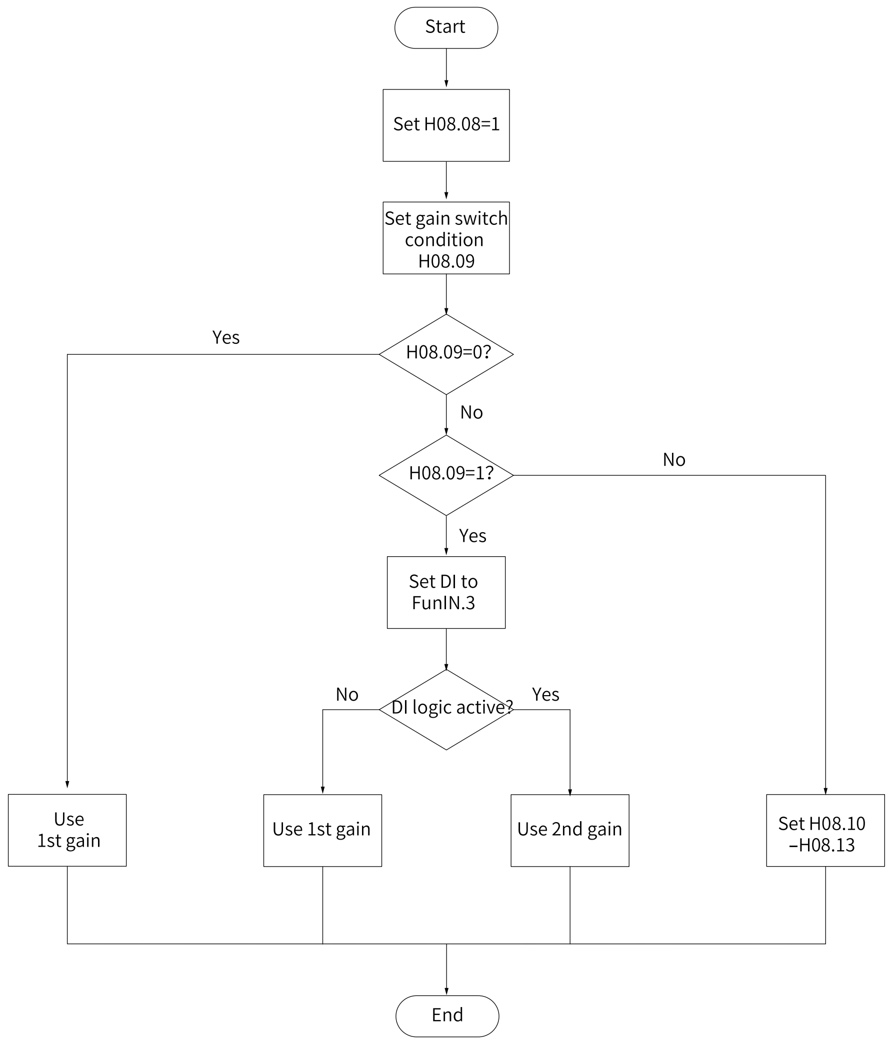
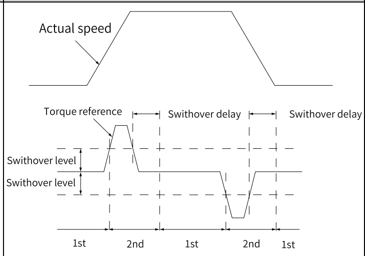
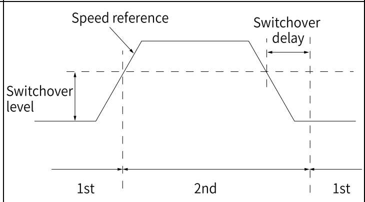
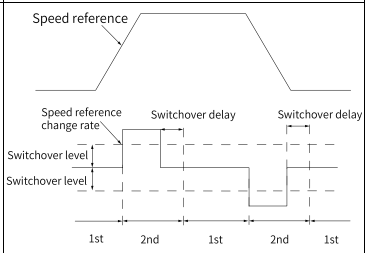
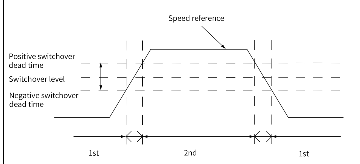
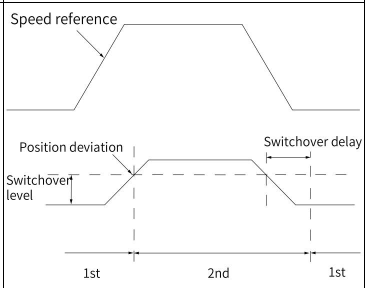
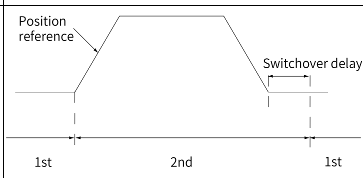
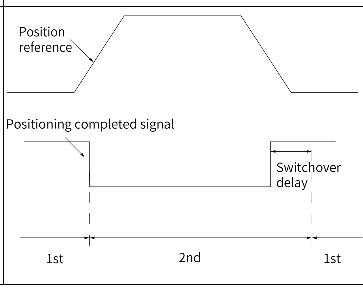


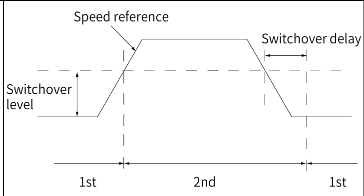

Figure 11-9 Gain switchover flowchart when H08.08 is set to 1

Table 3-8 shows diagrams and parameters for 11 kinds of gain switchover conditions. The following table describes the diagrams and related parameters of different conditions.

Table 11–8 Conditions for gain switchover

| Gain Switchover Condition | | | Related Parameters | | |
|---|---|---|---|---|---|
| H08.09 | Condition | Diagram | Delay Time (H08.10) | Gain switchover level (H08.11) | Switchover Dead Time (H08.12) |
| 0 | Fixed to the 1st gain set | - | Inactive | Inactive | Inactive |
| 1 | External DI signal | - | Inactive | Inactive | Inactive |

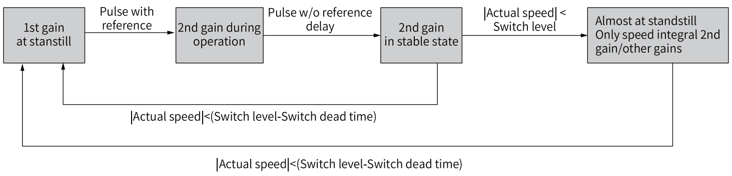
<table>
<tr><th colspan="3">Gain Switchover Condition</th><th colspan="3">Related Parameters</th></tr>
<tr><th>H08.09</th><th>Condition</th><th>Diagram</th><th>Delay Time (H08.10)</th><th>Gain switchover level (H08.11)</th><th>Switchover Dead Time (H08.12)</th></tr>
<tr><td>2</td><td>Torque reference</td><td></td><td>Active</td><td>Active (%)</td><td>Active (%)</td></tr>
<tr><td>3</td><td>Speed reference</td><td></td><td>Active</td><td>Active</td><td>Active</td></tr>
<tr><td>4</td><td>Speed reference change rate</td><td></td><td>Active</td><td>Active (10 rpm/s)</td><td>Active (10 rpm/s)</td></tr>
<tr><td>5</td><td>Speed reference high/low-speed threshold</td><td></td><td>Inactive</td><td>Active (rpm)</td><td>Active (rpm)</td></tr>
<tr><td>6</td><td>Position deviation</td><td></td><td>Active</td><td>Active (encoder unit)</td><td>Active (encoder unit)</td></tr>
<tr><td>7</td><td>Position reference</td><td></td><td>Active</td><td>Inactive</td><td>Inactive</td></tr>
<tr><td>8</td><td>Positioning uncompleted</td><td></td><td>Active</td><td>Inactive</td><td>Inactive</td></tr>
</table>

| Gain Switchover Condition | | | Related Parameters | | |
|---|---|---|---|---|---|
| H08.09 | Condition | Diagram | Delay Time (H08.10) | Gain switchover level (H08.11) | Switchover Dead Time (H08.12) |
| 9 | Actual speed |  | Active | Active (rpm) | Active (rpm) |
| 10 | Position reference + Actual speed | See the following note for details. | Active | Active (rpm) | Active (rpm) |

**Caution**

H08.10 (Gain switchover delay) is valid only during switching to the 1st gain set.

## *Note*




☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H08.02 | 2008-03h | Position loop gain | 0.0Hz to 2000.0Hz | 64.0 | Hz | Real-time | "H08_en.02" on page 454 |
| H08.09 | 2008-0Ah | Gain switchover condition | 0: Fixed to the 1st gain set (PS)<br>1: Switch with external DI (PS)<br>2: Torque reference too large (PS)<br>3: Speed reference too large (PS)<br>4: Speed reference change rate too large (PS)<br>5: Speed reference low/high speed threshold (PS)<br>6: Position deviation too large (P)<br>7: Position reference available (P)<br>8: Positioning unfinished (P)<br>9: Actual speed (P)<br>10: Position reference + Actual speed (P) | 0 | - | Real-time | "H08_en.09" on page 455 |
| H08.10 | 2008-0Bh | Gain switchover delay | 0.0 ms to 1000.0 ms | 5.0 | ms | At stop | "H08_en.10" on page 457 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H08.11 | 2008-0Ch | Gain switchover level | 0 to 20000 | 50 | - | Real-time | " H08_en.11" on page 457 |
| H08.12 | 2008-0Dh | Gain switchover hysteresis | 0 to 20000 | 30 | - | At stop | " H08_en.12" on page 457 |
| H08.13 | 2008-0Eh | Position gain switchover time | 0.0 ms to 1000.0 ms | 3.0 | ms | At stop | " H08_en.13" on page 458 |

## 11.4.3 Comparison of Filters

| Parameter Name | Function | Applicable Occasion | Impact of Excessive Filtering |
|---|---|---|---|
| Pulse input pin filter | Prevents interference to ensure the number of pulses received by the servo drive is accurate. | The system wiring does not comply with specifications.<br>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 | Filters the position references (encoder unit) divided or multiplied by the electronic gear ratio to smoothen the operation process of the motor and reduce shock to the machine. | The acceleration/deceleration process is not performed on the position references sent from the host controller.<br>The pulse reference frequency is low.<br>The electronic gear ratio is larger than 10. | The response delay is prolonged. |

## 11.4.4 Feedforward gain

### Speed feedforward

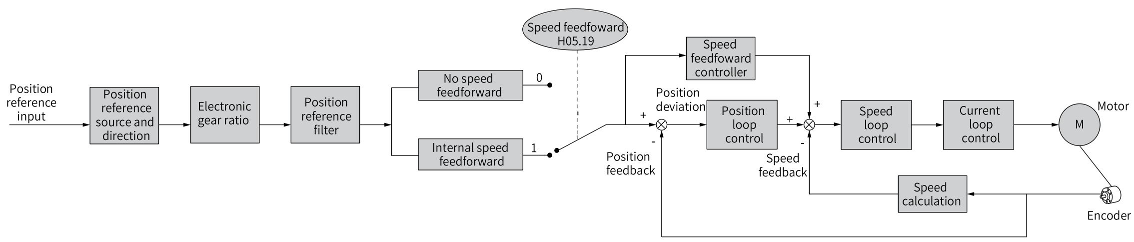



Figure 11-10 Operating procedure for speed feedforward control

Speed feedforward can be applied to the 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. Set 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.

| Param. | Parameter Name | Value | Remarks |
|---|---|---|---|
| H05.19 | Speed feedforward control | 0: No speed feedforward | - |
| | | 1: Internal speed feedforward | Defines the speed corresponding to the position reference (encoder unit) as the speed feedforward signal source. |

2. Set speed feedforward parameters.

Set the speed feedforward gain (H08.19) and speed feedforward filter time constant (H08.18).

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H08.18 | 2008-13h | Time constant of speed feedforward filter | 0.00ms to 64.00ms | 0.50 | ms | Real-time | " H08_en.18" on page 459 |
| H08.19 | 2008-14h | Speed feedforward gain | 0.0% to 100.0% | 0.0 | % | Real-time | " H08_en.19" on page 459 |

## Torque feedforward

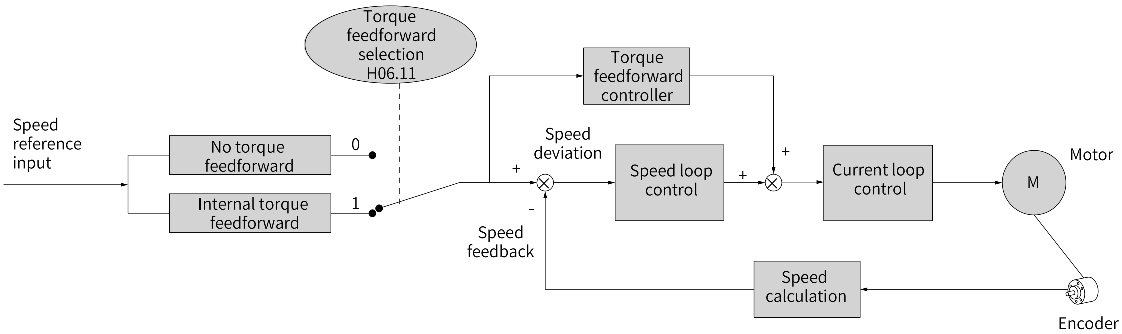



Figure 11-11 Operation diagram of torque feedforward control

In the position control mode, torque feedforward can be used to improve torque reference responsiveness 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 responsiveness and reduce the speed deviation during operation at constant speed.

The procedure for setting torque feedforward is as follows:

1. Set the torque feedforward signal source.

Set H06.11 (Torque feedforward control) to 1 to enable the torque feedforward function. The corresponding signal source will be selected as well.

| Param. | Parameter Name | Value | Remarks |
|---|---|---|---|
| H06.11 | Torque feedforward control | 0: No torque feedforward | - |
| | | 1: Internal torque feedforward | Use the speed reference as the source of the torque feedforward signal.<br>In the position control mode, the speed reference is outputted from the position controller. |

2. Set torque feedforward parameters.

| Param. | Parameter Name | Description |
|---|---|---|
| H08.20 | Torque feedforward filter time constant | Function:<br>• Increasing the value of H08.21 improves the response but may cause overshoot during acceleration/deceleration.<br>• Decreasing the value of H08.20 suppresses overshoot during acceleration/deceleration. Increasing the value of H08.20 suppresses the noise.<br>Note:<br>• Keep H08.20 to the default value, and then gradually increase the setpoint of H08.21 from 0 to a certain value at which torque feedforward achieves the required effect.<br>• Adjust H08.20 and H08.21 repeatedly until a balanced performance is achieved. |
| H08.21 | Torque feedforward gain | See this section for details. |

## 11.4.5 PDFF Control

The pseudo derivative feedback and feedforward (PDFF) control can be used to adjust speed loop control in the non-torque control mode.

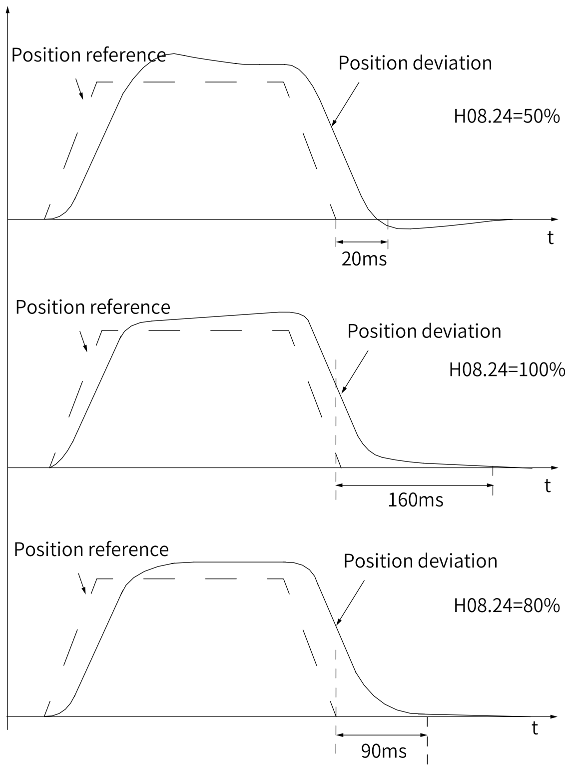



Figure 11-12 Example of PDFF control

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

| Param. | Parameter Name | Description |
|---|---|---|
| H08.24 | PDFF control coefficient | Function:<br>• Defines the control method of the speed loop in the non-torque control modes.<br>Note:<br>• Setting H08.24 to an excessively low value slows down the responsiveness of the speed loop.<br>• When the speed feedback overshoots, gradually decrease the setpoint of H08.24 from 100.0 to a certain value at which the PDFF control achieves the desired effect.<br>• When H08.24 is set to 100.0, the speed loop control method does not change and the default proportional integral control is used. |

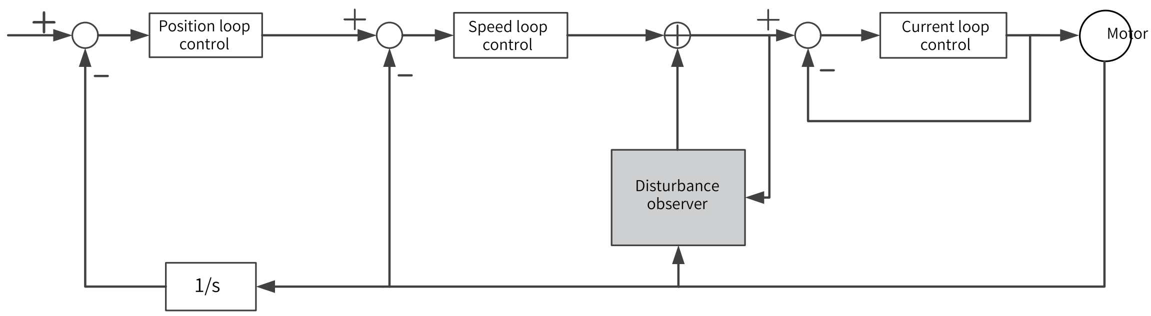
## 11.4.6 Torque disturbance observer

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

### Disturbance observer 1

The disturbance observer is used to observe external disturbance. You can set different cutoff frequencies and compensation values to observe and suppress the disturbance within the frequency range.

The following figure depicts the control block diagram for disturbance observer 1.




## Note

1/s: Integral element

| Param. | Parameter Name | Description |
|---|---|---|
| H08.31 | Disturbance observer cutoff frequency | The higher the cutoff frequency, the more easily will vibration occur. |
| H08.32 | Disturbance observer compensation coefficient | Defines the compensation percentage for the observer. |
| H08.33 | Disturbance observer inertia correction | H08.33 needs to be changed only when the inertia ratio does not reflect the actual condition. The acting inertia is the product of the set inertia and H08.33. It is recommended to use the default value of H08.33. |

☆Related parameters

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H08.31 | 2008-20h | Disturbance observer cutoff frequency | 1Hz to 1700Hz | 600 | Hz | Real-time | " H08_en.31" on page 462 |
| H08.32 | 2008-21h | Disturbance observer compensation coefficient | 0% to 100% | 0 | % | Real-time | " H08_en.32" on page 462 |
| H08.33 | 2008-22h | Disturbance inertia correction coefficient | 1% to 10000% | 100 | % | Real-time | " H08_en.33" on page 462 |

## Disturbance observer 2

The following figure depicts the control block diagram for disturbance observer 2.

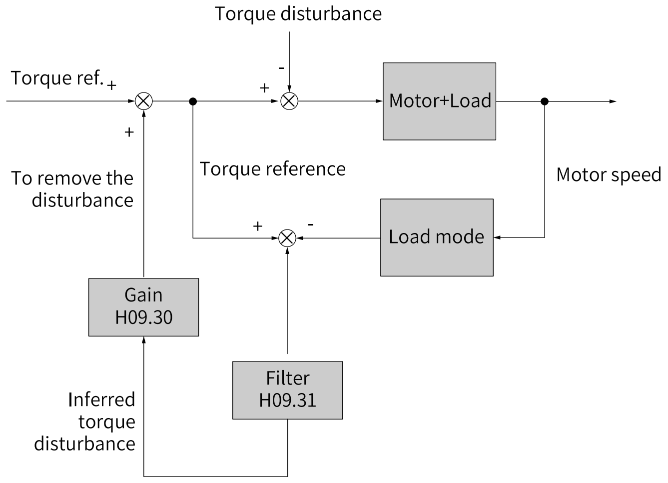



Figure 11-13 Block diagram for disturbance observation

The disturbance observer 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.

| Param. | Parameter Name | Description |
|---|---|---|
| H09.30 | Torque disturbance compensation gain | **Function:**<br>• Increasing the value of H09.30 improves disturbance suppression but increases the noise.<br>• 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.<br>**Note:**<br>• Set H09.31 to a large value first and then gradually increase the value of H09.30 from 0 to a certain value at which the desired performance is achieved. Finally, decrease the value of H09.31 gradually without affect the effectiveness of the disturbance observer.<br>• Adjust H09.30 and H09.31 repeatedly until a balanced performance is achieved. |
| H09.31 | Filter time constant of torque disturbance observer | |

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H08.18 | 2008-13h | Time constant of speed feedforward filter | 0.00ms to 64.00ms | 0.50 | ms | Real-time | "H08_en.18" on page 459 |
| H08.19 | 2008-14h | Speed feedforward gain | 0.0% to 100.0% | 0.0 | % | Real-time | "H08_en.19" on page 459 |
| H08.20 | 2008-15h | Torque feedforward filter time constant | 0.00ms to 64.00ms | 0.50 | ms | Real-time | "H08_en.20" on page 459 |

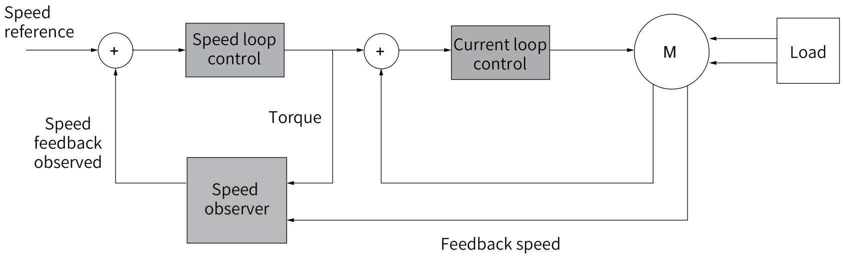
| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H08.21 | 2008-16h | Torque feedforward gain | 0.0% to 200.0% | 0.0 | % | Real-time | " H08_en.21" on page 459 |
| H08.24 | 2008-19h | PDFF control coefficient | 0.0% to 1000.0% | 100.0 | % | Real-time | " H08_en.24" on page 461 |

## 11.4.7 Speed Observer

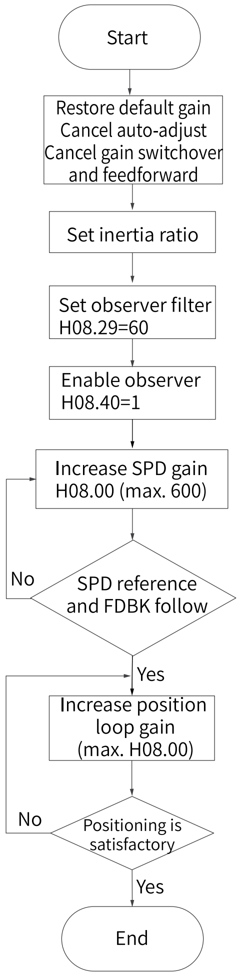
The speed observer, which facilitates quick positioning, applies in applications with slight load characteristic change and constant inertia.

It improves the responsiveness and filters high frequencies automatically, improving the gains and shortening the positioning time without incurring high-frequency vibration.

The block diagram for the speed observer is as follows.



## Commissioning Steps




## Related parameters

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H08.00 | 2008-01h | Speed loop gain | 0.1Hz to 2000.0Hz | 40.0 | Hz | Real-time | "H08_en.00" on page 453 |
| H08.27 | 2008-1Ch | Cutoff frequency of speed observer | 10Hz to 2000Hz | 170 | Hz | Real-time | "H08_en.27" on page 461 |
| H08.28 | 2008-1Dh | Speed inertia correction coefficient | 10% to 10000% | 100 | % | Real-time | "H08_en.28" on page 461 |
| H08.29 | 2008-1Eh | Speed observer filter time | 0.02ms to 20.00ms | 0.80 | ms | Real-time | "H08_en.29" on page 461 |
| H08.40 | 2008-29h | Speed observer selection | 0 to 1 | 0 | - | At stop | "H08_en.40" on page 463 |

## 11.4.8 Model Tracking

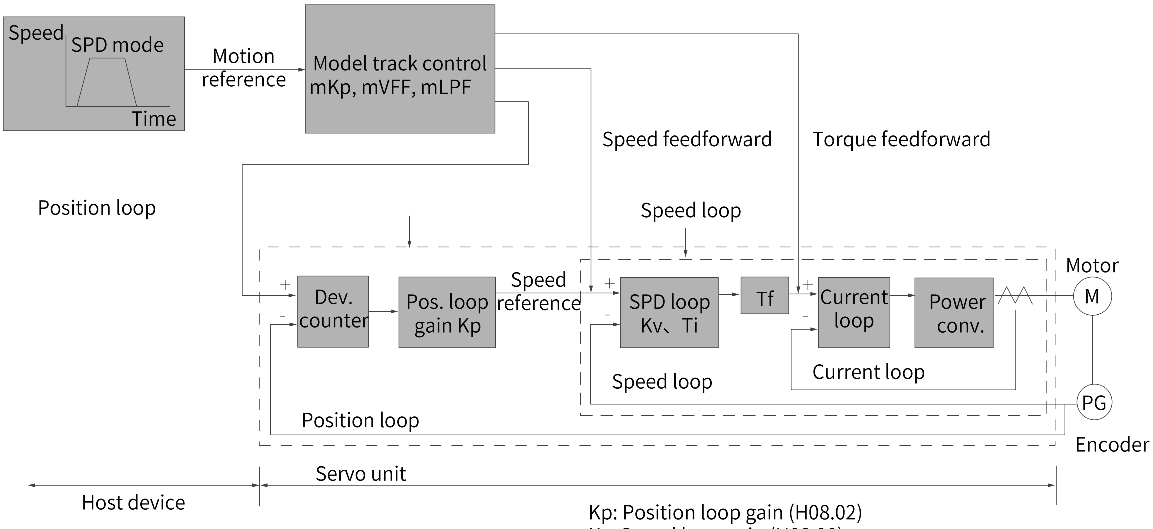
The model tracking control, which is only available in the position control mode, can be used to improve responsiveness and shorten the positioning time. It is only available in the position control mode.

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

However, manual tuning is needed in the following situations:

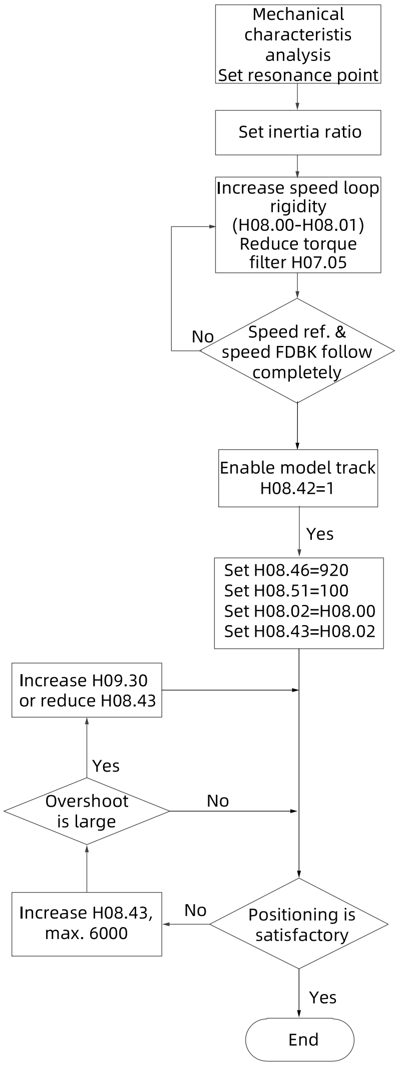
- The auto-tuned values cannot deliver desired performance.
- Improving the responsiveness takes priority over the auto-tuned or customized values.
- User-defined gain parameters or model tracking control parameters are needed.

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 track control gain (H08.43)
mVFF: Model track control SPD FDFWD compensation (H08.46)
mLPF: Model filter time

## Commissioning Steps




## Related parameters

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.05 | 2007-06h | Torque reference filter time constant | 0.00ms to 30.00ms | 0.50 | ms | Real-time | "H07_en.05" on page 448 |
| H08.00 | 2008-01h | Speed loop gain | 0.1Hz to 2000.0Hz | 40.0 | Hz | Real-time | "H08_en.00" on page 453 |
| H08.01 | 2008-02h | Speed loop integral time constant | 0.15ms to 512.00ms | 19.89 | ms | Real-time | "H08_en.01" on page 454 |
| H08.02 | 2008-03h | Position loop gain | 0.0Hz to 2000.0Hz | 64.0 | Hz | Real-time | "H08_en.02" on page 454 |
| H08.42 | 2008-2Bh | Model control selection | 0 to 1 | 0 | - | At stop | "H08_en.42" on page 464 |
| H08.43 | 2008-2Ch | Model gain | 0.0 to 2000.0 | 40.0 | - | Real-time | "H08_en.43" on page 464 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H08.46 | 2008-2Fh | Model feedforward | 0.0 to 102.4 | 95.0 | - | Real-time | "H08_en.46" on page 464 |
| H08.51 | 2008-34h | Model filter time 2 | 0.00ms to 20.00ms | 0.00 | ms | Real-time | "H08_en.51" on page 464 |

## 11.4.9 Friction Compensation

Friction compensation is used to reduce the impact of the friction on the operating effect during mechanical transmission. Use different positive/negative compensation values according to the direction of operation.

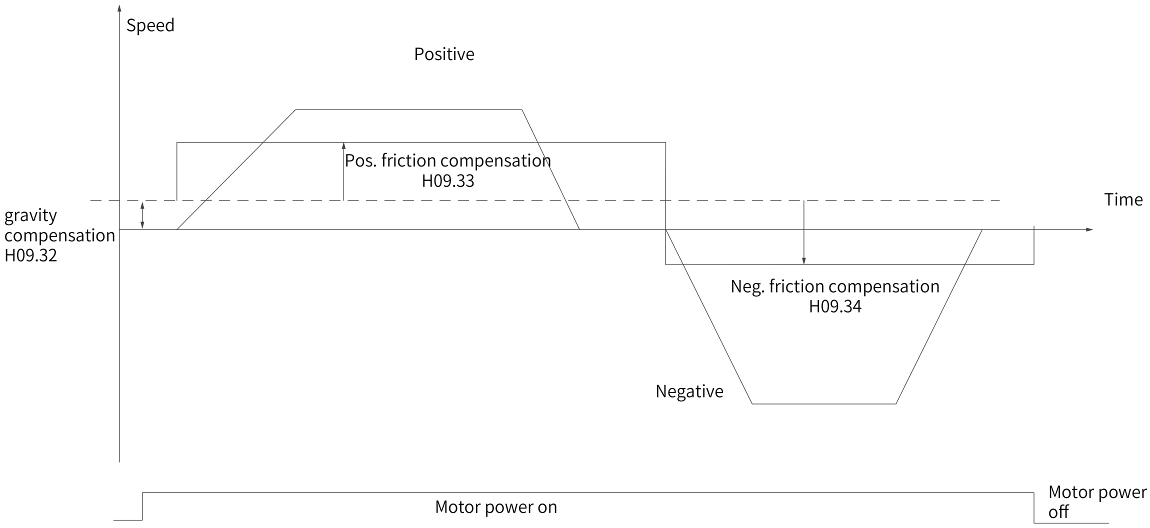
***Note***

Friction compensation is effective only in the position mode.

☆Related parameters

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.32 | 2009-21h | Gravity compensation value | 0.0 to 50.0 | 0.0 | - | Real-time | "H09_en.32" on page 474 |
| H09.33 | 2009-22h | Positive friction compensation | -100.0% to 100.0% | 0.0 | % | Real-time | "H09_en.33" on page 474 |
| H09.34 | 2009-23h | Negative friction compensation | -100.0% to 100.0% | 0.0 | % | Real-time | "H09_en.34" on page 474 |
| H09.35 | 2009-24h | Friction compensation speed threshold | 0.1 RPM to 30.0 RPM | 2.0 | RPM | Real-time | "H09_en.35" on page 474 |
| H09.36 | 2009-25h | Friction compensation speed | 0: Speed reference<br>1: Model tracking speed<br>2: Speed feedback | 0 | - | Real-time | "H09_en.36" on page 474 |

The diagram for friction compensation is as follows.




***Note***

Note: When the speed is less 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.

# 11.5 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.

## 11.5.1 Parameter Adjustment in the Position Control Mode

Obtain the value of H08.15 (Load inertia ratio) through inertia auto-tuning.

2) Perform gain adjustment.

- 1st gain set:

| Param. | Parameter Name | Function | Default |
|---|---|---|---|
| H07.05 | Torque reference filter time constant | Defines the torque reference filter time constant. | 0.79ms |
| H08.00 | Speed loop gain | Defines the speed loop proportional gain. | 40.0Hz |
| H08.01 | Speed loop integral time constant | Defines the integral time constant of the speed loop. | 19.89ms |
| H08.02 | Position loop gain | Defines the position loop proportional gain. | 64.0Hz |

- 2nd gain set:

| Param. | Parameter Name | Function | Default |
|---|---|---|---|
| H07.06 | 2nd torque reference filter time constant | Defines the torque reference filter time constant. | 0.79ms |
| H08.03 | 2nd speed loop gain | Defines the speed loop proportional gain. | 40.0Hz |
| H08.04 | 2nd speed loop integral time constant | Defines the integral time constant of the speed loop. | 20.00ms |
| H08.05 | 2nd position loop gain | Defines the position loop proportional gain. | 64.0Hz |
| 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. | 5.0ms |
| 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. | 3.0ms |

- Common gain set

| Param. | Parameter Name | Function | Default |
|---|---|---|---|
| H08.18 | Time constant of speed feedforward filter | Defines the filter time constant of the speed feedforward signal. | 0.50ms |
| H08.19 | Speed feedforward gain | Defines the speed feedforward gain. | 0.0% |
| H08.20 | Torque feedforward filter time constant | Defines the filter time constant of the torque feedforward signal. | 0.50ms |
| H08.21 | Torque feedforward gain | Defines the torque feedforward gain. | 0.0% |
| H08.22 | Speed feedback filtering option | Defines the speed feedback filtering function. | 0 |
| H08.23 | Cutoff frequency of speed feedback low-pass filter | Defines the cutoff frequency of the first-order low-pass filter for speed feedback. | 4000Hz |
| H08.24 | PDFF control coefficient | Defines the coefficient of the PDFF controller. | 100.0% |
| H09.38 | Model torque feedforward differential time | Sets the frequency of low-frequency resonance suppression 1 at the mechanical end. | 100.0Hz |
| H09.39 | Speed observer selection | Defines different low-frequency resonance suppression types at the mechanical load. | 2 |

Perform gain auto-tuning to get the initial values of the 1st gain set (or 2nd gain set) and the common gain set.

Fine-tune the following gains manually.

| Param. | Parameter Name | Function |
|---|---|---|
| H07.05 | Torque reference filter time constant | Defines the torque reference filter time constant. |
| H08.00 | Speed loop gain | Defines the speed loop proportional gain. |
| H08.01 | Speed loop integral time constant | Defines 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. |

### 11.5.2 Parameter Adjustment in the 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 *"11.5.1 Parameter Adjustment in the Position Control Mode" on page 255*.

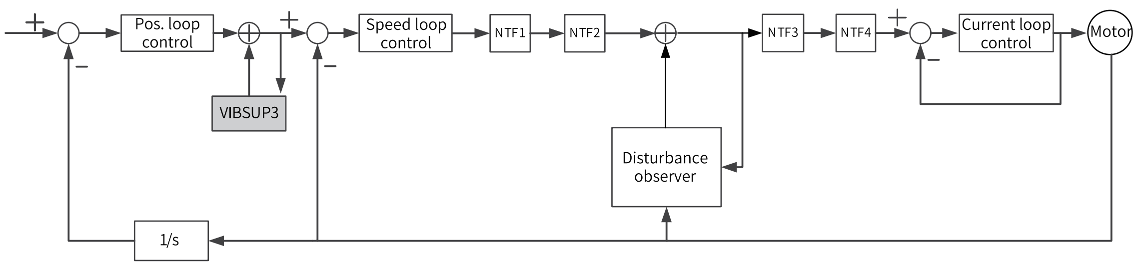
### 11.5.3 Parameter Adjustment in the Torque Control Mode

Parameter adjustment in the torque control mode are differentiated based on the following conditions:

- If the actual speed reaches the speed limit, the adjustment method is the same as that described in *"11.5.2 Parameter Adjustment in the Speed Control Mode" on page 257*.
- If the actual speed does not reach the speed limit, the adjustment method is the same as that described in *"11.5.2 Parameter Adjustment in the Speed Control Mode" on page 257*, except the position/speed loop gain and speed loop integral time constant.

## 11.6 Vibration suppression

The block diagram for vibration suppression is as follows.




Where:

- NTF1–4: 1st notch to 4th notch
- VIBSUP3: Suppression of medium- and low-frequency vibration Reduction applied at a carrier frequency lower than 8 K below 300 Hz
- 1/s: Integral element

***Note***

- jitter suppression phase modulation coefficient: synchronous phase adjustment of the compensation value and vibration. It is recommended to use the default value. Adjustment is needed when the compensation value phase differs greatly from the vibration phase.
- Jitter suppression frequency: Defines the jitter frequency that needs to be suppressed.
- Jitter suppression compensation coefficient: Defines the compensation coefficient for jitter suppression.

## 11.6.1 Mechanical Resonance Suppression

Resonance frequency is present in the mechanical system. When the gain of the drive increases, resonance may occur near the resonance frequency, disabling further increase of the gain.

Mechanical resonance can be suppressed in the following two methods:

### 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.

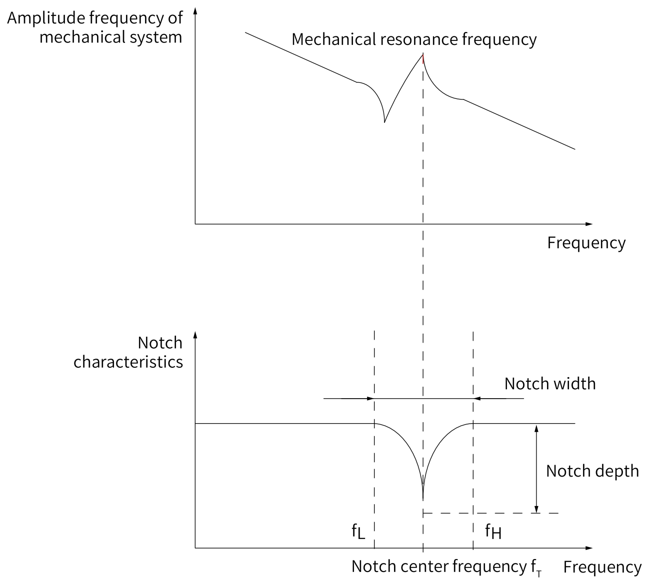



Figure 11-14 Operating principle of the notch

A total of four notches can be used, and each notch is defined by three parameters: frequency, width level, and depth level. The 1st and 2nd notches are manual notches whose parameters needs 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 11–9 Description of notch parameters

| Item | Manual Notch | | Manual/Adaptive Notch | |
|---|---|---|---|---|
| | 1st Notch | 2nd Notch | 3rd Notch | 4th Notch |
| Frequency | H09.12 | H09.15 | H09.18 | H09.21 |
| Width level | H09.13 | H09.16 | H09.19 | H09.22 |
| Depth level | H09.14 | H09.17 | H09.20 | H09.23 |

## *Note*

- When the frequency is 4000Hz (default), the notch is inactive.
- The adaptive notch is preferred for resonance suppression. The manual notch can be used in cases where the adaptive notch cannot deliver desired performance.

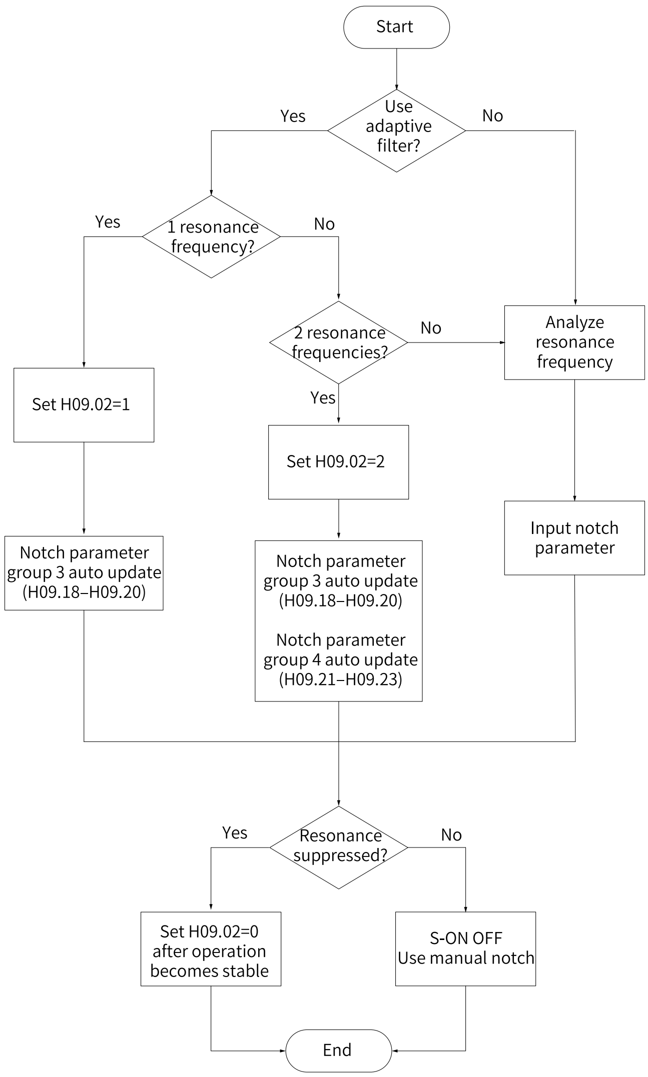



Figure 11-15 Using the notch

- Procedure for setting the adaptive notch:

1. Set H09.02 (Adaptive notch mode) to 1 or 2 based on the number of resonance points.
2. When resonance occurs, set H09.02 to 1 first to enable one adaptive notch. If new resonance occurs after gain adjustment, 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. In this case, add a manual notch, 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 be degraded.

---

- 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:
   - Use the "Mechanical characteristic analysis" function in Inovance software tool.
   - Calculate the resonance frequency based on the motor phase current displayed on the oscilloscope interface of the software tool.
   - 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 width level and depth level of this notch.
4. If resonance has been suppressed, it indicates the notch functions well and you can continue adjusting the gain. If resonance occurs again, repeat steps 1 and 2.
5. If resonance persists after the notch is working for a period of time, switch off the S-ON signal.

- Notch width level

  The width level indicates the ratio of the notch width to the center frequency of the notch.

$$\text{Notch width level} = \frac{f_H - f_L}{f_T}$$

Where:

$f_T$: center frequency of the notch, which is also the mechanical resonance frequency

$f_H - f_L$ is the notch width, that is, the frequency bandwidth with an amplitude attenuation rate of –3 dB relative to the notch central frequency.

The following figure shows the correspondence. 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.

When the depth level is 0, the input is completely suppressed at the center frequency. When the depth level is 100, the input can be fully passed 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.

## *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.

The following figure shows the frequency characteristics of the notch.

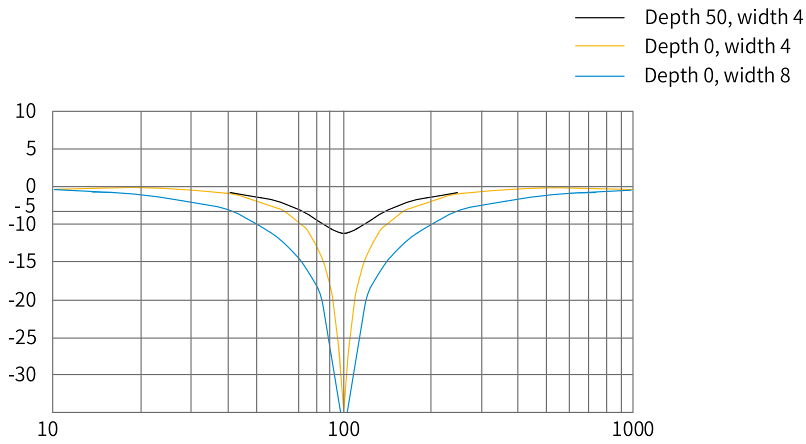



Figure 11-16 Notch frequency characteristics

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.02 | 2009-03h | Adaptive notch mode | 0: Adaptive notch no longer updated;<br>1: One adaptive notch activated (3rd notch)<br>2: Two adaptive notches activated (3rd and 4th notches)<br>3: Resonance point tested only (displayed in H09.24)<br>4: Adaptive notch cleared, values of 3rd and 4th notches restored to default | 0 | - | Real-time | " H09_en.02" on page 468 |
| H09.12 | 2009-0Dh | Frequency of the 1st notch | 50Hz to 4000Hz | 4000 | Hz | Real-time | " H09_en.12" on page 470 |
| H09.13 | 2009-0Eh | Width level of the 1st notch | 0 to 40 | 2 | - | Real-time | " H09_en.13" on page 471 |
| H09.14 | 2009-0Fh | Depth level of the 1st notch | 0 to 99 | 0 | - | Real-time | " H09_en.14" on page 471 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.15 | 2009-10h | Frequency of the 2nd notch | 50Hz to 4000Hz | 4000 | Hz | Real-time | "H09_en.15" on page 471 |
| H09.16 | 2009-11h | Width level of the 2nd notch | 0 to 20 | 2 | - | Real-time | "H09_en.16" on page 471 |
| H09.17 | 2009-12h | Depth level of the 2nd notch | 0 to 99 | 0 | - | Real-time | "H09_en.17" on page 472 |
| H09.18 | 2009-13h | Frequency of the 3rd notch | 50Hz to 4000Hz | 4000 | Hz | Real-time | "H09_en.18" on page 472 |
| H09.19 | 2009-14h | Width level of the 3rd notch | 0 to 20 | 2 | - | Real-time | "H09_en.19" on page 472 |
| H09.20 | 2009-15h | Depth level of the 3rd notch | 0 to 99 | 0 | - | Real-time | "H09_en.20" on page 472 |
| H09.21 | 2009-16h | Frequency of the 4th notch | 50Hz to 4000Hz | 4000 | Hz | Real-time | "H09_en.21" on page 472 |
| H09.22 | 2009-17h | Width level of the 4th notch | 0 to 20 | 2 | - | Real-time | "H09_en.22" on page 473 |
| H09.23 | 2009-18h | Depth level of the 4th notch | 0 to 99 | 0 | - | Real-time | "H09_en.23" on page 473 |
| H09.24 | 2009-19h | Auto-tuned resonance frequency | 0 to 2000 | 0 | - | Unchangeable | "H09_en.24" on page 473 |

### 11.6.2 Low-Frequency Resonance Suppression at the Mechanical End

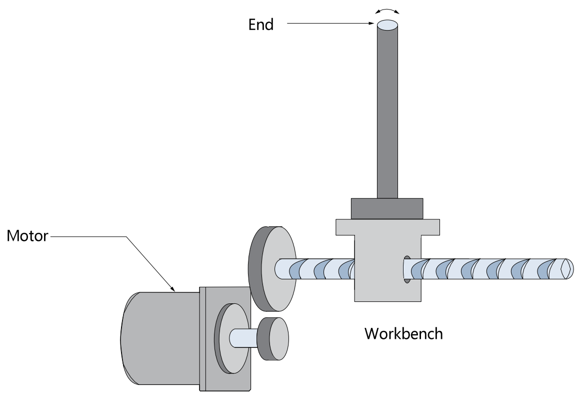



Figure 11-17 Low-frequency vibration at the mechanical end

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 mentioned in *"11.6.1 Mechanical Resonance Suppression" on page 258*. Use the low-frequency resonance suppression function to reduce such vibration.

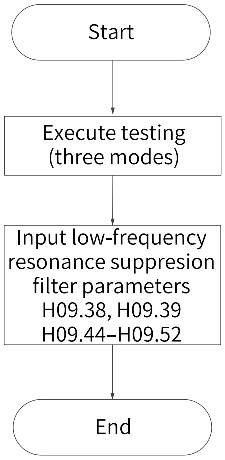



Figure 11-18 Procedure for setting low-frequency resonance suppression filter

First, use the oscilloscope function in the software tool to collect the position deviation waveform of the motor in the positioning state. Then calculate the position deviation fluctuation frequency, which is the low-frequency resonance frequency. Finally, input the value of H09.38 manually and use the default value of H09.39. Observe the resonance suppression effect after using the low-frequency resonance suppression filter.

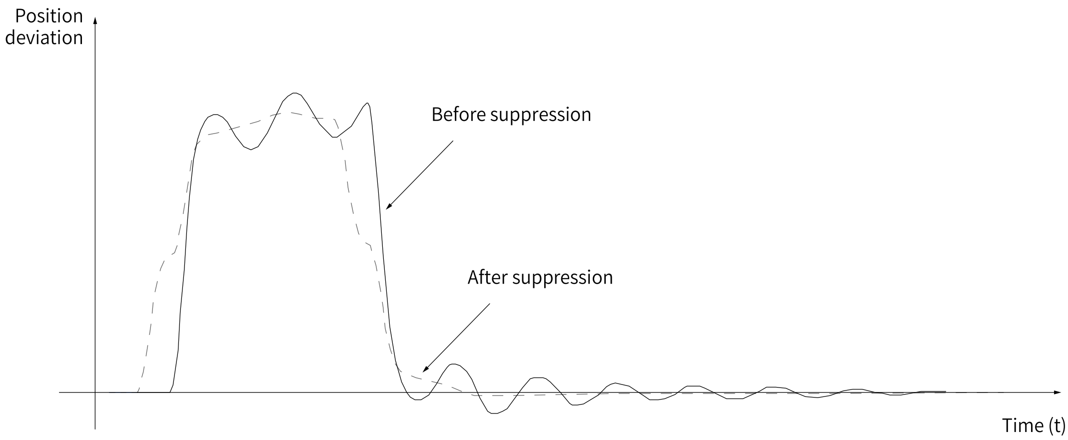



Figure 11-19 Low-frequency resonance suppression effect

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.38 | 2009-27h | Low-frequency resonance suppression frequency at the mechanical end | 1.0Hz to 100.0Hz | 100.0 | Hz | At stop | "H09_en.38" on page 475 |
| H09.39 | 2009-28h | Low-frequency resonance suppression at the mechanical end | 0 to 3 | 2 | - | At stop | "H09_en.39" on page 475 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.44 | 2009-2Dh | Frequency of low-frequency resonance suppression 1 at mechanical load end | 0.0Hz to 200.0Hz | 0.0 | Hz | Real-time | "H09_en.44" on page 476 |
| H09.45 | 2009-2Eh | Responsiveness of low-frequency resonance suppression 1 at mechanical load end | 0.01 to 10.00 | 1.00 | - | Real-time | "H09_en.45" on page 476 |
| H09.47 | 2009-30h | Width of low-frequency resonance suppression 1 at mechanical load end | 0.00 to 2.00 | 1.00 | - | Real-time | "H09_en.47" on page 476 |
| H09.49 | 2009-32h | Frequency of low-frequency resonance suppression 2 at mechanical load end | 0.0Hz to 200.0Hz | 0.0 | Hz | Real-time | "H09_en.49" on page 476 |
| H09.50 | 2009-33h | Responsiveness of low-frequency resonance suppression 2 at mechanical load end | 0.01 to 10.00 | 1.00 | - | Real-time | "H09_en.50" on page 476 |
| H09.52 | 2009-35h | Width of low-frequency resonance suppression 2 at mechanical load end | 0.00 to 2.00 | 1.00 | - | Real-time | "H09_en.52" on page 476 |

## 11.7 Mechanical Characteristic 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.

## Steps

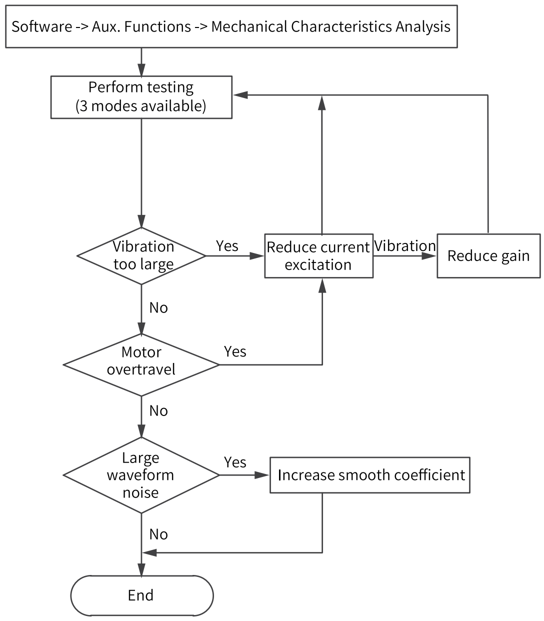



Figure 11-20 Operating procedure for mechanical characteristic analysis

## *Note*

- To avoid large vibration during the test, set the current excitation to 10% during initial execution.
- The analysis waveform may be distorted if the current excitation is too low.
- If the vibration generated during test cannot be suppressed after reducing the current excitation, the possible causes and solutions may be: 1) The gain is too high, reduce the speed gain or set the notch based on the auto-tuned resonance point. 2) The set inertia is too high, set the correct inertia.
- After setting the notch, the waveform under mechanical characteristic test mode is the same with that before the setting, but the speed closed loop and speed open loop modes will be attenuated.

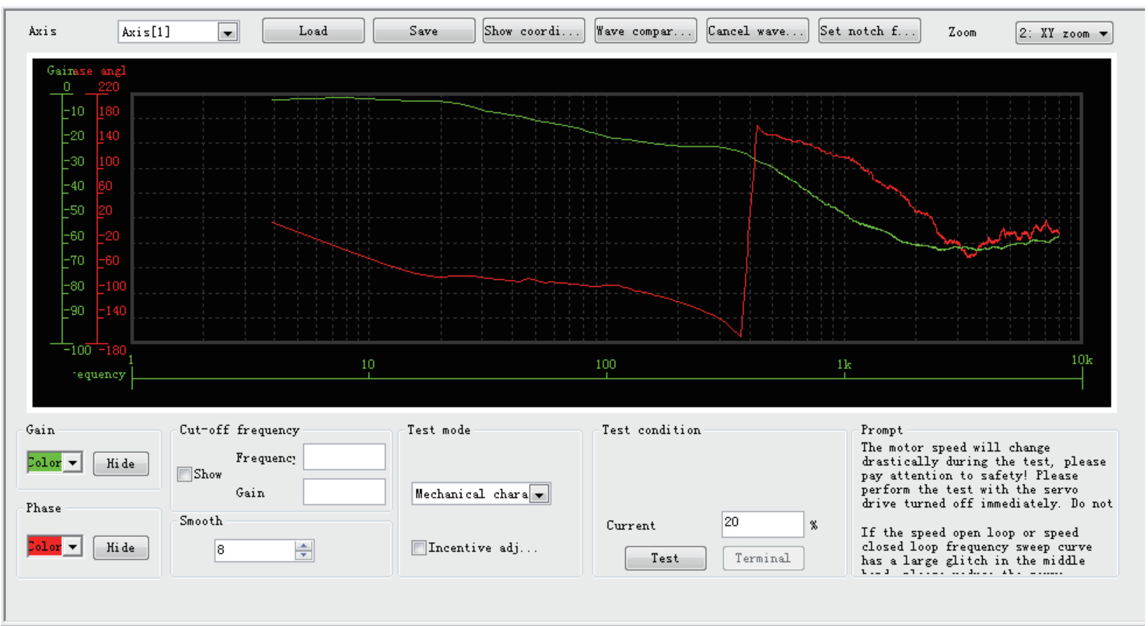



Figure 11-21 Example of the waveform obtained

An example of the waveform obtained with the mechanical characteristic analysis is shown in *“Figure 11–21 Example of the waveform obtained” on page 265*.

# 12 Function Overview

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

| Function | Description |
|---|---|
| Position control mode | Used to make the servo drive operate in the position control mode. |
| Speed Control Mode | Used to make the servo drive operate in the speed control mode. |
| Torque control mode | Used to make the servo drive operate in the torque control mode. |
| Position/Speed control switchover | Used to switch between position control and speed control through external input signals. |
| Position/Torque control switchover | Used to switch between speed control and torque control through external input signals. |
| Torque/Position control switchover | Used to switch between torque control and position control through external input signals. |
| Torque/Speed/Position control switchover | Used to switch among torque control, speed control and position control through external input signals. |
| High-resolution encoder | The servo drive is equipped with a high-performance encoder with resolution up to 262144P/r. |
| Mechanical characteristics analysis | Used to analyze the resonance frequency and characteristics of the mechanical system through a PC installed with Inovance software tool. |
| Auto Gain Tuning | The servo drive generates gain parameters automatically to match present working conditions through just one parameter. |
| Gain switchover | Used to apply different gains to different status (operating or stop) of the motor. Gains can also be switched by external terminals during operation. |
| Torque disturbance observer | The servo drive estimates the disturbance torque suffered by the system to suppress vibration through compensation. |
| Resonance suppression | The servo drive sets filter characteristics automatically to suppress mechanical system vibration after detecting the resonance point. |
| Torque Reference Filter | Used to suppress the mechanical resonance that may be generated when the response speed is excessively high. |
| Electronic gear ratio | Decreasing or increasing the pulse input by: 0.001 x Encoder resolution/ 10000 to 4000 x Encoder resolution/10000. |
| Position ramp | Smooth acceleration at position reference response is implemented. |
| Position first-order low-pass filter | Used to achieve smooth acceleration and deceleration. |
| Homing | Used to search for the mechanical home automatically to locate the relative position between the mechanical home and mechanical zero |
| Interrupt positioning | Used to interrupt present position reference and execute the set displacement. |
| Zero Clamp | Used to keep the motor speed below a certain value in the speed control mode to lock the position. |
| Reference pulse selection | Four pulse string input types can be selected. |
| External regenerative resistor | Used in case of insufficient braking capacity of the built-in regenerative resistor. |
| DI signal assignment | Used to assign functions such as S-ON to corresponding pins. |
| AI1 | Analogs voltage input. |
| Alarm history | The servo drive records the latest ten faults/warnings, which can also be cleared. |
| Status display | Used to display the drive status through the LED on the keypad. |
| External I/O display | Used to display ON/OFF status of external I/O signals. |

| Function | Description |
|---|---|
| Forced DO | Used to output signals not related to the drive status forcibly or used to check the wiring of output signals. |
| Trial run mode | Used to enable the motor through the keypad without a start signal. |
| Inovance servo commissioning software | Used to set parameters, perform trial run, and check status through a PC. |
| Warning code output | Outputting a three-digit warning code upon a warning event |

# 13 Basic Functions of the Servo Drive

## 13.1 Position control mode

### 13.1.1 Position control mode

★ Definition of terms:

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

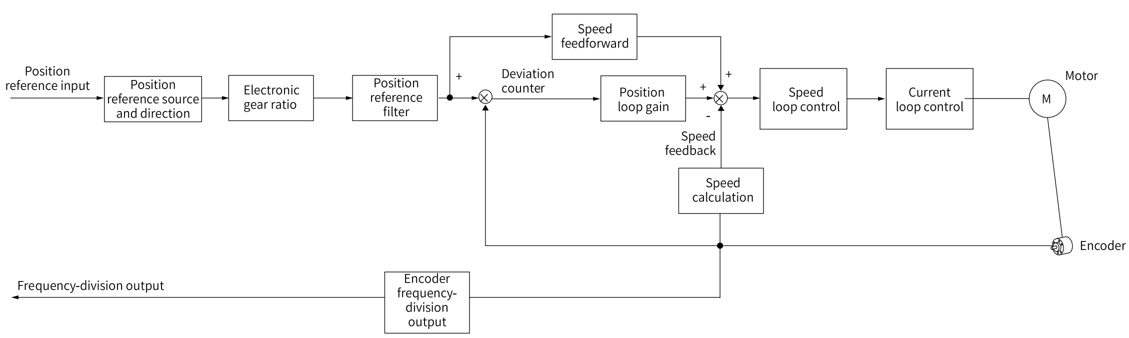



Figure 13-1 Position control diagram

Set H02.00 (Control mode selection) to 1 (Position control mode) through the keypad or Inovance software tool to make the servo drive operate in the position control mode. Set the drive parameters based on the mechanical structure and technical indicators.

The following describes basic parameter settings for the position control mode.

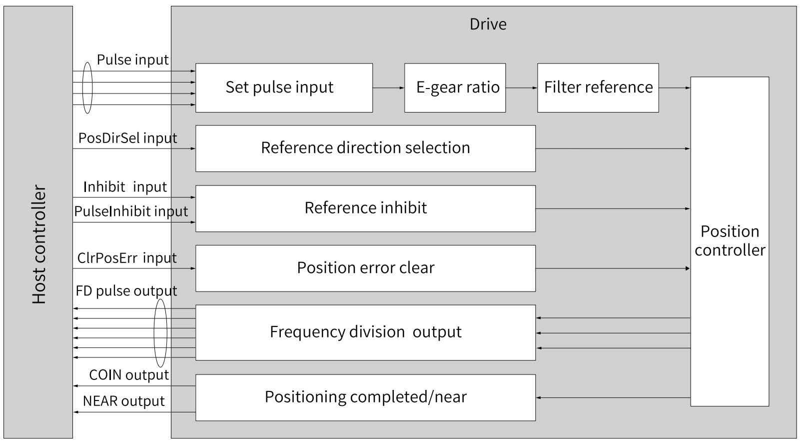



Figure 13-2 Signal exchange between the drive and the host controller

## 13.1.2 Block diagram of position control parameters

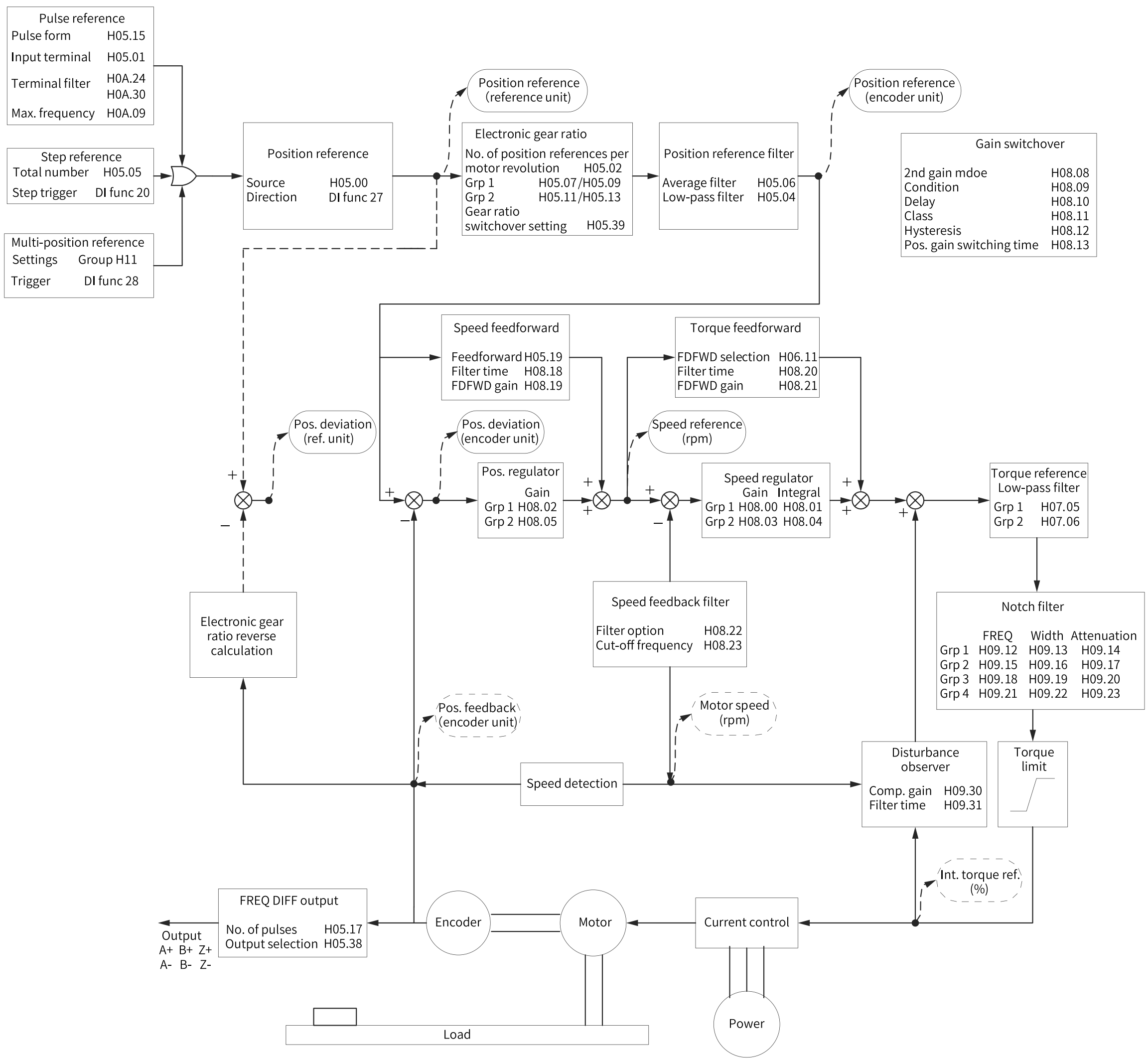



Figure 13-3 Block diagram of position control parameters

## 13.1.3 Position Reference Input Setting

The position reference input setting includes the position reference source, position reference direction, and FunIN.13 (Position reference inhibited).

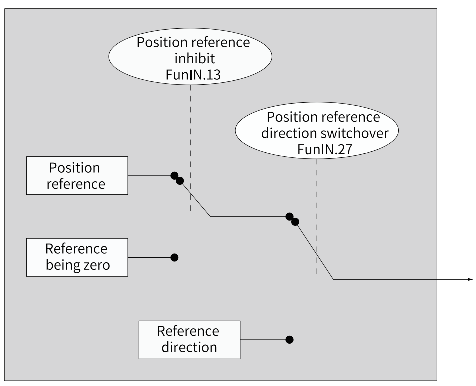



Figure 13-4 Position reference input setting

## Position reference source

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

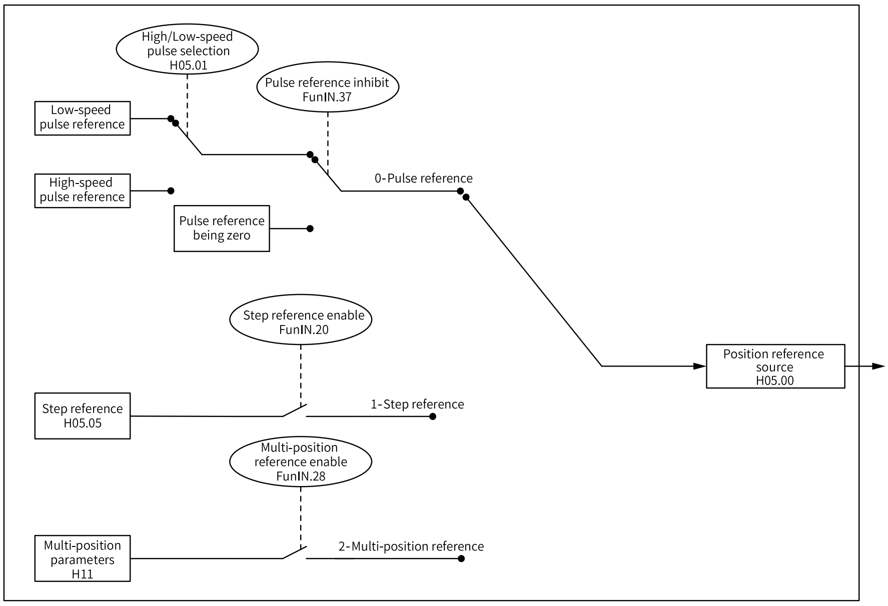



Figure 13-5 Setting the position reference source

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.00 | 2005-01h | Primary position reference source | 0: Pulse reference<br>1: Step reference<br>2: Multi-position reference | 0 | - | At stop | "H05_en.00" on page 415 |

- Pulse reference as the source (H05.00 = 0)
  Perform the following operations to obtain the correct pulse reference form.

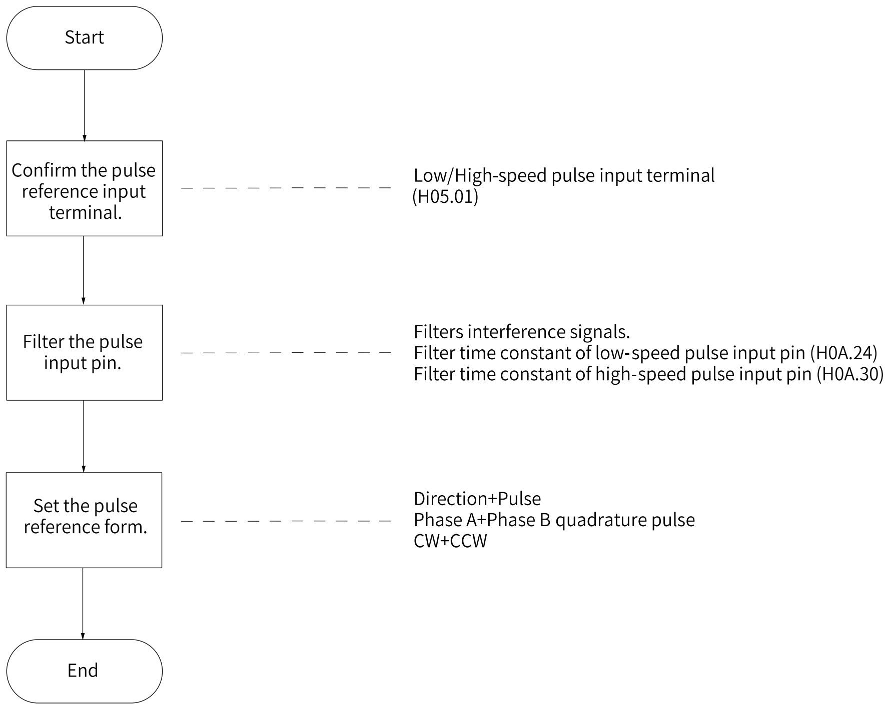
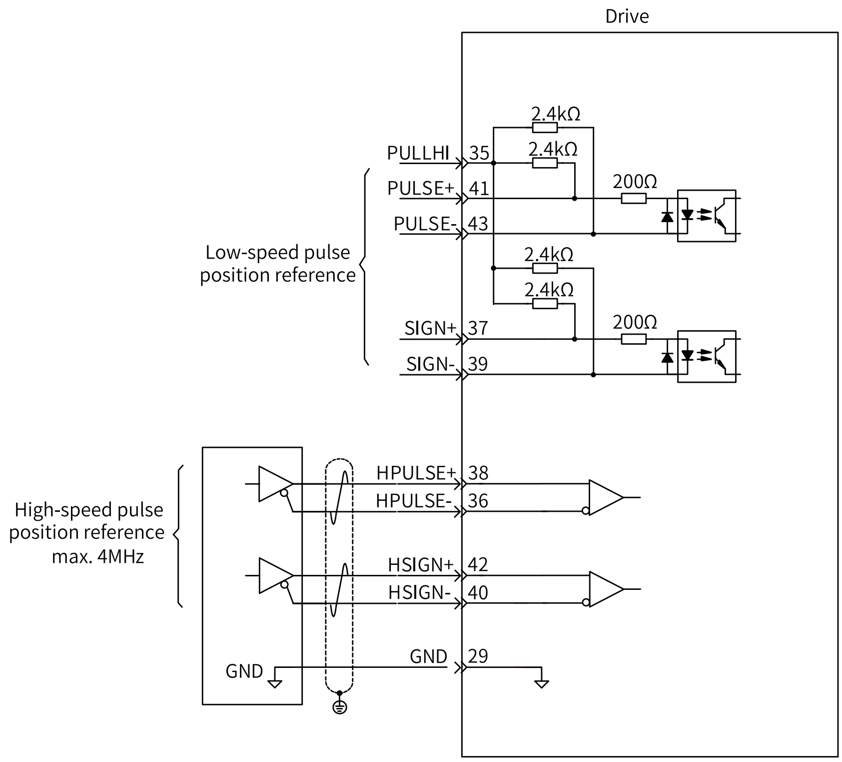



Figure 13-6 Flowchart for setting the pulse reference as the source

- Pulse reference input terminals

  The drive provides two groups of pulse input terminals.




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

The high-speed pulse input terminals (HPULSE+, HPULSE-, HSIGN+, HSIGN-) receive differential input (maximum frequency up to 4 Mpps) only.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.01 | 2005-02h | Position pulse reference input terminal | 0: Low speed<br>1: High speed | 0 | - | At stop | "H05_en.01" on page 416 |

For details on the circuit, see "8.3.2 Position Reference Input Signals" on page 149.

Table 13–1 Specifications of pulse input

| Pulse Type | | Maximum Input Frequency | Voltage | Forward Current |
|---|---|---|---|---|
| High-speed pulse | Differential signal | 4M | 5V | < 25mA |
| Low-speed pulse | Differential signal | 200k | 5V | < 15 mA |
| | Open-collector signal | 200k | 24V | < 15 mA |

- Pulse input pin filter

  Set the pin filter time for input terminals of low-speed and high-seed pulses. This is to prevent motor malfunction caused by interference signals.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0A.24 | 200A-19h | Filter time constant of low-speed pulse input terminal | 0 to 255 | 30 | - | At stop | "H0A_en.24" on page 481 |
| H0A.30 | 200A-1Fh | Filter time constant of high-speed pulse input terminal | 0ns to 255ns | 2 | ns | At stop | "H0A_en.30" on page 483 |

If the filter time constant for pulse input pins is tF, the minimum width of input signals is tmin, then the input signals before and after filtering are as follows. The filtered input signals will be delayed for tF over the unfiltered ones.

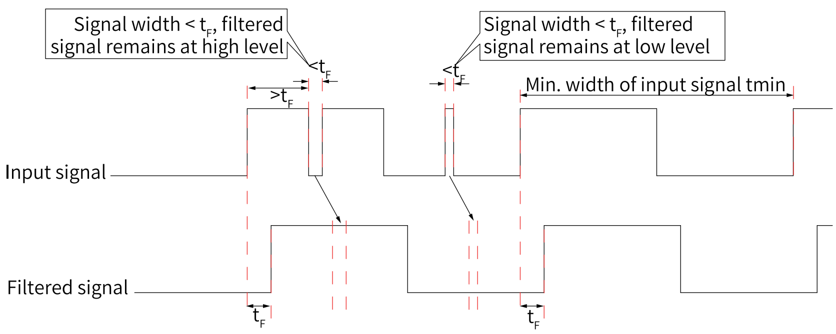



Figure 13-7 Example of filtered signal waveform

The pulse input pin filter time tF must meet the following requirement: $t_F \leqslant (20\% \text{ to } 25\%)\ t_{min}$

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

Table 13–2 Recommended filter time constant

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

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

- Pulse reference form

  The drive supports the following three types of pulse references:

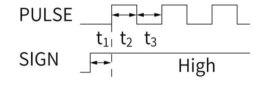
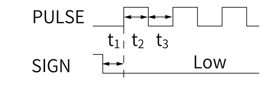
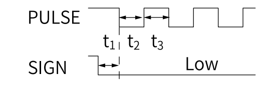
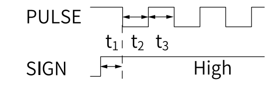
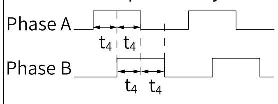
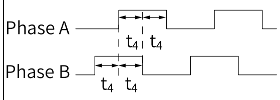
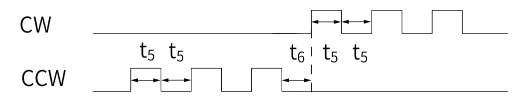
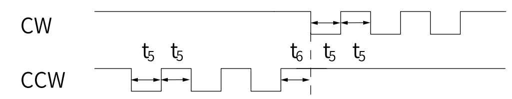
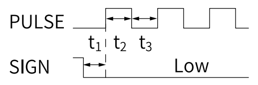
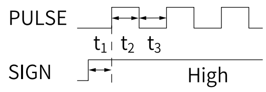
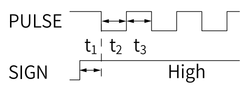
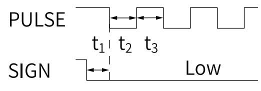
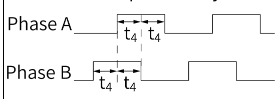
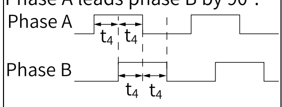
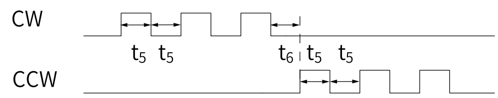
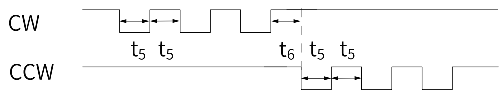
  – Direction + Pulse (positive or negative logic)
  – Phase A + Phase B quadrature pulse, quadrupled frequency
  – CW + CCW

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

  ☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.15 | 2005-10h | Pulse reference form | 0: Direction + Pulse, positive logic<br>1: Direction + Pulse, negative logic<br>2: Phase A + phase B quadrature pulse, quadrupled frequency<br>3: CW + CCW | 0 | - | At stop | "H05_en.15" on page 420 |

Table 13–3 Descriptions of the pulse form

| H02.02<br>Rotation direction selection | H05.15<br>Reference form | Pulse input form | Signal | Diagram of forward pulses | Diagram of reverse pulses |
|---|---|---|---|---|---|
| 0 | 0 | Pulse + Direction<br>Positive Logic | PULSE<br>SIGN |  |  |
| | 1 | Pulse + Direction<br>Negative Logic | PULSE<br>SIGN |  |  |
| | 2 | Phase A + Phase B<br>Quadrature pulse<br>Quadrupled frequency | PULSE (phase A)<br>SIGN (phase B) | Phase A leads phase B by 90°.<br> | Phase B leads phase A by 90°.<br> |
| | 3 | CW+CCW | PULSE (CW)<br>SIGN (CCW) | <br> | |
| 1 | 0 | Pulse + Direction<br>Positive Logic | PULSE<br>SIGN |  |  |
| | 1 | Pulse + Direction<br>Negative Logic | PULSE<br>SIGN |  |  |
| | 2 | Phase A + Phase B<br>Quadrature pulse<br>Quadrupled frequency | PULSE (phase A)<br>SIGN (phase B) | Phase B leads phase A by 90°.<br> | Phase A leads phase B by 90°.<br> |
| | 3 | CW+CCW | PULSE (CW)<br>SIGN (CCW) | <br> | |

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

Table 13–4 Specifications of pulse references

| Input terminal | | Max. Frequency | Minimum Time Width (unit: us) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | t1 | t2 | t3 | t4 | t5 | t6 |
| High-speed pulse input terminal | | 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 pulse references must be shorter than 0.1 us.

- 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.

  ☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0A.09 | 200A-0Ah | Maximum position pulse frequency | 100kHz to 4000kHz | 4000 | kHz | At stop | " H0A_en.09" on page 479 |

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

**Caution**

When the S-ON (Servo ON) signal is active, the motor is locked when the step reference is disabled or in the rotational state when the step reference is enabled. After H05.05 (Step reference) is done executing, the motor stays locked when no step reference is triggered again.

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

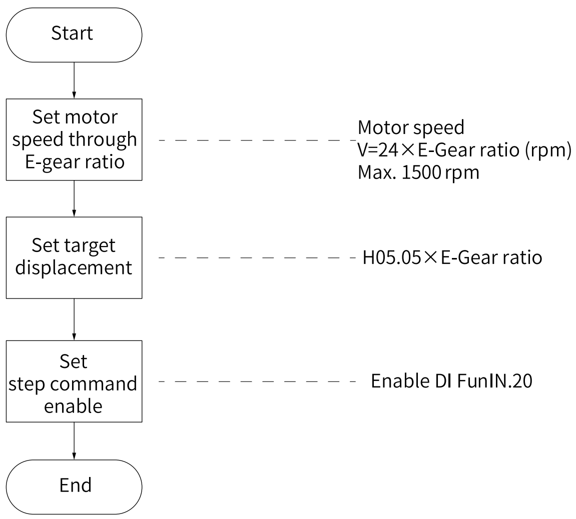



Figure 13-8 Flowchart for setting step reference as the position reference source

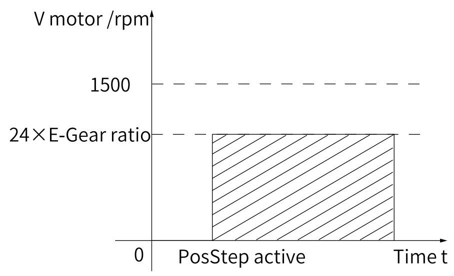



Figure 13-9 Motor operating curve (H05.00 = 1)

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

- Relationship between the 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.

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

- Motor displacement
  When the step reference is used as the position reference source, the sum of position references (reference unit) is set in H05.05. The sign of the setpoint of H05.05 determines whether the motor speed is a positive or a negative value.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.05 | 2005-06h | Step amount | -9999 to +9999 | 50 | Reference unit | At stop | *"H05_en.05" on page 418* |

- Step reference
  To use the step reference as the position reference source, assign FunIN.20 (PosStep, step reference enable) to a certain DI of the servo drive, and set the active logic of this DI.

☆ Related parameters:

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

FunIN.20 (Step reference enable) is edge-triggered. The motor is locked after the step reference is done executing. When FunIN.20 is triggered again, the motor executes the step reference defined by H05.05 again.

- 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 can be set. The interval time and switchover mode between positions can also be set according to actual requirements. The setting flowchart is as follows.

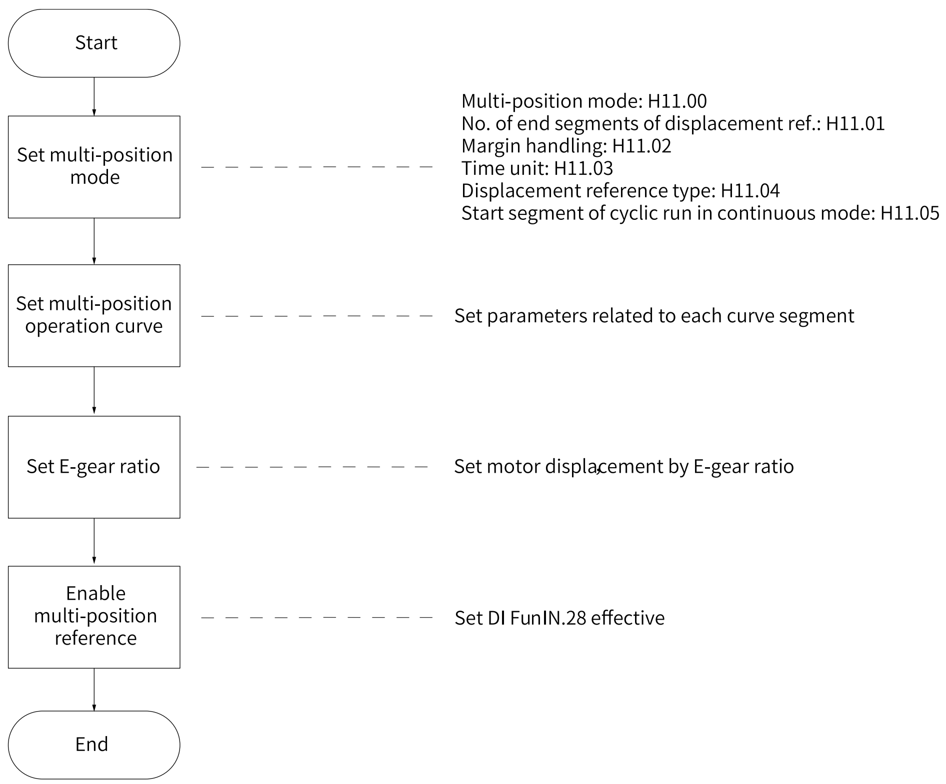



Figure 13-10 Flowchart for setting the multi-position reference as the source

- Setting the multi-position operation mode

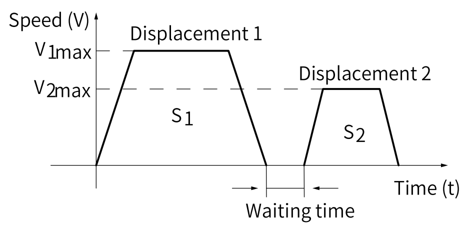
☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H11.00 | 2011-01h | Multi-position running mode | 0: Single run (number of displacements selected in H11.01)<br>1: Cyclic operation (number of displacement selected in H11.01)<br>2: DI-based operation (selected by DI)<br>3: Sequential operation<br>5: Axis-controlled continuous operation | 1 | - | At stop | *"H11_en.00" on page 510* |
| H11.01 | 2011-02h | End segments of displacement instruction | 1 to 16 | 1 | - | At stop | *"H11_en.01" on page 513* |
| H11.02 | 2011-03h | Starting displacement No. after pause | 0: Continue to execute the unexecuted displacements<br>1: Start from displacement 1 | 0 | - | At stop | *"H11_en.02" on page 513* |
| H11.03 | 2011-04h | Interval time unit | 0: ms<br>1: s | 0 | - | At stop | *"H11_en.03" on page 514* |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H11.04 | 2011-05h | Displacement reference type | 0: Relative displacement reference<br>1: Absolute displacement reference | 0 | - | Real-time | "H11_en.04" on page 514 |
| H11.05 | 2011-06h | Starting displacement No. in sequential operation | 0 to 16 | 0 | - | At stop | "H11_en.05" on page 515 |

(1) Individual operation (H11.00 = 0)

Table 13–5 Description of individual operation

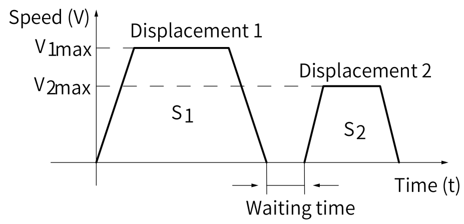
| Description | Operating Curve |
|---|---|
| • The drive stops after one cycle of operation.<br>• The drive switches to the next displacement automatically.<br>• The interval time between displacements can be set as needed.<br>• The PoslnSen (multi-position reference enable) signal is level-triggered. | <br>V1max, V2max: maximum operating speeds in displacement 1 and displacement 2<br>S1, S2: displacement 1 and displacement 2<br>• The positioning completed signal is active after each displacement is reached.<br>• 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.<br>• After the PoslnSen signal is enabled again, the drive executes the displacement defined by H11.02.<br>• 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.<br>• 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. |

★ Definition of terms:

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

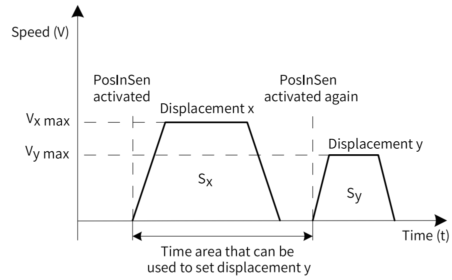
(2) Cyclic operation (H11.00 = 1)

Table 13–6 Descriptions of cyclic operation

| Description | Operating Curve |
|---|---|
| • The drive starts from displacement 1 again after each cycle of operation.<br>• The drive switches to the next displacement automatically.<br>• The interval time between displacements can be set as needed.<br>• The cyclic operation mode is kept when the FunIN.28 (Multi-position reference enable) is active.<br>• The PoslnSen (multi-position reference enable) signal is level-triggered. | <br>V1max, V2max: maximum operating speeds in displacement 1 and displacement 2<br>S1, S2: displacement 1 and displacement 2<br>• The positioning completed signal is active after each displacement is reached.<br>• 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.<br>• After the PoslnSen signal is enabled again, the drive executes the displacement defined by H11.02.<br>• 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.<br>• 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. |

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

Table 13–7 Descriptions of DI-based operation

<table>
<tr><th>Description</th><th>Operating Curve</th></tr>
<tr><td>• The displacement to be executed next can be set when the current displacement is in progress. The motor stops after current displacement is done executing. After the PoslnSen (position reference enable) signal is enabled again, the present displacement will be executed.<br>• The speed No. is determined by the DI logic.<br>• The interval time between displacements is determined by the command delay of the host controller.<br>• The PoslnSen (multi-position reference enable) signal is edge-triggered.</td><td>
<br>Vxmax, Vymax: maximum operating speeds in displacement x and displacement y<br>Sx, Sy: displacement x and displacement y<br>• The positioning completed signal is active after each displacement is reached.<br>• 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.<br>• The displacements must be switched in the following sequence:<br>1. Wait until displacement x is done executing before switching the displacement no..<br>2. When displacement x is in progress or done, 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).<br>3. After displacement x is done executing, switch on the PoslnSen (multi-position reference enable) signal again to make the drive execute displacement y.<br>• 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.<br>• 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.</td></tr>
</table>

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

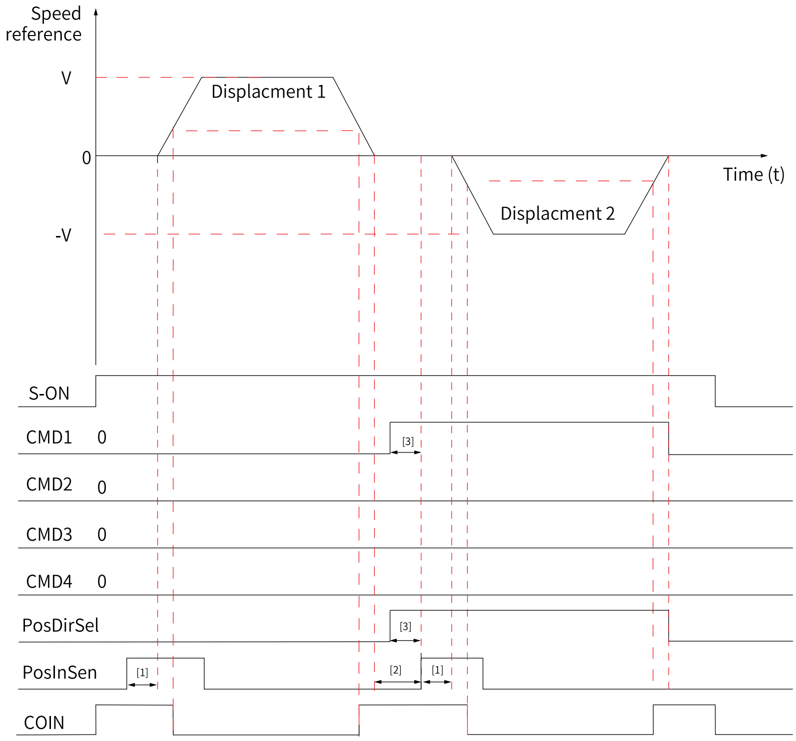



Figure 13-11 Multi-position sequence diagram

## 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 range 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.

☆ Related parameters:

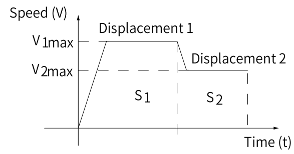
| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.6 | CMD1 | Multi-reference switchover 1 | The displacement No. is a 4-bit binary. The relationship between the displacement No. and CMD1 to CMD4 is shown in *"Table 13–8" on page 282*.<br>The DI logic is level-triggered. The CMD value is 1 upon active level input or 0 upon inactive level input. |
| FunIN.7 | CMD2 | Multi-reference switchover 2 | |
| FunIN.8 | CMD3 | Multi-reference switchover 3 | |
| FunIN.9 | CMD4 | Multi-reference switchover 4 | |

Table 13–8 Relationship between the displacement No. and CMD1 to CMD4

| CMD4 | CMD3 | CMD2 | CMD1 | Segment No. |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 2 |
| | | … | | |
| 1 | 1 | 1 | 1 | 16 |

**Sequential running (H11.00 = 3)**

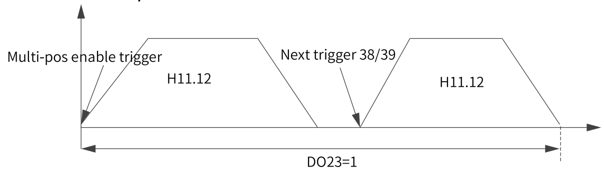
Table 13–9 Descriptions of sequential operation

| Description | Operating Curve |
| --- | --- |
| • The drive stops after one cycle of operation.<br>• (H11.05 = 0 or H11.05 > H11.01).<br>• The starting displacement after the first cycle of operation is defined by H11.05.<br>• The drive switches to the next displacement automatically.<br>• There is no interval time between displacements.<br>• The PoslnSen (multi-position reference enable) signal is level-triggered. | <br>V1max, V2max: maximum operating speeds in displacement 1 and displacement 2<br>S1, S2: displacement 1 and displacement 2<br>• The positioning completed signal is active after each displacement is reached.<br>• 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.<br>• After the PoslnSen signal is enabled again, the drive executes the displacement defined by H11.02.<br>• 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.<br>• 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. |

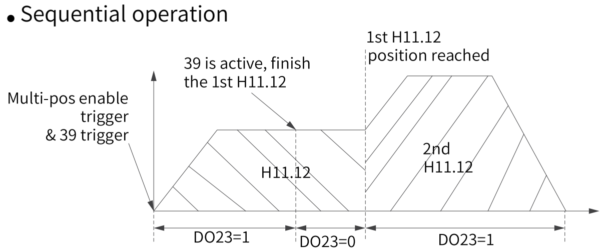
**Axis-controlled continuous operation (H11.00 = 5)**

Table 13–10 Description of axis-controlled continuous operation

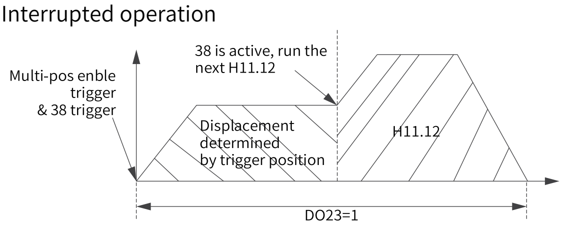
<table>
<tr><th>Description</th><th>Operating Curve</th></tr>
<tr><td>• The drives executes one displacement only.<br>• The individual operation mode, sequential operation mode, and interrupted operation mode are included.<br>• The PoslnSen (multi-position reference enable) signal is level-triggered.</td><td>• Individual operation




• The PoslnSen (multi-position reference enable) signal is triggered only once (FunIN.39/38 triggered later). The drive stops after executing the distance defined by H11.12.<br>• Sequential operation




• 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 drive continues executing the first H11.12 until the distance defined by the first H11.12 is done. 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.<br>• 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.</td></tr>
</table>

☆ Related parameters:

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

- Setting multi-position operating curve

A total of 16 position references can be set during multi-position operation. The displacement, maximum operating speed, acceleration/deceleration time, and interval time between displacements can be set separately. The following takes displacement 1 as an example.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H11.12 | 2011-0Dh | Displacement 1 | -1073741824 to 1073741824 | 10000 | Reference unit | Real-time | " H11_en.12" on page 516 |
| H11.14 | 2011-0Fh | Max. speed of displacement 1 | 1 rpm to 6000 rpm | 200 | RPM | Real-time | " H11_en.14" on page 517 |
| H11.15 | 2011-10h | Acc/Dec time of displacement 1 | 0ms to 65535ms | 10 | ms | Real-time | " H11_en.15" on page 517 |
| H11.16 | 2011-11h | Interval time after displacement 1 | 0 ms(s) to 10000 ms(s) | 10 | ms (s) | Real-time | " H11_en.16" on page 517 |

The actual operating curve of the motor based on preceding settings is shown in the following figure.

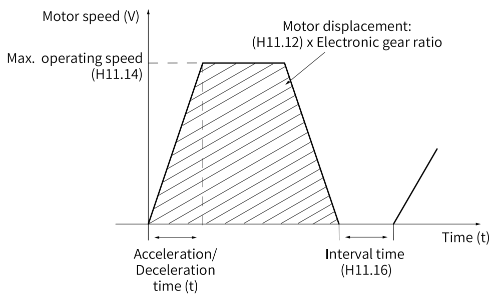



Figure 13-12 Motor operating curve in displacement 1

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".

- Setting multi-position reference enable mode

To use the multi-position reference as the position reference source, assign FunIN.28 (PosInSen, multi-position reference enable) to a certain DI of the drive, and set the active logic of this DI.

☆Related function No.:

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

## Position reference direction

A DI can be used to change the position reference direction, so as to change the motor direction of rotation. Assign FunIN.27 (PosDirSel, position reference direction) to a DI of the drive, and set the active logic of this DI.

☆ Related parameters:

| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.27 | PosDirSel | Position reference direction | Inactive: Actual position reference direction same as the set direction<br>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 position reference, position reference direction (FunIN.27).

Table 13–11 Motor direction of rotation

| H02.02 | Sign of Position Reference | FunIN.27 | Direction of Rotation |
|---|---|---|---|
| 0 | + | Inactive | CCW |
| 0 | + | Active | CW |
| 0 | - | Inactive | CW |
| 0 | - | Active | CCW |
| 1 | + | Inactive | CW |
| 1 | + | Active | CCW |
| 1 | - | Inactive | CCW |
| 1 | - | Active | CW |

## Position reference inhibited

FunIN.13 (Inhibit) and FunIN.37 (PulseInhibit) are used to inhibit position references and pulse references.

- Position reference inhibited

The servo drive sets all the position references to 0, which means it does not respond to any internal or external position references, and the motor is in the locked state in the 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 inhibited), 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.

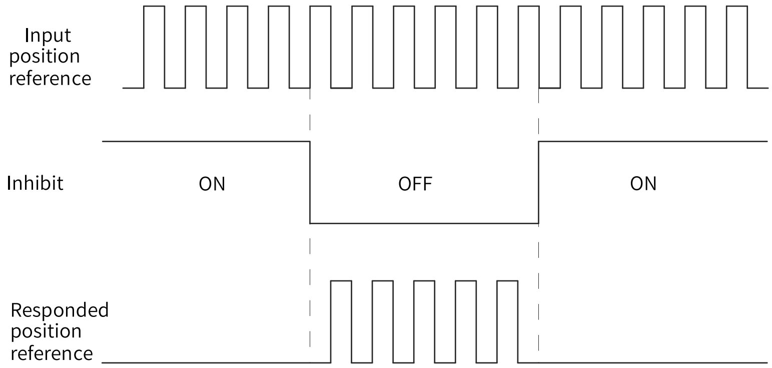



Figure 13-13 Waveform example for position reference inhibited

☆Related function No.:

| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.13 | Inhibit | Position reference inhibited | Inactive: The drive responds to position references in the position control mode.<br>Active: The drive does not respond to any internal or external position references in the position control modes. |

- 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 FunIN.37 (PulseInhibit, pulse reference inhibit), assign FunIN.37 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.

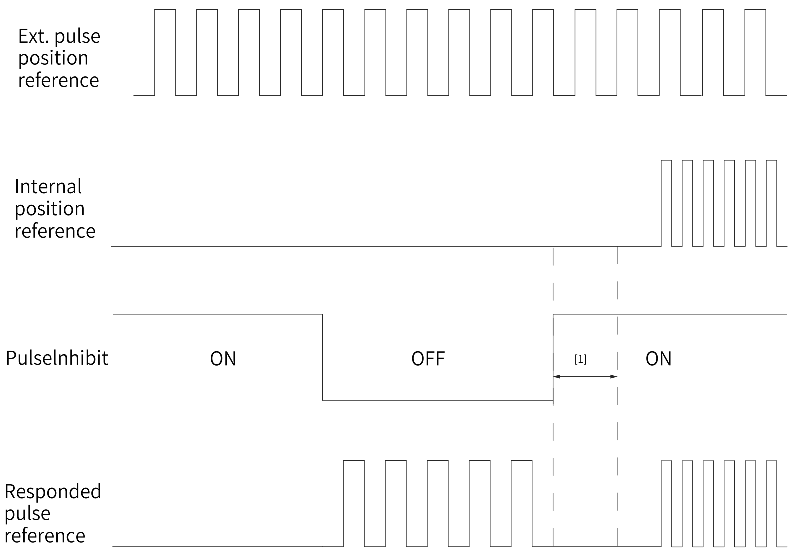



Figure 13-14 Waveform example for pulse reference inhibited

## *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.

☆Related function No.:

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

## 13.1.4 Reference Frequency Division/Multiplication (Electronic Gear Ratio)

**Caution**

- 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.

### Definition of the electronic gear ratio

In the position control mode, the input position reference (reference unit) defines the load displacement; 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.

★ Definition of terms:

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

## Procedure for setting the electronic gear ratio

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

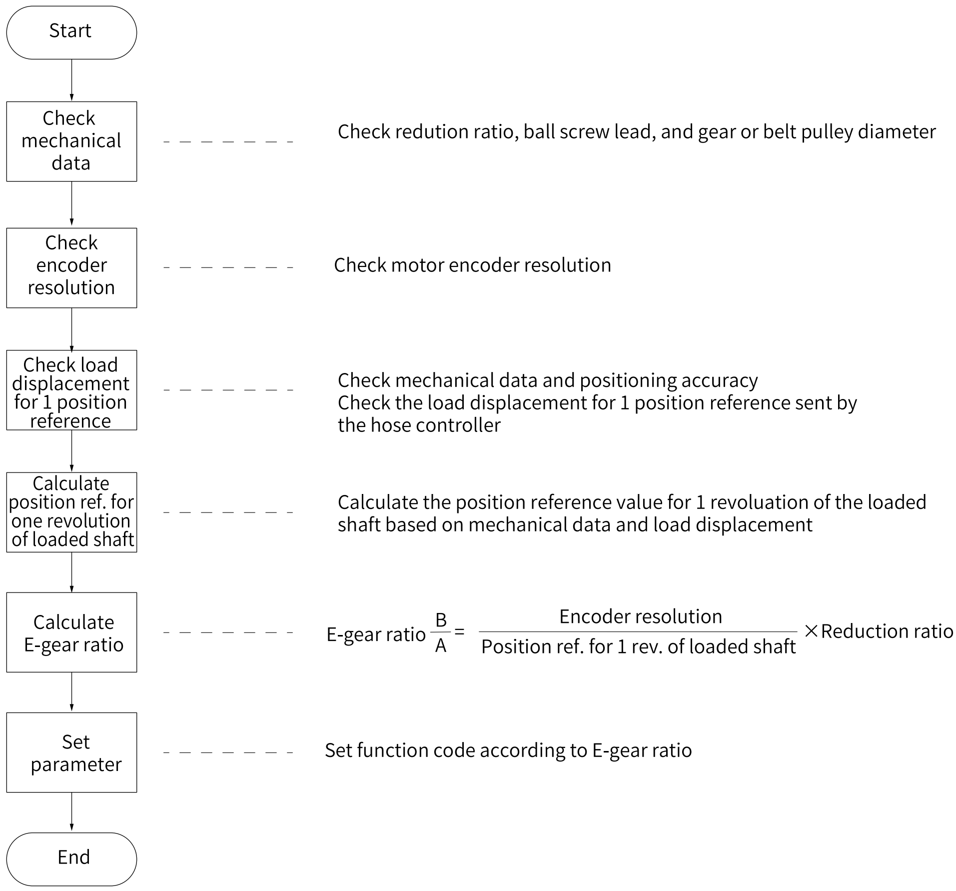



Figure 13-15 Procedure for setting the electronic gear ratio

See the following figure for how to set parameters.

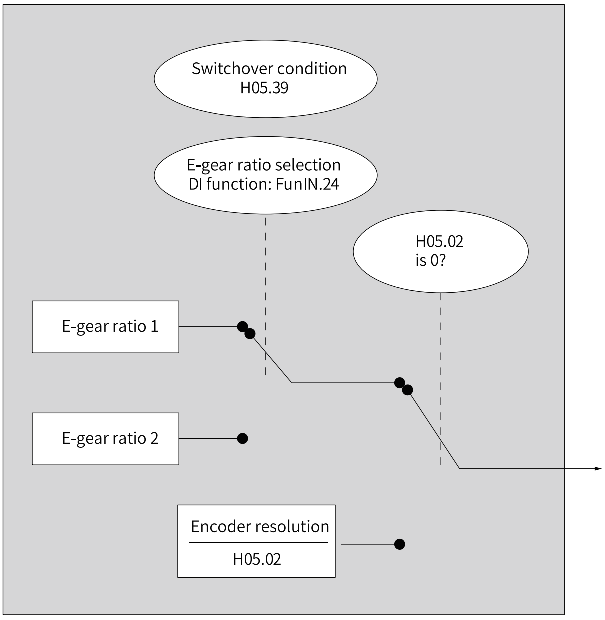



Figure 13-16 Procedure for setting the electronic gear ratio

## *Note*

When the setpoint of H05.02 (Pulses per revolution) is not 0, the following formula applies:

Electronic gear ratio $\frac{B}{A} = \frac{\text{Encoder resolution}}{\text{H05.02}}$. In this case, electronic gear ratios 1 and 2 are invalid.

## Related objects

- Setting the electronic gear ratio

  ☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.02 | 2005-03h | Pulses per revolution | 0 P/Rev–1048576 P/Rev | 0 | PPR | At stop | "H05_en.02" on page 418 |
| H05.07 | 2005-08h | Electronic gear ratio 1 (numerator) | 1 to 1073741824 | 262144 | - | Real-time | "H05_en.07" on page 419 |
| H05.09 | 2005-0Ah | Electronic gear ratio 1 (denominator) | 1 to 1073741824 | 10000 | - | Real-time | "H05_en.09" on page 419 |
| H05.11 | 2005-0Ch | Electronic gear ratio 2 (numerator) | 1 to 1073741824 | 262144 | - | Real-time | "H05_en.11" on page 419 |
| H05.13 | 2005-0Eh | Electronic gear ratio 2 (denominator) | 1 to 1073741824 | 10000 | - | Real-time | "H05_en.13" on page 420 |

- 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 position references.

- The electronic gear ratio can be switched when H05.02 (Pulses per revolution) is set to 0. Determine whether to switch between electronic gear ratios 1 and 2 based on mechanical conditions. Set the condition for switching the electronic gear ratio.
- Only one electronic gear ratio is effective at any moment.
- The effective time of real-time change in the electronic gear ratio is also restricted by the switchover condition.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.39 | 2005-28h | Electronic gear ratio switchover by DI | 0: Switch after position reference is kept 0 for 10ms<br>1: Switch in real time | 0 | - | At stop | “ ” on page |

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

☆ Related parameters:

| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.24 | GEAR_SEL | Electronic gear ratio selection | Inactive: Electronic gear ratio 1 used in the position control mode<br>Active: Electronic gear ratio 2 used in the 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 | Inactive | $\frac{H05.07}{H05.09}$ |
| | | Active | $\frac{H05.11}{H05.13}$ |
| | 1 | Inactive | $\frac{H05.07}{H05.09}$ |
| | | Active | $\frac{H05.11}{H05.13}$ |
| 1 to 1048576 | - | | - |

The resolution of the serial encoder is 2n PPR, where "n" is the number of bits of the serial encoder.

For example, the resolution of a 18-bit serial encoder is 223 PPR, which is 262144 PPR.

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

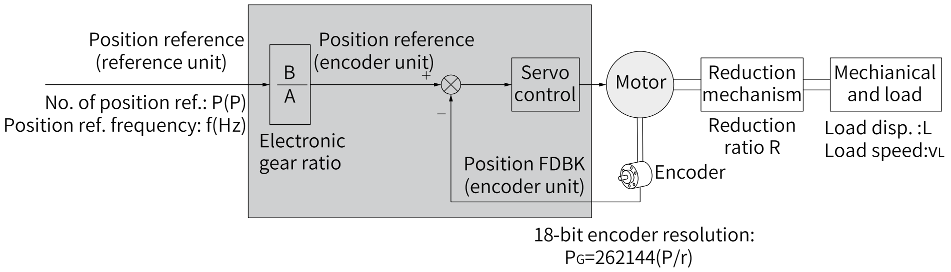



Figure 13-17 Relationship among the position reference (reference unit), load displacement, and electronic gear ratio

Take the ball screw in linear motion as an example, with PB (mm) as the screw lead, PG as the encoder resolution, and R as the reduction ratio of the reducer.

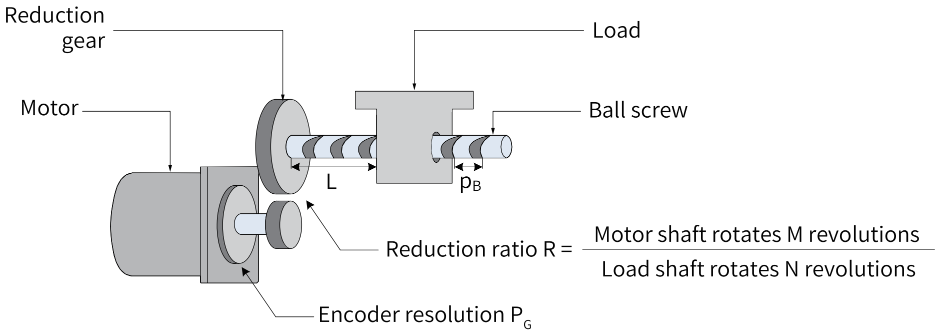



Figure 13-18 Ball screw

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

  The load shaft rotates $\frac{\Delta L}{p_B}$ circles and the motor shaft rotates $\frac{\Delta L}{p_B} \times R$ circles 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 as follows.

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

- When the load displacement L (mm) and position reference sum P (P) are known:

  The load shaft rotates $\frac{L}{p_B}$ circles, and the motor shaft rotates $\frac{L}{p_B} \times R$ circles when the mechanical displacement is L. 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 as follows.

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

- When the load moving speed VL (mm/s) and position reference frequency f (Hz) are known:

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

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

The relationship among the position reference frequency, electronic gear ratio, and motor speed is as follows:

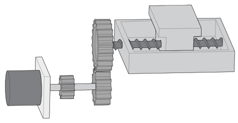
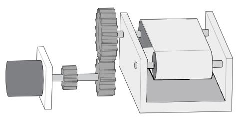
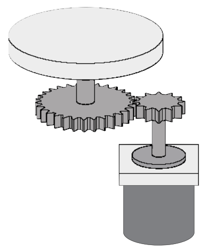
$$f \times \frac{B}{A} = v_M \times P_G$$

Therefore, the electronic gear ratio is as follows.

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

- Example for setting the electronic gear ratio

Table 13–12 Example for setting electronic gear ratio

| Step | Parameter Name | Mechanical Structure | | |
|---|---|---|---|---|
| | | Transmission With Ball Screw | Transmission With Belt Pulley | Rotary Load |
| - | |  |  |  |
| 1 | Mechanical parameters | Reduction ratio (R): 1/1<br>Screw lead: 0.01 m | Reduction ratio (R): 5/1<br>Diameter of belt pulley: 0.2 m<br>(Circumference of belt pulley): 0.628 m | Reduction ratio (R): 10/1<br>Load angle of rotation per revolution of the load shaft: 360° |
| 2 | Resolution | 18-bit = 262144P/r | 18-bit = 262144P/r | 18-bit = 262144P/r |
| 3 | Load displacement per position reference (reference unit) | 0.0001m | 0.000005m | 0.01° |
| 4 | Position references per revolution of the load shaft (reference unit) | $\frac{0.01}{0.0001} = 100$ | $\frac{0.628}{0.000005} = 125600$ | $\frac{360}{0.01} = 36000$ |
| 5 | Calculation | $\frac{B}{A} = \frac{262144}{100} \times \frac{1}{1}$ | $\frac{B}{A} = \frac{262144}{125600} \times \frac{5}{1}$ | $\frac{B}{A} = \frac{262144}{36000} \times \frac{10}{1}$ |
| 6 | Setting | H05.07 = 262144<br>H05.09 = 100 | H05.07 = 1310720<br>H05.09 = 125600 | H05.07 = 2621440<br>H05.09 = 36000 |

## 13.1.5 Position Reference Filter

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.

It is applicable to the following conditions:

- 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.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.04 | 2005-05h | First-order low-pass filter time constant | 0.0 ms to 6553.5ms | 0.0 | ms | At stop | " H05_en.04" on page 418 |
| H05.06 | 2005-07h | Time constant of moving average filter | 0.0 ms to 128.0ms | 0.0 | ms | At stop | " H05_en.06" on page 419 |

This function does not affect the displacement value (position reference sum).

An excessively high setpoint delays the responsiveness, so set a proper filter time constant based on actual conditions.

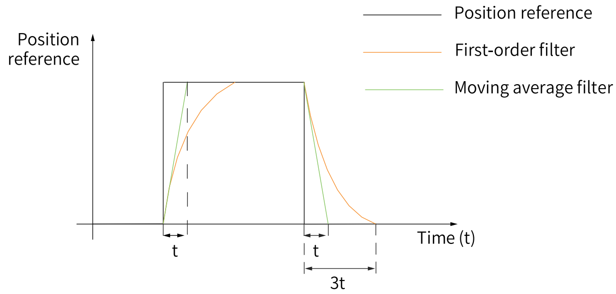



Figure 13-19 First-order filter and moving average filter for rectangular position references

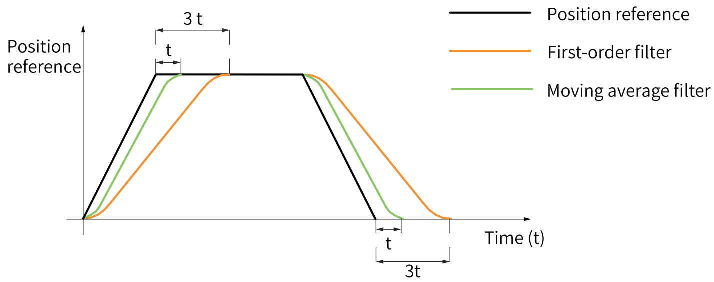



Figure 13-20 First-order filter and moving average filter for trapezoid position references

## 13.1.6 Position Deviation Clear

Position deviation = Position reference sum – Position feedback sum

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

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.16 | 2005-11h | Clear action | 0: Clear position deviation upon S-OFF and fault<br>1: Clear position deviation pulses upon S-OFF and fault<br>2: Clear position deviation by ClrPosErr signal input from DI | 0 | - | At stop | "H05_en.16" on page 421 |

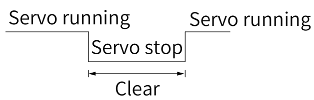
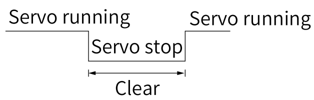
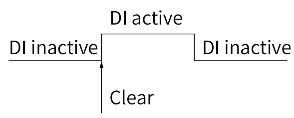
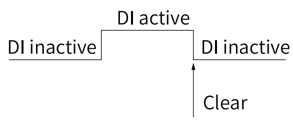
When H05.16 is set to 2, assign FunIN.35 (ClrPosErr, clear position deviation) to a certain DI and set the active logic of this DI.

☆ Related parameters:

| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.35 | ClrPosErr | Position deviation cleared | Active: Position deviation cleared<br>Inactive: Position deviation not cleared |

The setting method is shown as follows.

Table 13–13 Position deviation clear

| 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)<br>  (Falling edge-triggered) |

## 13.1.7 Frequency-Division Output

**Caution**

It is recommended to use the active edge output by the Z signal in cases where a high precision frequency-division output of Z signal is required.

- H05.41 = 0: Rising-edge triggered
- H05.41 = 1: Falling-edge triggered

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

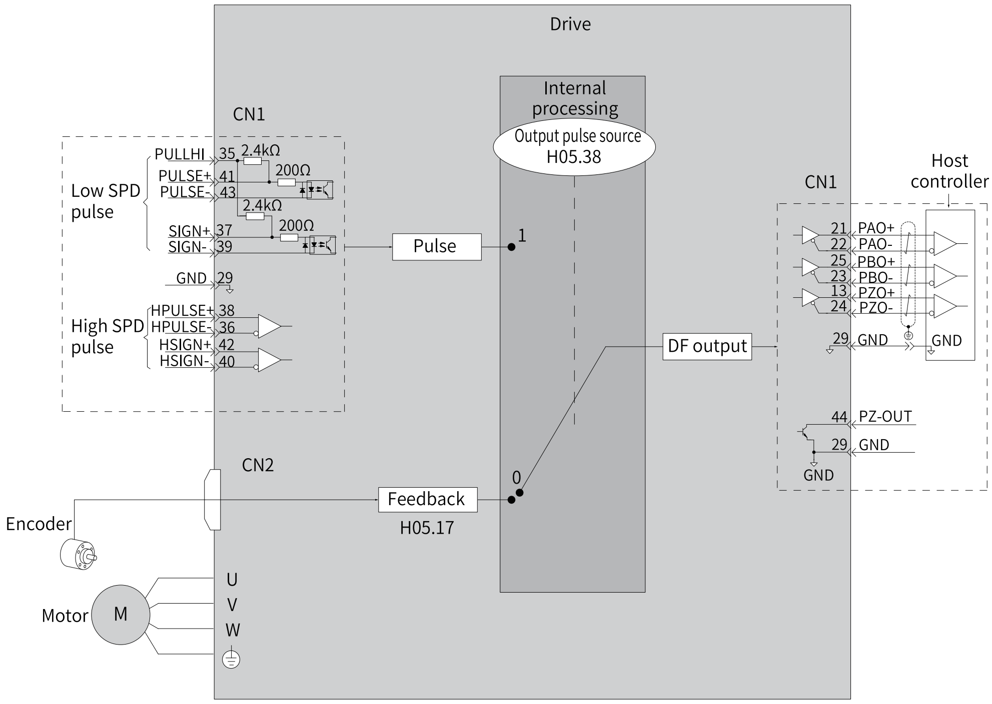



Figure 13-21 Schematic diagram of frequency-division output

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).

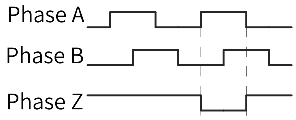
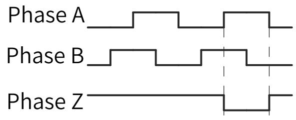
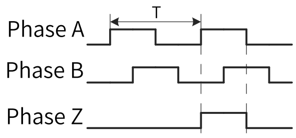
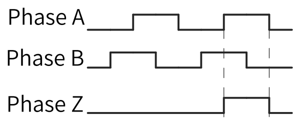
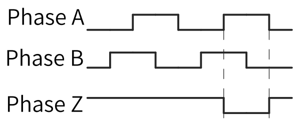
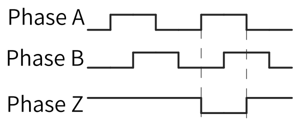
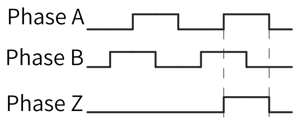
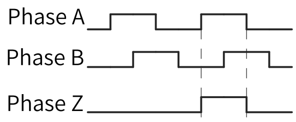
The drive offers one group of frequency-division terminals, as described below:

- 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 pulses: PZO+ and 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 13–14 Pulse diagrams of encoder frequency-division output (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 | <br><br>Phase A leads phase B by 90°. | <br><br>Phase B leads phase A by 90°. |
| | 1 | <br><br>Phase A leads phase B by 90°. | <br><br>Phase B leads phase A by 90°. |
| 1 | 0 | <br><br>Phase B leads phase A by 90°. | <br><br>Phase A leads phase B by 90°. |
| | 1 | <br><br>Phase B leads phase A by 90°. | <br><br>Phase A leads phase B by 90°. |

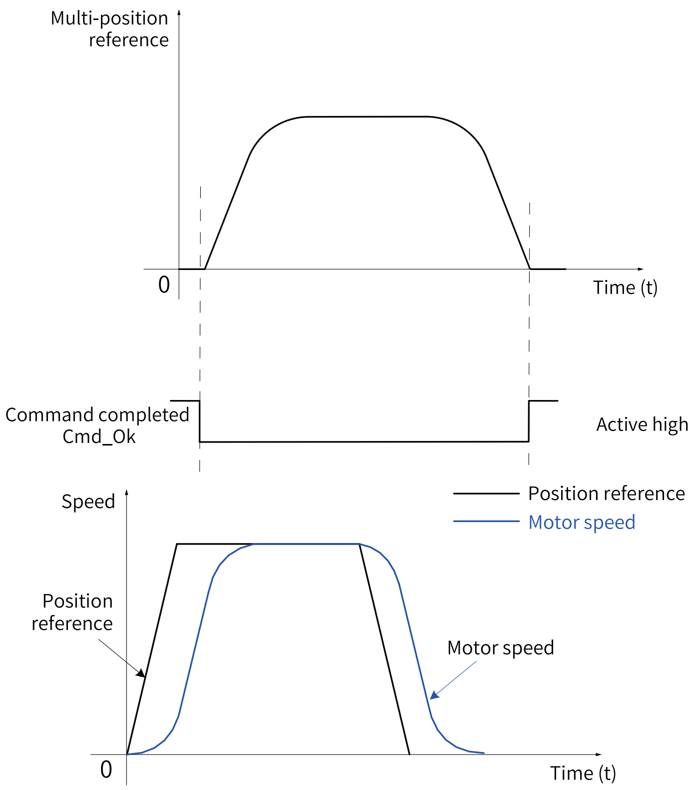
☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.03 | 2002-04h | Output pulse phase | 0: Phase A leads phase B<br>1: Phase A lags behind phase B | 0 | - | At stop | “H02_en.03” on page 394 |
| H05.17 | 2005-12h | Number of encoder frequency-division pulses | 35 P/Rev–32767 P/Rev | 2500 | PPR | At stop | “H05_en.17” on page 422 |
| H05.38 | 2005-27h | Servo pulse output source | 0: Encoder frequency division output<br>1: Pulse reference synchronous output<br>2: Frequency division or synchronous output inhibited | 0 | - | At stop | “H05_en.38” on page 429 |
| H05.41 | 2005-2Ah | Z pulse output polarity | 0: Negative (Z pulse active low)<br>1: Positive (Z pulse active high) | 1 | - | At stop | “H05_en.41” on page 431 |
| H05.61 | 2005-3Eh | Encoder frequency-division pulse output (32-bit) | 0 P/Rev–262143 P/Rev | 0 | PPR | At stop | “H05_en.61” on page 435 |

## 13.1.8 Motion Control/Internal Command/Positioning Completed/Proximity Functions

- "Motion control completed" refers to the completion of command transmission and positioning in the 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.
- "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 the internal command transmission is done.
- Positioning completed: When the position deviation fulfills the condition set by users (H05.20), it indicates the positioning in position control mode is completed. Meanwhile, the servo drive outputs positioning completed (COIN) signal, and the host controller, after receiving this signal, confirms the positioning is completed.

The following figure shows the schematic diagram.



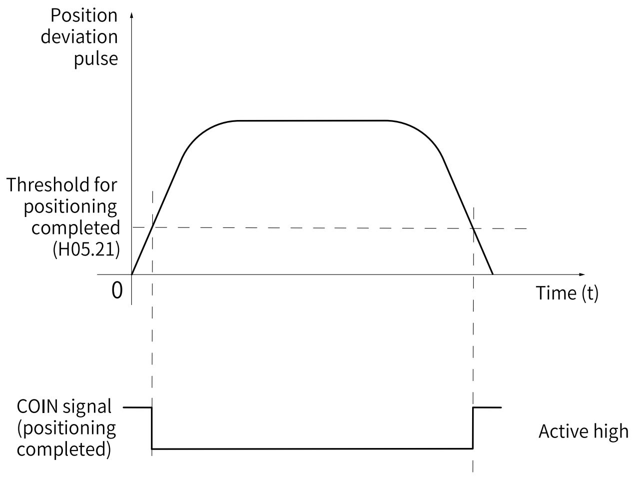



Figure 13-22 Description of positioning completed/proximity functions

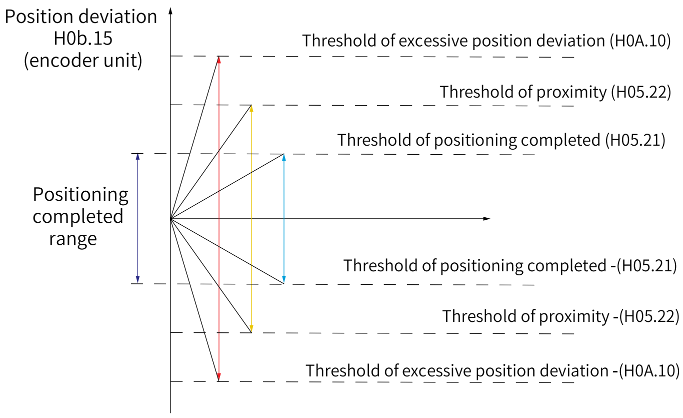
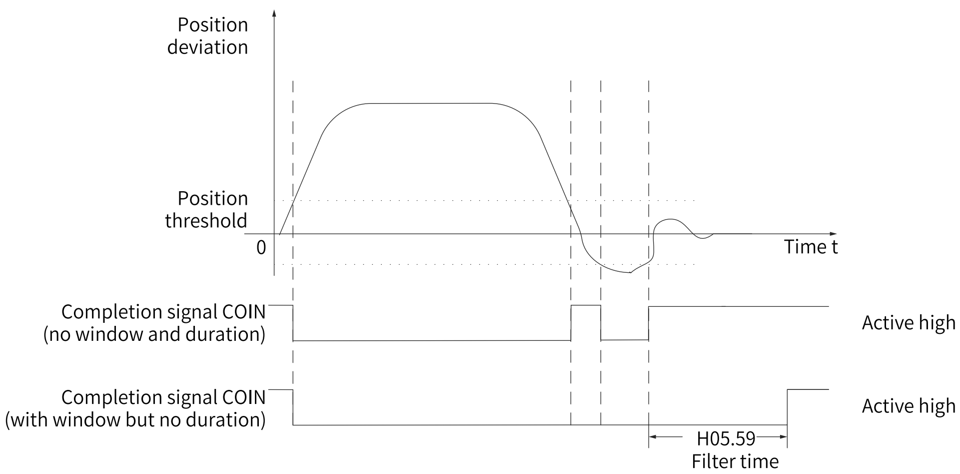



Figure 13-23 Signals related to position deviation

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

Before applying the positioning completed/proximity 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 positioning completed signal is as follows.



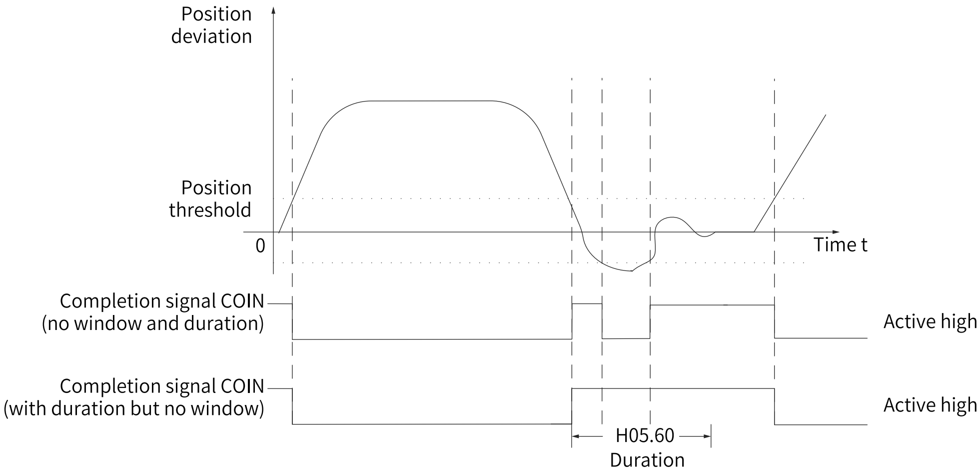



Figure 13-24 Schematic diagram for the window time (H05.59) and hold time (H05.60) of positioning completed signal

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

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0A.17 | 200A-12h | Reference/Pulse selection | 0: Pulse unit<br>1: Reference unit | 0 | - | At stop | "H0A_en.17" on page 480 |
| H05.20 | 2005-15h | Condition for positioning completed signal output | 0: Absolute position deviation below H05.21<br>1: Absolute position deviation below H05.21 and filtered position reference is 0<br>2: Absolute position deviation below H05.21 and unfiltered position reference is 0<br>3: Absolute position deviation kept below H05.21 within the time defined by H05.60 and unfiltered position reference is 0 | 0 | - | Real-time | "H05_en.20" on page 423 |
| H05.21 | 2005-16h | Threshold of positioning completed | 1 to 65535 | 183 | Encoder unit | Real-time | "H05_en.21" on page 423 |
| H05.22 | 2005-17h | Proximity threshold | 1 to 65535 | 65535 | Encoder unit | Real-time | "H05_en.22" on page 424 |
| H05.59 | 2005-3Ch | Positioning window time | 0ms to 30000ms | 0 | ms | Real-time | "H05_en.59" on page 435 |
| H05.60 | 2005-3Dh | Hold time of positioning completed | 0ms to 30000ms | 0 | ms | Real-time | "H05_en.60" on page 435 |

Caution

- Set H05.22 to a value higher than H05.21 in general cases.
- H05.21 only reflects the absolute threshold when the positioning completed signal is active. It is not related to the positioning precision.
- 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.
- When H05.21 is set to a low value along with small position deviation, you can change the condition for outputting the COIN (positioning completed) signal in H05.20.
- An inactive S-ON signal deactivates the COIN (positioning completed) signal and NEAR (proximity) signal output.
- The NEAR (proximity) signal output is not affected by H05.60 (Hold time of positioning completed) or H05.59 (Positioning window time)and requires no detection on the change of position references.

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.

☆ Related parameters:

| Code | Parameter 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.<br>Inactive: The servo drive is in the process of completion in the position control mode. |
| FunOUT.6 | NEAR | Proximity | Active: The absolute position deviation meets the condition defined by H05.22, indicating the servo drive is close to the target position.<br>Inactive: The servo drive is in the process of proximity in the position control mode. |
| 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.<br>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.<br>Inactive: The transmission of the multi-position reference or interrupt positioning reference or positioning is in progress in the position control mode. |

### 13.1.9 Interrupt Positioning

Caution

The interrupt positioning signal cannot be triggered during homing.

#### Description

If interrupt positioning is triggered in the position control mode, the servo drive halts current operation and turns to executing the pre-set fixed distance. To be specific, when the S-ON signal is active in the position control mode, if this function is enabled, the servo motor runs the position reference for interrupt positioning 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 interrupt positioning is done, the servo drive outputs the interrupt positioning completed (FunOUT.15: XintCoin) signal and positioning completed (FunOUT.5: COIN) signal, while the host controller, upon receiving XintCoin signal, acknowledges interrupt positioning is done. The XintCoin signal output is not related to the S-ON signal or the logic of DI9.

Interrupt positioning is effective only when the following conditions are met:

- The motor speed is higher than or equal to 10 rpm before interrupt positioning is triggered, or the setpoints of H05.26 (Constant operating speed in interrupt positioning) and H05.24 (Displacement of interrupt positioning) are not 0.
- The DI assigned with FunIN.33 (Interrupt positioning inhibited) is not used or the logic of this DI is inactive.

***Note***

The moving average filter is inactive when interrupt positioning is in progress.

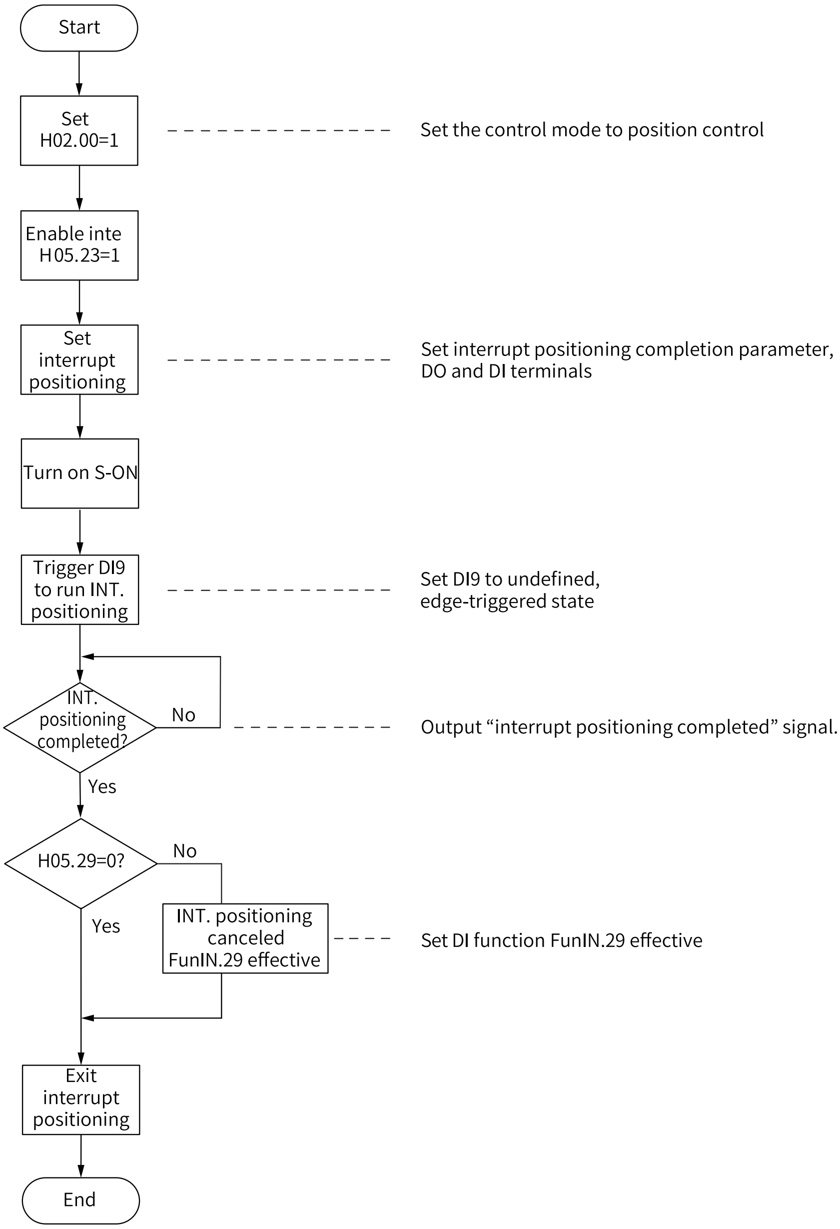



Figure 13-25 Flowchart of interrupt positioning signal

## Parameter Settings

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.23 | 2005-18h | Interrupt positioning selection | 0: Disable<br>1: Enabled | 0 | - | At stop | “H05_en.23” on page 424 |
| H05.24 | 2005-19h | Interrupt positioning displacement | 0 to 1073741824 | 10000 | Reference unit | Real-time | “H05_en.24” on page 424 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.26 | 2005-1Bh | Constant operating speed in interrupt positioning | 0rpm to 6000rpm | 200 | RPM | Real-time | *“ H05_en.26” on page 425* |
| H05.27 | 2005-1Ch | Acc./Dec. time of interrupt positioning | 0ms to 1000ms | 10 | ms | Real-time | *“ H05_en.27” on page 425* |
| H05.29 | 2005-1Eh | Interruption fixed length unlock | 0: Disabled<br>1: Enabled | 1 | - | Real-time | *“ H05_en.29” on page 425* |

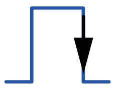
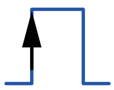
☆ Related parameters:

| Code | Parameter 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.<br>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<br>Inactive: Interrupt positioning allowed |
| FunOUT.15 | XintCoin | Interrupt positioning completed | Active: Interrupt positioning completed in position control<br>Inactive: Displacement in interrupt positioning not completed in position control |

**Caution**

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 13–15 Active logic of DI9 during interrupt positioning

| H03.19 | Active Logic of DI9 | Waveform |
|---|---|---|
| 0 | Active low |  |
| 1 | Active high |  |

The constant operating speed during interrupt positioning is shown in the following figure.

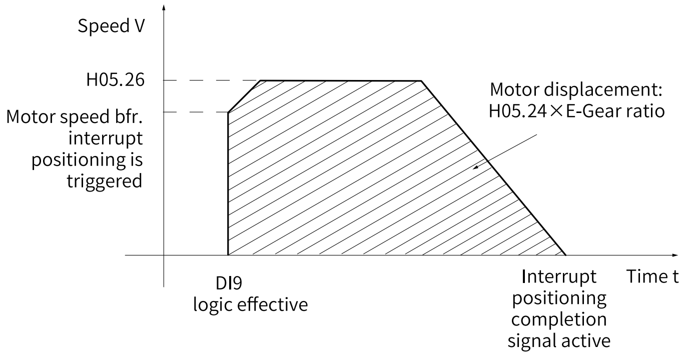



Figure 13-26 Motor operating curve during interrupt positioning

Table 13–16 Motor speed during interrupt positioning

| H05.26 | Motor Speed before Triggering Interrupt Positioning | Interrupt Positioning | Constant operating speed in interrupt positioning |
|---|---|---|---|
| 0 | < 10 | Inactive | - |
| | ⩾ 10 | Active | Motor Speed before Triggering Interrupt Positioning |
| 1 to 6000 | - | Active | H05.26 |

## 13.1.10 Homing

**Caution**

- The homing trigger signal is hidden 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 hidden.

### Description

- 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, represented as home + offset (set in H05.36). When H05.36 (Mechanical home offset) is set to 0, the zero position coincides with the home.

In the position control mode, when homing is triggered after the S-ON signal is activated, the motor starts searching for the zero position.

When homing is in progress, the servo drive does not respond to other position references (including another homing trigger signal) until homing is done.

This function includes two actions:

- Home attaining: 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 current position as the start position to execute a relative displacement.

After the homing function (both homing and electrical homing) is executed, The absolute position of the motor (H0b.07) is consistent with the home offset (H05.36).

The servo drive outputs the homing completed signal (FunOUT.16：HomeAttain) or electrical homing completed signal (FunOUT.17：ElecHomeAttain), and the host controller, upon receiving these two signals, acknowledges the homing function is done executing. HomeAttain or ElecHomeAttain signal is not related to the operation mode or operation state of the servo drive.

Table 13–17 Comparison between homing and electrical homing

| Mode | Homing trigger 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 | |

***Note***

Both the moving average filtering and low-pass filtering are invalid during homing.

## Homing

***Note***

- 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.

The following part takes an example to describe homing attaining:

- H05.31 = 0: Forward homing, home switch as the deceleration point and the home
- H05.31 = 2: Forward, Z signal as deceleration point and home
- H05.31 = 4: Forward homing, home switch as the deceleration point and Z signal as the home
- H05.31 = 6: Forward direction, deceleration point and home being forward limit switch signal
- Forward, positive limit switch as deceleration point and Z signal as home (H05.31 = 8)
- H05.31 = 10: Forward homing, mechanical limit position as the deceleration point and the home (H05-31 = 10)

- Forward, mechanical limit position as deceleration point and Z signal as home (H05.31 = 12)
- Forward single-turn homing (H05.31 = 14)
- Reverse single-turn homing (H05.31 = 15)
- Single-turn nearby homing (H05.31 = 16)

The other homing modes are the same as above, except the initial homing mode, which is contrary to the above.

- H05.31 = 0: Forward homing, home switch as the deceleration point and the home
  - 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 motor starts searching for the deceleration point signal in the forward direction at a speed defined by H05.32. After reaching the rising edge of the deceleration point signal, it decelerates as defined by H05.34 to the setpoint of "-(H05.33)". After that, it starts searching for the falling edge of the deceleration point signal in the reverse direction at a speed defined by "-(H05.33)" After reaching this falling edge, it turns to searching for the rising edge of the home signal at the same speed but in the opposite direction. Finally it stops immediately after reaching the rising edge of the home signal during forward acceleration or forward operation at a constant speed.

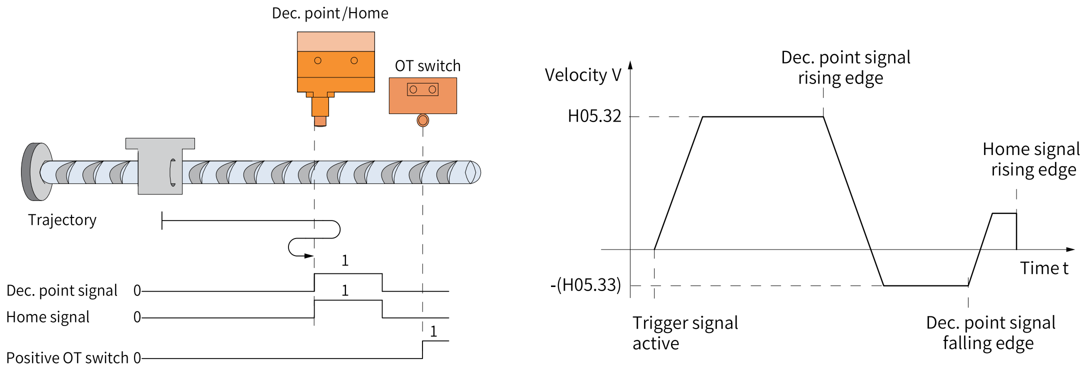



Figure 13-27 Motor running curve and speed in mode 0

  - 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 motor starts searching for the falling edge of the deceleration point in the reverse direction at the speed defined by "-(H05.33)". After reaching this falling edge, the motor turns to run in the forward direction and searches for the rising edge of the home signal at the same speed. During forward acceleration or forward operation at a constant speed, the motor stops immediately upon reaching the rising edge of the home signal.

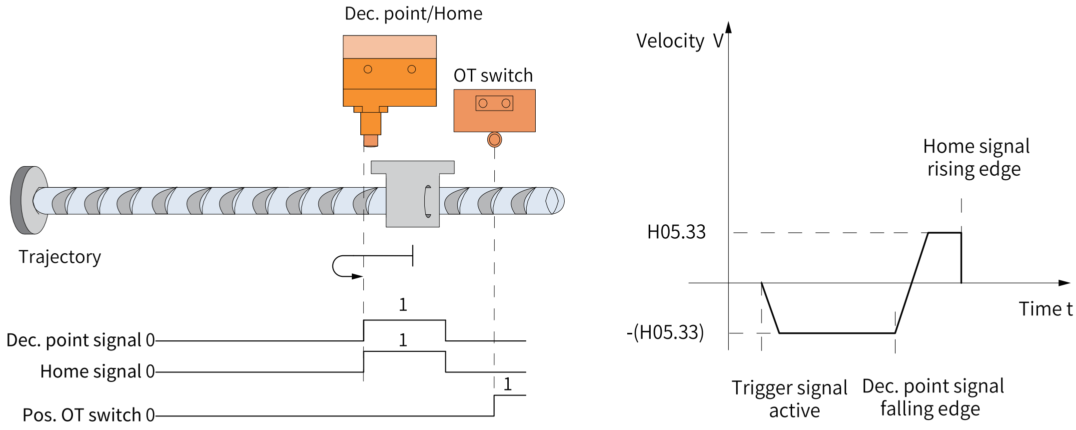



Figure 13-28 Motor running curve and speed in mode 0

- The home switch (deceleration point) signal is inactive when the motor starts to run, and the forward limit switch is sensed 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.

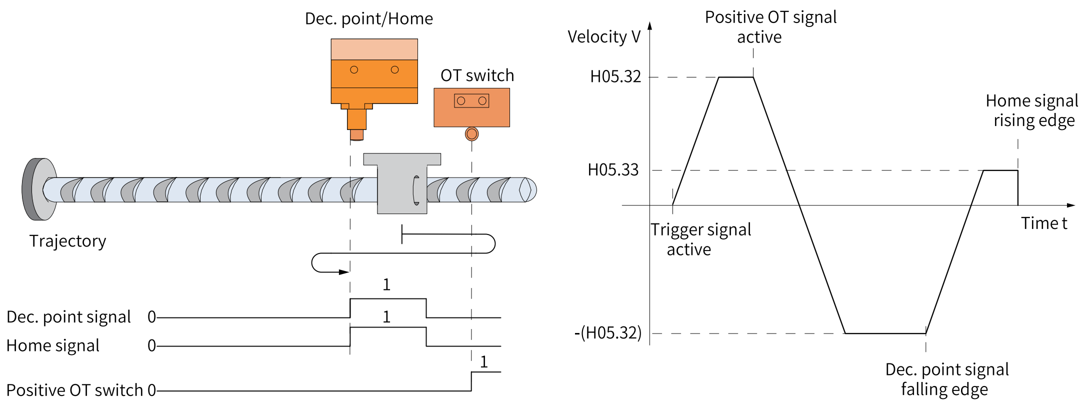



Figure 13-29 Motor running curve and speed in mode 0

- Mode 2: Forward homing, Z signal as the deceleration point and the home (H05.31 = 2)

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**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.

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- 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 motor starts searching for the Z signal in the forward direction at the high speed defined by H05.32. After reaching the rising edge of the Z signal, the motor decelerates as defined by H05.34 and tuns to run in the reverse direction. Then it accelerates to the speed defined by "-(H05.33)". During reverse acceleration or reverse operation at a constant speed, the motor stops immediately after reaching rising edge of the Z signal on the other side.

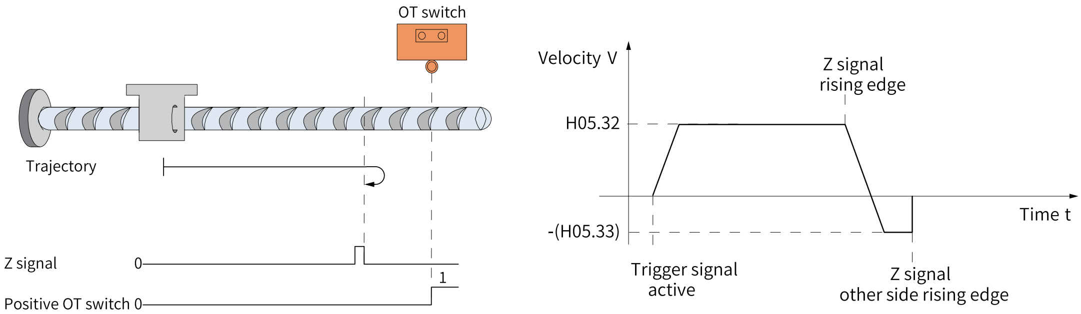



Figure 13-30 Motor running curve and speed in mode 2

- The Z signal is 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 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.

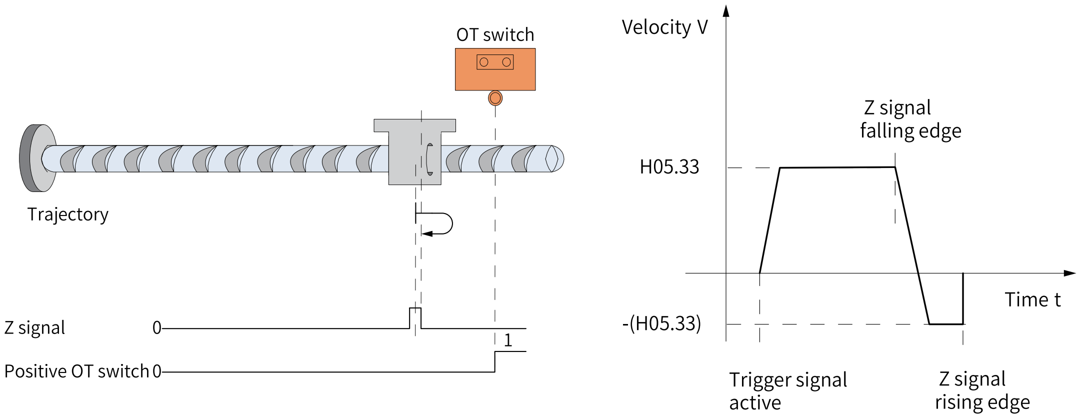



Figure 13-31 Motor running curve and speed in mode 2

- The Z signal is inactive when the motor starts to run, and the forward limit switch is sensed 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.

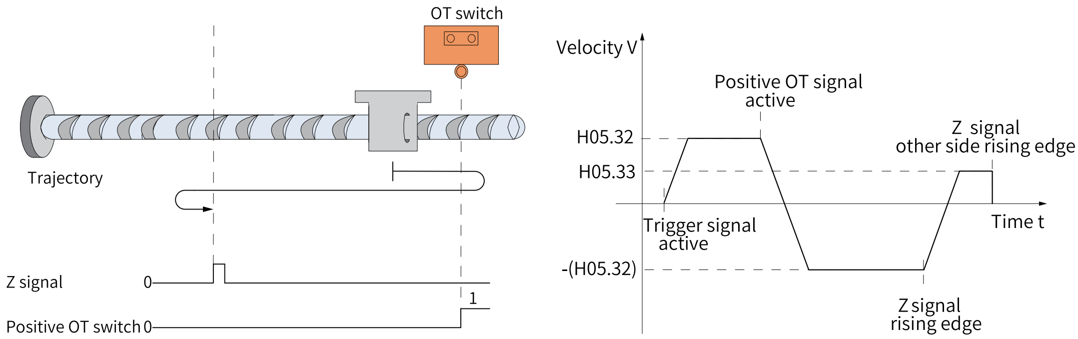



Figure 13-32 Motor running curve and speed in mode 2

- 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 motor starts searching for the home switch signal in the forward direction at the speed defined by H05.32. After reaching the rising edge of the home switch signal, it decelerates as defined by H05.34 and changes to search for the falling edge of the home switch signal at the speed defined by "-(H05.33)". After reaching this falling edge, it decelerates and changes to search for the rising edge of the home switch signal in the forward direction at the speed defined by "H05.33". After reaching this rising edge, it continues running and stops after reaching the first Z signal.

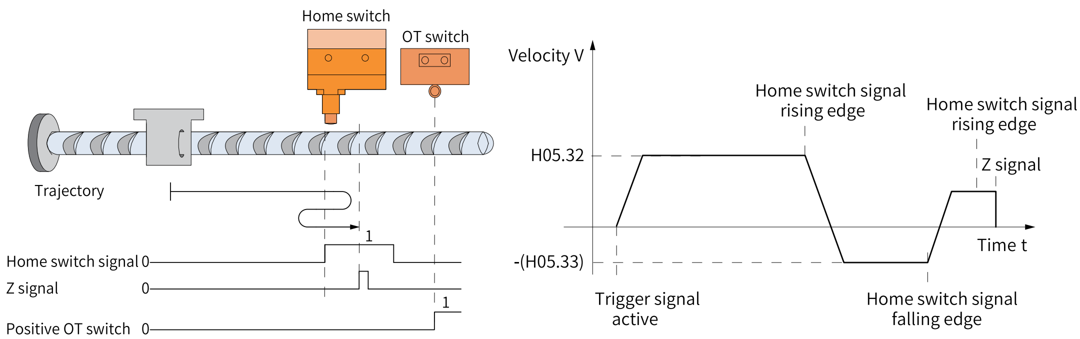



Figure 13-33 Motor running curve and speed in mode 4

  - The home switch signal is active when the motor starts to run, and the forward limit switch is not sensed in the entire process.
    The motor starts searching for the falling edge of the home switch signal in the reverse direction at the speed defined by "-(H05.33)". After reaching this falling edge, the motor decelerates 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 this rising edge, the motor continues running in the forward direction at the speed defined by H05.33 until it stops upon reaching the rising edge of the Z signal for the first time.

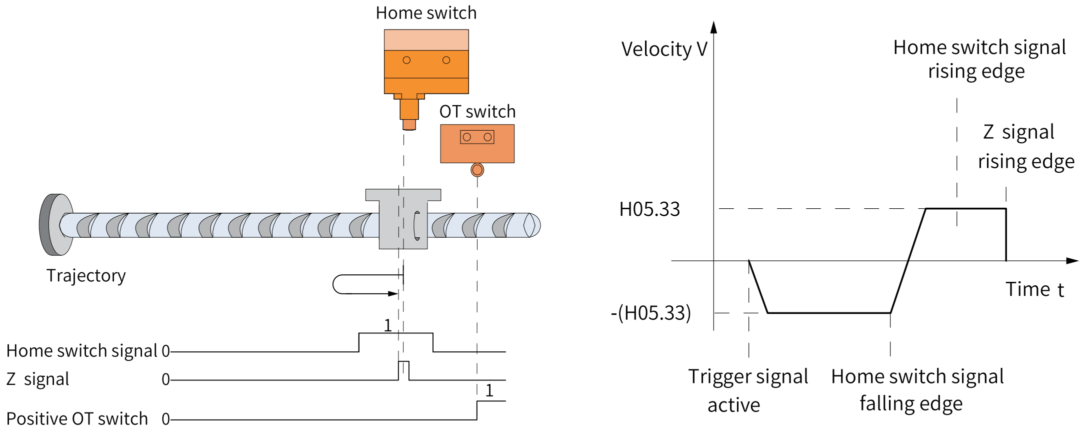



Figure 13-34 Motor running curve and speed in mode 4

- The home switch signal is inactive when the motor starts to run, and the forward limit switch is sensed 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.

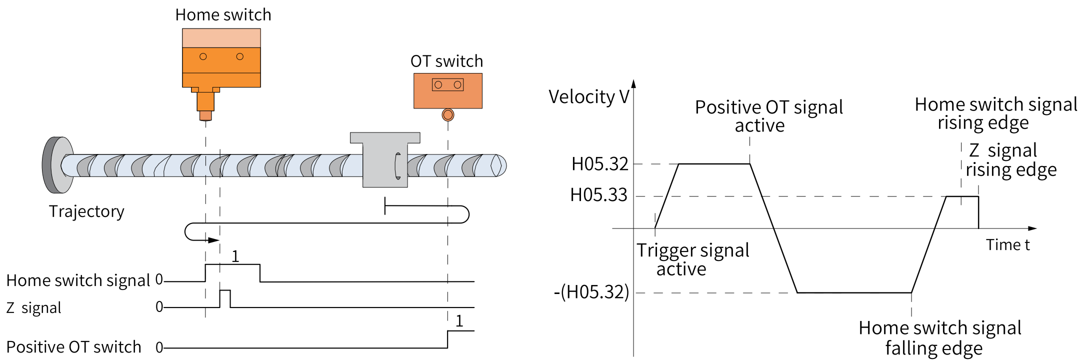



Figure 13-35 Motor running curve and speed in mode 4

- Mode 6: Forward homing, positive limit switch as the deceleration point and the home (H05.31 = 6)
  - The forward limit switch 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 decelerates and turns to searching for the rising edge of the positive limit switch signal in the forward direction at the low speed defined by H05.33. During forward acceleration or forward operation at a constant speed, the motor stops immediately after reaching the rising edge of the positive limit switch signal.

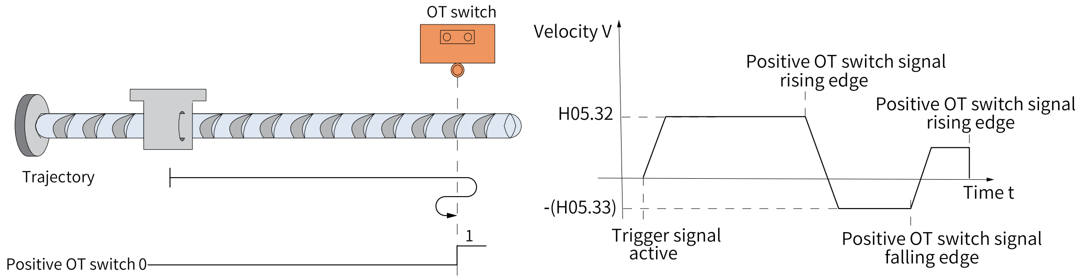



Figure 13-36 Motor running curve and speed in mode 6

- 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 the speed defined by "-(H05.33)". After reaching this falling edge, it decelerates and changes to search for the rising edge of the positive limit switch signal in the forward direction at the speed defined by H05.33. Finally, it stops immediately after reaching the rising edge of the positive limit switch signal during forward acceleration or forward operation at a constant speed.

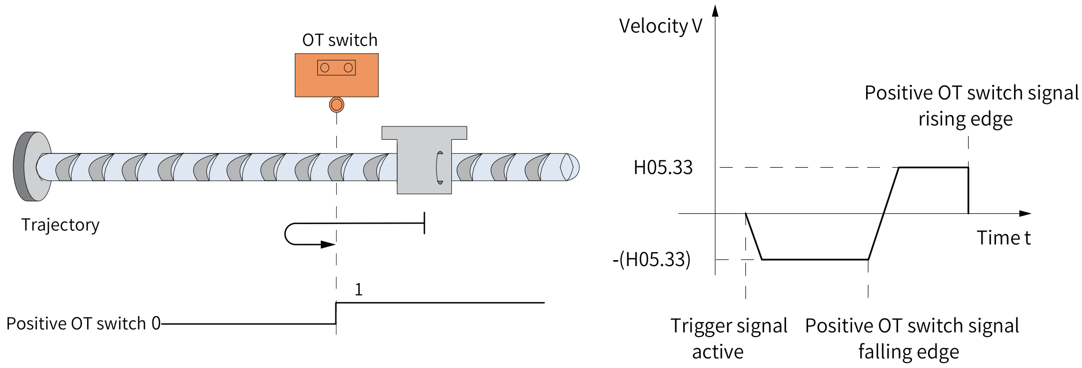



Figure 13-37 Motor running curve and speed in mode 6

- Mode 8: Forward homing, positive limit switch as the deceleration point and Z signal as the home (H05.31 = 8)
  - The forward limit switch 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.

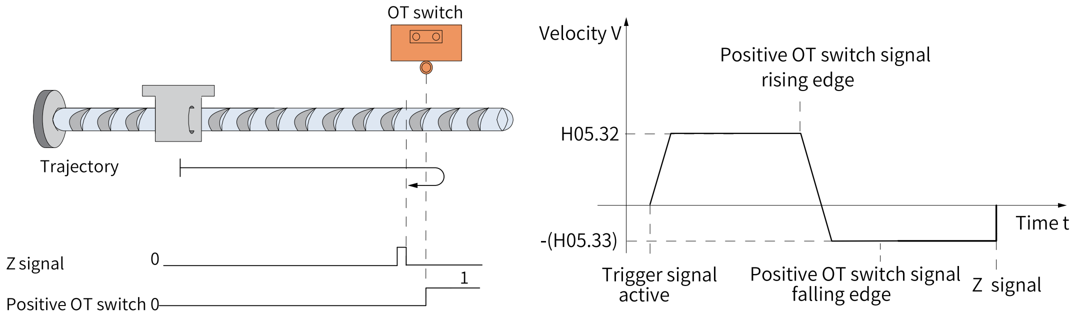



Figure 13-38 Motor running curve and speed in mode 8

- 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 13-39 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.

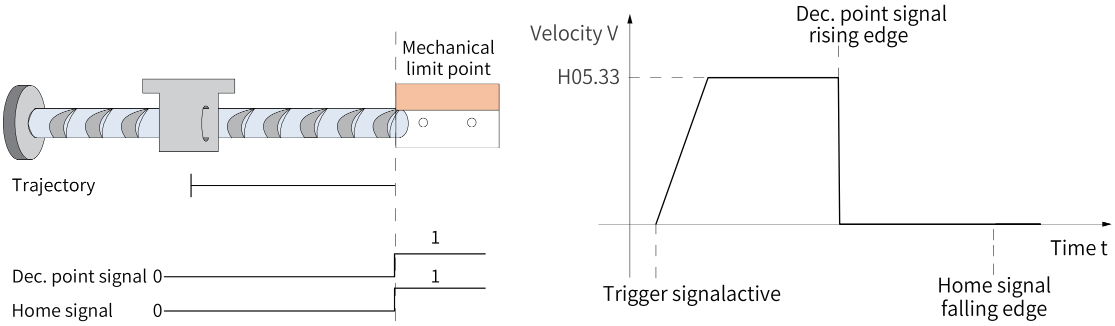



Figure 13-40 Motor running curve and speeds in Mode 10

- 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.

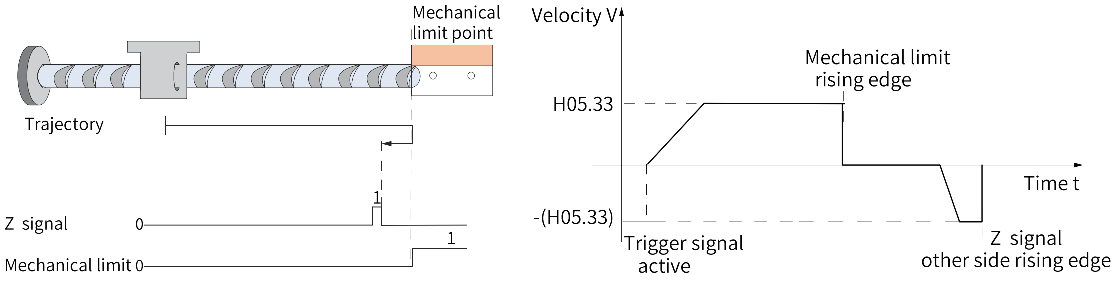



Figure 13-41 Motor running curve and speed in mode 12

- 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) * Electronic gear ratio + Encoder resolution. The motor stops immediately after the displacement command finishes.

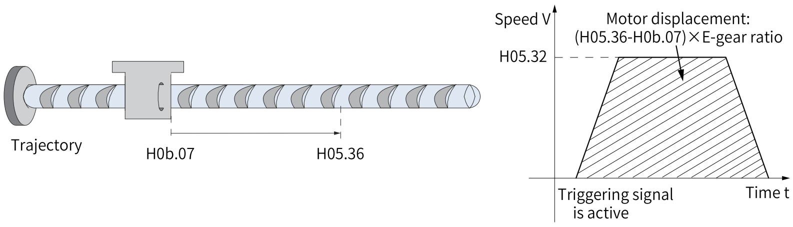



Figure 13-42 Motor running curve and speed in mode 14

- 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) * Electronic gear ratio – Encoder resolution. The motor stops immediately after the displacement command finishes.

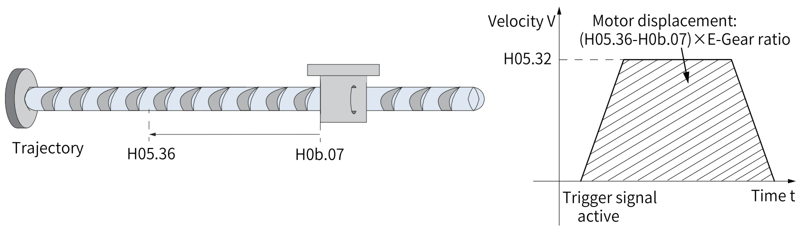



Figure 13-43 Motor running curve and speed in mode 15

- 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.

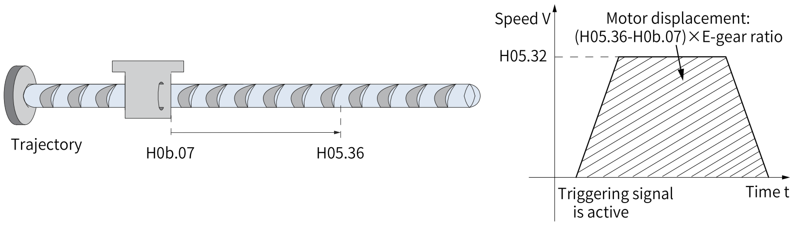



Figure 13-44 Motor running curve and speed in mode 16

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.

## Electrical homing: starting 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 (Mechanical home offset).

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.

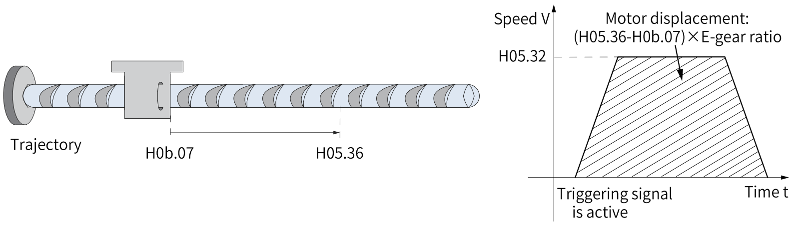
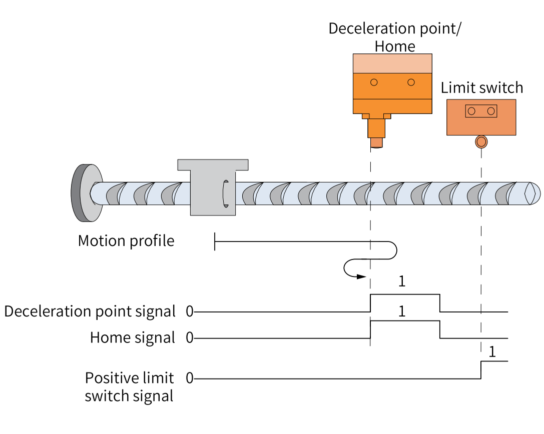
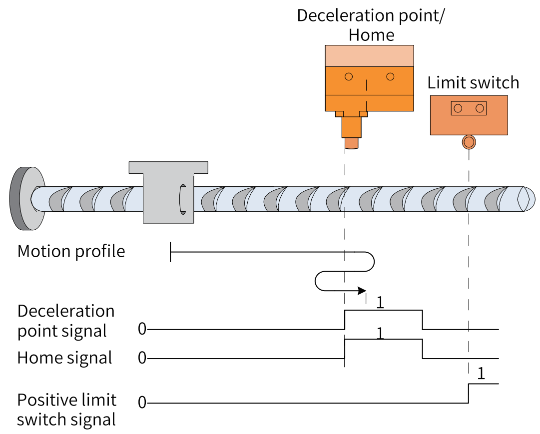
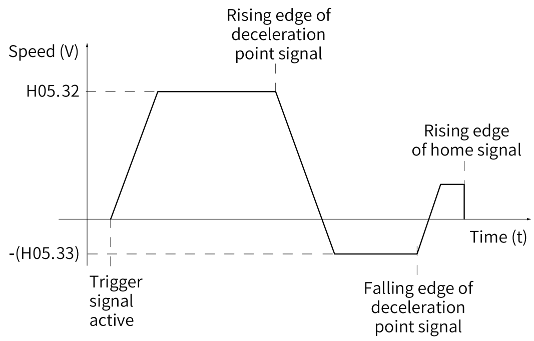
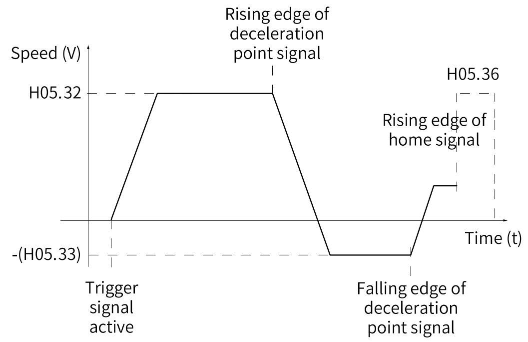



Figure 13-45 Motor running curve and speed in electrical homing

## Mechanical home and mechanical zero

The following takes "H05.30 = 0" as example to describe the difference between mechanical home and mechanical zero.

Table 13–18 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). |
|  |  |
|  |  |

## Parameter Settings

- Homing mode setting

  ☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.30 | 2005-1Fh | Homing enable selection | 0: Disabled<br>1: Homing enabled by ORGSET signal input from DI<br>2: Electrical homing enabled by ORGSET signal input from DI<br>3: Homing started immediately upon power-on<br>4: Homing executed immediately<br>5: Electrical homing started<br>6: Current position as home<br>8: D-triggered position as home | 0 | - | Real-time | “ ” on page |
| H05.31 | 2005-20h | Homing mode | 0: Forward, home switch as deceleration point and home<br>1: Reverse, home switch as deceleration point and home<br>2: Forward, Z signal as deceleration point and home<br>3: Reverse, motor Z signal as deceleration point and home<br>4: Forward, home switch as deceleration point and Z signal as home<br>5: Reverse, home switch as deceleration point and Z signal as home<br>6: Forward, positive limit switch as deceleration point and home<br>7: Reverse, negative limit switch as deceleration point and home<br>8: Forward, positive limit switch as deceleration point and Z signal as home<br>9: Reverse, negative limit switch as deceleration point and Z signal as home<br>10: Forward, mechanical limit position as deceleration point and home<br>11: Reverse, mechanical limit position as deceleration point and home<br>12: Forward, mechanical limit position as deceleration point and Z signal as home<br>13: Reverse, mechanical limit position as deceleration point and Z signal as home<br>14: Forward single-turn homing<br>15: Reverse single-turn homing<br>16: Nearby single-turn homing | 0 | - | Real-time | “ H05_en.31” on page 427 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.40 | 2005-29h | Mechanical home offset and action upon overtravel | 0: H05.36 as the coordinate after homing, reverse homing applied after homing triggered again on overtravel<br>1: H05.36 as the relative offset after homing, reverse homing applied after homing triggered again on overtravel<br>2: H05.36 as the coordinate after homing, reverse homing auto-applied on overtravel<br>3: H05.36 as the relative offset after homing, reverse homing auto-applied on overtravel | 0 | - | At stop | "H05_en.40" on page 431 |
| H05.69 | 2005-46h | Auxiliary homing function | 0: Disabled<br>1: Enable single-turn homing<br>2: Record deviation position<br>3: Start a new search for the Z signal (homing)<br>4: Clear the position deviation | 0 | - | At stop | "H05_en.69" on page 436 |

- Homing curve setting

  If the home signal is activated before the deceleration triggered by an active deceleration point signal is fully done executing, the final positioning may be unstable. Take the displacement required by deceleration into account before setting the deceleration point and homing signal input position. The acceleration/deceleration time during homing (H05-34) also affect the positioning stability.

  ☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.32 | 2005-21h | Speed of high-speed search for home switch signal | 0 RPM to 3000 RPM | 100 | RPM | Real-time | "H05_en.32" on page 428 |
| H05.33 | 2005-22h | Speed of low-speed search for home switch signal | 0 rpm to 1000 rpm | 10 | RPM | Real-time | "H05_en.33" on page 428 |
| H05.34 | 2005-23h | Acceleration/ Deceleration time during homing | 0ms to 1000ms | 1000 | ms | Real-time | "H05_en.34" on page 428 |
| H05.35 | 2005-24h | Home search time limit | 0ms to 65535ms | 10000 | ms | Real-time | "H05_en.35" on page 429 |
| H05.36 | 2005-25h | Mechanical home offset | -1073741824 to 1073741824 | 0 | Reference unit | Real-time | "H05_en.36" on page 429 |

☆ Related parameters:

| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.31 | HomeSwitch | Home switch | Active: Current position as home<br>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 for details. See the following table for details. |
| FunIN.32 | HomingStart | Homing enable | Active: Homing enabled (The HomingStart signal cannot be triggered repeatedly during homing.)<br>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 is completed. | Active: Homing completed in the position control mode<br>Inactive: Homing not completed |
| FunOut.17 | ElecHomeAttain | Electrical homing completed | Active: Electrical homing completed in the position control mode<br>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-triggered) | Low level |

## Sequence

- H05.30 = 1 or 2

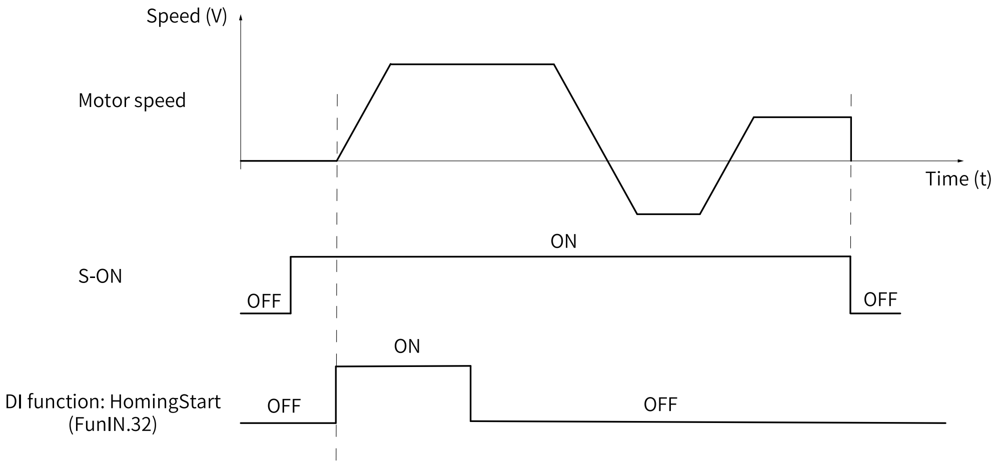



Figure 13-46 Sequence example

- 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.

## 13.2 Speed Control Mode

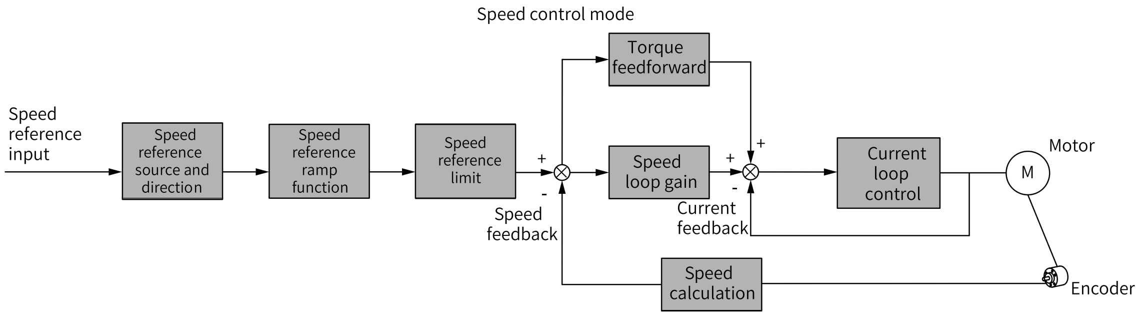



Figure 13-47 Block diagram of speed control

Set H02.00 (Control mode selection) to 0 (Speed control mode) through the keypad or Inovance software tool to make the servo drive operate in the speed control mode. Set the drive parameters based on the mechanical structure and technical indicators. The following part uses the basic parameter setting to describe the speed control mode.

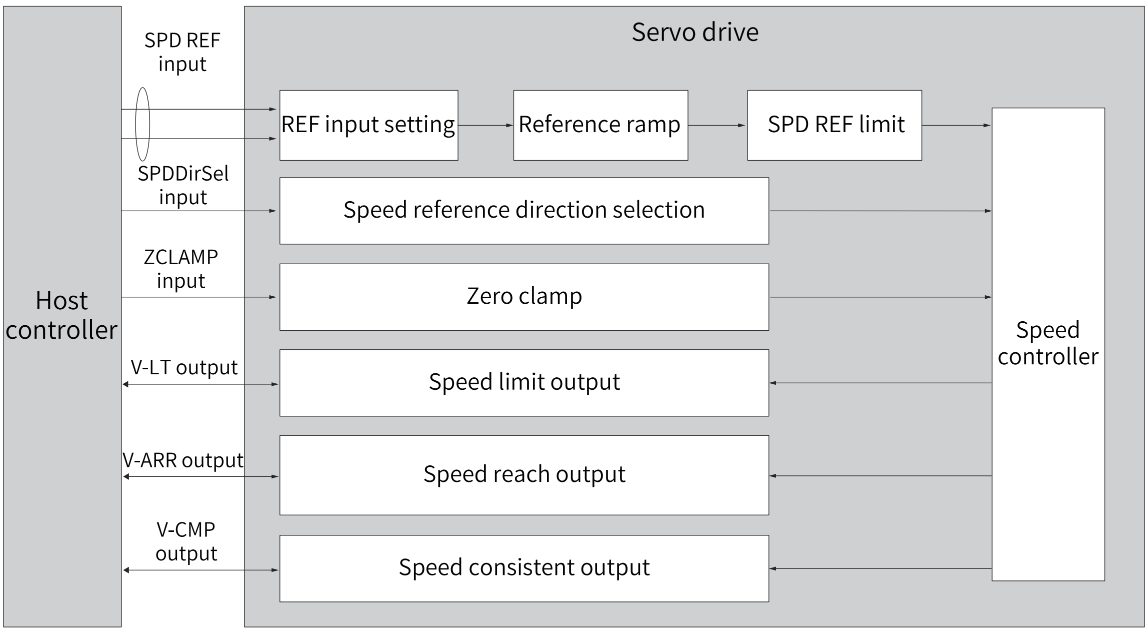



Figure 13-48 Signal exchange between the drive and the host controller

## 13.2.1 Block Diagram of Speed Control Parameters

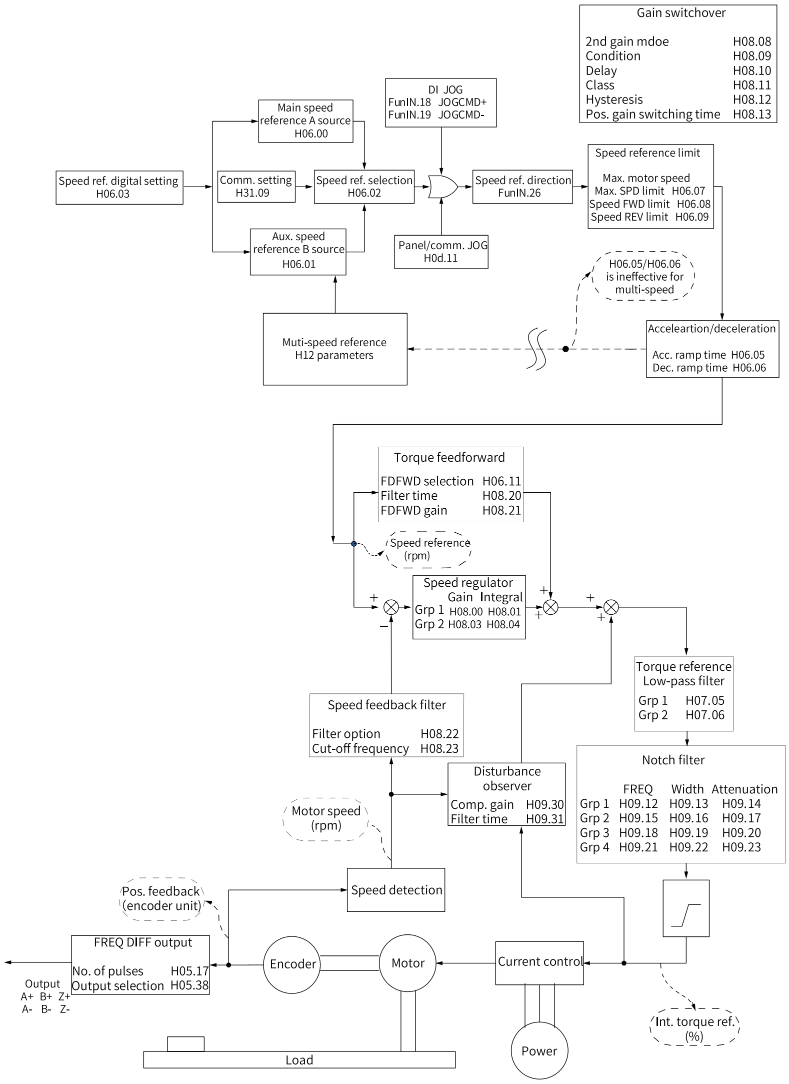



Figure 13-49 Block diagram of speed control parameters

## 13.2.2 Speed Reference Input Setting

### Speed reference source

Five speed reference sources are available in the speed control mode, which can be set in H06.02.

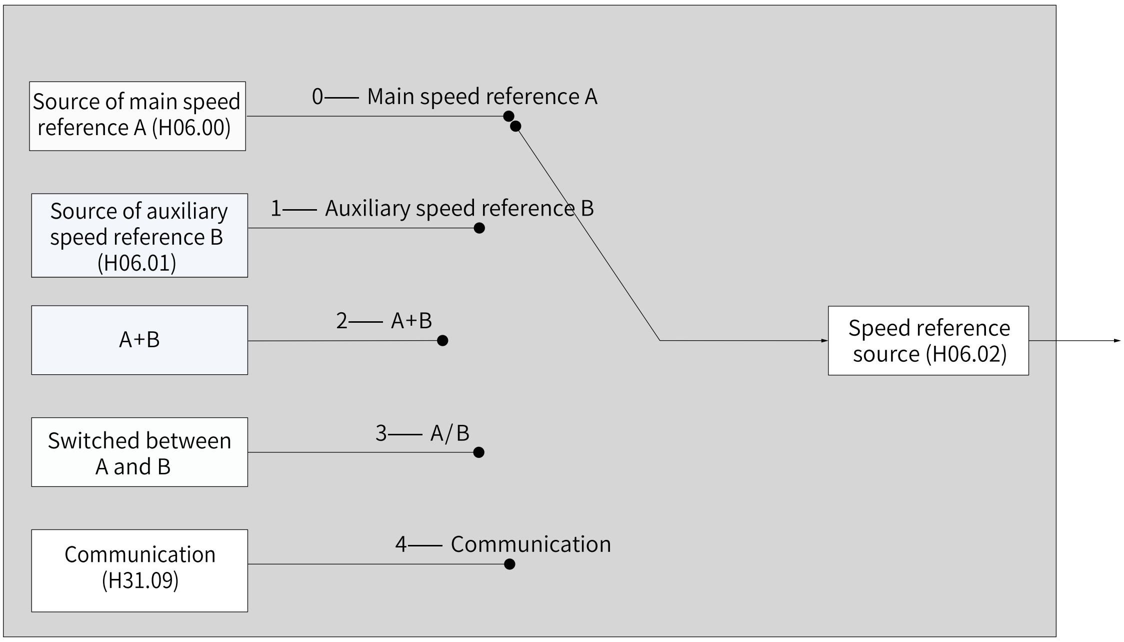



Figure 13-50 Speed reference source

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.02 | 2006-03h | Speed reference source | 0: Source of main speed reference A<br>1: Source of auxiliary speed reference B<br>2: A+B<br>3: Switched between A and B<br>4: Communication | 0 | - | At stop | " H06_en.02" on page 437 |

- Source of main speed reference A
  The main speed reference A is an internal speed reference that can be set through digital setting.

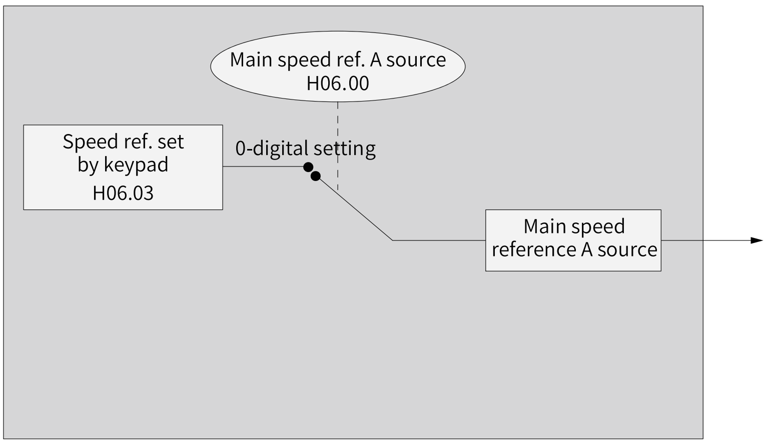



Figure 13-51 Source of main speed reference A

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.00 | 2006-01h | Source of main speed reference A | 0: Digital setting (H06.03) | 0 | - | At stop | " H06_en.00" on page 436 |

The speed reference is set in H06.03.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.03 | 2006-04h | Speed reference set through keypad | –6000 rpm to +6000 rpm | 200 | RPM | Real-time | " H06_en.03" on page 438 |

- Source of auxiliary speed reference B
  The auxiliary speed reference B sources include digital setting and multi-speed references. Both are internal speed references.

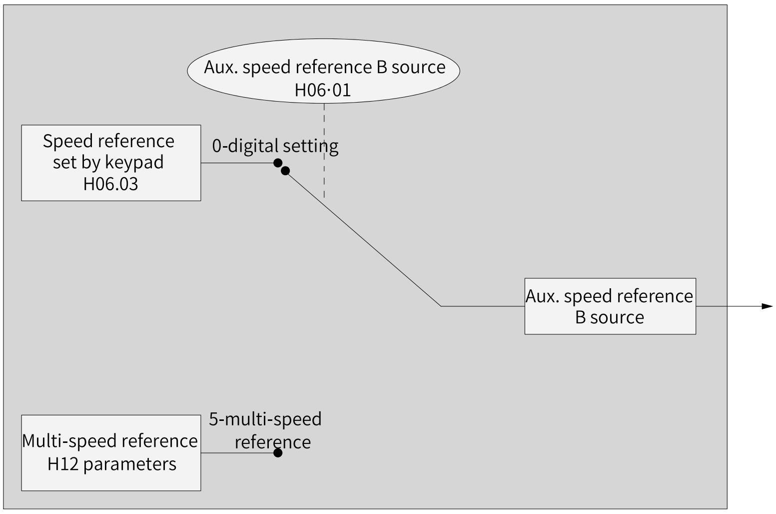



Figure 13-52 Source of auxiliary speed reference B

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.01 | 2006-02h | Source of auxiliary speed reference B | 0: Digital setting (H06.03)<br>5: Multi-speed reference | 5 | - | At stop | " H06_en.01" on page 437 |

The digital setting mode is the same as H06.00. The following describes multi-speed references.

The servo drive supports multi-speed operation. The servo drive stores 16 speed references, and the maximum running speed and running time of each can be set. Four groups of acceleration/ deceleration time are optional. The setting flowchart is as follows.

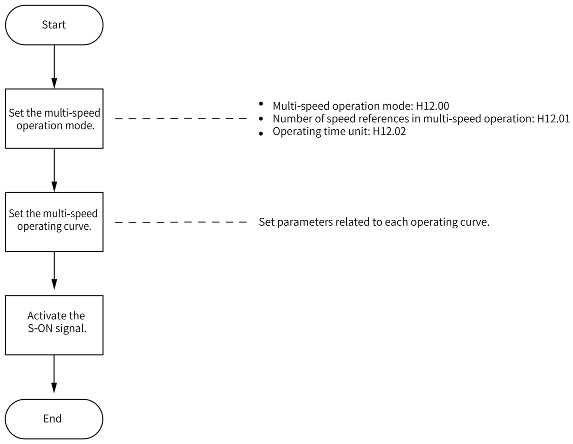



Figure 13-53 Flowchart for setting multi-speed operation

1. Set the multi-speed operation mode.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H12.00 | 2012-01h | Multi-speed operation mode | 0: Individual operation (number of speeds selected in H12.01)<br>1: Cyclic operation (number of speeds selected in H12.01)<br>2: DI-based operation | 1 | - | At stop | *"H12_en.00" on page 529* |
| H12.01 | 2012-02h | Number of speed references in multi-speed mode | 1 to 16 | 16 | - | At stop | *"H12_en.01" on page 530* |
| H12.02 | 2012-03h | Operating time unit | 0: sec<br>1: min | 0 | - | At stop | *"H12_en.02" on page 531* |

You can assign FunIN.5 (DIR- SEL) to an external DI to select the multi-speed reference direction.

☆ Related parameters:

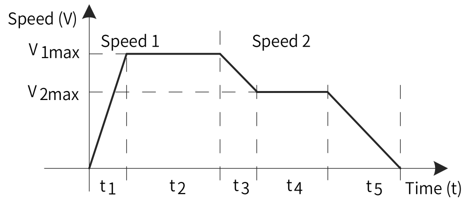
| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.5 | DIR-SEL | Multi-reference direction | Inactive: Reference direction by default<br>Active: Opposite to the reference direction |

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 13–19 Description of individual operation

| Description | Operating Curve |
|---|---|
| • The drive stops after one cycle of operation.<br>• The drive switches to the next displacement automatically. | <br>• V1max, V2max: reference values of speed 1 and speed 2<br>• t1: actual acceleration/deceleration time of speed 1<br>• t3, t5: acceleration/deceleration time of speed 2<br>• Operating time = Time taken in switching from the last speed to current speed + Duration of constant-speed operation at current speed (For example, the operating time of speed 1 is the sum of t1 and t2; the operating time of speed 2 is the sum of t3 and t4.)<br>• 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.<br>• The speed reach signal is activated when the motor speed feedback reaches the maximum operating speed set for this speed.<br>• If the S-ON signal is switched off during operation, the motor stops in the mode defined by H02.05 (Stop mode at S-ON OFF). |

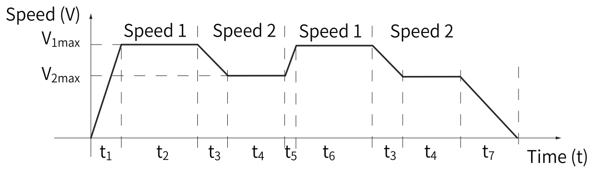
★ Definition of terms:

A complete operation cycle covers all the multi-speed references defined by H12.01.

- Cyclic running (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.

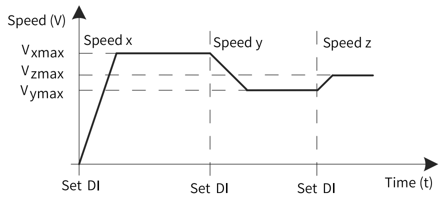
Table 13–20 Descriptions of cyclic operation

| Description | Operating Curve |
|---|---|
| • The drive starts from displacement 1 again after each cycle of operation.<br>• The drive switches to the next displacement automatically.<br>• The cyclic operation state remains active as long as the S-ON signal is active. | <br>• V1max, V2max: maximum operating speeds in displacement 1 and displacement 2<br>• Operating time = Time taken in switching from the last speed to current speed + Duration of constant-speed operation at this speed (For example, the operating time of speed 1 is the sum of t1 and t2; the operating time of speed 2 is the sum of t3 and t4.)<br>• 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.<br>• The speed reach signal is activated when the motor speed feedback reaches the maximum operating speed set for this speed.<br>• If the S-ON signal is switched off during operation, the motor stops in the mode defined by H02.05 (Stop mode at S-ON OFF). |

- 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 13–21 Descriptions of DI-based operation

| Description | Operating Curve |
|---|---|
| • The drive operates continuously as long as the S-ON signal is active.<br>• The speed No. is determined by the DI logic.<br>• The interval time between displacements is determined by the command delay of the host controller.<br>• The multi-speed reference is edge-triggered. | <br>• x, y: speed No. (The relationship between the speed No. and the DI logic is described below.)<br>• The operating time is independent of the parameter setpoint. If the speed No. changes during operation, the drive switches to the new speed No. immediately.<br>• The speed reach signal is activated when the motor speed feedback reaches the maximum operating speed set for this speed.<br>• If the S-ON signal is switched off during operation, the motor stops in the mode defined by H02.05 (Stop mode at S-ON OFF). |

When the multi-speed operation mode is DI-based operation, assign DI functions 6...9 (multi-reference switchover) to four DIs and set the active logic of these DIs. 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.

☆ Related parameters:

| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.5 | DIR-SEL | Direction switchover through DI in multi-speed mode | Defines the speed reference direction in the DI-based operation mode.<br>Inactive: Reference direction<br>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 13–22" on page 328*.<br>The value of CMD is 1 upon active DI level and 0 upon inactive DI level. |
| FunIN.7 | CMD2 | Multi-reference switchover 2 | |
| FunIN.8 | CMD3 | Multi-reference switchover 3 | |
| FunIN.9 | CMD4 | Multi-reference switchover 4 | |

Table 13–22 Relationship between the segment No. and CMD1 to CMD4

| CMD4 | CMD3 | CMD2 | CMD1 | Segment No. |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 2 |
| | | ... | | |
| 1 | 1 | 1 | 1 | 16 |

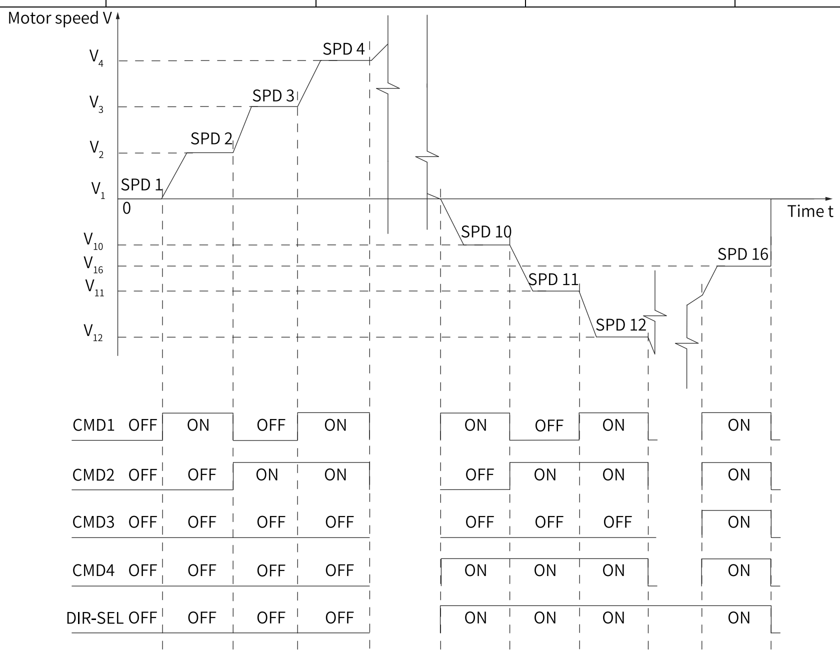



Figure 13-54 Example of multi-speed curve

2. Setting the multi-speed curve

The following takes speed 1 as an example.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H12.03 | 2012-04h | Acceleration time 1 | 0ms to 65535ms | 10 | ms | Real-time | "H12_en.03" on page 531 |
| H12.04 | 2012-05h | Deceleration time 1 | 0ms to 65535ms | 10 | ms | Real-time | "H12_en.04" on page 531 |
| H12.09 | 2012-0Ah | Acceleration time 4 | 0ms to 65535ms | 150 | ms | Real-time | "H12_en.09" on page 532 |
| H12.10 | 2012-0Bh | Deceleration time 4 | 0ms to 65535ms | 150 | ms | Real-time | "H12_en.10" on page 533 |
| H12.20 | 2012-15h | Speed reference 1 | –6000 rpm to +6000 rpm | 0 | RPM | Real-time | "H12_en.20" on page 533 |
| H12.21 | 2012-16h | Operating time of speed 1 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Real-time | "H12_en.21" on page 533 |
| H12.22 | 2012-17h | Acc./dec. time of speed 1 | 0: Zero acceleration/deceleration time<br>1: Acceleration/Deceleration time 1<br>2: Acceleration/Deceleration time 2<br>3: Acceleration/Deceleration time 3<br>4: Acceleration/Deceleration time 4 | 0 | - | Real-time | "H12_en.22" on page 533 |

For speed references in the 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).

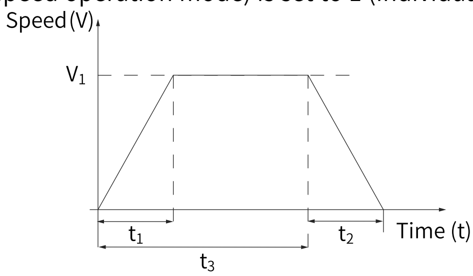



Figure 13-55 Example of multi-speed curve

As shown in the preceding figure, the speed reference is V1 and the actual acceleration time t1 is as follows.

$$t_1 = \frac{V_1}{1000} \times \text{Acc. time set for the speec}$$

The actual deceleration time $t_2$ is:

$$t_2 = \frac{V_1}{1000} \times \text{Dec. time set for the speed}$$

Operating time = Time taken in switching from the last speed to present speed + Duration of constant-speed operation at present speed (as shown by t3 in the preceding figure)

- Switched between A and B
  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.

  ☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
| --- | --- | --- | --- |
| FunIN.4 | CMD-SEL | Main/Auxiliary reference switchover | Inactive: Current reference being A<br>Active: Current reference being B |

- Communication
  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.

  ☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
| --- | --- | --- | --- | --- | --- | --- | --- |
| H31.09 | 2031-0Ah | Speed reference set via communication | -6000.000 RPM to 6000.000 RPM | 0.000 | RPM | Real-time | “H31_en.09” on page 565 |

## Speed reference direction setting

To switch the speed reference direction through DI, assign FunIN.26 to the corresponding DI. The input signal of this DI determines the speed reference direction.

☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
| --- | --- | --- | --- |
| FunIN.26 | SPDDirSel | Speed reference direction | Inactive: Forward<br>Active: Reverse |

The actual direction of rotation is related to the setting of H02.02 (Direction of rotation), the sign (+/-) of the speed reference value, and the logic of FunIN.26.

Table 13–23 Actual direction of rotation in the speed control mode

| H02.02 | Sign of Speed Reference | FunIN.26 | Direction of Rotation |
| --- | --- | --- | --- |
| 0 | + | Inactive | CCW |
| 0 | + | Active | CW |
| 0 | - | Inactive | CW |
| 0 | - | Active | CCW |
| 1 | + | Inactive | CW |
| 1 | + | Active | CCW |
| 1 | - | Inactive | CCW |
| 1 | - | Active | CW |

## 13.2.3 Ramp Function Setting

The ramp function is used to smooth the acceleration rate of speed references through acceleration/deceleration time setting.

In the speed control mode, a high acceleration rate easily leads to motor jerk or intense vibration. In this case, increasing the acceleration/deceleration time smoothens 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 multi-speed reference, the acceleration time and deceleration time are set in parameter group H12. For details, see Chapter "Description of Parameters".

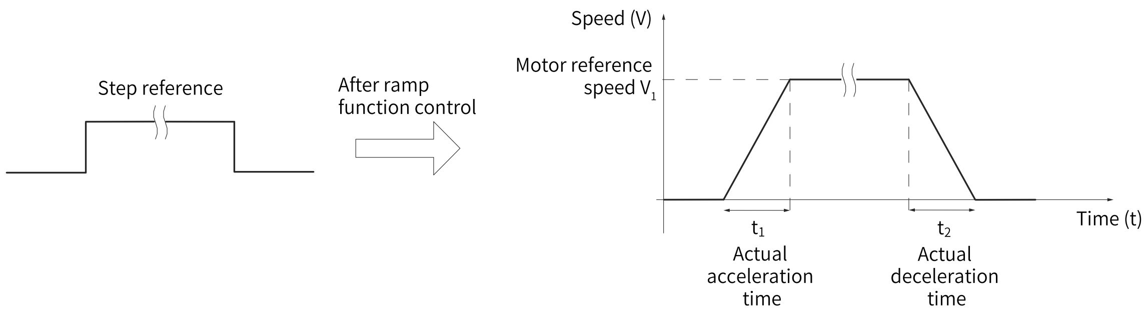



Figure 13-56 Ramp function definition

- 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 for calculating the actual acceleration/deceleration time are as follows:

$$\text{Actual acceleration time } t_1 = \frac{\text{Speed reference}}{1000} \text{ x Speed reference acceleration ramp time}$$

$$\text{Actual deceleration time } t_2 = \frac{\text{Speed reference}}{1000} \text{ x Speed reference deceleration ramp time}$$

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.05 | 2006-06h | Acceleration ramp time constant of speed reference | 0ms to 65535ms | 0 | ms | Real-time | " H06_en.05" on page 438 |
| H06.06 | 2006-07h | Deceleration ramp time constant of speed reference | 0ms to 65535ms | 0 | ms | Real-time | " H06_en.06" on page 439 |

## 13.2.4 Zero Clamp

Caution

- Zero clamp is used in systems where position loop is unavailable in the speed control mode.
- If the motor oscillates in the zero clamp state, adjust the position loop gain.

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.

When the speed reference amplitude exceeds the value of H06.15, the motor exits from the zero clamp state and continues running according to the speed reference received. Zero clamp is deactivated when the ZCLAMP (FunIN.12) signal is inactive.

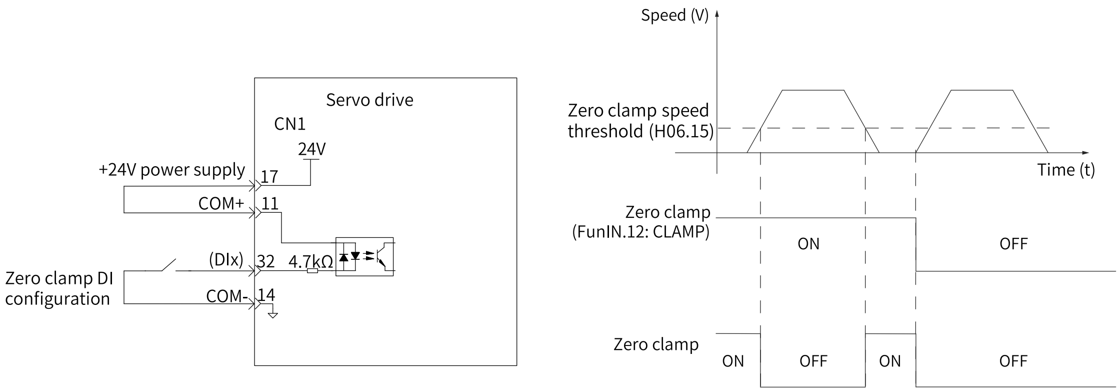



Figure 13-57 Wiring and waveform of zero clamp

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.15 | 2006-10h | Zero clamp speed threshold | 0rpm to 6000rpm | 10 | RPM | Real-time | " H06_en.15" on page 441 |

☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
|---|---|---|---|
| FunIN.12 | ZCLAMP | Zero speed clamp | Inactive: Zero clamp disabled<br>Active: Zero clamp enabled |

## 13.2.5 Speed Reference Limit

**Caution**

When the actual speed of the motor exceeds H0A.08 (Overspeed threshold), E500.0 (Motor overspeed) occurs. For details of H0A.08, see Chapter "Parameter List". The speed reference limit must be lower than H0A.08.

In the speed control mode, the sources of speed reference limit include:

- H06.07 (Maximum speed limit): Defines the speed reference limit in both directions. The limit value applies when speed references exceed it.
- H06.08 (Forward speed limit): Defines the speed limit in the forward direction.The limit value applies when forward speed references exceed it.
- H06.09 (Reverse speed limit): Defines the speed limit in the reverse direction.The limit value applies when reverse speed references exceed it.
- Maximum speed of the motor (default threshold): Depends on the motor model.

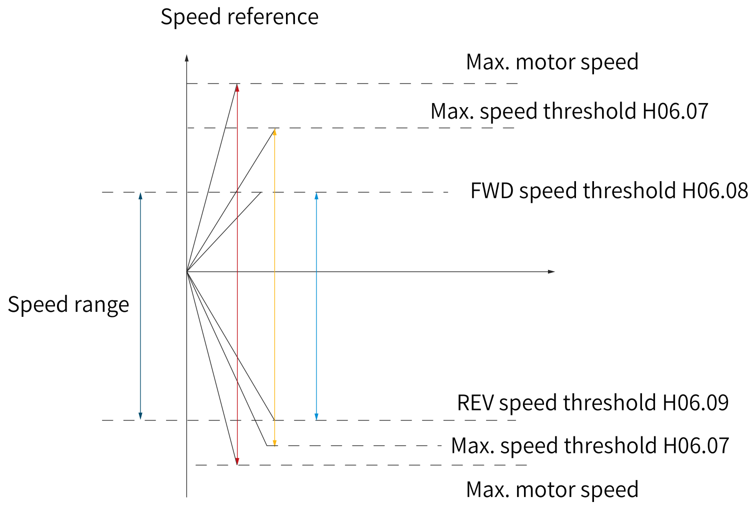



Figure 13-58 Example of speed reference limit

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}

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.07 | 2006-08h | Maximum speed limit | 0rpm to 6000rpm | 6000 | RPM | Real-time | "H06_en.07" on page 439 |
| H06.08 | 2006-09h | Forward speed threshold | 0rpm to 6000rpm | 6000 | RPM | Real-time | "H06_en.08" on page 439 |
| H06.09 | 2006-0Ah | Reverse speed threshold | 0rpm to 6000rpm | 6000 | RPM | Real-time | "H06_en.09" on page 440 |

## 13.2.6 Speed-Related DO

The filtered speed feedback can be compared with different thresholds, generating DO signals for use by the host controller. The filter time constant is set in H0A.27 (Speed DO filter time constant).

### Motor rotation DO signal

When the absolute value of the filtered actual motor speed reaches the value of H06.16 (Threshold of TGON (motor rotation) signal), the motor is acknowledged to be rotating. 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 filtered actual motor speed is lower than the value of H06.16, the motor is not rotating.

Judgment on the motor rotation signal (FunOUT.2, TGON) is not affected by the operating state or control mode of the drive.

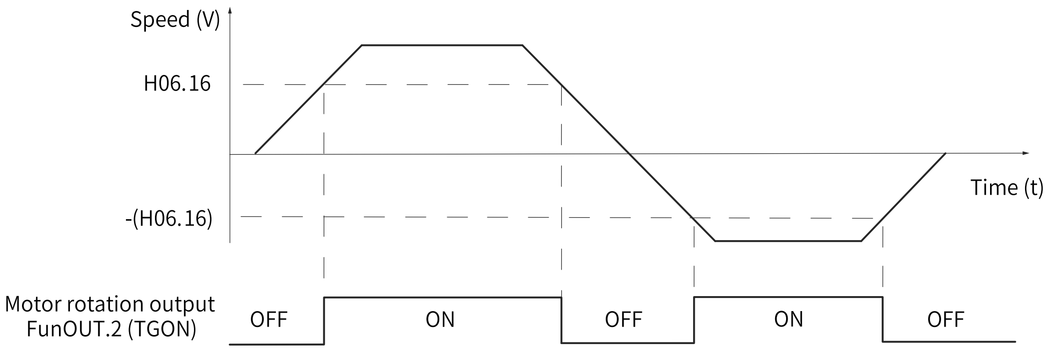



Figure 13-59 Waveform of motor rotation (TGON) signal

#### *Note*

In the preceding figure, "ON" indicates the TGON (motor rotation) signal is active. "OFF" indicates the TGON (motor rotation) signal is inactive.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.16 | 2006-11h | Threshold of TGON (motor rotation) signal | 0 rpm to 1000 rpm | 20 | RPM | Real-time | " H06_en.16" on page 442 |

To use the TGon signal, assign a DO with FunOUT.2 (TGon, motor rotation) and set the active logic of this DO.

☆ Related parameters:

| Code | Parameter 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.<br>Active. The absolute value of filtered motor speed reaches the setpoint of H06.16. |

## 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.

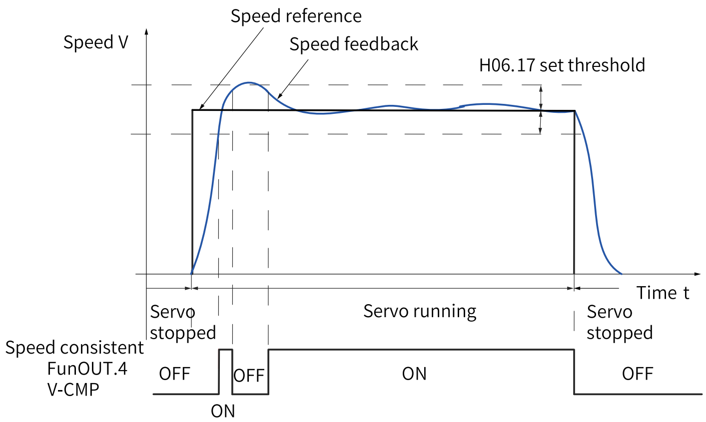



Figure 13-60 Waveform of speed matching (V-Cmp) signal

### Note

In the preceding figure, "ON" indicates the V-Cmp signal is active. "OFF" indicates the V-Cmp signal is inactive.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.17 | 2006-12h | Threshold of V-Cmp (speed matching) signal | 0 RPM –100 RPM | 10 | RPM | Real-time | “ H06_en.17” on page 443 |

To use the V-Cmp (speed matching) signal, assign FunOUT.4 (V-Cmp, speed matching) to a certain DO and set the active logic of this DO.

☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
|---|---|---|---|
| FunOUT.4 | V-Cmp | Speed matching | Inactive: The absolute difference between the filtered actual motor speed and the speed reference is higher than the value of H06.17.<br>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. |

## Speed reach DO signal

When the absolute value of the motor speed after filter exceeds the setting of H06.18 (Threshold of speed arrival signal), the motor speed is considered to reach the desired value. At this moment, the servo drive outputs the speed arrival 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.

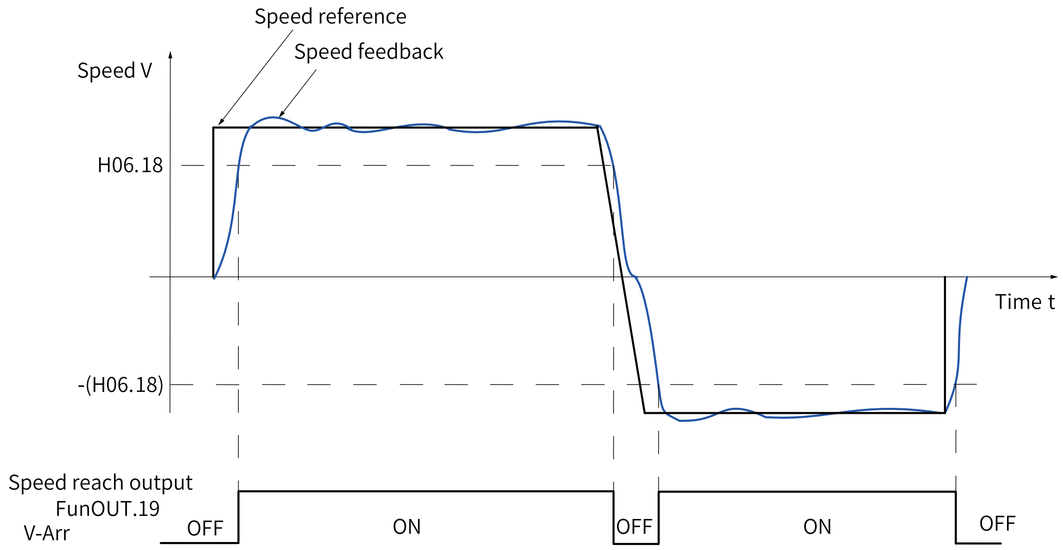



Figure 13-61 Waveform of the speed reach (V-Arr) signal

### *Note*

In the preceding figure, "ON" indicates the V-Arr (speed reached) signal is active. "OFF" indicates the V-Arr (speed reached) signal is inactive.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.18 | 2006-13h | Threshold of speed reach signal | 10rpm to 6000rpm | 1000 | RPM | Real-time | " *H06_en.18*" *on page 443* |

To use the V-Arr signal, assign FunOUT.19 (V-Arr, speed reach) to a DO and set the active logic of this DO.

☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
|---|---|---|---|
| FunOUT.19 | V-Arr | Speed reach | Inactive: The absolute value of filtered motor speed feedback exceeds H06.18.<br>Active: The absolute value of filtered motor speed feedback is lower than or equal to the value of H06.18. |

## Zero speed DO signal

The servo drive outputs the V-Zero (FunOUT.3: zero speed) signal only when the absolute value of actual motor speed is lower than the threshold defined by H06.19. 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.

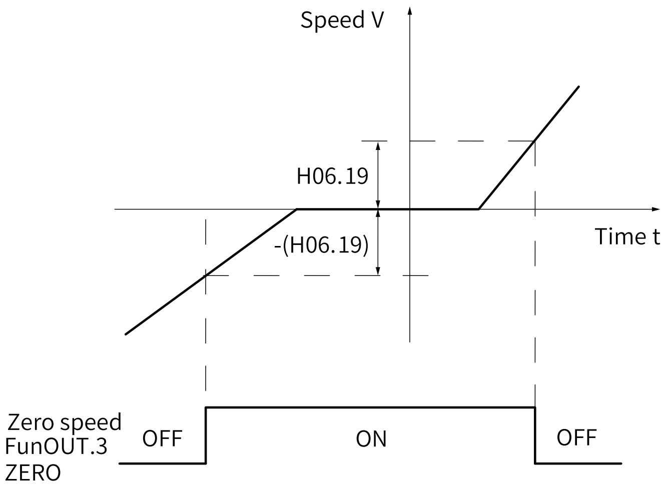



Figure 13-62 Waveform of the zero speed (V-Zero) signal

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### *Note*

In the preceding figure, "ON" indicates the V-Zero signal is active. "OFF" indicates the V-Zero signal is inactive.

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☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.19 | 2006-14h | Threshold of zero speed output signal | 1 rpm to 6000 rpm | 10 | RPM | Real-time | “ H06_en.19” on page 444 |

To use the zero speed (V-Zero) signal, assign FunOUT.3 (V-Zero, zero speed) to a DO and set the active logic of this DO.

☆ Related parameters:

| Code | Parameter 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.<br>Active: The difference between motor speed feedback and the reference value is lower than or equal to the value of H06.19. |

## 13.3 Torque Control Mode

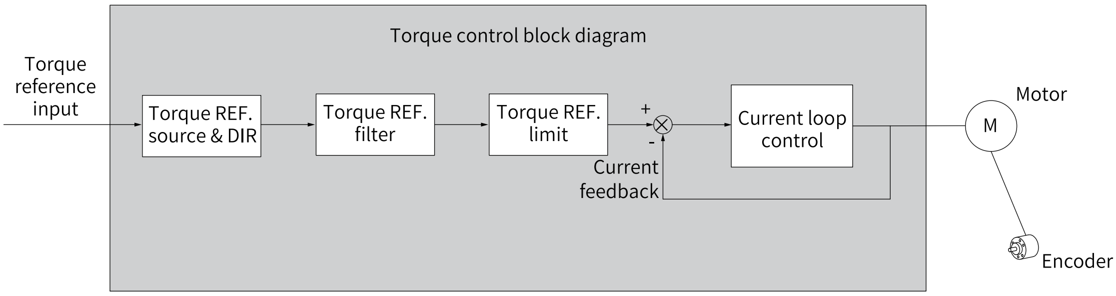



Figure 13-63 Block diagram of torque control mode

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 indicators. The following describes basic parameter settings in the torque control mode.

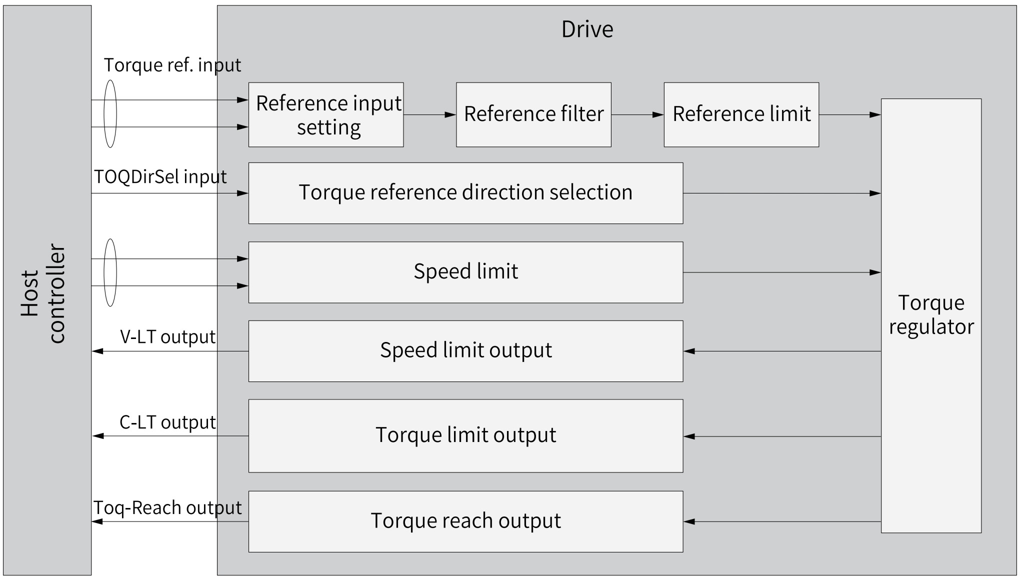



Figure 13-64 Signal exchange between the drive and the host controller

## 13.3.1 Block Diagram of Torque Control Parameters

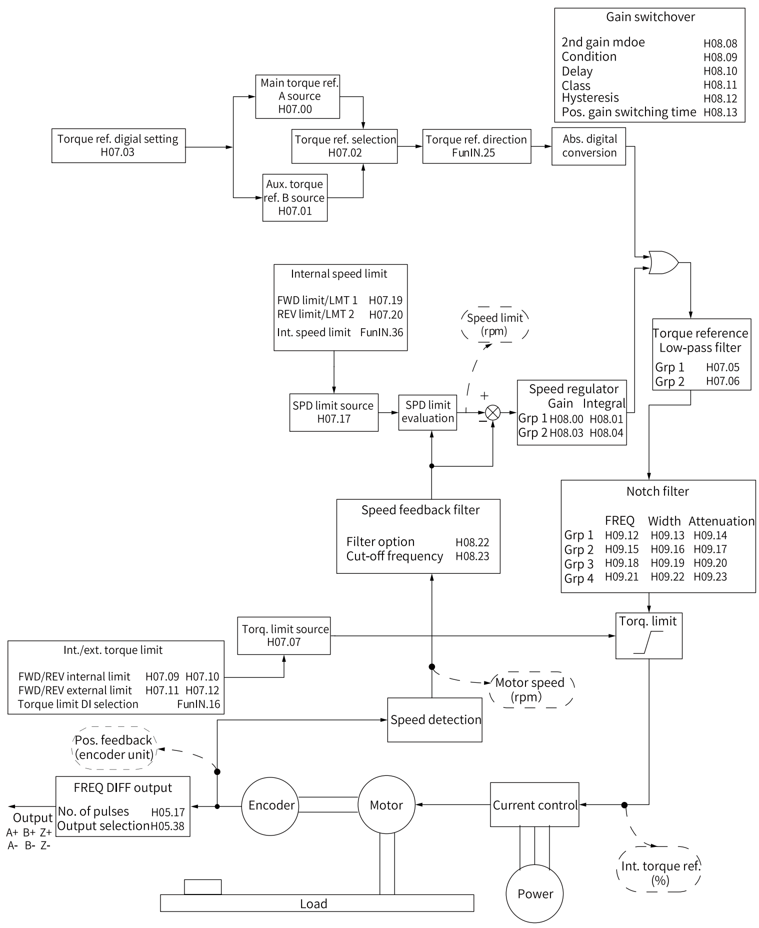



Figure 13-65 Block diagram of torque control parameters

## 13.3.2 Torque Reference Input Setting

### Torque reference source

Five torque reference sources are available in the torque control mode, which can be set in H07.02.

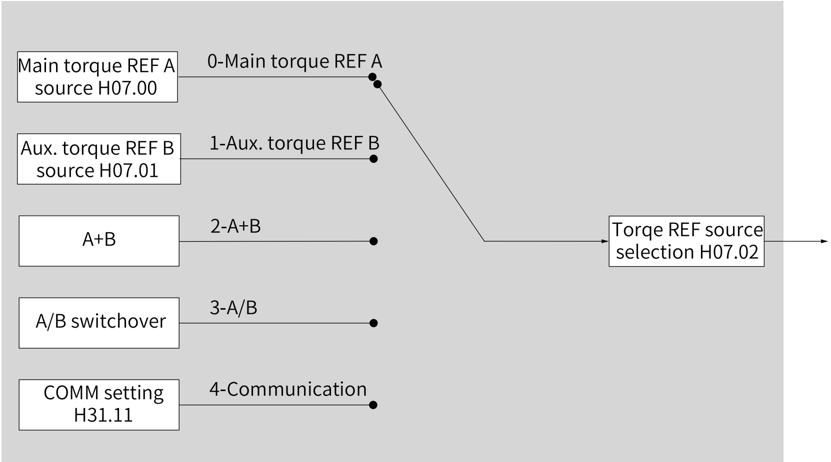



Figure 13-66 Torque reference sources

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.02 | 2007-03h | Torque reference source | 0: Source of main torque reference A<br>1: Source of auxiliary torque reference B<br>2: Source of A+B<br>3: Switched between A and B<br>4: Communication | 0 | - | At stop | "H07_en.02" on page 447 |

- **Source of main torque reference A**

  The main speed reference A is an internal speed reference that can be set through digital setting.

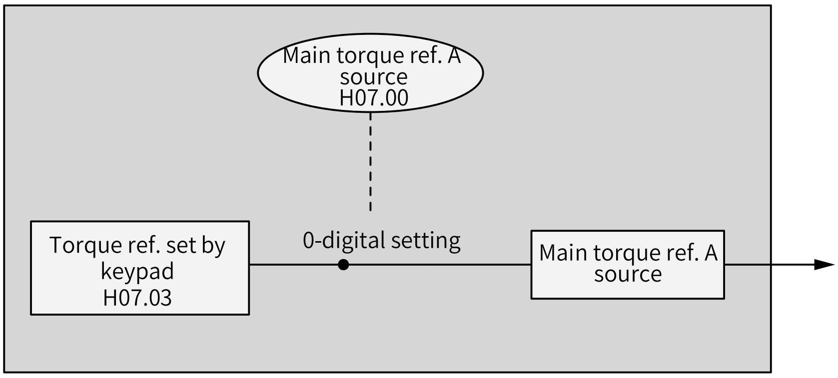



Figure 13-67 Description of source of main torque reference A

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.00 | 2007-01h | Source of main torque reference A | 0: Keypad (H07.03) | 0 | - | At stop | "H07_en.00" on page 446 |

- **Digital setting**

  In digital setting, the torque reference is set in H07.03, which defines the percentage of the torque reference to the rated torque of the motor.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.03 | 2007-04h | Torque reference set through keypad | -400.0% to 400.0% | 0.0 | % | Real-time | "H07_en.03" on page 447 |

- **Source of auxiliary torque reference B**
  The source of auxiliary torque reference B is set in the same way as the main torque reference A. For the descriptions of related parameters, see Chapter "List of Parameters".
- **Switched between A and B**
  When setting H07.02 (Torque 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.

  ☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
|---|---|---|---|
| FunIN.4 | CMD-SEL | Reference switchover | OFF: Active reference being A<br>ON: Active reference being B |

- **Communication**
  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.

  ☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H31.11 | 2031-0Ch | Torque reference set via communication | -100.000% to 100.000% | 0.000 | % | Real-time | "H31_en.11" on page 565 |

## Torque reference direction

To switch the torque reference direction through DI, assign FunIN.25 (TorDirSel, torque reference direction) to the corresponding DI. The input signal of this DI determines the torque reference direction.

☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
|---|---|---|---|
| FunIN.25 | ToqDirSel | Torque reference direction | Inactive: The actual torque reference direction is the same as the set direction.<br>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 sign (+/-) of the torque reference value, and the logic of FunIN.25.

Table 13–24 Actual direction of rotation in the torque control mode

| H02.02 | Sign (+/-) of the Torque Reference Value | FunIN.25 | Direction of Rotation |
|---|---|---|---|
| 0 | + | Inactive | CCW |
| 0 | + | Active | CW |
| 0 | - | Inactive | CW |
| 0 | - | Active | CCW |
| 1 | + | Inactive | CW |
| 1 | + | Active | CCW |
| 1 | - | Inactive | CCW |
| 1 | - | Active | CW |

### 13.3.3 Torque Reference Filter

Caution

If the filter time constant is set to an excessively high value, the responsiveness will be degraded, so pay attention to the responsiveness when setting the filter time constant.

The servo drive smoothens torque references through the low-pass filter to reduce vibration in all the 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.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.05 | 2007-06h | Torque reference filter time constant | 0.00ms to 30.00ms | 0.50 | ms | Real-time | "H07_en.05" on page 448 |
| H07.06 | 2007-07h | 2nd torque reference filter time constant | 0.00ms to 30.00ms | 0.27 | ms | Real-time | "H07_en.06" on page 448 |

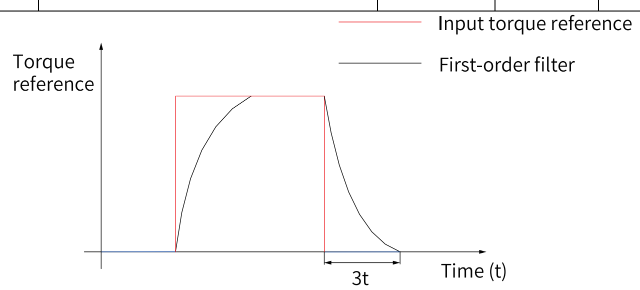



Figure 13-68 First-order filter for rectangular torque references

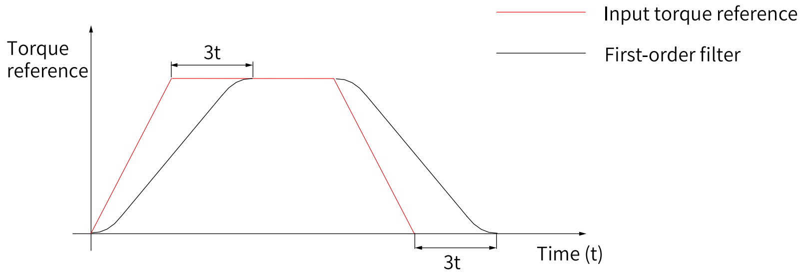



Figure 13-69 First-order filter for trapezoid torque references

### 13.3.4 Torque Reference Limit

**Caution**

Torque reference limit is active in and needed by all the control modes.

The torque reference limit is used to protect the servo drive and the motor.

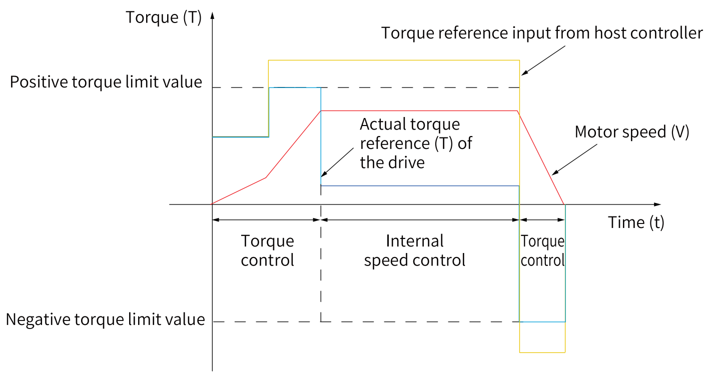



Figure 13-70 Torque reference and torque limit

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.

Only one torque reference limit is valid at a moment. The positive/negative torque limit must be lower than or equal to the maximum torque of the drive and the motor and ±300.0% of the rated torque.

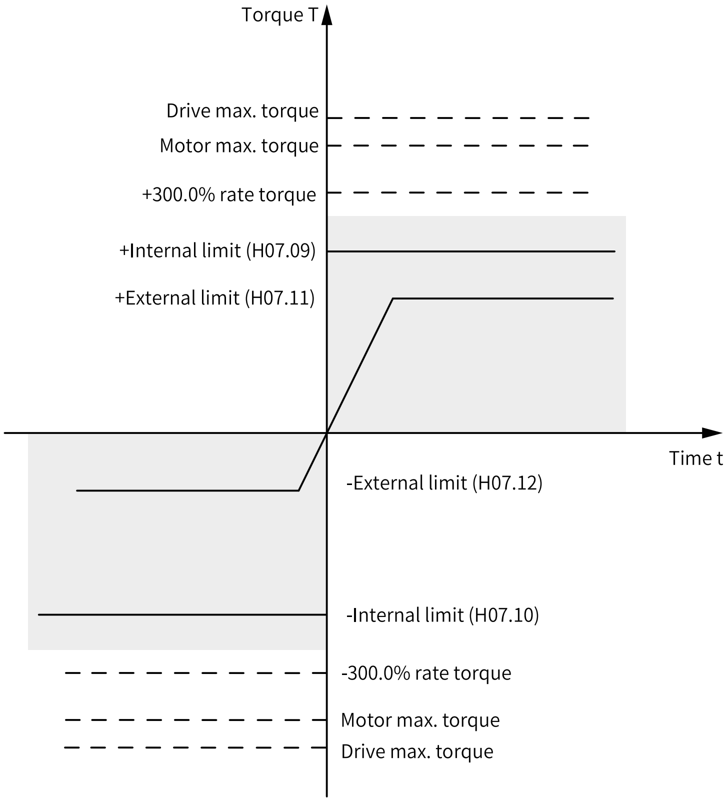



Figure 13-71 Example of torque limit

## Torque limit source

You can set the torque limit source in H07.07.

After the torque limit is set, the torque limit applies when the torque reference exceeds the limit. The torque limit must be set according to the load conditions. An excessively low limit may weaken the acceleration/deceleration ability of the motor, causing the actual motor speed to fall below the required value during operating at a constant torque.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.07 | 2007-08h | Torque Limit source | 0: Forward/Reverse internal torque limit (default)<br>1: Forward/Reverse external torque limit (selected through P-CL and N-CL) | 0 | - | At stop | "H07_en.07" on page 448 |

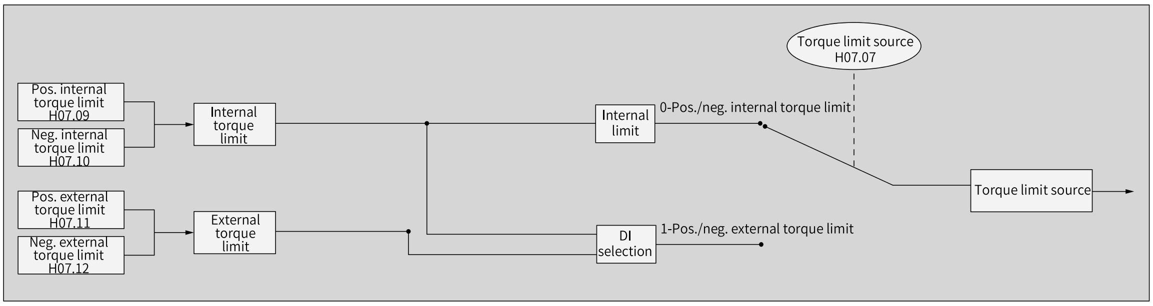



Figure 13-72 Torque Limit source

The following figures show examples in which absolute values of torque references input from the host controller exceed the absolute value of the torque limit in the torque control mode.

- H07.07 = 0 (Positive/Negative internal torque limit)
  The torque reference limit is determined only by H07.09 and H07.10.

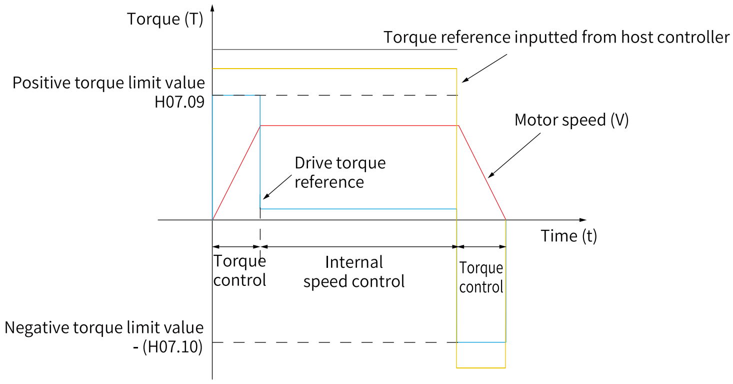



Figure 13-73 Torque limit curve (H07.07 = 0)

- H07.07 = 1 (Positive/Negative external torque limit)
  The torque reference limit is determined by the logic of the external DI signal. 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).

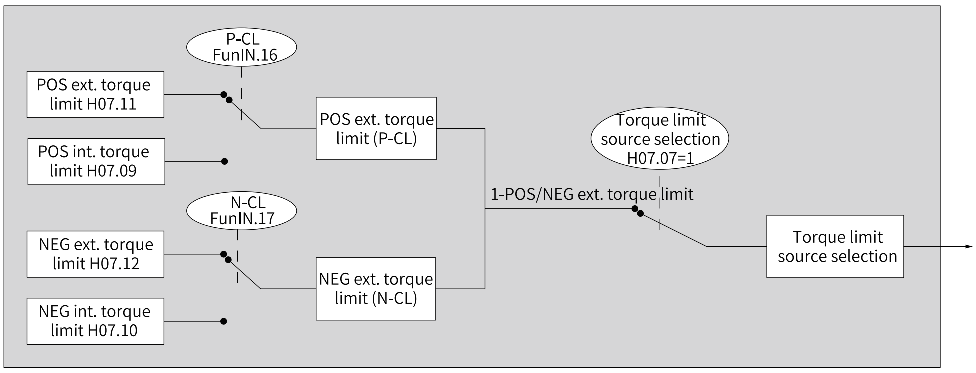
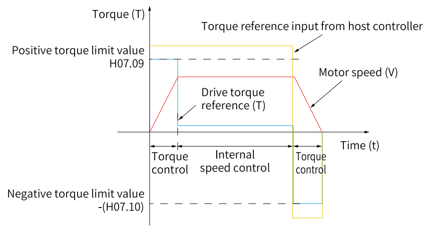
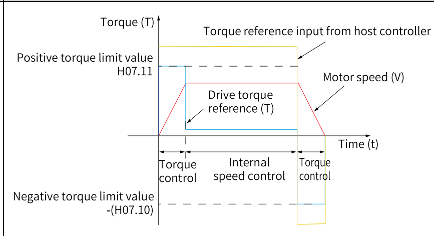
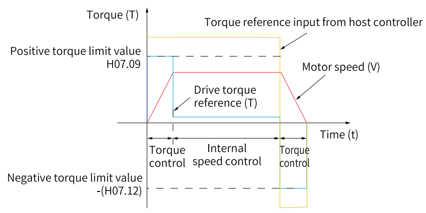
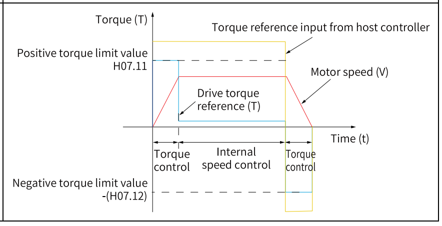



Figure 13-74 Torque limit source (H07.07 = 1)

Table 13–25 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 FunIN.16 (P-CL: Positive external torque limit) and FunIN.17 (N-CL: Negative external torque limit) to two DI of the drive and set the active logic of these DIs.

☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
|---|---|---|---|
| FunIN.16 | P-CL | Positive external torque limit | The torque limit source is switched based on H07.07 (Torque limit source).<br>H07.07 = 1:<br>Active: Positive external torque limit activated<br>Inactive: Positive internal torque limit activated |
| FunIN.17 | N-CL | Negative external torque limit | The torque limit source is switched based on H07.07 (Torque limit source).<br>H07.07 = 1:<br>Active: Negative external torque limit activated<br>Inactive: Negative internal torque limit activated |

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.09 | 2007-0Ah | Positive internal torque limit | 0.0% to 400.0% | 350.0 | % | Real-time | “ H07_en.09” on page 449 |
| H07.10 | 2007-0Bh | Negative internal torque limit | 0.0% to 400.0% | 350.0 | % | Real-time | “ H07_en.10” on page 449 |
| H07.11 | 2007-0Ch | Positive external torque limit | 0.0% to 400.0% | 350.0 | % | Real-time | “ H07_en.11” on page 449 |
| H07.12 | 2007-0Dh | Negative external torque limit | 0.0% to 400.0% | 350.0 | % | Real-time | “ H07_en.12” on page 449 |

### Setting torque limit DO signal

The drive outputs the C-LT (FunOUT.7: torque limit) signal to the host controller when the torque reference reaches the limit. In this case, assign FunOUT.7 to a DO of the drive and set the active logic of this DO.

☆ Related parameters:

| Code | Parameter 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.<br>Inactive: The torque reference does not reach the torque limit. |

## 13.3.5 Speed limit in Torque Control Mode

In the 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. A speed limit therefore must be set to protect the machine.

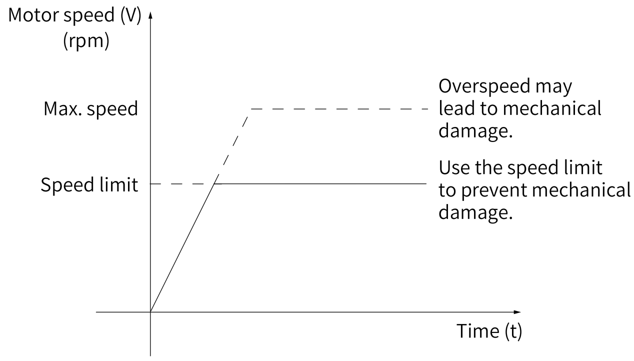



Figure 13-75 Speed limit in the torque control mode

### Setting the 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 will be limited. After reaching the speed limit, the motor keeps operating at the speed limit constantly. Set the speed limit based on the operating requirements of the load.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.17 | 2007-12h | Speed limit source | 0: Internal speed limit (in torque control)<br>1: V-LMT used as external speed limit<br>2: 1st or 2nd speed limit as defined by V-SEL | 0 | - | Real-time | *" " on page* |

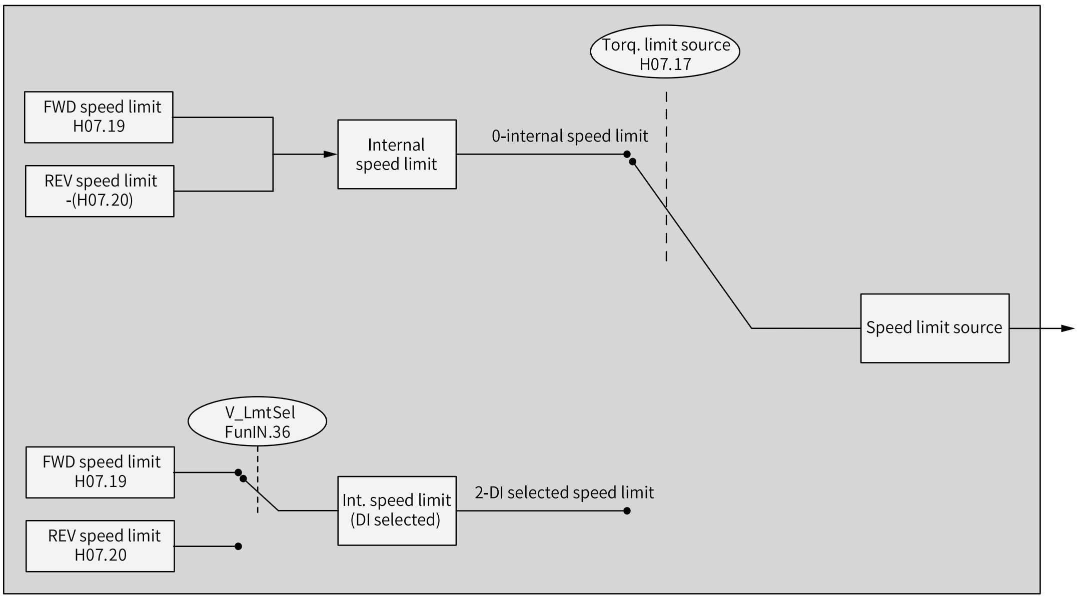



Figure 13-76 Speed limit source

- H07.17 = 0 (Internal speed limit)
  The speed limit is determined only by H07.19 (Positive speed limit) and H07.20 (Negative speed limit).

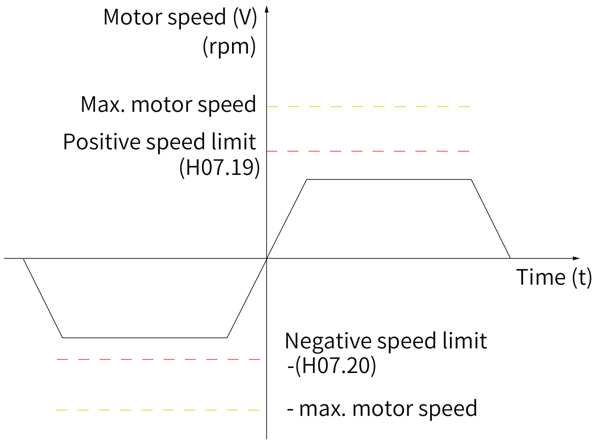



Figure 13-77 Speed limit curve (H07.17 = 0)

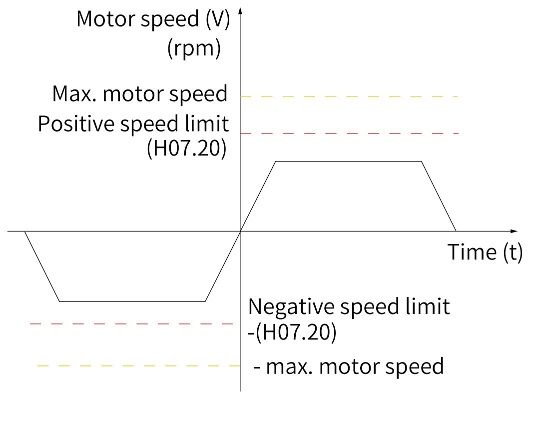
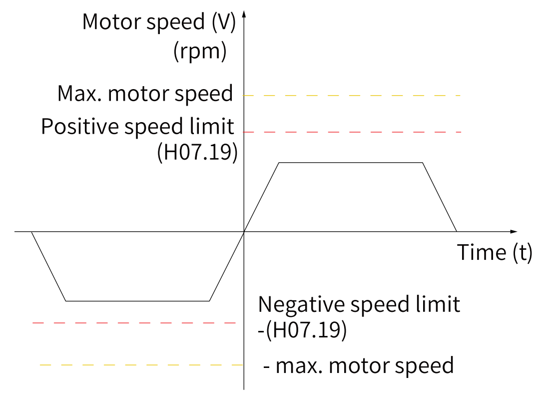
- H07.17 = 2 (1st or 2nd speed limit selected by DI)
  H07.19 or H07.20 is used as the speed limit based on the logic of the DI.

  Before setting H107.17 to 2, assign FunIN.36 (V-LmtSel: internal speed limit source) to a DI first, and then set the active logic of this DI.

  ☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
|---|---|---|---|
| FunIN.36 | V_LmtSel | Internal speed limit source | Inactive: H07.19 used as positive/negative internal speed limit<br>Active: H07.20 used as positive/negative internal speed limit |

Table 13–26 Descriptions of speed limit

<table>
<tr><th colspan="2">V_LmtSel</th></tr>
<tr><th>ON</th><th>OFF</th></tr>
<tr><td>
</td><td>
</td></tr>
</table>

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.19 | 2007-14h | Forward speed limit/1st speed limit in torque control | 0rpm to 6000rpm | 3000 | RPM | Real-time | *“ H07_en.19” on page 450* |
| H07.20 | 2007-15h | Reverse speed limit/2nd speed limit in torque control | 0rpm to 6000rpm | 3000 | RPM | Real-time | *“ H07_en.20” on page 450* |

## Speed limit DO signal

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 satisfied, the speed limit signal will be deactivated.

Acknowledgment of the V-LT (Speed limit) signal is executed only during operation in the torque control mode.

To use the V-LT signal, assign FunOUT.8 to a DO of the drive and set DO active logic of this DO.

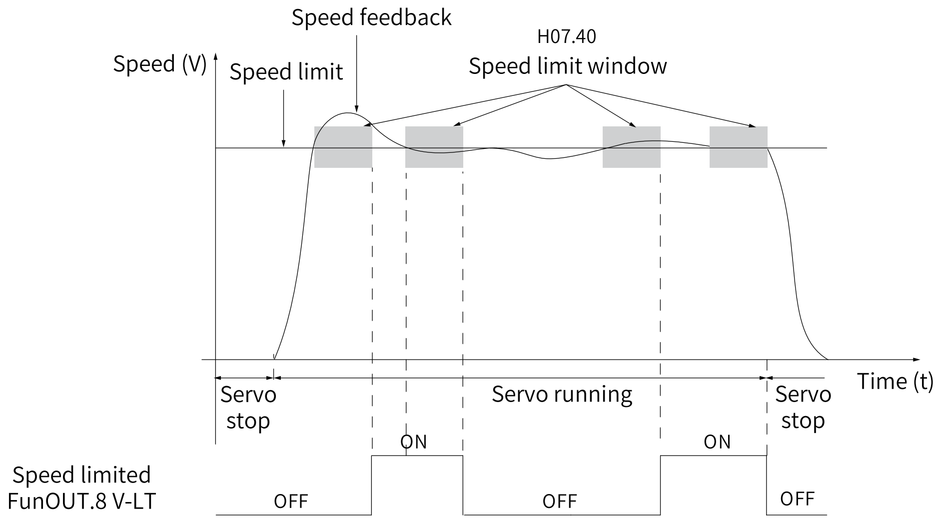



Figure 13-78 Example of speed limit DO waveform

☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
|---|---|---|---|
| FunOUT.8 | V-LT | Speed limit | Inactive: The motor speed does not reach the speed limit.<br>Active: The motor speed reaches the speed limit and a speed loop is built based on this limit. |

## 13.3.6 Torque Reach Output

The torque reach output is used to determine whether the actual torque reference reaches the set range. The drive outputs TorReach (FunOUT.18: torque reach) signal to the host controller when the actual torque reference reaches the torque reference threshold.

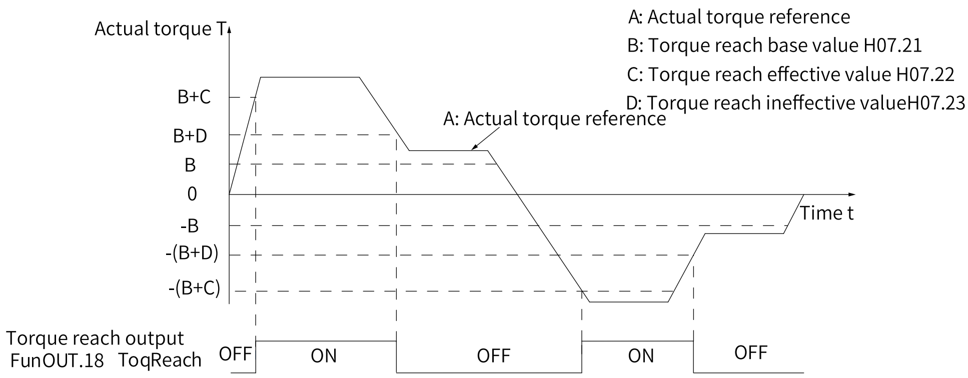



Figure 13-79 Example of TorReach signal waveform

- Actual torque reference (viewed in H0b.02): A
- Base value for torque reach (H07.21): B.
- Threshold of valid torque arrival (H07.22): C.
- Threshold of invalid torque reach (H07.23): D.

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 reach DO signal remains inactive.

For the torque reach DO signal to become inactive, the actual torque reference must meet the following condition: |A| < B + D. Otherwise, the torque reach signal remains active.

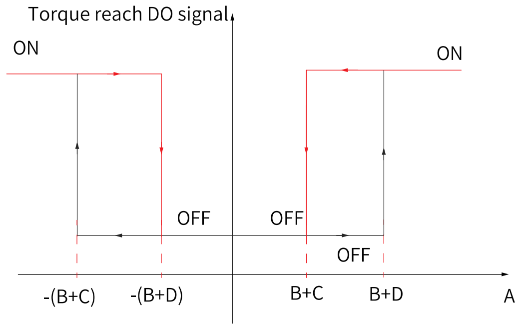



Figure 13-80 Description of torque reach output

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H07.21 | 2007-16h | Torque reach base value | 0.0% to 300.0% | 0.0 | % | Real-time | "H07_en.21" on page 451 |
| H07.22 | 2007-17h | Torque reach valid value | 0.0% to 300.0% | 20.0 | % | Real-time | "H07_en.22" on page 451 |
| H07.23 | 2007-18h | Torque reach invalid value | 0.0% to 300.0% | 10.0 | % | Real-time | "H07_en.23" on page 451 |

To use the TorReach (Torque reach) signal, assign FunOUT.18 (ToqReach, torque reach) to a DO of the drive and set the active logic of this DO.

☆ Related parameters:

| Code | Parameter Name | Function Name | Description |
|---|---|---|---|
| FunOUT.18 | ToqReach | Torque reach | Active: The absolute value of the torque reference reaches the setpoint.<br>Inactive: The absolute value of the torque reference is lower than the setpoint. |

## 13.4 Mixed Control Mode

In the 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. The following four compound control modes are available:

- Torque mode ↔ Speed mode
- Speed mode ↔ Position mode
- Torque mode ↔ Position mode
- Speed control mode ↔ Position control mode ↔ Torque control mode

You can enable the compound control mode by setting H02.00 through the keypad or the software tool.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H02.00 | 2002-01h | Mode selection | 0: Speed control mode<br>1: Position control mode<br>2: Torque control mode<br>3: Torque<->Speed control mode<br>4: Speed<->Position control mode<br>5: Torque<->Position control mode<br>6: Torque<->Speed<->Position compound mode<br>7: Process segment<br>8: CANopen mode | 8 | - | At stop | *" " on page* |

Set the parameters for different control modes based on the mechanical structure and technical indicators. See description of H02.00 for details.

When H02.00 is set to 3, 4, or 5, assign a DI with FunIN.10 (M1_SEL, mode switchover 1) and set the active logic of this DI. When H02.00 is set to 6, assign two DIs with FunIN.10 (Mode switchover 1) and FunIN.11 (Mode DI 2) and set the active logic of these two DIs.

☆ Related parameters:

| Code | Parameter Name | Function Name | Function |
|---|---|---|---|
| FunIN.10 | M1_SEL | Mode switchover 1 | Defines the present control mode during compound control when the servo drive is in the "run" state, as shown in *"Table 13–27" on page 352*. |
| FunIN.11 | M2_SEL | Mode switchover 2 | Defines the present control mode during compound control when the servo drive is in the "run" state, as shown in *"Table 13–28" on page 352*. |

Table 13–27 Drive control mode

| H02.00 | M1_SEL terminal logic | Control mode |
|---|---|---|
| 3 | Inactive | Torque control mode |
| | Active | Speed control mode |
| 4 | Inactive | Speed control mode |
| | Active | Position control mode |
| 5 | Inactive | Torque control mode |
| | Active | Position control mode |

Table 13–28 Drive control mode

| H02.00 | M2_SEL terminal logic | M1_SEL terminal logic | Control mode |
|---|---|---|---|
| 6 | - | Active | Position control mode |
| | Active | Inactive | Speed control mode |
| | Inactive | Inactive | Torque control mode |

# 13.5 Absolute System

## 13.5.1 Overview

The absolute encoder, which features a single-turn resolution of 262144 ($2^{18}$), is used to detect the motor position within one turn and count the number of motor revolutions, with 16-bit multi-turn data recorded. The absolute system integrated with the absolute encoder works in absolute position linear mode or absolute position rotating mode. These modes apply to position control, speed control, and torque control modes. The absolute encoder with a battery can back up data when the servo drive is powered off. This enables the servo drive to calculate the absolute mechanical position upon power-on again. Therefore, the homing operation is not required.

To match the absolute encoder with the SV630P series servo drives, H00.00 (Motor code) to 14101 (Inovance absolute encoder). Then set H02.01 (Absolute system selection) based on actual conditions. E731.0 (Encoder battery failure) will occur upon initial power-on of the battery. Set H0d.20 (Absolute encoder reset function) 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.

## 13.5.2 Related Parameters

### Absolute encoder system settings

Set H00.00 (Motor code) to 14101 (Inovance motor with 18-bit absolute encoder), and select the absolute position mode in H02.01.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H00.00 | 2000-01h | Motor SN | 0 to 65535 | 14101 | - | At stop | “ ” on page |
| H00.08 | 2000-09h | Bus encoder type | 0 to 65535 | 0 | - | At stop | “ ” on page |
| H02.01 | 2002-02h | Absolute position detection system | 0: Incremental position mode<br>1: Absolute position linear mode<br>2: Absolute position rotation mode | 0 | - | At stop | “ H02_en.01” on page 393 |

### *Note*

In the absolute position mode, the system detects the motor code automatically to check whether the motor used is configured with an absolute encoder. If not, E122.0 (multi-turn absolute encoder setting error) occurs.

## Absolute position linear mode

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0b.07 | 200b-08h | Absolute position counter | -2147483648 to 2147483647 | 0 | Reference unit | Unchangeable | "H0b_en.07" on page 490 |
| H0b.58 | 200b-3Bh | Mechanical absolute position (low 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.58" on page 497 |
| H0b.60 | 200b-3Dh | Mechanical absolute position (high 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.60" on page 497 |
| H0b.77 | 200b-4Eh | Absolute position fed back by the absolute encoder (low 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.77" on page 499 |
| H0b.79 | 200b-50h | Absolute position fed back by the absolute encoder (high 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.79" on page 499 |

This mode is mainly applicable to the scenario where the load traveling range is fixed and the encoder multi-turn data does not overflow, as shown by the following example of a ball screw transmission machine.

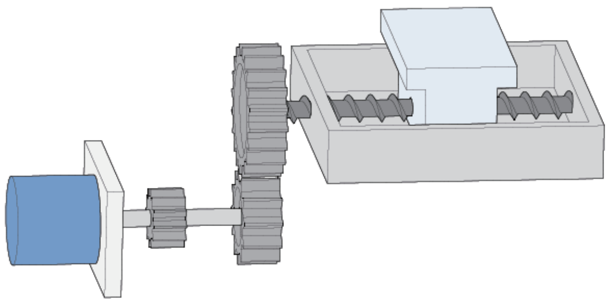


Figure 13-81 Ball screw transmission mechanism

In the formula PM = PE - PO:
PM: mechanical absolute position (H0b.58 and H0b.60)
PE [range: -238 to (238-1)]: absolute position fed back by the encoder
PO: position offset in the absolute position linear mode (H05.46 and H05.48)

If the electronic gear ratio is B/A, then the following formula applies: H0b.07 (Absolute position counter) = PM/(B/A) H0b.07 indicates present mechanical absolute position (in reference unit).

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. You can hide E735.0 by setting H0A.36 (encoder multi-turn overflow fault) to 1 (hide).

## Absolute position rotation mode

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.50 | 2005-33h | Mechanical gear ratio in absolute position rotation mode (numerator) | 1 to 65535 | 1 | - | At stop | "H05_en.50" on page 433 |
| H05.51 | 2005-34h | Mechanical gear ratio in absolute position rotation mode (denominator) | 1 to 65535 | 1 | - | At stop | "H05_en.51" on page 433 |
| H05.52 | 2005-35h | Pulses per revolution of the load in absolute position rotation mode (low 32 bits) | 0 to 2147483647 | 0 | Encoder unit | At stop | "H05_en.52" on page 434 |
| H05.54 | 2005-37h | Pulses per revolution of the load in absolute position rotation mode (high 32 bits) | 0 to 127 | 0 | Encoder unit | At stop | "H05_en.54" on page 434 |
| H0b.58 | 200b-3Bh | Mechanical absolute position (low 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.58" on page 497 |
| H0b.60 | 200b-3Dh | Mechanical absolute position (high 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.60" on page 497 |
| H0b.77 | 200b-4Eh | Absolute position fed back by the absolute encoder (low 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.77" on page 499 |
| H0b.79 | 200b-50h | Absolute position fed back by the absolute encoder (high 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.79" on page 499 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0b.81 | 200b-52h | Load position within one turn in absolute position rotation mode (low 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.81" on page 500 |
| H0b.83 | 200b-54h | Load position within one turn in absolute position rotation mode (high 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.83" on page 500 |
| H0b.85 | 200b-56h | Load position within one turn in absolute position rotation mode | -2147483647 to 2147483647 | 0 | Reference unit | Unchangeable | "H0b_en.85" on page 500 |

This mode applies in cases where the load travel range is unlimited and the number of unidirectional revolutions is lower than 32767 upon power failure, as shown in the following figure.

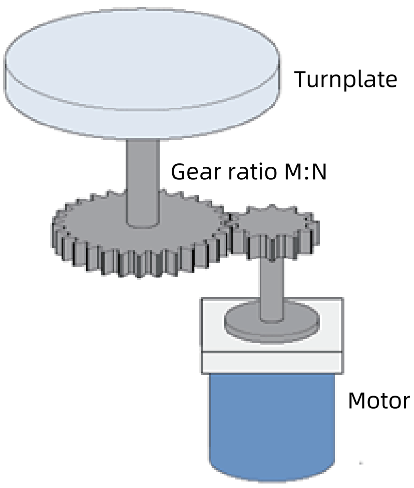



Figure 13-82 Rotating load

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. When the encoder resolution ($R_E$) is 223, and the encoder pulses per load revolution is represented by RM, the following formula applies: If H05.52 or H05.54 ≠ 0: $R_M$ = H05.54 x 232+ H05.52 if H05.52 and H05.54 = 0: $R_M$ = $R_E$

If the electronic gear ratio is B/ A, then the following formula applies: H0b.07 (absolute position counter) = RM/ (B ÷ A).

The following figure shows the relation between the single-turn position of the rotating load and the position of the rotary platen.

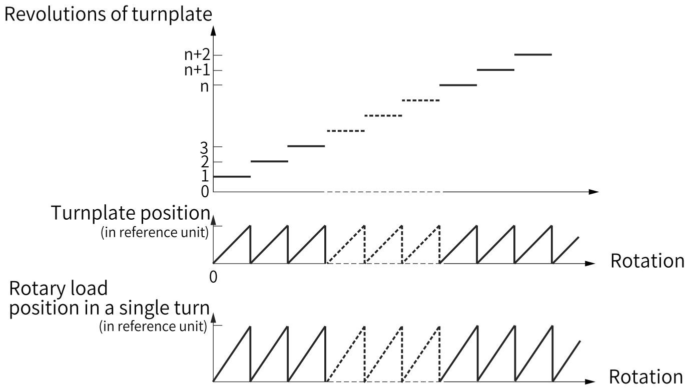



Figure 13-83 Relation between the single-turn position of the rotating load and the position of the rotating platform

The following figure shows the relation between the position fed back by the encoder and the single-turn position of the rotating load.

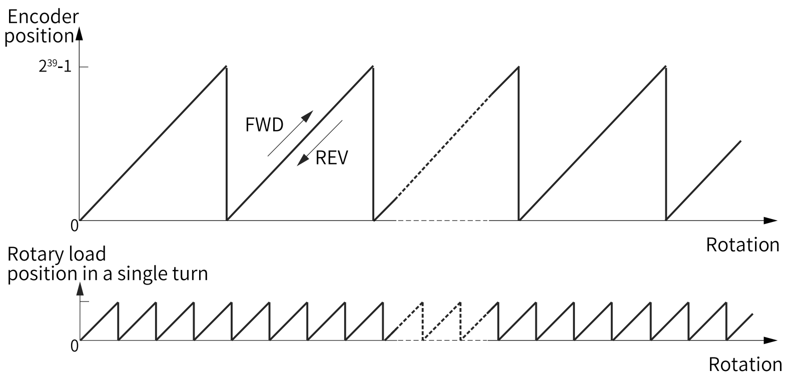



Figure 13-84 Relation between encoder feedback position and the single-turn position of the rotating load

The multi-turn data range is unlimited in the absolute position rotation mode. Therefore, E735.0 (encoder multi-turn counting overflow) is inactive.

## Encoder feedback data

The encoder feedback data is divided into the number of revolutions and the single-turn position. For the incremental position mode, the number of revolutions is not recorded.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0b.70 | 200b-47h | Number of revolutions recorded in the absolute encoder | 0Rev–65535Rev | 0 | Rev | Unchangeable | "H0b_en.70" on page 498 |
| H0b.71 | 200b-48h | Single-turn position fed back by the absolute encoder | 0 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.71" on page 498 |

## Encoder multi-turn overflow fault

In the absolute position linear mode, you can hide the encoder multi-turn overflow fault by setting H0A.36.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0A.36 | 200A-25h | Encoder multi-turn overflow fault | 0: Not hide<br>1: Hide | 0 | - | At stop | “ H0A_en.36” on page 484 |

## Absolute encoder reset

You can reset the encoder error or the multi-turn data fed back by the encoder by setting H0d.20.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0d.20 | 200d-15h | Multi-turn absolute encoder reset | 0: No operation<br>1: Reset<br>2: Reset the fault and multi-turn data | 0 | - | At stop | “ H0d_en.20” on page 509 |

### *Note*

The absolute position recorded by the encoder changes abruptly after multi-turn data reset. In this case, perform mechanical homing.

## 13.5.3 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 warning) occurs. In this case, replace the battery according to the following steps.

1. Power on the servo drive and make it stay in the non-operational state.
2. Replace the battery.
3. After the servo drive resets E730.0 automatically. If no other warning occurs, continue to operate the servo drive.

### *Note*

- If you replace the battery after powering off the servo drive, E731.0 (Encoder battery failure) will 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.
- Keep the battery in environments within the required ambient temperature range and ensure the battery is in reliable contact and carries sufficient power capacity. Otherwise, encoder data loss may occur.

# 13.6 Auxiliary Functions

The drive offers the following auxiliary functions to ensure a proper operation of the servo system.

## 13.6.1 Software position limit

Hardware position limit is implemented by inputting external sensor signals to CN1 of the servo drive.

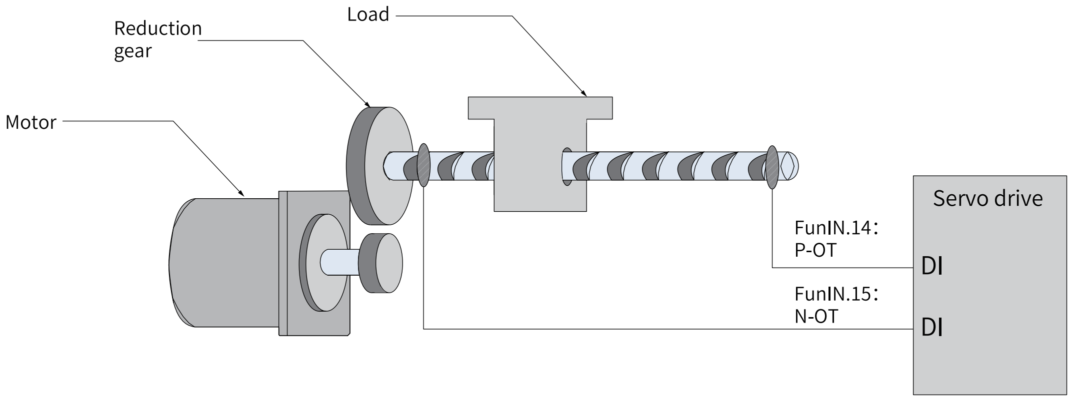



Figure 13-85 Installation of limit switches

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.

Table 13–29 Comparison between the hardware position limit and software position limit

| Hardware Position Limit | | Software position limit | |
|---|---|---|---|
| 1 | Restricted to linear motion and single-turn rotational motion. | 1 | Applicable to both the linear motion and the rotational motion. |
| 2 | Requires an external mechanical limit switch. | 2 | Removes the need for hardware wiring, preventing malfunction due to poor cable contact. |
| 3 | Suffered from the risk of mechanical slip. | 3 | Prevents malfunction due to mechanical slip through internal position comparison. |
| 4 | Unable to sense or detect an overtravel fault after power-off. | | |

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0A.40 | 200A-29h | Software limit selection | 0: No operation<br>1: Activated immediately<br>2: Activated after homing is done | 0 | - | At stop | "H0A_en.40" on page 485 |
| H0A.41 | 200A-2Ah | Forward position of software limit | -2147483648 to 2147483647 | 2147483647 | - | At stop | "H0A_en.41" on page 485 |
| H0A.43 | 200A-2Ch | Reverse position of software limit | -2147483648 to 2147483647 | -2147483648 | - | At stop | "H0A_en.43" on page 485 |

- 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 positive limit. When the absolute position counter (H0b.07) is smaller than H0A.43, the servo drive reports E952.0 (Reverse limit switch warning) and executes stop at negative 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.

## 13.6.2 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.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0d.00 | 200d-01h | Software Reset | 0: No operation<br>1: Enable | 0 | - | At stop | "H0d_en.00" on page 506 |

## 13.6.3 Motor protection

### Motor overload protection

The motor generates heat continuously due to thermal effect of the current after power-on. 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.

You can also hide motor overload detection (H0A.26 = 1) when you are sure that the motor will not be damaged due to overtemperature.

**Caution**

Take caution when hiding motor overload detection as such operation may damage the motor.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0A.04 | 200A-05h | Motor overload protection gain | 50% to 300% | 100 | % | At stop | "H0A_en.04" on page 479 |
| H0A.26 | 200A-1Bh | Motor overload detection | 0: Show motor overload warning (E909.0) and fault (E620.0)<br>1: Hide motor overload warning (E909.0) and fault (E620.0)<br>2: No meaning<br>3: Enabled for new motors | 3 | - | At stop | "H0A_en.26" on page 482 |

## Locked rotor over-temperature protection

When the motor is stalled, the motor speed is nearly 0 RPM while the current is large. In this case, the motor is overheated significantly. The motor is capable of operating upon stall in an allowable period of time, exceeding of which can damage the motor due to overtemperature. 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).

**Caution**

Take caution when disabling motor stall over-temperature protection as such operation may damage the motor.

Use a dedicated motor for the servo drive. Failure to comply will result in the risk of short circuit due to insulation deterioration.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0A.32 | 200A-21h | Time threshold for locked motor overheat protection | 10ms to 65535ms | 200 | ms | Real-time | " H0A_en.32" on page 483 |
| H0A.33 | 200A-22h | Locked motor overheat protection | 0: Disabled<br>1: Enable<br>2: Enabled for new over-temperature | 1 | - | Real-time | " H0A_en.33" on page 483 |

### Motor overspeed protection

An excessively high speed may damage 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.

$$\text{Overspeed threshold} = \begin{cases} \text{Max. motor speed x 1.2} & \text{H0A.08 = 0 or H0A.08 > Max. motor speed x 1.2} \\ \text{H0A.08} & \text{H0A.08} \neq 0 \text{ and H0A.08 < Max. motor speed x 1.2} \end{cases}$$

**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.

☆ Related parameters:

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H0A.08 | 200A-09h | Overspeed threshold | 0 rpm to 10000 rpm | 0 | RPM | Real-time | " H0A_en.08" on page 479 |
| H0A.12 | 200A-0Dh | Runaway protection enable | 0: Disabled<br>1: Enabled | 1 | - | Real-time | " H0A_en.12" on page 480 |

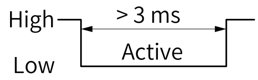
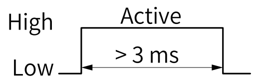
Besides runaway protection, the drive also allows you to set the speed limit in the speed/torque control mode to protect the motor and the machine.

## 13.6.4 DI Filter Time Setting

The servo drive provides seven DIs, in which DI1 to DI5 are normal low-speed DIs, and DI8 and DI9 are high-speed DIs.

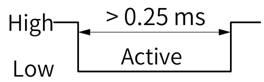
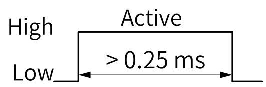
The following table describes the signal logic of low-speed DI terminals.

Table 13–30 Signal logic of low-speed DI terminals

| Value | DI Logic Upon Active DI Function | Remarks |
| --- | --- | --- |
| 0 | Low level |   |
| 1 | High level |   |

The following table describes the signal logic of high-speed DI terminals.

Table 13–31 Signal logic of high-speed DI terminals

| Value | DI Logic Upon Active DI Function | Remarks |
| --- | --- | --- |
| 0 | Low level |   |
| 1 | High level |   |

# 14 Communication

## 14.1 Modbus通信

### 14.1.1 Overview

The Modbus protocol is a common language applied to electronic controllers. Based on this protocol, controllers can communicate with each other and with other devices. This protocol has become a general industry standard. This communication protocol enables control devices produced by different manufacturers to be connected into an industrial network for centralized monitoring.

### 14.1.2 Hardware Configuration

#### Terminal Layout

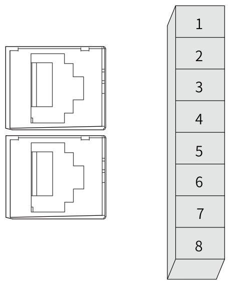



Figure 14-1 Communication Terminal pin layout of the servo drive

Table 14–1 Description of communication terminal pins

| Pin No. | Description | Description |
|---|---|---|
| 1 | CANH | CAN communication port |
| 2 | CANL | |
| 3 | CGND | CAN communication ground |
| 4 | RS485+ | RS485 communication port |
| 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 | Ground |
| Enclosure | PE | Shield |

## Terminal descriptions

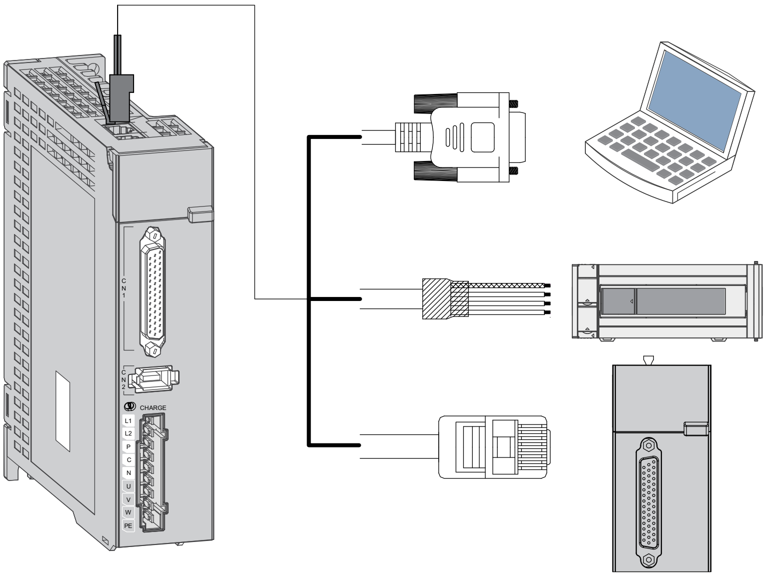


Figure 14-2 Wiring of communication cables

CN3 and CN4 are identical communication terminals connected in parallel internally.

CN3 and CN4 in the drive are used for communication with the PC, PLC, and other drives. For pin assignment of CN3/CN4, see *"Figure 14–1 Communication Terminal pin layout of the servo drive" on page 364*.

## RS485 communication with PLC

The following figure shows the cable used for 485 communication between the servo drive and PLC.


Figure 14-3 Outline drawing of cable used for CAN communication between the servo drive and PLC

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 circuit) respectively. Connect RS485+ and RS485- with two conductors twisted together and connect the remaining conductor to the RS485 reference ground (GND). Connect the shield to the device ground (PE). Connect a 120Ω termination resistor on each end of the bus to prevent RS485 signal reflection.

Table 14–2 Pin connection relation of the cable used for CAN communication between the servo drive and PLC

| RJ45 on the Drive Side (A) | | | PLC Side (B) | | |
|---|---|---|---|---|---|
| Communication Type | Pin No. | Description | Communication Type | Pin No. | Description |
| RS485 | 4 | 485+ | RS485 | 4 | 485+ |
| | 5 | 485- | | 5 | 485- |
| | 8 | GND | | 8 | GND |
| - | Enclosure | PE (shield layer) | - | Enclosure | PE (shield layer) |

## Wiring of multi-drive RS485 communication

The following figure shows the cable used for multi-drive RS485 communication.

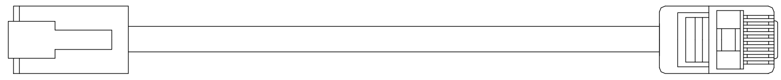



Figure 14-4 Outline drawing of the cable used for multi-drive RS485 communication

Table 14–3 Pin connection relation of the cable used for multi-drive RS485 communication (pins in 485 group used only)

| RJ45 on the Drive Side (A) | | | RJ45 on the Drive Side (B) | | |
|---|---|---|---|---|---|
| Communication Type | Pin No. | Description | Communication Type | Pin No. | Description |
| RS485 | 4 | 485+ | RS485 | 4 | 485+ |
| | 5 | 485- | | 5 | 485- |
| | 8 | GND | | 8 | GND |
| - | Enclosure | PE (shield layer) | - | Enclosure | PE (shield layer) |

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

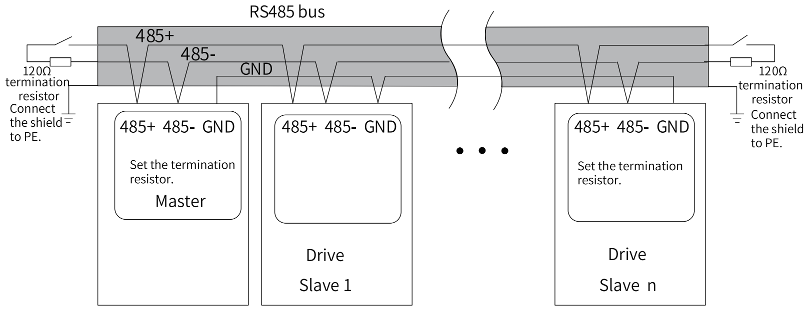



Figure 14-5 RS485 bus topology

Caution

Do not connect ⏚ (GND) terminal to the CGND terminal of the drive. Failure to comply may damage the machine.

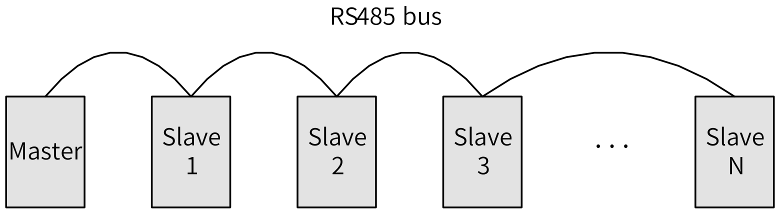



Figure 14-6 Daisy chain mode

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

Table 14–4 Transmission distance and number of nodes

| No. | Transmission Rate (kbps) | Transmission Distance (m) | Number of Nodes | Cross Sectional Area |
|---|---|---|---|---|
| 1 | 115.2 | 100 | 128 | AWG26 |
| 2 | 19.2 | 1000 | 128 | AWG26 |

## RS232 communication with PC

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.

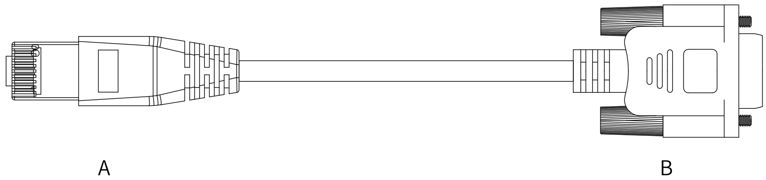


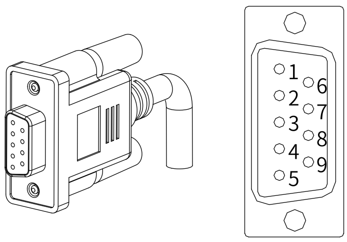

Figure 14-7 Outline drawing of the PC communication cable

Table 14–5 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 layer) | Enclosure | PE (shield layer) | Enclosure |

Pin assignment of DB9 terminal on the PC side is shown in the following table.

Table 14–6 Pin definition of DB9 terminal on the PC side ("B" in the preceding figure)

| Pin No. | Description | Description | Terminal Pin Layout |
|---|---|---|---|
| 2 | PC-RXD | PC receiving end |   |
| 3 | PC-TXD | PC transmitting end | |
| 5 | GND | Ground | |
| Enclosure | PE | Shield | |

If the host controller supports USB interface only, use the serial-to-USB cable.

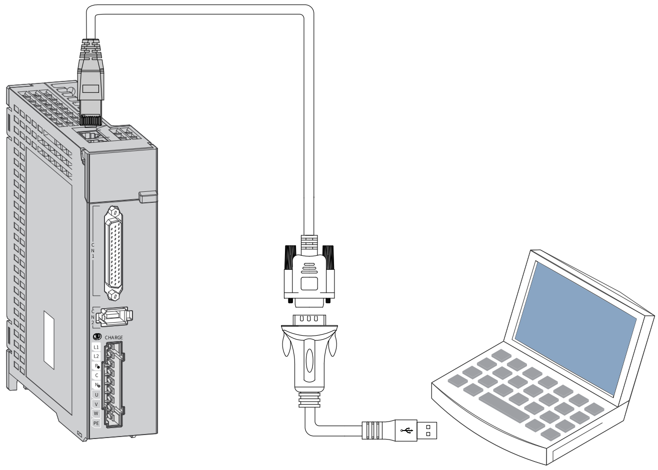


Figure 14-8 Outline drawing of the PC communication cable

Recommendations: Manufacture: Z-TEK Model: ZE551A, equipped with a 0.8 m USB extension cable
Chip model: FT232

## 14.1.3 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 |
|---|---|
| Read 16-bit/32-bit parameters | 0x03 |
| Write 16-bit parameters | 0x06 |
| Write 32-bit parameters | 0x10 |

### Command code for reading parameter: 0x03

In 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 larger than 3.5-character idle time, indicating the start of a frame |
| ADDR | Servo axis address: 1 to 247<br>**Note: 1 to 247 are decimal values which need to be converted into hexadecimal equivalents.** |
| CMD | Command code: 0x03 |
| DATA[0] | Register start address (eight high bits): parameter group number of the start register<br>Take H06.11 as an example, "06" is the group number, which means DATA[0] = 0x06.<br>**Note: In this example, "06" is a hexadecimal value that needs no conversion.** |

| Value | Description |
|---|---|
| DATA[1] | Register start address (eight low bits): offset within the parameter group of the start register<br>Take H06.11 as an example, "11" is the offset within the parameter group. That is, DATA [1] = 0x0B.<br>**Note: In this example, ''11" is a decimal value that needs to be converted into the hexadecimal equivalent 0x0B.** |
| DATA[2] | Read the eight high bits N (H) of the number of parameters (hexadecimal) |
| DATA[3] | Read the eight low bits N (L) of the number of parameters (hexadecimal) |
| CRCL | CRC valid byte (low 8 bits). |
| CRCH | CRC valid byte (high 8 bits). |
| END | Equal to or larger than 3.5-character idle time, indicating the end of a frame |

Response frame format:

| Value | Description |
|---|---|
| START | Equal to or larger than 3.5-character idle time, indicating the start of a frame |
| ADDR | Servo axis address, hexadecimal |
| CMD | Command code: 0x03 |
| DATALENGTH | Number of parameter bytes, equal to reading the number of parameters N x 2 |
| DATA[0] | Parameter data in the first register (eight high bits) |
| DATA[1] | Parameter data in the first register (eight low bits) |
| DATA[…] | … |
| DATA[N*2-2] | Parameter data in the Nth register (eight high bits) |
| DATA[N*2-1] | Parameter data in the Nth register (eight low bits) |
| CRCL | CRC valid byte (low 8 bits). |
| CRCH | CRC valid byte (high 8 bits). |
| END | Equal to or larger than 3.5-character idle time, indicating the end of a frame |

In Modbus RTU protocol, command code 0x06 is used to write 16-bit parameters. Command code for writing 32-bit parameters: 0x10

**Communication example**

- To read data with a length of two words by taking H02.02 as the start register in the drive whose servo axis address is 01:

  Master request frame

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 01 | 03 | 02 | 02 | 00 | 02 | CRCL | CRCH |

  Slave response frame:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 01 | 03 | 04 | 00 | 01 | 00 | 00 | CRCL | CRCH |

  The response frame indicates the slave returns data with a length of two words (four bytes), the content of which is 0x0001 and 0x0000.

  If the slave response frame is as follows:

| | | | | |
|---|---|---|---|---|
| 01 | 83 | 02 | CRCL | CRCH |

  This response frame indicates a communication error occurs and the error code is 0x02. (0x83 indicates an error.)

- To read H05.07 (32-bit) in the drive whose servo axis address is 01:

Master request frame

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 01 | 03 | 05 | 07 | 00 | 02 | CRCL | CRCH |

Slave response frame:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 01 | 03 | 04 | 00 | 01 | 00 | 00 | CRCL | CRCH |

The preceding response frame indicates the value of H05.07 is 0x00000001.

## Command code for writing 16-bit parameters: 0x06

Caution

Do not write 32-bit parameters with the command code 0x06. Failure to comply can result in unexpected error.

Request frame format:

| Value | Description |
|---|---|
| START | Equal to or larger than 3.5-character idle time, indicating the start of a frame |
| ADDR | Servo axis address 1 to 247<br>**Note: 1 to 247 are decimal values which need to be converted into hexadecimal equivalents.** |
| CMD | Command code: 0x06 |
| DATA[0] | Register start address (eight high bits): parameter group number of the start register<br>Take H06.11 as an example, "06" is the group number, which means DATA[0] = 0x06.<br>**Note: In this example, "06" is a hexadecimal value that needs no conversion.** |
| DATA[1] | Register start address (eight low bits): offset within the parameter group of the start register<br>Take H06.11 as an example, "11" is the offset within the parameter group, which means DATA[1] = 0x0B.<br>**Note: In this example, ''11" is a decimal value that needs to be converted into the hexadecimal equivalent 0x0B.** |
| DATA[2] | Write the 8 high bits of register data (hexadecimal) |
| DATA[3] | Write the 8 low bits of register data (hexadecimal) |
| CRCL | CRC valid byte (low 8 bits). |
| CRCH | CRC valid byte (high 8 bits). |
| END | Equal to or larger than 3.5-character idle time, indicating the end of a frame |

Response frame format:

| Value | Description |
|---|---|
| START | Equal to or larger than 3.5-character idle time, indicating the start of a frame |
| ADDR | Servo axis address, hexadecimal |
| CMD | Command code: 0x06 |
| DATA[0] | Register start address (eight high bits): parameter group number of the start register<br>Take H06.11 as an example, "06" is the group number, which means DATA[0] = 0x06.<br>**Note: In this example, "06" is a hexadecimal value that needs no conversion.** |

| Value | Description |
|---|---|
| DATA[1] | Register start address (eight low bits): offset within the parameter group of the start register<br>Take H06.11 as an example, "11" is the offset within the parameter group, which means DATA[1] = 0x0B.<br>**Note: In this example, ''11" is a decimal value that needs to be converted into the hexadecimal equivalent 0x0B.** |
| DATA[2] | Write the 8 high bits of register data (hexadecimal) |
| DATA[3] | Write the 8 low bits of register data (hexadecimal) |
| CRCL | CRC valid byte (low 8 bits). |
| CRCH | CRC valid byte (high 8 bits). |
| END | Equal to or larger than 3.5-character idle time, indicating the end of a frame |

**Communication example**

To write data 0x0001 to H02.02 in the drive whose servo axis address is 01:

Master request frame

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 01 | 06 | 02 | 02 | 00 | 01 | CRCL | CRCH |

Slave response frame:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 01 | 06 | 02 | 02 | 00 | 01 | CRCL | CRCH |

This response frame indicates 0x0001 has been written to H02.02 in the drive whose servo axis address is 01.

If the slave response frame is as follows:

| | | | | |
|---|---|---|---|---|
| 01 | 86 | 02 | CRCL | CRCH |

This response frame indicates a communication error occurs and the error code is 0x02. (0x86 indicates an error.)

## Command code for writing 32-bit parameters: 0x10

Caution

Do not write 16-bit parameters with the command code 0x10. Failure to comply can result in unexpected error.

Request frame format:

| Value | Description |
|---|---|
| START | Equal to or larger than 3.5-character idle time, indicating the start of a frame |
| ADDR | Servo axis address 1 to 247<br>**Note: 1 to 247 are decimal values which need to be converted into hexadecimal equivalents.** |
| CMD | Command code: 0x10 |

| Value | Description |
|---|---|
| DATA[0] | Register start address (eight high bits): parameter group number of the start register<br>Take H11.12 as an example, "11" is the group number, which means DATA[0] = 0x11.<br>**Note: In this example, "11" is a hexadecimal value that needs no conversion.** |
| DATA[1] | Register start address (eight low bits): offset within the parameter group of the start register<br>Take H11.12 as an example, "12" is the offset within the parameter group, which means DATA[1] = 0x0C.<br>**Note: In this example, ''12" is a decimal value that needs to be converted into the hexadecimal equivalent 0x0C.** |
| DATA[2] | Write the eight high bits M (H) of the number of parameters (hexadecimal)<br>Take H05.07 as an example, DATA[2] is 00, DATA[3] is 02, and M is H0002.<br>**For 32-bit parameters, each parameter is calculated as two words.** |
| DATA[3] | Write the eight low bits M (L) of the number of parameters (hexadecimal) |
| DATA[4] | Write the number of bytes (M x 2) corresponding to the register data<br>Take H05.07 as an example, DATA[4] is H04. |
| DATA[5] | Write the eight high bits of the start register data (hexadecimal) |
| DATA[6] | Write the eight low bits of the start register data (hexadecimal) |
| DATA[7] | Write the eight high bits of the start register address +1 (hexadecimal) |
| DATA[8] | Write the eight low bits of the start register address +1 (hexadecimal) |
| CRCL | CRC valid byte (low 8 bits). |
| CRCH | CRC valid byte (high 8 bits). |
| END | Equal to or larger than 3.5-character idle time, indicating the end of a frame |

Response frame format:

| Value | Description |
|---|---|
| START | Equal to or larger than 3.5-character idle time, indicating the start of a frame |
| ADDR | Servo axis address, hexadecimal |
| CMD | Command code: 0x10 |
| DATA[0] | Register start address (eight high bits): offset within the parameter group of the start register<br>Take H11.12 as an example, DATA[0] = 0x11. |
| DATA[1] | Register start address (eight low bits): offset within the parameter group of the start register<br>Take H11.12 as an example, DATA[1] = 0x0C. |
| DATA[2] | Write the eight high bits M (H) of the number of parameters (hexadecimal) |
| DATA[3] | Write the eight low bits M (L) of the number of parameters (hexadecimal) |
| CRCL | CRC valid byte (low 8 bits). |
| CRCH | CRC valid byte (high 8 bits). |
| END | Equal to or larger than 3.5-character idle time, indicating the end of a frame |

## Error response frame

Error frame response format:

| Value | |
|---|---|
| START | Equal to or larger than 3.5-character idle time, indicating the start of a frame |
| ADDR | Servo axis address, 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 larger than 3.5-character idle time, indicating the end of a frame |

Error code:

| Error code | Description |
|---|---|
| 0x0001 | Invalid command code |
| 0x0002 | Illegal data address |
| 0x0003 | Illegal data |
| 0x0004 | Slave device fault |

## 32-bit parameter addressing

When 32-bit parameters are read/written through Modbus commands, the communication address is determined by the address of the parameter with lower offset number. Two offset numbers are operated in one operation.

### *Note*

In the following examples, the servo axis address is 01 by default.

- The Modbus command for reading H11.12 (Displacement 1) 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 |

- When H0C.26 is set to 0 (High 16 bits before low 16 bits), the response frame is as follows.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 01 | 03 | 04 | 40 | 00 | 00 | 00 | CRCL | CRCH |

- For example, the Modbus command for writing 0x12345678 to H11.12 (Displacement 1) is as follows.

- 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 |

- For example, to write 0x00100000 (decimal: 1048576) to the 32-bit parameter H05-07:
When H0C.26 is set to 0 (High 16 bits before low 16 bits), the response frame is as follows.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 10 | 05 | 07 | 00 | 02 | 04 | 00 | 00 | 00 | 10 | CRCL | CRCH |

## CRC check

The host controller and the drive must use the same CRC algorithm during communication. Otherwise, a CRC error can occur. The SV630P series servo drive adopts 16-bit CRC with low bytes before high bytes. The polynomial used for CRC 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);
}
```

### 14.1.4 Communication Parameters

| Parameter | Default Value | Description | Remarks |
|---|---|---|---|
| H0C.00 | 1 | Drive axis address | - |
| H0C.02 | 5 | Serial baud rate | 5: 57600bps |
| H0C.03 | 3 | Modbus communication data format | 0: No check, 2 stop bits |
| H0C.26 | 1 | Modbus communication data sequence | 0: High bits before low bits<br>1: Low bits before high bits |

# 15 Description of Parameters

## 15.1 H00 Servo Motor Parameters

**H00.00** **Motor SN**

| | | | |
|---|---|---|---|
| Hex: | 2000-01h | Effective mode: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 14101 | Change: | At stop |

**Value Range:**

0 to 65535

**Description**

14000: Inovance 20-bit incremental encoder motor

14101: Inovance 18-bit absolute encoder motor

**H00.02** **Customized No.**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-03h | Effective Time: | - |
| Min.: | 0.00 | Unit: | - |
| Max.: | 42949672.95 | Data Type: | UInt32 |
| Default: | 0.00 | Change: | Unchangeable |

**Value Range:**

0.00 to 42949672.95

**Description**

Differentiates the customized MCU software version, which is not applicable to standard models.

**H00.04** **Encoder version**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-05h | Effective Time: | - |
| Min.: | 0.0 | Unit: | - |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**

0.0 to 6553.5

**Description**

Saved in the encoder and used to differentiate the encoder software version.

**H00.05** **Serial-type motor code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-06h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

0 to 65535

**Description**

Displays the code of the serial-type motor, which is determined by the motor model and unchangeable.

**H00.06** **FPGA customized SN**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-07h | Effective Time: | - |
| Min.: | 0.00 | Unit: | - |

| | | | |
|---|---|---|---|
| Max.: | 10485.75 | Data Type: | UInt32 |
| Default: | 0.00 | Change: | Unchangeable |

**Value Range:**

0.00 to 10485.75

**Description**

Differentiates the customized FPGA software version, which is not applicable to standard models.

**H00.08** **Serial encoder type**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-09h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 to 65535

**Description**

14100: Multi-turn absolute encoder

Others: Single-turn absolute encoder

**H00.09** **Rated voltage**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-0Ah | Effective Time: | - |
| Min.: | 0 | Unit: | V |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: 220 V

1: 380 V

**Description**

0: 220 V

1: 380 V

**H00.10** **Rated power**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-0Bh | Effective Time: | - |
| Min.: | 0.01 | Unit: | kW |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.01 | Change: | At stop |

**Value Range:**

0.01 kW–655.35 kW

**Description**

-

**H00.11** **Rated current**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-0Ch | Effective Time: | - |
| Min.: | 0.01 | Unit: | A |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.01 | Change: | At stop |

**Value Range:**

0.01 A to 655.35 A

**Description**

-

**H00.12** **Rated torque**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-0Dh | Effective Time: | - |
| Min.: | 0.10 | Unit: | N·m |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.10 | Change: | At stop |

**Value Range:**
0.10N·m–655.35N·m
**Description**
-

**H00.13** **Max. torque**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-0Eh | Effective Time: | - |
| Min.: | 0.10 | Unit: | N·m |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.10 | Change: | At stop |

**Value Range:**
0.10N·m–655.35N·m
**Description**
-

**H00.14** **Rated speed**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-0Fh | Effective Time: | - |
| Min.: | 100 | Unit: | rpm |
| Max.: | 9000 | Data Type: | UInt16 |
| Default: | 100 | Change: | At stop |

**Value Range:**
100rpm–9000rpm
**Description**
-

**H00.15** **Maximum speed**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-10h | Effective Time: | - |
| Min.: | 100 | Unit: | rpm |
| Max.: | 9000 | Data Type: | UInt16 |
| Default: | 100 | Change: | At stop |

**Value Range:**
100rpm–9000rpm
**Description**
-

**H00.16** **Moment of inertia Jm**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-11h | Effective Time: | - |
| Min.: | 0.01 | Unit: | $kgcm^2$ |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.01 | Change: | At stop |

**Value Range:**
0.01 $kgcm^2$–655.35 $kgcm^2$
**Description**
-

**H00.17** **Number of PMSM pole pairs**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-12h | Effective Time: | - |

Min.: 2 | Unit: -
Max.: 360 | Data Type: UInt16
Default: 2 | Change: At stop

**Value Range:**
2 to 360

**Description**
-

**H00.18** **Stator resistance**

Hexadecimal: 2000-13h | Effective Time: -
Min.: 0.001 | Unit: Ω
Max.: 65.535 | Data Type: UInt16
Default: 0.001 | Change: At stop

**Value Range:**
0.001 Ω to 65.535 Ω

**Description**
-

**H00.19** **Stator inductance Lq**

Hexadecimal: 2000-14h | Effective Time: -
Min.: 0.01 | Unit: mH
Max.: 655.35 | Data Type: UInt16
Default: 0.01 | Change: At stop

**Value Range:**
0.01mH–655.35mH

**Description**
-

**H00.20** **Stator inductance Ld**

Hexadecimal: 2000-15h | Effective Time: -
Min.: 0.01 | Unit: mH
Max.: 655.35 | Data Type: UInt16
Default: 0.01 | Change: At stop

**Value Range:**
0.01mH–655.35mH

**Description**
-

**H00.21** **Linear back EMF coefficient**

Hexadecimal: 2000-16h | Effective Time: -
Min.: 0.01 | Unit: mV/rpm
Max.: 655.35 | Data Type: UInt16
Default: 0.01 | Change: At stop

**Value Range:**
0.01 mV/rpm to 655.35 mV/rpm

**Description**
-

**H00.22** **Torque coefficient Kt**

Hexadecimal: 2000-17h | Effective Time: -
Min.: 0.01 | Unit: N·m/Arms
Max.: 655.35 | Data Type: UInt16

| | | | |
|---|---|---|---|
| Default: | 0.01 | Change: | At stop |

**Value Range:**
0.01 N·m/Arms to 655.35 N·m/Arms
**Description**
-

### H00.23 Electrical constant Te

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-18h | Effective Time: | - |
| Min.: | 0.01 | Unit: | ms |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.01 | Change: | At stop |

**Value Range:**
0.01 ms to 655.35 ms
**Description**
-

### H00.24 Mechanical constant Tm

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-19h | Effective Time: | - |
| Min.: | 0.01 | Unit: | ms |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.01 | Change: | At stop |

**Value Range:**
0.01 ms to 655.35 ms
**Description**
-

### H00.27 Sine/Cosine number of serial encoder motor

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-1Ch | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**
0 to 65535
**Description**
-

### H00.28 Absolute encoder position offset

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-1Dh | Effective Time: | - |
| Min.: | 0 | Unit: | PPR |
| Max.: | 1073741824 | Data Type: | UInt32 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0P/Rev–1073741824P/Rev
**Description**
Saves the values obtained from angle auto-tuning.

### H00.30 Encoder selection (Hex)

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-1Fh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 19 | Change: | At stop |

**Value Range:**

0: Regular 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: Optical scale

**Description**

00: Regular 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: Optical scale

### H00.31 Encoder PPR

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-20h | Effective Time: | - |
| Min.: | 1 | Unit: | PPR |
| Max.: | 1073741824 | Data Type: | UInt32 |
| Default: | 8388608 | Change: | At stop |

**Value Range:**

1P/Rev–1073741824P/Rev

**Description**

Defines the number of pulses fed back by the encoder per motor revolution.

### H00.35 Motor code saved in the serial encoder

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-24h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0 to 65535

**Description**

-

### H00.37 Encoder function setting bit

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-26h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 255 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

0 to 255

**Description**

-

### H00.43 Maximum Current

| | | | |
|---|---|---|---|
| Hexadecimal: | 2000-2Ch | Effective Time: | Upon the next power-on |
| Min.: | 0.00 | Unit: | A |
| Max.: | 655.35 | Data Type: | UInt16 |

| | | | |
|---|---|---|---|
| Default: | 16.95 | Change: | At stop |

**Value Range:**
0.00 A to 655.35 A
**Description**
-

## 15.2 H01 Servo Drive Parameters

**H01.00** **MCU software version**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-01h | Effective Time: | - |
| Min.: | 0.0 | Unit: | - |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**
0.0 to 6553.5
**Description**
Displays MCU software version (with one decimal place).

**H01.01** **FPGA software version**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-02h | Effective Time: | - |
| Min.: | 0.0 | Unit: | - |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**
0.0 to 6553.5
**Description**
Displays the FPGA software version, with 1 decimal place.

**H01.02** **Servo Drive Model**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-03h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

**H01.04** **Voltage class**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-05h | Effective Time: | - |
| Min.: | 0 | Unit: | V |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 220 | Change: | Immediately |

**Value Range:**
0 V to 65535 V
**Description**
-

**H01.05** **Rated power**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-06h | Effective Time: | - |

| | | | |
|---|---|---|---|
| Min.: | 0.01 | Unit: | kW |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 75.00 | Change: | Immediately |

**Value Range:**
0.01 kW–655.35 kW
**Description**
-

### H01.06 Max. output power

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-07h | Effective Time: | - |
| Min.: | 0.01 | Unit: | kW |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 75.00 | Change: | Immediately |

**Value Range:**
0.01 kW–655.35 kW
**Description**
Displays the maximum output power of the drive, with 2 decimal places.

### H01.07 Rated output current

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-08h | Effective Time: | - |
| Min.: | 0.01 | Unit: | A |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 5.50 | Change: | Immediately |

**Value Range:**
0.01 A to 655.35 A
**Description**
Displays the rated output current of the drive, with 2 decimal places.

### H01.08 Max. output current

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-09h | Effective Time: | - |
| Min.: | 0.01 | Unit: | A |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 16.90 | Change: | Immediately |

**Value Range:**
0.01 A to 655.35 A
**Description**
Displays the maximum output current of the drive, with 2 decimal places.

### H01.10 Carrier frequency

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-0Bh | Effective Time: | - |
| Min.: | 4000 | Unit: | - |
| Max.: | 20000 | Data Type: | UInt16 |
| Default: | 8000 | Change: | Immediately |

**Value Range:**
4000 to 20000
**Description**
Displays the carrier frequency, with no decimal place.

### H01.11 Current loop modulation frequency

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-0Ch | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |

Default: 1 Change: At stop

**Value Range:**

0: Carrier frequency

1: 2 × carrier frequency

**Description**

-

**H01.12** **Speed loop scheduling frequency-division coefficient**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-0Dh | Effective Time: | - |
| Min.: | 1 | Unit: | - |
| Max.: | 32 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value 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

**Description**

-

**H01.13** **Position loop scheduling frequency-division coefficient**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-0Eh | Effective Time: | - |
| Min.: | 2 | Unit: | - |
| Max.: | 128 | Data Type: | UInt16 |
| Default: | 4 | Change: | Immediately |

**Value 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

**Description**

-

**H01.14** **Dead zone time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-0Fh | Effective Time: | - |
| Min.: | 0.01 | Unit: | us |
| Max.: | 20.00 | Data Type: | UInt16 |
| Default: | 2.00 | Change: | Immediately |

**Value Range:**

0.01us–20.00us

**Description**

Displays the dead zone time, with two decimal places.

**H01.15** **DC bus overvoltage protection threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-10h | Effective Time: | - |

| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | V |
| Max.: | 2000 | Data Type: | UInt16 |
| Default: | 420 | Change: | Immediately |

**Value Range:**
0 V to 2000 V
**Description**
Displays DC bus overvoltage protection threshold, with 0 decimal place.

**H01.16** **DC bus voltage discharge threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-11h | Effective Time: | - |
| Min.: | 0 | Unit: | V |
| Max.: | 2000 | Data Type: | UInt16 |
| Default: | 380 | Change: | Immediately |

**Value Range:**
0 V to 2000 V
**Description**
Display DC bus voltage discharge threshold, with no decimal place.

**H01.17** **DC bus undervoltage threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-12h | Effective Time: | - |
| Min.: | 0 | Unit: | V |
| Max.: | 2000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**
0 V to 2000 V
**Description**
Displays DC bus undervoltage threshold, with no decimal place.

**H01.18** **Servo drive overcurrent protection threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-13h | Effective Time: | - |
| Min.: | 10 | Unit: | % |
| Max.: | 100 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**
10% to 100%
**Description**
-

**H01.19** **Sampling coefficient of 7860**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-14h | Effective Time: | - |
| Min.: | 1 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 3200 | Change: | Immediately |

**Value Range:**
1 to 65535
**Description**
-

**H01.20** **Dead zone compensation**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-15h | Effective Time: | - |
| Min.: | 0.00 | Unit: | us |

| | | | |
|---|---|---|---|
| Max.: | 20.00 | Data Type: | UInt16 |
| Default: | 2.00 | Change: | Immediately |

**Value Range:**
0.00us–20.00us
**Description**
-

**H01.21** **Minimum switch-on time of bootstrap circuit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-16h | Effective Time: | Upon the next power-on |
| Min.: | 1.0 | Unit: | us |
| Max.: | 20.0 | Data Type: | UInt16 |
| Default: | 4.0 | Change: | At stop |

**Value Range:**
1.0us–20.0us
**Description**
-

**H01.22** **D-axis back EMF constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-17h | Effective Time: | - |
| Min.: | 0.0 | Unit: | % |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 60.0 | Change: | Immediately |

**Value Range:**
0.0% to 6553.5%
**Description**
-

**H01.23** **Q-axis back EMF constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-18h | Effective Time: | - |
| Min.: | 0.0 | Unit: | % |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 100.0 | Change: | Immediately |

**Value Range:**
0.0% to 6553.5%
**Description**
-

**H01.24** **D-axis current loop gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-19h | Effective Time: | - |
| Min.: | 1 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 1000 | Change: | Immediately |

**Value Range:**
1 to 65535
**Description**
Displays D-axis current loop gain, with no decimal place.

**H01.25** **D-axis current loop integral compensation factor**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-1Ah | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**
0 to 65535
**Description**
Display D-axis current loop integral compensation factor, with 2 decimal places.

**H01.26** **Sinc3 filter data extraction rate in current sampling**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-1Bh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 3 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0: Extraction rate 32
1: Extraction rate 64
2: Extraction rate 128
3: Extraction rate 256
**Description**
Displays Sinc3 filter data extraction rate in current sampling, with no decimal place.

**H01.27** **Q-axis current loop gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-1Ch | Effective Time: | - |
| Min.: | 1 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 1000 | Change: | Immediately |

**Value Range:**
1 to 65535
**Description**
Displays Q-axis current loop gain, with no decimal place.

**H01.28** **Q-axis current loop integral compensation factor**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-1Dh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**
0 to 65535
**Description**
Displays Q-axis current loop integral compensation factor, with 2 decimal places.

**H01.29** **Control power voltage sampling coefficient**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-1Eh | Effective Time: | - |
| Min.: | 50.0 | Unit: | - |
| Max.: | 150.0 | Data Type: | UInt16 |
| Default: | 100.0 | Change: | At stop |

**Value Range:**
50.0 to 150.0
**Description**
-

**H01.30** **Bus voltage gain tuning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-1Fh | Effective Time: | - |
| Min.: | 50.0 | Unit: | % |

| | | | |
|---|---|---|---|
| Max.: | 150.0 | Data Type: | UInt16 |
| Default: | 100.0 | Change: | Immediately |

**Value Range:**
50.0% to 150.0%
**Description**
Displays bus voltage gain adjustment, with 1 decimal place.

### H01.31 FOC calculation time

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-20h | Effective Time: | - |
| Min.: | 1.00 | Unit: | us |
| Max.: | 100.00 | Data Type: | UInt16 |
| Default: | 2.60 | Change: | Immediately |

**Value Range:**
1.00us–100.00us
**Description**
-

### H01.32 Relative gain of UV sampling

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-21h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535
**Description**
Displays the relative gain of UV sampling, with no decimal place.

### H01.37 Model identification version

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-26h | Effective Time: | |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0 to 65535
**Description**
-

### H01.44 Sinc3 filter data extraction rate in 2nd group of current sampling

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-2Dh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 3 | Data Type: | UInt16 |
| Default: | 2 | Change: | At stop |

**Value Range:**
0: Extraction rate 32
1: Extraction rate 64
2: Extraction rate 128
3: Extraction rate 256
**Description**
-

**H01.45** **Phase U duty cycle obtained upon voltage injection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-2Eh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0 to 65535
**Description**
-

**H01.47** **MCU current reference processing time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-30h | Effective Time: | - |
| Min.: | 0.00 | Unit: | us |
| Max.: | 60.00 | Data Type: | UInt16 |
| Default: | 38.00 | Change: | Immediately |

**Value Range:**
0.00us–60.00us
**Description**
-

**H01.48** **AD sampling delay**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-31h | Effective Time: | - |
| Min.: | 0.00 | Unit: | us |
| Max.: | 20.00 | Data Type: | UInt16 |
| Default: | 1.00 | Change: | Immediately |

**Value Range:**
0.00us–20.00us
**Description**
-

**H01.49** **Serial encoder data dissemination delay**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-32h | Effective Time: | - |
| Min.: | 0.00 | Unit: | us |
| Max.: | 500.00 | Data Type: | UInt16 |
| Default: | 61.00 | Change: | Immediately |

**Value Range:**
0.00us–500.00us
**Description**
-

**H01.50** **Interval version of DSP software**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-33h | Effective Time: | - |
| Min.: | 0.00 | Unit: | - |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.00 | Change: | Immediately |

**Value Range:**
0.00 to 655.35
**Description**
-

**H01.52** **D-axis proportional gain in performance priority mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-35h | Effective Time: | - |

| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 2000 | Change: | Immediately |

**Value Range:**
0 to 65535
**Description**
Display D-axis proportional gain in performance priority mode, with no decimal place.

**H01.53** **D-axis integral gain in performance priority mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-36h | Effective Time: | - |
| Min.: | 0.00 | Unit: | - |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 2.00 | Change: | Immediately |

**Value Range:**
0.00 to 655.35
**Description**
Displays D-axis integral gain in performance priority mode, with 2 decimal places.

**H01.54** **Q-axis proportional gain in performance priority mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-37h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 2000 | Change: | Immediately |

**Value Range:**
0 to 65535
**Description**
Displays Q-axis proportional gain in performance priority mode, with no decimal place.

**H01.55** **Q-axis integral gain in performance priority mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-38h | Effective Time: | - |
| Min.: | 0.00 | Unit: | - |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 1.00 | Change: | Immediately |

**Value Range:**
0.00 to 655.35
**Description**
Displays Q-axis integral gain in performance priority mode, with 2 decimal places.

**H01.56** **2nd group of proportional gain coefficient in performance priority mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-39h | Effective Time: | - |
| Min.: | 0.0 | Unit: | % |
| Max.: | 1000.0 | Data Type: | UInt16 |
| Default: | 100.0 | Change: | Immediately |

**Value Range:**
0.0% to 1000.0%
**Description**
-

**H01.57** **3rd group of proportional gain coefficient in performance priority mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-3Ah | Effective Time: | - |
| Min.: | 0.0 | Unit: | % |

Max.: 1000.0 | Data Type: UInt16
Default: 100.0 | Change: Immediately

**Value Range:**
0.0% to 1000.0%

**Description**
-

**H01.58** **1st gain switchover threshold in performance priority mode**

Hexadecimal: 2001-3Bh | Effective Time: -
Min.: 0.0 | Unit: %
Max.: 300.0 | Data Type: UInt16
Default: 1.0 | Change: Immediately

**Value Range:**
0.0% to 300.0%

**Description**
-

**H01.59** **2nd gain switchover threshold in performance priority mode**

Hexadecimal: 2001-3Ch | Effective Time: -
Min.: 0.0 | Unit: %
Max.: 300.0 | Data Type: UInt16
Default: 2.0 | Change: Immediately

**Value Range:**
0.0% to 300.0%

**Description**
-

**H01.60** **3rd gain switchover threshold in performance priority mode**

Hexadecimal: 2001-3Dh | Effective Time: -
Min.: 0.0 | Unit: %
Max.: 300.0 | Data Type: UInt16
Default: 100.0 | Change: Immediately

**Value Range:**
0.0% to 300.0%

**Description**
-

**H01.61** **4th gain switchover threshold in performance priority mode**

Hexadecimal: 2001-3Eh | Effective Time: -
Min.: 0.0 | Unit: %
Max.: 300.0 | Data Type: UInt16
Default: 200.0 | Change: Immediately

**Value Range:**
0.0% to 300.0%

**Description**
-

**H01.62** **Phase U/V 7860 detection protection threshold**

Hexadecimal: 2001-3Fh | Effective Time: Upon the next power-on
Min.: 0 | Unit: -
Max.: 320 | Data Type: UInt16
Default: 280 | Change: Unchangeable

**Value Range:**
0 to 320
**Description**
-

**H01.63** **Serial encoder data transmission compensation time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2001-40h | Effective Time: | Upon the next power-on |
| Min.: | 0.00 | Unit: | - |
| Max.: | 10.00 | Data Type: | UInt16 |
| Default: | 0.00 | Change: | At stop |

**Value Range:**
0.00 to 10.00
**Description**
Display the data transmission compensation time of the serial encoder, with three decimal places.

## 15.3 H02 Basic Control Parameters

**H02.00** **Control mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-01h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 6 | Data Type: | UInt16 |
| Default: | 1 | Change: | At stop |

**Value 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
**Description**
Defines the control mode of the servo drive.

<table>
<tr><th>Setpoint</th><th>Control mode</th><th>Remarks</th></tr>
<tr><td>0</td><td>Speed control mode</td><td>For parameter settings in speed control mode, see the function guide.</td></tr>
<tr><td>1</td><td>Position control mode</td><td>For parameter settings in position control mode, see the function guide.</td></tr>
<tr><td>2</td><td>Torque control mode</td><td>For parameter settings in torque control mode, see the function 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<br>Terminal logic</th><th>Control mode</th></tr>
<tr><td>Inactive</td><td>Torque control mode</td></tr>
<tr><td>Active</td><td>Speed control mode</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Setpoint</th><th>Control mode</th><th>Remarks</th></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<br>Terminal logic</th><th>Control mode</th></tr>
<tr><td>Inactive</td><td>Speed control mode</td></tr>
<tr><td>Active</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<br>Terminal logic</th><th>Control mode</th></tr>
<tr><td>Inactive</td><td>Torque control mode</td></tr>
<tr><td>Active</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<br>Terminal logic</th><th>M1_SEL<br>Terminal logic</th><th>Control mode</th></tr>
<tr><td>Inactive</td><td>Inactive</td><td>Torque control mode</td></tr>
<tr><td>Active</td><td>Inactive</td><td>Speed control mode</td></tr>
<tr><td>-</td><td>Active</td><td>Position control mode</td></tr>
</table></td></tr>
</table>

**H02.01** **Absolute position detection system**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-02h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Incremental position mode

1: Absolute position linear mode

2: Absolute position rotation mode

**Description**

Used to set the absolute position function.

**H02.02** **Forward direction**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-03h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

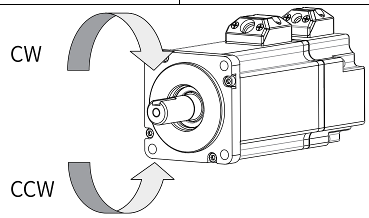
0: Counterclockwise (CCW) as forward direction

1: Clockwise (CW) as forward direction

**Description**

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

| Setpoint | Direction of rotation | Remarks |
|---|---|---|
| 0 | Counterclockwise (CCW) as forward direction | Defines the CCW direction as the forward direction when a forward run command is received, indicating the motor rotates in the CCW direction when viewed from the motor shaft side. |
| 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**

Hexadecimal: 2002-04h | Effective Time: Upon the next power-on
Min.: 0 | Unit: -
Max.: 1 | Data Type: UInt16
Default: 0 | Change: At stop

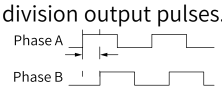
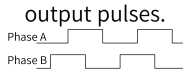
**Value Range:**

0: Phase A leads phase B

1: Phase A lags behind phase B

**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.

| Setpoint | Output pulse phase | Remarks |
|---|---|---|
| 0 | Phase A leads phase B. | Phase A leads phase B by 90° in encoder frequency-division output pulses.   |
| 1 | Phase A lags phase B. | Phase A lags phase B by 90° in encoder frequency-division output pulses.   |

**H02.05** **Stop mode at S-OFF**

Hexadecimal: 2002-06h | Effective Time: Real time
Min.: 0 | Unit: -
Max.: 3 | Data Type: UInt16
Default: 0 | Change: At stop

**Value 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

**Description**

Defines the deceleration mode of the motor for stopping rotating upon S-ON OFF and the motor status after stop.

**H02.06** **Stop mode at No.2 fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-07h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 2 | Change: | At stop |

**Value 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 DB state

4: DB stops, keeping operation state

**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 overtravel**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-08h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 1 | Change: | At stop |

**Value 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

**Description**

Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when overtravel occurs.

| Setpoint | Stop Mode |
|---|---|
| 0 | Coast to stop, keeping de-energized status |
| 1 | Stop at zero speed, keeping position lock status |
| 2 | Stop at zero speed, keeping de-energized status |

**H02.08** **Stop mode at No.1 fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-09h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 2 | Change: | At stop |

**Value Range:**

0: Coast to stop, keeping de-energized state1: DB stop, keeping de-energized state2: DB stop, keeping DB state

**Description**

Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when a No. 1 fault occurs.

| Setpoint | Stop Mode |
|---|---|
| 0 | Coast to stop, keeping de-energized status |
| 1 | Dynamic braking stop, keeping de-energized status |
| 2 | Dynamic braking stop, keeping dynamic braking status |

**H02.09** **Delay from brake output ON to command received**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-0Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 500 | Data Type: | UInt16 |
| Default: | 250 | Change: | Immediately |

**Value Range:**

0 ms to 500 ms

**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 the standstill state**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-0Bh | Effective Time: | Real time |
| Min.: | 1 | Unit: | ms |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 150 | Change: | Immediately |

**Value Range:**

1 ms to 1000 ms

**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 rotation state**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-0Ch | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 3000 | Data Type: | UInt16 |
| Default: | 30 | Change: | Immediately |

**Value Range:**

0rpm–3000rpm

**Description**

Defines the motor speed threshold when brake (BK) output is OFF in the rotating state.

**H02.12** **Delay from S-ON OFF to brake output OFF in rotation state**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-0Dh | Effective Time: | Real time |
| Min.: | 1 | Unit: | ms |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 500 | Change: | Immediately |

**Value Range:**

1 ms to 1000 ms

**Description**

Sets the delay time from BK OFF to S-ON OFF when the motor is in rotating state.

**H02.14** **Stop mode and state switching speed condition**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-0Fh | Effective Time: | Real time |
| Min.: | 10 | Unit: | rpm |
| Max.: | 100 | Data Type: | UInt16 |
| Default: | 10 | Change: | At stop |

**Value Range:**

10rpm–100rpm

**Description**

Defines the stop mode of the motor for stopping rotating upon main circuit power failure.

**H02.15** **Warning display on the keypad**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-10h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output warning information immediately

1: Not output warning information

**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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-12h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 1 | Change: | At stop |

**Value Range:**

0: Disabled

1: Enabled

**Description**

-

**H02.18** **S-ON filter time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-13h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 64 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0 ms to 64 ms

**Description**

-

**H02.19** **S-ON brake open delay**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-14h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0 ms to 1000 ms

**Description**

-

**H02.20** **Dynamic brake relay coil ON delay**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-15h | Effective Time: | Real time |
| Min.: | 10 | Unit: | ms |
| Max.: | 30000 | Data Type: | UInt16 |
| Default: | 30 | Change: | Immediately |

**Value Range:**

10 ms to 30000 ms

**Description**

-

**H02.21** **Min. permissible resistance of regenerative resistor**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-16h | Effective Time: | - |
| Min.: | 0 | Unit: | Ω |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 40 | Change: | Unchangeable |

**Value Range:**

0 Ω to 65535 Ω

**Description**

-

**H02.22** **Power of built-in regenerative resistor**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-17h | Effective Time: | - |
| Min.: | 0 | Unit: | W |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 40 | Change: | Unchangeable |

**Value Range:**

0 W–65535 W

**Description**

The power of the built-in regenerative resistor is only related to the servo drive model, which is unmodifiable.

**H02.23** **Resistance of built-in regenerative resistor**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-18h | Effective Time: | - |
| Min.: | 0 | Unit: | Ω |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 50 | Change: | Unchangeable |

**Value Range:**

0 Ω to 65535 Ω

**Description**

The resistance of the built-in regenerative resistor is only related to the servo drive model, which is unmodifiable.

Table 15–1 Specifications of the regenerative resistor

| Servo drive model (SV660, SV630) | Specifications of Built-in Regenerative 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**

Hexadecimal: 2002-19h | Effective Time: Real time
Min.: 10 | Unit: -
Max.: 100 | Data Type: UInt16
Default: 30 | Change: At stop

**Value Range:**

10 to 100

**Description**

Defines the heat dissipation coefficient of the regenerative resistor, which is applicable to both external and built-in regenerative resistors.

Defines the heat dissipation coefficient of the regenerative resistor, which is applicable to both external and built-in regenerative resistors.

Set this parameter properly according to actual heat dissipation conditions of the resistor.

Recommendations:

Generally, the value of H02.24 cannot exceed 30% for natural cooling.

The value of H02.24 cannot exceed 50% for forced air cooling.

**H02.25** **Regenerative resistor type**

Hexadecimal: 2002-1Ah | Effective Time: Real time
Min.: 0 | Unit: -
Max.: 3 | Data Type: UInt16
Default: 0 | Change: At stop

**Value Range:**

0: Built-in

1: External, natural ventilated

2: External, forced air cooling

3: Not needed

**Description**

Defines the resistor type and the mode of absorbing and releasing the braking energy.

| Setpoint | Defines the regenerative resistor type and the mode of absorbing and releasing the braking energy. | Remarks |
|---|---|---|
| 0 | Using the built-in regenerative resistor | 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 capacity of external regenerative resistor**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-1Bh | Effective Time: | Real time |
| Min.: | 1 | Unit: | W |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 40 | Change: | At stop |

**Value Range:**

1 W–65535 W

**Description**

Defines the power of external regenerative resistor.

**H02.27** **Resistance of external regenerative resistor**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-1Ch | Effective Time: | Real time |
| Min.: | 1 | Unit: | Ω |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 50 | Change: | At stop |

**Value Range:**

1 Ω to 1000 Ω

**Description**

Defines the resistance of the external regenerative resistor.

**H02.28** **220 V min. bus voltage**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-1Dh | Effective Time: | Upon the next power-on |
| Min.: | 190 | Unit: | V |

Max.: 260 | Data Type: UInt16
Default: 235 | Change: At stop

**Value Range:**

190 V to 260 V

**Description**

-

**H02.30** **User password**

Hexadecimal: 2002-1Fh | Effective Time: Real time
Min.: 0 | Unit: -
Max.: 65535 | Data Type: UInt16
Default: 0 | Change: At stop

**Value Range:**

0 to 65535

**Description**

-

**H02.31** **System parameter initialization**

Hexadecimal: 2002-20h | Effective Time: Real time
Min.: 0 | Unit: -
Max.: 2 | Data Type: UInt16
Default: 0 | Change: At stop

**Value Range:**

0: No operation

1: Restore default settings

2: Clear fault records

**Description**

Used to restore default values or clear fault records.

| Setpoint | 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**

Hexadecimal: 2002-21h | Effective Time: Real time
Min.: 0 | Unit: -
Max.: 99 | Data Type: UInt16
Default: 50 | Change: Immediately

**Value Range:**

0–99

**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.

| Setpoint | 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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-23h | Effective Time: | - |
| Min.: | 0.00 | Unit: | - |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.00 | Change: | Unchangeable |

**Value Range:**
0.00 to 655.35
**Description**
-

**H02.35** **Keypad display refresh frequency**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-24h | Effective Time: | Real time |
| Min.: | 0 | Unit: | Hz |
| Max.: | 29 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0 Hz to 29 Hz
**Description**
-

**H02.41** **Manufacturer password**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2002-2Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

## 15.4 H03 Terminal Input Parameters

**H03.00** **DI function allocation 1 (activated upon power-on)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-01h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value 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

**Description**

Used to enable a certain DI function (FunIN.1 to FunIN.16) to be activated immediately at next power-on.

**H03.01** **DI function allocation 2 (activated upon power-on)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-02h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value 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

**Description**

Used to enable a certain DI function (FunIN.17 to FunIN.32) to be activated immediately at next power-on.

**H03.02** **DI1 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-03h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 14 | Change: | Immediately |

**Value Range:**

0: No assignment
1: S-ON
2: Warning reset signal
3: Gain switchover switch
4: Switchover between main and auxiliary commands
5: Multi-reference direction
6: Multi-reference switchover CMD1
7: Multi-reference switchover CMD2
8: Multi-reference switchover CMD3
9: Multi-reference switchover CMD4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable signal
13: Position reference inhibited
14: Positive limit switch
15: Reverse limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Hand wheel override signal 1
22: Hand wheel override signal 2
23: Hand wheel enable signal
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 canceled
30: None

31: Home switch

32: Homing enable

33: Interrupt positioning inhibited

34: Emergency stop

35: Clear position deviation

36: Internal speed limit source

37: Pulse reference inhibited

38: Writing reference causes interrupt

39: Writing reference does not cause interrupt

40: Clear positioning and reference completed signals

41: Current position as home

**Description**

Defines the function of DI1.

**H03.03** **DI1 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-04h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Active low

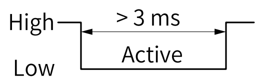
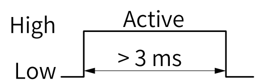
1: Active high

**Description**

Used to set the level logic of DI1 when the function assigned to DI1 is active.

DI1–DI5 are standard DIs, and DI8 and DI9 are high speed DIs. The width of the input signal must be larger than 3 ms. Set the valid logic correctly according to the host controller and peripheral circuits. The width of the input signal is shown in the following table.

Table 15–2 Signal logic of low-speed DI terminals

| Setpoint | DI Logic Upon Active DI Function | Remarks |
|---|---|---|
| 0 | Low level |  |
| 1 | High level |  |

**H03.04** **DI2 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-05h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 15 | Change: | Immediately |

**Value Range:**

See H03.02.

**Description**

-

**H03.05** **DI2 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-06h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Active low

1: Active high

**Description**

-

**H03.06** **DI3 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-07h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 13 | Change: | Immediately |

**Value Range:**

See H03.02.

**Description**

-

**H03.07** **DI3 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-08h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Active low

1: Active high

**Description**

-

**H03.08** **DI4 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-09h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 2 | Change: | Immediately |

**Value Range:**

See H03.02.

**Description**

-

**H03.09** **DI4 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-0Ah | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Active low

1: Active high

**Description**
-

**H03.10** **DI5 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-0Bh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**
See H03.02.
**Description**
-

**H03.11** **DI5 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-0Ch | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0: Active low
1: Active high
**Description**
-

**H03.16** **DI8 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-11h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 31 | Change: | Immediately |

**Value Range:**
See H03.02.
**Description**
-

**H03.17** **DI8 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-12h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

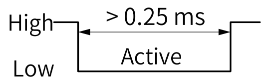
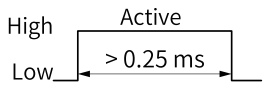
**Value Range:**
0: Active low
1: Active high

**Description**

It sets the DI8 logic when the DI function allocated to DI8 is enabled.

DI8 and DI9 are high-speed DI terminals. The width of the input signal must be larger than 0.25 ms. The width of the input signal must be larger than 3 ms. Set the valid logic correctly according to the host controller and peripheral circuits. The width of the input signal is shown in the following table.

Table 15–3 Signal logic of high-speed DI terminals

| Setpoint | DI Logic Upon Active DI Function | Remarks |
|---|---|---|
| 0 | Low level |   |
| 1 | High level |   |

**H03.18** **DI9 function selection**

Hexadecimal: 2003-13h | Effective Time: At stop
Min.: 0 | Unit: -
Max.: 41 | Data Type: UInt16
Default: 0 | Change: Immediately

**Value Range:**

See H03.02.

**Description**

-

**H03.19** **DI9 logic selection**

Hexadecimal: 2003-14h | Effective Time: At stop
Min.: 0 | Unit: -
Max.: 1 | Data Type: UInt16
Default: 0 | Change: Immediately

**Value Range:**

0: Active low

1: Active high

**Description**

-

**H03.34** **DI function allocation 3 (activated upon power-on)**

Hexadecimal: 2003-23h | Effective Time: Upon the next power-on
Min.: 0 | Unit: -
Max.: 65535 | Data Type: UInt16
Default: 0 | Change: Immediately

**Value 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

**Description**

-

**H03.35** **DI function allocation 4 (activated upon power-on)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-24h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value 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

**Description**

-

**H03.60** **DI1 filter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-3Dh | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 500.00 | Data Type: | UInt16 |

| | | | |
|---|---|---|---|
| Default: | 3.00 | Change: | Immediately |

**Value Range:**
0.00 ms to 500.00 ms
**Description**
Defines the filter time of DI1. The DI function is active only after the effective level is kept within the time defined by H03.60.

**H03.61** **DI2 filter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-3Eh | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 500.00 | Data Type: | UInt16 |
| Default: | 3.00 | Change: | Immediately |

**Value Range:**
0.00 ms to 500.00 ms
**Description**
Defines the filter time of DI2. The DI function is active only after the effective level is kept within the time defined by H03.61.

**H03.62** **DI3 filter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-3Fh | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 500.00 | Data Type: | UInt16 |
| Default: | 3.00 | Change: | Immediately |

**Value Range:**
0.00 ms to 500.00 ms
**Description**
Defines the filter time of DI3. The DI function is active only after the effective level is kept within the time defined by H03.62.

**H03.63** **DI4 filter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-40h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 500.00 | Data Type: | UInt16 |
| Default: | 3.00 | Change: | Immediately |

**Value Range:**
0.00 ms to 500.00 ms
**Description**
Defines the filter time of DI4. The DI function is active only after the effective level is kept within the time defined by H03.63.

**H03.64** **DI5 filter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-41h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 500.00 | Data Type: | UInt16 |
| Default: | 3.00 | Change: | Immediately |

**Value Range:**
0.00 ms to 500.00 ms
**Description**
Defines the filter time of DI5. The DI function is active only after the effective level is kept within the time defined by H03.64.

**H03.65** **DI8 filter 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-42h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 500.00 | Data Type: | UInt16 |
| Default: | 0.00 | Change: | Immediately |

**Value Range:**

0.00 ms to 500.00 ms

**Description**

Defines the filter time of DI8. The DI function is active only after the effective level is kept within the time defined by H03.65.

**H03.66** **DI9 filter 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2003-43h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 500.00 | Data Type: | UInt16 |
| Default: | 0.00 | Change: | Immediately |

**Value Range:**

0.00 ms to 500.00 ms

**Description**

Defines the filter time of DI9. The DI function is active only after the effective level is kept within the time defined by H03.66.

## 15.5 H04 Terminal Output Parameters

**H04.00** **DO1 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-01h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 27 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**

0: N/A

1: Servo ready

2: Motor rotating

3: Zero speed signal

4: Speed consistent

5: Positioning completed

6: Positioning approaches

7: Torque limit

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 identification output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal movement completed
26: Servo enabled to receive operating command
27: Fault or warning

**Description**

Defines the function of DO1.

**H04.01** **DO1 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-02h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

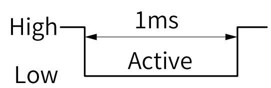
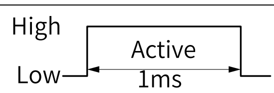
**Value Range:**

0: Output low (L) level when active (optocoupler ON)
1: Output high (H) level when active (optocoupler OFF)

**Description**

Defines the level logic of DO1 when the function assigned to DO1 is active.

DO1 to DO5 are normal DOs, requiring the minimum output signal width to be 1 ms. The host controller must be able to receive valid DO logic changes.

| Setpoint | DO1 Logic Upon Active DO Function | Transistor Status | Remarks |
|---|---|---|---|
| 0 | Low level | ON |  |
| 1 | High level | OFF |  |

View the setting of H04.22 (DO source) before receiving DO logic change to check whether DO output level is determined by the servo drive state or the communication.

**H04.02** **DO2 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-03h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 27 | Data Type: | UInt16 |

| | | | |
|---|---|---|---|
| Default: | 5 | Change: | Immediately |

**Value Range:**
See H04.00.
**Description**
-

**H04.03** **DO2 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-04h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0: Output low (L) level when active (optocoupler ON)
1: Output high (H) level when active (optocoupler OFF)
**Description**
-

**H04.04** **DO3 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-05h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 27 | Data Type: | UInt16 |
| Default: | 9 | Change: | Immediately |

**Value Range:**
See H04.00.
**Description**
-

**H04.05** **DO3 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-06h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0: Output low (L) level when active (optocoupler ON)
1: Output high (H) level when active (optocoupler OFF)
**Description**
-

**H04.06** **DO4 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-07h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 27 | Data Type: | UInt16 |
| Default: | 11 | Change: | Immediately |

**Value Range:**
See H04.00.
**Description**
-

**H04.07** **DO4 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-08h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |

| | | | |
|---|---|---|---|
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Output low (L) level when active (optocoupler ON)

1: Output high (H) level when active (optocoupler OFF)

**Description**

-

**H04.08** **DO5 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-09h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 27 | Data Type: | UInt16 |
| Default: | 16 | Change: | Immediately |

**Value Range:**

See H04.00.

**Description**

-

**H04.09** **DO5 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-0Ah | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Output low (L) level when active (optocoupler ON)

1: Output high (H) level when active (optocoupler OFF)

**Description**

-

**H04.22** **DO source selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2004-17h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 31 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0–31

**Description**

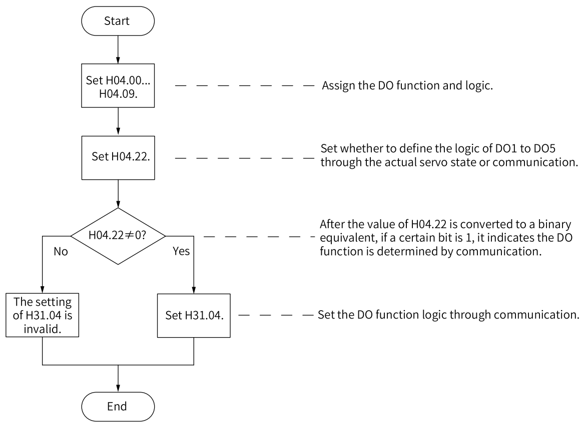
Defines whether the logic of a physical DO terminal is defined by the actual state of the drive or by communication.

The value of H04.22 is displayed in decimal on the keypad. When the value is converted to a binary equivalent: If bit(n) is 0, it indicates the logic of DO(n+1) is defined by the actual state of the drive. If bit(n) is 1, it indicates the logic of DO(n+1) is defined by communication (H31.04).

| Setpoint (decimal) | Setpoint (binary) | | | | | DO logic | |
|---|---|---|---|---|---|---|---|
| | bit4 | bit3 | bit2 | bit1 | bit0 | Defined by the Drive State | Defined by Communication (H31.04) |
| | DO5 | DO4 | DO3 | DO2 | DO1 | | |
| 0 | 0 | 0 | 0 | 0 | 0 | DO1–DO5 | / |
| 1 | 0 | 0 | 0 | 0 | 1 | DO2–DO5 | DO1 |
| ... | ... | ... | ... | ... | ... | ... | ... |
| 31 | 1 | 1 | 1 | 1 | 1 | / | DO1–DO5 |

Set H04.22 to a value listed in the preceding table.

H31.04 is not displayed on the keypad and can only be modified through communication. For H31.04, "bit(n) = 1" indicates the logic of DO(n+1) is active. "bit(n) = 0" indicates the logic of DO(n +1) is inactive.




## 15.6 H05 Position Control Parameters

**H05.00** **Main position reference source**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-01h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Pulse reference

1: Step reference

2: Multi-position reference

**Description**

Defines the position reference source in position control mode.

Pulse references are external position references. Step references and multi-position references are internal position references.

| Setpoint | Reference source | Instruction receiving method |
|---|---|---|
| 0 | Pulse reference | The host controller or other pulse generator generates pulses, which is input into the servo drive by hardware terminals.<br>The hardware terminal is selected in H05.01. |
| 1 | Step reference | The step displacement is set in H05.05 (step value).<br>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.<br>The multi-position reference is sent by the DI set for function FunIN.28. |

**H05.01** **Position pulse reference input terminal**

Hexadecimal: 2005-02h Effective Time: Real time
Min.: 0 Unit: -
Max.: 1 Data Type: UInt16
Default: 0 Change: At stop

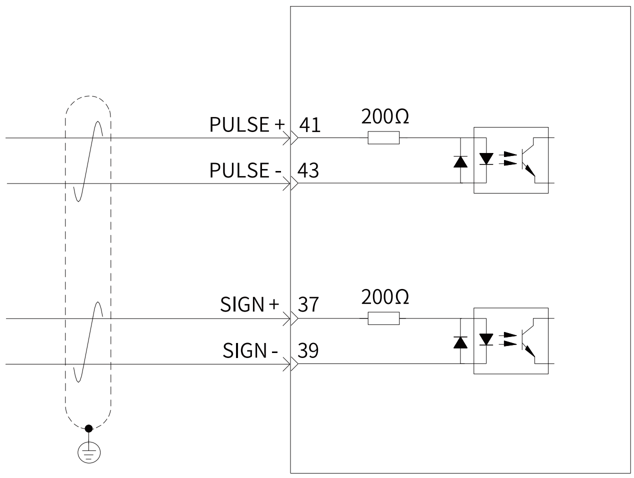
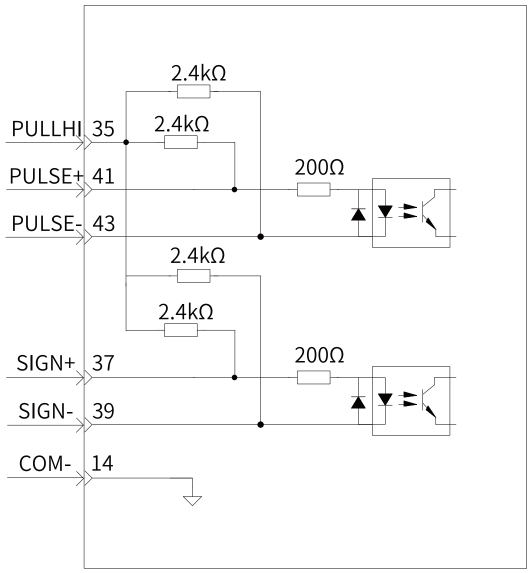
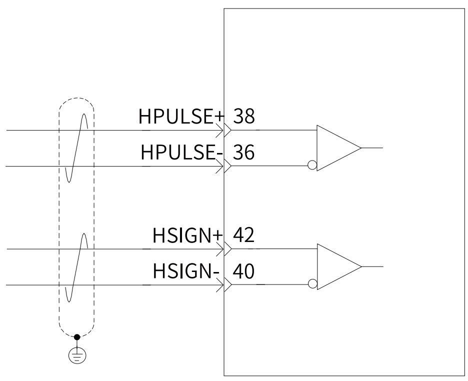
**Value Range:**

0: Low speed

1: High speed

**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.

| Setpoint | Input Terminal | Instruction receiving method |
|---|---|---|
| 0 | Low-speed | Differential input terminals: PULSE+, PULSE-, SIGN+, SIGN-<br>Drive<br><br><br>Max. pulse frequency: 500 kpps |
| | | Open-collector input terminals: PULLHI, PULSE+, PULSE-, SIGN+, SIGN-<br>Drive<br><br><br>Max. pulse frequency: 200 kbps |
| 1 | High speed | Differential input terminals: HPULSE+, HPULSE-, HSIGN+, HSIGN-<br>Drive<br><br><br>Max. pulse frequency: $ Mbps. |

**H05.02** **Pulses per revolution**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-03h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | PPR |
| Max.: | 1048576 | Data Type: | UInt32 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0P/Rev–1048576P/Rev

**Description**

Defines the number of pulses required per revolution of the motor.

**H05.04** **First-order low-pass filter time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-05h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | ms |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | At stop |

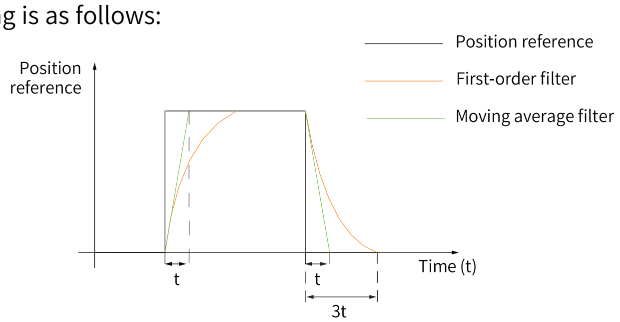
**Value Range:**

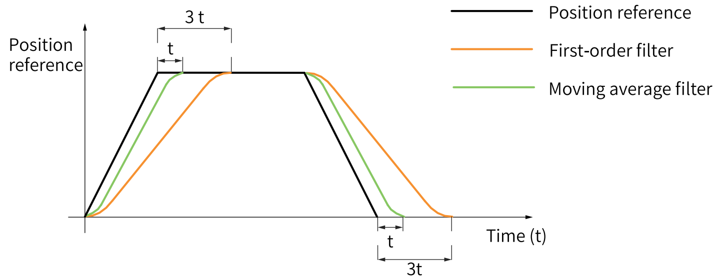
0.0 ms to 6553.5 ms

**Description**

Defines the first-order low pass filter time constant of position references.

If position reference P is rectangular wave or trapezoidal wave, the position reference after first-order low pass filtering is as follows:




This function does not affect the displacement value (position reference sum).

An excessively high setpoint delays the responsiveness, so set a proper filter time constant based on actual conditions.

**H05.05** **Step reference**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-06h | Effective Time: | Real time |
| Min.: | -9999 | Unit: | Reference unit |
| Max.: | 9999 | Data Type: | Int16 |
| Default: | 50 | Change: | At stop |

**Value Range:**

-9999 to +9999

**Description**

Defines the position reference sum when the step reference acts as the main position reference source.

### H05.06 Moving average filtering time constant

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-07h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | ms |
| Max.: | 128.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | At stop |

**Value Range:**

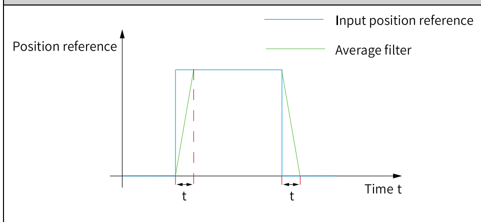
0.0 ms to 128.0 ms

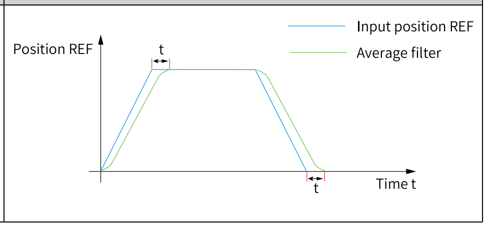
**Description**

Defines the moving average filter time constant of position references.

If position reference P is rectangular wave or trapezoidal wave, the position reference after average value filter is as follows:

| Position reference being rectangular wave | Position reference being trapezoidal wave |
|---|---|




This function does not affect the displacement value (position reference sum). An excessively high setpoint delays the responsiveness, so set a proper filter time constant based on actual conditions.

### H05.07 Electronic gear ratio 1 (numerator)

| | | | |
|---|---|---|---|
| Hex: | 2005-08h | Effective mode: | Real time |
| Min.: | 1 | Unit: | - |
| Max.: | 1073741824 | Data Type: | UInt32 |
| Default: | 262144 | Change: | Real-time |

**Value Range:**

1 to 1073741824

**Description**

Defines the numerator of electronic gear ratio 1.

### H05.09 Electronic gear ratio 1 (denominator)

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-0Ah | Effective Time: | Real time |
| Min.: | 1 | Unit: | - |
| Max.: | 1073741824 | Data Type: | UInt32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

1 to 1073741824

**Description**

Defines the denominator of electronic gear ratio 1.

### H05.11 Electronic gear ratio 2 (numerator)

| | | | |
|---|---|---|---|
| Hex: | 2005-0Ch | Effective mode: | Real time |

| | | | |
|---|---|---|---|
| Min.: | 1 | Unit: | - |
| Max.: | 1073741824 | Data Type: | UInt32 |
| Default: | 262144 | Change: | Real-time |

**Value Range:**

1 to 1073741824

**Description**

Defines the numerator of electronic gear ratio 2.

**H05.13** **Electronic gear ratio 2 (denominator)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-0Eh | Effective Time: | Real time |
| Min.: | 1 | Unit: | - |
| Max.: | 1073741824 | Data Type: | UInt32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

1 to 1073741824

**Description**

Defines the denominator of electronic gear ratio 2.

**H05.15** **Pulse reference form**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-10h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 3 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Direction + Pulse, positive logic

1: Direction + Pulse, negative logic

2: Phase A + phase B quadrature pulse, quadrupled frequency

3: CW + CCW

**Description**

Defines the input pulse form when the main position reference source is pulse input.

Table 15–4 Descriptions of the pulse form

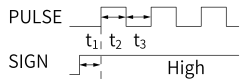
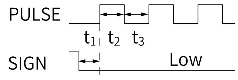
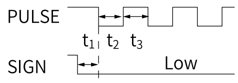
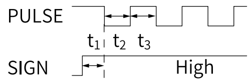
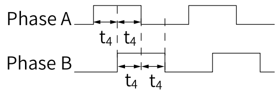
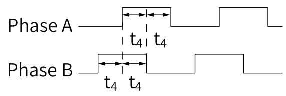
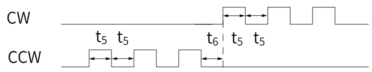
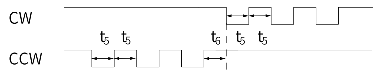
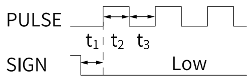
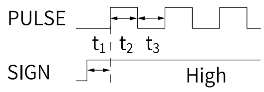
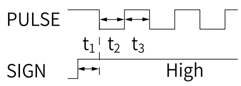
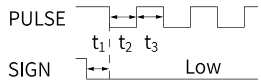
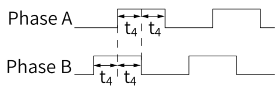
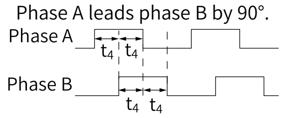
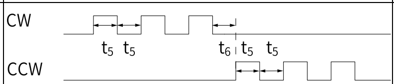
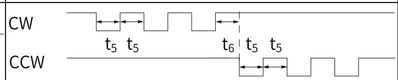
| H02.02 | H05.15 | Pulse form | Signal | Diagram of forward pulses | Diagram of reverse pulses |
|---|---|---|---|---|---|
| 0 | 0 | Pulse + Direction Positive Logic | PULSE SIGN |  |  |
| | 1 | Pulse + Direction Negative Logic | PULSE SIGN |  |  |
| | 2 | Phase A + Phase B Quadrature pulse Quadrupled frequency | 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 Quadrupled frequency | 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) |  |  |

Table 15–5 Specifications of pulse references

| Input Terminal | | Maximum Frequency | Minimum Time Width (unit: us) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | t1 | t2 | t3 | t4 | t5 | t6 |
| High-speed pulse input terminal | | 4 Mpps | 0.125 | 0.125 | 0.125 | 0.25 | 0.125 | 0.125 |
| Low-speed pulse input terminal | Differen-tial input | 200 kpps | 2.5 | 2.5 | 2.5 | 5 | 2.5 | 2.5 |
| | Open collector input | 200 kpps | 2.5 | 2.5 | 2.5 | 5 | 2.5 | 2.5 |

**H05.16** **Clear action**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-11h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Clear position deviation upon S-OFF and fault

1: Clear position deviation pulses upon S-OFF and fault

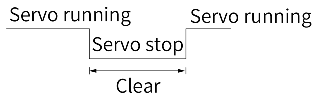
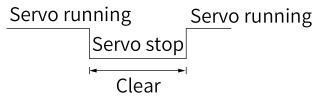
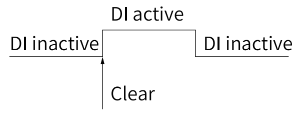
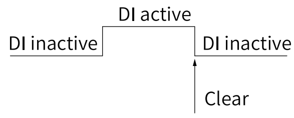
2: Clear position deviation by CIrPosErr signal input from DI

**Description**

Defines the condition for clearing the position deviation.

Position deviation = (Position reference – Position feedback) (encoder unit)

Table 15–6 Position deviation clear

| Setpoint | Clear Condition | Clear Time |
|---|---|---|
| H05.16 = 0 | Clear the position deviation when the S-ON signal is switched off or when a fault occurs. |  Servo running / Servo stop / Servo running / Clear |
| 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. |  Servo running / Servo stop / Servo running / Clear |
| 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. |  DI inactive / DI active / DI inactive / Clear<br>(Rising edge-triggered)<br> DI inactive / DI active / DI inactive / Clear<br>(Falling edge-triggered) |

If absolute value of position deviation is larger than H0A.10 (Threshold of position deviation excess), EB00.0 (Position deviation being large) will occur.

**H05.17** **Number of encoder frequency-division pulses**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-12h | Effective Time: | Upon the next power-on |
| Min.: | 35 | Unit: | PPR |
| Max.: | 32767 | Data Type: | UInt16 |
| Default: | 2500 | Change: | At stop |

**Value Range:**

35P/Rev–32767P/Rev

**Description**

Defines the number of pulses output by PAO or PBO per revolution.

Pulse output resolution per revolution = (H05.17) x 4

**H05.19** **Speed feedforward control**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-14h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 1 | Change: | At stop |

**Value Range:**

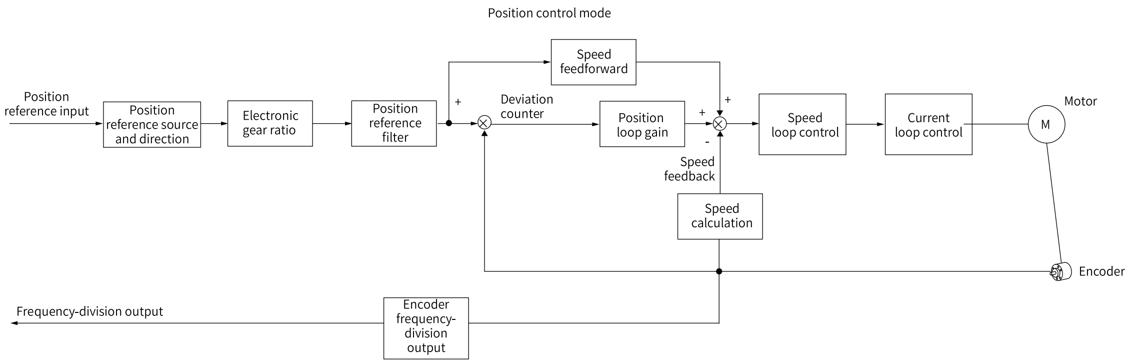
0: No speed feedforward

1: Internal speed feedforward

**Description**

Defines the source of the speed loop feedforward signal.

In the position control mode, speed feedforward can be used to improve the position reference response speed.




**H05.20** **Condition for positioning completed signal output**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-15h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 3 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value 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

**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.

| Setpoint | Output conditions |
|---|---|
| 0 | Absolute value of position deviation is smaller than the value of H05.21 |
| 1 | Absolute value of position deviation is smaller than the value of H05.21 and the position reference after filtering is 0 |
| 2 | Absolute value of position deviation is smaller than the value of H05.21 and the position reference before filtering is 0 |
| 3 | Absolute value of position deviation kept lower than H05.21 within the time defined by H05.60 and unfiltered position reference being 0 |

**H05.21** **Threshold of positioning completed**

| | | | |
|---|---|---|---|
| Hex: | 2005-16h | Effective mode: | Real time |
| Min.: | 1 | Unit: | Encoder unit |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 183 | Change: | Real-time |

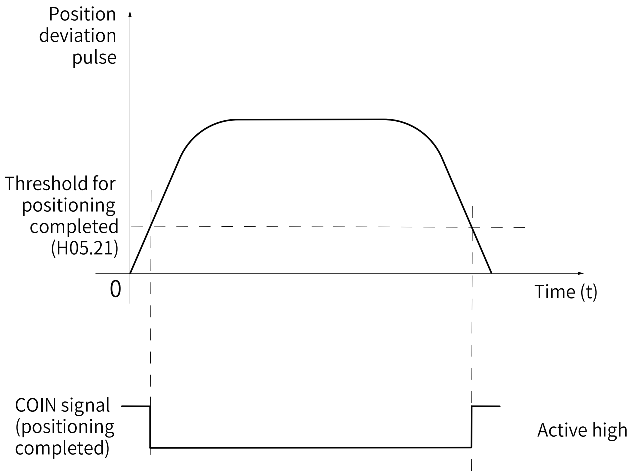
**Value Range:**

1 to 65535

**Description**

Defines the threshold of the absolute value of position deviation when the drive outputs the positioning completed signal.

Positioning completed signal: DO function 5 (FunOUT.5: COIN).




The positioning completed signal is valid only when the servo drive is in running state and in position control.

**H05.22** **Proximity threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-17h | Effective Time: | Real time |
| Min.: | 1 | Unit: | Encoder unit |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 65535 | Change: | Immediately |

**Value Range:**

1 to 65535

**Description**

Defines the threshold of the absolute value of position deviation when the drive outputs the proximity signal.

**H05.23** **Interrupt positioning selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-18h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Disable

1: Enabled

**Description**

| Setpoint | Interrupt Positioning |
|---|---|
| 0 | Prohibit |
| 1 | Working |

**H05.24** **Displacement of interrupt positioning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-19h | Effective Time: | Real time |

| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | UInt32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

0 to 1073741824

**Description**

Defines the position reference value during interrupt positioning.

**H05.26** **Constant operating speed in interrupt positioning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-1Bh | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

0rpm–6000rpm

**Description**

Defines the maximum speed during interrupt positioning.

Table 15–7 Motor speed during interrupt positioning

| H05.26 | Motor Speed before Triggering Interrupt Positioning | Interrupt Positioning | Constant operating speed in interrupt positioning |
|---|---|---|---|
| 0 | < 10 | Inactive | - |
| | ⩾ 10 | Active | Motor Speed before Triggering Interrupt Positioning |
| 1 to 6000 | - | Active | H05.26 |

**H05.27** **Acceleration/Deceleration time of interrupt positioning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-1Ch | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 1000 ms

**Description**

Defines the time for the motor to change from 0 rpm to 1000 rpm at a constant speed during interrupt positioning.

The actual motor acceleration time "t" during interrupt positioning is as follows:

$$t = \frac{|\text{H05.26-Motor speed before interrupt positioning}|}{1000} \times (\text{H05.27})$$

**H05.29** **Interrupt positioning cancel signal**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-1Eh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**

0: Disabled

1: Enabled

**Description**

Defines whether to unlock the interrupt positioning signal.

| Setpoint | Interrupt positioning cancel signal | Remarks |
|---|---|---|
| 0 | Disabled | After interrupt positioning is completed, the servo drive responds to the other position references directly. |
| 1 | Enabled | • After interrupt positioning is completed, the servo drive does not respond to the other position references directly.<br>• The servo drive can respond to other position references only after the DI function 29 (FunIN.29: XintFree, interrupt positioning unlock) is enabled. |

**H05.30** **Homing selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-1Fh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 8 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value 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: D-triggered position as home

**Description**

Defines the homing mode and the trigger signal source.

| Setpoint | Trigger Signal | Remarks | |
|---|---|---|---|
| | | Homing mode | Trigger Signal |
| 0 | Disabled | Homing is disabled. | |
| 1 | Homing enabled through the HomingStart signal inputted from DI | Homing | DI signal FunIN.32 (HomingStart: homing enabled) |
| 2 | Electrical homing enabled through the HomingStart signal inputted from DI | Electrical homing | DI signal FunIN.32 (HomingStart: homing enabled) |
| 3 | Homing enabled immediately upon power-on | Homing | S-ON signal active for the first time after next power-on in position control |
| 4 | Homing executed immediately | Homing | S-ON signal active in position control<br>After homing is done, set H05.30 to 0. |
| 5 | Electrical homing started | Electrical homing | S-ON signal active in position control<br>After homing is done, set H05.30 to 0. |
| 6 | Current position as home | Homing | Not required<br>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.38 (current position as the home) |

**H05.31** **Homing mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-20h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 16 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

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

**Description**

Defines the default motor direction of rotation, deceleration point, and home during homing.

**H05.32** **Speed in high-speed searching for the home switch signal**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-21h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 3000 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**

0rpm–3000rpm

**Description**

Defines the motor speed for searching for the deceleration point signal during homing.

**H05.33** **Speed in low-speed searching for the home switch signal**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-22h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0rpm–1000rpm

**Description**

Defines the motor speed for searching for the home signal during homing.

**H05.34** **Acceleration/Deceleration time during homing**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-23h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 1000 | Change: | Immediately |

**Value Range:**

0 ms to 1000 ms

**Description**

Defines the time for the motor to accelerate from 0 rpm to 1000 rpm at a constant speed during homing.

### H05.35 Home search time limit

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-24h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

Defines the maximum homing time.

### H05.36 Mechanical home offset

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-25h | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

-1073741824 to 1073741824

**Description**

Defines the absolute position of the motor after homing.

### H05.38 Servo pulse output source

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-27h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Encoder frequency division output

1: Pulse reference synchronous output

2: Frequency division or synchronous output inhibited

**Description**

Defines the output source of the pulse output terminal.

| Setpoint | 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.<br>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.<br>When the pulses of multi-axis servo is tracked synchronously, synchronous output of pulse references is recommended. |
| 2 | Frequency-division output inhibited | No output is generated from pulse output terminals. |

The pulse output terminals are as follows:

| Signal Name | 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 |

Signal width of phase A/B pulse is determined by motor speed. Signal width of phase Z pulse is half of that of phase A/B pulse.

The output polarity of phase Z signal is determined by the setting of H05.41 (Output polarity of pulse Z).

**H05.39** **Electronic gear ratio switchover condition**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-28h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Switchover after position reference is kept 0 for 2.5 ms

1: Switched in real time

**Description**

Defines the condition for switching the electronic gear ratio.

| Setpoint | switchover conditions | Remarks |
|---|---|---|
| 0 | Switching after the position pulse reference kept 0 for 2.5 ms | DI function 24 must be set for a DI terminal.<br>(FunIN.24: GEAR_SEL, electronic gear ratio selection) |
| 1 | Real-time switchover | |

**H05.40** **Mechanical home offset and action upon overtravel**

| | | | |
|---|---|---|---|
| Hex: | 2005-29h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 3 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: H05.36 as the coordinate after homing, reverse homing applied after homing triggered again on overtravel

1: H05.36 as the relative offset after homing, reverse homing applied after homing triggered again on overtravel

2: H05.36 as the coordinate after homing, reverse homing auto-applied on overtravel

3: H05.36 as the relative offset after homing, reverse homing auto-applied on overtravel

**Description**

Defines the offset relationship between the mechanical home and mechanical zero point, and the action upon overtravel during homing.

Note: The following logic takes effect when H11.00 is not 5.

| Set-point | Mechanical home offset and action upon overtravel | Remarks | |
|---|---|---|---|
| | | Mechanical home | Overtravel handling |
| 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. | When homing is triggered again, the drive performs homing in reverse direction. |
| 1 | H05.36 as the relative offset after homing, reverse homing triggered on hitting the limit | The mechanical home overlaps with the mechanical zero point. After locating the home position, the motor will not stop until reaching the value of H05.36. | When homing is triggered again, the drive performs homing in 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 drive continues to perform homing in reverse direction. |
| 3 | H05.36 as the relative offset after homing, reverse homing auto-applied on overtravel | The mechanical home overlaps with the mechanical zero point. After locating the home position, the motor will not stop until reaching the value of H05.36. | The drive continues to perform homing in reverse direction. |

After homing (including homing and electrical homing), the absolute motor position (H0b.07) is consistent with H05.36.

Homing completed signal (FunOUT.16: HomeAttain) or electrical homing completed signal (FunOUT.17: ElecHomeAttain) will be output only after H0b.07 = H05.36. Regardless of S-ON signal state.

**H05.41** **Z pulse output polarity**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-2Ah | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |

Max.: 1 | Data Type: UInt16
Default: 1 | Change: At stop

**Value Range:**

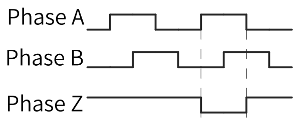
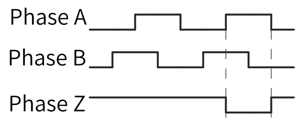
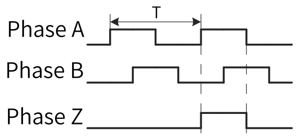
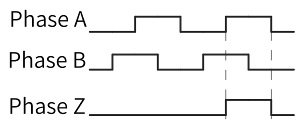
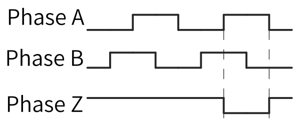
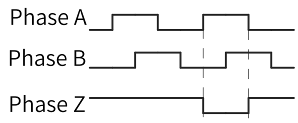
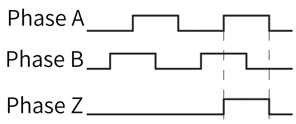
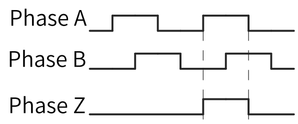
0: Negative (Z pulse active low)

1: Positive (Z pulse active high)

**Description**

Defines the output level when the Z pulse of pulse output terminal is active.

Table 15–8 Pulse diagrams of encoder frequency-division output (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 | <br>Phase A leads phase B by 90°. | <br>Phase B leads phase A by 90°. |
| | 1 | <br>Phase A leads phase B by 90°. | <br>Phase B leads phase A by 90°. |
| 1 | 0 | <br>Phase B leads phase A by 90°. | <br>Phase A leads phase B by 90°. |
| | 1 | <br>Phase B leads phase A by 90°. | <br>Phase A leads phase B by 90°. |

It is recommended to use the active edge outputted by Z signal when a high precision frequency-division output of Z signal is required.

| Setpoint | Z pulse output polarity |
|---|---|
| 0 | Negative (low level upon active Z pulse) |
| 1 | Positive (high level upon active Z pulse) |

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

**H05.43** **Position pulse edge**

Hexadecimal: 2005-2Ch | Effective Time: Upon the next power-on
Min.: 0 | Unit: -
Max.: 1 | Data Type: UInt16
Default: 1 | Change: Immediately

**Value Range:**

0: Falling edge-triggered

1: Rising edge-triggered

**Description**

-

**H05.44** **Encoder multi-turn data offset**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-2Dh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 to 65535

**Description**

**H05.46** **Position offset in absolute position linear mode (low 32 bits)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-2Fh | Effective Time: | Upon the next power-on |
| Min.: | -2147483648 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | At stop |

**Value Range:**

-2147483648 to 2147483647

**Description**

-

**H05.48** **Position offset in absolute position linear mode (high 32 bits)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-31h | Effective Time: | Upon the next power-on |
| Min.: | -2147483648 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | At stop |

**Value Range:**

-2147483648 to 2147483647

**Description**

-

**H05.50** **Mechanical gear ratio in absolute position rotation mode (numerator)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-33h | Effective Time: | Real time |
| Min.: | 1 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 1 | Change: | At stop |

**Value Range:**

1 to 65535

**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)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-34h | Effective Time: | Real time |
| Min.: | 1 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 1 | Change: | At stop |

**Value Range:**
1 to 65535
**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)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-35h | Effective Time: | Real time |
| Min.: | 0 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | UInt32 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 2147483647
**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)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-37h | Effective Time: | Real time |
| Min.: | 0 | Unit: | Encoder unit |
| Max.: | 127 | Data Type: | UInt32 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 127
**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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-39h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 2 | Change: | Immediately |

**Value Range:**
0rpm–1000rpm
**Description**
-

**H05.57 Mechanical limit times threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-3Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 20 | Change: | Immediately |

**Value Range:**
0 to 65535
**Description**
-

**H05.58 Torque threshold in homing upon hit-and-stop**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-3Bh | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |

| | | | |
|---|---|---|---|
| Max.: | 300.0 | Data Type: | UInt16 |
| Default: | 100.0 | Change: | Immediately |

**Value Range:**
0.0% to 300.0%
**Description**
Defines the maximum positive/negative torque limit in homing upon hit-and-stop.

**H05.59** **Positioning window time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-3Ch | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 30000 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0 ms to 30000 ms
**Description**
If the positioning deviation is less than the time threshold of positioning completed, the positioning completed signal is active only if the set time threshold is exceeded.

**H05.60** **Hold time of positioning completed**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-3Dh | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 30000 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0 ms to 30000 ms
**Description**
Defines the hold time of an active positioning completed signal.

**H05.61** **Encoder frequency-division pulse output (32-bit)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-3Eh | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | PPR |
| Max.: | 262143 | Data Type: | UInt32 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0P/Rev–262143P/Rev
**Description**
When the capacity of H05.17 is insufficient, defines the number of pulses output by PAO or PBO per revolution.
Pulse output resolution per revolution = (H05.61) x 4

**H05.63** **Real time update of position reference source**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-40h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 1
**Description**
-

**H05.66** **Homing time unit**

| | | | |
|---|---|---|---|
| Hex: | 2005-43h | Effective mode: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: 1 ms

1: 10 ms

2: 100 ms

**Description**

Defines the homing time unit. The actual timeout time is H05.35 x H05.66 ms.

**H05.67** **Offset between zero point and single-turn absolute position**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-44h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2147483648 | Data Type: | UInt32 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0 to 2147483648

**Description**

-

**H05.69** **Auxiliary homing function**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2005-46h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Disabled

1: Enable single-turn homing

2: Record deviation position

3: Start a new search for the Z signal (homing)

4: Clear the position deviation

**Description**

Single-turn homing mode setting

0: Disabled

1: Enable single-turn homing

2: Record deviation position

3: Start a new search for the Z signal (homing)

4: Clear the position deviation

## 15.7 H06 Speed Control Parameters

**H06.00** **Source of main speed reference A**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-01h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 0 | Data Type: | UInt16 |

| | | | |
|---|---|---|---|
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Digital setting (H06.03)

**Description**

Defines the source of main speed reference A.

| Setpoint | Reference source | Instruction receiving method |
|---|---|---|
| 0 | Digital setting | The source of speed reference A is set by H06.03. |

**H06.01** **Source of auxiliary speed reference B**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-02h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 5 | Data Type: | UInt16 |
| Default: | 5 | Change: | At stop |

**Value Range:**

0: Digital setting (H06.03)

5: Multi-speed reference

**Description**

Defines the source of auxiliary speed reference B.

| Setpoint | 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 defined by internal multi-speed references. For details on multi-speed, see parameters in group H12. |

**H06.02** **Speed reference source**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-03h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Source of main speed reference A

1: Source of auxiliary speed reference B

2: A+B

3: Switched between A and B

4: Communication

**Description**

Defines the source of speed references.

<table>
<tr><th>Setpoint</th><th>Control mode</th><th>Remarks</th></tr>
<tr><td>0</td><td>Source of main speed reference A</td><td>The reference source is defined by H06.00.</td></tr>
<tr><td>1</td><td>Source of auxiliary speed reference B</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>Inactive</td><td>Source of main speed reference A</td></tr><tr><td>Active</td><td>Source of auxiliary speed reference B</td></tr></table></td></tr>
<tr><td>4</td><td>Communication</td><td>The speed reference is defined by operating on H31.09 through communication (unit: 0.001 RPM).</td></tr>
</table>

**H06.03** **Speed reference set through keypad**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-04h | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

–6000 rpm to 6000 rpm

**Description**

Defines the speed reference value set through the keypad.

**H06.04** **Jog speed setpoint**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-05h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**

0rpm–6000rpm

**Description**

Defines the DI jog speed reference.

**H06.05** **Acceleration ramp time constant of speed reference**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-06h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

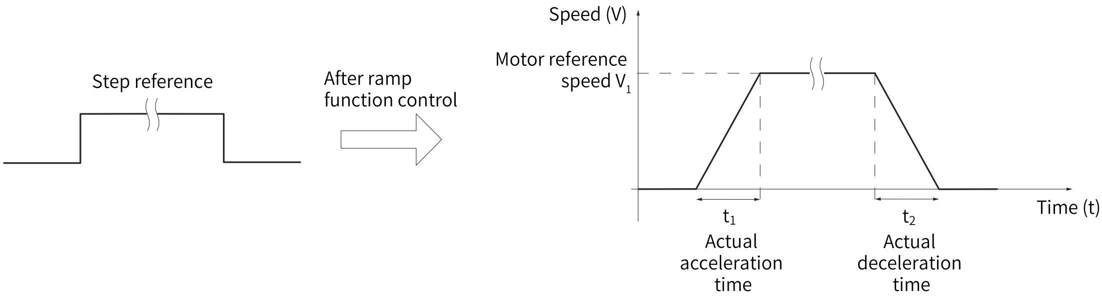
Sets acceleration ramp time of speed reference. The acceleration/deceleration time constant of multi-speed references are defined only by parameters in group H12.

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 for calculating the actual acceleration/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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-07h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0 ms to 65535 ms
**Description**
Set the acceleration/deceleration ramp time constant of speed reference. The acceleration/deceleration ramp time constant is determined 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 for calculating the actual acceleration/deceleration time are as follows:

$$\text{Actual acceleration time } t_1 = \frac{\text{Speed reference}}{1000} \times \text{Speed reference acceleration ramp time}$$

$$\text{Actual deceleration time } t_2 = \frac{\text{Speed reference}}{1000} \times \text{Speed reference deceleration ramp time}$$

**H06.07** **Maximum speed limit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-08h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 6000 | Change: | Immediately |

**Value Range:**
0rpm–6000rpm
**Description**
Defines the maximum speed limit.

**H06.08** **Forward speed limit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-09h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 6000 | Change: | Immediately |

**Value Range:**

0rpm–6000rpm

**Description**

Defines the forward speed threshold.

**H06.09** **Reverse speed limit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-0Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 6000 | Change: | Immediately |

**Value Range:**

0rpm–6000rpm

**Description**

Defines the reverse speed threshold.

In the speed control mode, the sources of speed reference limit include:

- H06.07 (Maximum speed limit): Defines the speed reference limit in both directions. The limit value applies when speed references exceed it.
- H06.08 (Forward speed limit): Defines the speed limit in the forward direction.The limit value applies when forward speed references exceed it.
- H06.09 (Reverse speed limit): Defines the speed limit in the reverse direction.The limit value applies when reverse speed references exceed it.
- Maximum speed of the motor (default threshold): Depends on the motor model.

The actual motor speed limit complies with the following range:

- |Forward speed limit| ≤ min {maximum motor speed, H06.07, H06.08}
- |Reverse speed limit| ≤ min {maximum motor speed, H06.07, H06.09}

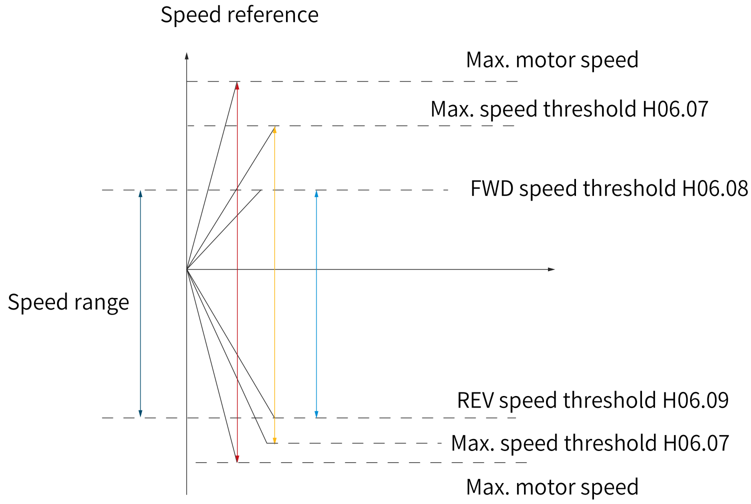



Figure 15-1 Example of speed reference limit

**H06.11** **Torque feedforward control**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-0Ch | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**

0: No torque feedforward

1: Internal torque feedforward

**Description**

Defines the source for torque feedforward control.

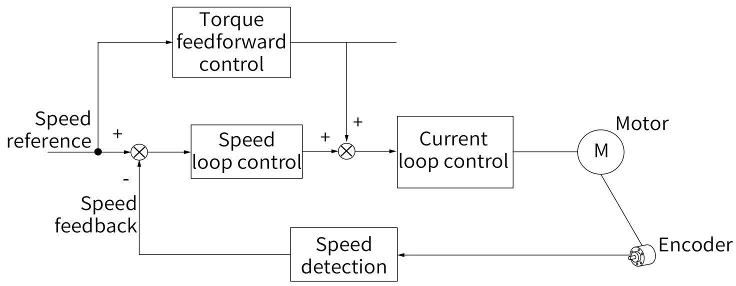
Defines whether to enable internal torque feedforward in the control modes other than torque control.

Torque feedforward can be used to improve the torque reference response speed and reduce the position deviation during acceleration/deceleration at constant speed.

| Setpoint | Torque feedforward control | Remarks |
|---|---|---|
| 0 | / | - |
| 1 | Internal torque feedforward | The speed reference is used as the torque feedforward signal source, which is further divided into the following two situations:<br>• In the position control mode, the speed reference refers to that output from the position controller.<br>• In the speed control mode, the speed reference refers to that set by the user. |

Parameters of the torque feedforward function include H08.20 (Torque feedforward filter time constant) and H08.21 (Torque feedforward gain).

The block diagram for torque feedforward control in control modes other than torque control is as follows:




**H06.13** **Speed smoothing time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-0Eh | Effective Time: | Real time |
| Min.: | 0 | Unit: | us |
| Max.: | 20000 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0us–20000us

**Description**

Defines the speed feedforward smoothing filter time.

**H06.15** **Zero clamp speed threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-10h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0rpm–6000rpm

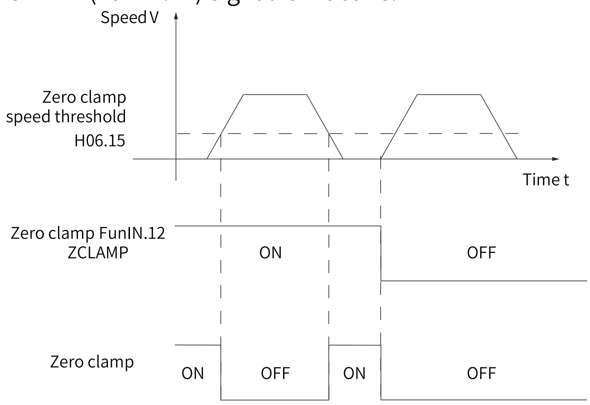
**Description**

Defines the zero clamp speed threshold.

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.

When the speed reference amplitude exceeds the value of H06.15, the motor exits from the zero clamp state and continues running according to the speed reference received. Zero clamp is deactivated when the ZCLAMP (FunIN.12) signal is inactive.




**H06.16** **Threshold of TGON (motor rotation) signal**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-11h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 20 | Change: | Immediately |

**Value Range:**

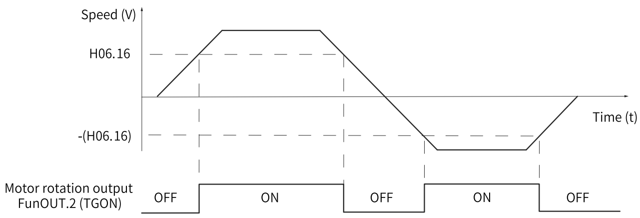
0rpm–1000rpm

**Description**

Sets the threshold of TGON (motor rotation) signal.

When the absolute value of the filtered actual motor speed reaches the value of H06.16 (Threshold of TGON (motor rotation) signal), the motor is acknowledged to be rotating. 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 filtered actual motor speed is lower than the value of H06.16, the motor is not rotating.

Judgment on the motor rotation signal (FunOUT.2, TGON) is not affected by the operating state or control mode of the drive.




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.

The filter time constant of the motor speed can be set in H0A.27 (Speed DO filter time constant).

**H06.17** **Threshold of V-Cmp (speed matching) signal**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-12h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 100 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

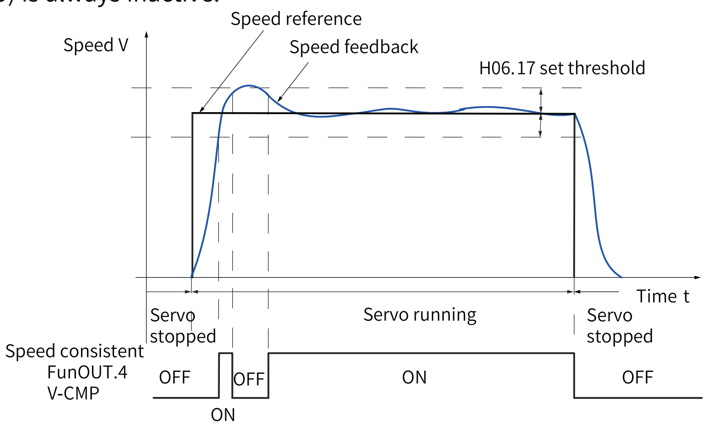
0rpm–100rpm

**Description**

Defines the threshold of speed match 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.




In the preceding figure, "ON" indicates the the V-Cmp (speed matching) signal is active. "OFF" indicates the V-Cmp signal is inactive.

The filter time constant of the motor speed can be set in H0A.27 (Speed DO filter time constant).

**H06.18** **Threshold of speed reach signal**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-13h | Effective Time: | Real time |
| Min.: | 10 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 1000 | Change: | Immediately |

**Value Range:**

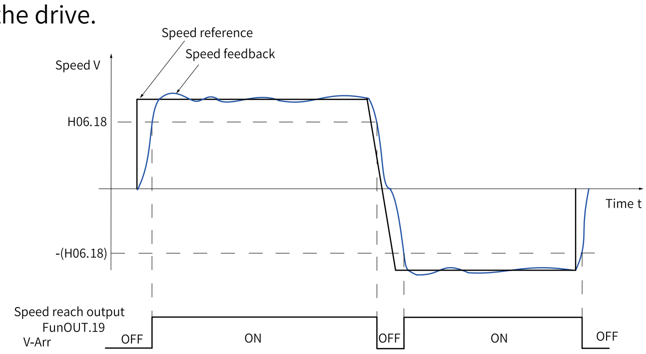
10rpm–6000rpm

**Description**

Defines the threshold of speed reached signal.

When the absolute value of the motor speed after filter exceeds the setting of H06.18 (Threshold of speed arrival signal), the motor speed is considered to reach the desired value. At this moment, the servo drive outputs the speed arrival 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.




Note: In the preceding figure, "ON" indicates the V-Arr (speed reached) signal is active. "OFF" indicates the V-Arr (speed reached) signal is inactive.

The filter time constant of the motor speed can be set in H0A.27 (Speed DO filter time constant).

**H06.19** **Threshold of zero speed output signal**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-14h | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

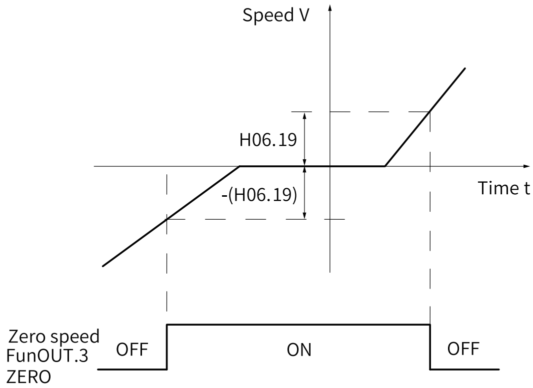
**Description**

Defines the threshold of zero speed output signal.

The servo drive outputs the V-Zero (FunOUT.3: zero speed) signal only when the absolute value of actual motor speed is lower than the threshold defined by H06.19. 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.




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.

The filter time constant of the motor speed can be set in H0A.27 (Speed DO filter time constant).

**H06.28** **Cogging torque ripple compensation**

| | | | |
|---|---|---|---|
| Hex: | 2006-1Dh | Effective mode: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Real-time |

**Value Range:**

0 to 1

**Description**

Used to enable the cogging torque fluctuation compensation function.

**H06.31** **Sine frequency**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-20h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 16000 | Data Type: | UInt16 |
| Default: | 50 | Change: | Immediately |

**Value Range:**

0 to 16000

**Description**

-

**H06.32** **Sine amplitude**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-21h | Effective Time: | Real time |

| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | - |
| Max.: | 30000 | Data Type: | UInt16 |
| Default: | 30 | Change: | Immediately |

**Value Range:**

0 to 30000

**Description**

-

**H06.33** **Sine amplitude**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-22h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 3 | Data Type: | UInt16 |
| Default: | 30 | Change: | Immediately |

**Value Range:**

0: Disabled

1: Position reference sine

2: Speed reference sine

3: Torque reference sine

**Description**

-

**H06.35** **Sine offset**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2006-24h | Effective Time: | Real time |
| Min.: | -9900 | Unit: | - |
| Max.: | 9900 | Data Type: | Int16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

-9900 to 9900

**Description**

-

## 15.8 H07 Torque Control Parameters

**H07.00** **Source of main torque reference A**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-01h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 0 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Keypad (H07.03)

**Description**

Defines the source of the main torque reference A.

| Setpoint | Reference source | Instruction receiving method |
|---|---|---|
| 0 | Keypad (H07.03) | Torque reference A is set by H07.03. |

**H07.01** **Source of auxiliary torque reference B**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-02h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |

| | | | |
|---|---|---|---|
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Keypad (H07.03)

**Description**

Defines the source of auxiliary torque references.

| Setpoint | Reference source | Instruction receiving method |
|---|---|---|
| 0 | Keypad (H07.03) | Torque reference A is set by H07.03. |

## H07.02 Torque reference source

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-03h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Source of main torque reference A

1: Source of auxiliary torque reference B

2: Source of A+B

3: Switched between A and B

4: Communication

**Description**

Selects torque reference.

<table>
<tr><th>Setpoint</th><th>Control mode</th><th>Remarks</th></tr>
<tr><td>0</td><td>Source of main torque reference A</td><td>The reference source is defined by H07.00.</td></tr>
<tr><td>1</td><td>Source of auxiliary torque reference B</td><td>The reference source is defined by H07.01.</td></tr>
<tr><td>2</td><td>A+B</td><td>The reference source is the product of A+B (H07.00 +H07.01).</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).<br>
<table>
<tr><th>State of FunIN.4 (Cmd_SEL)</th><th>Reference Source</th></tr>
<tr><td>Inactive</td><td>Source of main torque reference A</td></tr>
<tr><td>Active</td><td>Source of auxiliary torque reference B</td></tr>
</table></td></tr>
<tr><td>4</td><td>Communication</td><td>The torque reference is defined by operating on H31.11 through communication.</td></tr>
</table>

## H07.03 Torque reference set through keypad

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-04h | Effective Time: | Real time |
| Min.: | -400.0 | Unit: | % |
| Max.: | 400.0 | Data Type: | Int16 |
| Default: | 0.0 | Change: | Immediately |

**Value Range:**

-400.0% to 400.0%

**Description**

Sets torque reference set through keypad.

**H07.05** **Torque reference filter time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-06h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 30.00 | Data Type: | UInt16 |
| Default: | 0.50 | Change: | Immediately |

**Value Range:**

0.00 ms to 30.00 ms

**Description**

Defines the torque reference filter time constant 1.

**H07.06** **2nd torque reference filter time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-07h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 30.00 | Data Type: | UInt16 |
| Default: | 0.27 | Change: | Immediately |

**Value Range:**

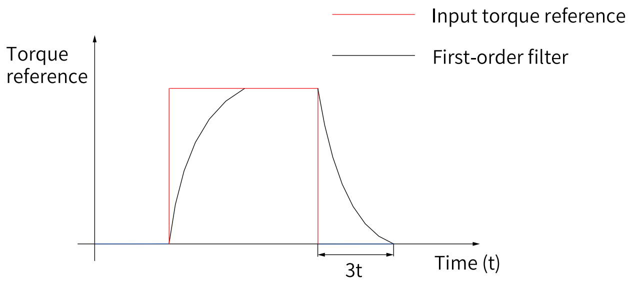
0.00 ms to 30.00 ms

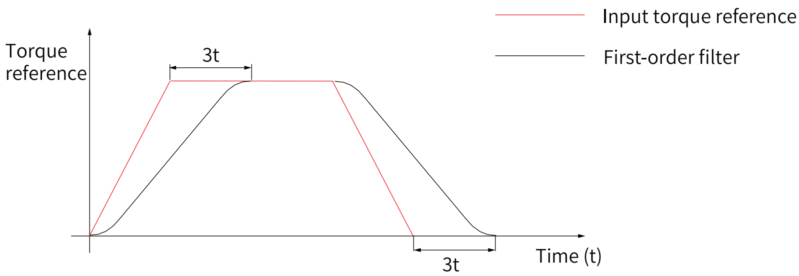
**Description**

Defines the torque reference filter time constant 2.

Low-pass filtering of torque references helps smoothen torque references and reduce vibration.

Pay attention to the responsiveness during setting as an excessively high setpoint lowers down the responsiveness.




***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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-08h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |

| | | | |
|---|---|---|---|
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Forward/Reverse internal torque limit (default)

1: Forward/Reverse external torque limit (selected through P-CL and N-CL)

**Description**

Sets the torque limit source.

| Setpoint | Torque limit source |
|---|---|
| 0 | Positive/Negative internal torque limit |
| 1 | Forward/Reverse external torque limit (selected through P-CL and N-CL) |

**H07.09** **Positive internal torque limit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-0Ah | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 400.0 | Data Type: | UInt16 |
| Default: | 350.0 | Change: | Immediately |

**Value Range:**

0.0% to 400.0%

**Description**

Sets the forward run internal torque limit.

**H07.10** **Negative internal torque limit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-0Bh | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 400.0 | Data Type: | UInt16 |
| Default: | 350.0 | Change: | Immediately |

**Value Range:**

0.0% to 400.0%

**Description**

Sets the reverse run internal torque limit.

**H07.11** **Positive external torque limit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-0Ch | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 400.0 | Data Type: | UInt16 |
| Default: | 350.0 | Change: | Immediately |

**Value Range:**

0.0% to 400.0%

**Description**

Sets the positive external torque limit.

**H07.12** **Negative external torque limit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-0Dh | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 400.0 | Data Type: | UInt16 |
| Default: | 350.0 | Change: | Immediately |

**Value Range:**

0.0% to 400.0%

**Description**

Sets the negative external torque limit.

**H07.15** **Emergency-stop torque**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-10h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 300.0 | Data Type: | UInt16 |
| Default: | 100.0 | Change: | At stop |

**Value Range:**

0.0% to 300.0%

**Description**

-

**H07.17** **Speed limit source**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-12h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Internal speed limit (in torque control)

1: 0 (no action)

2: 1st or 2nd speed limit input selected by FunIN.36

**Description**

Sets the speed limit source.

| Setpoint | 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<br>DI (FunIN.36) active: H07.20 used as positive/negative speed limit |

**H07.19** **Forward speed limit/1st speed limit in torque control**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-14h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 3000 | Change: | Immediately |

**Value Range:**

0rpm–6000rpm

**Description**

Defines the positive speed limit in torque control.

**H07.20** **Reverse speed limit/2nd speed limit in torque control**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-15h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 3000 | Change: | Immediately |

**Value Range:**

0rpm–6000rpm

**Description**

Defines the negative speed limit in torque control.

**H07.21** **Base value for torque reach**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-16h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 300.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Immediately |

**Value Range:**

0.0% to 300.0%

**Description**

Defines the torque reference of the base value for torque reach.

**H07.22** **Torque reach valid value**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-17h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 300.0 | Data Type: | UInt16 |
| Default: | 20.0 | Change: | Immediately |

**Value Range:**

0.0% to 300.0%

**Description**

Defines the torque reference for torque reach DO active.

**H07.23** **Torque reach invalid value**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-18h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 300.0 | Data Type: | UInt16 |
| Default: | 10.0 | Change: | Immediately |

**Value Range:**

0.0% to 300.0%

**Description**

Defines the torque reference for torque reach DO inactive.

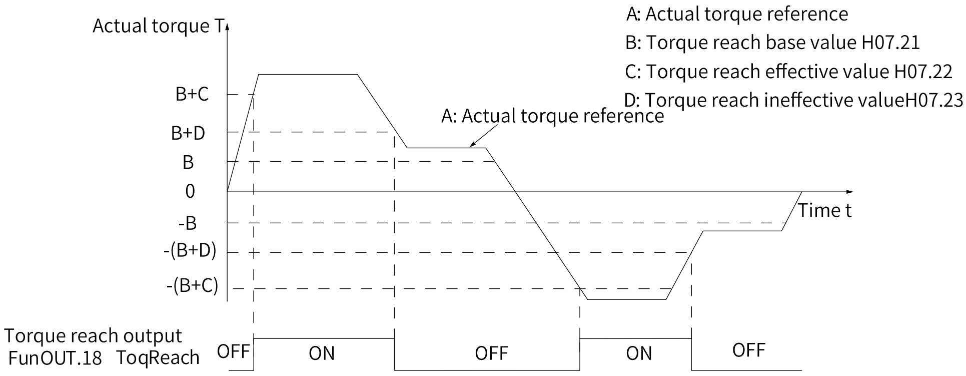
The torque reach output is used to determine whether the actual torque reference reaches the set range. The drive outputs TorReach (FunOUT.18: torque reach) signal to the host controller when the actual torque reference reaches the torque reference threshold.

- Actual torque reference (viewed in H0b.02): A
- Base value for torque reach (H07.21): B.
- Threshold of valid torque arrival (H07.22): C.
- Threshold of invalid torque reach (H07.23): D.

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: $|A| \geqslant B + C$ for 10 ms. Otherwise, the torque reach DO signal remains inactive.

For the torque reach DO signal to become inacive, the actual torque reference must meet the following condition: $|A| < B + D$. Otherwise, the torque reach signal remains active.




**H07.24** **Field weakening depth**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-19h | Effective Time: | Real time |
| Min.: | 60 | Unit: | % |
| Max.: | 120 | Data Type: | UInt16 |
| Default: | 115 | Change: | Immediately |

**Value Range:**

60% to 120%

**Description**

Set the flux eakening depth.

**H07.25** **Max. permissible demagnetizing current**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-1Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | % |
| Max.: | 200 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**

0% to 200%

**Description**

Set the maximum allowable demagnetization current value.

**H07.26** **Field weakening selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-1Bh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**

0 to 1

**Description**

Disable or enable field weakening.

**H07.27** **Flux weakening gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-1Ch | Effective Time: | Real time |
| Min.: | 1 | Unit: | Hz |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 30 | Change: | Immediately |

**Value Range:**

1 Hz to 1000 Hz

**Description**

Set the gain of flux weakening.

**H07.40** **Speed limit window in the torque control mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2007-29h | Effective Time: | Real time |
| Min.: | 0.5 | Unit: | ms |
| Max.: | 30.0 | Data Type: | UInt16 |
| Default: | 1.0 | Change: | Immediately |

**Value Range:**

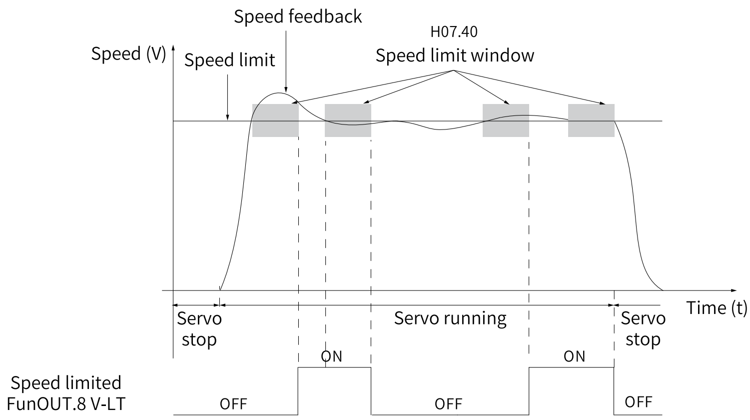
0.5 ms to 30.0 ms

**Description**

Sets speed limit window in the torque control mode.

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 satisfied, the speed limit signal will be deactivated.

Acknowledgment of the V-LT (Speed limit) signal is executed only during operation 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.

# 15.9 H08 Gain Parameters

**H08.00** **Speed loop gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-01h | Effective Time: | Real time |
| Min.: | 0.1 | Unit: | Hz |
| Max.: | 2000.0 | Data Type: | UInt16 |
| Default: | 40.0 | Change: | Immediately |

**Value Range:**

0.1 Hz to 2000.0 Hz

**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.
In the position control mode, the position loop gain must be increased together with the speed loop gain.

**H08.01** **Speed loop integral time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-02h | Effective Time: | Real time |
| Min.: | 0.15 | Unit: | ms |
| Max.: | 512.00 | Data Type: | UInt16 |
| Default: | 19.89 | Change: | Immediately |

**Value Range:**

0.15 ms to 512.00 ms

**Description**

Defines 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.

Note:

There is no integral action when H08.01 is set to 512.00.

**H08.02** **Position loop gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-03h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | Hz |
| Max.: | 2000.0 | Data Type: | UInt16 |
| Default: | 64.0 | Change: | Immediately |

**Value Range:**

0.0 Hz to 2000.0 Hz

**Description**

Defines the proportional gain of the position loop.

Defines the responsiveness of the position loop. A high setpoint shortens the positioning time. Note that an excessively high setpoint may cause vibration.

The 1st group of gain parameters 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** **2nd speed loop gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-04h | Effective Time: | Real time |
| Min.: | 0.1 | Unit: | Hz |
| Max.: | 2000.0 | Data Type: | UInt16 |
| Default: | 75.0 | Change: | Immediately |

**Value Range:**

0.1 Hz to 2000.0 Hz

**Description**

-

**H08.04** **2nd speed loop integral time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-05h | Effective Time: | Real time |
| Min.: | 0.15 | Unit: | ms |
| Max.: | 512.00 | Data Type: | UInt16 |
| Default: | 10.61 | Change: | Immediately |

**Value Range:**

0.15 ms to 512.00 ms

**Description**

-

**H08.05** **2nd position loop gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-06h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | Hz |

| | | | |
|---|---|---|---|
| Max.: | 2000.0 | Data Type: | UInt16 |
| Default: | 120.0 | Change: | Immediately |

**Value Range:**

0.0 Hz to 2000.0 Hz

**Description**

Defines the second gain set of the position loop and speed loop. The 2nd group of gain parameters include H08.03 (Speed loop gain), H08.04 (Speed loop integral time constant), H08.05, and H07.06 (Torque reference filter time constant 2).

**H08.08** **2nd gain mode setting**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-09h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value 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

**Description**

Defines the mode for switching to the 2nd gain set.

| Setpoint | Mode |
|---|---|
| 0 | Fixed at 1st gain. P/PI of speed control is switched through DI function 3 (FunIN.3: GAIN_SEL, gain switchover).<br>• GAIN_SEL invalid: PI control<br>• 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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-0Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 10 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Fixed to the 1st gain set (PS)

1: Switch with 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 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)

**Description**

Used to set the condition for gain switchover.

| Setpoint | Gain switchover condition | Remarks |
| --- | --- | --- |
| 0 | Fixed to the 1st gain set | The 1st gain set applies. |
| 1 | Switched as defined by bit26 of 60FEh | - |
| 2 | Torque reference too 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.<br>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 too large | If the speed reference absolute value exceeds (Level + Dead time) [rpm] in the last 1st gain set, the drive switches to the 2nd gain set.<br>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 too large | Active in the control modes other than speed control<br>If the absolute value of the change rate of the speed reference exceeds (Level + Dead time) [10 rpm/s] in the last 1st gain set, the drive switches to the 2nd gain set.<br>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.<br>In the speed control mode, the 1st gain set always applies. |
| 5 | Speed reference high/low-speed threshold | If the speed reference absolute value exceeds (Level - Dead time) [rpm] in the last 1st gain set, the drive starts to switch to the 2nd gain set, with gains changed gradually. When the speed reference absolute value reaches (Level + Dead time) [rpm], the 2nd gain set applies.<br>If the speed reference absolute value is lower than (Level + Dead time) [rpm] in the last 2nd gain set, the drive starts to return to the 1st gain set, with gains changed gradually. When the speed reference absolute value reaches (Level - Dead time) [rpm], the 1st gain set applies. |
| 6 | Position deviation too large | Active only in position control and full closed-loop control.<br>If the position deviation absolute value exceeds (Level + Dead time) [encoder unit] in the last 1st gain set, the drive switches to the 2nd gain set.<br>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.<br>If the drive is not in position control or full closed-loop control, the 1st gain set always applies. |
| 7 | Position reference available | Active only in position control and full closed-loop control.<br>If the position reference is not 0 in the last 1st gain set, the drive switches to the 2nd gain set.<br>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.<br>If the drive is not in position control or full closed-loop control, the 1st gain set always applies. |

| Setpoint | Gain switchover condition | Remarks |
|---|---|---|
| 8 | Positioning uncompleted | Active only in position control and full closed-loop control.<br>If positioning has not been completed in the last 1st gain set, the drive switches to the 2nd gain set.<br>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.<br>If the drive is not in position control or full closed-loop control, the 1st gain set always applies. |
| 9 | Actual speed too high | Active only in position control and full closed-loop control.<br>If the absolute value of actual speed exceeds (Level + Dead time) [rpm] in the last 1st gain set, the drive switches to the 2nd gain set.<br>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.<br>If the drive is not in position control or full closed-loop control, the 1st gain set always applies. |
| 10 | Position reference + Actual speed | Active only in position control and full closed-loop control.<br>If the position reference is not 0 in the last 1st gain set, the drive switches to the 2nd gain set.<br>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).<br>If the drive is not in position control or full closed-loop control, the 1st gain set always applies. |

**H08.10** **Gain switchover delay**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-0Bh | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | ms |
| Max.: | 1000.0 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | At stop |

**Value Range:**

0.0 ms to 1000.0 ms

**Description**

Defines the delay when the drive switches from the 2nd gain set to the 1st gain set.

**H08.11** **Gain switchover level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-0Ch | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 20000 | Data Type: | UInt16 |
| Default: | 50 | Change: | Immediately |

**Value Range:**

0 to 20000

**Description**

Defines the gain switchover level.

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 dead time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-0Dh | Effective Time: | Real time |

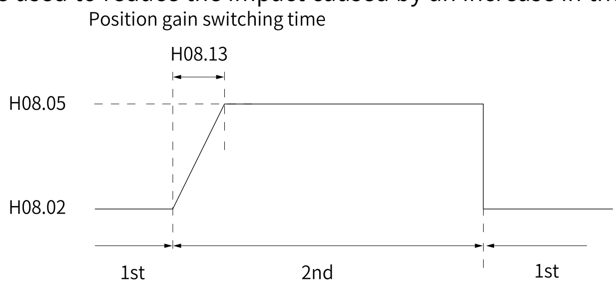
| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | - |
| Max.: | 20000 | Data Type: | UInt16 |
| Default: | 30 | Change: | At stop |

**Value Range:**
0 to 20000
**Description**
Defines the dead time 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:
The set value of H08.11 (Gain switchover level) must be no less than that of H08.12; otherwise, the H08.11 will be set to a value equal to H08.12 automatically.

**H08.13** **Position gain switchover time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-0Eh | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | ms |
| Max.: | 1000.0 | Data Type: | UInt16 |
| Default: | 3.0 | Change: | At stop |

**Value Range:**
0.0 ms to 1000.0 ms
**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 can be used to reduce the impact caused by an increase in the position loop gain.




If the set value of H08.05 is no more than that of H08.02, H08-13 will be invalid and the servo drive switches to the 2nd gain immediately.

**H08.14** **Auto-tuned inertia value**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-0Fh | Effective Time: | - |
| Min.: | 0.00 | Unit: | - |
| Max.: | 200.00 | Data Type: | UInt16 |
| Default: | 0.00 | Change: | Unchangeable |

**Value Range:**
0.00 to 200.00
**Description**
-

**H08.15** **Load moment of inertia ratio**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-10h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | - |
| Max.: | 120.00 | Data Type: | UInt16 |
| Default: | 2.00 | Change: | Immediately |

**Value Range:**

0.00 to 120.00

**Description**

Defines the mechanical load inertia ratio relative to the motor moment of inertia.

$$\text{Load moment of inertia ratio} = \frac{\text{Moment of inertia of mechanical load}}{\text{Moment of inertia of the motor}}$$

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** **Speed feedforward filter time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-13h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 64.00 | Data Type: | UInt16 |
| Default: | 0.50 | Change: | Immediately |

**Value Range:**

0.00 ms to 64.00 ms

**Description**

Defines the filter time constant of speed feedforward.

**H08.19** **Speed feedforward gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-14h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 100.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Immediately |

**Value Range:**

0.0% to 100.0%

**Description**

In position control and full closed-loop control, speed feedforward is the product of speed feedforwad signal multiplied by H08.19 and is part of the speed reference.

Increasing the setpoint improves the responsiveness to position references and reduces the position deviation during operation at a constant speed.

Set H08.18 to a fixed value first, and then increase the value of H08.19 gradually from 0 to a certain value at which speed feedforward achieves the desired effect.

Adjust H08.18 and H08.19 repeatedly until a balanced performance is achieved.

Note:

For how to enable the speed feedforward function and select the speed feedforward signal, see H05.19 (Speed feedforward control).

**H08.20** **Torque feedforward filter time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-15h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 64.00 | Data Type: | UInt16 |
| Default: | 0.50 | Change: | Immediately |

**Value Range:**

0.00 ms to 64.00 ms

**Description**

Defines the filter time constant of torque feedforward.

**H08.21** **Torque feedforward gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-16h | Effective Time: | Real time |

Min.: 0.0 | Unit: %
Max.: 200.0 | Data Type: UInt16
Default: 0.0 | Change: Immediately

**Value Range:**

0.0% to 200.0%

**Description**

In control modes other than torque control, torque feedforward is the product of torque feedforwad signal multiplied by H08.21 and is part of the torque reference.

Increasing the setpoint improves the responsiveness to variable speed references.

Increasing the setpoint improves the responsiveness to position references and reduces the position deviation during operation at a constant 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 filtering option**

Hexadecimal: 2008-17h | Effective Time: Real time
Min.: 0 | Unit: -
Max.: 4 | Data Type: UInt16
Default: 0 | Change: At stop

**Value Range:**

0: Inhibited

1: 2 times

2: 4 times

3: 8 times

4: 16 times

**Description**

Defines the moving average filtering times for speed feedback.

The higher the setpoint, the weaker the speed feedback fluctuation, but the longer the feedback delay will be.

| Setpoint | Setting of speed feedback filter |
|---|---|
| 0 | Moving average filtering of speed feedback inhibited |
| 1 | 2 times of moving average filtering on speed feedback |
| 2 | 4 times of moving average filtering on speed feedback |
| 3 | 8 times of moving average filtering on speed feedback |
| 4 | 16 times of moving average filtering on speed feedback |

**H08.23** **Cutoff frequency of speed feedback low-pass filter**

Hexadecimal: 2008-18h | Effective Time: Real time
Min.: 100 | Unit: Hz
Max.: 4000 | Data Type: UInt16
Default: 4000 | Change: Immediately

**Value Range:**

100 Hz to 4000 Hz

**Description**

Defines the cutoff frequency for first-order low-pass filtering on the speed feedback.

Note:

The lower the setpoint, the weaker the speed feedback fluctuation, and the longer the feedback delay will be.

Setting this parameter to 4000 Hz negates the filtering effect.

**H08.24** **PDFF control coefficient**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-19h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 1000.0 | Data Type: | UInt16 |
| Default: | 100.0 | Change: | Immediately |

**Value Range:**

0.0% to 1000.0%

**Description**

Defines the control mode of the speed loop.

When this parameter is set to 100.0, the speed loop adopts PI control (default) with quick 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.

H08.24 can be used to keep a good responsiveness of the speed loop, with the anti-interference capacity in low-frequency bands improved and the speed feedback overshoot unaffected.

**H08.27** **Cutoff frequency of speed observer**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-1Ch | Effective Time: | Real time |
| Min.: | 10 | Unit: | Hz |
| Max.: | 2000 | Data Type: | UInt16 |
| Default: | 170 | Change: | Immediately |

**Value Range:**

10 Hz to 2000 Hz

**Description**

Defines the cutoff frequency of the speed observer. Note that an excessively high setpoint may incur resonance. Decrease the setpoint properly in case of large speed feedback noise.

**H08.28** **Speed inertia correction coefficient**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-1Dh | Effective Time: | Real time |
| Min.: | 10 | Unit: | % |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**

10% to 10000%

**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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-1Eh | Effective Time: | Real time |
| Min.: | 0.02 | Unit: | ms |
| Max.: | 20.00 | Data Type: | UInt16 |
| Default: | 0.80 | Change: | Immediately |

**Value Range:**

0.02 ms to 20.00 ms

**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 observer cutoff frequency**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-20h | Effective Time: | Real time |
| Min.: | 1 | Unit: | Hz |
| Max.: | 1700 | Data Type: | UInt16 |
| Default: | 600 | Change: | Immediately |

**Value Range:**

1 Hz to 1700 Hz

**Description**

-

**H08.32** **Disturbance observer compensation coefficient**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-21h | Effective Time: | Real time |
| Min.: | 0 | Unit: | % |
| Max.: | 100 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0% to 100%

**Description**

-

**H08.33** **Disturbance inertia correction coefficient**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-22h | Effective Time: | Real time |
| Min.: | 1 | Unit: | % |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**

1% to 10000%

**Description**

-

**H08.34** **Medium- and high-frequency jitter suppression phase modulation 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-23h | Effective Time: | Real time |
| Min.: | 0 | Unit: | % |
| Max.: | 1600 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0% to 1600%

**Description**

-

**H08.35** **Medium- and high-frequency jitter suppression frequency 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-24h | Effective Time: | Real time |
| Min.: | 0 | Unit: | Hz |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 Hz to 1000 Hz

**Description**

-

**H08.36** **Medium- and high-frequency jitter suppression compensation 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-25h | Effective Time: | Real time |
| Min.: | 0 | Unit: | % |
| Max.: | 200 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0% to 200%

**Description**

-

**H08.37** **Phase modulation for medium-frequency jitter suppression 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-26h | Effective Time: | Real time |
| Min.: | -90 | Unit: | - |
| Max.: | 90 | Data Type: | Int16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

-90 to 90

**Description**

-

**H08.38** **Frequency of medium-frequency jitter suppression 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-27h | Effective Time: | Real time |
| Min.: | 0 | Unit: | Hz |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 Hz to 1000 Hz

**Description**

-

**H08.39** **Compensation gain of medium-frequency jitter suppression 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-28h | Effective Time: | Real time |
| Min.: | 0 | Unit: | % |
| Max.: | 300 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0% to 300%

**Description**

-

**H08.40** **Speed observer selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-29h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0 to 1

**Description**

Used to set the enable bit for speed observer.

**H08.42** **Model control selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-2Bh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0 to 1

**Description**

Used to enable model tracking control.

**H08.43** **Model gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-2Ch | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | - |
| Max.: | 2000.0 | Data Type: | UInt16 |
| Default: | 40.0 | Change: | Immediately |

**Value Range:**

0.0 to 2000.0

**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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-2Eh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 to 1

**Description**

-

**H08.46** **Model feedforward**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-2Fh | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | - |
| Max.: | 102.4 | Data Type: | UInt16 |
| Default: | 95.0 | Change: | Immediately |

**Value Range:**

0.0 to 102.4

**Description**

-

**H08.51** **Model filtering time 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-34h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 20.00 | Data Type: | UInt16 |
| Default: | 0.00 | Change: | Immediately |

**Value Range:**

0.00 ms to 20.00 ms

**Description**

-

**H08.53** **Medium- and low-frequency jitter suppression frequency 3**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-36h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | Hz |
| Max.: | 600.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Immediately |

**Value Range:**

0.0 Hz to 600.0 Hz

**Description**

-

**H08.54** **Medium- and low-frequency jitter suppression compensation 3**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-37h | Effective Time: | Real time |
| Min.: | 0 | Unit: | % |
| Max.: | 200 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0% to 200%

**Description**

-

**H08.56** **Medium- and low-frequency jitter suppression phase modulation 3**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-39h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1600 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**

0 to 1600

**Description**

-

**H08.58** **Er.660 (Vibration too strong) switch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-3Bh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 to 2

**Description**

-

**H08.59** **Medium- and low-frequency jitter suppression frequency 4**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-3Ch | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | Hz |
| Max.: | 600.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Immediately |

**Value Range:**

0.0 Hz to 600.0 Hz

**Description**

-

**H08.60** **Medium- and low-frequency jitter suppression compensation 4**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-3Dh | Effective Time: | Real time |
| Min.: | 0 | Unit: | % |
| Max.: | 200 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0% to 200%
**Description**
-

**H08.61** **Medium- and low-frequency jitter suppression phase modulation 4**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-3Eh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1600 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**
0 to 1600
**Description**
-

**H08.62** **Position loop integral time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-3Fh | Effective Time: | Real time |
| Min.: | 0.15 | Unit: | ms |
| Max.: | 512.00 | Data Type: | UInt16 |
| Default: | 512.00 | Change: | Immediately |

**Value Range:**
0.15 ms to 512.00 ms
**Description**
Defines the position loop integral time constant.

**H08.63** **2nd position loop integral time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-40h | Effective Time: | Real time |
| Min.: | 0.15 | Unit: | ms |
| Max.: | 512.00 | Data Type: | UInt16 |
| Default: | 512.00 | Change: | Immediately |

**Value Range:**
0.15 ms to 512.00 ms
**Description**
-

**H08.64** **Speed observer feedback selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2008-41h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0 to 1
**Description**
-

## 15.10 H09 Gain auto-tuning parameters

**H09.00** **Gain auto-tuning mode**

Hexadecimal: 2009-01h
Min.: 0
Max.: 7
Default: 0
Effective Time: Real time
Unit: -
Data Type: UInt16
Change: Immediately

**Value Range:**

0: Disabled, manual gain tuning required

1: Enabled, gain parameters generated automatically based on the stiffness level

2: Positioning mode, gain parameters generated automatically based on the stiffness level

3: Interpolation mode+Inertia auto-tuning

4: Standard mode+Inertia auto-tuning

6: Quick positioning mode+Inertia auto-tuning

**Description**

Defines different gain tuning modes. Related gain parameters can be set manually or automatically according to the stiffness level.

| Setpoint | Auto | Remarks |
|---|---|---|
| 0 | Disabled<br>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 | It is one stiffness 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**

Hexadecimal: 2009-02h
Min.: 0
Max.: 41
Default: 15
Effective Time: Real time
Unit: -
Data Type: UInt16
Change: Immediately

**Value Range:**

0 to 41

**Description**

Defines the stiffness level of the servo system. The higher the stiffness level, the stronger the gains and the quicker the response will be. But an excessively high stiffness level will cause vibration. The setpoint 0 indicates the weakest stiffness and 41 indicates the strongest stiffness.

**H09.02** **Adaptive notch mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-03h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Adaptive notch no longer updated;

1: One adaptive notch activated (3rd notch)

2: Two adaptive notches activated (3rd and 4th notches)

3: Resonance point tested only (displayed in H09.24)

4: Adaptive notch cleared, values of 3rd and 4th notches restored to default

**Description**

Defines the operation mode of the adaptive notch.

| Setpoint | Defines the operation mode of the adaptive notch. |
|---|---|
| 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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-04h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 3 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Disabled

1: Enabled, changing slowly

2: Enabled, changing normally

3: Enabled, changing quickly

**Description**

Defines whether to enable online inertia auto-tuning and the inertia ratio update speed during online inertia auto-tuning.

| Setpoint | 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** **Low-frequency resonance suppression mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-05h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Set vibration frequency manually

1: Identify vibration frequency

**Description**

-

**H09.05** **Offline inertia auto-tuning mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-06h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 3 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Positive/Negative triangular wave mode

1: JOG mode

2: Bidirectional auto-tuning mode

3: Unidirectional auto-tuning mode

**Description**

Defines the offline inertia auto-tuning mode. The offline inertia auto-tuning function can be enabled through H0d.02.

| Setpoint | Offline inertia auto-tuning mode | Remarks |
|---|---|---|
| 0 | Positive and negative triangular wave | Applicable to the scenario where the motor movement travel is short. |
| 1 | Jog | 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** **Max. speed of inertia auto-tuning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-07h | Effective Time: | Real time |
| Min.: | 100 | Unit: | rpm |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 500 | Change: | At stop |

**Value Range:**

100rpm–1000rpm

**Description**

Defines the maximum permissible speed reference in offline inertia auto-tuning mode.

During inertia auto-tuning, the higher the speed, the more accurate the auto-tuned values. Use the default setpoint in general cases.

**H09.07** **Time constant for accelerating to max. speed during inertia auto-tuning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-08h | Effective Time: | Real time |
| Min.: | 20 | Unit: | ms |
| Max.: | 800 | Data Type: | UInt16 |
| Default: | 125 | Change: | At stop |

**Value Range:**

20 ms to 800 ms

**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 time after an individual inertia auto-tuning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-09h | Effective Time: | Real time |
| Min.: | 50 | Unit: | ms |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 800 | Change: | At stop |

**Value Range:**

50 ms to 10000 ms

**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 per inertia auto-tuning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-0Ah | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | - |
| Max.: | 100.00 | Data Type: | UInt16 |
| Default: | 1.00 | Change: | Immediately |

**Value Range:**

0.00 to 100.00

**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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-0Ch | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | % |
| Max.: | 100.0 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**

0.0% to 100.0%

**Description**

Defines the warning threshold for current feedback vibration.

**H09.12** **Frequency of the 1st notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-0Dh | Effective Time: | Real time |
| Min.: | 50 | Unit: | Hz |

| | | | |
|---|---|---|---|
| Max.: | 4000 | Data Type: | UInt16 |
| Default: | 4000 | Change: | Immediately |

**Value Range:**
50 Hz to 4000 Hz
**Description**
Defines the center frequency of the notch, which is the mechanical resonance frequency.
In the torque control mode, setting the notch frequency to 4000 Hz deactivates the notch function.

**H09.13** **Width level of the 1st notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-0Eh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 40 | Data Type: | UInt16 |
| Default: | 2 | Change: | Immediately |

**Value Range:**
0 to 40
**Description**
Defines the width level of the notch. Use the default setpoint in general cases.
Width level is the ratio of the notch width to the notch center frequency.

**H09.14** **Depth level of the 1st notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-0Fh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 99 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0 to 99
**Description**
Defines the depth level of the notch.
The depth level of the notch is the ratio between the input to the output at the notch center frequency.
The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression will be. Note that an excessively high setpoint may cause system instability.

**H09.15** **Frequency of the 2nd notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-10h | Effective Time: | Real time |
| Min.: | 50 | Unit: | Hz |
| Max.: | 4000 | Data Type: | UInt16 |
| Default: | 4000 | Change: | Immediately |

**Value Range:**
50 Hz to 4000 Hz
**Description**
-

**H09.16** **Width level of the 2nd notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-11h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 20 | Data Type: | UInt16 |
| Default: | 2 | Change: | Immediately |

**Value Range:**
0 to 20

**Description**

-

**H09.17** **Depth level of the 2nd notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-12h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 99 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 to 99

**Description**

-

**H09.18** **Frequency of the 3rd notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-13h | Effective Time: | Real time |
| Min.: | 50 | Unit: | Hz |
| Max.: | 4000 | Data Type: | UInt16 |
| Default: | 4000 | Change: | Immediately |

**Value Range:**

50 Hz to 4000 Hz

**Description**

-

**H09.19** **Width level of the 3rd notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-14h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 20 | Data Type: | UInt16 |
| Default: | 2 | Change: | Immediately |

**Value Range:**

0 to 20

**Description**

-

**H09.20** **Depth level of the 3rd notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-15h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 99 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 to 99

**Description**

-

**H09.21** **Frequency of the 4th notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-16h | Effective Time: | Real time |
| Min.: | 50 | Unit: | Hz |
| Max.: | 4000 | Data Type: | UInt16 |
| Default: | 4000 | Change: | Immediately |

**Value Range:**

50 Hz to 4000 Hz

**Description**

-

**H09.22** **Width level of the 4th notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-17h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 20 | Data Type: | UInt16 |
| Default: | 2 | Change: | Immediately |

**Value Range:**
0 to 20
**Description**
-

**H09.23** **Depth level of the 4th notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-18h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 99 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0 to 99
**Description**
-

**H09.24** **Auto-tuned resonance frequency**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-19h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 2000 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 2000
**Description**
When H09.02 (Adaptive notch mode) is set to 3, the current mechanical resonance frequency is displayed.

**H09.30** **Torque disturbance compensation gain**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-1Fh | Effective Time: | Real time |
| Min.: | -100.0 | Unit: | % |
| Max.: | 100.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Immediately |

**Value Range:**
-100.0% to 100.0%
**Description**
-

**H09.31** **Filter time constant of torque disturbance observer**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-20h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | ms |
| Max.: | 25.00 | Data Type: | UInt16 |
| Default: | 0.50 | Change: | Immediately |

**Value Range:**
0.00 ms to 25.00 ms
**Description**
-

**H09.32** **Gravity compensation value**

| | | | |
|---|---|---|---|
| Hex: | 2009-21h | Effective mode: | Real time |
| Min.: | 0.0 | Unit: | - |
| Max.: | 50.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Real-time |

**Value Range:**

0.0 to 50.0

**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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-22h | Effective Time: | Real time |
| Min.: | -100.0 | Unit: | % |
| Max.: | 100.0 | Data Type: | Int16 |
| Default: | 0.0 | Change: | Immediately |

**Value Range:**

-100.0% to 100.0%

**Description**

Defines the forward friction compensation value.

**H09.34** **Negative friction compensation**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-23h | Effective Time: | Real time |
| Min.: | -100.0 | Unit: | % |
| Max.: | 100.0 | Data Type: | Int16 |
| Default: | 0.0 | Change: | Immediately |

**Value Range:**

-100.0% to 100.0%

**Description**

Defines the reverse direction friction compensation value.

**H09.35** **Friction compensation speed threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-24h | Effective Time: | Real time |
| Min.: | 0.1 | Unit: | rpm |
| Max.: | 30.0 | Data Type: | UInt16 |
| Default: | 2.0 | Change: | Immediately |

**Value Range:**

0.1rpm–30.0rpm

**Description**

-

**H09.36** **Friction compensation speed**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-25h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Speed reference

1: Model tracking speed

2: Speed feedback

**Description**

-

**H09.38** **Low-frequency resonance suppression frequency at the mechanical end**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-27h | Effective Time: | Real time |
| Min.: | 1.0 | Unit: | Hz |
| Max.: | 100.0 | Data Type: | UInt16 |
| Default: | 100.0 | Change: | At stop |

**Value Range:**

1.0 Hz to 100.0 Hz

**Description**

-

**H09.39** **Low-frequency resonance suppression at the mechanical end**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-28h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 3 | Data Type: | UInt16 |
| Default: | 2 | Change: | At stop |

**Value Range:**

0 to 3

**Description**

-

**H09.41** **Frequency of the 5th notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-2Ah | Effective Time: | Real time |
| Min.: | 50 | Unit: | Hz |
| Max.: | 8000 | Data Type: | UInt16 |
| Default: | 4000 | Change: | At stop |

**Value Range:**

50 Hz to 8000 Hz

**Description**

-

**H09.42** **Width level of the 5th notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-2Bh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 20 | Data Type: | UInt16 |
| Default: | 2 | Change: | Immediately |

**Value Range:**

0 to 20

**Description**

-

**H09.43** **Depth level of the 5th notch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-2Ch | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 99 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 to 99

**Description**

-

**H09.44** **Frequency of low-frequency resonance suppression 1 at mechanical load end**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-2Dh | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | Hz |
| Max.: | 200.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Immediately |

**Value Range:**
0.0 Hz to 200.0 Hz
**Description**
-

**H09.45** **Responsiveness of low-frequency resonance suppression 1 at mechanical load end**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-2Eh | Effective Time: | Real time |
| Min.: | 0.01 | Unit: | - |
| Max.: | 10.00 | Data Type: | UInt16 |
| Default: | 1.00 | Change: | Immediately |

**Value Range:**
0.01 to 10.00
**Description**
-

**H09.47** **Width of low-frequency resonance suppression 1 at mechanical load end**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-30h | Effective Time: | Real time |
| Min.: | 0.00 | Unit: | - |
| Max.: | 2.00 | Data Type: | UInt16 |
| Default: | 1.00 | Change: | Immediately |

**Value Range:**
0.00 to 2.00
**Description**
-

**H09.49** **Frequency of low-frequency resonance suppression 2 at mechanical load end**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-32h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | Hz |
| Max.: | 200.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Immediately |

**Value Range:**
0.0 Hz to 200.0 Hz
**Description**
Set this parameter based on the actual jitter frequency.

**H09.50** **Responsiveness of low-frequency resonance suppression 2 at mechanical load end**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-33h | Effective Time: | Real time |
| Min.: | 0.01 | Unit: | - |
| Max.: | 10.00 | Data Type: | UInt16 |
| Default: | 1.00 | Change: | Immediately |

**Value Range:**
0.01 to 10.00
**Description**
Use the default setpoint in general cases. To increase the setpoint, reduce the delay time.

**H09.52** **Width of low-frequency resonance suppression 2 at mechanical load end**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-35h | Effective Time: | Real time |

| | | | |
|---|---|---|---|
| Min.: | 0.00 | Unit: | - |
| Max.: | 2.00 | Data Type: | UInt16 |
| Default: | 1.00 | Change: | Immediately |

**Value Range:**

0.00 to 2.00

**Description**

Use the default setpoint in general cases. To increase the setpoint, increase the delay time.

**H09.57** **STune resonance suppression switchover frequency**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-3Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | Hz |
| Max.: | 4000 | Data Type: | UInt16 |
| Default: | 850 | Change: | Immediately |

**Value Range:**

0 Hz to 4000 Hz

**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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2009-3Bh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Disable

1: Enable

**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.

## 15.11 H0A Fault and Protection

**H0A.00** **Power input phase loss protection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-01h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value 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

**Description**

The main circuit power specifications vary according to the servo drive model.

Servo drives supporting single-phase/three-phase 220 V and three-phase 380 V power supplies Objects available. When voltage fluctuation or phase loss occurs on the power supply, the drive triggers power input phase loss protection based on H0A.00.

| Setpoint | 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.<br>• 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.<br>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**

Hexadecimal: 200A-03h
Min.: 0
Max.: 1
Default: 0
Effective Time: Real time
Unit: -
Data Type: UInt16
Change: Immediately

**Value Range:**

0: On

1: Off

**Description**

-

**H0A.03** **Power-off memory**

Hexadecimal: 200A-04h
Min.: 0
Max.: 1
Default: 0
Effective Time: Real time
Unit: -
Data Type: UInt16
Change: Immediately

**Value Range:**

0: Disabled

1: Enabled

**Description**

It sets whether to enable the function of retentive at power failure.

| Setpoint | Function | Instruction receiving method |
|---|---|---|
| 0 | Disabled | The function of retentive at power failure is disabled. |
| 1 | Enabled | 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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-05h | Effective Time: | Real time |
| Min.: | 50 | Unit: | % |
| Max.: | 300 | Data Type: | UInt16 |
| Default: | 100 | Change: | At stop |

**Value Range:**

50% to 300%

**Description**

Determines the motor overload duration before E620.0 (Motor overload) is reported.

You can change the setpoint to advance or delay the time when overload protection is triggered based on the motor temperature. The setpoint 50% indicates the time is cut by half; 150% indicates the time is increased by 50%.

Set this parameter based on the actual temperature of the motor.

**H0A.08** **Overspeed threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-09h | Effective Time: | Real time |
| Min.: | 0 | Unit: | rpm |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0rpm–10000rpm

**Description**

Defines the overspeed threshold of the motor.

| Setpoint | Overspeed Threshold | Condition for Reporting E500.0 |
|---|---|---|
| 0 | Maximum 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):<br>Overspeed threshold = Maximum motor speed x 1.2 | |
| | If H0A-08 < (Maximum motor speed x 1.2):<br>Overspeed threshold = H0A.08 | |

**H0A.09** **Maximum position pulse frequency**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-0Ah | Effective Time: | Real time |
| Min.: | 100 | Unit: | kHz |
| Max.: | 4000 | Data Type: | UInt16 |
| Default: | 4000 | Change: | At stop |

**Value Range:**

100 kHz–4000 kHz

**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 (excessive position reference increment).

**H0A.10** **Threshold of excessive position deviation**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-0Bh | Effective Time: | Real time |
| Min.: | 1 | Unit: | Encoder unit |
| Max.: | 1073741824 | Data Type: | UInt32 |
| Default: | 27486951 | Change: | Immediately |

**Value Range:**

1 to 1073741824

**Description**

Defines the threshold for excessive position deviation in the position control mode.

When the position deviation exceeds this threshold, the drive reports EB00.0 (Position deviation too large).

**H0A.12** **Runaway protection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-0Dh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**

0: Disabled

1: Enabled

**Description**

Defines whether to enable runaway protection.

0: Disables E234.0 detection when the motor drives a vertical axis or is driven by the load

1: Enables runaway protection

**H0A.16** **Threshold of low-frequency resonance position deviation**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-11h | Effective Time: | Real time |
| Min.: | 1 | Unit: | - |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 5 | Change: | Immediately |

**Value Range:**

1 to 1000

**Description**

-

**H0A.17** **Reference/Pulse selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-12h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Pulse unit

1: Reference unit

**Description**

Defines the unit for the position settings in H05.21, H05.22, and H0A.10.

| Setpoint | Description |
|---|---|
| 0 | Pulse unit |
| 1 | Reference unit |

**H0A.19** **DI8 filter time constant**

Hexadecimal: 200A-14h | Effective Time: Upon the next power-on
Min.: 0 | Unit: -
Max.: 255 | Data Type: UInt16
Default: 80 | Change: At stop

**Value Range:**

0 to 255

**Description**

-

**H0A.20** **DI9 filter time constant**

Hexadecimal: 200A-15h | Effective Time: Upon the next power-on
Min.: 0 | Unit: -
Max.: 255 | Data Type: UInt16
Default: 80 | Change: At stop

**Value Range:**

0 to 255

**Description**

-

**H0A.22** **Sigma_Delta filter time**

Hexadecimal: 200A-17h | Effective Time: Upon the next power-on
Min.: 0 | Unit: -
Max.: 3 | Data Type: UInt16
Default: 0 | Change: At stop

**Value Range:**

0 to 3

**Description**

-

**H0A.23** **Tz signal filter time**

Hexadecimal: 200A-18h | Effective Time: Upon the next power-on
Min.: 0 | Unit: -
Max.: 31 | Data Type: UInt16
Default: 15 | Change: At stop

**Value Range:**

0 to 31

**Description**

-

**H0A.24** **Filter time constant of low-speed pulse input pin**

Hexadecimal: 200A-19h | Effective Time: Upon the next power-on
Min.: 0 | Unit: -
Max.: 255 | Data Type: UInt16
Default: 30 | Change: At stop

**Value Range:**

0–255

**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 |
| 167k–250k | 20 |
| 250k–500k | 10 |

**H0A.25** **Filter time constant of speed feedback display value**

Hexadecimal: 200A-1Ah
Effective Time: Real time
Min.: 0
Unit: ms
Max.: 5000
Data Type: UInt16
Default: 200
Change: At stop

**Value Range:**

0 ms to 5000 ms

**Description**

Defines the low-pass filter time constant of the speed information for speed feedback and position references.

**H0A.26** **Motor overload detection**

Hexadecimal: 200A-1Bh
Effective Time: Real time
Min.: 0
Unit: -
Max.: 3
Data Type: UInt16
Default: 3
Change: At stop

**Value Range:**

0: Show motor overload warning (E909.0) and fault (E620.0)

1: Hide motor overload warning (E909.0) and fault (E620.0)

2: No meaning

3: Enabled for new motors

**Description**

Defines whether to enable motor overload detection.

| Setpoint | Function |
|---|---|
| 0 | Not hide |
| 1 | Hide motor overload warning (E909.0) and motor overload fault (E620.0) |
| 2 | No assignment |
| 3 | Enabled for new motors |

**H0A.27** **Speed DO filter time constant**

Hexadecimal: 200A-1Ch
Effective Time: Real time
Min.: 0
Unit: ms
Max.: 5000
Data Type: UInt16
Default: 10
Change: At stop

**Value Range:**
0 ms to 5000 ms
**Description**
Defines the the average filter time constant of the speed information for speed feedback and position references.

**H0A.28** **Quadrature encoder filter time constant**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-1Dh | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | ns |
| Max.: | 255 | Data Type: | UInt16 |
| Default: | 30 | Change: | At stop |

**Value Range:**
0 ns to 255 ns
**Description**
-

**H0A.30** **Filter time constant of high-speed pulse input pin**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-1Fh | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | ns |
| Max.: | 255 | Data Type: | UInt16 |
| Default: | 2 | Change: | At stop |

**Value Range:**
0 ns to 255 ns
**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: 25 ns) |
|---|---|
| 500k–1M | 5 |
| > 1 Mpps | 3 |

**H0A.32** **Motor stall over-temperature protection time window**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-21h | Effective Time: | Real time |
| Min.: | 10 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**
10 ms to 65535 ms
**Description**
Defines the overtemperature duration before E630.0 (Motor stall) is detected by the servo drive. H0A.32 can be used to adjust the sensitivity of motor stall overtemperature detection.

**H0A.33** **Motor stall over-temperature detection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-22h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |

Default: 1 Change: Immediately

**Value Range:**

0: Disabled

1: Enable

2: Enabled for new over-temperature

**Description**

Enables or disables the detection for E630.0 (Motor stall overtemperature protection).

| Setpoint | Function |
|---|---|
| 0 | Shield |
| 1 | Enabled |
| 2 | New over-temperature protection |

**H0A.35** **Inhibit reading encoder EEPRROM on power-on (for third-party encoders)**

Hexadecimal: 200A-24h Effective Time: Upon the next power-on

Min.: 0 Unit: -

Max.: 1 Data Type: UInt16

Default: 0 Change: Immediately

**Value Range:**

0: Allow

1: Inhibit

**Description**

-

**H0A.36** **Encoder multi-turn overflow fault**

Hexadecimal: 200A-25h Effective Time: Real time

Min.: 0 Unit: -

Max.: 1 Data Type: UInt16

Default: 0 Change: At stop

**Value Range:**

0: Not hide

1: Hide

**Description**

Defines whether to hide the encoder multi-turn overflow fault in the absolute position linear mode (H02.01 = 1).

| Setpoint | Function |
|---|---|
| 0 | Not hide |
| 1 | Shield |

**H0A.38** **IGBT over-temperature threshold**

Hexadecimal: 200A-27h Effective Time: Upon the next power-on

Min.: 0 Unit: °C

Max.: 175 Data Type: UInt16

Default: 135 Change: At stop

**Value Range:**

0°C to 175°C

**Description**

-

**H0A.39** **IGBT over-temperature protection switch**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-28h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Disabled

1: Enabled

**Description**

-

**H0A.40** **Software limit selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-29h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: No operation

1: Activated immediately

2: Activated after homing is done

**Description**

| Setpoint | Function |
|---|---|
| 0 | No operation |
| 1 | At once |
| 2 | Activated after homing is done |

**H0A.41** **Forward position of software limit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-2Ah | Effective Time: | Real time |
| Min.: | -2147483648 | Unit: | - |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 2147483647 | Change: | At stop |

**Value Range:**

-2147483648 to 2147483647

**Description**

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.

**H0A.43** **Reverse position of software limit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-2Ch | Effective Time: | Real time |
| Min.: | -2147483648 | Unit: | - |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | -2147483648 | Change: | At stop |

**Value Range:**

-2147483648 to 2147483647

**Description**

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.

**H0A.47** **Brake protection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-30h | Effective Time: | Real time |

| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0 to 1
**Description**
-

**H0A.48** **Gravity load**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-31h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 3000 | Data Type: | UInt16 |
| Default: | 300 | Change: | Immediately |

**Value Range:**
0 to 3000
**Description**
-

**H0A.49** **Regenerative wafer over-temperature threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-32h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | °C |
| Max.: | 175 | Data Type: | UInt16 |
| Default: | 115 | Change: | At stop |

**Value Range:**
0°C to 175°C
**Description**
Defines the temperature threshold for regenerative resistor overload.

**H0A.50** **Torque reference display filter time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-33h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 5000 | Data Type: | UInt16 |
| Default: | 200 | Change: | At stop |

**Value Range:**
0 ms to 5000 ms
**Description**
-

**H0A.51** **Encoder fault tolerance count**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-34h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 31 | Data Type: | UInt16 |
| Default: | 31 | Change: | Immediately |

**Value Range:**
0 to 31
**Description**
-

**H0A.52** **Defines the temperature threshold for encoder overtemperature protection.**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-35h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ° |
| Max.: | 175 | Data Type: | UInt16 |

| | | | |
|---|---|---|---|
| Default: | 105 | Change: | Immediately |

**Value Range:**

0° to 175°

**Description**

When the number of communication failures between the encoder and the drive exceeds H0A.50, the communication between the encoder and the drive fails.

**H0A.55** **Runaway current threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-38h | Effective Time: | Real time |
| Min.: | 100.0 | Unit: | % |
| Max.: | 400.0 | Data Type: | UInt16 |
| Default: | 200.0 | Change: | Immediately |

**Value Range:**

100.0% to 400.0%

**Description**

Defines the current threshold for runaway protection detection.

**H0A.57** **Runaway speed threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-3Ah | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

1rpm–1000rpm

**Description**

Defines the overspeed threshold for runaway protection detection.

**H0A.58** **Speed feedback filtering time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-3Bh | Effective Time: | Upon the next power-on |
| Min.: | 0.1 | Unit: | ms |
| Max.: | 100.0 | Data Type: | UInt16 |
| Default: | 2.0 | Change: | Immediately |

**Value Range:**

0.1 ms to 100.0 ms

**Description**

Defines the speed feedback filter time for runaway protection detection.

**H0A.59** **Runaway protection detection time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-3Ch | Effective Time: | Real time |
| Min.: | 10 | Unit: | ms |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 30 | Change: | Immediately |

**Value Range:**

10 ms to 1000 ms

**Description**

The runaway fault will be reported when runaway keeps active for a period longer than H0A.59.

**H0A.61** **Phase loss detection time threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-3Eh | Effective Time: | Real time |
| Min.: | 30 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |

| | | | |
|---|---|---|---|
| Default: | 50 | Change: | Immediately |

**Value Range:**
30 ms to 65535 ms
**Description**
-

**H0A.85** **Wire breakage detection torque threshold**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-56h | Effective Time: | Real time |
| Min.: | 4.0 | Unit: | % |
| Max.: | 400.0 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | At stop |

**Value Range:**
4.0% to 400.0%
**Description**
-

**H0A.86** **Wire breakage detection filter time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200A-57h | Effective Time: | Real time |
| Min.: | 5 | Unit: | ms |
| Max.: | 1000 | Data Type: | UInt16 |
| Default: | 30 | Change: | At stop |

**Value Range:**
5 ms to 1000 ms
**Description**
-

## 15.12 H0B Display Parameters

**H0b.00** **Motor speed actual value**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-01h | Effective Time: | - |
| Min.: | -9999 | Unit: | rpm |
| Max.: | 9999 | Data Type: | Int16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
-9999rpm to 9999rpm
**Description**
Indicates the round actual motor speed, 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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-02h | Effective Time: | - |
| Min.: | -9999 | Unit: | rpm |
| Max.: | 9999 | Data Type: | Int16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
-9999rpm to 9999rpm
**Description**
Indicates the present speed reference (accurate to 1rpm) of the drive in the position and speed control modes.

**H0b.02** **Internal torque reference**

Hexadecimal: 200b-03h
Min.: -300.0
Max.: 300.0
Default: 0.0
Effective Time: -
Unit: %
Data Type: Int16
Change: Unchangeable

**Value Range:**

-300.0% to 300.0%

**Description**

Displays present torque reference (accurate to 0.1%). The value 100.0% corresponds to the rated torque of the motor.

**H0b.03** **Monitored DI status**

Hexadecimal: 200b-04h
Min.: 0
Max.: 65535
Default: 0
Effective Time: -
Unit: -
Data Type: UInt16
Change: Unchangeable

**Value Range:**

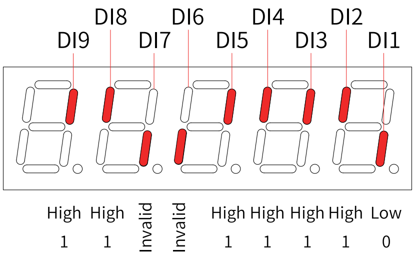
0–65535

**Description**

Displays the level status of 8 DI terminals without filtering.

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

Assume that the DI1 terminal is low level and DI2 to DI9 terminals are high level, and the corresponding binary number is "110011110". In this case, the value of H0b.03 (Monitored DO signal) read by the software tool is 414 (decimal). See the following figure.




**H0b.05** **Monitored DO status**

Hexadecimal: 200b-06h
Min.: 0
Max.: 65535
Default: 0
Effective Time: -
Unit: -
Data Type: UInt16
Change: Unchangeable

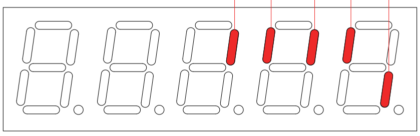
**Value Range:**

0–65535

**Description**

Displays the level status of 5 DO terminals without filtering.
Upper LED segments ON: high level (indicated by "1") Lower LED segments ON: low level (indicated by "0")

Assume that the DO1 terminal is low level and DO2 to DO5 terminals are high level, and the corresponding binary number is "11110". In this case, the value of H0b.05 (Monitored DO signal) read by the software tool is 30 (decimal). See the following figure.




**H0b.07** **Absolute position counter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-08h | Effective Time: | - |
| Min.: | -2147483648 | Unit: | Reference unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
-2147483648 to 2147483647

**Description**
Indicates present absolute position (reference unit) of the motor in the position control mode.
This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

**H0b.09** **Mechanical angle**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-0Ah | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535

**Description**
Displays 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: 65535

**H0b.10** **Electrical angle**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-0Bh | Effective Time: | - |
| Min.: | 0.0 | Unit: | ° |
| Max.: | 360.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**
0.0° to 360.0°

**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 the input position reference**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-0Ch | Effective Time: | - |
| Min.: | -9999 | Unit: | rpm |
| Max.: | 9999 | Data Type: | Int16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
-9999rpm to 9999rpm
**Description**
-

**H0b.12** **Average load rate**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-0Dh | Effective Time: | - |
| Min.: | 0.0 | Unit: | % |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**
0.0% to 6553.5%
**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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-0Eh | Effective Time: | - |
| Min.: | -2147483648 | Unit: | Reference unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
-2147483648 to 2147483647
**Description**
-

**H0b.15** **Encoder position deviation counter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-10h | Effective Time: | - |
| Min.: | -2147483648 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
-2147483648 to 2147483647
**Description**
-

**H0b.17** **Feedback pulse counter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-12h | Effective Time: | - |
| Min.: | -2147483648 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
-2147483648 to 2147483647
**Description**
Used to count the position pulses fed back by the encoder in any control mode.
This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

**H0b.19** **Total power-on time**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-14h | Effective Time: | - |
| Min.: | 0.0 | Unit: | s |
| Max.: | 214748364.7 | Data Type: | UInt32 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**
0.0s–214748364.7s
**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 the servo drive is switched on and off repeatedly within a short period of time, a deviation within 1h may be present in the total power-on time record.

**H0b.24** **RMS value of phase current**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-19h | Effective Time: | - |
| Min.: | 0.00 | Unit: | A |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.00 | Change: | Unchangeable |

**Value Range:**
0.00 A to 655.35 A
**Description**
Displays the RMS value of the phase current of the motor, accurate to 0.01 A.

**H0b.26** **Bus voltage**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-1Bh | Effective Time: | - |
| Min.: | 0.0 | Unit: | V |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**
0.0 V to 6553.5 V
**Description**
Displays the DC bus voltage of the main circuit input voltage after rectification, which is accurate to 0.01 V.

**H0b.27** **Module temperature**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-1Ch | Effective Time: | - |
| Min.: | 0 | Unit: | °C |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0°C to 65535°C
**Description**
Indicates the temperature of the module inside the servo drive, which can be used as a reference for estimating the actual temperature of the drive.

**H0b.28** **Absolute encoder fault information given by FPGA**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-1Dh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535
**Description**
-

**H0b.29** **System status information given by FPGA**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-1Eh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535
**Description**
-

**H0b.30** **System fault information given by FPGA**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-1Fh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535
**Description**
-

**H0b.33** **Fault log**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-22h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 19 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0: Present fault

1: Last fault2: 2nd to last fault3: 3rd to last fault4: 4th to last fault

5: 5th to last fault 6: 6th to last fault7: 7th to last fault8: 8th to last fault9: 9th to last fault10: 10th to last fault11: 11th to last fault12: 12th to last fault13: 13th to last fault14: 14th to last fault15: 15th to last fault16: 16th to last fault17: 17th to last fault18: 18th to last fault19: 19th to last fault
**Description**
Used to view the latest 20 faults of the drive.

**H0b.34** **Fault code of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-23h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535

**Description**

-

**H0b.35** **Time stamp upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-24h | Effective Time: | - |
| Min.: | 0.0 | Unit: | s |
| Max.: | 214748364.7 | Data Type: | UInt32 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**

0.0s–214748364.7s

**Description**

-

**H0b.37** **Motor speed upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-26h | Effective Time: | - |
| Min.: | -32767 | Unit: | rpm |
| Max.: | 32767 | Data Type: | Int16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

-32767rpm to 32767rpm

**Description**

-

**H0b.38** **Motor phase U current upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-27h | Effective Time: | - |
| Min.: | -327.67 | Unit: | A |
| Max.: | 327.67 | Data Type: | Int16 |
| Default: | 0.00 | Change: | Unchangeable |

**Value Range:**

-327.67 A to 327.67 A

**Description**

-

**H0b.39** **Motor phase V current upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-28h | Effective Time: | - |
| Min.: | -327.67 | Unit: | A |
| Max.: | 327.67 | Data Type: | Int16 |
| Default: | 0.00 | Change: | Unchangeable |

**Value Range:**

-327.67 A to 327.67 A

**Description**

-

**H0b.40** **Bus voltage upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-29h | Effective Time: | - |
| Min.: | 0.0 | Unit: | V |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**

0.0 V to 6553.5 V

**Description**

-

**H0b.41** **DI status upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-2Ah | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

0 to 65535

**Description**

-

**H0b.42** **DO status upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-2Bh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

0 to 65535

**Description**

-

**H0b.43** **Group No. of the abnormal parameter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-2Ch | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

0 to 65535

**Description**

-

**H0b.44** **Offset of the abnormal parameter within the parameter group**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-2Dh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

0 to 65535

**Description**

-

**H0b.45** **Internal fault code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-2Eh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

0 to 65535

**Description**

-

**H0b.46** **Absolute encoder fault information given by FPGA upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-2Fh | Effective Time: | - |

| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535
**Description**
-

**H0b.47** **System status information given by FPGA upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-30h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535
**Description**
-

**H0b.48** **System fault information given by FPGA upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-31h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535
**Description**
-

**H0b.51** **Internal fault code upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-34h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535
**Description**
-

**H0b.52** **Timeout fault flat bit given by FPGA upon occurrence of the selected fault**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-35h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
0 to 65535
**Description**
-

**H0b.53** **Position deviation counter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-36h | Effective Time: | - |
| Min.: | -2147483648 | Unit: | Reference unit |
| Max.: | 2147483647 | Data Type: | Int32 |

| | | | |
|---|---|---|---|
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
-2147483648 to 2147483647
**Description**
-

**H0b.55** **Motor speed actual value**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-38h | Effective Time: | - |
| Min.: | -6000.0 | Unit: | rpm |
| Max.: | 6000.0 | Data Type: | Int32 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**
-6000.0rpm to 6000.0rpm
**Description**
Indicates the round actual motor speed, 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.57** **Bus voltage of the control circuit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-3Ah | Effective Time: | - |
| Min.: | 0.0 | Unit: | V |
| Max.: | 65535.0 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**
0.0 V to 65535.0 V
**Description**
Displays the bus voltage of the control circuit.

**H0b.58** **Mechanical absolute position (low 32 bits)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-3Bh | Effective Time: | - |
| Min.: | -2147483647 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
-2147483647 to 2147483647
**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)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-3Dh | Effective Time: | - |
| Min.: | -2147483647 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**
-2147483647 to 2147483647
**Description**
Displays the high 32-bit value (encoder unit) of the mechanical position feedback when the absolute encoder is used.

**H0b.64** **Real-time input position reference counter**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-41h | Effective Time: | - |

| | | | |
|---|---|---|---|
| Min.: | -2147483648 | Unit: | Reference unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

-2147483648 to 2147483647

**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.63** **NotRdy state**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-22h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 7 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

1: Control circuit error

2: Main circuit power input error

3: Bus undervoltage

4: Soft start failed

5: Encoder initialization undone

6: Short circuit to ground failed

7: Others

**Description**

-

**H0b.66** **Encoder temperature**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-43h | Effective Time: | - |
| Min.: | -32768 | Unit: | °C |
| Max.: | 32767 | Data Type: | Int16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

-32768°C to 32767°C

**Description**

-

**H0b.70** **Number of revolutions recorded in the absolute encoder**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-47h | Effective Time: | - |
| Min.: | 0 | Unit: | Rev |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

0Rev–65535Rev

**Description**

-

**H0b.71** **Single-turn position fed back by the absolute encoder**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-48h | Effective Time: | - |
| Min.: | 0 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | UInt32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

0 to 2147483647

**Description**

Displays the position feedback of the absolute encoder within one turn.

**H0b.73** **Single-turn offset position of absolute encoder**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-4Ah | Effective Time: | - |
| Min.: | 0 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | UInt32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

0 to 2147483647

**Description**

-

**H0b.75** **Load inertia ratio in online inertia auto-tuning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-4Ch | Effective Time: | - |
| Min.: | 0.00 | Unit: | - |
| Max.: | 655.35 | Data Type: | UInt16 |
| Default: | 0.00 | Change: | Unchangeable |

**Value Range:**

0.00 to 655.35

**Description**

-

**H0b.76** **External load in online inertia auto-tuning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-4Dh | Effective Time: | - |
| Min.: | 0.0 | Unit: | - |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 0.0 | Change: | Unchangeable |

**Value Range:**

0.0 to 6553.5

**Description**

-

**H0b.77** **Absolute position fed back by the absolute encoder (low 32 bits)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-4Eh | Effective Time: | - |
| Min.: | -2147483647 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

-2147483647 to 2147483647

**Description**

-

**H0b.79** **Absolute position fed back by the absolute encoder (high 32 bits)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-50h | Effective Time: | - |
| Min.: | -2147483647 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

-2147483647 to 2147483647

**Description**

-

**H0b.81** **Load position within one turn in absolute position rotation mode (low 32 bits)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-52h | Effective Time: | - |
| Min.: | -2147483647 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

-2147483647 to 2147483647

**Description**

-

**H0b.83** **Load position within one turn in absolute position rotation mode (high 32 bits)**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-54h | Effective Time: | - |
| Min.: | -2147483647 | Unit: | Encoder unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

-2147483647 to 2147483647

**Description**

-

**H0b.85** **Load position within one turn in absolute position rotation mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200b-56h | Effective Time: | - |
| Min.: | -2147483647 | Unit: | Reference unit |
| Max.: | 2147483647 | Data Type: | Int32 |
| Default: | 0 | Change: | Unchangeable |

**Value Range:**

-2147483647 to 2147483647

**Description**

-

## 15.13 H0C Communication Parameters

**H0C.00** **Drive axis address**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-01h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 247 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**

0 to 247

**Description**

CAN Indicates the slave node address. Ensure this parameter is consistent with the configuration of the host controller.

**H0C.02** **Serial baud rate**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-03h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 6 | Data Type: | UInt16 |

Default: 5 | Change: Immediately

**Value Range:**

0: 2400bps

1: 4800bps

2: 9600bps

3: 19200bps

4: 38400bps

5: 57600bps

6: 115200bps

**Description**

| Setpoint | Baud rate |
|---|---|
| 0 | 2400bps |
| 1 | 4800bps |
| 2 | 9600bps |
| 3 | 19200bps |
| 4 | 38400bps |
| 5 | 57600bps |
| 6 | 115200bps |

**H0C.03** **Modbus data format**

Hexadecimal: 200C-04h | Effective Time: Real time

Min.: 0 | Unit: -

Max.: 3 | Data Type: UInt16

Default: 0 | Change: Immediately

**Value Range:**

0: No parity, 2 stop bits

1: Even parity, 1 stop bit

2: Odd parity, 1 stop bit

3: No parity, 1 stop bit

**Description**

Defines the data check mode between the servo drive and the host controller during communication.

| Setpoint | Data format |
|---|---|
| 0 | No check, 2 stop bits |
| 1 | Even parity check, 1 stop bit |
| 2 | Odd parity check, 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**

Hexadecimal: 200C-09h | Effective Time: Real time

Min.: 0 | Unit: -

Max.: 8 | Data Type: UInt16

Default: 5 | Change: Immediately

**Value Range:**

0: 20K

1: 50K

2: 100K

3: 125K

4: 250K

5: 500K

6: 1M

7: 1M

**Description**

It sets the CAN (CANlink or CANopen) communication rate between the servo drive and the host controller. The communication rate set in the servo drive must be the same as that in the host controller. Otherwise, communication will fail. 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.

If H0C.08 is set to 7, the baud rate is 1 Mbps. 70% sampling points are used to match most PLCs with a 1M non-standard (deviated) baud rate. Reducing sampling points can also reduce error frames.

| Setpoint | Baud rate |
|---|---|
| 0 | 20K |
| 1 | 50K |
| 2 | 100K |
| 3 | 125K |
| 4 | 250K |
| 5 | 500K |
| 6 | 1M |
| 7 | 1M |

**H0C.09** **Communication VDI**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-0Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Disabled

1: Enabled

**Description**

To use the VDI function:

1. Set H0C.09 to enable VDI.
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 upon power-on**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-0Bh | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

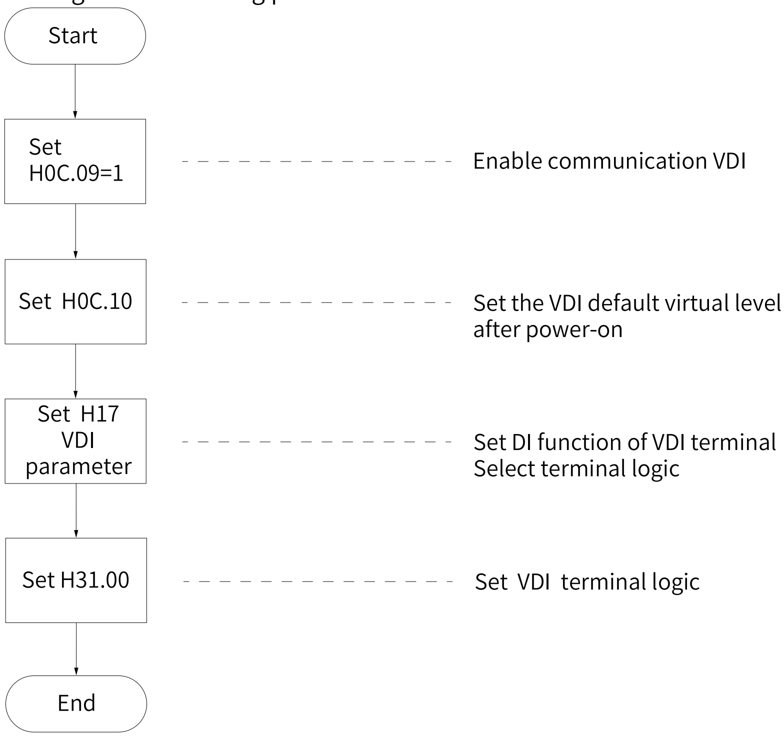
**Value Range:**

0–65535

**Description**

Configures the initial value of VDI upon power-on.
Bit 0 corresponds to VDI1.
Bit 1 corresponds to VDI2.
…
bit15 corresponds to VDI16.

Use the VDI according to the following procedure:




**H0C.11** **Communication VDO**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-0Ch | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Disabled

1: Enabled

**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 terminal through parameters in group H17.

4: Read the output level of the VDO terminal through H17.32.

**H0C.12** **Default level of the VDO allocated with function 0**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-0Dh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

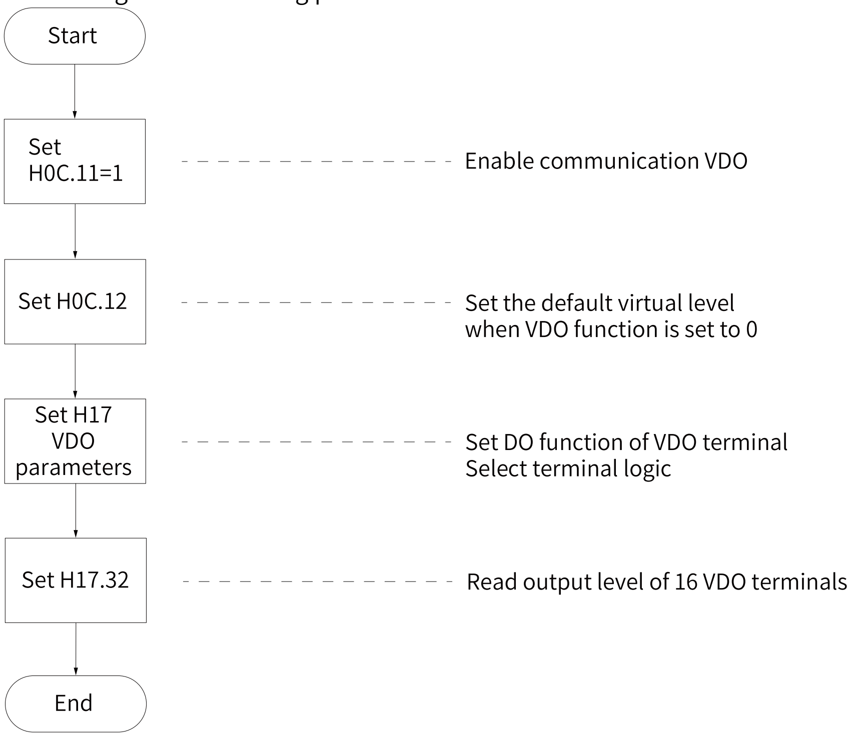
**Value Range:**

0 to 65535

**Description**

Used to configure the initial values of VDO upon power-on.
bit0 corresponds to VDO1.
bit1 corresponds to VDO2.
…
bit15 corresponds to VDO16.

Use the VDO according to the following procedure:




**H0C.13** **Update parameter values written through communication to EEPROM**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-0Eh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**

0: Not update EEPROM

1: Update EEPROM

**Description**

-

**H0C.14** **Modbus error code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-0Fh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 2 | Change: | Unchangeable |

**Value Range:**

0: N/A

1: Illegal parameter (command code)

2: Command code data address

3: Illegal data

4: Slave device fault

**Description**

-

**H0C.16** **Update parameter values written through CAN communication to EEPROM**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-11h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Not update EEPROM

1: Update EEPROM

**Description**

-

**H0C.25** **Modbus command response delay**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-1Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 20 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0 ms to 20 ms

**Description**

Defines 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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-1Bh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**

0: High 16 bits before low 16 bits

1: Low 16 bits before high 16 bits

**Description**

-

**H0C.30** **Modbus error frame format**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-1Fh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 1 | Change: | Immediately |

**Value Range:**

0: Old protocol

1: New protocol (standard)

**Description**

-

**H0C.31** **Modbus receiving selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200C-20h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |

| | | | |
|---|---|---|---|
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: Receiving interrupt enabled

1: Current loop interrupt inquiry

**Description**

-

## 15.14 H0d Auxiliary Parameters

**H0d.00** **Software Reset**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200d-01h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: No operation

1: Enable

**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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200d-02h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: No operation

1: Enable

**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.

When a No. 3 warning occurs, you can enable the fault reset function directly, regardless of the servo drive status.

Defines whether to enable fault reset.

| Setpoint | 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.<br>• When a No. 3 warning occurs, you can enable the fault reset function directly, regardless of the servo drive status. |

**H0d.02** **Inertia auto-tuning selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200d-03h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 65 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0 to 65

**Description**

-

**H0d.03** **Initial angle auto-tuning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200d-04h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: No operation

1: Enabled

**Description**

-

**H0d.04** **Read/write in encoder ROM**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200d-05h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: No operation

1: Write ROM

2: Read ROM

**Description**

-

**H0d.05** **Emergency stop**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200d-06h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0: No operation

1: Emergency stop

**Description**

| Setpoint | Function |
|---|---|
| 0 | No operation |
| 1 | Emergency stop |

**H0d.06** **Current loop parameter auto-tuning**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200d-07h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |

Default: 0 | Change: At stop

**Value Range:**

0: No operation

1: Save parameters

2: Do not save parameters

**Description**

-

**H0d.12** **Phase U/V current balance correction**

Hexadecimal: 200d-0Dh | Effective Time: -
Min.: 0 | Unit: -
Max.: 1 | Data Type: UInt16
Default: 0 | Change: Unchangeable

**Value Range:**

0 to 1

**Description**

-

**H0d.17** **Forced DI/DO selection**

Hexadecimal: 200d-12h | Effective Time: Real time
Min.: 0 | Unit: -
Max.: 3 | Data Type: UInt16
Default: 0 | Change: Immediately

**Value Range:**

0: No operation

1: Forced DI enabled, forced DO disabled

2: Forced DO enabled, forced DI disabled

3: Forced DI and DO enabled

**Description**

Forced DI/DO selection.

**H0d.18** **Forced DI setting**

Hexadecimal: 200d-13h | Effective Time: Real time
Min.: 0 | Unit: -
Max.: 511 | Data Type: UInt16
Default: 511 | Change: Immediately

**Value Range:**

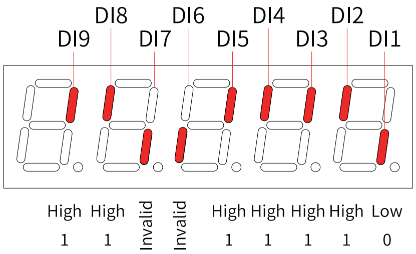
0–511

**Description**

Defines whether the DI functions set in group H03 is active when forced DI is activated (H0d.17 = 1 or 3).
The value of H0d.18 is displayed as a hexadecimal on the keypad. When it is converted to a binary value, "bit(n) = 1" indicates the level logic of DI function is high level; "bit(n) = 0" indicates the level logic of the DI function is low level.

Example:

H0d.18 value is 414 (decimal), and the corresponding binary value is 110011110, indicating that DI1 is low level and DI2 to DI9 are high level. The nine DI levels can also be monitored through H0b.03 (Monitored DI states).




View also the DI terminal logic in group H03 when checking whether a DI function is valid.

**H0d.19** **Forced DO setting**

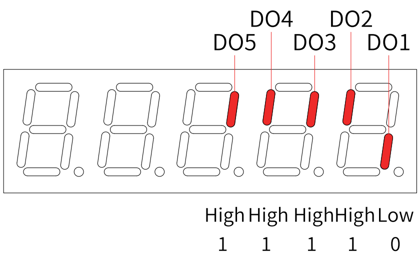
| | | | |
|---|---|---|---|
| Hexadecimal: | 200d-14h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 31 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
0–31

**Description**
Defines whether the DO functions assigned in group H04 are active when forced DO is active (H0d.17 = 2 or 3).
The value of H0d.19 is displayed as a hexadecimal on the keypad. When it is converted to a binary value, "bit(n) = 1" indicates the DO function is active; "bit(n) = 0" indicates the DO function is inactive.

Example:

If H0d.19 value is 30 (decimal), the corresponding binary is 11110, indicating that the DO1 function is invalid and functions of DO2 to DO5 are valid. The DO levels obtained based on the DO logics in group H04 and viewed in H0b.05 are shown as below:Assume that DO1 to DO5 logics in group H04 use 0 to indicate low level output at function valid.




**H0d.20** **Multi-turn absolute encoder reset**

| | | | |
|---|---|---|---|
| Hexadecimal: | 200d-15h | Effective Time: | Real time |

| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: No operation

1 Reset

2: Reset the fault and multi-turn data

**Description**

You can reset the encoder error or the multi-turn data fed back by the encoder by setting H0d.20.

| Setpoint | Function |
|---|---|
| 0 | No operation |
| 1 | Reset encoder fault |
| 2 | Reset encoder fault and multi-turn data |

## 15.15 H11 Multi-Position Function Parameters

**H11.00** **Multi-position operation mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-01h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 5 | Data Type: | UInt16 |
| Default: | 1 | Change: | At stop |

**Value Range:**

0: Single run (number of displacements selected in H11.01)

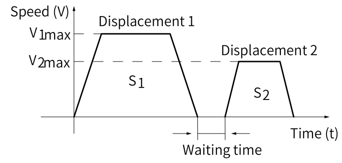
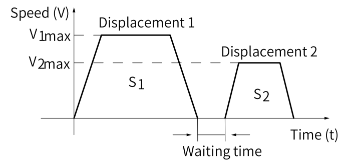
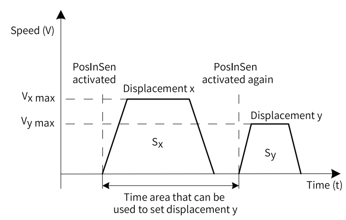
1: Cyclic operation (number of displacement selected in H11.01)

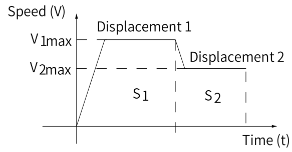
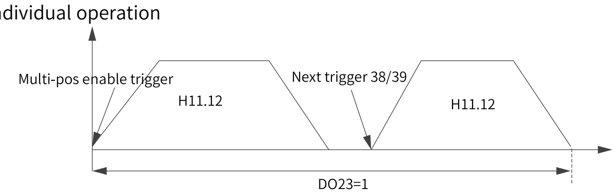
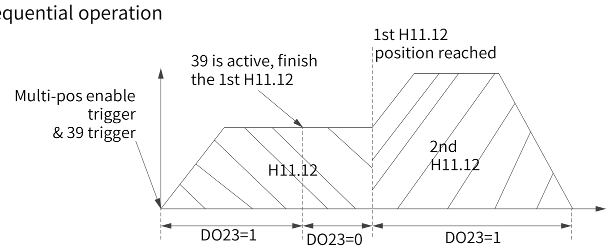
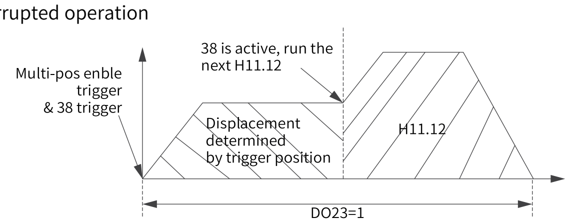
2: DI-based operation (selected by DI)

3: Sequential operation

5: Axis-controlled continuous operation

**Description**

| Setpoint | Operation Mode | Remarks | Operation Curve |
|---|---|---|---|
| 0 | Individual operation | • The drive stops after one cycle of operation.<br>• The drive switches to the next displacement automatically.<br>• The interval time between displacements can be set as needed.<br>• The PoslnSen (multi-position reference enable) signal is level-triggered. |  <br>$V_{1max}$, $V_{2max}$: maximum operating speeds in displacement 1 and displacement 2<br>$S_1$, $S_2$: displacement 1 and displacement 2 |
| 1 | Cyclic operation | • The drive starts from displacement 1 again after each cycle of operation.<br>• The drive switches to the next displacement automatically.<br>• The interval time between displacements can be set as needed.<br>• The cyclic operation mode is kept when the FunIN.28 (Multi-position reference enable) is active.<br>• The PoslnSen (multi-position reference enable) signal is level-triggered. |  <br>$V_{1max}$, $V_{2max}$: maximum operating speeds in displacement 1 and displacement 2<br>$S_1$, $S_2$: displacement 1 and displacement 2 |
| 2 | DI-based operation | • The displacement to be executed next can be set when the current displacement is in progress. The motor stops after current displacement is done executing. After the PoslnSen (position reference enable) signal is enabled again, the present displacement will be executed.<br>• The speed No. is determined by the DI logic.<br>• The interval time between displacements is determined by the command delay of the host controller.<br>• The PoslnSen (multi-position reference enable) signal is edge-triggered. |  <br>$V_{xmax}$, $V_{ymax}$: maximum operating speeds in displacement x and displacement y<br>$S_x$, $S_y$: displacement x and displacement y |

| Setpoint | Operation Mode | Remarks | Operation Curve |
|---|---|---|---|
| 3 | Sequential operation | • The drive stops after one cycle of operation.<br>• (H11.05 = 0 or H11.05 > H11.01).<br>• The starting displacement after the first cycle of operation is defined by H11.05.<br>• The drive switches to the next displacement automatically.<br>• There is no interval time between displacements.<br>• The PoslnSen (multi-position reference enable) signal is level-triggered. | <br>$V_{1max}$ , $V_{2max}$ : maximum operating speeds in displacement 1 and displacement 2<br>$S_1$ , $S_2$ : displacement 1 and displacement 2 |
| 5 | Axis-controlled continuous operation | • The drives executes one displacement only.<br>• The individual operation mode, sequential operation mode, and interrupted operation mode are included.<br>• The PoslnSen (multi-position reference enable) signal is level-triggered. | • Individual operation<br><br>• The PoslnSen (multi-position reference enable) signal is triggered only once (FunIN.39/38 triggered later). The drive stops after executing the distance defined by H11.12.<br>• Sequential operation<br><br>• 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 drive continues executing the first H11.12 until the distance defined by the first H11.12 is done. 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.<br>• Interrupted operation<br><br>• 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. |

To use the multi-position function, assign FunIN.28 (PosInSen, multi-position reference enable) to a DI first. See "Group H03: Terminal input parameters" for the setting mode.

The positioning completed (COIN) signal is activated each time upon completion of a displacement. To determine whether a certain displacement is done executing, use FunOUT.5 (COIN, positioning completed). See "Group H04: Terminal output parameters" for details.

Ensure the S-ON signal is active during operation of each displacement. Otherwise, the drive stops immediately as defined by H02.05 (Stop mode at S-ON OFF) and the positioning completed (COIN) signal in inactive. In modes other than DI-based operation, if the S-ON signal is active but multi-position is disabled during operation of a certain displacement, the drive abandons the unsent displacement reference and stops, with the positioning completed (COIN) signal being active. If the multi-position function is enabled again, the displacement to be executed is defined by H11.02.

**H11.01** **Number of displacement references in multi-position mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-02h | Effective Time: | Real time |
| Min.: | 1 | Unit: | - |
| Max.: | 16 | Data Type: | UInt16 |
| Default: | 1 | Change: | At stop |

**Value Range:**

1 to 16

**Description**

Defines the total number of displacement references in the multi-position mode. You can set different displacements, operating speeds, and acceleration/deceleration time for each displacement.

H11.00 ≠ 2: Displacements are switched automatically in a sequence from 1, 2...H11.01.

H11.00 = 2: Assign four DIs (hardware DI or VDI) with DI functions 6 to 9 (FunIN.6: CMD1 to FunIN.9: CMD4) and you can switch between different speeds by controlling the DI logic through the host controller. The segment No. is a 4-bit binary value. Bit0 to bit 3 correspond to CMD1 to CMD4.

The displacement No. is a 4-bit binary value. The relationship between the displacement numbers and CMD1...CMD4 is shown in the following table.

| FunIN.9 | FunIN.8 | FunIN.7 | FunIN.6 | Segment No. |
|---|---|---|---|---|
| CMD4 | CMD3 | CMD2 | CMD1 | |
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 2 |
| ... | | | | |
| 1 | 1 | 1 | 1 | 16 |

**H11.02** **Starting displacement No. after pause**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-03h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Continue to execute the unexecuted displacements

1: Start from displacement 1

**Description**

Defines the starting displacement No. when the multi-position operation recovers from a pause.

Pause:

1. The servo drive switches to another control mode or the interrupt positioning function is enabled during multi-position operation.

2. The internal multi-position enable signal (FunIN.28:PosInSen) changes from "active" to "inactive".

| Setpoint | Starting displacement 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** **Interval time unit**

Hexadecimal: 2011-04h
Min.: 0
Max.: 1
Default: 0
Effective Time: Real time
Unit: -
Data Type: UInt16
Change: At stop

**Value Range:**

0: ms

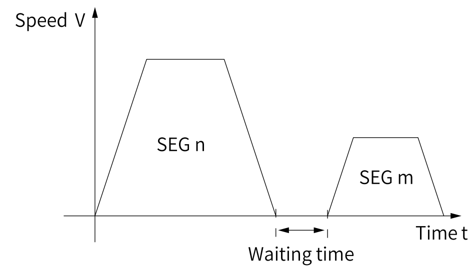
1: s

**Description**

Defines the unit of acceleration/deceleration time and the interval time during multi-position operation.

Acceleration/Deceleration time: time for the motor to change from 0 rpm to 1000 rpm at a constant speed.

Interval time: interval time that starts from the end of the last reference to the beginning of the next reference

| Setpoint | Interval time unit | Remarks |
|---|---|---|
| 0 | ms |  |
| 1 | s | |

When H11.00 = 3 (Sequential running), H11.03 is invalid, and there is no waiting time between positions.

When H11.00 = 2 (DI switchover), H11.03 is invalid, and the time interval between positions is determined by the delay time command from the host controller.

**H11.04** **Displacement reference type**

Hexadecimal: 2011-05h
Min.: 0
Max.: 1
Default: 0
Effective Time: Real time
Unit: -
Data Type: UInt16
Change: Immediately

**Value Range:**

0: Relative displacement reference

1: Absolute displacement reference

**Description**

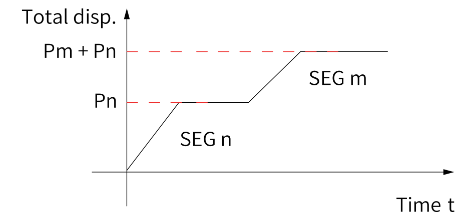
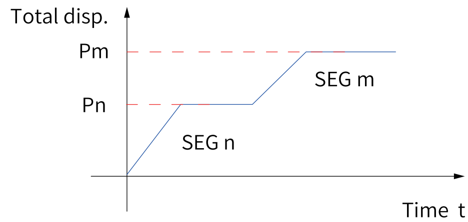
Relative displacement: position increment of the target position relative to the current motor position

Absolute displacement: position increment of the target position relative to the motor home.

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

Displacement reference: sum of position references in a certain period.

Relative displacement: position increment of the target position relative to the current motor position. Absolute displacement: position increment of the target position relative to motor home position. For example, the displacements of the nth position and mth position are Pn (Pn > 0) and Pm (Pm > 0) respectively. Suppose Pm is larger than Pn, the comparison diagram will be as follows.

| Setpoint | Displacement instruction type | Remarks |
| --- | --- | --- |
| 0 | Relative displacement reference | <br>mth actual displacement: Pm |
| 1 | Absolute displacement reference | <br>mth actual displacement: Pm |

When the actual displacement is a negative value, the motor runs in the reverse direction.

**H11.05** **Starting displacement No. in sequential operation**

| | | | |
| --- | --- | --- | --- |
| Hexadecimal: | 2011-06h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 16 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0–16

**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).

| Setpoint | Starting displacement No. in sequential operation | 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. |
| 1–16 | 1–16 | 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**

Hexadecimal: 2011-0Ah | Effective Time: Real time
Min.: 0 | Unit: ms
Max.: 65535 | Data Type: UInt16
Default: 65535 | Change: Immediately

**Value Range:**
0 ms to 65535 ms

**Description**
-

**H11.10** **Start speed of the 1st displacement**

Hexadecimal: 2011-0Bh | Effective Time: Real time
Min.: 0 | Unit: rpm
Max.: 6000 | Data Type: UInt16
Default: 0 | Change: Immediately

**Value Range:**
0rpm–6000rpm

**Description**
-

**H11.11** **Stop speed of the 1st displacement**

Hexadecimal: 2011-0Ch | Effective Time: Real time
Min.: 0 | Unit: rpm
Max.: 6000 | Data Type: UInt16
Default: 0 | Change: Immediately

**Value Range:**
0rpm–6000rpm

**Description**
-

**H11.12** **Displacement 1**

Hexadecimal: 2011-0Dh | Effective Time: Real time
Min.: -1073741824 | Unit: Reference unit
Max.: 1073741824 | Data Type: Int32
Default: 10000 | Change: Immediately

**Value Range:**
-1073741824 to 1073741824

**Description**

Defines displacement 1 (reference unit) in multi-position operation.

**H11.14** **Max. speed of displacement 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-0Fh | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

**Description**

Defines the maximum speed of displacement 1 in multi-position operation.

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** **Acc/Dec time of displacement 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-10h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**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):

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

Note: The rigidity must be good, and the speed loop can follow the position command.

**H11.16** **Interval time after displacement 1**

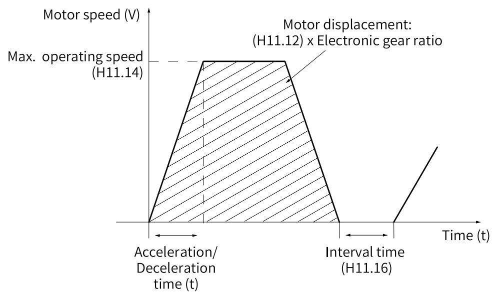
| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-11h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

Defines the interval time that starts from the end of displacement 1 to the beginning of the next displacement.



**H11.17** **Displacement 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-12h | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**
-1073741824 to 1073741824
**Description**
-

**H11.19** **Max. speed of displacement 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-14h | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**
1 rpm to 6000 rpm
**Description**
-

**H11.20** **Acc/Dec time of displacement 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-15h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**
0 ms to 65535 ms
**Description**
-

**H11.21** **Interval time after displacement 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-16h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**
0 ms(s) to 10000 ms(s)
**Description**
-

**H11.22** **Displacement 3**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-17h | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**
-1073741824 to 1073741824
**Description**
-

**H11.24** **Max. speed of displacement 3**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-19h | Effective Time: | Real time |

Min.: 1 | Unit: rpm
Max.: 6000 | Data Type: UInt16
Default: 200 | Change: Immediately

**Value Range:**
1 rpm to 6000 rpm

**Description**
-

**H11.25 Acc/Dec time of displacement 3**

Hexadecimal: 2011-1Ah | Effective Time: Real time
Min.: 0 | Unit: ms
Max.: 65535 | Data Type: UInt16
Default: 10 | Change: Immediately

**Value Range:**
0 ms to 65535 ms

**Description**
-

**H11.26 Interval time after displacement 3**

Hexadecimal: 2011-1Bh | Effective Time: Real time
Min.: 0 | Unit: ms (s)
Max.: 10000 | Data Type: UInt16
Default: 10 | Change: Immediately

**Value Range:**
0 ms(s) to 10000 ms(s)

**Description**
-

**H11.27 Displacement 4**

Hexadecimal: 2011-1Ch | Effective Time: Real time
Min.: -1073741824 | Unit: Reference unit
Max.: 1073741824 | Data Type: Int32
Default: 10000 | Change: Immediately

**Value Range:**
-1073741824 to 1073741824

**Description**
-

**H11.29 Max. speed of displacement 4**

Hexadecimal: 2011-1Eh | Effective Time: Real time
Min.: 1 | Unit: rpm
Max.: 6000 | Data Type: UInt16
Default: 200 | Change: Immediately

**Value Range:**
1 rpm to 6000 rpm

**Description**
-

**H11.30 Acc/Dec time of displacement 4**

Hexadecimal: 2011-1Fh | Effective Time: Real time
Min.: 0 | Unit: ms
Max.: 65535 | Data Type: UInt16

Default: 10 | Change: Immediately

**Value Range:**
0 ms to 65535 ms

**Description**
-

**H11.31** **Interval time after displacement 4**

Hexadecimal: 2011-20h | Effective Time: Real time
Min.: 0 | Unit: ms (s)
Max.: 10000 | Data Type: UInt16
Default: 10 | Change: Immediately

**Value Range:**
0 ms(s) to 10000 ms(s)

**Description**
-

**H11.32** **Displacement 5**

Hexadecimal: 2011-21h | Effective Time: Real time
Min.: -1073741824 | Unit: Reference unit
Max.: 1073741824 | Data Type: Int32
Default: 10000 | Change: Immediately

**Value Range:**
-1073741824 to 1073741824

**Description**
-

**H11.34** **Max. speed of displacement 5**

Hexadecimal: 2011-23h | Effective Time: Real time
Min.: 1 | Unit: rpm
Max.: 6000 | Data Type: UInt16
Default: 200 | Change: Immediately

**Value Range:**
1 rpm to 6000 rpm

**Description**
-

**H11.35** **Acc/Dec time of displacement 5**

Hexadecimal: 2011-24h | Effective Time: Real time
Min.: 0 | Unit: ms
Max.: 65535 | Data Type: UInt16
Default: 10 | Change: Immediately

**Value Range:**
0 ms to 65535 ms

**Description**
-

**H11.36** **Interval time after displacement 5**

Hexadecimal: 2011-25h | Effective Time: Real time
Min.: 0 | Unit: ms (s)
Max.: 10000 | Data Type: UInt16
Default: 10 | Change: Immediately

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

-

**H11.37** **Displacement 6**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-26h | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

-1073741824 to 1073741824

**Description**

-

**H11.39** **Max. speed of displacement 6**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-28h | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

**Description**

-

**H11.40** **Acc/Dec time of displacement 6**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-29h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

-

**H11.41** **Interval time after displacement 6**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-2Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

-

**H11.42** **Displacement 7**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-2Bh | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

-1073741824 to 1073741824

**Description**

-

**H11.44** **Max. speed of displacement 7**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-2Dh | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

**Description**

-

**H11.45** **Acc/Dec time of displacement 7**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-2Eh | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

-

**H11.46** **Interval time after displacement 7**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-2Fh | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

-

**H11.47** **Displacement 8**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-30h | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

-1073741824 to 1073741824

**Description**

-

**H11.49** **Max. speed of displacement 8**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-32h | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

**Description**

-

**H11.50** **Acc/Dec time of displacement 8**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-33h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

-

**H11.51** **Interval time after displacement 8**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-34h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

-

**H11.52** **Displacement 9**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-35h | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

-1073741824 to 1073741824

**Description**

-

**H11.54** **Max. speed of displacement 9**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-37h | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

**Description**

-

**H11.55** **Acc/Dec time of displacement 9**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-38h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

-

**H11.56** **Interval time after displacement 9**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-39h | Effective Time: | Real time |

| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

-

**H11.57** **Displacement 10**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-3Ah | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

-1073741824 to 1073741824

**Description**

-

**H11.59** **Max. speed of displacement 10**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-3Ch | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

**Description**

-

**H11.60** **Acc/Dec time of displacement 10**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-3Dh | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

-

**H11.61** **Interval time after displacement 10**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-3Eh | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

-

**H11.62** **Displacement 11**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-3Fh | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |

| | | | |
|---|---|---|---|
| Default: | 10000 | Change: | Immediately |

**Value Range:**
-1073741824 to 1073741824
**Description**
-

**H11.64** **Max. speed of displacement 11**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-41h | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**
1 rpm to 6000 rpm
**Description**
-

**H11.65** **Acc/Dec time of displacement 11**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-42h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**
0 ms to 65535 ms
**Description**
-

**H11.66** **Interval time after displacement 11**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-43h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**
0 ms(s) to 10000 ms(s)
**Description**
-

**H11.67** **Displacement 12**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-44h | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**
-1073741824 to 1073741824
**Description**
-

**H11.69** **Max. speed of displacement 12**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-46h | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

**Description**

-

**H11.70** **Acc/Dec time of displacement 12**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-47h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

-

**H11.71** **Interval time after displacement 12**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-48h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

-

**H11.72** **Displacement 13**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-49h | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

-1073741824 to 1073741824

**Description**

-

**H11.74** **Max. speed of displacement 13**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-4Bh | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

**Description**

-

**H11.75** **Acc/Dec time of displacement 13**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-4Ch | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

-

**H11.76** **Interval time after displacement 13**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-4Dh | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

-

**H11.77** **Displacement 14**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-4Eh | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

-1073741824 to 1073741824

**Description**

-

**H11.79** **Max. speed of displacement 14**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-50h | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

**Description**

-

**H11.80** **Acc/Dec time of displacement 14**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-51h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

-

**H11.81** **Interval time after displacement 14**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-52h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

-

**H11.82** **Displacement 15**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-53h | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

-1073741824 to 1073741824

**Description**

-

**H11.84** **Max. speed of displacement 15**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-55h | Effective Time: | Real time |
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**

1 rpm to 6000 rpm

**Description**

-

**H11.85** **Acc/Dec time of displacement 15**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-56h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

-

**H11.86** **Interval time after displacement 15**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-57h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms(s) to 10000 ms(s)

**Description**

-

**H11.87** **Displacement 16**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-58h | Effective Time: | Real time |
| Min.: | -1073741824 | Unit: | Reference unit |
| Max.: | 1073741824 | Data Type: | Int32 |
| Default: | 10000 | Change: | Immediately |

**Value Range:**

-1073741824 to 1073741824

**Description**

-

**H11.89** **Max. speed of displacement 16**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-5Ah | Effective Time: | Real time |

| | | | |
|---|---|---|---|
| Min.: | 1 | Unit: | rpm |
| Max.: | 6000 | Data Type: | UInt16 |
| Default: | 200 | Change: | Immediately |

**Value Range:**
1 rpm to 6000 rpm
**Description**
-

**H11.90** **Acc/Dec time of displacement 16**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-5Bh | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**
0 ms to 65535 ms
**Description**
-

**H11.91** **Interval time after displacement 16**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2011-5Ch | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms (s) |
| Max.: | 10000 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

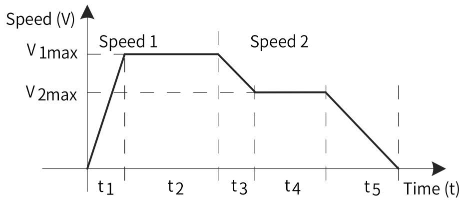
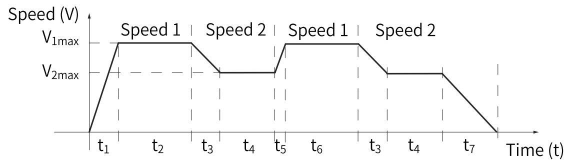
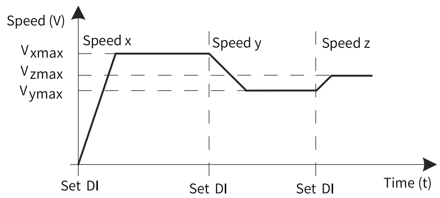
**Value Range:**
0 ms(s) to 10000 ms(s)
**Description**
-

## 15.16 H12 Multi-Speed Operation References

**H12.00** **Multi-speed operation mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-01h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 2 | Data Type: | UInt16 |
| Default: | 1 | Change: | At stop |

**Value Range:**
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
**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.
Speed arrival (FunOUT.19: V-Arr) signal is valid when a certain speed reference reaches the set value.

| Set point | Operation Mode | Remarks | Operation Curve |
|---|---|---|---|
| 0 | Individual operation | The drive stops after one cycle of operation.<br>The drive switches to the next displacement automatically. | <br>$V_{1max}$, $V_{2max}$: reference values of speed 1 and speed 2<br>$t_1$: actual acceleration/deceleration time of speed 1<br>$t_3$, $t_5$: acceleration/deceleration time of speed 2 |
| 1 | Cyclic operation | The drive starts from speed 1 after each cycle of operation.<br>The drive automatically switches to the next speed.<br>The cyclic operation state remains active as long as the S-ON signal is active. | <br>$V_{1max}$, $V_{2max}$: maximum operating speeds in displacement 1 and displacement 2 |
| 2 | External DI signal | The drive operates continuously as long as the S-ON signal is active.<br>The speed No. is determined by the DI logic.<br>The operating time of each speed is determined only by the interval time of speed switchover.<br>The speed reference direction can be switched through FunIN.5 (DIR-SEL). | <br>x, y: speed No. (The relationship between the speed No. and the DI logic is described below.)<br>$V_x$, $V_y$: speed references for speeds x and y<br>The speed No. determined by DI does not change, which means the speed reference operates continuously regardless of the reference operating time. |

**H12.01** **Number of speed references in multi-speed mode**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-02h | Effective Time: | Real time |
| Min.: | 1 | Unit: | - |
| Max.: | 16 | Data Type: | UInt16 |
| Default: | 16 | Change: | At stop |

**Value Range:**

1 to 16

**Description**

Defines the total number of speed references in the multi-speed mode. Different speed references, operating time, and acceleration/deceleration time (four groups optional) can be set for each speed.

H12.00 ≠ 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. The displacement No. is a 4-bit binary value. Bit 0 to bit 3 correspond to CMD1 to CMD4.

| FunIN.9 | FunIN.8 | FunIN.7 | FunIN.6 | Segment No. |
|---|---|---|---|---|
| CMD4 | CMD3 | CMD2 | CMD1 | |
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 2 |
| ... | | | | |
| 1 | 1 | 1 | 1 | 16 |

The value of CMD(n) is 1 upon active DI logic and 0 upon inactive DI logic.

**H12.02** **Operating time unit**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-03h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: sec

1: min

**Description**

Defines the time unit of multi-speed operation.

0: s

1: min

**H12.03** **Acceleration time 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-04h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

Four groups of acceleration/deceleration time can be set for each speed reference.

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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-05h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 10 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

Four groups of acceleration/deceleration time can be set for each speed reference.

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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-06h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 50 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

Four groups of acceleration/deceleration time can be set for each speed reference.

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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-07h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 50 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

Four groups of acceleration/deceleration time can be set for each speed reference.

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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-08h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

Four groups of acceleration/deceleration time can be set for each speed reference.

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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-09h | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**

0 ms to 65535 ms

**Description**

Four groups of acceleration/deceleration time can be set for each speed reference.

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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-0Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |

| | | | |
|---|---|---|---|
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 150 | Change: | Immediately |

**Value Range:**
0 ms to 65535 ms
**Description**
Four groups of acceleration/deceleration time can be set for each speed reference.
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**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-0Bh | Effective Time: | Real time |
| Min.: | 0 | Unit: | ms |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 150 | Change: | Immediately |

**Value Range:**
0 ms to 65535 ms
**Description**
Four groups of acceleration/deceleration time can be set for each speed reference.
Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.

**H12.20** **Speed reference 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-15h | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
–6000 rpm to 6000 rpm
**Description**
-

**H12.21** **Operating time of speed 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-16h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**
0.0s(m) to 6553.5s(m)
**Description**
Defines the operating time of speed 1.
The operating time is the sum of the speed variation time from previous speed reference to present speed reference plus the average operating time of present speed reference.
If the operating time is set to 0, the drive skips this speed reference automatically.
As long as H12.00 (Multi-speed operation mode) is set to 2 (DI-based operation) and the speed No. determined by the external DI does not change, the drive continues operating at the speed defined by this speed reference, not affected by the reference operating time.

**H12.22** **Acceleration/Deceleration time of speed 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-17h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |

Default: 0 | Change: Immediately

**Value Range:**

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2: Acceleration/Deceleration time 2

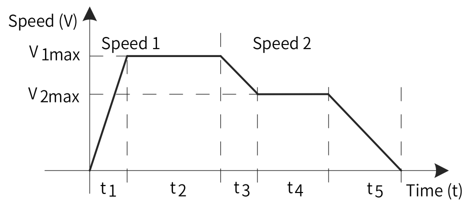
3: Acceleration/Deceleration time 3

4: Acceleration/Deceleration time 4

**Description**

Defines the acceleration/deceleration time of speed 1.

| Setpoint | Acceleration/Deceleration time | Remarks |
|---|---|---|
| 0 | Zero acceleration/ deceleration time | Acceleration time: 0<br>Deceleration time: 0 |
| 1 | Acceleration/Deceleration time 1 | Acceleration time: H12.03<br>Deceleration time: H12.04 |
| 2 | Acceleration/Deceleration time 2 | Acceleration time: H12.05<br>Deceleration time: H12.06 |
| 3 | Acceleration/Deceleration time 3 | Acceleration time: H12.07<br>Deceleration time: H12.08 |
| 4 | Acceleration/Deceleration time 4 | Acceleration time: H12.09<br>Deceleration time: H12.10 |




- $V_{1max}$, $V_{2max}$: reference values of speed 1 and speed 2
- $t_1$: actual acceleration/deceleration time of speed 1
- $t_3$, $t_5$: acceleration/deceleration time of speed 2
- Operating time = Time taken in switching from the last speed to current speed + Duration of constant-speed operation at current speed (For example, the operating time of speed 1 is the sum of $t_1$ and $t_2$; the operating time of speed 2 is the sum of $t_3$ and $t_4$.)
- 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 actual acceleration time t1 is as follows.

$$t_1 = \frac{V_1}{1000} \times \text{Acc. time set for the speec}$$

The actual deceleration time $t_2$ is:

$$t_2 = \frac{V_1}{1000} \times \text{Dec. time set for the speed}$$

## H12.23 Reference 2

Hexadecimal: 2012-18h | Effective Time: Real time

Min.: -6000 | Unit: rpm

Max.: 6000 | Data Type: Int16

Default: 100 | Change: Immediately

**Value Range:**

–6000 rpm to 6000 rpm

**Description**
-

**H12.24** **Operating time of speed 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-19h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**
0.0s(m) to 6553.5s(m)
**Description**
-

**H12.25** **Acceleration/Deceleration time of speed 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-1Ah | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
See H12.22.
**Description**
-

**H12.26** **Reference 3**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-1Bh | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | 300 | Change: | Immediately |

**Value Range:**
–6000 rpm to 6000 rpm
**Description**
-

**H12.27** **Operating time of speed 3**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-1Ch | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**
0.0s(m) to 6553.5s(m)
**Description**
-

**H12.28** **Acceleration/Deceleration time of speed 3**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-1Dh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
See H12.22.
**Description**
-

**H12.29** **Reference 4**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-1Eh | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | 500 | Change: | Immediately |

**Value Range:**
–6000 rpm to 6000 rpm
**Description**
-

**H12.30** **Operating time of speed 4**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-1Fh | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**
0.0s(m) to 6553.5s(m)
**Description**
-

**H12.31** **Acceleration/Deceleration time of speed 4**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-20h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
See H12.22.
**Description**
-

**H12.32** **Reference 5**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-21h | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | 700 | Change: | Immediately |

**Value Range:**
–6000 rpm to 6000 rpm
**Description**
-

**H12.33** **Operating time of speed 5**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-22h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**
0.0s(m) to 6553.5s(m)
**Description**
-

**H12.34** **Acceleration/Deceleration time of speed 5**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-23h | Effective Time: | Real time |

| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
See H12.22.
**Description**
-

**H12.35** **Reference 6**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-24h | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | 900 | Change: | Immediately |

**Value Range:**
–6000 rpm to 6000 rpm
**Description**
-

**H12.36** **Operating time of speed 6**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-25h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**
0.0s(m) to 6553.5s(m)
**Description**
-

**H12.37** **Acc./dec. time of speed 6**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-26h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
See H12.22.
**Description**
-

**H12.38** **Reference 7**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-27h | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | 600 | Change: | Immediately |

**Value Range:**
–6000 rpm to 6000 rpm
**Description**
-

**H12.39** **Operating time of speed 7**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-28h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |

| | | | |
|---|---|---|---|
| Default: | 5.0 | Change: | Immediately |

**Value Range:**
0.0s(m) to 6553.5s(m)
**Description**
-

**H12.40** **Acceleration/Deceleration time of speed 7**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-29h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
See H12.22.
**Description**
-

**H12.41** **Reference 8**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-2Ah | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | 300 | Change: | Immediately |

**Value Range:**
–6000 rpm to 6000 rpm
**Description**
-

**H12.42** **Operating time of speed 8**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-2Bh | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**
0.0s(m) to 6553.5s(m)
**Description**
-

**H12.43** **Acceleration/Deceleration time of speed 8**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-2Ch | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
See H12.22.
**Description**
-

**H12.44** **Reference 9**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-2Dh | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | 100 | Change: | Immediately |

**Value Range:**

–6000 rpm to 6000 rpm

**Description**

-

**H12.45** **Operating time of speed 9**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-2Eh | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**

0.0s(m) to 6553.5s(m)

**Description**

-

**H12.46** **Acceleration/Deceleration time of speed 9**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-2Fh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H12.22.

**Description**

-

**H12.47** **Reference 10**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-30h | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | -100 | Change: | Immediately |

**Value Range:**

–6000 rpm to 6000 rpm

**Description**

-

**H12.48** **Operating time of speed 10**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-31h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**

0.0s(m) to 6553.5s(m)

**Description**

-

**H12.49** **Acceleration/Deceleration time of speed 10**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-32h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H12.22.

**Description**

-

**H12.50** **Reference 11**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-33h | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | -300 | Change: | Immediately |

**Value Range:**

–6000 rpm to 6000 rpm

**Description**

-

**H12.51** **Operating time of speed 11**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-34h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**

0.0s(m) to 6553.5s(m)

**Description**

-

**H12.52** **Acceleration/Deceleration time of speed 11**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-35h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H12.22.

**Description**

-

**H12.53** **Reference 12**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-36h | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | -500 | Change: | Immediately |

**Value Range:**

–6000 rpm to 6000 rpm

**Description**

-

**H12.54** **Operating time of speed 12**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-37h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**

0.0s(m) to 6553.5s(m)

**Description**

-

**H12.55** **Acceleration/Deceleration time of speed 12**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-38h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H12.22.

**Description**

-

**H12.56** **Reference 13**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-39h | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | -700 | Change: | Immediately |

**Value Range:**

–6000 rpm to 6000 rpm

**Description**

-

**H12.57** **Operating time of speed 13**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-3Ah | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**

0.0s(m) to 6553.5s(m)

**Description**

-

**H12.58** **Acceleration/Deceleration time of speed 13**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-3Bh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H12.22.

**Description**

-

**H12.59** **Reference 14**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-3Ch | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | -900 | Change: | Immediately |

**Value Range:**

–6000 rpm to 6000 rpm

**Description**

-

**H12.60** **Operating time of speed 14**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-3Dh | Effective Time: | Real time |

| | | | |
|---|---|---|---|
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**
0.0s(m) to 6553.5s(m)
**Description**
-

**H12.61** **Acceleration/Deceleration time of speed 14**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-3Eh | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
See H12.22.
**Description**
-

**H12.62** **Reference 15**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-3Fh | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |
| Default: | -600 | Change: | Immediately |

**Value Range:**
–6000 rpm to 6000 rpm
**Description**
-

**H12.63** **Operating time of speed 15**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-40h | Effective Time: | Real time |
| Min.: | 0.0 | Unit: | s (m) |
| Max.: | 6553.5 | Data Type: | UInt16 |
| Default: | 5.0 | Change: | Immediately |

**Value Range:**
0.0s(m) to 6553.5s(m)
**Description**
-

**H12.64** **Acceleration/Deceleration time of speed 15**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-41h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 4 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**
See H12.22.
**Description**
-

**H12.65** **Reference 16**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2012-42h | Effective Time: | Real time |
| Min.: | -6000 | Unit: | rpm |
| Max.: | 6000 | Data Type: | Int16 |

Default: -300 | Change: Immediately

**Value Range:**

–6000 rpm to 6000 rpm

**Description**

-

**H12.66** **Operating time of speed 16**

Hexadecimal: 2012-43h | Effective Time: Real time
Min.: 0.0 | Unit: s (m)
Max.: 6553.5 | Data Type: UInt16
Default: 5.0 | Change: Immediately

**Value Range:**

0.0s(m) to 6553.5s(m)

**Description**

-

**H12.67** **Acc./dec. time of speed 16**

Hexadecimal: 2012-44h | Effective Time: Real time
Min.: 0 | Unit: -
Max.: 4 | Data Type: UInt16
Default: 0 | Change: Immediately

**Value Range:**

See H12.22.

**Description**

-

## 15.17 H17 VDO/VDI settings

**H17.00** **VDI1 function selection**

Hexadecimal: 2017-01h | Effective Time: At stop
Min.: 0 | Unit: -
Max.: 41 | Data Type: UInt16
Default: 0 | Change: Immediately

**Value Range:**

0: No assignment

1: S-ON

2: Warning reset signal

3: Gain switchover switch

4: Switchover between main and auxiliary commands

5: Multi-reference direction

6: Multi-reference switchover CMD1

7: Multi-reference switchover CMD2

8: Multi-reference switchover CMD3

9: Multi-reference switchover CMD4

10: Mode switchover M1-SEL

11: Mode switchover M2-SEL
12: Zero clamp enable signal
13: Position reference inhibited
14: Positive limit switch
15: Reverse limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Hand wheel override signal 1
22: Hand wheel override signal 2
23: Hand wheel enable signal
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 canceled
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Clear position deviation
36: Internal speed limit source
37: Pulse reference inhibited
38: Writing reference causes interrupt
39: Writing reference does not cause interrupt
40: Clear positioning and reference completed signals
41: Current position as home

**Description**

-

**H17.01** **VDI1 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-02h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

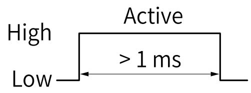
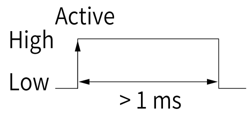
**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

It sets the input level logic of VDI1 for enabling the VDI1 function.

| Setpoint | 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**

Hexadecimal: 2017-03h Effective Time: At stop
Min.: 0 Unit: -
Max.: 41 Data Type: UInt16
Default: 0 Change: Immediately

**Value Range:**

See H17.00.

**Description**

-

**H17.03** **VDI2 logic selection**

Hexadecimal: 2017-04h Effective Time: At stop
Min.: 0 Unit: -
Max.: 1 Data Type: UInt16
Default: 0 Change: At stop

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.04** **VDI3 function selection**

Hexadecimal: 2017-05h Effective Time: At stop
Min.: 0 Unit: -
Max.: 41 Data Type: UInt16
Default: 0 Change: Immediately

**Value Range:**

See H17.00.

**Description**

-

**H17.05** **VDI3 logic selection**

Hexadecimal: 2017-06h Effective Time: At stop
Min.: 0 Unit: -
Max.: 1 Data Type: UInt16
Default: 0 Change: At stop

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.06** **VDI4 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-07h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.07** **VDI4 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-08h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.08** **VDI5 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-09h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.09** **VDI5 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-0Ah | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.10** **VDI6 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-0Bh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |

| | | | |
|---|---|---|---|
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.11** **VDI6 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-0Ch | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.12** **VDI7 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-0Dh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.13** **VDI7 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-0Eh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.14** **VDI8 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-0Fh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.15** **VDI8 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-10h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |

| | | | |
|---|---|---|---|
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.16** **VDI9 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-11h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.17** **VDI9 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-12h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.18** **VDI10 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-13h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.19** **VDI10 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-14h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.20** **VDI11 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-15h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.21** **VDI11 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-16h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.22** **VDI12 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-17h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.23** **VDI12 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-18h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.24** **VDI13 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-19h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.25** **VDI13 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-1Ah | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.26** **VDI14 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-1Bh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.27** **VDI14 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-1Ch | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.28** **VDI15 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-1Dh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.29** **VDI15 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-1Eh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.30** **VDI16 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-1Fh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 41 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

See H17.00.

**Description**

-

**H17.31** **VDI16 logic selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-20h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

**Description**

-

**H17.32** **VDO virtual level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-21h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Unchangeable |

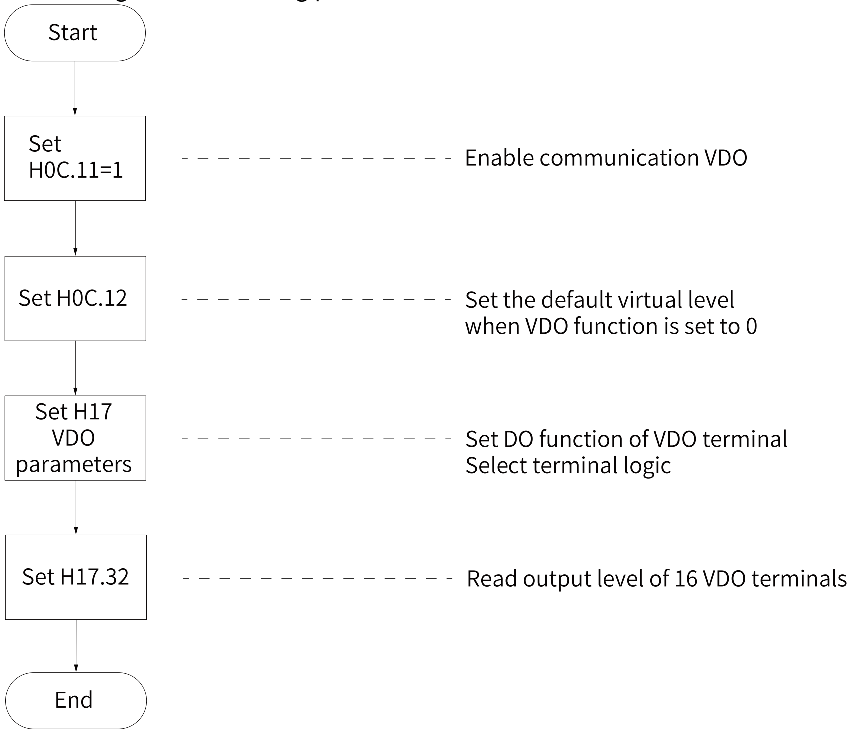
**Value Range:**

0–65535

**Description**

It sets the default virtual level of the VDO allocated with function 0 (disabled).

Use the VDO according to the following procedure:




**H17.33** **VDO1 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-22h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Proximity
7: Torque limited
8: Speed limited
9: Brake
10: Warning
11: Fault
12: Output 3-bit warning code
13: Output 3-bit warning code
14: Output 3-bit warning 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

**Description**

-

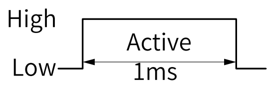
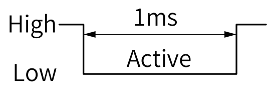
**H17.34** **VDO1 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-23h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output 1 upon active logic
1: Output 0 upon active logic

**Description**

| Setpoint | VDO1 terminal logic | Remarks |
|---|---|---|
| 0 | Output 1 when function valid |   |
| 1 | Output 0 when function valid |   |

**H17.35** **VDO2 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-24h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |

| | | | |
|---|---|---|---|
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
See H17.33.
**Description**
-

**H17.36** **VDO2 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-25h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0: Output 1 upon active logic
1: Output 0 upon active logic
**Description**
-

**H17.37** **VDO3 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-26h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
See H17.33.
**Description**
-

**H17.38** **VDO3 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-27h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0: Output 1 upon active logic
1: Output 0 upon active logic
**Description**
-

**H17.39** **VDO4 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-28h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
See H17.33.
**Description**
-

**H17.40** **VDO4 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-29h | Effective Time: | At stop |

Min.: 0 | Unit: -
Max.: 1 | Data Type: UInt16
Default: 0 | Change: At stop

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.41** **VDO5 function selection**

Hexadecimal: 2017-2Ah | Effective Time: At stop
Min.: 0 | Unit: -
Max.: 24 | Data Type: UInt16
Default: 0 | Change: At stop

**Value Range:**

See H17.33.

**Description**

-

**H17.42** **VDO5 logic level**

Hexadecimal: 2017-2Bh | Effective Time: At stop
Min.: 0 | Unit: -
Max.: 1 | Data Type: UInt16
Default: 0 | Change: At stop

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.43** **VDO6 function selection**

Hexadecimal: 2017-2Ch | Effective Time: At stop
Min.: 0 | Unit: -
Max.: 24 | Data Type: UInt16
Default: 0 | Change: At stop

**Value Range:**

See H17.33.

**Description**

-

**H17.44** **VDO6 logic level**

Hexadecimal: 2017-2Dh | Effective Time: At stop
Min.: 0 | Unit: -
Max.: 1 | Data Type: UInt16
Default: 0 | Change: At stop

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.45** **VDO7 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-2Eh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

See H17.33.

**Description**

-

**H17.46** **VDO7 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-2Fh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.47** **VDO8 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-30h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

See H17.33.

**Description**

-

**H17.48** **VDO8 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-31h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.49** **VDO9 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-32h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

See H17.33.

**Description**

-

**H17.50** **VDO9 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-33h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.51** **VDO10 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-34h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

See H17.33.

**Description**

-

**H17.52** **VDO10 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-35h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.53** **VDO11 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-36h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

See H17.33.

**Description**

-

**H17.54** **VDO11 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-37h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.55** **VDO12 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-38h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

See H17.33.

**Description**

-

**H17.56** **VDO12 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-39h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.57** **VDO13 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-3Ah | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

See H17.33.

**Description**

-

**H17.58** **VDO13 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-3Bh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.59** **VDO14 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-3Ch | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

See H17.33.

**Description**

-

**H17.60** **VDO14 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-3Dh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.61** **VDO15 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-3Eh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

See H17.33.

**Description**

-

**H17.62** **VDO15 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-3Fh | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

0: Output 1 upon active logic

1: Output 0 upon active logic

**Description**

-

**H17.63** **VDO16 function selection**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-40h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 24 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**

See H17.33.

**Description**

-

**H17.64** **VDO16 logic level**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2017-41h | Effective Time: | At stop |
| Min.: | 0 | Unit: | - |
| Max.: | 1 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0: Output 1 upon active logic
1: Output 0 upon active logic
**Description**
-

## 15.18 H1B Motor Storage Property

**H1B.14** **Bit01 of motor SN code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 201B-0Fh | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

**H1B.15** **Bit23 of motor SN code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 201B-10h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

**H1B.16** **Bit45 of motor SN code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 201B-11h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

**H1B.17** **Bit67 of motor SN code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 201B-12h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

**H1B.18** **Bit89 of motor SN code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 201B-13h | Effective Time: | - |

| | | | |
|---|---|---|---|
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

**H1B.19** **Bit11 of motor SN code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 201B-14h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

**H1B.20** **Bit13 of motor SN code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 201B-15h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

**H1B.21** **Bit15 of motor SN code**

| | | | |
|---|---|---|---|
| Hexadecimal: | 201B-16h | Effective Time: | - |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

**H1B.47** **Motor storage property shield word 1**

| | | | |
|---|---|---|---|
| Hexadecimal: | 201B-30h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | At stop |

**Value Range:**
0 to 65535
**Description**
-

**H1B.48** **Motor storage property shield word 2**

| | | | |
|---|---|---|---|
| Hexadecimal: | 201B-31h | Effective Time: | Upon the next power-on |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |

Default: 0 | Change: At stop

**Value Range:**
0 to 65535
**Description**
-

## 15.19 H30 Servo status variables read through communication

**H30.00** **Servo status read through communication**

Hexadecimal: 2030-01h | Effective Time: -
Min.: 0 | Unit: -
Max.: 65535 | Data Type: UInt16
Default: 0 | Change: Unchangeable

**Value Range:**
0 to 65535
**Description**
H30.00 value is hexadecimal, and is not displayed on the keypad. It is read as binary, and each bit of the binary is defined as follows:

| bit | Servo State | Remarks |
|---|---|---|
| 0 | Servo ready | It determines whether the servo main circuit DC bus voltage is ready and the servo drive is ready for running.<br>0: Servo drive not ready<br>1: Servo ready |
| 1–11 | Reserved | - |
| 12–13 | Servo running state | It determines the servo running state.<br>00: Servo drive not ready (main circuit DC bus voltage not set up correctly)<br>01: Servo drive ready (main circuit DC bus voltage set up correctly, servo drive is ready for running)<br>10: Servo drive running (S-ON active)<br>11: Servo drive fault (a level 1 or level 2 fault occurs) |
| 14–15 | Reserved | - |

**H30.01** **DO function state 1 read through communication**

Hexadecimal: 2030-02h | Effective Time: -
Min.: 0 | Unit: -
Max.: 65535 | Data Type: UInt16
Default: 0 | Change: Unchangeable

**Value Range:**
0 to 65535

**Description**

Used to read the state of DO functions 1 to 16 through communication. 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 Function | Remarks |
|---|---|---|
| 0 | DO function 1 (FunOUT.1: S-RDY, servo ready) | 0: Servo drive not ready<br>1: Servo ready |
| ... | | |
| 15 | DO function 16 (FunOUT.16: HomeAttain, homing output) | 0: Home not found<br>1: Home found |

**H30.02** **DO function state 2 read through communication**

Hexadecimal: 2030-03h | Effective Time: -
Min.: 0 | Unit: -
Max.: 65535 | Data Type: UInt16
Default: 0 | Change: Unchangeable

**Value Range:**

0 to 65535

**Description**

Bit 0 corresponds to DO function 17.

Bit 1 corresponds to DO function 18.

Bit 2 corresponds to DO function 19.

…

By analogy

| bit | DO Function | Remarks |
|---|---|---|
| 0 | DO function 17 (FunOUT.17: S-ElecHomeAttain, electrical homing output) | 0: Electrical homing not completed<br>1: Electrical homing completed |
| ... | | |
| 4 to 15 | Reserved | - |

**H30.03** **Input pulse reference sampling value read through communication**

Hexadecimal: 2030-04h | Effective Time: -
Min.: 0 | Unit: -
Max.: 65535 | Data Type: UInt16
Default: 0 | Change: Unchangeable

**Value Range:**

0 to 65535

**Description**

-

**H30.04** **DI status read through communication**

Hexadecimal: 2030-05h | Effective Time: -
Min.: 0 | Unit: -
Max.: 65535 | Data Type: UInt16
Default: 0 | Change: Unchangeable

**Value Range:**

0 to 65535

**Description**

-

## 15.20 H31 Related variables set through communication

**H31.00** **VDI virtual level set through communication**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2031-01h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 65535 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

**Value Range:**

0–65535

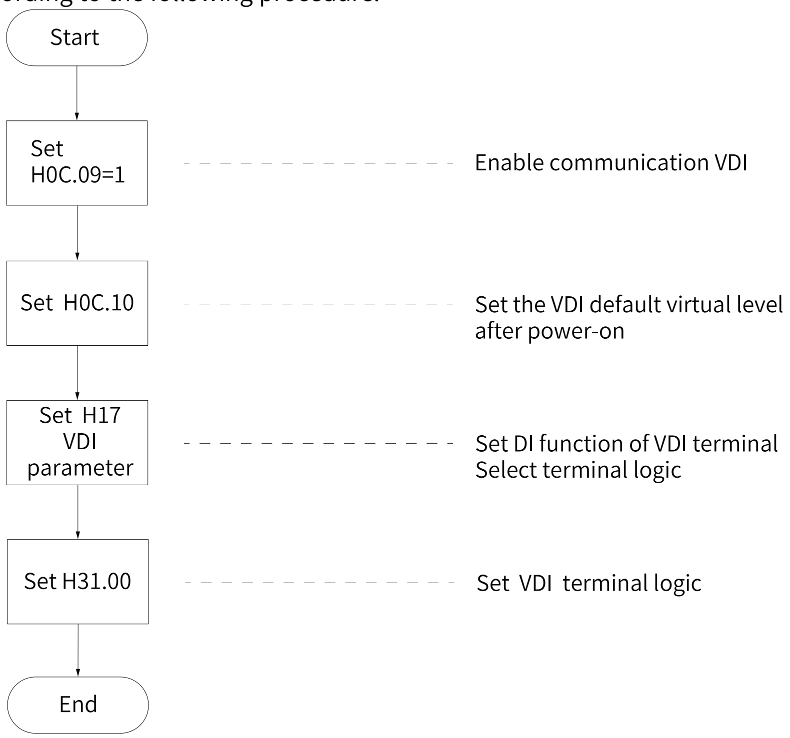
**Description**

When H0C.09 is set to 1, the VDI state is defined by H31.00.

The VDI logic is determined by H0C.10 (Default VDI virtual level value upon power-on) upon initial power-on. Then, H31.00 is determined by the VDI logic.

"bit(n) = 1" of H31.00 indicates the logic of VDI (n+1) is "1". "bit(n)=0" indicates the logic of VDI (n+1) is "0".

Use the VDI according to the following procedure:




**H31.04** **DO state set through communication**

| | | | |
|---|---|---|---|
| Hexadecimal: | 2031-05h | Effective Time: | Real time |
| Min.: | 0 | Unit: | - |
| Max.: | 31 | Data Type: | UInt16 |
| Default: | 0 | Change: | Immediately |

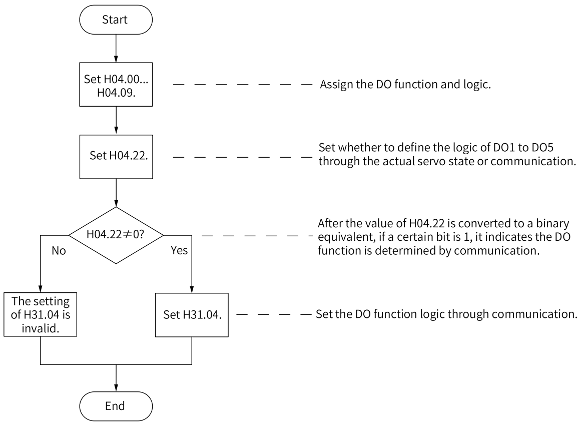
**Value Range:**

0 to 31

**Description**

Set H04.22 to define the DO state source by H31.04.

Use the DO according to the following procedure:




## H31.09 Speed reference set through communication

| | | | |
|---|---|---|---|
| Hexadecimal: | 2031-0Ah | Effective Time: | Real time |
| Min.: | -6000.000 | Unit: | rpm |
| Max.: | 6000.000 | Data Type: | Int32 |
| Default: | 0.000 | Change: | Immediately |

**Value Range:**

-6000.000rpm to 6000.000rpm

**Description**

Set H06.02 to 4 to define the speed reference in the speed control mode through H31.09 (unit: 0.001 rpm).

## H31.11 Torque reference set through communication

| | | | |
|---|---|---|---|
| Hexadecimal: | 2031-0Ch | Effective Time: | Real time |
| Min.: | -100.000 | Unit: | % |
| Max.: | 100.000 | Data Type: | Int32 |
| Default: | 0.000 | Change: | Immediately |

**Value Range:**

-100.000% to 100.000%

**Description**

Set H07.02 to 4 to define the torque reference in the torque control mode through H31.11 (unit: 0.001%). The setpoint 100.000% corresponds to the rated torque of the motor.

# 16 Parameter List

## 16.1 Parameter Group H00

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H00.00 | 2000-01h | Motor SN | 0 to 65535 | 14101 | - | At stop | "H00_en.00" on page 376 |
| H00.02 | 2000-03h | Customized No. | 0.00 to 42949672.95 | 0.00 | - | Unchangeable | "H00_en.02" on page 376 |
| H00.04 | 2000-05h | Encoder version | 0.0 to 6553.5 | 0.0 | - | Unchangeable | "H00_en.04" on page 376 |
| H00.05 | 2000-06h | Serial-type motor code | 0 to 65535 | 0 | - | Unchangeable | "H00_en.05" on page 376 |
| H00.06 | 2000-07h | FPGA customized SN | 0.00 to 10485.75 | 0.00 | - | Unchangeable | "H00_en.06" on page 376 |
| H00.08 | 2000-09h | Bus encoder type | 0 to 65535 | 0 | - | Real-time | "H00_en.08" on page 377 |
| H00.09 | 2000-0Ah | Rated voltage | 0: 220 V<br>1: 380 V | 0 | V | At stop | "H00_en.09" on page 377 |
| H00.10 | 2000-0Bh | Rated power | 0.01kW to 655.35kW | 0.01 | kW | At stop | "H00_en.10" on page 377 |
| H00.11 | 2000-0Ch | Rated current | 0.01A to 655.35A | 0.01 | A | At stop | "H00_en.11" on page 377 |
| H00.12 | 2000-0Dh | Rated torque | 0.10N·m–655.35N·m | 0.10 | N·m | At stop | "H00_en.12" on page 378 |
| H00.13 | 2000-0Eh | Max. torque | 0.10N·m–655.35N·m | 0.10 | N·m | At stop | "H00_en.13" on page 378 |
| H00.14 | 2000-0Fh | Rated speed | 100rpm–9000rpm | 100 | RPM | At stop | "H00_en.14" on page 378 |
| H00.15 | 2000-10h | Maximum speed | 100rpm–9000rpm | 100 | RPM | At stop | "H00_en.15" on page 378 |
| H00.16 | 2000-11h | Moment of inertia Jm | 0.01 kgcm²–655.35 kgcm² | 0.01 | $kgcm^2$ | At stop | "H00_en.16" on page 378 |
| H00.17 | 2000-12h | Number of PMSM pole pairs | 2 to 360 | 2 | - | At stop | "H00_en.17" on page 378 |
| H00.18 | 2000-13h | Stator resistance | 0.001Ω to 65.535Ω | 0.001 | Ω | At stop | "H00_en.18" on page 379 |
| H00.19 | 2000-14h | Stator inductance Lq | 0.01mH–655.35mH | 0.01 | mH | At stop | "H00_en.19" on page 379 |
| H00.20 | 2000-15h | Stator inductance Ld | 0.01mH–655.35mH | 0.01 | mH | At stop | "H00_en.20" on page 379 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H00.21 | 2000-16h | Linear back EMF coefficient | 0.01 mV/RPM to 655.35 mV/RPM | 0.01 | mV/rpm | At stop | "H00_en.21" on page 379 |
| H00.22 | 2000-17h | Torque coefficient Kt | 0.01 N·m/Arms to 655.35 N·m/Arms | 0.01 | N·m/ Arms | At stop | "H00_en.22" on page 379 |
| H00.23 | 2000-18h | Electrical constant Te | 0.01ms to 655.35ms | 0.01 | ms | At stop | "H00_en.23" on page 380 |
| H00.24 | 2000-19h | Mechanical constant Tm | 0.01ms to 655.35ms | 0.01 | ms | At stop | "H00_en.24" on page 380 |
| H00.27 | 2000-1Ch | Sine/Cosine number of serial encoder motor | 0 to 65535 | 1 | - | Real-time | "H00_en.27" on page 380 |
| H00.28 | 2000-1Dh | Absolute encoder position offset | 0 P/Rev–1073741824 P/Rev | 0 | PPR | At stop | "H00_en.28" on page 380 |
| H00.30 | 2000-1Fh | Encoder selection (HEX) | 0: Regular incremental encoder (UVW-ABZ)<br>1: Wire-saving encoder (ABZ[UVW])<br>2: Regular incremental encoder (ABZ, without UVW)<br>16: TAMAGAWA encoder<br>18: Nikon encoder<br>19: Inovance encoder<br>48: Optical scale | 19 | - | At stop | "H00_en.30" on page 380 |
| H00.31 | 2000-20h | Encoder PPR | 1 P/Rev–1073741824 P/Rev | 8388608 | PPR | At stop | "H00_en.31" on page 381 |
| H00.35 | 2000-24h | Motor code saved in the serial encoder | 0 to 65535 | 0 | - | At stop | "H00_en.35" on page 381 |
| H00.37 | 2000-26h | Encoder function setting bit | 0 to 255 | 0 | - | Unchangeable | "H00_en.37" on page 381 |
| H00.43 | 2000-2Ch | Max. current | 0.00 A to 655.35 A | 16.95 | A | At stop | "H00_en.43" on page 381 |

## 16.2 Parameter Group H01

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H01.00 | 2001-01h | MCU software version | 0.0–6553.5 | 0.0 | - | Unchangeable | "H01_en.00" on page 382 |
| H01.01 | 2001-02h | FPGA software version | 0.0–6553.5 | 0.0 | - | Unchangeable | "H01_en.01" on page 382 |
| H01.02 | 2001-03h | Servo Drive Model | 0–65535 | 0 | - | At stop | "H01_en.02" on page 382 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H01.04 | 2001-05h | Voltage class | 0 V to 65535 V | 220 | V | Immediately | "H01_en.04" on page 382 |
| H01.05 | 2001-06h | Rated power | 0.01 kW–655.35 kW | 75.00 | kW | Immediately | "H01_en.05" on page 382 |
| H01.06 | 2001-07h | Max. output power | 0.01 kW–655.35 kW | 75.00 | kW | Immediately | "H01_en.06" on page 383 |
| H01.07 | 2001-08h | Rated output current | 0.01 A to 655.35 A | 5.50 | A | Immediately | "H01_en.07" on page 383 |
| H01.08 | 2001-09h | Max. output current | 0.01 A to 655.35 A | 16.90 | A | Immediately | "H01_en.08" on page 383 |
| H01.10 | 2001-0Bh | Carrier frequency | 4000–20000 | 8000 | - | Immediately | "H01_en.10" on page 383 |
| H01.11 | 2001-0Ch | Current loop modulation frequency | 0: Carrier frequency<br>1: 2 × carrier frequency | 1 | - | At stop | "H01_en.11" on page 383 |
| H01.12 | 2001-0Dh | Speed loop scheduling frequency-division coefficient | 1: Current loop modulation frequency/1<br>2: Current loop modulation frequency/2<br>4: Current loop modulation frequency/4<br>8: Current loop modulation frequency/8<br>16: Current loop modulation frequency/16<br>32: Current loop modulation frequency/32 | 1 | - | Immediately | "H01_en.12" on page 384 |
| H01.13 | 2001-0Eh | Position loop scheduling frequency-division coefficient | 2: Current loop modulation frequency/2<br>4: Current loop modulation frequency/4<br>8: Current loop modulation frequency/8<br>16: Current loop modulation frequency/16<br>32: Current loop modulation frequency/32<br>64: Current loop modulation frequency/64<br>128: Current loop modulation frequency/128 | 4 | - | Immediately | "H01_en.13" on page 384 |
| H01.14 | 2001-0Fh | Dead zone time | 0.01 us to 20.00 us | 2.00 | us | Immediately | "H01_en.14" on page 384 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H01.15 | 2001-10h | DC bus overvoltage protection threshold | 0 V to 2000 V | 420 | V | Immediately | "H01_en.15" on page 384 |
| H01.16 | 2001-11h | DC bus voltage discharge threshold | 0 V to 2000 V | 380 | V | Immediately | "H01_en.16" on page 385 |
| H01.17 | 2001-12h | DC bus undervoltage threshold | 0 V to 2000 V | 200 | V | Immediately | "H01_en.17" on page 385 |
| H01.18 | 2001-13h | Servo drive overcurrent protection threshold | 10%–100% | 100 | % | Immediately | "H01_en.18" on page 385 |
| H01.19 | 2001-14h | Sampling coefficient of 7860 | 1–65535 | 3200 | - | Immediately | "H01_en.19" on page 385 |
| H01.20 | 2001-15h | Dead zone compensation | 0.00us–20.00us | 2.00 | us | Immediately | "H01_en.20" on page 385 |
| H01.21 | 2001-16h | Minimum switch-on time of bootstrap circuit | 1.0us–20.0us | 4.0 | us | At stop | "H01_en.21" on page 386 |
| H01.22 | 2001-17h | D-axis back EMF constant | 0.0%–6553.5% | 60.0 | % | Immediately | "H01_en.22" on page 386 |
| H01.23 | 2001-18h | Q-axis back EMF constant | 0.0%–6553.5% | 100.0 | % | Immediately | "H01_en.23" on page 386 |
| H01.24 | 2001-19h | D-axis current loop gain | 1–65535 | 1000 | - | Immediately | "H01_en.24" on page 386 |
| H01.25 | 2001-1Ah | D-axis current loop integral compensation factor | 0–65535 | 200 | - | Immediately | "H01_en.25" on page 386 |
| H01.26 | 2001-1Bh | Sinc3 filter data extraction rate in current sampling | 0: Extraction rate 32<br>1: Extraction rate 64<br>2: Extraction rate 128<br>3: Extraction rate 256 | 0 | - | At stop | "H01_en.26" on page 387 |
| H01.27 | 2001-1Ch | Q-axis current loop gain | 1–65535 | 1000 | - | Immediately | "H01_en.27" on page 387 |
| H01.28 | 2001-1Dh | Q-axis current loop integral compensation factor | 0–65535 | 100 | - | Immediately | "H01_en.28" on page 387 |
| H01.29 | 2001-1Eh | Control power voltage sampling coefficient | 50.0–150.0 | 100.0 | - | At stop | "H01_en.29" on page 387 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H01.30 | 2001-1Fh | Bus voltage gain tuning | 50.0%–150.0% | 100.0 | % | Immediately | "H01_en.30" on page 387 |
| H01.31 | 2001-20h | FOC calculation time | 1.00us–100.00us | 2.60 | us | Immediately | "H01_en.31" on page 388 |
| H01.32 | 2001-21h | Relative gain of UV sampling | 0–65535 | 0 | - | Unchangeable | "H01_en.32" on page 388 |
| H01.37 | 2001-26h | Model identification version | 0–65535 | 0 | - | Immediately | "H01_en.37" on page 388 |
| H01.44 | 2001-2Dh | Sinc3 filter data extraction rate in 2nd group of current sampling | 0: Extraction rate 32<br>1: Extraction rate 64<br>2: Extraction rate 128<br>3: Extraction rate 256 | 2 | - | At stop | "H01_en.44" on page 388 |
| H01.45 | 2001-2Eh | Phase U duty cycle obtained upon voltage injection | 0–65535 | 0 | - | Immediately | "H01_en.45" on page 389 |
| H01.47 | 2001-30h | MCU current reference processing time | 0.00us–60.00us | 38.00 | us | Immediately | "H01_en.47" on page 389 |
| H01.48 | 2001-31h | AD sampling delay | 0.00us–20.00us | 1.00 | us | Immediately | "H01_en.48" on page 389 |
| H01.49 | 2001-32h | Serial encoder data dissemination delay | 0.00us–500.00us | 61.00 | us | Immediately | "H01_en.49" on page 389 |
| H01.50 | 2001-33h | Interval version of DSP software | 0.00–655.35 | 0.00 | - | Immediately | "H01_en.50" on page 389 |
| H01.52 | 2001-35h | D-axis proportional gain in performance priority mode | 0–65535 | 2000 | - | Immediately | "H01_en.52" on page 389 |
| H01.53 | 2001-36h | D-axis integral gain in performance priority mode | 0.00–655.35 | 2.00 | - | Immediately | "H01_en.53" on page 390 |
| H01.54 | 2001-37h | Q-axis proportional gain in performance priority mode | 0–65535 | 2000 | - | Immediately | "H01_en.54" on page 390 |
| H01.55 | 2001-38h | Q-axis integral gain in performance priority mode | 0.00–655.35 | 1.00 | - | Immediately | "H01_en.55" on page 390 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H01.56 | 2001-39h | 2nd group of proportional gain coefficient in performance priority mode | 0.0%–1000.0% | 100.0 | % | Immediately | “H01_en.56” on page 390 |
| H01.57 | 2001-3Ah | 3rd group of proportional gain coefficient in performance priority mode | 0.0%–1000.0% | 100.0 | % | Immediately | “H01_en.57” on page 390 |
| H01.58 | 2001-3Bh | 1st gain switchover threshold in performance priority mode | 0.0%–300.0% | 1.0 | % | Immediately | “H01_en.58” on page 391 |
| H01.59 | 2001-3Ch | 2nd gain switchover threshold in performance priority mode | 0.0%–300.0% | 2.0 | % | Immediately | “H01_en.59” on page 391 |
| H01.60 | 2001-3Dh | 3rd gain switchover threshold in performance priority mode | 0.0%–300.0% | 100.0 | % | Immediately | “H01_en.60” on page 391 |
| H01.61 | 2001-3Eh | 4th gain switchover threshold in performance priority mode | 0.0%–300.0% | 200.0 | % | Immediately | “H01_en.61” on page 391 |
| H01.62 | 2001-3Fh | Phase U/V 7860 detection protection threshold | 0–320 | 280 | - | Unchangeable | “H01_en.62” on page 391 |
| H01.63 | 2001-40h | Serial encoder data transmission compensation time | 0.00–10.00 | 0.00 | - | At stop | “H01_en.63” on page 392 |

# 16.3 Parameter Group H02

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H02.00 | 2002-01h | Control mode | 0: Speed control mode<br>1: Position control mode<br>2: Torque control mode<br>3: Torque<->Speed control mode<br>4: Speed<->Position control mode<br>5: Torque<->Position control mode<br>6: Torque<->Speed<->Position compound mode | 1 | - | At stop | " H02_en.00" on page 392 |
| H02.01 | 2002-02h | Absolute position detection system | 0: Incremental position mode<br>1: Absolute position linear mode<br>2: Absolute position rotation mode | 0 | - | At stop | " H02_en.01" on page 393 |
| H02.02 | 2002-03h | Forward direction | 0: Counterclockwise (CCW) as forward direction<br>1: Clockwise (CW) as forward direction | 0 | - | At stop | " H02_en.02" on page 393 |
| H02.03 | 2002-04h | Output pulse phase | 0: Phase A leads phase B<br>1: Phase A lags behind phase B | 0 | - | At stop | " H02_en.03" on page 394 |
| H02.05 | 2002-06h | Stop mode at S-OFF | 0: Coast to stop, keeping de-energized state<br>1: Stop at zero speed, keeping de-energized state<br>2: Stop at zero speed, keeping dynamic braking state<br>3: Dynamic braking stop, keeping dynamic braking state | 0 | - | At stop | " H02_en.05" on page 394 |
| H02.06 | 2002-07h | Stop mode at No.2 fault | 0: Coast to stop, keeping de-energized state<br>1: Stop at zero speed, keeping de-energized state<br>2: Stop at zero speed, keeping dynamic braking state<br>3: Dynamic braking stop, keeping DB state<br>4: DB stops, keeping operation state | 2 | - | At stop | " H02_en.06" on page 395 |
| H02.07 | 2002-08h | Stop mode at overtravel | 0: Coast to stop, keeping de-energized state<br>1: Stop at zero speed, keeping position lock state<br>2: Stop at zero speed, keeping de-energized state | 1 | - | At stop | " H02_en.07" on page 395 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H02.08 | 2002-09h | Stop mode at No.1 fault | 0: Coast to stop, keeping de-energized state<br>1: DB stop, keeping de-energized state<br>2: DB stop, keeping DB state | 2 | - | At stop | "H02_en.08" on page 395 |
| H02.09 | 2002-0Ah | Delay from brake output ON to command received | 0 ms to 500 ms | 250 | ms | Immediately | "H02_en.09" on page 396 |
| H02.10 | 2002-0Bh | Delay from brake output OFF to motor de-energized in the standstill state | 1 ms to 1000 ms | 150 | ms | Immediately | "H02_en.10" on page 396 |
| H02.11 | 2002-0Ch | Motor speed threshold at brake output OFF in rotation state | 0 rpm to 3000 rpm | 30 | rpm | Immediately | "H02_en.11" on page 396 |
| H02.12 | 2002-0Dh | Delay from S-ON OFF to brake output OFF in rotation state | 1 ms to 1000 ms | 500 | ms | Immediately | "H02_en.12" on page 396 |
| H02.14 | 2002-0Fh | Stop mode and state switching speed condition | 10rpm–100rpm | 10 | rpm | At stop | "H02_en.14" on page 397 |
| H02.15 | 2002-10h | Warning display on the keypad | 0: Output warning information immediately<br>1: Not output warning information | 0 | - | At stop | "H02_en.15" on page 397 |
| H02.17 | 2002-12h | Stop at zero speed upon main circuit power-off | 0: Disabled<br>1: Enabled | 1 | - | At stop | "H02_en.17" on page 397 |
| H02.18 | 2002-13h | S-ON filter time constant | 0 ms to 64 ms | 0 | ms | At stop | "H02_en.18" on page 397 |
| H02.19 | 2002-14h | S-ON brake open delay | 0 ms to 1000 ms | 0 | ms | At stop | "H02_en.19" on page 397 |
| H02.20 | 2002-15h | Dynamic brake relay coil ON delay | 10 ms to 30000 ms | 30 | ms | Immediately | "H02_en.20" on page 398 |
| H02.21 | 2002-16h | Min. permissible resistance of regenerative resistor | 0 Ω to 65535 Ω | 40 | Ω | Unchangeable | "H02_en.21" on page 398 |
| H02.22 | 2002-17h | Power of built-in regenerative resistor | 0 W to 65535 W | 40 | W | Unchangeable | "H02_en.22" on page 398 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H02.23 | 2002-18h | Resistance of built-in regenerative resistor | 0 Ω to 65535 Ω | 50 | Ω | Unchangeable | "H02_en.23" on page 398 |
| H02.24 | 2002-19h | Resistor heat dissipation coefficient | 10–100 | 30 | - | At stop | "H02_en.24" on page 399 |
| H02.25 | 2002-1Ah | Regenerative resistor type | 0: Built-in<br>1: External, natural ventilated<br>2: External, forced air cooling<br>3: Not needed | 0 | - | At stop | "H02_en.25" on page 399 |
| H02.26 | 2002-1Bh | Power capacity of external regenerative resistor | 1 W–65535 W | 40 | W | At stop | "H02_en.26" on page 400 |
| H02.27 | 2002-1Ch | Resistance of external regenerative resistor | 1 Ω to 1000 Ω | 50 | Ω | At stop | "H02_en.27" on page 400 |
| H02.28 | 2002-1Dh | 220 V min. bus voltage | 190 V to 260 V | 235 | V | At stop | "H02_en.28" on page 400 |
| H02.30 | 2002-1Fh | User password | 0–65535 | 0 | - | At stop | "H02_en.30" on page 401 |
| H02.31 | 2002-20h | System parameter initialization | 0: No operation<br>1: Restore default settings<br>2: Clear fault records | 0 | - | At stop | "H02_en.31" on page 401 |
| H02.32 | 2002-21h | Default keypad display | 0–99 | 50 | - | Immediately | "H02_en.32" on page 401 |
| H02.34 | 2002-23h | CAN software version | 0.00–655.35 | 0.00 | - | Unchangeable | "H02_en.34" on page 402 |
| H02.35 | 2002-24h | Keypad display refresh frequency | 0 Hz–29 Hz | 0 | Hz | Immediately | "H02_en.35" on page 402 |
| H02.41 | 2002-2Ah | Manufacturer password | 0–65535 | 0 | - | At stop | "H02_en.41" on page 402 |

# 16.4 Parameter Group H03

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H03.00 | 2003-01h | DI function allocation 1 (activated upon power-on) | 0: Corresponding to null<br>1: Corresponding to FunIN.1<br>2: Corresponding to FunIN.2<br>4: Corresponding to FunIN.3<br>8: Corresponding to FunIN.4<br>16: Corresponding to FunIN.5<br>32: Corresponding to FunIN.6<br>64: Corresponding to FunIN.7<br>128: Corresponding to FunIN.8<br>256: Corresponding to FunIN.9<br>512: Corresponding to FunIN.10<br>1024: Corresponding to FunIN.11<br>2048: Corresponding to FunIN.12<br>4096: Corresponding to FunIN.13<br>8192: Corresponding to FunIN.14<br>16384: Corresponding to FunIN.15 | 0 | - | Immediately | "H03_en.00" on page 402 |
| H03.01 | 2003-02h | DI function allocation 2 (activated upon power-on) | 0: Corresponding to null<br>1: Corresponding to FunIN.17<br>2: Corresponding to FunIN.18<br>4: Corresponding to FunIN.19<br>8: Corresponding to FunIN.20<br>16: Corresponding to FunIN.21<br>32: Corresponding to FunIN.22<br>64: Corresponding to FunIN.23<br>128: Corresponding to FunIN.24<br>256: Corresponding to FunIN.25<br>512: Corresponding to FunIN.26<br>1024: Corresponding to FunIN.27<br>2048: Corresponding to FunIN.28<br>4096: Corresponding to FunIN.29<br>8192: Corresponding to FunIN.30<br>16384: Corresponding to FunIN.31 | 0 | - | Immediately | "H03_en.01" on page 403 |
| H03.02 | 2003-03h | DI1 function selection | See "H03_en.02" on page 404 for details. | 14 | - | Immediately | "H03_en.02" on page 404 |
| H03.03 | 2003-04h | DI1 logic selection | 0: Active low<br>1: Active high | 0 | - | Immediately | "H03_en.03" on page 405 |
| H03.04 | 2003-05h | DI2 function | See H03.02. | 15 | - | Immediately | "H03_en.04" on page 405 |
| H03.05 | 2003-06h | DI2 logic selection | 0: Active low<br>1: Active high | 0 | - | Immediately | "H03_en.05" on page 406 |
| H03.06 | 2003-07h | DI3 function | See H03.02. | 13 | - | Immediately | "H03_en.06" on page 406 |
| H03.07 | 2003-08h | DI3 logic selection | 0: Active low<br>1: Active high | 0 | - | Immediately | "H03_en.07" on page 406 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H03.08 | 2003-09h | DI4 function selection | See H03.02. | 2 | - | Immediately | “H03_en.08” on page 406 |
| H03.09 | 2003-0Ah | DI4 logic selection | 0: Active low<br>1: Active high | 0 | - | Immediately | “H03_en.09” on page 406 |
| H03.10 | 2003-0Bh | DI5 function selection | See H03.02. | 1 | - | Immediately | “H03_en.10” on page 407 |
| H03.11 | 2003-0Ch | DI5 logic selection | 0: Active low<br>1: Active high | 0 | - | Immediately | “H03_en.11” on page 407 |
| H03.16 | 2003-11h | DI8 function selection | See H03.02. | 31 | - | Immediately | “H03_en.16” on page 407 |
| H03.17 | 2003-12h | DI8 logic selection | 0: Active low<br>1: Active high | 0 | - | Immediately | “H03_en.17” on page 407 |
| H03.18 | 2003-13h | DI9 function selection | See H03.02. | 0 | - | Immediately | “H03_en.18” on page 408 |
| H03.19 | 2003-14h | DI9 logic selection | 0: Active low<br>1: Active high | 0 | - | Immediately | “H03_en.19” on page 408 |
| H03.34 | 2003-23h | DI function allocation 3 (activated upon power-on) | 0: 0x0: Corresponding to null<br>1: 0x1: Corresponding to FunIN.33<br>2: 0x2: Corresponding to FunIN.34<br>4: 0x4: Corresponding to FunIN.35<br>8: 0x8: Corresponding to FunIN.36<br>16: 0x10: Corresponding to FunIN.37<br>32: 0x20: Corresponding to FunIN.38<br>64: 0x40: Corresponding to FunIN.39<br>128: 0x80: Corresponding to FunIN.40<br>256: 0x100: Corresponding to FunIN.41<br>512: 0x200: Corresponding to FunIN.42<br>1024: 0x400: Corresponding to FunIN.43<br>2048: 0x800: Corresponding to FunIN.44<br>4096: 0x1000: Corresponding to FunIN.45<br>8192: 0x2000: Corresponding to FunIN.46<br>16384: 0x4000: Corresponding to FunIN.47 | 0 | - | Immediately | “H03_en.34” on page 408 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H03.35 | 2003-24h | DI function allocation 4 (activated upon power-on) | 0: 0x0: Corresponding to null<br>1: 0x1: Corresponding to FunIN.49<br>2: 0x2: Corresponding to FunIN.50<br>4: 0x4: Corresponding to FunIN.51<br>8: 0x8: Corresponding to FunIN.52<br>16: 0x10: Corresponding to FunIN.53<br>32: 0x20: Corresponding to FunIN.54<br>64: 0x40: Corresponding to FunIN.55<br>128: 0x80: Corresponding to FunIN.56<br>256: 0x100: Corresponding to FunIN.57<br>512: 0x200: Corresponding to FunIN.58<br>1024: 0x400: Corresponding to FunIN.59<br>2048: 0x800: Corresponding to FunIN.60<br>4096: 0x1000: Corresponding to FunIN.61<br>8192: 0x2000: Corresponding to FunIN.62<br>16384: 0x4000: Corresponding to FunIN.63 | 0 | - | Immediately | "H03_en.35" on page 409 |
| H03.60 | 2003-3Dh | DI1 filter | 0.00 ms to 500.00 ms | 3.00 | ms | Immediately | "H03_en.60" on page 409 |
| H03.61 | 2003-3Eh | DI2 filter | 0.00 ms to 500.00 ms | 3.00 | ms | Immediately | "H03_en.61" on page 410 |
| H03.62 | 2003-3Fh | DI3 filter | 0.00 ms to 500.00 ms | 3.00 | ms | Immediately | "H03_en.62" on page 410 |
| H03.63 | 2003-40h | DI4 filter | 0.00 ms to 500.00 ms | 3.00 | ms | Immediately | "H03_en.63" on page 410 |
| H03.64 | 2003-41h | DI5 filter | 0.00 ms to 500.00 ms | 3.00 | ms | Immediately | "H03_en.64" on page 410 |
| H03.65 | 2003-42h | DI8 filter 1 | 0.00 ms to 500.00 ms | 0.00 | ms | Immediately | "H03_en.65" on page 411 |
| H03.66 | 2003-43h | DI9 filter 1 | 0.00 ms to 500.00 ms | 0.00 | ms | Immediately | "H03_en.66" on page 411 |

# 16.5 Parameter Group H04

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H04.00 | 2004-01h | DO1 function selection | See "H04_en.00" on page 411 for details. | 1 | - | Immediately | "H04_en.00" on page 411 |
| H04.01 | 2004-02h | DO1 logic level | 0: Output low (L) level when active (optocoupler ON)<br>1: Output high (H) level when active (optocoupler OFF) | 0 | - | Immediately | "H04_en.01" on page 412 |
| H04.02 | 2004-03h | DO2 function selection | See H04.00. | 5 | - | Immediately | "H04_en.02" on page 412 |
| H04.03 | 2004-04h | DO2 logic level | 0: Output low (L) level when active (optocoupler ON)<br>1: Output high (H) level when active (optocoupler OFF) | 0 | - | Immediately | "H04_en.03" on page 413 |
| H04.04 | 2004-05h | DO3 function | See H04.00. | 9 | - | Immediately | "H04_en.04" on page 413 |
| H04.05 | 2004-06h | DO3 logic level | 0: Output low (L) level when active (optocoupler ON)<br>1: Output high (H) level when active (optocoupler OFF) | 0 | - | Immediately | "H04_en.05" on page 413 |
| H04.06 | 2004-07h | DO4 function | See H04.00. | 11 | - | Immediately | "H04_en.06" on page 413 |
| H04.07 | 2004-08h | DO4 logic level | 0: Output low (L) level when active (optocoupler ON)<br>1: Output high (H) level when active (optocoupler OFF) | 0 | - | Immediately | "H04_en.07" on page 413 |
| H04.08 | 2004-09h | DO5 function selection | See H04.00. | 16 | - | Immediately | "H04_en.08" on page 414 |
| H04.09 | 2004-0Ah | DO5 logic level | 0: Output low (L) level when active (optocoupler ON)<br>1: Output high (H) level when active (optocoupler OFF) | 0 | - | Immediately | "H04_en.09" on page 414 |
| H04.22 | 2004-17h | DO source selection | 0–31 | 0 | - | At stop | "H04_en.22" on page 414 |

# 16.6 Parameter Group H05

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.00 | 2005-01h | Primary position reference source | 0: Pulse reference<br>1: Step reference<br>2: Multi-position reference | 0 | - | At stop | "H05_en.00" on page 415 |
| H05.01 | 2005-02h | Position pulse reference input terminal | 0: Low speed<br>1: High speed | 0 | - | At stop | "H05_en.01" on page 416 |
| H05.02 | 2005-03h | Pulses per revolution | 0 P/Rev–1048576 P/Rev | 0 | PPR | At stop | "H05_en.02" on page 418 |
| H05.04 | 2005-05h | First-order low-pass filter time constant | 0.0 ms to 6553.5ms | 0.0 | ms | At stop | "H05_en.04" on page 418 |
| H05.05 | 2005-06h | Step amount | -9999 to +9999 | 50 | Reference unit | At stop | "H05_en.05" on page 418 |
| H05.06 | 2005-07h | Time constant of moving average filter | 0.0 ms to 128.0ms | 0.0 | ms | At stop | "H05_en.06" on page 419 |
| H05.07 | 2005-08h | Electronic gear ratio 1 (numerator) | 1 to 1073741824 | 262144 | - | Real-time | "H05_en.07" on page 419 |
| H05.09 | 2005-0Ah | Electronic gear ratio 1 (denominator) | 1 to 1073741824 | 10000 | - | Real-time | "H05_en.09" on page 419 |
| H05.11 | 2005-0Ch | Electronic gear ratio 2 (numerator) | 1 to 1073741824 | 262144 | - | Real-time | "H05_en.11" on page 419 |
| H05.13 | 2005-0Eh | Electronic gear ratio 2 (denominator) | 1 to 1073741824 | 10000 | - | Real-time | "H05_en.13" on page 420 |
| H05.15 | 2005-10h | Pulse reference form | 0: Direction + Pulse, positive logic<br>1: Direction + Pulse, negative logic<br>2: Phase A + phase B quadrature pulse, quadrupled frequency<br>3: CW + CCW | 0 | - | At stop | "H05_en.15" on page 420 |
| H05.16 | 2005-11h | Clear action | 0: Clear position deviation upon S-OFF and fault<br>1: Clear position deviation pulses upon S-OFF and fault<br>2: Clear position deviation by ClrPosErr signal input from DI | 0 | - | At stop | "H05_en.16" on page 421 |
| H05.17 | 2005-12h | Number of encoder frequency-division pulses | 35 P/Rev–32767 P/Rev | 2500 | PPR | At stop | "H05_en.17" on page 422 |
| H05.19 | 2005-14h | Speed feedforward control | 0: No speed feedforward<br>1: Internal speed feedforward | 1 | - | At stop | "H05_en.19" on page 422 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.20 | 2005-15h | Condition for positioning completed signal output | 0: Absolute position deviation lower than the setpoint of H05.21<br>1: Absolute position deviation lower than the setpoint of H05.21 and the filtered position reference is 0<br>2: Absolute position deviation lower than the setpoint of H05.21 and the unfiltered position reference is 0<br>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 | 0 | - | Real-time | "H05_en.20" on page 423 |
| H05.21 | 2005-16h | Threshold of positioning completed | 1 to 65535 | 183 | Encoder unit | Real-time | "H05_en.21" on page 423 |
| H05.22 | 2005-17h | Proximity threshold | 1 to 65535 | 65535 | Encoder unit | Real-time | "H05_en.22" on page 424 |
| H05.23 | 2005-18h | Interrupt positioning selection | 0: Disable<br>1: Enabled | 0 | - | At stop | "H05_en.23" on page 424 |
| H05.24 | 2005-19h | Interrupt positioning displacement | 0 to 1073741824 | 10000 | Refer ence unit | Real-time | "H05_en.24" on page 424 |
| H05.26 | 2005-1Bh | Constant operating speed in interrupt positioning | 0rpm–6000rpm | 200 | RPM | Real-time | "H05_en.26" on page 425 |
| H05.27 | 2005-1Ch | Acc./Dec. time of interrupt positioning | 0ms to 1000ms | 10 | ms | Real-time | "H05_en.27" on page 425 |
| H05.29 | 2005-1Eh | Interruption fixed length unlock | 0: Disabled<br>1: Enabled | 1 | - | Real-time | "H05_en.29" on page 425 |
| H05.30 | 2005-1Fh | Homing enable selection | 0: Disabled<br>1: Homing enabled through the HomingStart signal input from DI<br>2: Electrical homing enabled through the HomingStart signal input from DI<br>3: Homing started immediately upon power-on<br>4: Homing executed immediately<br>5: Electrical homing started<br>6: Current position as home<br>8: D-triggered position as home | 0 | - | Real-time | "H05_en.30" on page 426 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.31 | 2005-20h | Homing mode | 0: Forward, home switch as deceleration point and home<br>1: Reverse, home switch as deceleration point and home<br>2: Forward, Z signal as deceleration point and home<br>3: Reverse, motor Z signal as deceleration point and home<br>4: Forward, home switch as deceleration point and Z signal as home<br>5: Reverse, home switch as deceleration point and Z signal as home<br>6: Forward, positive limit switch as deceleration point and home<br>7: Reverse, negative limit switch as deceleration point and home<br>8: Forward, positive limit switch as deceleration point and Z signal as home<br>9: Reverse, negative limit switch as deceleration point and Z signal as home<br>10: Forward, mechanical limit position as deceleration point and home<br>11: Reverse, mechanical limit position as deceleration point and home<br>12: Forward, mechanical limit position as deceleration point and Z signal as home<br>13: Reverse, mechanical limit position as deceleration point and Z signal as home<br>14: Forward single-turn homing<br>15: Reverse single-turn homing<br>16: Nearby single-turn homing | 0 | - | Real-time | " H05_en.31" on page 427 |
| H05.32 | 2005-21h | Speed of high-speed search for home switch signal | 0rpm–3000rpm | 100 | RPM | Real-time | " H05_en.32" on page 428 |
| H05.33 | 2005-22h | Speed of low-speed search for home switch signal | 0rpm–1000rpm | 10 | RPM | Real-time | " H05_en.33" on page 428 |
| H05.34 | 2005-23h | Acceleration/ Deceleration time during homing | 0ms to 1000ms | 1000 | ms | Real-time | " H05_en.34" on page 428 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.35 | 2005-24h | Home search time limit | 0ms to 65535ms | 10000 | ms | Real-time | "H05_en.35" on page 429 |
| H05.36 | 2005-25h | Mechanical home offset | -1073741824 to 1073741824 | 0 | Refer ence unit | Real-time | "H05_en.36" on page 429 |
| H05.38 | 2005-27h | Servo pulse output source | 0: Encoder frequency division output<br>1: Pulse reference synchronous output<br>2: Frequency division or synchronous output inhibited | 0 | - | At stop | "H05_en.38" on page 429 |
| H05.39 | 2005-28h | Electronic gear ratio switchover condition | 0: Switchover after position reference is kept 0 for 2.5 ms<br>1: Switched in real time | 0 | - | At stop | "H05_en.39" on page 430 |
| H05.40 | 2005-29h | Mechanical home offset and action upon overtravel | 0: H05..36 as the coordinate after homing, reverse homing applied after homing triggered again on overtravel<br>1: H05..36 as the relative offset after homing, reverse homing applied after homing triggered again on overtravel<br>2: H05..36 as the coordinate after homing, reverse homing auto-applied on overtravel<br>3: H05..36 as the relative offset after homing, reverse homing auto-applied on overtravel | 0 | - | At stop | "H05_en.40" on page 431 |
| H05.41 | 2005-2Ah | Z pulse output polarity | 0: Negative (Z pulse active low)<br>1: Positive (Z pulse active high) | 1 | - | At stop | "H05_en.41" on page 431 |
| H05.43 | 2005-2Ch | Position pulse edge | 0: Falling edge-triggered<br>1: Rising edge-triggered | 1 | - | Real-time | "H05_en.43" on page 432 |
| H05.44 | 2005-2Dh | Encoder multi-turn data offset | 0 to 65535 | 0 | - | Real-time | "H05_en.44" on page 433 |
| H05.46 | 2005-2Fh | Position offset in absolute position linear mode (low 32 bits) | -2147483648 to 2147483647 | 0 | Encoder unit | At stop | "H05_en.46" on page 433 |
| H05.48 | 2005-31h | Position offset in absolute position linear mode (high 32 bits) | -2147483648 to 2147483647 | 0 | Encoder unit | At stop | "H05_en.48" on page 433 |
| H05.50 | 2005-33h | Mechanical gear ratio in absolute position rotation mode (numerator) | 1 to 65535 | 1 | - | At stop | "H05_en.50" on page 433 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.51 | 2005-34h | Mechanical gear ratio in absolute position rotation mode (denominator) | 1 to 65535 | 1 | - | At stop | "H05_en.51" on page 433 |
| H05.52 | 2005-35h | Pulses per revolution of the load in absolute position rotation mode (low 32 bits) | 0 to 2147483647 | 0 | Encoder unit | At stop | "H05_en.52" on page 434 |
| H05.54 | 2005-37h | Pulses per revolution of the load in absolute position rotation mode (high 32 bits) | 0 to 127 | 0 | Encoder unit | At stop | "H05_en.54" on page 434 |
| H05.56 | 2005-39h | Speed threshold in homing upon hit-and-stop | 0rpm–1000rpm | 2 | RPM | Real-time | "H05_en.56" on page 434 |
| H05.57 | 2005-3Ah | Mechanical limit times threshold | 0 to 65535 | 20 | - | Real-time | "H05_en.57" on page 434 |
| H05.58 | 2005-3Bh | Torque threshold in homing upon hit-and-stop | 0.0% to 300.0% | 100.0 | % | Real-time | "H05_en.58" on page 434 |
| H05.59 | 2005-3Ch | Positioning window time | 0ms to 30000ms | 0 | ms | Real-time | "H05_en.59" on page 435 |
| H05.60 | 2005-3Dh | Hold time of positioning completed | 0ms to 30000ms | 0 | ms | Real-time | "H05_en.60" on page 435 |
| H05.61 | 2005-3Eh | Encoder frequency-division pulse output (32-bit) | 0 P/Rev–262143 P/Rev | 0 | PPR | At stop | "H05_en.61" on page 435 |
| H05.63 | 2005-40h | Real time update of position reference source | 0 to 1 | 0 | - | At stop | "H05_en.63" on page 435 |
| H05.66 | 2005-43h | Homing time unit | 0: 1 ms<br>1: 10 ms<br>2: 100 ms | 0 | - | At stop | "H05_en.66" on page 436 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H05.67 | 2005-44h | Offset between zero point and single-turn absolute position | 0 to 2147483648 | 0 | - | At stop | "H05_en.67" on page 436 |
| H05.69 | 2005-46h | Auxiliary homing function | 0: Disabled<br>1: Enable single-turn homing<br>2: Record deviation position<br>3: Start a new search for the Z signal (homing)<br>4: Clear the position deviation | 0 | - | At stop | "H05_en.69" on page 436 |

## 16.7 Parameter Group H06

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.00 | 2006-01h | Source of main speed reference A | 0: Digital setting (H06.03) | 0 | - | At stop | "H06_en.00" on page 436 |
| H06.01 | 2006-02h | Source of auxiliary speed reference B | 0: Digital setting (H06.03)<br>5: Multi-speed reference | 5 | - | At stop | "H06_en.01" on page 437 |
| H06.02 | 2006-03h | Speed reference source | 0: Source of main speed reference A<br>1: Source of auxiliary speed reference B<br>2: A+B<br>3: Switched between A and B<br>4: Communication | 0 | - | At stop | "H06_en.02" on page 437 |
| H06.03 | 2006-04h | Speed reference set through keypad | –6000 rpm to +6000 rpm | 200 | RPM | Real-time | "H06_en.03" on page 438 |
| H06.04 | 2006-05h | Jog speed setpoint | 0rpm–6000rpm | 100 | RPM | Real-time | "H06_en.04" on page 438 |
| H06.05 | 2006-06h | Acceleration ramp time constant of speed reference | 0ms to 65535ms | 0 | ms | Real-time | "H06_en.05" on page 438 |
| H06.06 | 2006-07h | Deceleration ramp time constant of speed reference | 0ms to 65535ms | 0 | ms | Real-time | "H06_en.06" on page 439 |
| H06.07 | 2006-08h | Maximum speed limit | 0rpm–6000rpm | 6000 | RPM | Real-time | "H06_en.07" on page 439 |
| H06.08 | 2006-09h | Forward speed threshold | 0rpm–6000rpm | 6000 | RPM | Real-time | "H06_en.08" on page 439 |
| H06.09 | 2006-0Ah | Reverse speed threshold | 0rpm–6000rpm | 6000 | RPM | Real-time | "H06_en.09" on page 440 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H06.11 | 2006-0Ch | Torque feedforward control | 0: No torque feedforward<br>1: Internal torque feedforward | 1 | - | Real-time | "H06_en.11" on page 440 |
| H06.13 | 2006-0Eh | Speed smoothing time | 0us–20000us | 0 | us | At stop | "H06_en.13" on page 441 |
| H06.15 | 2006-10h | Zero clamp speed threshold | 0rpm–6000rpm | 10 | RPM | Real-time | "H06_en.15" on page 441 |
| H06.16 | 2006-11h | Threshold of TGON (motor rotation) signal | 0rpm–1000rpm | 20 | RPM | Real-time | "H06_en.16" on page 442 |
| H06.17 | 2006-12h | Threshold of V-Cmp (speed matching) signal | 0rpm–100rpm | 10 | RPM | Real-time | "H06_en.17" on page 443 |
| H06.18 | 2006-13h | Threshold of speed reach signal | 10rpm–6000rpm | 1000 | RPM | Real-time | "H06_en.18" on page 443 |
| H06.19 | 2006-14h | Threshold of zero speed output signal | 1rpm–6000rpm | 10 | RPM | Real-time | "H06_en.19" on page 444 |
| H06.28 | 2006-1Dh | Cogging torque ripple compensation | 0 to 1 | 0 | - | Real-time | "H06_en.28" on page 445 |
| H06.31 | 2006-20h | Sine frequency | 0 to 16000 | 50 | - | Real-time | "H06_en.31" on page 445 |
| H06.32 | 2006-21h | Sine amplitude | 0 to 30000 | 30 | - | Real-time | "H06_en.32" on page 445 |
| H06.33 | 2006-22h | Sine amplitude | 0: Disabled<br>1: Position reference sine<br>2: Speed reference sine<br>3: Torque reference sine | 30 | - | Real-time | "H06_en.33" on page 446 |
| H06.35 | 2006-24h | Sine offset | -9900 to 9900 | 0 | - | Real-time | "H06_en.35" on page 446 |

## 16.8 Parameter Group H07

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H07.00 | 2007-01h | Source of main torque reference A | 0: Keypad (H07.03) | 0 | - | At stop | "H07_en.00" on page 446 |
| H07.01 | 2007-02h | Source of auxiliary torque reference B | 0: Keypad (H07.03) | 0 | - | At stop | "H07_en.01" on page 446 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H07.02 | 2007-03h | Torque reference source | 0: Source of main torque reference A<br>1: Source of auxiliary torque reference B<br>2: Source of A+B<br>3: Switched between A and B<br>4: Communication | 0 | - | At stop | "H07_en.02" on page 447 |
| H07.03 | 2007-04h | Torque reference set through keypad | -400.0%–400.0% | 0.0 | % | Immediately | "H07_en.03" on page 447 |
| H07.05 | 2007-06h | Torque reference filter time constant | 0.00 ms to 30.00 ms | 0.50 | ms | Immediately | "H07_en.05" on page 448 |
| H07.06 | 2007-07h | 2nd torque reference filter time constant | 0.00 ms to 30.00 ms | 0.27 | ms | Immediately | "H07_en.06" on page 448 |
| H07.07 | 2007-08h | Torque limit source | 0: Forward/Reverse internal torque limit (default)<br>1: Forward/Reverse external torque limit (selected through P-CL and N-CL) | 0 | - | At stop | "H07_en.07" on page 448 |
| H07.09 | 2007-0Ah | Positive internal torque limit | 0.0%–400.0% | 350.0 | % | Immediately | "H07_en.09" on page 449 |
| H07.10 | 2007-0Bh | Negative internal torque limit | 0.0%–400.0% | 350.0 | % | Immediately | "H07_en.10" on page 449 |
| H07.11 | 2007-0Ch | Positive external torque limit | 0.0%–400.0% | 350.0 | % | Immediately | "H07_en.11" on page 449 |
| H07.12 | 2007-0Dh | Negative external torque limit | 0.0%–400.0% | 350.0 | % | Immediately | "H07_en.12" on page 449 |
| H07.15 | 2007-10h | Emergency-stop torque | 0.0%–300.0% | 100.0 | % | At stop | "H07_en.15" on page 450 |
| H07.17 | 2007-12h | Speed limit source | 0: Internal speed limit (in torque control)<br>1: 0 (no action)<br>2: 1st or 2nd speed limit input selected by FunIN.36 | 0 | - | Immediately | "H07_en.17" on page 450 |
| H07.19 | 2007-14h | Forward speed limit/1st speed limit in torque control | 0 rpm to 6000 rpm | 3000 | rpm | Immediately | "H07_en.19" on page 450 |
| H07.20 | 2007-15h | Reverse speed limit/2nd speed limit in torque control | 0 rpm to 6000 rpm | 3000 | rpm | Immediately | "H07_en.20" on page 450 |
| H07.21 | 2007-16h | Base value for torque reach | 0.0%–300.0% | 0.0 | % | Immediately | "H07_en.21" on page 451 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H07.22 | 2007-17h | Torque reach valid value | 0.0%–300.0% | 20.0 | % | Immediately | "H07_en.22" on page 451 |
| H07.23 | 2007-18h | Torque reach invalid value | 0.0%–300.0% | 10.0 | % | Immediately | "H07_en.23" on page 451 |
| H07.24 | 2007-19h | Field weakening depth | 60%–120% | 115 | % | Immediately | "H07_en.24" on page 452 |
| H07.25 | 2007-1Ah | Max. permissible demagnetizing current | 0%–200% | 100 | % | Immediately | "H07_en.25" on page 452 |
| H07.26 | 2007-1Bh | Field weakening selection | 0–1 | 1 | - | Immediately | "H07_en.26" on page 452 |
| H07.27 | 2007-1Ch | Flux weakening gain | 1 Hz–1000 Hz | 30 | Hz | Immediately | "H07_en.27" on page 452 |
| H07.40 | 2007-29h | Speed limit window in the torque control mode | 0.5 ms to 30.0 ms | 1.0 | ms | Immediately | "H07_en.40" on page 453 |

## 16.9 Parameter Group H08

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H08.00 | 2008-01h | Speed loop gain | 0.1 Hz–2000.0 Hz | 40.0 | Hz | Immediately | "H08_en.00" on page 453 |
| H08.01 | 2008-02h | Speed loop integral time constant | 0.15 ms to 512.00 ms | 19.89 | ms | Immediately | "H08_en.01" on page 454 |
| H08.02 | 2008-03h | Position loop gain | 0.0 Hz–2000.0 Hz | 64.0 | Hz | Immediately | "H08_en.02" on page 454 |
| H08.03 | 2008-04h | 2nd speed loop gain | 0.1 Hz–2000.0 Hz | 75.0 | Hz | Immediately | "H08_en.03" on page 454 |
| H08.04 | 2008-05h | 2nd speed loop integral time constant | 0.15 ms to 512.00 ms | 10.61 | ms | Immediately | "H08_en.04" on page 454 |
| H08.05 | 2008-06h | 2nd position loop gain | 0.0 Hz–2000.0 Hz | 120.0 | Hz | Immediately | "H08_en.05" on page 454 |
| H08.08 | 2008-09h | 2nd gain mode setting | 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 | 1 | - | Immediately | "H08_en.08" on page 455 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H08.09 | 2008-0Ah | Gain switchover condition | 0: Fixed to the 1st gain set (PS)<br>1: Switch with external DI (PS)<br>2: Torque reference too large (PS)<br>3: Speed reference too large (PS)<br>4: Speed reference change rate too large (PS)<br>5: Speed reference low/high speed threshold (PS)<br>6: Position deviation too large (P)<br>7: Position reference available (P)<br>8: Positioning unfinished (P)<br>9: Actual speed (P)<br>10: Position reference + Actual speed (P) | 0 | - | Immediately | "H08_en.09" on page 455 |
| H08.10 | 2008-0Bh | Gain switchover delay | 0.0 ms to 1000.0 ms | 5.0 | ms | At stop | "H08_en.10" on page 457 |
| H08.11 | 2008-0Ch | Gain switchover level | 0–20000 | 50 | - | Immediately | "H08_en.11" on page 457 |
| H08.12 | 2008-0Dh | Gain switchover dead time | 0–20000 | 30 | - | At stop | "H08_en.12" on page 457 |
| H08.13 | 2008-0Eh | Position gain switchover time | 0.0 ms to 1000.0 ms | 3.0 | ms | At stop | "H08_en.13" on page 458 |
| H08.14 | 2008-0Fh | Auto-tuned inertia value | 0.00–200.00 | 0.00 | - | Unchangeable | "H08_en.14" on page 458 |
| H08.15 | 2008-10h | Load moment of inertia ratio | 0.00–120.00 | 2.00 | - | Immediately | "H08_en.15" on page 458 |
| H08.18 | 2008-13h | Speed feedforward filter time constant | 0.00 ms to 64.00 ms | 0.50 | ms | Immediately | "H08_en.18" on page 459 |
| H08.19 | 2008-14h | Speed feedforward gain | 0.0%–100.0% | 0.0 | % | Immediately | "H08_en.19" on page 459 |
| H08.20 | 2008-15h | Torque feedforward filter time constant | 0.00 ms to 64.00 ms | 0.50 | ms | Immediately | "H08_en.20" on page 459 |
| H08.21 | 2008-16h | Torque feedforward gain | 0.0%–200.0% | 0.0 | % | Immediately | "H08_en.21" on page 459 |
| H08.22 | 2008-17h | Speed feedback filtering option | 0: Inhibited<br>1: 2 times<br>2: 4 times<br>3: 8 times<br>4: 16 times | 0 | - | At stop | "H08_en.22" on page 460 |
| H08.23 | 2008-18h | Cutoff frequency of speed feedback low-pass filter | 100 Hz–4000 Hz | 4000 | Hz | Immediately | "H08_en.23" on page 460 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H08.24 | 2008-19h | PDFF control coefficient | 0.0%–1000.0% | 100.0 | % | Immediately | "H08_en.24" on page 461 |
| H08.27 | 2008-1Ch | Cutoff frequency of speed observer | 10 Hz–2000 Hz | 170 | Hz | Immediately | "H08_en.27" on page 461 |
| H08.28 | 2008-1Dh | Speed inertia correction coefficient | 10%–10000% | 100 | % | Immediately | "H08_en.28" on page 461 |
| H08.29 | 2008-1Eh | Speed observer filter time | 0.02 ms to 20.00 ms | 0.80 | ms | Immediately | "H08_en.29" on page 461 |
| H08.31 | 2008-20h | Disturbance observer cutoff frequency | 1 Hz–1700 Hz | 600 | Hz | Immediately | "H08_en.31" on page 462 |
| H08.32 | 2008-21h | Disturbance observer compensation coefficient | 0%–100% | 0 | % | Immediately | "H08_en.32" on page 462 |
| H08.33 | 2008-22h | Disturbance inertia correction coefficient | 1%–10000% | 100 | % | Immediately | "H08_en.33" on page 462 |
| H08.34 | 2008-23h | Medium- and high-frequency jitter suppression phase modulation 1 | 0%–1600% | 0 | % | Immediately | "H08_en.34" on page 462 |
| H08.35 | 2008-24h | Medium- and high-frequency jitter suppression frequency 1 | 0 Hz–1000 Hz | 0 | Hz | Immediately | "H08_en.35" on page 462 |
| H08.36 | 2008-25h | Medium- and high-frequency jitter suppression compensation 1 | 0%–200% | 0 | % | Immediately | "H08_en.36" on page 463 |
| H08.37 | 2008-26h | Phase modulation for medium-frequency jitter suppression 2 | -90–90 | 0 | - | Immediately | "H08_en.37" on page 463 |
| H08.38 | 2008-27h | Frequency of medium-frequency jitter suppression 2 | 0 Hz–1000 Hz | 0 | Hz | Immediately | "H08_en.38" on page 463 |
| H08.39 | 2008-28h | Compensation gain of medium-frequency jitter suppression 2 | 0%–300% | 0 | % | Immediately | "H08_en.39" on page 463 |
| H08.40 | 2008-29h | Speed observer selection | 0–1 | 0 | - | At stop | "H08_en.40" on page 463 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H08.42 | 2008-2Bh | Model control selection | 0–1 | 0 | - | At stop | "H08_en.42" on page 464 |
| H08.43 | 2008-2Ch | Model gain | 0.0–2000.0 | 40.0 | - | Immediately | "H08_en.43" on page 464 |
| H08.45 | 2008-2Eh | Feedforward position | 0–1 | 0 | - | Immediately | "H08_en.45" on page 464 |
| H08.46 | 2008-2Fh | Model feedforward | 0.0–102.4 | 95.0 | - | Immediately | "H08_en.46" on page 464 |
| H08.51 | 2008-34h | Model filtering time 2 | 0.00 ms to 20.00 ms | 0.00 | ms | Immediately | "H08_en.51" on page 464 |
| H08.53 | 2008-36h | Medium- and low-frequency jitter suppression frequency 3 | 0.0 Hz–600.0 Hz | 0.0 | Hz | Immediately | "H08_en.53" on page 465 |
| H08.54 | 2008-37h | Medium- and low-frequency jitter suppression compensation 3 | 0%–200% | 0 | % | Immediately | "H08_en.54" on page 465 |
| H08.56 | 2008-39h | Medium- and low-frequency jitter suppression phase modulation 3 | 0–1600 | 100 | - | Immediately | "H08_en.56" on page 465 |
| H08.58 | 2008-3Bh | Er.660 (Vibration too strong) switch | 0–2 | 0 | - | Immediately | "H08_en.58" on page 465 |
| H08.59 | 2008-3Ch | Medium- and low-frequency jitter suppression frequency 4 | 0.0 Hz–600.0 Hz | 0.0 | Hz | Immediately | "H08_en.59" on page 465 |
| H08.60 | 2008-3Dh | Medium- and low-frequency jitter suppression compensation 4 | 0%–200% | 0 | % | Immediately | "H08_en.60" on page 466 |
| H08.61 | 2008-3Eh | Medium- and low-frequency jitter suppression phase modulation 4 | 0–1600 | 100 | - | Immediately | "H08_en.61" on page 466 |
| H08.62 | 2008-3Fh | Position loop integral time constant | 0.15 ms to 512.00 ms | 512.00 | ms | Immediately | "H08_en.62" on page 466 |
| H08.63 | 2008-40h | 2nd position loop integral time constant | 0.15 ms to 512.00 ms | 512.00 | ms | Immediately | "H08_en.63" on page 466 |
| H08.64 | 2008-41h | Speed observer feedback selection | 0–1 | 0 | - | Immediately | "H08_en.64" on page 466 |

## 16.10 Parameter Group H09

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.00 | 2009-01h | Auto-adjustment mode | 0: Disabled, manual gain tuning required<br>1: Enabled, gain parameters generated automatically based on the stiffness level<br>2: Positioning mode, gain parameters generated automatically based on the stiffness level<br>3: Interpolation mode+Inertia auto-tuning<br>4: Standard mode+Inertia auto-tuning<br>6: Quick positioning mode+Inertia auto-tuning | 0 | - | Real-time | "H09_en.00" on page 467 |
| H09.01 | 2009-02h | Stiffness level selection | 0 to 41 | 15 | - | Real-time | "H09_en.01" on page 467 |
| H09.02 | 2009-03h | Adaptive notch mode | 0: Adaptive notch no longer updated;<br>1: One adaptive notch activated (3rd notch)<br>2: Two adaptive notches activated (3rd and 4th notches)<br>3: Resonance point tested only (displayed in H09.24)<br>4: Adaptive notch cleared, values of 3rd and 4th notches restored to default | 0 | - | Real-time | "H09_en.02" on page 468 |
| H09.03 | 2009-04h | Online inertia auto-tuning mode | 0: Disabled<br>1: Enabled, changing slowly<br>2: Enabled, changing normally<br>3: Enabled, changing quickly | 0 | - | Real-time | "H09_en.03" on page 468 |
| H09.04 | 2009-05h | Low-frequency resonance suppression mode | 0: Set vibration frequency manually<br>1: Identify vibration frequency | 0 | - | Real-time | "H09_en.04" on page 469 |
| H09.05 | 2009-06h | Offline inertia auto-tuning mode | 0: Positive/Negative triangular wave mode<br>1: JOG mode<br>2: Bidirectional auto-tuning mode<br>3: Unidirectional auto-tuning mode | 0 | - | At stop | "H09_en.05" on page 469 |
| H09.06 | 2009-07h | Max. speed of inertia auto-tuning | 100 RPM to 1000 RPM | 500 | RPM | At stop | "H09_en.06" on page 469 |
| H09.07 | 2009-08h | Time constant for accelerating to max. speed during inertia auto-tuning | 20ms to 800ms | 125 | ms | At stop | "H09_en.07" on page 470 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.08 | 2009-09h | Interval time after an individual inertia auto-tuning | 50ms to 10000ms | 800 | ms | At stop | "H09_en.08" on page 470 |
| H09.09 | 2009-0Ah | Motor revolutions for an inertia auto-tuning | 0.00 to 100.00 | 1.00 | - | Real-time | "H09_en.09" on page 470 |
| H09.11 | 2009-0Ch | Vibration threshold | 0.0% to 100.0% | 5.0 | % | Real-time | "H09_en.11" on page 470 |
| H09.12 | 2009-0Dh | Frequency of the 1st notch | 50Hz to 4000Hz | 4000 | Hz | Real-time | "H09_en.12" on page 470 |
| H09.13 | 2009-0Eh | Width level of the 1st notch | 0 to 40 | 2 | - | Real-time | "H09_en.13" on page 471 |
| H09.14 | 2009-0Fh | Depth level of the 1st notch | 0 to 99 | 0 | - | Real-time | "H09_en.14" on page 471 |
| H09.15 | 2009-10h | Frequency of the 2nd notch | 50Hz to 4000Hz | 4000 | Hz | Real-time | "H09_en.15" on page 471 |
| H09.16 | 2009-11h | Width level of the 2nd notch | 0 to 20 | 2 | - | Real-time | "H09_en.16" on page 471 |
| H09.17 | 2009-12h | Depth level of the 2nd notch | 0 to 99 | 0 | - | Real-time | "H09_en.17" on page 472 |
| H09.18 | 2009-13h | Frequency of the 3rd notch | 50Hz to 4000Hz | 4000 | Hz | Real-time | "H09_en.18" on page 472 |
| H09.19 | 2009-14h | Width level of the 3rd notch | 0 to 20 | 2 | - | Real-time | "H09_en.19" on page 472 |
| H09.20 | 2009-15h | Depth level of the 3rd notch | 0 to 99 | 0 | - | Real-time | "H09_en.20" on page 472 |
| H09.21 | 2009-16h | Frequency of the 4th notch | 50Hz to 4000Hz | 4000 | Hz | Real-time | "H09_en.21" on page 472 |
| H09.22 | 2009-17h | Width level of the 4th notch | 0 to 20 | 2 | - | Real-time | "H09_en.22" on page 473 |
| H09.23 | 2009-18h | Depth level of the 4th notch | 0 to 99 | 0 | - | Real-time | "H09_en.23" on page 473 |
| H09.24 | 2009-19h | Auto-tuned resonance frequency | 0 to 2000 | 0 | - | Unchangeable | "H09_en.24" on page 473 |
| H09.30 | 2009-1Fh | Torque disturbance compensation gain | -100.0% to 100.0% | 0.0 | % | Real-time | "H09_en.30" on page 473 |
| H09.31 | 2009-20h | Filter time constant of torque disturbance observer | 0.00ms to 25.00ms | 0.50 | ms | Real-time | "H09_en.31" on page 473 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.32 | 2009-21h | Gravity compensation value | 0.0 to 50.0 | 0.0 | - | Real-time | "H09_en.32" on page 474 |
| H09.33 | 2009-22h | Positive friction compensation | -100.0% to 100.0% | 0.0 | % | Real-time | "H09_en.33" on page 474 |
| H09.34 | 2009-23h | Negative friction compensation | -100.0% to 100.0% | 0.0 | % | Real-time | "H09_en.34" on page 474 |
| H09.35 | 2009-24h | Friction compensation speed threshold | 0.1 RPM to 30.0 RPM | 2.0 | RPM | Real-time | "H09_en.35" on page 474 |
| H09.36 | 2009-25h | Friction compensation speed | 0: Speed reference<br>1: Model tracking speed<br>2: Speed feedback | 0 | - | Real-time | "H09_en.36" on page 474 |
| H09.38 | 2009-27h | Low-frequency resonance suppression frequency at the mechanical end | 1.0Hz to 100.0Hz | 100.0 | Hz | At stop | "H09_en.38" on page 475 |
| H09.39 | 2009-28h | Low-frequency resonance suppression at the mechanical end | 0 to 3 | 2 | - | At stop | "H09_en.39" on page 475 |
| H09.41 | 2009-2Ah | Frequency of the 5th notch | 50Hz to 8000Hz | 4000 | Hz | At stop | "H09_en.41" on page 475 |
| H09.42 | 2009-2Bh | Width level of the 5th notch | 0 to 20 | 2 | - | Real-time | "H09_en.42" on page 475 |
| H09.43 | 2009-2Ch | Depth level of the 5th notch | 0 to 99 | 0 | - | Real-time | "H09_en.43" on page 475 |
| H09.44 | 2009-2Dh | Frequency of low-frequency resonance suppression 1 at mechanical load end | 0.0Hz to 200.0Hz | 0.0 | Hz | Real-time | "H09_en.44" on page 476 |
| H09.45 | 2009-2Eh | Responsiveness of low-frequency resonance suppression 1 at mechanical load end | 0.01 to 10.00 | 1.00 | - | Real-time | "H09_en.45" on page 476 |
| H09.47 | 2009-30h | Width of low-frequency resonance suppression 1 at mechanical load end | 0.00 to 2.00 | 1.00 | - | Real-time | "H09_en.47" on page 476 |

| Param. | Hex | Name | Value | Default | Unit | Change Mode | Page |
|---|---|---|---|---|---|---|---|
| H09.49 | 2009-32h | Frequency of low-frequency resonance suppression 2 at mechanical load end | 0.0Hz to 200.0Hz | 0.0 | Hz | Real-time | "H09_en.49" on page 476 |
| H09.50 | 2009-33h | Responsiveness of low-frequency resonance suppression 2 at mechanical load end | 0.01 to 10.00 | 1.00 | - | Real-time | "H09_en.50" on page 476 |
| H09.52 | 2009-35h | Width of low-frequency resonance suppression 2 at mechanical load end | 0.00 to 2.00 | 1.00 | - | Real-time | "H09_en.52" on page 476 |
| H09.57 | 2009-3Ah | STune resonance suppression switchover frequency | 0Hz to 4000Hz | 850 | Hz | Real-time | "H09_en.57" on page 477 |
| H09.58 | 2009-3Bh | STune resonance suppression reset selection | 0: Disable<br>1: Enable | 0 | - | Real-time | "H09_en.58" on page 477 |

# 16.11 Parameter Group H0A

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0A.00 | 200A-01h | Power input phase loss protection | 0: Enable phase loss fault and inhibit phase loss warning<br>1: Enable phase loss fault and warning<br>2: Disable phase loss fault and warning | 0 | - | Immediately | "H0A_en.00" on page 477 |
| H0A.02 | 200A-03h | Vibration alarm switch | 0: On<br>1: Off | 0 | - | Immediately | "H0A_en.02" on page 478 |
| H0A.03 | 200A-04h | Power-off memory | 0: Disabled<br>1: Enabled | 0 | - | Immediately | "H0A_en.03" on page 478 |
| H0A.04 | 200A-05h | Motor overload protection gain | 50%–300% | 100 | % | At stop | "H0A_en.04" on page 479 |
| H0A.08 | 200A-09h | Overspeed threshold | 0 rpm to 10000 rpm | 0 | rpm | Immediately | "H0A_en.08" on page 479 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0A.09 | 200A-0Ah | Maximum position pulse frequency | 100 kHz–4000 kHz | 4000 | kHz | At stop | " H0A_en.09" on page 479 |
| H0A.10 | 200A-0Bh | Threshold of excessive position deviation | 1 to 1073741824 | 27486951 | Encoder unit | Immediately | " H0A_en.10" on page 480 |
| H0A.12 | 200A-0Dh | Runaway protection | 0: Disabled<br>1: Enabled | 1 | - | Immediately | " H0A_en.12" on page 480 |
| H0A.16 | 200A-11h | Threshold of low-frequency resonance position deviation | 1–1000 | 5 | - | Immediately | " H0A_en.16" on page 480 |
| H0A.17 | 200A-12h | Reference/Pulse selection | 0: Pulse unit<br>1: Reference unit | 0 | - | At stop | " H0A_en.17" on page 480 |
| H0A.19 | 200A-14h | DI8 filter time constant | 0–255 | 80 | - | At stop | " H0A_en.19" on page 481 |
| H0A.20 | 200A-15h | DI9 filter time constant | 0–255 | 80 | - | At stop | " H0A_en.20" on page 481 |
| H0A.22 | 200A-17h | Sigma_Delta filter time | 0–3 | 0 | - | At stop | " H0A_en.22" on page 481 |
| H0A.23 | 200A-18h | Tz signal filter time | 0–31 | 15 | - | At stop | " H0A_en.23" on page 481 |
| H0A.24 | 200A-19h | Filter time constant of low-speed pulse input pin | 0–255 | 30 | - | At stop | " H0A_en.24" on page 481 |
| H0A.25 | 200A-1Ah | Filter time constant of speed feedback display value | 0 ms to 5000 ms | 200 | ms | At stop | " H0A_en.25" on page 482 |
| H0A.26 | 200A-1Bh | Motor overload detection | 0: Show motor overload warning (E909.0) and fault (E620.0)<br>1: Hide motor overload warning (E909.0) and fault (E620.0)<br>2: No meaning<br>3: Enabled for new motors | 3 | - | At stop | " H0A_en.26" on page 482 |
| H0A.27 | 200A-1Ch | Speed DO filter time constant | 0 ms to 5000 ms | 10 | ms | At stop | " H0A_en.27" on page 482 |
| H0A.28 | 200A-1Dh | Quadrature encoder filter time constant | 0 ns to 255 ns | 30 | ns | At stop | " H0A_en.28" on page 483 |
| H0A.30 | 200A-1Fh | Filter time constant of high-speed pulse input pin | 0 ns to 255 ns | 2 | ns | At stop | " H0A_en.30" on page 483 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0A.32 | 200A-21h | Motor stall over-temperature protection time window | 10 ms to 65535 ms | 200 | ms | Immediately | "H0A_en.32" on page 483 |
| H0A.33 | 200A-22h | Motor stall over-temperature detection | 0: Disabled<br>1: Enable<br>2: Enabled for new over-temperature | 1 | - | Immediately | "H0A_en.33" on page 483 |
| H0A.35 | 200A-24h | Inhibit reading encoder EEPRROM on power-on (for third-party encoders) | 0: Allow<br>1: Inhibit | 0 | - | Immediately | "H0A_en.35" on page 484 |
| H0A.36 | 200A-25h | Encoder multi-turn overflow fault | 0: Not hide<br>1: Hide | 0 | - | At stop | "H0A_en.36" on page 484 |
| H0A.38 | 200A-27h | IGBT over-temperature threshold | 0°C to 175°C | 135 | °C | At stop | "H0A_en.38" on page 484 |
| H0A.39 | 200A-28h | IGBT over-temperature protection switch | 0: Disabled<br>1: Enabled | 0 | - | At stop | "H0A_en.39" on page 485 |
| H0A.40 | 200A-29h | Software limit selection | 0: No operation<br>1: Activated immediately<br>2: Activated after homing is done | 0 | - | At stop | "H0A_en.40" on page 485 |
| H0A.41 | 200A-2Ah | Forward position of software limit | -2147483648–2147483647 | 2147483647 | - | At stop | "H0A_en.41" on page 485 |
| H0A.43 | 200A-2Ch | Reverse position of software limit | -2147483648–2147483647 | -2147483648 | - | At stop | "H0A_en.43" on page 485 |
| H0A.47 | 200A-30h | Brake protection | 0–1 | 0 | - | Immediately | "H0A_en.47" on page 485 |
| H0A.48 | 200A-31h | Gravity load | 0–3000 | 300 | - | Immediately | "H0A_en.48" on page 486 |
| H0A.49 | 200A-32h | Regenerative wafer over-temperature threshold | 0°C to 175°C | 115 | °C | At stop | "H0A_en.49" on page 486 |
| H0A.50 | 200A-33h | Torque reference display filter time | 0 ms to 5000 ms | 200 | ms | At stop | "H0A_en.50" on page 486 |
| H0A.51 | 200A-34h | Encoder fault tolerance count | 0–31 | 31 | - | Immediately | "H0A_en.51" on page 486 |
| H0A.52 | 200A-35h | Defines the temperature threshold for encoder overtemperature protection. | 0° to 175° | 105 | ° | Immediately | "H0A_en.52" on page 486 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0A.55 | 200A-38h | Runaway current threshold | 100.0%–400.0% | 200.0 | % | Immediately | "H0A_en.55" on page 487 |
| H0A.57 | 200A-3Ah | Runaway speed threshold | 1 rpm to 1000 rpm | 10 | rpm | Immediately | "H0A_en.57" on page 487 |
| H0A.58 | 200A-3Bh | Speed feedback filtering time | 0.1 ms to 100.0 ms | 2.0 | ms | Immediately | "H0A_en.58" on page 487 |
| H0A.59 | 200A-3Ch | Runaway protection detection time | 10 ms to 1000 ms | 30 | ms | Immediately | "H0A_en.59" on page 487 |
| H0A.61 | 200A-3Eh | Phase loss detection time threshold | 30 ms to 65535 ms | 50 | ms | Immediately | "H0A_en.61" on page 487 |
| H0A.85 | 200A-56h | Wire breakage detection torque threshold | 4.0%–400.0% | 5.0 | % | At stop | "H0A_en.85" on page 488 |
| H0A.86 | 200A-57h | Wire breakage detection filter time | 5 ms to 1000 ms | 30 | ms | At stop | "H0A_en.86" on page 488 |

## 16.12 Parameter Group H0b

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0b.00 | 200b-01h | Motor speed actual value | -9999rpm to 9999rpm | 0 | rpm | Unchangeable | "H0b_en.00" on page 488 |
| H0b.01 | 200b-02h | Speed reference | -9999rpm to 9999rpm | 0 | rpm | Unchangeable | "H0b_en.01" on page 488 |
| H0b.02 | 200b-03h | Internal torque reference | -300.0%–300.0% | 0.0 | % | Unchangeable | "H0b_en.02" on page 489 |
| H0b.03 | 200b-04h | Monitored DI status | 0–65535 | 0 | - | Unchangeable | "H0b_en.03" on page 489 |
| H0b.05 | 200b-06h | Monitored DO status | 0–65535 | 0 | - | Unchangeable | "H0b_en.05" on page 489 |
| H0b.07 | 200b-08h | Absolute position counter | -2147483648 to 2147483647 | 0 | Reference unit | Unchangeable | "H0b_en.07" on page 490 |
| H0b.09 | 200b-0Ah | Mechanical angle | 0–65535 | 0 | - | Unchangeable | "H0b_en.09" on page 490 |
| H0b.10 | 200b-0Bh | Electrical angle | 0.0° to 360.0° | 0.0 | ° | Unchangeable | "H0b_en.10" on page 490 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0b.11 | 200b-0Ch | Speed corresponding to the input position reference | -9999rpm to 9999rpm | 0 | rpm | Unchangeable | "H0b_en.11" on page 491 |
| H0b.12 | 200b-0Dh | Average load rate | 0.0%–6553.5% | 0.0 | % | Unchangeable | "H0b_en.12" on page 491 |
| H0b.13 | 200b-0Eh | Input position reference counter | -2147483648 to 2147483647 | 0 | Reference unit | Unchangeable | "H0b_en.13" on page 491 |
| H0b.15 | 200b-10h | Encoder position deviation counter | -2147483648 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.15" on page 491 |
| H0b.17 | 200b-12h | Feedback pulse counter | -2147483648 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.17" on page 491 |
| H0b.19 | 200b-14h | Total power-on time | 0.0s–214748364.7s | 0.0 | s | Unchangeable | "H0b_en.19" on page 492 |
| H0b.24 | 200b-19h | RMS value of phase current | 0.00 A to 655.35 A | 0.00 | A | Unchangeable | "H0b_en.24" on page 492 |
| H0b.26 | 200b-1Bh | Bus voltage | 0.0 V to 6553.5 V | 0.0 | V | Unchangeable | "H0b_en.26" on page 492 |
| H0b.27 | 200b-1Ch | Module temperature | 0°C to 65535°C | 0 | °C | Unchangeable | "H0b_en.27" on page 492 |
| H0b.28 | 200b-1Dh | Absolute encoder fault information given by FPGA | 0–65535 | 0 | - | Unchangeable | "H0b_en.28" on page 493 |
| H0b.29 | 200b-1Eh | System status information given by FPGA | 0–65535 | 0 | - | Unchangeable | "H0b_en.29" on page 493 |
| H0b.30 | 200b-1Fh | System fault information given by FPGA | 0–65535 | 0 | - | Unchangeable | "H0b_en.30" on page 493 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0b.33 | 200b-22h | Fault log | 0: Present fault<br>1: Last fault<br>2: 2nd to last fault<br>3: 3rd to last fault<br>4: 4th to last fault<br>5: 5th to last fault 6: 6th to last fault<br>7: 7th to last fault<br>8: 8th to last fault<br>9: 9th to last fault<br>10: 10th to last fault<br>11: 11th to last fault<br>12: 12th to last fault<br>13: 13th to last fault<br>14: 14th to last fault<br>15: 15th to last fault<br>16: 16th to last fault<br>17: 17th to last fault<br>18: 18th to last fault<br>19: 19th to last fault | 0 | - | Immediately | "H0b_en.33" on page 493 |
| H0b.34 | 200b-23h | Fault code of the selected fault | 0–65535 | 0 | - | Unchangeable | "H0b_en.34" on page 493 |
| H0b.35 | 200b-24h | Time stamp upon occurrence of the selected fault | 0.0s–214748364.7s | 0.0 | s | Unchangeable | "H0b_en.35" on page 494 |
| H0b.37 | 200b-26h | Motor speed upon occurrence of the selected fault | -32767 rpm to +32767 rpm | 0 | rpm | Unchangeable | "H0b_en.37" on page 494 |
| H0b.38 | 200b-27h | Motor phase U current upon occurrence of the selected fault | -327.67 A to 327.67 A | 0.00 | A | Unchangeable | "H0b_en.38" on page 494 |
| H0b.39 | 200b-28h | Motor phase V current upon occurrence of the selected fault | -327.67 A to 327.67 A | 0.00 | A | Unchangeable | "H0b_en.39" on page 494 |
| H0b.40 | 200b-29h | Bus voltage upon occurrence of the selected fault | 0.0 V to 6553.5 V | 0.0 | V | Unchangeable | "H0b_en.40" on page 494 |
| H0b.41 | 200b-2Ah | DI status upon occurrence of the selected fault | 0–65535 | 0 | - | Unchangeable | "H0b_en.41" on page 495 |
| H0b.42 | 200b-2Bh | DO status upon occurrence of the selected fault | 0–65535 | 0 | - | Unchangeable | "H0b_en.42" on page 495 |
| H0b.43 | 200b-2Ch | Group No. of the abnormal parameter | 0–65535 | 0 | - | Unchangeable | "H0b_en.43" on page 495 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0b.44 | 200b-2Dh | Offset of the abnormal parameter within the parameter group | 0–65535 | 0 | - | Unchangeable | "H0b_en.44" on page 495 |
| H0b.45 | 200b-2Eh | Internal fault code | 0–65535 | 0 | - | Unchangeable | "H0b_en.45" on page 495 |
| H0b.46 | 200b-2Fh | Absolute encoder fault information given by FPGA upon occurrence of the selected fault | 0–65535 | 0 | - | Unchangeable | "H0b_en.46" on page 495 |
| H0b.47 | 200b-30h | System status information given by FPGA upon occurrence of the selected fault | 0–65535 | 0 | - | Unchangeable | "H0b_en.47" on page 496 |
| H0b.48 | 200b-31h | System fault information given by FPGA upon occurrence of the selected fault | 0–65535 | 0 | - | Unchangeable | "H0b_en.48" on page 496 |
| H0b.51 | 200b-34h | Internal fault code upon occurrence of the selected fault | 0–65535 | 0 | - | Unchangeable | "H0b_en.51" on page 496 |
| H0b.52 | 200b-35h | Timeout fault flat bit given by FPGA upon occurrence of the selected fault | 0–65535 | 0 | - | Unchangeable | "H0b_en.52" on page 496 |
| H0b.53 | 200b-36h | Position deviation counter | -2147483648 to 2147483647 | 0 | Reference unit | Unchangeable | "H0b_en.53" on page 496 |
| H0b.55 | 200b-38h | Motor speed actual value | -6000.0rpm to 6000.0rpm | 0.0 | rpm | Unchangeable | "H0b_en.55" on page 497 |
| H0b.57 | 200b-3Ah | Bus voltage of the control circuit | 0.0 V to 65535.0 V | 0.0 | V | Unchangeable | "H0b_en.57" on page 497 |
| H0b.58 | 200b-3Bh | Mechanical absolute position (low 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.58" on page 497 |
| H0b.60 | 200b-3Dh | Mechanical absolute position (high 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.60" on page 497 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0b.63 | 200b-40h | NotRdy state | 1: Control circuit error<br>2: Main circuit power input error<br>3: Bus undervoltage<br>4: Soft start failed<br>5: Encoder initialization undone<br>6: Short circuit to ground failed<br>7: Others | 0 | - | Unchangeable | "H0b_en.63" on page 498 |
| H0b.64 | 200b-41h | Real-time input position reference counter | -2147483648 to 2147483647 | 0 | Reference unit | Unchangeable | "H0b_en.64" on page 497 |
| H0b.66 | 200b-43h | Encoder temperature | -32768°C to 32767°C | 0 | °C | Unchangeable | "H0b_en.66" on page 498 |
| H0b.70 | 200b-47h | Number of revolutions recorded in the absolute encoder | 0 Rev to 65535 Rev | 0 | Rev | Unchangeable | "H0b_en.70" on page 498 |
| H0b.71 | 200b-48h | Single-turn position fed back by the absolute encoder | 0 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.71" on page 498 |
| H0b.73 | 200b-4Ah | Single-turn offset position of absolute encoder | 0 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.73" on page 499 |
| H0b.75 | 200b-4Ch | Load inertia ratio in online inertia auto-tuning | 0.00–655.35 | 0.00 | - | Unchangeable | "H0b_en.75" on page 499 |
| H0b.76 | 200b-4Dh | External load in online inertia auto-tuning | 0.0–6553.5 | 0.0 | - | Unchangeable | "H0b_en.76" on page 499 |
| H0b.77 | 200b-4Eh | Absolute position fed back by the absolute encoder (low 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.77" on page 499 |
| H0b.79 | 200b-50h | Absolute position fed back by the absolute encoder (high 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.79" on page 499 |
| H0b.81 | 200b-52h | Load position within one turn in absolute position rotation mode (low 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.81" on page 500 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0b.83 | 200b-54h | Load position within one turn in absolute position rotation mode (high 32 bits) | -2147483647 to 2147483647 | 0 | Encoder unit | Unchangeable | "H0b_en.83" on page 500 |
| H0b.85 | 200b-56h | Load position within one turn in absolute position rotation mode | -2147483647 to 2147483647 | 0 | Reference unit | Unchangeable | "H0b_en.85" on page 500 |

# 16.13 Parameter Group H0C

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0C.00 | 200C-01h | Drive axis address | 0–247 | 1 | - | Immediately | "H0C_en.00" on page 500 |
| H0C.02 | 200C-03h | Serial baud rate | 0: 2400bps<br>1: 4800bps<br>2: 9600bps<br>3: 19200bps<br>4: 38400bps<br>5: 57600bps<br>6: 115200bps | 5 | - | Immediately | "H0C_en.02" on page 500 |
| H0C.03 | 200C-04h | Modbus data format | 0: No parity, 2 stop bits<br>1: Even parity, 1 stop bit<br>2: Odd parity, 1 stop bit<br>3: No parity, 1 stop bit | 0 | - | Immediately | "H0C_en.03" on page 501 |
| H0C.08 | 200C-09h | CAN communication rate | 0: 20K<br>1: 50K<br>2: 100K<br>3: 125K<br>4: 250K<br>5: 500K<br>6: 1M<br>7: 1M | 5 | - | Immediately | "H0C_en.08" on page 501 |
| H0C.09 | 200C-0Ah | Communication VDI | 0: Disabled<br>1: Enabled | 0 | - | At stop | "H0C_en.09" on page 502 |
| H0C.10 | 200C-0Bh | VDI default value upon power-on | 0–65535 | 0 | - | Immediately | "H0C_en.10" on page 502 |
| H0C.11 | 200C-0Ch | Communication VDO | 0: Disabled<br>1: Enabled | 0 | - | At stop | "H0C_en.11" on page 503 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0C.12 | 200C-0Dh | Default level of the VDO allocated with function 0 | 0–65535 | 0 | - | At stop | "H0C_en.12" on page 503 |
| H0C.13 | 200C-0Eh | Update parameter values written through communication to EEPROM | 0: Not update EEPROM<br>1: Update EEPROM | 1 | - | Immediately | "H0C_en.13" on page 504 |
| H0C.14 | 200C-0Fh | Modbus error code | 0: N/A<br>1: Illegal parameter (command code)<br>2: Command code data address<br>3: Illegal data<br>4: Slave device fault | 2 | - | Unchangeable | "H0C_en.14" on page 504 |
| H0C.16 | 200C-11h | Update parameter values written through CAN communication to EEPROM | 0: Not update EEPROM<br>1: Update EEPROM | 0 | - | Immediately | "H0C_en.16" on page 505 |
| H0C.25 | 200C-1Ah | Modbus command response delay | 0 ms to 20 ms | 0 | ms | Immediately | "H0C_en.25" on page 505 |
| H0C.26 | 200C-1Bh | Modbus communication data sequence | 0: High 16 bits before low 16 bits<br>1: Low 16 bits before high 16 bits | 1 | - | Immediately | "H0C_en.26" on page 505 |
| H0C.30 | 200C-1Fh | Modbus error frame format | 0: Old protocol<br>1: New protocol (standard) | 1 | - | Immediately | "H0C_en.30" on page 505 |
| H0C.31 | 200C-20h | Modbus receiving selection | 0: Receiving interrupt enabled<br>1: Current loop interrupt inquiry | 0 | - | Immediately | "H0C_en.31" on page 505 |

## 16.14 Parameter Group H0d

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0d.00 | 200d-01h | Software Reset | 0: No operation<br>1: Enable | 0 | - | At stop | "H0d_en.00" on page 506 |
| H0d.01 | 200d-02h | Fault Reset | 0: No operation<br>1: Enable | 0 | - | At stop | "H0d_en.01" on page 506 |
| H0d.02 | 200d-03h | Inertia auto-tuning selection | 0–65 | 0 | - | At stop | "H0d_en.02" on page 507 |
| H0d.03 | 200d-04h | Initial angle auto-tuning | 0: No operation<br>1: Enabled | 0 | - | At stop | "H0d_en.03" on page 507 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H0d.04 | 200d-05h | Read/write in encoder ROM | 0: No operation<br>1: Write ROM<br>2: Read ROM | 0 | - | At stop | "H0d_en.04" on page 507 |
| H0d.05 | 200d-06h | Emergency stop | 0: No operation<br>1: Emergency stop | 0 | - | Immediately | "H0d_en.05" on page 507 |
| H0d.06 | 200d-07h | Current loop parameter auto-tuning | 0: No operation<br>1: Save parameters<br>2: Do not save parameters | 0 | - | At stop | "H0d_en.06" on page 507 |
| H0d.12 | 200d-0Dh | Phase U/V current balance correction | 0–1 | 0 | - | Unchangeable | "H0d_en.12" on page 508 |
| H0d.17 | 200d-12h | Forced DI/DO selection | 0: No operation<br>1: Forced DI enabled, forced DO disabled<br>2: Forced DO enabled, forced DI disabled<br>3: Forced DI and DO enabled | 0 | - | Immediately | "H0d_en.17" on page 508 |
| H0d.18 | 200d-13h | Forced DI setting | 0–511 | 511 | - | Immediately | "H0d_en.18" on page 508 |
| H0d.19 | 200d-14h | Forced DO setting | 0–31 | 0 | - | Immediately | "H0d_en.19" on page 509 |
| H0d.20 | 200d-15h | Multi-turn absolute encoder reset | 0: No operation<br>1 Reset<br>2: Reset the fault and multi-turn data | 0 | - | At stop | "H0d_en.20" on page 509 |

## 16.15 Parameter Group H11

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H11.00 | 2011-01h | Multi-position operation mode | 0: Single run (number of displacements selected in H11.01)<br>1: Cyclic operation (number of displacement selected in H11.01)<br>2: DI-based operation (selected by DI)<br>3: Sequential operation<br>5: Axis-controlled continuous operation | 1 | - | At stop | "H11_en.00" on page 510 |
| H11.01 | 2011-02h | Number of displacement references in multi-position mode | 1–16 | 1 | - | At stop | "H11_en.01" on page 513 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H11.02 | 2011-03h | Starting displacement No. after pause | 0: Continue to execute the unexecuted displacements<br>1: Start from displacement 1 | 0 | - | At stop | "H11_en.02" on page 513 |
| H11.03 | 2011-04h | Interval time unit | 0: ms<br>1: s | 0 | - | At stop | "H11_en.03" on page 514 |
| H11.04 | 2011-05h | Displacement reference type | 0: Relative displacement reference<br>1: Absolute displacement reference | 0 | - | Immediately | "H11_en.04" on page 514 |
| H11.05 | 2011-06h | Starting displacement No. in sequential operation | 0–16 | 0 | - | At stop | "H11_en.05" on page 515 |
| H11.09 | 2011-0Ah | Deceleration upon axis control OFF | 0 ms to 65535 ms | 65535 | ms | Immediately | "H11_en.09" on page 516 |
| H11.10 | 2011-0Bh | Start speed of the 1st displacement | 0 rpm to 6000 rpm | 0 | rpm | Immediately | "H11_en.10" on page 516 |
| H11.11 | 2011-0Ch | Stop speed of the 1st displacement | 0 rpm to 6000 rpm | 0 | rpm | Immediately | "H11_en.11" on page 516 |
| H11.12 | 2011-0Dh | Displacement 1 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.12" on page 516 |
| H11.14 | 2011-0Fh | Max. speed of displacement 1 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.14" on page 517 |
| H11.15 | 2011-10h | Acc/Dec time of displacement 1 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.15" on page 517 |
| H11.16 | 2011-11h | Interval time after displacement 1 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.16" on page 517 |
| H11.17 | 2011-12h | Displacement 2 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.17" on page 518 |
| H11.19 | 2011-14h | Max. speed of displacement 2 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.19" on page 518 |
| H11.20 | 2011-15h | Acc/Dec time of displacement 2 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.20" on page 518 |
| H11.21 | 2011-16h | Interval time after displacement 2 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.21" on page 518 |
| H11.22 | 2011-17h | Displacement 3 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.22" on page 518 |
| H11.24 | 2011-19h | Max. speed of displacement 3 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.24" on page 518 |
| H11.25 | 2011-1Ah | Acc/Dec time of displacement 3 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.25" on page 519 |
| H11.26 | 2011-1Bh | Interval time after displacement 3 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.26" on page 519 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H11.27 | 2011-1Ch | Displacement 4 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.27" on page 519 |
| H11.29 | 2011-1Eh | Max. speed of displacement 4 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.29" on page 519 |
| H11.30 | 2011-1Fh | Acc/Dec time of displacement 4 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.30" on page 519 |
| H11.31 | 2011-20h | Interval time after displacement 4 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.31" on page 520 |
| H11.32 | 2011-21h | Displacement 5 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.32" on page 520 |
| H11.34 | 2011-23h | Max. speed of displacement 5 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.34" on page 520 |
| H11.35 | 2011-24h | Acc/Dec time of displacement 5 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.35" on page 520 |
| H11.36 | 2011-25h | Interval time after displacement 5 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.36" on page 520 |
| H11.37 | 2011-26h | Displacement 6 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.37" on page 521 |
| H11.39 | 2011-28h | Max. speed of displacement 6 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.39" on page 521 |
| H11.40 | 2011-29h | Acc/Dec time of displacement 6 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.40" on page 521 |
| H11.41 | 2011-2Ah | Interval time after displacement 6 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.41" on page 521 |
| H11.42 | 2011-2Bh | Displacement 7 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.42" on page 521 |
| H11.44 | 2011-2Dh | Max. speed of displacement 7 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.44" on page 522 |
| H11.45 | 2011-2Eh | Acc/Dec time of displacement 7 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.45" on page 522 |
| H11.46 | 2011-2Fh | Interval time after displacement 7 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.46" on page 522 |
| H11.47 | 2011-30h | Displacement 8 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.47" on page 522 |
| H11.49 | 2011-32h | Max. speed of displacement 8 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.49" on page 522 |
| H11.50 | 2011-33h | Acc/Dec time of displacement 8 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.50" on page 523 |
| H11.51 | 2011-34h | Interval time after displacement 8 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.51" on page 523 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H11.52 | 2011-35h | Displacement 9 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.52" on page 523 |
| H11.54 | 2011-37h | Max. speed of displacement 9 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.54" on page 523 |
| H11.55 | 2011-38h | Acc/Dec time of displacement 9 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.55" on page 523 |
| H11.56 | 2011-39h | Interval time after displacement 9 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.56" on page 523 |
| H11.57 | 2011-3Ah | Displacement 10 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.57" on page 524 |
| H11.59 | 2011-3Ch | Max. speed of displacement 10 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.59" on page 524 |
| H11.60 | 2011-3Dh | Acc/Dec time of displacement 10 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.60" on page 524 |
| H11.61 | 2011-3Eh | Interval time after displacement 10 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.61" on page 524 |
| H11.62 | 2011-3Fh | Displacement 11 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.62" on page 524 |
| H11.64 | 2011-41h | Max. speed of displacement 11 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.64" on page 525 |
| H11.65 | 2011-42h | Acc/Dec time of displacement 11 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.65" on page 525 |
| H11.66 | 2011-43h | Interval time after displacement 11 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.66" on page 525 |
| H11.67 | 2011-44h | Displacement 12 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.67" on page 525 |
| H11.69 | 2011-46h | Max. speed of displacement 12 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.69" on page 525 |
| H11.70 | 2011-47h | Acc/Dec time of displacement 12 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.70" on page 526 |
| H11.71 | 2011-48h | Interval time after displacement 12 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.71" on page 526 |
| H11.72 | 2011-49h | Displacement 13 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.72" on page 526 |
| H11.74 | 2011-4Bh | Max. speed of displacement 13 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.74" on page 526 |
| H11.75 | 2011-4Ch | Acc/Dec time of displacement 13 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.75" on page 526 |
| H11.76 | 2011-4Dh | Interval time after displacement 13 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.76" on page 527 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H11.77 | 2011-4Eh | Displacement 14 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.77" on page 527 |
| H11.79 | 2011-50h | Max. speed of displacement 14 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.79" on page 527 |
| H11.80 | 2011-51h | Acc/Dec time of displacement 14 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.80" on page 527 |
| H11.81 | 2011-52h | Interval time after displacement 14 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.81" on page 527 |
| H11.82 | 2011-53h | Displacement 15 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.82" on page 528 |
| H11.84 | 2011-55h | Max. speed of displacement 15 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.84" on page 528 |
| H11.85 | 2011-56h | Acc/Dec time of displacement 15 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.85" on page 528 |
| H11.86 | 2011-57h | Interval time after displacement 15 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.86" on page 528 |
| H11.87 | 2011-58h | Displacement 16 | -1073741824 to 1073741824 | 10000 | Reference unit | Immediately | "H11_en.87" on page 528 |
| H11.89 | 2011-5Ah | Max. speed of displacement 16 | 1 rpm to 6000 rpm | 200 | rpm | Immediately | "H11_en.89" on page 528 |
| H11.90 | 2011-5Bh | Acc/Dec time of displacement 16 | 0 ms to 65535 ms | 10 | ms | Immediately | "H11_en.90" on page 529 |
| H11.91 | 2011-5Ch | Interval time after displacement 16 | 0 ms (s)–10000 ms (s) | 10 | ms (s) | Immediately | "H11_en.91" on page 529 |

## 16.16 Parameter Group H12

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H12.00 | 2012-01h | Multi-speed operation mode | 0: Individual operation (number of speeds selected in H12.01)<br>1: Cyclic operation (number of speeds selected in H12.01)<br>2: DI-based operation | 1 | - | At stop | "H12_en.00" on page 529 |
| H12.01 | 2012-02h | Number of speed references in multi-speed mode | 1–16 | 16 | - | At stop | "H12_en.01" on page 530 |
| H12.02 | 2012-03h | Operating time unit | 0: sec<br>1: min | 0 | - | At stop | "H12_en.02" on page 531 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H12.03 | 2012-04h | Acceleration time 1 | 0 ms to 65535 ms | 10 | ms | Immediately | "H12_en.03" on page 531 |
| H12.04 | 2012-05h | Deceleration time 1 | 0 ms to 65535 ms | 10 | ms | Immediately | "H12_en.04" on page 531 |
| H12.05 | 2012-06h | Acceleration time 2 | 0 ms to 65535 ms | 50 | ms | Immediately | "H12_en.05" on page 532 |
| H12.06 | 2012-07h | Deceleration time 2 | 0 ms to 65535 ms | 50 | ms | Immediately | "H12_en.06" on page 532 |
| H12.07 | 2012-08h | Acceleration time 3 | 0 ms to 65535 ms | 100 | ms | Immediately | "H12_en.07" on page 532 |
| H12.08 | 2012-09h | Deceleration time 3 | 0 ms to 65535 ms | 100 | ms | Immediately | "H12_en.08" on page 532 |
| H12.09 | 2012-0Ah | Acceleration time 4 | 0 ms to 65535 ms | 150 | ms | Immediately | "H12_en.09" on page 532 |
| H12.10 | 2012-0Bh | Deceleration time 4 | 0 ms to 65535 ms | 150 | ms | Immediately | "H12_en.10" on page 533 |
| H12.20 | 2012-15h | Speed reference 1 | –6000 rpm to 6000 rpm | 0 | rpm | Immediately | "H12_en.20" on page 533 |
| H12.21 | 2012-16h | Operating time of speed 1 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.21" on page 533 |
| H12.22 | 2012-17h | Acceleration/ Deceleration time of speed 1 | 0: Zero acceleration/deceleration time<br>1: Acceleration/Deceleration time 1<br>2: Acceleration/Deceleration time 2<br>3: Acceleration/Deceleration time 3<br>4: Acceleration/Deceleration time 4 | 0 | - | Immediately | "H12_en.22" on page 533 |
| H12.23 | 2012-18h | Reference 2 | –6000 rpm to 6000 rpm | 100 | rpm | Immediately | "H12_en.23" on page 534 |
| H12.24 | 2012-19h | Operating time of speed 2 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.24" on page 535 |
| H12.25 | 2012-1Ah | Acceleration/ Deceleration time of speed 2 | See H12.22. | 0 | - | Immediately | "H12_en.25" on page 535 |
| H12.26 | 2012-1Bh | Reference 3 | –6000 rpm to 6000 rpm | 300 | rpm | Immediately | "H12_en.26" on page 535 |
| H12.27 | 2012-1Ch | Operating time of speed 3 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.27" on page 535 |
| H12.28 | 2012-1Dh | Acceleration/ Deceleration time of speed 3 | See H12.22. | 0 | - | Immediately | "H12_en.28" on page 535 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H12.29 | 2012-1Eh | Reference 4 | –6000 rpm to 6000 rpm | 500 | rpm | Immediately | "H12_en.29" on page 536 |
| H12.30 | 2012-1Fh | Operating time of speed 4 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.30" on page 536 |
| H12.31 | 2012-20h | Acceleration/ Deceleration time of speed 4 | See H12.22. | 0 | - | Immediately | "H12_en.31" on page 536 |
| H12.32 | 2012-21h | Reference 5 | –6000 rpm to 6000 rpm | 700 | rpm | Immediately | "H12_en.32" on page 536 |
| H12.33 | 2012-22h | Operating time of speed 5 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.33" on page 536 |
| H12.34 | 2012-23h | Acceleration/ Deceleration time of speed 5 | See H12.22. | 0 | - | Immediately | "H12_en.34" on page 536 |
| H12.35 | 2012-24h | Reference 6 | –6000 rpm to 6000 rpm | 900 | rpm | Immediately | "H12_en.35" on page 537 |
| H12.36 | 2012-25h | Operating time of speed 6 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.36" on page 537 |
| H12.37 | 2012-26h | Acc./dec. time of speed 6 | See H12.22. | 0 | - | Immediately | "H12_en.37" on page 537 |
| H12.38 | 2012-27h | Reference 7 | –6000 rpm to 6000 rpm | 600 | rpm | Immediately | "H12_en.38" on page 537 |
| H12.39 | 2012-28h | Operating time of speed 7 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.39" on page 537 |
| H12.40 | 2012-29h | Acc./dec. time of speed 7 | See H12.22. | 0 | - | Immediately | "H12_en.40" on page 538 |
| H12.41 | 2012-2Ah | Reference 8 | –6000 rpm to 6000 rpm | 300 | rpm | Immediately | "H12_en.41" on page 538 |
| H12.42 | 2012-2Bh | Operating time of speed 8 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.42" on page 538 |
| H12.43 | 2012-2Ch | Acc./dec. time of speed 8 | See H12.22. | 0 | - | Immediately | "H12_en.43" on page 538 |
| H12.44 | 2012-2Dh | Reference 9 | –6000 rpm to 6000 rpm | 100 | rpm | Immediately | "H12_en.44" on page 538 |
| H12.45 | 2012-2Eh | Operating time of speed 9 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.45" on page 539 |
| H12.46 | 2012-2Fh | Acc./dec. time of speed 9 | See H12.22. | 0 | - | Immediately | "H12_en.46" on page 539 |
| H12.47 | 2012-30h | Reference 10 | –6000 rpm to 6000 rpm | -100 | rpm | Immediately | "H12_en.47" on page 539 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H12.48 | 2012-31h | Operating time of speed 10 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.48" on page 539 |
| H12.49 | 2012-32h | Acc./dec. time of speed 10 | See H12.22. | 0 | - | Immediately | "H12_en.49" on page 539 |
| H12.50 | 2012-33h | Reference 11 | –6000 rpm to 6000 rpm | -300 | rpm | Immediately | "H12_en.50" on page 540 |
| H12.51 | 2012-34h | Operating time of speed 11 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.51" on page 540 |
| H12.52 | 2012-35h | Acc./dec. time of speed 11 | See H12.22. | 0 | - | Immediately | "H12_en.52" on page 540 |
| H12.53 | 2012-36h | Reference 12 | –6000 rpm to 6000 rpm | -500 | rpm | Immediately | "H12_en.53" on page 540 |
| H12.54 | 2012-37h | Operating time of speed 12 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.54" on page 540 |
| H12.55 | 2012-38h | Acc./dec. time of speed 12 | See H12.22. | 0 | - | Immediately | "H12_en.55" on page 541 |
| H12.56 | 2012-39h | Reference 13 | –6000 rpm to 6000 rpm | -700 | rpm | Immediately | "H12_en.56" on page 541 |
| H12.57 | 2012-3Ah | Operating time of speed 13 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.57" on page 541 |
| H12.58 | 2012-3Bh | Acc./dec. time of speed 13 | See H12.22. | 0 | - | Immediately | "H12_en.58" on page 541 |
| H12.59 | 2012-3Ch | Reference 14 | –6000 rpm to 6000 rpm | -900 | rpm | Immediately | "H12_en.59" on page 541 |
| H12.60 | 2012-3Dh | Operating time of speed 14 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.60" on page 541 |
| H12.61 | 2012-3Eh | Acc./dec. time of speed 14 | See H12.22. | 0 | - | Immediately | "H12_en.61" on page 542 |
| H12.62 | 2012-3Fh | Reference 15 | –6000 rpm to 6000 rpm | -600 | rpm | Immediately | "H12_en.62" on page 542 |
| H12.63 | 2012-40h | Operating time of speed 15 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.63" on page 542 |
| H12.64 | 2012-41h | Acc./dec. time of speed 15 | See H12.22. | 0 | - | Immediately | "H12_en.64" on page 542 |
| H12.65 | 2012-42h | Reference 16 | –6000 rpm to 6000 rpm | -300 | rpm | Immediately | "H12_en.65" on page 542 |
| H12.66 | 2012-43h | Operating time of speed 16 | 0.0s(m) to 6553.5s(m) | 5.0 | s (m) | Immediately | "H12_en.66" on page 543 |
| H12.67 | 2012-44h | Acc./dec. time of speed 16 | See H12.22. | 0 | - | Immediately | "H12_en.67" on page 543 |

# 16.17 Parameter Group H17

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H17.00 | 2017-01h | VDI1 function selection | See "H17_en.00" on page 543 for details. | 0 | - | Immediately | "H17_en.00" on page 543 |
| H17.01 | 2017-02h | VDI1 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.01" on page 544 |
| H17.02 | 2017-03h | VDI2 function selection | See H17.00. | 0 | - | Immediately | "H17_en.02" on page 545 |
| H17.03 | 2017-04h | VDI2 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.03" on page 545 |
| H17.04 | 2017-05h | VDI3 function | See H17.00. | 0 | - | Immediately | "H17_en.04" on page 545 |
| H17.05 | 2017-06h | VDI3 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.05" on page 545 |
| H17.06 | 2017-07h | VDI4 function | See H17.00. | 0 | - | Immediately | "H17_en.06" on page 546 |
| H17.07 | 2017-08h | VDI4 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.07" on page 546 |
| H17.08 | 2017-09h | VDI5 function selection | See H17.00. | 0 | - | Immediately | "H17_en.08" on page 546 |
| H17.09 | 2017-0Ah | VDI5 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.09" on page 546 |
| H17.10 | 2017-0Bh | VDI6 function selection | See H17.00. | 0 | - | Immediately | "H17_en.10" on page 546 |
| H17.11 | 2017-0Ch | VDI6 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.11" on page 547 |
| H17.12 | 2017-0Dh | VDI7 function selection | See H17.00. | 0 | - | Immediately | "H17_en.12" on page 547 |
| H17.13 | 2017-0Eh | VDI7 logic | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.13" on page 547 |
| H17.14 | 2017-0Fh | VDI8 function | See H17.00. | 0 | - | Immediately | "H17_en.14" on page 547 |
| H17.15 | 2017-10h | VDI8 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.15" on page 547 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H17.16 | 2017-11h | VDI9 function | See H17.00. | 0 | - | Immediately | "H17_en.16" on page 548 |
| H17.17 | 2017-12h | VDI9 logic | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.17" on page 548 |
| H17.18 | 2017-13h | VDI10 function | See H17.00. | 0 | - | Immediately | "H17_en.18" on page 548 |
| H17.19 | 2017-14h | VDI10 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.19" on page 548 |
| H17.20 | 2017-15h | VDI11 function selection | See H17.00. | 0 | - | Immediately | "H17_en.20" on page 549 |
| H17.21 | 2017-16h | VDI11 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.21" on page 549 |
| H17.22 | 2017-17h | VDI12 function | See H17.00. | 0 | - | Immediately | "H17_en.22" on page 549 |
| H17.23 | 2017-18h | VDI12 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.23" on page 549 |
| H17.24 | 2017-19h | VDI13 function | See H17.00. | 0 | - | Immediately | "H17_en.24" on page 549 |
| H17.25 | 2017-1Ah | VDI13 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.25" on page 550 |
| H17.26 | 2017-1Bh | VDI14 function | See H17.00. | 0 | - | Immediately | "H17_en.26" on page 550 |
| H17.27 | 2017-1Ch | VDI14 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.27" on page 550 |
| H17.28 | 2017-1Dh | VDI15 function | See H17.00. | 0 | - | Immediately | "H17_en.28" on page 550 |
| H17.29 | 2017-1Eh | VDI15 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.29" on page 550 |
| H17.30 | 2017-1Fh | VDI16 function | See H17.00. | 0 | - | Immediately | "H17_en.30" on page 551 |
| H17.31 | 2017-20h | VDI16 logic selection | 0: Active when the written value is 1<br>1: Active when the written value changes from 0 to 1 | 0 | - | At stop | "H17_en.31" on page 551 |
| H17.32 | 2017-21h | VDO virtual level | 0–65535 | 0 | - | Unchangeable | "H17_en.32" on page 551 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H17.33 | 2017-22h | VDO1 function | 0: No assignment<br>1: Servo ready<br>2: Motor rotation<br>3: Zero speed<br>4: Speed matching<br>5: Positioning completed<br>6: Proximity<br>7: Torque limited<br>8: Speed limited<br>9: Brake<br>10: Warning<br>11: Fault<br>12: Output 3-bit warning code<br>13: Output 3-bit warning code<br>14: Output 3-bit warning code<br>15: Interrupt positioning completed<br>16: Homing completed<br>17: Electrical homing completed<br>18: Torque reach<br>19: Speed reach<br>22: Internal command completed<br>23: Writing next command allowed<br>24: Internal motion completed | 0 | - | At stop | “H17_en.33” on page 552 |
| H17.34 | 2017-23h | VDO1 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | “H17_en.34” on page 553 |
| H17.35 | 2017-24h | VDO2 function selection | See H17.33. | 0 | - | At stop | “H17_en.35” on page 553 |
| H17.36 | 2017-25h | VDO2 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | “H17_en.36” on page 554 |
| H17.37 | 2017-26h | VDO3 function | See H17.33. | 0 | - | At stop | “H17_en.37” on page 554 |
| H17.38 | 2017-27h | VDO3 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | “H17_en.38” on page 554 |
| H17.39 | 2017-28h | VDO4 function | See H17.33. | 0 | - | At stop | “H17_en.39” on page 554 |
| H17.40 | 2017-29h | VDO4 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | “H17_en.40” on page 554 |
| H17.41 | 2017-2Ah | VDO5 function | See H17.33. | 0 | - | At stop | “H17_en.41” on page 555 |
| H17.42 | 2017-2Bh | VDO5 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | “H17_en.42” on page 555 |
| H17.43 | 2017-2Ch | VDO6 function | See H17.33. | 0 | - | At stop | “H17_en.43” on page 555 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H17.44 | 2017-2Dh | VDO6 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.44" on page 555 |
| H17.45 | 2017-2Eh | VDO7 function | See H17.33. | 0 | - | At stop | "H17_en.45" on page 556 |
| H17.46 | 2017-2Fh | VDO7 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.46" on page 556 |
| H17.47 | 2017-30h | VDO8 function | See H17.33. | 0 | - | At stop | "H17_en.47" on page 556 |
| H17.48 | 2017-31h | VDO8 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.48" on page 556 |
| H17.49 | 2017-32h | VDO9 function | See H17.33. | 0 | - | At stop | "H17_en.49" on page 556 |
| H17.50 | 2017-33h | VDO9 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.50" on page 557 |
| H17.51 | 2017-34h | VDO10 function selection | See H17.33. | 0 | - | At stop | "H17_en.51" on page 557 |
| H17.52 | 2017-35h | VDO10 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.52" on page 557 |
| H17.53 | 2017-36h | VDO11 function | See H17.33. | 0 | - | At stop | "H17_en.53" on page 557 |
| H17.54 | 2017-37h | VDO11 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.54" on page 557 |
| H17.55 | 2017-38h | VDO12 function | See H17.33. | 0 | - | At stop | "H17_en.55" on page 558 |
| H17.56 | 2017-39h | VDO12 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.56" on page 558 |
| H17.57 | 2017-3Ah | VDO13 function | See H17.33. | 0 | - | At stop | "H17_en.57" on page 558 |
| H17.58 | 2017-3Bh | VDO13 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.58" on page 558 |
| H17.59 | 2017-3Ch | VDO14 function | See H17.33. | 0 | - | At stop | "H17_en.59" on page 558 |
| H17.60 | 2017-3Dh | VDO14 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.60" on page 559 |
| H17.61 | 2017-3Eh | VDO15 function | See H17.33. | 0 | - | At stop | "H17_en.61" on page 559 |
| H17.62 | 2017-3Fh | VDO15 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.62" on page 559 |

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H17.63 | 2017-40h | VDO16 function | See H17.33. | 0 | - | At stop | "H17_en.63" on page 559 |
| H17.64 | 2017-41h | VDO16 logic level | 0: Output 1 upon active logic<br>1: Output 0 upon active logic | 0 | - | At stop | "H17_en.64" on page 559 |

## 16.18 Parameter Group H1B

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H1B.14 | 201B-0Fh | Bit01 of motor SN code | 0–65535 | 0 | - | At stop | "H1B_en.14" on page 560 |
| H1B.15 | 201B-10h | Bit23 of motor SN code | 0–65535 | 0 | - | At stop | "H1B_en.15" on page 560 |
| H1B.16 | 201B-11h | Bit45 of motor SN code | 0–65535 | 0 | - | At stop | "H1B_en.16" on page 560 |
| H1B.17 | 201B-12h | Bit67 of motor SN code | 0–65535 | 0 | - | At stop | "H1B_en.17" on page 560 |
| H1B.18 | 201B-13h | Bit89 of motor SN code | 0–65535 | 0 | - | At stop | "H1B_en.18" on page 560 |
| H1B.19 | 201B-14h | Bit11 of motor SN code | 0–65535 | 0 | - | At stop | "H1B_en.19" on page 561 |
| H1B.20 | 201B-15h | Bit13 of motor SN code | 0–65535 | 0 | - | At stop | "H1B_en.20" on page 561 |
| H1B.21 | 201B-16h | Bit15 of motor SN code | 0–65535 | 0 | - | At stop | "H1B_en.21" on page 561 |
| H1B.47 | 201B-30h | Motor storage property shield word 1 | 0–65535 | 0 | - | At stop | "H1B_en.47" on page 561 |
| H1B.48 | 201B-31h | Motor storage property shield word 2 | 0–65535 | 0 | - | At stop | "H1B_en.48" on page 561 |

## 16.19 Parameter Group H30

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H30.00 | 2030-01h | Servo status read through communication | 0–65535 | 0 | - | Unchangeable | "H30_en.00" on page 562 |
| H30.01 | 2030-02h | DO function state 1 read through communication | 0–65535 | 0 | - | Unchangeable | "H30_en.01" on page 562 |
| H30.02 | 2030-03h | DO function state 2 read through communication | 0–65535 | 0 | - | Unchangeable | "H30_en.02" on page 563 |
| H30.03 | 2030-04h | Input pulse reference sampling value read through communication | 0–65535 | 0 | - | Unchangeable | "H30_en.03" on page 563 |
| H30.04 | 2030-05h | DI status read through communication | 0–65535 | 0 | - | Unchangeable | "H30_en.04" on page 563 |

## 16.20 Parameter Group H31

| Parameter | Hexadecimal Parameters | Name | Setpoint | Default | Unit | Change Method | Page |
|---|---|---|---|---|---|---|---|
| H31.00 | 2031-01h | VDI virtual level set through communication | 0–65535 | 0 | - | Immediately | "H31_en.00" on page 564 |
| H31.04 | 2031-05h | DO state set through communication | 0–31 | 0 | - | Immediately | "H31_en.04" on page 564 |
| H31.09 | 2031-0Ah | Speed reference set through communication | -6000.000rpm to 6000.000rpm | 0.000 | rpm | Immediately | "H31_en.09" on page 565 |
| H31.11 | 2031-0Ch | Torque reference set through communication | -100.000%–100.000% | 0.000 | % | Immediately | "H31_en.11" on page 565 |

# 17 Troubleshooting

## 17.1 Fault Levels and Display

Faults and warnings of the servo drive are divided into three levels based on severity: No. 1 > No. 2 > No. 3, as shown below.

- No. 1 non-resettable fault
- No. 1 resettable fault
- No. 2 resettable fault
- No. 3 resettable warning

### *Note*

"Resettable" means the keypad stops displaying the fault/warning once a "Reset signal" is input.

**Fault and warning log**

The servo drive can record the latest 20[1] faults and warnings and values of status parameters upon fault/warning. If a repeated fault or warning is present in the latest 5 records, the repeated fault can be logged more than once after being cleared.

A fault/warning will still be saved in the fault log after reset. To remove the fault/warning from the fault log, set H02.31 to 1. The following figure shows the details.


| ID | 故障码 | 时间戳 | 转速 | 电流U | 电流V | 母线电压 | 输入端子 | 输出端子 |
|---|---|---|---|---|---|---|---|---|
| 1 | 136.1 | 311253.5s | 0rpm | 0.0A | 0.0A | 0.0V | 0x001F | 0x0003 |
| 2 | 101.0 | 303793.4s | 0rpm | 0.0A | 0.0A | 0.0V | 0x0000 | 0x0000 |
| 3 | 101.0 | 296710.8s | 0rpm | 0.0A | 0.0A | 0.0V | 0x001F | 0x0003 |
| 4 | 740.0 | 294902.1s | 0rpm | 0.0A | 0.0A | 0.0V | 0x001F | 0x0002 |
| 5 | 740.2 | 294902.1s | 0rpm | 0.0A | 0.0A | 0.0V | 0x001F | 0x0002 |
| 6 | 601.4 | 210654.8s | 1001rpm | 0.0A | -0.1A | 309.1V | 0x001F | 0x0002 |
| 7 | 601.4 | 204921.0s | 50rpm | 0.0A | 0.0A | 310.4V | 0x001F | 0x0002 |
| 8 | 601.4 | 155877.9s | 10rpm | 0.0A | 0.0A | 312.7V | 0x001F | 0x0002 |
| 9 | 120.8 | 152588.5s | 0rpm | 0.0A | 0.0A | 0.0V | 0x001F | 0x0003 |

Read the value of H0b.34 to get the fault/warning code. See examples in the following table.

| H0b.34 (hexadecimal) | Description of H0b.34 (hexadecimal) |
|---|---|
| 0101 | 0: Fault subcode<br>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.

# 17.2 Troubleshooting During Startup

## Position Control Mode

- **Troubleshooting**

| Start Process | Fault | Cause | Troubleshooting |
|---|---|---|---|
| Turn on the control power (L1C, L2C) Main power supply (L1, L2) (L1, L2, L3) (R, S, T) | The LED neither lights up nor displays "rdy". | 1. The voltage of the control circuit power supply is abnormal. | The fault persists though CN1, CN2, CN3, and CN4 are disconnected.<br>Measure the AC voltage between L1C and L2C. |
| | | 2. The voltage of the main circuit power supply 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 235V, the keypad displays "nrd".<br>• 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 451V, the keypad displays "nrd". |
| | | 3. The programming terminal is shorted. | Check whether the programming terminal is shorted. |
| | | 4. The servo drive is faulty. | - |
| | The keypad displays "Exxx.x". | Rectify the fault causes according to "Solutions to Warnings" on page 627 and "17.5.1 Solutions to Faults" on page 638. | |
| | The keypad displays "rdy" after preceding faults are cleared. | | |
| Switching on the S-ON signal (S-ON signal switched on) | The keypad displays "Exxx.x". | Rectify the fault causes according to "Solutions to Warnings" on page 627 and "17.5.1 Solutions to Faults" on page 638. | |
| | The servo motor shaft is in the free running state. | 1. The S-ON signal is inactive. | Switch the keypad display to the servo status interface and view whether the keypad displays "rdy" instead of "run".<br>• Check parameters in groups H03 or H17 to see whether FunIN.1 (S-ON) is assigned to a DI. If FunIN.1 is assigned, check whether the corresponding DI logic is active. If FunIN.1 is not assigned, assign FunIN.1 to a DI and activate the logic of this DI. For how to assign FunIN.1 to a DI, see "16.4 Parameter Group H03" on page 575 and "16.17 Parameter Group H17" on page 612.<br>• 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 SV660P Series Servo Drive Hardware Guide. |
| | | 2. The control mode is wrong. | 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. |
| | The keypad displays "run" after preceding faults are cleared. | | |

| Start Process | Fault | Cause | Troubleshooting |
|---|---|---|---|
| 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.<br>• No position reference is inputted.<br>• Check whether FunIN.13 (Inhibit, position reference inhibited) or FunIN.37 (PulseInhibit, pulse reference inhibited) is used.<br>• 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.<br>• 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.<br>• 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.<br>• 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 the 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.<br>• 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.<br>• 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.<br>• Check whether FunIN.27 (PosDirSel, position reference direction selection) is assigned to a DI and whether the logic of this DI is active.<br>• Check whether H02.02 (Direction of rotation) is set properly. |
| | The servo motor can rotate after preceding faults are cleared. | | |
| Rotating unstably at low speed | The motor speed is unstable during low-speed operation. | Gains are set improperly. | See section Adjustments for automatic gain adjustment. |
| | The motor shaft vibrates leftward and rightward. | The load moment of inertia ratio (H08.15) is too high. | If the motor can operate safely, perform inertia auto-tuning and gain auto-tuning according to section "Adjustment". |
| | The servo motor can rotate properly after preceding fault are cleared. | | |
| Normal running | The positioning is inaccurate. | The position deviation is beyond the permissible range. | Check the position reference counter (H0b.13), feedback pulse counter (H0b.17), and the mechanical stop position according to the following procedure. |

- **Procedure for checking the causes of inaccurate positioning**
- 

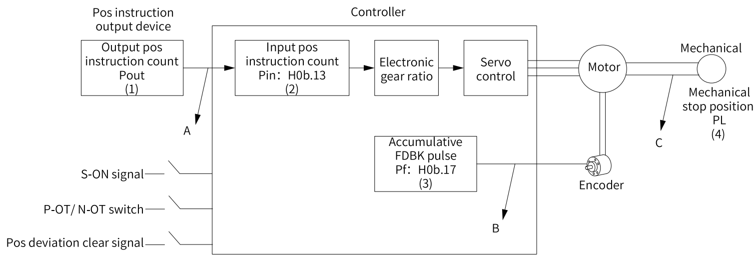



Figure 17-1 Schematic diagram for positioning control

- When inaccurate positioning occurs, check the following four signals in the preceding figure.
  - Output position reference count value (Pout) in the position reference output device (host controller or internal parameters of the servo drive)
  - Input position reference count value (Pin) received by the servo drive, corresponding to H0b.13 (Position reference counter)
  - Accumulative pulse feedback value (Pf) returned by the encoder, corresponding to H0b.17 (Feedback pulse counter)
  - Mechanical stop position (PL)
- The A, B, C shown in the preceding figure represent the three causes that lead to inaccurate positioning.
  - A: A position reference count error occurs due to the noise in the wiring of the host controller and the servo drive.
  - B: The 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 machine and servo motor.
- In an ideal scenario where the position deviation is 0, the following relations exist:
  - Pout = Pin: Output position reference count value = Input position reference count value
  - Pin x Electronic gear ratio = Pf: Input position reference count value x Electronic gear ratio = Accumulative pulse feedback
  - Pf x $\triangle$L = PL: Accumulative pulse feedback x Load displacement per position reference = Mechanical stop position
- When inaccurate positioning occurs, check the causes based on the following steps:
  - Pout $\neq$ Pin
    Fault cause: A

    To rectify cause A, 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:
  Fault cause: B

  To rectify cause A, 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:
  Fault cause: C

  To rectify cause C, check mechanical connections and find the sliding position.

## Speed Control Mode

| Start Process | Fault | Cause | Troubleshooting |
|---|---|---|---|
| Turn on the control power (L1C, L2C)<br>Main power supply (L1, L2)<br>(L1, L2, L3)<br>(R, S, T) | The LED neither lights up nor displays "rdy". | 1. The voltage of the control circuit power supply is abnormal. | The fault persists though CN1, CN2, CN3, and CN4 are disconnected.<br>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 235V, the keypad displays "nrd".<br>• 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 451V, the keypad displays "nrd". |
| | | 3. The programming terminal is shorted. | Check whether the programming terminal is shorted. |
| | | 4. The servo drive is faulty. | - |
| | The keypad displays "Exxx.x". | Rectify the fault causes according to "*Solutions to Warnings*" *on page 627* and "*17.5.1 Solutions to Faults*" *on page 638*. | |
| | The keypad displays "rdy" after preceding faults are cleared. | | |
| Switching on the S-ON signal<br>(S-ON signal switched on) | The keypad displays "Exxx.x". | Rectify the fault causes according to "*Solutions to Warnings*" *on page 627* and "*17.5.1 Solutions to Faults*" *on page 638*. | |
| | The servo motor shaft is in the free running state. | 1. The S-ON signal is inactive. | Switch the keypad display to the servo status interface and view whether the keypad displays "rdy" instead of "run".<br>• Check parameters in groups H03 or H17 to see whether FunIN.1 (S-ON) is assigned to a DI. If FunIN.1 is assigned, check whether the corresponding DI logic is active. If FunIN.1 is not assigned, assign FunIN.1 to a DI and activate the logic of this DI. For how to assign FunIN.1 to a DI, see "*16.4 Parameter Group H03*" *on page 575* and "*16.17 Parameter Group H17*" *on page 612*.<br>• 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. The control mode is wrong. | Check whether H02.00 (Control mode selection) is set to 0 (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. |
| | The keypad displays "run" after preceding faults are cleared. | | |

| Start Process | Fault | Cause | Troubleshooting |
|---|---|---|---|
| Inputting speed references | The servo motor does not rotate or the motor speed is incorrect. | The speed reference (H0b.01) is 0. | • The speed reference selected is wrong. Check whether H06.02 (Speed reference selection) is set correctly.<br>• No speed reference is inputted or the speed reference is abnormal.<br>• When the speed reference is set through the keypad, check whether H06.03 (Speed reference set through keypad) is set correctly.<br>• When the speed reference is set through multi-speed references, check whether parameters in group H12 are set correctly.<br>• When the speed reference is set through communication, check whether H31.09 (Speed reference set through communication) is set correctly.<br>• When the speed reference is set through jog speed references, check whether H06.04 (Jog speed) is set correctly and whether FunIN.18 (JOGCMD+, forward jog) and FunIN.19 (JOGCMD, reverse jog) are assigned to DIs and whether the DI logics are active.<br>• Check whether H06.05 (Acceleration time constant of speed reference) and H06.06 (Deceleration time constant of speed reference) are set correctly.<br>• Check whether the FunIN.12 (ZCLAMP, zero clamp) is mis-assigned and whether the active logic of the corresponding DI is correct. |
| Inputting speed references | The servo motor rotates in the reverse direction. | Speed reference (H0b.01) is negative. | • When the speed reference is set through the keypad, check whether the value of H06.03 (Speed reference set through keypad) is lower than 0.<br>• When the speed reference is set through multi-speed references, check the sign (+/-) of each speed reference value in group H12.<br>• When the speed reference is set through communication, check whether the value of H31.09 (Speed reference set through communication) is lower than 0.<br>• When the speed reference is set through jog speed references, check whether the value of H06.04 (Jog speed) and the active logics of FunIN.18 (JOGCMD+, forward jog) and FunIN.19 (JOGCMD-. reverse jog) match the desired direction of rotation.<br>• Check whether FunIN.26 (SpdDirSel, speed reference direction selection) is assigned to a DI and whether the logic of the DI is active.<br>• Check whether H02.02 (Direction of rotation) is set properly. |
| | The servo motor can rotate after preceding faults are cleared. | | |
| Rotating unstably at low speed | The motor speed is unstable during low-speed operation. | Gains are set improperly. | See section Adjustments for automatic gain adjustment. |
| | The motor shaft vibrates leftward and rightward. | The load moment of inertia ratio (H08-15) is too high. | If the motor can operate safely, perform inertia auto-tuning again according to section Adjustment.<br>See section Adjustments for automatic gain adjustment. |

## Torque control mode

| Start Process | Fault | Cause | Troubleshooting |
|---|---|---|---|
| Switch on the control power supply (L1C, L2C)<br>Main power supply<br>(L1, L2)<br>(L1, L2, L3)<br>(R, S, T) | The LED neither lights up nor displays "rdy". | 1. The voltage of the control circuit power supply is abnormal. | The fault persists though CN1, CN2, CN3, and CN4 are disconnected.<br>Measure the AC voltage between L1C and L2C. |
| | | 2. The voltage of the main circuit power supply 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 235V, the keypad displays "nrd".<br>• 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 451V, the keypad displays "nrd". |
| | | 3. The programming terminal is shorted. | Check whether the programming terminal is shorted. |
| | | 4. The servo drive is faulty. | - |
| | The keypad displays "Exxx.x". | Rectify the fault causes according to *"Solutions to Warnings" on page 627* and *"17.5.1 Solutions to Faults" on page 638*. | |
| | The keypad displays "rdy" after preceding faults are cleared. | | |
| Switching on the S-ON signal<br>(S-ON signal switched on) | The keypad displays "Exxx.x". | Rectify the fault causes according to *"Solutions to Warnings" on page 627* and *"17.5.1 Solutions to Faults" on page 638*. | |
| | The servo motor shaft is in the free running state. | The S-ON signal is inactive. | • Switch the keypad display to the servo status interface and view whether the keypad displays "rdy" instead of "run".<br>• Check parameters in groups H03 or H17 to see whether FunIN.1 (S-ON) is assigned to a DI. If FunIN.1 is assigned, check whether the corresponding DI logic is active. If FunIN.1 is not assigned, assign FunIN.1 to a DI and activate the logic of this DI. For how to assign FunIN.1 to a DI, see *"16.4 Parameter Group H03" on page 575* and *"16.17 Parameter Group H17" on page 612*.<br>• 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. |
| | The keypad displays "run" after preceding faults are cleared. | | |
| Input torque reference | The servo motor does not rotate. | The internal torque reference (H0b.02) is 0. | The torque reference selected is wrong.<br>Check whether H07.02 (Torque reference source) is set correctly.<br>No torque reference is inputted.<br>• When the torque reference is set through the keypad, check whether H07.03 (Torque reference set through keypad) is set to 0.<br>• When the torque reference is set through communication, check whether H31.11 (Torque reference set through communication) is set to 0. |
| | The servo motor rotates in the reverse direction. | The value of the internal torque reference (H0b.02) is a negative number. | • When the speed reference is set through the keypad, check whether the value of H07.03 (Speed reference set through keypad) is lower than 0.<br>• When the torque reference is set through communication, check whether the value of H31.11 (Torque reference set through communication) is lower than 0.<br>• Check whether FunIN.25 (ToqDirSel, speed reference direction selection) is assigned and whether the corresponding DI logic is active.<br>• Check whether H02.02 (Direction of rotation) is set properly. |
| | The servo motor can rotate after preceding faults are cleared. | | |

| Start Process | Fault | Cause | Troubleshooting |
|---|---|---|---|
| Rotating unstably at low speed | The motor speed is unstable during low-speed operation. | Gains are set improperly. | Perform gain auto-tuning. |
| | The motor shaft vibrates leftward and rightward. | The load moment of inertia ratio (H08.15) is too high. | If the servo motor can operate safely, perform inertia auto-tuning again.<br>Perform gain auto-tuning. |

## 17.3 Reset Method After Troubleshooting

Faults and warnings of the servo drive are divided into three levels based on severity: No. 1 > No. 2 > No. 3, as shown below.

- No. 1 non-resettable fault
- No. 1 resettable fault
- No. 2 resettable fault
- No. 3 resettable warning

***Note***

"Resettable" means the keypad stops displaying the fault/warning once a "Reset signal" is input.

Operating procedure:

- To stop the keypad from displaying the fault/warning, set H0d.01 (Fault reset) to 1 or activate the DI terminal assigned with DI function 2 (FunIN.2: ALM- RST, fault and warning reset).
- To reset No. 1 and No. 2 faults, switch off the S-ON signal, and then set H0d.01 to 1 or activate the DI terminal allocated with DI function 2.
- To reset No. 3 warnings, set H0d.01 to 1 or activate the DI terminal allocated with DI function 2.

***Note***

- Some faults and warnings can be reset only after the fault causes are rectified by modifying the settings. However, a reset operation does not necessarily activate the modifications to settings.
- For modifications activated at next power-on (R, S, T/L1C, L2C powered on again), perform a power cycle.
- For modifications activated after stop, switch off the S-ON signal. The servo drive can operate normally only after modifications are activated.

☆Related function No.

| Start Process | Fault Symptom | Cause | Check method |
|---|---|---|---|
| FunIN.2 | ALM-RST | Fault/Warning reset signal | The servo drive may, depending on the warning types, continue running after warning reset. When FunIN.2 is assigned to a low-speed DI, the effective level change of this DI must be kept for more than 3 ms. Otherwise, fault reset will be inactive. Do not assign FunIN.2 to a high-speed DI. Otherwise, fault/warning reset will be inactive.<br>• Inactive: Not resetting the fault/warning<br>• Active: Resetting the fault/warning |

## 17.4 Description of Warning Codes

- E108.0: Parameter write error

  Description:

  Parameter values cannot be written to EEPROM.

| Cause | Troubleshooting | Solution |
|---|---|---|
| An error occurs during parameter-writing. | Modify a certain parameter, power off and on the servo drive again and check whether the modification is saved. | If the modification is not saved and the fault persists after the servo drive is powered off and on repeatedly, replace the servo drive. |

- E108.1: Parameter read error

  Description:

  Parameter values cannot be read from EEPROM.

| Cause | Troubleshooting | 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 modification is saved. | If the modification is not saved and the fault persists after the servo drive is powered off and on repeatedly, replace the servo drive. |

- E108.2: EEPROM write check error

  Description:

  The check on the data written in EEPROM failed.

| Cause | Troubleshooting | Solution |
|---|---|---|
| An error occurs during parameter-writing. | Modify a certain parameter, power off and on the servo drive again and check whether the modification is saved. | If the modification is not saved and the fault persists after the servo drive is powered off and on repeatedly, replace the servo drive. |

- E108.3: EEPROM read check error

  Description:

  The check on the data read in EEPROM failed.

| Cause | Troubleshooting | Solution |
|---|---|---|
| An error occurs during parameter-reading. | Modify a certain parameter, power off and on the servo drive again and check whether the modification is saved. | If the modification is not saved and the fault persists after the servo drive is powered off and on repeatedly, replace the servo drive. |

- E108.4: Single data stored too many times

  Description:

  Single data is stored too frequently.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| That may damage EEPROM over time. | 1 Check H0b.90 and H0b.91. H0b.90 shows the parameter in question or object dictionaries (in hexadecimal). If H0b.91=15, H0b.90 shows internal variables of software.<br>2 Check "Func Test 1" through the oscilloscope channel. Be sure to display it in hexadecimal. This channel displays the address that EEPROM is storing.<br>3 Check the storage count through the oscilloscope channel "Func Test 2". | 1 If the alarm is caused by manually modifying a certain parameter or object dictionary, there will be no frequent storage of a certain data during operation, and you can reset the fault.<br>2 Check the abnormal parameter through H0b. 90 or oscilloscope channel, and find out the cause. For example, if the host controller program frequently writes parameters through SDO, you can modify the program to stop it. |

- E110.0: Frequency-division pulse output setting error

  Description:

  The number of frequency divisions (quadrupled) exceeds the motor revolutions

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The number of frequency divisions (quadrupled) exceeds the motor revolutions | Check the setpoint of H05.17. | Adjust the value of H05.17 on the basis of the motor revolutions. |

- E121.0: Invalid S-ON command

  Description:

  A redundant S-ON signal is sent when some auxiliary functions are used.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The Communication S-ON signal is active when servo drive is enabled internally. | Check whether the following auxiliary functions are used: Check whether DI functions (H0d.02, H0d.03, and H0d.12) are used and whether 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

  Description:

  The motor does not match the absolute position mode or the motor code is set improperly.

| Cause | Troubleshooting | 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.<br>2 Check whether 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

  Description:

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).

| Cause | Troubleshooting | Solution |
|---|---|---|
| The MCU detects excessive pulse increment fed back by FPGA. | When H05.38 is set to 0 (Encoder frequency-division output), check whether the output pulse frequency corresponding to the motor speed upon fault exceeds the limit.<br>Output pulse frequency (Hz) = Motor speed (rpm)/60 x H05.17 | 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. |
| | 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).<br>• High-speed pulse input pins:• open-collector input terminals: PULLHI, PULSE+, PULSE-, SIGN +, SIGN-; single-channel maximum pulse frequency: 200 kpps.<br>• High-speed pulse input pins: differential input terminals: HPULSE+, HPULSE-, HSIGN+, HSIGN-; single-channel maximum pulse frequency: 4 Mpps. | Decrease the input pulse frequency to a value within the frequency upper limit allowed by hardware.<br>**Note:**<br>In this case, if you do not modify the electronic gear ratio, the motor speed will decrease.<br>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 warnings caused by interference pulses superimposed to actual pulse references. |

- E600.0: Inertia auto-tuning failure
  Description:

  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 eccentric. Rectify the mechanical faults.

  A warning occurs during auto-tuning and causes interruption. Rectify the fault causes and perform inertia auto-tuning again.

  The vibration cannot be suppressed if the load carries large inertia. In this case, increase the acceleration/deceleration time to ensure the motor current is unsaturated.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1 Continuous vibration occurs during auto-tuning.<br>2 The auto-tuned values fluctuate dramatically.<br>3 Mechanical couplings of the load are loose or eccentric.<br>4 A warning occurs during auto-tuning and causes interruption.<br>5 The vibration cannot be suppressed if the load carries a large inertia. In this case, increase the acceleration/deceleration time first to ensure the motor current is unsaturated. | • Perform internal inspection to check whether the torque jitters upon stop (not FFT).<br>• Check whether 3 times more than the last auto-tuned value for variation less than 5 times; 0.5 times more than last auto-tuned value for variation above 5 times. | 1 Rectify the fault and perform inertia auto-tuning again.<br>2 For vibration that cannot be suppressed, enable vibration suppression.<br>3 Ensure mechanical couplings are connected securely.<br>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 warning

  Description:

  The homing time exceeds the time set by H05.35.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The home switch is faulty. | There is only high-speed searching but no low-speed searching during homing. After high-speed searching, low-speed searching in the reverse direction applies. | 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 homing time limit is too short. | Check whether the value of H05.35 (Time limit for homing) is too small. | Increase the value of H05.35. |
| 3. The speed in high-speed searching for the home switch signal is too low. | Check the distance between the start position of homing and the home switch. Then check whether the setpoint of 6099-01h is too low, resulting in a long homing process. | Increase the value of 6099-01h. |

- E601.1: Homing switch error

  Description:

  The homing switch is set improperly.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The home switch is set improperly. | Check whether the limit signals at both sides are activated.<br>Check whether the limit signal and the deceleration point signal/home signal are both activated.<br>Check whether the positive and negative position limits are activated successively. | Set the position of the physical switch properly. |

- E601.2: Homing mode setting error
  Description:

  The homing method value is too large.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The homing method value is too large. | Check if the homing method value exceeds the existent homing mode (technology segment homing, H22.70). | Change the value of H22.70. |

- E730.0: Encoder battery warning
  Description:

  The voltage of the absolute encoder battery is lower than 3.0 V.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The voltage of the absolute encoder battery is lower than 3.0 V. | Measure the battery voltage. | Use a new battery with the matching voltage. |

## *Note*

E731.0 and E733.0 can trigger E730.0. See E731.0 and E733.0 for other solutions.

- E731.0: Encoder battery failure
  Description:

  The voltage of the absolute encoder battery is lower than 2.9V.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| 1. The battery is not connected during power-off. | Check whether the battery is connected during power-off. | Set H0d.20 to 1 to clear the fault. |
| 2. The encoder battery voltage is too low. | Measure the battery voltage. | Use a new battery with the matching voltage. |

## *Note*

1. Use H05.31 to first select the homing method, and then perform homing. The warning is automatically cleared after homing is completed.
2. Set H05.30 = 6 to use the current position as the home, and the warning will be cleared immediately.
3. Use DI to configure function 41 (with the current position as the home), and then trigger DI to be active, and the warning is cleared immediately.

- E831.1: AI1 zero offset too large
  Description:

  AI1 zero offset too large.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| 1. The wiring is incorrect or interference exists. | Check the wiring according to the correct wiring diagram. | Use shielded twisted pairs and shorten the circuit length. Increase AI1 input filter time. |
| 2. The servo drive is faulty. | Disconnect AI1 and measure whether the actual terminal voltage exceeds 0.5 V. | If not, replace the servo drive. |

- E834.1: AI1 overvoltage

  Description:

  AI1 overvoltage.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The wiring is incorrect or interference exists. | Check the wiring according to the correct wiring diagram | Use shielded twisted pairs and shorten the circuit length. Increase AI1 input filter time. |
| 2. The input voltage is too high. | Measure whether the actual terminal voltage exceeds 11.5 V. | Adjust the input voltage to a value lower than 11.5 V. |

- E900.0: Emergency braking

  Description:

  The logic of the DI terminal (including the hardware DI and virtual DI) allocated with DI function 34 (FunIN.34) is effective.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The DI function 34 (EmergencyStop) is triggered. | Check whether the logic of the DI allocated with DI function 34 (FunIN.34: Emergency stop) is valid. | Check the operation mode and clear the active DI braking signal without affecting the safety performance. |

- E902.0: DI setting invalid

  Description:

  DI function parameters are set to invalid values.

| Cause | Troubleshooting | Solution |
|---|---|---|
| DI1–DI8 function selections are invalid. | H0b.45=0x 0902, Check whether H03.02, H03.04, H03.06, H03.08, H03.10, H03.12, H03.14, and H03.16 are set to invalid values. | Set DI function parameters to valid values. |

- E902.1: DO setting invalid

  Description:

  DO function parameters are set to invalid values.

| Cause | Troubleshooting | Solution |
|---|---|---|
| DO1–DO5 function selections are invalid. | H0b.45= 0x 1902. Check whether H04.00, H04.02, H04.04, H04.06 and H04.08 are set to invalid values. | Set DO function parameters to valid values. |

- E902.2: Invalid setting for torque reach

  Description:

  The DO parameters set for torque reach in the torque control mode are invalid.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The DO parameters set for torque reach in the torque control mode are invalid. | Check whether the value of H07.22 is lower than or equal to the value of H07.23 (unit: 0.1%). | Set H07.22 to a value higher than that of H07.23. |

- E908.0: Model identification failure

  Description:

  Model identification check code error.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| 1. The model identification check word store in EEPROM is incorrect. | Check whether the warning persists after restart. | Set H01-72 to 1 to disable model identification temporarily. |
| 2. The model parameters are not written in the drive before delivery. | Check whether parameters can be saved to EEPROM. | |

- E909.0: Motor overload warning
  Description:

  Accumulative motor heat exceeds the overload protective warning threshold.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| 1. The motor cables and encoder cable are connected improperly or in poor contact. | Check the wiring among the servo drive, servo motor and the encoder according to the correct wiring diagram. | Connect the cables according to the wiring diagram.<br>It is recommended to use the cables provided by Inovance.<br>When customized cables are used, prepare and connect the customized cables according to the wiring instructions. |
| 2. The load is so heavy that the effective torque outputted by the motor keeps exceeding the rated torque. | Confirm the overload characteristics of the servo drive or motor.<br>Check whether the average load rate (H0b.12) keeps exceeding 100.0%. | Use a servo drive of higher capacity and a matching servo motor.<br>Reduce the load and increase the acceleration/deceleration time. |
| 3. Acceleration/Deceleration is too frequent or the load inertia is too large. | Check the mechanical inertia ratio or perform inertia auto-tuning. View the value of H08.15 (load moment of inertia ratio).<br>Confirm the individual operation cycle when the servo motor operates cyclically. | Increase the acceleration/ deceleration time. |
| 4. Gains are improper or the stiffness level is too high. | Check whether the motor vibrates and generates unusual noise during operation. | Readjust the gain. |
| 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 H01.10. | Read the servo drive nameplate and set the servo drive model (H01.10) and motor model properly. |

| Cause | Troubleshooting | Solution |
|---|---|---|
| 6. The motor is stalled due to mechanical factors, resulting in overload during operation. | Check the running reference and motor speed (H0b.00) through Inovance servo commissioning software or keypad:<br>• References in the position control mode: H0b.13 (Input position reference counter)<br>• References in the speed control mode: H0b.01 (Speed reference)<br>• References in the torque control mode: H0b.02 (Internal torque reference)<br>Check whether the reference value is not 0 or is very large but the motor speed is 0 RPM in the corresponding mode. | Rectify the mechanical-related problem. |
| 7. The servo drive is faulty. | Power off and on the servo drive. | Replace the servo drive. |

- E910.0: Control circuit overvoltage
  Description:

  Overvoltage occurred on the control circuit of the drive.

| Cause | Troubleshooting | Solution |
|---|---|---|
| Overvoltage occurred on the control circuit of the drive. | 1 Measure whether the input voltage in the control circuit cable is within the following range:220 V servo drive:Value range: 220 V to 240 V Allowable deviation: –10% to +10% (198 V to 264 V)380V servo drive:Value range: 380V to 440VAllowable deviation: –10% to +10% (342 V to 484 V)<br>2 Check whether control circuit cables are connected properly and whether the voltage of control circuit cables (L1C, L2C) is within the specified range. | Re-connect or replace the cables. |

- E920.0: Regenerative resistor overload
  Description:

  The accumulative heat of the regenerative resistor exceeds the set value.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The external regenerative resistor is connected improperly or disconnected. | Remove the external regenerative resistor and measure whether its resistance is "∞" (infinite). Measure whether the resistance between terminals P⊕ and C is "∞" (infinite). | Replace with a new external regenerative resistor. After confirming the resistance measured is the same as the nominal value, connect it between terminals P⊕ and C. |
| | | Connect the external regenerative resistor between terminals P⊕ and C with a proper cable. |
| 2. The jumper between terminals P⊕ and D is shorted or disconnected when the built-in regenerative resistor is used. | Measure whether the resistance between terminals P⊕ and D is "∞" (infinite). | Ensure terminals P⊕ and D are jumpered. |
| 3. H02.25 (Regenerative resistor type) is set improperly when an external regenerative resistor is used. | • Check the setpoint of H02.25.<br>• Measure the resistance of the external regenerative resistor connected between P⊕ and C. Check whether the resistance measured is too large by comparing it with the value listed in Table "Specifications of the regenerative resistor".<br>• Check whether the value of H02.27 is larger than the resistance of the external regenerative resistor connected between terminals P⊕ and C. | Set H02.25 correctly.<br>H02.25 = 1 (external, naturally ventilated)<br>H02.25 = 2 (external, forced-air cooling) |
| 4. The resistance of the external regenerative resistor is too large. | | Select a proper braking resistor according to *"2.2.1 Electrical Specifications" on page 33*. |
| 5. The setpoint of H02.27 (Resistance of external regenerative resistor) is higher than the resistance of the external regenerative resistor used. | | Set H02.27 according to the resistance of the external regenerative resistor used. |
| 6. The input voltage of the main circuit is beyond the specified range. | Check whether the input voltage of the main circuit cable on the drive side is within the following range:<br>• 220 V servo drive:• Value range: 220 V to 240 V• Allowable deviation: –10% to +10% (198 V to 264 V)<br>• 380V servo drive:• Value range: 380V to 440V• Allowable deviation: –10% to +10% (342V to 484V) | Replace or adjust the power supply according to the specified range. |

| Cause | Troubleshooting | Solution |
|---|---|---|
| 7. The load moment of inertia ratio is too large. | Perform moment of inertia auto-tuning according to section Inertia Auto-tuning or calculate the total mechanical inertia based on mechanical parameters.<br>Check whether the actual load inertia ratio exceeds 30. | • Select an external regenerative resistor with large capacity and set H02.26 to a value consistent with the actual power.<br>• Select a larger servo drive.<br>• Reduce the load if allowed.<br>• Increase the acceleration/ deceleration time if allowed.<br>• Increase the motor operation cycle if allowed. |
| 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. | View the motor speed curve in cycle running and check whether the motor is in deceleration status for a long period. | |
| 9. The capacity of the servo drive or the regenerative resistor is insufficient. | View the motor's single cycle speed curve and calculate whether maximum braking energy can be absorbed completely. | |
| 10. The servo drive is faulty. | - | Replace the servo drive. |

- E922.0: Resistance of the external regenerative resistor too small
  Description:

  The value of H02.27 (resistance of external regenerative resistor) is lower than the value of H02.21 (permissible min. resistance of external regenerative resistor).

| Cause | Troubleshooting | Solution |
|---|---|---|
| When an external regenerative 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 whether the resistance of the external regenerative resistor between terminals P⊕ and C is lower than the value of H02.21 (Permissible minimum resistance of regenerative resistor). | • 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.<br>• If not, set H02.27 to a value consistent with the resistance of the external regenerative resistor used. |

- E924.0: Regenerative transistor overtemperature
  Description:

  The estimated temperature of the regenerative transistor is higher than H0A.18 (IGBT overtemperature threshold).

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The junction temperature of the braking is too high.<br>2. The regenerative transistor will be turned off automatically after overload occurs. | The regenerative transistor temperature exceeds the threshold defined by H0A.49. | Control the working conditions and usage of the regenerative transistor. |

- E941.0: Parameter modifications activated at next power-on
  Description:

  The parameters modified are those whose "Effective time" is "Next power-on".

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The parameters modified are those whose "Effective time" is "Next power-on". | Check whether parameters you modified are those whose "Effective Time" is "Next power-on". | Power off and on the servo drive again. |

- E942.0: Parameter saved frequently
  Description:

  The number of parameters modified at a time exceeds 200.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| Too many 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 to EEPROM, set H0C.13 to 0. |

- E950.0: Forward overtravel warning
  Description:

  The logic of the DI terminal allocated with DI function 14 (FunIN.14: P-OT, positive limit switch) is effective.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| 1. The logic of the DI assigned with FunIN.14 (P-OT function 14, positive limit switch) is effective. | • Check whether a certain DI in group H03 is assigned with FunIN.14.<br>• Check whether the logic of DI corresponding to the bit of H0b.03 (Monitored DI status) is effective. | Check the running mode. On the prerequisite of safety, send a reverse command or rotate the motor to deactivate the logic of the DI terminal allocated with DI function 14. |
| 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.<br>Check whether the software position limit is set in H0A.40. | Check if the motor stroke needs to exceed the forward soft limit. If so, adjust the forward soft limit value; If not, adjust the motor stroke. |

- E952.0: Reverse overtravel warning
  Description:

  The logic of the DI terminal allocated with DI function 15 (FunIN.15: N-OT, negative limit switch) is effective.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| 1. The logic of the DI assigned with FunIN.15 is effective. | • Check whether a certain DI in group H03 is assigned with FunIN.15.<br>• Check whether the logic of DI corresponding to the bit of H0b.03 (Monitored DI status) is effective. | Check the operation mode. On the prerequisite of ensuring safety, send a forward run command or rotate the motor to deactivate the logic of DI assigned with FunIN.15. |
| 2. The servo position feedback reaches the negative software position limit. | Check whether the position feedback (H0b.17) is close to the value of H0A.43.<br>Check whether the software position limit is set in H0A.40. | Check if the motor stroke needs to exceed the reverse soft limit. If so, adjust the reverse soft limit value; If not, adjust the motor stroke. |

- E980.0: Encoder algorithm error
  Description:

An encoder algorithm error occurs.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| An encoder algorithm error occurs | 1 Check the wiring<br>2 If the servo drive is powered off and on several times but the warning is still reported, it indicates that the encoder is faulty. | Replace the servo motor. |

- E990.1: Pulse input overspeed warning
  Description:

  Pulse input overspeed warning.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| Pulse input overspeed warning | Check if the input pulse frequency is too high. | Reduce the frequency below 4M. |

- EA41.0: Torque fluctuation compensation failure
  Description:

  The torque compensation fails.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| Auto-tuning torque fluctuation compensation failure | - | Turn off the torque fluctuation compensation function. |

# 17.5 Description of Fault Codes

## 17.5.1 Solutions to Faults

- E101.0: Abnormal parameters in groups H02 and above
  Cause:

  The total number of parameters changes, which generally occurs after software update.

  Values of parameters in groups H02 and above exceed the limit, which generally occurs after software update.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The voltage of the control circuit power supply drops instantaneously. | 1. Check whether the control circuit (L1C, L2C) is in the process of power-off or instantaneous power failure occurs. | Restore system parameters to default settings (H02.31 = 1) and write parameters again. |
| | 2. Measure whether the input voltage of the control circuit cable on the non-drive side is within the following range:<br>220 V servo drive:<br>Value range: 220 V to 240 V<br>Allowable deviation: –10% to +10% (198 V to 264 V)<br>380V servo drive:<br>Value range: 380V to 440V<br>Allowable deviation: –10% to +10% (342 V to 484 V) | Increase the power supply capacity or replace with a power supply of higher capacity. Restore system parameters to default settings (H02.31 = 1), and write parameters again. |
| 2. Instantaneous power failure occurs when saving parameters. | Check whether instantaneous power failure occurs when saving parameters. | Power on the system again, restore system parameters to default settings (H02.31 = 1), and write parameters again. |
| 3. The number of write operations within a certain period of time exceeds the limit. | 1 Check whether instantaneous power failure occurs when saving parameters.<br>2 Check whether parameters are updated frequently through the host controller. | 1 Power on the system, restore default settings (H02-31 = 1) and write parameters again.<br>2 Change the parameter writing method and write parameters again.<br>If the servo drive is faulty, replace it. |
| 4. The software is updated. | Check whether parameter values in group H02 and above exceed the upper/lower limit due to software update. | Reset the servo drive model and servo motor model, and restore system parameters to default settings (H02.31 = 1). |
| 5. The servo drive is faulty. | If the fault persists though parameters are restored to default settings and the servo drive is powered off and on repeatedly, the servo 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 exceed the limit, which generally occurs after software update.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The servo drive detects whether parameter values in groups H00 and H01 exceed the upper/lower limit during initialization upon power-on. | Check groups H00 and H01 to find the parameter whose value exceeds the limit. Confirm whether this parameter range is abnormal. | Set the servo drive model (H01.10) to a wrong value first and perform a power cycle, and then set the servo drive model to the correct value and perform a power cycle. |

- 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.

| Cause | Troubleshooting | Solution |
|---|---|---|
| Address error in read/write operation after the number of parameters changes. | Read H0b.90 and H0b.91 and obtain the abnormal parameter group number. | Rectify the wrong values value or restore the factory settings. |

- E101.9: Parameter attribute initialization check error
  Cause:

  Parameter attribute initialization check error.

| Cause | Troubleshooting | Solution |
|---|---|---|
| Parameter attribute initialization check error | Check that H0A.99 = AA5C. | If the problems persists after the servo drive is powered off and on several times, replace the servo drive. |

- E102.0: FPGA communication establishment error
  Cause:

  The communication between MCU and FPGA cannot be established.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The communication between MCU and FPGA cannot be established. | The fault persists after the servo drive is powered off and on repeatedly. | Replace the servo drive. |

- E102.1: FPGA initialization start error
  Cause:

  FPGA failed.

| Cause | Troubleshooting | Solution |
|---|---|---|
| FPGA cannot start. | The fault persists after the servo drive is powered off and on repeatedly. | Replace the servo drive. |

- E102.8: FPGA and MCU version mismatch
  Cause:

  FPGA and MCU version mismatch.

| Cause | Troubleshooting | Solution |
|---|---|---|
| FPGA and MCU version mismatch | • Check whether the MCU version (H01.00) is 9xx.x (the fourth digit displayed on the keypad is 9).<br>• 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 running timeout (MCU break down)
  Cause:

  MCU Access timeout (MCU break down).

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The MCU failed.<br>2. Real-time communication error between MCU and FPGA. | The fault persists after the servo drive is powered off and on repeatedly. | Replace the servo drive. |

- E104.2: FPGA running timeout (FPGA break down)
  Cause:

  FPGA running timeout (FPGA break down).

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1.FPGA failure<br>2. FPGA and MCU communication handshaking error | The fault persists after the servo drive is powered off and on repeatedly. | Replace the servo drive. |

- E104.4: MCU command 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, a warning will be reported.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The system reports that the encoder communication time is set improperly or the command calculation time is too long. | The fault persists after the servo drive is powered off and on repeatedly. | 1 Hide unnecessary functions.<br>2 Replace the servo drive. |

- E120.0: Unknown encoder model
  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.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The product (motor or servo drive) code does not exist. | Read the nameplates of the servo drive and motor to check whether SV630P series servo drive and 18-bit servo motor are used. Meanwhile, check whether H00.00 (motor code) is set to 14101. | If the motor code is unknown, set H00.00 to 14101 when the SV630P series servo drive and 18-bit servo motor are used. |
| | Check the servo drive code (H01.02) to see whether this servo drive code exists. | If the drive code is absent, set the servo drive model correctly according to the nameplate. |
| 2. The power rating of the motor does not match that of the servo drive. | Check whether the servo drive code (H01.02) matches the serial-type motor code (H00.05). | Replace the unmatched products. |
| The encoder is not matched. | Check whether the encoder model is correct. | Rectify the motor code. |

- E120.1: Unknown motor model
  Cause:

  The servo drive detects the motor model defined by H00.00 during initialization upon power-on. If the motor model does not exist, E120.1 occurs.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The motor model (H00.00) is set improperly. | Check whether the value of H00.00 matches the used motor. | Rectify the value of H00.00. |

- E120.2: Unknown drive model
  Cause:

  The servo drive detects the servo drive model defined by H01.10 during initialization upon power-on. If the servo drive model does not exist, E120.2 occurs.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The servo drive model (H01.10) is set improperly. | Check the value of H01.10. | Disable servo drive model auto detection and set H01.10 to a proper value manually.. |

- E120.5: Motor and drive current mismatch
  Cause:

  The rated output of the servo drive is far higher than the rated current of the motor. You must use a servo drive of lower rated output or a motor with higher rated current.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The internal scale value is abnormal. | Check whether the servo drive model is correct. If the set current sampling coefficient is too large, calculation overflow will occur. | Replace the servo drive. |

- E120.6: FPGA and motor model mismatch
  Cause:

  - The motor model is set improperly, causing mismatch and malfunction of the servo drive.
  - The motor model is set properly, but the motor encoder is not supported by the servo drive.

| Cause | Troubleshooting | Solution |
|---|---|---|
| FPGA software version and H00.00 mismatch | Check whether the FPGA software version (H01.01) supports the motor model set by H00.00. | Update the FPGA software to support the motor model motor. |

- E120.7: Model check error
  Cause:

  The servo drive model parameter cannot be identified.

| Cause | Troubleshooting | Solution |
|---|---|---|
| Model parameter CRC check failed | Check that the model parameter is present. | Write the model parameter again. |

- E120.8: Junction temperature parameter check error
  Cause:

  The junction temperature parameter is identified incorrectly.

| Cause | Troubleshooting | Solution |
|---|---|---|
| Junction temperature parameter CRC check failed | Check that the junction temperature parameter is present | Rewrite the junction temperature parameter. |

- E122.1: Different DIs assigned with the same function
  Cause:

  The same function is assigned to different DIs.

The DI function No. exceeds the maximum number allowed for DI functions.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. Multiple DIs are assigned with the same function. | Check whether DI function numbers set in group H03 are repetitive. | Change any repetitive number. |
| 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. |

- E122.2: Different DOs assigned with the same function
  Cause:

  The DO function No. exceeds the maximum number allowed for DO functions.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The DO function No. exceeds the maximum number allowed for DO functions | Check the DO function numbers defined by H04.00, H04.02 and H04.04. | Set the correct DO function No. |

- E122.3: Upper limit in the rotation mode invalid
  Cause:

  The upper limit (reference range) of the mechanical single-turn position exceeds $2^{31}$ in the absolute position rotation mode.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The upper limit of the mechanical single-turn position exceeds 231. | Check the setting of the mechanical gear ratio, the upper limit of mechanical single-turn position and the electronic gear ratio when the servo drive runs in the absolute rotation mode (H02.01 = 2). | Reset the mechanical gear ratio, the upper limit of mechanical single-turn position and the electronic gear ratio to ensure the upper limit of the mechanical single-turn position (reference range) does not exceed $2^{31}$. |

- E122.4: Different VDIs assigned with the same function
  Cause:

  The same function is assigned to different VDIs. The VDI function No. exceeds the maximum number allowed for VDI functions.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. Two or more VDIs are assigned with the same function No. | Check whether DI function numbers set in group H17 are repetitive. | Change any repetitive number. |
| 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 to different VDIs. The VDI function No. exceeds the maximum number allowed for VDI functions.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. 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. | 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. |

- E136.0: Encoder ROM motor parameter check error
  Cause:

  When reading parameters in the encoder ROM, the servo drive detects that no parameters are saved there or parameter values are inconsistent with the setpoints.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The servo Servo drive model does not match the motor model. | View the servo drive and servo motor nameplates to check whether the SV630P 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 ROM of the serial incremental encoder. | 1 Check whether the encoder cable provided by Inovance is used. For cable specifications, see "Matching Cables". The cable must be connected securely without scratching, breaking or poor contact.<br>2 Measure signals PS+, PS-, +5V and GND on both ends of the encoder cable and observe whether signals at both ends are consistent. For signal assignment, see Chapter "Wiring" in SV680P Series Servo Drive 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.<br>2 Route encoder cables and power cables (R/S/T, U/V/W) through different routes. |
| 3. The servo drive is faulty. | The fault persists after the servo drive is restarted. | Replace the servo drive. |

- 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.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The encoder cable connections are incorrect or loosened. | Check the encoder cable connection. Check whether ambient vibration is too large, which loosens the encoder cable and even damages the encoder. | Connect the cables again according to the correct wiring diagram. Connect the cables again and ensure encoder terminals are connected securely. |
| 2. The servo drive is faulty. | The fault persists after the servo drive is restarted. | Replace the servo drive. |

- E150.0: STO safety state applied
  Cause:

  The STO input protection applies (safety state).

| Cause | Troubleshooting | Solution |
|---|---|---|
| Two 24 V inputs are disconnected simultaneously, triggering the STO function. | 1. Check whether the STO function is activated. | There is no need to take any corrective actions. After the STO terminal is back to normal, clear the fault using the fault reset function. |
| | 2. Check whether the STO power supply is normal. | Check whether the 24 V power supply for the STO is stable. Tighten the cables that are loose or disconnected. |
| | 3. The fault persists after preceding causes are rectified. | Replace the servo drive. |

- E150.1: STO input state abnormal
  Cause:

  The single-channel input of STO is ineffective.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The STO power supply is abnormal. | Check whether the STO power supply is normal. | Check whether the 24 V power supply for the STO is stable. Tighten the cables that are loose or disconnected. |
| 2. The STO input resistor is abnormal. | After STO is triggered, only one STO signal is sent to MCU after the 24 V power supply is cut off due to input resistor drift. | Replace the servo drive. |
| 3. STO is ineffective | The fault persists after preceding causes are rectified. | Replace the servo drive. |

- E150.2: Buffer 5 V voltage detection error
  Cause:

  The MCU monitors the 5 V power supply of the PWM Buffer to detect whether overvoltage or undervoltage occurs. If the voltage is abnormal, E150.2 occurs.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The 5 V voltage supplied to the STO Buffer is abnormal due to undervoltage or overvoltage. | Check whether the fault can be removed by a restart. If not, the 5V voltage supplied to the Buffer is abnormal. | Replace the servo drive. |

- E150.3: STO input circuit hardware diagnosis failure
  Cause:

  Short circuit occurs on the optocoupler of the upstream hardware circuit of STO.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The upstream optocoupler of STO1 or STO2 failed. | The fault persists when the 24 V power supply is powered off and on again. The drive displays E150.3. | Replace the servo drive. |

- E150.4: PWM buffer hardware diagnosis failure
  Cause:

  An error occurs on the PWM Buffer integrated circuit during initialization detection upon power-on (the PWM signal cannot be blocked).

| Cause | Troubleshooting | Solution |
|---|---|---|
| STO Buffer power-on test error | The fault persists when the 24 V power supply is powered off and on again. The drive displays E150.4. | Replace the servo drive. |

- E201.0: Phase-P overcurrent
  Cause:

  An excessively high current flows through the positive pole of the DC-AC circuit.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. Gains are set improperly, leading to motor oscillation. | Check whether vibration or sharp noise occurs during start and operation of the motor, or view "Current feedback" in the software tool. | 1 Motor parameters are set improperly, modify motor parameter values.<br>2 Current loop parameters are set improperly, modify current loop parameter values.<br>3 Speed loop parameters are set improperly, leading to motor oscillation.<br>4 Servo drive operates improperly. Replace it. |
| 2. 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.<br>2 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. | Re-solder, tighten or replace the encoder cable. |
| 3. Overcurrent occurs on the regenerative resistor. | Check whether resistance of the external regenerative resistor is too small or the regenerative resistor is short-circuited (between terminals P, C). | Use a regenerative resistor of matching resistance. Perform wiring again. |
| 4. The servo drive is faulty. | Disconnect the motor cable but the fault persists after the servo drive is powered off and on again. | Replace the servo drive. |

- E201.1: Phase-U overcurrent
  Cause:

  A current higher than the threshold is collected in the phase-U current.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. Motor cables are in poor contact. | Check whether the servo drive power cables and motor cables on the U, V, and W sides of the servo drive are loose. | Tighten the cables that are loose or disconnected. |
| 2. The motor cables are grounded. | After confirming the servo drive power cables and motor cables are connected properly, measure whether the insulation resistance between the servo drive U/V/W side and the PE cable is at MΩ level. | Replace the motor in case of poor insulation. |

| Cause | Troubleshooting | Solution |
|---|---|---|
| 3. U/V/W cables of the motor are short-circuited. | Disconnect the motor cables and check whether short circuit occurs among U, V, and W phases and whether burrs exist in the wiring. | Connect the motor cables correctly. |
| 4. The motor is damaged. | 1 Disconnect motor cables and check whether short circuit occurs among motor U/V/W cables and whether burrs exist in the wiring.<br>2 Disconnect the motor cables and measure whether the resistance among UVW phases of motor cables is balanced. | 1 Connect the motor cables correctly.<br>2 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.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. Motor cables are in poor contact. | Check whether the servo drive power cables and motor cables on the U, V, and W sides of the servo drive are loose. | Tighten the cables that are loose or disconnected. |
| 2. The motor cables are grounded. | After confirming the servo drive power cables and motor cables are connected properly, measure whether the insulation resistance between the servo drive U/V/W side and the PE cable is at MΩ level. | Replace the motor in case of poor insulation. |
| 3. U/V/W cables of the motor are short-circuited. | Disconnect the motor cables and check whether short circuit occurs among U, V, and W phases and whether burrs exist in the wiring. | Connect the motor cables correctly. |
| 4. The motor is damaged. | 1 Disconnect motor cables and check whether short circuit occurs among motor U/V/W cables and whether burrs exist in the wiring.<br>2 Disconnect the motor cables and measure whether the resistance among UVW phases of motor cables is balanced. | 1 Connect the motor cables correctly.<br>2 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.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. Gains are set improperly, leading to motor oscillation. | Check whether vibration or sharp noise occurs during start and operation of the motor, or view "Current feedback" in the software tool. | Adjust the gains. |
| 2. The encoder cable is aged or corroded, or connected incorrectly or loosely. | Check whether the encoder cable provided by Inovance is used and whether the cable is aging, corroded, or connected loosely. | Re-solder, tighten or replace the encoder cable. |
| 3. Overcurrent occurs on the regenerative 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 regenerative resistor of matching resistance. Perform wiring again. |
| 4. Overcurrent is caused by the superposition of the braking current and phase current. | Check if the drive accelerates abruptly during braking. Check if the voltage feedback exceeds the release threshold through the Inovance drive commissioning platform, and if the torque command 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 cable but the fault persists after the servo drive is powered off and on again. | Replace the servo drive. |

- E208.2: Encoder communication timeout
  Cause:

  The servo drive fails to receive the data fed back by the encoder in three consecutive cycles.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The servo drive fails to receive the data fed back by the encoder in three consecutive cycles. | 1 Check bit12 of H0b.30.<br>2 The encoder cable is connected improperly.<br>3 The encoder cable is connected loosely.<br>4 The encoder cable is too long.<br>5 The encoder communication is being disturbed.<br>6 The encoder is faulty. | 1 Check whether the motor model is correct.<br>2 Check whether the encoder cable is proper.<br>3 Check whether the encoder version (H00.04) is set properly.<br>4 The servo drive operates improperly. Replace it. |

- E208.4: FPGA current loop operation timeout
  Cause:

  The operating time of the current loop exceeds the interval threshold.

| Cause | Troubleshooting | 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 short-circuited to ground

  Cause:

  An abnormal motor phase current or bus voltage is detected during power-on self-testing.

  - The DC bus voltage exceeds the braking threshold.
  - The U-phase current of SIZE C/D/E is greater than the setpoint.
  - Overcurrent occurs on phase-P and phase-N of servo drives in SIZE A and B.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. 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. |
| 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 servo 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 phase-to-ground detection. | Check whether the motor is in the generating status during power-on. | Reduce the motor speed. |

- E234.0: Runaway

  Cause:

  The torque reference direction is in reverse to the speed feedback direction in the torque control mode.

  The speed feedback direction is in reverse to the speed reference direction in the position or speed control mode.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The phase sequence of the U, V, and W cables is incorrect. | Check whether the servo drive power cables are connected in the correct sequence at both ends. | Connect the U, V, and W cables according to correct phase sequence. |
| The interference signal causes an error in the initial phase detection of the motor rotor upon power-on. | The U/V/W phase sequence is correct, but E234.0 occurs when the servo drive is enabled. | Power off and on the servo drive again. |
| 3. The encoder model is wrong or the encoder is wired improperly. | View the servo drive and servo motor nameplates to check whether the devices used are Inovance SV630P series servo drive and 18-bit servo motor. | Replace with a mutually-matching servo drive and servo motor. For use of of SV630P series servo drive and 18-bit servo motor, set H00.00 to 14101. Check the motor model, encoder type, and encoder cable connection again. |

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| 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.<br>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. 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. |
| 6. The gravity load in vertical axis applications is too large. | Check whether the load of the vertical shaft is too large. Adjust brake parameters H02.09...H02.12 and check whether the fault is cleared. | Reduce the load of the vertical axis, increase the stiffness level, or hide this fault without affecting the safety performance and normal use. |

- E320.0: Regenerative resistor overload

  Cause:

  The regenerative resistor is overloaded.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The accumulative heat of the regenerative resistor exceeds the maximum thermal capacity of the regenerative resistor. | Check whether the value of H0b.67 exceeds 100%. | 1 Check if large regenerative current is present due to high bus voltage.<br>2 Ensure that the motor cannot be driven reversely.<br>3 Replace the servo drive. |

**Caution**

In applications where the motor drives a vertical axis or is driven by the load, set H0A.12 to 0 to hide the runaway fault.

- E400.0: Main circuit overvoltage

  Cause:

  The DC bus voltage between P⊕ and N⊖ exceeds the overvoltage threshold.

  220 V servo drive: Normal value: 310 V Overvoltage threshold: 420 V

  380 V servo drive: Normal value: 540 V Undervoltage threshold: 760 V

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The voltage input to the main circuit is too high. | Check the power input specifications of the servo drive and measure whether the voltage input to main circuit cables (R/S/T) on the drive side is within the following range:<br>220 V servo drive:<br>Effective value: 220 V to 240 V<br>Allowable deviation: –10% to +10% (198 V to 264 V)<br>380V servo drive:<br>Value range: 380 V to 440 V<br>Allowable deviation: –10% to +10% (342 V to 484 V) | Replace or adjust the power supply according to the specified range. |
| The power supply is unstable or affected by lightning. | 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 regenerative resistor fails. | If the built-in regenerative resistor is used (H02.25 = 0), check whether terminals P ⊕ and D are jumpered. If yes, measure the resistance between terminals C and D.<br>If an external regenerative resistor is used (H02.25 = 1 or 2), measure the resistance of the external regenerative resistor connected between terminals P ⊕ and C.<br>For the specification of the braking resistor, see *"2.2.1 Electrical Specifications" on page 33*. | 1 If the resistance is "∞" (infinite), the regenerative resistor is disconnected internally.<br>2 If a built-in regenerative resistor is used, change to use an external regenerative resistor (H02.25 = 1 or 2) and remove the jumper between terminals P ⊕ and D. Select an external regenerative resistor of the same resistance and equal or higher power than the built-in one.<br>3 If an external regenerative resistor is used, replace with a new one and connect it between terminals P⊕ and C.<br>4 Set H02.26 (Power of external regenerative resistor) and H02.27 (Resistance of external regenerative resistor) to values consistent with the specifications of the external regenerative resistor used. |
| 4. The resistance of the external regenerative resistor is too large, resulting in insufficient energy absorption during braking. | Measure the resistance of the external regenerative resistor connected between terminals P⊕ and C, and compare the measured value with the recommended value. | 1 Replace with an external regenerative resistor of recommended resistance, and connect it between terminals P⊕ and C.<br>2 Set H02.26 (Power of external regenerative resistor) and H02.27 (Resistance of external regenerative resistor) to values consistent with the specifications of the external regenerative resistor used. |

| Cause | Troubleshooting | Solution |
|---|---|---|
| 5. The motor is in abrupt acceleration/deceleration status and the maximum braking energy exceeds the energy absorption value. | Confirm the acceleration/ deceleration time during operation and measure whether the DC bus voltage between terminals P⊕ and N⊖ exceeds the overvoltage threshold during deceleration. | After confirming the input voltage of the main circuit is within the specified range, increase the acceleration/deceleration time if the operating conditions allow. |
| 6. The bus voltage sampling value deviates greatly from the measured value. | Check whether H0b.26 (Bus voltage) is within the following range:<br>220 V servo drive: H0b.26 ＞ 420 V<br>380V servo drive: H0b.26 ＞ 760V<br>Measure whether the DC bus voltage detected between terminals P⊕ and N⊖ is lower than the value of H0b.26. | Contact Inovance for technical support. |
| 7. The servo drive is faulty. | The fault persists after the main circuit is powered off and on repeatedly. | Replace the servo drive. |

- E410.0: Main circuit undervoltage
  Cause:

  The DC bus voltage between terminals P⊕ and N⊖ is lower than the undervoltage threshold.

  220 V servo drive: Normal value: 310 V Undervoltage threshold: 200 V (180 V for S5R5 models)

  380 V servo drive: Normal value: 540 V Undervoltage threshold: 380 V

| Cause | Troubleshooting | Solution |
|---|---|---|
| The power supply of the main circuit is unstable or power failure occurs. | Check the power input specifications of the servo drive and measure whether the input voltage at the power supply side of the main circuit cables and R/S/T on the drive side is within the following range:<br>220 V servo drive:<br>Value range: 220 V to 240 V<br>Allowable deviation: –10% to +10% (198 V to 264 V)<br>Measure the voltages of all the three phases. | Increase the capacity of the power supply. |
| Instantaneous power failure occurs. | | |
| The power voltage drops during running. | Monitor the power supply voltage and check whether the main circuit power supply is applied to other devices, resulting in insufficient power capacity and voltage drop. | |
| 4. A three-phase servo drive is connected to a single-phase power supply, leading to phase loss. | Check whether the main circuit is wired correctly and whether phase loss detection (H0A.00) is hidden. | Replace the cables and wire the power cables correctly<br>Three-phase: R, S, T |
| 5. The servo drive is faulty. | Check whether H0b.26 (Bus voltage) is within the following range:<br>220 V servo drive: H0b.26 < 200 V<br>380V servo drive: H0b.26 < 380V<br>The fault persists after the main circuit is powered off and on repeatedly. | Replace the servo drive. |

- E410.1: Main circuit de-energized
  Cause:

  Phase loss occurs on the three-phase servo drive.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The power supply is disconnected during operation. | Check the power input specifications of the servo drive and measure whether the input voltage at the power supply side of the main circuit cables and R/S/T on the drive side is within the following range:<br>220 V servo drive:<br>Value range: 220 V to 240 V<br>Allowable deviation: –10% to +10% (198 V to 264 V)<br>Measure the voltages of all the three phases. | Increase the capacity of the power supply. |
| | Monitor the power supply voltage and check whether the main circuit power supply is applied to other devices, resulting in insufficient power capacity and voltage drop. | |
| | Check whether the main circuit is wired correctly and whether phase loss detection (H0A.00) is hidden. | Replace the cables and wire the power cables correctly<br>Three-phase: R, S, T |
| | Check whether H0b.26 (Bus voltage) is within the following range:<br>220 V servo drive: H0b.26 < 200 V<br>380V servo drive: H0b.26 < 380V<br>The fault persists after the main circuit is powered off and on repeatedly. | Replace the servo drive. |

- E420.0: Main circuit phase loss
  Cause:

  Main circuit PL signal detection error.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The three-phase input cables are connected improperly. | Check whether the cables between the power supply side and R/S/T terminals of the servo drive are connected properly. | Replace the cables and wire the power cables correctly |
| 2. A single-phase power supply is used for a three-phase servo drive. | Check the specifications of the power supply and measure whether the voltage input to the main circuit is within the following range:<br>220 V servo drive:<br>Effective value: 220 V to 240 V<br>Allowable deviation: –10% to +10% (198 V to 264 V)<br>380V servo drive:<br>Value range: 380 V to 440 V<br>Allowable deviation: –10% to +10% (342V to 484V)<br>Measure the voltages of all the three phases. | Servo drives of 0.75 kW (H01.02 = 5) can be supplied by single-phase power supplies.<br>If the input voltage is within the specified range, set H0A.00 to 2 (Inhibit power input phase loss fault and warning). If it exceeds the specified range, replace or adjust the power supply according to the specified range. |
| 3. The three-phase power supply is unbalanced or the voltages of the three phases are too low. | | |
| 4. The servo drive is faulty. | The fault persists after the main circuit (R/S/T) is powered off and on repeatedly. | Replace the servo drive. |

- E500.0: motor overspeed

  Cause:

  The actual speed of the motor exceeds the overspeed threshold.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The phase sequence of motor cables is wrong. | Check whether the servo drive power cables are connected in the correct sequence at both ends. | Connect the U, V, and W cables according to correct phase sequence. |
| 2. H0A.08 is set improperly. | Check whether the overspeed threshold is lower than the maximum speed.<br>Overspeed threshold = 1.2 x Maximum motor speed (H0A.08 = 0)<br>Overspeed threshold = H0A.08 (when H0A.08 ≠ 0, and H0A-08 < 1.2 x maximum motor speed). | Re-set the overspeed threshold according to the mechanical requirements. |

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The input reference exceeds the overspeed threshold. | Check whether the motor speed corresponding to the input reference exceeds the overspeed threshold.<br>• Position control mode:• In CSP mode, check the gear ratio 6091.01h/6091.02h to determine the position reference increment for an individual synchronization period and convert it to the speed information. • In PP mode, check the gear ratio 6091.01h/6091.02h and determine the 6081h (Profile velocity).• In HM mode, check the gear ratio 6091.01h/ 6091.02h, and determine 6099.01h and 6099.02h.<br>• Speed control mode:• Check the gear ratio (6091h), target velocity (60FFh), speed limits (H06.06 to H06.09), and the maximum profile velocity (607Fh).<br>• Torque control mode:• View the speed limit defined by H07.17 and check the corresponding speed limit. | • Position control mode:• CSP: Decrease the position reference increment per synchronization period. The host controller should cover the position ramp when generating references. • PP: Decrease the value 6081h or increase the acceleration/ deceleration ramp (6083h, 6084h).• HM: Decrease 6099.01h and 6099.02h or increase the acceleration/deceleration ramp (609Ah). • Decrease the gear ratio according to actual conditions.<br>• Speed mode:• Decrease the target velocity, speed limit, and gear ratio. In PV mode, increase the speed ramp (6083h and 6084h). In CSV mode, the host controller should cover the speed ramp.<br>• Torque control mode:• Set the speed limit to a value lower than the overspeed threshold. |
| The motor speed overshoots. | Check whether the speed feedback exceeds the overspeed threshold by using Inovance servo commissioning software. | Adjust the gain or mechanical running conditions. |
| 5. The servo drive is faulty. | The fault persists after the servo drive is powered off and on again. | Replace the servo drive. |

- E500.1: Speed feedback overflow
  Cause:

  The FPGA speed measurement overflows.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| 1. FPGA internal speed overflows. | Check whether the servo drive power cables are connected in the correct sequence at both ends. | Connect the U, V, and W cables according to correct phase sequence. |
| 2. The motor speed overshoots. | Check whether the speed feedback exceeds the overspeed threshold by using Inovance servo commissioning software. | Adjust the gain or mechanical running conditions. |
| 3. FPGA speed measurement is abnormal. | Check whether bit9 of H0b.30 is 1. | 1 The speed feedback is abnormal, check whether the encoder version (H00.04) is set properly.<br>2 The encoder cable is abnormal, replace the encoder cable.<br>3 The encoder cable is being disturbed. Re-connect the grounding cable and the shielded cable or install a magnetic ring. |

- E500.2: FPGA position feedback pulse overspeed
  Cause:

  The FPGA speed feedback overflows.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| Communication error occurred between boards of the drive. | The alarm persists in spite of repeated power off and on. | Replace the servo drive. |

- E602.2: U/V/W phase sequence reversed
  Cause:

  A wrong U/V/W phase sequence is detected during angle auto-tuning.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| Incorrect UVW is detected during angle auto-tuning. | Check whether U/V/W phases are wired correctly. | Exchange cables of any two phases among U/V/W and perform auto-tuning again. |

- E605.0: Motor speed too high upon S-ON
  Cause:

  The motor speed exceeds the rated speed when the servo drive in size A/B is switched on.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The motor speed exceeds the motor rated speed when the servo drive is switched on. | Check if the drive is enabled when the motor has been driven. | Switch on the drive when the motor is standstill. |

- E620.0: Motor overload
  Cause:

  The accumulative heat of the motor reaches the fault threshold.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The motor and encoder cables are connected incorrectly or in poor contact. | Check the wiring between the servo drive, servo motor and the encoder according to the correct "wiring diagram". | Connect the cables according to the wiring diagram.<br>It is recommended to use the cables provided by Inovance.<br>When customized cables are used, prepare and connect the customized cables according to the wiring instructions. |
| 2. The load is so heavy that the effective torque outputted by the motor keeps exceeding the rated torque. | Check the overload characteristics of the servo drive or servo motor. Check whether the average load rate (H0b.12) of the servo drive keeps exceeding 100.0%. | Use a servo drive of higher capacity and a matching servo motor, or reduce the load and increase the acceleration/deceleration time. |
| 3. Acceleration/deceleration is too frequent or the load inertia is too large. | Calculate the mechanical inertia ratio or perform inertia auto-tuning. Check the value of H08.00 (Load inertia ratio).<br>Confirm the individual operation cycle when the servo motor operates cyclically. | Increase the acceleration/ deceleration time during single-cycle running. |
| 4. The gain adjustment is improper or the stiffness is too high. | Check whether the motor vibrates and generates unusual noise during operation. | Readjust the gain. |
| 5. The servo drive model or motor model is set improperly. | Check the motor model (H00.05) and drive model (H01.10) stored in the bus encoder. | Read the servo drive nameplate and set the servo drive model (H01.10) and motor model properly. |
| 6. The motor is stalled due to mechanical factors, resulting in overload during operation. | Check the reference and motor speed (H0b.00) through the software tool or keypad.<br>• References in the position control mode: H0b.13 (Input position reference counter)<br>• References in the speed control mode: H0b.01 (Speed reference)<br>• References in the torque control mode: H0b.02 (Internal torque reference)<br>Check whether the reference value is not 0 but the motor speed is 0 rpm in the corresponding mode. | Rectify the mechanical-related problem. |
| 7. The servo drive is faulty. | The fault persists after the servo drive is powered off and on again. | Replace the servo drive. |

## *Note*

When E620.0 occurs, stop the servo drive for at least 30s before further operations.

- E625.0: Brake abnormality enabled

  Cause:

The brake fails when it is released.

| Cause | Troubleshooting | 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 brake wiring.<br>2 Replace the Brake motor. |

- E626.0: Brake abnormality enabled
  Cause:

  The brake fails when it is released.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The brake fails when it closes. | Check if the motor shaft end is not held tightly by the brake when the braking signal is active. | 1 Check the brake wiring.<br>2 Replace the Brake motor. |

- E630.0: motor rotor locked over-temperature
  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.

| Cause | Troubleshooting | 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. | View parameters in group H00 to check whether the number of pole pairs are set properly.<br>Perform angle auto-tuning on the motor several times and check whether the value of H00.28 is consistent during angle auto-tuning. | Modify the motor parameter values. |
| 3. The communication commands are being disturbed. | Check whether jitter occurs on the commands sent from the host controller and whether EtherCAT communication is being disturbed. | Check whether the communication line between the host controller and the servo drive is being disturbed. |
| 4. The motor is stalled due to mechanical factors. | Check the reference and motor speed (H0b.00) through the software tool or keypad.<br>• References in the position control mode: H0b.13 (Input position reference counter)<br>• References in the speed control mode: H0b.01 (Speed reference)<br>• References in the torque control mode: H0b.02 (Internal torque reference)<br>Check whether the reference value is not 0 but the motor speed is 0 rpm in the corresponding mode.<br>Check the current feedback (torque reference) waveform. | Check whether any mechanical part gets stuck or eccentric. |

### Note

When E620.0 occurs, stop the servo drive for at least 30s before further operations.

- E640.0: IGBT over-temperature

  Cause:

  The IGBT junction temperature reaches the fault threshold defined by H0A.18.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The ambient temperature is too high. | Measure the ambient temperature. | Improve the cooling conditions of the servo drive to lower down the ambient temperature. |
| 2. The servo drive is restarted repeatedly to reset the overload fault. | Check the fault records (set H0b.33 and check H0b.34) for any overload fault/warning (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0). | Change the fault reset method. After overload occurs, wait for 30s before reset. 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 servo drive is installed in a wrong direction and the clearance between servo drives is 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 even though the servo drive is restarted five minutes after power-off. | Replace the servo drive. |

### Note

When E620.0 occurs, stop the servo drive for at least 30s before further operations.

- E640.1: Flywheel diode overtemperature

  Cause:

  The temperature of the flywheel diode reaches the fault threshold defined by H0A.18.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The ambient temperature is too high. | Measure the ambient temperature. | Improve the cooling conditions of the servo drive to lower down the ambient temperature. |
| 2. The servo drive is restarted repeatedly to reset the overload fault. | Check the fault records (set H0b.33 and check H0b.34) for any overload fault/warning (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0). | Change the fault reset method. After overload occurs, wait for 30s before reset. 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 | Troubleshooting | Solution |
|---|---|---|
| 4. The servo drive is installed in a wrong direction and the clearance between servo drives is 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 even though the servo drive is restarted five minutes after power-off. | Replace the servo drive. |

## Note

When E620.0 occurs, stop the servo drive for at least 30s before further operations.

- E650.0: Heatsink overtemperature

  Cause:

  The temperature of the servo drive power module is higher than the overtemperature threshold.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The ambient temperature is too high. | Measure the ambient temperature. | Improve the cooling conditions of the servo drive to lower down the ambient temperature. |
| 2. The servo drive is restarted repeatedly to reset the overload fault. | Check the fault records (set H0b.33 and check H0b.34) for any overload fault/warning (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0). | Change the fault reset method. After overload occurs, wait for 30s before reset. 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 servo drive is installed in a wrong direction and the clearance between servo drives is 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 even though the servo drive is restarted five minutes after power-off. | Replace the servo drive. |

## Note

When E620.0 occurs, stop the servo drive for at least 30s before further operations.

- E660.0: Motor overtemperature

  Cause:

  The temperature of the air-cooled motor is too high.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The temperature of the air-cooled motor is too high. | Measure whether the temperature of the air-cooled motor is too high. | Cool the motor down. |

- E661.0: STune failure

  Cause:

  During ETune operation, the gain drops to the lower limit.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1.During STune operation, the gain drops to the lower limit, stiffness <= 10. | Check if vibration resonance is properly suppressed in the system. The torque vibration amplitude exceeds the setpoint of H09.11. | Set the notch manually when vibration cannot be suppressed automatically. Modify the electronic gear ratio to improve the command resolution, or increase the command filter time constant in the "Parameter configuration" interface. Check the machine for cyclic fluctuation. |
| Check whether resonance that occurred during ITune operation cannot be suppressed. | Check whether there is abnormal noise or torque fluctuation during operation. | 1 Set the notch manually.<br>2 Modify the electronic gear ratio to improve the command resolution, increase the command filter time constant in the parameter configuration interface.<br>3 Check whether the machine suffers from periodic fluctuation.<br>4 Set H09.58 to 1 to clear resonance suppression parameters, and perform STune again. |

- E662.0: ETune failure

  Cause:

  Check whether resonance that occurred during ETune operation cannot be suppressed.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. During ETune operation, the gain drops to the lower limit:<br>Position loop gain < 5<br>Speed loop gain < 5<br>Model loop gain < 10 | Check if vibration resonance is properly suppressed in the system. The torque vibration amplitude exceeds the setpoint of H09.11. | 1 Set the notch manually when vibration cannot be suppressed automatically.<br>2 Modify the electronic gear ratio to improve the command resolution, increase the command filter time constant or in the parameter configuration interface.<br>3 Increase the value of H09.11 as appropriate.<br>4 Check whether the machine suffers from periodic fluctuation.<br>5 Check whether the positioning threshold is too low. Increase the reference acceleration/ deceleration time. |
| Check whether resonance that occurred during ETune operation cannot be suppressed. | Check whether there is abnormal noise or torque fluctuation during operation. | 1 Set the notch manually.<br>2 Modify the electronic gear ratio to improve the command resolution, increase the command filter time constant in the parameter configuration interface.<br>3 Check whether the current of the machine fluctuates periodically. |

- E663.0: ITune failure

  Cause:

Check whether resonance that occurred during ITune operation cannot be suppressed.

| Cause | Troubleshooting | Solution |
|---|---|---|
| Check whether resonance that occurred during ITune operation cannot be suppressed. | Check if vibration resonance is properly suppressed in the system. The torque vibration amplitude exceeds the setpoint of H09.11. | 1 Set the notch manually when vibration cannot be suppressed automatically.<br>2 Modify the electronic gear ratio to improve the command resolution, increase the command filter time constant or in the parameter configuration interface.<br>3 Check whether the machine suffers from periodic fluctuation.<br>4 Increase the value of H09.11 as appropriate. |

- E664.0: Resonance too strong

  Cause:

  Resonance occurs on the servo system and the torque fluctuation amplitude is higher than the value of H09.54.

| Cause | Troubleshooting | Solution |
|---|---|---|
| Resonance occurs on the servo system and the torque fluctuation amplitude is higher than the value of H09.54. | 1 Check whether the torque fluctuation range is greater than the setpoint of H09.54.<br>2 Check whether there is abnormal noise or torque fluctuation during operation. | 1 Check whether the inertia ratio or loop gain parameters are set properly.<br>2 Check whether resonance parameters are set properly.<br>3 Increase the value of H09.54 or set H09.54 to 0 to disable this function. |

- E731.0: Encoder battery failure

  Cause:

  The voltage of the absolute encoder battery is lower than 2.9V.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The battery is not connected during power-off. | Check whether the battery is connected during power-off. | Set H0d.20 to 1 to clear the fault. |
| 2. The encoder battery voltage is too low. | Measure the battery voltage. | Use a new battery with the matching voltage. |

- E733.0: Encoder multi-turn counting error

  Cause:

  An encoder multi-turn counting error occurs.

| Cause | Troubleshooting | 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 counting overflow

  Cause:

  A multi-turn counting overflow occurs on the absolute encoder.

| Cause | Troubleshooting | 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) reach 32767 or 32768 when the servo drive works in the absolute linear mode (H02.01 = 1). | 1 This fault can be hidden in cases where no multi-turn absolute position is needed but the absolute position during running needs to be recorded.<br>2 The rotation mode applies to occasions where only single-turn absolute position needs to be recorded.<br>3 Set H0d.20 to 2 to power on again. Perform homing if necessary. |

- E740.0: Encoder communication timeout
  Cause:

  Communication timeout occurs on the absolute encoder.

| Cause | Troubleshooting | Solution |
|---|---|---|
| The encoder cable is not connected reliably. 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 the encoder cable connections.<br>2 Check whether vibration on site is too strong, which loosens the encoder cable and even damages the encoder.<br>3 Replace with a new encoder cable. If the fault no longer occurs after cable replacement, the original encoder cable is damaged.<br>4 Check whether the encoder version (H00.04) is set properly.<br>5 Check whether the servo drive software version (H01.00).<br>6 Replace the servo motor. |

- E740.2: Absolute encoder communication error
  Cause:

  A communication error occurs on the RX side of the encoder.

| Cause | Troubleshooting | Solution |
|---|---|---|
| 1. The encoder is wired improperly. | Check the wiring of the encoder. | Connect the encoder cables according to the correct wiring diagram. |
| The encoder cable connections become loose. | Check whether vibration on site is too strong, which loosens the encoder cable and even damages the encoder. | Re-connect encoder cables and ensure encoder terminals are connected securely. |

| Cause | Troubleshooting | Solution |
|---|---|---|
| 3. The encoder Z signal is being disturbed. | Check the field cable layout: Check whether ambient devices are generating disturbance and whether multiple disturbance sources such as variable-frequency devices are present inside the cabinet. Make servo drive stay in "Rdy" status and rotate motor shaft counterclockwise (CCW) manually and observer whether H0b.17 increases/decreases smoothly. Turning one circle corresponds to five 0–360° (for Z series motors). For X series motors, turning one circle corresponds to four 0–360°. If H0b.17 changes abnormally during motor rotating, the encoder is faulty. If no alarm is reported during motor shaft rotating but an alarm is reported during servo drive running, interference may exist. | It is recommended to use the cables provided by Inovance. For use of customized cables, check whether the customized cable complies with specifications and whether it is a shielded twisted pair cable. Route the motor cables and encoder cables through different routes. Ensure the servo motor and servo drive are grounded properly. Check whether the connectors at both ends of the encoder are in good contact and whether any pin retracts. |
| 4. The encoder is faulty. | Replace with a new encoder cable. If the fault no longer occurs after cable replacement, it indicates 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.17 (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 encoder cables are replaced, the encoder may be faulty. In this case, replace the servo motor. |
| 5. An error occurs on the communication between the servo drive and the encoder. | Check whether the value of H0b.28 is not 0. | 1 Check whether H00.00 (Motor code) is set properly.<br>2 Check whether the encoder cable is connected properly.<br>3 Check whether the servo drive and motor are grounded properly. You can wind a magnetic ring on the encoder cable to reduce interference. |

- E740.3: Absolute encoder single-turn calculation error

  Cause:

  The encoder is faulty.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| An internal fault occurs on the encoder. | Replace with a new encoder cable. If the fault no longer occurs after cable replacement, it indicates 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.17 (Electrical angle). The electrical angle deviation should be within ±30° when the motor position does not change. | 1 Check whether the encoder version (H00.04) is proper.<br>2 Check whether the encoder cable is proper.<br>3 Replace the motor. |

- E740.6: Encoder data write error
  Cause:

  The attempt to write the encoder data fails.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| An error occurs when writing the position offset after angle auto-tuning. | Replace with a new encoder cable. If the fault no longer occurs after cable replacement, it indicates 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.17 (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 overtemperature
  Cause:

  The temperature of the absolute encoder is too high.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The temperature of the absolute encoder is too high. | Measure the encoder or motor temperature. | Switch off the S-ON signal to wait for the encoder to cool down. |

- E765.0: Nikon encoder over-temperature or overspeed
  Cause:

  The temperature of the absolute encoder is too high.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The temperature of the absolute encoder is too high. | Measure the encoder or motor temperature. | Switch off the S-ON signal to wait for the encoder to cool down. |

- E939.0: Motor power cable failure
  Cause:

  Motor three phase cable breakage.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| Motor power cables are broken or not connected. | Check the wiring of U/V/W power cables. | 1 Check whether the power cables are disconnected or in poor contact. Re-connect the power cables.<br>2 Replace the servo motor. |

- E994.0: Station number conflict

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| CANlink station No. conflict | Check the setpoint of H0E.00. | Rectify the value of H0E.00. |

- EA33.0: Encoder read/write check error

  Cause:

  Internal parameters of the encoder are abnormal.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| 1. The serial incremental encoder cable is disconnected or 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. An error occurs when reading/ writing the serial incremental encoder parameters. | If the fault persists after the servo drive is powered off and on repeatedly, the encoder is faulty. | Replace the servo motor. |

- EB00.0: Position deviation too large

  Cause:

  The position deviation in the position control mode is larger than the setpoint of 6065h (Threshold of excessive position deviation).

| Cause | Troubleshooting | 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 cables or the encoder cable is disconnected. | Check the wiring. | Connect the cables again. The servo drive power cables must be connected in the correct order at both ends. If necessary, replace all cables and ensure a reliable connection. |

| Cause | Troubleshooting | Solution |
|---|---|---|
| 3. The motor is stalled due to mechanical factors. | Check the reference and motor speed (H0b.00) through the software tool or keypad.<br>• References in the position control mode: H0b.13 (Input position reference counter)<br>• References in the speed control mode: H0b.01 (Speed reference)<br>• References in the torque control mode: H0b.02 (Internal torque reference)<br>Check whether the reference value is not 0 but the motor speed is 0 rpm in the corresponding mode. | Rectify the mechanical-related problem. |
| The servo drive gain is too low. | Check the position loop gain and speed loop gain of the servo drive.<br>1st gain set: H08.00...H08.02<br>2nd gain set: H08.03...H08.05 | Adjust the gain values manually or perform gain auto-tuning. |
| 5. The position reference increment is too large. | Position control mode:<br>• In CSP mode, check the gear ratio 6091.01h/6091.02h to determine the position reference increment for an individual synchronization period and convert it to the speed information.<br>• In PP mode, check the gear ratio 6091.01h/6091.02h and determine the 6081h (Profile velocity).<br>• In HM mode, check the gear ratio 6091.01h/6091.02h, and determine 6099.01h and 6099.02h. | • CSP: Decrease the position reference increment per synchronization period. The host controller should cover the position ramp when generating references.<br>• PP: Decrease the value 6081h or increase the acceleration/ deceleration ramp (6083h, 6084h).<br>• HM: Decrease 6099.01h and 6099.02h or increase the acceleration/deceleration ramp (609Ah).<br>• Decrease the gear ratio according to actual conditions. |
| 6. The value of 6065h (H0A.10) is insufficient for the operating conditions. | Check the value of 6065h. | Increase the setpoint of 6065h. |
| 7. The servo drive/motor is faulty. | Monitor the operating waveform using the oscilloscope function of Inovance commissioning software and check whether the operating waveform includes the following information:<br>position reference, position feedback, speed reference, 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:

  The position deviation is too large.

| Cause | Troubleshooting | 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 cables or the encoder cable is disconnected. | Check the wiring. | Connect the cables again. The servo drive power cables must be connected in the correct order at both ends. If necessary, replace all cables and ensure a reliable connection. |
| 3. The motor is stalled due to mechanical factors. | Check the reference and motor speed (H0b.00) through the software tool or keypad.<br>• References in the position control mode: H0b.13 (Input position reference counter)<br>• References in the speed control mode: H0b.01 (Speed reference)<br>• References in the torque control mode: H0b.02 (Internal torque reference)<br>Check whether the reference value is not 0 but the motor speed is 0 rpm in the corresponding mode. | Rectify the mechanical-related problem. |
| The servo drive gain is too low. | Check the position loop gain and speed loop gain of the servo drive.<br>• 1st gain set: H08.00...H08.02<br>• 2nd gain set: H08.03...H08.05 | Adjust the gain values manually or perform gain auto-tuning. |
| 5. The position reference increment is too large. | Position control mode:<br>• In CSP mode, check the gear ratio 6091.01h/6091.02h to determine the position reference increment for an individual synchronization period and convert it to the speed information.<br>• In PP mode, check the gear ratio 6091.01h/6091.02h and determine the 6081h (Profile velocity).<br>• In HM mode, check the gear ratio 6091.01h/6091.02h, and determine 6099.01h and 6099.02h. | • CSP: Decrease the position reference increment per synchronization period. The host controller should cover the position ramp when generating references.<br>• PP: Decrease the value 6081h or increase the acceleration/ deceleration ramp (6083h, 6084h).<br>• HM: Decrease 6099.01h and 6099.02h or increase the acceleration/deceleration ramp (609Ah).<br>Decrease the gear ratio according to actual conditions. |
| 6. The value of 6065h (H0A.10) is insufficient for the operating conditions. | Check the value of 6065h. | Increase the setpoint of 6065h. |
| 7. The servo drive/motor is faulty. | Monitor the operation waveform through the oscilloscope function in the software tool: position references, position feedback, speed references, and torque references. | 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.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The pulse reference increment exceeds the excessive reference threshold three times consecutively. | Check whether the baud rate of pulse reference input exceeds H0A.09. | 1 Increase the value of H0A.09.<br>2 Reduce the baud rate of pulse input. |

- EB01.1: Individual position reference increment too large
  Cause:

  The target position increment is too large.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The target position increment is too large. | Check the variation between two adjacent target positions using the software tool. | 1 Check whether the maximum speed of the motor fulfills the application requirement. If yes, reduce the target position reference increment, which is to lower the profile reference speed. If not, replace the servo motor.<br>2 Before switching the mode or enabling the servo drive, check whether the target position is aligned with current position feedback.<br>3 The communication sequence of the host controller is abnormal, leading to slave data error. Check the communication sequence of the host controller. |

- EB01.3: Command overflow
  Cause:

  The target position is still in the process of transmission when the servo limit or software position limit signal is activated and the 32-bit upper/lower limit is reached.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The target position is still in the process of transmission when the servo limit or software position limit signal is activated and the 32-bit upper/lower limit is reached. | Check whether the host controller continues sending commands after overtravel warning is reported by the servo drive. | 1 Detect the servo limit signal (bit0 and bit1 of 60FD is recommended) through the host controller.<br>2 Stop sending limit direction commands when an active servo limit signal is detected by the host controller. |

- EB03.0: Electronic gear ratio beyond the limit-H05.02
  Cause:

  The electronic gear ratio exceeds the limit: (0.001–4000 x Encoder resolution/10000).

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The electronic gear ratio converted by converted exceeds the maximum gear ratio or is less than the minimum gear ratio. | Check if the electronic gear ratio is within the range of 0.001–4000 × Encoder resolution/10000. | Change the value of H05.02. |

- EB03.1: Electronic gear ratio beyond the limit-Electronic gear ratio 1
  Cause:

  The electronic gear ratio exceeds the limit: (0.001–4000 × Encoder resolution/10000).

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The group 1 electronic gear ratio exceeds the maximum gear ratio or is less than the minimum gear ratio. | Check if the electronic gear ratio is within the range of 0.001–4000 × Encoder resolution/10000. | Change the values of H05.07/ H05.09. |

- EB03.2: Electronic gear ratio beyond the limit-Electronic gear ratio 2
  Cause:

  The group 2 electronic gear ratio exceeds the limit: (0.001–4000 × Encoder resolution/10000).

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The group 2 electronic gear ratio exceeds the maximum gear ratio or is less 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. |

- ED02.0: Modbus communication timeout
  Cause:

  Modbus communication timeout.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| Modbus communication timeout | Increase the value of H0E.83. | Determine the Modbus access cycle by frame grab. |

- ED03.0: CANLink communication failure
  Cause:

  The master is offline.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The master is offline. | 1. Increase the heartbeat threshold of the master station.<br>2. Check the wiring. | Capture frames to ensure that the master station is online. |

- ED04.0: CANopen communication timeout
  Cause:

  The slave reaches the time configured by the consumer or the node guarding time.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The slave reaches the time configured by the consumer or the node guarding time. | Check whether the heartbeat frame cycle of the host controller is normal by frame grab. | Check whether all CAN nodes are online, or check the CANopen configuration, reset the node or communication. |

- ED05.0: CANopen communication initialized
  Cause:

After the motor is enabled, errors such as slave offline, heartbeat abnormal, load ratio too high, data frame loss, and false master reset occurred when NMT changes to the initialization state.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| After the motor is enabled, errors such as slave offline, heartbeat abnormal, load ratio too high, data frame loss, and false master reset occurred when NMT changes to the initialization state. | Check whether the reset frame is received during operation by capturing frames. | Reset the NMT node. When changing the NMT, disable the output stage.<br>1 Use shielded cables to prevent interference.<br>2 Ground the servo drive properly.<br>3 Ensure the load rate is proper.<br>4 If asynchronous transmission is configured, ensure the suppression time is set properly.<br>5 Ensure no false reset frame is triggered by the host controller.<br>6 Ensure the termination resistor is installed. |

- ED08.0: CANopen bus PDO transmission length error
  Cause:

  The length of the content transmitted by PDO is inconsistent with the configured mapping length.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The length of the content transmitted by PDO is inconsistent with the configured mapping length. | Check whether the PDO transmission length is consistent with the configuration by capturing frames. | Re-configure the PDO and reset the node or communication. |

- ED11.0: CANopen sync period error too large
  Cause:

  The SYNC period error exceeds the setpoint.

| Cause | Troubleshooting | Solution |
| --- | --- | --- |
| The SYNC period error exceeds the setpoint | Collect the synchronization signal using the software tool and calculate whether the cycle is higher than the fault threshold. | Check the settings of 60C2.01h and 60C2.02h and ensure the synchronization period is set properly.<br>Ensure the synchronization period of the host controller is set correctly and consistent with the setting of 60C2h.<br>Check the wiring between the slave and the master. |

## 17.5.2 Internal Faults

When any one of the following fault occurs, contact Inovance for technical support.

- E602.0: Angle auto-tuning failure
- E220.0: Phase sequence incorrect
- EA40.0: Parameter auto-tuning failure
- E111.0: Internal parameter error

# 17.6 List of Alarm Codes

Table 17–1 Resettable warning list

| Fault Code | Fault subcode | Name | Fault level | Resettable |
|---|---|---|---|---|
| E108 | E108.0 | Storage parameter write error | NO.3 | Yes |
| | E108.1 | Storage parameter read error | NO.3 | Yes |
| | E108.2 | Invalid check on data written in EEPROM | NO.3 | Yes |
| | E108.3 | Invalid check on data read in EEPROM | NO.3 | Yes |
| | E108.4 | Single data is stored too many times | NO.3 | Yes |
| E110 | E110.0 | Frequency-division pulse output setting error | NO.3 | Yes |
| E121 | E121.0 | Invalid S-ON command | NO.3 | Yes |
| E122 | E122.0 | Multi-turn absolute encoder setting error | NO.3 | Yes |
| E510 | E510.0 | Frequency division pulse output overspeed | NO.3 | Yes |
| E600 | E600.0 | Inertia auto-tuning failure | NO.3 | Yes |
| E601 | E601.0 | Homing warning | NO.3 | Yes |
| | E601.1 | Homing switch error | NO.3 | Yes |
| | E601.2 | Homing mode setting error | NO.3 | Yes |
| E730 | E730.0 | Encoder battery warning | NO.3 | Yes |
| E731 | E731.0 | Encoder battery failure | NO.3 | Yes |
| E831 | E831.1 | AI1 zero offset too large | NO.3 | Yes |
| E834 | E834.1 | AI1 overvoltage | NO.3 | Yes |
| E900 | E900.0 | DI emergency braking | NO.3 | Yes |
| E902 | E902.0 | DI setting invalid | NO.3 | Yes |
| | E902.1 | DO setting invalid | NO.3 | Yes |
| | E902.2 | Torque reach setting invalid | NO.3 | Yes |
| E908 | E908.0 | Model identification check code error | NO.3 | Yes |
| E909 | E909.0 | Motor overload | NO.3 | Yes |
| E910 | E910.0 | Control circuit overvoltage | NO.3 | Yes |
| E920 | E920.0 | Braking resistor overload | NO.3 | Yes |
| E922 | E922.0 | Resistance of the external regenerative resistor too small | NO.3 | Yes |
| E924 | E924.0 | Regenerative transistor over-temperature | NO.3 | Yes |
| E941 | E941.0 | Modified parameters activated at next power-on | NO.3 | Yes |
| E942 | E942.0 | Parameter storage too frequent | NO.3 | Yes |
| E950 | E950.0 | Positive limit switch warning | NO.3 | Yes |
| E952 | E952.0 | Negative limit switch warning | NO.3 | Yes |
| E980 | E980.0 | Encoder algorithm error | NO.3 | Yes |

| Fault Code | Fault subcode | Name | Fault level | Resettable |
|---|---|---|---|---|
| E990 | E990.1 | Pulse input overspeed warning | NO.3 | Yes |
| EA41 | EA41.0 | Torque fluctuation compensation failure | NO.3 | Yes |

# 17.7 List of Fault Codes

## No. 1 non-resettable faults:

Table 17–2 List of No. 1 non-resettable faults

| Fault Code | Fault subcode | Fault Name | Fault level | Resettable |
|---|---|---|---|---|
| E101 | E101.0 | Abnormal parameters in groups H02 and above | NO.1 | No |
| | E101.1 | Parameter error in group H00/H01 | NO.1 | No |
| | E101.2 | Address error in read/write operation after the number of parameters changes | NO.1 | No |
| | E101.9 | Parameter attribute initialization check error | NO.1 | No |
| E102 | E102.0 | FPGA communication establishment error | NO.1 | No |
| | E102.1 | FPGA initialization start error | NO.1 | No |
| | E102.8 | FPGA and MCU version mismatch | NO.1 | No |
| E104 | E104.1 | MCU running timeout (MCU break down) | NO.1 | No |
| | E104.2 | FPGA running timeout (FPGA break down) | NO.1 | No |
| | E104.4 | MCU command update timeout | NO.1 | No |
| E120 | E120.0 | Unknown encoder model | NO.1 | No |
| | E120.1 | Unknown motor model | NO.1 | No |
| | E120.2 | Unknown drive model | NO.1 | No |
| | E120.5 | Motor and drive current mismatch | NO.1 | No |
| | E120.6 | FPGA and motor model mismatch | NO.1 | No |
| | E120.7 | Model check error | NO.1 | No |
| | E120.8 | Junction temperature parameter check error | NO.1 | No |
| E136 | E136.0 | Encoder ROM motor parameter check error | NO.1 | No |
| | E136.1 | Encoder ROM motor parameter read error | NO.1 | No |
| E201 | E201.0 | Phase-P overcurrent | NO.1 | No |
| | E201.1 | Phase-U overcurrent | NO.1 | No |
| | E201.2 | Phase-V overcurrent | NO.1 | No |
| | E201.4 | Phase-N overcurrent | NO.1 | No |
| E210 | E210.0 | Output short-circuited to ground | NO.1 | No |
| E234 | E234.0 | Runaway | NO.1 | No |

| Fault Code | Fault subcode | Fault Name | Fault level | Resettable |
|---|---|---|---|---|
| E740 | E740.0 | Encoder communication timeout | NO.1 | No |
| | E740.2 | Absolute encoder error | NO.1 | No |
| | E740.3 | Absolute encoder single-turn calculation error | NO.1 | No |
| | E740.6 | Encoder write error | NO.1 | No |
| E765 | E765.0 | Nikon encoder over-temperature or overspeed | NO.1 | No |
| EA33 | EA33.0 | Encoder read/write check error | NO.1 | No |

## No. 1 resettable faults

Table 17–3 List of No. 1 resettable faults

| Fault Code | Fault subcode | Fault Name | Fault level | Resettable |
|---|---|---|---|---|
| E150 | E150.0 | STO safety state applied | NO.1 | Yes |
| | E150.1 | STO input state abnormal | NO.1 | Yes |
| | E150.2 | Buffer 5 V voltage detection error | NO.1 | Yes |
| | E150.3 | STO input circuit hardware diagnosis failure | NO.1 | Yes |
| | E150.4 | PWM Buffer hardware diagnosis failure | NO.1 | Yes |
| E208 | E208.2 | Encoder communication timeout | NO.1 | Yes |
| | E208.4 | FPGA current loop operation timeout | NO.1 | Yes |
| E320 | E320.0 | Braking resistor overload | NO.1 | Yes |
| E400 | E400.0 | Main circuit overvoltage | NO.1 | Yes |
| E410 | E410.0 | Main circuit undervoltage | NO.1 | Yes |
| | E410.1 | Main circuit de-energized | NO.1 | Yes |
| E500 | E500.0 | Motor overspeed | NO.1 | Yes |
| | E500.1 | Speed feedback overflow | NO.1 | Yes |
| | E500.2 | FPGA position feedback pulse overspeed | NO.1 | Yes |
| E602 | E602.0 | Angle auto-tuning failure | NO.1 | Yes |
| | E602.2 | U/V/W phase sequence reversed | NO.1 | Yes |
| E605 | E605.0 | Speed too fast upon S-ON | NO.1 | Yes |
| E620 | E620.0 | Motor overload | NO.1 | Yes |
| E625 | E625.0 | Brake abnormality enabled | NO.1 | Yes |
| E626 | E626.0 | Brake abnormality disabled | NO.1 | Yes |
| E630 | E630.0 | Motor stall over-temperature protection | NO.1 | Yes |
| E640 | E640.0 | High IGBT junction overtemperature | NO.1 | Yes |
| | E640.1 | Flywheel diode overtemperature | NO.1 | Yes |
| E650 | E650.0 | Heatsink overtemperature | NO.1 | Yes |
| E660 | E660.0 | Motor overtemperature | NO.1 | Yes |
| E939 | E939.0 | Motor power cables disconnected | NO.1 | Yes |

## No. 2 resettable faults

Table 17–4 List of No. 2 resettable faults

| Fault Code | Fault subcode | Fault Name | Fault level | Resettable |
|---|---|---|---|---|
| E122 | E122.1 | DI function allocation error | No. 2 | Yes |
| | E122.2 | DO function allocation error | No. 2 | Yes |
| | E122.3 | Upper limit in the rotation mode too high | No. 2 | Yes |
| | E122.4 | VDI function allocation error | No. 2 | Yes |
| | E122.5 | DI and VDI assigned with the same function | No. 2 | Yes |
| E420 | E420.0 | Main circuit phase loss | No. 2 | Yes |
| E661 | E661.0 | STune failure | No. 2 | Yes |
| E662 | E662.0 | ETune failure | No. 2 | Yes |
| E663 | E663.0 | ITune failure | No. 2 | Yes |
| E664 | E664.0 | Resonance too strong | No. 2 | Yes |
| E731 | E731.0 | Encoder battery failure | No. 2 | Yes |
| E733 | E733.0 | Encoder multi-turn counting error | No. 2 | Yes |
| E735 | E735.0 | Encoder multi-turn counting overflow | No. 2 | Yes |
| E760 | E760.0 | Encoder over-temperature | No. 2 | Yes |
| E994 | E994.0 | Station numbers conflict. | No. 2 | Yes |
| EB00 | EB00.0 | Excessive position deviation | No. 2 | Yes |
| | EB00.1 | Position deviation overflow | No. 2 | Yes |
| EB01 | EB01.0 | The position reference increment is too large. | No. 2 | Yes |
| | EB01.1 | Individual position reference increment too large | No. 2 | Yes |
| | EB01.3 | Reference overflow | No. 2 | Yes |
| EB03 | EB03.0 | Electronic gear ratio setpoint beyond the limit - H05.02 | No. 2 | Yes |
| | EB03.1 | Electronic gear ratio beyond the limit - Electronic gear ratio 1 | No. 2 | Yes |
| | EB03.2 | Electronic gear ratio beyond the limit -Electronic gear ratio 2 | No. 2 | Yes |
| ED02 | ED02.0 | Modbus communication timeout | No. 2 | Yes |
| ED03 | ED03.0 | CANLink communication failure | No. 2 | Yes |
| ED04 | ED04.0 | CANopen communication timeout | No. 2 | Yes |
| ED05 | ED05.0 | CANopen communication initialized | No. 2 | Yes |
| ED08 | ED08.0 | CANopen bus PDO transmission length error | No. 2 | Yes |
| ED11 | ED11.0 | CANopen sync period error too large | No. 2 | Yes |

# 18 Maintenance

## 18.1 Routine Maintenance

Standard operating conditions:

Average annual ambient temperature: 30°C Average load rate: < 80% Daily operating time: < 20 h

### 18.1.1 Routine Checklist

Check the following items during routine inspection.

Table 18–1 Routine checklist

| No. | Routine Checklist | Checked |
| --- | --- | --- |
| 1 | The ambient temperature and humidity are normal. There is no dust or unwanted objects in the servo drive. | ☐ |
| 2 | There is no abnormal vibration or noise. | ☐ |
| 3 | The voltage of the power supply is normal. | ☐ |
| 4 | There is no strange smell. | ☐ |
| 5 | There are no fibers adhered to the air inlet. | ☐ |
| 6 | There is no intrusion of unwanted object on the load end. | ☐ |

### 18.1.2 Routine Cleaning List

Check the following items during routine cleaning.

Table 18–2 Routine cleaning list

| No. | Routine Cleaning List | Checked |
| --- | --- | --- |
| 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. | ☐ |

***Note***

- Cut off the power supply before cleaning. Clean the equipment with an air gun or a piece of dry cloth.
- Do not use the gasoline, diluent, alcohol, acidic or alkaline detergent during cleaning to prevent enclosure discoloration or damage.

# 18.2 Periodic Maintenance

## 18.2.1 Periodic Checklist

Table 18–3 Periodic checklist

| No. | Item | Checked |
|---|---|---|
| 1 | The screws used to fix the couplings between devices are in place. | ☐ |
| 2 | There is no sign of overheating. | ☐ |
| 3 | Terminal blocks are in good condition without any sign of damage. | ☐ |
| 4 | The clamping units of terminal blocks are in place. | ☐ |

## 18.2.2 Periodic Maintenance List

The electrical and electronic parts inside the servo drive may be mechanically worn out and degraded. To keep the servo drive and servo motor in good condition, perform parts replacement based on the replacement cycles listed in the following table. Contact Inovance or Inovance agent before replacement to double check whether the part needs to be replaced.

| Equipment | Components | Standard Replacement Interval | Remarks |
|---|---|---|---|
| Servo drive | Bus filter capacitor | About five years | The standard replacement interval is for reference only.<br>If any device/component works improperly within the replacement interval, replace it immediately. |
| | Cooling fan | 2 to 3 years (10000 h to 30000 h) | |
| | Aluminum electrolytic capacitor on the PCB | About five years | |
| | Pre-charge relay | 100,000 operations (depending on the operating conditions) | |
| | Pre-charge resistor | 20,000 operations (depending on the operating conditions) | |
| Motor | Bearing | 3 to 5 years (20,000 h to 30,000 h) | |
| | Oil seal | 5000 h | |
| | Encoder | 3 to 5 years (20,000 h to 30,000 h) | |
| | Absolute encoder battery | Depends on the operating condition.<br>See the operation instructions for the encoder battery for details. | |

# 18.3 Parts Replacement

## 18.3.1 Replacing the Motor Flat Key

Caution

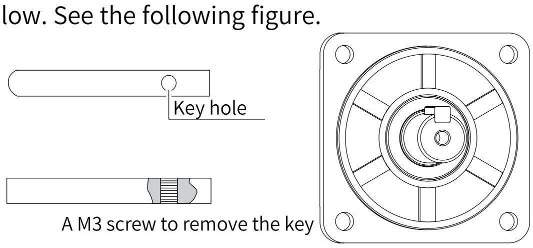
- Observe all the requirements presented in this chapter. Failure to comply may result in equipment fault or damage.
- Violent disassembly is not allowed. Take enough care during disassembly to prevent personal injury.

Standard MS1 series motors in flange 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 the key disassembly bolt | | |
|---|---|---|
| Motor Size | Dimensions of the Flat Key | Specifications of the Disassembly Bolt (Inner Hexagon Bolt) |
| Size 40 | Type-A flat key—A3×3×14 | No disassembly hole |
| Size 60 | Type-C flat key—C5×5×16.5 | M3 x 10 and above |
| Size 80 | Type-C flat key—C6×6×25 | M3 x 15 and above |
| Size 100 | Type-C flat key—C8×7×35 | M3 x 20 and above |
| Size 130 | Type-C flat key—C8×7×35 | M3 x 20 and above |
| Size 180 | Type-C flat key—C10×8×64 | M3 x 20 and above |

- Tool needed: an Allen wrench
- Disassembly procedure:

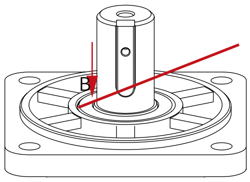
1. Select a proper disassembly bolt (inner hexagon bolt recommended) based on the motor model.
2. Use an Allen wrench to screw down the screw until the A-A end of the flat key is detached from the keyway, as shown below. See the following figure.



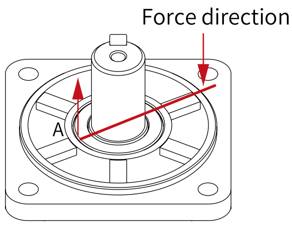

## 18.3.2 Removing the Motor Oil Seal

- Tools needed: a pair of needle-nose pliers, a pair of slip-proof gloves, and a piece of cotton cloth.
- Disassembly procedure:

1. Put the cotton cloth onto the supporting point B to avoid the end cover from being scratched during disassembly.
2. Secure the motor and use the needle-nose pliers to hold point A of the oil seal lip.
3. Pry the oil seal out gradually against the supporting point B.




(Support point B is at the step of the extension)




(Support point A is at the outer lip of the oil seal)

# 19 Appendix

## 19.1 Compliance Requirements

Table 19–1 Compliance list

| Certification | Directive | | Standard |
|---|---|---|---|
| CE Certification | EMC Directive | 2014/30/EU | EN IEC 61800-3 |
| | LVD Directive | 2014/35/EU | EN 61800-5-1<br>EN 60034 |
| | RoHS Directive | 2011/65/EU | EN 50581 |

***Note***

The product meets the requirements of the latest version of instructions and standards of the CE certification.

### 19.1.1 CE Certifications

Figure 19-1 CE mark

- 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 required for engaging in commercial business (production, importation, and distribution) in Europe.
- The drive complies with LVD, EMC, and RoHS directives and carries the CE mark.
- Machines and devices integrated with this drive must also comply with CE requirements for distribution in 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.

#### 19.1.1.1 Requirement for Compliance with EMC Directive

The SV660P series servo 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.

Caution

- 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, if necessary, to prevent the radio interference generated by the drive.

## Introduction to EMC standards

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices 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

Drives are divided into the following four categories based on the intended application environment.

- Category C1 drive: Power drive system (PDS) with rated voltage less than 1000 V, intended for use in the first environment
- Category C2 drive: 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 drive: 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 drive: 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

### 19.1.1.2 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 LVD.

## Installation location

Install the drive in a place with overvoltage category III and pollution degree 1 or 2 as specified by IEC 606641-1.

## Installation Environment

For requirements of the installation environment, see *"5.1.2 Installation Environment" on page 105*.

### Protection

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.

### Main Circuit Cable Requirements

For wiring requirements of main circuit terminals, see *"8.2.2 Main Circuit Wiring Requirements" on page 127*.

### Requirements of protective devices

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

# 19.2 Solutions to Common EMC Problems

## 19.2.1 Malfunction of the Residual Current Device (RCD)

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

- The drive may generate DC leakage current in the protective conductor, a B-type RCD therefore must be used.
- The drive may generate high-frequency leakage current during operation. To prevent malfunction of the RCD, install an RCD with tripping current not lower than 100 mA for each servo drive.
- When multiple drives connected in parallel share one RCD, select an RCD with tripping current not lower than 300 mA.
- Recommended RCD manufacturers are Siemens and Schneider.

When malfunction occurs on the RCD, take the following measures.

Table 19–2 Measures against leakage current

| Symptom | Possible Cause | Measure |
|---|---|---|
| The RCD trips at the moment of power-on. | The anti-interference performance of the RCD is weak. | • It is recommended to use Siemens or Schneider RCDs.<br>• It is recommended to use an RCD with a higher tripping current.<br>• Move the unbalanced load to the front end of the RCD. |
| | The tripping current of the RCD is too low. | |
| | An unbalanced load is connected to the rear end of the RCD. | |
| | The capacitance of the front end of the servo drive against the ground is too high. | |
| The RCD trips during operation. | The anti-interference performance of the RCD is weak. | • It is recommended to use Siemens or Schneider RCDs.<br>• It is recommended to use an RCD with a higher tripping current.<br>• Install a simple filter on the input side of the servo drive and wind magnetic rings on the LN and RST cables near the RCD, as shown in *"Figure 19–2 Magnetic ring on the input side" on page 684*.<br>• Reduce the carrier frequency without compromising the performance.<br>• Reduce the length of motor cables. |
| | The tripping current of the RCD is too low. | |
| | An unbalanced load is connected to the rear end of the RCD. | |
| | The distributed capacitance of the motor cable or motor against the ground is too high. | |

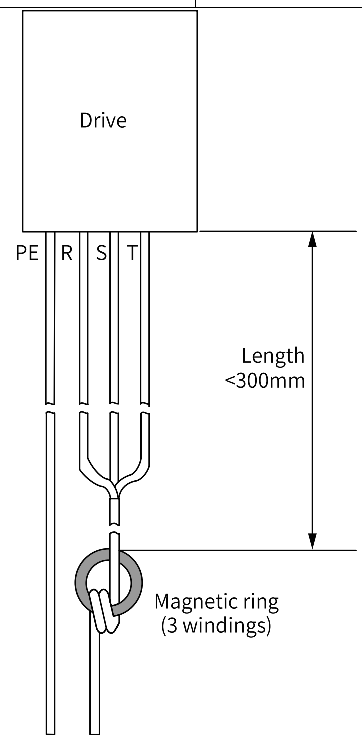



Figure 19-2 Magnetic ring on the input side

## 19.2.2 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. For the reactor model and installation mode, see *"5.2.2 Instructions for Installing the AC Input Reactor" on page 113*.

## 19.2.3 Control Circuit Interference

### 19.2.3.1 High-speed Pulse Interference

Take the measures listed in the following table to suppress interference.

| No. | Step |
|---|---|
| 1 | Used shielded twisted pair cables with both ends of the cable grounded (see *" I/O signal cable selection" on page 146*). |
| 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. |
| 4 | Add an equipotential bonding grounding cable between the host controller and drive (see *"Figure 8–20 Recommended wiring for the control cabinet system" on page 146*). |
| 5 | Separate signal cables from power cables with a distance of at least 30 cm. |
| 6 | Install the ferrite clamp or wind the magnetic ring on the signal cable by one or two turns. (see *"5.2.4 Installation of the Magnetic Ring and Ferrite Clamp" on page 113*). |
| 7 | Install the magnetic ring on the output side (UVW) of the drive by two to four turns (see *"5.2.4 Installation of the Magnetic Ring and Ferrite Clamp" on page 113*). |
| 8 | Use shielded power cables and ground the shield properly. |

### 19.2.3.2 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.

| Step | Measure |
|---|---|
| 1 | Use shielded cables as the I/O signal cables and connect the shield to the PE terminal. For details, see *" I/O signal cable selection" on page 146*. |
| 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 *"Figure 8–20 Recommended wiring for the control cabinet system" on page 146*). |
| 4 | Install the magnetic ring on the output side (UVW) of the drive by two to four turns (see *"5.2.4 Installation of the Magnetic Ring and Ferrite Clamp" on page 113*). |
| 5 | Increase the filter capacitance for low-speed DIs. A capacitance up to 0.1 µF is recommended, as shown in *"Figure 19–3 I/O signal cables with capacitance increased" on page 686*. |

| Step | Measure |
|---|---|
| 6 | Increase the filter capacitance between AI and GND. A capacitance up to 0.22 μF is recommended. |
| 7 | Install a ferrite clamp or wind a magnetic ring on the signal cable by one or two turns. (see *"5.2.4 Installation of the Magnetic Ring and Ferrite Clamp" on page 113*). |
| 8 | Use shielded power cables and ground the shield properly. |

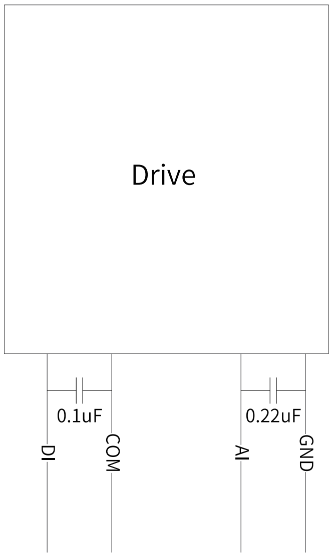



Figure 19-3 I/O signal cables with capacitance increased

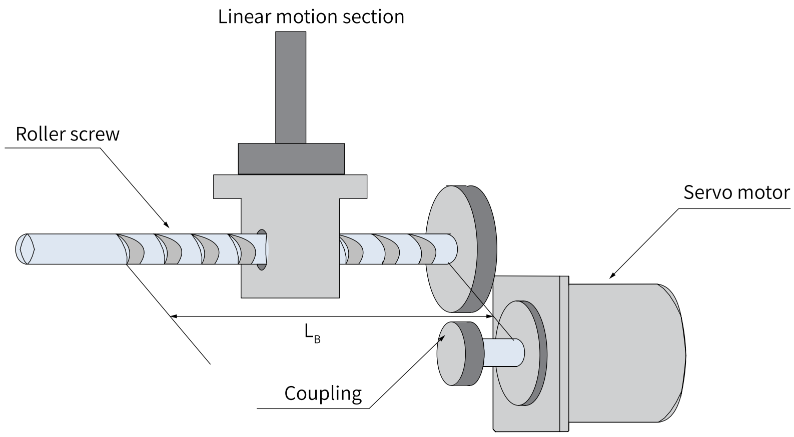
## 19.2.4 RS485&CAN Communication Interference

Take the measures listed in the following table to suppress interference.

| Step | Measure |
|---|---|
| 1 | Install a 120 Ω termination resistor on each end of the bus. |
| 2 | Replace with multi-conductor shielded twisted pair cables and ground both ends of the shield. |
| 3 | Separate communication cables from power cables with a distance of at least 30 cm. |
| 4 | Adopt daisy chain mode for multi-node communication layout. |
| 5 | Add an equipotential bonding grounding cable between nodes during multi-node communication (See *"Figure 8–20 Recommended wiring for the control cabinet system" on page 146*). |
| 6 | Install ferrite clamps on both sides of the communication cable or wind the magnetic ring by one or two turns (see *"Figure 5–15" on page 114* ). |
| 7 | Install the magnetic ring on the output side (UVW) of the drive by two to four turns (see *"Figure 5–14" on page 113* ). |
| 8 | Use shielded power cables and ground the shield properly. |

# 19.3 Capacity Selection Example for Servo Motor

## 19.3.1 Capacity Selection Example for Position Control




Load speed ($V_L$): 15 m/min

Mass of the rectilinear motion part (m): 80 kg

Roller screw length ($L_B$) = 0.8 m

Roller screw diameter ($d_B$) = 0.016 m

Roller screw pitch ($P_B$) = 0.005 m

Mass of the coupling ($m_c$): 0.3 kg

Outer diameter of the coupling ($d_c$) = 0.03 m

Times of feeding (n): 40/min

Length of feeding (L): 0.25 m

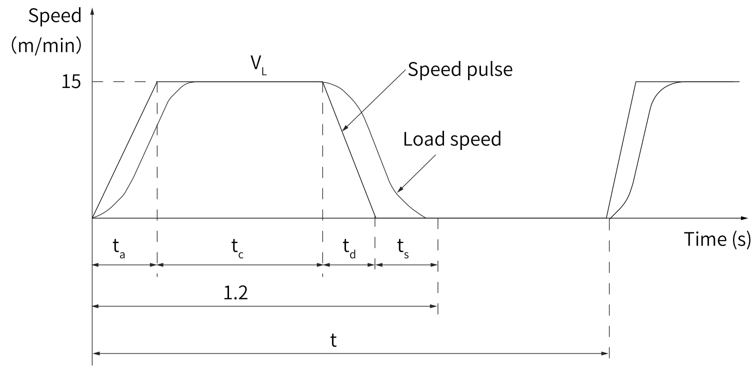
Feeding time ($t_m$) < 1.2s

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**

- Rotational speed of the load shaft

$$n_L = \frac{V_L}{P_B} = \frac{15}{0.005} = 3000 \text{ (rpm)}$$

- Rotational speed of the motor shaft

  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**

- Rectilinear motion part

$$J_{LI} = m \times \left(\frac{P_B}{2\pi R}\right)^2 = 80 \times \left(\frac{0.005}{2\pi \times 1}\right)^2 = 0.507 \times 10^{-4} \text{ (kg}\cdot\text{m}^2\text{)}$$

- Roller screw

$$J_B = \frac{\pi}{32} P \times L_B \times d_B^{\,4} = \frac{\pi}{32} \times 7.87 \times 10^3 \times 0.8 \times (0.016)^4 = 0.405 \times 10^{-4} \text{(kg}\cdot\text{m}^2\text{)}$$

- Coupling

$$J_C = \frac{1}{8} m_c \times d_c^{\,4} = \frac{1}{8} \times 0.3 \times (0.03)^2 = 0.338 \times 10^{-4} \text{(kg}\cdot\text{m}^2\text{)}$$

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. **Temporary settings of the servo motor**

- Selection condition

  $T_L \leqslant$ Rated torque of the motor

  $P_a + P_o$ = (1 to 2) x Rated output of the motor

  $n_M \leqslant$ Rated speed of the motor

  $J_L \leqslant$ Allowable load moment of inertia of the servo unit

  Perform the following provisional selections according to preceding conditions:

  Servo motor: MS1H1-20B30CB-T331Z

  Servo drive: SV630CS2R8I

- Specifications of the servo motor and servo drive

Rated output: 200 (W)

Rated speed: 3000 (RPM)

Rated torque: 0.637 (N·m)

Maximum instantaneous torque: 1.91 (N·m)

Rotor moment of inertia: 0.158 x $10^{-4}$ (kg·$m^2$)

Allowable load moment of inertia: 3.69 x $10^{-4}$ (kg·$m^2$)

Number of encoder pulses: 262144 (P/R)

8. **Confirmation of the servo motor selected temporarily**

Confirm the startup torque required

$$T_p = \frac{2\pi \times n_M \times (J_M + J_L)}{60 \times t_a} + T_L = \frac{2\pi \times 3000 \times (0.158 + 1.25) \times 10^{-4}}{60 \times 0.1} + 0.139$$

$= 0.581(N \cdot m) <$ Max. instantaneous torque  Satisfactory

Confirm the brake torque required

$$T_s = \frac{2\pi \times n_M \times (J_M + J_L)}{60 \times t_a} - T_L = \frac{2\pi \times 3000 \times (0.158 + 1.25) \times 10^{-4}}{60 \times 0.1} - 0.139$$

$= 0.303(N \cdot m) <$ Max. instantaneous torque  Satisfactory

Confirm the effective torque value

$$T_{rms} = \sqrt{\frac{T_p{}^2 \times t_a + T_L{}^2 \times t_c + T_s{}^2 \times t_d}{t}}$$

$$= \sqrt{\frac{(0.581)^2 \times 0.1 + (0.139)^2 \times 0.9 + (0.303)^2 \times 0.1}{1.5}}$$

$= 0.2\ (N \cdot m) <$ Rated torque  Satisfactory

The capacities of the servo motor and servo drive selected temporarily based on preceding steps are available for use. The position control analysis is as follows.

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.

$$\frac{P_B}{\Delta L} \times \frac{B}{A} = \frac{5}{0.01} \times \frac{B}{A} = 262144$$

$$\frac{B}{A} = \frac{262144 \times 0.01}{5} = \frac{262144}{500}$$

10. **Reference pulse frequency**

$$v_s = \frac{1000 \times V_L}{60 \times \Delta L} = \frac{1000 \times 15}{60 \times 0.01} = 25000 \text{ (pps)}$$

11. **Offset counter droop pulse**

- Set the position loop gain ($K_p$) to 30 (l/s).

$$\varepsilon = \frac{v_s}{K_p} = \frac{25000}{30} = 833 \text{ (pulse)}$$

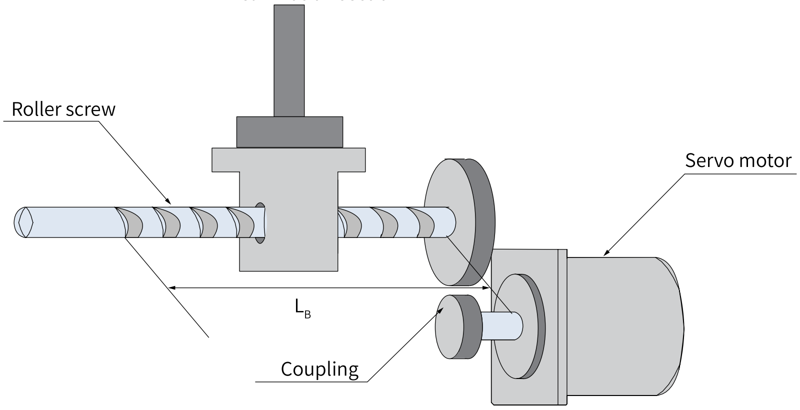
- Electrical stop precision

$$\pm\Delta\varepsilon = \pm\frac{\varepsilon}{(\text{Servo drive control range}) \times \frac{n_M}{n_R}} = \pm\frac{833}{5000 \times \frac{3000}{3000}}$$

$$= \pm 0.17 < \pm 1\ (\text{pulse}) \pm 0.01\ (\text{mm/pulse})$$

By observing preceding steps, the servo motor and servo drive selected temporarily for position control are available for use.

## 19.3.2 Capacity Selection Example for Speed Control




Load speed ($V_L$): 15 m/min

Mass of the rectilinear motion part (m): 80 kg

Roller screw length ($L_B$) = 0.8 m

Roller screw diameter ($d_B$) = 0.04 m

Roller screw pitch ($P_B$) = 0.01 m

Mass of the coupling ($m_c$): 1 kg

Outer diameter of the coupling ($d_c$) = 0.06 m

Times of feeding (n): 40/min

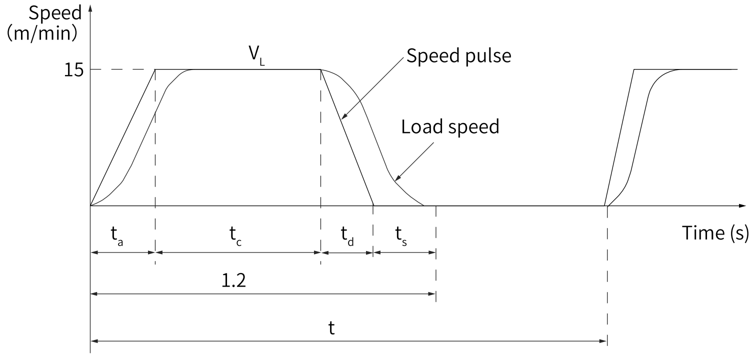
Length of feeding (L): 0.25 m

Feeding time ($t_m$) < 1.2s

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 $t_a$ to the same value as $t_d$.

$$t_a = t_m - t_s - \frac{60 \times L}{V_L} = 1.2 - 0.1 - \frac{60 \times 0.25}{15} = 0.1(s)$$

$$t_c = 1.2 - 0.1 - 0.1 \times 2 = 0.9(s)$$

2. **Speed**

- Rotational speed of the load shaft

$$n_L = \frac{V_L}{P_B} = \frac{15}{0.01} = 1500 \text{ (rpm)}$$

- Rotational speed of the motor shaft
  As the coupling is directly connected, the gear ratio (1/R) is 1:1.

$$n_M = n_L \times R = 1500 \times 1 = 1500 \text{ (RPM)}$$

3. **Load torque**

$$T_L = \frac{9.8\, \mu \times m \times P_B}{2\pi \times R \times \eta} = \frac{9.8 \times 0.2 \times 80 \times 0.01}{2\pi \times 1 \times 0.9} = 0.277 \text{ (N·m)}$$

4. **Load Moment of Inertia**

- Rectilinear motion part

$$J_{LI} = m \times \left(\frac{P_B}{2\pi R}\right)^2 = 80 \times \left(\frac{0.01}{2\pi \times 1}\right)^2 = 2.02 \times 10^{-4} \text{ (kg·m}^2)$$

- Roller screw

$$J_B = \frac{\pi}{32} P \times L_B \times d_B^4 = \frac{\pi}{32} \times 7.87 \times 10^3 \times 1.4 \times (0.04)^4 = 27.7 \times 10^{-4} \text{ (kg·m}^2)$$

- Coupling

$$J_C = \frac{1}{8} m_c \times d_c^4 = \frac{1}{8} \times 1 \times (0.06)^2 = 4.5 \times 10^{-4} \text{ (kg·m}^2)$$

5. **Load moving power**

$$P_O = \frac{2\pi \times n_M \times T_L}{60} = \frac{2\pi \times 1500 \times 0.277}{60} = 43.6 \text{ (W)}$$

6. **Load acceleration power**

$$P_a = \left(\frac{2\pi}{60} \times n_m\right)^2 \times \frac{J_L}{t_a} = \left(\frac{2\pi}{60} \times n_m\right)^2 \times \frac{J_C + J_B + J_{LI}}{t_a}$$

$$= \left(\frac{2\pi}{60} \times 1500\right)^2 \times \frac{34.22 \times 10^{-4}}{0.1} = 844 \text{ (W)}$$

7. **Temporary settings of the servo motor**

- Selection condition
  $T_L \leqslant$ Rated torque of the motor

  $P_a + P_o = (1 \text{ to } 2) \times$ Rated output of the motor

  $n_M \leqslant$ Rated speed of the motor

  $J_L \leqslant$ Allowable load moment of inertia of the servo unit

Perform the following provisional selections according to preceding conditions:

Servo motor: MS1H3-85B15CD-T331Z

Servo drive: SV630CT5R4I

- Specifications of the servo motor and servo drive
  Rated output: 850 (W)

  Rated speed: 1500 (RPM)

  Rated torque: 5.39 (N·m)

  Maximum instantaneous torque: 13.8 (N·m)

  Rotor moment of inertia: 13.0 x $10^{-4}$ (kg·$m^2$)

  Allowable load moment of inertia: 69.58 x $10^{-4}$ (kg·$m^2$)

8. **Confirmation of the servo motor selected temporarily**

Confirm the startup torque required

$$T_p = \frac{2\pi \times n_M \times (J_M+J_L)}{60 \times t_a} + T_L = \frac{2\pi \times 1500 \times (13 + 34.22) \times 10^{-4}}{60 \times 0.1} + 0.277$$

$= 7.69(N \cdot m) <$ Max. instantaneous torque   Satisfactory

Confirm the brake torque required

$$T_s = \frac{2\pi \times n_M \times (J_M+J_L)}{60 \times t_a} - T_L = \frac{2\pi \times 1500 \times (13+ 34.22) \times 10^{-4}}{60 \times 0.1} - 0.277$$

$= 7.14(N \cdot m) <$ Max. instantaneous torque   Satisfactory

Confirm the effective torque value

$$T_{rms} = \sqrt{\frac{T_p^2 \times t_a + T_L^2 \times t_c + T_s^2 \times t_d}{t}}$$

$$= \sqrt{\frac{(7.69)^2 \times 0.1 + (0.277)^2 \times 0.9 + (7.14)^2 \times 0.1}{1.5}}$$

$= 2.71(N \cdot m) <$ Rated torque   Satisfactory

9. **Selection result**

The servo motor and servo drive selected temporarily according to preceding steps are available for use. The torque diagram is as follows.

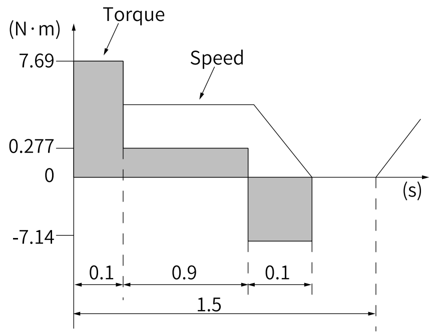



Figure 19-4 Torque diagram

## 19.4 CANlink Enhanced Axis Control Parameters

Table 19–3 List of default parameters for enhanced axis control

| Param. | Description | Default |
|---|---|---|
| H11.00 | Multi-position running mode | 5: Axis-controlled continuous operation |
| H11.04 | Displacement reference type | 1: Absolute displacement reference |
| H11.05 | Starting displacement No. in sequential operation | 1 |
| H11.16 | Interval time after displacement 1 | 0 |
| H05.00 | Primary position reference source | 2: Multi-position reference |
| H05.02 | Pulses per revolution | 10000 |
| H05.30 | Homing enable selection | 1: Homing enabled by signal input from DI |
| H05.31 | Homing mode | 1: Reverse homing, home switch as the deceleration point and the home |
| H05.32 | Speed in high-speed searching for the home switch signal | 200 RPM |
| H05.33 | Speed in low-speed searching for the home switch signal | 20 RPM |
| H05.35 | Home search time limit | 30000 ms |
| H05.40 | Mechanical home offset and action upon overtravel | 3: H05.36 (Mechanical home offset) used as the relative offset after homing, reverse homing applied automatically upon overtravel |
| H09.00 | Auto-adjustment mode | 1: Standard stiffness level mode |
| H09.02 | Adaptive notch mode | 1: Only one adaptive notch (3rd notch) activated |
| H0C.09 | Communication VDI | 1: Enable |
| H0C.11 | Communication VDO | 1: Enable |
| H04.00 | DO1 function selection | 0: No assignment |
| H04.02 | DO2 function selection | 0: No assignment |
| H04.04 | DO3 function selection | 9: Brake |
| H04.06 | DO4 function selection | 0: No assignment |
| H04.08 | DO5 function selection | 0: No assignment |
| H03.06 | DI3 function selection | 0: No assignment |
| H03.08 | DI4 function selection | 0: No assignment |
| H03.10 | DI5 function selection | 0: No assignment |
| H17.00 | VDI1 function selection | 1: Servo ON |
| H17.02 | VDI2 function selection | 18: Forward jog |
| H17.04 | VDI3 function selection | 19: Reverse jog |
| H17.06 | VDI4 function selection | 28: Multi-position reference selection |
| H17.08 | VDI5 function selection | 32: Homing enable |
| H17.10 | VDI6 function selection | 34: Emergency stop |
| H17.12 | VDI7 function selection | 2: Fault and warning reset signal |
| H17.14 | VDI8 function selection | 38: Command-write interrupted |
| H17.15 | VDI8 logic selection | 1: Active when the written value changes from 0 to 1 |
| H17.16 | VDI9 function selection | Active: Command-write not interrupted |
| H17.17 | VDI9 logic selection | 1: Active when the written value changes from 0 to 1 |
| H17.18 | VDI10 function selection | 40: Positioning and reference completed signal cleared |

### Note

See the following for how to use CANlink enhanced axis control function:

1. Set H02.31 to 1 to restore parameters to default values.
2. Set H11.00 to 5. If the previous value of H11-00 is not 5, setting it to 5 enables enhanced axis control function. Parameter involved will be correlated automatically. See the detailed setpoints in the preceding table.
3. If the previous value of H11.00 is 5, setting it to a value other than 5 restores all the parameters listed in the preceding table to default values.

# 19.5 DIDO Function Assignment

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

| Code | Parameter Name | Function Name | Description | Remarks |
|---|---|---|---|---|
| FunIN.10 | M1-SEL | Mode switchover 1 | Used to perform switchover between speed control, position control, and torque control based on the selected control mode (values 3, 4, 5 of H02-00). | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.11 | M2-SEL | Mode switchover 2 | Used to perform switchover between speed control, position control, and torque control based on the selected control mode (value 6 of H02-00). | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.12 | ZCLAMP | Zero speed clamp | Active: Zero clamp enabled<br>Inactive: Zero clamp disabled | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.13 | INHIBIT | Position reference inhibited | Active: Pulse reference input inhibited<br>Inactive: Pulse reference input allowed | It is originally pulse inhibit. The position references include internal and external position references.<br>The corresponding terminal logic must be level-triggered. |
| FunIN.14 | P-OT | Positive limit switch | Enabled: Forward drive inhibited<br>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.<br>Active: Reverse drive inhibited<br>Inactive: Reverse drive allowed | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.16 | P-CL | Positive external torque limit | The torque limit source is switched based on H07.07 (Torque limit source).<br>H07.07 = 1:<br>Active: Positive external torque limit activated<br>Inactive: Positive internal torque limit activated | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.17 | N-CL | Negative external torque limit | The torque limit source is switched based on H07.07 (Torque limit source).<br>H07.07 = 1:<br>Active: Negative external torque limit activated<br>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<br>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<br>Inactive: Command input stopped | The corresponding terminal logic is recommended to be level-triggered. |

| Code | Parameter Name | Function Name | Description | Remarks |
|---|---|---|---|---|
| FunIN.20 | POSSTEP | Step reference | Active: Execute step reference set in H05-05, servo motor running<br>Inactive: Servo motor in locked state | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.21 | HX1 | Hand wheel override signal 1 | HX1 active, HX2 inactive: X10.<br>HX1 inactive, HX2 active: x 100.<br>Other: X1. | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.22 | HX2 | Hand wheel override signal 2 | | |
| FunIN.23 | HX_EN | Handwheel enable signal | Inactive: Execute position control as defined by H05-00.<br>Active: Execute position control based on handwheel signal in position mode | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.24 | GEAR_SEL | Electronic gear ratio switchover | Inactive: Electronic gear ratio 1<br>Active: Electronic gear ratio 2 | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.25 | TOQDirSel | Torque reference direction | Inactive: Forward.<br>Active: Reverse | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.26 | SPDDirSel | Speed reference direction | Inactive: Forward.<br>Active: Reverse | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.27 | POSDirSel | Position reference direction | Inactive: Actual position reference direction same as the set direction<br>Active: Actual position reference direction opposite to the set direction | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.28 | PosInSen | Multi-position reference enable | Disabled: The reference is ineffective.<br>Enabled: The reference is enabled. | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.29 | XintFree | Interrupt positioning clear | Inactive: Disabled<br>Active: Enabled | - |
| FunIN.31 | HomeSwitch | Home switch | Inactive: The switch is not triggered<br>Enabled: The switch is triggered. | The corresponding terminal logic must be level-triggered.<br>It is recommended to assign this function to a high-speed DI terminal.<br>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<br>Active: Enabled | - |

| Code | Parameter Name | Function Name | Description | Remarks |
|---|---|---|---|---|
| FunIN.33 | XintInhibit | Interrupt positioning inhibited | Active: Interrupt positioning inhibited.<br>Inactive: Interrupt positioning allowed. | The corresponding terminal logic must be level-triggered.<br>• If the logic is set to 2 (rising edge active), the servo drive forcibly changes it to 1 (active high).<br>• If the logic is set to 3 (falling edge active), the servo drive forcibly changes it to 0 (active low).<br>• 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.<br>Disabled: Current operating state is unaffected. | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.35 | ClrPosErr | Position deviation cleared | Active: Clear the position deviation<br>Inactive: Do not clear the position deviation | It is recommended to assign this function to DI8 or DI9. |
| FunIN.36 | V_LmtSel | Internal speed limit source | Inactive: H07.19 used as positive/ negative internal speed limit<br>Active: H07.20 used as positive/ negative internal speed limit | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.37 | PulseInhibit | Pulse reference inhibited | When the position reference source is pulse reference (H05.00 = 0) in the position control mode:<br>Inactive: Respond to pulse references<br>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:<br>Inactive: Not write commands<br>Active: Write command and generate interrupt | The corresponding terminal logic is recommended to be level-triggered. |
| 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:<br>Inactive: Not write commands<br>Active: Command written and interrupt not generated | The corresponding terminal logic is recommended to be level-triggered. |
| FunIN.40 | ClrCmdOkAndArrOk | Command cleared and positioning completed | Inactive: Command not cleared and positioning completed<br>Active: Command cleared and positioning completed | The corresponding terminal logic is recommended to be level-triggered. |

| Code | Parameter Name | Function Name | Description | Remarks |
|---|---|---|---|---|
| FunIN.41 | HomeRecord | Present position as the home | Inactive: The switch is not triggered<br>Active: Triggered | The corresponding terminal logic is recommended to be level-triggered. |
| Description of DO signals | | | | |
| FunOUT.1 | S-RDY | Ready to switch on | The servo drive is ready to receive the S-ON signal. Enabled: The servo drive is ready. Disabled: The servo drive not ready. | - |
| FunOUT.2 | TGON | Motor rotation output | Inactive. Absolute value of filtered motor speed is lower than the setpoint of H06.16.<br>Active. Absolute value of filtered motor speed reaches the setpoint of H06.16. | - |
| FunOUT.3 | ZERO | Zero speed signal | Inactive: Difference between motor speed feedback and reference value larger than H06.19 (Threshold of zero speed output signal)<br>Active: The difference between the motor speed feedback and the reference value is within the threshold defined by H06.19. | - |
| FunOUT.4 | V-CMP | Speed matching | Active when the absolute value of the difference between the motor speed and the speed reference lower than H06.17 (Threshold of V-Cmp signal) in the speed control mode | - |
| FunOUT.5 | COIN | Positioning completed | Active when position deviation pulses reaching H05.21 (Threshold of positioning completion) in the position control mode | - |
| FunOUT.6 | NEAR | Proximity | Active when position deviation pulses reaching H05.22 (Threshold of proximity) in the position control mode | - |
| FunOUT.7 | C-LT | Torque limit | Confirming torque limit:<br>Active: Servo drive torque reference reaching the torque limit value and restricted to this value<br>Inactive: Servo drive torque reference not reaching the torque limit value | - |
| FunOUT.8 | V-LT | Speed limit | Confirming speed limit in torque control:<br>Active: Motor speed limited<br>Inactive: Motor speed unlimited | - |

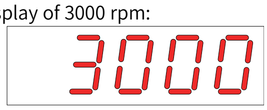
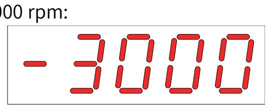
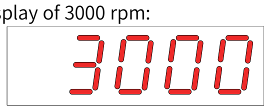
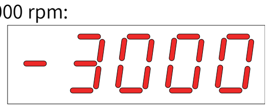
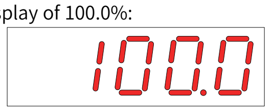
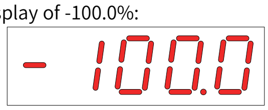
| Code | Parameter Name | Function Name | Description | Remarks |
|---|---|---|---|---|
| FunOUT.9 | BK | Brake output | Brake signal output:<br>Active: Brake released<br>Active: The power is off, the brake is released, and the motor can rotate. | - |
| FunOUT.10 | WARN | Warning output | The warning output is active (conducted). (ON) | - |
| FunOUT.11 | ALM | Fault output | Active upon fault event | - |
| FunOUT.12 | ALMO1 | Output 3-digit warning code | Output 3-digit warning code | - |
| FunOUT.13 | ALMO2 | Output 3-digit warning code | Output 3-digit warning code | - |
| FunOUT.14 | ALMO3 | Output 3-digit warning code | Output 3-digit warning code | - |
| FunOUT.15 | Xintcoin | Interrupt positioning completed | Active: Interrupt positioning completed<br>Invalid: Interruption fixed length not completed | - |
| FunOUT.16 | HomeAttain | Homing is completed. | Homing state:<br>Active: Homing completed in the position control mode<br>Inactive: Homing not completed | - |
| FunOUT.17 | ElecHome Attain | Electrical homing output | Electrical homing state:<br>Active: Electrical homing completed<br>Inactive: Electrical homing not completed | - |
| FunOUT.18 | ToqReach | Torque Reach Output | Active: Absolute value of torque reference reached setpoint<br>Inactive: Absolute value of torque reference smaller than setpoint | - |
| FunOUT.19 | V-Arr | Speed reaches output | Active: Speed feedback reaches setpoint<br>Inactive: Speed feedback smaller than setpoint | - |
| FunOUT.20 | AngIntRdy | Angle auto-tuning output | Active: Angle auto-tuning completed<br>Inactive: Angle auto-tuning not completed | - |
| FunOUT.21 | DB | Dynamic braking output | Active: Dynamic brake relay opened<br>Inactive: Dynamic braking relay closed | - |
| FunOUT.22 | CmdOk | Internal reference output | Active: Internal reference completed<br>Inactive: Internal reference not completed | - |

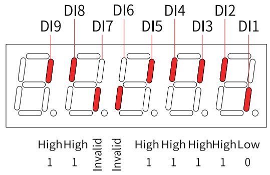
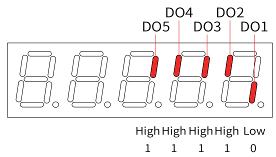
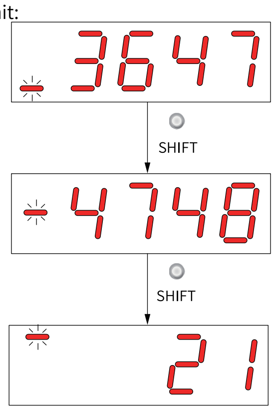
| Code | Parameter Name | Function Name | Description | Remarks |
|---|---|---|---|---|
| FunOUT.23 | WrNextBlockEn | Write next block enabled | Active: Writing the next segment allowed.<br>Inactive: Writing the next segment inhibited. | - |
| FunOUT.24 | McOk | Motion control output | Active: Motion control done<br>Inactive: Motion control not done | - |

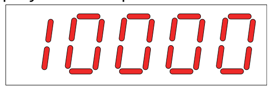
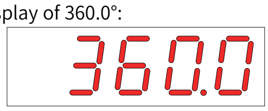
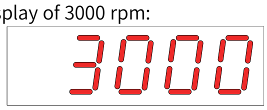
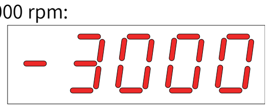
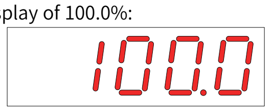
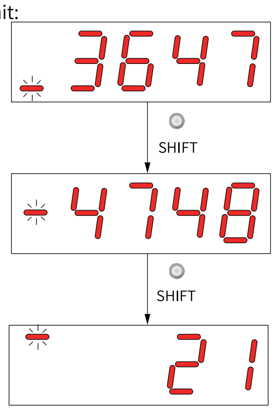
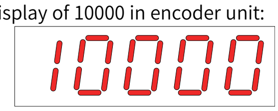
## 19.6 Display of Monitoring Parameters

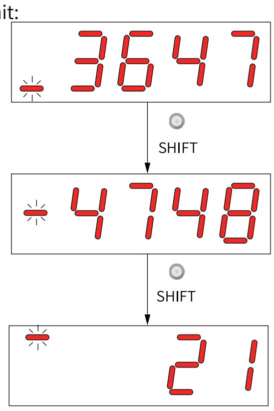
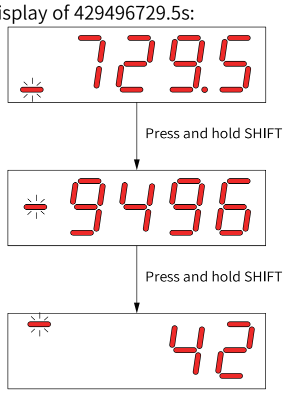
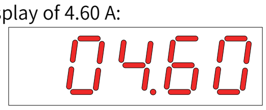
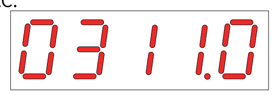
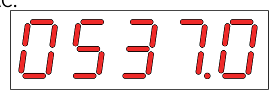
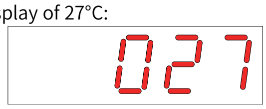
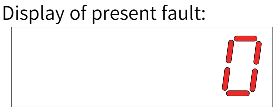
- Group H0b: Displays parameters used to monitor the operating state of the servo drive.
- Set H02.32 (Default keypad display) properly. After the motor operates normally, the keypad switches from status display to parameter display. The parameter group number is H0b and the offset within the group is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

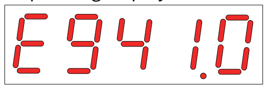
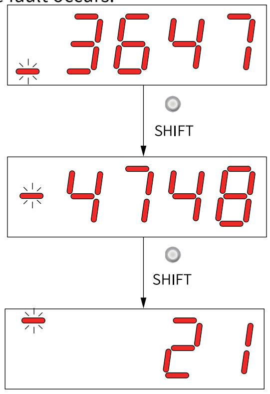
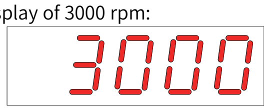
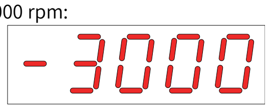
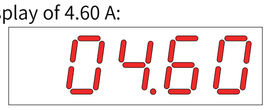
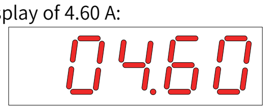
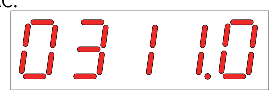
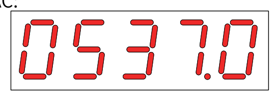
The following table describes the monitoring parameters in group H0b.

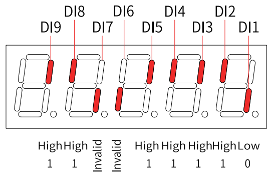
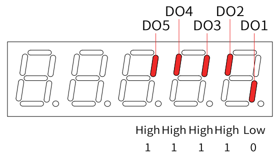
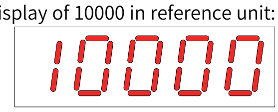
| Parameter | Name | Unit | Meaning | Example of Display |
|---|---|---|---|---|
| H0b.00 | Motor speed actual value | rpm | Displays the actual value of the motor speed after round-off, which can be accurate to 1 rpm. | Display of 3000 rpm:<br><br>-3000 rpm:<br> |
| H0b.01 | Speed reference | rpm | Displays the present speed reference of the servo drive. | Display of 3000 rpm:<br><br>-3000 rpm:<br> |
| 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%:<br><br>Display of -100.0%:<br> |

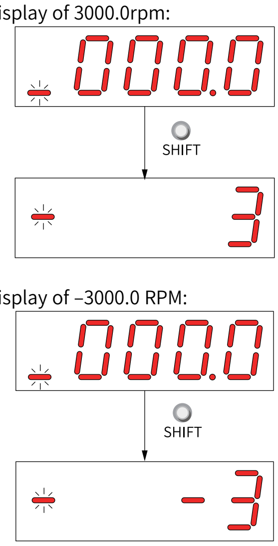
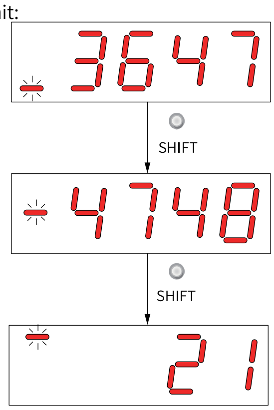
| Parameter | Name | Unit | Meaning | Example of Display |
|---|---|---|---|---|
| H0b.03 | Monitored DI status | - | Displays the optocoupler status of DI1 to DI9:<br>Upper LED segments turned on: The optocoupler is switched off (indicated by "1").<br>Lower LED segments turned on: The optocoupler is switched on (indicated by "0").<br>The value of H0b.03 read in the software tool is a decimal. | For example, if DI1 is low level and DI2 to DI9 are high level,<br>The corresponding binary value is "110011110", and the value of H0b.03 read in the software tool is 414.<br>The keypad displays as follows:<br><br> |
| H0b.05 | Monitored DO status | - | Displays the optocoupler status of DO1 to DO5:<br>Upper LED segments turned on: The optocoupler is switched off (indicated by "1").<br>Lower LED segments turned on: The optocoupler is switched on (indicated by "0").<br>The value of H0b.05 read in the software tool is a decimal. | For example, if DO1 is low level and DO2 to DO5 are high level:<br>then, the binary value is "11110".<br>and the value of H0b.05 read in the software tool is 30.<br>The keypad displays as follows:<br><br> |
| H0b.07 | Absolute position counter (32-bit decimal) | Reference unit | Displays current absolute position of the motor (reference unit). | Display of 1073741824 in reference unit:<br><br> |

| Parameter | Name | Unit | Meaning | Example of 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°.<br>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.<br>Maximum value of H0b.09 for an absolute encoder is 65535.<br>The actual mechanical angle is calculated using the following formula:<br>$\text{Actual mechanical angle} = \frac{\text{H0B-09}}{\text{Max. H0B-09+1}} \times 360.0°$ | Display of 10000 p:   |
| H0b.10 | Rotation angle (electrical angle) | 0.1° | Displays current electrical angle of the motor. | Display of 360.0°:   |
| H0b.11 | Speed corresponding to the input position reference | rpm | Displays the speed corresponding to the position reference per control cycle of the servo drive. | Display of 3000 rpm:  <br>-3000 rpm:   |
| H0b.12 | Average load rate | 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 (32-bit decimal) | Reference unit | Counts and displays the number of input position references. | Display of 1073741824 in reference unit:   |
| H0b.15 | Encoder position deviation counter (32-bit decimal) | Encoder unit | Encoder position deviation = Sum of input position references (encoder unit) – Sum of pulses fed back by the encoder (encoder unit) | Display of 10000 in encoder unit:   |

| Parameter | Name | Unit | Meaning | Example of Display |
|---|---|---|---|---|
| H0b.17 | Feedback pulse counter (32-bit decimal) | Encoder unit | Counts and displays the number of pulses fed back by the encoder (encoder unit). | Display of 1073741824 in encoder unit:   |
| H0b.19 | Total power-on time (32-bit decimal) | 0.1s | Counts and displays the total power-on time of the servo drive. | Display of 429496729.5s:   |
| H0b.24 | RMS value of phase current | 0.01 A | 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: <br>Display of 537.0 V rectified from 380 VAC:  |
| H0b.27 | Module temperature | °C | Displays the temperature of the power module inside the servo drive. | Display of 27°C:  |
| H0b.33 | Fault log | - | Used to select the previous fault to be viewed.<br>0: Present fault<br>1: Last fault<br>2: 2nd to last fault<br>...<br>9: 9th to last fault | 0: Display of present fault:  |

| Parameter | Name | Unit | Meaning | Example of Display |
|---|---|---|---|---|
| H0b.34 | Fault code of the selected fault | - | Displays the code of the fault selected in H0b.33.<br>When no fault occurs, the displayed value of H0b.34 is E000.0. | If H0b.33 is 0, and H0b.34 is E941.0, the current fault code is 941.<br>Corresponding display:<br> |
| H0b.35 | Time stamp upon occurrence of the selected fault | s | Displays the total operating time of the servo drive when the fault displayed in H0b.34 occurred.<br>When no fault occurs, the value of H0b.35 is 0. | If H0b.34 is E941.0 and H0b.35 is 107374182.4, the current fault code is 941 and the total operating time of the servo drive is 107374182.4s when the fault occurs.<br> |
| H0b.37 | Motor speed upon occurrence of the selected fault | rpm | Displays the servo motor speed when the fault displayed in H0b.34 occurred.<br>When no fault occurs, the value of H0b.37 is 0. | Display of 3000 rpm:<br><br>-3000 rpm:<br> |
| H0b.38 | Motor phase U current upon occurrence of the selected fault | 0.01 A | Displays the RMS value of motor phase U winding current when the fault displayed in H0b.34 occurred.<br>When no fault occurs, the value of H0b.38 is 0. | Display of 4.60 A:<br> |
| H0b.39 | Motor phase V current upon occurrence of the selected fault | 0.01 A | Displays the RMS value of motor phase V winding current when the fault displayed in H0b.34 occurred.<br>When no fault occurs, the value of H0b.39 is 0. | Display of 4.60 A:<br> |
| H0b.40 | Bus voltage upon occurrence of the selected fault | V | Displays the DC bus voltage of the main circuit when the fault displayed in H0b.34 occurred.<br>When no fault occurs, the value of H0b.40 is 0. | Display of 311.0 V rectified from 220 VAC:<br><br>Display of 537.0 V rectified from 380 VAC:<br> |

| Parameter | Name | Unit | Meaning | Example of Display |
|---|---|---|---|---|
| H0b.41 | DI status upon occurrence of the selected fault | - | Displays the high/low level status of DI1 to DI9 when the fault displayed in H0b.34 occurs.<br>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 | DO status upon occurrence of the selected fault | - | Displays the high/low level status of DO1 to DO5 when the fault displayed in H0b.34 occurred.<br>The method for determining the DO level status is the same as that of H0b.05.<br>When no fault occurs, all DOs are displayed as low level in H0b.42 (indicated by the decimal value 0). | Display of H0b.42 = 15:   |
| H0b.53 | Position deviation counter<br>(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 | Meaning | Example of Display |
|---|---|---|---|---|
| H0b.55 | Motor speed actual value | 0.1 rpm | Displays the actual value of the motor speed, which can be accurate to 0.1 RPM. | Display of 3000.0rpm:<br>Display of –3000.0 RPM:<br><br> |
| H0b.64 | Real-time input position reference counter | Reference unit | Displays the value of the position reference counter before being divided or multiplied by the electronic gear ratio. This value is independent of the servo drive status and the control mode. | Display of 1073741824 in reference unit:<br><br> |

# 19.7 Ordering

Table 19–4 Terminal accessory package list

| Material Code | Parameter Name | Quantity |
|---|---|---|
| 15210928 | Plug-in terminal block-plug-spring clamp wiring-9P-black | 1 |
| 19020818 | Label-CV100-3D006-ECY-CV100 blank QR code (RoHS) | 1 |
| 19021377 | Label-servo drive-SV630PS2R8I-220V Input 2.8 A-SV630P pulse type servo drive terminal | 1 |
| 19021600 | Label-SV660PS2R8I-wiring warning | 1 |
| 19033058 | Bag-SIT8.840.054-40Z603GAZ-Ziplock bag for screws delivered with the 60 kW hybrid bus motor inverter | 1 |
| 21020021 | Plastic parts-plug wiring key-for use with servo drive power plug | 1 |

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

Table 19–5 Material code of the accessory package for each model

| Material Code | Parameter Name |
|---|---|
| 98050331 | Accessories (sale)-S6-C40-SV630P size A terminal accessory kit |
| 98050332 | Accessories (sale)-S6-C42-SV630P size B terminal accessory kit |
| 98050333 | Accessories (sale)-S6-C44-SV630P size C&D terminal accessory kit |

***Note***

SV630P and SV630N products share the same terminal kit.

## 19.8 服务与支持

### Downloads

More product manuals, leaflets, brochures, certificates, 2D/3D drawings and other information can be downloaded in the following ways:

Do keyword search under “Service and Support-After-sales Service” at *https://www.inovance.com*“”.

### Contact us

We are honored to have you as our client. You can submit basic information to us in the following way, so that we can reach you as soon as possible. We are committed to your privacy. We will never share your information with any third party.

Go to our official website (*https://www.inovance.com*), select “Service and Support-Contact Us”, and submit your information.

### After-sales service

If you have product quality problems and need after-sales service, or you need to purchase spare parts, you can get the after-sales service person in your region through the following way.

Go to our official website (*https://www.inovance.com*), select “Service and Support-After-sales Service”, and submit the product category and your region.

### Repair service

If a product is in trouble and needs to be repaired, you can check the maintenance instructions, submit the service request and check the service record in the following way.

Go to our official website (*https://www.inovance.com*), select “Service and Support-Repair”, and submit the repair request.

### Authentication

You can authenticate Inovance products in the following way:

Go to our official website (*https://www.inovance.com*), select “Service and Support-Authentication”, and enter the 16-digit serial number.

## FAQ

You can go through frequently asked questions about Inovance products in the following way:

Go to our official website (*https://www.inovance.com*) and select **"**Service and Support-FAQ**"**.

## Feedback

You can submit your feedback in the following way:

Go to our official website (*https://www.inovance.com*), select **"**Service and Support-Feedback**"**, and submit your feedback.

## Forum

The forum provides high-quality courses for beginners and advanced learners. You are free to learn and share there. To get access to the forum:

Go to our official website (*https://www.inovance.com*) and select **"**Service and Support-Forum**"**.

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**Shenzhen Inovance Technology Co., Ltd.**

www.inovance.com

Add.: Inovance Headquarters Tower, High-tech Industrial Park, Guanlan Street, Longhua New District, Shenzhen

Tel: (0755) 2979 9595 Fax: (0755) 2961 9897

**Suzhou Inovance Technology Co., Ltd.**

www.inovance.com

Add.: No. 16 Youxiang Road, Yuexi Town, Wuzhong District, Suzhou 215104, P.R. China

Tel: (0512) 6637 6666 Fax: (0512) 6285 6720