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SV660P Series Servo Drive

Function Guide

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

Data code 19011393D01

Legal Information

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

Waste Disposal

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

Qualified Personnel

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

Proper Use of the Product

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

Preface

Introduction

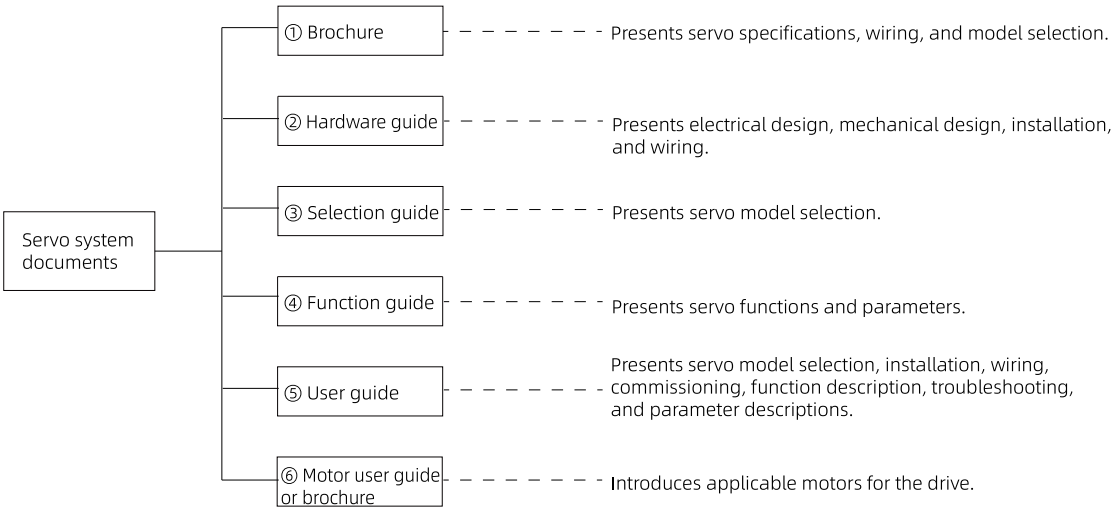
The SV660P series is a high-performance AC servo drive developed by Inovance for small and medium power applications. The servo drive covers a power range from 0.05 kW to 7.5 kW and carries Modbus communication interfaces to work with the host controller for a networked operation of multiple servo drives.

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

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

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

More documents



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

No.	Name	Code	Description
⑤	SV660P Series Servo Drive User Guide	PS00005513	Provides information about model selection, installation, commissioning, function, troubleshooting and parameters of the equipment.
⑥	MS1-R Series Servo Motor Selection Guide	PS00004605	Describes product information, general specifications, motor selection, cable selection, certification categories and standards of the motor.
	MS1-R-INT Series Servo Motor with Battery-less Encoder Selection Guide	PS00019892	Describes product information, general specifications, motor selection, cable selection, certification categories and standards of the motor.
	MS1-R Series Servo Motor Installation Guide	PS00005407	Describes the installation of the motor, including motor installation flowcharts, wiring, unpacking and handling, mechanical installation, and electrical installation.

Revision history

Date	Document version	Software version	Revision
August 2026	D01	Model: SV660P Version tag: H01-00=0607.4/ H00-02=000.00/ DD00	**Updated:** • Updated section "Preface". • Updated section "Safety Precautions": Added precautions for power-on. • Updated section "Certifications, Directives, and Standards". • Updated section "Parameter Description": Updated the latest parameter list. • Updated section "Troubleshooting": Updated the list of fault codes and alarm codes, and descriptions of fault codes and alarm codes according to the latest parameter guide. • Made minor corrections.
December 2025	D00	Model: SV660P Version tag: H01-00=0607.3/ H00-02=000.00/ DD00	• Made structural optimization. • Made content optimization. • Updated parameters and faults. • Changed the torque reference (H07.02) value to 0 and 4. • Updated the fault descriptions of E980.0 and E924.0. • Made minor corrections.
January 2025	C03	-	• Made minor corrections. • Updated parameter descriptions.
August 2024	C02	-	• Updated parameters H0b.45, H05.30, and H0A.52. • Updated the Suzhou address and added the My Inovance QR code on the cover page.
December 2023	C01	-	• Added FunOUT.26, FunOUT.27, and H0A.18. • Updated the descriptions of H00.00, H02.00, H09.35, H09.38, H09.39, H0A.47, H0A.56, H0d.19, H30.03, H30.04, and H31.00. • Updated the description of switching operation mode through DI in the "Speed Reference Input Setting" chapter.

Date	Document version	Software version	Revision
March 2023	C00	-	• Optimized H0b.33 and H0b.63. • Optimized the detailed description of H02.00 and H05.26.
January 2023	B03	-	• Added warranty information in the preface. • Deleted information on AI1. • Modified the electronic gear ratio range: • Added hexadecimal parameters in parameter description.
October 2022	B02	-	Made minor corrections.
September 2022	B01	-	• Added a section on homing. • Made minor corrections.
August 2022	B00	-	• Modified the example for setting the electronic gear ratio. • Deleted section "Faults". • Updated the list of parameters and description of parameters.
March 2022	A05	-	Modified the effective mode of H00.08 to H00.35 to "-".
December 2021	A04	-	• Added other safety precautions to the safety precautions. • Changed the default value of H0A.30 to 2. • Changed the valid range of H09.32 to -1000–1000. • Changed the default value of H00.31 to 8388608. • Changed the default value of H09.37 to 300. • Changed power cable breakage to a No.2 recoverable fault.
May 2021	A03	-	• Updated the description of H05.16. • Updated the description of Er.510.
January 2021	A02	-	• Updated the descriptions of parameters including H02.06, H02.08, H03.65, H03.66, H05.16, H05.31, H05.41, H06.01, H07.17, H0A.26, H0C.02, and H0C.08. • Updated the descriptions of Er.136 and Er.210. • Added Appendix A: CANlink Enhanced Axis Control Parameters.
November 2020	A01	-	Made minor corrections.
August 2020	A00	-	First release

Access to the guide

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

- Visit *https://www.inovance.com/global*, and choose **Service&Support > Support > Documentation Download**.
- **Scan the QR code** on the equipment to acquire more information.
- Scan the QR code below to install the **My Inovance** app, where you can search for and download the guide.

Warranty disclaimer

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. Maintenance will be charged after the warranty expires.

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

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

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

For details, see the Warranty Card.

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1 Fundamental Safety Instructions

1.1 Safety Precautions

Safety disclaimer

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

Safety levels and definitions

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

Safety Precautions

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

Unpacking



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



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

Storage and transportation



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



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

Installation
DANGER • Ensure peripheral power distribution requirements are met, and select air switches, fuses, cables, and cable terminals correctly. • Use standard torque to fasten screws, and use appropriate terminal crimping tools for to crimp terminals. • Ensure heat dissipation requirements are met and design inlet and outlet airflow duct properly. • Avoid environments with dripping water, conductive foreign objects (such as carbon fiber filaments, conductive metal dust, metal chips), and salt spray. **Failure to follow the above instructions will pose a fire risk.** • This equipment must be operated only by trained and qualified electrical personnel. Operations can be performed by professionals only.
WARNING • Read through the guide and safety instructions before installation. • Do not install this equipment in places with strong electric or magnetic field. • Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply may result in mechanical hazards. • Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock. • When installing the equipment in an enclosed environment (such as a cabinet or case), use cooling devices (such as fans or air conditioners) to cool the space and meet the installation environment requirements. Failure to do so can result in equipment overtemperature or fire accidents. • Do not retrofit the equipment. • Do not fiddle with the bolts used to fix equipment components or the bolts marked in red. • When the equipment is installed in a cabinet or terminal device, appropriate guard devices (guards for fire, electrical, and mechanical protection) meeting applicable IEC standards and local laws and regulations must be provided. • Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction. • Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply may result in a fire. **The edges of the equipment metal enclosure are sharp. Note the following precautions during installation to avoid personal injury or cable damage:** • When performing installation, handling, or maintenance operations, always wear cut-resistant gloves. • Avoid direct skin contact with enclosure edges and cut surfaces during operation.
Caution • Cover the top of the product with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the product and causing faults. After installation, remove the cloth or paper on top of the product to prevent over-temperature caused by poor ventilation due to blocked ventilation holes. • Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring
DANGER • Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Before wiring, switch off all power supplies of the device. Wait for at least the time designated on the warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply can result in electric shock. • Do not perform wiring, remove the equipment cover, or touch the circuit board and other exposed live parts with power on. Failure to comply can result in electric shock. • Make sure that the equipment and product are grounded properly. Failure to comply can result in the risk of electric shock.
WARNING • Do not connect the power cable to output terminals of the equipment or product. Failure to comply may cause equipment damage or even a fire. • When connecting a drive with the motor, make sure that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation. • Cables used must comply with corresponding cross-sectional area and shielding requirements. The shield of the shielded cable must be grounded at one end properly. • Tighten the terminal screws with the torque specified in the user guide. Insufficient or excessive torque may cause overheating and damage to the joint, which could result in fire. • After wiring is done, ensure that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply could result in electric shock or equipment damage. • Avoid direct skin contact with enclosure edges and cut surfaces during operation. • Route cables carefully during wiring. Keep them away from sharp edges to prevent squeezing or cutting. It is recommended to use protective sleeves. • If the enclosure has a protective film, remove it only after installation is completed and all work involving sharp edges has been finished.
Caution • During wiring, follow the proper electrostatic discharge (ESD) procedure and wear an anti-static wrist strap. Failure to comply may result in damage to the equipment or its internal circuits. • Use the shielded twisted pair cable to wire the control circuit, and connect the shield to the grounding terminal of the equipment. Failure to comply may result in equipment malfunction.

Power-on

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

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

Operation

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

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

Maintenance

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

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

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

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

Additional precautions

Cautions for the dynamic brake

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

Precautions for grounding

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

Effects of electromagnetic fields on medical implants

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

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

Safety Label

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

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

1.2 Industrial Information Security

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

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

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



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

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

1.3 Certifications, Directives, and Standards

Table 1–1 Compliance list

Certification	Directive		Standard
CE certification	EMC directive	2014/30/EU	EN 61800-3
	LVD directive	2014/35/EU	EN 61800-5-1 EN 60034-1 EN 60034-5
	RoHS directive	2011/65/EU 2015/863/EU	-
UL/cUL certification	-		UL61800-5-1 CSA C22.2 No.274 UL 1004-1 UL 1004-6 CSA C22.2 No.100

Note

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

2 Function Overview

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

Function	Description	References
Position control mode	Used to make the servo drive operate in the position control mode.	*" Position control mode" on page 21*
Speed control mode	Used to make the servo drive operate in the speed control mode.	*" Speed control mode" on page 92*
Torque control mode	Used to make the servo drive operate in the torque control mode.	*" Torque control mode" on page 116*
Position/Speed control switchover	Switchover between position control and speed control is implemented via external input signal.	*"3.5 Compound Control Mode" on page 134*
Position/Torque control switchover	Switchover between speed control and torque control is implemented via external input signal.	
Torque/Position control switchover	Switchover between torque control and position control is implemented via external input signal.	
Torque/Speed/ Position control switchover	Switchover between torque control, speed control and position control is implemented via external input signal.	
Torque Reference Filter	It suppresses possible mechanical resonance generated when the response speed of the servo drive is very high.	*"3.4.3 Torque Reference Filter" on page 122*
Electronic gear ratio	Decreasing or increasing the pulse input by: (0.001 x Encoder resolution/10000) to (4000 x Encoder resolution/10000).	*" Reference Frequency Division/ Multiplication (Electronic Gear Ratio)" on page 50*
Position first-order low-pass filter	It implements smooth acceleration/deceleration.	*"3.2.4 Position reference filter" on page 56*
Homing	Used to search for the mechanical home automatically to locate the relative position between the mechanical home and mechanical zero	*" Homing" on page 73*
Fixed length	Used to interrupt present position reference and execute the set displacement.	*"3.2.8 Interrupt Positioning" on page 69*
Zero Clamp	Used to keep the motor speed below a certain value in the speed control mode to lock the position.	*"3.3.4 Zero Clamp" on page 108*
Absolute Encoder System	When the servo drive is powered off, the encoder records data with the power supplied by the battery. The servo drive therefore can calculate the absolute mechanical position through the encoder after power-on, removing the need for homing.	*" Absolute Encoder System" on page 135*
Soft Limit Function	The servo drive compares the internal position feedback with the limit position, and alarms or stops when determining that the motor exceeds the limit position.	*"4.2 Software Limit Function" on page 145*
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.	*"4.3 Software Reset" on page 146*

Function	Description	References
Motor protection	The servo drive provides the motor overload protection function to prevent the motor from being damaged due to over-temperature.	“ *Motor protection*” *on page 147*
Alarm history	The latest alarms are recorded, and the alarm history can be cleared.	“ *Fault Log*” *on page 490*
Alarm code output	A 3-digit alarm code is output when an alarm occurs.	“ *List of Alarm Codes*” *on page 492* “ *List of Fault Codes*” *on page 493*

3 Basic Functions of the Servo Drive

3.1 Servo Mode

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

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

3.2 Position Control Mode

3.2.1 Overview

3.2.1.1 Function Description

In position control mode, the servo drive controls the motor position based on position references. In position control mode, the target position of a motor is determined by the sum of position references, and the motor speed is determined by the position reference frequency. The drive performs quick and accurate position control and speed control through the internal or external encoder.

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

Application scenarios

The position control mode is applicable to scenarios requiring positioning control, such as manipulators, SMT machines, engraving and milling machines (pulse sequence reference), and CNC machine tools.

3.2.1.2 Working Principle

Function Block Diagram

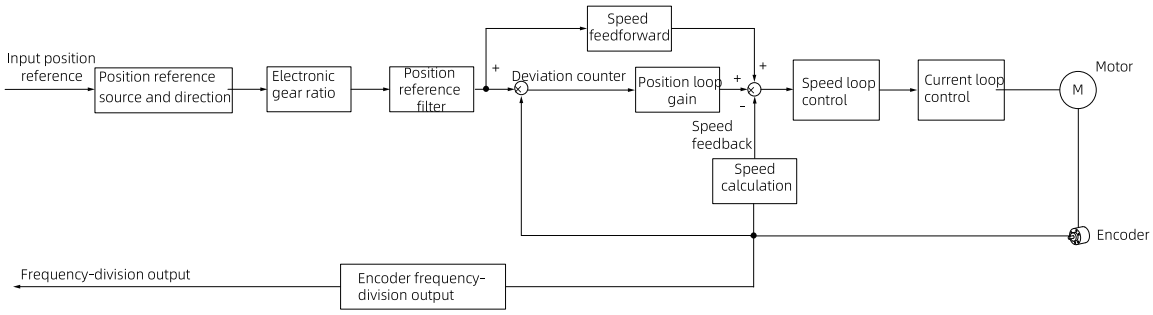


Figure 3-1 Position control diagram

Signal exchange between the drive and the host controller

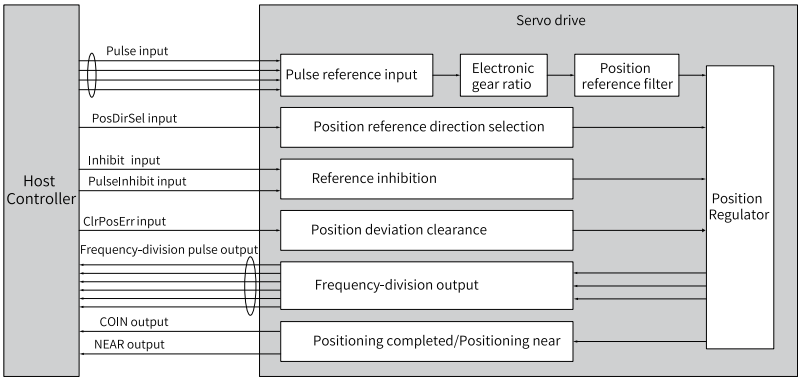


Figure 3-2 Signal exchange between the servo drive and the host controller

Parameter diagram

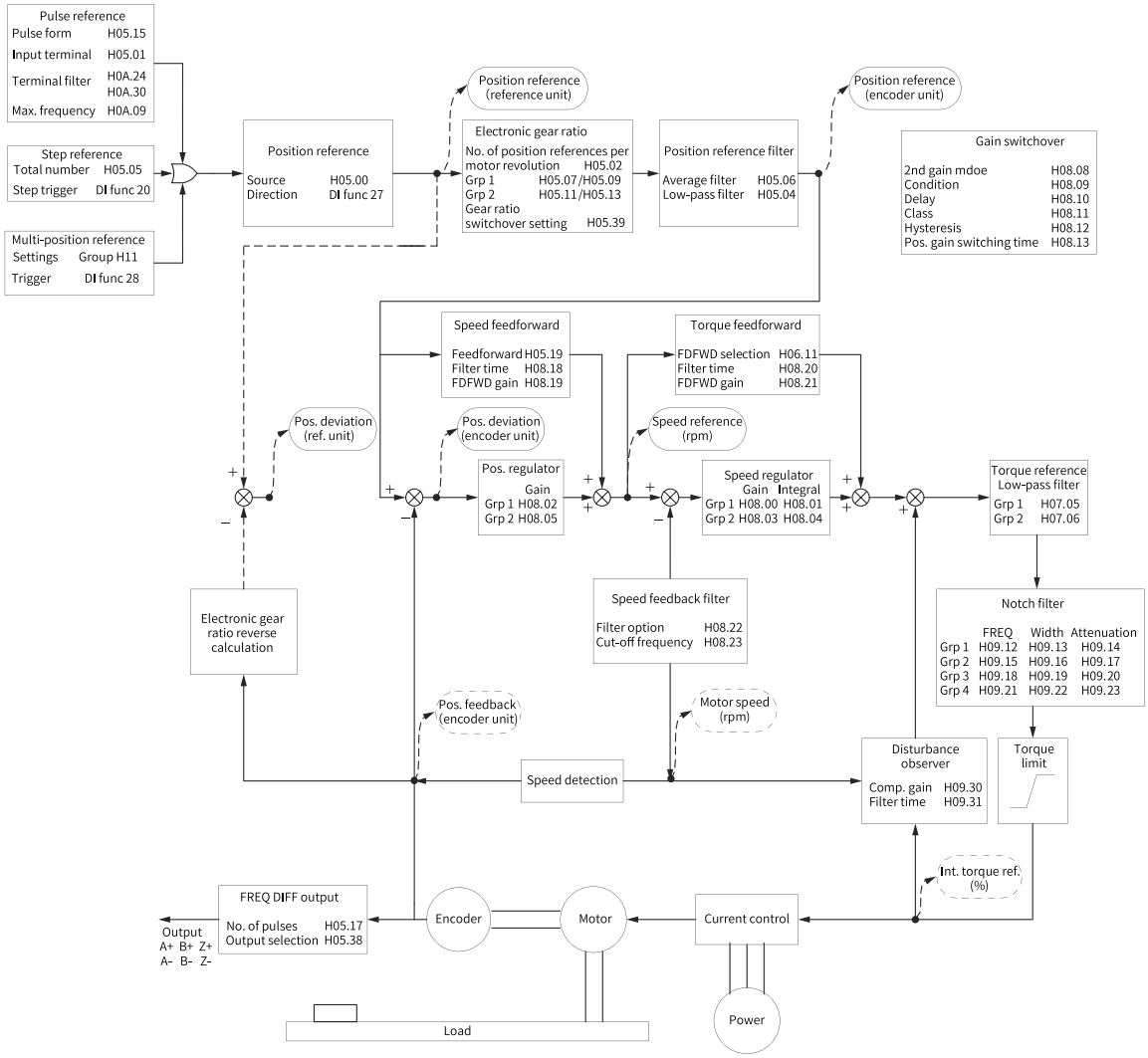


Figure 3-3 Block diagram of position control parameters

3.2.1.3 Control mode setting guide

Step	Name	Description	
1	Select the position control mode	Set H02.00 to 1.	
2	Defines the position reference source.	Sets the pulse reference as the source (H05.00 = 0)	"Pulse reference input terminal" on page 27
			"Pulse input terminal filter" on page 29
			"Pulse input format" on page 30
			"Pulse reference frequency" on page 32
		Sets the step reference as position reference source (H05.00 = 1)	"Set the motor speed based on the electronic gear ratio." on page 33
			"Set the target displacement." on page 33
			"Enable the step amount reference." on page 34
		Sets the multi-position reference as the position reference source (H05.00 = 2)	"Setting the multi-position operation mode" on page 35
			"Setting the multi-position operating curve" on page 45
			"Setting multi-position reference enable mode" on page 47
3	Set the position reference direction	"3.2.2.2 Position reference direction" on page 47	
4	Other function setting	Position reference inhibited	"3.2.2.3 Position reference inhibited" on page 48
		Reference Frequency Division/ Multiplication (Electronic Gear Ratio)	"Reference Frequency Division/ Multiplication (Electronic Gear Ratio)" on page 50
		Position reference filter	"3.2.4 Position reference filter" on page 56
		Position deviation clear	"3.2.5 Position Deviation Clear" on page 58
		Frequency-division output	"3.2.6 Frequency-Division Output" on page 59
		Motion control completed, internal reference completed, positioning completed, positioning almost completed	"Motion control completed" on page 63
		Interrupt positioning	"3.2.8 Interrupt Positioning" on page 69
		Homing	"Homing" on page 73

3.2.2 Position Reference Input Setting

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

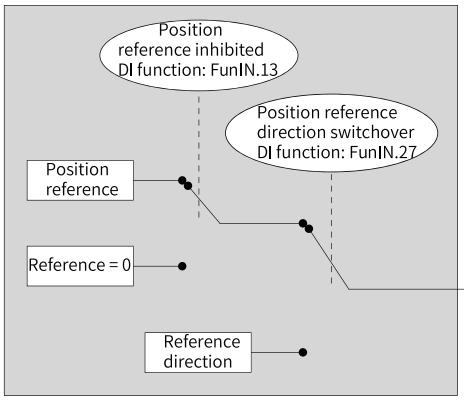


Figure 3-4 Block diagram of position reference input setting

3.2.2.1 Position reference source

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

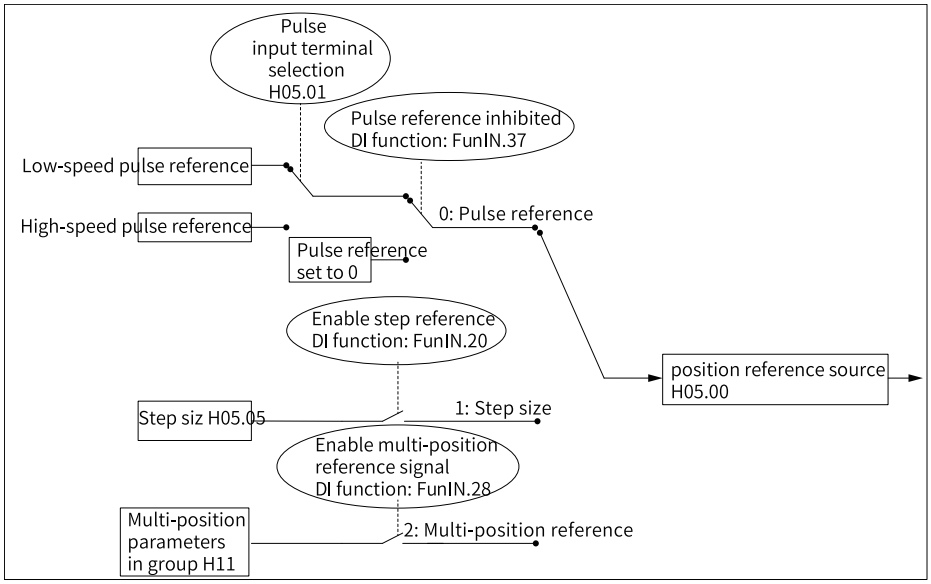


Figure 3-5 Setting the position reference source

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

Parameter description:

Defines the position reference source in the position control mode.

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

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

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

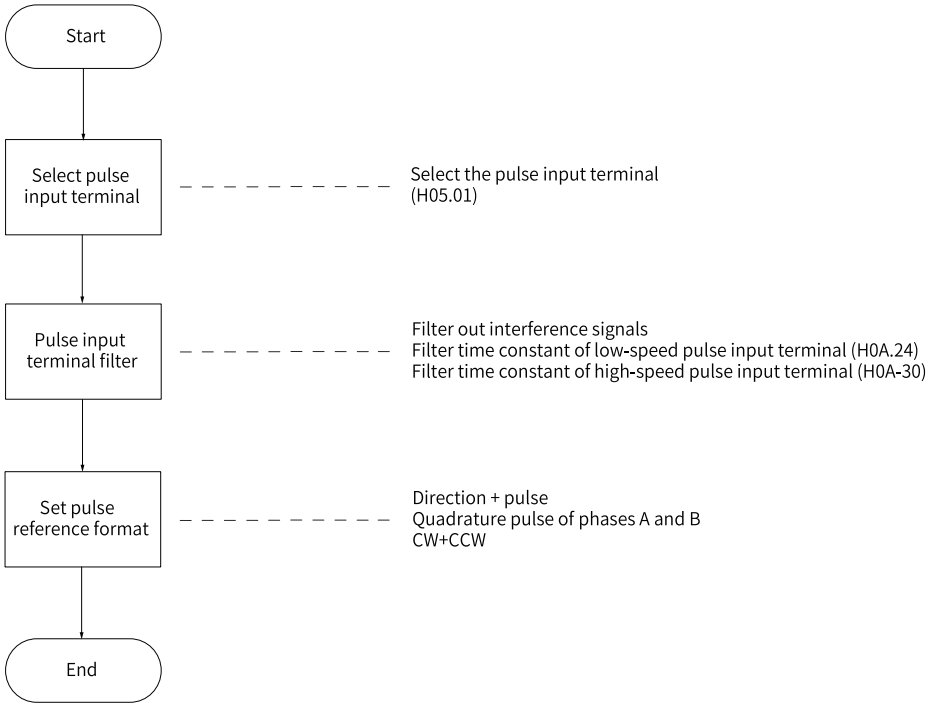
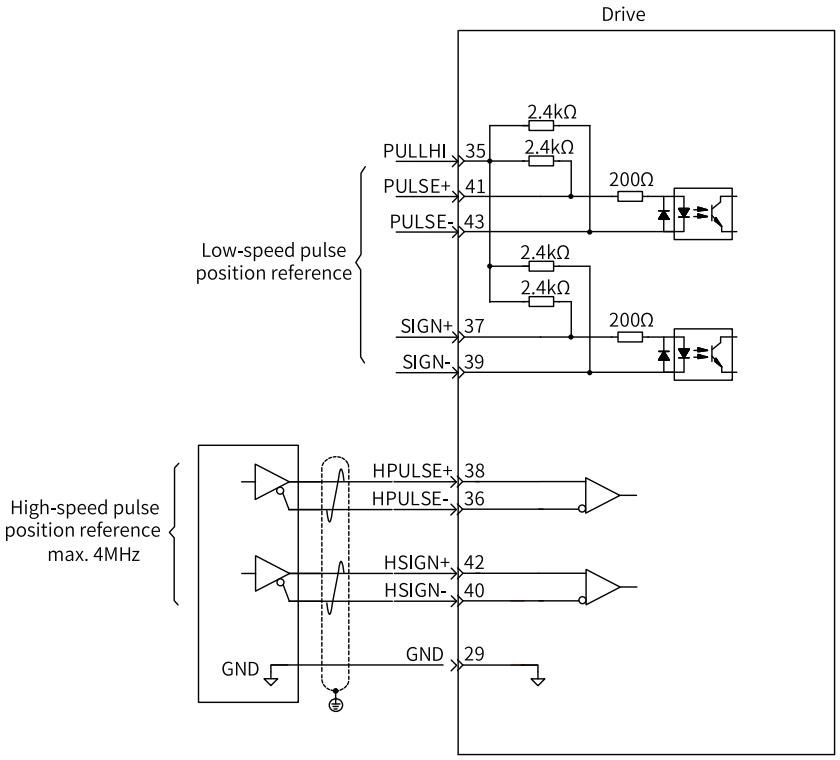


Figure 3-6 Flowchart for setting the pulse reference as the source

Pulse reference input terminals

The servo drive provides two pulse input terminals.



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

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

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

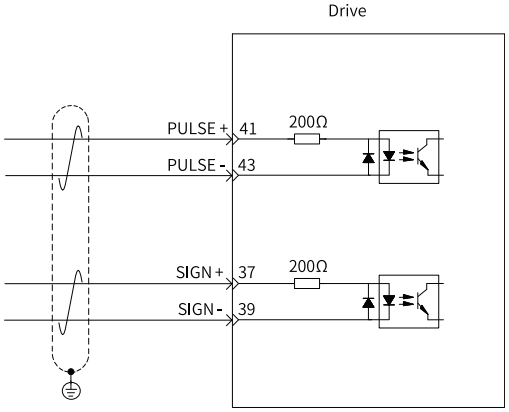
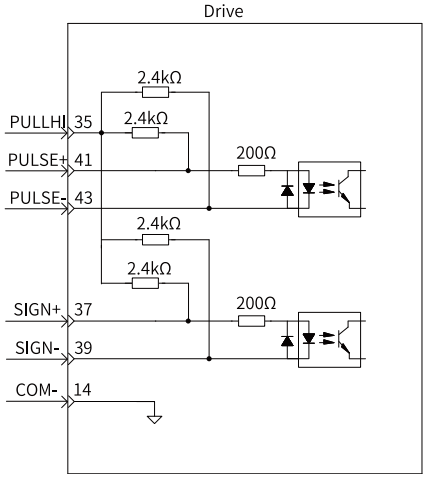
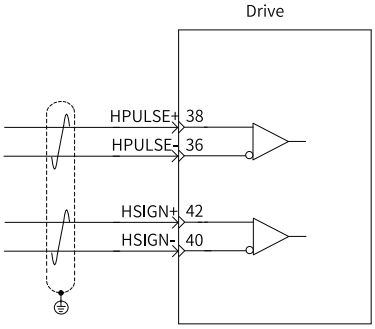
Table 3–1 Specifications of pulse input

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

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H05.01	Position pulse reference input terminal selection	0x0501	See "Value".	-	0	UInt16	At stop	Standard user	Real time

Value:

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

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

Pulse input terminal filter

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

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

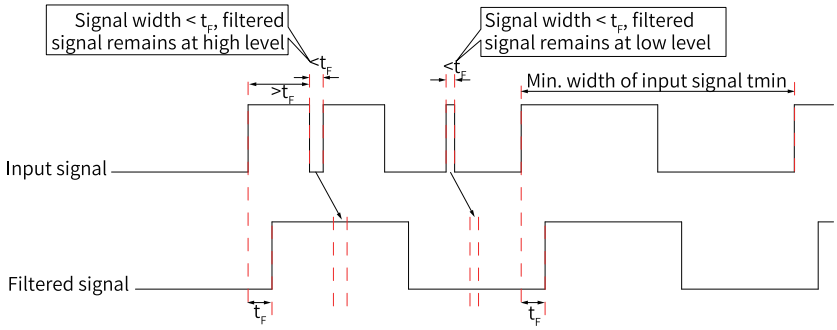


Figure 3-7 Sample signal filtering waveform

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

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

Table 3–2 Recommended filter parameter settings

Pulse input terminal	Parameter	Maximum frequency of input pulses	Recommended filter time constant (25 ns)
Low-speed pulse input terminal	H0A.24	< 167 kpps	30
Low-speed pulse input terminal	H0A.24	167 kpps to 200 kpps	20
High-speed pulse input	H0A.30	200 kpps to 1 Mpps	5
High-speed pulse input	H0A.30	> 1 Mpps	3

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

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0A.24	Filter time constant of low-speed pulse input terminal	0x0A18	0 to 255	25 ns	30	UInt16	At stop	Standard user	Next power-on

Parameter description:

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

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

Maximum frequency of input pulses	Recommended filter time constant (25 ns)
< 167 kpps	30
167 kpps to 250 kpps	20
250 kpps to 500 kpps	10

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H0A.30	Filter time constant of high-speed pulse input terminal	0x0A1E	0 to 255	25 ns	2	UInt16	At stop	Standard user	Next power-on

Parameter description:

Defines the filter time constant of high-speed pulse input terminal which is enabled (H05.01 = 1) when the position reference source is pulse reference (H05.00 = 0) in 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)
500 kpps to 1 Mpps	5
> 1 Mpps	3

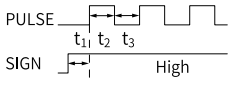
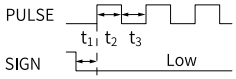
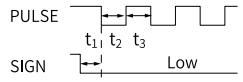
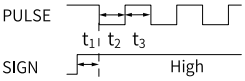
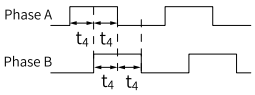
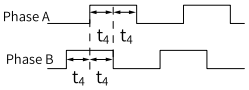
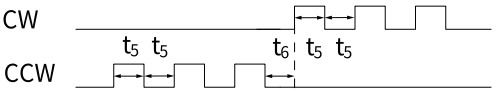
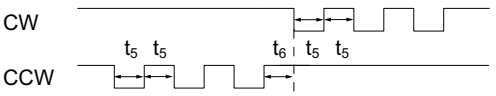
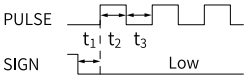
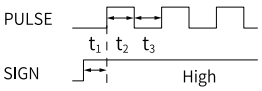
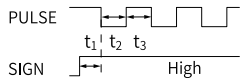
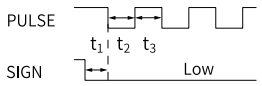
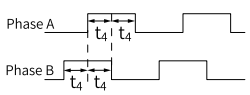
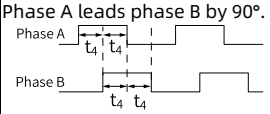
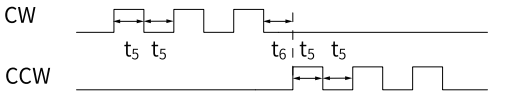
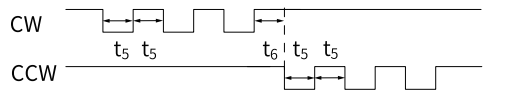
Pulse input format

The servo drive supports three pulse input formats:

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

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

Table 3–3 Pulse forms

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

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

Table 3–4 Pulse reference specifications

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

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

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

Pulse reference frequency

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

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

3.2.2.1.2 Step Reference as Position Reference Source (H05.00 = 1)

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

Caution

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

Setting process

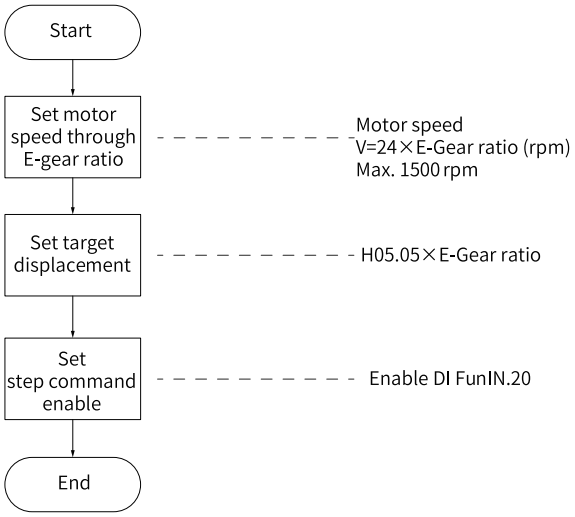


Figure 3-8 Flowchart of setting step reference as the source

Set the motor speed based on the electronic gear ratio.

Motor speed and electronic gear ratio

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

$$V_{Motor}=24\times\text{Electronic gear ratio(rpm)}$$

Set the target displacement.

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

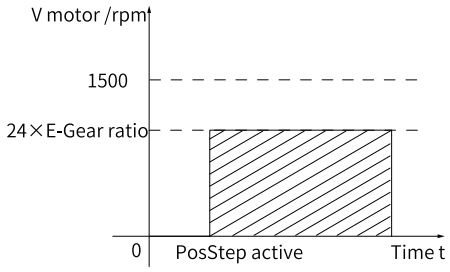


Figure 3-9 Motor operating curve (H05.00 = 1)

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

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

Enable the step amount reference.

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

Relevant function No.:

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

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

3.2.2.1.3 Multi-position Reference as Position Reference Source (H05.00 = 2)

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

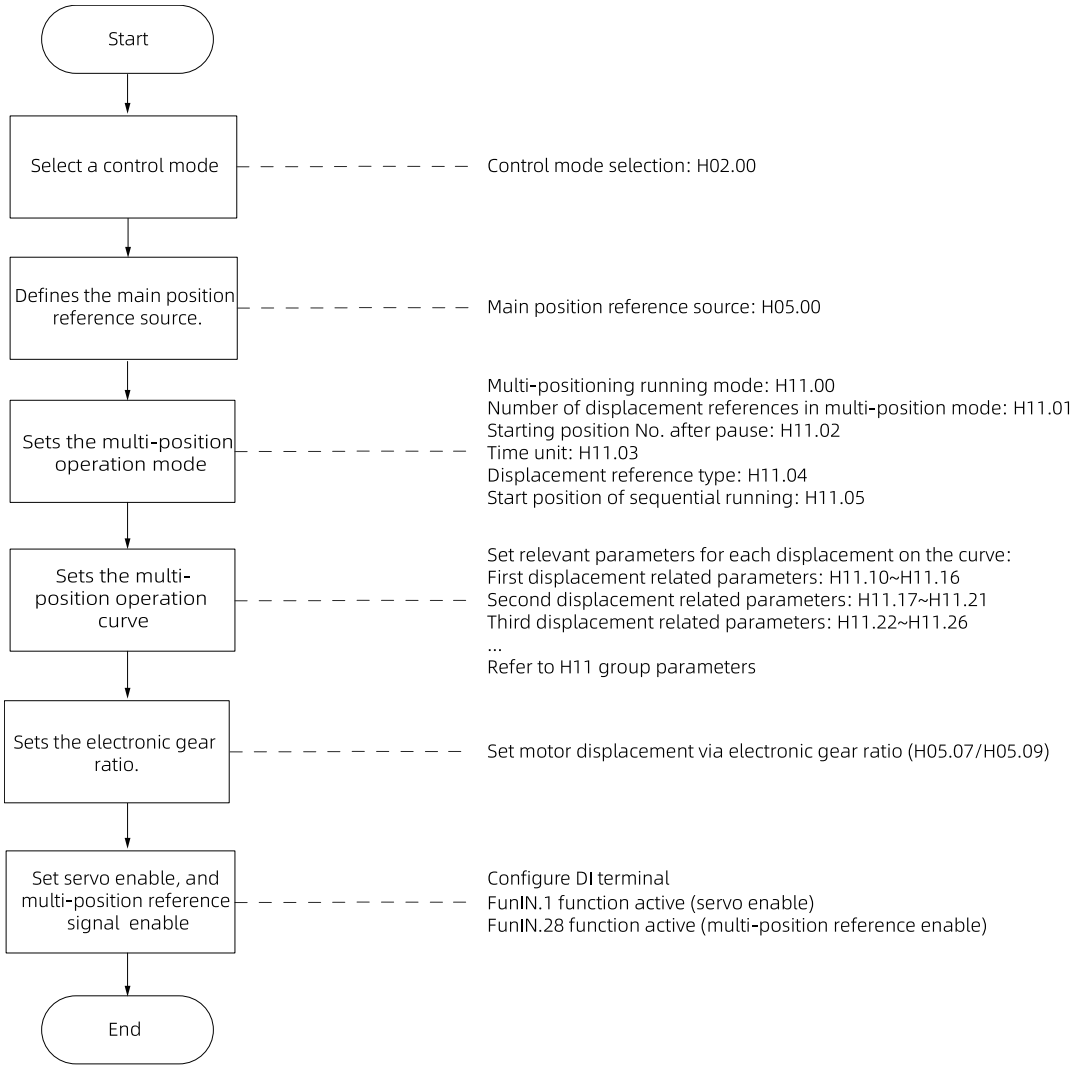
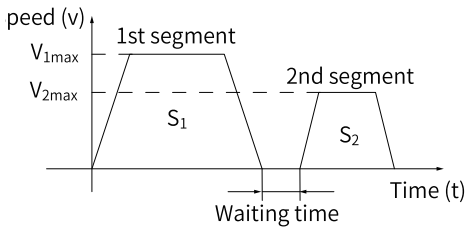


Figure 3-10 Flowchart for setting the multi-position reference as the source

Setting the multi-position operation mode

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

Table 3–5 Description of individual operation

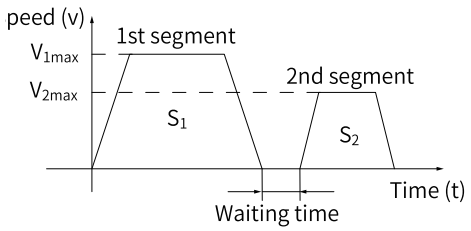
Mode description	Operation curve
• The drive stops after one cycle of operation. • The drive switches to the next displacement automatically. • The interval time between displacements can be set as needed. • The PoslnSen (multi-position reference enable) signal is level-triggered.	 V_{1max} , V_{2max}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

★Terms:

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

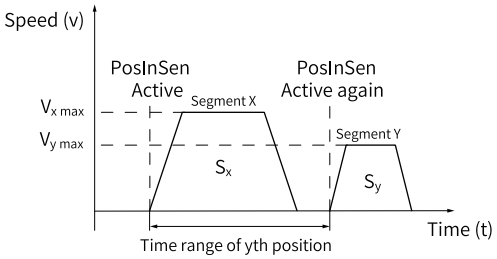
- **Cyclic operation (H11.00 = 1)**

Table 3–6 Descriptions of cyclic operation

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

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

Table 3–7 Descriptions of DI-based operation

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

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

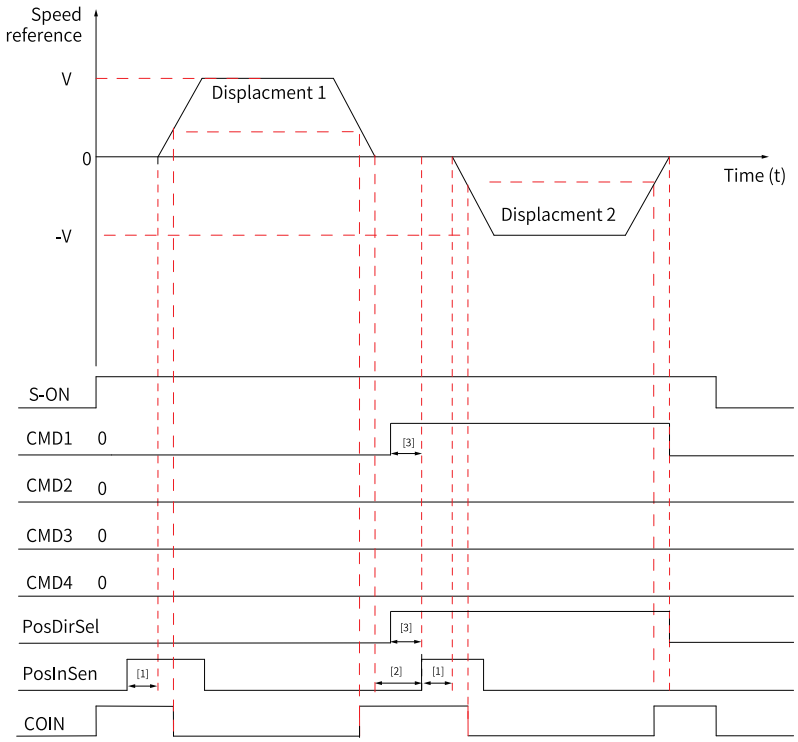


Figure 3-11 Multi-position sequence diagram

Note

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

Relevant function No.:

Code	Name	Function Name	Function
FunIN.6	CMD1	Multi-reference switchover 1	The position No. is a 4-bit binary value, and the relationship between CMD1 to CMD4 and the position No. is listed in *"Table 3-8" on page 39*. The DI logic is level-triggered. The CMD value is 1 upon active level input or 0 upon inactive level input.
FunIN.7	CMD2	Multi-position reference switchover 2	
FunIN.8	CMD3	Multi-position reference switchover 3	
FunIN.9	CMD4	Multi-reference switchover 4	

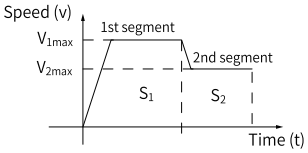
Table 3–8 Relationship between the displacement No. and CMD1 to CMD4

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

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

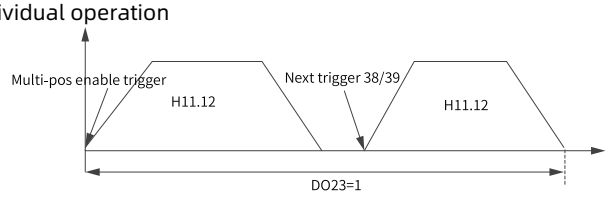
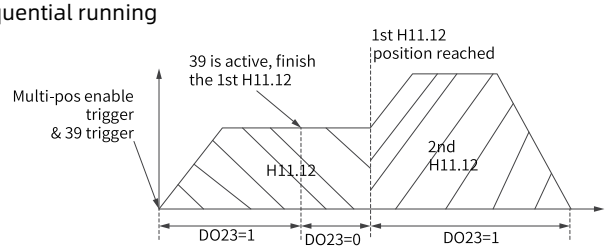
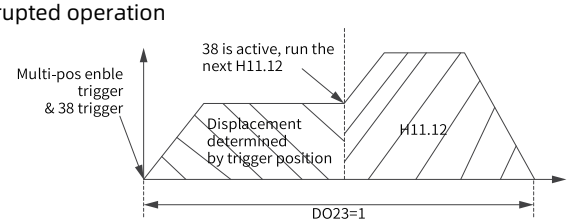
- **Sequential operation (H11.00 = 3)**

Table 3–9 Descriptions of sequential operation

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

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

Table 3–10 Description of axis-controlled continuous operation

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

Relevant function No.:

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

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

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

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H11.02	Remaining profile processing mode	0x1102	See "Parameter Description"	-	0	UInt16	At stop	Standard user	Real time

Parameter description:

Sets the starting position number when the multi-function running recovers after a pause. The function defined by H11.02 is valid only when H11.00 (Multi-position mode) is set to 0, 1, or 3.

Setpoint	Remaining profile processing mode	Remarks
0	Complete the remaining positions	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 from position 1	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.

Note: In multi-position mode, when the drive moves from the position after the home to the position before the home, it does not take the shortest path, but moves directly according to the difference between the two positions.

For example, if the drive runs from 2159 to 359, the displacement is 359 – 2159 = -1800, and the drive rotates in the reverse direction.

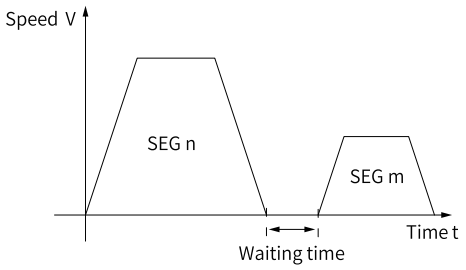
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.03	Waiting time unit	0x1103	See "Values".	-	0	UInt16	At stop	Ordinary user	At once

Values:

0: ms
1: s

Parameter description:

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

Set value	Waiting time unit	Remarks
0	ms	
1	s	

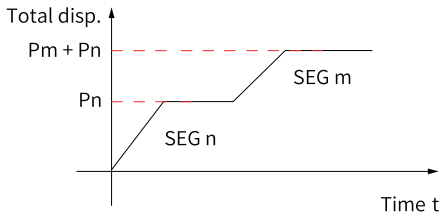
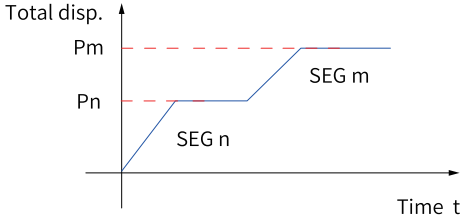
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H11.04	Displacement reference type	0x1104	See "Values".	-	0	UInt16	At once	Ordinary user	During shutdown

Values:

0: Relative displacement reference
1: Absolute displacement reference

Parameter description:

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

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

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

Parameter description:

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

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

Setting the multi-position operating curve

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

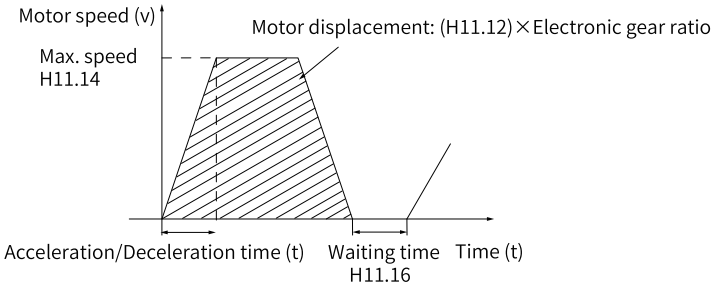


Figure 3-12 Motor operating curve in displacement 1

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

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

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

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

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

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

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

Setting multi-position reference enable mode

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

Relevant function No.:

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

3.2.2.2 Position reference direction

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

Relevant function No.:

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

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

Table 3–11 Motor direction of rotation

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

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

3.2.2.3 Position reference inhibited

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

Position reference inhibited

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

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

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

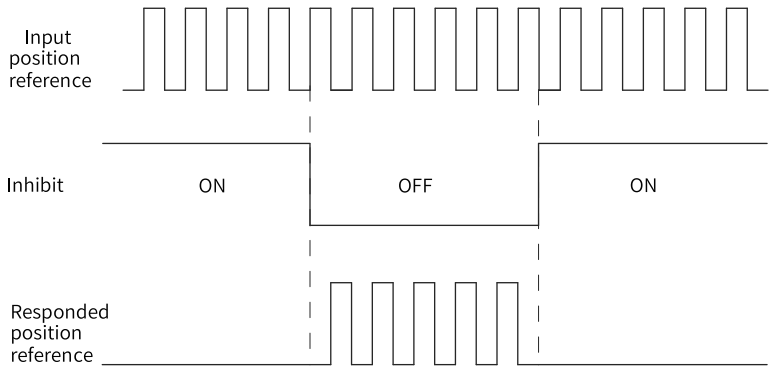


Figure 3-13 Waveform example for position reference inhibited

Relevant function No.:

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

Pulse reference inhibited

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

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

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

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

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

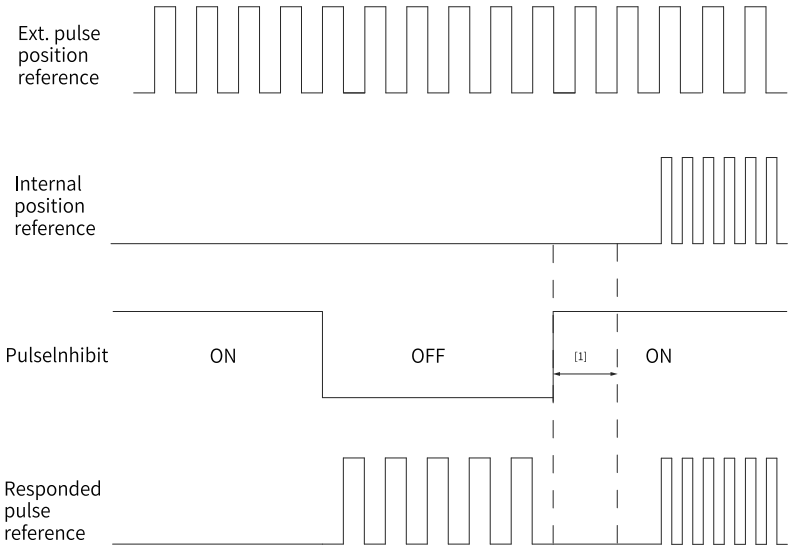


Figure 3-14 Waveform example for pulse reference inhibited

Note

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

Relevant function No.:

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

3.2.3 Reference Frequency Division/Multiplication (Electronic Gear Ratio)

3.2.3.1 Function Description

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

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

★Terms:

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

3.2.3.2 Setting Electronic Gear Ratio

3.2.3.2.1 Procedure for setting the electronic gear ratio

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

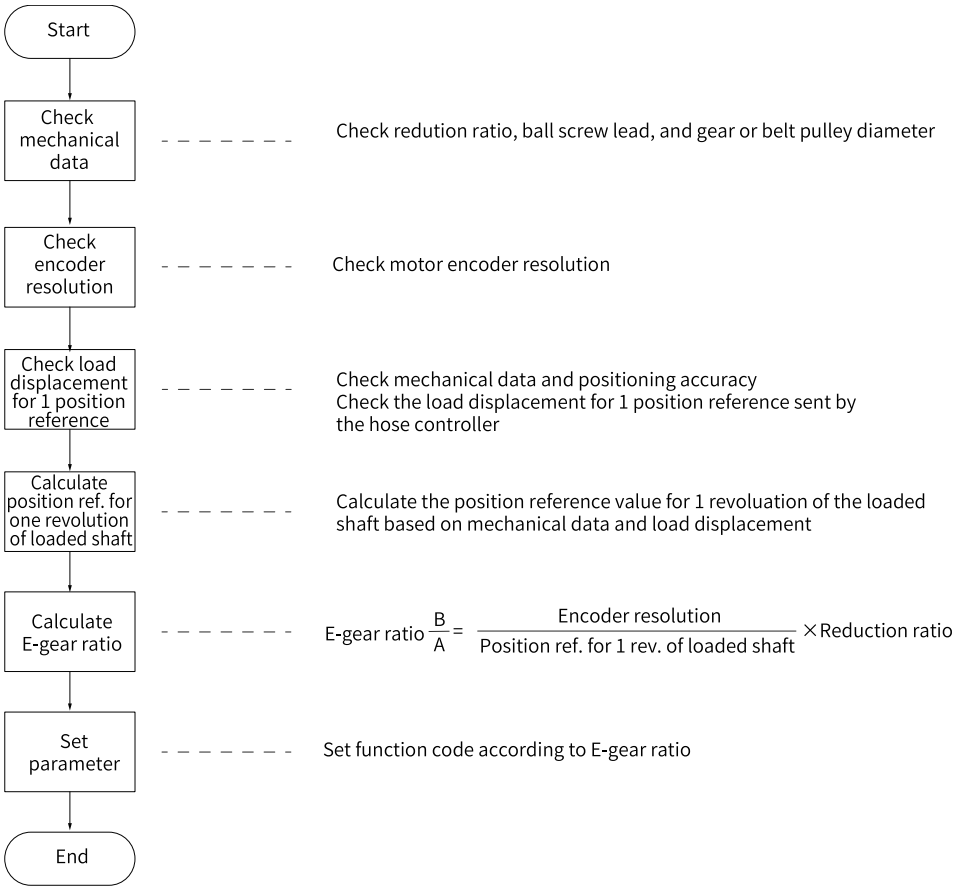


Figure 3-15 Procedure for setting the electronic gear ratio

See the following figure for how to set parameters.

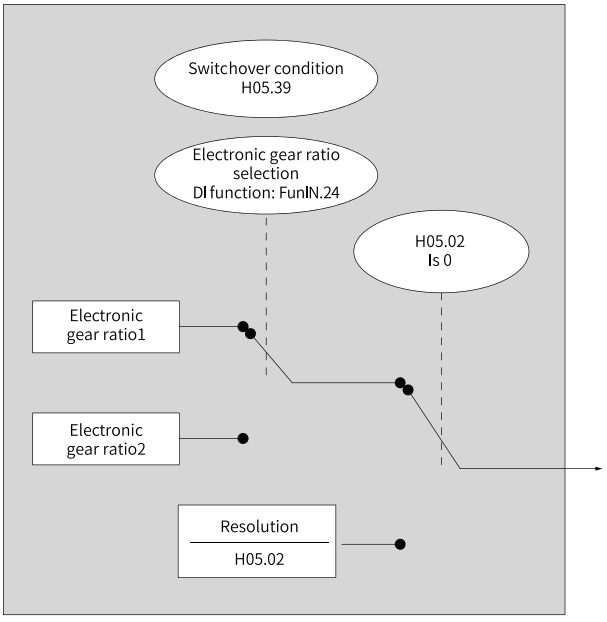


Figure 3-16 Procedure for setting the electronic gear ratio

Note

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

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

3.2.3.2.2 Setting the electronic gear ratio

The electronic gear ratio must be within the following range:

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

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

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

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

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H05.07	Electronic gear ratio 1 (numerator)	0x0507	1 to 1073741824	-	8388608	UInt32	Real time	Standard user	Real time
	Parameter description:								
	Defines the numerator of electronic gear ratio 1 for encoder unit conversion to user unit. The default value matches the actual encoder bits and is adaptive to the program. The gear ratio is the number of encoder bits divided by 10000.								

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

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H05.11	Electronic gear ratio 2 (numerator)	0x050B	1 to 1073741824	-	8388608	UInt32	Real time	Standard user	Real time
	Parameter description:								
	Defines the numerator of electronic gear ratio 2 for encoder unit conversion to user unit. The default value matches the actual encoder bits and is adaptive to the program. The gear ratio is the number of encoder bits divided by 10000.								

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

3.2.3.2.3 Calculating formula of the electronic gear ratio

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

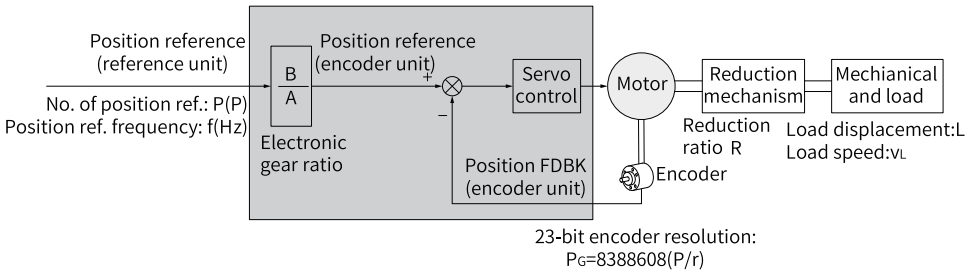


Figure 3-17 Relationship among the position reference (reference unit), load displacement, and electronic gear ratio

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

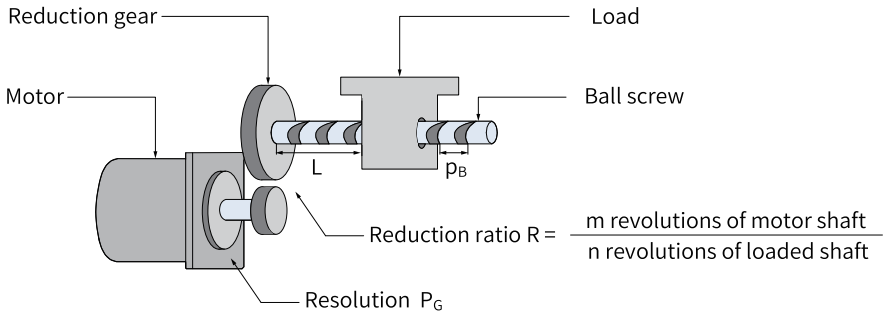


Figure 3-18 Ball screw

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

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

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

Therefore, the electronic gear ratio is:

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

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

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

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

Therefore, the electronic gear ratio is:

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

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

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

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

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

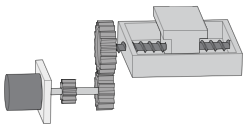
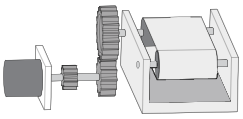
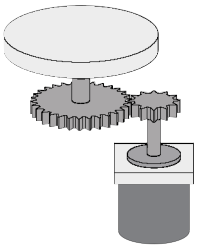
$$f \times \frac{B}{A} = v_M \times P_G$$

Therefore, the electronic gear ratio is:

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

3.2.3.2.4 Electronic gear ratio setting example

Table 3–12 Electronic gear ratio setting example

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

3.2.3.3 Switching the electronic gear ratio

Caution

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

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

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

Relevant function No.:

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

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

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

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

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

3.2.4 Position reference filter

Function Description

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

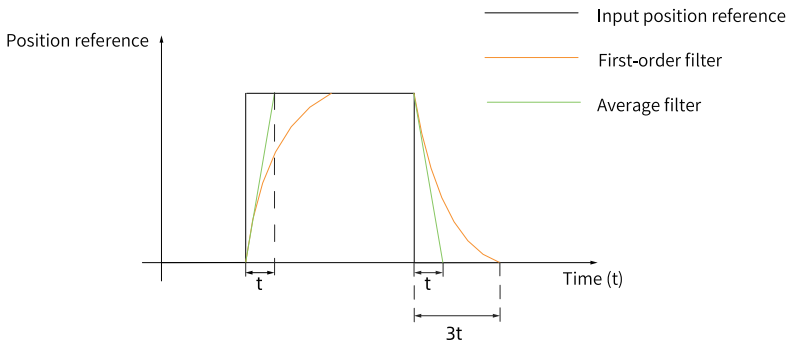


Figure 3-19 First-order filter and moving average filter for rectangular position references

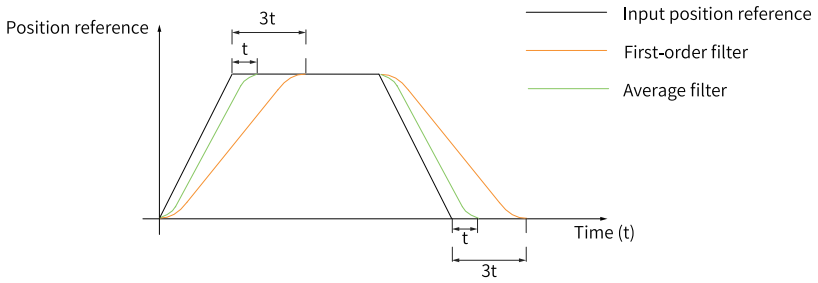


Figure 3-20 First-order filter and moving average filter for trapezoid position references

Application scenarios

It is applicable to the following scenarios:

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

Note:

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

Related parameter

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

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

3.2.5 Position Deviation Clear

Function Description

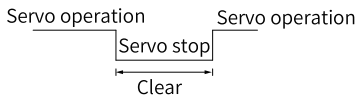
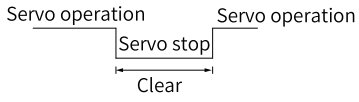
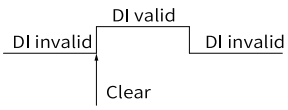
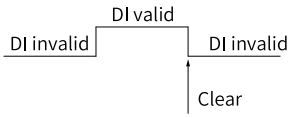
This function serves to clear the position deviation when the condition defined by H05.16 (Clear action selection) is met.

Note

Position deviation = Position reference sum – Position feedback sum

Setting value

Table 3–13 Position deviation clear

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

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

Relevant function No.:

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

Related parameter

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

3.2.6 Frequency-Division Output

Function Description

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

Working Principle

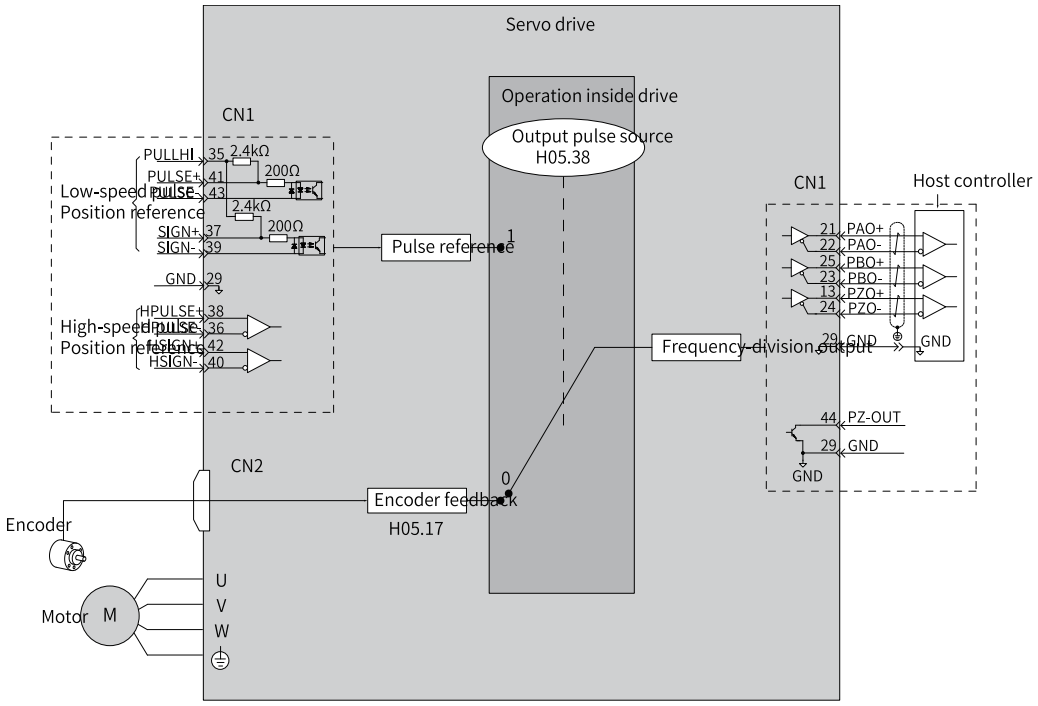


Figure 3-21 Schematic diagram of frequency-division output

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

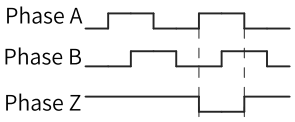
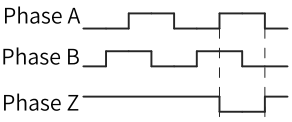
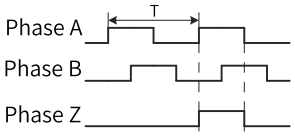
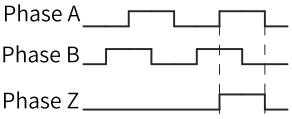
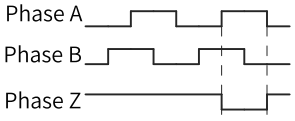
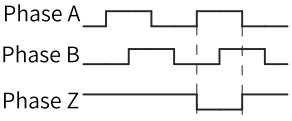
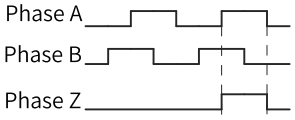
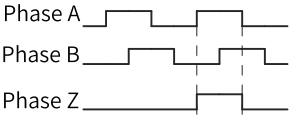
The servo drive provides one frequency-division terminal:

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

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

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

Table 3–14 Pulse diagrams of encoder frequency-division (H05.38 = 0)

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

Note:

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

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

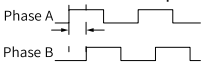
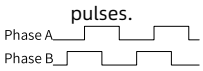
H05.41 is 0: Falling-edge triggered; H05.41 is 1: Rising-edge triggered

Related parameter

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

Parameter description:

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

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

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

Parameter description:

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

Pulse output resolution = H05.17 x 4

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

Parameter description:

It sets the output source of the pulse output terminal.

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

The pulse output terminals are as follows:

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

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

Values:

1: Negative (high level upon active Z pulse)

0: Positive (low level upon active Z pulse)

Parameter description:

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

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H05.61	Encoder frequency-division pulse output (32-bit)	0x053D	0 to 262143	P/Rev	0	UInt32	At stop	Standard user	Next power-on
	Parameter description:								
	When the capacity of H05.17 is insufficient, defines the number of pulses output by PAO or PBO per revolution. Pulse output resolution = H05.61 × 4								

3.2.7 Motion Control/Internal Command/Positioning Completed/Proximity Function

Motion control completed

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

Internal command completed

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

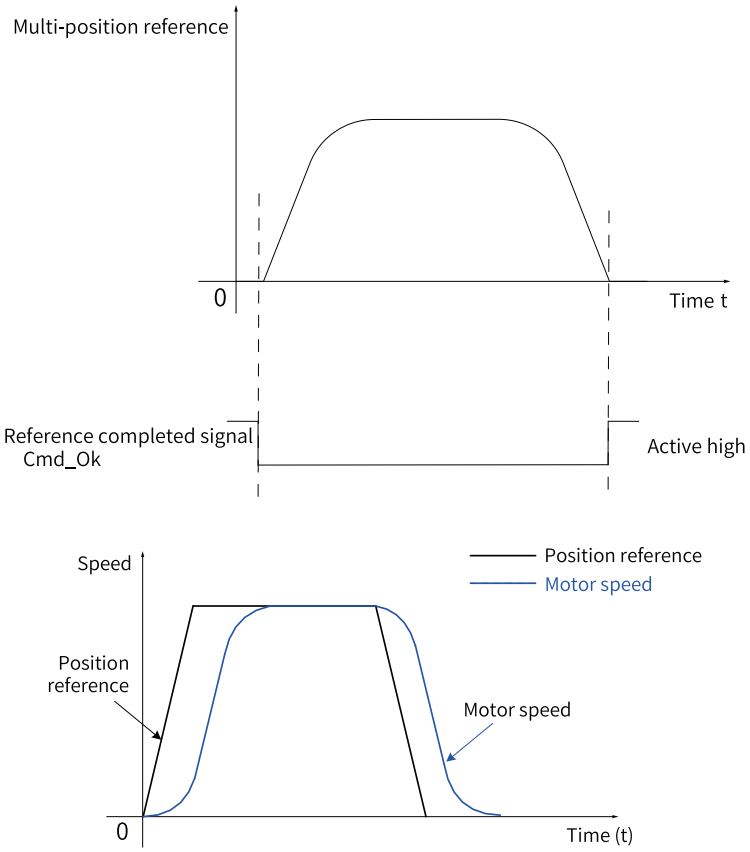


Figure 3-22 Function diagram

Positioning completed

- **Function Description**

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

- **Working Principle**

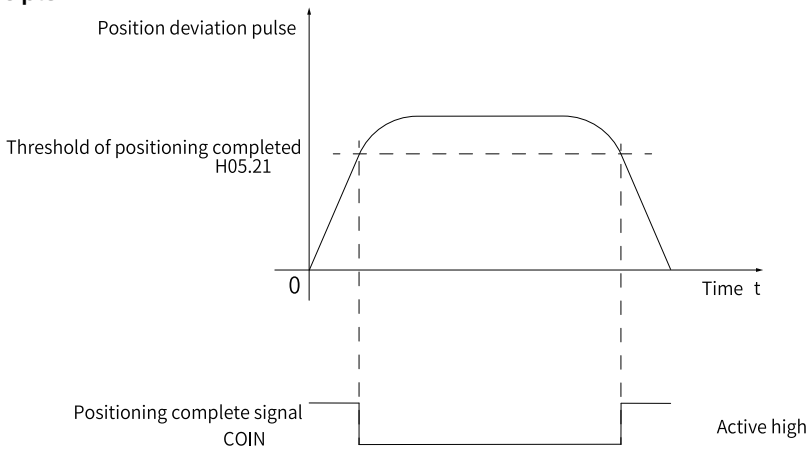


Figure 3-23 Function diagram

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

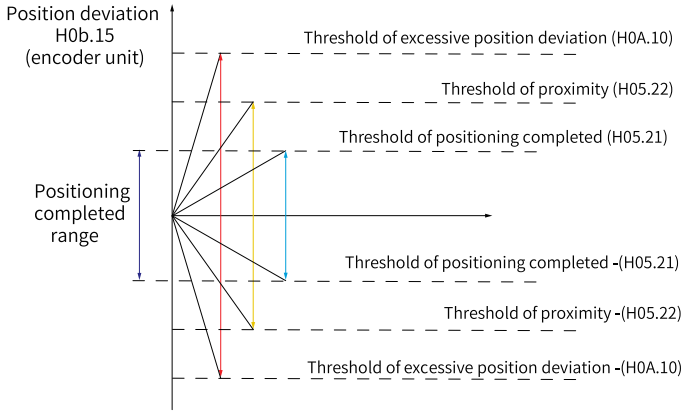


Figure 3-24 Signals related to position deviation

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

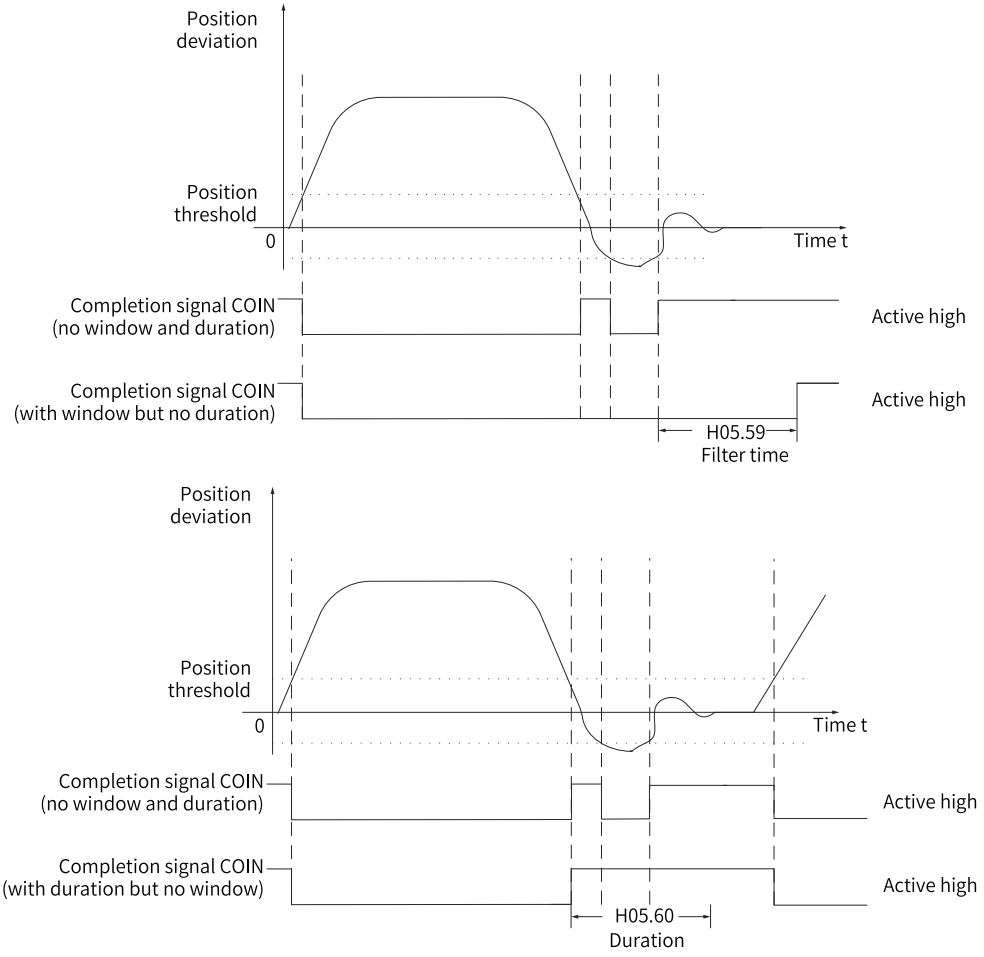


Figure 3-25 Schematic diagram for the window time (H05.59) and hold time (H05.60) of positioning completed signal

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

Positioning almost completed

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

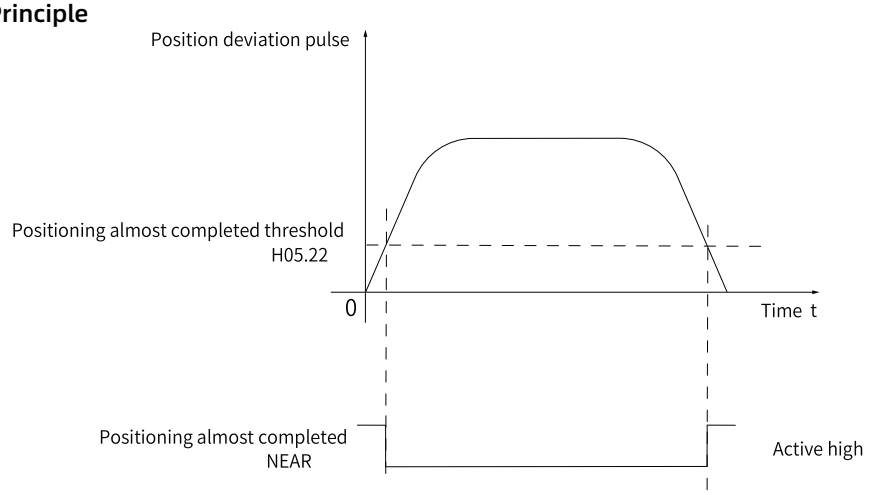


Figure 3-26 Function diagram

Related parameter

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

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

Note:

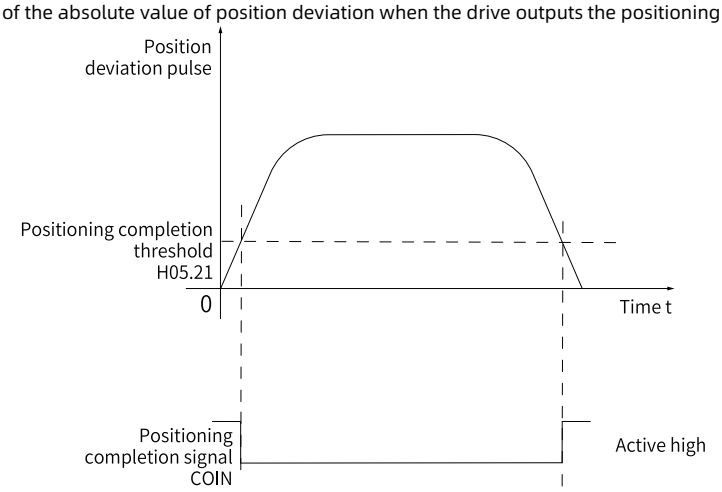
Caution

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

Related parameter

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

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

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H05.21	Threshold of positioning completion	0x0515	1 to 65535	Encoder unit	5872	UInt16	Real time	Standard user	Real time
	Parameter description:								
	The default value is adaptive to the program. It defines the threshold of the absolute value of position deviation when the drive outputs the positioning completion signal.  								

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.59	Positioning window time	0x053B	0 to 30000	ms	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	When the position deviation remains smaller than the threshold of positioning completed for more than the time set in this parameter, the positioning completed signal can output the valid state.								

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

3.2.8 Interrupt Positioning

Function Description

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

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

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

Interrupt positioning is effective only when the following conditions are met:

- Before this function is triggered, motor current speed ≥ 10 RPM or H05-26 and H05.24 ≠ 0
- The DI assigned with FunIN.33 (Interrupt positioning inhibited) is not used or the logic of this DI is inactive.

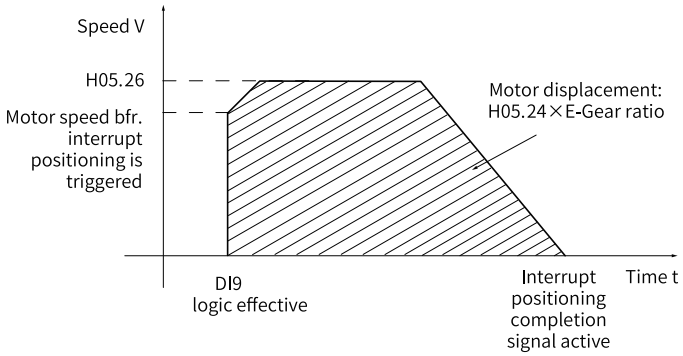


Figure 3-27 Motor operating curve during interrupt positioning

Table 3–15 Motor speed for interrupt positioning

H05.26 setpoint	Motor speed before function triggered	Interrupt Positioning	Constant speed for interruption fixed length
0	< 10	OFF	-
	≥ 10	ON	Motor speed before function triggered
1 to 6000	-	ON	H05.26

Procedure

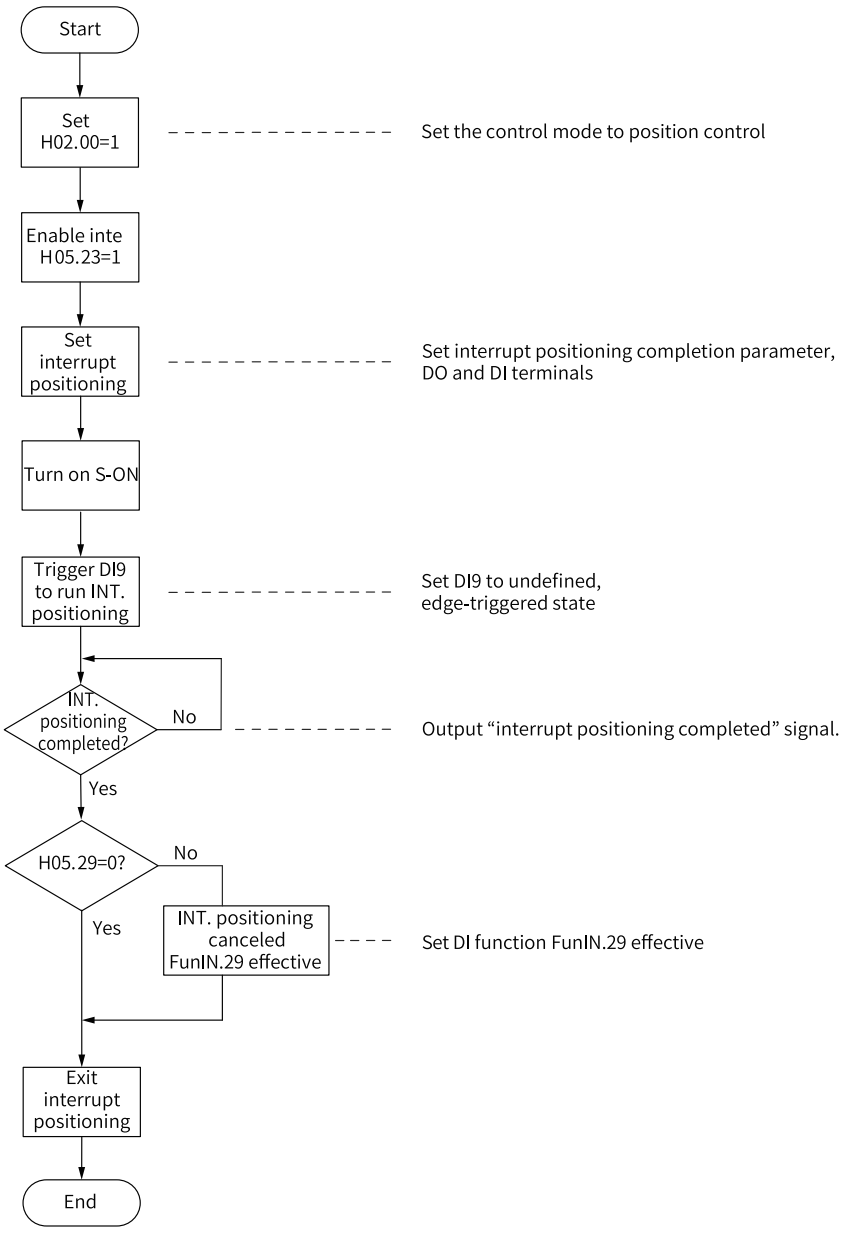


Figure 3-28 Flowchart of interrupt positioning signal

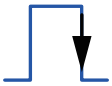
Relevant function No.:

Code	Name	Function Name	Function
FunIN.29	XintFree	Interrupt positioning clear	Active: The interrupt positioning state is cleared, which means the servo drive can respond to other position references. Inactive: The interrupt positioning state is locked, which means the servo drive cannot respond to other position references.
FunIN.33	XintInHibit	Interrupt positioning inhibited	Active: Interrupt positioning inhibited Inactive: Interrupt positioning allowed
FunOUT.15	XintCoin	Interrupt positioning completed	Active: Interrupt positioning completed in position control Inactive: Displacement in interrupt positioning not completed in position control

Note:

- The interrupt positioning signal cannot be triggered during homing.
- The moving average filter is inactive when interrupt positioning is in progress.
- During interrupt positioning, DI9 is used to trigger interrupt positioning only, which means no other functions can be assigned to DI9 through H03.18 (DI9 function selection) and no other DIs can trigger interrupt positioning. The logic of DI9 (H03.18) is "edge-triggered" .

Table 3–16 Active logic of DI9 during interrupt positioning

H03.19	Active logic of DI9	Waveform
0	Active low	
1	Active high	

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.23	Interruption fixed length	0x0517	See "Values".	-	0	UInt16	At stop	Ordinary user	Effective upon next power-on
	Values:								
	0: Disabled 1: Enabled								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.24	Displacement of interruption fixed length	0x0518	0 to 1073741824	Reference unit	10,000	UInt32	At once	Ordinary user	At once
	Parameter description:								
	Defines the position reference for interrupt positioning.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.26	Constant speed for interruption fixed length	0x051A	0 to 7000	rpm	200	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Set the maximum running speed when running in interrupt positioning mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.27	Acceleration/ Deceleration time of interruption fixed length	0x051B	0 to 1000	ms	10	UInt16	At once	Ordinary user	At once
	Values:								
	Defines the time for the motor to accelerate from 0 RPM to 1000 RPM or decelerate from 1000 RPM to 0 RPM for interrupt positioning. The actual motor acceleration time t during interrupt positioning is: $t = \frac{\lvert \text{H05.26-Motor speed before interrupt positioning} \rvert}{1000} \times (\text{H05.27})$								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.29	Interruption fixed length unlock	0x051D	See "Parameter Description"	-	1	UInt16	At once	Ordinary user	At once

Parameter description:

Sets whether to unlock the interrupt positioning signal.

Set value	Interrupt positioning cancel signal	Remarks
0	Disabled	After interrupt positioning is completed, the servo drive responds to the other position references directly.
1	Enable	• After interrupt positioning is completed, the servo drive does not directly respond to other position references. • The servo drive can respond to other position references only after the DI function 29 (FunIN.29: XintFree, interrupt positioning unlock) is enabled.

3.2.9 Homing

3.2.9.1 Function Description

Function Description

Homing function: When the S-ON signal is active in position control mode, the servo motor proactively searches for the zero position and completes positioning if the homing function is triggered.

Note

- Home (or mechanical home): Indicates the position of the home switch or Z signal depending on the value of H05.31 (Homing mode).
- Zero: positioning target point, expressed as home + offset (set in H05.36). When H05.36 (Mechanical home offset) is set to 0, the zero position coincides with the home.

During the homing operation, the servo drive shields the other position references (including the homing reference triggered again). After the homing operation is completed, the servo drive can respond to other position references.

This function includes homing and electrical homing.

- Home: After receiving the homing signal, the servo drive proactively locates the relative position between the motor shaft and the preset mechanical home reference point. It finds the home and then moves through the offset from the home reference point to the zero point. The homing mode usually applies in initial searching for the zero position.
- Electrical homing: After determining the absolute zero position through homing, the drive takes the current position as the start position to execute a relative displacement.

After the homing operation is completed (including home attaining and electric home attaining), the absolute motor position (H0b.07) is the same as the mechanical home offset (H05.36).

After the homing operation is completed, the servo drive outputs the home attaining completed signal (FunOUT.16: HomeAttain) or electric home attaining completed signal (FunOUT.17: ElecHomeAttain). After receiving this signal, the host controller confirms that the homing operation is completed. The HomeAttain or ElecHomeAttain signal is irrelevant to the operation mode or operation state of the servo drive.

Table 3–17 Comparison between homing and electrical homing

Mode	Homing Mode (H05.30)	Homing direction, deceleration point, home	Trigger signal	Total motor displacement
Homing	0	-	-	-
	1	Determined by H05.31	HomingStart signal	Determined by the mechanical home coordinate and offset displacement
	3		Servo ON	
	4		Servo ON	
	6	-	-	-
	8	-	-	-
Electrical homing	2	The homing direction is consistent with the motor displacement sign (+/-). The deceleration point or home signal is not needed.	HomingStart signal	(H05.36 - H0b.07) x Electronic gear ratio
	5		Servo ON	

Caution

- The homing trigger signal is shielded when interrupt positioning or multi-position reference is in progress.
- To use the homing function, ensure H11.00 is not set to 5 as the setpoint 5 indicates enhanced axis control mode, in which the homing function is shielded.
- Do not set H05.30=6 or H05.30=8 during motor operation upon receiving references; otherwise speed fluctuations will occur.

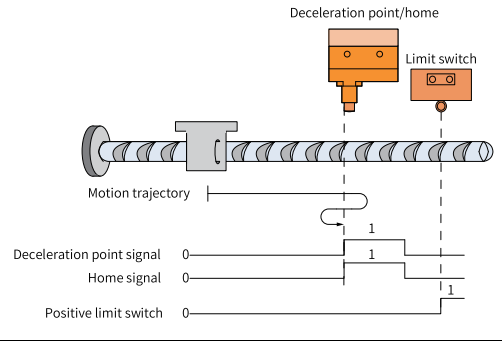
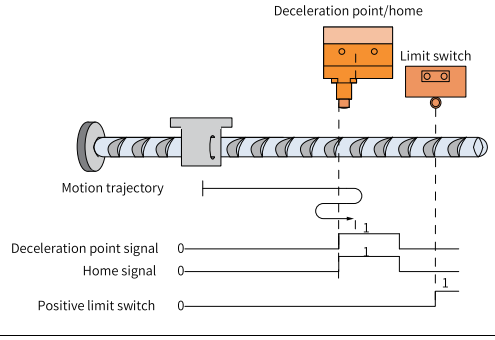
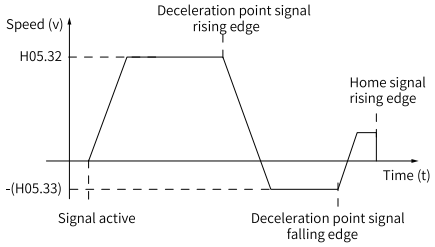
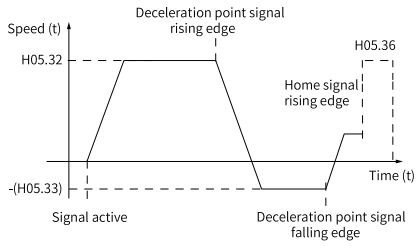
Note

Both the moving average filter and low-pass filter are invalid when the homing function is used.

Mechanical home and mechanical zero

The following takes "H05.30 = 0" as example to describe the difference between mechanical home and mechanical zero.

Table 3–18 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).
	
	

3.2.9.2 Homing

Note

- Do not set H05.30=6 or H05.30=8 during motor operation upon receiving references; otherwise speed fluctuations will occur.
- Set mechanical limit switches before enabling the homing function. For homing upon hit-and-stop, set the offset to a value within the travel range to prevent the machine from collision due to high-speed operation during homing.
- When the motor hits the limit switch during homing, the drive reports E950.0 (Forward overtravel) or E952.0 (Reverse overtravel), and the motor, if H05.40 is set to 0 or 1, stops in the stop mode defined by H02.07.

Homing Mode	Description
H05.31 = 0: Forward direction, deceleration point and home being home switch signal	*" H05.31 = 0: Forward direction, deceleration point and home being home switch signal" on page 76*
H05.31 = 2: Forward direction, deceleration point and home being motor Z signal	*" Mode 2: Forward homing, Z signal as the deceleration point and the home (H05.31 = 2)" on page 78*

Homing Mode	Description
H05.31 = 4: Forward direction, deceleration point being home switch signal and home being motor Z signal	*" Mode 4: Forward homing, home switch as the deceleration point and Z signal as the home (H05.31 = 4)" on page 79*
H05.31 = 6: Forward direction, deceleration point and home being forward limit switch signal	*" Mode 6: Forward homing, positive limit switch as the deceleration point and the home (H05.31 = 6)" on page 81*
Forward, positive limit switch as deceleration point and Z signal as home (H05.31 = 8)	*" Mode 8: Forward homing, positive limit switch as the deceleration point and Z signal as the home (H05.31 = 8)" on page 82*
H05.31 = 10: Forward homing, mechanical limit position as the deceleration point and the home (H05-31 = 10)	*" Mode 10: Forward homing, forward mechanical limit as the deceleration point and the home (H05.31 = 10)" on page 83*
Forward, mechanical limit position as deceleration point and Z signal as home (H05.31 = 12)	*" Mode 12: Forward homing, forward mechanical limit as the deceleration point and Z signal at the home (H05.31 = 12)" on page 83*
Forward single-turn homing (H05.31 = 14)	*" Forward single-turn homing (H05.31 = 14)" on page 84*
Reverse single-turn homing (H05.31 = 15)	*" Reverse single-turn homing (H05.31 = 15)" on page 84*
Single-turn nearby homing (H05.31 = 16)	*" Single-turn nearby homing (H05.31 = 16)" on page 84*

The other homing modes are the same as above, except the initial homing mode, which is contrary to the above.

H05.31 = 0: Forward direction, deceleration point and home being home switch signal

- The home switch (deceleration point) signal is inactive (0: inactive, 1: active) when the motor starts to run, and the forward limit switch is not sensed in the entire process.
  The running process is as follows:
  The servo motor searches for the deceleration point signal in forward direction at high speed set in H05.32.
  After reaching the rising edge of the deceleration point signal, the motor decelerates to -(H05.33) according to the time set in H05.34.
  The motor searches for the falling edge of the deceleration point signal in reverse direction at low speed of -(H05.33).
  After reaching the falling edge of the deceleration point signal, the motor then changes to forward direction, and searches for the rising edge of the home signal at the speed of H05.33.
  During forward acceleration or forward constant speed running, the motor stops immediately after reaching the rising edge of the home signal.

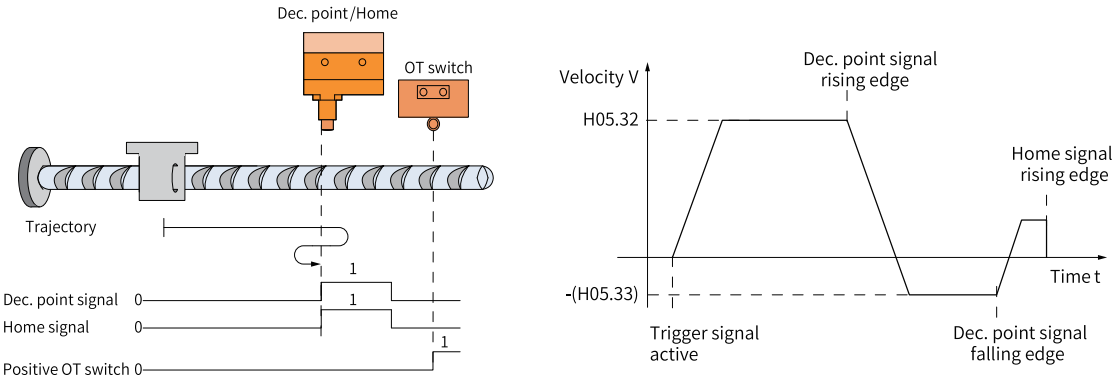


Figure 3-29 Motor running curve and speed in mode 0

- The home switch (deceleration point) signal is active when the motor starts running, with the positive limit switch not triggered in the whole process.
  The running process is as follows:
  The servo motor directly searches for the falling edge of the deceleration point signal in reverse direction at low speed of -(H05.33).
  After reaching the falling edge of the deceleration point signal, the motor changes to forward direction, and searches for the rising edge of the home signal at low speed of H05.33.
  During forward acceleration or forward constant speed running, the motor stops immediately after reaching the rising edge of the home signal.

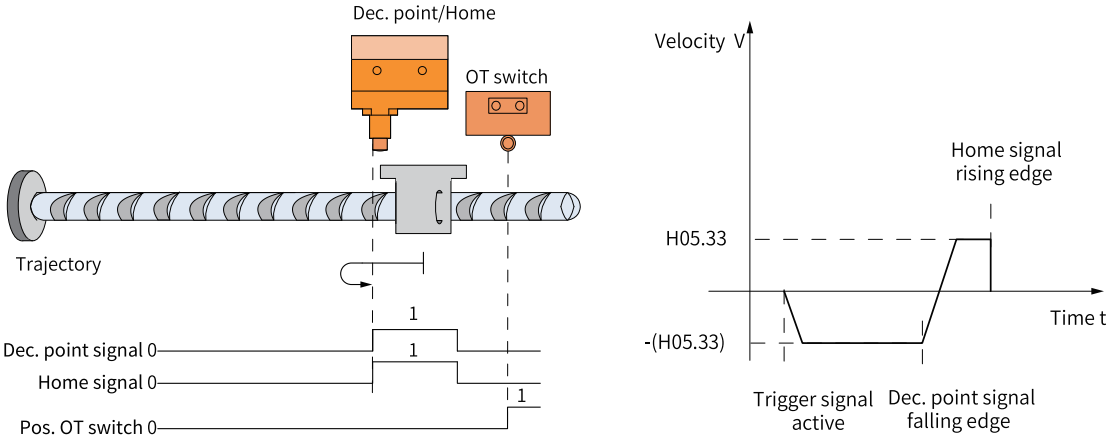


Figure 3-30 Motor running curve and speed in mode 0

- The home switch (deceleration point) signal is inactive when the motor starts to run, and the forward limit switch is triggered in the process.
  The motor starts searching for the deceleration point signal in the forward direction at a speed defined by H05.32. After reaching the positive limit switch, it changes to execute reverse homing (H05.40 = 2 or 3) or stops and waits for another homing trigger signal (H05.40 = 0 or 1). After receiving the signal, it starts searching for the falling edge of the deceleration point signal in the reverse direction at a speed defined by "-H05.32". After reaching this falling edge, it decelerates as defined by H05.34 and changes to search for the rising edge of the home signal in the forward direction as defined by H05.33. Finally, it stops immediately after reaching the rising edge of the home signal during forward acceleration or forward operation at a constant speed.

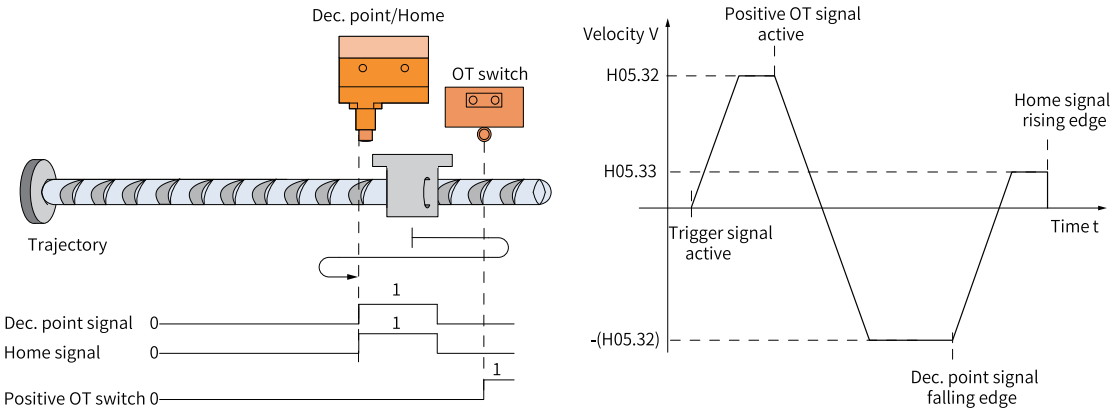


Figure 3-31 Motor running curve and speed in mode 0

Mode 2: Forward homing, Z signal as the deceleration point and the home (H05.31 = 2)

Caution

Note: In Modes 2 and 3 (H05.31 = 2 or 3) where the motor Z signal acts as the home and deceleration point, the actual stop position of the motor may not be on the rising edge on the same side of the motor Z signal. A deviation of ±1 pulse (in encoder unit) may be present in the stop position.

- The Z signal is inactive (0: inactive, 1: active) when the motor starts to run, and the forward limit switch is not sensed in the entire process.
  The running process is as follows:
  The servo motor searches for Z signal in forward direction at high speed of H05.32.
  After reaching the rising edge of Z signal, the motor then decelerates and changes to reverse direction according to the time set in H05.34, and accelerates to -(H05.33).
  During reverse acceleration or reverse constant speed running, the motor immediately stops after reaching motor Z signal rising edge of the other side.

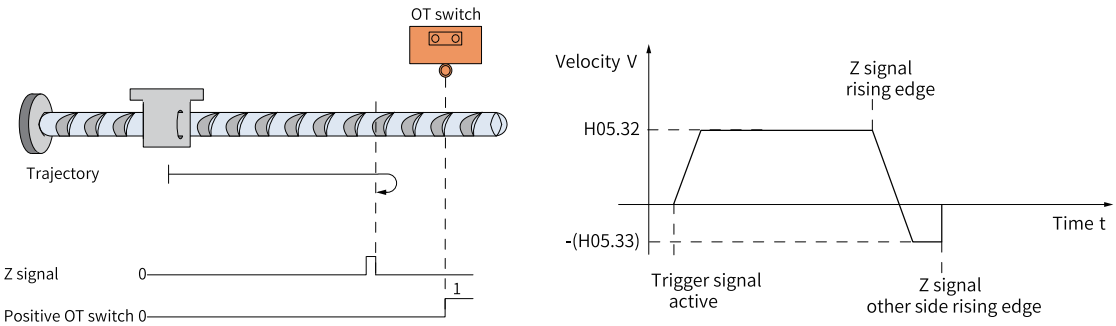


Figure 3-32 Motor operation curve and speed in mode 2

- The Z signal is active when the motor starts to run, and the forward limit switch is not triggered in the entire process.
  The running process is as follows: The servo motor directly searches for the falling edge of Z signal in forward direction at the speed defined by H05.33 (speed for low-speed home switch signal searching). After reaching the falling edge of Z signal, the motor changes to reverse direction, and searches for the rising edge of Z signal at the speed of -(H05.33). During reverse

acceleration or reverse constant speed running, the motor stops immediately after reaching the rising edge of Z signal.

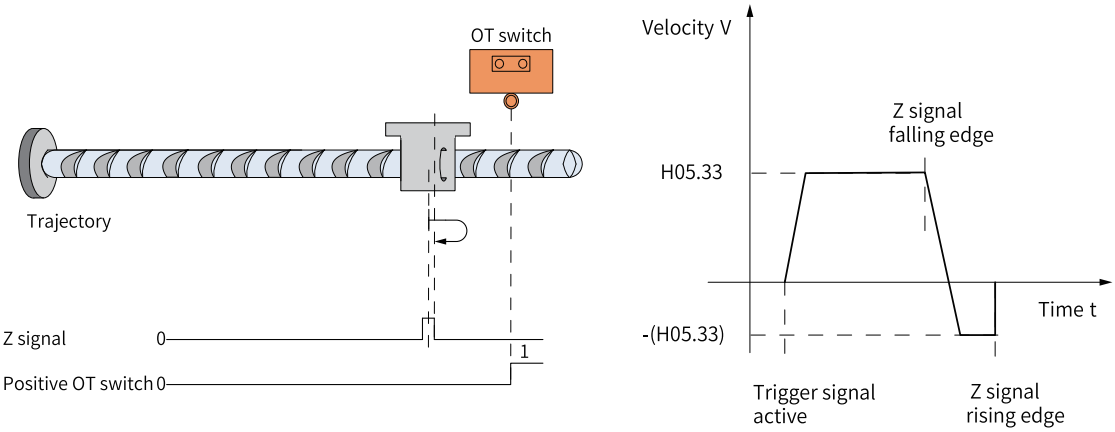


Figure 3-33 Motor operation curve and speed in mode 2

- The Z signal is inactive when the motor starts to run, and the forward limit switch is triggered in the process.
  The motor starts searching for the Z signal in the forward direction at the high speed defined by H05.32. After hitting the positive limit switch, the motor turns to executing reverse homing (H05.40 = 2 or 3) or stops and waits for another homing trigger signal (H05.40 = 0 or 1) sent from the host controller. After the signal is sent, the motor starts searching for the Z signal in the reverse direction at the speed defined by "-(H05.32)" until reaching the rising edge of the Z signal, where it decelerates as defined by H05.34 in the forward direction and turns to searching for the rising edge of the Z signal on the other side at the low speed defined by H05.33. During forward acceleration or forward operation at a constant speed, the motor stops immediately after reaching rising edge of the Z signal on the other side.

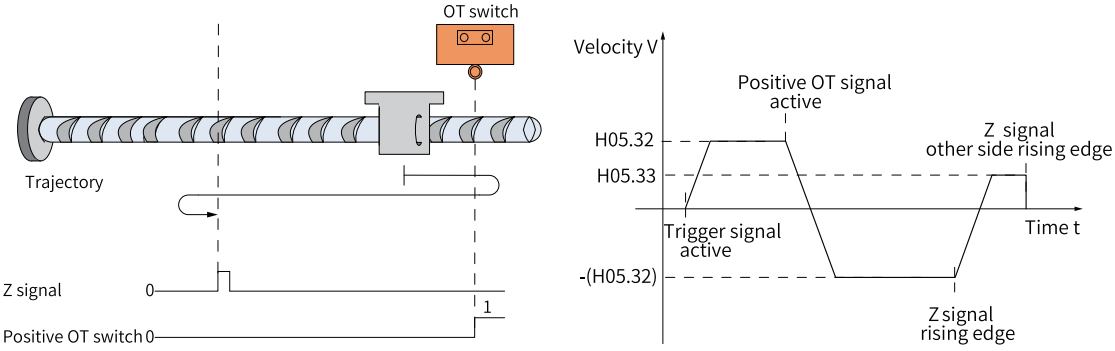


Figure 3-34 Motor operation curve and speed in mode 2

Mode 4: Forward homing, home switch as the deceleration point and Z signal as the home (H05.31 = 4)

- The home switch signal is inactive (0: inactive, 1: active) when the motor starts running, with the positive limit switch not triggered in the whole process.
  The running process is as follows:
  The servo motor searches for the home switch signal in forward direction at high speed of H05.32.
  After reaching the rising edge of the home switch signal, the motor then decelerates and

changes to reverse direction according to the time set in H05.34, and searches for the falling edge of the home switch signal at low speed of -(H05.33).

After reaching the falling edge of the home switch signal, the motor decelerates and restores to forward direction, and searches for the rising edge of the home switch signal at low speed of H05.33.

After reaching the rising edge of the home switch signal, the motor continues to run and immediately stops after reaching Z signal for the first time.

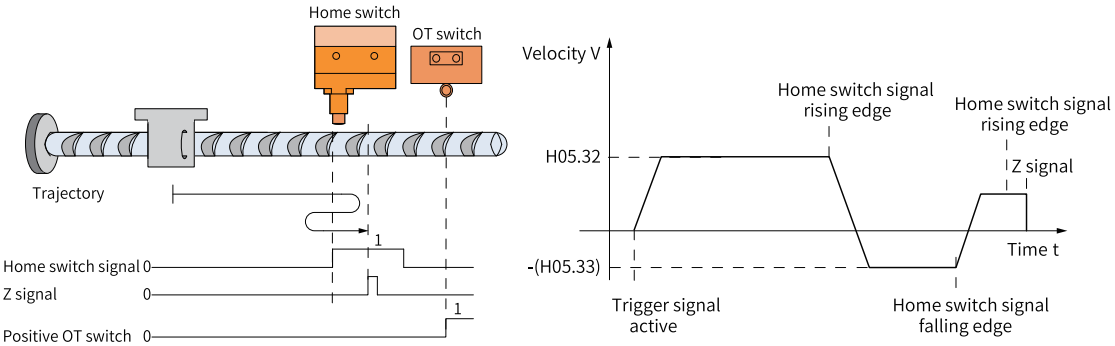


Figure 3-35 Motor running curve and speed in mode 4

- The home switch signal is active when the motor starts to run, and the forward limit switch is not triggered in the entire process.

  The running process is as follows:

  The servo motor directly searches for the falling edge of the home switch signal in reverse direction at low speed of -(H05.33).

  After reaching the falling edge of the home switch signal, the motor decelerates and restores to forward direction, and searches for the rising edge of the home switch signal at low speed of H05.33.

  After reaching the rising edge of the home switch signal, the motor continues to run in forward direction at low speed of H05.33, and stops immediately after reaching Z signal for the first time.

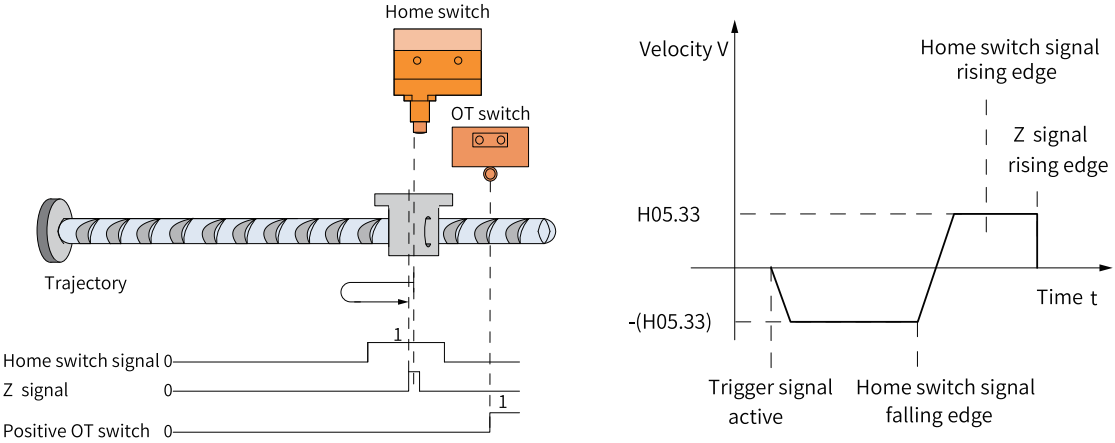


Figure 3-36 Motor running curve and speed in mode 4

- The home switch signal is inactive when the motor starts to run, and the forward limit switch is triggered in the process.

  The motor starts searching for the home switch in the forward direction at the high speed defined by H05.32. After hitting the positive limit switch, the motor executes reverse homing (H05.40 = 2

or 3) as defined by H05.40 or stops and waits for another homing trigger signal (H05.40 = 0 or 1) sent from the host controller. After this signal is sent, the motor starts searching for the deceleration point in the reverse direction at the high speed defined by "-(H05.32)" until reaching the falling edge of the home switch signal, where it decelerates gradually as defined by H05.34 and turns to searching for the rising edge of the home switch signal in the forward direction at the low speed defined by H05.33. After reaching the rising edge of the home switch signal, the motor continues running until it stops at the first Z signal.

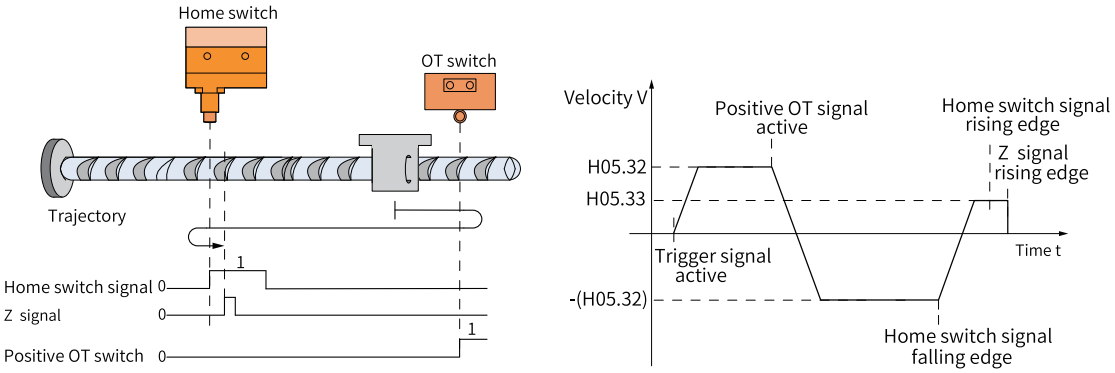


Figure 3-37 Motor running curve and speed in mode 4

Mode 6: Forward homing, positive limit switch as the deceleration point and the home (H05.31 = 6)

- The forward limit signal is inactive (0: inactive, 1: active) when the motor starts to run.
  The running process is as follows:
  The servo motor searches for the forward limit switch signal in forward direction at high speed of H05.32.
  After reaching the rising edge of the forward limit switch signal, the motor then decelerates and changes to reverse direction according to the time set in H05.34, and searches for the falling edge of the forward limit switch signal at low speed of -(H05.33).
  After reaching the falling edge of the forward limit switch signal, the motor decelerates and restores to forward direction, and searches for the rising edge of the forward limit switch signal at low speed of H05.33.
  During forward acceleration or forward constant speed running, the motor stops immediately after reaching the rising edge of the forward limit switch signal.

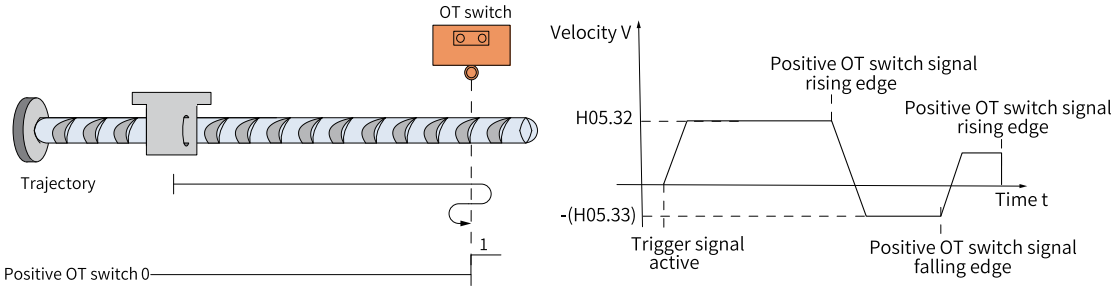


Figure 3-38 Motor running curve and speed in mode 6

- The forward limit switch signal is active when the motor starts to run.
  The running process is as follows:
  The servo motor directly searches for the falling edge of the forward limit switch signal in reverse

direction at low speed of -(H05.33).
After reaching the falling edge of the forward limit switch signal, the motor decelerates and changes to forward direction, and searches for the rising edge of the forward limit switch signal at low speed of H05.33.
During forward acceleration or forward constant speed running, the motor stops immediately after reaching the rising edge of the forward limit switch signal.

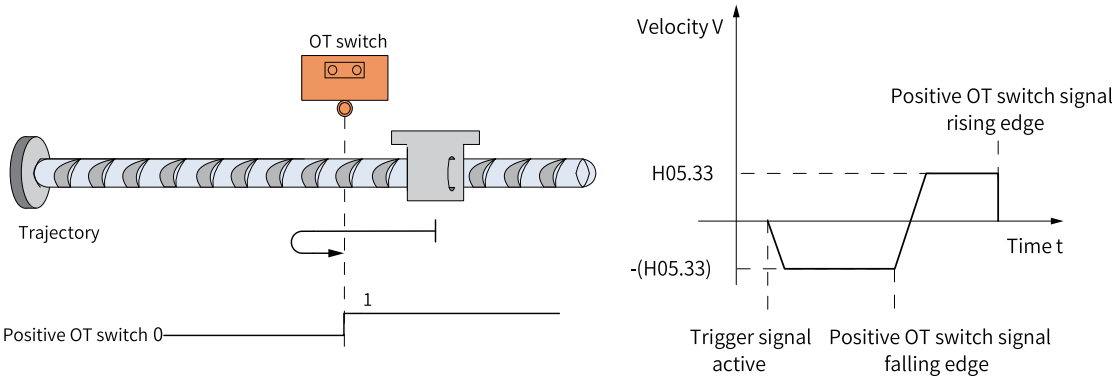


Figure 3-39 Motor running curve and speed in mode 6

Mode 8: Forward homing, positive limit switch as the deceleration point and Z signal as the home (H05.31 = 8)

- The forward limit signal is inactive (0: inactive, 1: active) when the motor starts to run.
  The motor starts searching for the positive limit switch in the forward direction at the high speed defined by H05.32. After reaching the rising edge of the positive limit switch signal, the motor decelerates gradually as defined by H05.34 and turns to searching for the falling edge of the positive limit switch signal in the reverse direction at the low speed defined by "-(H05.33)". After reaching this falling edge, the motor continues running until it stops upon reaching the Z signal for the first time.

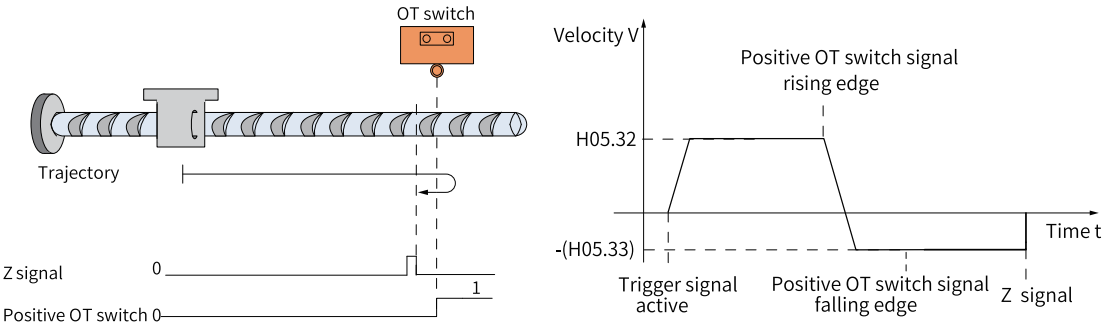


Figure 3-40 Motor running curve and speed in mode 8

- The forward limit switch signal is active when the motor starts to run.
  The motor starts searching for the falling edge of the positive limit switch signal in the reverse direction at a low speed defined by "-(H05.33)". After reaching the falling edge of the positive limit switch signal, the motor continues running until it stops at the first rising edge of the Z signal.

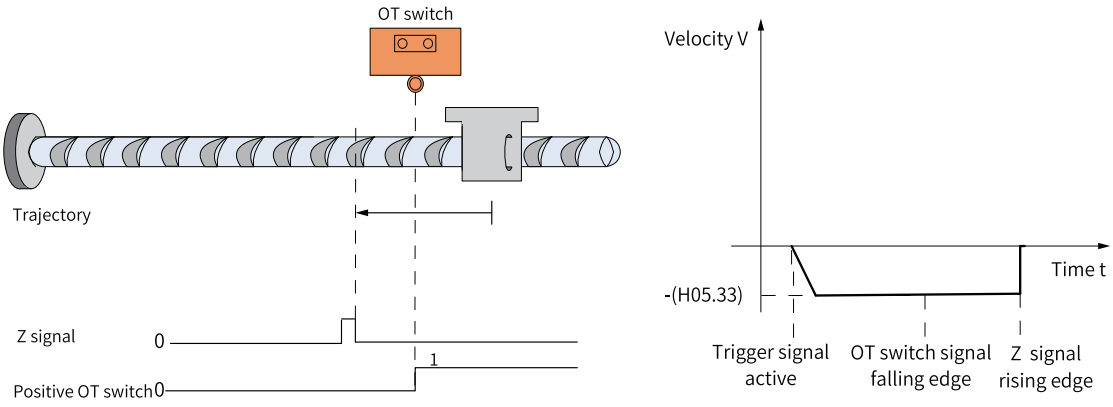


Figure 3-41 Motor running curve and speed in mode 8

Mode 10: Forward homing, forward mechanical limit as the deceleration point and the home (H05.31 = 10)

The motor starts running in the forward direction at the low speed defined by H05.33. After hitting the mechanical limit, the motor stops if the torque keeps reaching the upper limit (H05.58) and the speed keeps lower than H05.56 for a period of time.

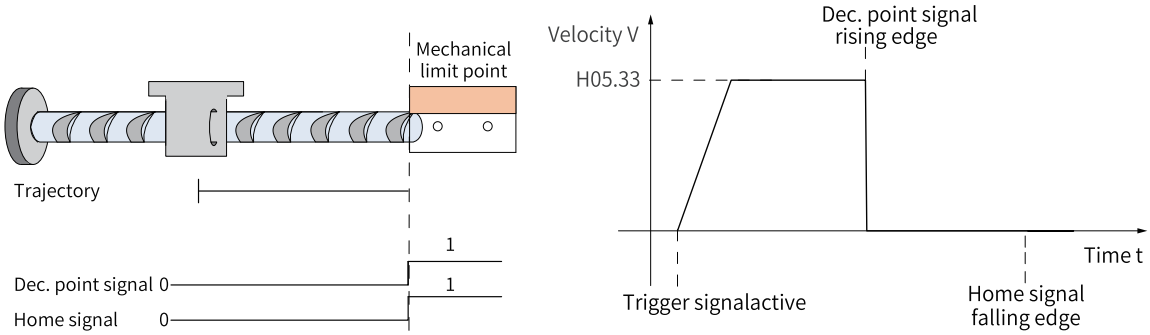


Figure 3-42 Motor running curve and speed in mode 10

Mode 12: Forward homing, forward mechanical limit as the deceleration point and Z signal at the home (H05.31 = 12)

The motor runs in the forward direction at the low speed defined by H05.33. After hitting the mechanical limit, the motor changes to run in the reverse direction at the speed defined by H05.33 if the torque keeps reaching the upper limit (H05.58) and the speed keeps lower than H05.56 for a period of time. Then the motor stops after reaching the rising edge of the Z signal for the first time.

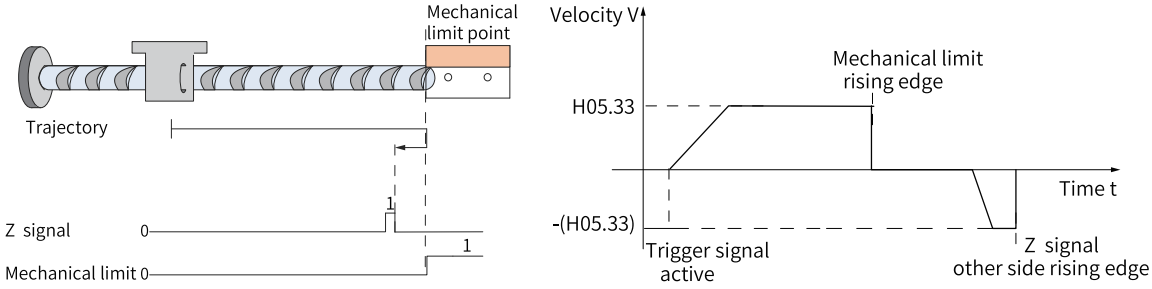


Figure 3-43 Motor running curve and speeds in mode 12

Forward single-turn homing (H05.31 = 14)

- When H05.31 = 14, the motor performs forward homing. After you set H05.36, the servo motor can be moved from the current absolute position (H0b.07) to the specified position (H05.36). Motor displacement = (H05.36–H0b.07) × Electronic gear ratio.
- If motor displacement is < 0, the actual motor displacement = (H05.36–H0b.07) x Electronic gear ratio + Encoder resolution. The motor stops immediately after the displacement command finishes.

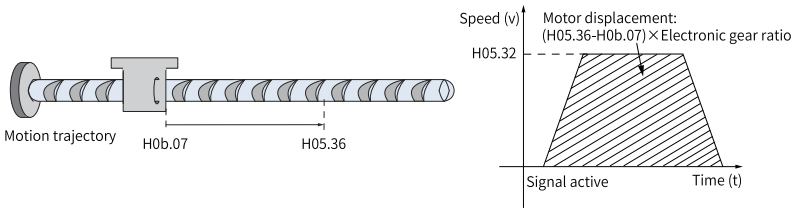


Figure 3-44 Motor running curve and speed in mode 14

Reverse single-turn homing (H05.31 = 15)

- When H05.31 = 15, the motor performs reverse homing. After you set H05.36, the servo motor can be moved from the current absolute position (H0b.07) to the specified position (H05.36). Motor displacement = (H05.36–H0b.07) × Electronic gear ratio.
- If motor displacement is > 0, the actual motor displacement = (H05.36–H0b.07) x Electronic gear ratio - Encoder resolution. The motor stops immediately after the displacement command finishes.

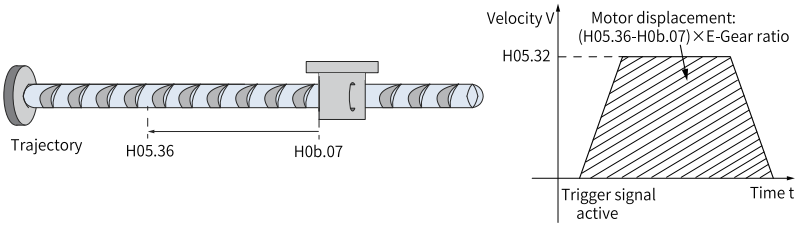


Figure 3-45 Motor running curve and speed in mode 15

Single-turn nearby homing (H05.31 = 16)

When H05.31 = 16, the motor performs nearby homing. The actual motor displacement is the distance from the current position to the specified position (H05.36). The direction of operation is determined by the distance. The motor stops immediately after the displacement command finishes.

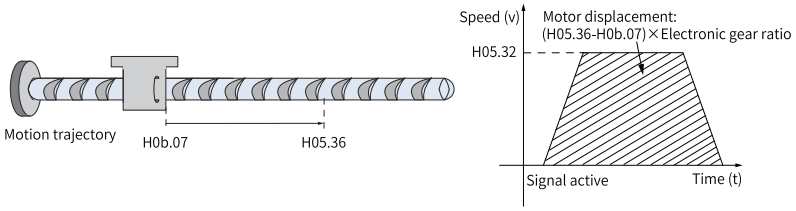


Figure 3-46 Motor running curve and speed in mode 16

Evaluation condition for torque homing: After the motor reaches the hard limit, and the torque feedback reaches the limit value defined in H05.58 (mechanical torque limit, in %), the first Z signal in the reverse direction is searched for and regarded as the home after the motor stops.

3.2.9.3 Electrical homing

Start electrical homing (H05.30 = 5)

The mechanical zero position is obtained after homing is done. In this case, you can make the motor move from current position (H0b.07) to the designated position (H05.36) by setting H05.36.

In the electrical homing mode, the motor runs at the speed defined by H05.32 in the direction defined by the sign (+/-) of the displacement value. The total displacement is determined by the difference between H05.36 and H0b.07. The motor stops immediately after the displacement reference is done executing.

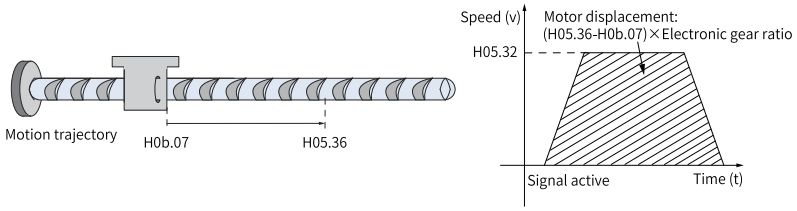


Figure 3-47 Motor running curve and speed in electrical homing

3.2.9.4 Sequence

H05.30 = 1 or 2

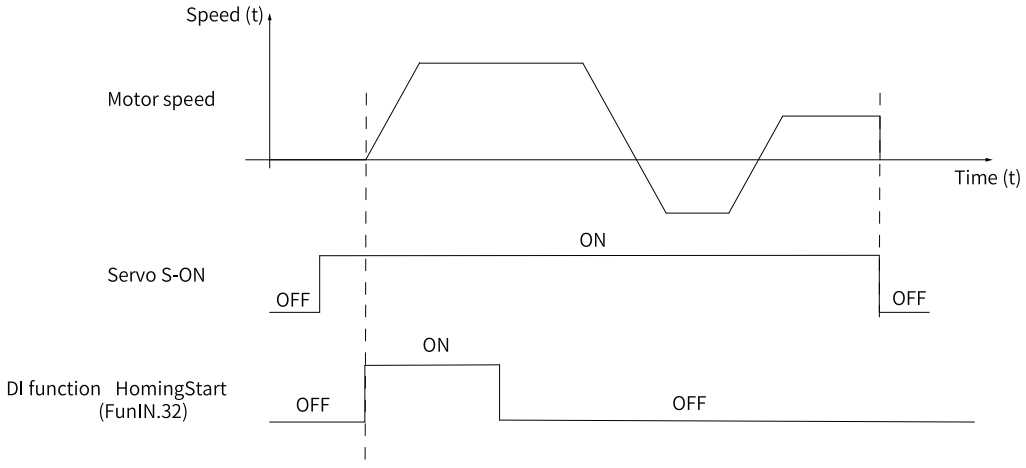


Figure 3-48 Sequence example

- Switch on the S-ON signal first and then the HomingStart signal.
- During homing, the S-ON signal remains active and the change of the HomingStart signal is shielded.
- During homing, the motor stops if the S-ON signal is switched off. To enable homing again, switch on the S-ON signal first and then the HomingStart signal.
- If E601.0 (Homing timeout) occurs, the motor stops, but the S-ON signal remains active. In this case, trigger the HomingStart signal again to reset E601.0, and execute homing again.

- The homing operation can be triggered repeatedly.

H05.30=3

- The homing operation is executed only when the S-ON signal is switched on for the first time after power-on.
- The motor stops when E601.0 (Homing timeout) occurs. To reset E601.0, deactivate the S-ON signal.
- The homing operation can only be triggered again at next power-on.

H05.30 = 4 or 5

- The homing operation is executed immediately after the S-ON signal is switched on upon power-on.
- If the S-ON signal is deactivated during homing, the motor stops immediately. To trigger homing again, activate the S-ON signal again.
- When E601.0 (Homing timeout) occurs, H05.30 is set to 0 and the motor stops. To reset E601.0, deactivate the S-ON signal. To perform homing again, reset H05.30. After homing is done, H05.30 is set to 0. To perform homing again, set H05.30 again.

H05.30=6

- To take the current position as the home and achieve home offset (H05.40 = 0 or 2, H05.36 ≠ 0), set H05.36 and H05.40 first, and then set H05.30 to 6. Failing to do so will cause H0b.07 to keep the previous value of H05.36 rather than the one set currently.
- After homing is done, H05.30 will be set to 0. To enable homing again, re-write H05.36 and set H05.30 to 6.

H05.30=8

- To take the DI-triggered position as the home, assign FunIN.41 to a DI first and set the current position as the home.
- To achieve home offset (H05.40 = 0 or 2, H05.36 ≠ 0), set H05.36 and H05.40 first, and then set H05.30 to 6. Failing to do so will cause H0b.07 to keep the previous value of H05.36 rather than the one set currently.

3.2.9.5 Related Parameters

Parameters related to homing mode

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.30	Control of home return	0x051E	See "Parameter Description"	-	0	UInt16	At once	Ordinary user	At once

Parameter description:

Defines the homing mode and the trigger signal source.

Set value	Trigger signal	Remarks	
		Mode of home return	Trigger signal
0	Disabled	The homing function is disabled.	-
1	Homing enabled through HomingStart signal input from DI	Homing	DI function FunIN.32 (HomingStart, homing enable)
2	Electrical homing enabled through HomingStart signal input from DI	Electrical homing	DI function FunIN.32 (HomingStart, homing enable)
3	Homing started immediately upon power-on	Homing	S-ON signal active for the first time after power-on again in the position mode
4	Homing started immediately	Homing	S-ON signal active in the position mode After homing is done, set H05.30 to 0.
5	Electrical homing started	Electrical homing	S-ON signal active in the position mode After homing is done, set H05.30 to 0.
6	Homing on current position	Homing	Not required After homing is done, set H05.30 to 0.
8	Current position as the home enabled through signal input from DI	Homing	DI signal FunIN.41 (current position as the home)

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.31	Mode of home return	0x051F	See "Values".	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Forward, home switch as deceleration point and home 1: Reverse, home switch as deceleration point and home 2: Forward, Z signal as deceleration point and home 3: Reverse, motor Z signal as deceleration point and home 4: Forward, home switch as deceleration point and Z signal as home 5: Reverse, home switch as deceleration point and Z signal as home 6: Forward, positive limit switch as deceleration point and home 7: Reverse, negative limit switch as deceleration point and home 8: Forward, positive limit switch as deceleration point and Z signal as home 9: Reverse, negative limit switch as deceleration point and Z signal as home 10: Forward, mechanical limit position as deceleration point and home 11: Reverse, mechanical limit position as deceleration point and home 12: Forward, mechanical limit position as deceleration point and Z signal as home 13: Reverse, mechanical limit position as deceleration point and Z signal as home 14: Forward single-turn homing 15: Reverse single-turn homing 16: Nearby single-turn homing								
	Parameter description:								
	Defines the default motor direction of rotation, deceleration point, and home during homing.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.40	Mechanical home offset and action upon active limit signal	0x0528	See "Values".	-	0	UInt16	At stop	Ordinary user	At once

Values:

0: H05.36 as the coordinate after homing, reverse homing applied after homing triggered again upon overtravel
1: H05.36 as the relative offset after homing, reverse homing applied after homing triggered again upon overtravel
2: H05.36 as the coordinate after homing, reverse homing applied automatically upon overtravel3: H05.36 as the relative offset after homing, reverse homing applied automatically upon overtravel

Parameter description:

Defines the offset relationship between the mechanical home and mechanical zero, as well as the action upon overtravel during homing.

Set value	Mechanical home offset and action upon active limit signal	Remarks	
		Mechanical home	Action upon Active Limit Signal
0	H05.36 as the coordinate after homing, reverse homing applied after homing triggered again on overtravel	The mechanical home differs from the mechanical zero point. After homing, the motor stops at the home position and the home coordinate is forced to the value of H05.36.	After the homing enable signal is sent again, the servo drive performs homing in the reverse direction.
1	H05.36 as the relative offset after homing, reverse homing triggered on hitting the limit	The mechanical home is the same as the mechanical zero. After positioning the mechanical home, the motor continues to move according to the setting of H05.36 and then stops.	After the homing enable signal is sent again, the servo drive performs homing in the reverse direction.
2	H05.36 as the coordinate after homing, reverse homing auto-applied on overtravel	The mechanical home differs from the mechanical zero point. After homing, the motor stops at the home position and the home coordinate is forced to the value of H05.36.	The servo drive automatically continuous to perform homing in the reverse direction.
3	H05.36 as the relative offset after homing, reverse homing auto-applied on overtravel	The mechanical home is the same as the mechanical zero. After positioning the mechanical home, the motor continues to move according to the setting of H05.36 and then stops.	The servo drive automatically continuous to perform homing in the reverse direction.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.59	Positioning window time	0x053B	0 to 30000	ms	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	When the position deviation remains smaller than the threshold of positioning completed for more than the time set in this parameter, the positioning completed signal can output the valid state.								

If the home signal is activated before the deceleration triggered by an active deceleration point signal is completed, the final positioning may be unstable. Take the displacement required by deceleration into account before setting the deceleration point and home signal input position. The acceleration/deceleration time during homing (H05.34) also affect the positioning stability.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.32	Speed of home switch signal at high-speed searching	0x0520	0 to 3000	rpm	100	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the motor speed for searching for the deceleration point signal during homing.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.33	Speed of low-speed homing	0x0521	0 to 1000	rpm	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the motor speed for searching for the home signal during homing.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.34	Acceleration/ Deceleration time during homing	0x0522	0 to 1000	ms	1,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the time for the motor to accelerate from 0 rpm to 1000 rpm at a constant speed during homing.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.35	Duration limit of homing	0x0523	0–65535	ms	10,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets maximum time for searching the home.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.36	Mechanical origin offset	0x0524	-1073741824 to +1073741824	Reference unit	0	Int32	At once	Ordinary user	At once
	Parameter description:								
	Defines the absolute position value of the motor after homing.								

3.2.9.6 Related parameters

Code	Name	Function Name	Function
FunIN.31	HomeSwitch	Home switch	Active: Current position as home Set the logic of the DI assigned with FunIN.31 to "active high" or "active low" based on the output of the host controller. See the following table.
FunIN.32	HomingStart	Homing enable	Active: Homing enabled (The HomingStart signal cannot be triggered repeatedly during homing.) Inactive: Homing inhibited
FunIN.41	HomingRecord	DI-triggered point as the home	The edge-triggered position is taken as the home.
FunOut.16	HomeAttain	Homing completed	Active: Homing completed in position control mode Inactive: Homing not completed
FunOut.17	ElecHomeAttain	Electrical homing completed	Active: Electrical homing completed in position control mode Inactive: Electrical homing not completed

DI logic set by HomeSwitch	Actual active level
0 (Low level)	Low level
1 (High level)	High level
3 (Rising edge)	High level
4 (Falling edge)	Low level
5 (Edge transition)	Low level

3.3 Speed Control Mode

3.3.1 Overview

3.3.1.1 Function Description

In speed control, the device speed is controlled through speed references. In the speed control mode, the drive performs quick and accurate speed control through the speed reference set through communication.

Set H02.00 (Mode selection) to 0 (Speed mode) through the operating panel or Inovance servo commissioning software to enable the speed control mode.

Application scenarios

The speed control mode mainly applies to application requiring speed control or where a host controller is used for position control or the references sent from the host controller are used as the speed references for the drive, such as the engraving and milling machines.

3.3.1.2 Working Principle

Function Block Diagram

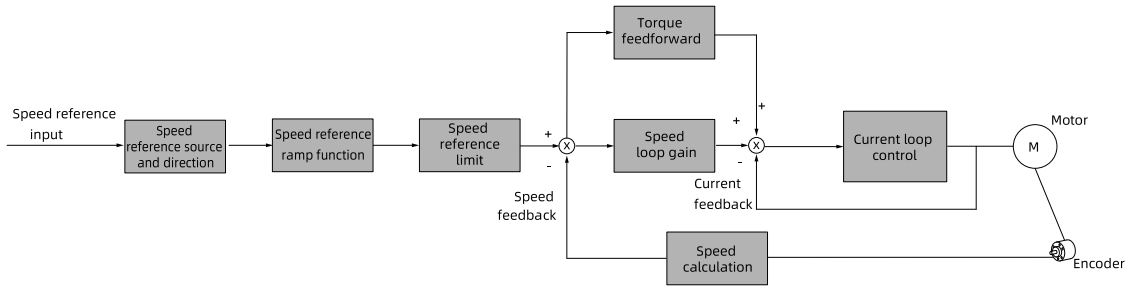


Figure 3-49 Block diagram of speed control

Signal exchange between the drive and the host controller

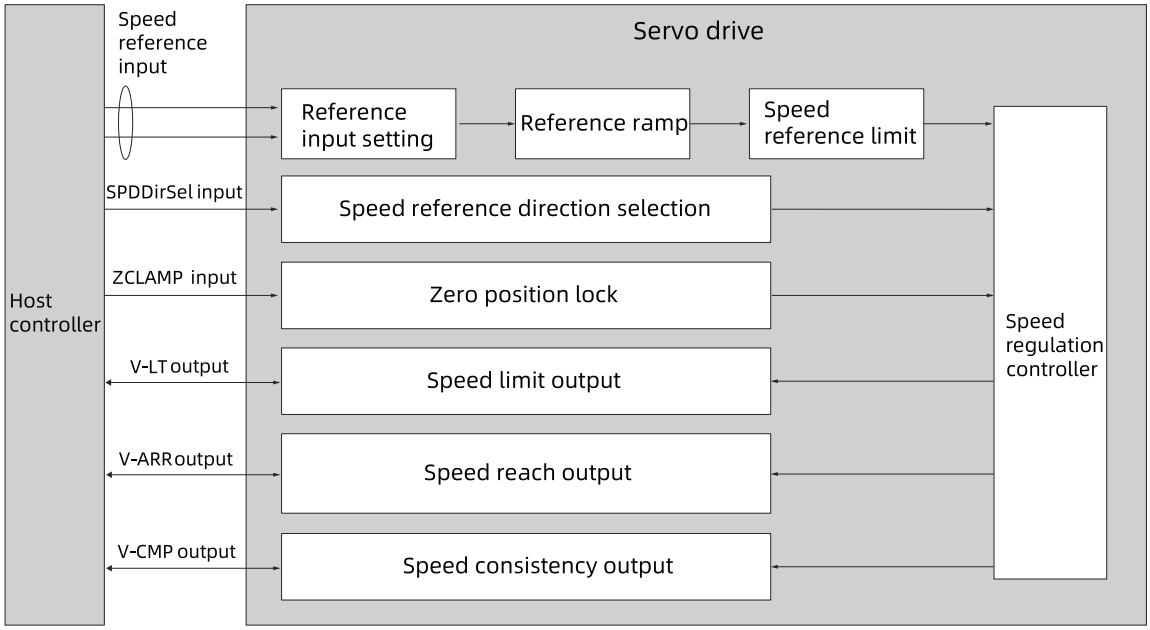


Figure 3-50 Signal exchange between the servo drive and the host controller

Parameter diagram

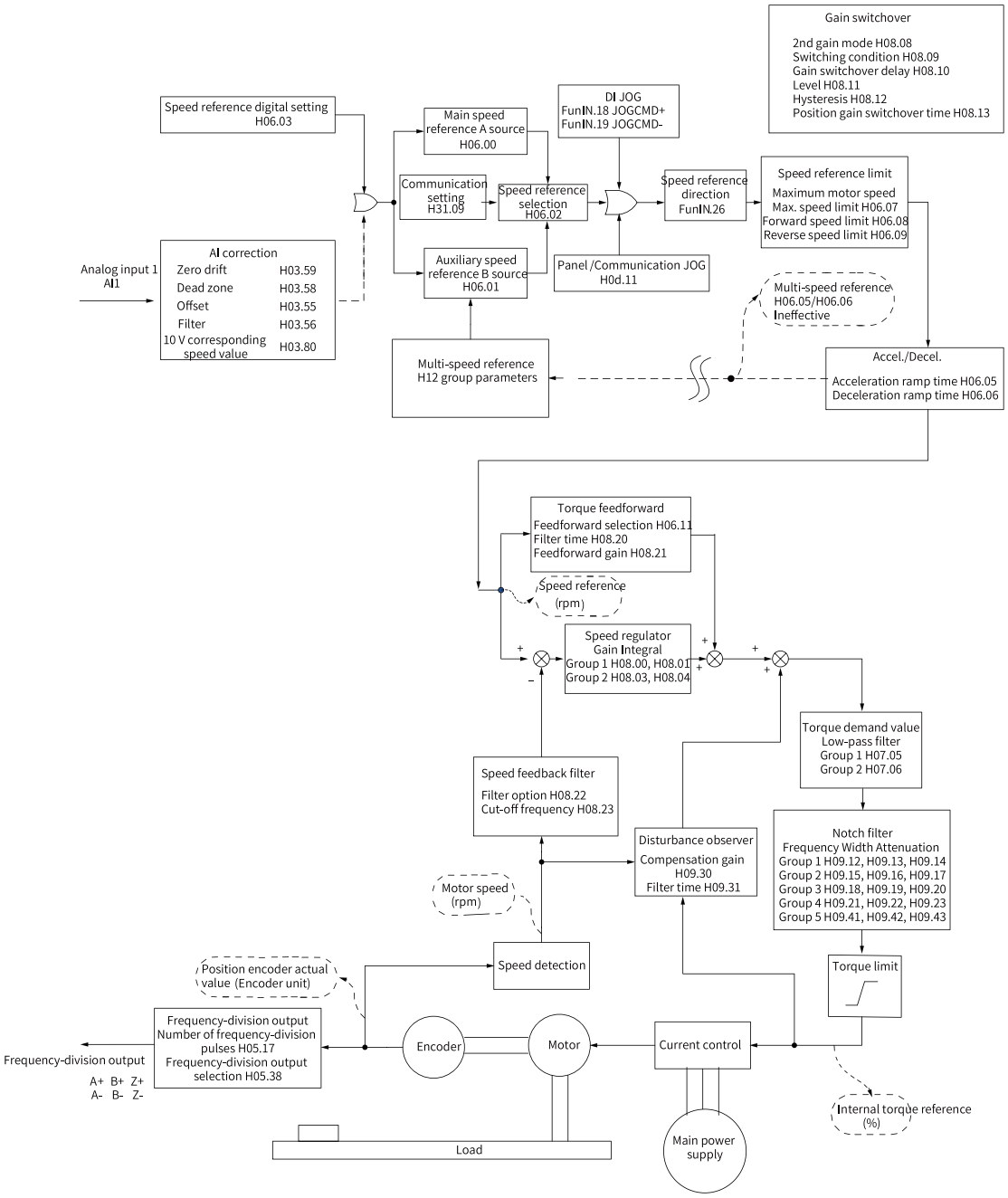


Figure 3-51 Block diagram of speed control mode parameters

3.3.1.3 Control mode setting guide

Step	Name	Description	
1	Select the speed control mode	Set H02.00 to 0.	
2	Defines the speed reference source.	Main speed command A source (H06.02=0)	
		Auxiliary speed command B source (H06.02=1)	*" Set multi-speed operation mode" on page 98*
			" Setting the multi-speed curve" on page 102
		Main speed command A source + Auxiliary speed command B source (H06.02=2)	
		Main command A source and auxiliary command B source switching (H06.02=3)	
		Communication setting (H06.02=4)	
3	Set the speed reference direction	*"3.3.2.2 Speed reference direction" on page 106*	
4	Other function setting	Ramp function setting	*"3.3.3 Ramp Function Setting" on page 107*
		Zero clamp	*"3.3.4 Zero Clamp" on page 108*
		Speed reference limit	*"3.3.5 Speed Reference Limit" on page 109*
		Speed-related DO	*" Speed-Related DO" on page 111*

3.3.2 Speed Reference Input Setting

Speed command input settings include: speed command source, speed command direction.

3.3.2.1 Speed Reference Source

Five speed reference sources are available in the speed control mode, which can be set in H06.02.

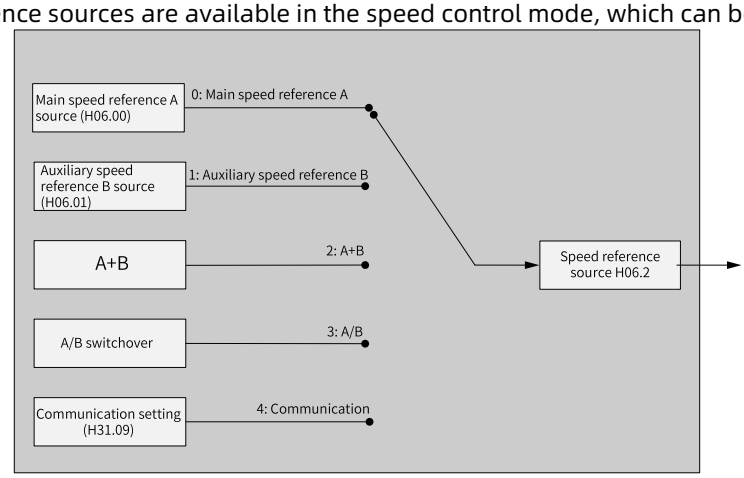


Figure 3-52 Speed reference source

<table>
<tr><th>Parameter</th><th>Name</th><th>Add.</th><th>Range</th><th>Unit</th><th>Default value</th><th>Data Format</th><th>Change Method</th><th>User Permissions</th><th>Effective Way</th></tr>
<tr><td>H06.02</td><td>Speed reference selection</td><td>0x0602</td><td>See "Parameter Description"</td><td>-</td><td>0</td><td>UInt16</td><td>At stop</td><td>Ordinary user</td><td>At once</td></tr>
<tr><td></td><td colspan="9">Parameter description:
Defines the source of speed references.
<table>
<tr><th>Set value</th><th>Control mode</th><th>Remarks</th></tr>
<tr><td>0</td><td>Main speed reference A source</td><td>The reference source is defined by H06.00.</td></tr>
<tr><td>1</td><td>Auxiliary speed command B source</td><td>The reference source is defined by H06.01.</td></tr>
<tr><td>2</td><td>A + B</td><td>The reference source is the product of A + B (H06.00 + H06.01).</td></tr>
<tr><td>3</td><td>Switched between A and B</td><td>The reference source is switched between A and B as defined by FunIN.4 (Cmd_SEL).
<table>
<tr><th>State of FunIN.4 (Cmd_ SEL)</th><th>Reference Source</th></tr>
<tr><td>OFF</td><td>Main speed reference A source</td></tr>
<tr><td>ON</td><td>Auxiliary speed command B source</td></tr>
</table></td></tr>
<tr><td>4</td><td>Communication setting</td><td>The speed reference is defined by operating on H31.09 through communication (unit: 0.001 RPM).</td></tr>
</table></td></tr>
</table>

3.3.2.1.1 Source of Main Speed Reference A (H06.02 = 0)

The main speed reference A is an internal speed reference that can be set through digital setting.

The speed reference is set in H06.03.

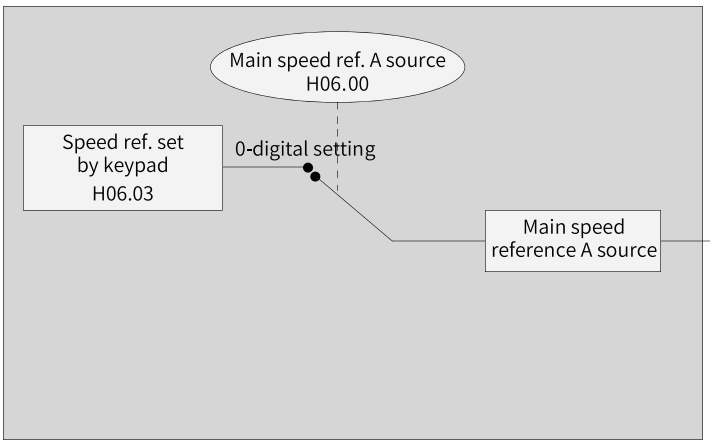


Figure 3-53 Source of main speed reference A

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.00	Main speed reference A source	0x0600	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Digital setting (H06.03)								
	Parameter description:								
	Defines the source of main speed reference A.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.03	Keypad setting value of speed reference	0x0603	-7000 to 7000	rpm	200	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines the speed reference value set through the keypad.								

3.3.2.1.2 Source of Auxiliary Speed Reference B (H06.02 = 1)

The auxiliary speed reference B sources include digital setting and multi-speed references. Both are internal speed references.

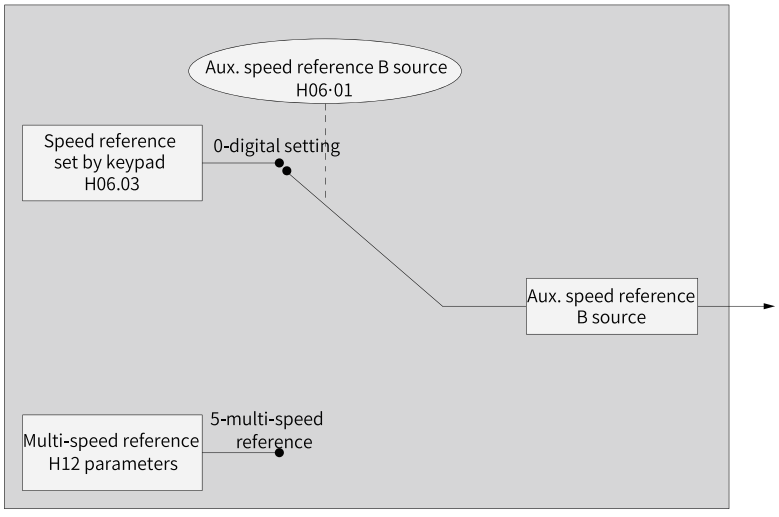


Figure 3-54 Source of auxiliary speed reference B

The digital setting method is the same as the main speed command A source. .

The servo drive supports multi-speed operation, in which 16 multi-speed references can be saved in the servo drive. The maximum operating speed, operating time, and acceleration/deceleration time (four groups) can be set separately for each multi-speed reference.

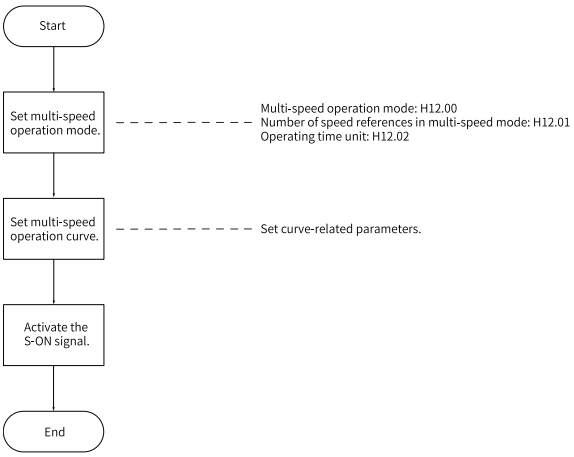


Figure 3-55 Multi-speed reference setting flowchart

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.01	Auxiliary speed command B source	0x0601	See "Values".	-	5	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Digital setting (H06.03) 5: Multi-speed reference								
	Parameter description:								
	Defines the source of auxiliary speed reference B.								

Set the multi-speed operation mode.

You can assign FunIN.5 (DIR-SEL) to an external DI to select the multi-speed operation direction.

Relevant function No.:

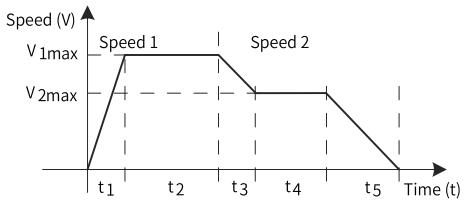
Code	Name	Function Name	Function
FunIN.5	DIR-SEL	Multi-reference direction	Inactive: Reference direction by default Active: Opposite to the reference direction

The following takes "H12.01 = 2" as an example to describe each mode.

- **Individual operation (H12.00 = 0)**
  Set H12.00 to 0 to select the individual operation mode.

Set H12.01 and H12.02 as needed. Then set the reference value, operating time, and acceleration/deceleration time of each speed. The drive executes multi-speed references in a sequence from speed 1 to speed N. After all the speeds are executed, the drive stops.

Table 3–19 Description of individual operation

Mode description	Operation curve
• The drive stops after one cycle of operation. • The drive switches to the next displacement automatically.	 • V_{1max} , V_{2max} : 1st and 2nd speeds • t_1 : actual acceleration/deceleration time of 1st speed • t_3 , T_5 : actual acceleration/deceleration time of 2nd speed • Operation time of a certain speed = Speed change time from previous speed reference switched over to the current speed reference + Average operation time (For example, the operating time of speed 1 is the sum of t_1 +t_2 , the second running time is t_3 +t_4 , and so on). • Do not set the operating time of a certain speed to 0. Otherwise, the drive skips this speed and switches to the next speed directly. • The speed reach signal is activated when the motor speed feedback reaches the maximum operating speed set for this speed. • If the servo ON signal becomes OFF during running of a certain speed, the servo motor stops according to the stop mode in H02.05.

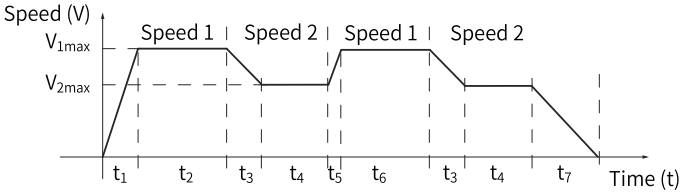
★Terms:

A complete operation cycle covers all the multi-speed references defined by H12.01.

- **Cyclic operation (H12.00 = 1)**
  Set H12.00 to 1 to select the cyclic operation mode.

  Set H12.01 and H12.02 based on the number of speeds and the operating time unit. Then set the reference value, operating time and acceleration/deceleration time for each speed. The drive executes the set speeds in a sequence from speed 1 to speed N (last speed). After all the speeds are executed, the drive jumps to speed 1 and repeats the preceding process.

Table 3–20 Descriptions of cyclic operation

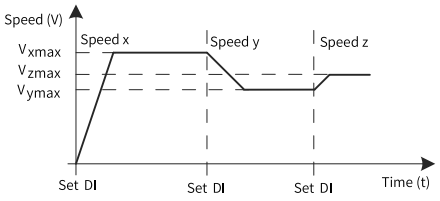
Mode description	Operation curve
• The drive starts from displacement 1 again after each cycle of operation. • The drive switches to the next displacement automatically. • The cyclic running state remains if the servo ON signal is active.	 • V_{1max}, V_{2max}: maximum values of 1st and 2nd speeds. • Running time of a certain speed = Speed change time from previous speed reference switched over to the current speed reference + Average running time (For example, the first running time is t_1+t_2, the second running time is t_3+t_4, and so on). • Do not set the operating time of a certain speed to 0. Otherwise, the drive skips this speed and switches to the next speed directly. • The speed reach signal is activated when the motor speed feedback reaches the maximum operating speed set for this speed. • If the servo ON signal becomes OFF during running of a certain speed, the servo motor stops according to the stop mode in H02.05.

- **DI-based operation (H12.00 = 2)**

  Set H12.00 to 2 to select DI-based operation.

  Set H12.01 and H12.02 based on the number of speeds to be executed and the operating time unit. Then set the reference value, operating time and acceleration/deceleration time for each speed. The drive executes the speed references according to ON/OFF combination of the external DIs (CMDx).

Table 3–21 Descriptions of DI-based operation

Mode description	Operation curve
• The drive operates continuously as long as the S-ON signal is active. • The speed No. is determined by the DI logic. • The interval time between displacements is determined by the command delay of the host controller. • The multi-speed reference is edge-triggered.	 • x and y: speed No. (The relationship between the speed No. and the DI logic is described below.) • The operation time is independent of the parameter setpoint. If the speed No. changes during operation, the drive switches to the new speed No. immediately. • The speed reach signal is activated when the motor speed feedback reaches the maximum operating speed set for this speed. • If the servo ON signal becomes OFF during running of a certain speed, the servo motor stops according to the stop mode in H02.05.

When the multi-speed operation mode is set to DI switching, you can execute the corresponding speed no. reference by configuring the combined DI terminal functions (FunIN.6 to FunIN.9 for multi-reference switchover) and determining the valid logic of the DI terminals. In addition, assign FunIN.5 (DIR-SEL, direction selection in DI-based multi-speed operation) to a certain DI to switch the speed reference direction.

Relevant function No.:

Code	Name	Function Name	Function
FunIN.5	DIR-SEL	Setting of multi-speed DI switchover running direction	Defines the speed reference direction in DI-based operation mode. Inactive: Reference direction Active: Opposite to the reference direction
FunIN.6	CMD1	Multi-reference switchover 1	The speed No. is a 4-bit binary value. The relationship between the speed no. and CMD1 to CMD4 is shown in *"Table 3-22" on page 101*. The DI logic is level-triggered. The CMD value is 1 upon active level input or 0 upon inactive level input.
FunIN.7	CMD2	Multi-position reference switchover 2	
FunIN.8	CMD3	Multi-position reference switchover 3	
FunIN.9	CMD4	Multi-reference switchover 4	

Table 3–22 Relationship between the speed No. and CMD1 to CMD4

CMD4	CMD3	CMD2	CMD1	Speed No.
0	0	0	0	1
0	0	0	1	2
…				
1	1	1	1	16

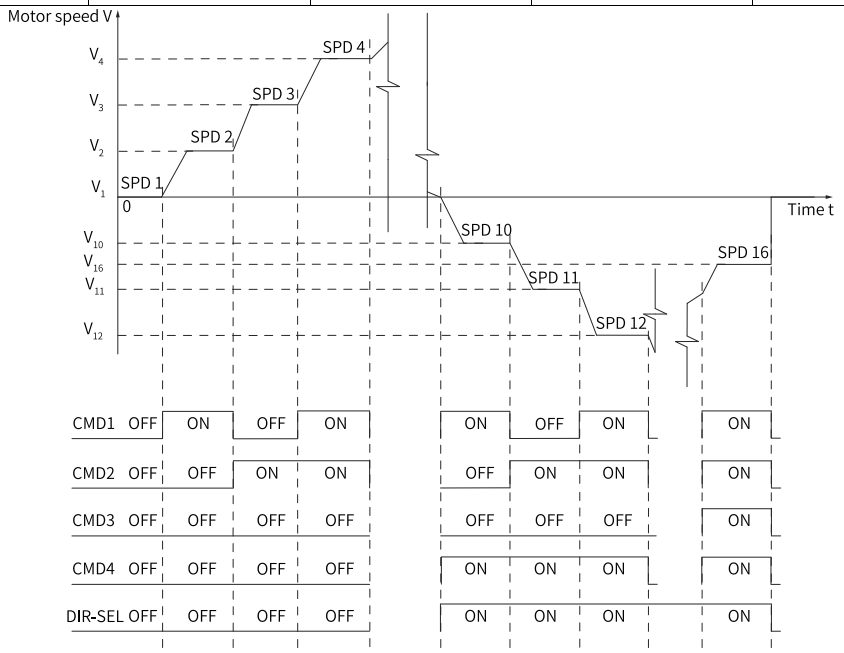


Figure 3-56 Example of multi-speed curve

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.00	Multi-speed running mode	0x1200	See "Values".	-	1	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Stop after running for one cycle (number of speeds defined by H12.01) 1: Cyclic operation (number of speeds defined by H12.01) 2: DI-based operation								
	Parameter description:								
	Defines the multi-speed operation mode when the speed reference source is multi-speed reference (H06.01 = 5, H06.02 = 1/2/3) in the speed control mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.01	End speed No. in speed reference	0x1201	1 to 16	-	16	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	It sets the total number of speed references. Different speed references, operating time, and acceleration/deceleration time (four groups optional) can be set for each speed. H12.00 is not 2: Speeds are switched automatically in a sequence from 1, 2...H12.01. H12.00 is 2: Assign four DIs (Hardware DI or VDI) with DI functions 6 to 9 (FunIN.6: CMD1 to FunIN.9: CMD4) and control the DI logic through the host controller to switch between different speeds.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.02	Running time unit	0x1202	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: sec 1: min								

Setting the multi-speed curve

For speed references in multi-speed operation mode, besides the reference value and operating time, four groups of acceleration/deceleration time options are also available. There is no acceleration/deceleration time by default.

The following describes the actual acceleration/deceleration time and the operating time in cases where H12.00 (Multi-speed operation mode) is set to 1 (Individual operation).

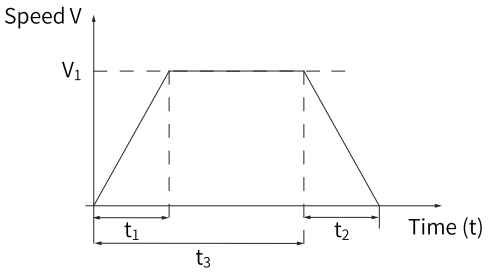


Figure 3-57 Example of multi-speed curve

As shown in the above figure, the velocity command for this segment is V_1, and the actual acceleration time $_1$:

$$t_1 = \frac{V_1}{1000} \times \text{Acceleration time set for this speed}$$

Actual deceleration time t_2:

$$t_2 = \frac{V_1}{1000} \times \text{Deceleration time set for this speed}$$

Operation time = Time taken in switching from the last speed to present speed + Duration of constant-speed operation at present speed (as shown by t_3.

For the parameter settings of the other 15 displacements, see *" Parameter description" on page 242*.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.03	Acceleration time 1	0x1203	0-65535	ms	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.04	Deceleration time 1	0x1204	0-65535	ms	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.09	Acceleration time 4	0x1209	0–65535	ms	150	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.10	Deceleration time 4	0x120A	0–65535	ms	150	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.20	1st speed reference	0x1214	-7000 to +7000	rpm	0	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines speed reference 1 in multi-speed operation mode.								

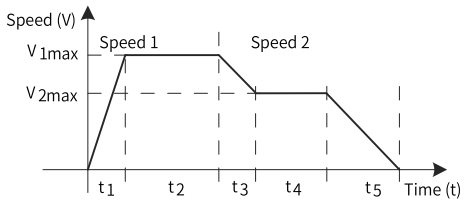
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.21	Running time of 1st speed reference	0x1215	0.0 to 6553.5	s(m)	5.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the running time of the 1st speed reference. If the running time is 0, the servo drive automatically ignores this speed reference.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H12.22	Acceleration/ Deceleration time of 1st speed reference	0x1216	See "Parameter Description"	-	0	UInt16	At once	Ordinary user	At once

Parameter description:

Sets the acceleration/deceleration time of the 1st speed reference.

Set value	Acceleration/Deceleration time	Remarks
0	Zero acceleration/deceleration time	Acceleration time: 0 Deceleration time: 0
1	Acceleration/Deceleration time 1	Acceleration time: H12.03 Deceleration time: H12.04
2	Acceleration/Deceleration time 2	Acceleration time: H12.05 Deceleration time: H12.06
3	Acceleration/Deceleration time 3	Acceleration time: H12.07 Deceleration time: H12.08
4	Acceleration/Deceleration time 4	Acceleration time: H12.09 Deceleration time: H12.10



- V_{1max}, V_{2max}: 1st and 2nd speeds
- t_1: actual acceleration/deceleration time of 1st speed
- t_3, T_5: actual acceleration/deceleration time of 2nd speed
- Running time of a certain speed = Speed change time from previous speed reference switched over to the current speed reference + Average running time (For example, the first running time is $t)_1 + t_2$, the second running time is $t_3 + t_4$, and so on).
- Do not set the operating time of a certain speed to 0. Otherwise, the drive skips this speed and switches to the next speed directly.

Actual acceleration time t_1:

$$t_1 = \frac{V_1}{1000} \times \text{Acceleration time set for this speed}$$

Actual deceleration time t_2:

$$t_2 = \frac{V_1}{1000} \times \text{Deceleration time set for this speed}$$

3.3.2.1.3 Main speed reference A source + Auxiliary speed reference B source (H06.02=02)

The speed reference is defined by both H06.00 (Main speed reference A source) and H06.01 (Auxiliary speed reference B source).

3.3.2.1.4 Switching Between Speed Reference A and Auxiliary Speed Reference B (H06.02 = 3)

When setting H06.02 (speed reference source) to 3 (Switched between A and B), you need to assign FunIN.4 (DI-SEL) to the corresponding DI. The input signal of this DI determines which source (A or B) is active.

Relevant function No.:

Code	Name	Function Name	Description
FunIN.4	CMD-SEL	Main/Auxiliary reference switchover	Inactive: Current reference being A Active: Current reference being B

3.3.2.1.5 Communication setting (H06.02=4)

When H06.02 (Speed reference source) is set to 4 (Communication), the speed reference is the setpoint of H31.09. H31.09 is not displayed on the keypad, it can be set through communication only.

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H31.09	Speed reference set through communication	0x3109	-6000 to +6000	rpm	0	Int32	Real time	Standard user	Real time
	Parameter description:								
	It sets the speed reference (in precision of 0.001 RPM) when the speed reference source is communication in speed control mode. The setpoint of H31.09 is a 32-bit value, which is not displayed on the keypad. It can only be set through communication.								

3.3.2.2 Speed reference direction

A DI terminal with FunIN.26 (SPDDirSel, speed reference direction selection) is used to change the speed reference direction.

Relevant function No.:

Code	Name	Function Name	Description
FunIN.26	SPDDirSel	Speed reference direction	Inactive: Forward direction Invalid: Reverse direction

The actual motor direction is determined by the rotation direction specified in parameter H02.02, speed reference direction, and DI switchover of speed reference direction (FunIN.26).

Table 3–23 Actual motor rotation direction in the speed control mode

H02.02 setpoint	Positive/Negative of Speed Reference	FunIN.26	Actual Motor Rotating Direction
0	+	OFF	CCW
0	+	ON	Clockwise
0	-	OFF	Clockwise
0	-	ON	CCW
1	+	OFF	Clockwise
1	+	ON	CCW
1	-	OFF	CCW
1	-	ON	Clockwise

3.3.3 Ramp Function Setting

Function Description

The ramp function is used to smooth the acceleration rate of speed references through acceleration/deceleration time setting.

In speed control mode, a high acceleration rate easily leads to motor jerk or intense vibration. In this case, increasing the acceleration/deceleration time smooths the motor speed change, preventing mechanical damage caused by jerk or vibration.

Caution

- When the speed reference source is digital setting or jog speed, the acceleration time and deceleration time are set in H06.05 and H06.06.
- When the speed reference source is a multi-speed reference, the acceleration time and deceleration time are set in parameter group H12. For details, see *" Parameter description" on page 242*.

Working Principle

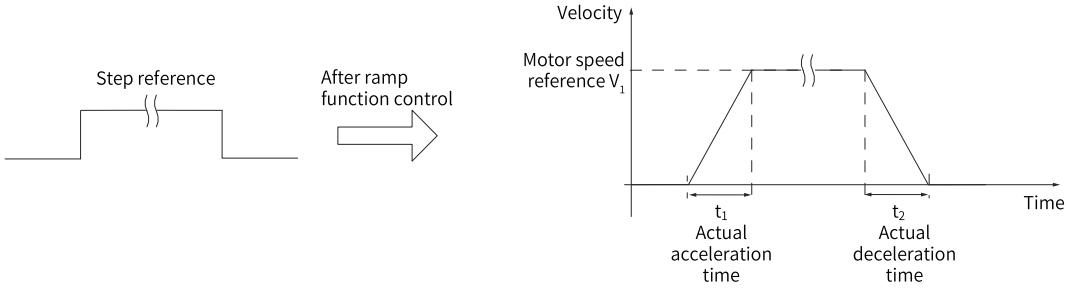


Figure 3-58 Ramp function definition

- H06.05: Defines the time for the speed reference to change from 0 rpm to 1000 rpm.
- H06.06: Defines the time for the speed reference to change from 1000 rpm to 0 rpm.

The formulas of calculating the actual acceleration and deceleration time are as follows:

$$\text{Actual acceleration time } t_1 = \frac{\text{Speed reference}}{1000} \times \text{Acceleration ramp time of speed reference}$$

$$\text{Actual deceleration time } t_2 = \frac{\text{Speed reference}}{1000} \times \text{Deceleration ramp time of speed reference}$$

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.05	Acceleration ramp time constant of speed reference	0x0605	0–65535	ms	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the acceleration/deceleration ramp time of speed reference. The acceleration/ deceleration time constant of multi-speed references are defined only by parameters in group H12. H06.05: Defines the time for the speed reference to change from 0 rpm to 1000 rpm. H06.06: Defines the time for the speed reference to change from 1000 rpm to 0 rpm. The formulas of calculating the actual acceleration and deceleration time are as follows: Actual acceleration time t1 = Speed reference/1000 x Speed reference acceleration ramp time Actual deceleration time t2 = Speed reference/1000 x Speed reference deceleration ramp time								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.06	Deceleration ramp time constant of speed reference	0x0606	0–65535	ms	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the acceleration/deceleration ramp time of speed reference. The acceleration/ deceleration time constant of multi-speed references are defined only by parameters in group H12.								

3.3.4 Zero Clamp

Function Description

In the speed control mode, if FunIN.12 (ZCLAMP) is enabled, and the speed reference amplitude is smaller than or equal to the value of H06.15, the motor enters zero position clamp state. In this case, a position loop is built inside the drive and the speed reference is invalid.

The motor is clamped within ±1 pulse of the position at which zero clamp is activated. Even if it rotates due to external force, it will return to the zero position and be clamped.j

When the speed reference amplitude is larger than the value of H06.15, the servo motor exits the zero speed clamp state and continues running according to the input speed reference. If the signal of the DI terminal with FunIN.12 (ZCLAMP) is inactive, the zero speed clamp function is disabled.

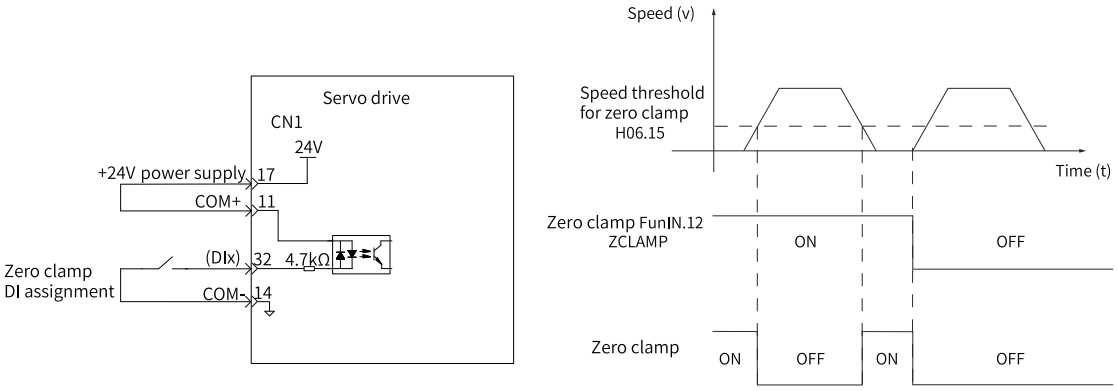


Figure 3-59 Wiring and waveform of zero clamp

Relevant function No.:

Code	Name	Function Name	Description
FunIN.12	ZCLAMP	Zero speed clamp	Invalid: Zero clamp disabled Valid: Zero clamp enabled

Application scenarios

- The zero speed clamp function is used in systems where the host controller does not construct the position loop in speed control mode.
- If servo motor oscillation occurs in zero speed clamp state, tune the position loop gain.

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.15	Zero clamp speed threshold	0x060F	0 to 7000	rpm	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the zero clamp speed threshold.								

3.3.5 Speed Reference Limit

Function Description

In speed control mode, the sources of speed reference limit include:

- H06.07 specifies speed limit of speed reference in both forward and reverse directions. If speed reference exceeds the setting of H06-07, the speed reference will be limited as this value.
- H06.08 specifies the forward speed limit. If forward speed reference exceeds the setting of H06-08, the reference will be limited as this value.
- H06.09 specifies the reverse speed limit. If reverse speed reference exceeds the setting of H06-09, the reference will be limited as this value.
- Maximum speed of the motor (default threshold): Depends on the motor model.

Application Example

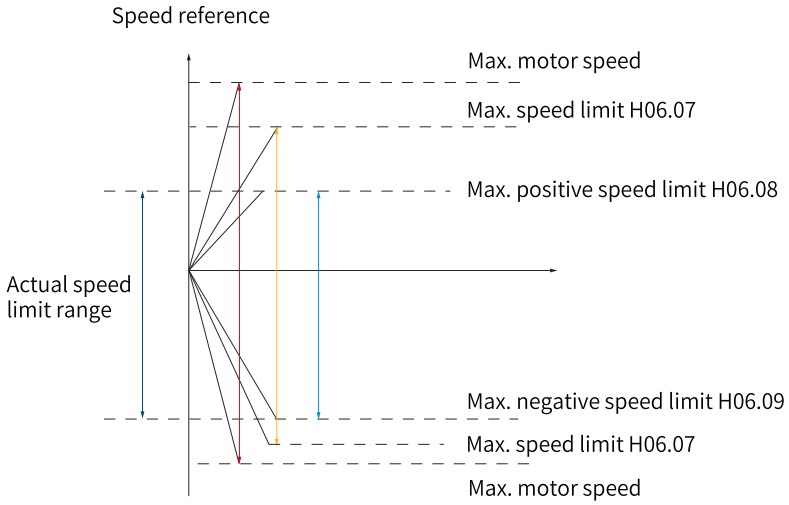


Figure 3-60 Example of speed reference limit

The actual motor speed limit meets the following requirements:

- |Forward speed limit| ≤ min {maximum motor speed, H06.07, H06.08}
- |Reverse speed limit| ≤ min {maximum speed of the motor, H06.07, H06.09}

Note:

The speed reference limit value shall be less than the over-speed fault threshold (H0A.08). When the motor actual speed exceeds the over-speed fault threshold, the servo drive will trigger a motor over-speed fault (E500.0).

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.07	Max. speed limit	0x0607	0 to 7000	rpm	6,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the maximum speed limit.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.08	Forward speed threshold	0x0608	0 to 7000	rpm	6,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the forward speed threshold.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.09	Reverse speed threshold	0x0609	0 to 7000	rpm	6,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the reverse speed threshold.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.08	Overspeed threshold	0x0A08	0 to 10000	rpm	0	UInt16	At once	Ordinary user	At once
	Parameter description:								

It sets the motor speed threshold at which the overspeed fault is detected.

Set value	Overspeed Threshold	Condition for Reporting E500.0
0	Max. motor speed x 1.2	If the speed feedback exceeds the overspeed threshold several times, the drive reports E500.0 (Motor overspeed).
1 to 10000	If H0A-08 ≥ (Maximum motor speed x 1.2): the overspeed threshold equals the maximum motor speed x 1.2.	
	If H0A-08 < (Maximum motor speed x 1.2): the overspeed threshold equals H0A.08.	

3.3.6 Speed-Related DO

Different DO signals are output to the host controller based on comparison between the speed feedback after filter and different thresholds. The corresponding filter time parameter is set by the speed DO filter time constant (H0A.27).

Motor rotation DO signal

When the absolute value of the filtered motor actual speed reaches the motor speed threshold (H06.16), the motor rotation occurred. In this case, the drive outputs the motor rotation signal (FunOUT.2: TGON) to acknowledge that the motor is rotating. When the absolute value of the actual motor speed after filter is smaller than the value of H06.16, the motor is considered not rotating.

Judgment on the motor rotation signal (FunOUT.2, TGON) is not affected by the operating state or control mode of the drive.

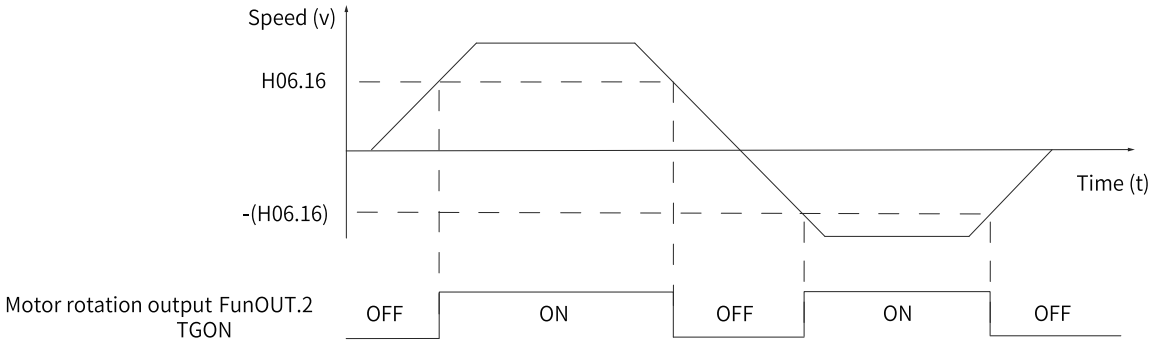


Figure 3-61 Waveform of motor rotation (TGON) signal

Note

In the preceding figure, ON indicates that the motor rotation DO signal is active. OFF indicates that the motor rotation DO signal is inactive.

To use the TGon signal, assign a DO with FunOUT.2 (TGon, motor rotation) and set the active logic of this DO.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.2	TGon	Motor rotation	Inactive: The absolute value of filtered motor speed is lower than the setpoint of H06.16. Active. The absolute value of filtered motor speed reaches the setpoint of H06.16.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.16	Motor rotation speed threshold	0x0610	0 to 1000	rpm	20	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of TGON (motor rotation) signal.								

Speed matching DO signal

In speed control, when the absolute value of the difference between the motor speed after filter and the speed reference satisfies the setting of H06.17, the actual motor speed is considered to reach the speed reference. At this moment, the servo drive outputs the speed matching signal (FunOUT.4: V-CMP). When the absolute value of the difference between the motor speed after filter and the speed reference exceeds the setting of H06-17, the speed matching signal is inactive.

If the drive is not in the operational state or the speed control mode, the speed matching signal (FunOUT.4: V-Cmp) is always inactive.

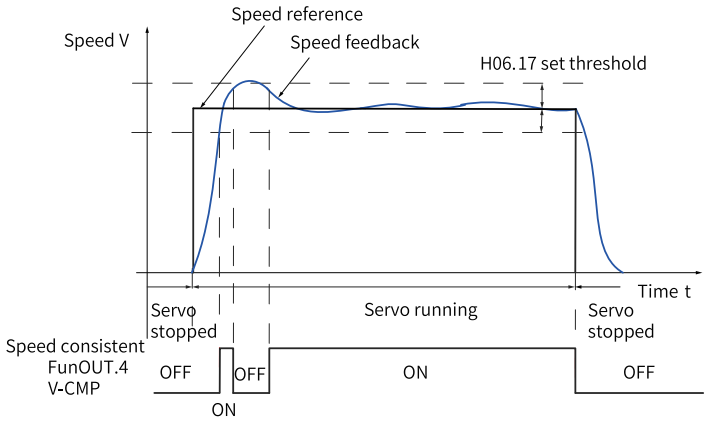


Figure 3-62 Waveform of speed matching (V-Cmp) signal

Note

In the preceding figure, "ON" indicates the the V-Cmp (speed matching) signal is active. "OFF" indicates the V-Cmp signal is inactive.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.4	V-Cmp	Speed match	Inactive: The absolute difference between the filtered actual motor speed and the speed reference is higher than the value of H06.17. Active: The absolute difference between the filtered actual motor speed and the speed reference is lower than or equal to the value of H06.17.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.17	Threshold of speed match signal	0x0611	0 to 100	rpm	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of speed matching signal.								

Speed reach DO signal

When the absolute value of the motor speed after filter exceeds the setting of H06.18, the motor speed is acknowledged to reach the desired value. At this moment, the servo drive outputs the speed reached signal (FunOUT.19: V-Arr). When the absolute value of the motor speed after filter is smaller than or equal to the setting of H06-18, the speed arrival signal is inactive.

Acknowledgment of the speed reach (FunOUT.19: V-Arr) signal is not affected by the operating state or control mode of the drive.

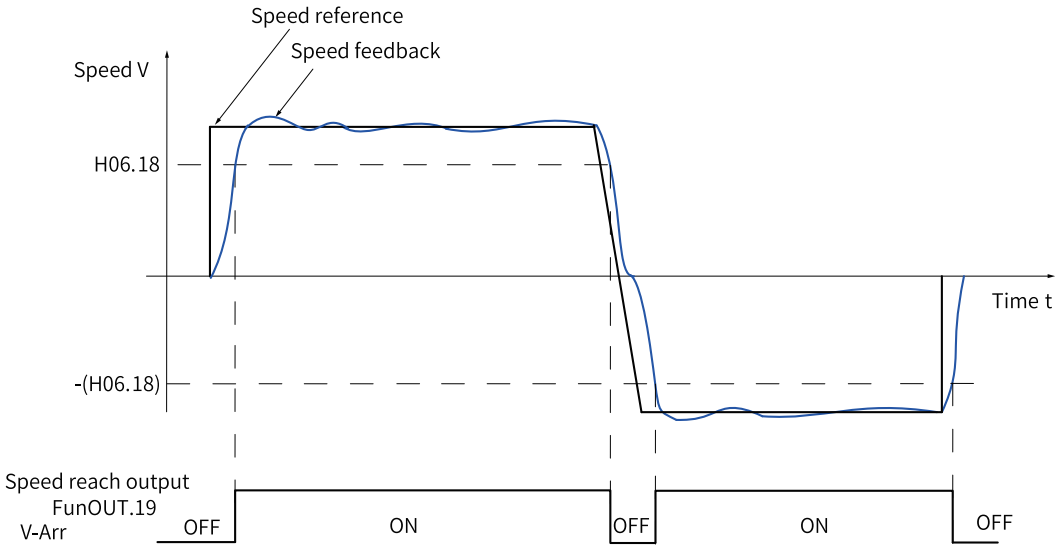


Figure 3-63 Waveform of the speed reach (V-Arr) signal

Note

In the preceding figure, ON indicates that the speed reached DO signal is active. OFF indicates that the speed reached DO signal is inactive.

To use the V-Arr signal, assign FunOUT.19 (V-Arr, speed reach) to a DO and set the active logic of this DO.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.19	V-Arr	Speed reach	Inactive: The absolute value of filtered motor speed feedback exceeds H06.18. Active: The absolute value of filtered motor speed feedback is lower than or equal to the value of H06.18.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.18	Threshold of speed reached signal	0x0612	10 to 7000	rpm	1,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of speed reached signal.								

Zero speed DO signal

When the absolute value of the motor speed after filter is smaller than the setting of H06.19, the motor speed is considered to be close to 0. At this moment, the servo drive outputs the zero speed signal (FunOUT.3: V-Zero). When the absolute value of the motor speed after filter is equal to or large than to the setting of H06-19, the zero speed signal is inactive.

Acknowledgment of the zero speed (FunOUT.3: V-Zero) signal is not affected by the operating state and control mode of the drive.

The interference in the speed feedback can be filtered by the speed feedback DO filter. You can set the corresponding filter time constant in H0A.27.

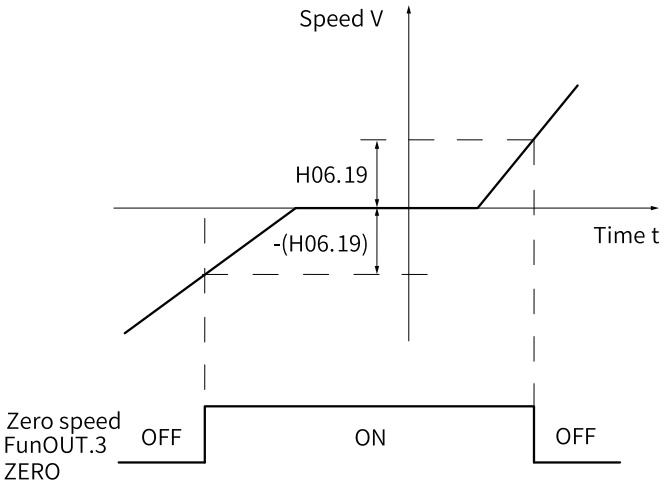


Figure 3-64 Waveform of the zero speed (V-Zero) signal

Note

In the preceding figure, "ON" indicates the V-Zero (zero speed) signal is active. "OFF" indicates the V-Zero (zero speed) signal is inactive.

Set a DO terminal of the servo drive with function 3 (FunOUT.3: ZERO, zero speed) and set the terminal logic.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.3	V-Zero	Zero speed signal	Inactive: The difference between motor speed feedback and the reference value is higher than the setpoint of H06.19. Active: The difference between motor speed feedback and the reference value is lower than or equal to the value of H06.19.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H06.19	Threshold of zero speed output signal	0x0613	1 to 7000	rpm	10	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of zero speed output signal.								

3.4 Torque Control Mode

3.4.1 Overview

3.4.1.1 Function Description

In the torque control mode, the motor current is linearly proportional to the torque. Therefore, torque control is implemented through current control. The drive controls the motor output torque based on torque references. The torque reference can be set through communication.

Set H02.00 (Control mode selection) to 2 (Torque control mode) through the keypad or the Inovance software tool to make the drive operate in the torque control mode. Set the drive parameters based on the mechanical structure and technical specifications.

Application scenarios

This control mode is mainly applicable to the winding and unwinding devices with strict tension requirements. In these applications, the torque always changes with the winding radius so that the tension will not change along with the change of the winding radius.

3.4.1.2 Working Principle

Function Block Diagram

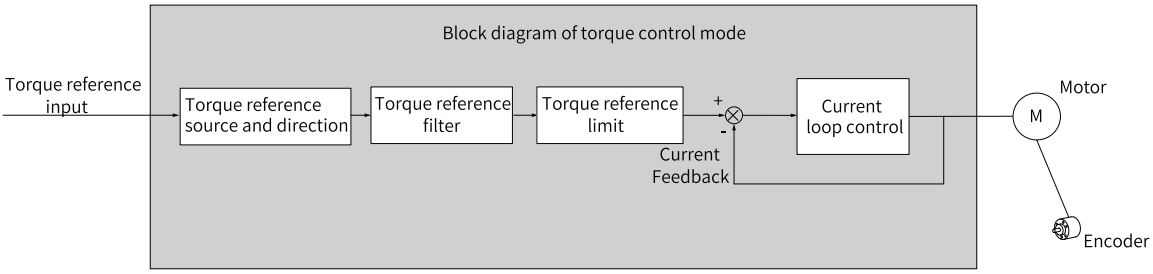


Figure 3-65 Torque control block diagram

Signal exchange between the drive and the host controller

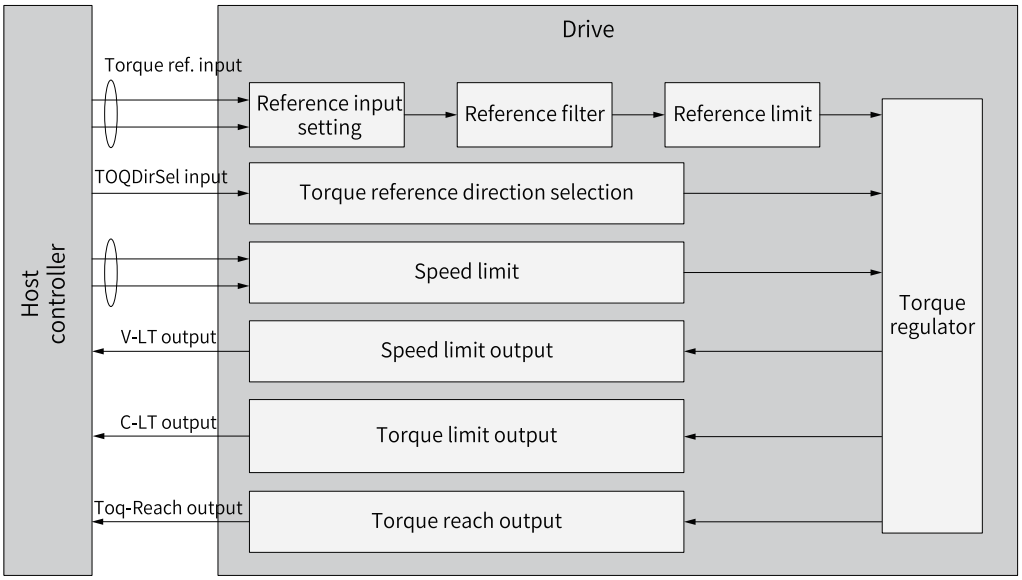


Figure 3-66 Signal exchange between the servo drive and the host controller

Parameter diagram

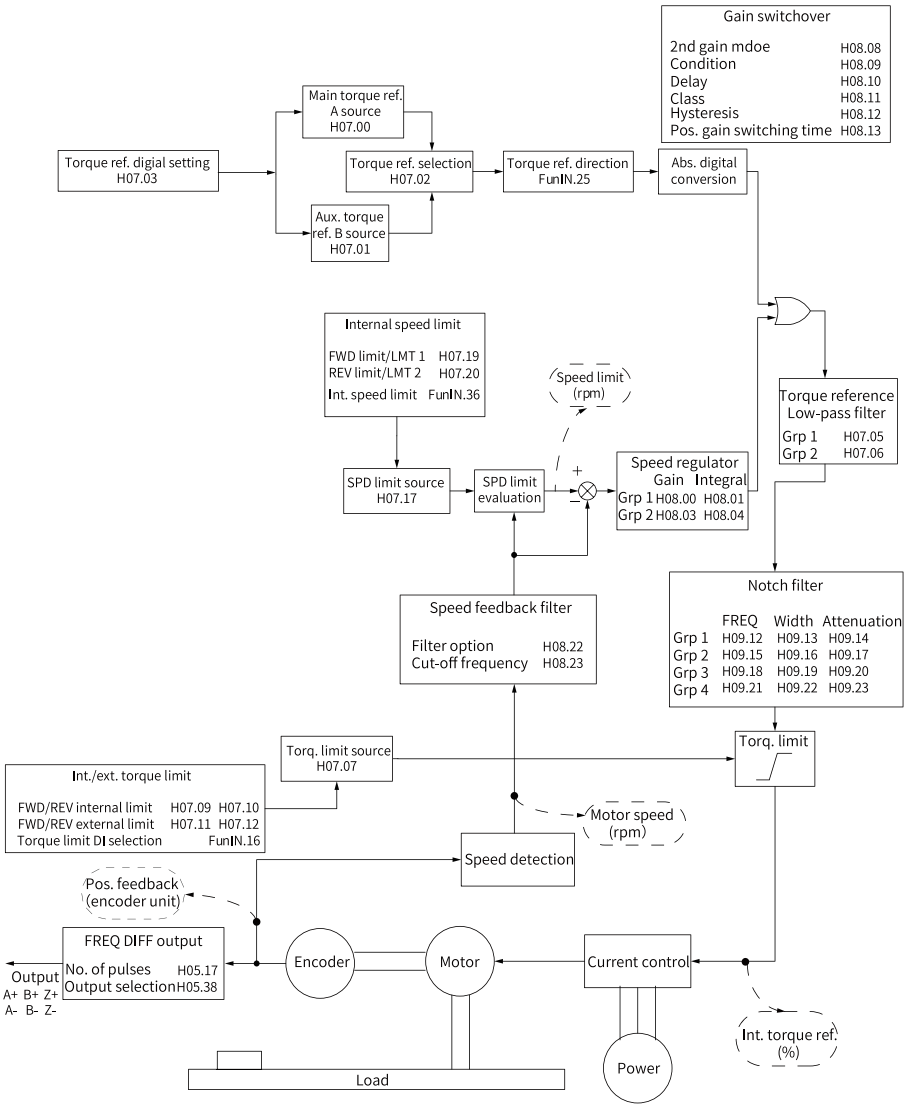


Figure 3-67 Block diagram of torque control parameters

3.4.1.3 Control mode setting guide

Step	Name	Description	
1	Select the reference control mode	Set H02.00 to 2.	
2	Defines the torque reference source.	Main torque command A source (H06.02=0)	*"3.4.2.1.1 Main torque command A source (H07.02=0)" on page 120*
		Communication setting (H07.02=4)	*"3.4.2.1.2 Communication setting (H07.02=4)" on page 121*
3	Torque reference direction	*"3.4.2.2 Torque reference direction" on page 121*	

Step	Name	Description	
4	Other function setting	Torque Reference Filter	*"3.4.3 Torque Reference Filter" on page 122*
		Torque Reference Limit	*" Torque Reference Limit" on page 123*
		Speed Limit in Torque Control	*" Speed Limit in Torque Control" on page 128*
		Torque Reach Output	*"3.4.6 Torque Reach Output" on page 132*

3.4.2 Torque Reference Input Setting

Torque reference input settings include: torque reference source, torque reference direction.

3.4.2.1 Torque Reference Source

Two torque reference sources are available in torque control mode, which can be set in H07.02.

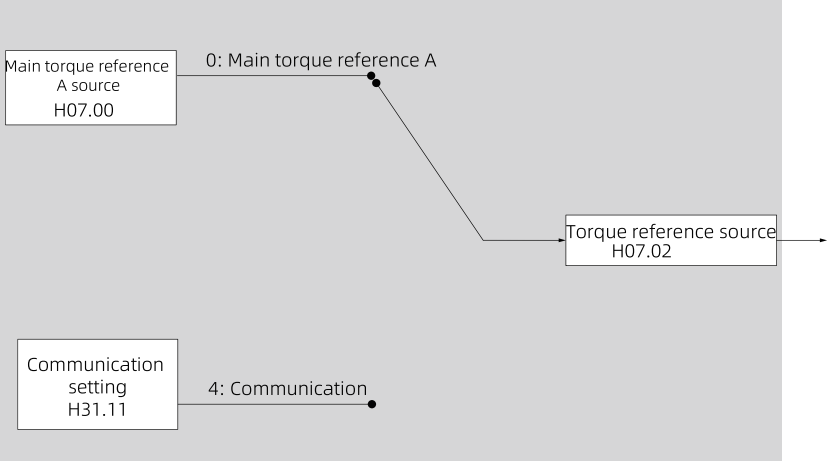


Figure 3-68 Selection of torque reference source

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.02	Torque reference source	0x0702	See "Values".	-	0	UInt16	At stop	Ordinary user	At once

Values:

0: Main torque command A source
4: Communication

Parameter description:

Defines the torque reference.

H07.02 setpoint	Control mode	Remarks
0	Sources of main torque reference A	The reference source is defined by H07.00.
4	Via communication	The torque reference is defined by operating on H31.11 through communication.

3.4.2.1.1 Main torque command A source (H07.02=0)

The main speed reference A is an internal speed reference that can be set through digital setting.

The speed reference is set in H07.03. The setpoint of H07.03 is the percentage of the torque reference to the rated torque of the motor.

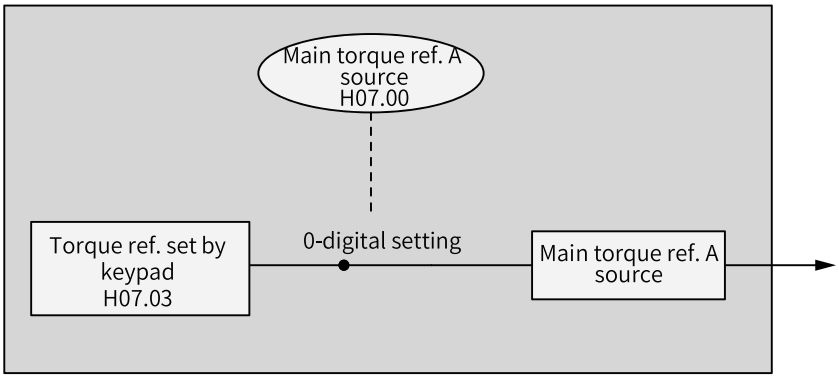


Figure 3-69 Description of main torque reference A sources

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.00	Torque reference source	0x0702	See "Parameter Description"	-	0	UInt16	At stop	Ordinary user	At once

Parameter description:

Defines main torque reference A.

Set value	Reference source	Instruction receiving method
0	Keypad (H07.03)	Torque reference A is set by H07.03.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.03	Keypad setting value of torque reference	0x0703	-400.0 to +400.0	%	0.0	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference value set through keypad.								

3.4.2.1.2 Communication setting (H07.02=4)

When H07.02 (Torque reference source) is set to 4 (Communication), the torque reference is the value of H31.11. H31.11 is not displayed on the keypad, it can be set through communication only.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H31.11	Torque reference set via communication	0x310B	-100000 to +100000	%	0	Int32	At once	Ordinary user	At once
	Parameter description:								
	Sets the torque reference (accurate to 0.001%) when the torque reference source is communication in the torque control mode. The setpoint 100.000% corresponds to the rated torque of the motor. The setpoint of H31.11 is a 32-bit value, which is not displayed on the keypad. It can only be set through communication.								

3.4.2.2 Torque reference direction

To switch the torque reference direction through the DI, assign FunIN.25 (TorDirSel, torque reference direction) to the corresponding DI. The input signal of this DI determines the torque reference direction.

Relevant function No.:

Code	Name	Function Name	Description
FunIN.25	ToqDirSel	Torque reference direction	Inactive: The actual torque reference direction is the same as the set direction. Active: The actual torque reference direction is opposite to the set direction.

The actual direction of rotation is related to the setting of H02.02 (Direction of rotation), the torque reference direction, and the logic of FunIN.25.

Table 3–24 Actual direction of rotation in torque control mode

H02.02 setpoint	Sign (+/-) of the torque reference value	FunIN.25	Actual Motor Rotating Direction
0	+	OFF	CCW
0	+	ON	Clockwise
0	-	OFF	Clockwise
0	-	ON	CCW
1	+	OFF	Clockwise
1	+	ON	CCW
1	-	OFF	CCW
1	-	ON	Clockwise

3.4.3 Torque Reference Filter

Function Description

The servo drive can perform low-pass filtering on the torque reference, making the reference smoother and reducing vibration.

Applicable control modes: position, speed, torque, and hybrid control modes.

The servo drive offers two low-pass filters for torque references, in which the low-pass filter 1 is used by default.

The servo drive switches to low-pass filter 2 when gain switchover is enabled (H08.08 = 1) and the condition defined by H08.09 (H08.09 ≠ 0) is met.

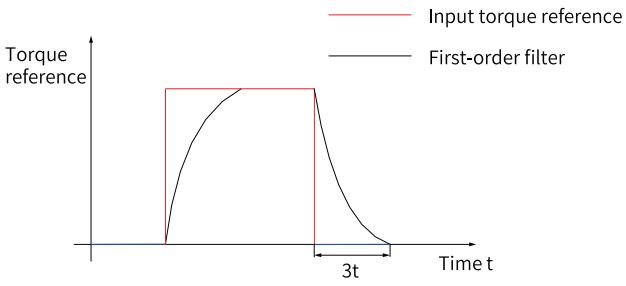


Figure 3-70 First-order filter for rectangular torque references

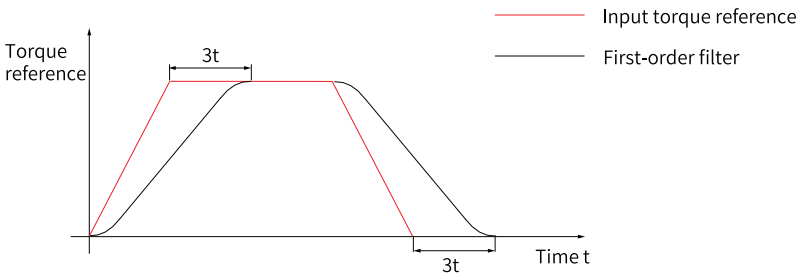


Figure 3-71 First-order filter for trapezoid torque references

Note

In the figure, the "t" in "3t" refers to the torque reference filter time constant. Pay attention to the responsiveness when you set the filter time constant because an excessively high setpoint decreases the responsiveness.

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.05	Time constant of torque reference filter	0x0705	0.00 to 30.00	ms	0.50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference filter time constant 1. Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.06	2nd time constant of torque reference filter	0x0706	0.00 to 30.00	ms	0.27	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference filter time constant 2.								

3.4.4 Torque Reference Limit

3.4.4.1 Function Description

The torque reference limit is used to protect the servo drive and the motor.

When the absolute value of the torque reference input from the host controller or output by the speed regulator is higher than the absolute value of the torque reference limit, the actual torque reference of the drive is limited to the torque reference limit. Otherwise, the torque reference input from the host controller or output by the speed regulator is used.

At any moment, only one torque limit value is effective, and both positive and negative torque limits do not exceed the maximum torque of the drive and motor, nor do they exceed ±300.0% of rated torque.

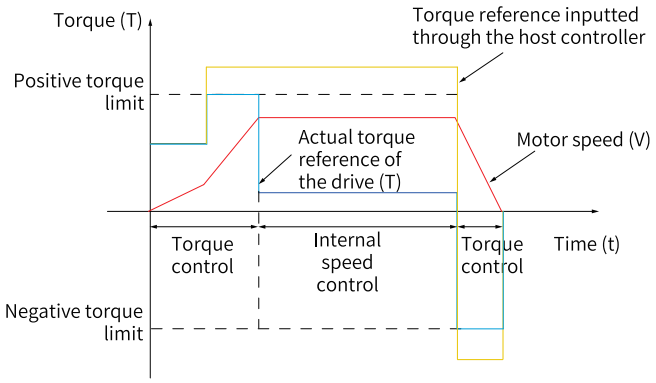


Figure 3-72 Torque reference and torque limit

Application Example

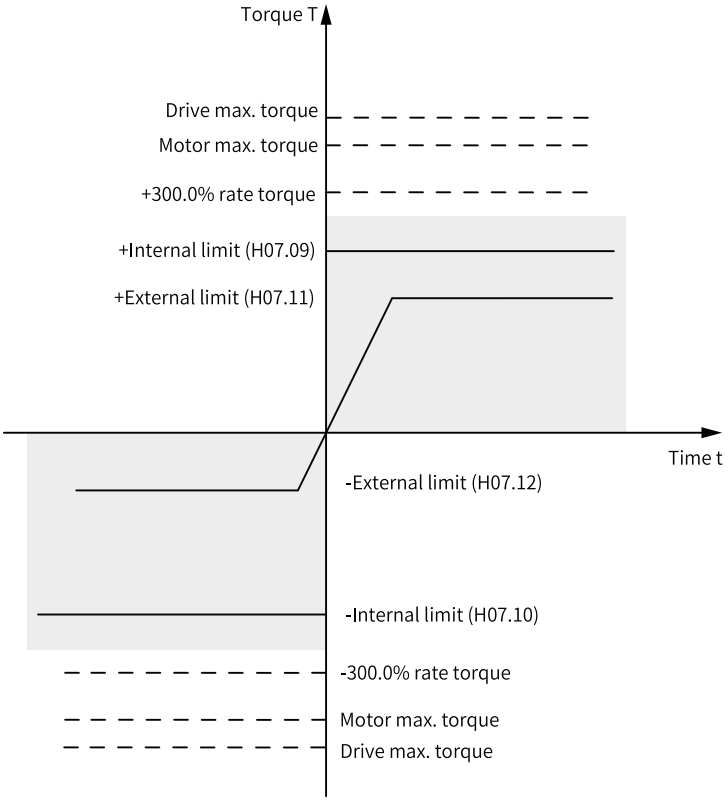


Figure 3-73 Torque limit example

3.4.4.2 Torque limit source

You can set the torque limit source in H07.07.

After the torque limit is set, the servo drive torque reference is restricted to within the torque limit. After the torque reference reaches the limit, the motor runs according to the torque limit. The torque limit must be set according to the load conditions. If the setting is very small, it may cause longer acceleration/deceleration time of the motor, and the actual motor speed may not reach the required value at constant speed running.

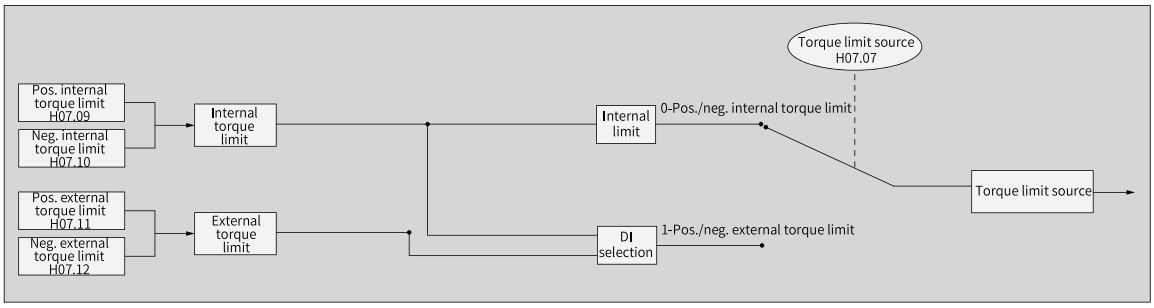


Figure 3-74 Torque limit source

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.07	Torque limit source	0x0707	See "Values".	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Forward/Reverse internal torque limit (default) 1: Forward/Reverse external torque limit (selected through P-CL and N-CL)								
	Parameter description:								
	Defines the torque limit source.								

3.4.4.2.1 Positive and negative internal torque limits (H07.07=0)

The torque reference limit is determined only by H07.09 and H07.10.

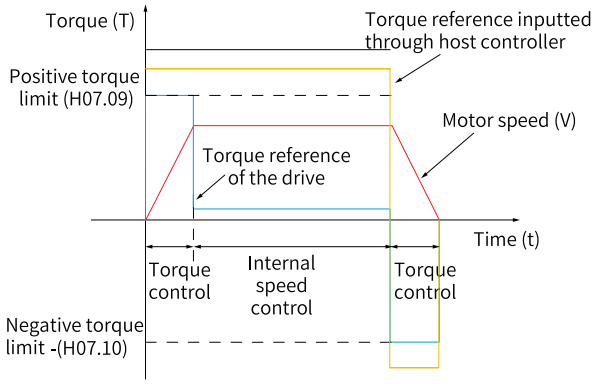


Figure 3-75 Torque limit curve (H07.07 = 0)

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.09	Internal forward torque limit	0x0709	0.0 to 400.0	%	350.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the positive internal torque limit.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.10	Internal reverse torque limit	0x070A	0.0 to 400.0	%	350.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the negative internal torque limit.								

3.4.4.2.2 Positive and negative external torque limits (H07.07=1)

The torque reference limit value is determined by the logic state of external DI signals. The positive torque limit is selected between H07.09 (Positive internal torque limit) and H07.11 (Positive external torque limit). The negative torque limit is selected between H07.10 (Negative internal torque limit) and H07.12 (Negative external torque limit).

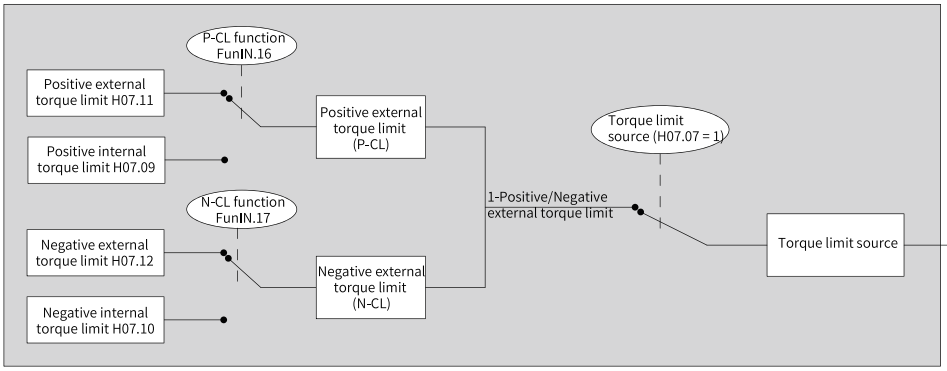
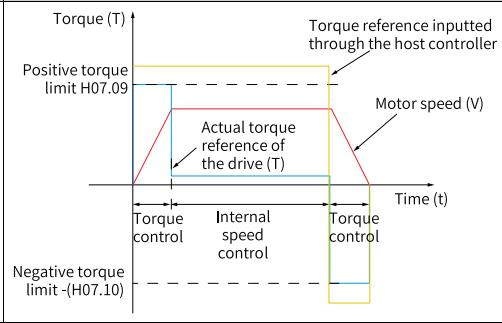
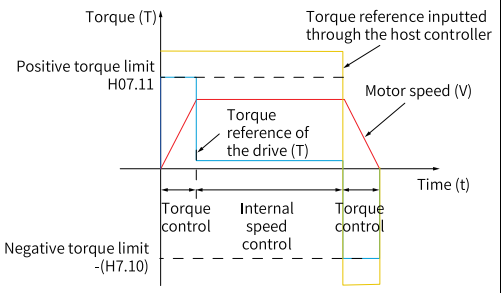


Figure 3-76 Torque limit source (H07.07 = 1)

Table 3–25 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>
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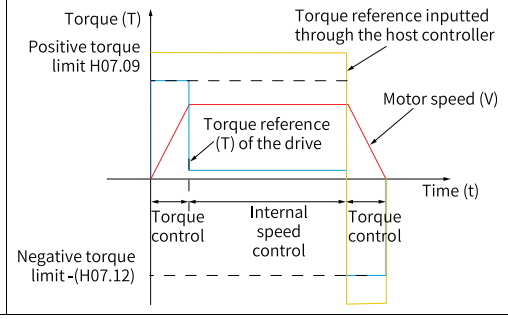
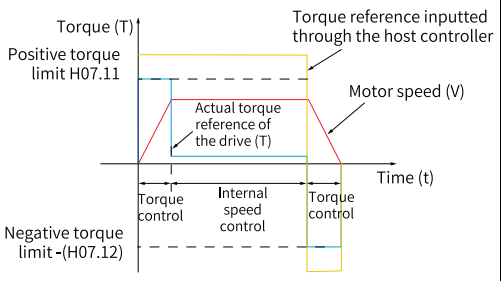
<tr><td>ON</td><td>
</td><td>
</td></tr>
</table>

Assign function 16 (FunIN.16: P-CL, external positive torque limit) and function 17 (FunIN.17: N-CL, external negative torque limit) to two DI terminals of the servo drive respectively and set the terminal logics.

Relevant function No.:

Code	Name	Function Name	Description
FunIN.16	P-CL	External positive torque limit	The torque limit source is switched based on H07.07 (Torque limit source). H07.07 = 1: Active: Positive external torque limit activated Inactive: Positive internal torque limit activated
FunIN.17	N-CL	External negative torque limit	The torque limit source is switched based on H07.07 (Torque limit source). H07.07 = 1: Active: Negative external torque limit activated Invalid: Internal reverse torque limit enabled

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.11	External positive torque limit	0x070B	0.0 to 400.0	%	350.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the positive external torque limit.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.12	External negative torque limit	0x070C	0.0 to 400.0	%	350.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the negative external torque limit.								

3.4.4.2.3 Setting torque limit DO signal

When the torque reference reaches the torque limit, the servo drive outputs the torque limit signal to the host controller. Set a DO terminal of the servo drive with function 7 (FunOUT.7: C-LT, torque limit) and set the terminal logic.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.7	C-LT	Torque limit signal	Active: The torque reference value reaches the torque limit and is limited by the torque limit. Inactive: The torque reference does not reach the torque limit.

3.4.5 Speed Limit in Torque Control Mode

3.4.5.1 Function Description

In torque control mode, the motor accelerates continuously if the torque reference is higher than the load torque on the machine side, which may lead to overspeed and damage the machine. The motor speed needs to be limited to protect the machine.

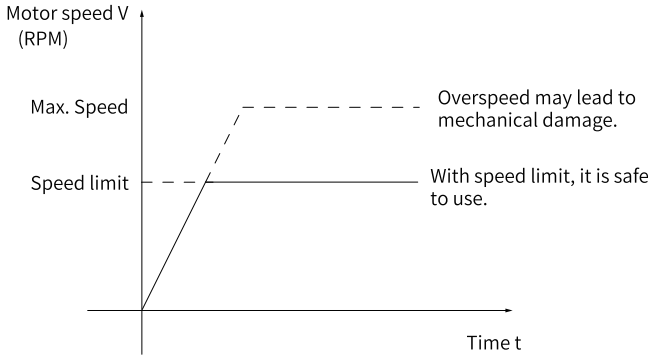


Figure 3-77 Speed limit in torque control mode

3.4.5.2 Setting Speed Limit Source

In the torque control mode, you can set the speed limit source in H07.17. After the speed limit is set, the actual motor speed is restricted to within the speed limit. After reaching the speed limit, the

motor keeps constant-speed running at the speed limit value. The speed limit must be set according to the load conditions.

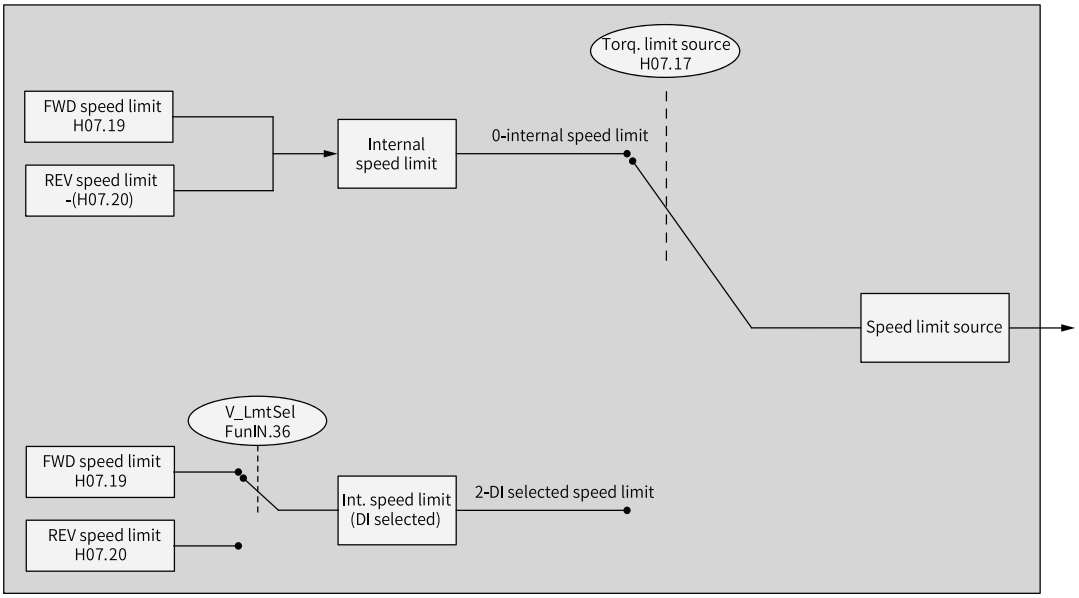


Figure 3-78 Speed limit source

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.17	Speed limit source	0x0711	See "Parameter Description"	-	0	UInt16	At once	Ordinary user	At once

Parameter description:

Defines the speed limit source.

Set value	Reference source	Description
0	Internal speed limit	The speed limit is defined by both H07.19 and H07.20.
1	-	-
2	H07.19 or H07.20 used as speed limit as defined by DI	DI (FunIN.36) inactive: H07.19 used as positive/negative speed limit DI (FunIN.36) active: H07.20 used as positive/negative speed limit

3.4.5.2.1 Internal speed limit (H07.17=0)

The speed limit is determined only by H07.19 and H07.20.

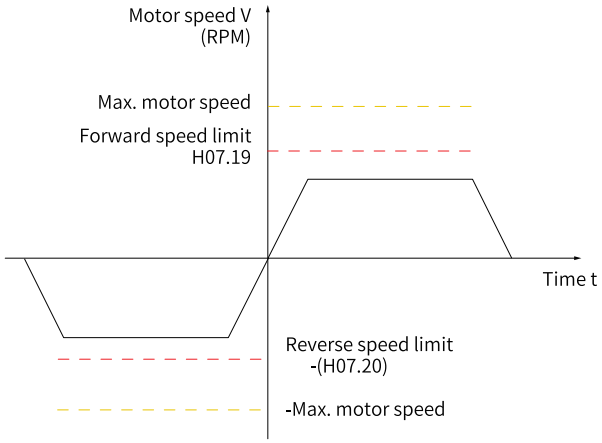


Figure 3-79 Speed limit curve (H07.17 = 0)

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.19	Positive speed limit/ Speed limit 1 in the torque control mode	0x0713	0 to 7000	rpm	3,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the positive speed limit in torque control.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.20	Reverse speed limit/ 2nd speed limit in torque control	0x0714	0 to 7000	rpm	3,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the negative speed limit in torque control.								

3.4.5.2.2 Speed limit selected via DI (H07.17=2)

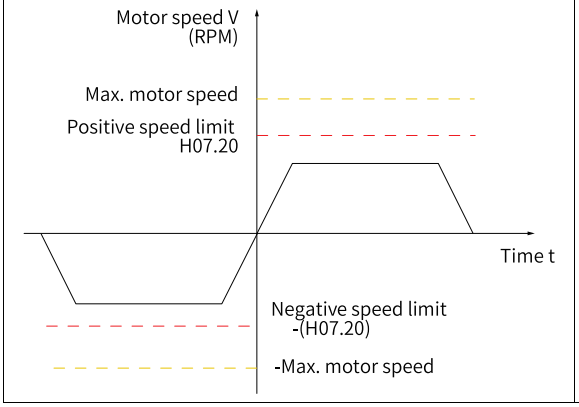
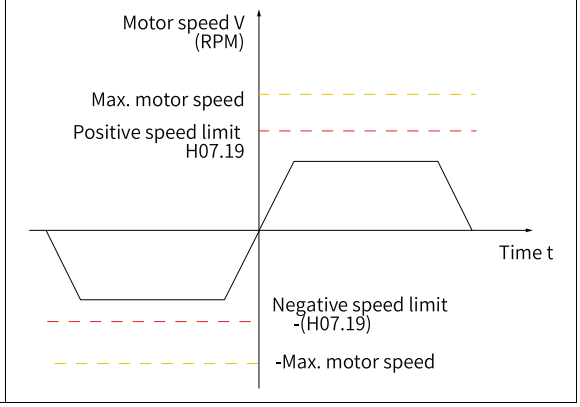
H07.19 or H07.20 is used as the speed limit based on the logic of the DI.

To use this function, set a DI terminal of the servo drive with function 36 (FunIN.36: V-LmtSel, internal speed limit source) and set the terminal logic.

Relevant function No.:

Code	Name	Function Name	Description
FunIN.36	V_LmtSel	Internal speed limit source	Inactive: H07.19 used as positive/negative internal speed limit Active: H07.20 used as positive/negative internal speed limit

Table 3–26 Descriptions of speed limit

V_LmtSel	
ON	OFF
	

3.4.5.2.3 Setting the speed limit DO singnal

In the torque control mode, the servo drive outputs the V- LT (FunOUT.8: speed limit) signal to the host controller when the absolute value of the motor speed keeps exceeding the speed limit in the period defined by H07.40. If either of the preceding two conditions is not met, the speed limit signal will be deactivated.

The speed limit signal (FunOUT.8:V-LT) is judged only in the torque mode and servo running status.

Assign function 8 (FunOUT.8:V-LT) to a DO terminal of the servo drive and set the DO terminal logic.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.8	V-LT	Speed limit	Inactive: The motor speed does not reach the speed limit. Active: The motor speed reaches the speed limit and a speed loop is built based on this limit.

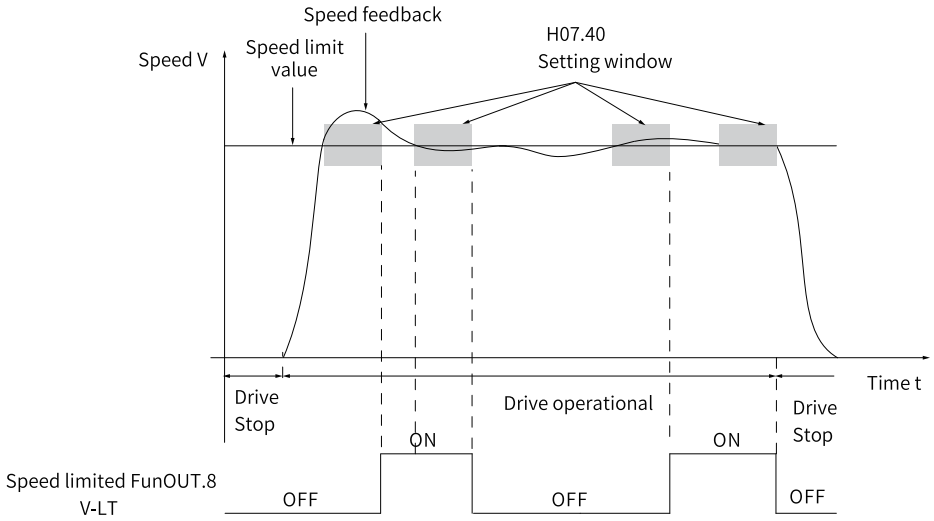


Figure 3-80 Example of speed limit DO waveform

3.4.6 Torque Reach Output

Function Description

The torque reach output is used to determine whether the actual torque reference reaches the set range. When the actual torque reference reaches the threshold, the servo drive outputs the related DO signal (FunOUT.18: ToqReach, torque reached) to the host controller.

To use the torque reached function, assign function 18 (FunOUT.18: ToqReach, torque reached) to a DO terminal of the servo drive and set the DO terminal logic.

Relevant function No.:

Code	Name	Function Name	Description
FunOUT.18	ToqReach	Torque reach	Active: The absolute value of the torque reference reaches the setpoint. Inactive: The absolute value of the torque reference is lower than the setpoint.

Application Example

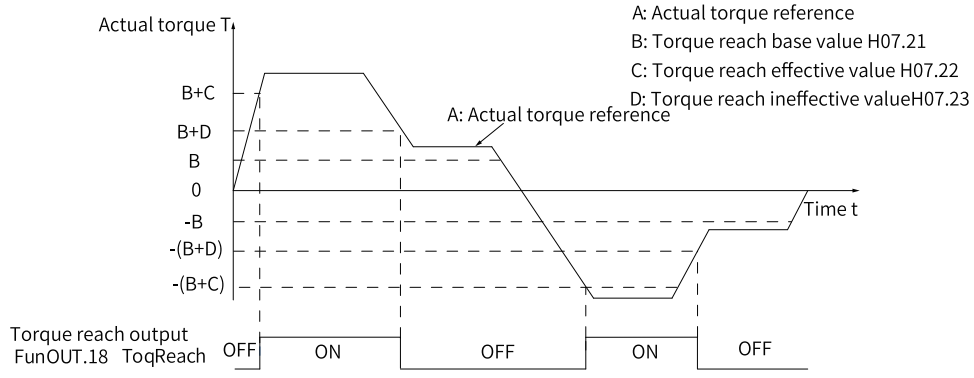


Figure 3-81 Example of TorReach signal waveform

C and D are the offset based on B.

The torque reach DO signal can be activated only when the actual torque reference meets the following condition: |A| ≥ B + C. Otherwise, the torque reached signal remains inactive.

The torque reach signal is deactivated only when the actual torque reference meets the following condition: |A| < B + D. Otherwise, the torque reached signal remains active.

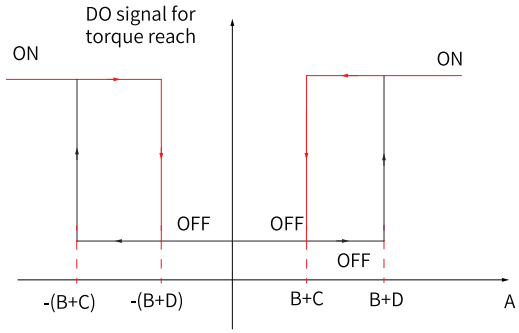


Figure 3-82 Description of torque reach output

Related parameter

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.21	Base value for torque reached	0x0715	0.0 to 300.0	%	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference of the base value for torque reach.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.22	Threshold of torque reached valid	0x0716	10.0 to 300.0	%	20.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference for valid torque reach.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.23	Threshold of torque reached invalid	0x0717	0.0 to 52.8	%	10.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the threshold of invalid torque reach.								

3.5 Compound Control Mode

In compound control mode, the control mode can be switched when the S-ON signal is switched on and the servo drive is in the "run" state. You can enable the compound control mode by setting H02.00 through the keypad or the software tool.

For details, see the following figure.

<table>
<tr><th>H02.00 setpoint</th><th>Control mode</th><th>Remarks</th></tr>
<tr><td>3</td><td>Torque control mode <->
Speed control mode</td><td>Allocate a DI with the function FunIN.10: M1_SEL (Mode switchover) and determine the terminal logic.
<table>
<tr><th>M1_SEL
Terminal Logic</th><th>Control mode</th></tr>
<tr><td>OFF</td><td>Torque control mode</td></tr>
<tr><td>ON</td><td>Speed control mode</td></tr>
</table></td></tr>
<tr><td>4</td><td>Speed control mode<-
>Position control mode</td><td>Allocate a DI with the function FunIN.10: M1_SEL (Mode switchover) and determine the terminal logic.
<table>
<tr><th>M1_SEL
Terminal Logic</th><th>Control mode</th></tr>
<tr><td>OFF</td><td>Speed control mode</td></tr>
<tr><td>ON</td><td>Position control mode</td></tr>
</table></td></tr>
<tr><td>5</td><td>Torque control mode<-
>Position control mode</td><td>Allocate a DI with the function FunIN.10: M1_SEL (Mode switchover) and determine the terminal logic.
<table>
<tr><th>M1_SEL
Terminal Logic</th><th>Control mode</th></tr>
<tr><td>OFF</td><td>Torque control mode</td></tr>
<tr><td>ON</td><td>Position control mode</td></tr>
</table></td></tr>
<tr><td>6</td><td>Torque control mode<-
>Speed control mode<-
>Position control mode</td><td>Allocate two DIs with the function FunIN.10: M1_SEL (Mode switchover) and FunIN.11: M2_SEL (Mode switchover) and determine the terminal logic.
<table>
<tr><th>M2_SEL
Terminal Logic</th><th>M1_SEL
Terminal Logic</th><th>Control mode</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Torque control mode</td></tr>
<tr><td>ON</td><td>OFF</td><td>Speed control mode</td></tr>
<tr><td>-</td><td>ON</td><td>Position control mode</td></tr>
</table></td></tr>
</table>

4 Common Functions

4.1 Absolute System

4.1.1 Connecting the Absolute Encoder System

For how to connect the absolute encoder and how to install the battery box, see section "Connecting Absolute Encoder Cable" and "Installing Absolute Encoder Battery" for details.

4.1.2 Absolute Encoder System Setting

Overview

The absolute encoder, which carries a resolution of 8388608 (2^{23}) PPR, detects the motor position within one revolution and counts the number of revolutions, with 23-bit multi-turn data recorded. The absolute value encoder-based absolute system is divided into absolute position linear mode, absolute position rotation mode, and absolute position single-turn mode.

E731.0 (Encoder multi-turn position data loss) will be reported upon initial power-on of the battery. Set H0d.20 to 1 to reset E731.0 and perform a power cycle before performing the homing operation.

Note

When you change the value of H02.02 (Direction of rotation) or H0d.20 (Absolute encoder reset selection), the absolute position recorded by the encoder changes suddenly, causing the mechanical absolute position reference to change. In this case, perform the homing operation. After homing is done, the deviation between the mechanical absolute position and that recorded in the encoder will be calculated automatically and saved in the EEPROM of the drive.

Applicable scenarios

The absolute encoder system works in the position control, speed control, and torque control modes. When the servo drive is powered off, the encoder records data with the power supplied by the battery. The servo drive therefore can calculate the absolute mechanical position through the encoder after power-on, removing the need for homing.

Absolute value system setting

To match the absolute encoder with the SV660P series servo drive, set H00.00 (Motor code) to 14101 (Inovance 23-bit absolute encoder). Then set H02.01 (Absolute encoder system selection) based on actual conditions.

Encoder feedback data

The feedback data of the absolute encoder includes the encoder revolution count and the position within single-turn of the encoder. In incremental position mode, the encoder revolution count is not available.

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H00.08	Serial encoder type	0x0008	0 to 65535	-	0	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	14100: Multi-turn absolute encoder Others: Single-turn absolute encoder								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H02.01	Absolute position detection system	0x0201	0 to 2	-	0	UInt16	At stop	Ordinary user	Effective upon next power-on
	Parameter description:								

Used to set the absolute position function.

Set value	Absolute system selection	Remarks
0	Incremental position mode	The encoder is used as a serial incremental encoder, and the position retentive at power failure is not supported.
1	Absolute position linear mode	The encoder is used as an absolute encoder, and the position is retentive at power failure. It is applicable to the scenario where the travel range of the device load is fixed and the encoder multi-turn data does not overflow.
2	Absolute position rotation mode	The encoder is used as an absolute encoder, and the position is retentive at power failure. This mode is mainly applicable to the scenario where the load travel range is not limited and the number of motor single-direction revolutions is smaller than 32767.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.70	Number of absolute encoder revolutions	0x0B46	0-65535	Rev	0	UInt16	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the number of absolute encoder turns.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.71	Position of absolute encoder within one turn	0x0B47	0 to 2147483647	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the single-turn position feedback of the absolute encoder.								

4.1.3 Absolute Position Linear Mode

This mode applies to applications where the axis travel range is fixed without multi-turn data overflow.

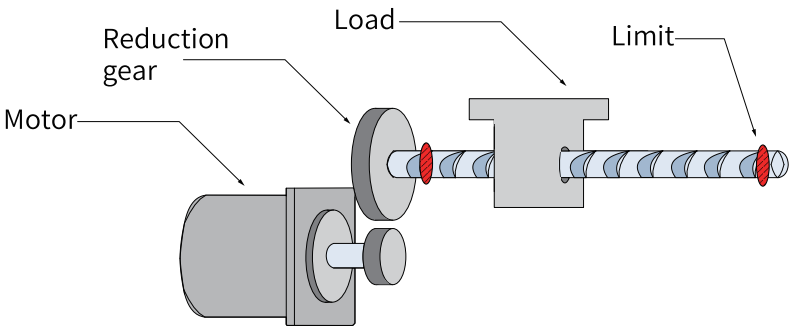


Figure 4-1 Application of the linear mode

Assume the mechanical absolute position (H0b.58 and H0b.60) is P_M, the encoder absolute position is P_E [P_E range is -2^{38}~ (2^{38}-1)], and the absolute position linear mode offset (H05.46 and H05.48) is P_O, then the relationship among the three is $P_M = P_E - P_O$.

If the electronic gear ratio is B/ A, then the following formula applies: H0b.07 (absolute position counter) = P_M / (B/A).

Position offset in the absolute position linear mode (H05.46 and H05.48) is 0 by default. After homing is done, The servo drive calculates the deviation between the absolute position of the machine and that fed back by the encoder, assigns the value to H05.46 and H05.48, and saves the deviation in EEPROM.

The encoder multi-turn data range in the absolute position linear mode is -32768 to +32767. If the number of forward revolutions exceeds 32767 or the number of reverse revolutions is lower than

-32768, E735.0 (encoder multi-turn count overflow) occurs. In this case, set H0d.20 to 2 (Reset multi-turn data), and then perform homing again.

In absolute position linear mode, set H0A.36 to shield the encoder multi-turn overflow fault.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.07	Absolute position counter	0x0B07	-2147483648 to +2147483647	Reference unit	0	Int32	Unmodifiable	Ordinary user	-
	Parameter description:								
	Indicates the current absolute position of the motor (in reference unit). This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.58	Mechanical absolute position (low 32 bits)	0x0B3A	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	Displays the low 32 low-order bit values (encoder unit) of the mechanical position feedback when the absolute encoder is used.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.60	Mechanical absolute position (high 32 bits)	0x0B3C	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	Displays the 32 high-order bit values (encoder unit) of the mechanical position feedback when the absolute encoder is used.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.77	Absolute position (low 32 bits) of absolute encoder	0x0B4D	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the low 32-bit data of the position feedback of the absolute encoder.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.79	Absolute position (high 32 bits) of absolute encoder	0x0B4F	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the high 32-bit data of the position feedback of the absolute encoder.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.36	Encoder multi-turn overflow fault selection	0x0A24	0–1	-	0	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	0: Disabled 1: Enabled Defines whether to hide the encoder multi-turn overflow fault (H0A.36=1) in the absolute position linear mode (H02.01 = 1).								

4.1.4 Absolute Position Rotation Mode

This mode applies when the load traveling range is not limited and the number of unidirectional revolutions of the motor is lower than 32767 upon power failure, as shown in the following figure.

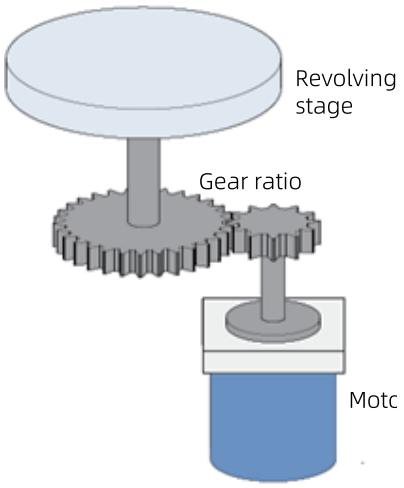


Figure 4-2 Rotating load

The servo drive calculates the absolute position upper limit of the machine based on H05.52 and H05.54 first. If H05.52 and H05.54 are 0, the servo drive turns to H05.50 and H05.51. Assume the encoder resolution R_E, $R_E = 2^{23}$, and assume the number of encoder pulses corresponding to one

load rotation is R_M, when H05.52 or H05.54 is not equal to 0, R_M = H05.54×2^{32}+ H05.52; when both H05.52 and H05.54 are 0, $R_M = R_E$.

If the electronic gear ratio is B/ A, then the following formula applies: H0b.07 (absolute position counter) = R_M / (B/A).

The following figure shows the relation between the single-turn position of the rotating load and the position of the rotary platen.

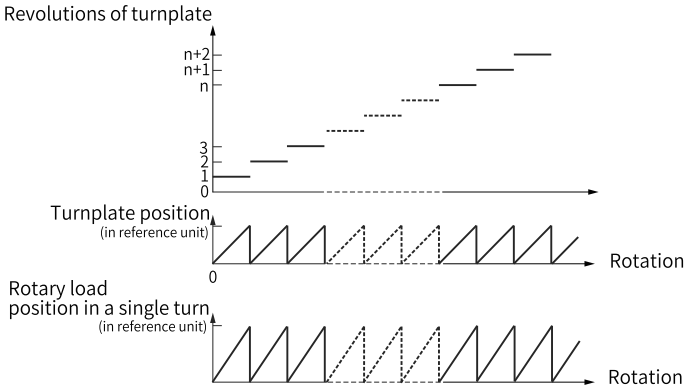


Figure 4-3 Relation between the single-turn position of the rotating load and the position of the rotating platen

The following figure shows the relation between the position fed back by the encoder and the single-turn position of the rotating load.

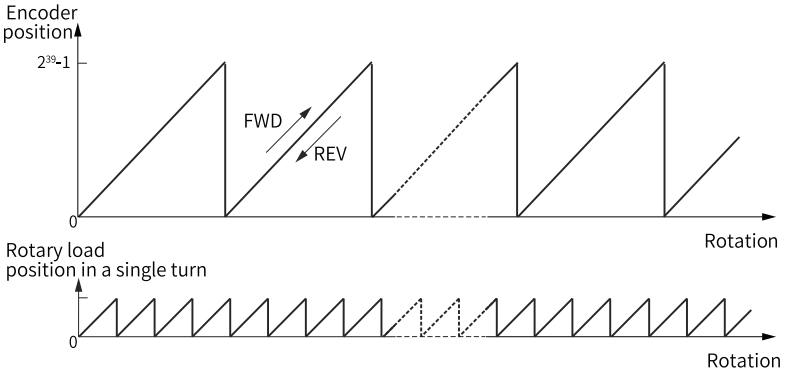


Figure 4-4 Relation between encoder feedback position and the rotating load single-turn position

The multi-turn data range is unlimited in the absolute position rotation mode. Therefore, E735.0 (encoder multi-turn counting overflow) is inactive.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.50	Mechanical gear ratio in absolute position rotation mode (numerator)	0x0532	1 to 65535	-	1	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	Defines the transmission ratio between the mechanical rotary load and the motor in the absolute position rotation mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.51	Mechanical gear ratio in absolute position rotation mode (denominator)	0x0533	1 to 65535	-	1	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	Defines the transmission ratio between the mechanical rotary load and the motor in the absolute position rotation mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.52	Pulses per revolution of the load in absolute position rotation mode (low 32 bits)	0x0534	0 to 4294967295	Encoder unit	0	UInt32	At stop	Ordinary user	At once
	Parameter description:								
	Defines the number of pulses per revolution of the rotary load in the absolute position rotation mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.54	Pulses per revolution of the load in absolute position rotation mode (high 32 bits)	0x0536	0 to 4294967295	Encoder unit	0	UInt32	At stop	Ordinary user	At once
	Parameter description:								
	Defines the number of pulses per revolution of the rotary load in the absolute position rotation mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H05.58	Torque threshold in homing upon hit-and-stop	0x053A	0 to 3000	%	1,000	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the maximum positive/negative torque limit during homing upon hit-and-stop.								

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.77	Absolute position (low 32 bits) of absolute encoder	0x0B4D	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the low 32-bit data of the position feedback of the absolute encoder.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.79	Absolute position (high 32 bits) of absolute encoder	0x0B4F	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the high 32-bit data of the position feedback of the absolute encoder.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.81	Load position within one turn in absolute position rotation mode (low 32 bits)	0x0B51	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the low 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.83	Load position within one turn in absolute position rotation mode (high 32 bits)	0x0B53	0 to 4294967295	Encoder unit	0	UInt32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the high 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.85	Load position within one turn in absolute position rotation mode	0x0B55	-2147483648 to +2147483647	Reference unit	0	Int32	Unmodifiable	Ordinary user	-
	Parameter description:								
	It displays the high 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.								

4.1.5 Precautions for Use of the Battery Box

E731.0 (Encoder multi-turn position data loss) will be reported upon initial power-on of the battery. Set H0d.20 to 1 to reset E731.0 and perform a power cycle before performing the homing operation.

When the battery voltage detected is lower than 3.0 V, E730.0 (Encoder battery alarm) occurs. In this case, replace the battery according to the following procedure.

1. Power on the drive and make it stay in the non-operational state.
2. Replace the battery.
3. After the drive resets E730.0 automatically. If no other alarm occurs, continue to operate the drive.

Note

- If you replace the battery after powering off the drive, E731.0 (Encoder multi-turn position data loss) can occur at next power-on, leading to an abrupt change in the multi-turn data. In this case, set H0d.20 to 1 to reset the encoder fault. Then perform the homing operation again.
- Ensure the maximum motor speed does not exceed 6000 rpm upon power-down of the servo drive. This is to enable the encoder to record the position accurately.
- Store the battery in required temperature and ensure reliable contact and sufficient electricity. Failure to comply may cause loss of the encoder position.
- The absolute position recorded by the encoder changes abruptly after multi-turn data reset. In this case, perform mechanical homing.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.20	Multi-turn absolute encoder reset	0x0D14	0 to 2	-	0	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	0: No action 1: Reset fault 2: Reset fault and multi-turn data You can reset the encoder fault or the multi-turn data fed back by the encoder through H0d.20.								

4.2 Software Limit Function

Function description

Software position limit is implemented through a comparison between the internal position feedback and the set limit value. If the set limit value is exceeded, the servo drive reports an alarm and stops immediately. Software position limit is available both in absolute position mode and the incremental position mode. To use the software position limit in incremental position mode, set H0A.40 (Software position limit) to 2 (Enabled after homing) first, and then perform homing upon power-on before applying software position limit.

Traditional hardware limit function:
This function is implemented by inputting the external sensor signal to the CN1 terminal of the servo drive.

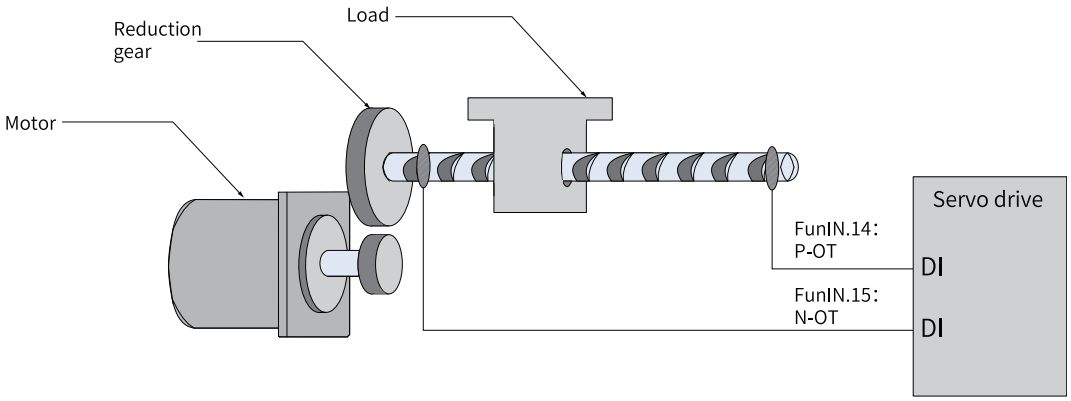


Figure 4-5 Installation of limit switches

Table 4–1 Comparison between the hardware limit and software limit

Hardware limit function		Software limit function	
Disad-vantages	Restricted to linear motion and single-turn rotational motion.	Advantages	Applicable to both linear motion and rotational motion.
	Requires an external mechanical limit switch.		Hardware wiring is not required, preventing malfunction due to poor cable connection.
	Suffered from the risk of mechanical slip.		Internal position comparison can prevent malfunction due to mechanical slip.
	Unable to sense or detect an overtravel fault after power-off.		

Precautions

- 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 alarm E950.0 and executes stop at positive limit. When the absolute position counter (H0b.07) is smaller than H0A.43, the servo drive reports alarm E952.0 and executes stop at negative limit.
- If H0A.40 is set to 2, software 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, alarm E950.0 is reported, 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.43 after homing, alarm E952.0 is reported, and the servo drive stops at reverse overtravel.

- The local limit is active only in local mode. The limit defined by the object dictionary is active in CANopen mode.

Related parameters

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.40	Software limit selection	0x0A28	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: No action 1: Activated immediately 2: Activated after homing completed								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.41	Forward position of software limit	0x0A29	-2147483648 to +2147483647	-	2147483647	Int32	At stop	Ordinary user	At once
	Parameter description:								
	When the absolute position counter (H0b.07) is larger than H0A.41, the servo drive reports E950.0 (Forward overtravel) and stops accordingly.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.43	Reverse position of software limit	0x0A2B	-2147483648 to +2147483647	-	-2147483648	Int32	At stop	Ordinary user	At once
	Parameter description:								
	When the absolute position counter (H0b.07) is smaller than H0A.43, the servo drive reports E952.0 (Reverse overtravel) and stops accordingly.								

4.3 Software Reset

Function Description

The software reset function comes into reset when a restart of the servo drive in the non-operating state is not allowed because a No.1 non-resettable fault does not occur.

Related parameters

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.00	Software reset	0x0D00	See "Values".	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: No action 1: Enable reset								
	Parameter description:								
	Programs in the drive are reset automatically (similar to the program reset upon power-on) after the software reset function is enabled, without the need for a power cycle.								

4.4 Motor Protection

Motor overload protection

After power-on, the motor continuously generates heat due to thermal effect of the current. The heat is then dissipated to the surroundings. When the heat generated exceeds the heat dissipated, the motor temperature will rise to a point that could damage the motor. To prevent such risks, the drive offers the motor overload protection function to prevent the motor from being damaged due to over-temperature.

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

Set the motor overload protection gain (H0A.04) to adjust the report time of fault E620.0. Use the default value of H0A.04 in general conditions, however, in case of one of the following situations, modify H0A.04 based on the actual heating condition.

- The motor works in environments with high temperature.
- The motor is in the cyclic motion featuring short motion cycle and frequent acceleration/ deceleration.

Motor overload detection can be shielded (H0A.26 = 1) when you ensure that the motor will not be damaged.

Caution

Take caution when using the motor overload shielding function as it may easily lead to motor damage.

Related parameters

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.04	Motor overload protection gain	0x0A04	50 to 300	%	100	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	Determines the motor overload duration before E620.0 (Motor overload) is reported. Change the value to advance or delay the overload protection time based on the motor heating condition. The value 50% indicates half of the base time, and 150% indicates 1.5 times of the base time. Set this parameter based on the actual temperature of the motor.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.26	Enable motor overload shielding	0x0A1A	See "Values".	-	3	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Show motor overload warning (E909.0) and fault (E620.0) 1: Hide motor overload warning (E909.0) and fault (E620.0)			2: No function 3: Enabled for new motors					
	Parameter description:								
	It sets whether to shield motor overload detection.								

Over-temperature protection upon motor stall

When the motor is stalled, the motor speed is nearly 0 rpm at high current input. In this case, the motor can be overheated significantly. The motor is capable of operating upon stall in an allowable period of time, exceeding of which can lead to over-temperature and damage the motor. To prevent such a risk, the servo drive offers motor stall overtemperature protection to protect the motor from being damaged by overtemperature upon stall.

You can set the time for reporting E630.0 (Motor stall over-temperature fault) by setting the time threshold for motor overtemperature protection (H0A.32). The motor overtemperature protection function is enabled by default (H0A.33 = 1).



- To prevent damages to the motor, take caution when you use the motor stall over-temperature protection function.
- Use the dedicated motor for the drive. Failure to comply will result in the risk of short circuit due to ageing of insulation.

Related parameters

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.32	Time threshold for locked rotor over-temperature protection	0x0A20	10 to 65535	ms	200	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the time duration of locked-rotor over-temperature (E630.0) before it is detected by the servo drive. H0A.32 can be used to adjust the sensitivity of motor stall over-temperature detection.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.33	Locked rotor over-temperature protection	0x0A21	See "Values".	-	1	UInt16	At once	Ordinary user	At once
	Values:								
	0: Disabled 1: Enable 2: Enabled for new over-temperature								
	Parameter description:								
	Defines whether to enable the detection for E630.0 (Motor stall overtemperature protection).								

Motor overspeed protection

A very large speed causes damage to the motor or machine. Motor overspeed protection is used to protect the motor in case of overspeed, preventing the motor or machine from being damaged due to overtemperature.

$$\text{Overspeed threshold} = \begin{cases} \text{Max. motor speed} \times 1.2 & \text{H0A.08} = 0 \text{ or H0A.08} > \text{Max. motor speed x 1.2} \\ \text{H0A.08} & \text{H0A.08} \neq 0 \text{ and H0A.08} < \text{Max. motor speed x 1.2} \end{cases}$$

Caution

- The servo drive also offers motor runaway protection to prevent motor stall caused by lose of control.
- In applications where the motor drives a vertical axis or is driven by load, set H0A.12 to 0 to hide runaway fault detection. Use this function with caution.

Besides runaway protection, the servo drive allows you to set the speed limit in speed control mode and torque control mode to protect the motor and machine.

Related parameters

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.08	Overspeed threshold	0x0A08	0 to 10000	rpm	0	UInt16	At once	Ordinary user	At once

Parameter description:

It sets the motor speed threshold at which the overspeed fault is detected.

Set value	Overspeed Threshold	Condition for Reporting E500.0
0	Max. motor speed x 1.2	If the speed feedback exceeds the overspeed threshold several times, the drive reports E500.0 (Motor overspeed).
1 to 10000	If H0A.08 ≥ (maximum motor speed x 1.2), the overspeed threshold equals the maximum motor speed x 1.2.	
	If H0A.08 < (maximum motor speed x 1.2), the overspeed threshold equals H0A.08.	

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0A.12	Enable runaway protection function	0x0A0C	0–1	-	1	UInt16	At once	Ordinary user	At once

Values:

0: Disabled
1: Enabled

Parameter description:

Defines whether to enable runaway protection.

0: Hide the detection on E234.0 in applications where the motor drives a vertical axis or is driven by the load.
1: Enable runaway protection

5 Modbus RTU Communication

5.1 Communication Overview

5.1.1 Modbus Protocol

The Modbus protocol is a common language applied to electronic controllers. This protocol allows communication between the drives and between the drive and other devices such as the HMI and PLC. This protocol has become a general industry standard. Based on the Modbus protocol, control devices produced by different manufacturers can be connected to form an industrial network for centralized monitoring.

5.1.2 Modbus communication specifications

Item		Specification
Modbus Basic per-for-mance of slave	Link layer protocol	RS485
	Application layer protocol	Modbus RTU
	Baud rate	2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps
	Duplex mode	Half-duplex
	Data format	8-N-1 (8 data bits, no parity check, 1 stop bit)

5.2 Communication Data Frame Structure

Parameters of the servo drive are divided into 16-bit and 32-bit parameters based on the data length. You can read and write parameters through the Modbus RTU protocol.

The command codes for reading/writing parameters vary with the data length.

Operation	Command code
Reading 16-bit/32-bit parameters	0x03
Writing 16-bit parameters	0x06
Write 32-bit parameters	0x10

Command code for reading parameter: 0x03

Based on the Modbus RTU protocol, command code 0x03 is used to read both 16-bit and 32-bit parameters.

Request frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame.
ADDR	Servo axis address: 1 to 247 **Note: 1 to 247 are decimal values and need to be converted to hexadecimal equivalents.**
CMD	Command code: 0x03.

Value	Description
DATA[0]	Register start address (high 8 bits): parameter group number of the start register. For example, for parameter H06.11, where 06 is the group number, DATA[0] is 0x06. **Note: In this example, 06 is a hexadecimal value and needs no conversion.**
DATA [1]	Register start address (low 8 bits): offset within the parameter group of the start register. For example, for parameter H06.11, where 11 is the offset within the parameter group, DATA[1] is 0x0B. **Note: In this example, 11 is a decimal value and needs to be converted to its hexadecimal equivalent 0x0B.**
DATA [2]	High 8 bits of the number of parameters to be read (hexadecimal), N(H).
DATA [3]	Low 8 bits of the number of parameters to be read (hexadecimal), N(L).
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame.

Response frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame.
ADDR	Servo axis address, hexadecimal.
CMD	Command code: 0x03.
DATALENGTH	Number of parameter bytes, equal to twice the number of parameters to be read, that is, N × 2.
DATA[0]	Data of the first register parameter (high 8 bits).
DATA [1]	Data of the first register parameter (low 8 bits).
DATA[...]	...
DATA[N × 2 – 2]	Data of the Nth register parameter (high 8 bits).
DATA[N × 2 – 1]	Data of the Nth register parameter (low 8 bits).
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame.

Based on the Modbus RTU protocol, command code 0x06 is used to write 16-bit parameters. Command code 0x10 is used to write 32-bit parameters.

Communication Cases

- To read two-word data with H02.02 as the start register from the drive whose servo axis address is 01:

  The master sends the following request frame:

01	03	02	02	00	02	CRCL	CRCH

  The slave returns the response frame:

01	03	04	00	01	00	00	CRCL	CRCH

  The response frame means that the slave returns data of 2 word length (4 bytes), and the data content is 0x0001, 0x0000.

  If the slave response frame is:

01	83	02	CRCL	CRCH

The response frame means that a communication error occurs, and the error code is 0x02. 0x83 indicates the error.

- To read parameter H05.07 (32-bit) from the drive whose servo axis address is 01:
  The master sends the following request frame:

01	03	05	07	00	02	CRCL	CRCH

The slave returns the response frame:

01	03	04	00	01	00	00	CRCL	CRCH

The response frame indicates that the value of parameter H05.07 is 0x00000001.

Command code for writing 16-bit parameters: 0x06

Caution

Do not write 32-bit parameters with 0x06. Failure to comply can result in unexpected error.

Request frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame.
ADDR	Servo axis address 1 to 247. **Note: 1 to 247 are decimal values and need to be converted to hexadecimal equivalents.**
CMD	Command code: 0x06.
DATA[0]	Register start address (high 8 bits): parameter group number of the start register. For example, to write data to parameter H06.11, where 06 is the group number, DATA[0] is 0x06. **Note: In this example, 06 is a hexadecimal value and needs no conversion.**
DATA [1]	Register start address (low 8 bits): offset within the parameter group of the start register. For example, to write data to parameter H06.11, where 11 is the offset within the parameter group, DATA[1] is 0x0B. **Note: In this example, 11 is a decimal value and needs to be converted to its hexadecimal equivalent 0x0B.**
DATA [2]	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 greater than 3.5-character idle time, indicating the end of a frame.

Response frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame.
ADDR	Servo axis address, hexadecimal.
CMD	Command code: 0x06.

Value	Description
DATA[0]	Register start address (high 8 bits): parameter group number of the start register. For example, to write data to parameter H06.11, where 06 is the group number, DATA[0] is 0x06. **Note: In this example, 06 is a hexadecimal value and needs no conversion.**
DATA [1]	Register start address (low 8 bits): offset within the parameter group of the start register. For example, to write data to parameter H06.11, where 11 is the offset within the parameter group, DATA[1] is 0x0B. **Note: In this example, 11 is a decimal value and needs to be converted to its hexadecimal equivalent 0x0B.**
DATA [2]	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 greater than 3.5-character idle time, indicating the end of a frame.

Communication Cases

To write data 0x0001 to parameter H02.02 in the drive whose servo axis address is 01:

The master sends the following request frame:

01	06	02	02	00	01	CRCL	CRCH

The slave returns the response frame:

01	06	02	02	00	01	CRCL	CRCH

The response frame indicates that data 0x0001 has been written to parameter H02.02 in the drive whose servo axis address is 01.

If the slave response frame is:

01	86	02	CRCL	CRCH

The response frame means that a communication error occurs, and the error code is 0x02. 0x86 indicates the error.

Command code for writing 32-bit parameters: 0x10



Do not write 16-bit parameters with 0x10. Failure to comply can result in unexpected error.

Request frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame.
ADDR	Servo axis address 1 to 247. **Note: 1 to 247 are decimal values and need to be converted to hexadecimal equivalents.**

Value	Description
CMD	Command code: 0x10.
DATA[0]	Register start address (high 8 bits): parameter group number of the start register. For example, to write data to parameter H11.12, where 11 is the group number, DATA[0] is 0x11. **Note: In this example, "11" is a hexadecimal value that does not need to be converted.**
DATA [1]	Register start address (low 8 bits): offset within the parameter group of the start register. For example, to write data to parameter H11.12, where **12 is the offset within the parameter group**, DATA[1] is 0x0C. **Note: In this example, 12 is a decimal value and needs to be converted to its hexadecimal equivalent 0x0C.**
DATA [2]	High 8 bits of the number of parameters to which data will be written (hexadecimal), M(H). For example, to write data to parameter H05.07 alone, DATA[2] is 00, DATA[3] is 02, and M is H0002. **One 32-bit parameter is counted as two words.**
DATA [3]	Low 8 bits of the number of parameters to which data will be written (hexadecimal), M(L).
DATA [4]	Number of bytes corresponding to data to be written to the register, that is, M × 2. For example, to write data to parameter H05.07 alone, 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 greater than 3.5-character idle time, indicating the end of a frame.

Response frame format:

Value	Description
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame.
ADDR	Servo axis address, hexadecimal.
CMD	Command code: 0x10.
DATA[0]	Register start address (high 8 bits): offset within the parameter group of the start register. For example, to write data to parameter H11.12, DATA[0] is 0x11.
DATA [1]	Register start address (low 8 bits): offset within the parameter group of the start register. For example, to write data to parameter H11.12, DATA[1] is 0x0C.
DATA [2]	High 8 bits of the number of parameters to which data will be written (hexadecimal), M(H).
DATA [3]	Low 8 bits of the number of parameters to which data will be written (hexadecimal), M(L).
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame.

Error response frame

Error frame response format:

Value	
START	Equal to or greater than 3.5-character idle time, indicating the start of a frame.
ADDR	Servo axis address, hexadecimal.
CMD	Command code: 0x80.
DATA[0] to DATA[3]	DATA error code
CRCL	CRC valid byte (low 8 bits).
CRCH	CRC valid byte (high 8 bits).
END	Equal to or greater than 3.5-character idle time, indicating the end of a frame.

Error codes:

Error code	Description
0x0001	Invalid command code
0x0002	Invalid data address
0x0003	Invalid data
0x0004	Slave device fault

32-bit parameter addressing

When Modbus commands are used to read/write 32-bit parameters, the communication address is determined by the address of the parameter with the smaller offset number. Two parameters are operated per operation. See the following examples.

Note

In the following examples, the servo axis address is 01 by default.

- The Modbus command for reading parameter H11.12 (1st displacement) is as follows.

01	03	11	0C	00	02	CRCL	CRCH

If the "1st displacement" is 0x40000000 (decimal equivalent: 1073741824), then the following response frames apply:

- When H0C.26 is set to 1 (Low 16 bits before high 16 bits), the response frame is as follows.

01	03	04	00	00	40	00	CRCL	CRCH

- H0C.26 = 0 (High 16 bits before low 16 bits), then the response frame is:

01	03	04	40	00	00	00	CRCL	CRCH

- The Modbus command for writing 0x12345678 to parameter H11.12 (1st displacement) 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

CRC check

The host controller and servo drive must use the same CRC algorithm. Otherwise, a CRC error will occur. The SV660P series servo drive adopts 16-bit CRC with low bytes before high bytes. The polynomial used for 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);
}
```

5.3 Communication Parameters

Parameter	Default Value	Description	Remarks
H0C.00	1	Servo axis address	-
H0C.02	5	Serial port baud rate	5: 57600 bps

Parameter	Default Value	Description	Remarks
H0C.03	0	Modbus communication data format	0: No check, 2 stop bits
H0C.26	1	Modbus communication data sequence	0: High bits before low bits 1: Low bits before high bits

5.4 Communication Configuration Examples

5.4.1 Servo Modbus RTU Communication Configuration

5.4.1.1 Communication Overview

The following describes the Modbus RTU communication connection between Inovance H2U and SV660P series servo drive. The connection can be implemented through the configuration table or programming. The following case takes H06.03 (Write speed) and H0b.00 (Read speed) as examples.

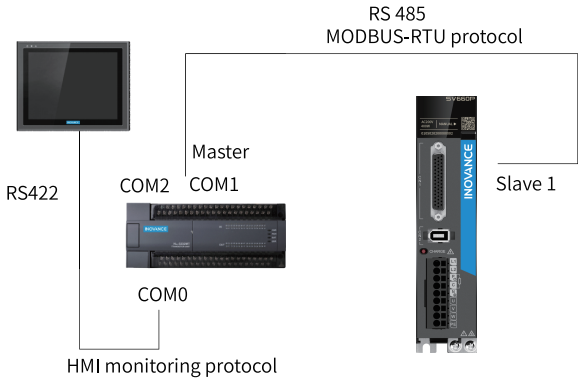


Figure 5-1 Schematic and wiring diagram

5.4.1.2 Wiring for Modbus RTU Communication Between Servo Drive and Different PLCs

Inovance H2U and SV660P

Product Name	Model	Quantity	Remarks
PLC	H2U-1616MT/MR	1	-
Inovance SV660P series servo drive and applicable motor	SV660PT012I MS1H3-*******	1 set	-

COM1 Terminal Layout on PLC Side		CN3/CN4 Terminal Layout on Drive Side	
Signal	Pin No.	Signal	Pin No.
RS485+	1	RS485+	4
RS485-	2	RS485-	5
-	-	PE (shield)	Enclosure

Siemens PLC and SV660P

Siemens S7200 PLC		CN3/CN4 Terminal Layout on Drive Side	
PLC PORT0-RS485	Pin No.	Signal	Pin No.
Data+	3	RS485+	4
Data–	8	RS485-	5
PE (shield)	Enclosure	PE (shield)	Enclosure

Mitsubishi FX3U and SV660P

Mitsubishi FX3U PLC		CN3/CN4 Terminal Layout on Drive Side	
FX3U-485-BD	Pin No.	Signal	Pin No.
SDA	Short	RS485+	4
RDA			
SDB	Short	RS485-	5
RDB			
SG	Enclosure	PE (shield)	Enclosure

Setting communication parameters through GX PLC software (initialization of communication port 1):

1. Communication port 1 parameter setting (RS485, 19200, 7, N, 1)
2. LD M8002
3. Initial ON
4. MOV H0C91 D8120
5. Communication port 1 setting
6. SET M8161
7. Communication format: 8-bit

Using two major references (See the user guide for FX3U communication.)

- RS D100 K8 D120 K8
  - D100: station No. being "?"
  - D120: starting address for data receiving (8 bytes)
- CRC D100 D106 K6
  - D100: station No. being "?"
  - D106: CRC checked address

Omron PLC and SV660P

Omron CP1L		CN3/CN4 Terminal Layout on Drive Side	
PLC PORT0-RS485	Pin No.	Signal	Pin No.
SDB+	-	RS485+	4
SDA–	-	RS485-	5
PE (shield)	Enclosure	PE (shield)	Enclosure

Note

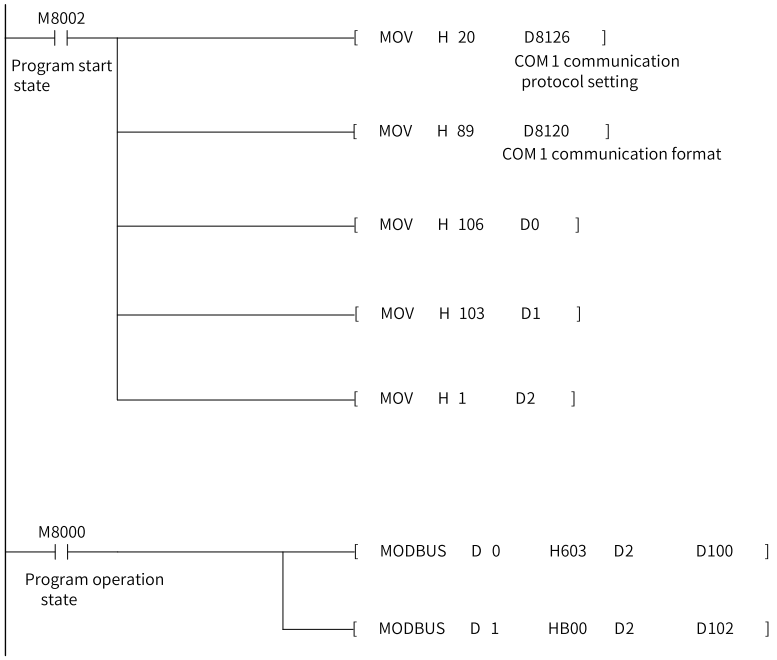
Set 2, 3, 5, and 6 on the DIP switch to ON, and others to OFF. The DIP switch is on the back of PLC communication card.

5.4.1.3 Servo parameter setting

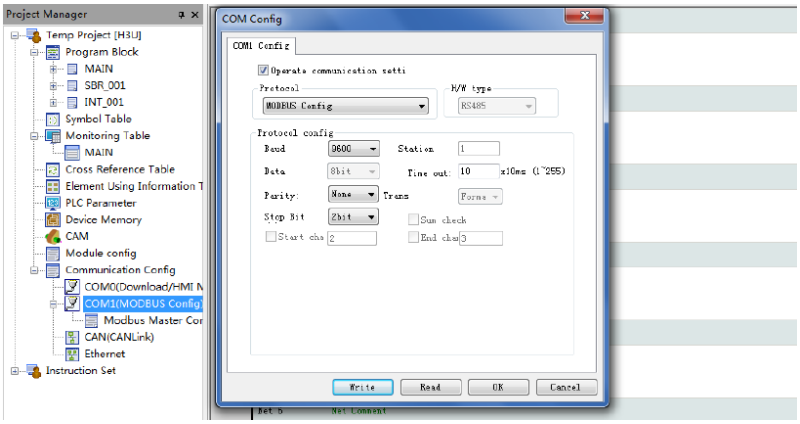
Parameter	Set Value	Description	Remarks
H0C.00	1	Servo axis address	-
H0C.02	5	Serial port baud rate	5: 57600 bps
H0C.26	0	Modbus communication data sequence	0: High 16 bits before low 16 bits 1: Low 16 bits before high 16 bits

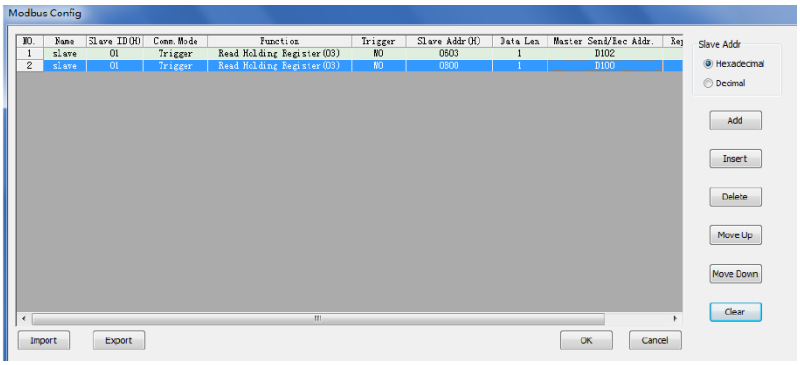
5.4.1.4 PLC Program Examples

Communication connection implemented through programming



Communication connection implemented through configuration table

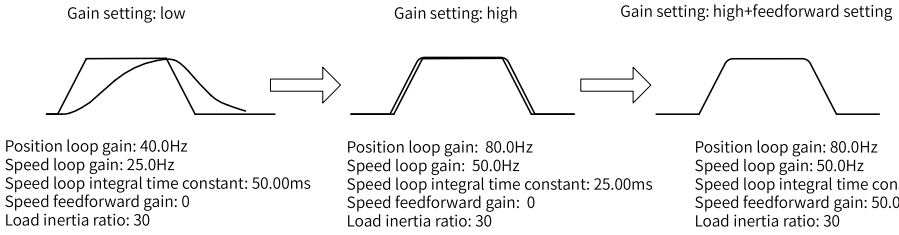



Modbus Config
NO.
Name
Slave ID(H)
Comm.Mode
Function
Trigger
Slave Addr(H)
Data Len
Master Send/Rec Addr.
1
slave
01
Trigger
Read Holding Register(03)
NO
0603
1
D102
2
slave
01
Trigger
Read Holding Register(03)
NO
0800
1
D100
Slave Addr
Hexadecimal
Decimal
Add
Insert
Delete
Move Up
Move Down
Clear
Import
Export
OK
Cancel

6 Tuning

6.1 Overview

The servo drive must drive the motor as quick and accurate as possible to follow the commands from the host controller or internal setting. To meet such requirements, gain tuning is required.



Gains are defined by a combination of multiple parameters that affect each other, including the position loop gain, speed loop gain, filter, and load moment of inertia ratio. The values of these parameters must be balanced against each other during gain tuning.

Note

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

The following figure shows the general flowchart for gain tuning.

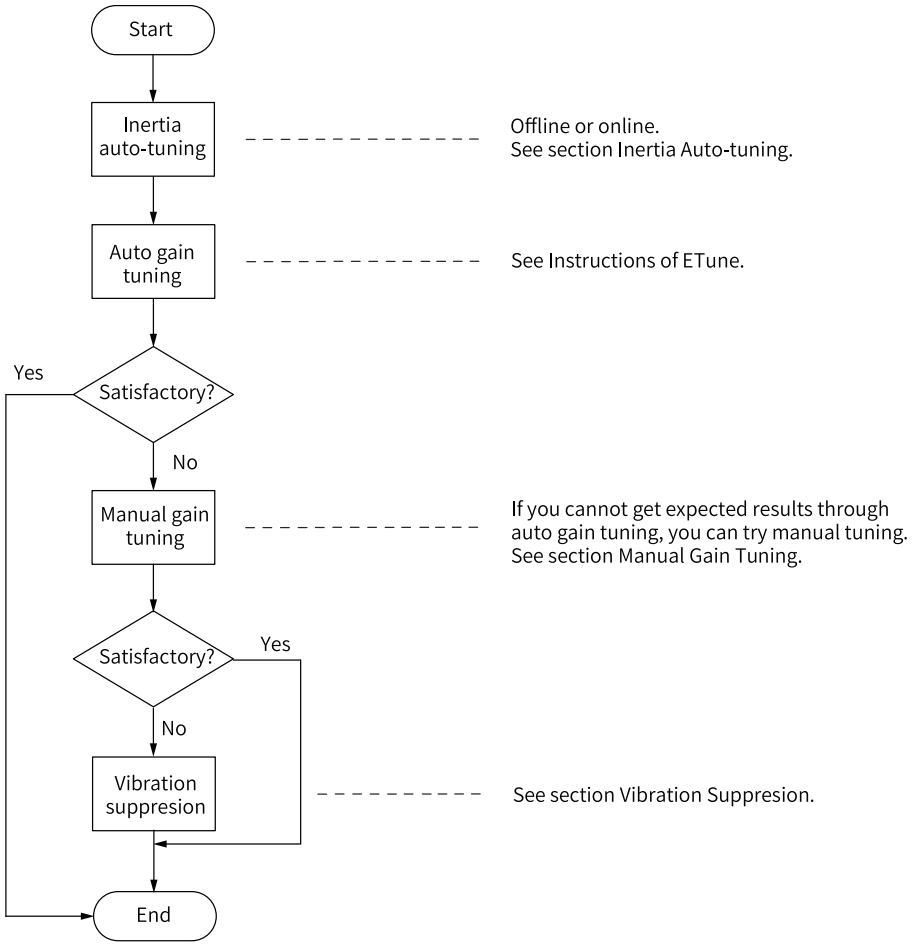


Figure 6-1 Gain tuning process

Table 6–1 Gain tuning process

Gain tuning process			Description	References
1	Inertia auto-tuning	Offline	The servo drive calculates the load inertia ratio automatically through inertia auto-tuning.	*"6.2.1 Offline Inertia Auto-Tuning" on page 166*
		Online	The host controller sends a command to make the motor rotate, and the drive calculates the inertia ratio in real time.	*"6.2.2 Online inertia auto-tuning" on page 170*
2	Automatic gain tuning		The drive automatically gives the gain parameters matching the inertia ratio (it must be set correctly).	*" ETune" on page 172*and *" STune" on page 177*

Gain tuning process			Description	References
3	Manual gain tuning	Basic gains	If the auto-tuned gain values fail to deliver desired performance, fine-tune the gains manually to improve the performance.	*"6.4.1 Basic Parameters" on page 194*
		Gain switchover	Switch to higher or lower gains depending on the actual condition for optimal auto-tuning performance.	*"6.4.2 Gain switchover" on page 199*
		Reference filter	It filters the position, speed, and torque references.	*"6.4.3 Comparison of filters" on page 207*
		Feedforward gain	The feedforward function is enabled to improve the following performance.	*" Feedforward gain tuning" on page 207*
		Pseudo differential regulator	Adjust the speed loop control mode and improve the low-frequency anti-interference capability.	*"6.4.5 Pseudo Differential Feedforward Control" on page 211*
		Torque disturbance observer	Enable this function to improve the anti-torque disturbance capability.	*" Torque disturbance observer" on page 212*
		Model tracking	Model tracking control can improve response and shorten the positioning time.	*"6.4.7 Model Tracking" on page 214*
		Speed observer	Increases the gains while shortening the positioning time, and avoids high-frequency vibration.	*"6.4.8 Speed Observer" on page 218*
		Friction compensation	Reduces the impact of friction in mechanical transmission on the operational performance.	*"6.4.9 Friction Compensa-tion" on page 221*
4	Vibration suppression	Mechanical resonance	Enable the notch function to suppress mechanical resonance.	*"6.6.2 Mechanical Resonance Suppression" on page 229*
		Low-frequency resonance	Enable the filter for suppressing low-frequency resonance.	*"6.6.3 Low-Frequency Resonance Suppression at the Mechanical End" on page 237*

6.2 Inertia Identification

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

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

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

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

The following two inertia auto-tuning modes are available:

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

Note

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

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

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

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

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.00	Speed loop gain	0x0800	0.1 to 2000.0	Hz	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the speed loop. This parameter determines the response of the speed loop. The higher the setpoint, the higher the response. Note that an excessively high setpoint may cause vibration. In the position control mode, the position loop gain must be increased together with the speed loop gain.								
	Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

6.2.1 Offline Inertia Auto-Tuning

Note

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

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

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

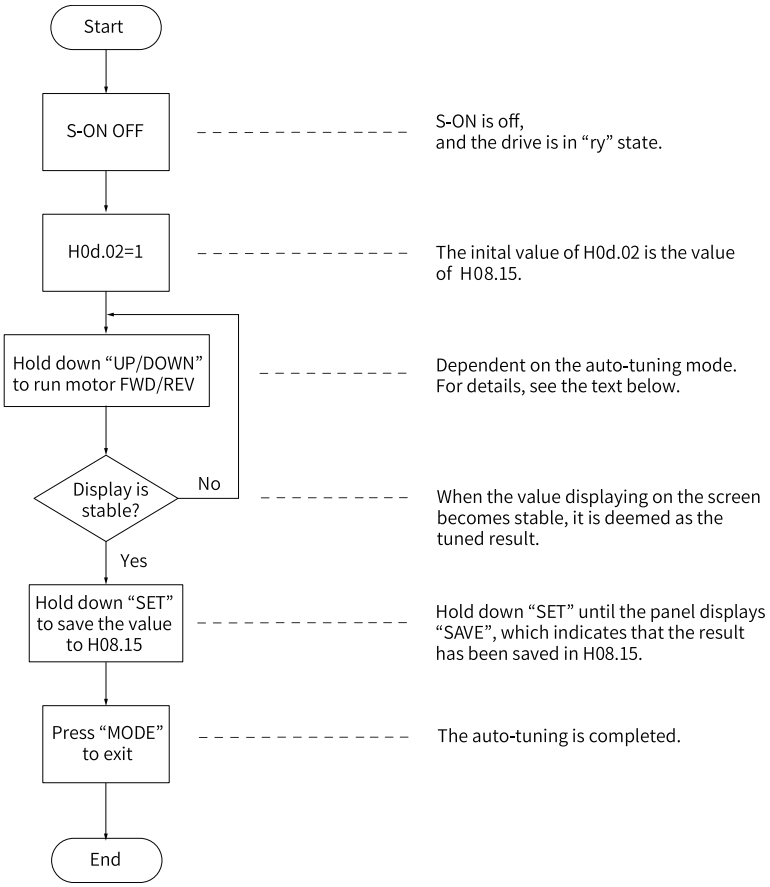


Figure 6-2 Offline inertia auto-tuning flowchart

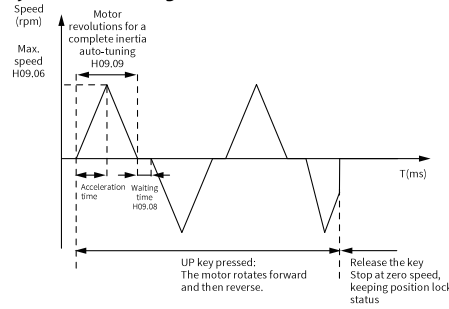
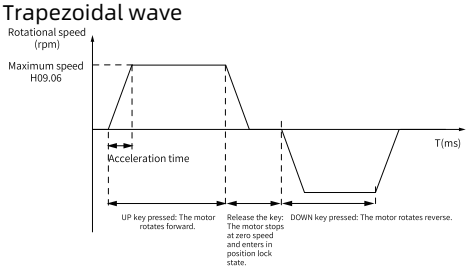
Flowchart description:

1. In the parameter configuration interface, set the auto-tuning mode (H09.05).
   - Mode 0: Positive/Negative triangular wave mode (initial inertia ratio H08.15 shall be set)
   - Mode 1: JOG mode (initial inertia ratio H08.15 shall be set)
   - Mode 2: Bidirectional auto-tuning mode (initial inertia ratio not required)
   - Mode 3: Unidirectional auto-tuning mode (initial inertia ratio not required)
2. If Mode 2/3 is set, skip this step; if Mode 0/1 is set, the inertia ratio H08.15 shall still be set, as the default value of H08.15 is 1.00. If the actual load inertia ratio > 30.00, motor response may become sluggish or auto-tuning may fail.
   The recommended preset value is 5.00.
   Increase H08.15 gradually until the value displayed on the operation panel changes with it.
3. Enter parameter display mode, switch to the H0d.02 parameter setting interface, set H0d.02 to 1, then press the "SET" key to enable offline inertia auto-tuning.
4. Return to the operation page, and press the UP/DOWN keys to start offline auto-tuning. The UP/DOWN keys determine the motor running direction (forward/reverse). For applications allowing unidirectional operations only, set H09.05 to 3.
5. During auto-tuning, releasing the button will stop the device. Pressing UP/DOWN key again will restart the auto-tuning.

6. If the motor cannot reach the maximum speed for inertia auto-tuning (H09.06), increase the stiffness level (H09.01) of the drive properly to achieve the maximum speed, delivering more accurate auto-tuned values.
7. Hold down the "SET" key until the panel displays "SAVE", indicating that the auto-tuned values have been saved to H08.15.

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

Table 6–2 Descriptions of two offline inertia auto-tuning modes

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.05	Offline inertia auto-tuning mode	0x0905	0 to 3	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: Positive/Negative triangular wave mode 1: JOG mode 2: Bidirectional auto-tuning mode 3: Unidirectional auto-tuning mode								
	Parameter description:								
	Defines the offline inertia auto-tuning mode. The offline inertia auto-tuning function can be enabled through H0d.02. For details on offline inertia auto-tuning, see section "Inertia Auto-tuning".								

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.07	Time constant of accelerating to max. speed for inertia auto-tuning	0x0907	20 to 800	ms	125	UInt16	At stop	Ordinary user	At once
	Parameter description:								
	Defines the time for the motor to accelerate from 0 rpm to the maximum speed of inertia auto-tuning (H09.06) during offline inertia auto-tuning.								

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.09	Motor revolutions for an inertia auto-tuning	0x0909	0.00 to 655.35	-	1.00	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the motor revolutions per inertia auto-tuning when H09.05 (Offline inertia auto-tuning mode) is set to 0 (Positive/ Negative triangular wave mode). Note: When using the offline inertia auto-tuning function, check that the travel distance of the motor at the stop position is larger than the value of H09.09. If not, decrease the value of H09.06 (Maximum speed for inertia auto-tuning) or H09.07 (Time constant of accelerating to max. speed during inertia auto-tuning) properly until the motor travel distance fulfills the requirement.								

6.2.2 Online inertia auto-tuning

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

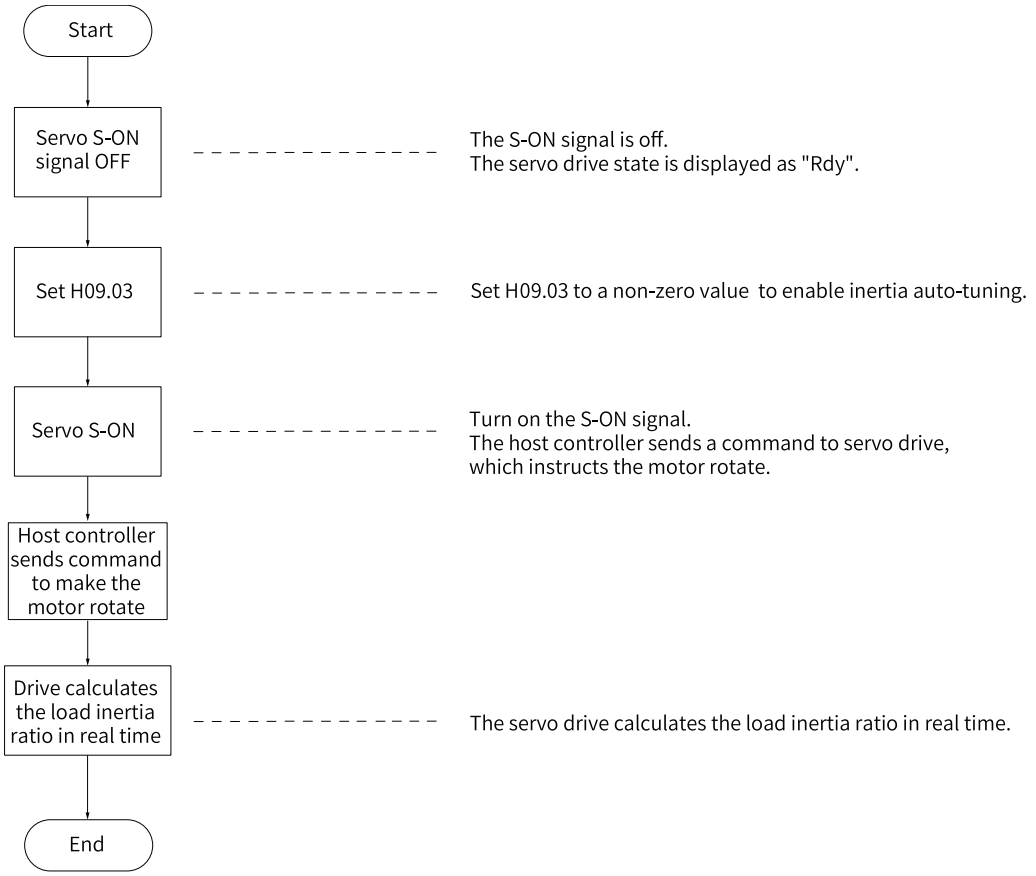


Figure 6-3 Online inertia auto-tuning flowchart

Note

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

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

.

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.03	Online inertia auto-tuning mode	0x0903	0 to 3	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Disabled 1: Enabled, inertia ratio changing slowly 2: Enabled, inertia ratio changing normally 3: Enabled, inertia ratio changing quickly								
	Parameter description:								
	Defines whether to enable online inertia auto-tuning and the inertia ratio update speed during online inertia auto-tuning. In applications where the inertia does not change, set H09.03 (Online inertia auto-tuning mode) to 1 (Enabled, changing slowly). In applications where the inertia changes quickly, set H09.03 to 3 (Enabled, changing quickly).								

6.3 Automatic Gain Tuning

6.3.1 ETune

6.3.1.1 Overview

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

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

6.3.1.2 Procedure

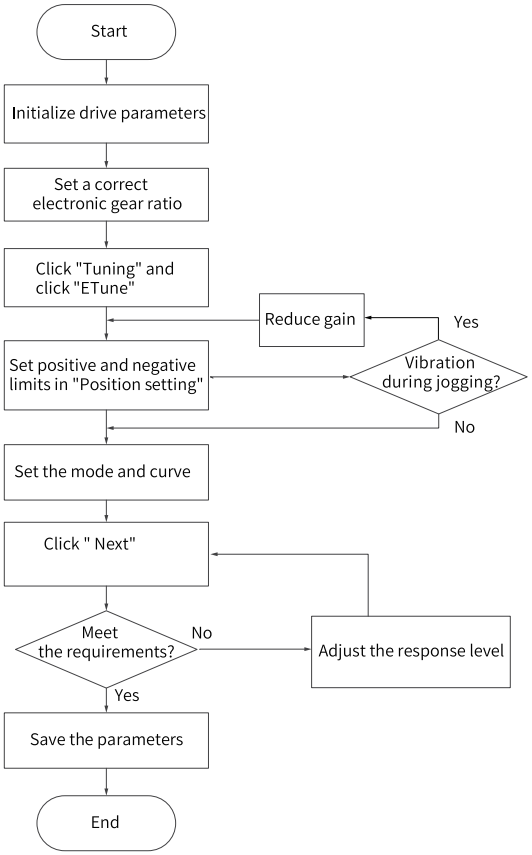
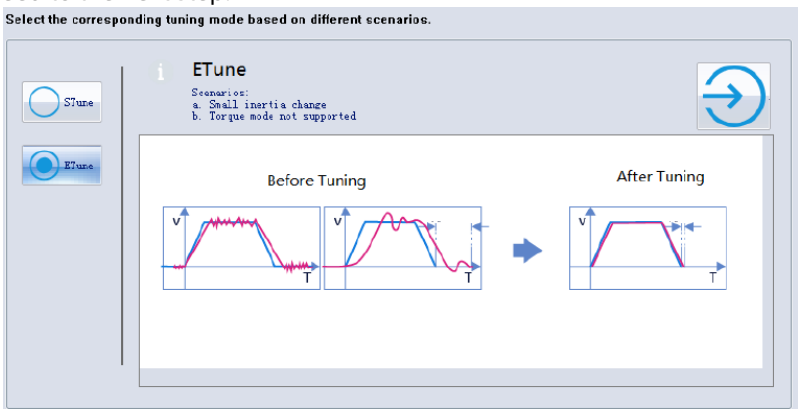


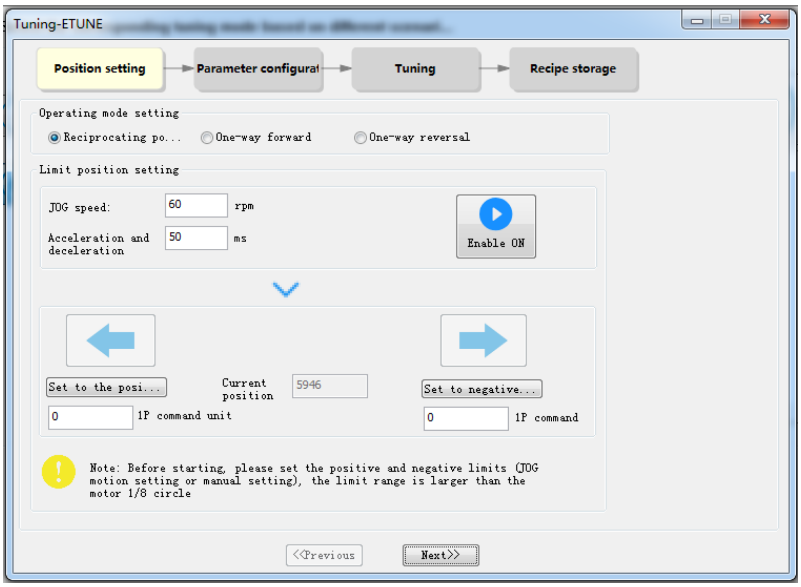
Figure 6-4 Procedure flowchart

Process description

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



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



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

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

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

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

Note

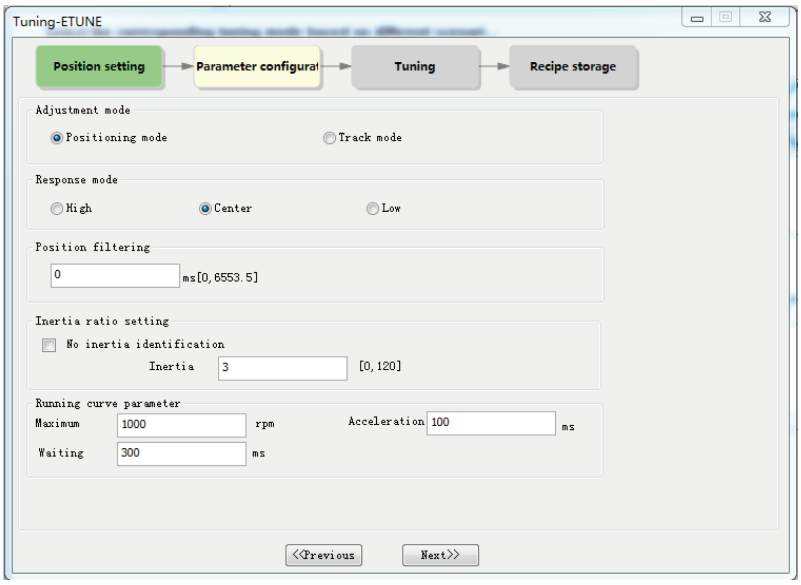
The difference between the positive and negative position limits must be larger than 1/8 of one revolution. The larger the value of the limit position, the better the adaptability of the auto-tuned parameters, but the longer will ETune adjustment take.

---

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

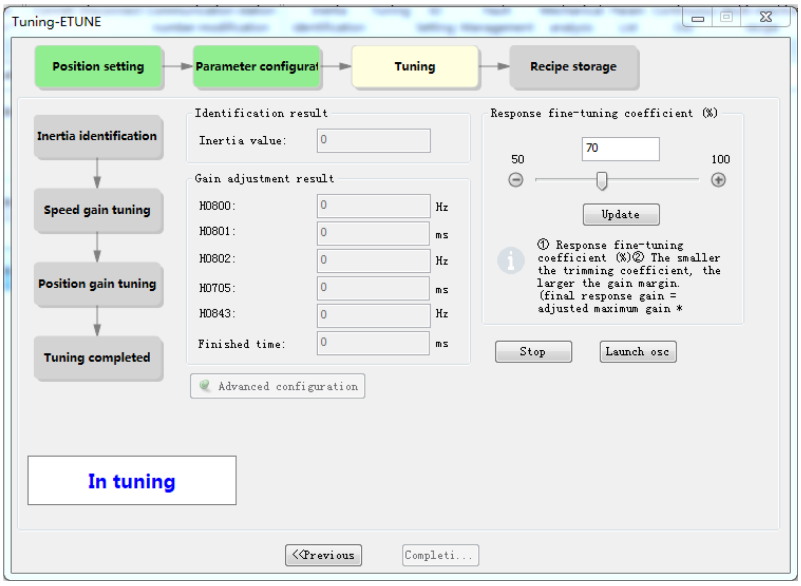
- The adjustment mode is divided into "Positioning mode" and "Track mode".
- Response mode and position filter time constant: Make corresponding adjustment according to the response performance needed and actual position reference noise.

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

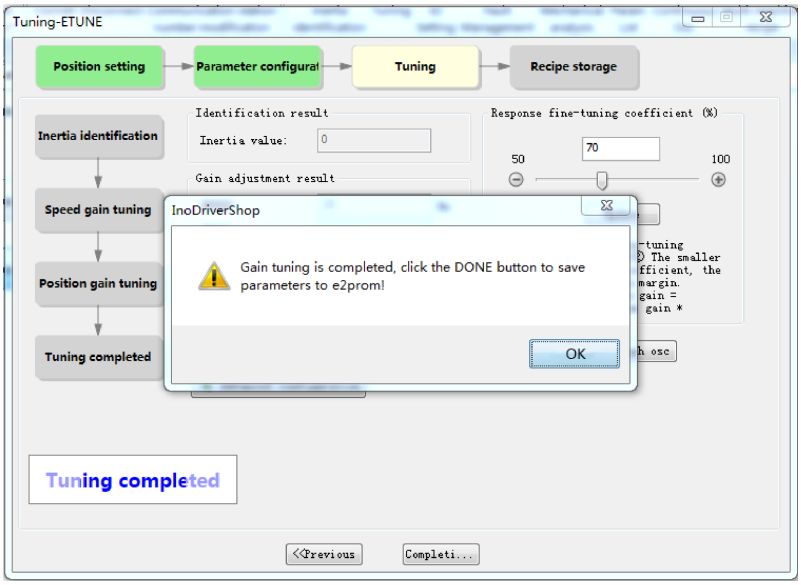


4. Click " **Next** " to enter the "Tuning" step.

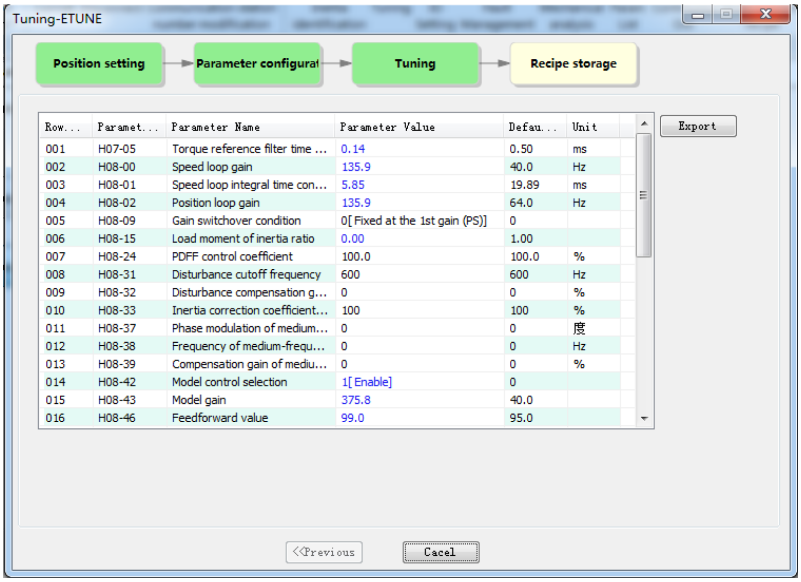
- If you choose to perform inertia auto-tuning, the drive starts inertia auto-tuning based on the set motion profile. After inertia auto-tuning is done, the drive starts gain auto-tuning.
- If you choose not to perform inertia auto-tuning in the previous step, the drive starts gain tuning directly after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



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



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



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

6.3.1.3 Precautions

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

6.3.1.4 Troubleshooting

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

6.3.2 STune

6.3.2.1 Overview

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

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

Table 6–3 Six STune modes

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

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

6.3.2.2 Procedure

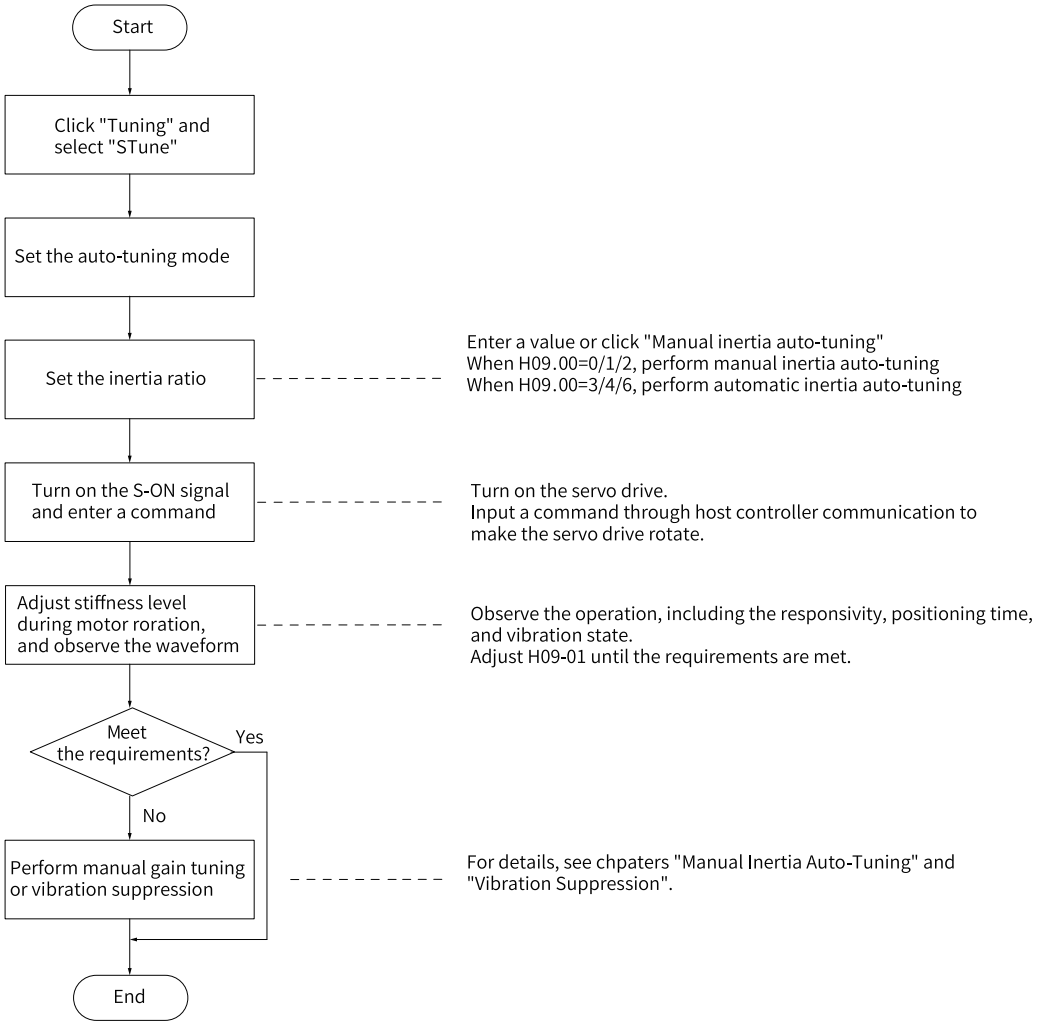


Figure 6-5 Procedure flowchart

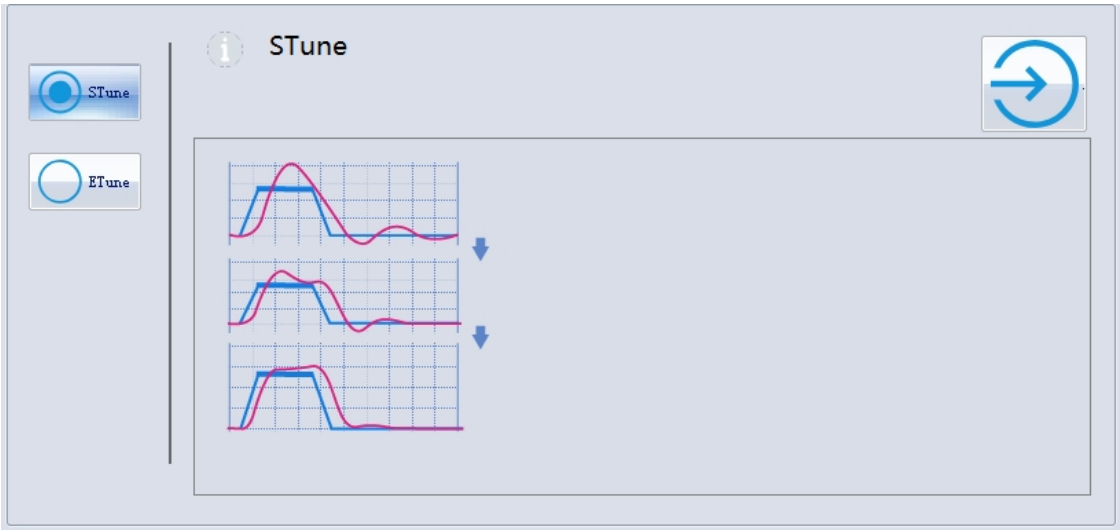
Flowchart description

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

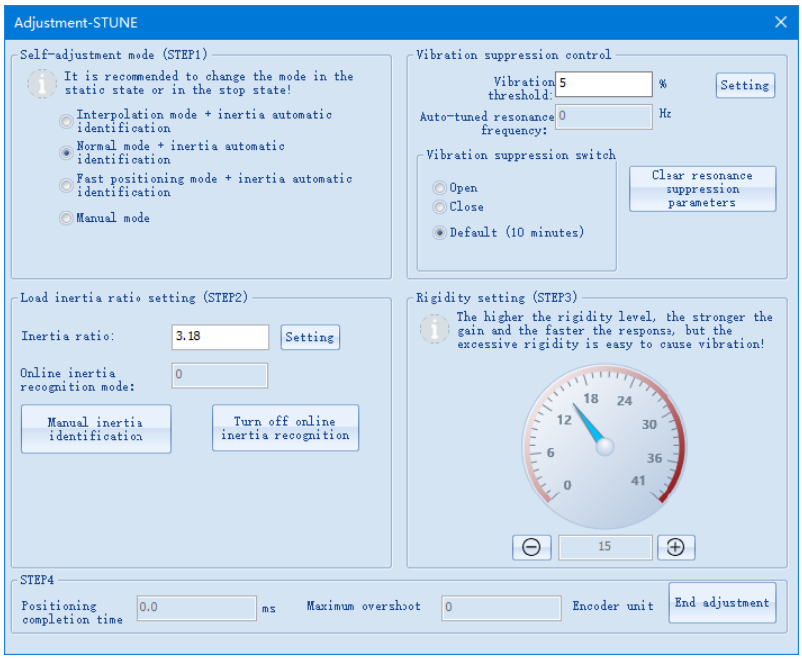
Note

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

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



2. Select an auto-tuning mode. For modes 3/4/6, no inertia ratio setting is required as inertia auto-tuning will be performed automatically. For manual mode (mode 0), the inertia ratio must be set. You can directly input the inertia ratio and set it in the "Load inertia ratio setting" panel below, or click "Manual inertia auto-tuning". If mechanical vibration exists, reduce the stiffness level before performing manual inertia auto-tuning.



Note

For STune modes 3, 4, and 6, online inertia auto-tuning (H09.03) must be used for load inertia auto-tuning, and the following conditions must be met:

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

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

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

    - In STune modes 3 and 4, determine the minimum value of H08.02 (Position loop gain), and then set H09.00 of each axis to 0 and set H08.02 of each axis to the same value.

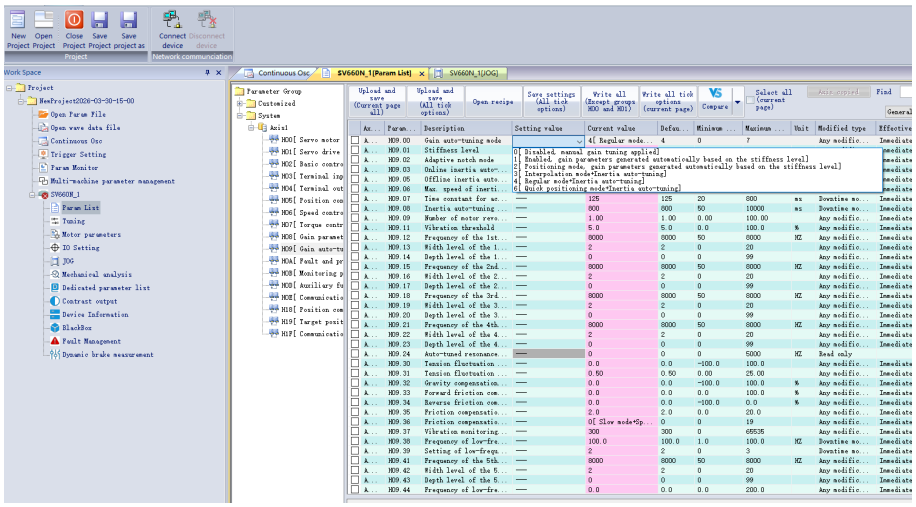
- In STune mode 6, determine the minimum value of H08.43 (Model gain), and then set H09.00 of each axis to 0, and set H08.43 of each axis to the same value.

Note

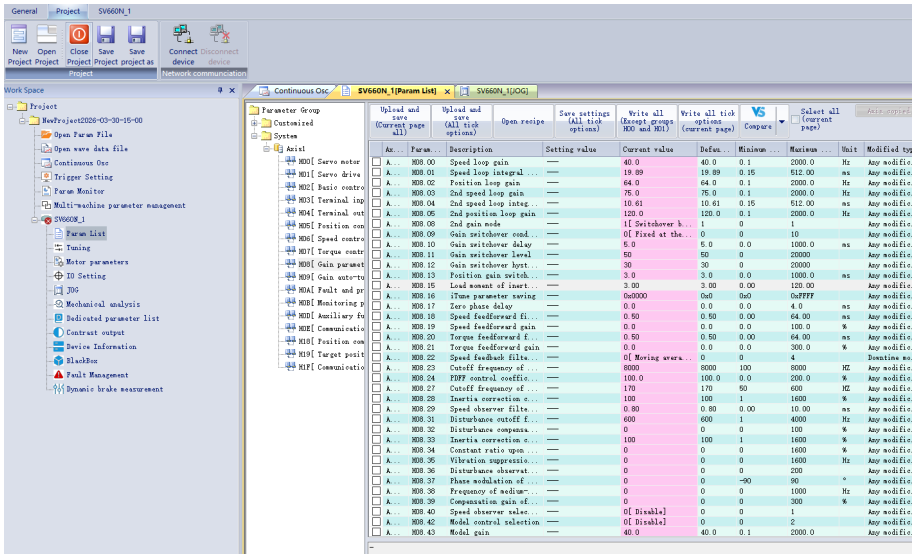
To ensure a stable operation in STune modes 3/4/6 with default parameter settings, gain parameters will be adjusted along with the inertia ratio when the inertia ratio is higher than 13:1. In multi-axis trajectories, responses may be inconsistent under the same stiffness level.

Setting methods for modes 1/2:

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



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



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

6.3.2.3 Note

Recommended load inertia ratio

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

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

- In applications requiring medium-level accuracy and dynamic response, the inertia ratio cannot exceed 30:1.
- For inertia ratio higher than 30:1, trajectory control is not available. Inertia ratios that higher than 30:1 only apply to point-to-point control with low accuracy requirements and some rotary mechanism, with long acceleration/deceleration time needed.

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

Recommended stiffness level

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

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

Table 6–4 Recommended stiffness level table

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.01	Stiffness level selection	0x0901	0 to 41	-	15	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the servo system stiffness. Level 0 indicates the lowest stiffness, and level 41 indicates the highest stiffness. The higher the stiffness level, the higher the gains and the quicker the response can be. But an excessively high stiffness level can result in vibration.								

Mode description

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

H07.37	Torque reference filter selection
H08.08	2nd gain mode setting
H08.18	Speed feedforward filter time constant
H08.19	Speed feedforward gain
H08.20	Torque feedforward filter time constant
H08.21	Torque feedforward gain

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

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

Parameters related to mode 1 (standard stiffness level mode)

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.00	Speed loop gain	0x0800	0.1 to 2000.0	Hz	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the speed loop. This parameter determines the response of the speed loop. The higher the setpoint, the higher the response. Note that an excessively high setpoint may cause vibration. If the position loop gain is increased in position control mode, the speed loop gain also needs to be increased.								
	Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.01	Time constant of speed loop integration	0x0801	0.15 to 512.00	ms	19.89	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the integral time constant of the speed loop. The lower the setpoint, the better the integral action, and the quicker will the deviation value be close to 0. There is no integral action when this parameter is set to 512.00. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H07.05	Torque reference filter time constant 1	0x0705	0.00 to 30.00	ms	0.50	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the torque reference filter time constant 1. Low-pass filter of torque reference helps to make torque reference more smooth and reduce vibration. Note that an excessively high setpoint can reduce responsiveness. Note: This parameter can only be manually set when H09.00 is set to 0. In other modes, this value is auto-tuned.								

Parameters related to mode 2 (positioning mode)

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

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

Note

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.03	Second speed loop gain	0x0803	0.1 to 2000.0	Hz	75.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the 2nd speed loop gain. This parameter determines response of the speed loop. The larger the setting is, the quicker response will be. Note that a very large setting may cause vibration. If the position loop gain is increased in position control mode, the speed loop gain also needs to be increased. Note: Parameters for the 2nd gain set include H08.03, H08.04, H08.05, and H07.06 (Torque reference filter time constant). For details on gain switchover, see section "Gain Switchover".								

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

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

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.19	Speed feedforward gain	0x0813	0.0 to 100.0	%	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	In the position control mode, speed feedforward is the value of H08.19 multiplied by the speed feedforward signal, which is part of the speed reference. Increasing this parameter improves position reference response and reduces position deviation at fixed speed. Set H08.18 to a fixed value first, and then increase the value of H08.19 gradually from 0 to a certain value at which speed feedforward achieves the desired effect. Adjust H08.18 and H08.19 repeatedly until a balanced performance is achieved.								
	Note: For how to enable the speed feedforward function and select the speed feedforward signal, see H05.19 (Speed feedforward control selection).								

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

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

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

Values:

0: Fixed to the 1st gain set (PS)
1: Switched through external DIs
2: Torque reference too large (PS)
3: Speed reference too large (PS)4: Speed reference change rate too large (PS)
5: Speed reference low/high speed threshold (PS)
6: Position deviation too large (P)
7: Position reference available (P)
8: Positioning unfinished (P)
9: Actual speed (P)
10: Position reference+Actual speed (P)

Parameter description:

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

Table 6–5 Conditions for gain switchover

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

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

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

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

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

Parameters related to modes 3/4/6

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

Note

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.38	Frequency for medium frequency suppression 2	0x0826	0 to 1000	Hz	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Set this parameter based on actual resonance frequency. The valid suppression frequency range for medium-frequency jitter suppression 2 is 100 Hz to 1000 Hz.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.39	Compensation gain for medium frequency suppression 2	0x0827	0 to 1500	%	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the compensation gain for medium-frequency jitter suppression 2. When the compensation gain is excessively low, the resonance suppression effect is poor. When the compensation gain is excessively high, new resonance may be incurred. Set this parameter to be within the range of 40% to 55% in general cases. Setting this parameter to 0 negates the effect of medium-frequency jitter suppression 2.								

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

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

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

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.23	Depth level of the 4th notch	0x0917	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the depth level of the 1st notch. When H09.00 = 3/4/6, the fourth notch will be automatically set. The notch depth level indicates the ratio of input to output at center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively low setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.58	STune resonance suppression reset selection	0x093A	0–1	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Disable 1: Enable								
	Parameter description:								
	Used to enable STune resonance suppression reset, which is to clear the resonance suppression parameters automatically set in the STune mode.								

6.3.2.4 Troubleshooting

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

6.4 Manual Gain Tuning

6.4.1 Basic Parameters

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

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

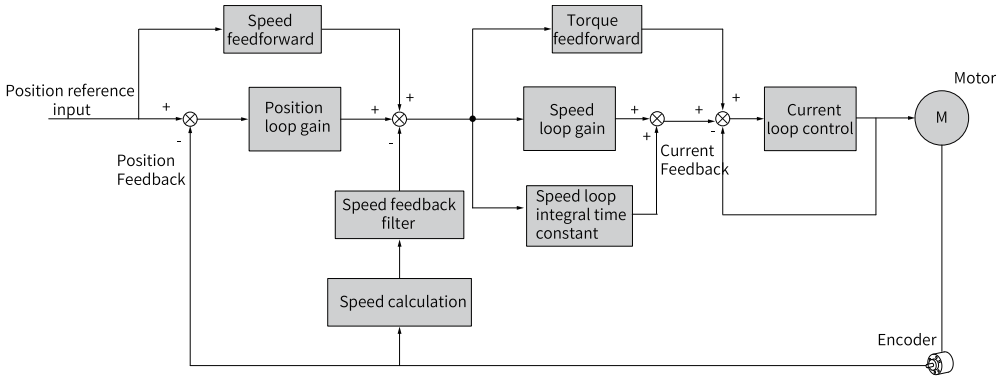


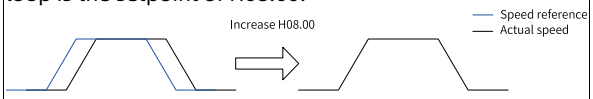
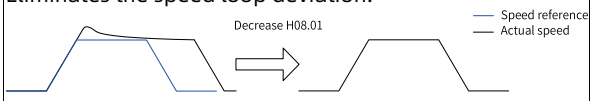
Figure 6-6 Basic control for manual gain tuning

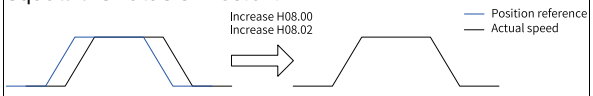
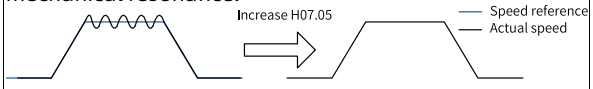
Note

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

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

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

Step	Parameter	Name	Description
1	H08.00	Speed loop gain	**Parameter function:** • Determines the maximum frequency of a variable speed reference that can be followed by the speed loop. • When H08.15 (Load inertia ratio) is correctly set, the maximum frequency that can be followed by the speed loop is the setpoint of H08.00.  **Tuning method:** • Increasing the setpoint without incurring extra noise or vibration shortens the positioning time, stabilizes the speed, and improves the follow-up behavior. • If noise occurs, decrease the setpoint. • If mechanical vibration occurs, enable the resonance suppression function according to *"6.6.2 Mechanical Resonance Suppression" on page 229*.
2	H08.01	Speed loop integral time constant	**Parameter function:** Eliminates the speed loop deviation.  **Tuning method:** • Set H08.01 according to the following formula: 500 ≤ H08.00 × H08.01 ≤ 1000.• For example, if H08.00 is set to 40.0 Hz, the setpoint of H08.01 must meet the following requirement: 12.50 ms ≤ H08.01 ≤ 25.00 ms. • Decreasing the setpoint strengthens the integral action and shortens the positioning time, but an excessively low setpoint may easily lead to mechanical vibration. • An excessively high setpoint prevents the speed loop deviation from being cleared. • When H08.01 is set to 512.00 ms, the integral is inactive.

Step	Parameter	Name	Description
3	H08.02	Position loop gain	**Parameter function:** • Defines the maximum frequency of position references that can be followed by the position loop. • The maximum following frequency of the position loop equals the value of H08.02.  **Tuning method:** • To ensure system stability, the maximum following frequency of the speed loop is 3 to 5 times of the maximum following frequency of the position loop. $3 \leqslant \frac{2\times\pi\times H08.00}{H08.02} \leqslant 5$ • For example, when H08.00 is set to 40.0 Hz, H08.02 must meet the following requirement: 50.2 Hz ≤ H08.02 ≤ 83.7 Hz. • Adjust the setting based on the positioning time. Increasing the setpoint shortens the positioning time and improves the anti-interference capacity of a motor at standstill. • An excessively high setpoint may easily lead to system instability and oscillation.
4	H07.05	Torque reference filter time constant	**Parameter function:** Eliminates the high-frequency noise and suppresses mechanical resonance.  **Tuning method:** • Ensure that the cutoff frequency of the torque reference low-pass filter is higher than 4 times of the maximum follow frequency of the speed loop. $\frac{1000}{2\times\pi\times H07.05} \geqslant (H08.00)\times 4$ • For example, when H08.00 is set to 40.0 Hz, the setpoint of H07.05 must be lower than or equal to 1.00 ms. • If increasing the setpoint of H08.00 incurs vibration, adjust the setpoint of H07.05 to suppress vibration. For details, see *"6.6.2 Mechanical Resonance Suppression" on page 229*. An excessively high setpoint weakens the response of the current loop. • To suppress vibration at stop, increase H08.00 and decrease H07.05. • If strong vibration occurs upon stop, decrease the setpoint of H07.05.

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.00	Speed loop gain	0x0800	0.1 to 2000.0	Hz	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the speed loop. This parameter determines the response of the speed loop. The higher the setpoint, the higher the response. Note that an excessively high setpoint may cause vibration. In the position control mode, the position loop gain must be increased together with the speed loop gain.								
	Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

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

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

6.4.2 Gain switchover

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

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

H08.08 set to 0

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

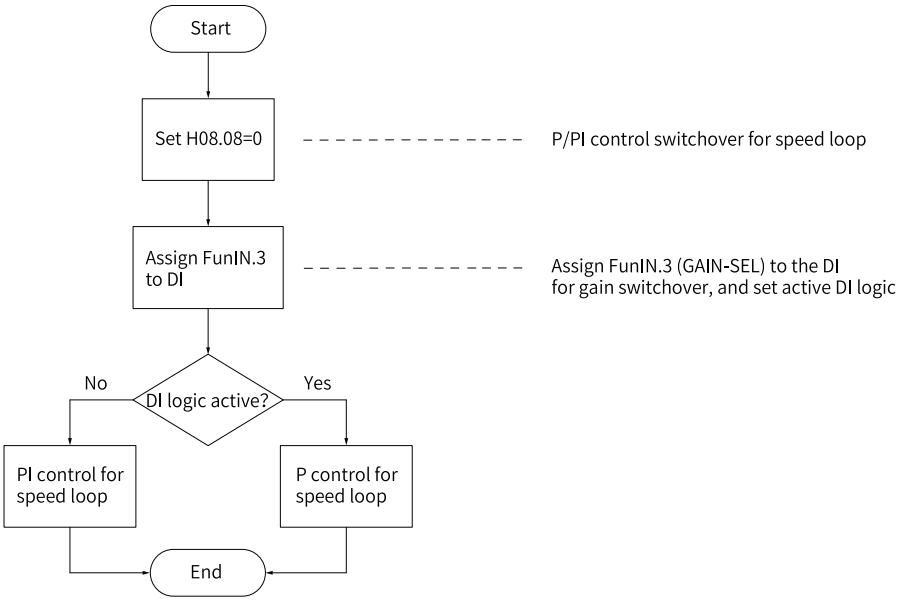


Figure 6-7 Gain switchover flowchart (H08.08 set to 0)

H08.08=1

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

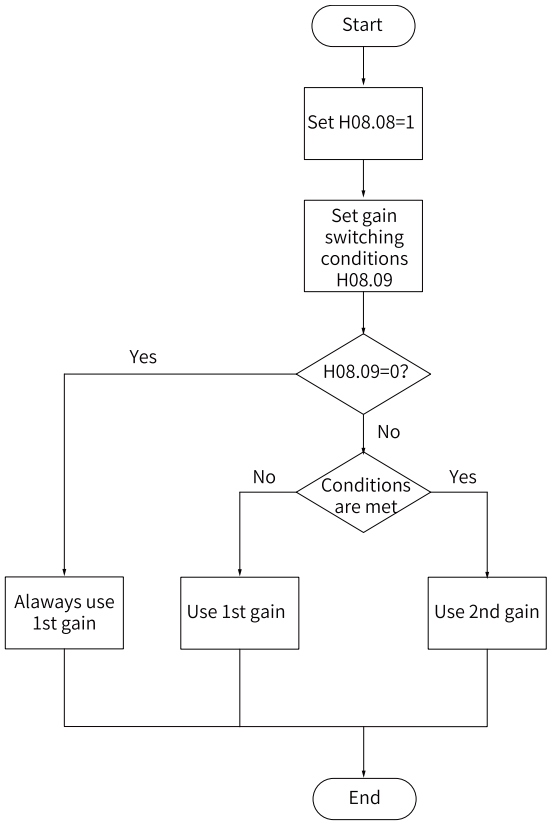
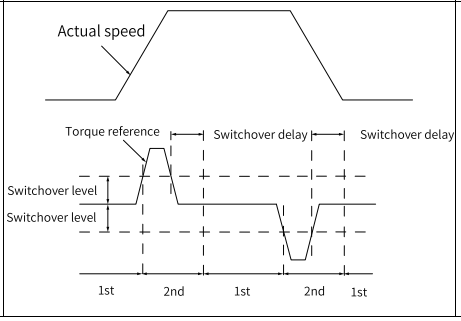
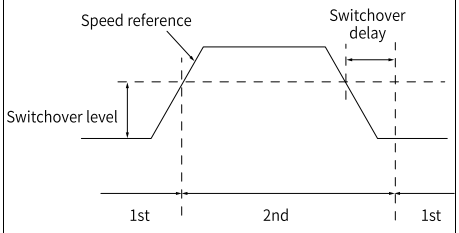
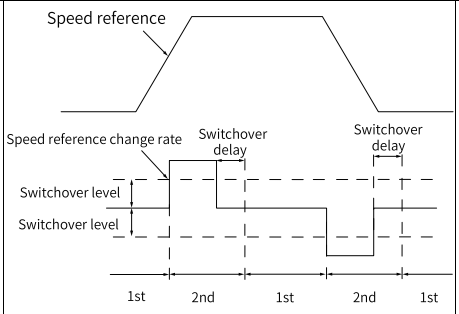
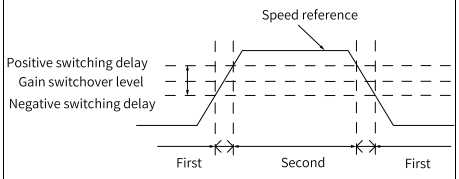
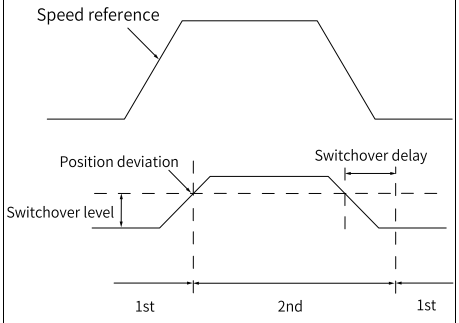
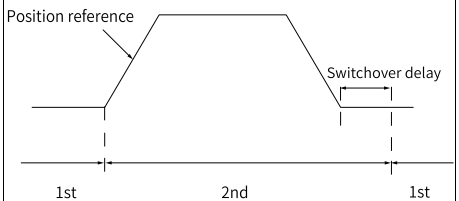
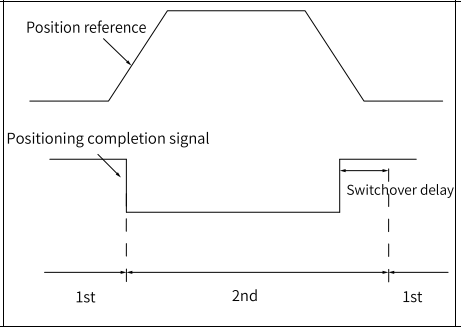


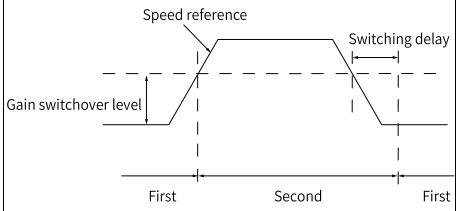
Figure 6-8 Gain switchover flowchart when H08.08 is set to 1

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

Table 6–6 Gain switchover modes

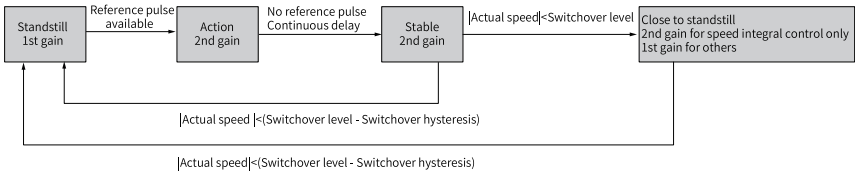
Gain switchover condition			Related parameter		
H08.09	Condition	Diagram	Delay time (H08.10)	Switchover level (H08.11)	Switchover hysteresis (H08.12)
0	Fixed at 1st gain	-	OFF	OFF	OFF
1	Switchover by external DI	-	OFF	OFF	OFF
2	Torque reference		ON	ON (%)	ON (%)

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

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

Note

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



Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.08	2nd gain mode setting	0x0808	0–1	-	1	UInt16	At once	Ordinary user	At once
	Values:								
	0: Fixed to the 1st gain, switched between P and PI by external DI 1: Switched between the 1st and 2nd gain according to H08.09								
	Parameter description:								
	It sets switchover mode of the 2nd gain.								

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

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

Values:

0: Fixed to the 1st gain set (PS)
1: Switched through external DIs
2: Torque reference too large (PS)
3: Speed reference too large (PS)
4: Speed reference change rate too large (PS)
5: Speed reference low/high speed threshold (PS)
6: Position deviation too large (P)
7: Position reference available (P)
8: Positioning unfinished (P)
9: Actual speed (P)
10: Position reference+Actual speed (P)

Parameter description:

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

Table 6–7 Conditions for gain switchover

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

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

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

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.13	Position gain switchover time	0x080D	0.0 to 1000.0	ms	3.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	In position control, if H08.05 (2nd position loop gain) is much higher than H08.02 (Position loop gain), you can set the time for switching from H08.02 to H08.05 through this parameter. This parameter can be used to reduce the impact caused by an increase in the position loop gain. If the set value of H08.05 is equal to or lower than H08.02, this parameter is invalid and the drive switches to the 2nd gain set immediately.								

6.4.3 Comparison of filters

Name	Function	Applicable scenario	Impact of excessive filtering
Pulse input terminal filter	Prevents interference to ensure the number of pulses received by the servo drive is accurate.	• The system wiring does not comply with specifications. • The ambient interference is strong.	The number of pulses received by the servo drive is smaller than those sent by the host controller.
Position reference filter	The position reference filter is used to filter the position references (in encoder unit) divided or multiplied by the electronic gear ratio, smoothening motor operation and reducing impact to the machine.	• The acceleration/ deceleration process is not performed on the position references sent from the host controller. • The pulse reference frequency is low. • The electronic gear ratio is larger than 10.	The response delay is prolonged.

6.4.4 Feedforward Gain Tuning

Speed feedforward

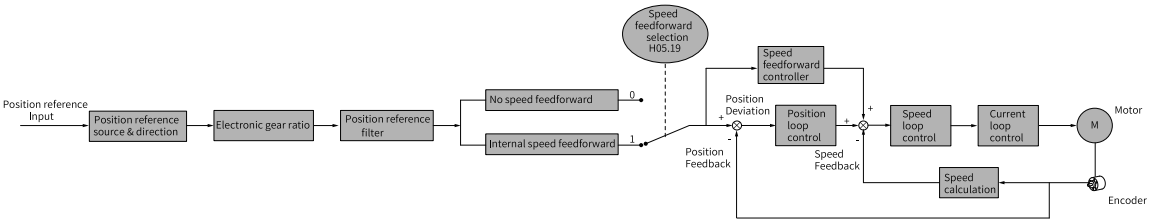


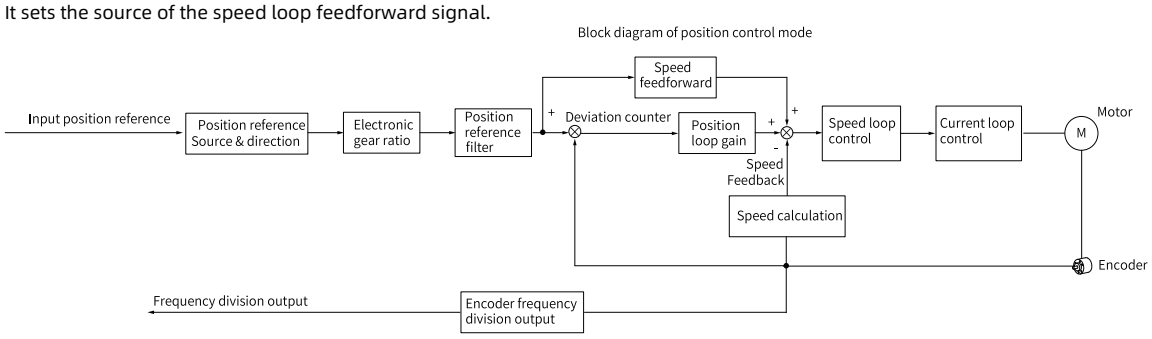
Figure 6-9 Block diagram of speed feedforward control

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

Operating procedure for speed feedforward:

1. Setting the speed feedforward signal source:
   Set H05.19 (Speed feedforward control) to a non-zero value to enable the speed feedforward function. The corresponding signal source will be selected as well.

2. Setting speed feedforward parameters:
   Speed feedforward parameters include H08.19 (Speed feedforward gain) and H08.18 (Speed feedforward filter time constant).

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.19	Speed feedforward gain	0x0813	0.0 to 100.0	%	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	In the position control mode, speed feedforward is the value of H08.19 multiplied by the speed feedforward signal, which is part of the speed reference. Increasing this parameter improves position reference response and reduces position deviation at fixed speed. Set H08.18 to a fixed value first, and then increase the value of H08.19 gradually from 0 to a certain value at which speed feedforward achieves the desired effect. Adjust H08.18 and H08.19 repeatedly until a balanced performance is achieved.								
	Note: For how to enable the speed feedforward function and select the speed feedforward signal, see H05.19 (Speed feedforward control selection).								

Torque feedforward

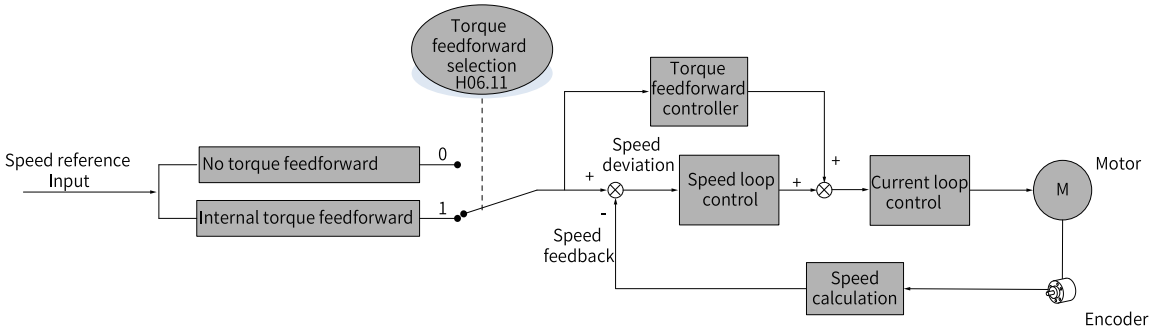


Figure 6-10 Block diagram of torque feedforward control

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

The procedure for setting torque feedforward is as follows:

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

2. Setting torque feedforward parameters:

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

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

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

Values:

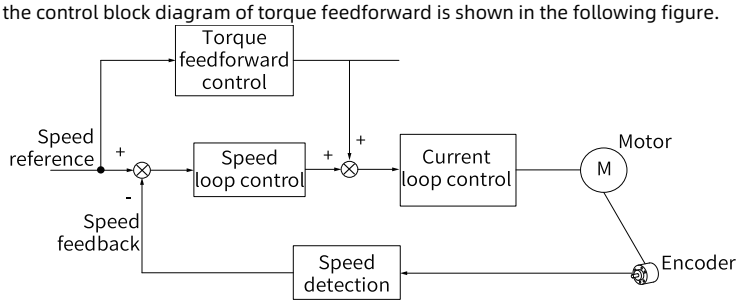
0: No torque feedforward
1: Internal torque feedforward

Parameter description:

Defines the source for torque feedforward control.
It sets whether to enable the internal torque feedforward function in non-torque control mode.
Torque feedforward can be used to improve the torque reference response speed and reduce the position deviation during acceleration/deceleration at constant speed.

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

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



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

Parameter description:

It sets the time constant of torque feedforward filter.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.21	Torque feedforward gain	0x0815	0.0 to 200.0	%	0.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	In control modes other than torque control, torque feedforward is the product of torque feedforward signal multiplied by H08.21 and is part of the torque reference. Increasing this parameter improves response to changing speed references. Increasing this parameter improves position reference response and reduces position deviation at fixed speed. During parameter adjustment, set H08.20 (Torque feedforward filter time constant) to the default value first, and then increase H08.21 gradually to enhance the effect of torque feedforward. When speed overshoot occurs, keep H08.21 unchanged and increase the value of H08.20. Adjust H08.20 and H08.21 repeatedly until a balanced performance is achieved. Note: For how to enable the torque feedforward function and select the torque feedforward signal, see H06.11 (Torque feedforward control).								

6.4.5 Pseudo Differential Feedforward Control

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

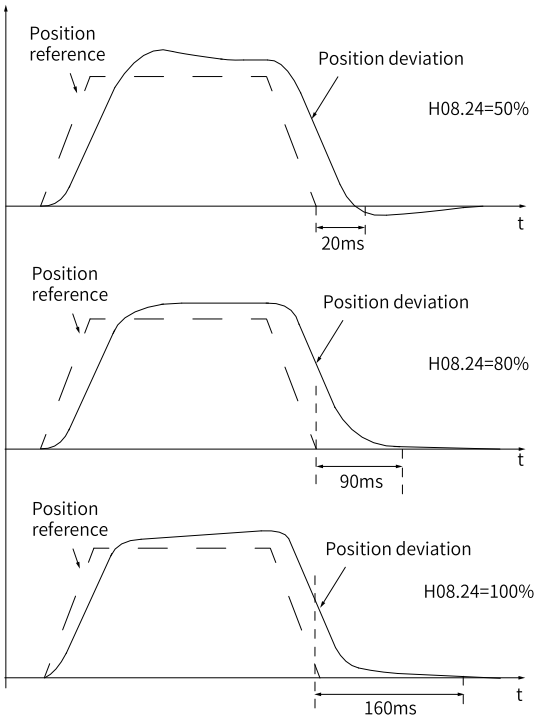


Figure 6-11 Example of pseudo differential feedforward control

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

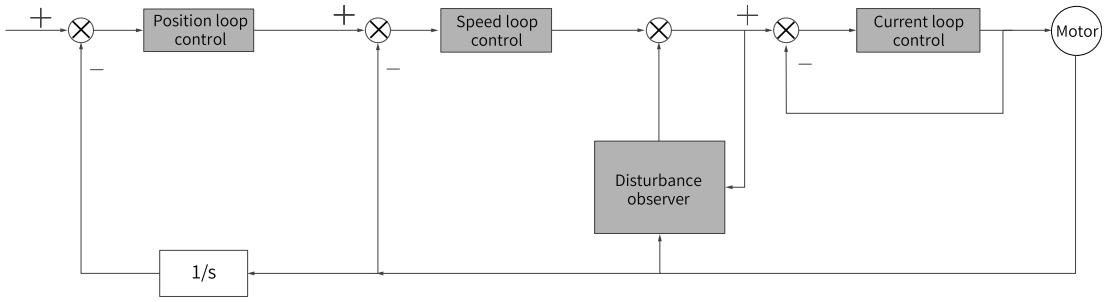
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.24	PDFF control coefficient	0x0818	0.0 to 1000.0	%	100.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the control mode of the speed loop. • When the parameter is set to 100.0, PI control (default control mode of the speed loop) is applied to the speed loop, which features fast dynamic response. • When this parameter is set to 0.0, speed loop integral action is enhanced, which filters out low-frequency interference but also slows down the dynamic response. This parameter can be used to keep a quick response of the speed loop, with the anti-interference capacity in low-frequency bands improved and the speed feedback overshoot unaffected.								

6.4.6 Torque Disturbance Observer

Disturbance observer 1

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

The following figure shows the function block diagram for disturbance observer 1.



Note:

1/s: Integral element

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.31	Disturbance cut-off frequency	0x081F	1 to 4000	Hz	600	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the cutoff frequency of the disturbance observer. Increasing the setpoint improves the responsivity of the disturbance observer and the compensation effect. Note that an excessively high setpoint may incur resonance.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.32	Disturbance observation compensation coefficient	0x0820	0 to 100	%	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the compensation coefficient of the disturbance observer. When the gain is set to a value other than 0, the disturbance observer compensation function is enabled, allowing effective observation and suppression of disturbances within the frequency range. Full compensation applies when this parameter is set to 100.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.33	Disturbance inertia correction coefficient	0x0821	1 to 10000	%	100	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the disturbance observer inertia correction coefficient. If H08.15 is set based on the actual inertia, there is no need to adjust this parameter.								

Disturbance observer 2

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

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

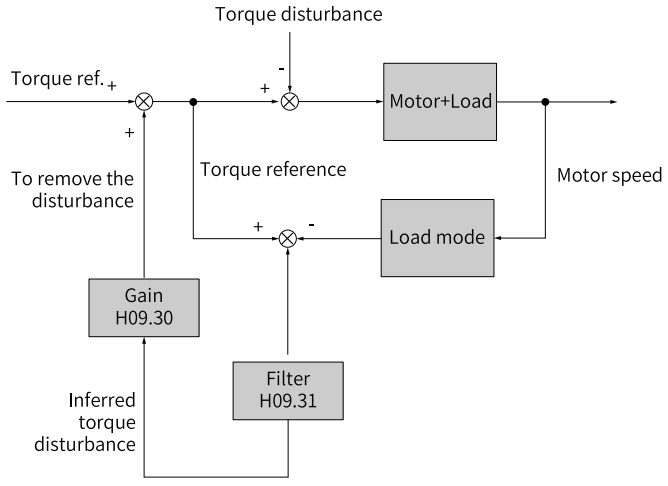


Figure 6-12 Block diagram for disturbance observation

Note:

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

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

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

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

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

6.4.7 Model Tracking

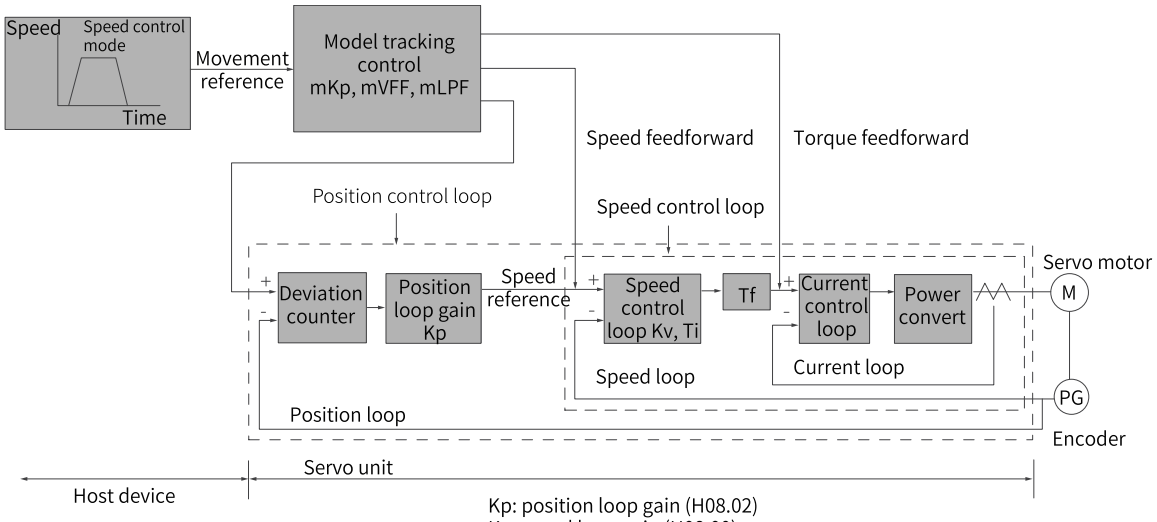
The model tracking control, which is only available in the position control mode, can be used to improve responsiveness and shorten the positioning time. It is only available in the position control mode.

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

However, manual tuning is needed in the following situations:

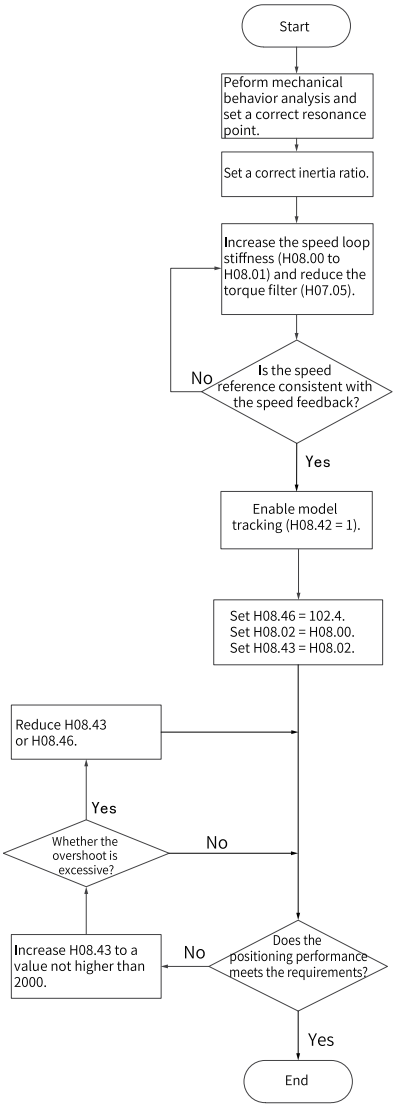
- The auto-tuned values cannot deliver desired performance.
- Improving the responsiveness takes priority over the auto-tuned or customized values.
- User-defined gain parameters or model tracking control parameters are needed.

The block diagram for model tracking control is as follows.



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

Commissioning procedure



Note

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.00	Speed loop gain	0x0800	0.1 to 2000.0	Hz	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the speed loop. This parameter determines the response of the speed loop. The higher the setpoint, the higher the response. Note that an excessively high setpoint may cause vibration. In the position control mode, the position loop gain must be increased together with the speed loop gain.								
	Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

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

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.43	Model gain	0x082B	0.0 to 2000.0	-	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the single inertia model gain. The higher the gain, the faster the position response. Note that an excessively high setpoint may incur excessive overshoot.								

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

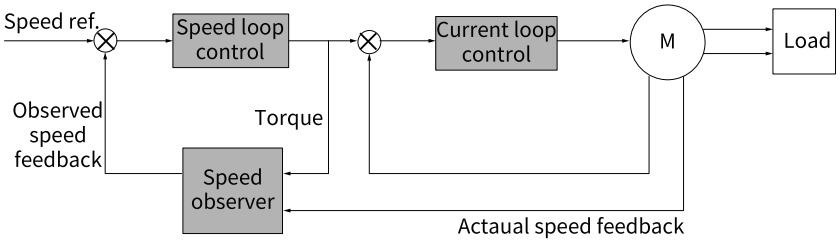
Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.51	Model filter time 2	0x0833	0.00 to 655.35	ms	0.00	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the model filter time 2.								

6.4.8 Speed Observer

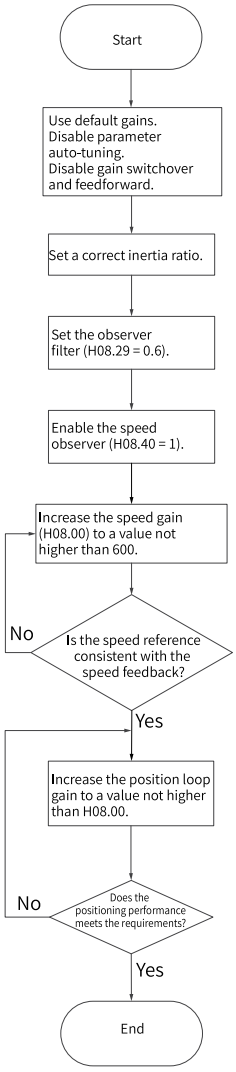
The speed observer is mainly applicable to scenarios with small variations in load characteristics and negligible inertia changes, which helps achieve rapid positioning.

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

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



Commissioning procedure



Note

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.00	Speed loop gain	0x0800	0.1 to 2000.0	Hz	40.0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	It sets the proportional gain of the speed loop. This parameter determines the response of the speed loop. The higher the setpoint, the higher the response. Note that an excessively high setpoint may cause vibration. In the position control mode, the position loop gain must be increased together with the speed loop gain.								
	Note: This value can be manually set only when H09.00 is set to 0. In other modes, the auto-tuned value applies. Note 2: Parameters for the 1st gain set include H08.00, H08.01, H08.02, and H07.05 (Filter time constant of torque reference).								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.27	Cutoff frequency of speed observer	0x081B	10 to 2000	Hz	170	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the cutoff frequency of the speed observer. Note that an excessively high setpoint may incur resonance. Decrease the setpoint properly in case of loud speed feedback noise.								

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H08.29	Speed observer filter time	0x081D	0.02 to 20.00	ms	0.80	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the speed observer filter time. It is recommended to set this parameter to a value equal to the sum of H07.05 plus 0.2 ms. The longer the filtering time, the lower the fluctuation of the speed feedback observation value, but the greater the delay of the speed feedback observation value can be.								

Parameter	Name	Address	Range	Unit	Default value	Data type	Change mode	User permission	Effective time
H08.40	Speed observer enable	0x0828	0 to 1	-	0	UInt16	Real time	Standard user	Real time
	Value:								
	0: Inactive 1: Active								
	Parameter description:								
	Defines the bit for enabling the speed observer. After enabling this function, high-frequency noise in the speed feedback can be filtered out, improving the response range.								

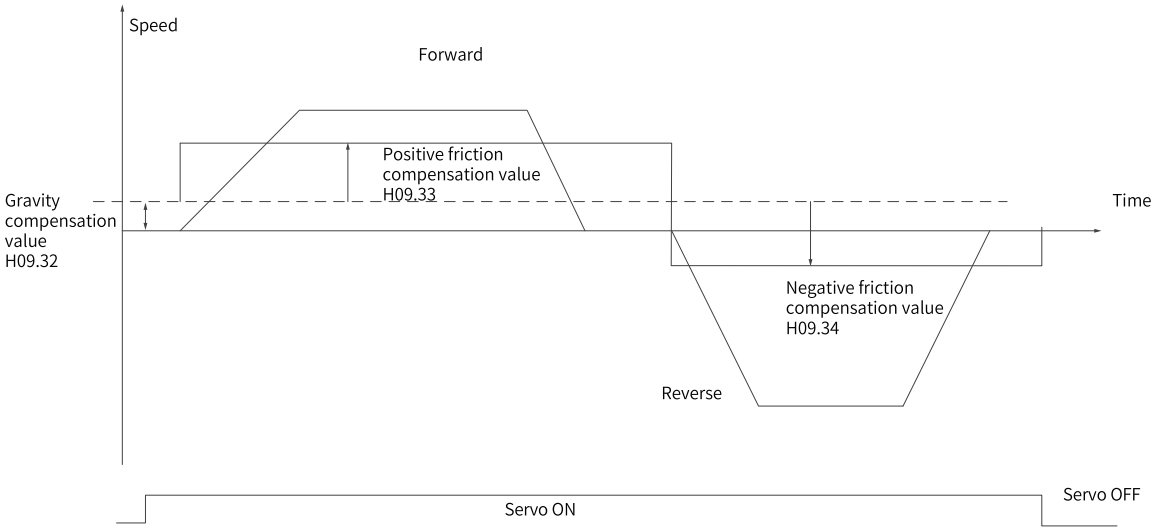
6.4.9 Friction Compensation

Friction compensation is used to reduce the impact of the friction on the operation effect during mechanical transmission. Use different positive/negative compensation values according to the direction of operation.

Note

Friction compensation is active only in the position mode.

The diagram for friction compensation is as follows.



Note

When the speed is lower than the speed threshold, static friction applies. When the speed exceeds the speed threshold, dynamic friction applies. The compensation direction is determined by the direction of the actual position reference. Forward direction requires positive compensation value. Reverse direction requires negative compensation value.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.32	Gravity compensation value	0x0920	-100.0 to +100.0	-	0.0	Int16	At once	Ordinary user	At once
	Parameter description:								
	Defines the gravity compensation value. In vertical axis applications, this value can be set to counteract the effects of gravity, reducing the initial drop during startup. It is recommended to start with low values and gradually increase the setpoint.								

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

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

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

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

6.5 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.

6.5.1 Parameter Tuning in Position Control Mode

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

- 1st gain:

Parameter	Name	Function	Default value
H07.05	Time constant of torque reference filter	These parameters set the time constant of the torque reference filter.	0.79 ms
H08.00	Speed loop gain	Defines the speed loop proportional gain.	40.0 Hz
H08.01	Time constant of speed loop integration	It sets the integral time constant of the speed loop.	19.89 ms
H08.02	Position loop gain	Defines the position loop proportional gain.	64.0 Hz

- Parameters related to the 2nd gain set:

Parameter	Name	Function	Default value
H07.06	2nd time constant of torque reference filter	Defines the torque reference filter time constant.	0.79 ms
H08.03	2nd speed loop gain	Defines the speed loop proportional gain.	40.0 Hz
H08.04	2nd speed loop integral time constant	Defines the integral time constant of the speed loop.	20.00 ms
H08.05	2nd position loop gain	Defines the position loop proportional gain.	64.0 Hz
H08.08	2nd gain mode setting	Defines the mode of the 2nd gain set.	1
H08.09	Gain switchover condition	Defines the gain switchover condition.	0
H08.10	Gain switchover delay	Defines the gain switchover delay.	5.0 ms
H08.11	Gain switchover level	Defines the gain switchover level.	50
H08.12	Gain switchover hysteresis	Defines the dead time of gain switchover.	30
H08.13	Position gain switchover time	Defines the position loop gain switchover time.	3.0 ms

- Common gain

Parameter	Name	Function	Default value
H08.18	Time constant of speed feedforward filter	Defines the speed feedforward filter time constant.	0.50 ms
H08.19	Speed feedforward gain	Defines the speed feedforward gain.	0.0%
H08.20	Time constant of torque feedforward filter	Defines the torque feedforward filter time constant.	0.50 ms
H08.21	Torque feedforward gain	Defines the torque feedforward gain.	0.0%
H08.22	Speed feedback filter option	Defines the speed feedback filter function.	0
H08.23	Cutoff frequency of speed feedback low-pass filter	Defines the cutoff frequency of the first-order low-pass filter for speed feedback.	4000 Hz
H08.24	PDFF control coefficient	Defines the coefficient of the PDFF controller	100.0%
H09.30	Torque disturbance compensation gain	Defines the torque disturbance compensation gain.	0.0%
H09.31	Time constant of torque disturbance observer filter	Defines the filter time constant of torque disturbance observer.	0.5 ms
H09.38	Low-frequency resonance suppression frequency at the mechanical end	Sets the frequency of low-frequency resonance suppression at the mechanical end.	100.0 Hz
H09.39	Low-frequency resonance suppression at the mechanical end	Defines different low-frequency resonance suppression types at the mechanical end.	2

3. Manually fine-tune the following gains.

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

6.5.2 Parameter Tuning in Speed Control Mode

Parameter adjustment in the speed control mode is the same as that in the position control mode, except for the position loop gain (H08.02 and H08.05). For details, see *"6.5.1 Parameter Tuning in Position Control Mode" on page 223*.

6.5.3 Parameter Tuning in Torque Control Mode

Parameter tuning in torque control mode varies with the condition:

- If the actual speed reaches the speed limit, the adjustment method is the same as that described in *"6.5.2 Parameter Tuning in Speed Control Mode" on page 224*;
- If the actual speed does not reach the speed limit value, except for the position loop gain (H08.02, H08.05), the speed loop gain (H08.00, H08.03), and the speed loop integral time constant (H08.01, H08.04), the adjustment method is the same as *"6.5.2 Parameter Tuning in Speed Control Mode" on page 224*.

6.6 Vibration Suppression

The block diagram for vibration suppression is as follows.

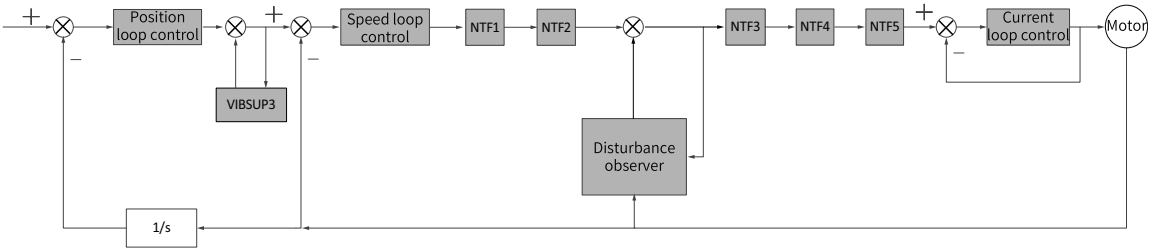


Diagram description:

- NTF1–5: 1st notch to 5th notch
- VIBSUP3: Suppression of medium- and low-frequency vibration Reduction applied at a carrier frequency lower than 8 k under 300 Hz
- 1/s: Integral term

The following are related parameters.

Note

Vibration suppression parameters are divided into the following three types:

- Vibration suppression frequency: Defines the vibration frequency to be suppressed.
- Vibration suppression compensation coefficient: Defines the compensation magnitude for jitter suppression.
- Vibration suppression phase modulation coefficient: Used for synchronous phase adjustment of the compensation value. It is recommended to use the default value. Adjustment is needed when the compensation value phase differs greatly from the vibration phase.

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

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

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

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

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

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

6.6.1 Mechanical Characteristics Analysis

Overview

Mechanical characteristic analysis is used to determine the mechanical resonance point and system bandwidth. Up to 8 kHz response characteristic analysis is available and three modes including mechanical characteristics, speed open loop, and speed closed loop are supported.

Operation Flowchart

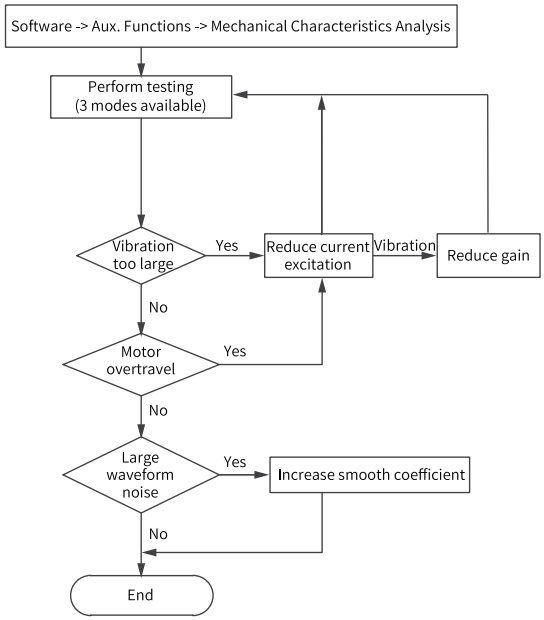


Figure 6-13 Operating procedure for mechanical characteristic analysis

Note

- To avoid excessive vibration during the test, set the current excitation to 10% during initial execution.
- The analysis waveform may be distorted if the current excitation is excessively low.
- If the vibration generated during test cannot be suppressed by reducing the current excitation, the possible causes and solutions are as follows: 1. The gain value is excessively high, reduce the speed gain or set the notch based on the auto-tuned resonance point. 2. The inertia is excessively high, set a correct inertia.
- In the mechanical characteristic test mode, waveforms before and after notch settings are consistent. In the speed closed loop and speed open loop modes, waveforms are attenuated after notch settings.

An example of the waveform obtained with the mechanical characteristic analysis is shown in the following figure.

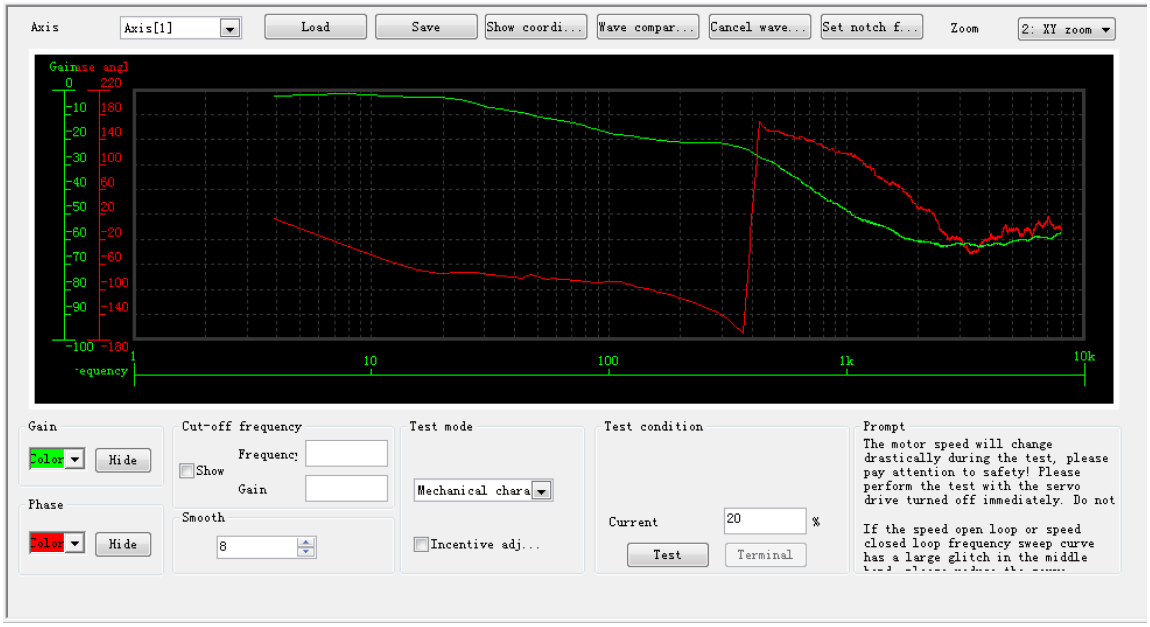


Figure 6-14 Example of the waveform obtained

6.6.2 Mechanical Resonance Suppression

Working principles

The mechanical system has a certain resonance frequency. When the servo gain is increased, resonance may occur near the mechanical resonance frequency, which can prevent further gain increase. Therefore, resonance must be suppressed.

Mechanical resonance can be suppressed in the following two ways:

- Torque reference filter (H07.05, H07.06)
  To suppress the mechanical resonance, set the filter time constant to enable the torque reference to be attenuated in the frequency range above the cutoff frequency.

  Filter cutoff frequency fc (Hz) = 1/[2π x H07.05 (ms) x 0.001]

- Notch
  The notch reduces the gain at certain frequencies to suppress mechanical resonance. After the vibration is suppressed by the notch, you can continue to increase the gain.

  The operating principle of the notch is shown in the following figure.

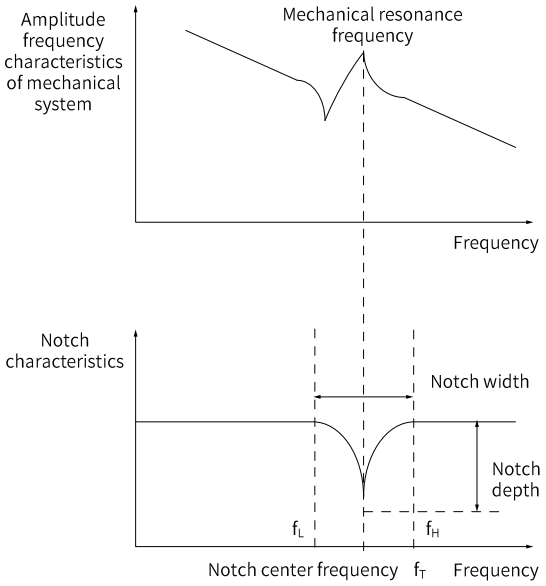


Figure 6-15 Operating principle of the notch

Note

If the amplitude frequency characteristic curve obtained through the mechanical analysis function does not have obvious peak, it indicates that vibration occurs actually. Such vibration may not be mechanical resonance, and cannot be suppressed by the notch. It occurs because the gain reaches the limit, and can be suppressed only by reducing the gain or the filter time of torque reference.

Description of the notch

A total of five notches can be used, and each notch is defined by three parameters: frequency, bandwidth level, and depth level.

The 1st, 2nd, and 5th notches are manual notches whose parameters need to be set by the user.

Parameters of the 3rd and 4th notches can be either set by the user or set automatically after being configured as an adaptive notch (H09.02 = 1 or 2).

Table 6–8 Description of the notch

Item	Manual notch			Manual/Adaptive notch	
	1st notch	2nd notch	5th notch	3rd notch	4th notch
Frequency	H09.12	H09.15	H09.41	H09.18	H09.21
Bandwidth level	H09.13	H09.16	H09.42	H09.19	H09.22
Depth level	H09.14	H09.17	H09.43	H09.20	H09.23

- Bandwidth level of the notch

  The bandwidth level indicates the ratio of the notch bandwidth to the center frequency of the notch.

$$\text{Width level of the notch} = \frac{f_H - f_L}{f_T}$$

  Where:

  f_T: Center frequency of the notch, which is also the mechanical resonance frequency

f_H-f_L: Notch filter bandwidth, indicating the frequency bandwidth where the amplitude attenuation reaches -3dB relative to the notch center frequency.

The following figure shows the mapping relationship. Use the default value (2) in normal cases.

- Depth level of the notch
  The notch depth level indicates the ratio of the input to the output at the center frequency.

  The input is completely shut with depth level 0 and fully received with depth level 99 at the center frequency. Therefore, the lower the depth level is, the higher the notch depth is, and the stronger the suppression effect will be. Note that an excessively low depth level may lead to system oscillation.

  The following figure shows the frequency characteristics of the notch.

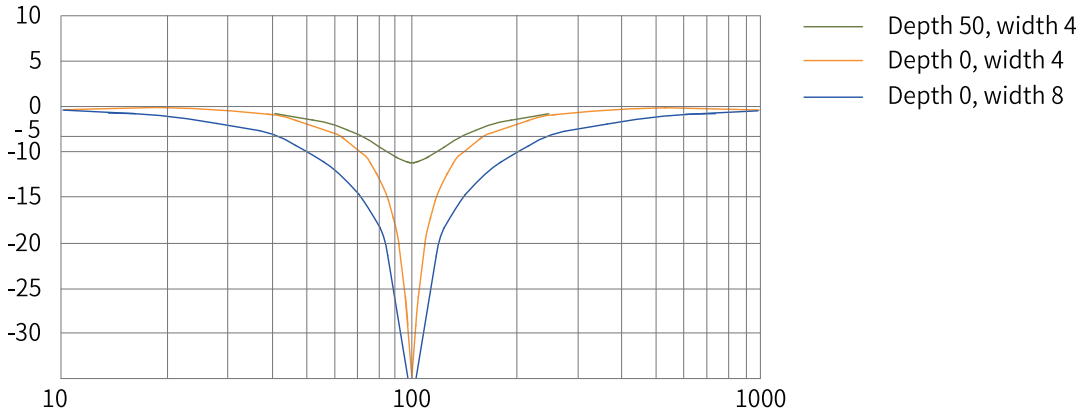


Figure 6-16 Notch frequency characteristics

Use of the notch

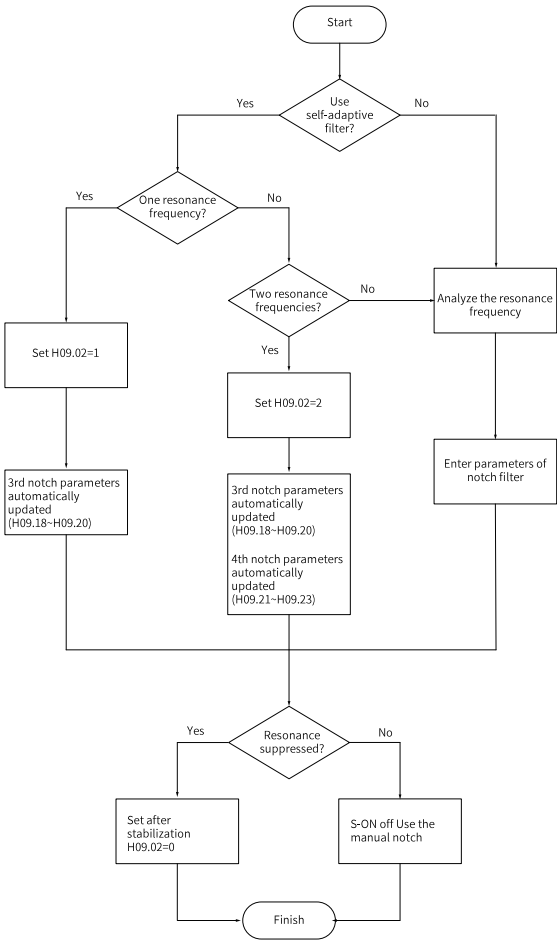


Figure 6-17 Flowchart for using the notch

Note

- The notch is inactive when the "Notch frequency" is set to the default value.
- The adaptive notch is preferred for resonance suppression. The manual notch can be used in cases where the adaptive notch cannot deliver desired performance.

Procedure for setting the adaptive notch:

1. Set H09.02 (Adaptive notch mode selection) to 1 or 2 based on the number of resonance frequencies.
2. When resonance occurs, set H09.02 to 1 first to enable one adaptive notch. If resonance occurs again after gain tuning, set H09.02 to 2 to enable two adaptive notches.
3. Parameters of the 3rd or 4th notches are updated automatically during operation, and parameter values are saved automatically to the corresponding parameters in group H09 every 30 min.
4. If resonance is suppressed, the adaptive notch works. After the servo drive runs stably for a period of time, set H09.02 to 0 and the parameters of the adaptive notch are fixed to the last updated values.

   This is to prevent notch parameters from being updated to wrong values due to misoperation. Wrong values will intensity resonance.

5. If resonance persists after the notch is working for a period of time, switch off the S-ON signal.
6. If there are more than two resonance frequencies, the problem cannot be solved by only using the adaptive notches. Additionally use the manual notch, or use all the four notches as manual ones (H09.02 = 0).

Note

- When adaptive notch is applied, if the S-OFF signal is activated within 30 min, the notch parameters will not be saved to the corresponding parameter
- When the resonance frequency is below 300 Hz, the suppression effect of the adaptive notch may degrade.

Procedure for setting the manual notch:

1. Analyze the resonance frequency.
2. When using the manual notch, set the notch frequency to same value as the actual resonance frequency obtained in the following ways:
   The resonance frequency can be obtained by using the following methods:
   a. Use the "Mechanical characteristic analysis" function in Inovance software tool.
   b. Calculate the resonance frequency based on the motor phase current displayed on the oscilloscope interface of the software tool.
   c. Set H09.02 (Adaptive notch mode) to 3. The drive detects the resonance frequency and saves the detected value to H09.24 automatically during operation.
3. Input the resonance frequency obtained in step 1 to the parameter of the selected notch, and input the bandwidth level and depth level of this notch.
4. If the resonance is suppressed, it indicates that the notch acts properly, and the gain can be further adjusted. If new resonance appears after increasing the gain, repeat the above steps.
5. If vibration persists after the notch is working for a period of time, switch off the S-ON signal.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.02	Working mode of self-adaptive notch	0x0902	0 to 4	-	0	UInt16	At once	Ordinary user	At once
	Values:								
	0: Adaptive notch no longer updated1 : One adaptive notch activated (3rd notch)2 : Two adaptive notches activated (3rd and 4th notches) 3: Resonance point tested only (mechanical resonance frequency displayed in H09.24) 4: Adaptive notch cleared, values of 3rd and 4th notches restored to default								
	Parameter description:								
	It sets the working mode of the adaptive notch.								

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.14	Group 1 notch depth level	0x090E	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the depth level of the 1st notch. The notch depth level indicates the ratio of input to output at center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.17	2nd notch depth level	0x0911	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the depth level of the 2nd notch. The notch depth level indicates the ratio of input to output at center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.20	3rd notch depth level	0x0914	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the depth level of the 3rd notch. The notch depth level indicates the ratio of input to output at center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.23	Depth level of the 4th notch	0x0917	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the depth level of the 4th notch. The notch depth level indicates the ratio of input to output at center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

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

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

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

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H09.43	Depth level of the 5th notch	0x092B	0 to 99	-	0	UInt16	At once	Ordinary user	At once
	Parameter description:								
	Defines the depth level of the 5th notch. The notch depth level indicates the ratio of input to output at center frequency. The higher the setpoint, the lower the notch depth and the weaker the mechanical resonance suppression. Note that an excessively high setpoint may cause system instability. For use of the notch, see section "Vibration Suppression".								

6.6.3 Low-Frequency Resonance Suppression at the Mechanical End

Working principles

If the mechanical load end is long and heavy, vibration may easily occur in this part during emergency stop, affecting the positioning effect. Such vibration is called low-frequency resonance as its frequency is generally within 100 Hz, which is lower than the mechanical resonance frequency.

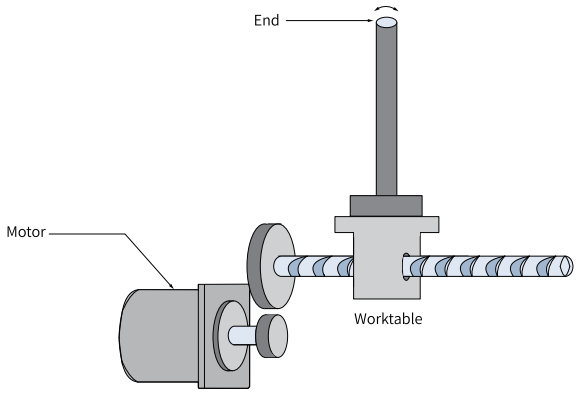


Figure 6-18 Low-frequency vibration at the mechanical end

Use of the filter

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

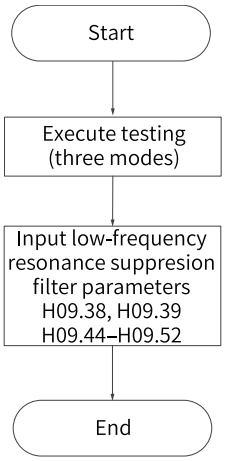


Figure 6-19 Flowchart for setting low-frequency resonance suppression filter

Flowchart description:

1. Collect the position deviation waveform in motor positioning mode by using the oscilloscope function of the Inovance software tool and calculate the position deviation fluctuation frequency, that is, low-frequency resonance frequency.
2. Manually enter H09.38 or H09.44, and H09.49 (low-frequency resonance frequency). Keep other parameters at default values generally.
3. The following shows the improved resonance suppression effect after using the low-frequency resonance suppression filter.

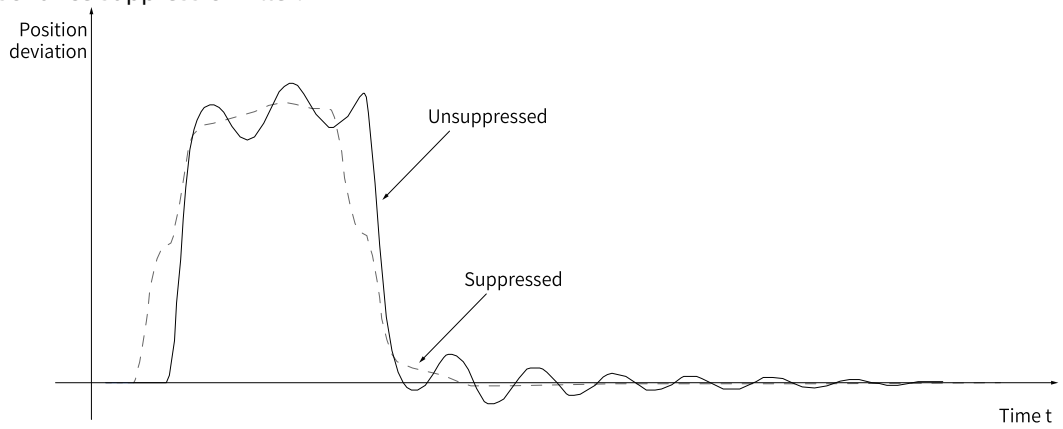


Figure 6-20 Low-frequency resonance suppression effect

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

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

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

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

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

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

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

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

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

7 Parameter Descriptions

7.1 H00 Servo Motor Parameters

H00.00 **Motor SN**

Address:	0x0000	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	14101	Change:	At stop

Range:

0–65535

Parameter description

14000: Inovance motor with 20-bit incremental encoder

14101: Inovance motor with 23-bit absolute encoder

H00.02 **Customized motor SN**

Address:	0x0002	Effective mode:	-
Minimum:	0.00	Unit:	-
Maximum:	42949672.95	Data type	UInt32
Default:	0.00	Change:	Unmodifiable

Range:

0.00 to 42949672.95

Parameter description

Differentiates the customized MCU software version, which is not applicable to standard models.

H00.04 **Encoder version SN**

Address:	0x0004	Effective mode:	-
Minimum:	0.0	Unit:	-
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0 to 6553.5

Parameter description

Saved in the encoder to differentiate the encoder software version.

H00.05 **Bus motor SN**

Address:	0x0005	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Displays the code of the serial-type motor, which is determined by the motor model and unchangeable.

H00.06 **FPGA customized SN**

Address:	0x0006	Effective mode:	-
Minimum:	0.00	Unit:	-
Maximum:	42949672.95	Data type	UInt32
Default:	0.00	Change:	Unmodifiable

Range:

0.00 to 42949672.95

Parameter description

Used to differentiate the customized FPGA software version, which is not applicable to standard models.

H00.08 **Serial encoder type**

Address:	0x0008	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0–65535

Parameter description

14100: Multi-turn absolute encoder

Others: Single-turn absolute encoder

H00.09 **Motor voltage class**

Address:	0x0009	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	V
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: 220 V

1: 380 V

Parameter description

0: 220 V

1: 380 V

H00.10 **Rated power**

Address:	0x000A	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	kW
Maximum:	655.35	Data type:	UInt16
Default:	0.75	Change:	At stop

Range:

0.00 kW–655.35kW

Parameter description

Defines the rated motor power.

H00.11 **Rated current**

Address:	0x000B	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	A.

Maximum:	655.35	Data type:	UInt16
Default:	4.70	Change:	At stop

Range:

0.00 A to 655.35 A

Parameter description

Defines the rated motor current.

H00.12 **Rated torque**

Address:	0x000C	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	N·m
Maximum:	655.35	Data type:	UInt16
Default:	2.39	Change:	At stop

Range:

0.00 N·m to 655.35 N·m

Parameter description

Defines the rated motor torque.

H00.13 **Maximum torque**

Address:	0x000D	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	N·m
Maximum:	655.35	Data type:	UInt16
Default:	7.16	Change:	At stop

Range:

0.00 N·m to 655.35 N·m

Parameter description

Defines the maximum current/torque (DDR) of the motor.

H00.14 **Rated speed**

Address:	0x000E	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	rpm
Maximum:	65535	Data type:	UInt16
Default:	3,000	Change:	At stop

Range:

0rpm~65535rpm

Parameter description

Defines the rated motor speed.

H00.15 **Maximum motor rotational speed**

Address:	0x000F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	rpm
Maximum:	65535	Data type:	UInt16
Default:	6,000	Change:	At stop

Range:

0rpm~65535rpm

Parameter description

Defines the maximum motor speed.

H00.16 **Rotor inertia**

Address:	0x0010	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	kg·cm²
Maximum:	655.35	Data type:	UInt16
Default:	1.30	Change:	At stop

Range:

0.00kg·cm² to 655.35kg·cm²

Parameter description

Defines the motor moment of inertia.

H00.17 **Number of pole pairs of PMSM**

Address:	0x0011	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	4	Change:	At stop

Range:

0–65535

Parameter description

Defines the number of PMSM pole pairs.

H00.18 **Stator resistance**

Address:	0x0012	Effective mode:	Effective upon next power-on
Minimum:	0.000	Unit:	Ω
Maximum:	65.535	Data type:	UInt16
Default:	0.500	Change:	At stop

Range:

0.000 Ω to 65.535 Ω

Parameter description

Defines the motor stator resistance.

H00.19 **Stator inductance Lq**

Address:	0x0013	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	mH
Maximum:	655.35	Data type:	UInt16
Default:	3.27	Change:	At stop

Range:

0.00 mH to 655.35 mH

Parameter description

Defines motor stator inductance Lq.

H00.20 **Stator inductance Ld**

Address:	0x0014	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	mH
Maximum:	655.35	Data type:	UInt16
Default:	3.87	Change:	At stop

Range:

0.00 mH to 655.35 mH

Parameter description
Defines motor stator inductance Ld.

H00.21 **Line back EMF coefficient**

Address:	0x0015	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	mV/RPM
Maximum:	655.35	Data type:	UInt16
Default:	33.30	Change:	At stop

Range:
0.00 mV/rpm to 655.35 mV/rpm
Parameter description
Defines the motor back EMF coefficient.

H00.22 **Torque coefficient Kt**

Address:	0x0016	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	N·m/Arms
Maximum:	655.35	Data type:	UInt16
Default:	0.51	Change:	At stop

Range:
0.00 N·m/Arms to 655.35 N·m/Arms
Parameter description
Defines the motor torque coefficient Kt.

H00.23 **Electrical constant Te**

Address:	0x0017	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	ms
Maximum:	655.35	Data type:	UInt16
Default:	6.54	Change:	At stop

Range:
0.00 to 655.35
Parameter description
Defines the motor electrical constant Te.

H00.24 **Mechanical constant Tm**

Address:	0x0018	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	ms
Maximum:	655.35	Data type:	UInt16
Default:	0.24	Change:	At stop

Range:
0.00 to 655.35
Parameter description
Defines the motor mechanical constant Tm.

H00.28 **Position offset of absolute encoder**

Address:	0x001C	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	P/Rev
Maximum:	4294967295	Data type	UInt32

Default:	8192	Change:	At stop

Range:

0 PPR to 4294967295 PPR

Parameter description

Used to save the values obtained from angle auto-tuning.

H00.30 Encoder selection

Address:	0x001E	Effective mode:	Effective upon next power-on
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x13	Change:	At stop

Range:

0: Standard incremental encoder (UVW - ABZ)

1: Wire-saving encoder (ABZ (UVW))

2: Regular incremental encoder (ABZ, without UVW)

16: TAMAGAWA encoder

18: Nikon encoder

19: Inovance encoder

48: Grating scale

Parameter description

0: Standard incremental encoder (UVW - ABZ)

1: Wire-saving encoder (ABZ (UVW))

2: Regular incremental encoder (ABZ, without UVW)

16: TAMAGAWA encoder

18: Nikon encoder

19: Inovance encoder

48: Grating scale

H00.31 Encoder PPR

Address:	0x001F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	P/Rev
Maximum:	4294967295	Data type	UInt32
Default:	8388608	Change:	At stop

Range:

0 PPR to 4294967295 PPR

Parameter description

Defines the number of pulses fed back by the encoder per motor revolution.

H00.35 Motor SN stored by serial encoder

Address:	0x0023	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0–65535

Parameter description

Defines the serial encoder model.

H00.37 **Serial encoder function setting bit**

Address:	0x0025	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Defines the absolute encoder function setting bit.

7.2 H01 Drive Parameters

H01.00 **MCU software version SN**

Address:	0x0100	Effective mode:	-
Minimum:	0.0	Unit:	-
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0 to 6553.5

Parameter description

Displays MCU software version (with one decimal place).

H01.01 **FPGA software version**

Address:	0x0101	Effective mode:	-
Minimum:	0.0	Unit:	-
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0 to 6553.5

Parameter description

Displays the FPGA software version (with one decimal place).

H01.02 **Servo drive series No.**

Address:	0x0102	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	3	Change:	At stop

Range:

0–65535

Parameter description

Displays the drive series (without decimal place).

H01.04 **Voltage class**

Address:	0x0104	Effective mode:	-
Minimum:	0	Unit:	V
Maximum:	65535	Data type:	UInt16

Default:	220	Change:	Unmodifiable

Range:

0 to 65535

Parameter description

Displays the voltage class of the servo drive.

H01.05 **Rated Power**

Address:	0x0105	Effective mode:	-
Minimum:	0.01	Unit:	kW
Maximum:	655.35	Data type:	UInt16
Default:	0.75	Change:	Unmodifiable

Range:

0.01 to 655.35

Parameter description

Displays the rated power of the drive (with two decimal places).

H01.06 **Max. output power**

Address:	0x0106	Effective mode:	-
Minimum:	0.01	Unit:	kW
Maximum:	655.35	Data type:	UInt16
Default:	0.75	Change:	Unmodifiable

Range:

0.01 to 655.35

Parameter description

Displays the maximum output power of the drive (with two decimal places).

H01.07 **Rated output current**

Address:	0x0107	Effective mode:	-
Minimum:	0.01	Unit:	A.
Maximum:	655.35	Data type:	UInt16
Default:	5.50	Change:	Unmodifiable

Range:

0.01 to 655.35

Parameter description

Displays the rated output current of the drive (with two decimal places).

H01.08 **Max. output current**

Address:	0x0108	Effective mode:	-
Minimum:	0.01	Unit:	A.
Maximum:	655.35	Data type:	UInt16
Default:	16.90	Change:	Unmodifiable

Range:

0.01 to 655.35

Parameter description

Displays the maximum output current of the drive (with two decimal places).

H01.10 **Carrier frequency**

Address:	0x010A	Effective mode:	Effective upon next power-on

Minimum:	4,000	Unit:	-
Maximum:	20000	Data type:	UInt16
Default:	8000	Change:	At stop

Range:

4000 to 20000

Parameter description

Displays the carrier frequency (without decimal place).

H01.11 **Current loop modulation frequency**

Address:	0x010B	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At stop

Range:

0 - Carrier frequency

1 - Two times the carrier frequency

Parameter description

Defines current loop modulation frequency.

H01.12 **Speed loop scheduling frequency-division coefficient**

Address:	0x010C	Effective mode:	Effective upon next power-on
Minimum:	1	Unit:	-
Maximum:	32	Data type:	UInt16
Default:	1	Change:	At stop

Range:

1 - Current loop modulation frequency/1

2 - Current loop modulation frequency/2

4 - Current loop modulation frequency/4

8 - Current loop modulation frequency/8

16 - Current loop modulation frequency/16

32 - Current loop modulation frequency/32

Parameter description

Defines speed loop scheduling frequency-division coefficient.

H01.13 **Position loop scheduling frequency-division coefficient**

Address:	0x010D	Effective mode:	Effective upon next power-on
Minimum:	2	Unit:	-
Maximum:	128	Data type:	UInt16
Default:	4	Change:	At stop

Range:

2 - Current loop modulation frequency/2

4 - Current loop modulation frequency/4

8 - Current loop modulation frequency/8

16 - Current loop modulation frequency/16

32 - Current loop modulation frequency/32

64 - Current loop modulation frequency/64

128 - Current loop modulation frequency/128

Parameter description

Defines position loop scheduling frequency-division coefficient.

H01.14 Dead zone time

Address:	0x010E	Effective mode:	Effective upon next power-on
Minimum:	0.01	Unit:	μs
Maximum:	20.00	Data type:	UInt16
Default:	2.00	Change:	At stop

Range:

0.01 μs to 20.00 μs

Parameter description

Displays the dead zone time (with two decimal places).

H01.15 DC bus overvoltage protective point

Address:	0x010F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	V
Maximum:	900	Data type:	UInt16
Default:	420	Change:	At stop

Range:

0 V~900V

Parameter description

Displays DC bus overvoltage protection threshold (without decimal place).

H01.16 DC bus voltage discharge point

Address:	0x0110	Effective mode:	At once
Minimum:	0	Unit:	V
Maximum:	900	Data type:	UInt16
Default:	380	Change:	At stop

Range:

0 V~900V

Parameter description

Displays DC bus voltage discharge threshold (without decimal place).

H01.17 DC bus voltage under pressure point

Address:	0x0111	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	V
Maximum:	900	Data type:	UInt16
Default:	200	Change:	At stop

Range:

0 V~900V

Parameter description

Displays DC bus undervoltage threshold (without decimal place).

H01.18 Servo drive overcurrent protection threshold

Address:	0x0112	Effective mode:	Effective upon next power-on
Minimum:	10	Unit:	%
Maximum:	100	Data type:	UInt16

Default:	100	Change:	At stop

Range:

10% to 100%

Parameter description

Displays the overcurrent protection threshold of the drive.

H01.19 Sampling coefficient of 7860

Address:	0x0113	Effective mode:	Effective upon next power-on
Minimum:	1	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	3200	Change:	At stop

Range:

1 to 65535

Parameter description

Displays the sampling factor of the drive.

H01.20 Dead zone compensation

Address:	0x0114	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	μs
Maximum:	20.00	Data type:	UInt16
Default:	2.00	Change mode:	At once

Range:

0.00 μs to 20.00 μs

Parameter description

Displays the dead zone compensation coefficient.

H01.21 Minimum switch-on time of bootstrap circuit

Address:	0x0115	Effective mode:	Effective upon next power-on
Minimum:	1.0	Unit:	μs
Maximum:	60.0	Data type:	UInt16
Default:	4.0	Change mode:	At once

Range:

1.0μs~60.0μs

Parameter description

Displays the minimum switch-ON time of the bootstrap circuit.

H01.22 D-axis back EMF constant

Address:	0x0116	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	6553.5	Data type:	UInt16
Default:	60.0	Change mode:	At once

Range:

0.0 to 6553.5

Parameter description

Displays the D-axis coupling voltage compensation coefficient.

H01.23 **Q-axis back EMF constant**

Address:	0x0117	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	6553.5	Data type:	UInt16
Default:	100.0	Change mode:	At once

Range:

0.0 to 6553.5

Parameter description

Displays Q-axis back EMF compensation coefficient.

H01.24 **D-axis current loop gain**

Address:	0x0118	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	1,000	Change mode:	At once

Range:

0–65535

Parameter description

Displays D-axis current loop gain (without decimal place).

H01.25 **D-axis current loop integral compensation factor**

Address:	0x0119	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	2.00	Change mode:	At once

Range:

0.00 to 655.35

Parameter description

Displays D-axis current loop integral compensation factor (with two decimal places).

H01.26 **Current sampling Sinc3 filter data extraction rate**

Address:	0x011A	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Extraction rate 32

1: Extraction rate 64

2: Extraction rate 128

3: Extraction rate 256

Parameter description

Display Sinc3 filter data extraction rate in current sampling (without decimal place).

H01.27 **Q-axis current loop gain**

Address:	0x011B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	1,000	Change mode:	At once

Range:
0–65535
Parameter description
Displays Q-axis current loop gain (without decimal place).

H01.28 **Q-axis current loop integral compensation factor**

Address:	0x011C	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Displays Q-axis current loop integral compensation factor (with two decimal places).

H01.29 **Control power voltage sampling coefficient**

Address:	0x011D	Effective mode:	At once
Minimum:	50.0	Unit:	-
Maximum:	150.0	Data type:	UInt16
Default:	100.0	Change:	At stop

Range:
50.0 to 150.0
Parameter description
Displays bus voltage gain tuning of control circuit (with one decimal place).

H01.30 **Bus voltage gain adjustment**

Address:	0x011E	Effective mode:	At once
Minimum:	50.0	Unit:	%
Maximum:	150.0	Data type:	UInt16
Default:	100.0	Change:	At stop

Range:
50.0 %~150.0%
Parameter description
Displays bus voltage gain tuning (with one decimal place).

H01.31 **FOC calculation time**

Address:	0x011F	Effective mode:	Effective upon next power-on
Minimum:	100	Unit:	μs
Maximum:	10,000	Data type:	UInt16
Default:	260	Change:	At once

Range:
100μs~10000μs
Parameter description
FOC calculation time

H01.32 **UV sampling relative gain**

Address:	0x0120	Effective mode:	Effective upon next power-on
Minimum:	1	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	32768	Change:	At stop

Range:
1 to 65535
Parameter description
Displays the relative gain of UV sampling (without decimal place).

H01.37 **Model identification version**

Address:	0x0125	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	0.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Displays the model parameter version.

H01.44 **Sinc3 filter data extraction rate in 2nd group of current sampling**

Address:	0x012C	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0: Extraction rate 32
1: Extraction rate 64
2: Extraction rate 128
3: Extraction rate 256
Parameter description
Displays Sinc3 filter data extraction rate in current sampling.
0: Extraction rate 32
1: Extraction rate 64
2: Extraction rate 128
3: Extraction rate 256

H01.45 **Phase U duty cycle obtained upon voltage injection**

Address:	0x012D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16

Default:	0	Change:	At stop

Range:

0–65535

Parameter description

Displays phase U duty cycle obtained upon voltage injection.

H01.47 MCU current reference processing time

Address:	0x012F	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	μs
Maximum:	60.00	Data type:	UInt16
Default:	38.00	Change:	At stop

Range:

0.00μs~60.00μs

Parameter description

Displays MCU current reference processing time.

H01.48 AD sampling delay

Address:	0x0130	Effective mode:	Effective upon next power-on
Minimum:	-40.00	Unit:	μs
Maximum:	40.00	Data type	Int16
Default:	1.00	Change:	At stop

Range:

-40.00 μs to +40.00 μs

Parameter description

Displays AD sampling delay.

H01.49 Serial encoder data dissemination delay

Address:	0x0131	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	μs
Maximum:	500.00	Data type:	UInt16
Default:	61.00	Change:	At stop

Range:

0.00 μs to 500.00 μs

Parameter description

Displays serial encoder data dissemination delay.

H01.52 D-axis proportional gain in performance priority mode

Address:	0x0134	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	2,000	Change mode:	At once

Range:

0–65535

Parameter description

Displays D-axis proportional gain in performance priority mode (without decimal place).

H01.53 **D-axis integral gain in performance priority mode**

Address:	0x0135	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	2.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Displays D-axis integral gain in performance priority mode (with two decimal places).

H01.54 **Q-axis proportional gain in performance priority mode**

Address:	0x0136	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	2,000	Change mode:	At once

Range:
0–65535
Parameter description
Displays Q-axis proportional gain in performance priority mode (without decimal place).

H01.55 **Q-axis integral gain in performance priority mode**

Address:	0x0137	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Displays Q-axis integral gain in performance priority mode (with two decimal places).

H01.56 **2nd group of proportional gain coefficient in performance priority mode**

Address:	0x0138	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	1000.0	Data type:	UInt16
Default:	102.4	Change mode:	At once

Range:
0.0 %~1000.0%
Parameter description
Displays the 2nd group of proportional gain coefficient in performance priority mode (with one decimal place).

H01.57 **3rd group of proportional gain coefficient in performance priority mode**

Address:	0x0139	Effective mode:	At once

Minimum:	0.0	Unit:	%
Maximum:	1000.0	Data type:	UInt16
Default:	102.4	Change mode:	At once

Range:
0.0 %~1000.0%
Parameter description
Displays the 3rd group of proportional gain coefficient in performance priority mode (with one decimal place).

H01.58 **1st gain switchover threshold in performance priority mode**

Address:	0x013A	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	1.0	Change mode:	At once

Range:
0.0% to 300.0%
Parameter description
Displays the 1st gain switchover threshold in performance priority mode (with one decimal place).

H01.59 **2nd gain switchover threshold in performance priority mode**

Address:	0x013B	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	2.0	Change mode:	At once

Range:
0.0% to 300.0%
Parameter description
Displays the 2nd gain switchover threshold in performance priority mode (with one decimal place).

H01.60 **3rd gain switchover threshold in performance priority mode**

Address:	0x013C	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	100.0	Change mode:	At once

Range:
0.0% to 300.0%
Parameter description
Displays the 3rd gain switchover threshold in performance priority mode (with one decimal place).

H01.61 **4th gain switchover threshold in performance priority mode**

Address:	0x013D	Effective mode:	At once

Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	200.0	Change mode:	At once

Range:
0.0% to 300.0%
Parameter description
Displays the 4th gain switchover threshold in performance priority mode (with one decimal place).

H01.62 **Phase U/V 7860 detection protection threshold**

Address:	0x013E	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	320	Data type:	UInt16
Default:	280	Change:	Unmodifiable

Range:
0 to 320
Parameter description
Displays the protection threshold of phase U/V overcurrent detection.

H01.63 **Serial encoder data transmission compensation time**

Address:	0x013F	Effective mode:	Effective upon next power-on
Minimum:	0.00	Unit:	-
Maximum:	10.00	Data type:	UInt16
Default:	0.00	Change:	At stop

Range:
0.00 to 10.00
Parameter description
Displays the data transmission compensation time of the serial encoder (with three decimal places).

7.3 H02 Basic Control Parameters

H02.00 **Control mode selection**

Address:	0x0200	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	6	Data type:	UInt16
Default:	1	Change:	At stop

Range:

0: Speed control mode
1: Position control mode 2: Torque control mode 3: Torque<->Speed control mode 4: Speed<->Position control mode 5: Torque<->Position control mode 6: Torque<->Speed<->Position compound mode

Parameter description

0: Speed control mode
1: Position control mode 2: Torque control mode 3: Torque<->Speed control mode 4: Speed<->Position control mode 5: Torque<->Position control mode 6: Torque<->Speed<->Position compound mode

<table>
<tr><th>Set value</th><th>Control mode</th><th>Remarks</th></tr>
<tr><td>0</td><td>Speed control mode</td><td>For speed mode parameter settings, see the "Basic Functions of the Servo Drive" section in the user guide.</td></tr>
<tr><td>1</td><td>Position control mode</td><td>For position mode parameter settings, see the "Basic Functions of the Servo Drive" section in the user guide.</td></tr>
<tr><td>2</td><td>Torque control mode</td><td>For torque mode parameter settings, see the "Basic Functions of the Servo Drive" section in the user guide.</td></tr>
<tr><td>3</td><td>3: Torque control mode <-> Speed control mode</td><td>Set a DI terminal for FunIN.10: M1_SEL (Mode switchover 1) and determine terminal logic.<table><tr><th>M1_SEL Terminal Logic</th><th>Control mode</th></tr><tr><td>OFF</td><td>Torque control mode</td></tr><tr><td>ON</td><td>Speed control mode</td></tr></table></td></tr>
<tr><td>4</td><td>Speed control mode<->Position control mode</td><td>Set a DI terminal for FunIN.10: M1_SEL (Mode switchover 1) and determine terminal logic.<table><tr><th>M1_SEL Terminal Logic</th><th>Control mode</th></tr><tr><td>OFF</td><td>Speed control mode</td></tr><tr><td>ON</td><td>Position control mode</td></tr></table></td></tr>
<tr><td>5</td><td>Torque control mode<->Position control mode</td><td>Set a DI terminal for FunIN.10: M1_SEL (Mode switchover 1) and determine terminal logic.<table><tr><th>M1_SEL Terminal Logic</th><th>Control mode</th></tr><tr><td>OFF</td><td>Torque control mode</td></tr><tr><td>ON</td><td>Position control mode</td></tr></table></td></tr>
<tr><td>6</td><td>Torque control mode<->Speed control mode<->Position control mode</td><td>Set two DI terminal for FunIN.10: M1_SEL (Mode switchover 1) and FunIN.11: M2_SEL (Mode switchover 2), respectively and determine terminal logic.<table><tr><th>M2_SEL Terminal Logic</th><th>M1_SEL Terminal Logic</th><th>Control mode</th></tr><tr><td>OFF</td><td>OFF</td><td>Torque control mode</td></tr><tr><td>ON</td><td>OFF</td><td>Speed control mode</td></tr><tr><td>-</td><td>ON</td><td>Position control mode</td></tr></table></td></tr>
</table>

H02.01 **Absolute position detection system**

Address:	0x0201	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Incremental position mode

1: Absolute position linear mode

2: Absolute position rotating mode

Parameter description

Used to set the absolute position function.

H02.02 **Forward direction selection**

Comm. address:	0x0202	Effective mode:	Next power-on
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:

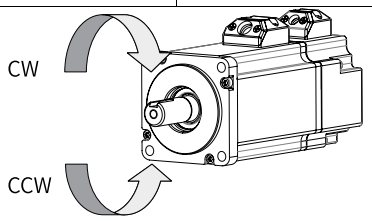
0: CCW direction as the forward direction

1: CW direction as the forward direction

Description

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

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



H02.03 **Output pulse phase**

Address:	0x0203	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

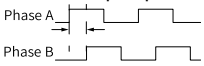
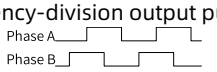
Range:

0: Phase A leads phase B

1: Phase A lags behind phase B

Parameter description

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

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

H02.05 **Disable operation option code**

Address:	0x0205	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Coast to stop, keeping de-energized state

1: Stop at zero speed, keeping de-energized state

2: Stop at zero speed, keeping dynamic braking state

3: Dynamic braking stop, keeping dynamic braking state

Parameter description

Defines the deceleration mode of the motor for stopping rotating upon S-ON OFF and the motor status after stop.

H02.06 **Fault reaction option code**

Address:	0x0206	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	2	Change:	At stop

Range:

0: Coast to stop, keeping de-energized state

1: Stop at zero speed, keeping de-energized state

2: Stop at zero speed, keeping dynamic braking state

3: Dynamic braking stop, keeping dynamic braking state

4: Dynamic braking stop, keeping de-energized status

Parameter description

Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when a No. 2 fault occurs.

H02.07 **Stop mode at limit switch signal**

Address:	0x0207	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	1	Change:	At stop

Range:

0: Coast to stop, keeping de-energized state

1: Stop at zero speed, keeping position lock state

2: Stop at zero speed, keeping de-energized state

Parameter description

Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when overtravel occurs.

H02.08 **Stop mode at No.1 fault**

Address:	0x0208	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	2	Change:	At stop

Range:

0: Coast to stop, keeping de-energized state

1: Dynamic braking stop; keeping de-energized state

2: Dynamic braking stop, keeping dynamic braking state

Parameter description

Defines the deceleration mode of the servo motor for stopping rotating and the servo motor status when a No. 1 fault occurs.

H02.09 **Delay from brake output on to command received**

Address:	0x0209	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	500	Data type:	UInt16
Default:	250	Change mode:	At once

Range:

0 to 500

Parameter description

Defines the delay from the moment the brake output signal is ON to the moment the servo drive starts to receive commands after power-on.

H02.10 **Delay from brake output OFF to motor de-energized in static state**

Address:	0x020A	Effective mode:	At once
Minimum:	1	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	150	Change mode:	At once

Range:

1 to 1000

Parameter description

Defines the delay from the moment brake output is OFF to the moment when the motor at standstill enters the de-energized status.

H02.11 **Motor speed threshold at brake output off in rotating state**

Address:	0x020B	Effective mode:	At once

Minimum:	0	Unit:	rpm
Maximum:	3,000	Data type:	UInt16
Default:	30	Change mode:	At once

Range:
0 to 3000
Parameter description
Defines the motor speed threshold when brake (BK) output is OFF in the rotation state.

H02.12 **Delay from S-ON off to brake output off in the rotating state**

Address:	0x020C	Effective mode:	At once
Minimum:	1	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	500	Change mode:	At once

Range:
1 to 1000
Parameter description
Defines the delay from the moment the S-ON signal is OFF to the moment the brake (BK) output signal is OFF in the rotating state.

H02.14 **Speed threshold for stop mode and stop status switchover**

Address:	0x020E	Effective mode:	At once
Minimum:	10	Unit:	rpm
Maximum:	100	Data type:	UInt16
Default:	10	Change:	At stop

Range:
10rpm~100rpm
Parameter description
Defines the speed threshold for stop mode and stop status switchover.

H02.15 **LED warning display selection**

Address:	0x020F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0: Alarm information output immediately
1: Alarm information not output
Parameter description
Defines whether to switch the keypad to the fault display mode when a No. 3 fault occurs.

H02.17 **Stop at zero speed upon main circuit power-off**

Address:	0x0211	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At stop

Range:

0: Disable

1: Enable

Parameter description

Defines the stop mode of the motor for stopping rotating upon main circuit power failure.

H02.18 **S-ON filter time constant**

Address:	0x0212	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	64	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0 ms~64ms

Parameter description

Defines the S-ON filter time constant.

H02.19 **Brake release delay upon S-ON**

Address:	0x0213	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0 ms to 1000 ms

Parameter description

Defines the delay time from servo ON to brake release.

H02.20 **Energizing delay of DB relay coil**

Address:	0x0214	Effective mode:	At once
Minimum:	10	Unit:	ms
Maximum:	30000	Data type:	UInt16
Default:	30	Change mode:	At once

Range:

10 to 30000

Parameter description

Defined based on hardware dynamic brake relay response time

H02.21 **Minimum allowable resistance of braking resistor**

Comm. address:	0x0215	Effective mode:	-
Min. value:	1	Unit:	Ω
Max. value:	1000	Data type:	UInt16
Default value:	40	Change mode:	Read-only

Value range:

1 to 1000

Description

The minimum allowable resistance of the braking resistor is only related to the drive model.

The minimum allowable resistance varies with the drive model. The following table describes the specifications of braking resistors.

Table 7–1 Braking resistor specifications

Drive model	Specifications of built-in braking resistor			External braking resistor Min. allowable resistance (Ω) (H02.21)
	Resistance (Ω)	Power Pr (W)	Processing power Pa (W)	
SV660PS1R6I	-	-	-	40
SV660PS2R8I	-	-	-	40
SV660PS5R5I	50	50	25	40
SV660PS7R6I	25	80	40	20
SV660PS012I				15
SV660PT3R5I	100	80	40	80
SV660PT5R4I	100	80	40	60
SV660PT8R4I	50	80	40	45
SV660PT012I				40
SV660PT017I	35	100	50	35
SV660PT021I				25
SV660PT026I				

Note

The built-in braking resistor is not available in S1R6 or S2R8 models. For these models, you can install an external braking resistor as needed.

H02.22 **Power of built-in regenerative resistor**

Address:	0x0216	Effective mode:	-
Minimum:	1	Unit:	W
Maximum:	65535	Data type:	UInt16
Default:	40	Change:	Unmodifiable

Range:

1W–65535W

Parameter description

The power of the built-in regenerative resistor is dependent on the drive model and cannot be modified.

H02.23 **Resistance of built-in regenerative resistor**

Address:	0x0217	Effective mode:	-
Minimum:	1	Unit:	Ω
Maximum:	1,000	Data type:	UInt16
Default:	50	Change:	Unmodifiable

Range:

1 Ω~1000Ω

Parameter description

The resistance of the built-in regenerative resistor is dependent on the drive model and cannot be modified.

Table 7–2 Specifications of the Braking Resistor

Servo drive model (SV660, SV630)	Specifications of built-in braking resistor		External regenerative resistor Min. allowable resistance (Ω) (H02.21)
	Resistance (Ω)	Power Pr (W)	
SV6*0PS1R6I	-	-	50
SV6*0PS2R8I	-	-	45
SV6*0PS5R5I	50	50	40
SV6*0PS7R6I	25	80	20
SV6*0PS012I			15
SV6*0PT3R5I	100	80	80
SV6*0PT5R4I	100	80	60
SV6*0PT8R4I	50	80	45
SV6*0PT012I			40
SV6*0PT017I	35	100	35
SV6*0PT021I			25
SV6*0PT026I			

H02.24 **Resistor heat dissipation coefficient**

Address:	0x0218	Effective mode:	At once
Minimum:	10	Unit:	-
Maximum:	100	Data type:	UInt16
Default:	30	Change:	At stop

Range:

10 to 100

Parameter description

Defines the heat dissipation coefficient of the braking resistor,

It sets the heat dissipation coefficient of the regenerative resistor, which is valid for both built-in and external ones.

Set H02.24 properly according to actual heat dissipation conditions of the resistor.

Recommendations:

Generally, the value of H02.24 cannot exceed 30% for natural cooling or 50% for forced air cooling.

H02.25 **Regenerative resistor type**

Address:	0x0219	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Built-in

1: External, natural ventilated

2: External, forced air cooling

3: Not needed

Parameter description

Defines the resistor type and the mode of absorbing and releasing the braking energy.

Set value	Defines the regenerative resistor type and the mode of absorbing and releasing the braking energy.	Remarks
0	Built-in	When the calculated value of the maximum braking energy is larger than the maximum braking energy absorbed by capacitors, and the calculated value of braking power is no larger than the built-in regenerative resistor power.
1	External, naturally ventilated	When the calculated value of the maximum braking energy is larger than the maximum braking energy absorbed by capacitors, and the calculated value of braking power is larger than the built-in regenerative resistor power.
2	External, forcible cooling	When the calculated value of the maximum braking energy is larger than the maximum braking energy absorbed by capacitors, and the calculated value of braking power is larger than the built-in regenerative resistor power.
3	No resistor, using only capacitor	When the calculated value of maximum braking energy is no larger than the maximum braking energy absorbed by capacitors.

H02.26 **Power of external braking resistor**

Address:	0x021A	Effective mode:	At once
Minimum:	1	Unit:	W
Maximum:	65535	Data type:	UInt16
Default:	40	Change:	At stop

Range:

1W–65535W

Parameter description

Defines the power of the external braking resistor.

H02.27 **Resistance of external regenerative resistor**

Address:	0x021B	Effective mode:	At once
Minimum:	1	Unit:	Ω
Maximum:	1,000	Data type:	UInt16
Default:	50	Change:	At stop

Range:

1 Ω~1000Ω

Parameter description

Defines the resistance of the external braking resistor.

H02.28 **Minimum bus voltage of 220 V voltage class**

Address:	0x021C	Effective mode:	Effective upon next power-on
Minimum:	190	Unit:	V
Maximum:	260	Data type:	UInt16
Default:	235	Change:	At stop

Range:

190 V~260V

Parameter description

Defines the minimum bus voltage of 220 V voltage class.

H02.30 **User Password**

Address:	0x021E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0–65535

Parameter description

Defines the user password.

H02.31 **System parameter initialization**

Address:	0x021F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No operation

1: Restore default settings

2: Clear fault records

Parameter description

Used to restore default values or clear fault log.

Set value	Stop mode	Remarks
0	No operation	-
1	Restore default setting	Restore parameters to default values except parameters in groups H00 and H01.
2	Clear fault records	Clear the latest 10 faults and warnings.

H02.32 **Default keypad display**

Address:	0x0220	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	50	Change:	At once

Range:

0 to 99

Parameter description

According to the setting, the keypad can switch to monitoring parameter display mode (parameters in group H0b) automatically. H02.32 is used to set the offset in group H0b.

Set value	Parameters in group H0b	Remarks
0	H0b.00	Motor speed is not zero, the keypad displays the setting of H0b.00 (Actual motor speed).
1	H0b.01	The keypad displays the setting of H0b.01 (speed reference).

H02.34 CAN software version

Address:	0x0222	Effective mode:	-
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	0.00	Change:	Unmodifiable

Range:

0.00 to 655.35

Parameter description

Displays the CAN software version.

H02.35 Keypad display refresh frequency

Address:	0x0223	Effective mode:	At once
Minimum:	0	Unit:	Hz
Maximum:	20	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 to 20

Parameter description

Defines the keypad data refresh frequency.

H02.37 Bus voltage hold time

Address:	0x0225	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	ms
Maximum:	3,000	Data type:	UInt16
Default:	150	Change mode:	At once

Range:

0 ms~3000ms

Parameter description

Used to set the hold time of bus voltage before the soft-start relay closes.

H02.41 Manufacturer password

Address:	0x0229	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0–65535
Parameter description
Enter the manufacturer password to enable the manufacturer protection parameters.

7.4 H03 Terminal Input Parameters

H03.00 **States of DI functions FunIN1 to 16**

Address:	0x0300	Effective mode:	Effective upon next power-on
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	At once

Range:
0: Corresponding to null
1: Corresponding to FunIN.1
2: Corresponding to FunIN.2
4: Corresponding to FunIN.3
8: Corresponding to FunIN.4
16: Corresponding to FunIN.5
32: Corresponding to FunIN.6
64: Corresponding to FunIN.7
128: Corresponding to FunIN.8
256: Corresponding to FunIN.9
512: Corresponding to FunIN.10
1024: Corresponding to FunIN.11
2048: Corresponding to FunIN.12
4096: Corresponding to FunIN.13
8192: Corresponding to FunIN.14
16384: Corresponding to FunIN.15
32768: Corresponding to FunIN.16
Parameter description
Used to enable a certain DI function (FunIN.1 to FunIN.16) to be activated immediately at next power-on.

H03.01 **States of DI functions FunIN17 to 32**

Address:	0x0301	Effective mode:	Effective upon next power-on
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	At once

Range:

0: Corresponding to null
1: Corresponding to FunIN.17
2: Corresponding to FunIN.18
4: Corresponding to FunIN.19
8: Corresponding to FunIN.20
16: Corresponding to FunIN.21
32: Corresponding to FunIN.22
64: Corresponding to FunIN.23
128: Corresponding to FunIN.24
256: Corresponding to FunIN.25
512: Corresponding to FunIN.26
1024: Corresponding to FunIN.27
2048: Corresponding to FunIN.28
4096: Corresponding to FunIN.29
8192: Corresponding to FunIN.30
16384: Corresponding to FunIN.31

Parameter description

Used to enable a certain DI function (FunIN.17 to FunIN.31) to be activated immediately at next power-on.

H03.02 **DI1 function selection**

Address:	0x0302	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	14	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI1.

H03.03 **DI1 logic selection**

Address:	0x0303	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

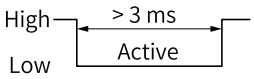
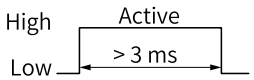
0: Active low

1: Active high

Parameter description

It sets the level logic of DI1 for enabling the DI1 function. DI1 to DI5 are standard DIs, and DI8 to DI9 are high-speed DIs.

Table 7–3 Signal logic of low-speed DI terminals

Set value	Terminal logic when DI function valid	Remarks
0	Low level	
1	High level	

H03.04 **DI2 terminal function selection**

Address:	0x0304	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	15	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI2.

H03.05 **DI2 terminal logic selection**

Address:	0x0305	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Low level active

1: High level active

Parameter description

Defines the level logic of DI2 when the function assigned to DI2 is active. DI1 to DI5 are standard DIs, and DI8 to DI9 are high-speed DIs.

H03.06 **DI3 terminal function selection**

Address:	0x0306	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	13	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI3.

H03.07 **DI3 terminal logic selection**

Address:	0x0307	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Low level active

1: High level active

Parameter description

It sets the level logic of DI3 for enabling the DI3 function. DI1 to DI5 are standard DIs, and DI8 to DI9 are high-speed DIs.

H03.08 **DI4 terminal function selection**

Address:	0x0308	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	2	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI4.

H03.09 **DI4 terminal logic selection**

Address:	0x0309	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Low level active

1: High level active

Parameter description

It sets the level logic of DI4 for enabling the DI4 function. DI1 to DI5 are standard DIs, and DI8 to DI9 are high-speed DIs.

H03.10 **DI5 terminal function selection**

Address:	0x030A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI5.

H03.11 **DI5 terminal logic selection**

Address:	0x030B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Low level active

1: High level active

Parameter description

It sets the level logic of DI5 for enabling the DI5 function. DI1 to DI5 are standard DIs, and DI8 to DI9 are high-speed DIs.

H03.16 **DI8 terminal function selection**

Address:	0x0310	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	31	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI8.

H03.17 **DI8 terminal logic selection**

Address:	0x0311	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

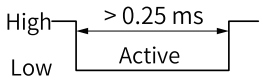
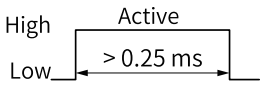
0: Active low

1: Active high

Parameter description

It sets the level logic of DI8 for enabling the DI8 function. DI8 and DI9 are high-speed DIs. The width of the input signal must be higher than 0.25 ms.

Table 7–4 Signal logic of high-speed DI terminals

Set value	Terminal logic when DI function valid	Remarks
0	Low level	
1	High level	

H03.18 **DI9 terminal function selection**

Address:	0x0312	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the function of DI9.

H03.19 **DI9 terminal logic selection**

Address:	0x0313	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Low level active

1: High level active

Parameter description

It sets the level logic of DI9 for enabling the DI9 function. DI8 and DI9 are high-speed DIs. The width of the input signal must be higher than 0.25 ms.

H03.34 **DI function assignment 3 (activated upon power-on)**

Comm. address:	0x0322	Effective mode:	Next power-on
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Real time

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

Used to enable a certain DI function (FunIN.33 to FunIN.47) to be activated immediately at next power-on.

H03.35 **States of DI functions FunIN49 to 64**

Address:	0x0323	Effective mode:	Effective upon next power-on
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change mode:	At once

Range:

0: 0x0 - Corresponding to null
1: 0x1 - Corresponding to FunIN.49
2: 0x2 - Corresponding to FunIN.50
4: 0x4 - Corresponding to FunIN.51
8: 0x8 - Corresponding to FunIN.52
16: 0x10 - Corresponding to FunIN.53
32: 0x20 - Corresponding to FunIN.54
64: 0x40 - Corresponding to FunIN.55
128: 0x80 - Corresponding to FunIN.56
256: 0x100 - Corresponding to FunIN.57
512: 0x200 - Corresponding to FunIN.58
1024: 0x400 - Corresponding to FunIN.59
2048: 0x800 - Corresponding to FunIN.60
4096: 0x1000 - Corresponding to FunIN.61
8192: 0x2000 - Corresponding to FunIN.62
16384: 0x4000 - Corresponding to FunIN.63

Parameter description

Used to enable a certain DI function (FunIN.49 to FunIN.64) to be activated immediately at next power-on.

H03.60 **DI1 filter**

Address:	0x033C	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	At once

Range:

0.00 to 500.00

Parameter description

Defines the filter time of DI1. The DI function is active only after the active level is kept for the time defined by H03.60.

H03.61 **DI2 filter**

Address:	0x033D	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	At once

Range:

0.00 to 500.00

Parameter description

Defines the filter time of DI2. The DI function is active only after the active level is kept for the time defined by H03.61.

H03.62 **DI3 filter**

Address:	0x033E	Effective mode:	At once
Minimum:	0.00	Unit:	ms

Maximum:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	At once

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI3. The DI function is active only after the active level is kept for the time defined by H03.62.

H03.63 **DI4 filter**

Address:	0x033F	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	At once

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI4. The DI function is active only after the active level is kept for the time defined by H03.63.

H03.64 **DI5 filter**

Address:	0x0340	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	500.00	Data type:	UInt16
Default:	3.00	Change mode:	At once

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI5. The DI function is active only after the active level is kept for the time defined by H03.64.

H03.65 **DI8 filter 1**

Address:	0x0341	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	500.00	Data type:	UInt16
Default:	0.00	Change mode:	At once

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI8. The DI function is active only after the active level is kept for the time defined by H03.65.

H03.66 **DI9 filter 1**

Address:	0x0342	Effective mode:	At once
Minimum:	0.00	Unit:	ms

Maximum:	500.00	Data type:	UInt16
Default:	0.00	Change mode:	At once

Range:
0.00 to 500.00
Parameter description
Defines the filter time of DI9. The DI function is active only after the active level is kept for the time defined by H03.66.

7.5 H04 Terminal Output Parameters

H04.00 **DO1 terminal function selection**

Address:	0x0400	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	1	Change mode:	At once

Range:
0: No function
1: Servo ready
2: Motor rotation
3: Zero speed signal
4: Speed consistent
5: Positioning completed
6: Positioning near
7: Torque limit
8: Speed limit
9: Braking
10: Warning
11: Fault
12: Output 3-digit alarm code
13: Output 3-digit alarm code
14: Output 3-digit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reached
19: Speed reached
20: Angle auto-tuning output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed
26: Servo enabled to receive operating command
27: Fault or alarm

Parameter description

Defines the function of DO1.

H04.01 DO1 logic selection

Address:	0x0401	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

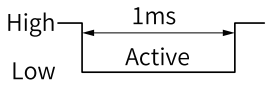
Range:

0: Output low (L) level when active (optocoupler ON)

1: Output high (H) level when active (optocoupler OFF)

Parameter description

Defines the level logic of DO1 when the function assigned to DO1 is active. DO1 to DO5 are low-speed DO terminals and their minimum output signal width is 1 ms.

Set value	DO1 Logic When DO1 Function Enabled	Transistor State	Remarks
0	Low level	ON	
1	High level	OFF	

H04.02 DO2 terminal function selection

Address:	0x0402	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	5	Change mode:	At once

Range:

0: No function
1: Servo ready
2: Motor rotation
3: Zero speed signal
4: Speed consistent
5: Positioning completed
6: Positioning near
7: Torque limit
8: Speed limit
9: Braking
10: Warning
11: Fault
12: Output 3-digit alarm code
13: Output 3-digit alarm code
14: Output 3-digit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reached
19: Speed reached
20: Angle auto-tuning output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed
26: Servo enabled to receive operating command
27: Fault or alarm

Parameter description

Defines the function of DO2.

H04.03 **DO2 logic selection**

Address:	0x0403	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Output low level (L) when active (optocoupler ON)
1: Output high level (H) when active (optocoupler OFF)

Parameter description

Defines the level logic of DO2 when the function assigned to DO2 is active. DO1 to DO5 are low-speed DO terminals and their minimum output signal width is 1 ms.

H04.04 **DO3 terminal function selection**

Address:	0x0404	Effective mode:	At once
Minimum:	0	Unit:	-

Maximum:	27	Data type:	UInt16
Default:	9th	Change mode:	At once

Range:

0: No function
1: Servo ready
2: Motor rotation
3: Zero speed signal
4: Speed consistent
5: Positioning completed
6: Positioning near
7: Torque limit
8: Speed limit
9: Braking
10: Warning
11: Fault
12: Output 3-digit alarm code
13: Output 3-digit alarm code
14: Output 3-digit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reached
19: Speed reached
20: Angle auto-tuning output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed
26: Servo enabled to receive operating command
27: Fault or alarm

Parameter description

Defines the function of DO3.

H04.05 **DO3 logic level selection**

Comm. address:	0x0405	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	Real time

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 DO3 when the function assigned to DO3 is active. DO1 to DO5 are low-speed DO terminals and their minimum output signal width is 1 ms.

H04.06 **DO4 terminal function selection**

Address:	0x0406	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	11	Change mode:	At once

Range:

0: No function
1: Servo ready
2: Motor rotation
3: Zero speed signal
4: Speed consistent
5: Positioning completed
6: Positioning near
7: Torque limit
8: Speed limit
9: Braking
10: Warning
11: Fault
12: Output 3-digit alarm code
13: Output 3-digit alarm code
14: Output 3-digit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reached
19: Speed reached
20: Angle auto-tuning output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed
26: Servo enabled to receive operating command
27: Fault or alarm

Parameter description

Defines the function of DO4.

H04.07 **DO4 logic level selection**

Comm. address:	0x0407	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	Real time

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 DO4 when the function assigned to DO4 is active. DO1 to DO5 are low-speed DO terminals and their minimum output signal width is 1 ms.

H04.08 **DO5 terminal function selection**

Address:	0x0408	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	16	Change mode:	At once

Range:

0: No function
1: Servo ready
2: Motor rotation
3: Zero speed signal
4: Speed consistent
5: Positioning completed
6: Positioning near
7: Torque limit
8: Speed limit
9: Braking
10: Warning
11: Fault
12: Output 3-digit alarm code
13: Output 3-digit alarm code
14: Output 3-digit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reached
19: Speed reached
20: Angle auto-tuning output
21: DB brake output
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed
26: Servo enabled to receive operating command
27: Fault or alarm

Parameter description

Defines the function of DO5.

H04.09 **DO5 logic selection**

Comm. address:	0x0409	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	Real time

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 DO5 when the function assigned to DO5 is active. DO1 to DO5 are low-speed DO terminals and their minimum output signal width is 1 ms.

H04.22 DO source

Address:	0x0416	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:

bit0: DO1

0: DO1 function output

1: bit0 of H31.04

bit1: DO2

0: DO2 function output

1: bit1 of H31.04

bit2: DO3

0: DO3 function output

1: bit2 of H31.04

bit3: DO4

0: DO4 function output

1: bit3 of H31.04

bit4: DO5

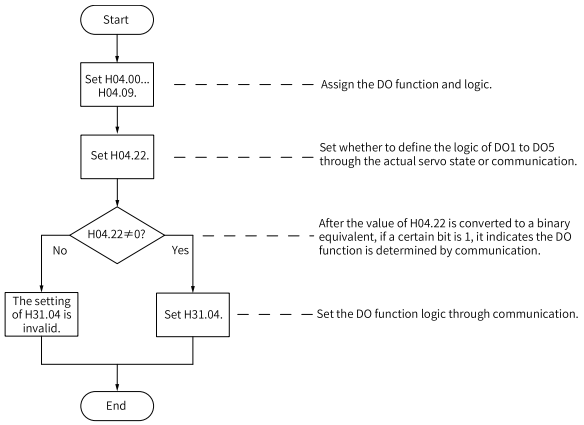
0: DO5 function output

1: bit4 of H31.04

Parameter description

Defines whether the logic of a physical DO terminal is defined by the actual state of the drive or by communication.

Value Range (Decimal)	Setpoint (binary)					DO logic	
	bit4	bit 3	bit2	bit1	bit0	Defined by the drive state	Defined by Communica-tion (H31.04)
	DO5	DO4	DO3	DO2	DO1		
0	0	0	0	0	0	DO1-DO5	None
1	0	0	0	0	1	DO2-DO5	DO1
…	…	…	…	…	…	…	…
31	1	1	1	1	1	None	DO1-DO5



7.6 H05 Position Control Parameters

H05.00 **Main position reference source**

Comm. address:	0x0500	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	2	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:

0: Pulse reference

1: Step amount

2: Multi-position reference

Description

Defines the position reference source in position control mode.

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

H05.01 **Position pulse reference input terminal selection**

Comm. address:	0x0501	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	At stop

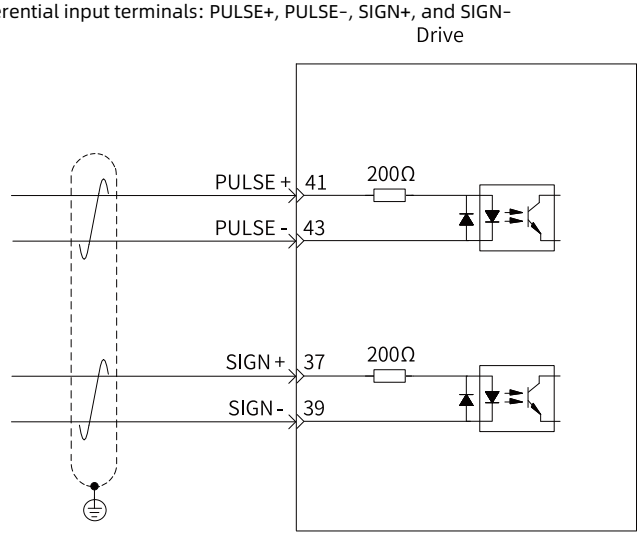
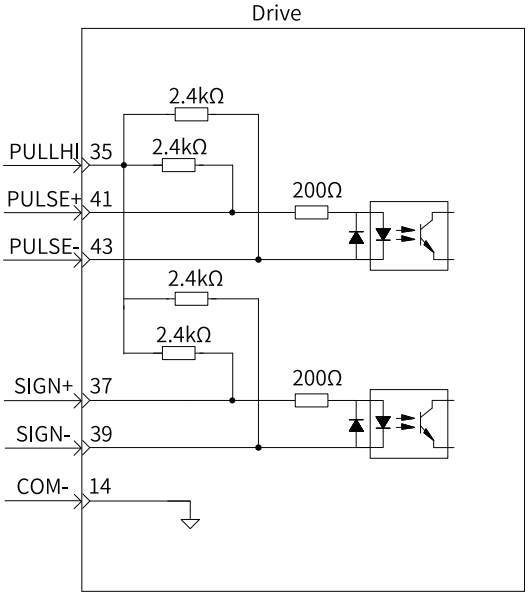
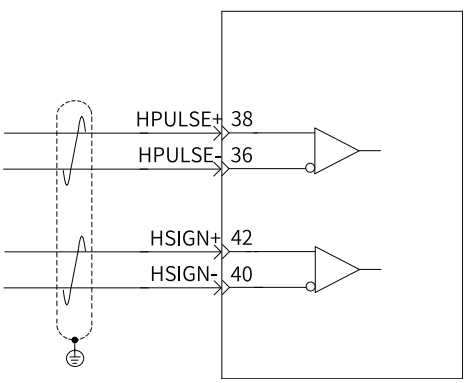
Value range:

0: Low speed

1: High speed

Description

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

Setpoint	Input terminal	Description
0	Low speed	Differential input terminals: PULSE+, PULSE-, SIGN+, and SIGN-  Max. pulse frequency: 200 kpps
		Open-collector input terminals: PULLHI, PULSE+, PULSE-, SIGN+, and SIGN-  Max. pulse frequency: 200 kbps
1	High speed	Differential input terminals: HPULSE+, HPULSE-, HSIGN+, HSIGN-  Max. pulse frequency: 4 Mbps.

H05.02 **Pulses per revolution**

Address:	0x0502	Effective mode:	At once
Minimum:	0	Unit:	P/Rev
Maximum:	1048576	Data type	UInt32
Default:	0	Change:	At stop

Range:

0 P/Rev–1048576 P/Rev

Parameter description

Sets the number of position references when the motor rotates one revolution.

H05.04 **Time constant of first-order low-pass filter**

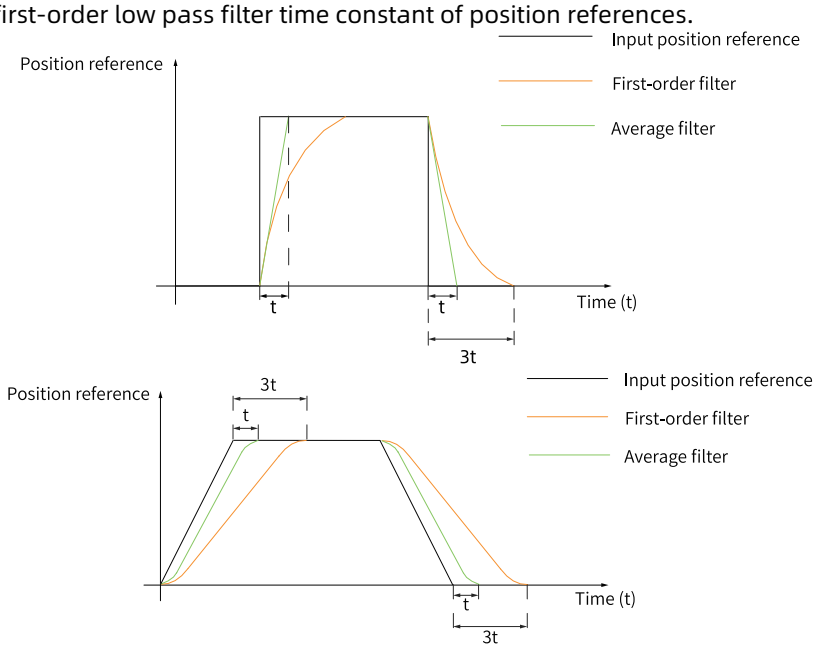
Address:	0x0504	Effective mode:	At once
Minimum:	0.0	Unit:	ms
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	At stop

Range:

0.0 ms to 6553.5ms

Parameter description

Defines the first-order low pass filter time constant of position references.



H05.05 **Step size**

Address:	0x0505	Effective mode:	At once
Minimum:	-9999	Unit:	Reference unit
Maximum:	9999	Data type	Int16
Default:	50	Change:	At stop

Range:

-9999 to +9999

Parameter description

Defines the position reference sum when the step reference acts as the main position reference source.

H05.06 **Time constant of moving average filter**

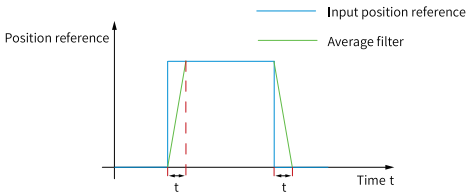
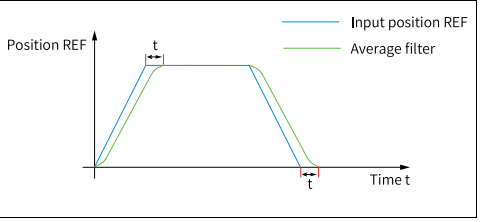
Address:	0x0506	Effective mode:	At once
Minimum:	0.0	Unit:	ms
Maximum:	128.0	Data type:	UInt16
Default:	0.0	Change:	At stop

Range:

0.0 to 128.0

Parameter description

Defines the moving average filter time constant of position references.

Position Reference Being Rectangular Wave	Position Reference Being Trapezoidal Wave
	

H05.07 **Electronic gear ratio 1 (numerator)**

Comm. address:	0x0507	Effective mode:	Real time
Min. value:	1	Unit:	-
Max. value:	1073741824	Data type:	UInt32
Default value:	8388608	Change mode:	Real time

Value range:

1 to 1073741824

Description

Defines the numerator of electronic gear ratio 1 for encoder unit conversion to user unit.

The default value matches the actual encoder bits and is adaptive to the program. The gear ratio is the number of encoder bits divided by 10000.

H05.09 **Electronic gear ratio 1 (denominator)**

Comm. address:	0x0509	Effective mode:	Real time
Min. value:	1	Unit:	-
Max. value:	1073741824	Data type:	UInt32
Default value:	10000	Change mode:	Real time

Value range:

1 to 1073741824

Description

Defines the denominator of electronic gear ratio 1 for encoder unit conversion to user unit.

H05.11 **Electronic gear ratio 2 (numerator)**

Comm. address:	0x050B	Effective mode:	Real time
Min. value:	1	Unit:	-
Max. value:	1073741824	Data type:	UInt32
Default value:	8388608	Change mode:	Real time

Value range:
1 to 1073741824
Description
Defines the numerator of electronic gear ratio 2 for encoder unit conversion to user unit.

The default value matches the actual encoder bits and is adaptive to the program. The gear ratio is the number of encoder bits divided by 10000.

H05.13 **Electronic gear ratio 2 (denominator)**

Comm. address:	0x050D	Effective mode:	Real time
Min. value:	1	Unit:	-
Max. value:	1073741824	Data type:	UInt32
Default value:	10000	Change mode:	Real time

Value range:
1 to 1073741824
Description
Defines the denominator of electronic gear ratio 2 for encoder unit conversion to user unit.

H05.15 **Pulse input format**

Comm. address:	0x050F	Effective mode:	Next power-on
Min. value:	0	Unit:	-
Max. value:	3	Data type:	UInt16
Default value:	0	Change mode:	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 7–5 Pulse forms

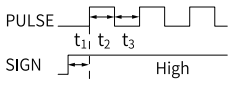
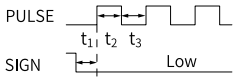
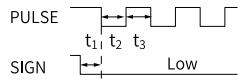
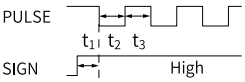
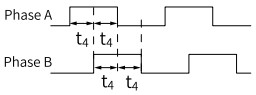
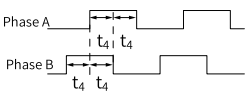
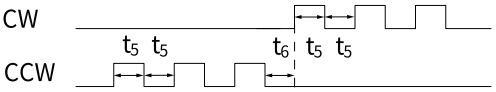
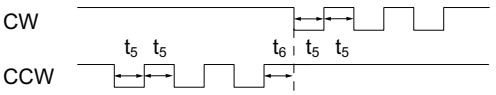
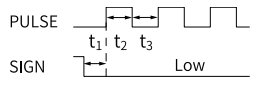
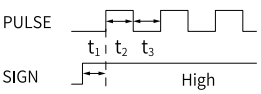
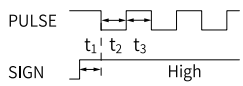
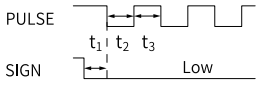
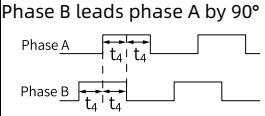
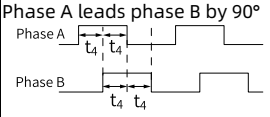
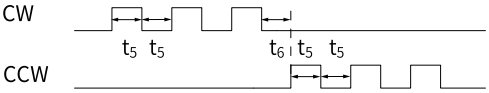
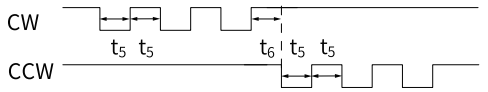
H02.02 Direction of rotation	H05.15 Reference form settings	Pulse form	Signal	Diagram of forward pulses	Diagram of reverse pulses
0	0	Pulse + direction Positive logic	PULSE SIGN		
	1	Pulse + direction Negative logic	PULSE SIGN		
	2	Phase A + phase B Quadrature pulse 4-frequency multiplication	PULSE (phase A) SIGN (phase B)	Phase A leads phase B by 90° 	Phase B leads phase A by 90° 
	3	CW + CCW	PULSE (CW) SIGN (CCW)	 	
1	0	Pulse + direction Positive logic	PULSE SIGN		
	1	Pulse + direction Negative logic	PULSE SIGN		
	2	Phase A + phase B Quadrature pulse 4-frequency multiplication	PULSE (phase A) SIGN (phase B)	Phase B leads phase A by 90° 	Phase A leads phase B by 90° 
	3	CW + CCW	PULSE (CW) SIGN (CCW)	 	

Table 7–6 Pulse reference specifications

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

H05.16 **Clear action selection**

Comm. address:	0x0510	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	2	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:

0: Clear position deviation upon S-OFF and fault

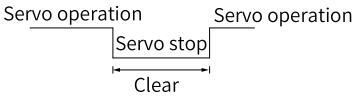
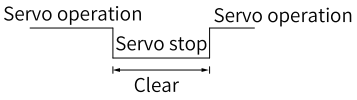
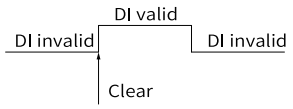
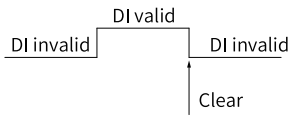
1: Clear position deviation pulses upon S-OFF and fault

2: Clear position deviation by ClrPosErr signal input from DI

Description

Defines the condition for clearing the position deviation.

Table 7–7 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.	
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 valid)  (Falling edge valid)

H05.17 **Encoder frequency-division pulses**

Address:	0x0511	Effective mode:	Effective upon next power-on
Minimum:	35	Unit:	P/Rev
Maximum:	32767	Data type:	UInt16
Default:	2500	Change:	At stop

Range:

35 P/Rev–32767 P/Rev

Parameter description

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

Pulse output resolution per revolution = (H05.17) x 4

H05.19 **Speed feedforward control selection**

Address:	0x0513	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16

Default:	1	Change:	At stop

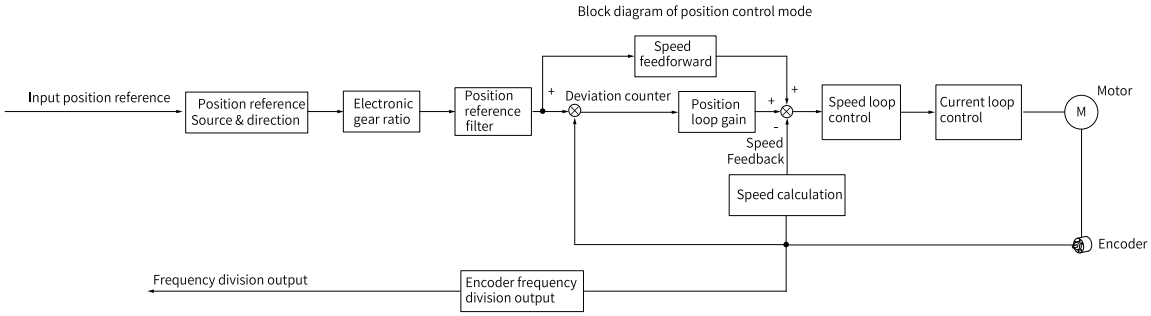
Range:

0: No speed feedforward

1: Internal speed feedforward

Parameter description

It sets the source of the speed loop feedforward signal.



H05.20 Condition for positioning completed signal output

Comm. address:	0x0514	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	3	Data type:	UInt16
Default value:	0	Change mode:	Real time

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 position control mode, if the absolute value of the position deviation during operation is within the setpoint of H05.21, the drive outputs the positioning completed/proximity signal. You can set the condition for outputting the positioning completed/proximity signal in H05.20.

H05.21 Threshold of positioning completion

Comm. address:	0x0515	Effective mode:	Real time
Min. value:	1	Unit:	Encoder unit
Max. value:	65535	Data type:	UInt16
Default value:	5872	Change mode:	Real time

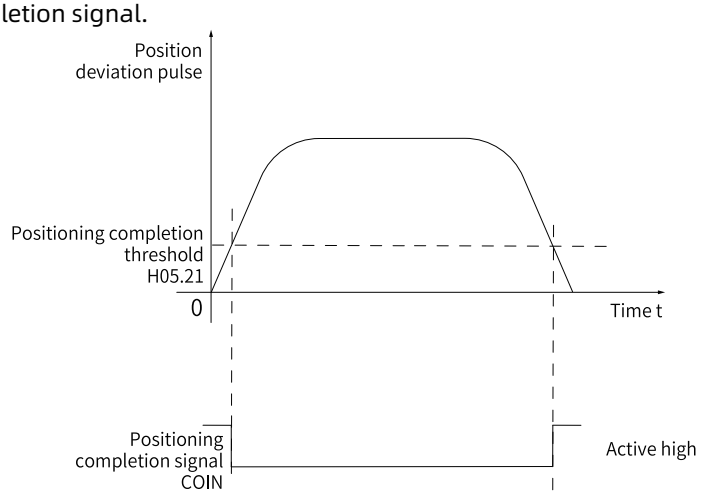
Value range:

1 to 65535

Description

The default value is adaptive to the program.

It defines the threshold of the absolute value of position deviation when the drive outputs the positioning completion signal.



H05.22 Positioning near threshold

Address:	0x0516	Effective mode:	At once
Minimum:	1	Unit:	Encoder unit
Maximum:	65535	Data type:	UInt16
Default:	65535	Change mode:	At once

Range:

1 to 65535

Parameter description

Defines the threshold of the absolute value of position deviation when the drive outputs the proximity signal.

H05.23 Interruption fixed length

Address:	0x0517	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Disabled

1: Enabled

Parameter description

0: Disabled

1: Enabled

H05.24 Displacement of interruption fixed length

Address:	0x0518	Effective mode:	At once
Minimum:	0	Unit:	Reference unit
Maximum:	1073741824	Data type	UInt32
Default:	10,000	Change mode:	At once

Range:
0 to 1073741824
Parameter description
Defines the position reference for interrupt positioning.

H05.26 **Constant speed for interruption fixed length**

Address:	0x051A	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change:	At once

Range:
0rpm~7000rpm
Parameter description
Defines the maximum speed during interrupt positioning.

Table 7–8 Motor speed for interrupt positioning

H05.26	Motor speed before function triggered	Interrupt Positioning	Constant speed for interruption fixed length
0	< 10	OFF	-
	≥ 10	ON	Motor speed before function triggered
1 to 7000	-	ON	H05.26

H05.27 **Acceleration/Deceleration time of interruption fixed length**

Address:	0x051B	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms to 1000 ms
Parameter description
Defines the time for the motor to accelerate from 0 RPM to 1000 RPM or decelerate from 1000 RPM to 0 RPM for interrupt positioning.

The actual motor acceleration time t during interrupt positioning is:

$$t = \frac{|\text{H05.26-Motor speed before interrupt positioning}|}{1000} \times (\text{H05.27})$$

H05.29 **Interruption fixed length unlock**

Address:	0x051D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At once

Range:
0: Disable
1: Enable

Parameter description

Sets whether to unlock the interrupt positioning signal.

Set value	Interrupt positioning cancel signal	Remarks
0	Disabled	After interrupt positioning is completed, the servo drive responds to the other position references directly.
1	Enable	• After interrupt positioning is completed, the servo drive does not directly respond to other position references. • After you enable the DI function 29 (FunIN.29: XintFree, unlock interrupt positioning), the servo drive can respond to other position references.

H05.30 Control of home return

Address:	0x051E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	8	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Disabled

1: Homing enabled through the HomingStart signal input from DI

2: Electrical homing enabled through the HomingStart signal input from DI

3: Homing started immediately upon power-on

4: Homing executed immediately

5: Electrical homing started

6: Current position as home

8: DI-triggered position as home

Parameter description

Defines the homing mode and the trigger signal source.

Set value	Trigger signal	Remarks	
		Mode of home return	Trigger signal
0	Disabled	The homing function is disabled.	
1	Homing enabled through HomingStart signal input from DI	Homing	DI function FunIN.32 (HomingStart, homing enable)
2	Electrical homing enabled through HomingStart signal input from DI	Electrical homing	DI function FunIN.32 (HomingStart, homing enable)
3	Homing started immediately upon power-on	Homing	S-ON signal active for the first time after power-on again in the position mode
4	Homing started immediately	Homing	S-ON signal active in the position mode After homing is done, set H05.30 to 0.
5	Electrical homing started	Electrical homing	S-ON signal active in the position mode After homing is done, set H05.30 to 0.
6	Homing on current position	Homing	Not required After homing is done, set H05.30 to 0.
8	Current position as the home enabled through signal input from DI	Homing	DI signal FunIN.41 (current position as the home)

H05.31 Mode of home return

Address:	0x051F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	16	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Forward homing, home switch as the deceleration point and the home
1: Reverse homing, home switch as the deceleration point and the home
2: Forward homing, Z signal as deceleration point and home
3: Reverse homing, Z signal as deceleration point and home
4: Forward homing, home switch as the deceleration point and motor Z signal as the home
5 - Reverse homing, home switch as the deceleration point and motor Z signal as the home
6: Forward homing, deceleration point and home being positive limit switch
7: Reverse homing, deceleration point and home being negative limit switch
8: Forward homing, deceleration point being positive limit switch and home being motor Z signal
9: Reverse homing, deceleration point being negative limit switch and home being motor Z signal
10: Forward homing, deceleration point and home being mechanical final limit position
11: Reverse homing, deceleration point and home being mechanical final limit position
12: Forward homing, deceleration point being mechanical final limit position and home being motor Z signal
13: Reverse homing, deceleration point being mechanical final limit position and home being motor Z signal
14: Forward single-turn homing
15: Reverse single-turn homing
16: Single-turn homing to the nearest reference point

Parameter description

Defines the default motor direction of rotation, deceleration point, and home during homing.

H05.32 **Speed of home switch signal at high-speed searching**

Address:	0x0520	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	3,000	Data type:	UInt16
Default:	100	Change mode:	At once

Range:

0 to 3000

Parameter description

Defines the motor speed for searching for the deceleration point signal during homing.

H05.33 **Speed of low-speed homing**

Address:	0x0521	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	1,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 rpm to 1000 rpm

Parameter description

Defines the motor speed for searching for the home signal during homing.

H05.34 **Acceleration/Deceleration time during homing**

Address:	0x0522	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	1,000	Change mode:	At once

Range:

0 ms to 1000 ms

Parameter description

Defines the time for the motor to accelerate from 0 rpm to 1000 rpm at a constant speed during homing.

H05.35 **Duration limit of homing**

Address:	0x0523	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10,000	Change mode:	At once

Range:

0ms~65535ms

Parameter description

It sets maximum time for searching the home.

H05.36 **Mechanical origin offset**

Address:	0x0524	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	0	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Defines the absolute position value of the motor after homing.

H05.38 **Servo pulse output source**

Address:	0x0526	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Encoder frequency division output

1: Pulse reference synchronous output

2: Frequency division or synchronous output inhibited

Parameter description

It sets the output source of the pulse output terminal.

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

The pulse output terminals are as follows:

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

H05.39 Electronic gear ratio switchover condition

Address:	0x0527	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Switchover after position reference is kept 0 for 2.5 ms

1: Switched in real time

Parameter description

Defines the electronic gear ratio switchover condition.

Set value	Switchover conditions	Remarks
0	Switching after the position pulse reference kept 0 for 2.5 ms	Allocate a DI terminal with the DI function 24 (FunIN.24: GEAR_SEL, electronic gear ratio switchover).
1	Switchover in real time	

H05.40 Mechanical home offset and action upon active limit signal

Address:	0x0528	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16

Default: 0 Change: At stop

Range:

0: H05.36 as the coordinate after homing, reverse homing applied after homing triggered again upon overtravel

1: H05.36 as the relative offset after homing, reverse homing applied after homing triggered again upon overtravel

2: H05.36 as the coordinate after homing, reverse homing applied automatically upon overtravel

3: H05.36 as the relative offset after homing, reverse homing applied automatically upon overtravel

Parameter description

Defines the offset relationship between the mechanical home and mechanical zero, as well as the action upon overtravel during homing.

Set value	Mechanical home offset and action upon active limit signal	Remarks	
		Mechanical home	Action upon Active Limit Signal
0	H05.36 as the coordinate after homing, reverse homing applied after homing triggered again on overtravel	The mechanical home differs from the mechanical zero point. After homing, the motor stops at the home position and the home coordinate is forced to the displacement defined by H05.36.	After the homing enable signal is sent again, the servo drive performs homing in the reverse direction.
1	H05.36 as the relative offset after homing, reverse homing triggered on hitting the limit	The mechanical home is the same as the mechanical zero. After positioning the mechanical home, the motor continues to move according to the setting of H05.36 and then stops.	After the homing enable signal is sent again, the servo drive performs homing in the reverse direction.
2	H05.36 as the coordinate after homing, reverse homing auto-applied on overtravel	The mechanical home differs from the mechanical zero point. After homing, the motor stops at the home position and the home coordinate is forced to the displacement defined by H05.36.	The servo drive automatically continuous to perform homing in the reverse direction.
3	H05.36 as the relative offset after homing, reverse homing auto-applied on overtravel	The mechanical home is the same as the mechanical zero. After positioning the mechanical home, the motor continues to move according to the setting of H05.36 and then stops.	The servo drive automatically continuous to perform homing in the reverse direction.

H05.41 **Z pulse output polarity**

Address:	0x0529	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At stop

Range:

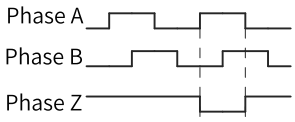
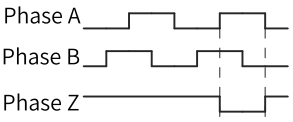
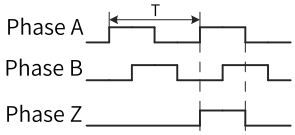
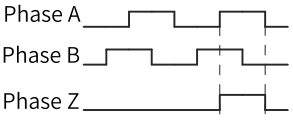
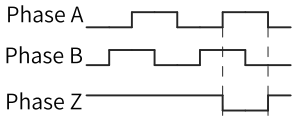
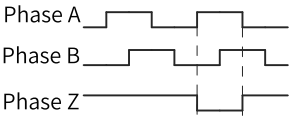
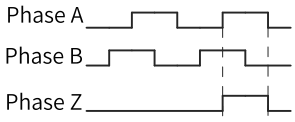
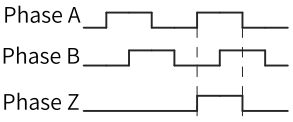
1: Negative (low level upon active Z pulse)

0: Positive (high level upon active Z pulse)

Parameter description

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

Table 7–9 Pulse diagrams of encoder frequency-division (H05.38 = 0)

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

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

H05.41 = 0: Triggered by falling-edge; H05.41 = 1: Triggered by rising-edge

H05.43 **Position pulse edge**

Address:	0x052B	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Valid at the falling edge

1: Active at rising edge

Parameter description

Defines the valid edge of pulse reference. When it is set to 0, the falling edge of the pulse is valid. When it is set to 1, the rising edge of the pulse is valid.

H05.44 Encoder multi-turn data offset

Address:	0x052C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0–65535

Parameter description

Defines the multi-turn position offset of the encoder.

H05.46 Position offset in absolute position linear mode (low 32 bits)

Address:	0x052E	Effective mode:	At once
Minimum:	-2147483648	Unit:	Encoder unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	At stop

Range:

-2147483648 to 2147483647

Parameter description

When H02.01 (Absolute system selection) is set to 1 (Absolute position linear mode), position offset in absolute position linear mode equals the difference between present encoder absolute position and mechanical position (encoder unit).

H05.48 Position offset in absolute position linear mode (high 32 bits)

Address:	0x0530	Effective mode:	At once
Minimum:	-2147483648	Unit:	Encoder unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	At stop

Range:

-2147483648 to 2147483647

Parameter description

When H02.01 (Absolute system selection) is set to 1 (Absolute position linear mode), position offset in absolute position linear mode equals the difference between present encoder absolute position and mechanical position (encoder unit).

H05.50 Mechanical gear ratio in absolute position rotation mode (numerator)

Address:	0x0532	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	1	Change:	At stop

Range:

1 to 65535

Parameter description

Defines the transmission ratio between the mechanical rotary load and the motor in the absolute position rotation mode.

H05.51 Mechanical gear ratio in absolute position rotation mode (denominator)

Address:	0x0533	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	1	Change:	At stop

Range:

1 to 65535

Parameter description

Defines the transmission ratio between the mechanical rotary load and the motor in the absolute position rotation mode.

H05.52 Pulses per revolution of the load in absolute position rotation mode (low 32 bits)

Address:	0x0534	Effective mode:	At once
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	At stop

Range:

0 to 4294967295

Parameter description

Defines the number of pulses per revolution of the rotary load in the absolute position rotation mode.

H05.54 Pulses per revolution of the load in absolute position rotation mode (high 32 bits)

Address:	0x0536	Effective mode:	At once
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	At stop

Range:

0 to 4294967295

Parameter description

Defines the number of pulses per revolution of the rotary load in the absolute position rotation mode.

H05.56 Speed threshold in homing upon hit-and-stop

Address:	0x0538	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	1,000	Data type:	UInt16
Default:	2	Change mode:	At once

Range:

0 rpm to 1000 rpm

Parameter description

Defines the speed threshold for judging whether the load reaches the mechanical position in touch-triggered homing.

H05.57 **Mechanical limit judgment times**

Address:	0x0539	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	20	Change mode:	At once

Range:
0–65535
Parameter description
Defines the threshold of mechanical limits during touch-triggered homing.

H05.58 **Torque threshold in homing upon hit-and-stop**

Address:	0x053A	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	3,000	Data type:	UInt16
Default:	1,000	Change mode:	At once

Range:
0 %~3000%
Parameter description
Defines the maximum positive/negative torque limit in touch-triggered homing.

H05.59 **Positioning window time**

Address:	0x053B	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	30000	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 30000
Parameter description
When the position deviation remains smaller than the threshold of positioning completed for more than the time set in this parameter, the positioning completed signal can output the valid state.

H05.60 **Holding time of positioning completed**

Address:	0x053C	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	30000	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 30000
Parameter description
Defines the holding time of an active positioning completed signal.

H05.61 **Encoder frequency-division pulse output (32-bit)**

Comm. address:	0x053D	Effective mode:	Next power-on

Min. value:	0	Unit:	P/Rev
Max. value:	262143	Data type:	UInt32
Default value:	0	Change mode:	At stop

Value range:
0 to 262143
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) × 4.

H05.63 Real time update of position reference source

Address:	0x053F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0–1
Parameter description
Used to set whether the position reference source is updated in real time.

H05.66 Homing time unit

Address:	0x0542	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0: ms
1: 10 ms
2: 100 ms
Parameter description
Defines the homing time unit. The actual timeout is H05.35 x H05.66 (ms).

H05.67 Offset between zero point and single-turn absolute position

Address:	0x0543	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2147483647	Data type	UInt32
Default:	0	Change:	At stop

Range:
0 to 2147483647
Parameter description
Displays or defines the offset position relative to the home in the single-turn absolute mode (H0201 = 4).

H05.69 Auxiliary homing function

Address:	0x0545	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16

Default: 0 Change: At stop

Range:

0: Disable

1: Enable single-turn homing

2: Record offset position

3: Start a new search for the Z signal (homing)

4: Clear offset position

Parameter description

Single-turn homing mode setting

0: Disable

1: Enable single-turn homing

2: Record offset position

3: Start a new search for the Z signal (homing)

4: Clear offset position

7.7 H06 Speed Control Parameters

H06.00 **Main speed reference A source**

Address: 0x0600 Effective mode: At once

Minimum: 0 Unit: -

Maximum: 0 Data type: UInt16

Default: 0 Change: At stop

Range:

0: Digital setting (H06.03)

Parameter description

Defines the source of main speed reference A.

0: Digital setting (H06.03)

Set value	Reference source	Instruction receiving method
0	Digital setting	The source of speed reference A is set by H06.03.

H06.01 **Auxiliary speed command B source**

Address: 0x0601 Effective mode: At once

Minimum: 0 Unit: -

Maximum: 5 Data type: UInt16

Default: 5 Change: At stop

Range:

0: Digital setting (H06.03)

5: Multi-speed reference

Parameter description

Defines the source of auxiliary speed reference B.

Set value	Reference source	Instruction receiving method
0	Digital setting	The source of speed reference A is set by H06.03.
1	-	-
2	-	-
3	-	-
4	-	-
5	Multi-speed reference	The source of auxiliary speed reference B is determined by internal multi-speed references. For settings of multi-speed parameters, see parameters in group H12.

H06.02 Speed reference selection

Address:	0x0602	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Source of main speed reference A

1: Source of auxiliary speed reference B

2: Source of A + B

3: Switched between A and B4: Communication

Parameter description

Defines the source of speed references.

Set value	Control mode	Remarks
0	Main speed reference A source	The reference source is defined by H06.00.
1	Auxiliary speed command B source	The reference source is defined by H06.01.
2	A + B	The reference source is the product of A + B (H06.00 + H06.01).
3	Switched between A and B	The reference source is switched between A and B as defined by FunIN.4 (Cmd_SEL).
4	Via communication	The speed reference is defined by operating on H31.09 through communication (unit: 0.001 RPM).

State of FunIN.4 (Cmd_ SEL)	Reference Source
OFF	Main speed reference A source
ON	Auxiliary speed command B source

H06.03 Keypad setting value of speed reference

Address:	0x0603	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16

Default:	200	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Defines the speed reference value set through the keypad.

H06.04 **Jog speed setting value**

Address:	0x0604	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
0rpm~7000rpm
Parameter description
Defines the DI jog speed reference.

H06.05 **Acceleration ramp time constant of speed reference**

Address:	0x0605	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

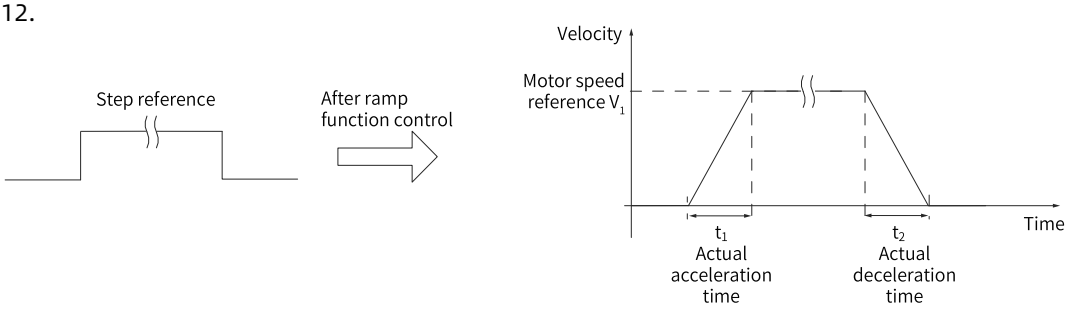
Range:
0ms~65535ms
Parameter description
Defines the acceleration/deceleration ramp time of speed reference. The acceleration/deceleration time constant of multi-speed references are defined only by parameters in group H12.
Parameter H06.05 defines the time for the speed reference to change from 0 RPM to 1000 RPM.
Parameter H06.06 defines the time for the speed reference to change from 1000 RPM to 0 RPM.
The formulas of calculating the actual acceleration and deceleration time are as follows:
Actual acceleration time t1 = Speed reference/1000 x Acceleration ramp time of speed reference
Actual deceleration time t2 = Speed reference/1000 x Deceleration ramp time of speed reference

H06.06 **Deceleration ramp time constant of speed reference**

Address:	0x0606	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0ms~65535ms
Parameter description

Defines the acceleration/deceleration ramp time of speed reference. The acceleration/deceleration time constant of multi-speed references are defined only by parameters in group H12.



Parameter H06.05 defines the time for the speed reference to change from 0 RPM to 1000 RPM.
Parameter H06.06 defines the time for the speed reference to change from 1000 RPM to 0 RPM.
The formulas of calculating the actual acceleration and deceleration time are as follows:

$$\text{Actual acceleration time } t_1 = \frac{\text{Speed reference}}{1000} \times \text{Speed reference acceleration ramp time}$$

$$\text{Actual deceleration time } t_2 = \frac{\text{Speed reference}}{1000} \times \text{Speed reference deceleration ramp time}$$

Actual acceleration time t1 = Speed reference/1000 x Acceleration ramp time of speed reference
Actual deceleration time t2 = Speed reference/1000 x Deceleration ramp time of speed reference

H06.07 **Max. speed limit**

Address:	0x0607	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	6,000	Change mode:	At once

Range:
0rpm~7000rpm
Parameter description
Defines the maximum speed limit.

H06.08 **Forward speed threshold**

Address:	0x0608	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	6,000	Change mode:	At once

Range:
0rpm~7000rpm
Parameter description
Defines the forward speed threshold.

H06.09 **Reverse speed threshold**

Address:	0x0609	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16

Default:	6,000	Change mode:	At once

Range:

0rpm~7000rpm

Parameter description

Defines the reverse speed threshold.

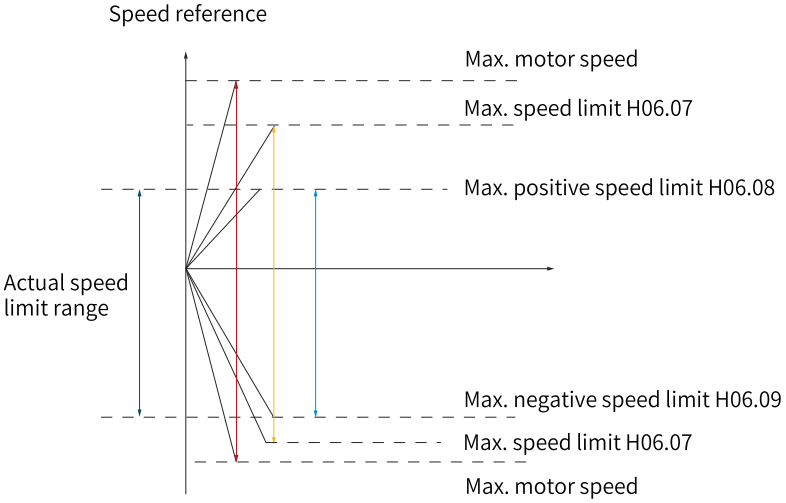


Figure 7-1 Example of speed reference limit

H06.11 **Torque feedforward control**

Address:	0x060B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At once

Range:

0: No torque feedforward

1: Internal torque feedforward

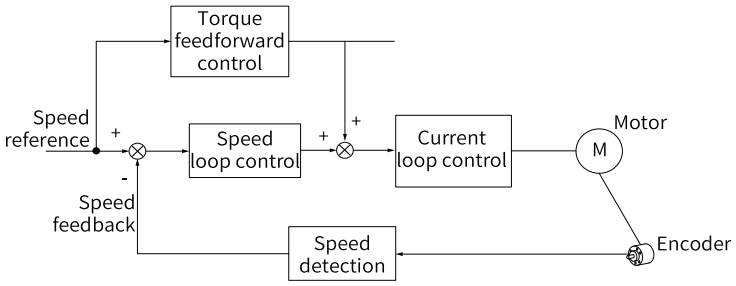
Parameter description

Defines the source for torque feedforward control.

It sets whether to enable the internal torque feedforward function in non-torque control mode. The torque feedforward function can improve the torque reference response and reduce the position deviation during fixed acceleration/deceleration.

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

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



H06.13 **Speed smoothing time**

Address:	0x060D	Effective mode:	At once
Minimum:	0	Unit:	μs
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 μs to 65535 μs
Parameter description
Defines the speed feedforward smoothing filter time.

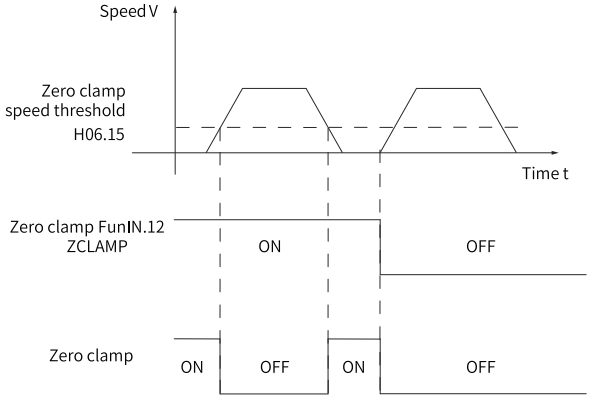
H06.15 **Speed threshold for zero speed clamp**

Address:	0x060F	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0rpm~7000rpm

Parameter description

Defines the zero clamp speed threshold.



H06.16 Motor rotation speed threshold

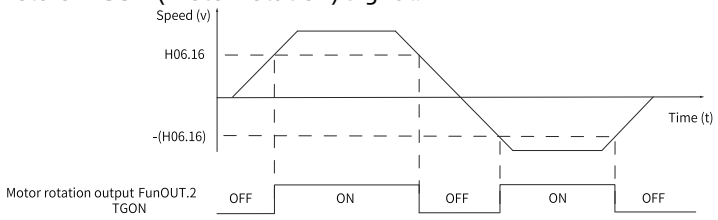
Address:	0x0610	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	1,000	Data type:	UInt16
Default:	20	Change mode:	At once

Range:

0 rpm to 1000 rpm

Parameter description

Defines the threshold of TGON (motor rotation) signal.



H06.17 Threshold of speed match signal

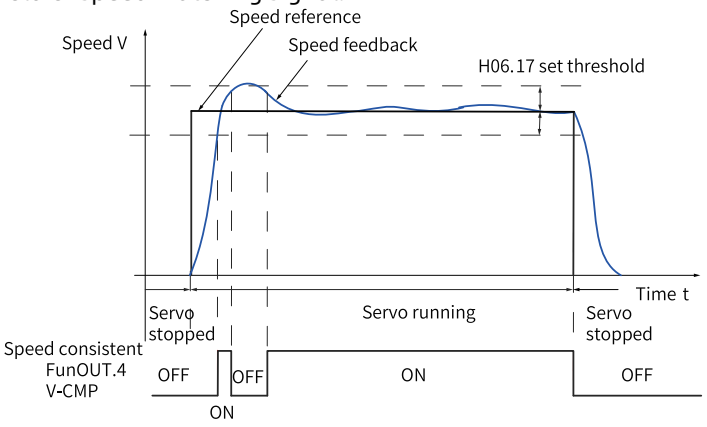
Address:	0x0611	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	100	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 RPM –100 RPM

Parameter description

Defines the threshold of speed matching signal.



H06.18 **Threshold of speed reached signal**

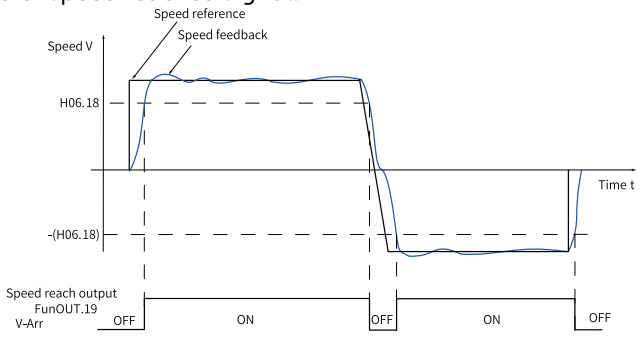
Address:	0x0612	Effective mode:	At once
Minimum:	10	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	1,000	Change mode:	At once

Range:

10rpm~7000rpm

Parameter description

Defines the threshold of speed reached signal.



H06.19 **Threshold of zero speed output signal**

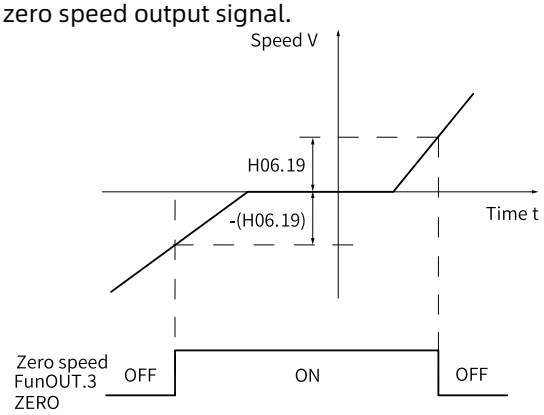
Address:	0x0613	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Defines the threshold of zero speed output signal.



H06.28 Cogging torque ripple compensation

Address:	0x061C	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: Disable

1: Enable

Parameter description

Used to enable the cogging torque fluctuation compensation function.

H06.31 SIN frequency

Address:	0x061F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	16000	Data type:	UInt16
Default:	50	Change mode:	At once

Range:

0 to 16000

Parameter description

Used to set the SIN frequency.

H06.32 SIN amptitude

Address:	0x0620	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	30000	Data type:	UInt16
Default:	30	Change mode:	At once

Range:

0 to 30000

Parameter description

Defines the sine reference amplitude.

H06.33 **Sine reference enable**

Address:	0x0621	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Disabled

1: Position reference sine

2: Speed reference sine3: Torque reference sine

Parameter description

Used to turn on the sine references.

H06.35 **SIN offset**

Address:	0x0623	Effective mode:	At once
Minimum:	-9900	Unit:	-
Maximum:	9900	Data type	Int16
Default:	0	Change mode:	At once

Range:

-9900 to 9900

Parameter description

Used to set the SIN command offset.

7.8 H07 Torque Control Parameters

H07.00 **Sources of main torque reference A**

Address:	0x0700	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	0	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: H07.03

Parameter description

Defines main torque reference A.

Set value	Reference source	Instruction receiving method
0	Keypad (H07.03)	Torque reference A is set by H07.03.

H07.02 **Torque reference source**

Address:	0x0702	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Main torque command A source

4: Communication

Parameter description

Selects the torque reference.

Set value	Control mode	Remarks
0	Sources of main torque reference A	The reference source is defined by H07.00.
4	Via communication	The torque reference is defined by operating on H31.11 through communication.

H07.03 Keypad setting value of torque reference

Address:	0x0703	Effective mode:	At once
Minimum:	-400.0	Unit:	%
Maximum:	400.0	Data type	Int16
Default:	0.0	Change mode:	At once

Range:

-400.0 %~400.0%

Parameter description

Defines the torque reference value set through keypad.

H07.05 Time constant of torque reference filter

Address:	0x0705	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	30.00	Data type:	UInt16
Default:	0.50	Change mode:	At once

Range:

0.00 to 30.00

Parameter description

Defines the torque reference filter time constant 1.

H07.06 2nd time constant of torque reference filter

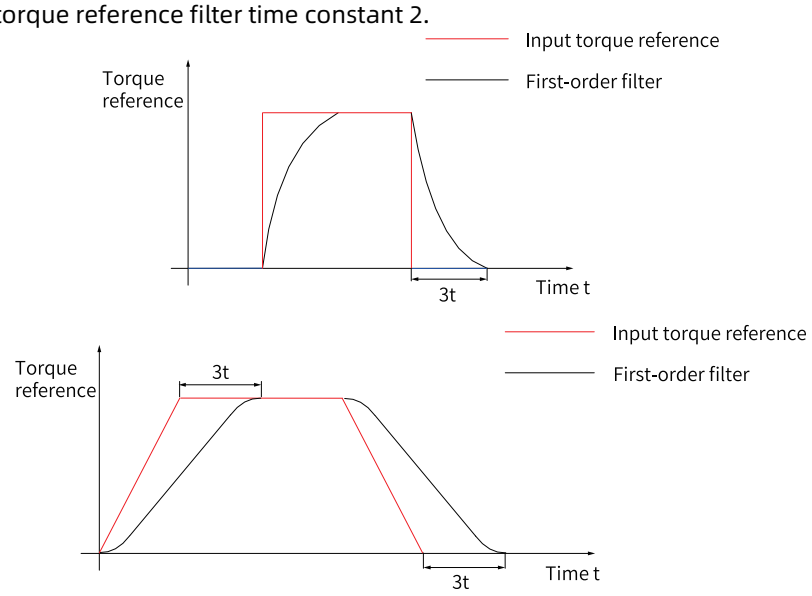
Address:	0x0706	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	30.00	Data type:	UInt16
Default:	0.27	Change mode:	At once

Range:

0.00 to 30.00

Parameter description

Defines the torque reference filter time constant 2.



Note

- The servo drive offers two low-pass filters for torque references, in which the low-pass filter 1 is used by default.
- The gain switchover function can be used In the position or speed control mode. Once certain conditions are satisfied, you can switch to low-pass filter 2.

H07.07 **Torque limit source**

Address:	0x0707	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Forward/Reverse internal torque limit (default)

1: Forward/Reverse external torque limit (selected through P-CL and N-CL)

Parameter description

Defines the torque limit source.

H07.09 **Internal forward torque limit**

Address:	0x0709	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	At once

Range:

0.0% to 400.0%

Parameter description

Defines the positive internal torque limit.

H07.10 **Internal reverse torque limit**

Address:	0x070A	Effective mode:	At once

Minimum:	0.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	At once

Range:
0.0% to 400.0%
Parameter description
Defines the negative internal torque limit.

H07.11 External positive torque limit

Address:	0x070B	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	At once

Range:
0.0% to 400.0%
Parameter description
Defines the positive external torque limit.

H07.12 External negative torque limit

Address:	0x070C	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	350.0	Change mode:	At once

Range:
0.0% to 400.0%
Parameter description
Defines the negative external torque limit.

H07.15 Emergency stop torque

Address:	0x070F	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	100.0	Change:	At stop

Range:
0.0% to 300.0%
Parameter description
Defines the emergency stop torque.

H07.17 Speed limit source

Address:	0x0711	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Internal speed limit (in torque control)

1: 0 (no action)

2: 1st or 2nd speed limit input selected by FunIN.36

Parameter description

Defines the speed limit source.

Set value	Reference source	Description
0	Internal speed limit	The speed limit is defined by both H07.19 and H07.20.
1	-	-
2	H07.19 or H07.20 used as speed limit as defined by DI	DI (FunIN.36) inactive: H07.19 used as positive/ negative speed limit DI (FunIN.36) active: H07.20 used as positive/ negative speed limit

H07.19 Positive speed limit/Speed limit 1 in the torque control mode

Address:	0x0713	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	3,000	Change mode:	At once

Range:

0rpm~7000rpm

Parameter description

Defines the positive speed limit in torque control.

H07.20 Reverse speed limit/2nd speed limit in torque control

Address:	0x0714	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	3,000	Change mode:	At once

Range:

0rpm~7000rpm

Parameter description

Defines the negative speed limit in torque control.

H07.21 Base value for torque reached

Address:	0x0715	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:

0.0% to 300.0%

Parameter description

Defines the torque reference of the base value for torque reach.

H07.22 **Threshold of torque reached valid**

Address:	0x0716	Effective mode:	At once
Minimum:	10.0	Unit:	%
Maximum:	300.0	Data type:	UInt16
Default:	20.0	Change mode:	At once

Range:

10.0 %~300.0%

Parameter description

Defines the torque reference for valid torque reach.

H07.23 **Threshold of torque reached invalid**

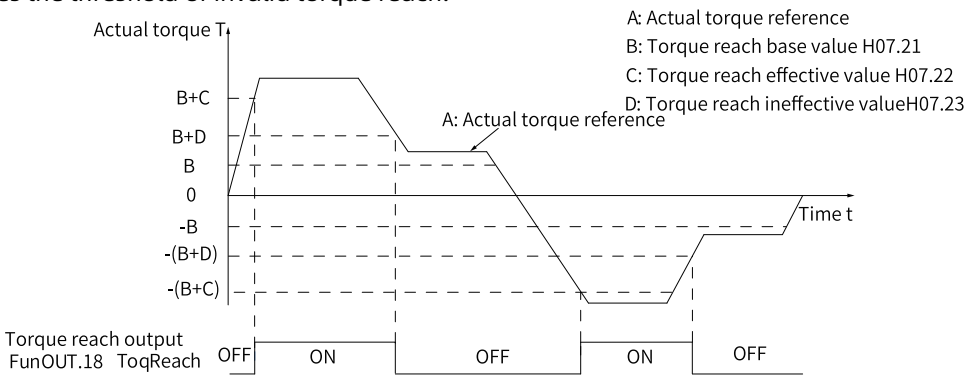
Address:	0x0717	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	52.8	Data type:	UInt16
Default:	10.0	Change mode:	At once

Range:

0.0 %~52.8%

Parameter description

Defines the threshold of invalid torque reach.



H07.24 **Field weakening depth**

Address:	0x0718	Effective mode:	At once
Minimum:	60	Unit:	%
Maximum:	120	Data type:	UInt16
Default:	115	Change mode:	At once

Range:

60 %~120%

Parameter description

Defines the flux weakening depth.

H07.25 **Maximum permissible demagnetization current**

Address:	0x0719	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	200	Data type:	UInt16

Default:	100	Change mode:	At once

Range:
0 %~200%
Parameter description
Defines the maximum permissible demagnetization current.

H07.26 **Flux weakening selection**

Address:	0x071A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:
0: Disable
1: Enable
Parameter description
Used to disable or enable field weakening.

H07.27 **Field weakening gain**

Address:	0x071B	Effective mode:	At once
Minimum:	1	Unit:	Hz
Maximum:	1,000	Data type:	UInt16
Default:	30	Change mode:	At once

Range:
1 Hz~1000Hz
Parameter description
Defines the field weakening gain.

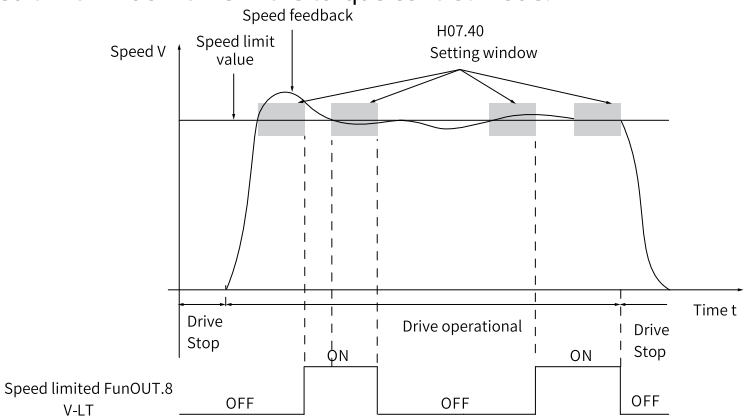
H07.40 **Time duration of speed limit in torque control mode**

Address:	0x0728	Effective mode:	At once
Minimum:	0.5	Unit:	ms
Maximum:	30.0	Data type:	UInt16
Default:	1.0	Change mode:	At once

Range:
0.5 ms~30.0ms

Parameter description

Defines the speed limit window time in the torque control mode.



Note

In the preceding figure, ON indicates that the speed limit DO signal is valid. OFF indicates that the speed limit DO signal is invalid.

7.9 H08 Gain Parameters

H08.00 **Speed loop gain**

Address:	0x0800	Effective mode:	At once
Minimum:	0.1	Unit:	Hz
Maximum:	2000.0	Data type:	UInt16
Default:	40.0	Change mode:	At once

Range:

0.1 to 2000.0

Parameter description

Defines the responsiveness of the speed loop. The higher the setpoint, the faster the speed loop response is. Note that an excessively high setpoint may cause vibration.

If the position loop gain is increased in position control mode, the speed loop gain also needs to be increased.

H08.01 **Time constant of speed loop integration**

Address:	0x0801	Effective mode:	At once
Minimum:	0.15	Unit:	ms
Maximum:	512.00	Data type:	UInt16
Default:	19.89	Change mode:	At once

Range:

0.15 to 512.00

Parameter description

It sets the integral time constant of the speed loop.

The smaller the setting is, the better integration effect will be obtained and the deviation value at stop will approach 0 more quickly.

Note:
There is no integral action when H08.01 is set to 512.00.

H08.02 **Position loop gain**

Address:	0x0802	Effective mode:	At once
Minimum:	0.0	Unit:	Hz
Maximum:	2000.0	Data type:	UInt16
Default:	64.0	Change mode:	At once

Range:
0.0 Hz to 2000.0 Hz
Parameter description
It sets the proportional gain of the position loop.
This parameter determines response of the position loop. A large position loop gain shortens the positioning time. Note that a very large setting may cause vibration.
The 1st gains include H08.00 (Speed loop gain), H08.01 (Speed loop integral time constant), H08.02, and H07.05 (Filter time constant of torque reference).

H08.03 **Second speed loop gain**

Address:	0x0803	Effective mode:	At once
Minimum:	0.1	Unit:	Hz
Maximum:	2000.0	Data type:	UInt16
Default:	75.0	Change mode:	At once

Range:
0.1 to 2000.0
Parameter description
Defines the 2nd speed loop gain.

H08.04 **Second speed loop integral time constant**

Address:	0x0804	Effective mode:	At once
Minimum:	0.15	Unit:	ms
Maximum:	512.00	Data type:	UInt16
Default:	10.61	Change mode:	At once

Range:
0.15 to 512.00
Parameter description
Defines the 2nd speed loop integral time constant.

H08.05 **Second position loop gain**

Address:	0x0805	Effective mode:	At once
Minimum:	0.0	Unit:	Hz
Maximum:	2000.0	Data type:	UInt16
Default:	120.0	Change mode:	At once

Range:
0.0 Hz to 2000.0 Hz

Parameter description

They are the 2nd gain parameters of the position loop and speed loop. The 2nd gain parameters include H08.03 (Speed loop gain), H08.04 (Speed loop integral time constant), H08.05, and H07.06 (2nd torque reference filter time constant).

H08.08 2nd gain mode setting

Address:	0x0808	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change:	At once

Range:

0: Fixed to the 1st group of gains, P/PI switched through external DI1:Switched between the 1st and 2nd group of gains as defined by H08.09

Parameter description

It sets switchover mode of the 2nd gain.

Set value	Meaning
0	Fixed at 1st gain. P/PI of speed control is switched through DI function 3 (FunIN.3: GAIN_SEL, gain switchover). • GAIN_SEL invalid: PI control • GAIN_SEL valid: P control
1	Switchover between the 1st gain and the 2nd gain, determined by H08.09. The 1st gain includes H08.00 (Speed loop gain), H08-01 (Speed loop integral time constant), H08.02 (Position loop gain), and H07.05 (Filter time constant of torque reference). The 2nd gain includes H08.03 (2nd speed loop gain), H08-04 (2nd speed loop integral time constant), H08.05 (2nd position loop gain), and H07.06 (Filter time constant of 2nd torque reference).

H08.09 Gain switchover condition

Address:	0x0809	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	10	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Fixed to the 1st gain (PS)

1: Switched by external DI (PS)

2: Torque reference too large (PS)

3: Speed reference too large (PS)

4: Speed reference change rate too large (PS)

5: Speed reference high-speed/low-speed thresholds (PS)

6: Position deviation too large (P)

7: Position reference available (P)

8: Positioning not completed (P)

9: Actual speed (P)

10: Position reference available+Actual speed (P)

Parameter description

Defines the gain switchover condition.

Set value	Gain Switchover Condition	Remarks
0	Fixed at 1st gain	The 1st gain is always used.
1	Switchover via DI	-
2	Torque reference being large	If the torque reference absolute value exceeds (Level + Dead time) [%] in the last 1st gain set, the drive switches to the 2nd gain set. If the absolute value of the torque reference is lower than (level – Dead time) [%] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set.
3	Speed reference being large	When the absolute value of the speed reference exceeds (level + hysteresis, RPM) in the 1st gain, the drive switches over to the 2nd gain. If the absolute value of the speed reference is lower than (level - Dead time) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set.
4	Speed reference change rate being large	It is valid only in non-speed control mode. When the absolute value of the speed reference change rate exceeds (level + hysteresis, 10 RPM/s) in the 1st gain, the drive switches over to the 2nd gain. If the absolute value of the speed reference change rate is lower than (level – hysteresis) [10 rpm/s] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set. The drive always uses the 1st gain in speed control mode.
5	Speed reference high-speed/ low-speed thresholds	When the absolute value of the speed reference exceeds (level – hysteresis, RPM) in the 1st gain, the drive starts to switch over to the 2nd gain and the gain changes gradually. When the absolute value of the speed reference exceeds (level + hysteresis, RPM), the drive completely switches over to the 2nd gain. When the absolute value of the speed reference is smaller than (level + hysteresis, RPM) in the 2nd gain, the drive starts to return to the 1st gain and the gain changes gradually. When the absolute value of the speed reference reaches (level – hysteresis, RPM), the drive completely returns to the 1st gain.
6	Position deviation being large	It is valid only in fully closed-loop position control mode. When the absolute value of the position deviation exceeds (level + hysteresis, encoder unit) in the 1st gain, the drive switches over to the 2nd gain. When the absolute value of the position deviation is lower than (Level - Dead time) [encoder unit] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set. The drive always uses the 1st gain if not in position control or fully closed-loop control.
7	Position reference available	It is valid only in fully closed-loop position control mode. When the position reference is not 0 in the 1st gain, the drive switches to the 2nd gain. When the position reference is 0 and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain, the drive returns to the 1st gain set. The drive always uses the 1st gain if not in position control or fully closed-loop control.
8	Positioning uncompleted	It is valid only in fully closed-loop position control mode. When positioning is not completed in the 1st gain, the drive switches to the 2nd gain. If positioning is not completed and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the servo drive returns to the 1st gain set. The drive always uses the 1st gain if not in position control or fully closed-loop control.

Set value	Gain Switchover Condition	Remarks
9th	Large actual motor speed	It is valid only in fully closed-loop position control mode. When the absolute value of the actual motor speed exceeds (level + hysteresis, RPM) in the 1st gain, the drive switches over to the 2nd gain. If the absolute value of actual speed is lower than (Level - Dead time) [rpm] and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the drive returns to the 1st gain set. The drive always uses the 1st gain if not in position control or fully closed-loop control.
10	Position reference available + Actual speed	It is valid only in fully closed-loop position control mode. When the position reference is not 0 in the 1st gain, the drive switches to the 2nd gain. If the position reference is 0 and such status lasts within the delay defined by H08.10 (Gain switchover delay) in the 2nd gain set, the 2nd gain set applies. When the position reference is 0 and the delay defined by (H08.10) is reached, if the absolute value of actual speed is lower than (Level) [rpm], the speed loop integral time constant is fixed to the setpoint of H08.04 (2nd speed loop integral time constant), and others return to the 1st gain set; if the absolute value of actual speed does not reach (Level - Dead time) [rpm], the speed integral also returns to the setpoint of H08.01 (Speed loop integral time constant). The drive always uses the 1st gain if not in position control or fully closed-loop control.

H08.10 **Gain switchover delay**

Address:	0x080A	Effective mode:	At once
Minimum:	0.0	Unit:	ms
Maximum:	1000.0	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:
0.0 to 1000.0
Parameter description
It sets the delay when the servo drive returns from the 2nd gain to the 1st gain.

H08.11 **Gain switchover level**

Address:	0x080B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20000	Data type:	UInt16
Default:	50	Change mode:	At once

Range:
0 to 20000
Parameter description
It sets the level for gain switchover.
Gain switchover is affected by both the level and the dead time, as defined by H08.09. The unit of gain switchover level varies with the switchover condition.

H08.12 **Gain switchover hysteresis**

Address:	0x080C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20000	Data type:	UInt16

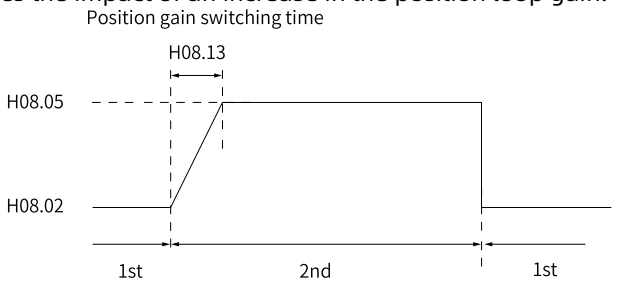
Default:	30	Change mode:	At once

Range:
0 to 20000
Parameter description
It sets the hysteresis for gain switchover.
Gain switchover is affected by both the level and the dead time, as defined by H08.09. The unit of gain switchover hysteresis varies with the switchover condition.
Note:
Set H08.11 to a value higher than or equal to H08.12. Otherwise, the drive forcibly sets H08.11 to the same value as H08.12.

H08.13 **Position gain switchover time**

Address:	0x080D	Effective mode:	At once
Minimum:	0.0	Unit:	ms
Maximum:	1000.0	Data type:	UInt16
Default:	3.0	Change mode:	At once

Range:
0.0 to 1000.0
Parameter description
In position control, if H08.05 (2nd position loop gain) is much higher than H08.02 (Position loop gain), set the time for switching from H08.02 to H08.05.
This parameter reduces the impact of an increase in the position loop gain.



H08.14 **Auto-tuned inertia value**

Address:	0x080E	Effective mode:	-
Minimum:	0.00	Unit:	-
Maximum:	120.00	Data type:	UInt16
Default:	1.00	Change:	Unmodifiable

Range:
0.00 to 120.00
Parameter description
Displays the auto-tuned inertia value.

H08.15 **Load/Rotor inertia ratio**

Address:	0x080F	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	120.00	Data type:	UInt16
Default:	2.00	Change mode:	At once

Range:
0.00 to 120.00
Parameter description
It sets the ratio of the load inertia against the rotor (of the motor) inertia.
When H08.15 is set to 0, it indicates the motor carries no load; if it is set to 1.00, it indicates the mechanical load inertia is the same as the motor moment of inertia.

H08.18 **Time constant of speed feedforward filter**

Address:	0x0812	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	64.00	Data type:	UInt16
Default:	0.50	Change mode:	At once

Range:
0.00 to 64.00
Parameter description
It sets the time constant of speed feedforward filter.

H08.19 **Speed feedforward gain**

Address:	0x0813	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	100.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:
0.0% to 100.0%
Parameter description
In position control and full closed-loop control modes, speed feedforward is the product of speed feedforward signal multiplied by H08.19 and is part of the speed reference.
Increasing this parameter improves position reference response and reduces position deviation at fixed speed.
Set H08.18 to a fixed value first, and then increase the value of H08.19 gradually from 0 to a certain value at which speed feedforward achieves the desired effect.
Adjust H08.18 and H08.19 repeatedly until a balanced performance is achieved.
Note:
For how to enable the speed feedforward function and select the speed feedforward signal, see H05.19 (Speed feedforward control).

H08.20 **Time constant of torque feedforward filter**

Address:	0x0814	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	64.00	Data type:	UInt16
Default:	0.50	Change mode:	At once

Range:
0.00 to 64.00
Parameter description
It sets the time constant of torque feedforward filter.

H08.21 **Torque feedforward gain**

Address:	0x0815	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	200.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:

0.0% to 200.0%

Parameter description

In control modes other than torque control, torque feedforward is the product of torque feedforward signal multiplied by H08.21 and is part of the torque reference.

Increasing this parameter improves response to changing speed references.

Increasing this parameter improves position reference response and reduces position deviation at fixed speed.

During parameter adjustment, set H08.20 (Torque feedforward filter time constant) to the default value first, and then increase H08.21 gradually to enhance the effect of torque feedforward.

When speed overshoot occurs, keep H08.21 unchanged and increase the value of H08.20. Adjust H08.20 and H08.21 repeatedly until a balanced performance is achieved.

Note:

For how to enable the torque feedforward function and select the torque feedforward signal, see H06.11 (Torque feedforward control).

H08.22 **Speed feedback filter option**

Address:	0x0816	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Disable

1: Two times

2: Four times

3: Eight times

4: Sixteen times

Parameter description

It sets the times of carrying out moving average filter on speed feedback.

A larger filter times causes smaller speed feedback fluctuation and larger feedback delay.

H08.23 **Cutoff frequency of speed feedback low-pass filter**

Address:	0x0817	Effective mode:	At once
Minimum:	100	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change mode:	At once

Range:

100 Hz~4000Hz

Parameter description

It sets the cutoff frequency of first-order low-pass filter on speed feedback.

Note:

The lower the setpoint, the weaker the speed feedback fluctuation, and the longer the feedback delay can be.
If this parameter is set to 4000 Hz, there is no filter.

H08.24 **PDFF control coefficient**

Address:	0x0818	Effective mode:	At once
Minimum:	0.0	Unit:	%
Maximum:	1000.0	Data type:	UInt16
Default:	100.0	Change mode:	At once

Range:
0.0 %~1000.0%
Parameter description
It sets the speed loop control mode.
When this parameter is set to 100.0, PI control (default mode) is used for speed loop, bringing rapid dynamic response.
When this parameter is set to 0.0, there is good integral effect on the speed loop, which eliminates low-frequency interference and slows dynamic response.
H08.24 can be used to keep a good responsivity of the speed loop, with anti-interference capacity in low-frequency bands improved and speed feedback overshoot unaffected.

H08.27 **Cutoff frequency of speed observer**

Address:	0x081B	Effective mode:	At once
Minimum:	10	Unit:	Hz
Maximum:	2,000	Data type:	UInt16
Default:	170	Change mode:	At once

Range:
10 Hz~2000Hz
Parameter description
Defines the cutoff frequency of the speed observer. Note that an excessively high setpoint may incur resonance. Decrease the setpoint properly in case of loud speed feedback noise.

H08.28 **Speed inertia correction coefficient**

Address:	0x081C	Effective mode:	At once
Minimum:	10	Unit:	%
Maximum:	10,000	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
10 %~10000%
Parameter description
Defines the speed observer inertia correction coefficient. If H08.15 is set based on the actual inertia, there is no need to adjust this parameter.

H08.29 **Speed observer filter time**

Address:	0x081D	Effective mode:	At once

Minimum:	0.02	Unit:	ms
Maximum:	20.00	Data type:	UInt16
Default:	0.80	Change mode:	At once

Range:
0.02 ms~20.00ms
Parameter description
Defines the speed observer filter time. It is recommended to set this parameter to a value equal to the sum of H07.05 plus 0.2 ms.

H08.31 **Disturbance compensation gain**

Address:	0x081F	Effective mode:	At once
Minimum:	1	Unit:	%
Maximum:	1700	Data type:	UInt16
Default:	600	Change mode:	At once

Range:
1 %~1700%
Parameter description
Defines the cutoff frequency of the disturbance observer. Increasing the setpoint improves the responsivity of the disturbance observer and the compensation effect. Note that an excessively high setpoint may incur resonance.

H08.32 **Disturbance observation compensation coefficient**

Address:	0x0820	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	100	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0% to 100%
Parameter description
Defines the compensation factor of the disturbance observer. The setpoint 100% indicates full compensation.

H08.33 **Disturbance inertia correction coefficient**

Address:	0x0821	Effective mode:	At once
Minimum:	1	Unit:	%
Maximum:	10,000	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
1 %~10000%
Parameter description
Defines the disturbance observer inertia correction coefficient. If H08.15 is set based on the actual inertia, there is no need to adjust this parameter.

H08.34 **Medium- and high-frequency jitter suppression phase modulation 1**

Address:	0x0822	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	1600	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 %~1600%

Parameter description

Defines the compensation phase of medium- and high-frequency jitter suppression 1.

H08.35 **Medium- and high-frequency jitter suppression frequency 1**

Address:	0x0823	Effective mode:	At once
Minimum:	0	Unit:	Hz
Maximum:	1,000	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 to 1000

Parameter description

Defines medium- and high-frequency jitter suppression frequency 1.

H08.36 **Medium- and high-frequency jitter suppression compensation 1**

Address:	0x0824	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	200	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 %~200%

Parameter description

Defines medium- and high-frequency jitter suppression compensation 1.

H08.37 **Phase modulation for medium frequency suppression 2**

Address:	0x0825	Effective mode:	At once
Minimum:	-90	Unit:	-
Maximum:	90	Data type	Int16
Default:	0	Change mode:	At once

Range:

-90–90

Parameter description

Defines the compensation phase of medium-frequency jitter suppression 2.

H08.38 **Frequency for medium frequency suppression 2**

Address:	0x0826	Effective mode:	At once
Minimum:	0	Unit:	Hz

Maximum:	1,000	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 1000
Parameter description
Set this parameter based on actual resonance frequency. The valid suppression frequency range for medium-frequency jitter suppression 2 is 100 Hz to 1000 Hz.

H08.39 Compensation gain for medium frequency suppression 2

Address:	0x0827	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	1500	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 %~1500%
Parameter description
Defines the compensation gain for medium-frequency jitter suppression 2. Set this parameter to be within the range of 40% to 55% in general cases. Setting this parameter to 0 negates the effect of medium-frequency jitter suppression 2.

H08.40 Speed observer enable

Comm. address:	0x0828	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:
0: Disable
1: Enable
Description
Defines the bit for enabling the speed observer.

H08.42 Model control selection

Address:	0x082A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0: Disable
1: Enable
Parameter description
Used to enable model tracking control.

H08.43 Model gain

Address:	0x082B	Effective mode:	At once

Minimum:	0.0	Unit:	-
Maximum:	2000.0	Data type:	UInt16
Default:	40.0	Change mode:	At once

Range:
0.0 to 2000.0
Parameter description
Defines the single inertia model gain. The higher the gain, the faster the position response. Note that an excessively high setpoint may incur excessive overshoot.

H08.45 **Feedforward position selection**

Address:	0x082D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:
0–1
Parameter description
Defines the feedforward position of single inertia model.
0: Add torque feedforward before filtering
1: Add torque feedforward after filtering

H08.46 **Model feedforward**

Address:	0x082E	Effective mode:	At once
Minimum:	0.0	Unit:	-
Maximum:	102.4	Data type:	UInt16
Default:	95.0	Change mode:	At once

Range:
0.0 to 102.4
Parameter description
Defines the speed feedforward gain for single inertia model control. If overshoot occurs, reduce the setpoint properly.

H08.51 **Model filter time 2**

Address:	0x0833	Effective mode:	At once
Minimum:	0.00	Unit:	ms
Maximum:	655.35	Data type:	UInt16
Default:	0.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Defines the model filter time 2.

H08.53 **Medium- and low-frequency jitter suppression frequency 3**

Address:	0x0835	Effective mode:	At once

Minimum:	0.0	Unit:	Hz
Maximum:	600.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:
0.0 Hz to 600.0 Hz
Parameter description
Defines the medium- and low-frequency jitter suppression frequency.

H08.54 **Medium- and low-frequency jitter suppression compensation 3**

Address:	0x0836	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	200	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 %~200%
Parameter description
Defines the medium- and low-frequency jitter suppression compensation.

H08.56 **Medium- and low-frequency jitter suppression phase modulation 3**

Address:	0x0838	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1600	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
0 to 1600
Parameter description
Defines the medium- and low-frequency jitter suppression phase.

H08.59 **Medium- and low-frequency jitter suppression frequency 4**

Address:	0x083B	Effective mode:	At once
Minimum:	0.0	Unit:	Hz
Maximum:	600.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:
0.0 Hz to 600.0 Hz
Parameter description
Defines the jitter frequency for medium- and low-frequency jitter suppression 4.

H08.60 **Medium- and low-frequency jitter suppression compensation 4**

Address:	0x083C	Effective mode:	At once
Minimum:	0	Unit:	%
Maximum:	200	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 %~200%
Parameter description
Defines the compensation gain for medium- and low-frequency jitter suppression 4.

H08.61 **Medium- and low-frequency jitter suppression phase modulation 4**

Address:	0x083D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1600	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
0 to 1600
Parameter description
Adjust this parameter based on the actual compensation effect.

H08.62 **Position loop integral time constant**

Address:	0x083E	Effective mode:	At once
Minimum:	0.15	Unit:	ms
Maximum:	512.00	Data type:	UInt16
Default:	512.00	Change mode:	At once

Range:
0.15 to 512.00
Parameter description
Defines the position loop integral time constant.

H08.63 **2nd position loop integral time constant**

Address:	0x083F	Effective mode:	At once
Minimum:	0.15	Unit:	ms
Maximum:	512.00	Data type:	UInt16
Default:	512.00	Change mode:	At once

Range:
0.15 to 512.00
Parameter description
Defines the 2nd position loop integral time constant.

H08.64 **Speed observer feedback selection**

Address:	0x0840	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0–1
Parameter description
Defines the feedback source of speed observer.

7.10 H09 Gain Auto-Tuning Parameters

H09.00 **Self-adjustment mode selection**

Address:	0x0900	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	7	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Disabled, manual gain tuning required

1: Enabled, gain parameters generated automatically based on the stiffness level

2: Positioning mode, gain parameters generated automatically based on the stiffness level3: Interpolation mode+Inertia auto-tuning

4: Standard mode+Inertia auto-tuning

6: Quick positioning mode+Inertia auto-tuning

Parameter description

Defines different gain tuning modes. Related gain parameters can be set manually or automatically according to the rigidity meter.

Set value	Meaning	Remarks
0	Disabled Gain parameters set manually	-
1	Standard stiffness level mode, gain parameters tuned automatically based on the stiffness level.	The 2nd gain does not follow the stiffness table to change automatically.
2	Positioning mode, gain parameters tuned automatically based on stiffness table	Changing automatically along with the stiffness table, the 2nd gain is always one level higher than the 1st gain, but does not exceed the highest stiffness level.
3	Interpolation mode + Inertia auto-tuning	In this mode, gain and inertia is auto-tuned and vibration is suppressed automatically according to the rigidity level. This mode is applicable to multi-axis interpolation.
4	Standerd mode + Inertia auto-tuning	The gain and inertia is auto-tuned and vibration is suppressed automatically according to the rigidity level.
6	Quick positioning mode + Inertia auto-tuning	In this mode, gain and inertia is auto-tuned and vibration is suppressed automatically according to the rigidity level. This mode is applicable to applications requiring quick positioning.

H09.01 **Stiffness level selection**

Address:	0x0901	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16

Default:	15	Change mode:	At once

Range:

0 to 41

Parameter description

It sets the stiffness level of the servo system. The higher the stiffness level is, the stronger gain and quicker response will be obtained. However, too strong stiffness will cause vibration.
The setpoint 0 indicates the lowest rigidity and 41 indicates the highest rigidity.

H09.02 Working mode of self-adaptive notch

Address:	0x0902	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Adaptive notch no longer updated;

1: One adaptive notch activated (3rd notch)

2: Two adaptive notches activated (3rd and 4th notches)

3: Resonance point tested only (displayed in H09.24)

4: Adaptive notch cleared, values of 3rd and 4th notches restored to default

Parameter description

It sets the working mode of the adaptive notch.

Set value	Meaning
0	Parameters not updated
1	Only one notch (3rd notch) valid, parameters updated in real time
2	Both notches (3rd and 4th notches) valid, parameters updated in real time
3	Only detect resonance frequency (displayed in H09.24)
4	Clear 3rd and 4th notches, restore parameters to default setting

H09.03 Online inertia auto-tuning mode

Address:	0x0903	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Disabled

1: Enabled, changing slowly

2: Enabled, changing normally3: Enabled, changing quickly

Parameter description

It sets whether to enable online inertia auto-tuning and sets the inertia ratio update speed during online inertia auto-tuning.

Set value	Online inertia auto-tuning mode	Remarks
0	Online auto-tuning disabled	-
1	Enabled, changing slowly	Applicable to the scenario where the inertia ratio almost does not change.
2	Enabled, changing normally	Applicable to the scenario where the inertia ratio changes slowly.
3	Enabled, changing quickly	Applicable to the scenario where the inertia ratio changes quickly.

H09.04 **Suppression mode of low-frequency resonance**

Comm. address:	0x0904	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:

0: Set vibration frequency manually

1: Identify vibration frequency

Description

Defines the low-frequency resonance suppression mode.

When H09.04=0, manually set parameters of low-frequency resonance suppression filter (H09.38 and H09.39);

When H09.04=1, automatically set parameters of low-frequency resonance suppression filter (H09.38 and H09.39).

H09.05 **Offline inertia auto-tuning mode**

Address:	0x0905	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Positive/Negative triangular wave mode

1: JOG mode

2: Bidirectional auto-tuning mode

3: Unidirectional auto-tuning mode

Parameter description

Defines the offline inertia auto-tuning mode. The offline inertia auto-tuning function can be enabled through H0d.02.

Set value	Meaning	Remarks
0	Positive and negative triangular wave mode	Applicable to the scenario where the motor movement travel is short.
1	Jog mode	Applicable to the scenario where the motor movement travel is long.
2	0: Bidirectional auto-tuning.	No pre-set ratio of inertia is required, suitable for applications where the motor can rotate in both directions.
3	1: Unidirectional auto-tuning	No preset ratio of inertia is required, suitable for applications where the motor can only rotate in one direction.

H09.06 Maximum speed for inertia auto-tuning

Address:	0x0906	Effective mode:	At once
Minimum:	100	Unit:	rpm
Maximum:	1,000	Data type:	UInt16
Default:	500	Change:	At stop

Range:

100 to 1000

Parameter description

It sets the permissible maximum motor speed reference in offline inertia auto-tuning mode. During inertia auto-tuning, a larger motor speed causes a more accurate auto-tuning result. Use the default value of this parameter generally.

H09.07 Time constant of accelerating to max. speed for inertia auto-tuning

Address:	0x0907	Effective mode:	At once
Minimum:	20	Unit:	ms
Maximum:	2500+	Data type:	UInt16
Default:	125	Change:	At stop

Range:

20 to 800

Parameter description

Defines the time for the motor to accelerate from 0 RPM to the maximum speed of inertia auto-tuning (H09.06) during offline inertia auto-tuning.

H09.08 Interval after an inertia auto-tuning

Address:	0x0908	Effective mode:	At once
Minimum:	50	Unit:	ms
Maximum:	10,000	Data type:	UInt16
Default:	2500+	Change:	At stop

Range:

50 to 10000

Parameter description

Defines the interval time between two consecutive speed references when H09.05 (Offline inertia auto-tuning mode) is set to 1 (Positive/Negative triangular wave mode).

H09.09 **Motor revolutions for an inertia auto-tuning**

Address:	0x0909	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.00 to 655.35
Parameter description
Defines the motor revolutions per inertia auto-tuning when H09.05 (Offline inertia auto-tuning mode) is set to 1 (Positive/Negative triangular wave mode).
Note:
When using the offline inertia auto-tuning function, check that the travel distance of the motor at the stop position is larger than the value of H09.09. If not, decrease the value of H09.06 (Maximum speed for inertia auto-tuning) or H09.07 (Time constant of accelerating to max. speed during inertia auto-tuning) properly until the motor travel distance fulfills the requirement.

H09.11 **Oscillation threshold**

Comm. address:	0x090B	Effective mode:	Real time
Min. value:	0.0	Unit:	%
Max. value:	100.0	Data type:	UInt16
Default value:	5.0	Change mode:	Real time

Value range:
0.0 to 100.0
Description
Defines the alarm threshold for current feedback vibration.

H09.12 **Group 1 notch frequency**

Address:	0x090C	Effective mode:	At once
Minimum:	50	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change mode:	At once

Range:
50 Hz~4000Hz
Parameter description
It sets the center frequency of the 1st notch, that is, mechanical resonance frequency.
If the notch frequency is 4000 Hz in torque control mode, the notch function is disabled.

H09.13 **Group 1 notch width level**

Address:	0x090D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0 to 20

Parameter description
It sets the width level of the 2nd notch. Use the default value of this parameter.
The notch width level indicates the ratio of the notch width to the notch center frequency.

H09.14 **Group 1 notch depth level**

Address:	0x090E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 99
Parameter description
It sets the depth level of the 1st notch.
The notch depth level indicates the ratio of input to output at center frequency.
The larger the setting of this parameter is, the smaller the notch depth is and the weaker the suppression effect on mechanical resonance will be. Note that a very large setting may cause system instability.

H09.15 **2nd notch frequency**

Address:	0x090F	Effective mode:	At once
Minimum:	50	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change mode:	At once

Range:
50 Hz~4000Hz
Parameter description
Defines the frequency of the 2nd notch.

H09.16 **2nd notch width level**

Address:	0x0910	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0 to 20
Parameter description
Defines the width level of the 2nd notch.

H09.17 **2nd notch depth level**

Address:	0x0911	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 to 99

Parameter description

Defines the depth level of the 2nd notch.

H09.18 **3rd notch frequency**

Address:	0x0912	Effective mode:	At once
Minimum:	50	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change mode:	At once

Range:

50 Hz~4000Hz

Parameter description

Defines the frequency of the 3rd notch.

H09.19 **3rd notch width level**

Address:	0x0913	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20	Data type:	UInt16
Default:	2	Change mode:	At once

Range:

0 to 20

Parameter description

Defines the width level of the 3rd notch.

H09.20 **3rd notch depth level**

Address:	0x0914	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 to 99

Parameter description

Defines the depth level of the 3rd notch.

H09.21 **4th notch frequency**

Address:	0x0915	Effective mode:	At once
Minimum:	50	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change mode:	At once

Range:

50 Hz~4000Hz

Parameter description

Defines the frequency of the 4th notch.

H09.22 **4th notch width level**

Address:	0x0916	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0 to 20
Parameter description
Defines the width level of the 4th notch.

H09.23 **Depth level of the 4th notch**

Address:	0x0917	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 99
Parameter description
Defines the depth level of the 4th notch.

H09.24 **Obtained resonance frequency**

Address:	0x0918	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	4,000	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:
0 to 4000
Parameter description
When H09.02 (Adaptive notch mode) is set to 3, the current mechanical resonance frequency is displayed.

H09.30 **Torque disturbance compensation gain**

Address:	0x091E	Effective mode:	At once
Minimum:	-100.0	Unit:	%
Maximum:	100.0	Data type	Int16
Default:	0.0	Change mode:	At once

Range:
-100.0% to +100.0%
Parameter description
Defines the torque disturbance compensation gain.

H09.31 **Time constant of torque disturbance observer filter**

Address:	0x091F	Effective mode:	At once
Minimum:	0.00	Unit:	ms

Maximum:	25.00	Data type:	UInt16
Default:	0.50	Change mode:	At once

Range:
0.00 ms~25.00ms
Parameter description
Defines the filter time constant of torque disturbance observer.

H09.32 Gravity compensation value

Address:	0x0920	Effective mode:	At once
Minimum:	-100.0	Unit:	-
Maximum:	100.0	Data type	Int16
Default:	0.0	Change mode:	At once

Range:
-100.0 to 100.0
Parameter description
Defines the gravity compensation value. Setting this parameter properly in vertical axis applications can reduce the falling amplitude upon start.

H09.33 Positive friction compensation

Address:	0x0921	Effective mode:	At once
Minimum:	-100.0	Unit:	%
Maximum:	100.0	Data type	Int16
Default:	0.0	Change mode:	At once

Range:
-100.0% to +100.0%
Parameter description
Defines the positive friction compensation value.

H09.34 Negative friction compensation

Address:	0x0922	Effective mode:	At once
Minimum:	-100.0	Unit:	%
Maximum:	100.0	Data type	Int16
Default:	0.0	Change mode:	At once

Range:
-100.0% to +100.0%
Parameter description
Defines the negative friction compensation value.

H09.35 Friction compensation speed threshold

Address:	0x0923	Effective mode:	At once
Minimum:	0.1	Unit:	rpm
Maximum:	30.0	Data type:	UInt16
Default:	2.0	Change mode:	At once

Range:
0.1 RPM to 30.0 RPM
Parameter description
Defines the friction compensation speed.

H09.36 **Friction compensation speed**

Address:	0x0924	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0x12	Data type:	UInt16
Default:	0x0	Change mode:	At once

Range:
0: Speed reference
1: Model tracking speed
2: Speed feedback
Parameter description
Friction compensation speed selection:
0: Slow speed mode + Speed reference
1: Slow speed mode + Model speed
2: Slow speed mode + Speed feedback

H09.38 **Low-frequency resonance suppression frequency at the mechanical end**

Address:	0x0926	Effective mode:	At once
Minimum:	1.0	Unit:	Hz
Maximum:	100.0	Data type:	UInt16
Default:	100.0	Change mode:	At once

Range:
1.0 Hz~100.0Hz
Parameter description
Set this parameter based on the actual jitter frequency.

H09.39 **Low-frequency resonance suppression at the mechanical end**

Address:	0x0927	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0 to 3
Parameter description
Defines different low-frequency resonance suppression types at the mechanical end. Type 1 features the shortest delay.

H09.41 **Frequency of the 5th notch**

Address:	0x0929	Effective mode:	At once
Minimum:	50	Unit:	Hz
Maximum:	8000	Data type:	UInt16

Default:	4,000	Change mode:	At once

Range:
50 to 8000
Parameter description
Defines the frequency of the 5th notch.

H09.42 **Width level of the 5th notch**

Address:	0x092A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	20	Data type:	UInt16
Default:	2	Change mode:	At once

Range:
0 to 20
Parameter description
Defines the width level of the 5th notch.

H09.43 **Depth level of the 5th notch**

Address:	0x092B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	99	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0 to 99
Parameter description
Defines the depth level of the 5th notch.

H09.44 **Frequency of low-frequency resonance suppression 1 at mechanical load end**

Address:	0x092C	Effective mode:	At once
Minimum:	0.0	Unit:	Hz
Maximum:	200.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:
0.0 Hz~200.0Hz
Parameter description
Set this parameter based on the actual jitter frequency.

H09.45 **Responsiveness of low-frequency resonance suppression 1 at the end-effector**

Address:	0x092D	Effective mode:	At once
Minimum:	0.01	Unit:	-
Maximum:	10.00	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.01 to 10.00

Parameter description
Use the default setpoint in general cases. Increasing this setpoint can reduce the delay time.

H09.47 **Width of low-frequency resonance suppression 1 at mechanical load end**

Address:	0x092F	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	2.00	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.00 to 2.00
Parameter description
Use the default setpoint in general cases. Increasing this setpoint can increase the delay time.

H09.49 **Frequency of low-frequency suppression 2 at the mechanical end**

Address:	0x0931	Effective mode:	At once
Minimum:	0.0	Unit:	Hz
Maximum:	200.0	Data type:	UInt16
Default:	0.0	Change mode:	At once

Range:
0.0 Hz~200.0Hz
Parameter description
Set this parameter based on the actual jitter frequency.

H09.50 **Response to low-frequency suppression 2 at the mechanical end**

Address:	0x0932	Effective mode:	At once
Minimum:	0.01	Unit:	-
Maximum:	10.00	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.01 to 10.00
Parameter description
Defines the end low-frequency suppression 2 response. Use the default setpoint in general cases. To increase the setpoint, decrease the delay time.

H09.52 **Width of low-frequency suppression 2 at the mechanical end**

Address:	0x0934	Effective mode:	At once
Minimum:	0.00	Unit:	-
Maximum:	2.00	Data type:	UInt16
Default:	1.00	Change mode:	At once

Range:
0.00 to 2.00
Parameter description
Defines the end low-frequency suppression 2 width. Use the default setpoint in general cases. To increase the setpoint, increase the delay time.

H09.57 **STune resonance suppression switchover frequency**

Address:	0x0939	Effective mode:	At once
Minimum:	0	Unit:	Hz
Maximum:	4,000	Data type:	UInt16
Default:	850	Change mode:	At once

Range:
0 to 4000
Parameter description
If the resonance frequency is lower than the setpoint, use medium-frequency resonance suppression 2 to suppress resonance. Otherwise, use the notch to suppress resonance.

H09.58 **STune resonance suppression reset selection**

Address:	0x093A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0: Disable
1: Enable
Parameter description
Used to enable STune resonance suppression reset to clear parameters related to resonance suppression, medium-frequency resonance suppression 2, and notches 3 and 4.

7.11 H0A Fault and Protection Parameters

H0A.00 **Power input phase loss protection**

Address:	0x0A00	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At once

Range:
0: Enable phase loss fault and inhibit phase loss warning
1: Enable phase loss fault and warning
2: Disable phase loss fault and warning

Parameter description

Inovance provides servo drives of single-phase 220 V, three-phase 220 V, and three-phase 380 V. When the input voltage fluctuates violently or phase loss occurs, the servo drive flexibly selects the protection mode based on this setpoint.

Set value	Phase loss protection method	Remarks
0	Enable faults and inhibit warnings	If the main circuit input voltage is single phase for the drive with rated power of 1 kW and above (H01.02 ≥ 6), E420.0 occurs.
1	Enable faults and warnings	• If the main circuit input voltage is single phase for the drive with rated power of 1 kW and above (H01.02 ≥ 6), E420.0 occurs. • If the main circuit input voltage is single phase for the servo drive with 0.75 kW rated power (H01.02 = 5), E990.0 (Power input phase loss warning) occurs.
2	Inhibit faults and warnings	Er.420 and E990.0 will not be detected. In common bus mode, set H0A.00 to 2. Otherwise, the servo drive cannot enter "rdy" state after power-on. Note that power-off discharge and power-off retentive are not supported when H0A.00 is set to 2.

H0A.02 **Vibration alarm switch**

Address:	0x0A02	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Alarm

1: No alarm

Parameter description

Used to enable/disable the vibration runaway alarm function.

H0A.03 **Power-off memory**

Comm. address:	0x0A03	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	2	Data type:	UInt16
Default value:	0	Change mode:	Real time

Value range:

0: Disable

1: Enable

Description

When this parameter is set to 1, the drive saves the value of H0b.17 (Pulse count value of the encoder) upon power failure, which can be viewed through the corresponding parameter at next power-on. When this parameter is set to 0, the value of H0b.17 is not saved upon power failure.

Setpoint	Description	Instruction receiving method
0	Disable	The function of retentive at power failure is disabled.
1	Enable	The function of retentive at power failure is enabled. The servo drive automatically stores the encoder feedback pulse count (H0b.17) at power failure, which can be viewed in the corresponding function code after power-on again.

H0A.04 Motor overload protection gain

Address:	0x0A04	Effective mode:	At once
Minimum:	50	Unit:	%
Maximum:	300	Data type:	UInt16
Default:	100	Change:	At stop

Range:

50 %~300%

Parameter description

Determines the motor overload duration before E620.0 (Motor overload) is reported.

Change the value to advance or delay the overload protection time based on the motor heating condition. The value 50% indicates half of the base time, and 150% indicates 1.5 times of the base time.

The setting must be based on the actual heating condition, and take caution during use.

H0A.08 Overspeed threshold

Address:	0x0A08	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	10,000	Data type:	UInt16
Default:	0	Change:	At once

Range:

0 rpm to 10000 rpm

Parameter description

It sets the motor speed threshold at which the overspeed fault is detected.

Set value	Overspeed Threshold	Condition for Reporting E500.0
0	Max. motor speed x 1.2	If the speed feedback exceeds the overspeed threshold several times, the drive reports E500.0 (Motor overspeed).
1 to 10000	If H0A-08 ≥ (Maximum motor speed x 1.2): the overspeed threshold equals the maximum motor speed x 1.2.	
	If H0A-08 < (Maximum motor speed x 1.2): the overspeed threshold equals H0A.08.	

H0A.09 **Maximum position pulse frequency**

Address:	0x0A09	Effective mode:	At once
Minimum:	100	Unit:	kHz
Maximum:	4,000	Data type:	UInt16
Default:	4,000	Change:	At stop

Range:

100 kHz~4000kHz

Parameter description

Defines the maximum frequency of input pulses when the position reference source is pulse reference (H05.00 = 0) in the position control mode.

When the actual pulse input frequency exceeds the value of H0A.09, the drive reports EB01.0 (Position reference input error).

H0A.10 **Threshold of position deviation excess**

Address:	0x0A0A	Effective mode:	At once
Minimum:	1	Unit:	Encoder unit
Maximum:	1073741824	Data type	UInt32
Default:	32767	Change mode:	At once

Range:

1 to 1073741824

Parameter description

It sets the threshold of the position deviation excess fault in the position control mode.

When the position deviation exceeds this threshold, the drive reports EB00.0 (Position deviation too large).

H0A.12 **Enable runaway protection function**

Address:	0x0A0C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: Disabled

1: Enabled

Parameter description

Defines whether to enable runaway protection.

0: Hide the detection on E234.0 in applications where the motor drives a vertical axis or is driven by the load.

1: Enable runaway protection

H0A.16 **Position deviation threshold for low-frequency resonance suppression**

Comm. address:	0x0A10	Effective mode:	Real time
Min. value:	0	Unit:	p
Max. value:	1000	Data type:	UInt16
Default value:	5	Change mode:	Real time

Value range:

0 to 1000

Description

Defines the threshold of low-frequency resonance position deviation.

H0A.17 **Reference/Pulse selection**

Address:	0x0A11	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Pulse unit

1: Reference unit

Parameter description

Defines the unit for the position settings in H05.21, H05.22, and H0A.10.

H0A.18 **IGBT over-temperature threshold**

Address:	0x0A12	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	℃
Maximum:	100	Data type:	UInt16
Default:	90	Change:	At stop

Range:

0°C to 100°C

Parameter description

Defines the threshold for reporting E640.0 and E640.1.

H0A.19 **DI8 filter time**

Comm. address:	0x0A13	Effective mode:	Next power-on
Min. value:	0	Unit:	μs
Max. value:	255	Data type:	UInt16
Default value:	80	Change mode:	At stop

Value range:

0 to 255

Description

Defines the filter time constant of DI8 (high-speed DI terminal). When peak interference exists on the external input signals, set H0A.19 to filter out the peak interference.

H0A.20 **DI9 filter time constant**

Comm. address:	0x0A14	Effective mode:	Next power-on
Min. value:	0	Unit:	μs
Max. value:	255	Data type:	UInt16
Default value:	80	Change mode:	At stop

Value range:

0 to 255

Description

Defines the filter time constant of DI9 (high-speed DI terminal). When peak interference exists on the external input signals, set H0A.20 to filter out the peak interference.

H0A.22 **Sigma Delta filter time**

Comm. address:	0x0A16	Effective mode:	Next power-on
Min. value:	0	Unit:	μs
Max. value:	3	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:
0 to 3
Description
Defines the Sigma Delta filter time.

H0A.23 **Tz signal filter time**

Comm. address:	0x0A17	Effective mode:	Next power-on
Min. value:	0	Unit:	25 ns
Max. value:	31	Data type:	UInt16
Default value:	15	Change mode:	At stop

Value range:
0 to 31
Description
Defines the TZ signal filter time.

H0A.24 **Filter time constant of low-speed pulse input terminal**

Comm. address:	0x0A18	Effective mode:	Next power-on
Min. value:	0	Unit:	25 ns
Max. value:	255	Data type:	UInt16
Default value:	30	Change mode:	At stop

Value range:
0 to 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 k	30
167 k to 250 k	20
250 k to 500 k	10

H0A.25 **Filter time constant of speed feedback display value**

Address:	0x0A19	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	5,000	Data type:	UInt16

Default:	200	Change:	At stop

Range:

0ms~5000ms

Parameter description

It sets the low-pass filter time constant of speed signals for the speed feedback and position reference.

H0A.26 **Motor overload mask**

Comm. address:	0x0A1A	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	3	Data type:	UInt16
Default value:	3	Change mode:	At stop

Value range:

0: Show motor overload alarm (E909.0) and fault (E620.0)

1: Hide motor overload alarm (E909.0) and fault (E620.0)

2: No meaning

3: Enabled for new motors

Description

Defines whether to enable motor overload detection.

H0A.27 **Filter time constant of speed DO**

Address:	0x0A1B	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	5,000	Data type:	UInt16
Default:	10	Change:	At stop

Range:

0ms~5000ms

Parameter description

Defines the moving average filter time constant of the speed information for speed feedback and position references.

H0A.28 **Filter time constant of quadrature encoder**

Comm. address:	0x0A1C	Effective mode:	Next power-on
Min. value:	0	Unit:	25 ns
Max. value:	255	Data type:	UInt16
Default value:	30	Change mode:	At stop

Value range:

0 to 255

Description

Used to suppress peak interference on feedback signals from the incremental quadrature encoder.

H0A.30 **Filter time constant of high-speed pulse input terminal**

Comm. address:	0x0A1E	Effective mode:	Next power-on
Min. value:	0	Unit:	25 ns
Max. value:	255	Data type:	UInt16

Default value:	2	Change mode:	At stop

Value range:
0 to 255
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 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)
500 k to 1 M	5
> 1 M	3

H0A.32 Time threshold for locked rotor over-temperature protection

Address:	0x0A20	Effective mode:	At once
Minimum:	10	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
10ms~65535ms
Parameter description
Defines the over-temperature duration before E630.0 (Motor stall) is detected by the servo drive. H0A.32 can be used to adjust the sensitivity of motor stall over-temperature detection.

H0A.33 Over-temperature protection selection upon stall

Comm. address:	0x0A21	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	2	Data type:	UInt16
Default value:	1	Change mode:	Real time

Value range:
0: Disabled
1: Enable
2: Enabled for new over-temperature
Description
Defines whether to enable the detection for E630.0 (Over-temperature protection upon motor stall).

H0A.35 Reading encoder EEPRROM upon power-on (for third-party encoders)

Address:	0x0A23	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Enabled

1: Disabled

Parameter description

Used to set whether to inhibit the read-write operations in the ROM of Nikon, TAMAGAWA, and Endat2.2 encoders.

0: Disabled

1: Enabled

H0A.36 **Encoder multi-turn overflow fault selection**

Comm. address:	0x0A24	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:

0: Not hide

1: Hide

Description

Defines whether to hide the encoder multi-turn overflow fault in absolute position linear mode (H02.01 set to 1).

H0A.38 **IGBT over-temperature threshold**

Address:	0x0A26	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	℃
Maximum:	175	Data type:	UInt16
Default:	135 m	Change:	At stop

Range:

0 ℃~175℃

Parameter description

Displays the IGBT overtemperature threshold.

H0A.39 **IGBT over-temperature protection switch**

Address:	0x0A27	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Disable

1: Enable

Parameter description

Used to enable IGBT overtemperature protection.

H0A.40 **Software limit selection**

Address:	0x0A28	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16

Default:	0	Change:	At stop

Range:

0: No action

1: Activated immediately

2: Activated after homing completed

Parameter description

0: No action

1: Activated immediately

2: Activated after homing completed

H0A.41 **Forward position of software limit**

Address:	0x0A29	Effective mode:	At once
Minimum:	-2147483648	Unit:	-
Maximum:	2147483647	Data type	Int32
Default:	2147483647	Change:	At stop

Range:

-2147483648 to 2147483647

Parameter description

When the absolute position counter value (H0b.07) is higher than H0A.41, the drive reports E950.0 (Forward overtravel) and stops accordinly.

H0A.43 **Reverse position of software limit**

Address:	0x0A2B	Effective mode:	At once
Minimum:	-2147483648	Unit:	-
Maximum:	2147483647	Data type	Int32
Default:	-2147483648	Change:	At stop

Range:

-2147483648 to 2147483647

Parameter description

When the absolute position counter value (H0b.07) is lower than H0A.43, the drive reports E952.0 (Reverse overtravel) and stops accordingly.

H0A.47 **Brake protection**

Address:	0x0A2F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Disable brake protection detection

1: Enable brake protection detection

Parameter description

When this parameter is set to 0, the brake protection detection function is disabled. When this parameter is set to 1, the function is enabled.

H0A.48 **Gravity load**

Address:	0x0A30	Effective mode:	At once

Minimum:	0	Unit:	-
Maximum:	3,000	Data type:	UInt16
Default:	300	Change mode:	At once

Range:
0 to 3000
Parameter description
Displays the gravity load.

H0A.49 **Bleeder wafer over-temperature threshold**

Address:	0x0A31	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	℃
Maximum:	175	Data type:	UInt16
Default:	115	Change:	At stop

Range:
0 ℃~175℃
Parameter description
Defines the temperature threshold for braking resistor overload.

H0A.50 **Torque reference display filter time**

Address:	0x0A32	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	5,000	Data type:	UInt16
Default:	200	Change:	At stop

Range:
0ms~5000ms
Parameter description
Defines the torque reference display filter time.

H0A.51 **Encoder fault tolerance count**

Address:	0x0A33	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	31	Data type:	UInt16
Default:	31	Change mode:	At once

Range:
0 to 31
Parameter description
When the number of communication failures between the encoder and the drive exceeds H0A.51, the communication between the encoder and the drive fails.

H0A.52 **Encoder overtemperature protection threshold**

Comm. address:	0x0A34	Effective mode:	Real time
Min. value:	0	Unit:	°
Max. value:	175	Data type:	UInt16
Default value:	105	Change mode:	Real time

Value range:

0 to 175

Description

E760.0 is reported when the encoder temperature (H0b.66) exceeds H0A.52 + 15℃ for 100 ms, or E760.0 is reported after H0A.52 + 5℃ for 1000 ms. When H0A-52 is set to 0, 760 detection is disabled.

H0A.55 **Runaway current threshold**

Address:	0x0A37	Effective mode:	At once
Minimum:	100.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	200.0	Change mode:	At once

Range:

100.0 %~400.0%

Parameter description

Defines the current threshold for runaway protection detection.

H0A.57 **Runaway speed threshold**

Address:	0x0A39	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	1,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

1 rpm to 1000 rpm

Parameter description

Defines the overspeed threshold for runaway protection detection.

H0A.58 **Speed feedback filter time constant**

Address:	0x0A3A	Effective mode:	Effective upon next power-on
Minimum:	0.1	Unit:	ms
Maximum:	100.0	Data type:	UInt16
Default:	2.0	Change mode:	At once

Range:

0.1 to 100.0

Parameter description

Defines the speed feedback filter time for runaway protection detection.

H0A.59 **Runaway protection detection time**

Address:	0x0A3B	Effective mode:	At once
Minimum:	10	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	30	Change mode:	At once

Range:

10 ms to 1000 ms

Parameter description

The runaway fault will be reported when runaway fault keeps active for a period longer than that defined by H0A.59.

H0A.61 Phase loss detection time threshold

Address:	0x0A3D	Effective mode:	At once
Minimum:	30	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	50	Change mode:	At once

Range:

30 ms~65535ms

Parameter description

Defines the phase loss detection time threshold.

H0A.85 Wire breakage detection torque threshold

Address:	0x0A55	Effective mode:	At once
Minimum:	4.0	Unit:	%
Maximum:	400.0	Data type:	UInt16
Default:	5.0	Change:	At stop

Range:

4.0 %~400.0%

Parameter description

Defines the open circuit detection torque threshold.

H0A.86 Wire breakage detection filter time

Address:	0x0A56	Effective mode:	At once
Minimum:	5	Unit:	ms
Maximum:	1,000	Data type:	UInt16
Default:	30	Change:	At stop

Range:

5 to 1000

Parameter description

Defines the open circuit detection filter time.

7.12 H0B Display Parameters

H0b.00 Actual motor speed

Address:	0x0B00	Effective mode:	-
Minimum:	-32767	Unit:	rpm
Maximum:	32767	Data type	Int16
Default:	0	Change:	Unmodifiable

Range:

-32767rpm to 32767rpm

Parameter description

Indicates the actual motor speed after round-off, which is accurate to 1 RPM.
Set in H0A.25 (Filter time constant of speed feedback display) the filter time constant for H0b.00.

H0b.01 **Speed reference**

Address:	0x0B01	Effective mode:	-
Minimum:	-32767	Unit:	rpm
Maximum:	32767	Data type	Int16
Default:	0	Change:	Unmodifiable

Range:
-32767rpm to 32767rpm
Parameter description
Indicates the present speed reference (accurate to 1 RPM) of the drive in the position and speed control modes.

H0b.02 **Internal torque reference**

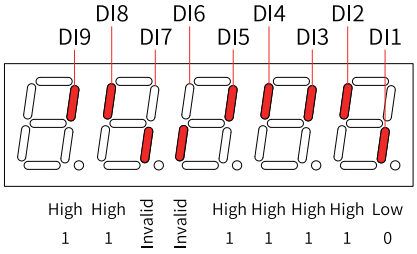
Address:	0x0B02	Effective mode:	-
Minimum:	-3276.7	Unit:	%
Maximum:	3276.7	Data type	Int16
Default:	0.0	Change:	Unmodifiable

Range:
-3276.7% to 3276.7%
Parameter description
It displays the current torque reference, in unit of 0.1%. The value 100.0% corresponds to the rated motor torque.

H0b.03 **Monitored DI states**

Comm. address:	0x0B03	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Read-only

Value range:
0 to 65535
Description
Displays the level states of the 9 DI terminals without filtering.
Upper LED segments ON: high level (indicated by "1"); Lower LED segments ON: low level (indicated by "0").



H0b.05 **Monitored DO states**

Address:	0x0B05	Effective mode:	-

Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

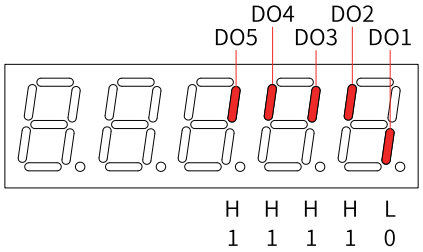
Range:

0–65535

Parameter description

Displays the level status of five DOs without filtering.

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



H0b.07 Absolute position counter

Address:	0x0B07	Effective mode:	-
Minimum:	-2147483648	Unit:	Reference unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

–2147483648 to +2147483647

Parameter description

Displays current absolute position of the motor in reference unit.

This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.09 Mechanical angle

Address:	0x0B09	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Displays the present mechanical angle (encoder unit) of the motor. The setpoint 0 indicates the mechanical angle is 0°.

Actual mechanical angle = 360° x H0b.09/(Maximum value of H0b.09 + 1)

Maximum value of H0b.09 for an absolute encoder is 65535.

H0b.10 Electric angle

Address:	0x0B0A	Effective mode:	-
Minimum:	0.0	Unit:	°
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0 to 6553.5

Parameter description

Indicates the present electrical angle of the motor, which is accurate to 0.1°.

The electrical angle variation range is ±360.0° during rotation. If the motor has four pairs of poles, each revolution generates four rounds of angle change from 0° to 359°. Similarly, if the motor has five pairs of poles, each revolution generates five rounds of angle change from 0° to 359°.

H0b.11 Speed corresponding to input position reference

Address:	0x0B0B	Effective mode:	-
Minimum:	-32767	Unit:	rpm
Maximum:	32767	Data type	Int16
Default:	0	Change:	Unmodifiable

Range:

-32767rpm to 32767rpm

Parameter description

It displays the speed corresponding to the position references within one position control period in the position control mode.

H0b.12 Average load ratio

Address:	0x0B0C	Effective mode:	-
Minimum:	0.0	Unit:	%
Maximum:	800.0	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0% to 800.0%

Parameter description

Displays the percentage of the average load torque to the rated torque of the motor, which is accurate to 0.1%. The value 100.0% corresponds to the rated torque of the motor.

H0b.13 Input position reference counter

Address:	0x0B0D	Effective mode:	-
Minimum:	-2147483648	Unit:	Reference unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

–2147483648 to +2147483647

Parameter description

Used to count and display the number of position references not divided or multiplied by the electronic gear ratio during operation.

This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.15 Encoder position deviation counter

Address:	0x0B0F	Effective mode:	-
Minimum:	-2147483648	Unit:	Encoder unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

-2147483648 to 2147483647

Parameter description

It counts and displays the position deviation value after being divided or multiplied by the electronic gear ratio in the position control mode. The setting is 32-bit data, and the keypad display is a decimal.

H0b.17 Feedback pulse counter

Address:	0x0B11	Effective mode:	-
Minimum:	-2147483648	Unit:	Encoder unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

-2147483648 to 2147483647

Parameter description

It counts the position pulses fed back by the encoder in any mode.
This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.19 Total power-on time

Address:	0x0B13	Effective mode:	-
Minimum:	0.0	Unit:	s
Maximum:	429496729.5	Data type	UInt32
Default:	0.0	Change:	Unmodifiable

Range:

0.0s to 429496729.5s

Parameter description

Used to record the total operating time of the servo drive.
This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.
Note:
If multiple times of power-on/off are performed in the servo drive within a short time, there may be one-hour deviation between the value of this parameter and the actual time.

H0b.24 Phase current effective value

Address:	0x0B18	Effective mode:	-
Minimum:	0.00	Unit:	A.
Maximum:	655.35	Data type:	UInt16
Default:	0.00	Change:	Unmodifiable

Range:

0.00 A to 655.35 A

Parameter description

It displays the phase current effective value of the servo motor, in unit of 0.01 A.

H0b.26 Bus voltage

Address:	0x0B1A	Effective mode:	-
Minimum:	0.0	Unit:	V
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0 V to 6553.5 V

Parameter description

It displays the DC bus voltage of the main circuit input voltage after rectification, in unit of 0.01 V.

H0b.27 Module temperature

Address:	0x0B1B	Effective mode:	-
Minimum:	-20	Unit:	℃
Maximum:	200	Data type	Int16
Default:	0	Change:	Unmodifiable

Range:

–20°C to +200°C

Parameter description

It displays the temperature of the modules inside the servo drive, which can be used as the reference of current servo drive temperature.

H0b.28 Absolute encoder fault information given by FPGA

Address:	0x0B1C	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the absolute encoder fault information given by FPGA

H0b.29 System status information given by FPGA

Address:	0x0B1D	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the axis status information given by FPGA.

H0b.30 System fault information given by FPGA

Address:	0x0B1E	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the axis fault information given by FPGA.

H0b.33 Fault record

Address:	0x0B21	Effective mode:	At once
Minimum:	0	Unit:	-

Maximum:	19	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0: Present fault
1: Latest fault
2: 2nd to last fault
3: 3rd to last fault
4: 4th to last fault
5: 5th to last fault
6: 6th to last fault
7: 7th to last fault
8: 8th to last fault
9: 9th to last fault
10: 10th to last fault
11: 11th to last fault
12: 12th to last fault
13: 13th to last fault
14: 14th to last fault
15: 15th to last fault
16: 16th to last fault
17: 17th to last fault
18: 18th to last fault
19: 19th to last fault

Parameter description
Used to view the latest 20 faults of the drive.

H0b.34 Fault code of the selected fault record

Address:	0x0B22	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:
0x0 to 0xFFFF

Parameter description
Displays the fault code of the selected fault.

H0b.35 Time stamp upon displayed fault

Address:	0x0B23	Effective mode:	-
Minimum:	0	Unit:	s
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:
0.0s~4294967295s

Parameter description
Displays the time stamp of the selected fault.

H0b.37 Motor speed upon displayed fault

Address:	0x0B25	Effective mode:	-
Minimum:	-32767	Unit:	rpm
Maximum:	32767	Data type	Int16
Default:	0	Change:	Unmodifiable

Range:

-32767rpm to 32767rpm

Parameter description

Displays the motor speed upon occurrence of the selected fault.

H0b.38 Motor phase U current upon displayed fault

Address:	0x0B26	Effective mode:	-
Minimum:	-327.67	Unit:	A.
Maximum:	327.67	Data type	Int16
Default:	0.00	Change:	Unmodifiable

Range:

-327.67 A~327.67A

Parameter description

Displays the motor phase U current upon occurrence of the selected fault.

H0b.39 Motor phase V current upon displayed fault

Address:	0x0B27	Effective mode:	-
Minimum:	-327.67	Unit:	A.
Maximum:	327.67	Data type	Int16
Default:	0.00	Change:	Unmodifiable

Range:

-327.67 A~327.67A

Parameter description

Displays the motor phase V current upon occurrence of the selected fault.

H0b.40 Bus voltage upon displayed fault

Address:	0x0B28	Effective mode:	-
Minimum:	0.0	Unit:	V
Maximum:	6553.5	Data type:	UInt16
Default:	0.0	Change:	Unmodifiable

Range:

0.0 V to 6553.5 V

Parameter description

Displays the bus voltage upon occurrence of the selected fault.

H0b.41 Input terminal state upon displayed fault

Address:	0x0B29	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description
Displays the input terminal state upon occurrence of the selected fault.

H0b.42 Output terminal state upon displayed fault

Address:	0x0B2A	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:
0–65535
Parameter description
Displays the output terminal status upon occurrence of the selected fault.

H0b.43 Function code group number with abnormal parameter

Address:	0x0B2B	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:
0x0 to 0xFFFF
Parameter description
Displays the group number of the abnormal parameter.

H0b.44 Offset in function code group with abnormal parameter

Address:	0x0B2C	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:
0–65535
Parameter description
Displays the offset within the group of the abnormal parameter.

H0b.45 Internal fault code

Address:	0x0B2D	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:
0x0 to 0xFFFF
Parameter description
Displays the master code + fault subcode of the current servo fault.

H0b.46 Absolute encoder fault information given by FPGA upon occurrence of the selected fault

Address:	0x0B2E	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16

Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the absolute encoder fault information given by FPGA upon occurrence of the selected fault.

H0b.47 System status information given by FPGA upon occurrence of the selected fault

Address:	0x0B2F	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the system status information given by FPGA upon occurrence of the selected fault.

H0b.48 System fault information given by FPGA upon occurrence of the selected fault

Address:	0x0B30	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the system fault information given by FPGA upon occurrence of the selected fault.

H0b.51 Internal fault code when the fault is selected

Address:	0x0B33	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the internal fault code upon occurrence of the selected fault.

H0b.52 Timeout fault flat bit given by FPGA upon occurrence of the selected fault

Address:	0x0B34	Effective mode:	-
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0x0 to 0xFFFF

Parameter description

Displays the FPGA timeout fault standard bit upon occurrence of the selected fault.

H0b.53 Position deviation counter

Address:	0x0B35	Effective mode:	-
Minimum:	-2147483648	Unit:	Reference unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

-2147483648 to +2147483647

Parameter description

It displays the position deviation not processed by the electronic gear ration in the position control mode.

Position deviation (reference unit) is the value obtained after encoder position deviation calculation. The precision is compromised during division.

This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0b.55 Actual motor speed

Address:	0x0B37	Effective mode:	-
Minimum:	-214748364.8	Unit:	rpm
Maximum:	214748364.7	Data type	Int32
Default:	0.0	Change:	Unmodifiable

Range:

-214748364.8rpm to 214748364.7rpm

Parameter description

Indicates the actual value of motor speed, which is accurate to 0.1 RPM.

This parameter is a 32-bit integer, which is displayed as a decimal on the keypad.

H0A.25 (Filter time constant of speed feedback display) can be used to set the filter time constant of the speed feedback.

H0b.58 Mechanical absolute position (low 32 bits)

Address:	0x0B3A	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 4294967295

Parameter description

Displays the low 32-bit value (encoder unit) of the mechanical position feedback when the absolute encoder is used.

H0b.60 Mechanical absolute position (high 32 bits)

Address:	0x0B3C	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 4294967295

Parameter description

Displays the high 32-bit value (encoder unit) of the mechanical position feedback when the absolute encoder is used.

H0b.63 **NotRdy state**

Address:	0x0B3F	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	7	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

1: Control circuit power input error

2: Main circuit power input error

3: Bus undervoltage

4: Soft start failed

5: Encoder initialization not done

6: Short-circuit to ground failed

7: Others

Parameter description

Displays the reason for NotRdy state.

H0b.64 **Real-time input position reference counter**

Address:	0x0B40	Effective mode:	-
Minimum:	-2147483648	Unit:	Reference unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:

-2147483648 to +2147483647

Parameter description

Displays the value of the pulse reference counter before being divided or multiplied by the electronic gear ratio. This value is independent of the servo drive status and the control mode.

H0b.66 **Encoder temperature**

Address:	0x0B42	Effective mode:	-
Minimum:	-32768	Unit:	℃
Maximum:	32767	Data type	Int16
Default:	0	Change:	Unmodifiable

Range:

-32768 ℃~32767℃

Parameter description

Displays the encoder temperature.

H0b.70 **Number of absolute encoder revolutions**

Address:	0x0B46	Effective mode:	-
Minimum:	0	Unit:	Rev
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0 Rev to 65535 Rev

Parameter description

It displays the number of absolute encoder turns.

H0b.71 Position of absolute encoder within one turn

Address:	0x0B47	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	2147483647	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 2147483647

Parameter description

It displays the single-turn position feedback of the absolute encoder.

H0b.73 Single-turn offset position of absolute encoder

Address:	0x0B49	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	2147483647	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 2147483647

Parameter description

Displays the offset position of absolute encoder within one turn.

H0b.75 Load inertia ratio during online inertia auto-tuning

Address:	0x0B4B	Effective mode:	-
Minimum:	0.00	Unit:	-
Maximum:	655.35	Data type:	UInt16
Default:	0.00	Change:	Unmodifiable

Range:

0.00 to 655.35

Parameter description

Displays the load inertia ratio upon online inertia auto-tuning.

H0b.76 External load during online inertia auto-tuning

Address:	0x0B4C	Effective mode:	-
Minimum:	-100.0	Unit:	-
Maximum:	100.0	Data type	Int16
Default:	0.0	Change:	Unmodifiable

Range:

-100.0 to 100.0

Parameter description

Displays the external load in online inertia auto-tuning.

H0b.77 Absolute position (low 32 bits) of absolute encoder

Address:	0x0B4D	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:

0 to 4294967295

Parameter description
It displays the low 32-bit data of the position feedback of the absolute encoder.

H0b.79 Absolute position (high 32 bits) of absolute encoder

Address:	0x0B4F	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:
0 to 4294967295
Parameter description
It displays the high 32-bit data of the position feedback of the absolute encoder.

H0b.81 Load position within one turn in absolute position rotation mode (low 32 bits)

Address:	0x0B51	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:
0 to 4294967295
Parameter description
It displays the low 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.

H0b.83 Load position within one turn in absolute position rotation mode (high 32 bits)

Address:	0x0B53	Effective mode:	-
Minimum:	0	Unit:	Encoder unit
Maximum:	4294967295	Data type	UInt32
Default:	0	Change:	Unmodifiable

Range:
0 to 4294967295
Parameter description
It displays the high 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.

H0b.85 Load position within one turn in absolute position rotation mode

Address:	0x0B55	Effective mode:	-
Minimum:	-2147483648	Unit:	Reference unit
Maximum:	2147483647	Data type	Int32
Default:	0	Change:	Unmodifiable

Range:
–2147483648 to +2147483647
Parameter description
It displays the high 32-bit data of the position feedback of the rotating load when the absolute system works in rotating mode.

H0b.89 **Low bits 0 to 15 of active state of DI function**

Address:	0x0B59	Effective mode:	
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Displays the low bits 0 to 15 of active state of DI function.

H0b.90 **Low bits 16 to 31 of active state of DI function**

Address:	0x0B60	Effective mode:	
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Displays the low bits 16 to 31 of active state of DI function.

H0b.91 **Low bits 32 to 47 of active state of DI function**

Address:	0x0B61	Effective mode:	
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Displays the low bits 32 to 47 of active state of DI function.

H0b.92 **Low bits 48 to 63 of active state of DI function**

Address:	0x0B62	Effective mode:	
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Displays the low bits 48 to 63 of active state of DI function.

7.13 H0C Communication Parameters

H0C.00 **Servo axis address**

Address:	0x0C00	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	247	Data type:	UInt16

Default:	1	Change:	At stop

Range:

1 to 247

Parameter description

Indicates the CAN slave node address. Ensure this parameter is consistent with the configuration of the host controller.

H0C.02 **Serial port baud rate**

Address:	0x0C02	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	7	Data type:	UInt16
Default:	5	Change mode:	At once

Range:

0: 2400 bps

1: 4800 bps

2: 9600 bps

3: 19200 bps

4: 38400 bps

5: 57600 bps

6: 115200 bps

Parameter description

Defines the serial port baud rate during RS485 communication between the drive and host controller.

0: 2400 bps

1: 4800 bps

2: 9600 bps

3: 19200 bps

4: 38400 bps

5: 57600 bps

6: 115200 bps

The data format set in the servo drive must be the same as that in the host controller. Otherwise, communication will fail.

H0C.03 **Modbus data format**

Address:	0x0C03	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: No check, 2 stop bits

1: Even parity, 1 stop bit

2: Odd parity, 1 stop bit

3: No check, 1 stop bits

Parameter description

Defines the data check mode between the drive and the host controller during RS485 communication.
0: No check, 2 stop bits
1: Even parity, 1 stop bit
2: Odd parity, 1 stop bit
3: No check, 1 stop bits
The data format set in the servo drive must be the same as that in the host controller. Otherwise, communication will fail.

H0C.08 **CAN communication rate selection**

Comm. address:	0x0C08	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	8	Data type:	UInt16
Default value:	5	Change mode:	At stop

Value range:
0: 20 K
1: 50 K
2: 100 K
3: 125 K
4: 250 K
5: 500 K
6: 1 M
7: 1 M
Description
Defines the communication rate between the drive and the host controller in CANlink or CANopen mode. The communication rate set in the servo drive must be the same as that in the host controller. Otherwise, communication fails. If H0C.08 is set to 6, the baud rate is 1 Mbps. 80% sampling points are used to match most PLCs with a 1M standard baud rate.

H0C.09 **Communication VDI**

Address:	0x0C09	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0: Disable
1: Enable
Parameter description
To use the VDI function:
1. Enable VDI through H0C.09.
2. Set the default level after power-on through H0C.10.
3. Set the DI function of the VDI terminal through parameters in group H17.
4. Set VDI output through H31.00.

H0C.10 **VDI default value after power-on**

Address:	0x0C0A	Effective mode:	Effective upon next power-on

Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0-65535

Parameter description

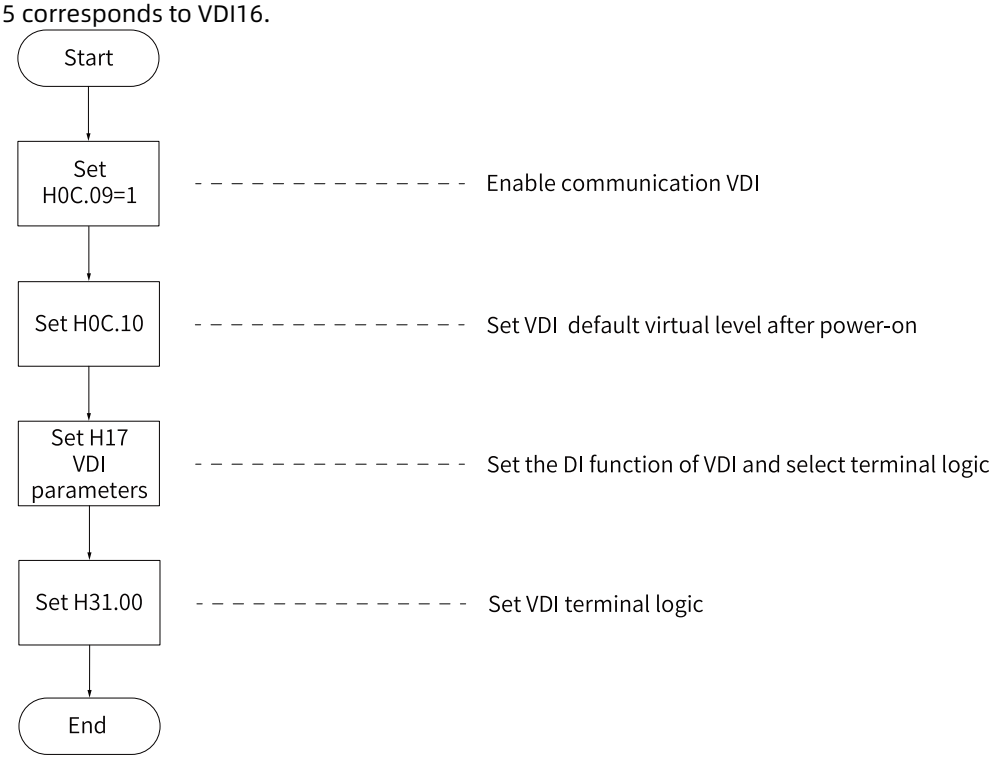
Configures the initial value of VDI upon power-on.

Bit 0 corresponds to VDI1.

Bit 1 corresponds to VDI2.

…

Bit 15 corresponds to VDI16.



H0C.11 Communication VDO

Address:	0x0C0B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: Disable

1: Enable

Parameter description

To use the VDO function:

1. Enable VDO through H0C.11.

2. Set the default level after power-on through H0C.12.

3. Set the DO function of the VDO through parameters in group H17.

4: Read the output level of the VDO in H17.32.

H0C.12 **Default level of the VDO allocated with function 0**

Address:	0x0C0C	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

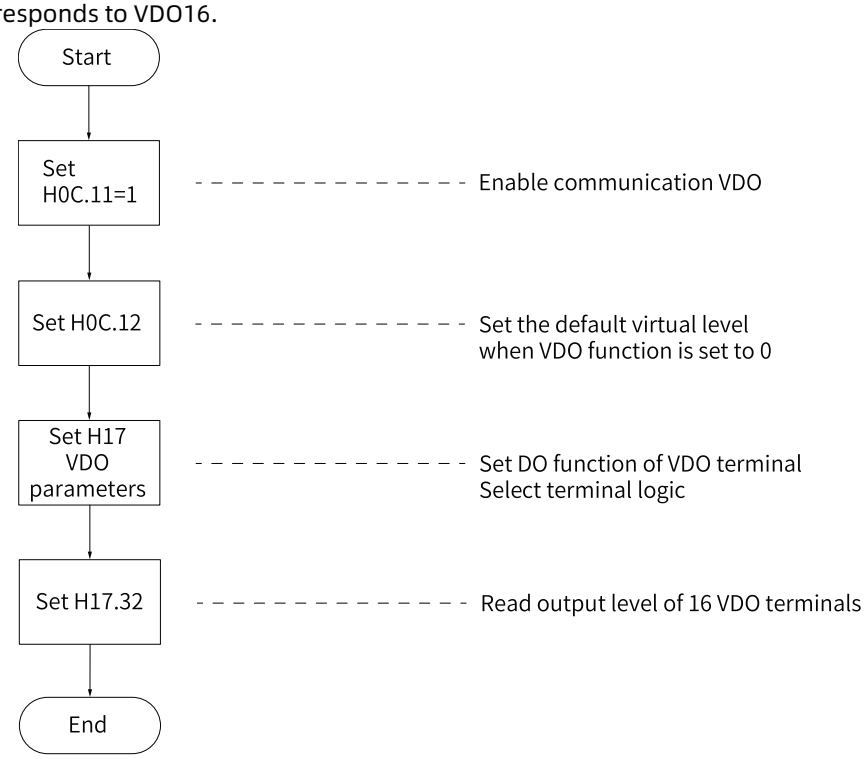
Configures the initial value of VDO upon power-on.

Bit 0 corresponds to VDO1.

Bit 1 corresponds to VDO2.

…

Bit 15 corresponds to VDO16.



H0C.13 **Writing the updated parameter values in the EEPROM**

Address:	0x0C0D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: No writing to EEPROM

1: Writing to EEPROM

Parameter description

Defines whether to save the parameters written via Modbus communication to EEPROM (InoDriverShop also communicates with servo drive via Modbus protocol).

H0C.14 **Modbus error** code

Address:	0x0C0E	Effective mode:	-

Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	Unmodifiable

Range:

0: None

1: 0x0001 illegal parameter (command code)

2: 0x0002 command code data address

3: 0x0003 illegal data

4: 0x0004 slave station device fault

Parameter description

Displays the error code when a communication fault occurs.

H0C.16 Update parameter values written through CAN communication to EEPROM

Address:	0x0C10	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: No writing to EEPROM

1: Writing to EEPROM

Parameter description

Defines whether to save parameters written through CAN communication to EEPROM.

H0C.25 Modbus response delay

Address:	0x0C19	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	20	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0ms~20ms

Parameter description

It sets the delay from the moment when the slave receives a command from the host controller to the moment when the slave returns a response.

H0C.26 Modbus communication data sequence

Address:	0x0C1A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: High 16 bits before low 16 bits

1: Low 16 bits before high 16 bits

Parameter description

Defines the 32-bit data transmission format of Modbus communication.

H0C.30 **Modbus error frame format**

Address:	0x0C1E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	1	Change mode:	At once

Range:

0: Previous protocol

1: New protocol (Standard protocol)

Parameter description

Defines the protocol for reporting communication errors.

H0C.31 **Modbus receiving selection**

Address:	0x0C1F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Enable receive interrupt

1: Current loop interrupt query

Parameter description

Defines the Modbus reception processing mode.

7.14 H0d Auxiliary Function Parameters

H0d.00 **Software reset**

Address:	0x0D00	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No action

1: Enable reset

Parameter description

Programs in the drive are reset automatically (similar to the program reset upon power-on) after the software reset function is enabled, without the need for a power cycle.

H0d.01 **Fault reset**

Address:	0x0D01	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No operation

1: Fault reset

Parameter description

When a No.1 or No.2 resettable fault occurs, you can enable the fault reset function in the non-operational state after rectifying the fault cause, stopping the keypad from displaying the fault and allowing the drive to enter the "rdy" state.

NO. 3 warnings can be reset directly regardless of the servo state.

Set value	Function	Remarks
0	No operation	-
1	Fault reset	• When a No.1 or No.2 resettable fault occurs, you can enable the fault reset function in the non-operational state after rectifying the fault cause, stopping the keypad from displaying the fault and allowing the drive to enter the "rdy" state. • NO. 3 warnings can be reset directly regardless of the servo state.

H0d.02 Inertia auto-tuning selection

Address:	0x0D02	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0 to 65

Parameter description

Used to enable offline inertia auto-tuning through the keypad.

H0d.03 Initial angle auto-tuning

Address:	0x0D03	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No action

1: Enable

Parameter description

0: No action

1: Enable

H0d.04 Encoder ROM read/write

Address:	0x0D04	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No action

1: Read ROM

2: Write ROM

Parameter description

0: No action

1: Read ROM

2: Write ROM

H0d.05 Emergency Stop

Address:	0x0D05	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: No action

1: Emergency stop

Parameter description

0: No action

1: Emergency stop

H0d.06 Current loop parameter auto-tuning

Address:	0x0D06	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No action

1: Saving parameters during auto-tuning

2: Not saving parameters during auto-tuning

Parameter description

Current loop parameter auto-tuning

H0d.12 Phase U/V current balance correction

Address:	0x0D0C	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–1

Parameter description

Phase U/V current balance correction enable

H0d.17 Forced DI/DO selection

Address:	0x0D11	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	3	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: No action

1: Forced DI enabled, forced DO disabled

2: Forced DO enabled, forced DI disabled

3: Forced DI and DO enabled

Parameter description

Defines whether to enable forced DI/DO.

H0d.18 **Forced DI level**

Address:	0x0D12	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0x1FF	Data type:	UInt16
Default:	0x1FF	Change mode:	At once

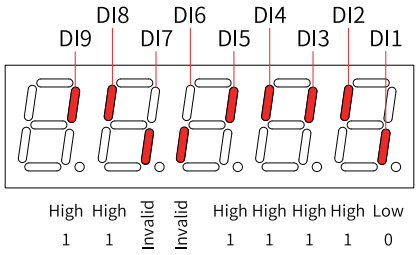
Range:

0x0~0x1FF

Parameter description

Defines the level logic of the DI functions set in group H03 when forced DI is active (H0d.17 set to 1 or 3).

H0d.18 is displayed in hex on the keypad. In the converted binary value, bit(n) = 1 indicates that the DI is active high. bit(n)=0 indicates that the level logic of the DI function is low level.



H0d.19 **Forced DO reference**

Comm. address:	0x0D13	Effective mode:	Real time
Min. value:	0x0	Unit:	-
Max. value:	0x1F	Data type:	UInt16
Default value:	0x0	Change mode:	Real time

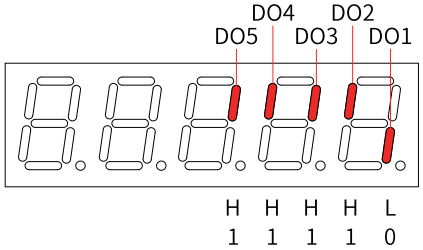
Value range:

0x0 to 0x1F

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 in hex on the keypad. When it is converted to a binary value, "bit (n) = 1" indicates that the DO is active, and "bit(n) = 0" indicates that the DO is inactive.



H0d.20 **Multi-turn absolute encoder reset**

Address:	0x0D14	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: No action

1: Reset fault

2: Reset fault and multi-turn data

Parameter description

You can reset the encoder fault or the multi-turn data fed back by the encoder through H0d.20.

7.15 H11 Multi-Speed Parameters

H11.00 **Multi-position running mode**

Address:	0x1100	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	5	Data type:	UInt16
Default:	1	Change:	At stop

Range:

0: Individual operation (number of positions defined by H11.01)

1: Cyclic operation (number of positions defined by H11.01)

2: DI-based operation (selected through DI)

3: Sequential operation

5: Axis-controlled continuous operation

Parameter description

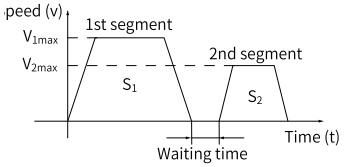
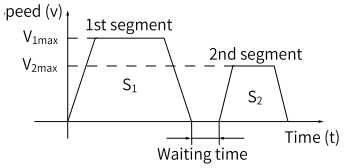
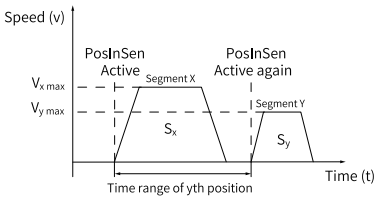
0: Individual operation (number of positions defined by H1101)

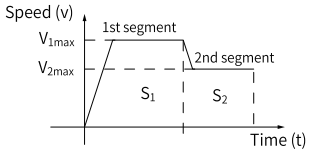
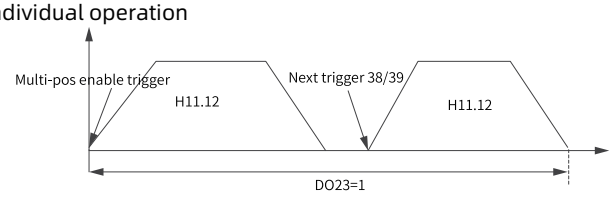
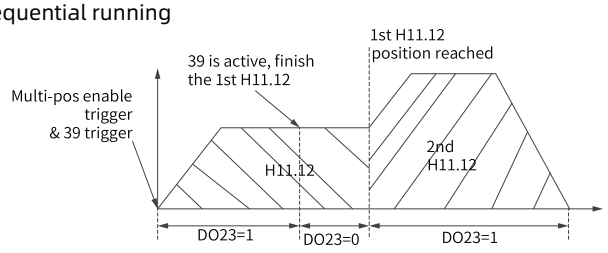
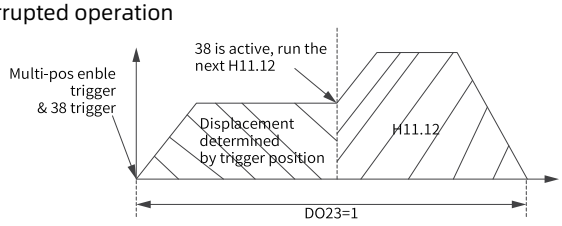
1: Cyclic operation (number of positions defined by H1101)

2: DI-based operation (selected through DI)

3: Sequential operation

5: Axis-controlled continuous operation

Set value	Operating mode	Remarks	Operation Curve
0	Stop after a single running	• The drive stops after one cycle of operation. • The drive switches to the next displacement automatically. • The interval time between displacements can be set as needed. • The PoslnSen (Multi-position reference enable) signal is level-triggered.	 V 1max , V 2max: maximum values of 1st and 2nd speeds S 1 and S 2 : displacement 1 and displacement 2
1	Cyclic running	• The drive starts from displacement 1 again after each cycle of operation. • The drive switches to the next displacement automatically. • The interval time between displacements can be set as needed. • The cyclic operation state remains active as long as the FunIN.28 (Multi-position reference enable) signal is active. • The PoslnSen (Multi-position reference enable) signal is level-triggered.	 V 1max , V 2max: maximum values of 1st and 2nd speeds S 1 and S 2 : displacement 1 and displacement 2
2	DI switchover	• When the servo drive runs the current position, you can set the next position No. After the position reference of the current number is completed, the servo motor stops. After the PoslnSen (position reference enable) signal is enabled again, the present displacement will be executed. • The speed No. is determined by the DI logic. • The interval time between displacements is determined by the command delay of the host controller. • The PoslnSen (Multi-position reference enable) signal is edge-triggered.	 V xmax and V ymax : maximum operating speeds in position x and position y S x , S y : displacements of xth and yth positions

Set value	Operating mode	Remarks	Operation Curve
3	Sequential running	• The drive stops after one cycle of operation. • (H11.05 = 0 or H11.05 > H11.01). • The starting displacement after the first cycle of operation is defined by H11.05. • The drive switches to the next displacement automatically. • There is no interval time between displacements. • The PoslnSen (Multi-position reference enable) signal is level-triggered.	 V_{1max} , V_{2max}: maximum values of 1st and 2nd speeds S_1 and S_2 : displacement 1 and displacement 2
5	Axis-controlled continuous operation	• The drives executes one displacement only. • The individual operation mode, sequential operation mode, and interrupted operation mode are included. • The PoslnSen (Multi-position reference enable) signal is level-triggered.	• Individual operation  • The PoslnSen (multi-position reference enable) signal is triggered only once (FunIN.38/39 triggered later). The servo drive stops after executing the distance defined by H11.12 (Displacement 1). • Sequential running  • The PoslnSen (multi-position reference enable) signal is triggered only once. Write H11.12 again and activate FunIN.39 when the distance defined by the first H11.12 is still in progress.• After receiving the new distance (or speed), which is the second H11.12, the servo drive continues executing the first H11.12 until the distance defined by the first H11.12 is reached. Then it starts to execute the second H11.12 directly. The travel distance therefore is the sum of the first H11.12 and the second H11.12. • Interrupted operation  • The PoslnSen (Multi-position reference enable) signal is triggered only once. Write H11.12 (such as 1000000) again and activate FunIN.38 when the first H11.12 (such as 9000000) is still in progress. After receiving the new distance (or speed), which is the second H11.12, the servo drive stops executing the first H11.12 and turns to executing the second H11.12.

H11.01 **End position No. in displacement reference**

Address:	0x1101	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	16	Data type:	UInt16
Default:	1	Change:	At stop

Range:

1 to 16

Parameter description

It sets the total number of positions. You can set different displacements, running speed, and acceleration/deceleration time for each position.

FunIN.9	FunIN.8	FunIN.7	FunIN.6	Speed No.
CMD4	CMD3	CMD2	CMD1	
0	0	0	0	1
0	0	0	1	2
...				
1	1	1	1	16

H11.02 **Remaining profile processing mode**

Comm. address:	0x1102	Effective mode:	Real time
Min. value:	0	Unit:	-
Max. value:	1	Data type:	UInt16
Default value:	0	Change mode:	At stop

Value range:

0: Continue to execute the remaining positions

1: Start from position 1

Description

Sets the starting position number when the multi-function running recovers after a pause. The function defined by H11.02 is valid only when H11.00 (Multi-position mode) is set to 0, 1, or 3.

Setpoint	Remaining profile processing mode	Remarks
0	Complete the remaining positions	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 from position 1	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.

Note: In multi-position mode, when the drive moves from the position after the home to the position before the home, it does not take the shortest path, but moves directly according to the difference between the two positions.

For example, if the drive runs from 2159 to 359, the displacement is 359 – 2159 = -1800, and the drive rotates in the reverse direction.

H11.03 **Waiting time unit**

Address:	0x1103	Effective mode:	At once

Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

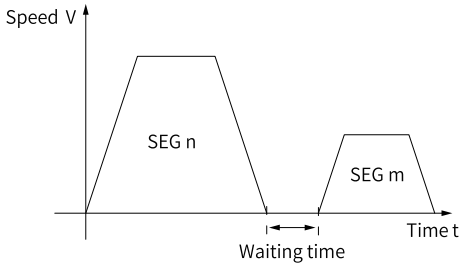
Range:

0: ms

1: s

Parameter description

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

Set value	Waiting time unit	Remarks
0	ms	
1	s	

H11.04 Displacement reference type

Address:	0x1104	Effective mode:	During shutdown
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

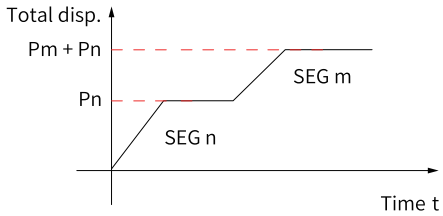
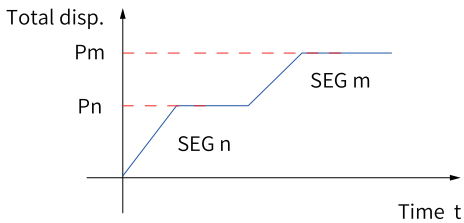
Range:

0: Relative displacement reference

1: Absolute displacement reference

Parameter description

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

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

H11.05 **Start position of sequential running**

Address:	0x1105	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	16	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0 to 16

Parameter description

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

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

H11.09 **Deceleration upon axis control OFF**

Address:	0x1109	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	65535	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Defines the deceleration rate upon axis control OFF.

H11.10 **Start speed of the 1st displacement**

Address:	0x110A	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0rpm~7000rpm

Parameter description

Defines the starting speed of displacement 1.

H11.11 **Stop speed of the 1st displacement**

Address:	0x110B	Effective mode:	At once
Minimum:	0	Unit:	rpm
Maximum:	7000	Data type:	UInt16

Default:	0	Change mode:	At once

Range:
0rpm~7000rpm
Parameter description
Defines the stop speed of displacement 1.

H11.12 **1st displacement**

Address:	0x110C	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Sets the 1st displacement in multi-position operation (in reference unit).

H11.14 **Maximum running speed of first displacement**

Address:	0x110E	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
It sets the maximum running speed of the 1st position in multi-position. The maximum speed is the average operating speed when the motor is not in the acceleration/deceleration process. If H11.12 is set to a too low value, the actual motor speed will be lower than H11.14.

H11.15 **Acceleration/Deceleration time of 1st displacement**

Address:	0x110F	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

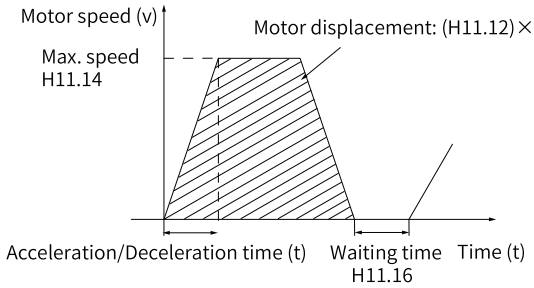
Range:
0ms~65535ms
Parameter description
Defines the time for the motor to change from 0 rpm 1000 rpm at a constant speed during displacement 1. Actual time needed for accelerating to H11.14 (Max. speed of displacement 1): t = (H11.14 x H11.15)/1000

H11.16 **Waiting time after 1st displacement**

Address:	0x1110	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16

Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
It sets the waiting time from completion of the 1st displacement to starting of the next displacement.



H11.17 2nd displacement

Address:	0x1111	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.19 Maximum running speed of 2nd displacement

Address:	0x1113	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.20 Acceleration/Deceleration time of 2nd displacement

Address:	0x1114	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.21 **Waiting time after 2nd displacement**

Address:	0x1115	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.22 **3rd displacement**

Address:	0x1116	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.24 **Max. running speed of 3rd displacement**

Address:	0x1118	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.25 **Acceleration/Deceleration time of 3rd displacement**

Address:	0x1119	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.26 **Waiting time after 3rd displacement**

Address:	0x111A	Effective mode:	At once
Minimum:	0	Unit:	ms(s)

Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.27 **4th displacement**

Address:	0x111B	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.29 **Max. running speed of 4th displacement**

Address:	0x111D	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.30 **Acceleration/Deceleration time of 4th displacement**

Address:	0x111E	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.31 **Waiting time after 4th displacement**

Address:	0x111F	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.32 **5th displacement**

Address:	0x1120	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.34 **Max. running speed of 5th displacement**

Address:	0x1122	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.35 **Acceleration/Deceleration time of 5th displacement**

Address:	0x1123	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.36 **Waiting time after 5th displacement**

Address:	0x1124	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.37 **6th displacement**

Address:	0x1125	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.39 **Max. running speed of 6th displacement**

Address:	0x1127	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.40 **Acceleration/Deceleration time of 6th displacement**

Address:	0x1128	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.41 **Waiting time after 6th displacement**

Address:	0x1129	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.42 **7th displacement**

Address:	0x112A	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit

Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.44 **Max. running speed of 7th displacement**

Address:	0x112C	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.45 **Acceleration/Deceleration time of 7th displacement**

Address:	0x112D	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.46 **Waiting time after 7th displacement**

Address:	0x112E	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.47 **8th displacement**

Address:	0x112F	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.49 **Max. running speed of 8th displacement**

Address:	0x1131	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.50 **Acceleration/Deceleration time of 8th displacement**

Address:	0x1132	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.51 **Waiting time after 8th displacement**

Address:	0x1133	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.52 **9th displacement**

Address:	0x1134	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.54 **Max. running speed of 9th displacement**

Address:	0x1136	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.55 **Acceleration/Deceleration time of 9th displacement**

Address:	0x1137	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.56 **Waiting time after 9th displacement**

Address:	0x1138	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.57 **10th displacement**

Address:	0x1139	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.59 **Max. running speed of 10th displacement**

Address:	0x113B	Effective mode:	At once
Minimum:	1	Unit:	rpm

Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.60 Acceleration/Deceleration time of 10th displacement

Address:	0x113C	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.61 Waiting time after 10th displacement

Address:	0x113D	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.62 11th displacement

Address:	0x113E	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.64 Max. running speed of 11th displacement

Address:	0x1140	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.65 **Acceleration/Deceleration time of 11th displacement**

Address:	0x1141	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.66 **Waiting time after 11th displacement**

Address:	0x1142	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.67 **12th displacement**

Address:	0x1143	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.69 **Max. running speed of 12th displacement**

Address:	0x1145	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.70 **Acceleration/Deceleration time of 12th displacement**

Address:	0x1146	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.71 **Waiting time after 12th displacement**

Address:	0x1147	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.72 **13th displacement**

Address:	0x1148	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.74 **Max. running speed of 13th displacement**

Address:	0x114A	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.75 **Acceleration/Deceleration time of 13th displacement**

Address:	0x114B	Effective mode:	At once
Minimum:	0	Unit:	ms

Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.76 Waiting time after 13th displacement

Address:	0x114C	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.77 14th displacement

Address:	0x114D	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.79 Max. running speed of 14th displacement

Address:	0x114F	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.80 Acceleration/Deceleration time of 14th displacement

Address:	0x1150	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.81 **Waiting time after 14th displacement**

Address:	0x1151	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

H11.82 **15th displacement**

Address:	0x1152	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:

-1073741824 to 1073741824

Parameter description

Same as displacement 1

H11.84 **Max. running speed of 15th displacement**

Address:	0x1154	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:

1rpm~7000rpm

Parameter description

Same as the maximum speed of displacement 1

H11.85 **Acceleration/Deceleration time of 15th displacement**

Address:	0x1155	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Same as the acceleration/deceleration time of displacement 1

H11.86 **Waiting time after 15th displacement**

Address:	0x1156	Effective mode:	At once
Minimum:	0	Unit:	ms(s)
Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0 ms(s) to 10000 ms(s)
Parameter description
Same as the interval time after displacement 1

H11.87 **16th displacement**

Address:	0x1157	Effective mode:	At once
Minimum:	-1073741824	Unit:	Reference unit
Maximum:	1073741824	Data type	Int32
Default:	10,000	Change mode:	At once

Range:
-1073741824 to 1073741824
Parameter description
Same as displacement 1

H11.89 **Max. running speed of 16th displacement**

Address:	0x1159	Effective mode:	At once
Minimum:	1	Unit:	rpm
Maximum:	7000	Data type:	UInt16
Default:	200	Change mode:	At once

Range:
1rpm~7000rpm
Parameter description
Same as the maximum speed of displacement 1

H11.90 **Acceleration/Deceleration time of 16th displacement**

Address:	0x115A	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Same as the acceleration/deceleration time of displacement 1

H11.91 **Waiting time after 16th displacement**

Address:	0x115B	Effective mode:	At once
Minimum:	0	Unit:	ms(s)

Maximum:	10,000	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0 ms(s) to 10000 ms(s)

Parameter description

Same as the interval time after displacement 1

7.16 H12 Multi-Speed Operation References

H12.00 **Multi-speed running mode**

Address:	0x1200	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	2	Data type:	UInt16
Default:	1	Change:	At stop

Range:

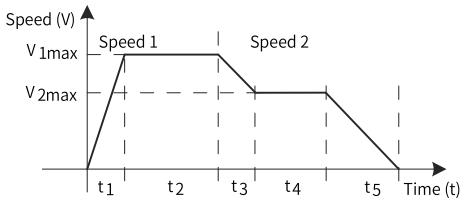
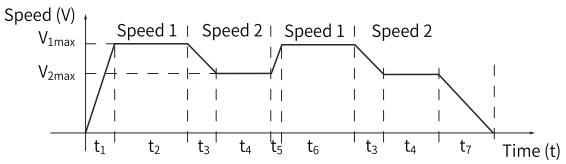
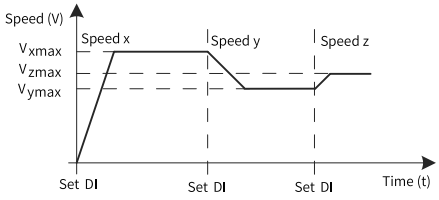
0: Individual operation (number of speeds defined by H12.01)

1: Cyclic operation (number of speeds defined by H12.01)

2: Switchover by DI

Parameter description

Defines the multi-speed operation mode when the speed reference source is multi-speed reference (H06.01 = 5, H06.02 = 1/2/3) in the speed control mode.

Set value	Operating mode	Remarks	Operation Curve
0	Stop after a single running	The servo drive stops at one round of running. The drive switches to the next displacement automatically.	 V_{1max} and V_{2max} : reference values of speed 1 and speed 2 t_1 : actual acceleration/deceleration time of speed 1 t_3 , t_5: actual acceleration/deceleration time of 2nd speed
1	Cyclic running	The servo drive repeats from the 1st speed after each round of running. The servo drive automatically switches to the next speed with a larger No. The cyclic running state remains if the servo ON signal is active.	 V_{1max} , V_{2max}: maximum values of 1st and 2nd speeds
2	Switchover by DI	The servo drive continues running when the servo ON signal is active. The speed No. is determined by the DI terminal logic. The running time of each speed reference is determined by the time interval for speed No. switchover. The speed reference direction can be switched over through FunIN.5 (DlR-SEL).	 x and y: speed No. (The relationship between the speed No. and the DI logic is described below.) V_x and V_y : speed references for speeds x and y The speed No. determined by DI does not change, which means the speed reference operates continuously regardless of the reference operating time.

H12.01 **End speed No. in speed reference**

Address:	0x1201	Effective mode:	At once
Minimum:	1	Unit:	-
Maximum:	16	Data type:	UInt16
Default:	16	Change:	At stop

Range:
1 to 16

Parameter description

It sets the total number of speed references. Different speed references, operating time, and acceleration/deceleration time (four groups optional) can be set for each speed.

FunIN.9	FunIN.8	FunIN.7	FunIN.6	Speed No.
CMD4	CMD3	CMD2	CMD1	
0	0	0	0	1
0	0	0	1	2
...				
1	1	1	1	16

H12.02 **Running time unit**

Address:	0x1202	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At stop

Range:

0: sec

1: min

Parameter description

0: sec

1: min

H12.03 **Acceleration time 1**

Address:	0x1203	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.

H12.04 **Deceleration time 1**

Address:	0x1204	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	10	Change mode:	At once

Range:

0ms~65535ms

Parameter description

Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.

H12.05 **Acceleration time 2**

Address:	0x1205	Effective mode:	At once

Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	50	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.

H12.06 **Deceleration time 2**

Address:	0x1206	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	50	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.

H12.07 **Acceleration time 3**

Address:	0x1207	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.

H12.08 **Deceleration time 3**

Address:	0x1208	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	100	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.

H12.09 **Acceleration time 4**

Address:	0x1209	Effective mode:	At once

Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	150	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Acceleration time is the time for the motor to accelerate from 0 RPM to 1000 RPM at a constant speed.

H12.10 **Deceleration time 4**

Address:	0x120A	Effective mode:	At once
Minimum:	0	Unit:	ms
Maximum:	65535	Data type:	UInt16
Default:	150	Change mode:	At once

Range:
0ms~65535ms
Parameter description
Four groups of acceleration/deceleration time can be selected for each speed No. Deceleration time is the time for the motor to decelerate from 1000 RPM to 0 RPM at a constant speed.

H12.20 **1st speed reference**

Address:	0x1214	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	0	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Defines speed reference 1 in multi-speed operation mode.

H12.21 **Running time of 1st speed reference**

Address:	0x1215	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
It sets the running time of the 1st speed reference. If the running time is 0, the servo drive automatically ignores this speed reference.

H12.22 **Acceleration/Deceleration time of 1st speed reference**

Address:	0x1216	Effective mode:	At once
Minimum:	0	Unit:	-

Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/deceleration time 1

2: Acceleration/deceleration time 2

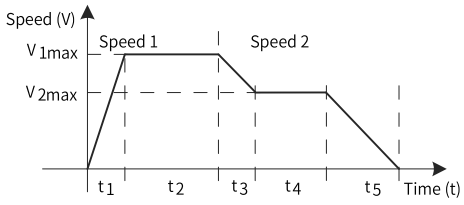
3: Acceleration/deceleration time 3

4: Acceleration/deceleration time 4

Parameter description

Sets the acceleration/deceleration time of the 1st speed reference.

Set value	Acceleration/Deceleration time	Remarks
0	Zero acceleration/ deceleration time	Acceleration time: 0 Deceleration time: 0
1	Acceleration/Deceleration time 1	Acceleration time: H12.03 Deceleration time: H12.04
2	Acceleration/Deceleration time 2	Acceleration time: H12.05 Deceleration time: H12.06
3	Acceleration/Deceleration time 3	Acceleration time: H12.07 Deceleration time: H12.08
4	Acceleration/Deceleration time 4	Acceleration time: H12.09 Deceleration time: H12.10



- V_{1max} , V_{2max} : 1st and 2nd speeds
- t_1 : actual acceleration/deceleration time of 1st speed
- t_3 , T_5 : actual acceleration/deceleration time of 2nd speed
- Running time of a certain speed = Speed change time from previous speed reference switched over to the current speed reference + Average running time (For example, the first running time is $t)_1 + t_2$, the second running time is $t_3 + t_4$, and so on).
- Do not set the operating time of a certain speed to 0. Otherwise, the drive skips this speed and switches to the next speed directly.

Actual acceleration time t_1 :

$$t_1 = \frac{V_1}{1000} \times \text{Acceleration time set for this speed}$$

Actual deceleration time t_2 :

$$t_2 = \frac{V_1}{1000} \times \text{Deceleration time set for this speed}$$

H12.23 2nd speed reference

Address:	0x1217	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16

Default:	100	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.24 **Running time of the 2nd speed reference**

Address:	0x1218	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.25 **Acc./dec. time of speed 2**

Address:	0x1219	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0: Zero acceleration/deceleration time
1: Acceleration/Deceleration time 1
2. Acceleration/Deceleration time selection 2
3. Acceleration/Deceleration time selection 3
4. Acceleration/Deceleration time selection 4
Parameter description
Same as the acceleration/deceleration time of speed 1

H12.26 **3rd speed reference**

Address:	0x121A	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	300	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.27 **Running time of the 3rd speed reference**

Address:	0x121B	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16

Default:	5.0	Change mode:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.28 **Acceleration/deceleration time of speed 3**

Address:	0x121C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:
0: Zero acceleration/deceleration time
1: Acceleration/Deceleration time 1
2. Acceleration/Deceleration time selection 2
3. Acceleration/Deceleration time selection 3
4. Acceleration/Deceleration time selection 4
Parameter description
Same as the acceleration/deceleration time of speed 1

H12.29 **4th speed reference**

Address:	0x121D	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	500	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.30 **Running time of the 4th speed reference**

Address:	0x121E	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.31 **Acceleration/deceleration time of speed 4**

Address:	0x121F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16

Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.32 **5th speed reference**

Address:	0x1220	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	700	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.33 **Running time of the 5th speed reference**

Address:	0x1221	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.34 **Acceleration/deceleration time of speed 5**

Address:	0x1222	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.35 **6th speed reference**

Address:	0x1223	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	900	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.36 **Running time of the 6th speed reference**

Address:	0x1224	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.37 **Acceleration/deceleration time of speed 6**

Address:	0x1225	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.38 **7th speed reference**

Address:	0x1226	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	600	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.39 **Running time of the 7th speed reference**

Address:	0x1227	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.40 **Acceleration/deceleration time of speed 7**

Address:	0x1228	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.41 **8th speed reference**

Address:	0x1229	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	300	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.42 **Running time of the 8th speed reference**

Address:	0x122A	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.43 **Acceleration/deceleration time of speed 8**

Address:	0x122B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.44 **9th speed reference**

Address:	0x122C	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	100	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.45 **Running time of the 9th speed reference**

Address:	0x122D	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.46 **Acceleration/deceleration time of speed 9**

Address:	0x122E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.47 **10th speed reference**

Address:	0x122F	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	-100	Change mode:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.48 **Running time of the 10th speed reference**

Address:	0x1230	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change mode:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.49 **Acceleration/deceleration time of speed 10**

Address:	0x1231	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/Deceleration time 1

2. Acceleration/Deceleration time selection 2

3. Acceleration/Deceleration time selection 3

4. Acceleration/Deceleration time selection 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.50 **11th speed reference**

Address:	0x1232	Effective mode:	At once

Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type	Int16
Default:	-300	Change mode:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.51 **Running time of the 11th speed reference**

Address:	0x1233	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.52 **Acceleration/deceleration time of speed 11**

Address:	0x1234	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:
0: Zero acceleration/deceleration time
1: Acceleration/deceleration time 1
2: Acceleration/deceleration time 2
3: Acceleration/deceleration time 3
4: Acceleration/deceleration time 4
Parameter description
Same as the acceleration/deceleration time of speed 1

H12.53 **12th speed reference**

Address:	0x1235	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type:	Int16
Default:	-500	Change:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.54 **Running time of the 12th speed reference**

Address:	0x1236	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.55 **Acceleration/deceleration time of speed 12**

Address:	0x1237	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/deceleration time 1

2: Acceleration/deceleration time 2

3: Acceleration/deceleration time 3

4: Acceleration/deceleration time 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.56 **13th speed reference**

Address:	0x1238	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type:	Int16
Default:	-700	Change:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.57 **Running time of the 13th speed reference**

Address:	0x1239	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.58 **Acceleration/deceleration time of speed 13**

Address:	0x123A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/deceleration time 1

2: Acceleration/deceleration time 2

3: Acceleration/deceleration time 3

4: Acceleration/deceleration time 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.59 **14th speed reference**

Address:	0x123B	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type:	Int16
Default:	-900	Change:	At once

Range:

-7000rpm~7000rpm

Parameter description

Same as reference 1.

H12.60 **Running time of the 14th speed reference**

Address:	0x123C	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:

0.0s(m) to 6553.5s(m)

Parameter description

Same as the operating time of speed 1.

H12.61 **Acceleration/deceleration time of speed 14**

Address:	0x123D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/deceleration time 1

2: Acceleration/deceleration time 2

3: Acceleration/deceleration time 3

4: Acceleration/deceleration time 4

Parameter description

Same as the acceleration/deceleration time of speed 1

H12.62 **15th speed reference**

Address:	0x123E	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type:	Int16
Default:	-600	Change:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.63 **Running time of the 15th speed reference**

Address:	0x123F	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.64 **Acceleration/deceleration time of speed 15**

Address:	0x1240	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:
0: Zero acceleration/deceleration time
1: Acceleration/deceleration time 1
2: Acceleration/deceleration time 2
3: Acceleration/deceleration time 3
4: Acceleration/deceleration time 4
Parameter description
Same as the acceleration/deceleration time of speed 1

H12.65 **16th speed reference**

Address:	0x1241	Effective mode:	At once
Minimum:	-7000	Unit:	rpm
Maximum:	7000	Data type:	Int16
Default:	-300	Change:	At once

Range:
-7000rpm~7000rpm
Parameter description
Same as reference 1.

H12.66 **Running time of the 16th speed reference**

Address:	0x1242	Effective mode:	At once
Minimum:	0.0	Unit:	s(m)
Maximum:	6553.5	Data type:	UInt16
Default:	5.0	Change:	At once

Range:
0.0s(m) to 6553.5s(m)
Parameter description
Same as the operating time of speed 1.

H12.67 **Acceleration/deceleration time of speed 16**

Address:	0x1243	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	4	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Zero acceleration/deceleration time

1: Acceleration/deceleration time 1

2: Acceleration/deceleration time 2

3: Acceleration/deceleration time 3

4: Acceleration/deceleration time 4

Parameter description

Same as the acceleration/deceleration time of speed 1

7.17 H17 VDO/VDI Parameters

H17.00 **VDI1 function selection**

Address:	0x1700	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Defines the VDI1 function.

H17.01 **VDI1 logic selection**

Address:	0x1701	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

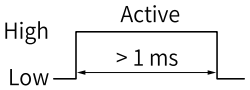
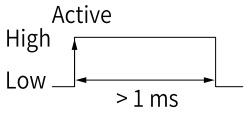
Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Defines the active level of VDI1.

Set value	VDI1 logic upon active DI function	Remarks
0	0: Active when 1 is written	
1	Active when written value changes from 0 to 1	

H17.02 **VDI2 function selection**

Address:	0x1702	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.03 **VDI2 logic selection**

Address:	0x1703	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.04 **VDI3 function selection**

Address:	0x1704	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.05 **VDI3 logic selection**

Address:	0x1705	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.06 **VDI4 function selection**

Address:	0x1706	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.07 **VDI4 logic selection**

Address:	0x1707	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.08 **VDI5 function selection**

Address:	0x1708	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.09 **VDI5 logic selection**

Address:	0x1709	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.10 **VDI6 function selection**

Address:	0x170A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.11 **VDI6 logic selection**

Address:	0x170B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.12 **VDI7 function selection**

Address:	0x170C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.13 **VDI7 logic selection**

Address:	0x170D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.14 **VDI8 function selection**

Address:	0x170E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.15 **VDI8 logic selection**

Address:	0x170F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.16 **VDI9 function selection**

Address:	0x1710	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.17 **VDI9 logic selection**

Address:	0x1711	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.18 **VDI10 function selection**

Address:	0x1712	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.19 **VDI10 logic selection**

Address:	0x1713	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.20 **VDI11 function selection**

Address:	0x1714	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.21 **VDI11 logic selection**

Address:	0x1715	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.22 **VDI12 function selection**

Address:	0x1716	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.23 **VDI12 logic selection**

Address:	0x1717	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.24 **VDI13 function selection**

Address:	0x1718	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.25 **VDI13 logic selection**

Address:	0x1719	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.26 **VDI14 function selection**

Address:	0x171A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.27 **VDI14 logic selection**

Address:	0x171B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.28 **VDI15 function selection**

Address:	0x171C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.29 **VDI15 logic selection**

Address:	0x171D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.30 **VDI16 function selection**

Address:	0x171E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	41	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No function
1: Servo ON
2: Alarm reset signal
3: Gain switchover switch
4: Main/Auxiliary reference switchover
5: Multi-reference direction
6: Multi-reference switchover 1
7: Multi-reference switchover 2
8: Multi-reference switchover 3
9: Multi-reference switchover 4
10: Mode switchover M1-SEL
11: Mode switchover M2-SEL
12: Zero clamp enable
13: Position reference inhibited
14: Positive limit switch
15: Negative limit switch
16: Positive external torque limit
17: Negative external torque limit
18: Forward jog
19: Reverse jog
20: Step enable
21: Handwheel override signal 1
22: Handwheel override signal 2
23: Hand wheel enable
24: Electronic gear ratio selection
25: Torque reference direction
26: Speed reference direction
27: Position reference direction
28: Multi-position reference enable
29: Interrupt positioning cancel
30: None
31: Home switch
32: Homing enable
33: Interrupt positioning inhibited
34: Emergency stop
35: Position deviation clear
36: Internal speed limit
37: Pulse reference inhibited
38: Axis control command-write interrupted
Active: Axis control command-write not interrupted
40: Positioning and reference completed signal clear
41: Current position as the home

Parameter description

Same as H17.00

H17.31 **VDI16 logic selection**

Address:	0x171F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Active when the written value is 1

1: Active when the written value changes from 0 to 1

Parameter description

Same as H17.01

H17.32 **VDO virtual level**

Comm. address:	0x1720	Effective mode:	Real time
Min. value:	0x0	Unit:	-
Max. value:	0xFFFF	Data type:	UInt16
Default value:	0x0	Change mode:	Read-only

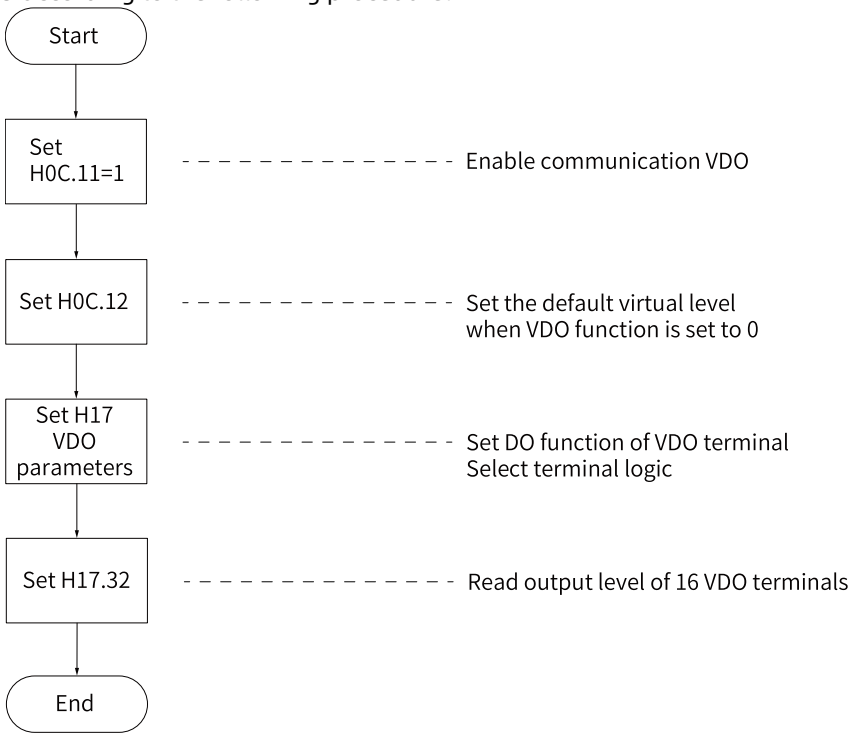
Value range:

0x0 to 0xFFFF

Description

Sets the default virtual level of the VDO allocated with function 0 (invalid).

Use the VDO according to the following procedure:



H17.33 **VDO1 function selection**

Address:	0x1721	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment

1: Servo ready

2: Motor rotation

3: Zero speed

4: Speed matching

5: Positioning completed

6: Positioning almost completed

7: Torque limited

8: Speed limited

9: Brake

10: Alarm

11: Fault

12: Output 3-bit alarm code

13: Output 3-bit alarm code

14: Output 3-bit alarm code

15: Interrupt positioning completed

16: Homing completed

17: Electrical homing completed

18: Torque reach

19: Speed reach

22: Internal command completed

23: Writing next command allowed

24: Internal motion completed

Parameter description

Defines the function of VDO1.

H17.34 VDO1 logic level

Address:	0x1722	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

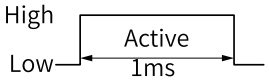
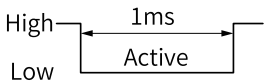
Range:

0: Output 1 upon active logic

1: Output 0 upon active logic

Parameter description

Defines the active level of VDO1.

Set value	VDO1 terminal logic	Remarks
0	Output 1 when function valid	
1	Output 0 when function valid	

H17.35 **VDO2 function selection**

Address:	0x1723	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment

1: Servo ready

2: Motor rotation

3: Zero speed

4: Speed matching

5: Positioning completed

6: Positioning almost completed

7: Torque limited

8: Speed limited

9: Brake

10: Alarm

11: Fault

12: Output 3-bit alarm code

13: Output 3-bit alarm code

14: Output 3-bit alarm code

15: Interrupt positioning completed

16: Homing completed

17: Electrical homing completed

18: Torque reach

19: Speed reach

22: Internal command completed

23: Writing next command allowed

24: Internal motion completed

Parameter description

Same as H17.33

H17.36 **VDO2 logic level**

Address:	0x1724	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic

1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.37 **VDO3 function selection**

Address:	0x1725	Effective mode:	At once
Minimum:	0	Unit:	-

Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment

1: Servo ready

2: Motor rotation

3: Zero speed

4: Speed matching

5: Positioning completed

6: Positioning almost completed

7: Torque limited

8: Speed limited

9: Brake

10: Alarm

11: Fault

12: Output 3-bit alarm code

13: Output 3-bit alarm code

14: Output 3-bit alarm code

15: Interrupt positioning completed

16: Homing completed

17: Electrical homing completed

18: Torque reach

19: Speed reach

22: Internal command completed

23: Writing next command allowed

24: Internal motion completed

Parameter description

Same as H17.33

H17.38 VDO3 logic level

Address:	0x1726	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic

1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.39 VDO4 function selection

Address:	0x1727	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.40 **VDO4 logic level**

Address:	0x1728	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.41 **VDO5 function selection**

Address:	0x1729	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.42 VDO5 logic level

Address:	0x172A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.43 VDO6 function selection

Address:	0x172B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description
Same as H17.33

H17.44 **VDO6 logic level**

Address:	0x172C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:
0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description
Same as H17.34

H17.45 **VDO7 function selection**

Address:	0x172D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.46 **VDO7 logic level**

Address:	0x172E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.47 **VDO8 function selection**

Address:	0x172F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.48 VDO8 logic level

Address:	0x1730	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.49 VDO9 function selection

Address:	0x1731	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.50 **VDO9 logic level**

Address:	0x1732	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.51 **VDO10 function selection**

Address:	0x1733	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.52 **VDO10 logic level**

Address:	0x1734	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.53 **VDO11 function selection**

Address:	0x1735	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.54 **VDO11 logic level**

Address:	0x1736	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.55 **VDO12 function selection**

Address:	0x1737	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.56 **VDO12 logic level**

Address:	0x1738	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.57 **VDO13 function selection**

Address:	0x1739	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.58 VDO13 logic level

Address:	0x173A	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.59 VDO14 function selection

Address:	0x173B	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.60 **VDO14 logic level**

Address:	0x173C	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.61 **VDO15 function selection**

Address:	0x173D	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.62 **VDO15 logic level**

Address:	0x173E	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

H17.63 **VDO16 function selection**

Address:	0x173F	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	27	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: No assignment
1: Servo ready
2: Motor rotation
3: Zero speed
4: Speed matching
5: Positioning completed
6: Positioning almost completed
7: Torque limited
8: Speed limited
9: Brake
10: Alarm
11: Fault
12: Output 3-bit alarm code
13: Output 3-bit alarm code
14: Output 3-bit alarm code
15: Interrupt positioning completed
16: Homing completed
17: Electrical homing completed
18: Torque reach
19: Speed reach
22: Internal command completed
23: Writing next command allowed
24: Internal motion completed

Parameter description

Same as H17.33

H17.64 **VDO16 logic level**

Address:	0x1740	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	1	Data type:	UInt16
Default:	0	Change:	At once

Range:

0: Output 1 upon active logic
1: Output 0 upon active logic

Parameter description

Same as H17.34

7.18 H1b Motor Storage Property

H1b.14 **Bit01 of motor SN**

Address:	0x1B0E	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Displays bit01 of motor SN code.

H1b.15 **Bit23 of motor SN**

Address:	0x1B0F	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Displays bit23 of motor SN code.

H1b.16 **Bit45 of motor SN**

Address:	0x1B10	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Displays bit45 of motor SN code.

H1b.17 **Bit67 of motor SN**

Address:	0x1B11	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Displays bit67 of motor SN code.

H1b.18 **Bit89 of motor SN**

Address:	0x1B12	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:

0x0 to 0xFFFF

Parameter description

Displays bit89 of motor SN code.

H1b.19 **Bit11 of motor SN**

Address:	0x1B13	Effective mode:	At once
Minimum:	0x0	Unit:	-

Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:
0x0 to 0xFFFF
Parameter description
Displays bit11 of motor SN code.

H1b.20 Bit13 of motor SN

Address:	0x1B14	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:
0x0 to 0xFFFF
Parameter description
Displays bit13 of motor SN code.

H1b.21 Bit15 of motor SN

Address:	0x1B15	Effective mode:	At once
Minimum:	0x0	Unit:	-
Maximum:	0xFFFF	Data type:	UInt16
Default:	0x0	Change:	At stop

Range:
0x0 to 0xFFFF
Parameter description
Displays bit15 of motor SN code.

H1b.47 Motor storage property mask word 1

Address:	0x1B2F	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0–65535
Parameter description
Defines the motor property mask word 1.

H1b.48 Motor storage property mask word 2

Address:	0x1B30	Effective mode:	Effective upon next power-on
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	At stop

Range:
0–65535
Parameter description
Defines the motor property mask word 2.

7.19 H30 Servo Status Variables Read Through Communication

H30.00 **Servo state read by communication**

Address:	0x3000	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

The value of H30.00 is a hexadecimal, which is not displayed on the keypad and must be converted to a binary equivalent when it is being read through communication.

Bit	Servo Status	Remarks
0	Servo ready	It determines whether the servo main circuit DC bus voltage is ready and the servo drive is ready for running. 0: Servo drive not ready 1: Servo ready
1 to 11	Reserved	-
12 to 13	Servo running state	It determines the servo running state. 00: Servo drive not ready (main circuit DC bus voltage not set up correctly) 01: Servo drive ready (main circuit DC bus voltage set up correctly, servo drive is ready for running) 10: Servo drive running (S-ON active) 11: Servo drive fault (a level 1 or level 2 fault occurs)
14 to 15	Reserved	-

H30.01 **DO function state 1 read via communication**

Address:	0x3001	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

The state of DO function 1 to DO function 16 are read through communication based on the DO function list. H30.01 is a hexadecimal, which is not displayed on the keypad and must be converted to a binary equivalent when it is being read through communication.

Bit	DO Functions	Remarks
0	DO function 1 (FunOUT.1:S-RDY, servo ready)	0: Servo drive not ready 1: Servo ready
...		
15	DO function 16 (FunOUT.16: HomeAttain, homing output)	0: Homing not completed 1: Homing completed

H30.02 **DO function state 2 read via communication**

Address:	0x3002	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

bit0 corresponds to DO function 17.
bit1 corresponds to DO function 18.
bit2 corresponds to DO function 19.
…
By analogy

Bit	DO Functions	Remarks
0	DO function 17 (FunOUT.17: ElecHomeAttain, electric homing output)	0: Electrical homing not completed 1: Electrical homing completed
…		
9th	DO function 27 (FunOUT.27: AlmAndWarn, fault or alarm output signal)	0: Fault or alarm output invalid 1: Fault or alarm output valid

H30.03 **Input pulse reference sampling read via communication**

Address:	0x3003	Effective mode:	-
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change:	Unmodifiable

Range:

0–65535

Parameter description

Indicates the number of pulses at the pulse input terminal read through communication within an individual control cycle when the position reference source is pulse input (H05.00 = 0) or handwheel input. This parameter is irrelevant to the servo running mode and running status.

H30.04 **DI status read via communication**

Comm. address:	0x3004	Effective mode:	-
Min. value:	0	Unit:	-
Max. value:	65535	Data type:	UInt16
Default value:	0	Change mode:	Read-only

Value range:

0 to 65535

Description

Indicates the state of DI1 to DI9. The value 1 represents the corresponding DI is switched on and the value 0 represents the corresponding DI not switched on.
For example:
When DI9 is switched on while DI1 to DI8 are not, H30.04 = 256 (binary: 100 000 000).

When DI8 and DI9 are switched on while DI1 to DI7 are not, H30.04 = 384 (binary: 110 000 000). When DI9, DI8 and DI3 are switched on while DI4 to DI7 or DI2 to DI1 are not, H30.04 = 388 (binary: 110 000 100).

7.20 H31 Related Variables Set Through Communication

H31.00 **VDI virtual level set via communication**

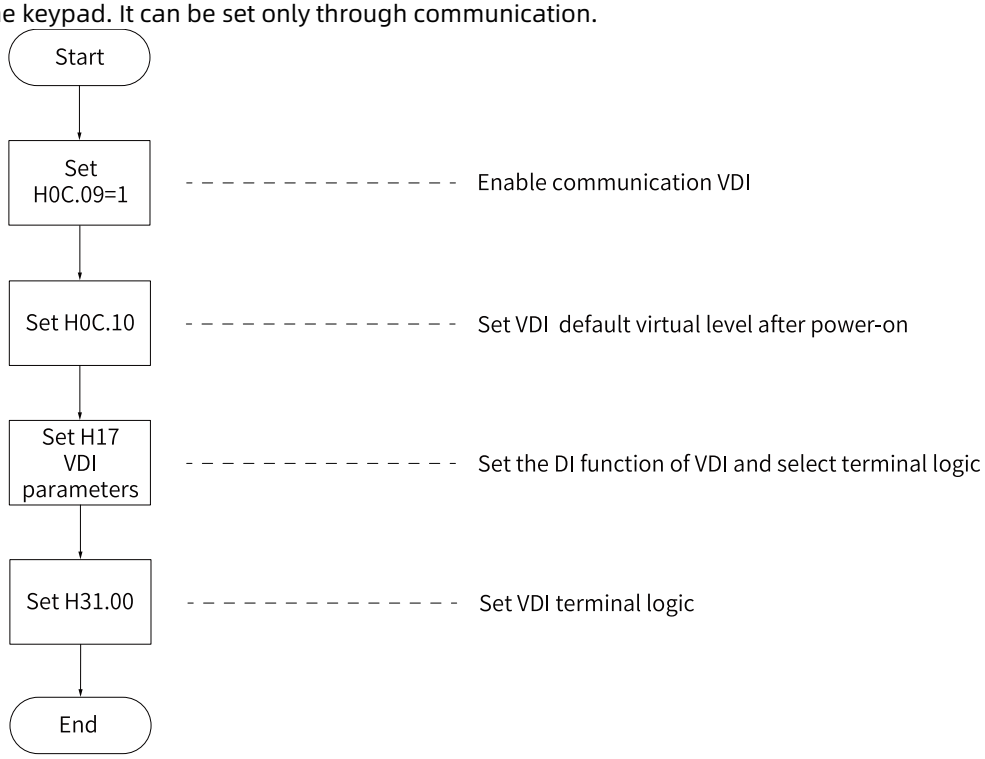
Address:	0x3100	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0–65535

Parameter description

Defines the DI function levels of VDI1 to VDI6. H31.00 is a decimal value, which is not displayed on the keypad. It can be set only through communication.



H31.04 **DO state set via communication**

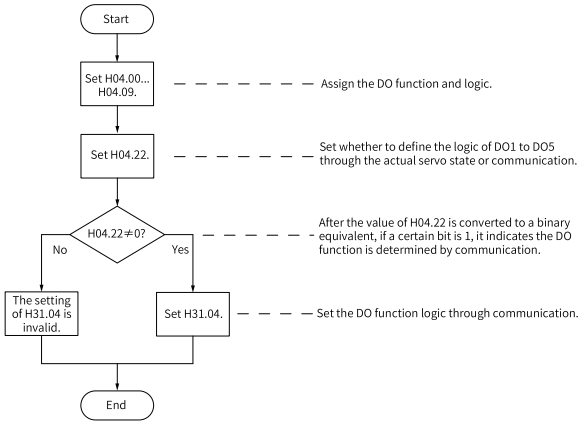
Address:	0x3104	Effective mode:	At once
Minimum:	0	Unit:	-
Maximum:	65535	Data type:	UInt16
Default:	0	Change mode:	At once

Range:

0–65535

Parameter description

If DO function is used, the DO state will be set through communication based on the setting of H04.22 (DO source). H31.04 is a decimal value, which is not displayed on the keypad. It can be set only through communication.



H31.09 **Speed reference set through communication**

Comm. address:	0x3109	Effective mode:	Real time
Min. value:	-6000.000	Unit:	rpm
Max. value:	6000.000	Data type:	Int32
Default value:	0.000	Change mode:	Real time

Value range:

-6000.000 to +6000.000

Description

The value is accurate to 0.001.

It sets the speed reference (in precision of 0.001 RPM) when the speed reference source is communication in speed control mode. The setpoint of H31.09 is a 32-bit value, which is not displayed on the keypad. It can only be set through communication.

H31.11 **Torque reference set via communication**

Address:	0x310B	Effective mode:	At once
Minimum:	-100000	Unit:	%
Maximum:	100000	Data type	Int32
Default:	0	Change mode:	At once

Range:

-100000 %~100000%

Parameter description

Sets the torque reference (accurate to 0.001%) when the torque reference source is communication in the torque control mode.

The setpoint 100.000% corresponds to the rated torque of the motor.

The setpoint of H31.11 is a 32-bit value, which is not displayed on the keypad. It can only be set through communication.

8 Troubleshooting

8.1 Fault and alarm levels

Fault and alarm levels

Faults and alarms of the driver are classified into three levels according to severity, from highest to lowest: level 1 fault, level 2 fault, and level 3 alarm. Level 1 faults are further divided into non-resettable faults and resettable faults. See the following table for details.

- No. 1 non-resettable faults
- No. 1 resettable faults
- No. 2 resettable faults
- No. 3 resettable alarms

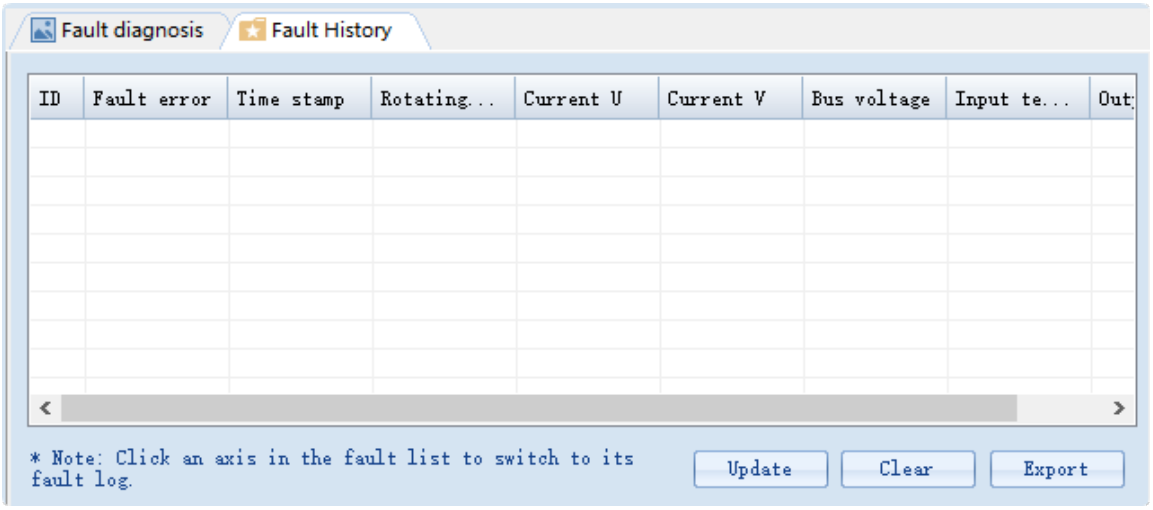
Note

"Resettable" means the keypad stops displaying the fault/alarm once a "Reset signal" is input.

Fault Log

The servo drive can record the latest 10[1]faults and alarms, as well as the status parameters upon fault/alarm. However, duplicate faults or alarms are not recorded by default. The fault log must be cleared before the same fault or alarm can be recorded again.

After a fault or alarm is reset, it still exists in the fault log. To remove the fault/alarm log from the fault log, set H02.31 to 2. See the following figure for details.



Read the value of H0b.34 through InoDrivershop to get the fault/alarm name. See examples in the following table.

H0b.34 (Hexadecimal)	Description of H0b.34 (hexadecimal)
0101	0: Fault subcode 101: Fault code

Note

[1]: To show 20 fault records: The MCU software version is required to be 6.3 and above, and the commissioning software must be the latest.

8.2 Reset After Troubleshooting

You can set H0d.01 to 1 (Fault reset) to stop the keypad from displaying the fault. Procedure:

- To reset No. 1 and No. 2 faults, switch off the S-ON signal first, and then set H0d.01 to 1.
- To reset No.3 alarms, set H0d.01 to 1.

☆ Related parameters:

Parameter	Name	Value range	Unit	Default setting	Setting mode	Effective time	Related modes
H0d.01	Fault reset	0: Inactive 1: Active	-	0	At stop	Real time	-



When a resettable fault occurs, reset the fault as instructed. Failure to comply may result in sudden startup of the motor, leading to personal injury.

Note

- Some faults and alarms can be reset only after the fault causes are rectified by modifying the settings. The fault can be reset only after the fault causes are rectified.
- For modifications that can be activated only at next power-on. Power off and on the drive again.
- For modifications that can be activated only after stop, switch off the S-ON signal. The drive can operate normally after the modification is activated.

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0d.01	Fault reset	0x0D01	0–1	-	0	UInt16	At stop	Ordinary user	At once
	Values:								
	0: No action 1: Fault reset								
	Parameter description:								
	Defines whether to enable fault reset. After fault reset, the keypad stops displaying the fault only, but parameter change still does not take effect. This function is invalid to non-resettable faults. Take caution with this function if the fault causes are not removed. Note: This parameter is non-retentive upon power failure as it is not saved to EERPOM.								

Parameter	Name	Add.	Range	Unit	Default value	Data Format	Change Method	User Permissions	Effective Way
H0b.34	Fault code of the selected fault record	0x0B22	0x0 to 0xFFFF	-	0x0	UInt16	Unmodifiable	Ordinary user	-
	Parameter description:								
	Displays the fault code corresponding to the fault set by H0b.33.								

8.3 List of Alarm Codes

Table 8–1 Resettable alarms

Fault code	Fault name	Fault level	Resettable	Error code (603Fh)	Auxiliary code (203Fh)
E108.0	Storage parameter write error	3	Yes	0x5530	0x01080108
E108.1	Storage parameter read error	3	Yes	0x5530	0x01080108
E110.0	Frequency-division pulse output setting error	3	Yes	0x6320	0x01100110
E121.0	Invalid S-ON command	3	Yes	0x5441	0x01210121
E122.0	Multi-turn absolute encoder setting error	3	Yes	0x0122	0x01220122
E510.0	Frequency division pulse output overspeed	3	Yes	0x0510	0x05100510
E600.0	Inertia auto-tuning failure	3	Yes	0x0600	0x06000600
E601.0	Homing alarm	3	Yes	0x0601	0x06010601
E730.0	Encoder battery alarm	3	Yes	0x7305	0x07300730
E900.0	DI emergency braking	3	Yes	0x5442	0x09000900
E908.0	Model ID checksum failure	3	Yes	0x0908	0x09080908
E909.0	Motor overload alarm	3	Yes	0x3230	0x09090909
E920.0	Braking resistor overloaded	3	Yes	0x3210	0x09200920
E922.0	Excessively low resistance of the external braking resistor	3	Yes	0x6320	0x09220922
E924.0	Braking transistor over-temperature	3	Yes	0x0924	0x09240924
E941.0	Modified parameters activated at next power-on	3	Yes	0x6320	0x09410941
E942.0	Parameter stored too frequently	3	Yes	0x7600	0x09420942
E950.0	Forward overtravel	3	Yes	0x5443	0x09500950
E952.0	Reverse overtravel	3	Yes	0x5444	0x09520952
E980.0	Encoder algorithm error	3	Yes	0x7305	0x09800980
E998.0	Incorrect homing method for CANopen communication	3	Yes	0x6320	0x09980998
EA40.0	Parameter auto-tuning failed	3	Yes	0x0A40	0x0A400A40
EA41.0	Torque fluctuation compensation failure	3	Yes	0x0A41	0x0A410A41

8.4 List of Fault Codes

Fault code	Fault name	Fault level	Resettable	Error code (603Fh)	Auxiliary code (203Fh)
E101.0	Abnormal parameters in groups H02 and above	1	No	0x6320	0x01010101
E101.1	Group H00/H01 parameter error	1	No	0x6320	0x01010101
E101.2	Address error in read/write operation after the number of parameters changes	1	No	0x6320	0x01010101
E102.0	FPGA communication establishment error	1	No	0x7500	0x01020102
E102.1	FPGA initialization start error	1	No	0x7500	0x01020102
E102.8	Software versions of MCU and FPGA mismatch	1	No	0x7500	0x01020102
E104.1	MCU running timeout (MCU breakdown)	1	No	0x7500	0x01040104
E104.2	FPGA operation timeout (FPGA crashed)	1	No	0x7500	0x01040104
E104.4	MCU reference update timeout	1	No	0x7500	0x01040104
E120.0	Unknown encoder type	1	No	0x7122	0x01200120
E120.1	Unknown motor model	1	No	0x7122	0x01200120
E120.2	Unknown drive model	1	No	0x7122	0x01200120
E120.7	Model check error	1	No	0x7122	0x01200120
E122.1	DI function allocation error	2	Yes	0x0122	0x01220122
E122.4	VDI function assignment error	2	Yes	0x0122	0x01220122
E122.5	DI and VDI assigned with the same function	2	Yes	0x0122	0x01220122
E136.0	Encoder ROM motor parameter verification error	1	No	0x7305	0x01360136
E136.1	Encoder ROM motor parameter read error	1	No	0x7305	0x01360136
E136.2	Torque fluctuation compensation data verification error	1	No	0x7305	0x01360136
E201.0	Phase-P overcurrent	1	No	0x2312	0x02010201
E201.1	Phase-U overcurrent	1	No	0x2312	0x02010201
E201.2	Phase-V overcurrent	1	No	0x2312	0x02010201
E201.4	Phase-N overcurrent	1	No	0x2312	0x02010201
E207.0	D-/Q-axis current overflow	1	Yes	0x0207	0x02070207
E208.2	Encoder communication timeout	1	Yes	0x0208	0x02080208
E208.4	FPGA current loop operation timeout	1	Yes	0x0208	0x02080208
E210.0	Output ground fault	1	No	0x2330	0x02100210
E210.1	Output short-circuited to ground (new)	1	No	0x2330	0x02100210
E234.0	Runaway	1	No	0x0234	0x02340234
E321.0	Dynamic brake resistor overload	1	Yes	0x0321	0x03210321
E400.0	Main circuit overvoltage	1	Yes	0x3210	0x04000400

Fault code	Fault name	Fault level	Resettable	Error code (603Fh)	Auxiliary code (203Fh)
E410.0	Main circuit undervoltage	1	Yes	0x3220	0x04100410
E420.0	Main circuit phase loss	2	Yes	0x3130	0x04200420
E430.0	Control power supply undervoltage	2	Yes	0x3120	0x04300430
E500.0	Motor overspeed	1	Yes	0x8400	0x05000500
E602.0	Angle auto-tuning failure	1	Yes	0x0602	0x06020602
E602.2	U/V/W phase sequence reversed	1	Yes	0x0602	0x06020602
E605.0	Speed too fast upon S-ON	1	Supported	0x0605	0x06050605
E620.0	Motor overload	1	Yes	0x3230	0x06200620
E625.0	Brake abnormality enabled	1	Yes	0x0625	0x06250625
E626.0	Brake abnormality disabled	1	Yes	0x0626	0x06260626
E630.0	Motor stall overtemperature protection	1	Yes	0x7121	0x06300630
E640.0	IGBT junction temperature excessively high	1	Yes	0x0640	0x06400640
E640.1	Flywheel diode junction temperature excessively high	1	Yes	0x0640	0x06400640
E650.0	Heatsink temperature excessively high	1	Yes	0x4210	0x06500650
E660.0	Motor over-temperature	1	Yes	0x0660	0x06600660
E661.6	Gain auto-adjustment failed	2	Yes	0x0661	0x06610661
E668.0	The homing method does not match the current encoder.	2	Yes	0x0668	0x06680668
E731.0	Encoder multi-turn position data loss	2	Yes	0x7305	0x07310731
E733.0	Encoder multi-turn counting error	2	Yes	0x7305	0x07330733
E735.0	Encoder multi-turn counting overflow	2	Yes	0x7305	0x07350735
E740.0	Absolute encoder communication timeout	1	No	0x7305	0x07400740
E740.2	Absolute encoder error	1	No	0x7305	0x07400740
E740.3	Absolute encoder single-turn calculation error	1	No	0x7305	0x07400740
E740.6	Encoder write error	1	No	0x7305	0x07400740
E760.0	Encoder over-temperature	2	Yes	0x4210	0x07600760
E939.0	Motor power cable disconnected	1	Yes	0x3331	0x09390939
E994.0	CANlink station number conflict	2	Yes	0x0994	0x09940994
EA33.0	Encoder read/write verification error	1	No	0x7305	0x0A330A33
EA34.0	Encoder communication check abnormal	1	No	0x7305	0x0A340A34
EB00.0	Excessive position deviation	2	Supported	0x8611	0x0B000B00
EB00.1	Position deviation overflow	2	Supported	0x8611	0x0B000B00
EB01.0	The position reference increment is too large.	2	Yes	0x0B01	0x0B010B01

Fault code	Fault name	Fault level	Resettable	Error code (603Fh)	Auxiliary code (203Fh)
EB03.0	Electronic gear ratio beyond the limit - H05.02	2	Yes	0x6320	0x0B030B03
EB03.1	Electronic gear ratio beyond the limit - Electronic gear ratio 1	2	Yes	0x6320	0x0B030B03
EB03.2	Electronic gear ratio beyond the limit - Electronic gear ratio 2	2	Yes	0x6320	0x0B030B03
ED03.0	CANlink disconnected	2	Yes	0x0D03	0x0D030D03

8.5 Description of Alarm Codes

E108.0: Storage parameter write fault

Cause:

Parameter values cannot be written to EEPROM.

Troubleshooting:

Cause	Verification method	Solution
A fault occurs when writing parameters.	Modify a certain parameter, power cycle the drive, and check whether the modification is saved.	If the modification is not saved and the fault persists after the drive is restarted repeatedly, replace the drive.

E108.1: Storage parameter read fault

Cause:

Parameter values cannot be read from EEPROM.

Troubleshooting:

Cause	Verification method	Solution
The parameter-read operation is abnormal, and the system indicates an EEPROM read failure.	Modify a certain parameter, power off and on the servo drive again and check whether the modified value can be read.	If the modified value cannot be read and the fault persists after the servo drive is powered off and on repeatedly, replace the drive.

E110.0: Frequency-division pulse output setting error

Cause:

The number of frequency-division pulses (after quadrature multiplication) exceeds the motor resolution.

Troubleshooting:

Cause	Verification method	Solution
The number of frequency-division pulses (after quadrature multiplication) exceeds the motor resolution.	Check the setpoint of H05.61.	Adjust the value of H05.61 on the basis of the motor revolutions.

E121.0: S-ON command inactive

Cause:

A redundant S-ON signal is sent when some auxiliary functions are used.

Troubleshooting:

Cause	Verification method	Solution
The external S-ON signal is active when servo drive is enabled internally.	Check whether auxiliary functions (H0d.02, H0d.03, and H0d.12) are used and whether DI function 1 (FunIN.1: S-ON signal) is active.	Deactivate the DI assigned with FunIN.1 (both hardware DI and virtual DI).

E122.0: Multi-turn absolute encoder setting error

Cause:

The motor does not match the absolute position mode or the motor code is set improperly.

Troubleshooting:

Cause	Verification method	Solution
The motor does not match the absolute position mode or the motor code is set incorrectly.	1. Check the motor nameplate to see whether the motor is configured with a multi-turn absolute encoder. 2. Check whether the H00.00 (Motor code) is set properly.	Reset H00.00 (motor code) according to the motor nameplate or use a suitable motor.

E510.0: Frequency division pulse output overspeed

Cause:

The single-channel output pulse frequency exceeds the frequency upper limit allowed by the hardware (4 MHz) when pulse output is used (H05.38 = 0/1/2).

Troubleshooting:

Cause	Verification method	Solution
The MCU detects excessive pulse increment fed back by FPGA.	1. When H05.38 is set to 0 (encoder frequency-division output) or 2 (secondary encoder frequency-division output), check whether the output pulse frequency corresponding to the motor speed upon fault exceeds the limit. Output pulse frequency (Hz) = Motor speed (rpm) ÷ 60 × H05.17 2. The input pulse frequency exceeds 2 MHz or interference exists in the pulse input pins when H05.38 is set to 1 (Reference pulse synchronous output). Low-speed pulse input pins: open-collector input terminals: PULLHI, PULSE+, PULSE-, SIGN+, SIGN-; maximum pulse frequency: 200 kpps. High-speed pulse input pins: differential input terminals: HPULSE+, HPULSE-, HSIGN+, HSIGN, maximum pulse frequency: 8 Mpps	1. Decrease the value of H05.17 (encoder frequency-division pulses) to allow the output pulse frequency, within the speed range required by the machine, to drop below the frequency upper limit allowed by the hardware. 2. Decrease the input pulse frequency to a value within the frequency upper limit allowed by hardware. In this case, if you do not modify the electronic gear ratio, the motor speed will decrease. If the input pulse frequency is high but is still within the frequency upper limit allowed by the hardware, take anti-interference measures (use STP cable for pulse input and set pin filter parameter H0A.24 or H0A.30). This is to prevent false alarms caused by interference pulses superimposed to actual pulse references.

E600.0: Angle auto-tuning failure

Cause:

Vibration cannot be suppressed. You can set notch parameters (H09.12 to H09.23) manually to suppress vibration.
The auto-tuned values fluctuate dramatically. Increase the maximum operating speed, reduce the acceleration/deceleration time, and shorten the stroke of the lead screw during ETune operation.
Mechanical couplings of the load are loose, or the mechanism is eccentric. Rectify mechanical faults.
An alarm occurs during auto-tuning and causes interruption. Clear the alarm and perform auto-tuning again.
The vibration cannot be suppressed if the load carries large inertia. In this case, increase the acceleration/deceleration time to ensure the motor current is not saturated.

Troubleshooting:

Cause	Verification method	Solution
1. Continuous vibration exists during auto-tuning. 2. The auto-tuned values fluctuate dramatically. 3. Mechanical connections of the load are loosened or eccentric. 4. A warning occurs during auto-tuning and causes interruption. 5. The vibration cannot be suppressed if the load carries large inertia. In this case, increase the acceleration/deceleration time to ensure the motor current is unsaturated.	1. Perform internal inspection to check whether the torque jitters upon stop (not FFT). 2. If the current inertia value is <5 × the previous value, check whether the change exceeds 3 × the previous value. If the current inertia value is ≥ 5 × the previous value, check whether the change exceeds 0.5 × the previous value.	1. Clear and reset the alarm. Clear the alarm and perform auto-tuning again. 2. For vibration that cannot be suppressed, enable vibration suppression function. 3. Ensure mechanical couplings are connected securely. 4. Increase the maximum operating speed, reduce the acceleration/deceleration time, and shorten the stroke of the lead screw during ETune operation.

E601.0: Homing alarm

Cause:

Homing timeout alarm.

Troubleshooting:

Cause	Verification method	Solution
1. The home switch is faulty.	1. There is only high-speed searching and no low-speed searching during the homing operation. 2. After high-speed searching of homing, the drive keeps reverse low-speed searching.	If a hardware DI is used, check whether the corresponding DI function is allocated to a certain DI in group H03 and check the wiring of this DI. Change the DI logic manually and observe the value of H0b.03 (monitored DI status) to monitor whether the servo drive receives corresponding DI level changes. If the home signal is Z signal, but it cannot be found, check the condition of the Z signal.
2. The home-searching time is too short.	Check whether the value of H05.35 is excessively low.	Increase the value of H05.35.
3. The speed for searching for the home switch signal at high speed is excessively low.	Based on the distance between the start position of homing and the home switch, check whether the value of H05.32 is excessively low, resulting in a prolonged homing process.	Increase the value of H05.32.

E730.0: Encoder battery alarm

Cause:

The battery voltage of the absolute encoder is lower than 3.0 V.

Troubleshooting:

Cause	Verification method	Solution
The battery voltage of the absolute encoder is lower than 3.0 V.	Measure the battery voltage.	Replace the battery with a new one that provides matching voltage.

E900.0: DI emergency braking

Cause:

The logic of the DI (including the hardware DI and virtual DI) assigned with DI function 34 (FunIN.34: Emergency stop) is active.

Troubleshooting:

Cause	Verification method	Solution
The DI function 34 (FunIN.34: Emergency stop) is triggered.	Check whether the logic of DI assigned with FunIN.34: Emergency stop is activated.	Check the operation mode and clear the DI braking signal without affecting the safety performance.

E908.0: Model identification check code failure

Cause:

Model identification check code error.

Troubleshooting:

Cause	Verification method	Solution
1. The model check word saved in EEPROM is wrong. 2. The model parameters are not programmed before delivery.	1. Check whether the alarm persists after restart. 2. Check whether parameters can be saved to EEPROM. Note: For software versions 6.3 and later, E908.0 is replaced by E120.7.	Set 1.H01.36 to 0 to shield the model identification function temporarily. 2. If you confirm that the drive is faulty, contact the technical personnel of the manufacturer. Note: For software versions 6.3 and later, E908.0 is replaced by E120.7.

E909.0: Motor overload alarm

Cause:

The cumulative motor heat exceeds the overload protective alarm threshold.

Troubleshooting:

Cause	Verification method	Solution
1. Wiring of the motor and encoder is incorrect or in poor contact.	Check the wiring among the servo drive, servo motor and the encoder according to the correct wiring diagram.	1. Connect the cables according to the correct wiring diagram. 2. It is recommended to use the cables provided by Inovance. 3. When self-made cables are used, prepare and connect the cables according to the hardware wiring instructions.
2. The load is excessive. The motor keeps outputting effective torque that higher than the rated torque for a long time.	1. Confirm the overload characteristics of the drive or motor. Check whether the average load rate (H0b.12) remains above 100.0% for a long time.	1. Use a servo drive of higher capacity and a matching servo motor. 2. You can also reduce the load and increase the acceleration/ deceleration time.
3. Acceleration/deceleration is frequent, or the load inertia is high.	1. Check the mechanical inertia ratio or perform inertia auto-tuning. View the value of H08.15 (Load moment of inertia ratio). 2. Check the single-shot operation cycle when the motor runs cyclically.	Increase the acceleration/ deceleration time.

Cause	Verification method	Solution
4. The gain is improper, or the stiffness is excessively high.	Check whether the motor vibrates and generates unusual noise during operation.	Adjust the gains.
5. The set servo drive model or motor model are incorrect.	View the model of the motor equipped with a serial-type encoder in H00.05 and the servo drive model in H01.02.	Read the servo drive nameplate and set the servo drive model (H01.02) and motor model properly.
6. The motor is stalled due to mechanical factors, resulting in excessive load during operation.	Check the reference and motor speed (H0b.00) through the software tool or keypad: Reference in the position control mode: H0b.13 (Input position reference counter) Reference in the speed control mode: H0b.01 (Speed reference) Reference in the torque control mode: H0b.02 (Internal torque reference) Check whether the reference is not 0 but the motor speed is 0 in the corresponding mode.	Eliminate mechanical factors and confirm whether the load has increased or the brake is releasing normally.
7. The servo drive is faulty.	Power cycle the servo drive.	If the fault persists after a power cycle, replace the drive.

E920.0: braking resistor overload

Cause:

The accumulative heat of the braking resistor exceeds the threshold.

Troubleshooting:

Cause	Verification method	Solution
1. The cable of the external braking resistor is in poor connection, connected loosely, or disconnected.	1. Remove the external regenerative resistor and measure whether its resistance is "∞" (infinite). 2. Measure whether the resistance between terminals P⊕ and C is "∞" (infinite).	Use a new external braking resistor. If the resistance measured is the same as the nominal value, connect the resistor between P and C. Connect the external braking resistor between P and C with a new cable.
2. The jumper between terminals P⊕ and D is shorted or disconnected when the built-in braking resistor is used.	Measure whether the resistance between terminals P⊕ and D is "∞" (infinite).	Connect terminals P⊕ and D directly with a proper cable.

Cause	Verification method	Solution
3. H02.25 is set to an incorrect value when an external braking resistor is used. 4. The resistance of the external braking resistor used is excessively high. 5. The value of H02.27 is higher than the resistance of the external braking resistor used.	1. View the value of H02.25. 2. Check whether the resistance of the external braking resistor connected between P⊕ and C is excessively high by comparing it with the value listed in the user guide. 3. Check whether the value of H02.27 is higher than the resistance of the external braking resistor connected between terminals P⊕ and C.	1. Set H02.25 according to section "Wiring and Settings of Braking Resistor". Set H02.25 to 1 (External resistor, natural cooling) Set H02.25 to 2 (external resistor, fan cooling) 2. Select a resistor of proper resistance based on the braking resistor specifications. 3. Set H02.27 according to the resistance of the external braking resistor used.
6. The input voltage of the main circuit exceeds the specifications.	Measure whether the main circuit input voltage on the drive side complies with the following specifications: 220 V servo drive: Valid value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) 380 V servo drive: Valid value: 380 V to 440V Allowable deviation: -10% to +10% (342 V to 484 V)	Replace or adjust the power supply according to the specified range.
7. The load moment of inertia ratio is excessively high. 8. The motor speed is excessively high and deceleration is not done within the set time. The motor is in the continuous deceleration status during cyclic operation. 9. The capacity of the drive or braking resistor is not sufficient.	1. Perform inertia auto-tuning or calculate total mechanical inertia according to mechanical parameters. Check whether the actual load inertia ratio exceeds 30. 2. View the motor speed curve during cyclic operation and check whether the motor is in the deceleration status for a long time. 3. View the motor speed curve in a single cycle and calculate whether the maximum braking energy can be absorbed completely.	Select an external braking resistor with large capacity and set H02.26 (Power of the external braking resistor) to a value consistent with the actual value. Select a drive with larger capacity. Reduce the load if allowed. Increase the acceleration/ deceleration time if allowed. Increase the motor operation cycle if allowed.
10. The servo drive is faulty.	-	Replace the servo drive.

E922.0: Resistance of the external braking resistor too small

Cause:

The value of H02.27 (resistance of external braking resistor) is lower than the value of H02.21 (allowed minimum resistance of external braking resistor).

Troubleshooting:

Cause	Verification method	Solution
When an external braking resistor is used (H02.25 = 1 or 2), the resistance of this resistor is lower than the minimum resistance allowed by the servo drive.	Measure whether the resistance of the external braking resistor between terminals P⊕ and C is lower than the value of H02.21.	If yes, replace with an external braking resistor that matches the drive, then set H02.27 according to the resistance of the resistor used. Finally, connect the new resistor between P⊕ and C. If not, set H02.27 to a value consistent with the resistance of the external braking resistor used.

E924.0: Braking transistor overtemperature

Cause:

The estimated temperature of the braking transistor is higher than H0A.49 (Braking resistor overtemperature threshold).

Troubleshooting:

Cause	Verification method	Solution
1. The junction temperature of the braking transistor is too high. 2. The braking transistor will be turned off automatically after overload occurs.	The braking transistor temperature exceeds the threshold defined by H0A.49.	Increase the deceleration time and control the usage of the braking transistor.

E941.0: Parameter modifications activated at next power-on

Cause:

The parameters modified are those whose "Effective time" is "Next power-on".

Troubleshooting:

Cause	Verification method	Solution
The parameters modified are those whose "Effective time" is "Next power-on".	Check whether parameters modified are designed to be activated at next power-on.	Power cycle the motor.

E942.0: Frequent parameter storage

Cause:

The number of parameters modified at a time exceeds 200.

Troubleshooting:

Cause	Verification method	Solution
A massive number of parameters are modified and saved to EEPROM (H0C.13 = 1) at a brief interval.	Check whether parameters are modified through the host controller at a brief interval.	Check the operation mode. For parameters that need not be saved in EEPROM, set H0C.13 to 0 before the host controller performs the write operation.

E950.0: Forward overtravel alarm

Cause:

The logic of the DI allocated with FunIN.14: P-OT (Positive limit switch) is valid.

Troubleshooting:

Cause	Verification method	Solution
1. The logic of the DI assigned with FunIN.14 (P-OT function 14, positive limit switch) is active.	1. Check whether a certain DI in group H03 is assigned with FunIN.14. 2. Check whether the logic of DI corresponding to the bit of H0b.03 (Monitored DI status) is active.	Check the operation mode. Send a reverse run command or rotate the motor to deactivate the DI function 14 without affecting the safety performance.
2. The position feedback of the drive reaches the positive software position limit.	Check whether the position feedback (H0b.17) is close to the value of H0A.41 (Forward overtravel). Check whether the software position limit is set in H0A.01.	Use proper servo drive references to ensure the load travel range is within the software position limit.

E952.0: Reverse overtravel alarm

Cause:

The logic of the DI allocated with FunIN.15: N-OT (negative limit switch) is valid.

Troubleshooting:

Cause	Verification method	Solution
1. The logic of the DI assigned with FunIN.15 is active.	Check whether a certain DI in group H03 is assigned with FunIN.15. 2. Check whether the logic of DI corresponding to the bit of H0b.03 (Monitored DI status) is active.	Check the operation mode. On the prerequisite of safety, send a forward run command or rotate the motor to deactivate the logic of DI assigned with FunIN.15.
2. The position feedback of the drive reaches the negative software position limit.	1. Check whether the value of H0b.17 (Position feedback) is close to that of H0A.43 (Reverse overtravel). 2. Check whether the software position limit is set in H0A.01.	Use proper servo drive references to ensure the load travel range is within the software position limit.

E980.0: Encoder algorithm error

Cause:

An encoder algorithm error occurs.

Troubleshooting:

Cause	Verification method	Solution
An internal fault occurs on the encoder.	If the fault persists after the servo drive is powered off and on several times, the encoder is faulty. Check whether E510.0 alarm occurred and set H05.17 to a value until E510.0 is not reported.	Replace the servo motor. Set H05.17 properly or decrease the maximum operating speed.

E998.0: Incorrect homing method for CANopen communication

Cause:

The homing method set for CANopen communication is incorrect.

Troubleshooting:

Cause	Verification method	Solution
The homing method set for CANopen communication is incorrect.	Check whether 6098h is set to 15, 16, 31, 32, >35, or <0 for CANopen communication in homing mode.	Change the value of 6098h.

EA40.0: Parameter auto-tuning failure

Cause:

Parameter auto-tuning failed during the phase current vector auto-tuning process.

Troubleshooting:

Cause	Verification method	Solution
In phase current vector auto-tuning, parameter auto-tuning through voltage injection fails when dynamic scanning of duty cycle is enabled, or parameter auto-tuning through voltage pulse injection fails.	Power cycle the servo drive.	Replace the servo drive.

EA41.0: Torque fluctuation compensation failure

Cause:

The torque compensation fails.

Troubleshooting:

Cause	Verification method	Solution
The torque compensation fails.	Power cycle the servo drive.	1. Disable the torque fluctuation compensation function by setting H0d.23=0 and H06.26=0. 2. Do not trigger emergency stop or external faults during auto-tuning of cogging torque fluctuation. 3. If the torque fluctuation compensation value fails, try again.

8.6 Description of Fault Codes

8.6.1 Troubleshooting Faults

E101.0: Abnormal parameters in groups H02 and above

Cause:

The total number of parameters changes, which generally occurs after software update. Values of parameters in groups H02 and above are outside the valid value range, which generally occurs after software update.

Troubleshooting:

Cause	Verification method	Solution
1. The control power voltage drops instantaneously.	1. Check whether the control circuit (L1C, L2C) is in the process of power-off or instantaneous power failure occurs. 2. Measure whether the voltage input of the control cable on the non-drive side during operation is within the following specifications: 220 V servo drive: Effective value: 220 V to 240 V Allowable deviation: 10% to +10% (198 V to 264 V) 380 V servo drive: Effective value: 380 V to 440 V Allowable deviation: 10% to +10% (342 V to 484 V)	1. Restore system parameters to default (H02.31 = 1) and write parameters again. 2. Enlarge the power capacity or replace with a power supply of higher capacity, restore system parameters to default values (H02.31 = 1), and then write parameters again.
2. Instantaneous power failure occurs during parameter storage.	Check whether instantaneous power failure occurs during parameter storage.	Power on the system again, restore system parameters to default (H02.31 = 1), and write parameters again.
3. The number of parameter-write operations within a certain period of time exceeds the limit.	1. Check whether instantaneous power failure occurs during parameter storage. 2. Check whether parameters are updated frequently through the host controller. 3. Read H0b.43 and H0b.44 to get parameter group that the abnormal parameter belongs to.	1. If the drive is faulty, replace the drive. 2. Change the way of writing and write parameters again. 3. Power on the system, restore default setting (H02.31 = 1), and write parameters again.
4. The software is upgraded.	Check whether parameter values in group H02 and above exceed the upper/lower limit due to software update.	Reset the servo drive model and servo motor model, and restore system parameters to default (H02.31 = 1).
5. The servo drive is faulty.	Restart the power supply and restore parameters to default values. If the fault persists, the drive is faulty.	Replace the servo drive.

E101.1: Parameter error in group H00/H01

Cause:

The total number of parameters changes, which generally occurs after software update. Values of parameters in groups H00 or H01 are outside the valid value range, which generally occurs after software update.

Troubleshooting:

Cause	Verification method	Solution
The drive detects whether parameter values in groups H00 and H01 exceed the upper/lower limit range during initialization upon power-on. If yes, the keypad displays E101.1. Motor parameters in group H00 are read from the encoder. Drive parameters in group H01 are mapped based on the drive model defined by H01.02.	Check which parameter in groups H00 and H01 exceeds the limit range. Check whether this parameter range is abnormal. View the abnormal parameter group number through H0b.43 and H0b.44.	Replace the motor or servo drive.

E101.2: Address error in read/write operation after the number of parameters changes

Cause:

Address error in read/write operation after the number of parameters changes.

Troubleshooting:

Cause	Verification method	Solution
The total number of parameters changes after software update, leading to an address error in read/write operation.	View the abnormal parameter group number through H0b.43 and H0b.44.	1. Change the abnormal parameter value to a value within the specified range. 2. Restore default values.

E102.0: FPGA communication establishment error

Cause:

The communication between MCU and FPGA cannot be established.

Troubleshooting:

Cause	Verification method	Solution
The communication between MCU and FPGA cannot be established.	Check whether the fault persists after the drive is powered off and on repeatedly.	Replace the servo drive.

E102.1: FPGA initialization startup error

Cause:

FPGA failed.

Troubleshooting:

Cause	Verification method	Solution
FPGA cannot start.	Check whether the fault persists after the drive is powered off and on repeatedly.	Replace the servo drive.

E102.8: FPGA and MCU versions mismatch

Cause:

FPGA and MCU software versions do not match.

Troubleshooting:

Cause	Verification method	Solution
The software versions of MCU and FPGA are inconsistent.	1. Check whether the MCU version (H01.00) is 9xx.x (the fourth digit displayed on the keypad is 9). 2. Check whether the FPGA version (H01.01) is 9xx.x (the fourth digit displayed on the keypad is 9).	Contact Inovance for technical support. Update the FPGA or MCU software.

E104.1: MCU operation timeout (MCU crashed)

Cause:

The access to MCU times out.

Troubleshooting:

Cause	Verification method	Solution
1. The FPGA is faulty. 2. The communication handshake between FPGA and HOST is abnormal. 3. Access timeout occurs between the HOST and the coprocessor.	Check whether the fault persists after the drive is powered off and on repeatedly.	Replace the servo drive.

E104.2: FPGA operation timeout (FPGA crashed)

Cause:

The MCU torque interrupt scheduling time is abnormal. This fault is reported only in the commissioning stage.

Troubleshooting:

Cause	Verification method	Solution
1. The FPGA is faulty. 2. The communication handshake between the FPGA and the MCU is abnormal.	Check whether the fault persists after the drive is powered off and on repeatedly.	Replace the servo drive.

E104.4: MCU reference update timeout

Cause:

Taking the moment when the interruption starts as the starting time, if the time when commands are written to MCU is larger than the time when position and speed regulators are started by FPGA, an alarm will be reported.

Troubleshooting:

Cause	Verification method	Solution
The system reports that the encoder communication time is set improperly, or the command calculation time is excessively long.	Check whether the fault persists after the drive is powered off and on repeatedly.	1. Disable unnecessary functions, such as notch, speed observer, filtering, etc. 2. Replace the servo drive.

E120.0: Unknown encoder type

Cause:

The servo drive detects the encoder model during initialization upon power-on. If the encoder model does not comply with the requirement, E120.0 occurs.

Troubleshooting:

Cause	Verification method	Solution
The product (motor or servo drive) code does not exist.	1. Read the nameplates of the servo drive and motor to check whether SV660 series servo drive and 23-bit encoder are used. Meanwhile, check whether H00.00 (Motor code) is set to 14101. 2. Check the servo drive code (H01.02) to see whether this servo drive code exists.	1. If the motor code does not exist, set H00.00 to 14101 when the SV660 series servo drive and 23-bit encoder are used. 2. If the drive code is absent, set the servo drive model correctly according to the nameplate.

E120.1: Unknown motor model

Cause:

The drive detects the motor model defined by H00.00 during initialization upon power-on. If the motor model does not exist, E120.1 occurs.

Troubleshooting:

Cause	Verification method	Solution
The motor model defined by H00.00 is abnormal.	Check whether the value of H00.00 matches the motor used.	Rectify the value of H00.00.

E120.2: Unknown drive model

Cause:

The servo drive detects the servo drive model defined by H01.02 during initialization upon power-on. If the servo drive model does not exist, E120.2 occurs.

Troubleshooting:

Cause	Verification method	Solution
H01.02 is incorrect.	Check the value of H01.02.	Replace the servo drive.

E120.7: Model parameter verification error

Cause:

The drive model parameter cannot be identified.

Troubleshooting:

Cause	Verification method	Solution
Model parameter CRC failed.	Check whether the model parameters are lost or not programmed.	Program the model parameters again.

E122.1: Different DIs assigned with the same function

Cause:

1. The same function is assigned to different DIs.
2. The DI function No. exceeds the maximum number allowed for DI functions.

Troubleshooting:

Cause	Verification method	Solution
1. The same function is assigned to different DIs.	Check whether parameters in groups H03 (H03.02, and H03.04 to H03.20) and H17 (H17.00, and H17.02 to H17.30) are assigned with the same non-zero DI function number.	Assign different DI function numbers to parameters in groups H03 or H17, and then restart the control circuit to activate the assignment, or switch off the S-ON signal and send a RESET signal to activate the assignment.
2. The DI function No. exceeds the maximum number allowed for DI functions.	Check whether the MCU program is updated.	Restore system parameters to default values (H02.31 = 1) and restart the servo drive.

E122.4: Different VDIs assigned with the same function

Cause:

The same function is assigned to different VDIs. The VDI function No. exceeds the maximum number allowed for VDI functions.

Troubleshooting:

Cause	Verification method	Solution
1. The same function is assigned to different VDIs.	Check whether parameters in groups H03 (H03.02, and H03.04 to H03.20) and H17 (H17.00, and H17.02 to H17.30) are assigned with the same non-zero DI function number.	Assign different DI function numbers to parameters in groups H03 or H17, and then restart the control circuit to activate the assignment, or switch off the S-ON signal and send a RESET signal to activate the assignment.
2. The VDI function No. exceeds the maximum number allowed for VDI functions.	Check whether the MCU program is updated.	Restore system parameters to default values (H02.31 = 1) and restart the servo drive.

E122.5: DI and VDI assigned with the same function

Cause:

The same function is assigned repeatedly to DI and VDI. The VDI function No. exceeds the maximum number allowed for VDI functions.

Troubleshooting:

Cause	Verification method	Solution
Two or more DIs and VDIs are assigned with the same function No.	Check whether DI function numbers set in groups H03 and H17 are repetitive.	Make sure that each DI or VDI is assigned a unique function No.

E136.0: Encoder ROM motor parameter check error

Cause:

When reading parameters from the encoder ROM, the servo drive detects that no parameters are saved or parameter values are inconsistent with the setpoints.

Troubleshooting:

Cause	Verification method	Solution
1. The servo drive model does not match the motor model.	Check whether the SV660 series servo drive and servo motor are used.	Replace the servo drive and motor.
2. A parameter check error occurs, or no parameter is saved in the serial incremental encoder ROM.	1. Check whether the encoder cable provided by Inovance is used. The cable must be connected securely without scratching, breaking or poor contact on both ends. 2. Check whether signals PS+, PS-, +5V, and GND on both ends of the encoder cable are consistent. For signal assignment, see Chapter "Wiring" in the hardware guide.	1. Use the encoder cable provided by Inovance. Ensure motor terminals are connected securely and servo drive screws are tightened properly. Use a new encoder cable if necessary. 2. Route encoder cables and power cables (R/S/T, U/V/W) through different routes.
3. The drive is faulty.	The fault persists after the servo drive is restarted.	Replace the servo drive.
4. The motor is faulty.	The fault persists after the servo drive is restarted.	Replace the motor.

E136.1: Encoder ROM motor parameter read error

Cause:

The encoder cable is not connected properly.

A communication error occurs on the encoder due to interference.

Troubleshooting:

Cause	Verification method	Solution
1. The encoder cable connections are incorrect or loosened.	1. Check the encoder wiring. 2. Check whether on-site vibration is too large, which loosens the encoder cable and even damages the encoder.	1. Connect the encoder cables according to the correct wiring diagram. 2. Re-connect the encoder cables and ensure the encoder terminals are connected securely.
2. The servo drive is faulty.	The fault persists after the servo drive is restarted.	Replace the servo drive.

E136.2: Torque fluctuation compensation data verification error

Cause:

Check whether the torque fluctuation compensation data in the motor ROM is read successfully.

Troubleshooting:

Cause	Verification method	Solution
When the R/W switch for saving the value of H06.22 (Auto-tuned torque fluctuation) to the encoder is set to 1 and motor torque fluctuation compensation is enabled, the first two check words saved in the motor ROM will be read. If these two check words differ from those set by the flash, E136.2 can be reported.	The fault persists after the servo drive is restarted.	1. Check encoder wiring; set H06.22 to 1, then power on again. 2. Replace the servo drive.

E201.0: Phase P overcurrent

Cause:

An excessively high current flows through the positive pole of the DC-AC circuit.

Troubleshooting:

Cause	Verification method	Solution
1. Gains are set improperly, leading to motor oscillation.	Check whether the motor vibrates or generates a sharp noise during startup and operation, or view the current feedback through Inovance commissioning software.	1. The motor parameters are set to improper values. Modify the motor parameter values. 2. The current loop parameters are set to improper values. Modify current loop parameter values. 3. Improper speed loop parameters cause vibration. 4. Check whether the servo drive is faulty. If yes, replace it.
2. The encoder cable is aged, corroded, or connected improperly or loosely.	1. Check whether the encoder cable provided by Inovance is used. 2. Check whether the cable is aged, corroded, or connected loosely. 3. Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.17 (Electrical angle) changes as motor shaft rotates.	Re-solder, tighten, or replace the encoder cable.
3. The drive is faulty.	1. Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.17 (Electrical angle) changes as motor shaft rotates. 2. Disconnect the motor and restart the drive to check whether the fault can be cleared. 3. Check whether the resistance of the external braking resistor is excessively low or the braking resistor is short-circuited (between terminals P ⊕ and C).	1. Replace with a braking resistor of proper resistance and model. Perform wiring again. 2. Replace the servo drive.
4. Overcurrent occurs on the braking resistor.	Check whether resistance of the external braking resistor is excessively low or the braking resistor is short-circuited (between terminals P and C).	1. Use a braking resistor with correct resistance and model. 2. Reconnect the wiring.

E201.1: Phase U overcurrent

Cause:

A current higher than the detection threshold is collected in the phase-U current.

Troubleshooting:

Cause	Verification method	Solution
1. The motor cables are in poor contact.	Check whether the drive power cables and motor cables on the U, V, and W sides of the drive are loose.	Tighten the cables that are loose or disconnected.
2. The motor cables are grounded.	After confirming the drive power cables and motor cables are connected properly, measure whether the insulation resistance between the drive U/V/W side and the PE cable is at MΩ level.	Replace the motor if the insulation is degraded.
3. The motor cables (U/V/W) are short-circuited.	Disconnect motor cables and check whether short circuit occurs among motor U/V/W cables and whether burrs exist in the wiring.	Connect the motor cables correctly.
4. The motor is damaged.	Disconnect the motor cables and measure whether the resistance among U/V/W phases of motor cables is balanced.	Replace the motor if the resistance is unbalanced.

E201.2: Phase V overcurrent

Cause:

A current higher than the threshold is collected in the phase-V current.

Troubleshooting:

Cause	Verification method	Solution
1. The motor cables are in poor contact.	Check whether the drive power cables and motor cables on the U, V, and W sides of the drive are loose.	Tighten the cables that are loose or disconnected.
2. The motor cables are grounded.	After confirming the drive power cables and motor cables are connected properly, measure whether the insulation resistance between the drive U/V/W side and the PE cable is at MΩ level.	Replace the motor if the insulation is degraded.
3. The motor cables (U/V/W) are short-circuited.	Disconnect motor cables and check whether short circuit occurs among motor U/V/W cables and whether burrs exist in the wiring.	Connect the motor cables correctly.
4. The motor is damaged.	Disconnect the motor cables and measure whether the resistance among U/V/W phases of motor cables is balanced.	Replace the motor if the resistance is unbalanced.

E201.4: Phase N overcurrent

Cause:

An excessively high current flows through the negative pole of the DC-AC circuit.

Troubleshooting:

Cause	Verification method	Solution
1. Gains are set improperly, leading to motor oscillation.	Check whether the motor vibrates or generates a sharp noise during startup and operation, or view the current feedback through Inovance commissioning software.	Perform gain tuning.
2. The encoder cable is aged, corroded, or connected improperly or loosely.	Check whether the encoder cable provided by Inovance is used and whether the cable is aged, corroded, or connected loosely.	Re-solder, tighten, or replace the encoder cable.
3. Overcurrent occurs on the braking resistor.	Check whether resistance of the external braking resistor is excessively low or the braking resistor is short-circuited (between terminals P ⊕ and C).	Replace with a braking resistor of proper resistance. Perform wiring again.
4. Overcurrent is caused by the superposition of the braking current and phase current.	Check whether the drive accelerates abruptly during braking. Check whether the voltage feedback exceeds the braking threshold through the Inovance drive software tool and whether the torque reference increases abruptly.	Increase the acceleration/ deceleration time.
5. The servo drive is faulty.	Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.17 (Electrical angle) changes as motor shaft rotates. Disconnect the motor cables and check whether the fault persists at next power-on.	Replace the servo drive.

E207.0: D/Q shaft current overflow

Cause:

The D/Q axis current overflows, which is often caused by U/V phase current errors.

Troubleshooting:

Cause	Verification method	Solution
This fault is reported when the D/1 axis current overflow flag is set to 1 in the fault register sent by the FPGA to the MCU, which is often caused by phase U/V errors.	The fault persists after the 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.

Troubleshooting:

Cause	Verification method	Solution
The servo drive fails to receive the data fed back by the encoder in three consecutive cycles.	Check whether bit12 of H0b.30 is 1. The encoder cable is wired improperly. The encoder cable is loosened. The encoder cable is too long. The encoder communication suffers from interference. The encoder is faulty.	1. Check whether the motor model is correct. 2. Check the condition of the encoder cable. 3. Check whether the encoder version (H00.04) is set properly. 4. The drive is abnormal, replace the drive.

E208.4: FPGA current loop operation timeout

Cause:

The operating time of the current loop exceeds the interval threshold.

Troubleshooting:

Cause	Verification method	Solution
FPGA operation timeout	Internal fault code H0b.45 = 4208: Current loop operation timeout	Disable some unnecessary functions to reduce the operating load of the current loop.

E210.0: Output ground fault

Cause:

The drive detects an abnormal motor phase current or bus voltage during self-test upon power-on.

1. The bus voltage exceeds the discharge threshold.
2. The phase U current of drives in size C/D/E exceeds 1/4 of the value of H01.07.
3. Overcurrent occurs on phase P and phase N of drives in size A and B.

Troubleshooting:

Cause	Verification method	Solution
1. The drive power cables (U/V/W) are short-circuited to ground.	Disconnect the motor cables, and measure whether the servo drive power cables (U/V/W) are short-circuited to ground (PE).	Connect the cables again or replace the servo drive power cables.
2. The motor is short-circuited to ground.	After confirming the servo drive power cables and motor cables are connected properly, measure whether the insulation resistance between the servo drive U/V/W side and the PE cable is at MΩ level.	Replace the motor.
3. The drive is faulty.	Disconnect the servo drive power cables from the servo drive. Check whether the fault persists after the power supply is switched on multiple times.	Replace the servo drive.
4. The motor speed is excessively high during ground fault detection.	Check whether the motor is rotating upon power-on.	Reduce the motor speed.

E210.1: Output short-circuit to ground (new)

Cause:

During short circuit to ground detection, the bus voltage exceeds the discharge threshold.

Troubleshooting:

Cause	Verification method	Solution
The servo drive power cables (U/V/W) are short-circuited to ground.	Disconnect the motor cables, and measure whether the servo drive power cables (U/V/W) are short-circuited to ground (PE).	Connect the cables again or replace the servo drive power cables.

E234.0: Runaway

Cause:

In torque control mode, the torque reference direction is reverse to the speed feedback direction. The speed feedback direction is opposite to the speed reference direction in the position or speed control mode.

Troubleshooting:

Cause	Verification method	Solution
1. The U/V/W cables are connected improperly.	Check whether the servo drive power cables are connected in the correct sequence at both ends.	Connect the U/V/W cables according to the correct sequence.
2. The motor rotor initial phase error is detected due to interference signals upon power-on.	The U/V/W phase sequence is correct, but E234.0 is reported when the servo drive is enabled.	Power cycle the motor.
3. The encoder type is set incorrectly, or the wiring is incorrect.	View the servo drive and motor nameplates to check whether the devices used are Inovance SV660 series servo drive and servo motor equipped with 23-bit encoder.	Replace with a mutually-matching servo drive and motor. For use of SV660 series servo drive and servo motor equipped with 23-bit encoder, set H00.00 to 14101. Check the motor model, encoder type, and encoder cable connection again.
4. The encoder cable is aged or corroded, or connected incorrectly or loosely.	1. Check whether the encoder cable provided by Inovance is used and whether the cable is aging, corroded, or connected loosely. 2. Switch off the S-ON signal and rotate the motor shaft manually. Check whether the value of H0b.10 (Electrical angle) changes as motor shaft rotates.	Re-solder, tighten, or replace the encoder cable.
5. The gravity load is excessive in a vertical axis application.	Check whether the load of the vertical axis is excessive. Adjust brake parameters H02.09 to H02.12 to check whether the fault can be cleared.	Reduce the load on the vertical axis or increase the stiffness level. You can also mask this fault if it does not affect safety performance and normal use.
6. Improper parameter setting leads to excessive vibration.	The stiffness level is set to an excessively high value, leading to excessive vibration.	Set a proper stiffness level to avoid excessive vibration.

E321.0: Dynamic brake resistor overload

Cause:

The dynamic braking resistor is overloaded.

Troubleshooting:

Cause	Verification method	Solution
The accumulative heat of the dynamic braking resistor exceeds the maximum thermal capacity of the resistor.	Check whether the value of H0b.98 exceeds 100%.	To avoid excessively high discharge current, prevent the motor from being driven reversely.

E400.0: Main circuit overvoltage

Cause:

The DC bus voltage between $P_{\oplus}$ and $N_{\ominus}$ exceeds the threshold:

For 220 V servo drive, the normal value is 310 V, and the overvoltage threshold is 420 V.

For 380 V servo drive, the normal value is 540 V, and the overvoltage threshold is 760 V.

Troubleshooting:

Cause	Verification method	Solution
1. The main circuit input voltage is excessively high.	Check the input power supply specifications of the drive and measure whether the input voltage of the main circuit cable (RST) on the drive side meets the following specifications: 220 V servo drive: Effective value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) 380 V servo drive: Effective value: 380 Vto 440 V Allowable deviation: -10% to +10% (342 V to 484 V)	Replace or adjust the power supply according to the specified range.
2. The power supply is unstable or affected by the lightning strike.	Check whether the power supply is unstable, affected by lightning, or complies with the preceding range.	Connect a surge protection device (SPD) and switch on the power supplies of the control circuit and the main circuit. If the fault persists, replace the servo drive.
3. The braking resistor fails.	If the built-in braking resistor is used (H02.25 = 0), check whether terminals $P_{\oplus}$ and D are jumpered. If yes, measure the resistance between terminals C and D. If an external braking resistor is used (H02.25 = 1 or 2), measure the resistance between terminals $P_{\oplus}$ and C. For details, See table "Specifications of the braking resistor" in the user guide.	1. If the resistance is "∞" (infinite), the braking resistor is disconnected internally. If 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 $P_{\oplus}$ and D. Select an external regenerative resistor of the same resistance and equal or higher power than the built-in one. If an external regenerative resistor is used, replace with a new one and connect it between $P_{\oplus}$ and C. 4. Set H02.26 (Power of external braking resistor) and H02.27 (Resistance of external braking resistor) to values consistent with the specifications of the external braking resistor used.

Cause	Verification method	Solution
4. The resistance of the braking resistor is excessively high, and energy absorption during braking is insufficient.	Measure the resistance of the external braking resistor connected between terminals P ⊕ and C. Compare the measured value with the recommended value.	1. Connect a new external braking resistor with recommended resistance between terminals P ⊕ and C. 2. Set H02.26 (Power of external braking resistor) and H02.27 (Resistance of external braking resistor) to values consistent with the specifications of the external braking resistor used.
5. The motor is in abrupt acceleration/deceleration status. The maximum braking energy exceeds the energy absorption value.	Confirm the acceleration/ deceleration time during operation and measure whether the DC bus voltage between P ⊕ and N ⊖ exceeds the overvoltage threshold during deceleration.	After verifying that the input voltage of the main circuit is within the specified range, increase the acceleration/deceleration time if allowed.
6. The bus voltage sampling value deviates greatly from the measured value.	Check whether H0b.26 (Bus voltage) is within the following range: 220 V servo drive: H0b.26 > 420 V 380 V servo drive: H0b.26 > 760 V Measure whether the DC bus voltage between P ⊕ and N ⊖ is within the normal range and lower than H0b.26.	Check whether the power supply input is normal.
7. The servo drive is faulty.	Check whether the fault persists after repeated power cycling of the main circuit.	Replace the servo drive.

E410.0: Main circuit undervoltage

Cause:

The DC bus voltage between terminals P ⊕ and N ⊖ is lower than the threshold:
220 V servo drive: Normal value: 310 V; Undervoltage threshold: 200 V (180 V for S5R5 models)
For 380 V servo drive, the normal voltage is 540 V, and the undervoltage threshold is 380 V.

Troubleshooting:

Cause	Verification method	Solution
1. The power supply of the main circuit is unstable or a power failure occurs. 2. An instantaneous power failure occurs.	Check the input power supply specifications of the drive. Measure whether the input voltage of the main circuit cable on the non-drive side and drive side (RST) meets the following specifications. 220 V drive: Effective value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) All three phases need to be measured.	Increase the power supply capacity or ensure that the input voltage is stable.
3. The power voltage drops during operation.	Check the power input voltage and check whether the main circuit power supply is applied to other devices, resulting in insufficient power capacity and a voltage dip.	Increase the power capacity.
4. A three-phase servo drive is connected to a single-phase power supply, leading to phase loss.	Check the wiring of the main circuit.	Replace the cables and connect the main circuit cables in the correct phase sequence (three-phase: R/S/T).
5. The servo drive is faulty.	Check whether the value of H0b.26 (Bus voltage) is within the following range: 220 V drive: H0b.26 < 200 V 380 V drive: H0b.26 < 380 V The fault persists after the main circuit (R/S/T) is restarted several times.	Replace the servo drive.

E420.0: Main circuit phase loss

Cause:

Main circuit PL signal detection error.

Troubleshooting:

Cause	Verification method	Solution
1. The three-phase power cables are not connected well.	Check whether the R/S/T cables on the drive side and cables on the non-drive side are in good condition and connected properly.	Replace the cables and connect the main circuit cables properly.
2. A single-phase power supply is used for a three-phase drive. 3. The three-phase power supply is unbalanced or the voltages of the three phases are excessively low.	Check the input power supply specifications of the drive and check the actual input voltage specifications. Measure whether the input voltage of the main circuit meets the following specifications: 220 V servo drive: Effective value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) 380 V servo drive: Effective value: 380 V to 440 V Allowable deviation: -10% to +10% (342 V to 484 V) All three phases need to be measured.	1. Servo drives of 0.75 kW (H01.02 = 5) can be supplied by single-phase power supplies. 2. If the input voltage complies with the specifications, set H0A.00 (Power input phase loss protection) to 2 to inhibit phase loss faults and warnings. 3. If the input voltage does not satisfy the specifications, replace or adjust the power capacity.

E430.0: Control circuit power supply undervoltage

Cause:

Undervoltage occurred on the control power supply of servo drives in size C/D/E.

Troubleshooting:

Cause	Verification method	Solution
1. The control circuit power supply of servo drives in size C/D/E are unstable or fails.	Check the input power supply specifications of the drive and check the actual input voltage specifications. Measure whether the input voltage of the main circuit meets the following specifications: 220 V servo drive: Effective value: 220 V to 240 V Allowable deviation: -10% to +10% (198 V to 264 V) 380 V servo drive: Effective value: 380 V to 440 V Allowable deviation: -10% to +10% (342 V to 484 V) All three phases need to be measured.	Increase the power capacity.
2. The control circuit power supply of servo drives in size C/D/E is in poor contact.	Check whether control circuit cables are connected properly and whether the voltage of control circuit cables (L1C, L2C) on the drive side is within the specified range.	Re-connect or replace the cables.

E500.0: Motor overspeed

Cause:

The actual speed of the motor exceeds the overspeed threshold.

Troubleshooting:

Cause	Verification method	Solution
1. The U/V/W phase sequence of the motor is incorrect.	Check whether the drive power cables are connected in the correct sequence at both ends.	Connect the U/V/W cables according to the correct sequence.
2. H0A.08 is set to an improper value.	1. Check whether the overspeed fault threshold is lower than the maximum motor speed required for operation 2. Overspeed threshold = 1.2 x maximum motor speed (H0A.08 = 0). 3. Overspeed fault threshold = H0A.08 (H0A.08 ≠ 0 and H0A.08 < 1.2 × max. motor speed)	Reset the overspeed threshold according to the actual mechanical requirement.
3. The input reference is higher than the overspeed threshold.	1. Whether the motor speed corresponding to the input reference exceeds the overspeed fault threshold. Position control mode: View the gear ratio H05.07/H05.09 to determine the increment of the position reference corresponding to an individual synchronization cycle and convert it to speed information. 2. Speed control mode: View the gear ratio H05.07/H05.09 and the target speed and speed limit (H06.06 to H06.09). 3. In torque control mode, view the speed limit defined by H07.17 and check the corresponding speed limit.	1. Position control mode: Decrease the position reference increment for an individual synchronization cycle. The host controller should cover the position ramp when generating references or reduce the target speed, increase the acceleration/ deceleration ramp, or reduce the gear ratio based on actual applications. 2. Speed mode: Reduce the target speed, speed limit, and gear ratio. 3. Torque control mode: Set the speed limit to a value below the overspeed threshold.
4. The motor speed overshoots.	Check whether the speed feedback exceeds the overspeed threshold through the software tool.	Adjust the gain or mechanical operating conditions.
5. The servo drive is faulty.	The fault persists after the drive is powered off and on again.	Replace the servo drive.

E602.0: Angle auto-tuning failure

Cause:

Unusual jitter occurs on the encoder feedback during angle auto-tuning.

Troubleshooting:

Cause	Verification method	Solution
The data fed back by the encoder is abnormal.	Check whether the encoder communication is disturbed.	Check the wiring of the encoder.

E602.2: U/V/W phase sequence reversed

Cause:

An incorrect U/V/W phase sequence is detected during angle auto-tuning.

Troubleshooting:

Cause	Verification method	Solution
A wrong U/V/W phase sequence is detected during angle auto-tuning.	Check whether U/V/W phases are wired correctly.	Exchange the cables of any two phases and start auto-tuning again.

E605.0: Motor overspeed upon S-ON

Cause:

The motor speed exceeds the rated speed when the servo drive in size A/B is enabled.

Troubleshooting:

Cause	Verification method	Solution
The motor speed exceeds the rated speed when the servo drive is switched on.	Check whether the drive is enabled when the motor is being driven.	Enable the drive when the motor is at standstill.

E620.0: Motor overload

Cause:

Heat accumulation of the motor reaches the fault threshold.

Troubleshooting:

Cause	Verification method	Solution
1. Wiring of the motor and encoder is incorrect or in poor contact.	Check the wiring between the servo drive, servo motor and the encoder according to the correct "wiring diagram".	1. Connect the cables according to the correct wiring diagram. 2. It is recommended to use the cables provided by Inovance. 3. When self-made cables are used, prepare and connect the cables according to the hardware wiring instructions.
2. The load is excessive. The motor keeps outputting effective torque that higher than the rated torque for a long time.	Check the overload characteristics of the servo drive or servo motor. Check whether the average load rate (H0b.12) of the drive keeps exceeding 100.0%.	1. Use a servo drive of higher capacity and a matching servo motor. 2. You can also reduce the load and increase the acceleration/ deceleration time.
3. Acceleration/deceleration is frequent, or the load inertia is large.	1. Calculate the mechanical inertia ratio or perform inertia auto-tuning. Check the value of H08.00 (Load inertia ratio). 2. Check the single-shot operation cycle when the motor runs cyclically.	Increase the acceleration/ deceleration time for single-shot operation.
4. The gain is improper, or the stiffness is excessively high.	Check whether the motor vibrates and generates unusual noise during operation.	Re-adjust the gain, such as the speed loop gain (H08.00).
5. The set servo drive model or motor model are incorrect.	View the motor model in H00.00 and the drive model in H01.02.	Read the servo drive nameplate and set the servo drive model (H01.02) and motor model properly.

Cause	Verification method	Solution
6. The motor is stalled due to mechanical problems, resulting in excessive load during operation.	Check the reference and motor speed (H0b.00) through the software tool or keypad: References in the position control mode: H0b.13 (Input position reference counter) References in speed control mode: H0b.01 (Speed reference) Operation reference in torque control mode: H0b.02 (Internal torque reference) Check whether the operation reference is not 0, but the motor speed is 0 in the corresponding mode.	1. Eliminate mechanical factors. 2. Check whether the brake can be released properly. 3. Check if the motor connection mechanism is normal.
7. The servo drive is faulty.	The fault persists after the drive is power-cycled.	Replace the servo drive.

E625.0: Brake abnormality enabled

Cause:

The brake fails when it is released.

Troubleshooting:

Cause	Verification method	Solution
The brake fails when it is released.	Check whether the motor shaft end is locked by the brake when the brake release signal is active.	1. Check the wiring of the brake. Use a 24 VDC power supply to power up BK+ and BK- separately, and check whether the brake can be released properly 2. Replace the motor.

E626.0: brake abnormality disabled

Cause:

The brake failed to apply.

Troubleshooting:

Cause	Verification method	Solution
The brake fails when it is applied.	Check whether the motor shaft end is not locked by the brake when the braking signal is active.	1. Check the wiring of the brake. Use a 24 VDC power supply to power up BK+ and BK- separately, and check whether the brake can be released properly 2. Replace the motor.

E630.0: Motor stall over-temperature protection

Cause:

The actual motor speed is lower than 10 rpm but the torque reference reaches the limit, and such status lasts for the time defined by H0A.32.

Troubleshooting:

Cause	Verification method	Solution
1. U/V/W output phase loss, open circuit, or incorrect phase sequence occurs on the servo drive.	Perform a motor trial run without load and check cable connections and the phase sequence with a multimeter.	Re-connect the cables according to the wiring diagram or replace the cables.
2. The motor parameters (especially the number of pole pairs) are set improperly and motor angle auto-tuning is not performed.	1. View parameters in group H00 to check whether the number of pole pairs are set properly. 2. Perform angle auto-tuning on the motor several times and check whether the value of H00.28 is consistent during angle auto-tuning.	Correct motor parameters, such as H00.17 (Number of motor pole pairs).
3. The references set through communication are disturbed.	Check whether jitter occurs on the references sent from the host controller and whether communication is disturbed.	Check whether communication between the host controller and the drive is disturbed.
4. The motor is stalled due to mechanical problems.	Check the operation reference and motor speed (H0b.00) through the software tool or keypad: References in position control mode: H0b.13 (Input position reference counter) References in speed control mode: H0b.01 (Speed reference) Operation reference in torque control mode: H0b.02 (Internal torque reference) Check whether the operation reference is not 0, but the motor speed is 0 in the corresponding mode. Check the current feedback (torque reference) waveform.	Check whether any mechanical part is stuck or eccentric.

E640.0: IGBT junction temperature excessively high

Cause:

The IGBT temperature reaches the fault threshold defined by H0A.18.

Troubleshooting:

Cause	Verification method	Solution
1. The ambient temperature is excessively high. 2. The drive is restarted repeatedly to reset the overload fault.	Measure the ambient temperature and view the fault log (set H0b.33 and view H0b.34) to check whether an overload fault/alarm is reported (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0).	Improve the cooling conditions of the drive to lower down the ambient temperature. Change the fault reset method. After overload occurs, wait for 30s and then perform the reset operation. Increase the capacities of the servo drive and servo motor. Increase the acceleration/ deceleration time and reduce the load.
3. The fan is damaged.	Check whether the fan works properly during operation.	Replace the servo drive.

Cause	Verification method	Solution
4. The installation direction and clearance between servo drives are improper.	Check whether the drive is installed properly.	Install the drive according to the installation requirements.
5. The servo drive is faulty.	The fault persists upon restart five minutes after power-off.	Replace the servo drive.

E640.1: Flywheel diode junction temperature excessively high

Cause:

The temperature of the flywheel diode reaches the fault threshold defined by H0A.18.

Troubleshooting:

Cause	Verification method	Solution
1. The ambient temperature is excessively high. 2. The drive is restarted repeatedly to reset the overload fault.	Measure the ambient temperature and view the fault log (set H0b.33 and view H0b.34) to check whether an overload fault/alarm is reported (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0).	Improve the cooling conditions of the drive to lower down the ambient temperature. Change the fault reset method. After overload occurs, wait for 30s and then perform the reset operation. Increase the capacities of the servo drive and servo motor. Increase the acceleration/ deceleration time and reduce the load.
3. The fan is damaged.	Check whether the fan works properly during operation.	Replace the servo drive.
4. The installation direction and clearance between servo drives are improper.	Check whether the drive is installed properly.	Install the drive according to the installation requirements.
5. The servo drive is faulty.	The fault persists upon restart five minutes after power-off.	Replace the servo drive.

E650.0: Heatsink over-temperature

Cause:

The temperature of the servo drive power module is higher than the over-temperature threshold.

Troubleshooting:

Cause	Verification method	Solution
1. The ambient temperature is excessively high. 2. The drive is restarted repeatedly to reset the overload fault.	Measure the ambient temperature and view the fault log (set H0b.33 and view H0b.34) to check whether an overload fault/alarm is reported (E620.0, E630.0, E650.0, E909.0, E920.0, E922.0).	Improve the cooling conditions of the drive to lower down the ambient temperature. Change the fault reset method. After overload occurs, wait for 30s and then perform the reset operation. Increase the capacities of the servo drive and servo motor. Increase the acceleration/ deceleration time and reduce the load.
3. The fan is damaged.	Check whether the fan works properly during operation.	Replace the servo drive.

Cause	Verification method	Solution
4. The installation direction and clearance between servo drives are improper.	Check whether the drive is installed properly.	Install the drive according to the installation requirements.
5. The servo drive is faulty.	The fault persists upon restart five minutes after power-off.	Replace the servo drive.

E660.0: Motor over-temperature

Cause:

The temperature of the air-cooled motor is too high.

Troubleshooting:

Cause	Verification method	Solution
The temperature of the air-cooled motor is excessively high (above 130°C).	1. Measure whether the temperature of the air-cooled motor is too high (exceeding 130° C). 2. Wiring error.	1. Cool the motor down. 2. Check whether the wiring is normal.

E661.6: Gain auto-tuning failed

Cause:

Excessive resonance occurs and gain auto-tuning fails.

Troubleshooting:

Cause	Verification method	Solution
The drive vibrates during gain tuning.	Check whether unusual noise or vibration occurs during operation.	Rule out mechanical causes and try to set the gain parameters manually.

E668.0: Homing mode does not match the current encoder

Cause:

The homing method does not match the current encoder.

Troubleshooting:

Cause	Verification method	Solution
The homing method does not match the current encoder.	Check for the following parameter errors: 1. When H05.69 is set to 1 or H05.69 is set to 3, this fault is reported when H02.01 is not set to 0 or H00.00 is not set to 14101. 2. During electrical homing, this fault is reported when H05.69 is set to 1 but the value of homing mode is lower than 14. 2. During electrical homing, this fault is reported when H05.69 is not set to 1 but the value of homing mode is between 13 and 17. 4. This fault is reported when the value of homing mode is between 13 and 17 in the regular homing mode, or the value of homing mode is lower than 2 or set to 6, 7, 10, or 11 when H05.69 is set to 3.	Change the homing mode (H05.31).

E731.0: Encoder multi-turn position data loss

Cause:

The encoder multi-turn position data is lost.

Troubleshooting:

Cause	Verification method	Solution
1. The battery is not connected during power-off.	Check whether the battery is connected during power-off.	Set H0d.20 to 1 and restart the power supply to clear the fault.
2. The encoder battery voltage is lower than 2.9 V.	Measure the battery voltage.	Replace the battery with a new one that provides matching voltage.
3. The encoder is disturbed by strong magnetic field.	Check whether the encoder is in environment with a strong magnetic field.	Remove the strong magnetic field, set H0d.20 to 1, and then restart the power supply to clear the fault.

E733.0: Encoder multi-turn counting error

Cause:

An encoder multi-turn counting error occurs.

Troubleshooting:

Cause	Verification method	Solution
The encoder is faulty.	Set H0d.20 to 2 to clear the fault, but E733.0 persists after a power cycle.	Replace the motor.

E735.0: Encoder multi-turn count overflow

Cause:

A multi-turn counting overflow occurs on the absolute encoder.

Troubleshooting:

Cause	Verification method	Solution
The number of forward revolutions exceeds 32767 or the number of reverse revolutions exceeds 32768.	Check whether the value of H0b.70 (Number of absolute encoder revolutions) is 32767 or 32768 when the servo drive works in absolute linear mode (H02.01 = 1).	Set H0d.20 to 2 to power on again. Perform homing if necessary.

E740.0: Absolute encoder communication timeout

Cause:

Communication timeout occurs on the absolute encoder.

Troubleshooting:

Cause	Verification method	Solution
The communication between the servo drive and the encoder times out.	Check the wiring of the encoder and power on the drive again.	1. Check whether the encoder version (H00.04) is set properly. 2. Check the servo drive software version (H01.00). 3. Check the encoder wiring. 4. Replace the servo motor.

E740.2: Absolute encoder error

Cause:

A communication error occurs on the RX side of the encoder.

Troubleshooting:

Cause	Verification method	Solution
An error occurs in communication between the servo drive and the encoder.	Check whether the value of H0b.28 is not 0.	1. Ensure the motor model is set correctly. 2. Check whether the encoder cable is connected properly. 3. Ensure the servo drive and motor are grounded properly. You can wind the encoder cable around a magnetic ring to reduce interference. Note: For software versions earlier than 6.3, E740.4 fault is present, which can be rectified in the same way as E740.2. For software versions later than 6.3, E740.4 is replaced by E740.2.

E740.3: Absolute encoder single-turn calculation error

Cause:

An internal fault occurs on the encoder.

Troubleshooting:

Cause	Verification method	Solution
An internal fault occurs on the encoder.	Check whether bit8 of H0b.28 is set to 1.	1. Check whether the encoder version (H00.04) is set properly. 2. Check the condition of the encoder cable. 3. Replace the motor.

E740.6: Encoder write fault

Cause:

The attempt to write the encoder data fails.

Troubleshooting:

Cause	Verification method	Solution
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.10 (Electrical angle). The electrical angle deviation should be within ±30° when the motor position does not change.	Use a new encoder cable. If the fault persists after the encoder cable is replaced, the encoder may be faulty. In this case, replace the servo motor.

E760.0: Encoder over-temperature

Cause:

The temperature of the absolute encoder is too high.

Troubleshooting:

Cause	Verification method	Solution
The temperature of the absolute encoder is too high.	Measure the encoder temperature or motor temperature using a thermometric label to determine whether the measured temperature exceeds the temperature threshold defined by H0b.66. When H0A.52 is set to 0, E760.0 can be ignored.	Switch off the S-ON signal to wait for the encoder to cool down. Check whether the encoder cable is susceptible to interference.

E939.0: Motor power cable disconnected

Cause:

Motor three-phase cable breakage.

Troubleshooting:

Cause	Verification method	Solution
The three-phase power cables of the motor are disconnected.	Check the wiring of U/V/W power cables.	1. If the power cables are disconnected or in poor contact, re-connect the power cables. 2. Replace the servo motor.

EA33.0: Encoder read/write check error

Cause:

Internal parameters of the encoder are abnormal.

Troubleshooting:

Cause	Verification method	Solution
1. The serial incremental encoder cable breaks or becomes loose.	Check the wiring.	Check whether the encoder cables are connected incorrectly, disconnected, or in poor contact. If the motor cables and encoder cables are bundled together, separate them.
2. The attempt to read/write bus incremental encoder parameters failed.	If the fault persists after the drive is powered off and on repeatedly, the encoder is faulty.	Replace the servo motor.

EA34.0: Encoder communication check abnormal

Cause:

Encoder U/V/W Hall signal abnormal

Troubleshooting:

Cause	Verification method	Solution
Abnormal encoder U/V/W Hall signal, encoder U/V/W phase logic error, or incorrect U/V/W phase information read at power-up	If the fault persists after the power supply is restarted several times, the encoder or the drive is faulty.	Replace the faulty servo drive or servo motor.

EB00.0: Excessive position deviation

Cause:

The position deviation is higher than the setpoint of H0A.10 in the position control mode.

Troubleshooting:

Cause	Verification method	Solution
1. U/V/W output phase loss or incorrect phase sequence occurs on the servo drive.	Perform a no-load trial run on the motor and check the wiring.	Re-connect the cables according to the wiring diagram or replace the cables.
2. The servo drive U/V/W output cables or encoder cables are disconnected.	Check the wiring.	Connect the cables again. The servo drive power cables (U/V/W) must be connected in the correct order at both ends. If necessary, replace all cables and ensure a reliable connection.

Cause	Verification method	Solution
3. The motor rotor is stalled due to mechanical factors.	Check the reference and motor speed (H0b.00) through the software tool or keypad: Reference in position control mode: H0b.13 (Input position reference counter) Reference in speed control mode: H0b.01 (Speed reference) Reference in torque control mode: H0b.02 (Internal torque reference) Check whether the reference is not 0 but the motor speed is 0 in the corresponding mode.	Rule out mechanical factors. For example, check whether the motor brake is released.
4. The servo drive gains are excessively low.	Check the position loop gain and speed loop gain of the drive: First gain set: H08.00 to H08.02 2nd gain set: H08.03 to H08.05	Adjust the gain values manually or perform gain auto-tuning.
5. The value of H0A.10 is excessively low under the operating conditions.	Check whether H0A.10 is set to an excessively low value.	Increase the value of H0A.10.
6. The servo drive or motor is faulty.	Monitor the operation waveform through the oscilloscope function in the software tool: position reference, position feedback, speed reference, and torque reference.	If the position reference is not 0 but the position feedback remains 0, replace the servo drive or motor.

EB00.1: Position deviation overflow

Cause:

Deviation of the position calculated by the drive is excessive.

Troubleshooting:

Cause	Verification method	Solution
1. U/V/W output phase loss or incorrect phase sequence occurs on the servo drive.	Perform a no-load trial run on the motor and check the wiring.	Re-connect the cables according to the wiring diagram or replace the cables.
2. The servo drive U/V/W output cables or encoder cables are disconnected.	Check the wiring.	Connect the cables again. The servo drive power cables (U/V/W) must be connected in the correct order at both ends. If necessary, replace all cables and ensure a reliable connection.

Cause	Verification method	Solution
3. The motor rotor is stalled due to mechanical factors.	Check the reference and motor speed (H0b.00) through the software tool or keypad: References in the position control mode: H0b.13 (Input position reference counter) References in speed control mode: H0b.01 (Speed reference) Operation reference in torque control mode: H0b.02 (Internal torque reference) Check whether the operation reference is not 0, but the motor speed is 0 in the corresponding mode.	Rule out mechanical factors. For example, check whether the motor brake is released.
4. The servo drive gains are excessively low.	Check the position loop gain and speed loop gain of the drive: First gain set: H08.00 to H08.02 2nd gain set: H08.03 to H08.05	Adjust the gain values manually or perform gain auto-tuning.
5. The value of H0A.10 is excessively low under the operating conditions.	Check whether H0A.10 is set to an excessively low value.	Increase the value of H0A.10.
6. The servo drive or motor is faulty.	Monitor the operation waveform through the oscilloscope function in the software tool: position reference, position feedback, speed reference, and torque reference.	If the position reference is not 0 but the position feedback remains 0, replace the servo drive or motor.

EB01.0: Position reference increment too large

Cause:

The pulse reference increment exceeds the excessive reference threshold three times consecutively.

Troubleshooting:

Cause	Verification method	Solution
The pulse reference increment exceeds the excessive reference threshold three times consecutively.	Check whether the pulse reference input frequency exceeds H0A.09. Note: Maximum pulse input frequency: When H05.15 is set to 2 (Quadrature relationship of phase A + phase B): if H05.01 is set to 0 (low speed), the maximum low-speed input pulse is the minimum value between 4 × 240 kHz and 4 × H0A.09; if H05.01 is set to 1 (high speed), the maximum input pulse is the minimum value between 16000 kHz and 4 × H0A.09. When H05.15 is set to non-2: if H05.01 is set to 0 (low speed), the maximum input pulse is the minimum value between 240 kHz and H0A.09; if H05.01 is set to 1 (high speed), the maximum input pulse is the minimum value between 4000 kHz and H0A.09.	1. Increase the value of H0A.09. 2. Reduce the baud rate of pulse input.

EB03.0: Electronic gear ratio beyond the limit - H05.02

Cause:

The electronic gear ratio (H05.02) exceeds the limit: (0.001 to 4000 × Encoder resolution ÷ 10000).

Troubleshooting:

Cause	Verification method	Solution
The electronic gear ratio converted by H05.02 exceeds the maximum gear ratio or is lower than the minimum gear ratio.	Check whether the electronic gear ratio converted by H05.02 is within the range of 0.001–4000 × Encoder resolution ÷ 10000.	Change the value of H05.02.

EB03.1: Electronic gear ratio 1 beyond the limit

Cause:

The electronic gear ratio exceeds the limit: [0.001 to 4000 × Encoder resolution ÷ 10000].

Troubleshooting:

Cause	Verification method	Solution
The electronic gear ratio 1 exceeds the maximum gear ratio or is lower than the minimum gear ratio.	Check whether electronic gear ratio 1 is within the range of 0.001 to 4000 × Encoder resolution ÷ 10000.	Change the values of H05.07 and H05.09.

EB03.2: Electronic gear ratio 2 beyond the limit

Cause:

The electronic gear ratio 2 exceeds the limit: (0.001 to 4000 × Encoder resolution ÷ 10000).

Troubleshooting:

Cause	Verification method	Solution
The electronic gear ratio 2 exceeds the maximum gear ratio or is lower than the minimum gear ratio.	Check if the group 2 electronic gear ratio is within the range of 0.001 to 4000 × Encoder resolution ÷ 10000.	Change the values of H05.11 and H05.13.

ED03.0: CANlink communication failure

Cause:

The master is offline.

Troubleshooting:

Cause	Verification method	Solution
The master is offline.	1. Increase the heartbeat threshold of the master station. 2. Check the wiring.	Capture frames to ensure that the master station is online.

8.6.2 Internal fault

When any one of the following fault occurs, contact Inovance for technical support.

- E602.0: Angle auto-tuning failure
- E220.0: Phase sequence fault
- EA40.0: Parameter auto-tuning failure
- E111.0: Internal parameter fault

8.7 Troubleshooting During Startup

Position control mode

- **Fault diagnosis**

Startup process	Fault symptom	Cause	Verification method
Connection of control power (L1C, L2C) Main power supply (L1, L2) (L1, L2, L3) (R/S/T terminals)	The LED display is OFF or does not display "rdy".	1. The control power voltage is abnormal.	After CN1, CN2, CN3, and CN4 are disconnected, the fault persists. Measure the AC voltage between L1C and L2C.
		2. The main power supply voltage is abnormal.	• For single-phase 220 V models, measure the AC voltage between L1 and L2. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 235 V, the keypad displays "nrd". • For three-phase 220 V/380 V models, measure the AC voltage among L1, L2, L3/R, S, T. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 451 V, the keypad displays "nrd".
		3. The programming terminal is short-circuited.	Check whether the programming terminal is short-circuited.
		4. The servo drive is faulty.	-
	The keypad displays "Exxx.x".	For details, see *"8.6.1 Troubleshooting Faults" on page 504*and *" Troubleshooting Alarms" on page 495*Rectify the fault.	
	After the faults are rectified, the operating panel displays "rdy".		
Activation of S-ON signal (S-ON signal switched on)	The keypad displays "Exxx.x".	For details, see *"8.6.1 Troubleshooting Faults" on page 504*and *" Troubleshooting Alarms" on page 495*Rectify the fault.	
	The shaft of the servo motor is in free operation state.	1. The S-ON signal is inactive.	Set the operating panel to servo status display and check whether the operating panel displays "rdy" rather than "run". • Check whether any parameter in groups H03 and H17 is set to the S-ON signal (DI function 1: S-ON). If yes, check whether the logic of the corresponding terminal is valid. If not, allocate the function to a terminal and make the corresponding terminal logic valid. See the parameter settings for group H03 and group H17. • If the keypad keeps displaying "rdy" even though the S-ON signal has been assigned to a DI through parameters in group H03 or H17 and the corresponding DI logic is active, check whether the DI is connected correctly according to Chapter "Wiring" in the user guide.
		2. An improper control mode is selected.	Check whether H02.00 (Control mode selection) is set to 1 (Position control mode). If it is set to 2 (Torque control mode), the motor shaft will be in the free running state because the default torque reference is 0.
	After the faults are rectified, the operating panel displays "run".		

Startup process	Fault symptom	Cause	Verification method
Input position reference	The servo motor does not rotate.	The value of the input position reference counter (H0b.13) is 0.	• The high/low-speed pulse input terminal is wired incorrectly. When H05.00 (Position reference source) is set to 0, check whether the high/low-speed pulse input terminal is connected correctly according to section "Description of Terminals". Additionally, check whether the setting of H05.01 (Pulse reference input terminal selection) is matched. • No position reference is inputted. • Check whether FunIN.13 (Inhibit, position reference inhibited) or FunIN.37 (PulseInhibit, pulse reference inhibited) is used. • When H05.00 (Position reference source) is set to 0 (pulse input), the host controller or other pulse generator does not output pulses. Check whether there are pulses into high/low-speed pulse input terminals with an oscilloscope. See section Terminals for details. • When H05.00 (Position reference source) is set to 1 (Step reference), check whether H05.05 (Step reference) is 0. If not, check whether FunIN.20 (PosStep, step reference enabled) is assigned to a DI and whether the logic of this DI is active. • When H05.00 (Position reference source) is set to 2 (Multi-position reference), check whether parameters in group H11 are set correctly. If yes, check whether FunIN.28 (PosInSen, internal multi-position enable) is assigned to a DI and whether the logic of this DI is active. • If interrupt positioning is used, check whether H05.29 (Interrupt positioning cancellation) is set to 1 (Enabled). If yes, check whether FunIN.29 (XintFree, interrupt positioning cancellation) is used.
Input position reference	The servo motor rotates in reverse direction.	The value of the input position reference counter (H0b.13) is a negative number.	• When H05.00 (Position reference source) is set to 0 (Pulse reference), check whether the setting of H05.15 (Pulse reference form) is consistent with the actual input pulses. If not, H05.15 is set improperly or terminals are wired incorrectly. • When H05.00 (Position reference source) is set to 1 (Step reference), check whether the value of H05.05 (Step reference) is positive or negative. • When H05.00 (Position reference source) is set to 2 (Multi-position reference), check the sign (+/-) of each displacement reference value in parameter group H11. • Check whether FunIN.27 (PosDirSel, position reference direction selection) is assigned to a DI and whether the logic of this DI is active. • Check whether H02.02 is set correctly.
	After the faults are rectified, the servo motor can rotate.		
Unstable rotation during low-speed operation	Motor speed is not steady.	The gain is set improperly.	Perform automatic gain adjustment.
	Side-to-side vibrations occur on the motor shaft.	The load moment of inertia ratio (H08.15) is too large.	If the drive can operate securely, perform inertia auto-tuning and automatic gain adjustment again.
	After preceding faults are removed, the servo motor can operate normally.		
Normal running	Inaccurate localization	Unsatisfactory position deviation is generated.	Confirm position reference counter (H0b.13), feedback pulse counter (H0b.17) and mechanical stop position according to the following steps.

- **Procedure for checking the causes of inaccurate positioning**

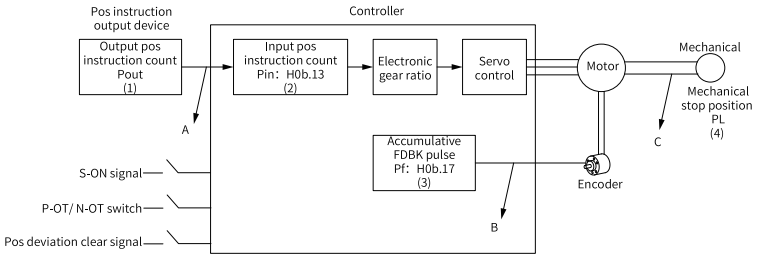


Figure 8-1 Schematic diagram for positioning control

- When localization is inaccurate, check the four signals in the preceding figure.
  - Count of output position references (Pout) of the position reference output device (host controller or internal parameters of the drive)
  - Count of input position references (Pin) received by the servo controller, corresponding to H0b.13
  - Accumulative feedback pulses from the built-in encoder of the servo motor, corresponding to H0b.17
  - Mechanical stop position PL
- There are three causes resulting in inaccurate localization, corresponding to A, B, and C in the preceding figure.
  - A: The count of input position references is incorrect because the cable connecting the position reference output device (host controller to be specific) and the servo drive is affected by noise.
  - B: Input position reference is interrupted during motor operation.
    Cause: Servo ON signal (S-ON) is set to OFF, the positive/negative limit switch signal (P-OT or N-OT) is ON and the position deviation clearing signal (ClrPosErr) is ON.
  - C: Mechanical position slides between the machine and servo motor.
- In ideal state (no position deviation), the following relationships hold:
  - Pout = Pin, meaning count of output position references = count of input position references
  - Pin x electronic gear ratio = Pf, meaning count of input position references x electronic gear ratio = accumulative feedback pulses
  - Pf x △L = PL, meaning accumulative feedback pulses x load displacement per position reference = mechanical stop position
- When inaccurate localization occurs, perform the following checks:
  - Pout ≠ Pin
    Cause: A

    To solve issue B, do as follows:

    1. Check if twisted pair shielded cables are connected to pulse input terminals (For low or high speed pulse input terminals, see section "Description of Terminals").
    2. If the open-collector input mode for low-speed pulse input terminals is used, change to the differential input mode.
    3. Route pulse input terminals and the main circuit terminals (L1, L2/R, S, T/U, V, W) through different routes.

4. If low-speed pulse input terminals are used, increase the filter time constant of low-speed pulse input pins (H0A.24). If high-speed pulse input terminals are used, increase the filter time constant of the high-speed pulse input pins (H0A.30).

- Pin x electronic gear ratio ≠ Pf:
  Cause: B

  To solve issue B, do as follows:

  1. Check whether a fault occurs during operation, causing the servo drive to stop before executing all the commands.
  2. If the fault is caused by an active position deviation clear signal (ClrPosErr), check whether the position deviation clear mode (H05.16) is proper.

- Pf x △L ≠ PL
  Cause: C

  To rectify cause C, check mechanical connections and find the sliding position.

Speed control mode

Startup process	Fault symptom	Cause	Verification method
Connection of control power (L1C, L2C) Main power supply (L1, L2) (L1, L2, L3) (R/S/T terminals)	The LED display is OFF or does not display "rdy".	1. The control power voltage is abnormal.	After CN1, CN2, CN3, and CN4 are disconnected, the fault persists. Measure the AC voltage between L1C and L2C.
		2. The input voltage is abnormal.	• For single-phase 220 V models, measure the AC voltage between L1 and L2. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 235 V, the keypad displays "nrd". • For three-phase 220 V/380 V models, measure the AC voltage among L1, L2, L3/R, S, T. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 451 V, the keypad displays "nrd".
		3. The programming terminal is short-circuited.	Check whether the programming terminal is short-circuited.
		4. The servo drive is faulty.	-
	The keypad displays "Exxx.x".	For details, see *"8.6.1 Troubleshooting Faults" on page 504* and *" Troubleshooting Alarms" on page 495* Rectify the fault.	
	After the faults are rectified, the operating panel displays "rdy".		
Activation of S-ON signal (S-ON signal switched on)	The keypad displays "Exxx.x".	For details, see *"8.6.1 Troubleshooting Faults" on page 504* and *" Troubleshooting Alarms" on page 495* Rectify the fault.	
	The shaft of the servo motor is in free operation state.	1. The S-ON signal is inactive.	Set the operating panel to servo status display and check whether the operating panel displays "rdy" rather than "run". • Check whether any parameter in groups H03 and H17 is set to the S-ON signal (DI function 1: S-ON). If yes, check whether the logic of the corresponding terminal is valid. If not, allocate the function to a terminal and make the corresponding terminal logic valid. See the parameter settings for group H03 and group H17. • If the keypad keeps displaying "rdy" even though the S-ON signal has been assigned to a DI through parameters in group H03 or H17 and the corresponding DI logic is active, check whether the DI is connected correctly according to section Description of Terminals.
		2. An improper control mode is selected.	Check whether H02.00 is set to 0. If it is set to 2 (torque control mode), the motor shaft is in free operating status because the default torque reference is 0.
	After the faults are rectified, the operating panel displays "run".		
Input of speed reference	The servo motor does not rotate or the motor speed is abnormal.	The speed reference (H0b.01) is 0.	• The speed reference source is incorrect. Check whether H06.02 is set correctly. • The speed reference is not specified or is abnormal. • When digital setting is used to set the speed reference, check whether H06-03 is set correctly. • When multi-speed is used to set the speed reference, check whether the parameters in group H12 are set correctly. • When communication is used to set the speed reference, check whether H31.09 is set correctly. • When jog speed reference is used to set the speed reference, check whether H06.04 is set correctly, whether DI functions are set to 18 and 19, and whether the logic of corresponding DI is valid. • Check whether the acceleration time and deceleration time (H06.05 and H06.06) are set correctly. • Check whether the DI function 12 (zero clamp) is enabled incorrectly and whether the logic of corresponding DI is valid.

Startup process	Fault symptom	Cause	Verification method
Input of speed reference	The servo motor rotates in reverse direction.	Speed reference (H0b.01) is negative.	• When digital setting is used to set the speed reference, check whether H06.03 is less than 0. • When multi-speed is used to set the speed reference, check whether speed references in group H12 are positive or negative. • When serial communication is used to set the speed reference, check whether H31.09 is less than 0. • When jog speed reference is used to set the speed reference, check the value of H06.04 and whether the valid logic of DI functions 18 and 19 matches the predicted rotating direction. • Check whether DI function 26 (FunIN.26: SpdDirSel, speed reference direction) has been configured and whether the logic of corresponding DI is valid. • Check whether H02.02 is set correctly.
	After the faults are rectified, the servo motor can rotate.		
Unstable rotation during low-speed operation	Motor speed is not steady.	The gain is set improperly.	Perform automatic gain adjustment.
	Side-to-side vibrations occur on the motor shaft.	The load moment of inertia ratio (H08-15) is too large.	If the servo motor can run safely, perform inertia auto-tuning again. Perform automatic gain adjustment.

Torque control mode

Startup process	Fault symptom	Cause	Verification method
Switch on the control power supply (L1C, L2C) Main power supply (L1, L2) (L1, L2, L3) (R/S/T terminals)	The LED display is OFF or does not display "rdy".	1. The control power voltage is abnormal.	After CN1, CN2, CN3, and CN4 are disconnected, the fault persists. Measure the AC voltage between L1C and L2C.
		2. The main power supply voltage is abnormal.	• For single-phase 220 V models, measure the AC voltage between L1 and L2. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 235 V, the keypad displays "nrd". • For three-phase 220 V/380 V models, measure the AC voltage among L1, L2, L3/R, S, T. When the DC bus voltage amplitude (voltage between P⊕ and N⊖) is lower than 451 V, the keypad displays "nrd".
		3. The programming terminal is short-circuited.	Check whether the programming terminal is short-circuited.
		4. The servo drive is faulty.	-
	The keypad displays "Exxx.x".	For details, see *"8.6.1 Troubleshooting Faults" on page 504* and *"Troubleshooting Alarms" on page 495* Rectify the fault.	
	After the faults are rectified, the operating panel displays "rdy".		
Activation of S-ON signal (S-ON signal switched on)	The keypad displays "Exxx.x".	For details, see *"8.6.1 Troubleshooting Faults" on page 504* and *"Troubleshooting Alarms" on page 495* Rectify the fault.	
	The shaft of the servo motor is in free operation state.	The S-ON signal is inactive.	• Set the operating panel to servo status display and check whether the operating panel displays "rdy" rather than "run". • Check whether any parameter in groups H03 and H17 is set to the S-ON signal (DI function 1: S-ON). If yes, check whether the logic of the corresponding terminal is valid. If not, allocate the function to a terminal and make the corresponding terminal logic valid. See the parameter settings for group H03 and group H17. • If the keypad keeps displaying "rdy" even though the S-ON signal has been assigned to a DI through parameters in group H03 or H17 and the corresponding DI logic is active, check whether the DI is connected correctly according to section Description of Terminals.
	After the faults are rectified, the operating panel displays "run".		
Input torque reference	The servo motor does not rotate.	The internal torque reference (H0b.02) is 0.	The torque reference source is set incorrectly. Check whether H07.02 is set correctly. No torque reference is specified. • In digital setting mode, check whether H07.03 is set to 0. • In communication setting mode, check whether H31.11 is set to 0.
	The servo motor rotates in reverse direction.	The value of internal torque reference (H0b.02) is a negative number.	• In digital setting mode, check whether H07.03 is set to a value smaller than 0. • In communication setting mode, check whether H31.11 is set to a value smaller than 0. • Check that DI function 25 (FunIN.25: TqqDirSel, torque reference direction setting) is set properly and that the corresponding terminal logic is valid. • Check whether H02.02 is set correctly.
	After the faults are rectified, the servo motor can rotate.		

Startup process	Fault symptom	Cause	Verification method
Unstable rotation during low-speed operation	Motor speed is not steady.	The gain is set improperly.	Perform automatic gain adjustment.
	Side-to-side vibrations occur on the motor shaft.	The load moment of inertia ratio (H08.15) is too large.	If the servo motor can run safely, perform inertia auto-tuning again. Perform automatic gain adjustment.

8.8 FAQ and Solutions

8.8.1 Fault symptom

- It is recommended to perform troubleshooting according to the sequence numbers from lowest to highest.
- If a drive needs to be replaced on-site and returned, record the fault cause identified on site and return it together with the drive.

8.8.2 No Display on the Keypad

Fault symptom

There is no display on the LED of the drive after the main circuit power supply (L1, L2) is powered on.

Troubleshooting

No.	Possible cause	Detection method/Solution		Remarks
1	The external device is short-circuited.	After removing the CN1, CN2, and network port terminals, keep only the main circuit power supply terminals and check whether the display is normal.	Check whether the peripheral device is short-circuited.	-
2	The main circuit power supply is abnormal.	Check whether the power supply of input terminals L1/L2 is normal.	The voltage of a 220 V drive is 180 VAC to 264 VAC. When the input power supply does not meet requirements, rectify or replace the power supply.	"*Detailed detection methods and solutions*" *on page 541*
3	The drive is damaged.	Replace the drive and perform a cross-test.	Contact Inovance service personnel.	-

Detailed detection methods and solutions

Set the multimeter to the voltage (AC) range and measure the voltage across L1 and L2.

When the voltage between L1 and L2 cannot be measured, it is recommended to measure the voltage at the starting point of the power supply cable (typically the distribution cabinet).

Voltage of the input power supply for S2R8 model: 180 VAC to 264 VAC.

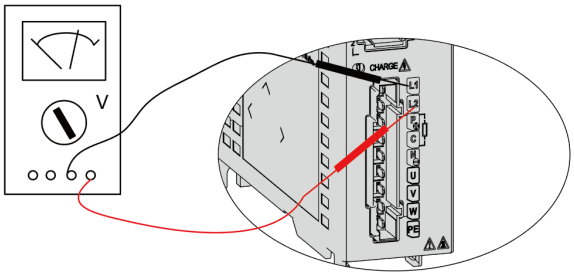


Figure 8-2 Input voltage detection instance

8.8.3 Smoke or Damage upon Power-on

If any one of the following fault symptoms occurs, power off immediately and perform the following troubleshooting process.

Fault symptom

Tripping occurs upon power-on, or the bus capacitor is damaged, leading to smoke or leakage liquid in the drive.

Troubleshooting

No.	Possible cause	Detection method/Solution		Remarks
1	Cables are wired improperly.	A 220 V drive is connected to a 380 V power supply.	Replace the power supply voltage.	-
2	The main circuit power supply is abnormal.	Check whether the power supply of input terminals L1/L2 is normal.	The voltage of a 220 V drive is 180 VAC to 264 VAC. When the input power supply does not meet requirements, rectify or replace the power supply.	*"Detailed detection methods and solutions" on page 542*
3	The drive is damaged.	If the input power supply voltage is normal, replace the drive and perform a cross-testing.	Contact Inovance service personnel.	-

Detailed detection methods and solutions

Set the multimeter to the voltage (AC) range and measure the voltage across L1 and L2.

Voltage of the input power supply for S2R8 model: 180 VAC to 264 VAC.

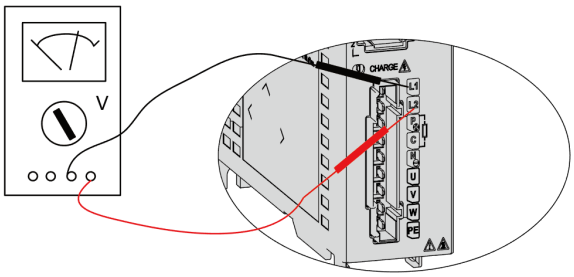


Figure 8-3 Input voltage detection instance

8.8.4 Motor Stall

Fault symptom

The motor shaft does not rotate with an operation command after the drive is enabled.

Troubleshooting

No.	Possible cause	Detection method		Solution
1	The emergency stop function of the drive is triggered.	Check whether the emergency stop button has been pressed.		Release the emergency stop button.
2	The power cable or encoder cable is faulty.	Check whether the encoder terminal and power cable terminal are connected properly.		Re-connect the cables properly.
		Replace the cable and perform cross-verification to check whether the cable is disconnected.		Replace the cable.
3	The drive does not receive the commands.	Trigger jog through the keypad or software tool.	The motor rotates after jog.	1 .Trigger the jog function through the keypad or software tool. During jog, check whether the motor operates properly. If yes, check whether external references or references sent from the host controller are normal. 2 .Check whether certain functions of the drive can cause operation failure of the motor, such as low torque limit, emergency stop enable, references inconsistent with setting, or improper wiring of CN1. See wiring of CN1 in section "Wiring Instance".
			The motor does not rotate when jog is triggered.	The drive can report an alarm when the motor does not rotate upon receiving a reference. Check the alarm information displayed by the drive. Check the position or speed reference through the software tool. If the reference is not zero and the motor does not rotate, the drive reports an alarm, such as E939, E610, and E630. See the solutions for the fault code or replace the drive for cross-verification.

No.	Possible cause		Detection method	Solution
4	The motor is abnormal.	The motor is damaged internally.	Check whether the motor is damaged. If yes, replace the motor, and perform cross-testing.	Contact Inovance service personnel to replace the motor.
		The motor brake is not released.	Check whether the brake is not connected to the power supply.	Connect the brake to a 24 V power supply. After the brake is released, you can rotate the motor shaft manually. See section "Brake Wiring Instance" for correct wiring of the brake.
5	The load is stalled.		Check whether the load is stalled, leading to motor stall.	Rectify the fault For stall-related solutions, see E630.0 in section "Troubleshooting".

8.8.5 Failure To Connect Software Tool

Fault symptom

The PC cannot detect the serial port.

Troubleshooting

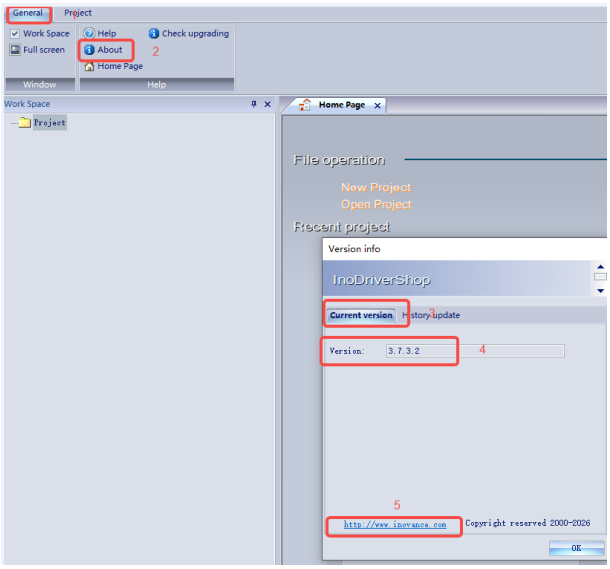
No.	Possible cause	Detection method/Solution		Remarks
1	The version of the software tool is outdated.	Check whether it is the latest version.	Update the software tool to the latest version on the official website.	"①" on page 544
2	The COM terminal is set improperly.	Open the software tool and check whether the COM port setting is correct in the connection serial port.	Re-select the correct COM port.	"②" on page 545
3	The communication parameters are set improperly.	Open the software tool and check whether the baud rate and other settings are correct.	Set the correct node address, baud rate, and parity bit according to H0C.00, H0C.02, and H0C.03.	
4	The serial port (COM port) is occupied by another software.	Open the software tool and check whether the serial port (COM port) is occupied.	Close other software occupying the COM port and reconnect the software.	
5	The communication cable is improper.	The communication cable is incompatible.	Please select the correct cable.	"③" on page 546
		The communication cable is faulty.	Perform a cross-test and replace the cable.	-
6	The drive is faulty.	Replace the drive and perform a cross-test.	Contact Inovance service personnel.	-

Detailed detection methods and solutions

①

Check whether it is the latest version.

Follow steps 1 to 4 in the figure below to confirm the current version, open the link in step 5, and compare it with the latest version on the official website.

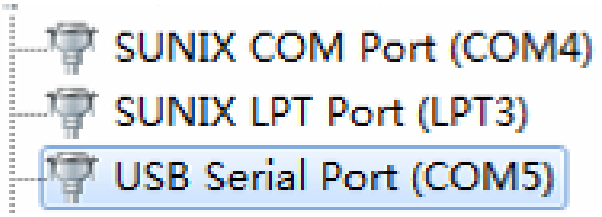


②

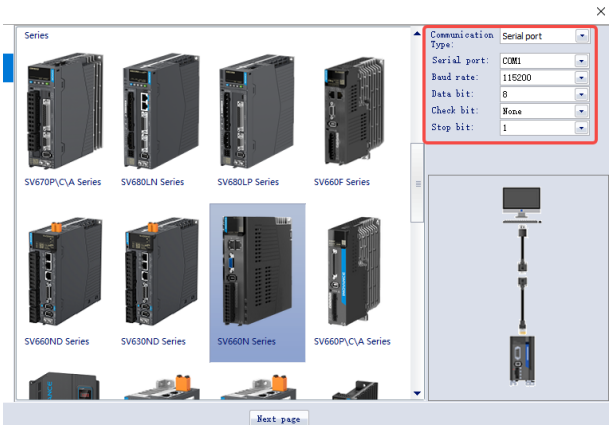
Confirm the serial port and related parameter settings.

Open the software tool, select "Connect serial port" from the "Start" menu, and in the pop-up dialog box, select the correct COM port, station number, and baud rate.

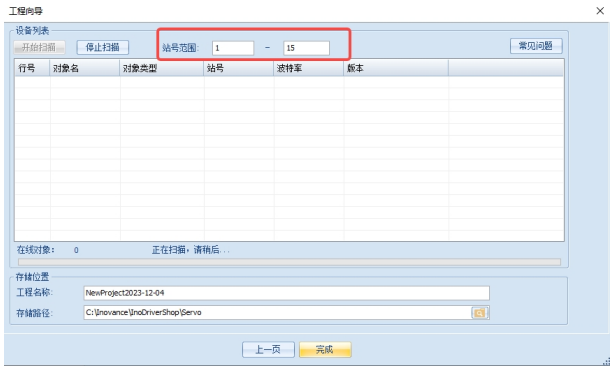
1. Find the corresponding port.



2. Select the correct COM port and baud rate.



3. Ensure the value of H0E.00 is within the "Station number range," and to minimize the scanning time, set the value of H0E.00 as low as possible.
   The default value of H0E.00 is 1.



③

Select the correct communication cable.

Communication cable model: S6-L-T00-3.0; Servo drive-to-PC communication cable

8.8.6 Parameters cannot be modified.

Fault symptom

- When manually changing parameters via the keypad, the parameters do not change with the increase (△) or decrease (▽) keys.
- When modifying parameters via the software tool, after writing the selected parameter, the drive parameter is not updated.

Troubleshooting

No.	Fault type	Possible cause	Detection method/Solution		Remarks
1	Parameters cannot be modified via keypad/ software tool.	Some parameters cannot be modified when the drive is enabled.	Check whether the drive is enabled.	Turn off the S-ON signal and modify parameters again.	"①" on page 546
		The user password (H02.30) is enabled.	Check that the password is entered correctly.	If the password is forgotten, contact the equipment manufacturer and enter the correct password.	-
2	The drive is faulty.	An internal fault occurs on the drive.	Replace the drive and perform a cross-test.	Contact Inovance service personnel.	-

Detailed detection methods and solutions

①

The following describes parameter setting methods.

Parameter setting methods are divided into "During running" and "At stop". Parameters set in stop state must be changed after the S-ON signal is turned off. Determine the parameter setting method through the user guide first and then modify parameters through the keypad.

See section "Status Display" for servo status display.

8.8.7 Tripping upon Power-on

Fault symptom

When the drive is powered on, the air switch on the power supply circuit trips.

Troubleshooting

No.	Possible cause		Detection method	Solution
1	The rated current of the air switch is excessively low.		See the input power supply specifications of the drive to check whether the rated current of the air switch is excessively low.	Select a circuit breaker of the correct specification. For detailed circuit breaker selection, see section "Electrical Peripherals".
2	The drive is wired improperly.	The input power supply terminal/PN of the main circuit/control circuit is short-circuited.	Check whether the input cables of the main circuit/control circuit are short-circuited, or whether the braking resistor is connected to PN by mistake.	Perform wiring again based on the terminal assignment. For information regarding main circuit terminals, see section "Power Wiring Instance".
3		The power cable is faulty.	After ensuring the cables are normal, replace the cables and perform a cross-test.	Contact the equipment supplier.
4	The drive is faulty.		Replace the drive and perform a cross-test.	Contact the equipment supplier.

8.8.8 The host controller cannot receive the DO signal output from the drive.

Fault symptom

After setting the DO function, the host controller cannot receive the DO signal output from the drive.

Troubleshooting

No.	Possible cause		Detection method/Solution		Remarks
1	The DO terminal does not generate output.	Check the status of the DO bit through H0b.05.	Not changed. Check whether parameters in group H04 are configured improperly.	Reconfigure parameters in group H04.	See detailed detection methods and solutions in: "*The DO terminal does not generate output.*" on page 548
			Changed. Check whether the DO wiring is correct.	Perform wiring properly.	
		The DO terminals are wired improperly.	Check whether the wiring is proper.	Perform wiring properly.	
2	The DO signals are disturbed.		The DO signal cable and power cable are routed in parallel or routed close to each other.	Route the DO signal cable and power cable through different routes. Check the DO wiring. Do not route the signal cable and power cable in parallel or route them close to each other.	See detailed detection methods and solutions in: "*The DO signals are disturbed.*" on page 549
3	The load exceeds the load capacity of the DO.		When using an external power supply, the resistance of the current-limiting resistor is excessively high.	Check whether the resistance of the current-limiting resistor value is excessively high.	See detailed detection methods and solutions in: "*The load exceeds the load capacity of the DO. When an external power supply is used, supply voltage is unstable or excessively low.*" on page 549
4	When using an external power supply, the power supply voltage is unstable or excessively low.		Check whether the power supply voltage is stable or excessively low.	Adjust the resistance of the current-limiting resistor to ensure the current does not exceed 50 mA. Alternatively, you can use the internal 24 V power supply.	
5	The DO terminals are abnormal.		Replace the DO terminal and perform cross-verification.	If the DO terminal works properly, continue using it. If it does not generate output, replace the drive.	-

Detailed detection methods and solutions

The DO terminal does not generate output.

- You can check the DO level status through H0b.05. For detailed instructions, see section "Forced DI/DO Setting".
- For correct wiring of DO, see section "DO Signals".

The DO signals are disturbed.

Route the DO cables and main circuit cables (R/S/T, U/V/W) or other power cables through different routes with a distance of at least 30 cm. Failure to comply can disturb I/O signals.

The load exceeds the load capacity of the DO. When an external power supply is used, supply voltage is unstable or excessively low.

Check the resistance of the current-limiting resistor.

Ensure that the DO loop current does not exceed 50 mA.

- The following formula is used to calculate the external current-limiting resistor for DO1 and DO2.

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

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

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

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

Note

Common causes of DO errors are as follows:

- If the upstream device provides relay input, the flywheel diode is not connected, or the polarity of the flywheel diode connected is incorrect.
- If the upstream device provides relay input, but the relay impedance is excessively low (a resistor needs to be connected in series), the drive DO output optocoupler current can exceed 50 mA. The maximum allowable voltage of the drive DO circuit is 30 VDC. The maximum current is DC 50 mA.
- The DO is not integrated with a current-limiting resistor. You need to select an appropriate current-limiting resistor based on the DO load and pull-up voltage. Also, note that the number of DIs that can be driven simultaneously is determined according to the DO driving capability and the internal impedance of the downstream DI (DIs of all drives and PLCs are integrated with current-limiting resistors).

8.8.9 Tripping/Leakage Current of Residual Current Device

Fault symptom

The residual current device trips when the drive is powered on or during operation.

Troubleshooting

No.	Fault symptom	Possible cause	Detection method/Solution	Remarks
1	The residual current device trips immediately upon power-on.	The interference resistance performance of the residual current device is poor.	• Use RCDs of recommended brands. • Use an RCD with a higher tripping current. • Move the unbalanced load to the upstream side of the residual current device. • Disconnect the filter grounding terminal to reduce the ground capacitance of the input end.	"*Recommended residual current device model*" *on page 550*
2		The tripping current of the residual current device is excessively low.		
		An unbalanced load is connected on the downstream of the residual current device.		
		Excessive ground capacitance exists in the upstream of the drive.		
3	Residual current device trips during operation.	The interference resistance performance of the residual current device is poor.	• Use RCDs of recommended brands. • Use an RCD with a higher tripping current. • Install a simple filter on the input side of the drive and wind the LN and RST cables around the magnetic ring near the RCD. • Reduce the carrier frequency without compromising the performance. • Use shorter motor cables.	"*Recommended residual current device model*" *on page 550* "*Selection of the EMC filter*" *on page 551* "*Leakage current test*" *on page 551*
		The tripping current of the residual current device is excessively low.		
4		An unbalanced load is connected on the downstream of the residual current device.		
		The ground distributed capacitance of the motor cable or motor is excessively high.		

Detailed detection methods and solutions

Recommended residual current device model

- In the case of n drives connected in parallel, the rated sensitivity current of the selected residual current device is: Ig = Ig1 + Ig2 + Ig3 + ... + Ign.
- The leakage current must be lower than 50% of the rated residual non-operating current of the residual current device. Therefore, during actual selection, ensure that the rated residual non-operating current of the selected residual current device > 2 × Ig.
- Use Chint or Schneider RCDs (recommended).

Selection of the EMC filter

- The connecting cable between the filter and the controller must be as short as possible (shorter than 30 cm).
- Connect the filter and the controller to the same ground reference plane, and ground the filter reliably. Failure to comply may result in poor filtering effect.

Use CE-compliant filters that comply with the emission requirements in Category C2 of EN 61800-3. Properly ground the filter. Keep the cable connecting the filter and the controller shorter than 30 cm.

For EMC-related model selection, see the EMC filter section in section "Electrical Peripherals".

Leakage current test



It is recommended to prioritize power input cables when using a magnetic ring. Never wind the PE line around a magnetic ring.

Use a multimeter to detect the current value (mA, AC) between the PE terminal of the drive and PE wire of the power supply cable for leakage current detection.

For magnetic ring and ferrite clamp selection, see section "Electrical Peripherals" in the user guide. For how to install the magnetic ring and ferrite clamp, see section "Instructions for Installing the Magnetic Ring and Ferrite Clamp" in the user guide.

8.8.10 Brake Release Failure

Fault symptom

After the drive is enabled, the brake cannot be released, which may cause excessive drive load rate or motor stall.

Troubleshooting

No.	Possible cause	Detection method	Solution
1	The motor brake is wired improperly.	See section "Wiring of the Brake" in the user guide.	-
2	The DO is faulty.	For details, see *"8.8.8 The host controller cannot receive the DO signal output from the drive." on page 547*	-
3	The brake relay is faulty.	Check whether the relay acts. After supplying 24 V power directly to the relay coil, if you hear the relay engage, it indicates the relay acts properly.	Replace the relay.
4	The brake winding is faulty.	Check whether the motor brake winding is faulty, replace the motor, and perform cross-verification.	Replace the servo motor.

8.8.11 Panel Display Error

Fault symptom

LED display errors, including missing segments, extra segments, garbled characters, "RESET" displayed continuously, flashes continuously in Run mode, and five horizontal lines displayed.

Troubleshooting

No.	Fault symptom	Possible cause	Detection method/Solution	
1	The LED displays extra or missing segments.	The drive is abnormal.	Power off and restart the drive. If the fault persists, replace the drive.	
2	The LED continuously displays garbled characters or displays Fault.			
3	The LED continuously displays RESET, either constantly lit or flashing.			
4	The panel flashes continuously in the Run mode.	The speed or other parameters are displayed by default as set by the drive.	Check the setting of H02.32.	The default value 50 is displayed by default as defined by H02.32.
5	Five horizontal lines are displayed.	The user password was inadvertently set by the customer.	Check whether a new password is set in H02.30.	Try setting a password in H02.30 or directly restore default setting.

8.8.12 "88888" Displayed upon Power-on

Fault symptom

"88888" is displayed upon power-on.

Troubleshooting

No.	Possible cause	Detection method/Solution	
1	The drive is abnormal.	Power off and on the drive again.	If the fault persists, contact Inovance service personnel.

9 Appendix

9.1 DI/DO Function Assignment

Code	Name	Function Name	Description	Remarks
Description of DI signals				
FunIN.1	S-ON	Servo ON	Disabled: Servo motor disabled Enabled: Servo motor enabled	The corresponding terminal logic must be level-triggered. The change of the corresponding DI/VDI or terminal logic is activated at next power-on.
FunIN.2	ALM-RST	Fault and warning reset	Inactive: Disabled Active: Enabled	"Edge-triggered" will be applied even if "level-triggered" is selected. To reset No. 1 and No. 2 resettable faults, switch off the S-ON signal first. The servo drive can continue to work after alarms of certain types are reset.
FunIN.3	GAIN-SEL	Gain Switchover	• H08.09 = 1: • Inactive: Speed control loop being PI control • Invalid: Speed control loop being P control • H08.09 = 2: • Inactive: Fixed to the 1st group of gains • Valid: Fixed at 2nd gain	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.4	CMD-SEL	Main/Auxiliary reference switchover	Inactive: Current reference being A Valid: Current reference being B	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.5	DIR-SEL	Setting of multi-speed DI switchover running direction	Inactive: Reference direction by default Valid: Reverse reference direction	The corresponding terminal logic is recommended to be level-triggered.
FunIN.6	CMD1	Multi-position reference switchover 1	Used to select one from the 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.7	CMD2	Multi-position reference switchover 2	Used to select one from the 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.8	CMD3	Multi-position reference switchover 3	Used to select one from the 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.9	CMD4	Multi-position reference switchover 4	Used to select one from the 16 references.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.10	M1-SEL	Mode switchover 1	Perform switchover between speed control, position control, and torque control based on the selected control mode (values 3, 4, 5 of H02-00).	It is recommended that the logic of the corresponding terminal be set to level valid.

Code	Name	Function Name	Description	Remarks
FunIN.11	M2-SEL	Mode switchover 2	Perform switchover between speed control, position control, and torque control based on the selected control mode (values 6 of H02-00).	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.12	ZCLAMP	Zero speed clamp	Valid: Zero clamp enabled Invalid: Zero clamp disabled	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.13	INHIBIT	Position reference inhibited	Active: Pulse reference input inhibited Invalid: Pulse reference input allowed	The function is upgraded from pulse inhibited to position reference inhibited. Position references include internal and external position references. The logic of the corresponding terminal needs to be set to level valid.
FunIN.14	P-OT	Positive limit switch	Enabled: Forward drive inhibited Disabled: Forward drive permitted	Overtravel prevention applies when the machine moves beyond the limit. It is recommended that the corresponding terminal logic is level-triggered.
FunIN.15	N-OT	Negative limit switch	Overtravel prevention applies when the load moves beyond the limit. Active: Reverse drive inhibited Inactive: Reverse drive allowed	The corresponding terminal logic is recommended to be level-triggered.
FunIN.16	P-CL	External positive torque limit	The torque limit source is switched based on H07.07 (Torque limit source). H07.07 = 1: Active: Positive external torque limit activated Inactive: Positive internal torque limit activated	The corresponding terminal logic is recommended to be level-triggered.
FunIN.17	N-CL	External negative torque limit	The torque limit source is switched based on H07.07 (Torque limit source). H07.07 = 1: Active: Negative external torque limit activated Inactive: Negative internal torque limit activated	The corresponding terminal logic is recommended to be level-triggered.
FunIN.18	JOGCMD+	Forward jog	Active: Input based on command Inactive: Command input stopped	The corresponding terminal logic is recommended to be level-triggered.
FunIN.19	JOGCMD-	Reverse jog	Active: Input in reverse to the command Inactive: Command input stopped	The corresponding terminal logic is recommended to be level-triggered.

Code	Name	Function Name	Description	Remarks
FunIN.20	POSSTEP	Step reference	Active: Execute step reference set in H05-05, servo motor running Invalid: Reference being zero, in positioning state	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.21	HX1	Handwheel multiplying factor signal 1	HX1 active, HX2 inactive: X10. HX1 inactive, HX2 active: x 100. Other: X1.	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.22	HX2	Handwheel multiplying factor signal 2		
FunIN.23	HX_EN	Handwheel enable signal	Inactive: Execute position control as defined by H05-00. Invalid: Receive pulse signal from the handwheel for position control in position control mode	The corresponding terminal logic is recommended to be level-triggered.
FunIN.24	GEAR_SEL	Electronic gear ratio switchover	Inactive: Electronic gear ratio 1 Valid: Electronic gear ratio 2	The corresponding terminal logic is recommended to be level-triggered.
FunIN.25	TOQDirSel	Torque reference direction	Inactive: Forward. Invalid: Reverse direction	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.26	SPDDirSel	Speed reference direction	Inactive: Forward. Invalid: Reverse direction	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.27	POSDirSel	Position reference direction	Inactive: Actual position reference direction same as the set direction Active: Actual position reference direction opposite to the set direction	The corresponding terminal logic is recommended to be level-triggered.
FunIN.28	PosInSen	Multi-position reference signal enable	Disabled: The reference is ineffective. Enabled: The reference is enabled.	The corresponding terminal logic is recommended to be level-triggered.
FunIN.29	XintFree	Interrupt positioning clear	Inactive: Disabled Active: Enabled	The corresponding terminal logic is recommended to be level-triggered.
FunIN.31	HomeSwitch	Home switch	Inactive: The switch is not triggered Enabled: The switch is triggered.	The corresponding terminal logic must be level-triggered. Allocate this function to the high-speed DI terminal. If the logic is set to 2 (rising edge active), the servo drive forcibly changes it to 1 (active high). If the logic is set to 3 (falling edge active), the servo drive forcibly changes it to 0 (active low). If the logic is set to 4 (both rising edge and falling edge active), the servo drive forcibly changes it to 0 (low level active).
FunIN.32	HomingStart	Homing enable	Inactive: Disabled Active: Enabled	It is recommended that the logic of the corresponding terminal be set to level valid.

Code	Name	Function Name	Description	Remarks
FunIN.33	XintInhibit	Interrupt positioning inhibited	Active: Interrupt positioning inhibited. Invalid: Interruption fixed length allowed	The logic of the corresponding terminal needs to be set to level valid. • If the logic is set to 2 (rising edge active), the servo drive forcibly changes it to 1 (active high). • If the logic is set to 3 (Active falling edge), the servo drive forcibly changes it to 0 (Active low). • If the logic is set to 4 (both rising edge and falling edge active), the servo drive forcibly changes it to 0 (low level active).
FunIN.34	Emergence Stop	Emergency Stop	Enabled: Position lock is applied after stop at zero speed. Invalid: Not affect currnt running state	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.35	ClrPosErr	Position deviation cleared	Valid: Position deviation cleared Invalid: Not clear	It is recommended that this function be allocated to DI8 or DI9.
FunIN.36	V_LmtSel	Internal speed limit source	Inactive: H07.19 used as positive/ negative internal speed limit Active: H07.20 used as positive/ negative internal speed limit	The corresponding terminal logic is recommended to be level-triggered.
FunIN.37	PulseInhibit	Pulse reference inhibited	The position reference source is pulse reference (H05.00 = 0) in the position control mode: Inactive: Respond to pulse references Active: Not respond to pulse references	The corresponding terminal logic is recommended to be level-triggered.
FunIN.38	MultiBlockTrig	Axis control command write interrupted	When the position reference source is multi-position reference (H05.00 = 2) in the position control mode: Inactive: Not write commands Active: Write command and generate interrupt	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.39	MultiBlockWr	Axis control command write not interrupted	When the position reference source is multi-position reference (H05.00 = 2) in the position control mode: Inactive: Not write commands Active: Command written and interrupt not generated	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.40	ClrCmdOkAndArrOk	Command cleared and positioning completed	Inactive: Command not cleared and positioning completed Active: Command cleared and positioning completed	It is recommended that the logic of the corresponding terminal be set to level valid.

Code	Name	Function Name	Description	Remarks
FunIN.41	HomeRecord	Present position as the home	Invalid: Not triggered Active: Triggered	It is recommended that the logic of the corresponding terminal be set to level valid.
Description of DO signals				
FunOUT.1	S-RDY	Servo ready	The servo drive is ready to receive S-ON signal: Active - Ready to switch on Inactive: Not ready to switch on	-
FunOUT.2	TGON	Motor rotation output	Inactive: The absolute value of filtered motor speed is lower than the setpoint of H06.16. Active: The absolute value of filtered motor speed reaches the setpoint of H06.16.	-
FunOUT.3	ZERO	Zero speed signal	Inactive: Difference between motor speed feedback and reference value larger than H06.19 (Threshold of zero speed output signal) Active: The difference between the motor speed feedback and the reference value is within the threshold defined by H06.19.	-
FunOUT.4	V-CMP	Speed match	In the speed control mode, when the absolute value of the deviation between the motor rotational speed and the speed reference is smaller than the value of H06.17, this signal is valid.	-
FunOUT.5	COIN	Positioning completed	In the position control mode, when the position deviation pulses reach the value of H05.21, this signal is valid.	-
FunOUT.6	NEAR	Positioning almost completed	In the position control mode, when the position deviation pulses reach the value of H05.22, this signal is valid.	-
FunOUT.7	C-LT	Torque limit	Confirming torque limit: Valid: Motor torque limited Invalid: Motor torque not limited	-
FunOUT.8	V-LT	Torque limit	Confirming rotational speed limit in torque control: Valid: Motor speed limited Invalid: Motor rotational speed not limited	-
FunOUT.9	BK	Brake output	Brake output: Valid: Brake released Invalid: Brake applied	-

Code	Name	Function Name	Description	Remarks
FunOUT.10	WARN	Warning output	The warning output is active (conducted). (ON)	-
FunOUT.11	ALM	Fault output	This signal is valid when a fault occurs.	-
FunOUT.12	ALMO1	3-digit fault code output	A 3-digit fault code is output.	-
FunOUT.13	ALMO2	3-digit fault code output	A 3-digit fault code is output.	-
FunOUT.14	ALMO3	3-digit fault code output	A 3-digit fault code is output.	-
FunOUT.15	Xintcoin	Interruption fixed length completed	Active: Interrupt positioning completed Invalid: Interruption fixed length not completed	-
FunOUT.17	ElecHome Attain	Electrical home return output	Electric home return state: Active: Electrical homing completed Invalid: Not return to electrical home position	-
FunOUT.18	ToqReach	Torque Reach Output	Active: The absolute value of torque reference reaches the reference value. Inactive: The absolute value of torque reference is lower than the reference value.	-
FunOUT.19	V-Arr	Speed reached output	Valid: Speed feedback reaches the set value. Invalid: Speed feedback smaller than the setting	-
FunOUT.20	AngIntRdy	Angle auto-tuning output	Active: Angle auto-tuning completed Inactive: Angle auto-tuning not completed	-
FunOUT.21	DB	Dynamic braking output	Active: Dynamic brake relay opened Inactive: Dynamic braking relay closed	-
FunOUT.22	CmdOk	Internal reference output	Active: Internal reference completed Inactive: Internal reference not completed	-
FunOUT.23	WrNextBlockEn	Write next block enabled	Active: Writing the next segment allowed. Inactive: Writing the next segment inhibited.	-
FunOUT.24	McOk	Motion control output	Active: Motion control done Inactive: Motion control not done	-

Code	Name	Function Name	Description	Remarks
FunOUT.26	RefAllow	Servo enabled to receive command	Valid - Enable allowed to receive command. Invalid - Enable not allowed to receive command.	-
FunOUT.27	AlmAndWarn	Fault or alarm valid output signal	Valid - Fault or alarm output is valid. Invalid - Fault or alarm output is invalid.	-

9.2 Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

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Shenzhen Inovance Technology Co., Ltd.

www.inovance.com

Add.: Inovance Headquarters Tower, High-tech Industrial Park,
Guanlan Street, Longhua New District,
Shenzhen 518000, P.R. China

Tel: (0755) 2979 9595 Fax: (0755) 2961 9897

Suzhou Inovance Technology Co., Ltd.

www.inovance.com

Add.: No. 52, Tian E Dang Road, Wuzhong District, 215104,
Suzhou City, Jiangsu Province, P.R. China

Tel: (0512) 6637 6666 Fax: (0512) 6285 6720