Inovance

IS620P Series Servo Drive User Manual V1.0

IS620P

Series Servo Drive User Manual

Inovance Technology

Data code:19010204

Preface

Thank you for purchasing the IS620P series servo drive developed by Inovance Technology Co., Ltd.

The IS620P series is a high-performance AC servo drive for small and medium power applications. The IS620P series ranges from 100 W to 7.5 kW. It supports the Modbus communication protocol with RS232/RS485 communication port, and thus allowing networking of multiple IS620P drives controlled by a host PC. The IS620P is easy to use with the functions of rigid table setting, inertia identification and oscillation suppression. It works quietly together with Inovance ISMH series small/medium-inertia high-response servo motor configured with 20-bit incremental encoder. This servo drive is able to realize rapid and accurate position, speed and torque control, and is applicable for such automation equipment as semiconductor manufacturing equipment, chip mounter, PCB punching machine, transport machinery, food processing machinery, machine tool and conveying machinery.

This manual describes the correct use of the IS620P series servo drive, including safety information, mechanical and electrical installation, commissioning and maintenance. Read and understand this manual before use. Contact our customer service center if you have any question during the use.

The instructions are subject to change, without notice, due to product upgrade, specification modification as well as efforts to increase the accuracy and convenience of the manual.

If you are an equipment manufacturer, forward this manual to the end user.

■ Product Checking

Upon unpacking, check the items described in the following table.

Check Item	Description
Whether the product that you received is consistent with your order	The box contains the IS620P servo drive and user manual. Check the models of the servo drive and servo motor on the nameplate.
Whether the servo drive is damaged during transportation	Check the overall appearance of the product. If there is any omission or damage, contact Inovance or your supplier immediately.
Whether the rotating shaft of the servo motor rotates smoothly	If the shaft of the servo motor can be rotated manually, it is normal. The servo motor configured with a brake, however, cannot be rotated manually.

Notes
• This drive is a general industrial automation product, and is not designed for use in machinery or system on which lives depend. • Wiring, operation, maintenance and inspection of the product can only be performed by qualified persons. • When selecting the tightening torque of the screw, consider the strength of the screw and material of the installation part. Select a proper value while the screw is fixed solidly and the installation part will not be damaged. • Install an appropriate safety device when this product is to be used on machinery which may cause severe accidents or loss due to trips of the product. • Contact Inovance when this product is to be used on special applications such as atomic energy control, aerospace equipment, transport equipment, medical apparatus, safety devices and other equipment that require high cleanliness. • Although this product has passed all QC testing, it may react unexpectedly due to trips arising from ambient noise, static interference, input power supply, wiring, optional parts, and etc. Take mechanical safety measures into fully consideration to ensure safety in the applications where all possible actions of the equipment occur. • When the motor shaft runs without being grounded, based on the actual mechanical and installation conditions, the motor bearing may suffer from electric corrosion or large noise. • Trips of this product may cause rising smoke. Pay special attention to such condition when the product is to be used in purification workshop and environment alike. • Chip resistor disconnection or poor contact condition may occur due to sulfuration reaction if the product is to be used in an environment with high-density sulphur or sulfuretted gas. • Verify that the input voltage of the drive is within the allowable range. If the input voltage is much larger than the rated value, internal components may be damaged, thus resulting in smoke or even a fire. • End users decide whether the servo drive matches the structure, size, service life, features, specification change of the equipment (to which the servo drive is to be installed) and its parts, and whether complies with local codes and regulations. • Never use the drive beyond the technical specifications. • This product is subject to change of certain components for the purpose of continuous improvement of the product.

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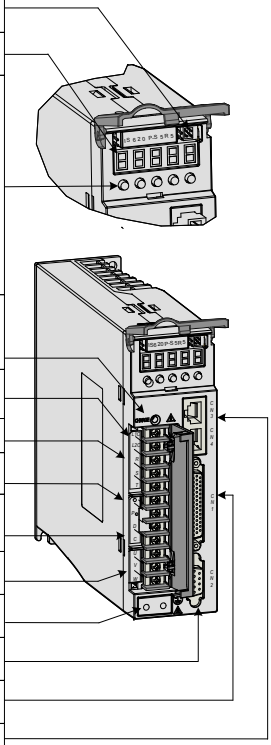
Servo System Selection

Chapter 1 Servo System Selection

Figure 1-1 Servo drive composition

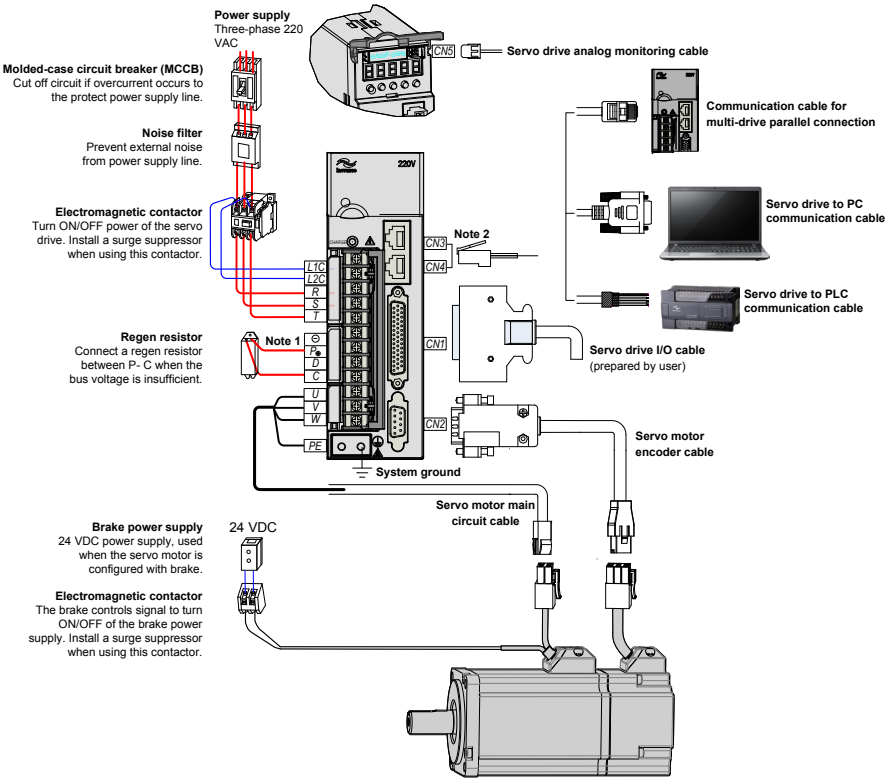
Name	Function
CN5 analog monitoring signal terminal	Connect to the measuring instrument (such as an oscilloscope) to facilitate viewing signal status when gains are adjusted.
LED display	Display the running status and parameter setting of the servo system.
Operation buttons	MODE ▲ ▼ ◀◀ SET Save and enter the next-level menu. Shift the blinking digit to the left. Hold down: Turn page when more than 5 digits are displayed. Decrease value of the blinking digit. Increase value of the blinking digit. Switch function codes in turn.
CHARGE bus voltage indicator	Used to indicate that the bus voltage is in CHARGE status. Indicator ON: Capacitors inside the servo drive still contain electricity even if the main circuit power is OFF. Thus, do not touch the power supply terminal when CHARGE indicator is ON, to prevent electric shock.
L1C/L2C control circuit power input terminals	Input control circuit power supply as per the rated voltage on the nameplate.
R/S/T main circuit power input terminals	Input main circuit power supply as per the rated voltage on the nameplate.
$P_{\oplus}$/⊖ servo drive bus terminals	Used when multiple servo drives share the same DC bus.
$P_{\oplus}$/D/C braking resistor connection terminals	$P_{\oplus}$-D is shorted by default. Remove jumper between $P_{\oplus}$-D when connecting an external braking resistor, and connect the resistor between $P_{\oplus}$-C.
U/V/W servo motor connection terminals	Connect U, V and W phases of the servo motor.
⏚ PE grounding terminal	Used as the grounding terminal of the power supply and motor.
CN2 encoder connection terminal	Connect to the motor encoder.
CN1 control terminal	Used for reference input signals and other I/O signals.
CN3/CN4 communication terminals	Connected in parallel inside the servo drive. Connect to RS232 or RS485 communication devices.



Note

For models (S1R6 and S2R8) using the single-phase power supply, the main circuit power input terminals are L1 and L2. These models do not have the built-in regenerative braking resistor (hereinafter shorted as "regen resistor"), and therefore terminal D is unavailable. If you need to connect an external regen resistor, connect it between $P_{\oplus}$ and C.

Figure 1-2 Wiring example of three-phase 220 V system



- The IS620P servo drive is directly connected to an industrial power supply, with no isolation such as using a transformer. In this case, you need to connect a fuse or molded-case circuit breaker (MCCB) on the input power supply to prevent cross electric accidents in the servo system.
- The IS620P servo drive has no built-in protective grounding circuit. Thus, connect a residual-current circuit breaker (RCCB) against overload or short-circuit or a specialized RCCB combined with the protective grounding.
- Never use magnetic contactor for running or stopping the servo motor. Since motor is a large inductance element, instantaneous medium voltage generated may damage the contactor.
- Pay attention to the power capacity when connecting an external power supply or 24 VDC, especially when the power supply is for powering up multiple drives or brakes. Insufficient power supply will lead to lack of supply current, thus causing failure of the drives or brakes. The brake shall be powered up by a 24 VDC power supply. For power information, refer to the model of the motor.

Observe the following precautions during wiring:

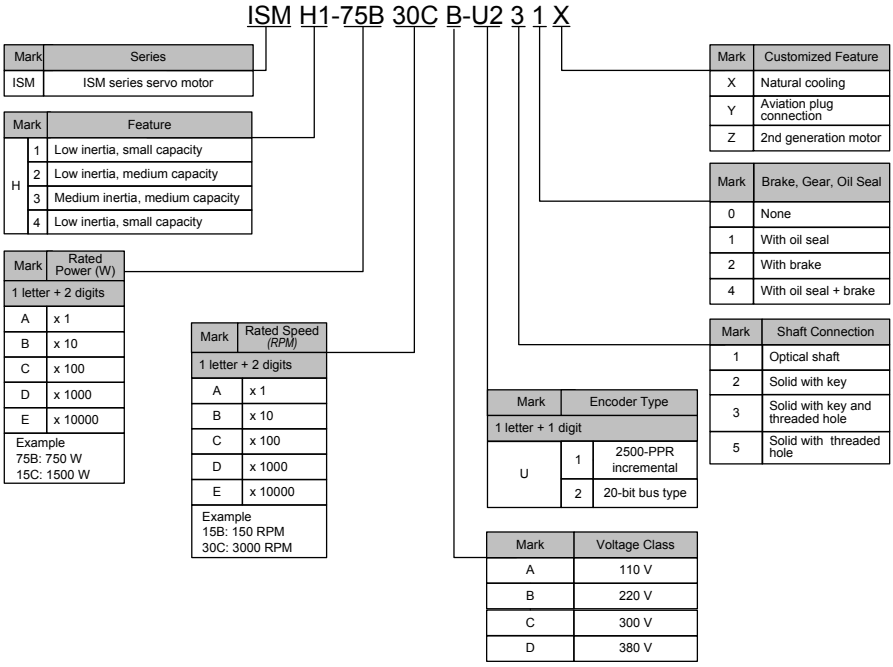
Note 1: Remove the jumper between terminals $P_{\oplus}$ and D of the servo drive before connecting a regen resistor.

Note 2: CN3 and CN4 are two same communication ports, which can be used at random.

Note 3: For the single-phase 220 V servo drive, the main circuit terminals are L1 and L2. Never wire the reserved terminal.

1.1 Designation Rules of the Servo Motor and Servo Drive

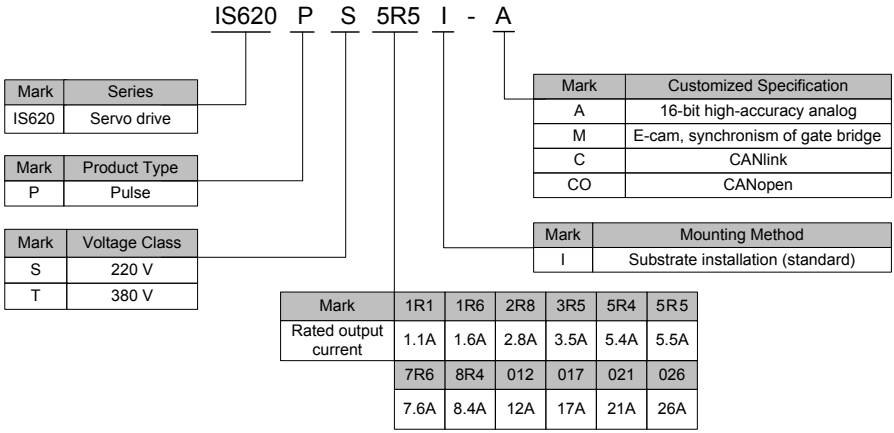
Figure 1-3 Designation rules of the servo motor



Note

Models ending in –U231* and –U234 * are standard models. Prior ordering is required for non-standard models.
ISMH2-20C/25C/30C/40C/50C are not configured with a brake now.

Figure 1-4 Designation rules of the servo drive



Note

The models T017, T021, and T026 are under development.

1.2 Servo System Configuration

■ **220 V**

Rated Speed (RPM)	Max. Speed (RPM)	Rated Power (W)	Servo Motor Model (ISMH□-□□□□□□□-*****)		Motor Frame Size	Servo Drive Model (IS620P□□□□I)		Drive Size	Drive SN (H01-02)
						Single-phase 220 VAC	Three-phase 220 VAC		
3000	5000	100	H1 (low inertia, small capacity)	10B30CB	40	S1R6	-	A	00002
	6000	200		20B30CB	60	S1R6	-	A	00002
		400		40B30CB	60	S2R8	-	A	00003
		750		75B30CB	80	S5R5		A	00005
		1000	H2 (low inertia, medium capacity)	10C30CB	100	-	S7R6	C	00006
	5000	1500		15C30CB	100	-	S012	C	00007
1500	3000	850	H3 (medium inertia, medium capacity)	85B15CB	130	-	S7R6	C	00006
		1300		13C15CB	130	-	S012	C	00007

Rated Speed (RPM)	Max. Speed (RPM)	Rated Power (W)	Servo Motor Model (ISMH□-□□□□□□□-*****)		Motor Frame Size	Servo Drive Model (IS620P□□□□I)		Drive Size	Drive SN (H01-02)
						Single-phase 220 VAC	Three-phase 220 VAC		
3000	6000	400	H4 (medium inertia, small capacity)	40B30CB	60	S2R8	-	A	00003
		750		75B30CB	80	S5R5		A	00005

■ **380 V**

Rated Speed (RPM)	Max. Speed (RPM)	Rated Power (W)	Servo Motor Model (ISMH□-□□□□□□□-*****)		Motor Frame Size	Servo Drive Model (IS620P□□□□I)	Drive Size	Drive SN (H01-02)
						Three-phase 380 VAC		
3000	6000	1000	H2 (low inertia, medium capacity)	10C30CD	100	T5R4	C	10002
	5000	1500		15C30CD	100	T5R4	C	10002
		2000		20C30CD	100	T8R4	C	10003
		2500		25C30CD	100	T8R4	C	10003
		3000		30C30CD	130	T012	C	10004
		4000		40C30CD	130	T017	E	10005
		5000		50C30CD	130	T017	E	10005
1500	3000	850	H3 (medium inertia, medium capacity)	85B15CD	130	T3R5	C	10001
		1300		13C15CD	130	T5R4	C	10002
		1800		18C15CD	130	T8R4	C	10003
		2900		29C15CD	180	T012	C	10004
		4400		44C15CD	180	T017	E	10005
		5500		55C15CD	180	T021	E	10006
		7500		75C15CD	180	T026	E	10007

1.3 Adapted Cables

Table 1-1 Adapted cables for servo motor without brake

Servo Motor	Servo Motor Main Circuit Cable			Servo Motor Encoder Cable			Connector Kit	
	L = 3.0 m	L = 5.0 m	L = 10.0 m	L = 3.0 m	L = 5.0 m	L = 10.0 m		
ISMH1 ISMH4	S6-L-M00-3.0	S6-L-M00-5.0	S6-L-M00-10.0	S6-L-P00-3.0	S6-L-P00-5.0	S6-L-P00-10.0	S6-C1	CN1 terminal
								CN2 terminal
								6-pin connector
								9-pin connector

Servo Motor	Servo Motor Main Circuit Cable			Servo Motor Encoder Cable			Connector Kit	
	L = 3.0 m	L = 5.0 m	L = 10.0 m	L = 3.0 m	L = 5.0 m	L = 10.0 m		
ISMH1 ISMH4 X series	S5-L-M03-3.0	S5-L-M03-5.0	S5-L-M03-10.0	S60-L-P00-3.0	S60-L-P00-5.0	S60-L-P00-10.0	S62-C1	CN1 terminal
								CN2 terminal
								4-pin connector
								9-pin connector
ISMH2	S6-L-M11-3.0	S6-L-M11-5.0	S6-L-M11-10.0	S6-L-P01-3.0	S6-L-P01-5.0	S6-L-P01-10.0	S6-C2 (elbow)	CN1 terminal
								CN2 terminal
								20-18 aviation plug (elbow)
								20-29 aviation plug (elbow)
ISMH3 (1.8 kW and below)	S6-L-M11-3.0	S6-L-M11-5.0	S6-L-M11-10.0	S6-L-P01-3.0	S6-L-P01-5.0	S6-L-P01-10.0	S6-C2 (elbow)	CN1 terminal
								CN2 terminal
								20-18 aviation plug (elbow)
								20-29 aviation plug (elbow)
ISMH3 (2.9 kW)	S6-L-M12-3.0	S6-L-M12-5.0	S6-L-M12-10.0	S6-L-P01-3.0	S6-L-P01-5.0	S6-L-P01-10.0	S6-C3 (elbow)	CN1 terminal
								CN2 terminal
ISMH3 (2.9 kW above)	S6-L-M22-3.0	S6-L-M22-5.0	S6-L-M22-10.0	S6-L-P01-3.0	S6-L-P01-5.0	S6-L-P01-10.0		20-22 aviation plug (elbow)
								20-29 aviation plug (elbow)

Table 1-2 Adapted cables for servo motor with brake

Servo Motor	Servo Motor Main Circuit Cable			Servo Motor Encoder Cable			Connector Kit	
	L = 3.0 m	L = 5.0 m	L = 10.0 m	L = 3.0 m	L = 5.0 m	L = 10.0 m		
ISMH1 ISMH4	S6-L-B00-3.0	S6-L-B00-5.0	S6-L-B00-10.0	S6-L-P00-3.0	S6-L-P00-5.0	S6-L-P00-10.0	S6-C1	CN1 terminal
								CN2 terminal
								6-pin connector
								9-pin connector

Servo Motor	Servo Motor Main Circuit Cable			Servo Motor Encoder Cable			Connector Kit	
	L = 3.0 m	L = 5.0 m	L = 10.0 m	L = 3.0 m	L = 5.0 m	L = 10.0 m		
ISMH1 ISMH4 X series	S5-L-M03-3.0	S5-L-M03-5.0	S5-L-M03-10.0	S60-L-P00-3.0	S60-L-P00-5.0	S60-L-P00-10.0	S62-C1	CN1 terminal
								CN2 terminal
								4-pin connector
								9-pin connector
ISMH2	S6-L-B11-3.0	S6-L-B11-5.0	S6-L-B11-10.0	S6-L-P01-3.0	S6-L-P01-5.0	S6-L-P01-10.0	S6-C2 (elbow)	CN1 terminal
								CN2 terminal
								20-18 aviation plug (elbow)
								20-29 aviation plug (elbow)
ISMH3 (1.8 kW and below)	S6-L-B11-3.0	S6-L-B11-5.0	S6-L-B11-10.0	S6-L-P01-3.0	S6-L-P01-5.0	S6-L-P01-10.0	S6-C2 (elbow)	CN1 terminal
								CN2 terminal
								20-18 aviation plug (elbow)
								20-29 aviation plug (elbow)
ISMH3 (2.9 kW)	Prepared by the customer			S6-L-P01-3.0	S6-L-P01-5.0	S6-L-P01-10.0	S6-C3 (elbow)	CN1 terminal
								CN2 terminal
ISMH3 (2.9 kW above)	Prepared by the customer			S6-L-P01-3.0	S6-L-P01-5.0	S6-L-P01-10.0		20-22 aviation plug (elbow)
								20-29 aviation plug (elbow)

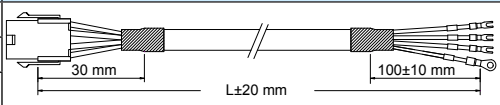
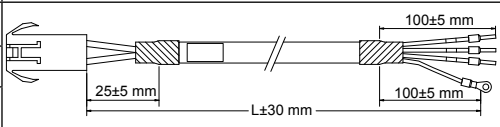
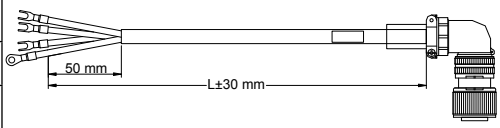
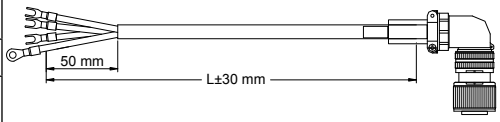
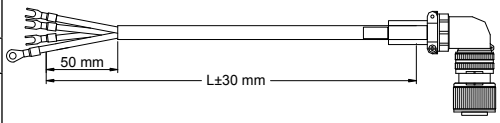
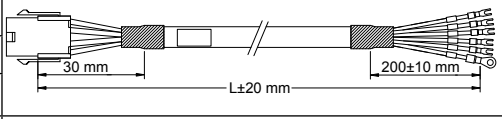
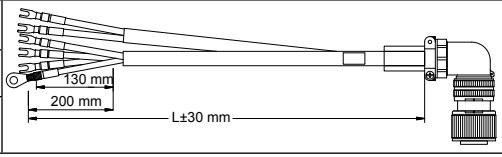
Note

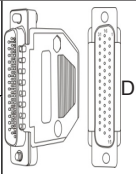
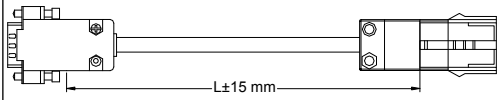
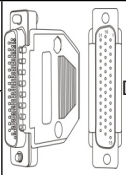
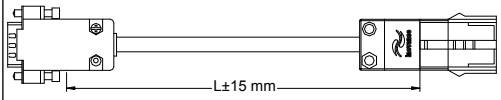
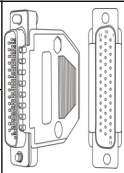
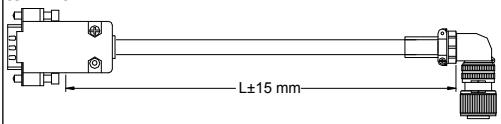
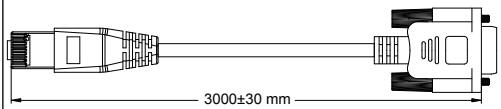
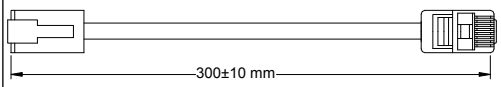
The servo motor encoder cable package includes the CN1 connector.

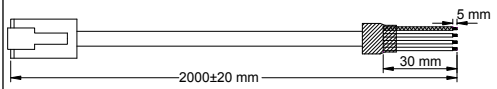
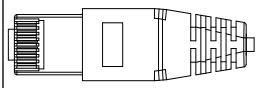
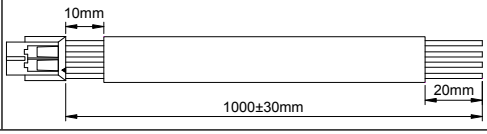
Table 1-3 Communication cables

Cable Model	Description
S62-L-T00-3.0	Servo drive to PC communication cable
S62-L-T01-0.3	Communication cable for multi-drive parallel connection
S62-L-T02-2.0	Servo drive to PLC communication cable
S62-L-T03-0.0	Plug for matching terminal matching resistor for servo drive communication

Table 1-4 Physical appearance of cables for the servo motor and servo drive

Cable Name	Cable Model	Cable Length (mm)	Cable Appearance
Servo motor main circuit cable	S6-L-M00-3.0	3000	
	S6-L-M00-5.0	5000	
	S6-L-M00-10.0	10000	
	S5-L-M03-3.0	3000	
	S5-L-M03-5.0	5000	
	S5-L-M03-10.0	10000	
	S6-L-M11-3.0	3000	
	S6-L-M11-5.0	5000	
	S6-L-M11-10.0	10000	
	S6-L-M12-3.0	3000	
	S6-L-M12-5.0	5000	
	S6-L-M12-10.0	10000	
	S6-L-M22-3.0	3000	
	S6-L-M22-5.0	5000	
	S6-L-M22-10.0	10000	
	S6-L-B00-3.0	3000	
	S6-L-B00-5.0	5000	
	S6-L-B00-10.0	10000	
	S6-L-B11-3.0	3000	
	S6-L-B11-5.0	5000	
	S6-L-B11-10.0	10000	

Cable Name	Cable Model	Cable Length (mm)	Cable Appearance
Servo motor encoder cable	S6-L-P00-3.0	3000	 DB44 plug Note: DB44 is an attached plug, used to connect the CN1 terminal. 
	S6-L-P00-5.0	5000	
	S6-L-P00-10.0	10000	
	S60-L-P00-3.0	3000	 DB44 plug Note: DB44 is an attached plug, used to connect the CN1 terminal. 
	S60-L-P00-5.0	5000	
	S60-L-P00-10.0	10000	
	S6-L-P01-3.0	3000	 DB44 plug Note: DB44 is an attached plug, used to connect the CN1 terminal. 
	S6-L-P01-5.0	5000	
	S6-L-P01-10.0	10000	
Servo drive to PC communication cable	S6-L-T00-3.0	3000	
Communication cable for multi-drive parallel connection	S6-L-T01-0.3	300	

Cable Name	Cable Model	Cable Length (mm)	Cable Appearance
Servo drive to PLC communication cable	S6-L-T02-2.0	2000	
Resistor plug for servo drive communication terminal	S6-L-T03-0.0	0	
Servo drive analog output cable with loose wire at one end	S5-L-A01-1.0	1000	

1.4 Regen Resistor Specifications

Servo Drive Model		Braking Regen Specs		Min. Allowed Resistance (Ω)	Max. Braking Energy Absorbed by Capacitor (J)
		Resistance (Ω)	Capacity (W)		
Single-phase 220 V	IS620PS1R1I	-	-	50	9
	IS620PS1R6I	-	-	50	9
	IS620PS2R8I	-	-	45	18
Single/Three-phase 220 V	IS620PS5R5I	50	50	40	26
Three-phase 220 V	IS620PS7R6I	25	80	20	26
	IS620PS012I			15	47
Three-phase 380 V	IS620PT3R5I	100	80	80	28
	IS620PT5R4I	100	80	60	34
	IS620PT8R4I	50	80	45	50
	IS620PT012I				50
	IS620PT017I	40	100	35	81
	IS620PT021I			25	122
	IS620PT026I				122

Models IS620PS1R6 and IS620PS2R8 are not configured with a built-in regen resistor. Use an external regen resistor if necessary. For selecting proper external regen resistors, contact Inovance for technical support.

2

Mounting Dimensions

Chapter 2 Mounting Dimensions of Servo System

2.1 Installation of the Servo Motor

2.1.1 Installation Location

1. Install the servo motor in an environment free from corrosive or inflammable gases or combustibles, such as hydrogen sulfide, chlorine, anmonia, sulphur gas, chloridize gas, acid, soda and salt.
2. Select and use the servo motor with oil seal in a place with grinding fluid, oil spray, iron powder or cuttings.
3. Install the servo motor away from heat sources such as heating stove.
4. Never use the servo motor in an enclosed environment. Working in the enclosed environment will lead to high temperature of the servo motor, which will shorten its service life.

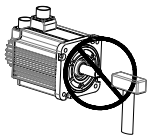
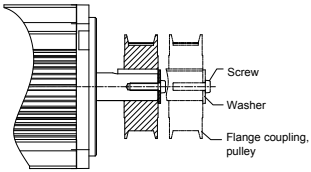
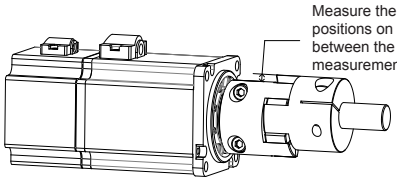
2.1.2 Installation Environment

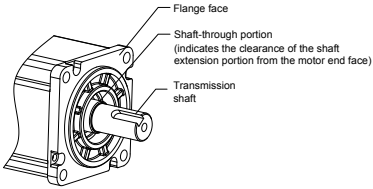
Table 2-1 Installation environment

Item	Description
Ambient temperature	0–40°C (non-freezing)
Environment humidity	20%–90% RH (no condensation)
Storage temperature	-20 to 60°C (Peak temperature ensurance: 80°C for 72 hours)
Storage humidity	20%–90% RH (no condensation)
Vibration	< 49 m/s^2
Shock	< 490 m/s^2
IP level	ISMH1/H4: IP65 (except for the shaft-through portion and motor connectors) Other series: IP67 (except for the shaft-through portion and motor connectors)
Altitude	< 1000 m (de-rated if the altitude is above 1000 m)

2.1.3 Installation Precautions

Table 2-2 Installation precautions

Item	Description
Rust-proof treatment	Wipe up the antirust agent at the motor shaft end before installing the servo motor, and then take rust-proof treatment.
Encoder	• Do not strike the shaft end during installation. Failure to comply will lead to damage to the internal encoder. 
	• Use the screw hole at the shaft end when mounting a pulley to the servo motor shaft with a keyway. To fit the pulley, insert a double-end screw into the screw hole of the shaft, put a washer against the coupling end, and then use a nut to push the pulley in. • For the servo motor shaft without a keyway, use friction coupling or the like. • When removing the pulley, use a pulley remover to protect the shaft from suffering severe impact from load. • To ensure safety, install a protective cover or similar device on the rotary area such as the pulley mounted on the shaft. 
Alignment	Align the shaft of the servo motor with the shaft of the equipment and then couple the shafts. When installing the servo motor, make sure that the alignment accuracy satisfies the requirement as described in the following figure. If the shafts are not properly aligned, vibration will be generated and may damage the bearings and encoder. 
Installation direction	The servo motor can be installed horizontally or vertically.

Item	Description
Handling oil and water	Confirm the IP level of the servo drive in water drop applications (except for the shaft-through portion). In the environment where the shaft-through portion is exposed to oil drops, select and use a servo motor with an oil seal. Observe the following conditions when using the servo motor with oil seal: • Keep the oil level under the oil seal lip during usage. • Use the oil seal in favourably lubricated condition. • Avoid oil accumulation at the oil seal lip when using the servo motor with its shaft in upward direction. 
Stress of cables	Do not bend or apply tension to the cables, especially the signal cables whose core wire is 0.2 or 0.3 mm thick. Do not pull the cables tightly during wiring.
Connectors	• When connecting the connectors, make sure there is no waste or sheet metal inside the connectors. • When connecting a connector to servo motor, be sure to connect the servo motor main circuit cables first and ensure reliable grounding of the cable. If the encoder cable is connected first, the encoder may fail because of voltage difference between PEs. • Make sure the pins are correctly arranged during wiring. • The connector is made up of resins. Do not apply shock to prevent damage to the connector. • When moving a servo motor with cables connected, hold the main body of the servo motor. If you hold the cables only, connectors and cables may be damaged. If bending cables are used, do not attach stress on the cables during wiring. Failure to comply may cause damage to the connectors.

2.2 Installation of the Servo Drive

2.2.1 Installation Location

1. The servo drive of plastic housing is a whole unit built-in product operated through remote control and needs to be installed in the final system. The final system must have the required fireproof cover, electrical protective cover and mechanical protective cover, and satisfy the regional laws & regulations and related IEC requirements.
2. Install the servo drive inside a cabinet free of sun light and rain.
3. Do not install the servo drive in an environment with corrosive or inflammable gases or combustibles, such as hydrogen sulfide, chlorine, anmonia, sulphur gas, chloridize gas, acid, soda and salt.
4. Do no install the servo drive in the environment with high temperature, moisture, dust and metal powder.
5. Install the servo drive in a place with no vibration.

2.2.2 Installation Environment

Table 2-3 Installation environment

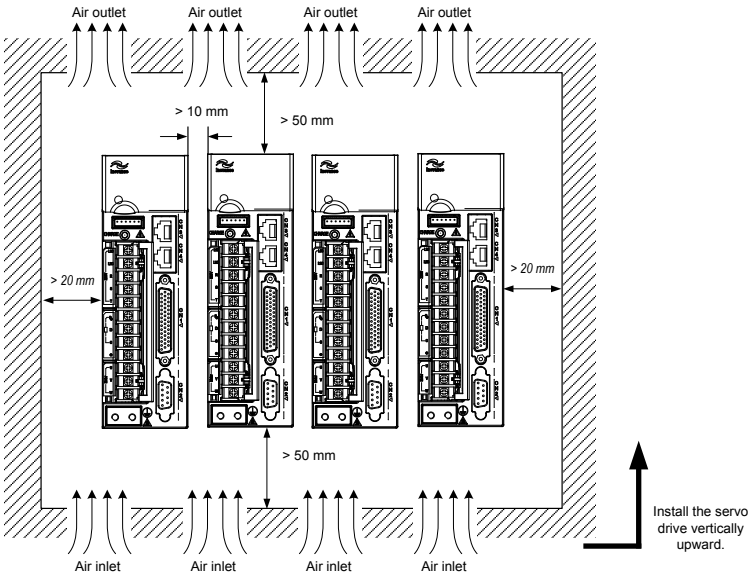
Item	Description
Ambient temperature	0 to 40°C (The average load rate must not exceed 80% at 40°C to 55°C.) (no freezing)
Environment humidity	< 90% RH (no condensation)
Storage temperature	-20 to 85°C (no freezing)
Storage humidity	< 90% RH (no condensation)
Vibration	< 4.9 m/s^2
Shock	< 19.6 m/s^2
IP level	IP10
Altitude	< 1000 m

2.2.3 Installation Precautions

1. Installation Method

   Make sure the installation direction of the servo drive is vertical to the wall. Cool the servo drive with natural air or via a cooling fan. Fix the servo drive solidly on the mounting surface via two to four mounting holes (number of such mounting holes depends on the capacity of the servo drive).

Figure 2-1 Installation diagram of the servo drive



Install the servo drive vertical to the wall, making its front panel faces outward.

2. Cooling

   As shown in the above figure, keep sufficient clearances around the servo drive to ensure cooling by cooling fans or natural convection. Install cooling fans above the servo drive to avoid excessive temperature rise and maintain even temperature inside the control cabinet.

3. Installation side by side

   When installing multiple servo drives side by side, keep at least 10 mm between two servo drives (if installation space is limited, such clearance between servo drives can be ignored) and at least 50 mm above and below each servo drive.

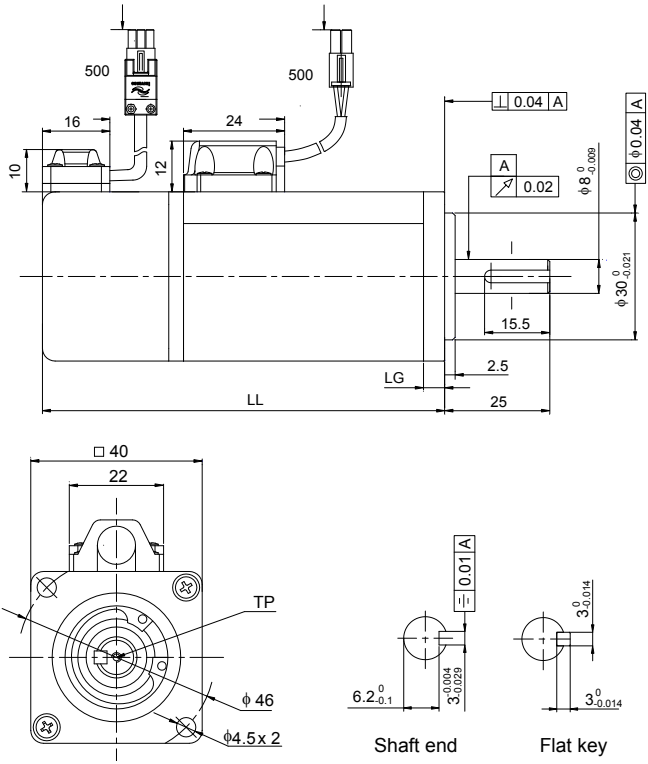
4. Grounding

   The grounding terminal must be properly grounded. Failure to comply may cause electric shock or malfunction due to interference.

2.3 Mounting Dimensions of the Servo Motor

2.3.1 Mounting Dimensions of the ISMH1 Series Z Motor

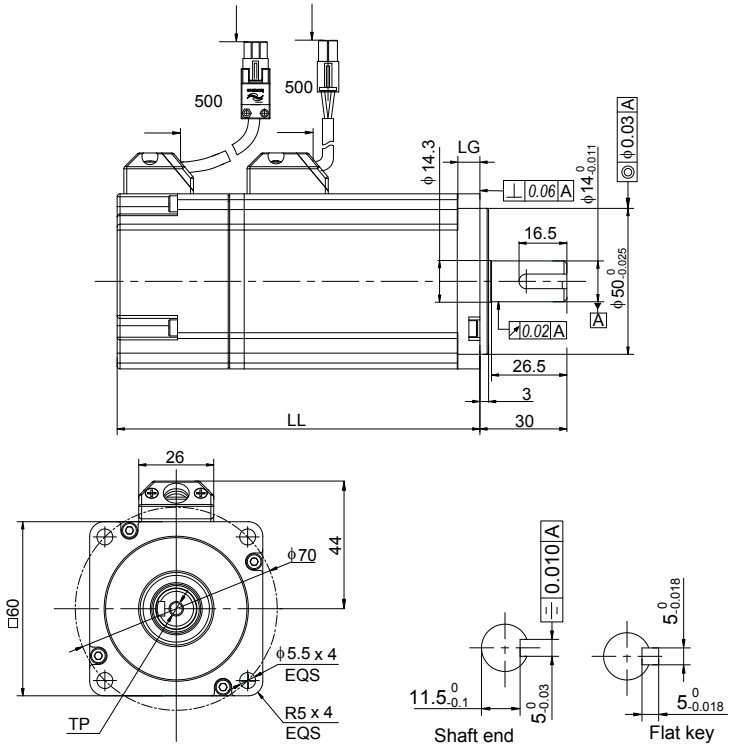
1) 100 W (Vn = 3000 RPM, Vmax = 5000 RPM)



Connector	Power Side (Including Brake)	Encoder Side
Plastic housing	MOLEX-50361672	AMP 172169-9
Terminal	MOLEX-39000059	AMP 1473226-1

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	Weight (kg)
ISMH1-10B30CB-U2**Z	106.5 (139.6)	5	M3 x 6	0.59 (0.77)

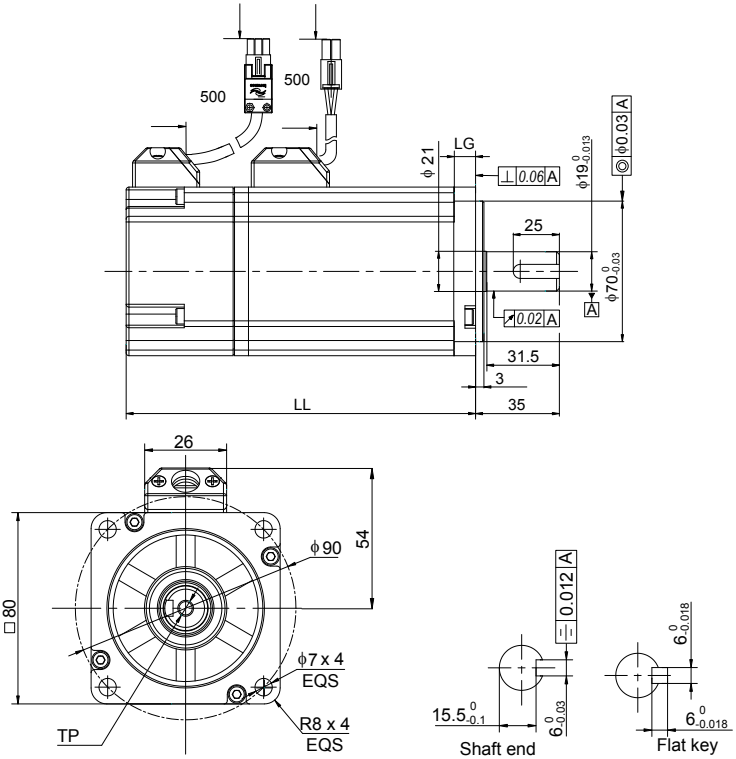
2) 200 W, 400 W (Vn = 3000 RPM, Vmax = 6000 RPM)



Connector	Power Side (Including Brake)	Encoder Side
Plastic housing	MOLEX-50361672	AMP 172169-9
Terminal	MOLEX-39000059	AMP 1473226-1

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	Weight (kg)
ISMH1-20B30CB-U2**Z	98 (138)	7.6	M5 × 8	1.1 (1.4)
ISMH1-40B30CB-U2*1Z	118			1.6

3) 750 W (Vn = 3000 RPM, Vmax = 6000 RPM)

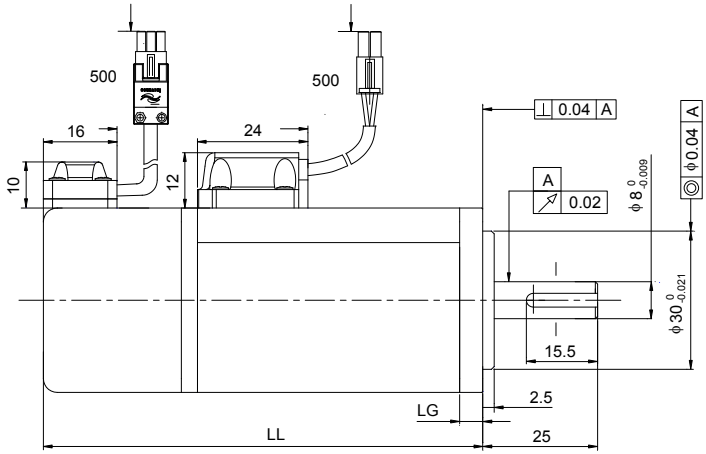


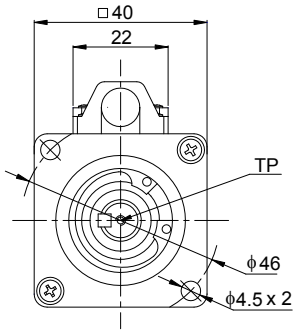
Connector	Power Side (Including Brake)	Encoder Side
Plastic housing	MOLEX-50361672	AMP 172169-9
Terminal	MOLEX-39000059	AMP 1473226-1

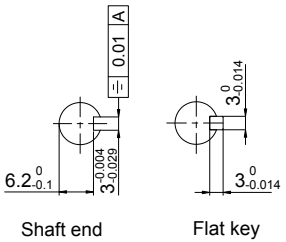
Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	Weight (kg)
ISMH1-75B30CB-U**1Z	135.5	7.8	M6 × 20	2.7

2.3.2 Overall Dimensions of the ISMH1 Series X Motor

1) 100 W (Vn = 3000 RPM, Vmax = 5000 RPM)







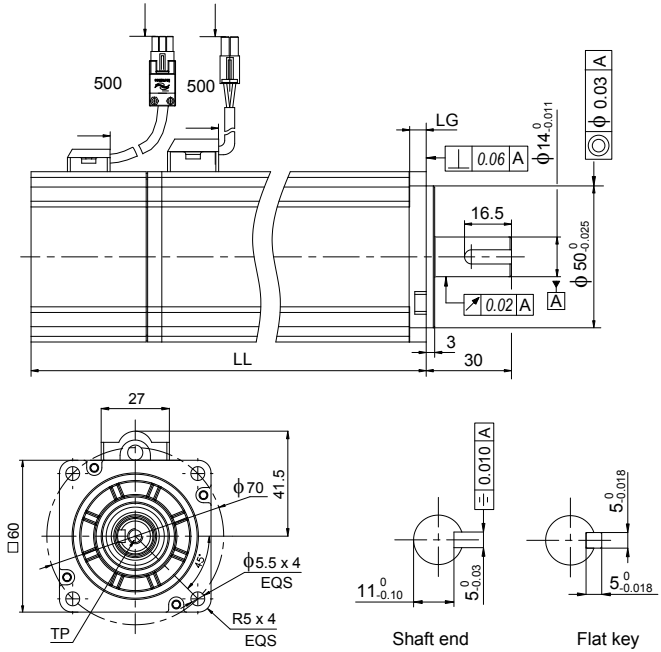
Connector	Power Side	Brake Side	Encoder Side
Plastic housing	EL-4Y (CWB in Zhejiang)	AMP 172165-1	AMP 172169-1
Terminal	422.6006.0 (CWB in Zhejiang)	AMP 770834-1	AMP 770834-1

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	Weight (kg)
ISMH1-10B30CB-U***X	106.5 (139.6)	5	M3 x 6	0.59 (0.77)

Note

This series servo motors are no longer manufactured.

2) 200 W, 400 W (Vn = 3000 rpm, Vmax = 6000 rpm)



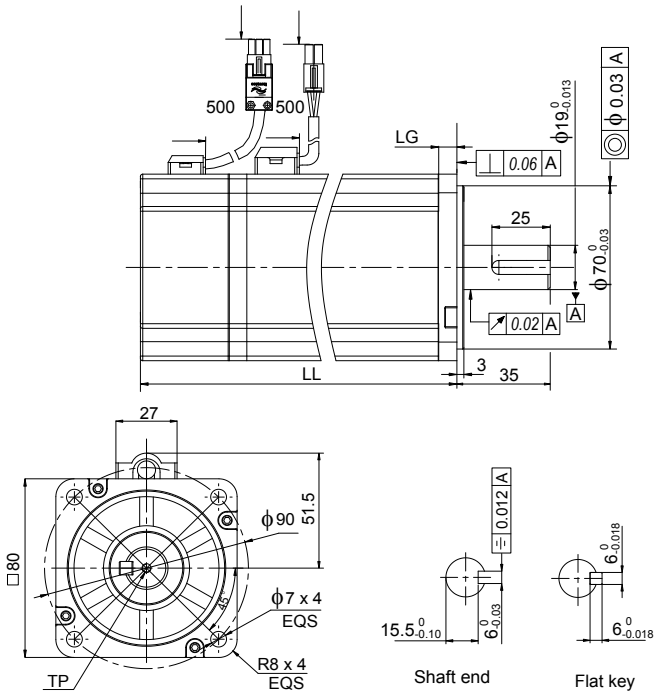
Connector	Power Side	Brake Side	Encoder Side
Plastic housing	EL-4Y (CWB in Zhejiang)	AMP 172165-1	AMP 172169-1
Terminal	422.6006.0 (CWB in Zhejiang)	AMP 770834-1	AMP 770834-1

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	Weight (kg)
ISMH1-20B30CB-U***X	114 (153)	5.8	M5 × 8	1.1 (1.4)
ISMH1-40B30CB-U***X	139 (178)			

Note

This series servo motors are no longer manufactured.

3) 750 W (Vn = 3000 rpm, Vmax = 6000 rpm)



Connector	Power Side	Brake Side	Encoder Side
Plastic housing	EL-4Y (CWB in Zhejiang)	AMP 172165-1	AMP 172169-1
Terminal	422.6006.0 (CWB in Zhejiang)	AMP 770834-1	AMP 770834-1

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	Weight (kg)
ISMH1-75B30CB-U***X	135.5 (182.5)	7.8	M6 × 10	2.7 (3.1)

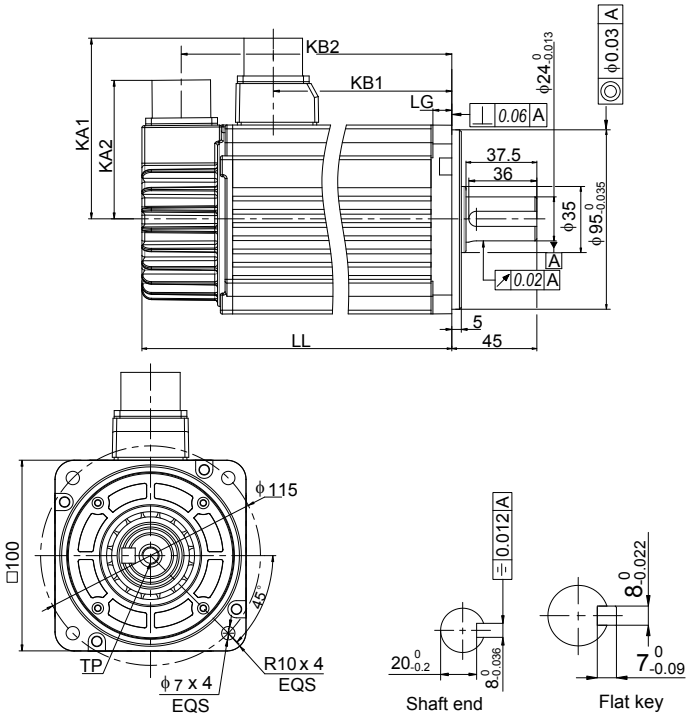
Note

This series servo motors are no longer manufactured.

2.3.3 Overall Dimensions of the ISMH2 Series Servo Motor

(Vn = 3000rpm, Vmax = 6000/5000 rpm)

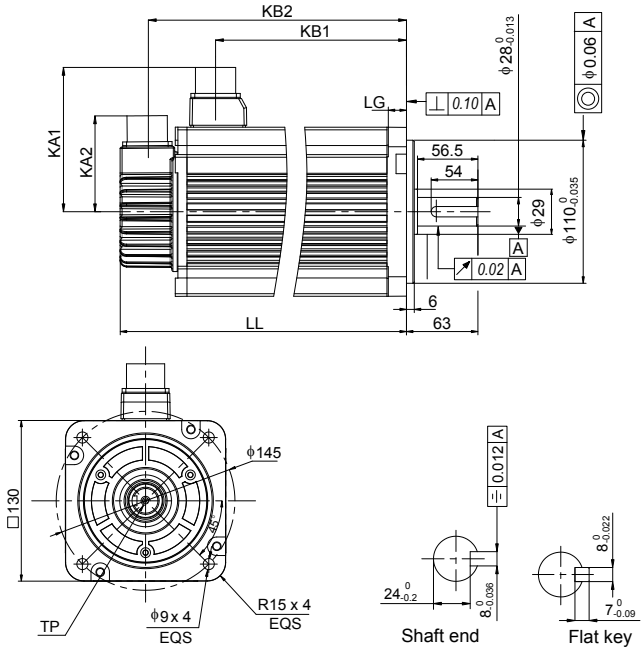
1) 1.0 kW, 1.5 kW, 2.0 kW, 2.5 kW



Connector	Power Side	Brake Side	Encoder Side
Aviation plug	MIL-DTL-5015 series 3102E20-18P	MIL-DTL-5015 series 3102E10SL-4P	MIL-DTL-5015 series 3102E20-29P

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	KA1 (mm)	KA2 (mm)	KB1 (mm)	KB2 (mm)	Weight (kg)
ISMH2-10C30CB(D)-U***Y	164 (213)	10	M8 x 16	96	74	94.5 (101)	143.5 (192.5)	5.11 (6.41)
ISMH2-15C30CB(D)-U***Y	1189 (239)					119.5 (128)	168.5 (219.5)	6.22 (7.52)
ISMH2-20C30CD-U***Y	214					144.5	193.5	7.39
ISMH2-25C30CD-U***Y	239					169.5	218.5	8.55

2) 3.0 kW, 4.0 kW, 5.0 kW



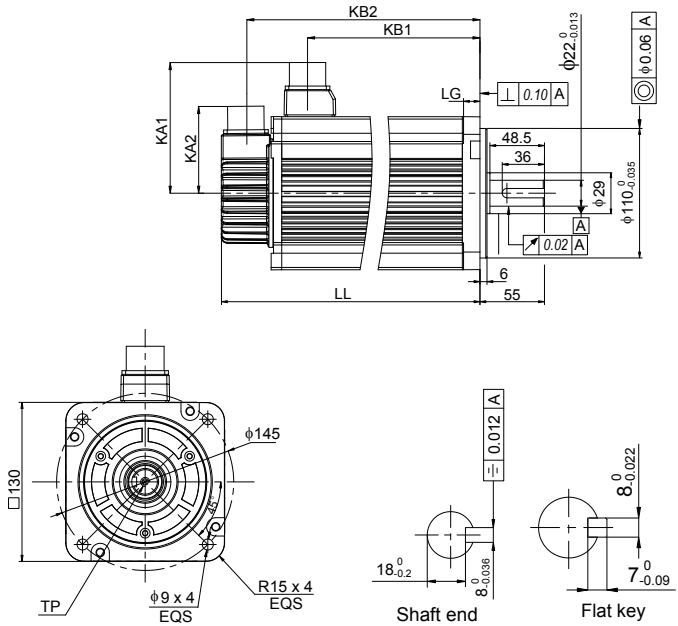
Connector	Power Side	Brake Side	Encoder Side
Aviation plug	MIL-DTL-5015 series 3102E20-18P	MIL-DTL-5015 series 3102E10SL-4P	MIL-DTL-5015 series 3102E20-29P

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	KA1 (mm)	KA2 (mm)	KB1 (mm)	KB2 (mm)	Weight (kg)
ISMH2-30C30CD-U***Y	209.5	14	M8 x 20	111	74	136	188.5	10.73
ISMH2-40C30CD-U***Y	252					178.5	231	15.43
ISMH2-50C30CD-U***Y	294.5					221	273.5	16.2

2.3.4 Overall Dimensions of the ISMH3 Series Servo Motor

(Vn = 1500 RPM, Vmax = 3000 RPM)

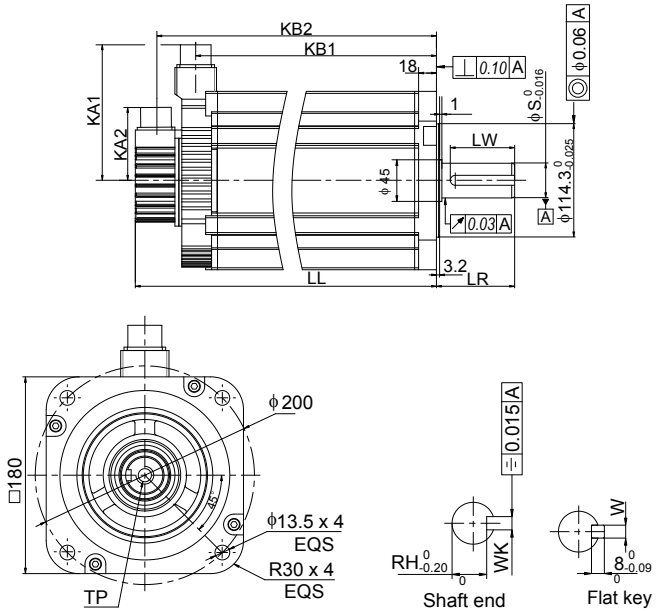
1) 850 W, 1.3 kW, 1.8 kW



Connector	Power Side	Brake Side	Encoder Side
Aviation plug	MIL-DTL-5015 series 3102E20-18P	MIL-DTL-5015 series 3102E10SL-4P	MIL-DTL-5015 series 3102E20-29P

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	KA1 (mm)	KA2 (mm)	KB1 (mm)	KB2 (mm)	Weight (kg)
ISMH3-85B15CB(D)-U***Y	168.5 (227.5)	14	M6 x 20	111	74	95	147.5 (191.5)	8.23 (10.73)
ISMH3-13C15CB(D)-U***Y	194.5 (253.5)					121	173.5 (217.5)	10.57 (13.0)
ISMH3-18C15CD-U***Y	220.5 (279.5)					147	199.5 (243.5)	12.7 (15.2)

2) 2.9 kW, 4.4 kW, 5.5 kW, 7.5 kW



Connector	Power Side	Brake Side	Encoder Side
Aviation plug	MIL-DTL-5015 series 3102E20-22P	MIL-DTL-5015 series 3102E10SL-4P	MIL-DTL-5015 series 3102E20-29P

Servo Motor Model	LL (mm)	LR (mm)	LW (mm)	S (mm)	RH (mm)	WK (mm)	W (mm)	TP (mm)	KA1 (mm)	KA2 (mm)	KB1 (mm)	KB2 (mm)	Weight (kg)
ISMH3-29C15CD-U***Z	197 (273)	79	65	35	30	$10^{0}_{-0.036}$	$10^{0}_{-0.022}$	M12 x 25	138	74	136 (134)	177 (253)	15 (25)
ISMH3-44C15CD-U***Z	230 (307)										169 (167)	210 (286)	19.5 (30)
ISMH3-55C15CD-U***Z	274 (350)	113	96	42	37	$12^{0}_{-0.043}$	$12^{0}_{-0.027}$	M16 x 32	138	74	213 (211)	254 (330)	28 (38)
ISMH3-75C15CD-U***Z	330 (407)										269 (267)	310 (386)	32 (42)

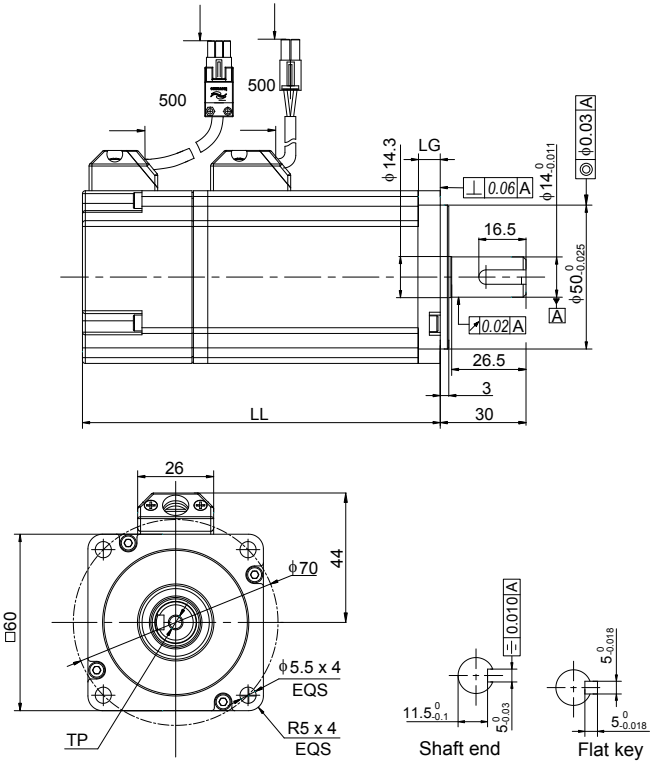
Note

The U1 series Y motors are no longer manufactured.

2.3.5 Overall Dimensions of the ISMH4 Series Z Servo Motor

(Vn = 3000 RPM, Vmax = 6000 RPM)

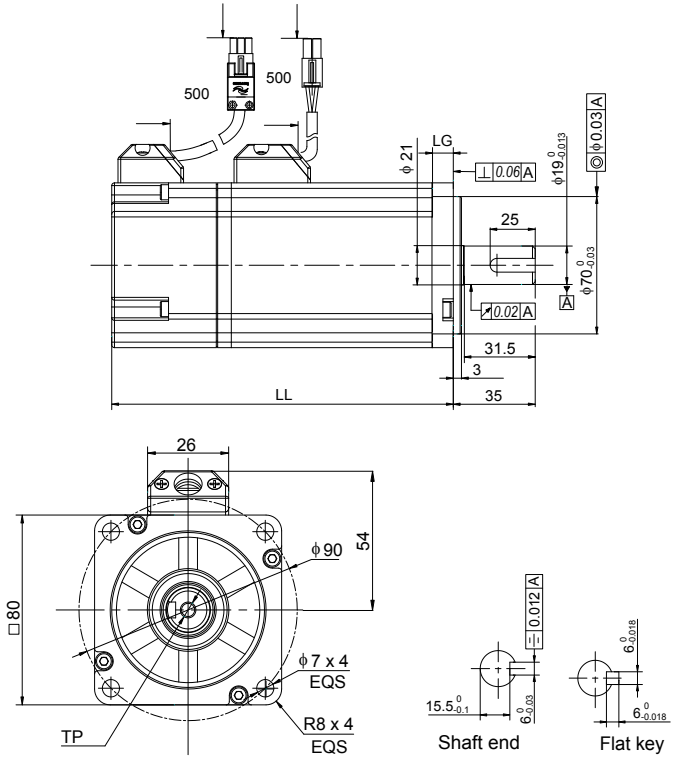
1) 400 W



Connector	Power Side (Including Brake)	Encoder Side
Plastic housing	MOLEX-50361672	AMP 172169-9
Terminal	MOLEX-39000059	AMP 1473226-1

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	Weight (kg)
ISMH4-40B30CB-U2**Z	125 (165)	7.6	M5 x 8	1.7 (2.0)

2) 750 W



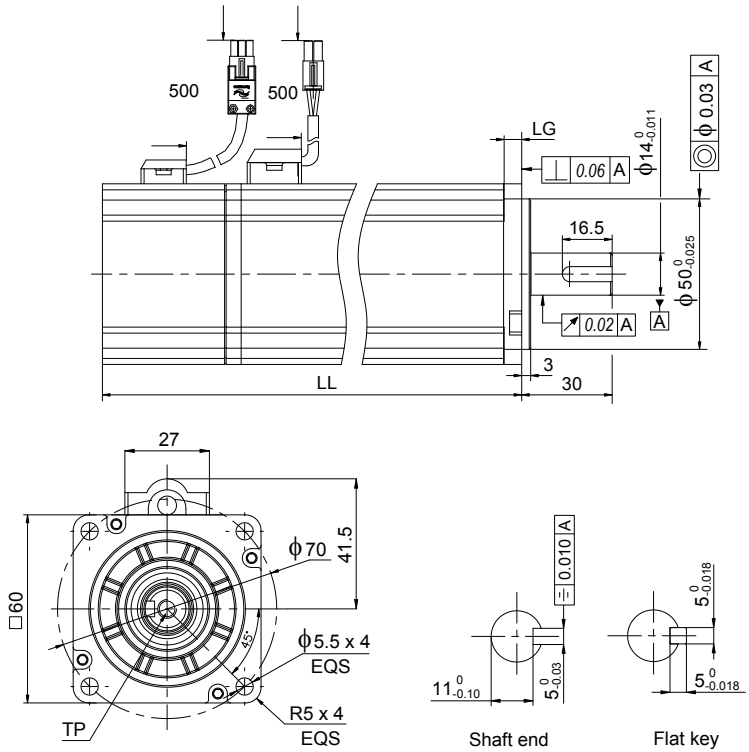
Connector	Power Side (Including Brake)	Encoder Side
Plastic housing	MOLEX-50361672	AMP 172169-9
Terminal	MOLEX-39000059	AMP 1473226-1

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	Weight (kg)
ISMH4-75B30CB-U***Z	146.5 (184.5)	7.8	M6 x 20	2.9 (3.3)

2.3.6 Overall Dimensions of the ISMH4 Series Z Servo Motor

(Vn = 3000rpm, Vmax = 6000 rpm)

1) 400 W



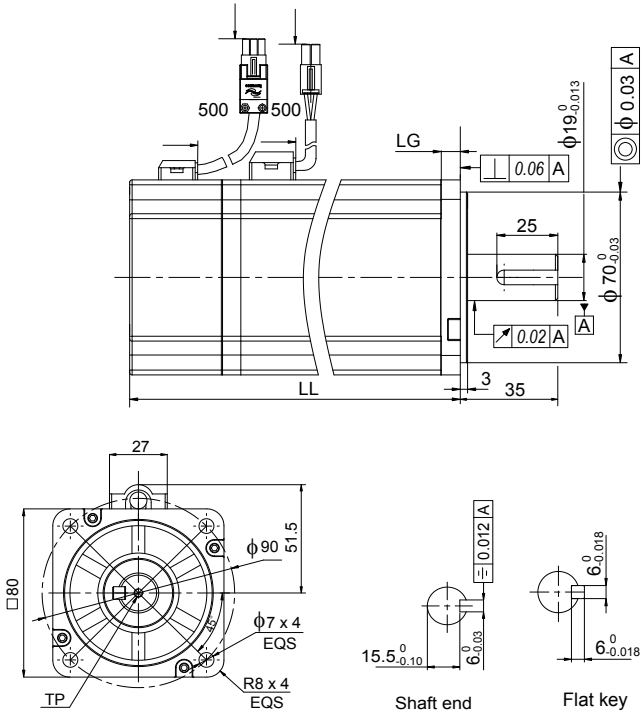
Connector	Power Side	Brake Side	Encoder Side
Plastic housing	EL-4Y (CWB in Zhejiang)	AMP 172165-1	AMP 172169-1
Terminal	422.6006.0 (CWB in Zhejiang)	AMP 770834-1	AMP 770834-1

Servo Motor Model	LL (mm)	LG (mm)	T (mm)	TP (mm)	Weight (kg)
ISMH4-40B30CB-U***X	147.5	5.8	5	M5 × 8	1.7

Note

This series servo motors are no longer manufactured.

2) 750 W



Connector	Power Side	Brake Side	Encoder Side
Plastic housing	EL-4Y (CWB in Zhejiang)	AMP 172165-1	AMP 172169-1
Terminal	422.6006.0 (CWB in Zhejiang)	AMP 770834-1	AMP 770834-1

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	Weight (kg)
ISMH4-75B30CB-U2**X	146.5 (193.5)	7.8	M6 x 10	2.9 (3.3)

Note

This series servo motors are no longer manufactured.

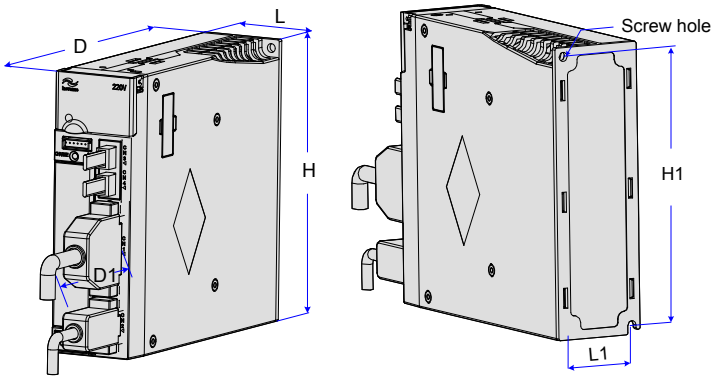
2.4 Overall Dimensions of the Servo Drive

SIZE A: IS620PS1R6I, IS620PS2R8I, IS620PS5R5I

SIZE C: IS620PS7R6I, IS620PS012I, IS620PT3R5I, IS620PT5R4I, IS620PT8R4I, IS620PT012I

SIZE E: IS620PT017I, IS620PT021I, IS620PT026I

Figure 2-2 Overall dimensions of the servo drive



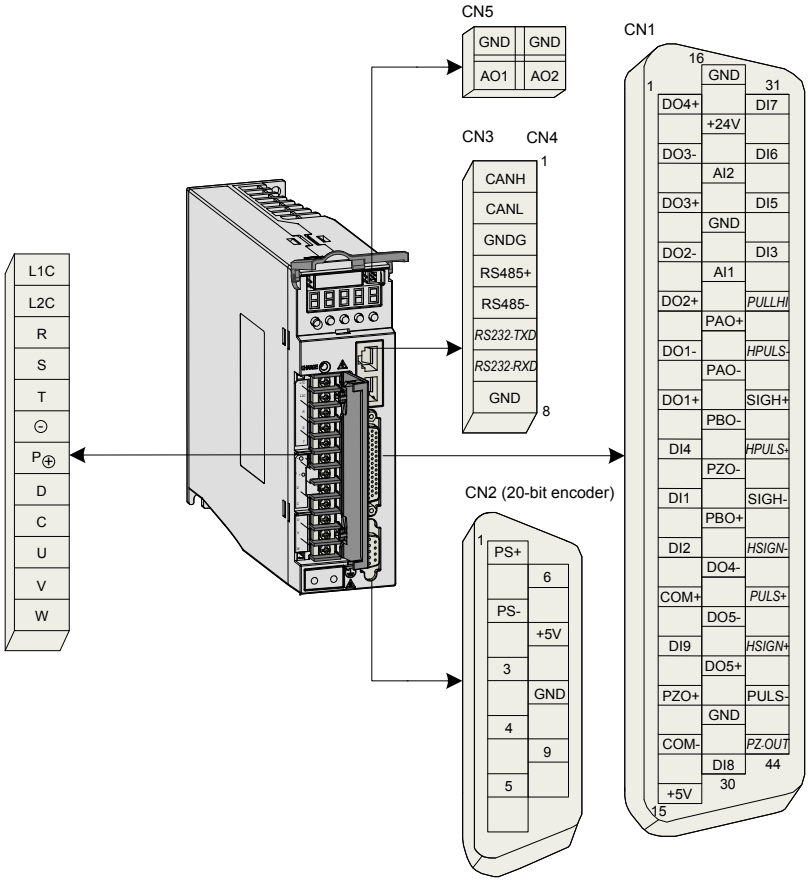
Servo Drive Size	L (mm)	H (mm)	D (mm)	L1 (mm)	H1 (mm)	D1 (mm)	Screw Hole	Tightening Torque (Nm)
SIZE A	50	160	173	40	150	75	2-M4	0.6–1.2
SIZE C	90	160	183	80	150	75	4-M4	0.6–1.2
SIZE E	100	250	230	90	240	75	4-M4	0.6–1.2

3

Wiring of Servo System

Chapter 3 Wiring of Servo System

Figure 3-1 Terminal pin arrangement of the servo drive



3.1 Servo Drive Main Circuit Wiring

3.1.1 Introduction to the Main Circuit

Figure 3-2 Servo drive main circuit wiring example

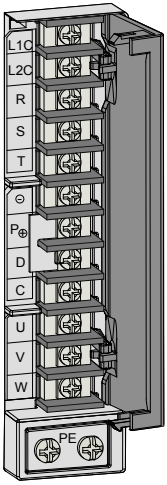
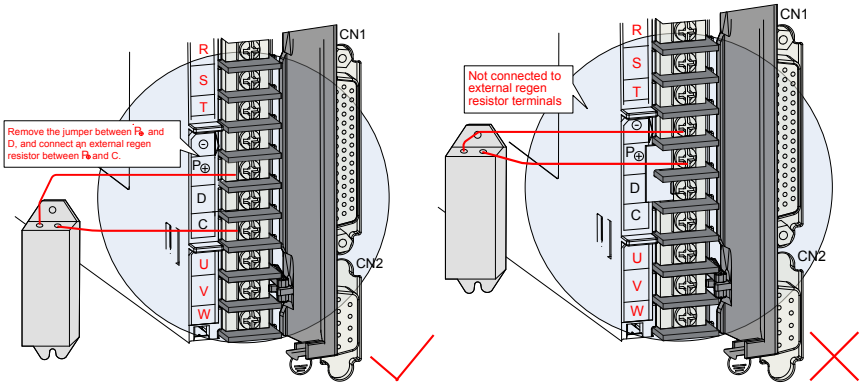


Table 3-1 Names and functions of main circuit terminals

Terminal Symbol	Terminal Name	Terminal Function	
L1, L2	Main circuit power input terminals	IS620P: S1R6, S2R8, S5R5	Main circuit single-phase 220 V power input. Only L1 and L2 terminals are used. Connect 220 VAC power supply between L1 and L2 terminals.
R, S, T		IS620P: S5R5, S7R6, S012	Main circuit three-phase 220 V power input.
		IS620P: T3R5, T5R4, T8R4, T012, T017, T021, T026	Main circuit three-phase 380 V power input.
L1C, L2C	Control power input terminals	Connect to control power input. For specific value, refer to the rated voltage on the nameplate.	
$P_{\oplus}$, D, C	External regen resistor terminals	IS620P: S1R6, S2R8	Connect an external regen resistor between $P_{\oplus}$ and C if the braking capacity is insufficient. You need to purchase the external regen resistor.
		IS620P: S5R5, S7R6, S012, T3R5, T5R4, T8R4, T012, T017, T021, T026	Short $P_{\oplus}$ and D by default. Remove the jumper between $P_{\oplus}$ and D, and connect an external regen resistor between $P_{\oplus}$ and C if the braking capacity is insufficient. You need to purchase the external regen resistor.

Terminal Symbol	Terminal Name	Terminal Function
$P_{\oplus}$ and $\ominus$	Common DC bus terminal	For common DC bus connection when multiple servo drives are used in parallel.
U, V, W	Servo motor connection terminals	Connect to U, V and W phases of the servo motor.
PE	Grounding terminal	Two grounding terminals are respectively connected to the power supply grounding terminal and the servo motor grounding terminal. The entire system must be grounded.

The following figures show the correct and wrong wiring of the external regen resistor.

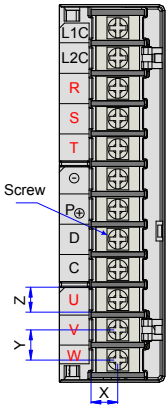


Observe the following precautions when wiring the external regen resistor:

1. Do not directly connect the external regen resistor to the positive and negative poles of $P_{\oplus}$. Failure to comply will lead to damage of the servo drive or even cause a fire.
2. Remove the jumper between $P_{\oplus}$ and D before using the external regen resistor. Failure to comply will cause overcurrent trip and thus damage the braking tube.
3. For selection of external regen resistors, refer to section 1.4. Do not select any resistor lower than the minimum resistance value. Otherwise, the servo drive will report Er201 or be damaged.
4. Make sure that H02-25, H02-26 and H02-27 are accurately set before using the servo drive.
5. Install the external regen resistor on incombustible matters (such as metal).

3.1.2 Recommended Models and Specifications of Main Circuit Cables

Figure 3-3 Dimension drawing of the servo drive terminal block



Servo Drive Size	Main Circuit Terminal					PE Grounding Terminal	
	X (mm)	Y (mm)	Z (mm)	Screw	Tightening Torque (N·m)	Screw Size	Tightening Torque (N·m)
SIZE A	6.8	7.6	6.3	M3 combination screw	0.4–0.6	M4	0.6–1.2
SIZE C	8	8.2	7	M3 combination screw	0.4–0.6		
SIZE E	9	13	10	M4 combination screw	0.7–1.0		

Table 3-2 Rated input and output currents of IS620P series servo drive

Servo Drive Model (IS620P□□□□I)		Rated Input Current (A)	Rated Output Current (A)	Max. Output Current (A)
SIZE A	S1R6	2.3	1.6	5.8
	S2R8	4.0	2.8	10.1
	S5R5	7.9 (single-phase)/3.7 (three-phase)	5.5	16.9
SIZE C	S7R6	5.1	7.6	17
	S012	8.0	11.6	28
	T3R5	2.4	3.5	8.5
	T5R4	3.6	5.4	14
	T8R4	5.6	8.4	20
	T012	8.0	11.9	23.8
SIZE E	T017	12.0	16.5	42
	T021	16.0	20.8	55
	T026	21.0	25.7	65

Table 3-3 Recommended main circuit cable sizes of IS620P series servo drive

Servo Drive Model (IS620P□□□□I)		L1C, L2C	R, S, T	$P_{\oplus}$, C	U, V, W	PE
SIZE A	S1R6	18 AWG (0.82 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.09 mm^2)
	S2R8	18 AWG (0.82 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.09 mm^2)
	S5R5	18 AWG (0.82 mm2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.09 mm^2)
SIZE C	S7R6	18 AWG (0.82 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.09 mm^2)
	S012	18 AWG (0.82 mm^2)	14 AWG (2.09 mm^2)	14 AWG (2.09 mm^2)	14 AWG (2.09 mm^2)	14 AWG (2.09 mm^2)
	T3R5	18 AWG (0.82 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.09 mm^2)
	T5R4	18AWG (0.82 mm^2)	16 AWG (1.31 mm^2)	16AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.09 mm^2)
	T8R4	18 AWG (0.82 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.09 mm2)
	T012	18 AWG (0.82 mm^2)	14 AWG (2.09 mm^2)	14 AWG (2.09 mm^2)	14 AWG (2.09 mm^2)	14 AWG (2.09 mm^2)
SIZE E	T017	18 AWG (0.82 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)
	T021	18 AWG (0.82 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)
	T026	18 AWG (0.82 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)

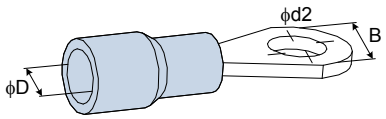
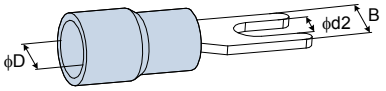
Table 3-4 Recommended main circuit lugs of IS620P series servo drive

Servo Drive Model (IS620P□□□□I)		L1C, L2C	R, S, T	$P_{\oplus}$, C	U, V, W	PE
SIZE A	S1R6	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 2-4
	S2R8	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 2-4
	S5R5	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 2-4

Servo Drive Model (IS620P□□□□I)		L1C, L2C	R, S, T	P⊕ , C	U, V, W	PE
SIZE C	S7R6	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 2-4
	S012	TVR 1.25-3 TVS 1.25-3	TVR 2-3M TVS 2-3W	TVR 2-3M TVS 2-3W	TVR 2-3M TVS 2-3W	TVR 2-4
	T3R5	TVR 1.25-3 TVS 1.25-3	TVR 2-3M TVS 2-3W	TVR 2-3M TVS 2-3W	TVR 2-3M TVS 2-3W	TVR 2-4
	T5R4	TVR 1.25-3 TVS 1.25-3	TVR 2-3M TVS 2-3W	TVR 2-3M TVS 2-3W	TVR 2-3M TVS 2-3W	TVR 2-4
	T8R4	TVR 1.25-3 TVS 1.25-3	TVR 2-3M TVS 2-3W	TVR 2-3M TVS 2-3W	TVR 2-3M TVS 2-3W	TVR 2-4
	T012	TVR 1.25-3 TVS 1.25-3	TVR 2-3M TVS 2-3W	TVR 2-3M TVS 2-3W	TVR 2-3M TVS 2-3W	TVR 2-4
SIZE E	T017	TVR 1.25-4 TVS 1.25-4W	TVR 5.5-4 TVS 5.5-4	TVR 5.5-4 TVS 5.5-4	TVR 5.5-4 TVS 5.5-4	TVR 5.5-4
	T021	TVR 1.25-4 TVS 1.25-4W	TVR 5.5-4 TVS 5.5-4	TVR 5.5-4 TVS 5.5-4	TVR 5.5-4 TVS 5.5-4	TVR 5.5-4
	T026	TVR 1.25-4 TVS 1.25-4W	TVR 5.5-4 TVS 5.5-4	TVR 5.5-4 TVS 5.5-4	TVR 5.5-4 TVS 5.5-4	TVR 5.5-4

The recommended lugs are manufactured by Suzhou Yuanli Metal Enterprise Co., Ltd.

Table 3-5 Sizes and appearance of lugs

Lug Model		D (mm)	d2 (mm)	B (mm)	Appearance
TVR series	1.25-3	4.0	3.7	5.5	
	1.25-4	4.0	4.3	8.0	
	2-3M	4.5	3.7	6.6	
	2-4	4.5	4.3	8.5	
	5.5-3	6.3	3.7	9.5	
	5.5-4	6.3	4.3	9.5	
TVS series	1.25-3	4.0	3.2	5.7	
	1.25-4W	4.0	4.3	7.2	
	2-3W	4.5	3.7	6.2	
	5.5-3	6.3	3.2	7.3	
	5.5-4	6.3	4.3	8.2	

3.1.3 Power Supply Wiring Example

Figure 3-4 Main circuit wiring of single-phase 220 V servo drive

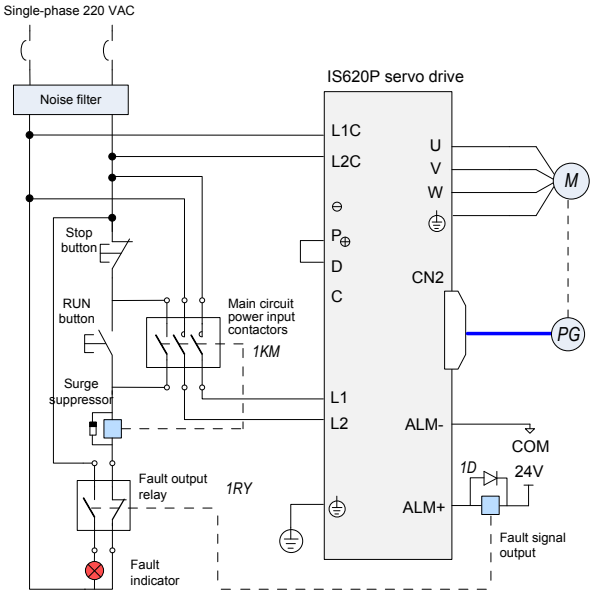
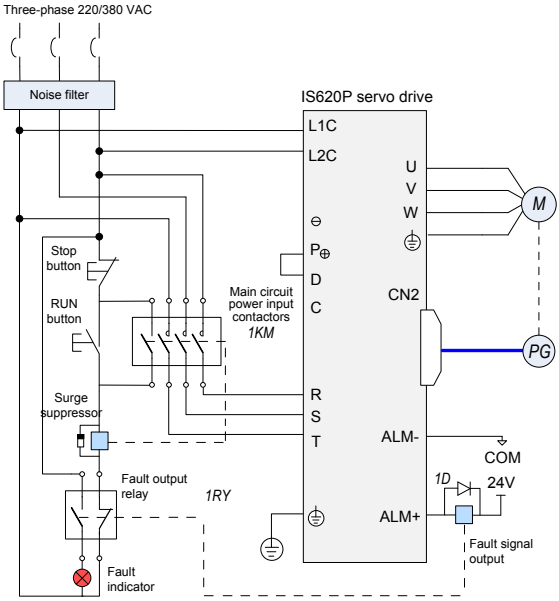


Figure 3-5 Main circuit wiring of three-phase 220/380 V servo drive



Note

1KM: electromagnetic contactor; 1RY: relay; 1D: bypass diode

Connect the main circuit power supply according to the preceding two figures.

DOs (ALM+/-) are set as fault output. Power supply is automatically cut off when the servo drive reports an error. Meanwhile, the fault indicator goes ON.

Observe the following precautions when wiring the main circuit:

1. Do not connect the input power cables to the output terminals U, V and W. Failure to comply will cause damage to the servo drive.
2. When cables are bundled together in a duct, take current reduction into consideration since the cooling condition becomes poor.
3. Common cables become quickly aged in high temperature environment and easily sclerotic and broken in low temperature environment. Thus, use high-temperature cables in high temperature environment and take thermal measures in low temperature environment.
4. The bending radius of a cable shall exceed 10 times that of its outer diameter to prevent the internal wire core from breaking due to long time bending.
5. Select and use cables with withstand voltage of 600 VAC (and above) and temperature of 75°C (and above). Under the ambient temperature of 30°C and with normal cooling conditions, the allowable current density of the cables shall not exceed 8 A/mm^2 when the total current is below 50 A, or 5 A/mm^2 when the total current is above 50 A. This value shall be adjusted when the ambient temperature is high or when the cables are bundled. The allowable current density (A/mm^2) can be calculated as below:

   Allowable current density = 8 x Current reduction coefficient of conductor x Current augmenting coefficient

   $$\text{Current augmenting coefficient} = \sqrt{(\text{Max. allowable temperature of cable} - \text{Ambient temperature}) / 30}$$

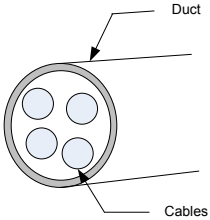


Table 3-6 Current reduction coefficient of conductor

No. of Cables in the Same Duct	Current Reduction Coefficient
≤ 3	0.7
4	0.63
5 to 6	0.56
7 to 15	0.49

6. The regen resistor cannot be connected between terminals $P_{\oplus}$ and $\ominus$. Failure to comply may cause a fire.
7. Do not bundle power cables and signal cables together or run them through the same duct. Power and signal cables shall be separated by at least 30 cm to prevent interference.
8. Hazardous voltage may still remain in the servo drive when the power supply is cut off. Do not touch the power terminals within 5 minutes after power-off.

9. Conduct maintenance after confirming that the CHARGE indicator is OFF.
10. Do not frequently turn ON and OFF the power supply. Do not turn power ON or OFF more than once per minute. Since the servo drive contains a capacitor in the power supply, and high charging current flows for 0.2 seconds when the power supply is turned OFF. Frequently turning ON and OFF the power supply will deteriorate performance of the main circuit components inside the servo drive.
11. Use a grounding wire with the same cross-sectional area of the main circuit wire. If the cross-sectional area of the main circuit wire is less than 1.6 mm^2, use a grounding wire with a cross-sectional area of 2.0 mm^2.
12. The servo drive must be reliably grounded.
13. Do not power on the servo drive when any screw of the terminal block becomes loose or any cable is loose. Otherwise, a fire may occur.

3.1.4 Connecting Servo Drive Output and Servo Motor

Figure 3-6 Example of connecting servo drive output and servo motor

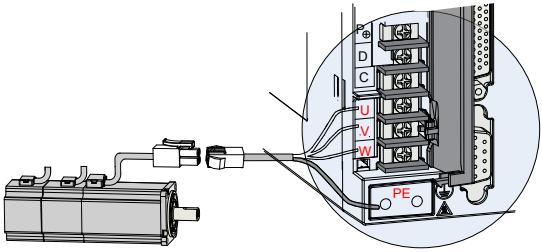
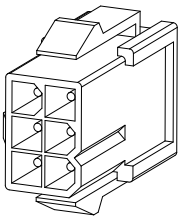
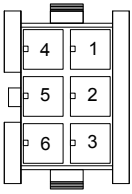
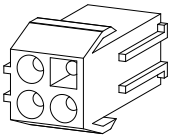
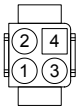
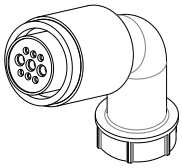
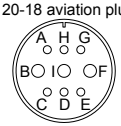
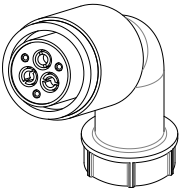


Table 3-7 Connectors of power cables on servo motor side

Connector Appearance	Terminal Pin Layout	Frame Size of Adaptable Motor
	6-pin black connector  Pin No. / Signal: 1 – U 2 – V 4 – W 5 – PE 3, 6 – Brake (regardless of positive or negative) Recommendation: Plastic housing: MOLEX-50361736 Terminal: MOLEX-39000061	40 (Z series) 60 (Z series) 80 (Z series)

<table>
<tr><th>Connector Appearance</th><th>Terminal Pin Layout</th><th>Frame Size of Adaptable Motor</th></tr>
<tr><td>  </td><td>4-pin connector
 
<table><tr><th>Pin No.</th><th>Signal</th></tr><tr><td>1</td><td>U</td></tr><tr><td>2</td><td>V</td></tr><tr><td>3</td><td>W</td></tr><tr><td>4</td><td>PE</td></tr></table>Recommendation:
Plastic housing: EL-4A (CWB);
Terminal: 421.6003.0 (CWB)</td><td>40 (X series)
60 (X series)
80 (X series)</td></tr>
<tr><td>  </td><td>MIL-DTL-5015 series
3108E20-18S aviation plug
20-18 aviation plug
 
<table><tr><th colspan="2">New Structure</th><th colspan="2">Old Structure</th></tr><tr><th>Pin No.</th><th>Signal</th><th>Pin No.</th><th>Signal</th></tr><tr><td>B</td><td>U</td><td>B</td><td>U</td></tr><tr><td>I</td><td>V</td><td>I</td><td>V</td></tr><tr><td>F</td><td>W</td><td>F</td><td>W</td></tr><tr><td>G</td><td>PE</td><td>G</td><td>PE</td></tr><tr><td>C</td><td rowspan="2">Brake (regardless of positive or negative)</td><td></td><td></td></tr><tr><td>E</td><td></td><td></td></tr></table></td><td>100
130</td></tr>
<tr><td>  </td><td>MIL-DTL-5015 series
3108E20-22S aviation plug
20-22 aviation plug
 
<table><tr><th colspan="2">Y Series</th><th colspan="2">Z Series</th></tr><tr><th>Pin No.</th><th>Signal</th><th>Pin No.</th><th>Signal</th></tr><tr><td>A</td><td>U</td><td>A</td><td>U</td></tr><tr><td>C</td><td>V</td><td>C</td><td>V</td></tr><tr><td>E</td><td>W</td><td>E</td><td>W</td></tr><tr><td>F</td><td>PE</td><td>F</td><td>PE</td></tr><tr><td rowspan="2"></td><td rowspan="2"></td><td>B</td><td rowspan="2">Brake (regardless of positive or negative)</td></tr><tr><td>D</td></tr></table></td><td>180</td></tr>
</table>

Note

Frame size of motor: indicates the width of motor flange.

3.2 Connecting Servo Motor Encoder Signals

Figure 3-7 Example of connecting encoder signals

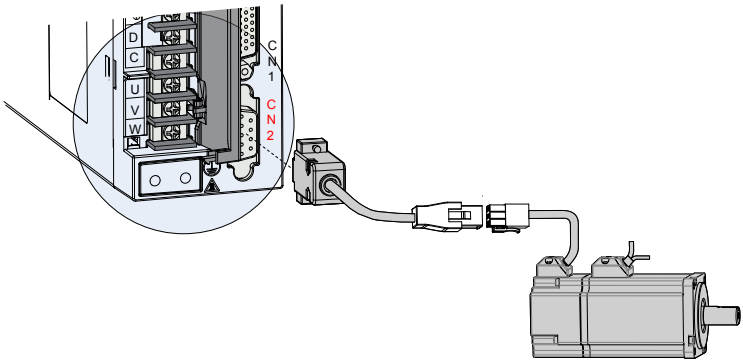


Table 3-8 Connectors of encoder cables on servo drive side

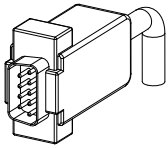
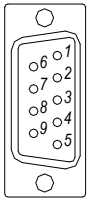
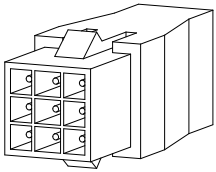
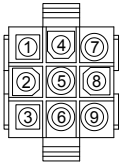
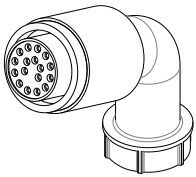
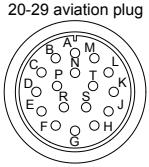
Connector Appearance	Terminal Pin Layout
	 Pin No. / Signal 1 PS+ 2 PS- 7 +5V 8 GND Housing PE Recommendation: Plastic housing of plug on cable side: DB9P (TELE-DATA COM), black housing Core: DB9P plug (TELE-DATA COM), blue glue

Table 3-9 Connectors of encoder cables at servo motor side

Connector Appearance	Terminal Pin Layout	Frame Size of Adaptable Motor
	9-pin plug  Pin No. / Signal / (Twisted-pair) 3 PS+ (Twisted-pair) 6 PS- (Twisted-pair) 9 +5V 8 GND 7 Shielded Recommendation: Plastic housing: AMP 172161-1: Terminal: AMP 770835-1	40 60 80

<table>
<tr><th>Connector Appearance</th><th>Terminal Pin Layout</th><th>Frame Size of Adaptable Motor</th></tr>
<tr>
<td>  </td>
<td>MIL-DTL-5015 series
3108E20-29S aviation plug
20-29 aviation plug
 

<table>
<tr><th>Pin No.</th><th>Signal</th><th></th></tr>
<tr><td>A</td><td>PS+</td><td rowspan="2">Twisted-pair</td></tr>
<tr><td>B</td><td>PS-</td></tr>
<tr><td>G</td><td>+5V</td><td rowspan="3"></td></tr>
<tr><td>H</td><td>GND</td></tr>
<tr><td>J</td><td>Shielded</td></tr>
</table>
</td>
<td>100
130
180</td>
</tr>
</table>

Table 3-10 Pin connection relation of encoder cables

DB9 at Servo Drive Side		Function Description	Motor Side	
			9-pin	20-29 Aviation Plug
Signal	Pin No.		Pin No.	Pin No.
PS+	1	Serial communication signal +	3	A
PS-	2	Serial communication signal -	6	B
+5V	7	Encoder +5V power supply	9	G
GND	8	Encoder +5V power ground	8	H
PE	Housing	Shield	7	J

Observe the following precautions when wiring the encoder:

1. Servo drive and shield at servo motor side must be properly grounded. Otherwise, the servo drive will report false error.
2. It is recommended that twisted-pair cables of size from AWG26 to AWG16 be used. The cables shall not exceed 20 m.
3. Do not connect wires to the reserved pins.
4. To determine the length of the encoder cable, consider voltage drop caused by the cable resistance and signal attenuation caused by the distributed capacitance. It is recommended to use twisted-pair cable of size AWG26 or above (as per UL2464 standard) and with a length within 10 m. The following table lists the recommended cable sizes.

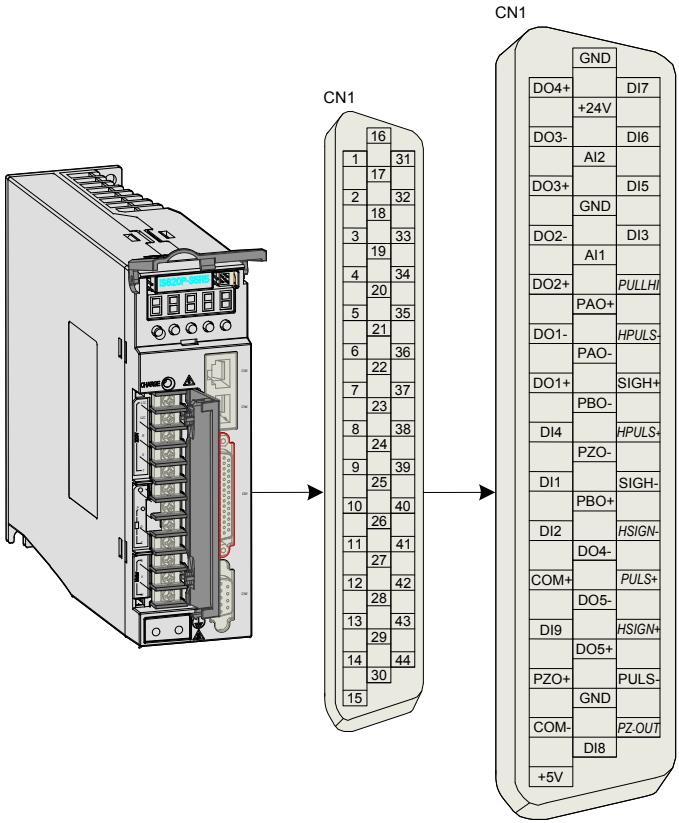
Table 3-11 Recommended cable sizes

Cable Size	Ω/km	Allowed Cable Length
26 AWG (0.13 mm^2)	143	10.0
25 AWG (0.15 mm^2)	89.4	16.0
24 AWG (0.21 mm^2)	79.6	18.0
23 AWG (0.26 mm^2)	68.5	20.9
22 AWG (0.32 mm^2)	54.3	26.4
21 AWG (0.41 mm^2)	42.7	33.5
20 AWG (0.52 mm^2)	33.9	42.2
19 AWG (0.65 mm^2)	26.9	53.2
18 AWG (0.82 mm^2)	21.4	66.9

5. The shield of the encoder cable must be properly grounded. Differential signals shall be connected to the two wires of the twisted-pair cable.
6. To determine the length of the signal cable, consider voltage drop caused by the cable resistance. Pay attention to the capacity of the power supply and make sure that the signal and power are strong enough when arriving at the input side of the servo drive. It is recommended to use twisted-pair cable of size AWG26 and above.
7. The encoder cable and signal cable must be separated with a distance of at least 30 cm.
8. If the encoder cable is not long enough and an extension cable is to be added, make sure the shields of two separate cables are well connected to ensure reliable grounding.

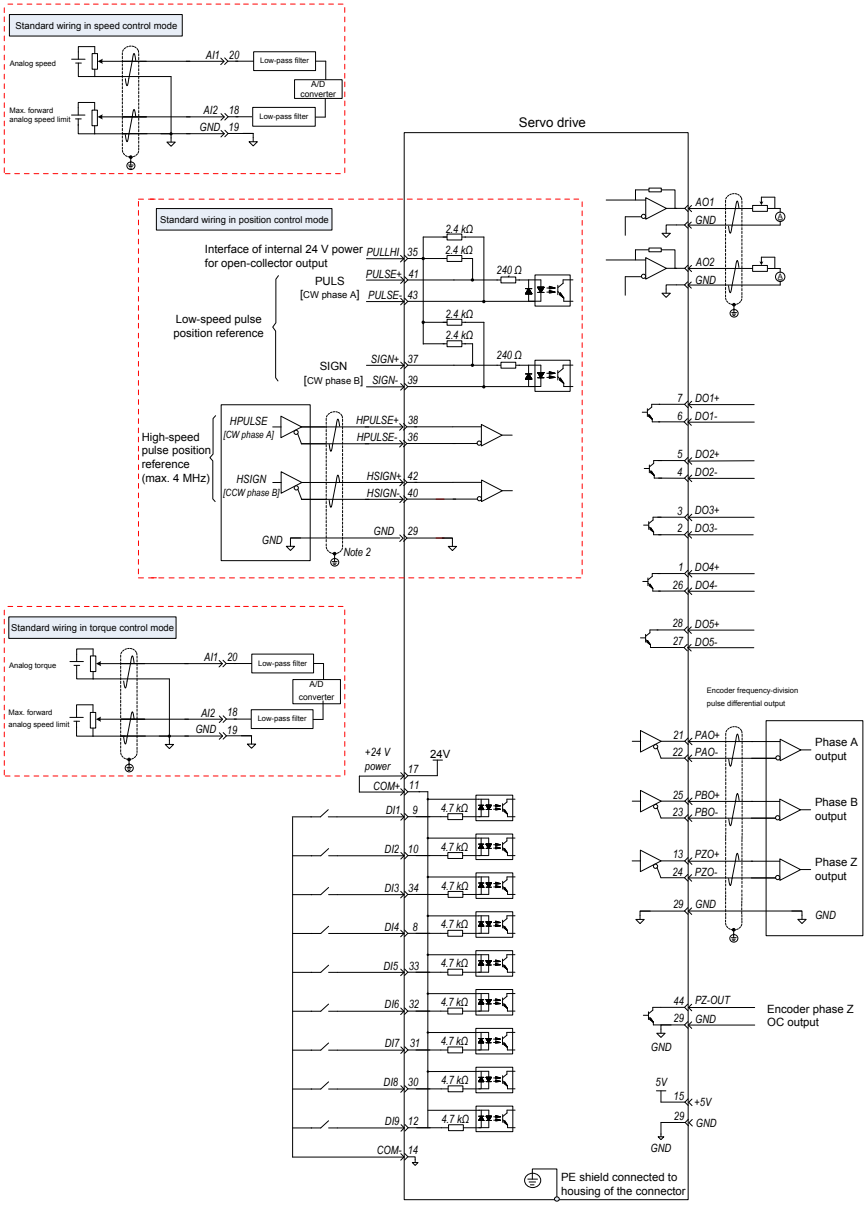
3.3 Connecting Control Signal Terminals

Figure 3-8 Pin layout of control circuit terminal connectors of servo drive



CN1 terminal: Plastic housing the connector plug: DB25P (TELE-DATA COM), black housing; Core: HDB44P (TELE-DATA COM)

Figure 3-9 Wiring examples in speed/position/torque control mode



3.3.1 DI/DO Signals

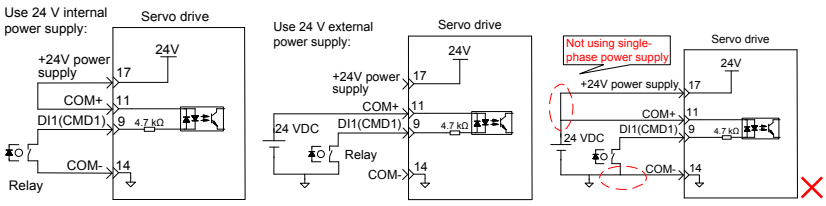
Table 3-12 DI/DO signal description

Signal		Default Function	Pin No.	Function Description
Common	DI1	P-OT	9	Forward drive forbidden
	DI2	N-OT	10	Reverse drive forbidden
	DI3	INHIBIT	34	Pulse input forbidden
	DI4	ALM-RST	8	Alarm reset (edge valid)
	DI5	S-ON	33	Servo enabled
	DI6	ZCLAMP	32	Zero clamp function
	DI7	GAIN-SEL	31	Gain switchover
	DI8	Home Switch	30	Home switch
	DI9	Reserved	12	-
	+24V		17	Internal 24 V power supply, voltage range: 20 to 28 V maximum output current: 200 mA
	COM-		14	
	COM+		11	Power supply input (12 to 24 V)
	DO1+	S-RDY+	7	ON when the servo drive is ready and the S-ON signal can be received.
	DO1-	S-RDY-	6	
	DO2+	COIN+	5	Position reached
	DO2-	COIN-	4	
	DO3+	ZERO+	3	Zero speed
	DO3-	ZERO-	2	
	DO4+	ALM+	1	ON when a fault occurs.
	DO4-	ALM-	26	
	DO5+	Home Attain+	28	ON at home return is completed.
	DO5-	Home Attain-	27	

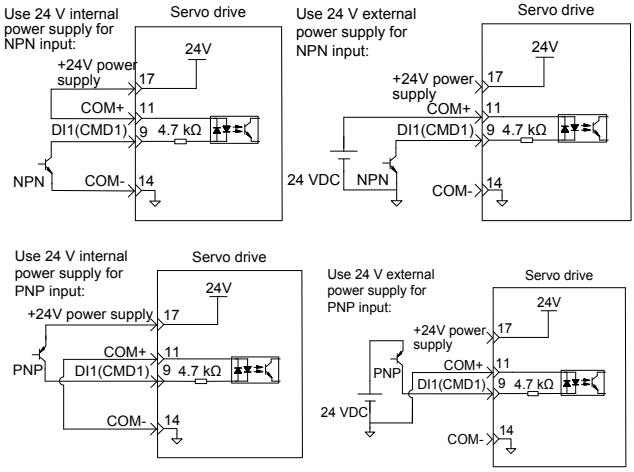
1) DI circuit

DI1 to DI9 circuits are the same. The following takes DI1 circuit as an example.

a) When output signal of the upper device is relay output:



b) When output signal of the upper device is OC output:



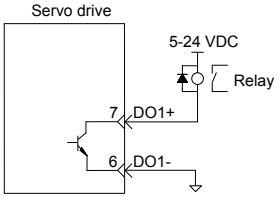
Note

PNP and NPN input cannot be applied in the same circuit.

2) DO circuit

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

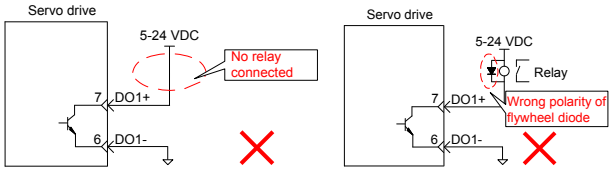
a) When input signal of the upper device is relay input:



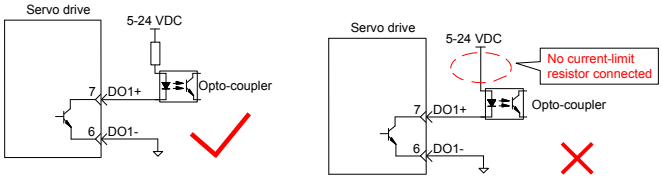
Note

When the upper-level input is relay input, a flywheel diode must be installed; otherwise, the DO terminals may be damaged.

The following figures are examples of wrong connection.



b) When input signal of the upper device is optocoupler input:



The maximum allowable voltage and current of the optocoupler output circuit inside the servo drive are as below:

Maximum voltage: 30 VDC

Maximum current: DC 50 mA

3.3.2 AI Signals

Table 3-13 AI signal description

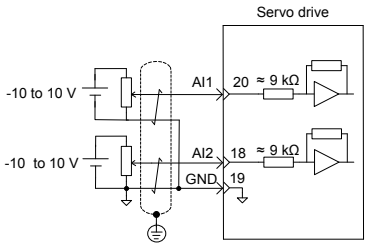
Signal	Default Function	Pin No.	Function Description
Analog	AI2	18	Common analog input signals: Resolution: 12 bit Input voltage: maximum ±12V
	AI1	20	
	GND	19	Analog input signal ground

Speed and torque analog signal input terminals are AI1 and AI2, resolution of which is 12 bit. Corresponding voltage values are set via parameters of H03 group.

Input voltage range: -10 to +10 V; resolution: 12 bit;

Maximum allowable voltage: ±12 V;

Input impedance: ≈ 9 kΩ



3.3.3 Position Reference Input Signals

Table 3-14 Position reference signal description

Signal		Pin No.	Function Description	
Position reference	PULSE+ PULSE- SIGN+ SIGN-	41 43 37 39	Common reference pulse input mode: • Differential drive mode • OC mode	Pulse input status: Direction + pulse Phase A + B quadrature pulse CW/CCW pulse
	HPULSE+ HPULSE-	38 36	High-speed reference pulse input	
	HSIGN+ HSIGN-	42 40	High-speed position reference symbols	
	PULLHI	35	External power input terminal of reference pulse	
	GND	29	Ground	

An output circuit for the reference pulse or symbol signal at the host controller can either be differential drive output or OC output. The following table lists the maximum input frequency and minimum pulse width of these output modes.

Table 3-15 Correspondence between maximum input frequency and minimum pulse width

Pulse Mode		Max. Frequency (pps)	Min. Pulse Width (us)
Common	Differential	500 k	1
	OC	200 k	2.5
High-speed differential		4 M	0.125

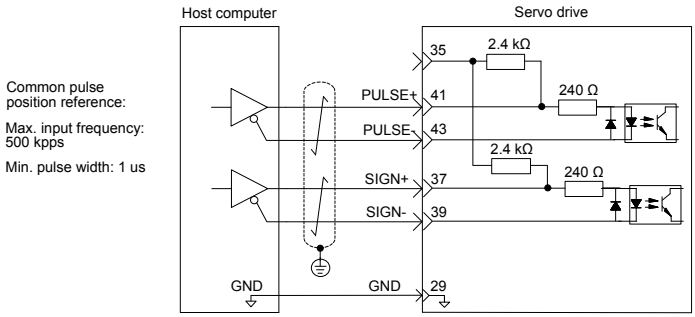
Note

If the output pulse width of the host controller is smaller than the minimum value, the servo drive will receive wrong pulses.

■ **Common Reference Pulse Input**

The following figures show the two modes of common reference pulse input.

a) Differential drive mode

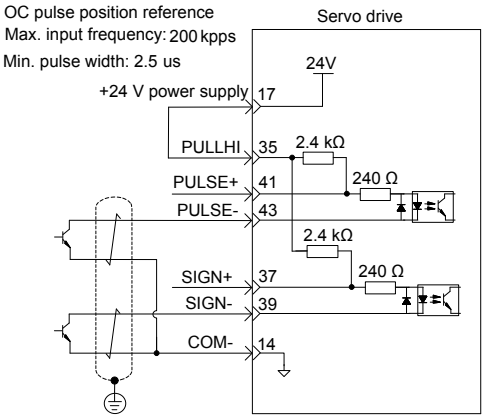


Make sure "2.8 V ≤ (H level) - (L level) ≤ 3.7 V". Otherwise, input pulses of the servo drive are unstable, which will cause:

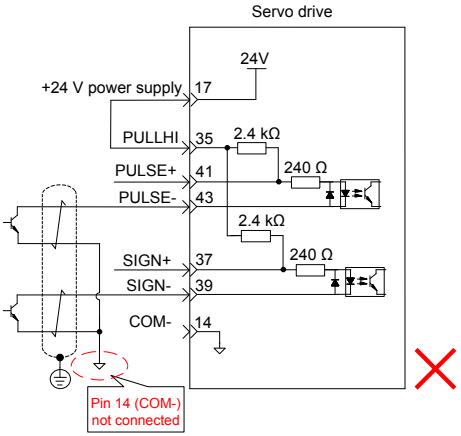
- When the reference pulse is input, pulse loss occurs.
- When the reference direction is input, the direction will reverse.

b) OC mode

When the internal 24 V power supply of the servo drive is used:

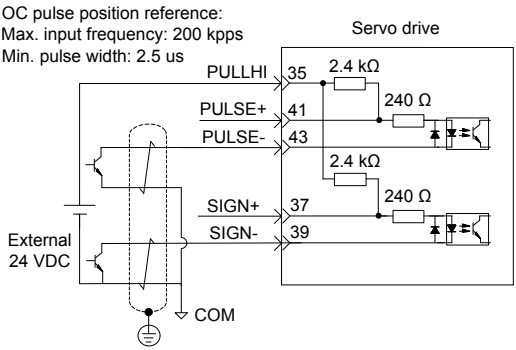


Wrong connection: Pin 14 (COM-) is not connected, which cannot form a closed-loop circuit.

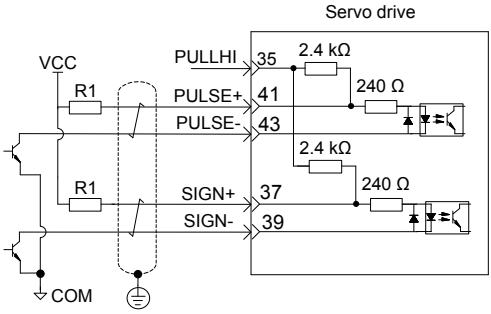


The following two figures show the wiring method when the external 24 V power supply is used.

1) Using internal resistor of the servo drive (recommended)



2) Using external current-limit resistor



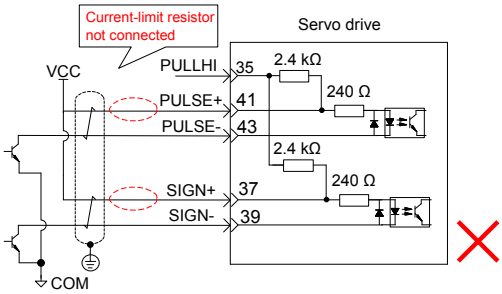
Value of resistor R1 shall satisfy the following formula: $\frac{V_{CC}-1.5}{R1+200} = 10mA$

Table 3-16 Recommended R1 resistance

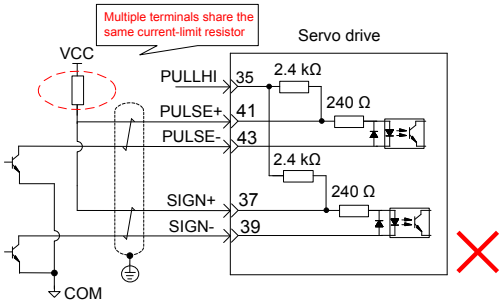
V_{CC} Voltage	R1	Power of R1
24 V	2.4 kΩ	0.5 W
12 V	1.5 kΩ	0.5 W

The following figures show the wrong wiring examples:

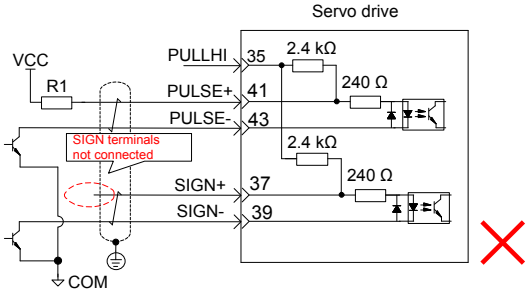
Wrong connection 1: The current-limiting resistor is not connected, resulting in burnout of terminals.



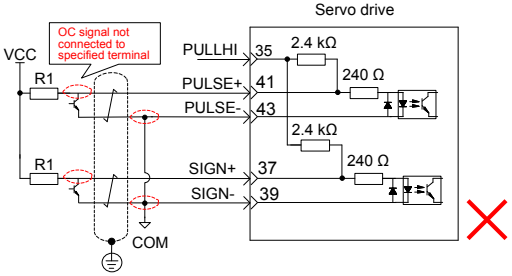
Wrong connection 2: Multiple terminals share the same current-limiting resistor, resulting in the pulses receiving error.



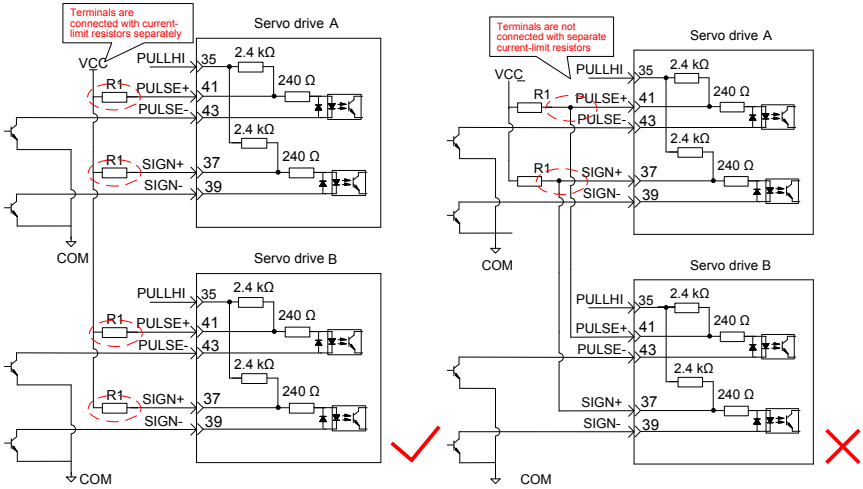
Wrong connection 3: SIGN terminals are not connected, resulting in that these two terminals receive no pulses.



Wrong connection 4: Terminals are not correctly connected, resulting in burnout of terminals.

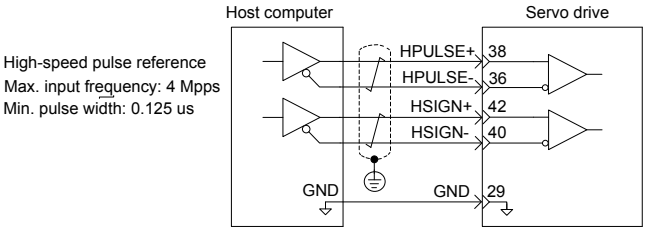


Wrong connection 5: Multiple terminals share the same current-limit resistor, resulting in that pulses are inaccurately received.



■ High-Speed Reference Pulse Input

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



Make sure the differential input is 5 V. Otherwise, input pulses of the servo drive are unstable, which will cause:

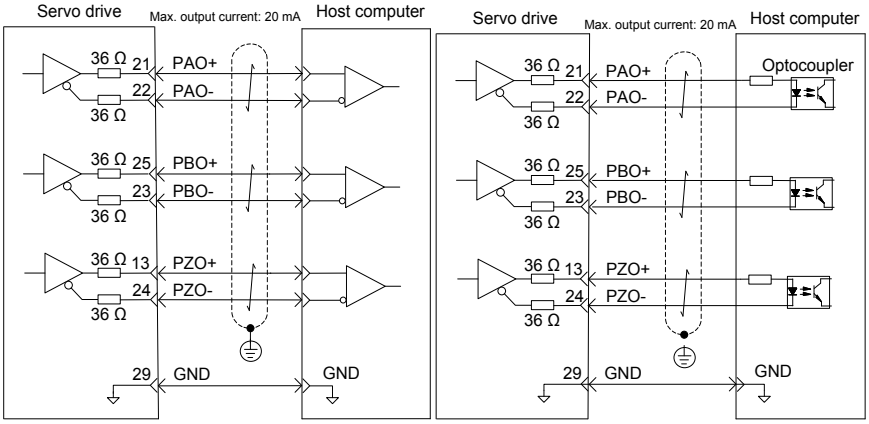
- When the reference pulse is input, pulse loss occurs.
- When reference direction is input, the direction will reverse.

The 5V ground of the host controller must be connected to GND terminal of the servo drive to reduce noise interference.

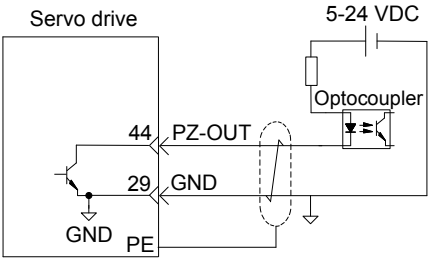
3.3.4 Encoder Frequency Dividing Output Circuit

Signal	Default Function	Pin No.	Function Description	
Common	PAO+ PAO-	21 22	Phase A output signal	Phases A+B quadrature pulse output signal
	PBO+ PBO-	25 23	Phase B output signal	
	PZO+ PZO-	13 24	Phase Z output signal	Origin pulse output signal
	PZ-OUT	44	Phase Z output signal	Origin pulse OC output signal
	GND	29	Origin pulse OC output signal ground	
Common	+5V	15	5 V internal power supply: Maximum output current: 200 mA	
	GND	16		
	PE	Housing		

Encoder frequency dividing output circuit outputs differential signals via differential drive. Normally, the encoder output circuit provides feedback signals to the host controller. The circuit and the host controller together form a closed-loop position control system. A differential or optocoupler circuit shall be used in the host controller to receive feedback signals. The maximum output current is 20 mA.



Encoder phase Z output circuit outputs OC signals. Normally, the encoder phase Z output circuit provides feedback signals to the host controller. The circuit and the host controller together form a closed-loop position control system. An optocoupler circuit, relay circuit, or bus receiver circuit shall be used in the host controller to receive feedback signals.



To reduce noise interference, connect the 5V ground of the host controller to the GND terminal of the servo drive, and use the shielded twisted-pair.

The maximum allowable voltage and current of the optocoupler output circuit inside the servo drive are as below:

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

3.3.5 Wiring of Holding Brake

The holding brake is used when the servo motor controls a vertical shaft. The servo motor with brake prevents the movable part from shifting due to gravity when the power supply fails.

Note

- The holding brake built in the servo motor is only used for keeping the stopped state. Do not use it to stop running of the servo motor.
- Brake coils are of no polarity.
- When the servo motor with brake runs, the brake may generate click sound, which does not affect its functions.
- When brake coils are energized (the brake is ON), magnetic flux leakage may occur at the shaft end. Thus, pay special attention when using magnetic sensors around the servo motor.

The following table describes the models of holding brake connectors.

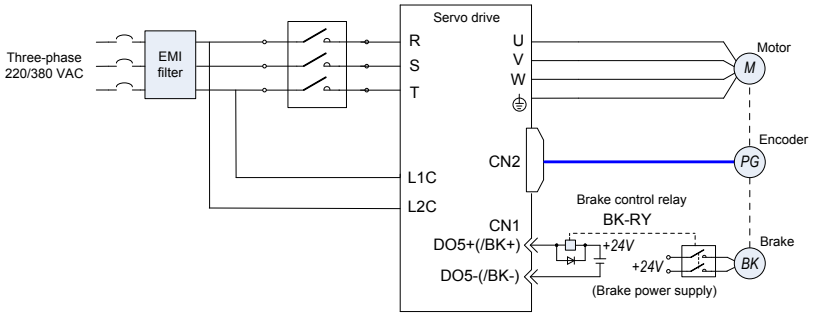
Table 3-17 Models of holding brake connectors for frame 40/60/80 servo motor

2-pin plug, regardless of positive or negative polarity
Plastic housing: AMP 172157-1 Terminal: AMP 770835-1

1) Wiring example of holding brake

The connector of the holding brake is of no polarity. You needs to prepare a 24 V external power supply. The following figure shows the standard wiring of brake signal (/BK) and power supply of the brake.

Figure 3-10 Wiring of the holding brake



2) Wiring precautions

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

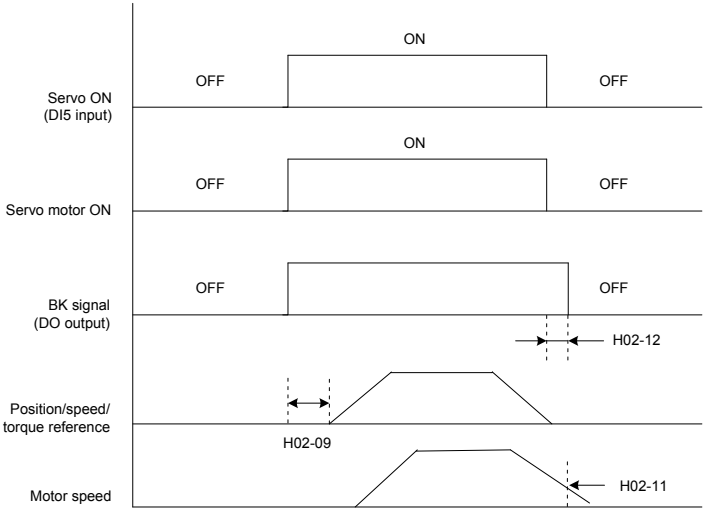
Table 3-18 Brake specifications

Servo Motor Model	Holding Torque (N·m)	Supplied Voltage (V)±10%	Resistance (Ω) ±7%	Supplied Current Range (A)	Release Time (ms)	Applying Time (ms)
ISMH1-10B	0.32	24	96	0.23–0.27	10	30
ISMH1-20B/40B	1.3	24	82.3	0.25–0.34	20	50
ISMH1-75B	2.39	24	50.1	0.40–0.57	25	60
ISMH2-10C/15C/20C/25C	8	24	25	0.81–1.14	30	90
ISMH2-30C/40C/50C	16	24	21.3	0.95–1.33	60	120
ISMH3-85B/13C/18C	16	24	21.3	0.95–1.33	60	120
ISMH3-29C/ 44C/55C/75C	48	24	13.7	1.47–2.07	100	230
ISMH4-40B	1.3	24	82.3	0.25–0.34	20	50
ISMH4-75B	2.39	24	50.1	0.40–0.57	25	60

b. The brake shall not share the same power supply with other devices. Otherwise, the brake may conduct false operation due to voltage or current drop resulted from working of other devices.

c. Cables of 0.5 mm^2 and above are recommended.

3) Servo motor running when servo drive is OFF

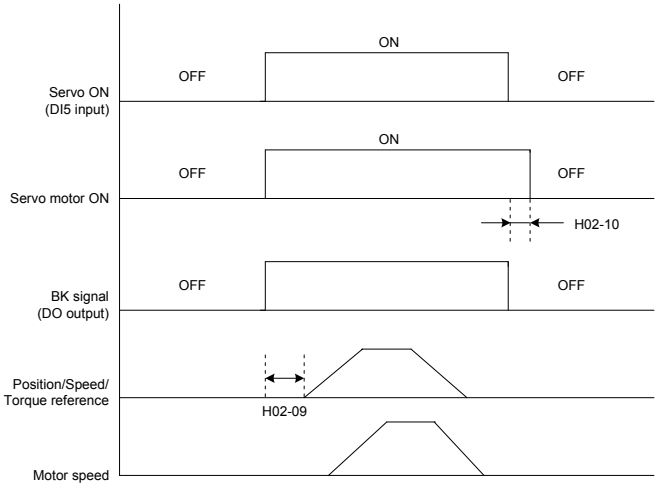


The description of the brake output time sequence is as follows:

When the servo is ON, wait for the operation delay time of the brake (as set in H02-09) before sending commands to the servo drive. Otherwise, the servo drive does not respond.

When the servo is OFF, the brake applying output signal turns off after the delay time set in H02-12 or when the motor speed is lower than the value set in H02-11. That is, the brake becomes de-energized and is applied, the servo motor stops running and stays in the stop state.

4) Servo motor stopping when servo drive is OFF



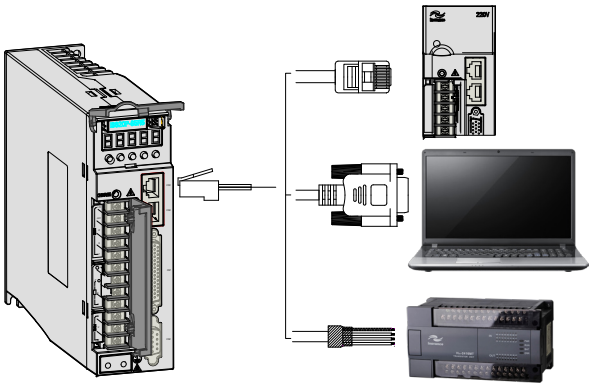
The description of brake output time sequence is as follows:

When the servo is ON, wait for the operation delay time of the brake (as set in H02-09) before sending commands to the servo drive. Otherwise, the servo drive does not respond.

When the servo is OFF, the brake signal is immediately sent out. The servo motor is still ON within the delay time as set in H02-10, to prevent heavy objects from falling due to gravity.

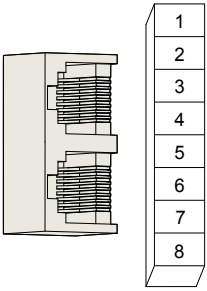
3.4 Communication Signal Wiring

Figure 3-11 Communication wiring



CN3 and CN4 are two same communication signal terminals connected in parallel. Do not connect wires to the reserved pins.

Table 3-19 Communication signal terminal pin definition

Pin No.	Pin	Description	Terminal Pin layout
1	CANH	CAN communication port	
2	CANL		
3	GNDG	CAN communication ground	
4	RS485+	RS485 communication port	
5	RS485-		
6	RS232-TXD	RS232 sending end, connected to the receiving end of the host controller	
7	RS232-RXD	RS232 receiving end, connected to the sending end of the host controller	
8	GND	Ground	
Housing	PE	Shield	

The following table lists definition of DB9 terminal at the PC side.

Table 3-20 Definition of DB9 terminal pins at PC side

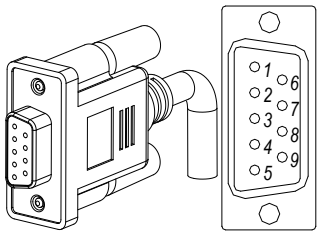
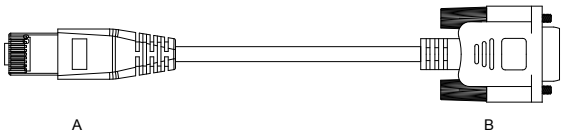
Pin No.	Pin	Description	Terminal Pin layout
2	PC-RXD	PC receiving end	
3	PC-TXD	PC sending end	
5	⏚GND	Ground	
Housing	PE	Shield	

Figure 3-12 Communication cable appearance



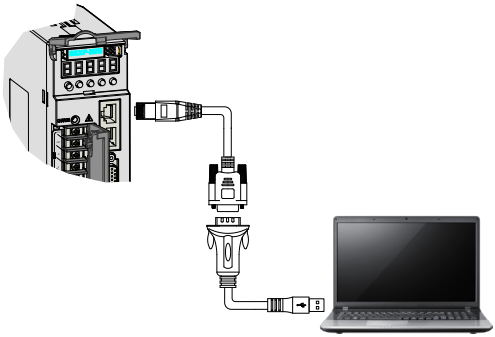
A B

Table 3-21 Pin definition of the communication cable

RJ45 at Servo Drive Side (A)		DB9 at PC Side (B)	
Signal	Pin No.	Signal	Pin No.
GND	8	GND	5
RS232-TXD	6	PC-RXD	2
RS232-RXD	7	PC-TXD	3
PE (shield)	Housing	PE (shield)	Housing

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

Figure 3-13 Serial-to-USB conversion diagram



The recommended cable is as follows:

Z-TEK, model: ZE551A, 0.8-m USN extension cable, chip model: FT232

Figure 3-14 Appearance of the communication cable for parallel connection of multiple servo drives

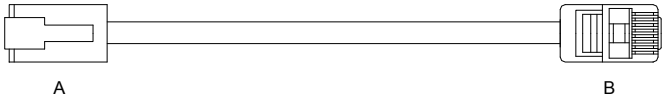


Table 3-22 Pin definition of the communication cable for parallel connection

A		B	
Signal	Pin No.	Signal	Pin No.
GND	8	GND	8
CANH	1	CANH	1
CANL	2	CANL	2
CGND	3	CGND	3
RS485+	4	RS485+	4
RS485-	5	RS485-	5
PE (shield)	Housing	PE (shield)	Housing

Figure 3-15 Appearance of the communication cable between the PLC and the servo drive

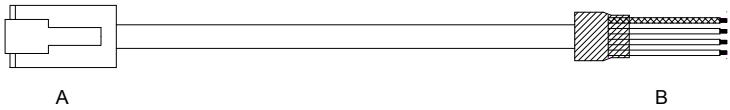


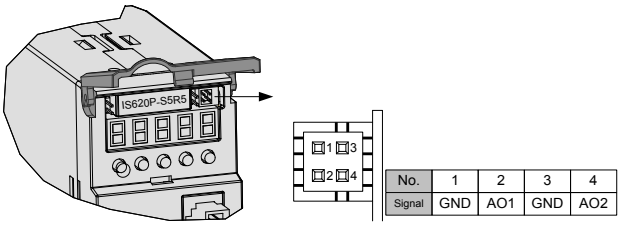
Table 3-23 Pin definition of the communication cable between the PLC and the servo drive

A		B	
Signal	Pin No.	Signal	Pin No.
GND	8	GND	8
CANH	1	CANH	1
CANL	2	CANL	2
CGND	3	CGND	3
RS485+	4	RS485+	4
RS485-	5	RS485-	5
PE (shield)	Housing	PE (shield)	Housing

3.5 Analog Monitoring Signal Wiring

The following figures shows pin layout of the analog monitoring signal terminal CN5.

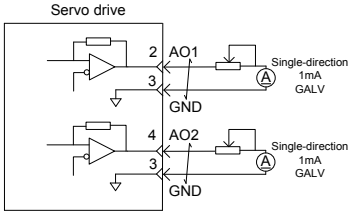
Figure 3-16 Analog monitoring signal terminal



No.	1	2	3	4
Signal	GND	AO1	GND	AO2

Corresponding interface circuit:

- Analog output: -10 to +10 V
- Maximum output current: 1 mA



The monitored objects of analog signals are listed in the following table.

Table 3-24 Monitored objects of analog signals

Signal	Monitored Object
AO1	0: Motor speed, 1: Speed reference, 2: Torque reference, 3: Position deviation, 4: Position amplifier deviation, 5: Position reference speed, 6: Positioning completed reference, 7: Speed feedforward (H04-50/H04-53)
AO2	

Note

After the control power turns OFF, the analog monitoring output terminal may output around 5 V voltage for 50 ms at most. Take this into full consideration when using this terminal.

3.6 Anti-interference Measures for Electrical Wiring

Take the following measures to suppress interference:

1. Use cables (such as reference input and encoder cables) as short as possible.
2. Use cables as thick as possible (> 2.0 mm^2) for grounding.

   a. D class (or higher class) grounding is recommended (grounding resistance is below 100 Ω).

   b. Ground to one point only.
3. Use an EMI filter to prevent radio frequency interference. In home application or application with noise interference, install the EMI filter on the input side of the power supply line.
4. To prevent malfunction due to electromagnetic interference, take the following measures:

   a. Install the upper devices and EMI filter as close to the servo drive as possible.

   b. Install a surge absorber on the relay, solenoid and electromagnetic contactor coils.

   c. The distance between a strong-current cable and a weak-current cable shall be at least 30 cm. Do not run these cables in the same duct or bundle them together.

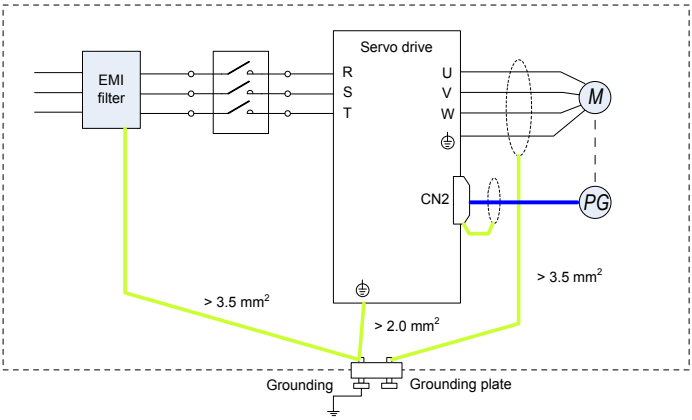
   d. Do not share the power supply with an electric welder or electrical discharge machine. When the servo drive is placed near a high-frequency generator, install an EMI filter on the input side of the power supply line.

3.6.1 Anti-interference Wiring Example and Grounding

The servo drive uses high-speed switching element in the main circuit. Switching noise from these elements may affect normal operation of the servo drive due to improper wiring or grounding. Thus, the servo drive must be properly wired and grounded. An EMI filter can be added if necessary.

1) Anti-interference wiring example

Figure 3-17 Anti-interference wiring example



Note

For the grounding cable connected to the casing, use a cable of at least 3.5 mm^2 thick. Plain stitch copper wires are recommended.
If an EMI filter is used, observe the precautions as described in section 3.6.2.

2) Grounding

To prevent potential magnetic interference, conduct grounding correctly according to the following instructions.

a. Grounding the motor housing

Connect the grounding terminal of the servo motor to the PE terminal of the servo drive and ground the PE terminal, to reduce potential magnetic interference.

b. Grounding the shield of the power cable

Ground both ends of the shield or metal conduit of the motor main circuit. Crimping is preferable to ensure good contact.

c. Grounding the servo drive

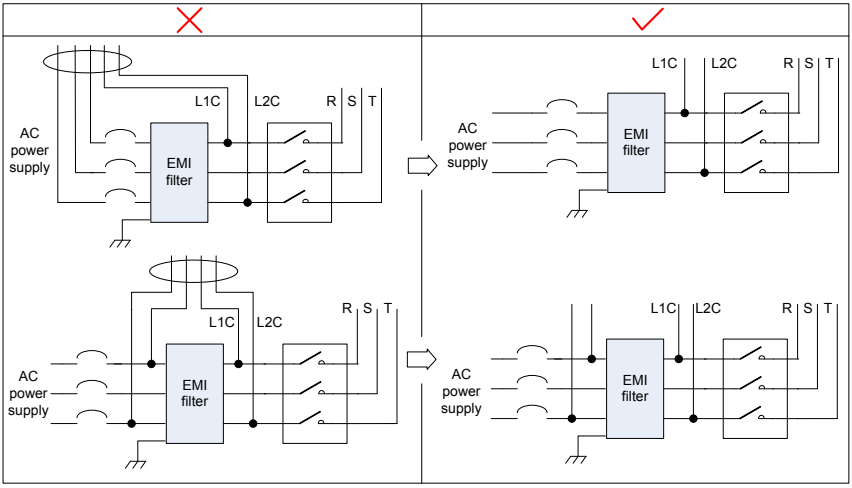
Ground the PE terminal of the servo drive properly. The screw of this terminal must be fixed solidly to ensure good contact.

3.6.2 Using EMI Filters

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

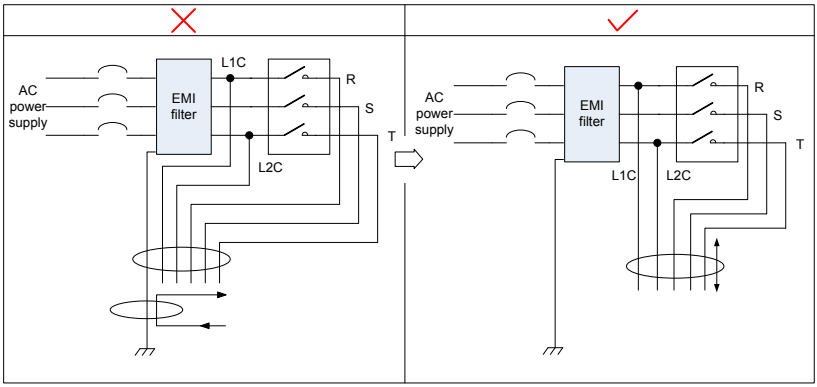
1) Do not put the input and output lines of the EMI filer in the same duct or bundle them together.

Figure 3-18 EMI filter input and output line wiring



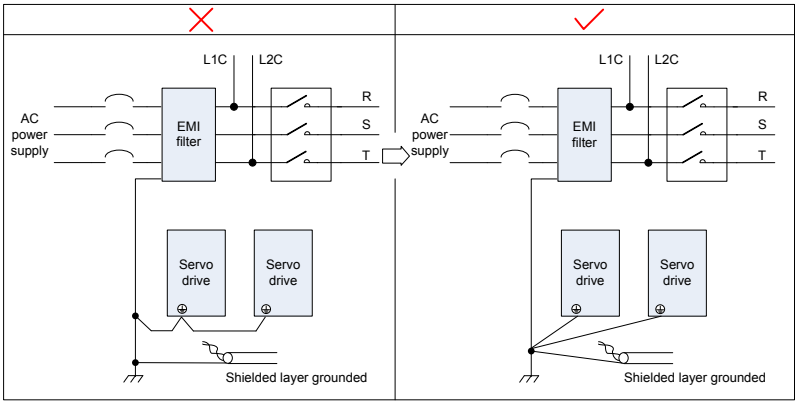
2) Separate the grounding cable and output power supply line of the EMI filter.

Figure 3-19 EMI filter grounding cable and output line wiring



3) Use a separate grounding cable as short and thick as possible for the EMI filter. Do not share the same grounding cable with other grounding devices.

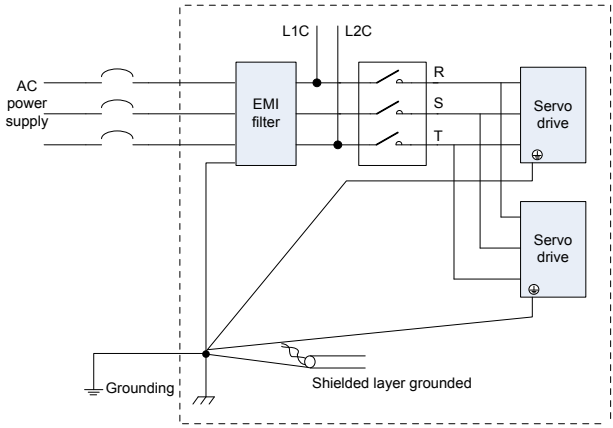
Figure 3-20 Grounding to one point



4) Ground the EMI inside the cabinet.

If the EMI filter and the servo drive are installed in the same cabinet, fix the EMI filter and the servo drive on the same metal plate. Make sure the contact part is in good conductive condition, and ground the metal plate properly. They can also be grounded separately, as shown in Figure 3-18.

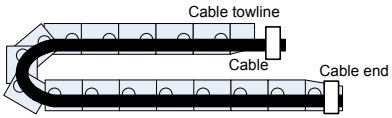
Figure 3-21 EMI filter grounding



3.7 Precautions of Using Cables

1. Do not bend or apply tensions to cables. The core wire of a signal cable is only 0.2 or 0.3 mm thin. Handle the cables carefully.
2. In scenarios where cables need to be moved, use flexible cables. Common cables are easily damaged after being bent for a long time. Cables of low power servo motors cannot be moved.
3. If cable towline is used, make sure:
   - The bending radius of the cable must be at least 10 times of the diameter of the cable.
   - Do not fix or bundle the cables inside the cable towline. You can bundle them at both ends of the cable towline.
   - Cables must not be wound or warped.
   - Space factor inside the cable towline must not exceed 60%.
   - Do not mix cables of great difference in size together. Otherwise, thick cables may crush thin cables. If you need to use them together, place a spacer plate to separate them.

Figure 3-22 Cable towline



4

Running and Commissioning

Chapter 4 Running and Commissioning

Based on the command modes and running characteristics, the servo drive supports three running modes, position control, speed control, and torque control.

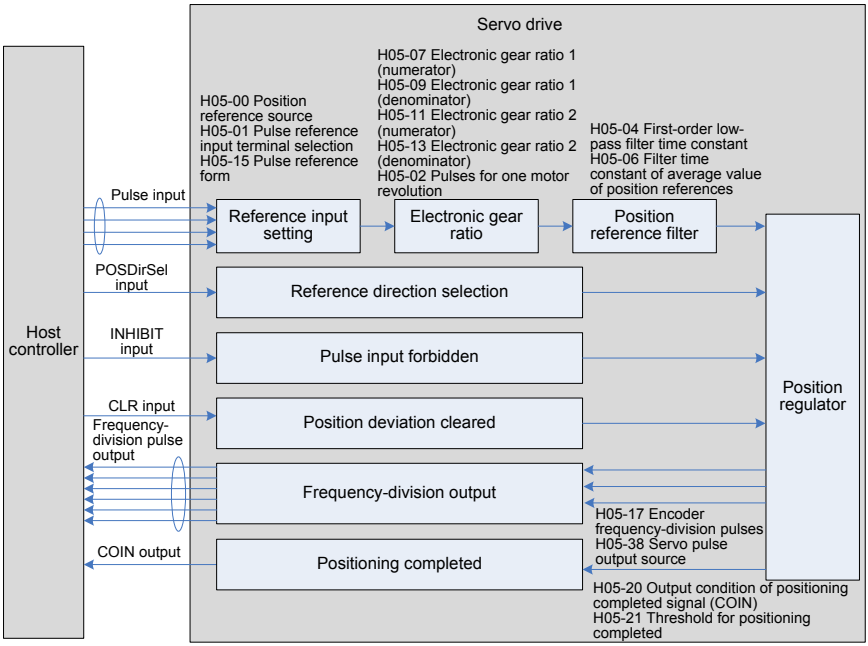
In the position control mode, the displacement is determined based on the number of pulses and the speed is determined based on the input pulse frequency. The position control mode strictly controls the position and speed, and is often used in the positioning device. It is the most commonly used mode of the servo drive, applicable to the mechanical arm, mounter, engraving and milling machine, and computer numerical control (CNC) machine tool.

In the speed control mode, the speed is controlled by the AI setting, DI setting, or communication setting. It is often used in scenarios with constant speed. For example, for the analog engraving and milling machine, the host controller uses the position control mode, and the servo drive uses the speed control mode.

In the torque control mode, the torque is changed by changing the analog setting or the address value by means of communication. This mode is mainly applied to the winding and unwinding devices with strict tension requirements, for example, tension control scenarios of the winding device or fiber pulling device. In these scenarios, the torque always changes with the winding radius so that the tension will not change along with the change of the winding radius.

4.1 Use of the Position Control Mode

Figure 4-1 Diagram of the position control mode

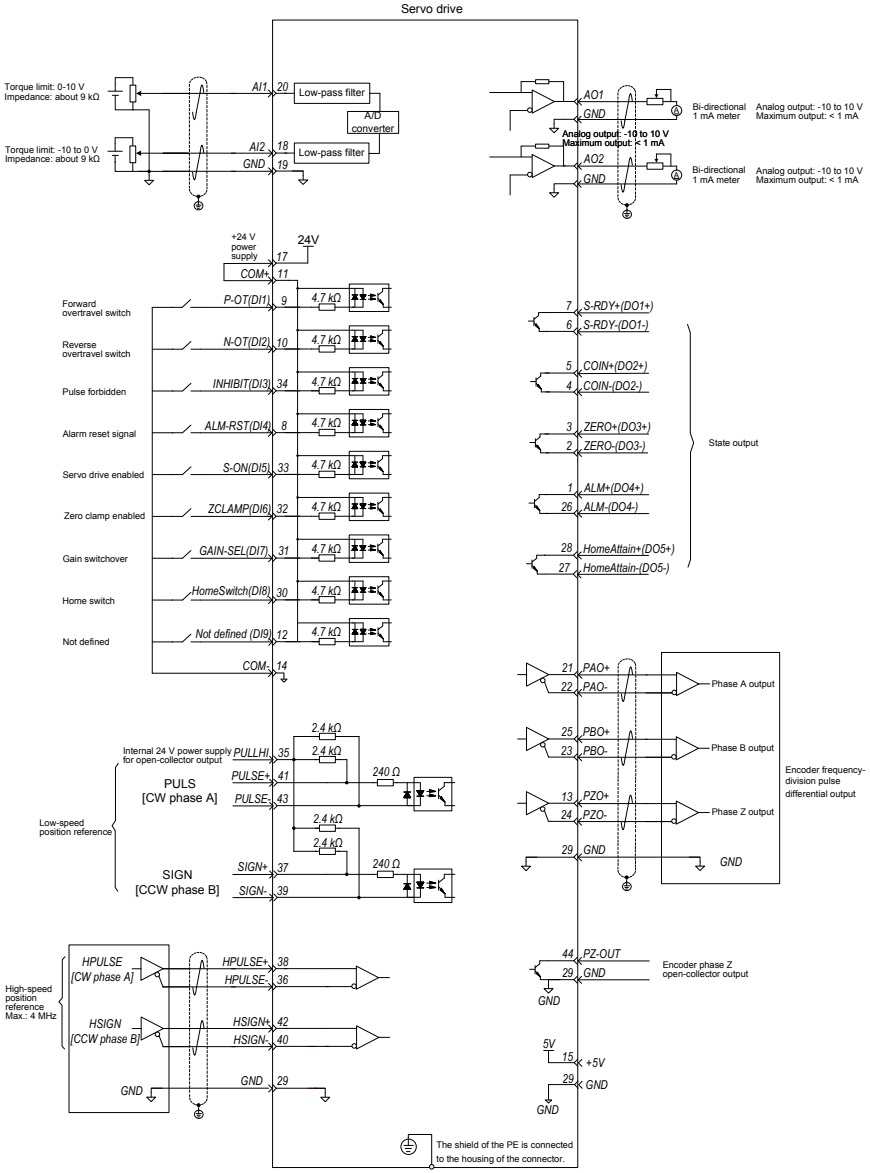


The position control mode is the most common mode of the servo drive. The main use procedure is as follows:

1. Connect the power cables of the main circuit and control circuit of the servo drive, motor power cables, and encoder cables correctly. After power-on, the keypad of the servo drive displays "rdy", indicating that the wiring is correct.
2. Perform trial jog running by pressing keys and ensure that the motor can run properly.
3. Connect the signals of terminal CN1, such as the pulse direction input, reference pulse input, and required DI/DO signals (servo drive enabled and positioning completed) according to Figure 4-2.
4. Perform the setting related to the position control mode. Set the DI/DO functions in groups H03 and H04 based on actual requirements. You may also need to set the home return and frequency-division functions based on actual requirements.
5. Enable the servo drive. Send a position reference from the host controller to enable the servo motor to rotate. Make the motor rotate at a low speed and check whether the rotating direction and electronic gear ratio are normal. Then, adjust the gain. For details, see the commissioning procedure in section 4.5.

4.1.1 Wiring of the Position Control Mode

Figure 4-2 Wiring of the position control mode



indicates the twisted pair.

Note

- The signal cables and power cables must be laid separately with the distance at least above 30 cm.
- When the signal cable is not long enough and an extension cable needs to be connected, ensure that the shield is connected reliably and the shielding and grounding are reliable.
- +5V is referenced to GND, and +24V is referenced to COM-.
- The current must not exceed the maximum allowable value. Otherwise, the servo drive cannot work properly.

4.1.2 Function Code Setting of the Position Control Mode

The parameters for the position control mode include the mode selection, reference pulse form, electronic gear ratio, and DI/DO setting.

1. Position reference input setting

a. Position reference source

Use the default value 0 of H05-00, or set this parameter based on the actual situation.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	00	Position reference source	0: Pulse 1: Step setting 2: Multi-position setting	-	0	Immediate	At stop	P

b. Pulse reference input terminal selection

Specify whether the reference pulse source is high-speed pulse input or low-speed pulse input by setting the function code H05-01.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	01	Pulse reference input terminal	0: Low-speed pulse input 1: High-speed pulse input	-	0	Power-on again	At stop	P

c. Position reference direction setting

Set the function FunIN.27 to switch over the position reference direction by a DI.

Function No.	Function Name	Description	Setting	Remarks
FunIN.27	POSDirSel	Position reference direction	Valid: Forward direction Invalid: Reverse direction	It is recommended that the logic of the corresponding terminal be set to level valid.

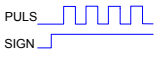
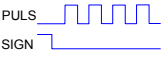
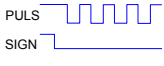
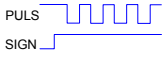
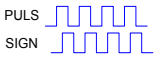
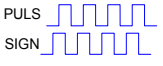
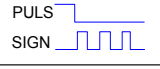
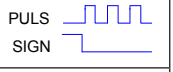
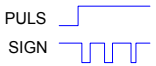
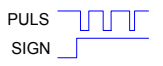
d. Reference pulse form

Select the reference pulse form by setting H05-15.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	15	Reference pulse form	0: Direction + pulse, positive logic 1: Direction + Pulse, negative logic 2: Phase A + Phase B orthogonal pulse, 4-frequency multiplication 3: CW + CCW	-	0	Power-on again	At stop	P

The following table describes the principles of the three reference pulse forms.

Table 4-1 Principles of reference pulse forms

Reference Pulse Form	Positive Logic		Negative Logic	
	Forward Rotation	Reverse Rotation	Forward Rotation	Reverse Rotation
Direction + Pulse				
Phase A + Phase B orthogonal pulse				
CW + CCW				
				

e. Position reference forbidden

Set the function FunIN.13 for a DI to forbid reference pulse input.

Function No.	Function Name	Description	Setting	Remarks
FunIN.13	INHIBIT	Position reference forbidden	Valid: Reference pulse input forbidden Invalid: Reference pulse input allowed	This function is now actually used as position reference forbidden, involving internal and external position references. The logic of the corresponding DI must be set to level valid.

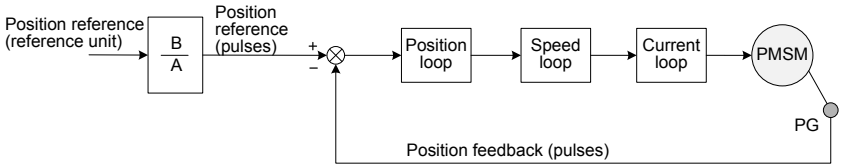
2. Electronic gear ratio

Set the electronic gear ratio based on the actual situation of the mechanism and host controller.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	07	Electronic gear ratio 1 (numerator)	1–1073741824	-	1048576	Immediate	During running	P
H05	09	Electronic gear 1 (denominator)	1–1073741824	-	10000	Immediate	During running	P
H05	11	Gear ratio 2 (numerator)	1–1073741824	-	1048576	Immediate	During running	P
H05	13	Gear ratio 2 (denominator)	1–1073741824	-	10000	Immediate	During running	P

The following figure shows the working principle of the electronic gear ratio.

Figure 4-3 Working principle of the electronic gear ratio



When H05-02 is 0 and the motor is connected to the load through the reduction gear, assume that the reduction ratio between the motor shaft and the load mechanical side is n/m (the load shaft rotates n revolutions when the motor shaft rotates m revolutions), and the formula of calculating the electronic gear ratio is as follows:

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{\text{H05-07}}{\text{H05-09}} = \frac{\text{Encoder resolution}}{\text{Displacement (command unit) when the load shaft rotates one revolution}} \times \frac{m}{n}$$

The IS620P supports two electronic gear ratios, which can be switched over by using the function FunIN.24.

When H05 ≠ 0:

$$\text{Electronic gear ratio } \frac{B}{A} = \frac{\text{Encoder resolution}}{\text{H05-02}}$$

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	02	Pulses for one motor revolution	0–1048576	P/Rev	0	Power-on again	At stop	P

When this parameter is set, the electronic gear ratio is irrelative to H05-07, H05-09, H05-11 and H05-13, and the electronic gear ratio switchover is not supported.

3. Position reference filter

The input position references are filtered to make rotation of the servo motor smoother. This function has obvious effects in the following scenarios:

- Acceleration/deceleration processing is not performed on the reference pulses output by the host controller and the acceleration/deceleration rate is large.
- The pulse frequency is too low.
- The electronic gear ratio is larger than 10.

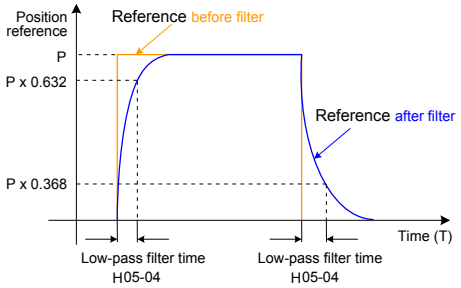
Note

This function has no effect on the displacement (total pulses of position references).

The parameter setting for the position reference filter is as follows:

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	04	First-order low-pass filter time constant	0.0–6553.5	ms	0.0	Immediate	At stop	P

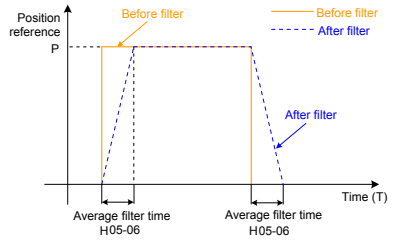
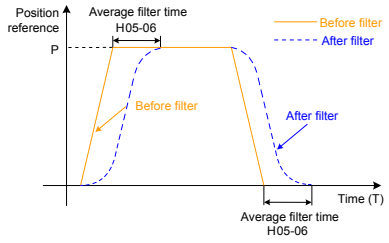
Figure 4-4 Example of first-order low-pass filter



Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	06	Average filter time of position references	0.0–128.0	ms	0.0	Immediate	At stop	P

When H05-06 = 0, the average filter is invalid.

Table 4-2 Different filter effects of two position reference types under the average filter

Rectangular Position Reference	Ladder Position Reference
	

4. Clearing position deviation

Set the function FunIN.35 for a DI to determine whether to clear the position deviation.

Function No.	Function Name	Description	Setting	Remarks
FunIN.35	ClrPosErr	Position deviation cleared	Valid: Clear Invalid: Not clear	It is recommended that this function be allocated to DI8 or DI9 and the logic of the corresponding terminal be set to edge valid. If you set the logic to level valid, the servo drive forcibly changes it to edge logic internally.

5. Frequency-division output

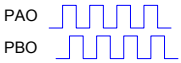
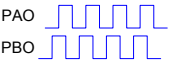
This parameter is used to select the pulse output source. The reference pulse synchronous output is used in the synchronous control scenario.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	38	Servo pulse output source	0: Encoder frequency-division output 1: Reference pulse synchronous output 2: Frequency-division and synchronous output forbidden	-	0	Power-on again	At stop	P

The servo drive performs frequency division on the pulses from the encoder based on the value of H05-17 and then outputs the processed pulses via the frequency-division output terminal. The value of H05-17 corresponds to the pulses from PAO/PBO at each revolution (before 4-frequency multiplication). In other words, the final output pulses of PAO/PBO is four times of the setting value of H05-17.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	17	Encoder frequency-division pulses	35–32767	P/Rev	2500	Power-on again	At stop	-

Table 4-3 Output phase pattern

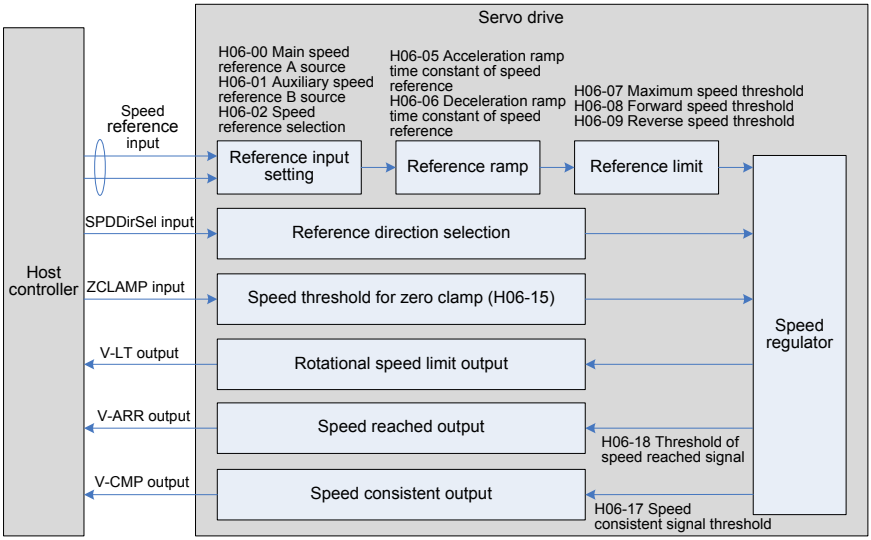
Forward Rotation (Phase A Advancing Phase B by 90°)	Reverse Rotation (Phase B Advancing Phase A by 90°)
	

The phase pattern of output pulse feedback can be modified in H02-23.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H02	03	Output pulse phase	0: CCW direction as the forward direction (phase A advancing phase B) 1: CW direction as the forward direction (reverse rotation mode, phase A lagging phase B)	-	0	Power-on again	At stop	PST

4.2 Use of the Speed Control Mode

Figure 4-5 Diagram of the speed control mode

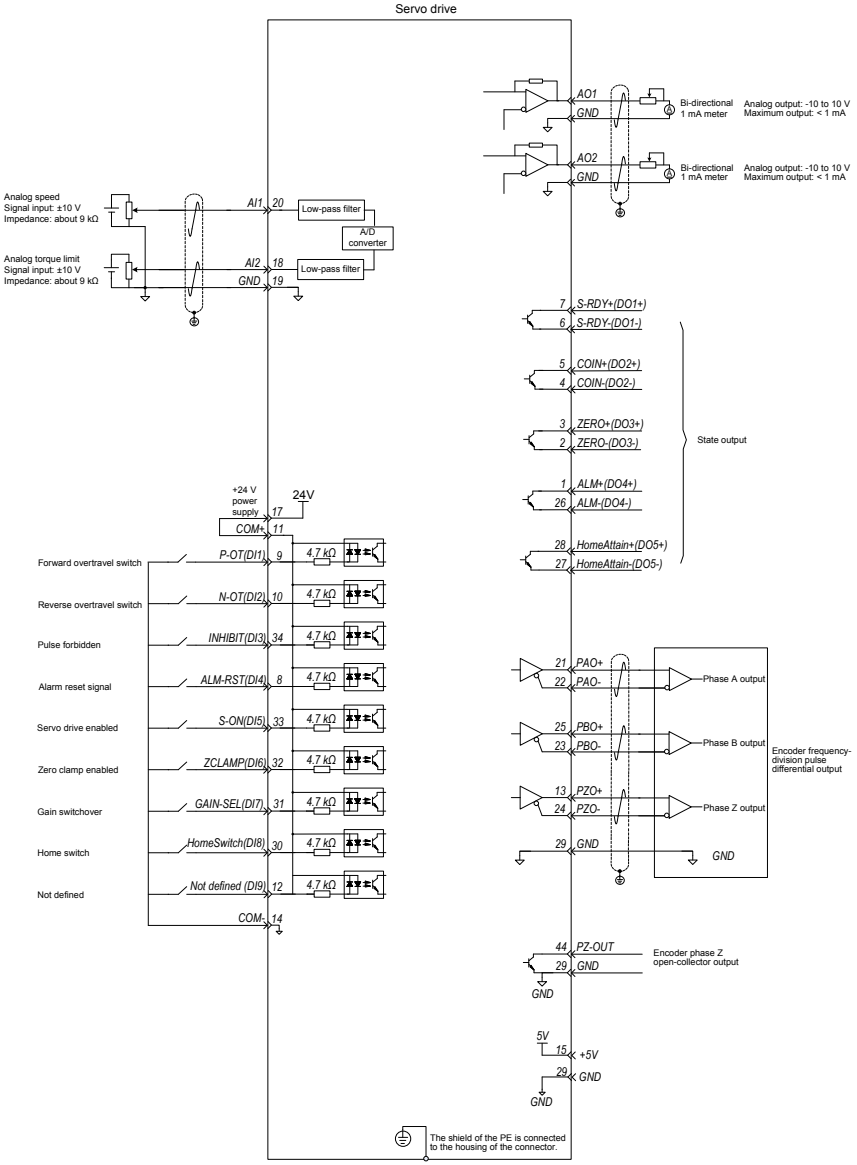


The main use procedure of the speed control mode is as follows:

1. Connect the power cables of the main circuit and control circuit of the servo drive, motor power cables, and encoder cables correctly. After power-on, the keypad of the servo drive displays "rdy", indicating that the wiring is correct.
2. Perform trial jog running by pressing keys and ensure that the motor can run properly.
3. Connect the required DI/DO signals and analog speed references of terminal CN1 according to Figure 4-6.
4. Perform the setting related to the speed control mode.
5. Make the motor rotate at a low speed and ensure that the rotating direction is normal. Then, adjust the gain. For details, see the commissioning procedure in section 4.5.

4.2.1 Wiring of the Speed Control Mode

Figure 4-6 Wiring of the speed control mode



indicates the twisted pair.

Note

- The signal cables and power cables must be laid separately with the distance at least above 30 cm.
- When the signal cable is not long enough and an extension cable needs to be connected, ensure that the shield is connected reliably and the shielding and grounding are reliable.
- +5V is referenced to GND, and +24V is referenced to COM-.
- The current must not exceed the maximum allowable value. Otherwise, the servo drive cannot work properly.

4.2.2 Function Code Setting of the Speed Control Mode

1. Speed reference input setting

a. Speed reference source

In the speed control mode, there are two speed reference sources, source A and source B.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H06	00	Main speed reference A source	0: Digital setting (H06-03) 1: AI1 2: AI2	-	0	Immediate	At stop	S
H06	01	Auxiliary speed reference B source	0: Digital setting (H06-03) 1: AI1 2: AI2 3: 0 (No function) 4: 0 (No function) 5: Multi-speed reference	-	1	Immediate	At stop	S
H06	03	Keypad setting value of speed reference	-6000 to 6000	rpm	200	Immediate	During running	S
H06	04	Jog speed setting value	0–6000 RPM	rpm	100	Immediate	During running	S

- The digital setting is performed on the keypad, and the speed set in H06-03 is used as the speed reference.
- The analog setting means that the externally input analog voltage signal is converted to the speed reference signal.

The following table takes AI2 as an example to describe the analog setting of the speed reference.

Table 4-4 Analog setting of speed reference

Step	Operation	Remarks
1	Set H06-00 (Main speed reference A source) to 2 (AI2), and H06-02 (Keypad setting value of speed reference) to 0 (Digital setting).	Set the speed reference source in the speed control mode.
2	Set related parameters of AI2. a. Zero drift correction (set in H03-59 or auto correction in H0D-10) b. Offset setting (H03-55) c. Dead zone setting (H03-58)	Adjust AI2 sampling by setting the zero drift, offset, and dead zone.
3	Set H03-80 (Speed corresponding to 10 V) to 3000 RPM.	Set the maximum speed (value of H03-80) corresponding to +10 V. Set the minimum speed (negative value of H03-80) corresponding to -10 V.

When there is interference on the AI2 input signal, set the AI2 input filter time (H03-56).

Figure 4-7 No-offset AI2

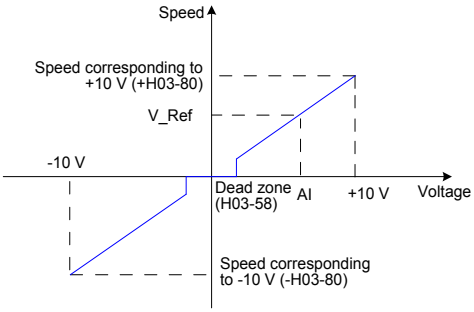
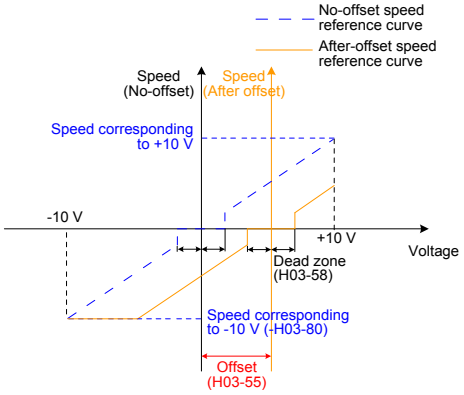


Figure 4-8 After-offset AI2



View the set speed reference value in H0B-01.

The multi-speed references refer to the 16 groups of speed references and related control parameters stored in the internal register and specified internally or via external DI. The multi-speed references can be used in all the three working modes.

For the jog speed references, two DIs or the host control software is configured with the jog running functions (FunIN.18 and FunIN.19); the jog running speed is the speed stored in H06-04, and the speed reference direction is determined based on the DI states.

b. Speed reference direction switchover

Set the function FunIN.26 to switch over the speed reference direction by a DI.

Function No.	Function Name	Description	Setting	Remarks
FunIN.26	SPDDirSel	Speed reference direction	Valid: Forward direction Invalid: Reverse direction	It is recommended that the logic of the corresponding terminal be set to level valid.

c. Speed reference selection

In the speed control mode, five methods of obtaining speed references are available, and you can select one in H06-02.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H06	02	Speed reference selection	0: Main speed reference A source 1: Auxiliary speed reference B source 2: A+B 3: A/B switchover 4: Communication setting	-	0	Immediate	At stop	S

When H06-02 is set to 3, you need to allocate a DI with the A/B switchover function to determine whether A reference input or B reference input is active currently.

Function No.	Function Name	Description	Setting	Remarks
FunIN.4	CMD-SEL	Main/Auxiliary reference switchover	Invalid: Current running reference being A Valid: Current running reference being B	It is recommended that the logic of the corresponding terminal be set to level valid.

2. Reference ramp parameter setting

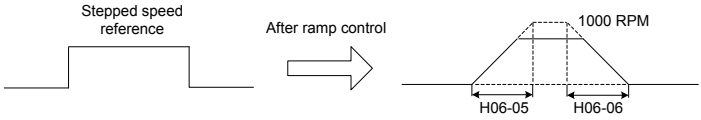
The ramp control function is to change the speed references with large difference to smoother speed references with constant acceleration and deceleration, that is, controlling acceleration and deceleration by setting the acceleration and deceleration time. If the set speed references change greatly, the motor may jitter or vibrate greatly. In this case, the soft start acceleration and deceleration time can implement smooth running of the motor and prevent vibration and damage to the mechanical parts.

The related function codes are set in the following table.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H06	05	Acceleration ramp time of speed reference	0-65535	ms	0	Immediate	During running	S
H06	06	Deceleration ramp time of speed reference	0-65535	ms	0	Immediate	During running	S

The ramp control function converts the stepped speed references to smooth speed references with constant acceleration/deceleration, implementing smooth speed control (including internally set speed reference).

Figure 4-9 Ramp control diagram

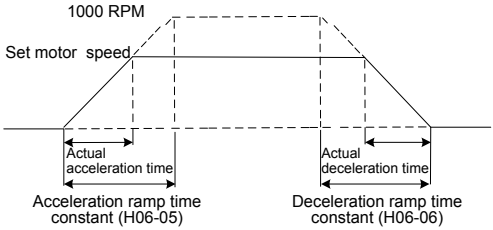


- H06-05 specifies the time constant for the speed reference to accelerate from zero to 1000 RPM.
- H06-06 specifies the time constant for the speed reference to decelerate from1000 RPM to zero.

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

- Actual acceleration time = (Speed reference/1000) x Acceleration ramp time constant of speed reference
- Actual deceleration time = (Speed reference/1000) x Deceleration ramp time constant of speed reference

Figure 4-10 Acceleration/Deceleration time diagram



3. Speed reference limit

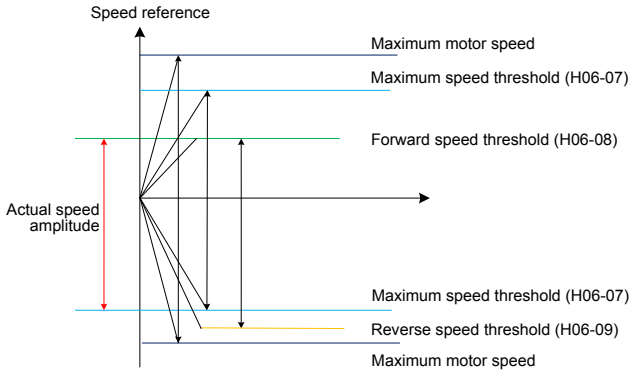
The speed references in the speed control mode can be limited.

- H06-07 specifies the limit of speed references. The forward or reverse speed references must not exceed the limit. If speed references exceed the limit value, the servo drive outputs the limit value.
- H06-08 specifies the forward speed threshold. If the speed reference of the forward direction exceeds the value, the servo drive outputs the value.
- H06-09 specifies the reverse speed threshold. If the speed reference of the reverse direction exceeds the value, the servo drive outputs the value.
- The maximum motor speed changes with the actual motor parameters.

Note

When the speed is restricted, the smallest value of H06-07, H06-08, and H06-09 takes effect, as shown in the following figure, where the value of H06-09 is larger than the value of H06-07, the actual forward speed limit is the value of H06-08, and the reverse speed limit is the value of H06-07.

Figure 4-11 Speed reference limit



Note

By default, the limit does not exceed the maximum motor speed.

The actual motor speed amplitude meets the following requirements:

- |Amplitude of forward speed| ≤ min {maximum motor speed, H06-07, H06-08}
- |Amplitude of reverse speed| ≤ min {maximum motor speed, H06-07, H06-09}

The related function codes are set in the following table.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H06	07	Maximum speed threshold	0–6000	rpm	6000	Immediate	During running	S
H06	08	Forward speed threshold	0–6000	rpm	6000	Immediate	During running	S
H06	09	Reverse speed threshold	0–6000	rpm	6000	Immediate	During running	S

4. Zero clamp function

In the speed control mode, if the ZCLAMP function is valid, and the speed reference amplitude is smaller than or equal to the value of H06-15, the servo motor enters the zero clamp state. If oscillation occurs at this moment, you can adjust the position loop gain. When the speed reference amplitude is larger than the value of H06-15, the servo motor exits the zero clamp state.

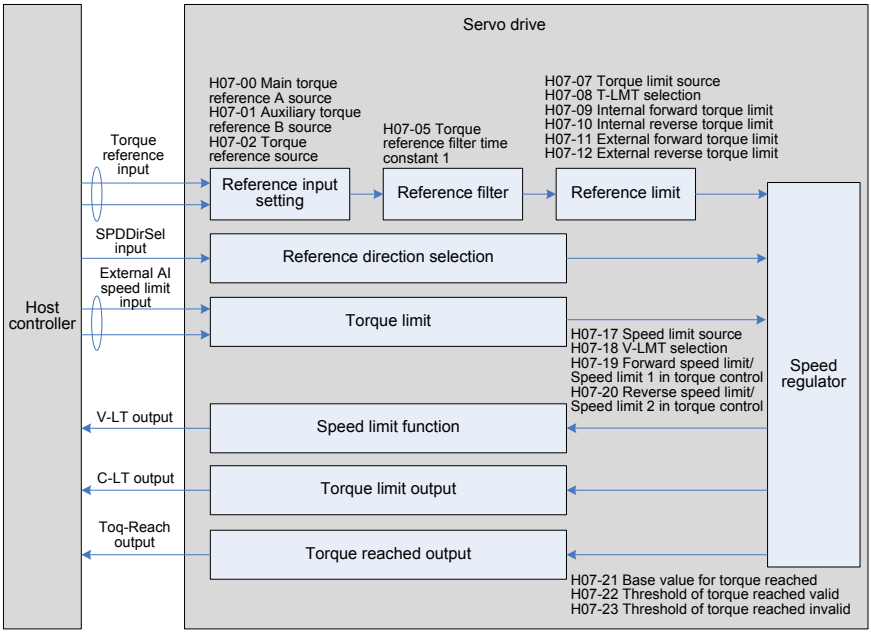
Function No.	Function Name	Description	Setting	Remarks
FunIN.12	ZCLAMP	Zero clamp enabled	Valid: Zero clamp enabled Invalid: Zero clamp disabled	It is recommended that the logic of the corresponding terminal be set to level valid.

The related function code is set in the following table.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H06	15	Speed threshold for zero clamp	0–6000	rpm	10	Immediate	During running	S

4.3 Use of the Torque Control Mode

Figure 4-12 Diagram of the torque control mode

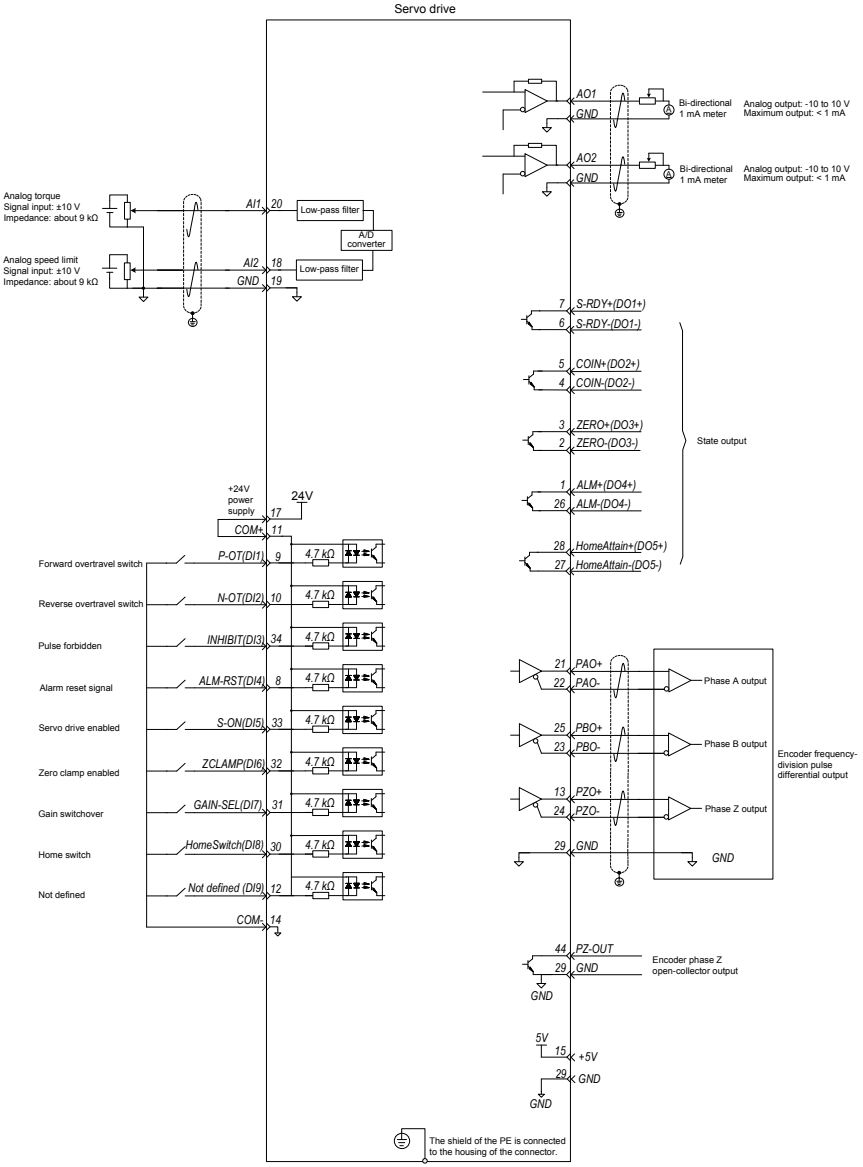


The main use procedure of the torque control mode is as follows:

1. Connect the power cables of the main circuit and control circuit of the servo drive, motor power cables, and encoder cables correctly. After power-on, the keypad of the servo drive displays "rdy", indicating that the wiring is correct.
2. Perform trial jog running by pressing keys and ensure that the motor can run properly.
3. Connect the required DI/DO signals and analog speed references of terminal CN1 according to Figure 4-13.
4. Perform the setting related to the torque control mode.
5. Set a low speed limit, send a forward or reverse torque reference, and check whether the rotating direction of the motor is correct and whether the torque is correctly limited. If yes, the servo system can be used properly.

4.3.1 Wiring of the Torque Control Mode

Figure 4-13 Wiring of the torque control mode



indicates the twisted pair.

Note

- The signal cables and power cables must be laid separately with the distance at least above 30 cm.
- When the signal cable is not long enough and an extension cable needs to be connected, ensure that the shield is connected reliably and the shielding and grounding are reliable.
- +5V is referenced to GND, and +24V is referenced to COM-.
- The current must not exceed the maximum allowable value. Otherwise, the servo drive cannot work properly.

4.3.2 Function Code Setting of the Torque Control Mode

1. Torque reference input setting

a. Torque reference source

In the torque control mode, there are two torque reference sources, source A and source B, set as follows:

- Digital setting is performed on the keypad, and the percentage of the torque relative to the rated torque set in H07-03 is used as the torque reference.
- The analog setting means that the externally input analog voltage signal is converted to the torque reference signal of motor speed. The relationship between the analog and the torque reference can be defined based on actual requirements.

The related function codes are set in the following table.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H07	00	Main torque reference A source	0: Digital setting (H07-03) 1: AI1 2: AI2	-	0	Immediate	At stop	T
H07	01	Auxiliary torque reference B source	0: Digital setting (H07-03) 1: AI1 2: AI2		1	Immediate	At stop	T
H07	03	Keypad setting value of torque reference	-300.0 to 300.0	%	0.0	Immediate	During running	T

b. Torque reference selection

In the torque control mode, five methods of obtaining torque references are available, and you can select one in H07-02.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H07	02	Torque reference source	0: Main torque reference A source 1: Auxiliary torque reference B source 2: A+B 3: A/B switchover 4: Communication setting	-	0	Immediate	At stop	T

c. Torque reference direction switchover

Set the function FunIN.25 to switch over the torque reference direction by a DI.

Function No.	Function Name	Description	Setting	Remarks
FunIN.25	TOQDirSel	Torque reference direction	Valid: Forward direction Invalid: Reverse direction	It is recommended that the logic of the corresponding terminal be set to level valid.

When H07-02 = 3, you need to allocate a DI with the A/B switchover function to determine whether A reference input or B reference input is active currently.

Function No.	Function Name	Description	Setting	Remarks
FunIN.4	CMD-SEL	Main/Auxiliary reference switchover	Valid: Current running reference being A Invalid: Current running reference being B	It is recommended that the logic of the corresponding terminal be set to level valid.

The following table takes AI1 as an example to describe the analog setting of the torque reference.

Table 4-5 Analog setting of torque reference

Step	Operation	Remarks
1	Set H07-02 (Torque reference selection) to 1 (Auxiliary torque reference B source) and H07-01 (Auxiliary torque reference B source) to 1 (AI1).	Set the torque reference source in the torque control mode.
2	Set related parameters of AI1. a. Zero drift correction (set in H03-54 or auto correction in H0D-10) b. AI1 offset (H03-50) c. AI1 dead zone (H03-53)	Adjust AI2 sampling by setting the zero drift, offset, and dead zone.
3	Set H03-81 (Torque corresponding to 10 V) to 3 times of the rated torque.	Set the maximum torque (value of H03-81) corresponding to +10 V. Set the minimum torque (negative value of H03-81) corresponding to -10 V.

When there is interference on the AI1 input signal, set the AI1 input filter time (H03-51).

Figure 4-14 No-offset AI1

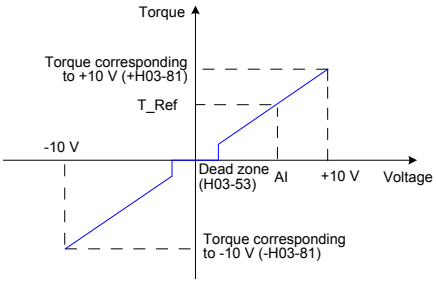
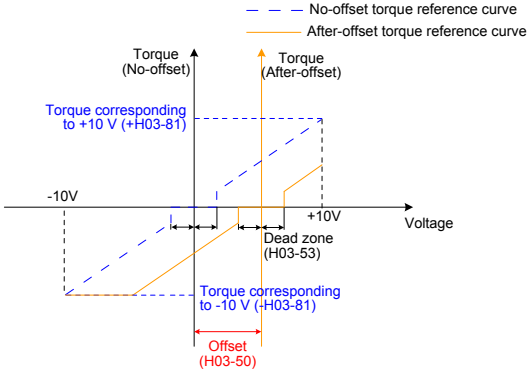


Figure 4-15 After-offset AI2



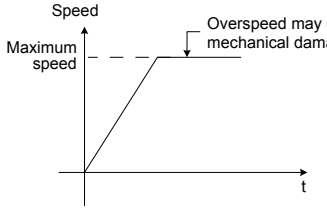
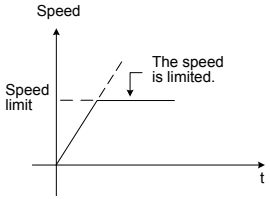
View the set torque reference (a percentage relative to the rated motor torque) in H03-02.

2. Speed limit in torque control

In the torque control mode, the speed of the servo motor needs to be limited to protect the mechanism. In the torque control mode, only the output torque reference of the servo motor is limited, and the speed is not controlled. Therefore, if the set torque reference is larger than the load torque on the mechanical side, the motor will keep acceleration. This may cause overload. In this case, the speed limit needs to be set.

When the actual speed exceeds the limit, the difference between the actual speed and the limit is converted to a certain percentage of torque and cleared negatively, so that the speed reaches the limited range. The actual speed limit changes with the load. The speed limit can be set internally or by analog sampling (similar to speed reference in the speed control mode).

Table 4-6 Speed limit diagram

Without Speed Limit	With Speed Limit
	

When the speed is limited, the DO terminal outputs the signal described in the following table.

Function No.	Function Name	Description	Setting	Remarks
FunOUT.8	V-LT	Speed limit	Confirming speed limit in torque control: Valid: Motor speed limited Invalid: Motor speed not limited	-

Note

The V-LT function needs to be allocated to a certain DI.

The speed limit source can be internal or external. When the internal speed limit source is used (H07-17 = 0), directly set the forward speed limit (H07-19) and reverse speed limit (H07-20). When H07-17 = 2, the DI allocated with FunIN.36 is used to select H0-19 or H07-20 as speed limit. When the external speed limit source is used (H07-17 = 1), the analog setting is specified in H07-18, and the corresponding relationship between the speed limit and the analog setting is set based on actual requirements. In addition, the externally set speed limit must be lower than the internally set speed limit to prevent faults due to improper setting of external speed limit.

The speed limit setting modes are set in the following function codes.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H07	17	Speed limit source	0: Internal setting (in torque control) 1: External V-LMT setting 2: H07-19/H07-20 as internal speed limit source selected by FunIN.36 (V-SEL)	-	0	Immediate	During running	T
H07	18	V-LMT selection	1: AI1 2: AI2	-	1	Immediate	During running	T
H07	19	Forward speed limit/Speed limit 1 in torque control	0–6000	rpm	3000	Immediate	During running	T

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H07	20	Reverse speed limit/Speed limit 2 in torque control	0–6000	rpm	3000	Immediate	During running	T

3. Torque reference limit

The output torque needs to be limited to protect the mechanism. Set the torque limit in H07-07.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H07	07	Torque limit source	0: Internal setting 1: External setting (P-CL and N-CL selection) 2: External T-LMT setting 3: Smaller of external setting and external T-LMT setting (P-CL and N-CL selection) 4: Switchover between internal setting and T-LMT setting	1	0	Immediate	At stop	PST

Allocate DIs with the P-CL/N-CL function for selecting external forward/reverse torque limit.

Function No.	Function Name	Description	Setting	Remarks
FunIN.16	P-CL	External forward torque limit	The torque limit source is switched over based on the setting of H07-07. H07-07 = 1: Valid: External forward torque limit enabled Invalid: Internal forward torque limit enabled H07-07 = 3 and AI limit larger than external forward limit: Valid: External forward torque limit enabled Invalid: AI torque limit enabled H07-07 = 4: Valid: AI torque limit enabled Invalid: Internal forward torque limit valid	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.17	N-CL	External reverse torque limit	The torque limit source is switched over based on the setting of H07-07. H07-07 = 1: Valid: External reverse torque limit enabled Invalid: Internal reverse torque limit enabled H07-07 = 3 and AI limit smaller than external reverse limit: Valid: External reverse torque limit enabled Invalid: AI torque limit enabled H07-07 = 4: Valid: AI torque limit enabled Invalid: Internal reverse torque limit valid	It is recommended that the logic of the corresponding terminal be set to level valid.

When the output torque is limited, the DO terminal outputs the C-LT signal described in the following table.

Function No.	Function Name	Description	Setting	Remarks
FunOUT.7	C-LT	Torque limit	Confirming torque limit Valid: Motor torque limited Invalid: Motor torque not limited	-

Allocate the functions and logics to DIs and DOs by setting the related function codes.

For example, when setting AI, specify T_LMT in H07-08, and then set the corresponding relationship between the torque and the analog voltage.

When H07-07 = 1, the external setting is triggered by the DIs with functions P-CL and N-CL, and torque limit is implemented according to the values of H07-11 and H07-12. When the external torque limit or T_LMT value is larger than the internal limit value, the internal limit value is used. That is, among all the limit conditions, the smallest limit value is used. During forward rotation, the torque is limited to the positive value of |T_LMT|; during reverse rotation, the torque is limited to the negative value of |T_LMT|.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H07	07	Torque limit source	0: Internal setting 1: External setting (P-CL and N-CL selection) 2: External T-LMT setting 3: Smaller of external setting and external T-LMT setting (P-CL and N-CL selection) 4: Switchover between internal setting and T-LMT setting	-	0	Immediate	At stop	PST
H07	08	T-LMT selection	1: AI1 2: AI2	-	2	Immediate	At stop	PST
H07	09	Internal forward torque limit	0.0–300.0	%	300.0	Immediate	During running	PST
H07	10	Internal reverse torque limit	0.0–300.0	%	300.0	Immediate	During running	PST
H07	11	External forward torque limit	0.0–300.0	%	300.0	Immediate	During running	PST
H07	12	External reverse torque limit	0.0–300.0	%	300.0	Immediate	During running	PST

4.4 Check Before Running

Disconnect the servo motor from the load, the coupling connected to the motor shaft, and other related components. To prevent potential risks, check that the servo motor can work properly without load, and then connect the load.

Before running, check that the following requirements are met:

1. There is no obvious damage on the appearance of the servo drive.
2. The wiring terminals have been insulated.
3. There are no conductive objects such as screw or metal sheet or flammable objects inside the servo drive, and there are no conductive objects around the wiring terminals.
4. The servo drive or external regen resistor is not placed on flammable subjects.
5. The wiring is complete and correct:
   - Power cables, auxiliary power cables and grounding cable of the servo drive
   - All control signal cables
   - Limit switches and protection signals
6. The servo drive enable switch is in OFF state.
7. The power circuit is cut off, and the emergency stop circuit is ON.
8. The external voltage reference of the servo drive is correct.

When the host controller does not send the running reference, power on the servo drive. Then, check that:

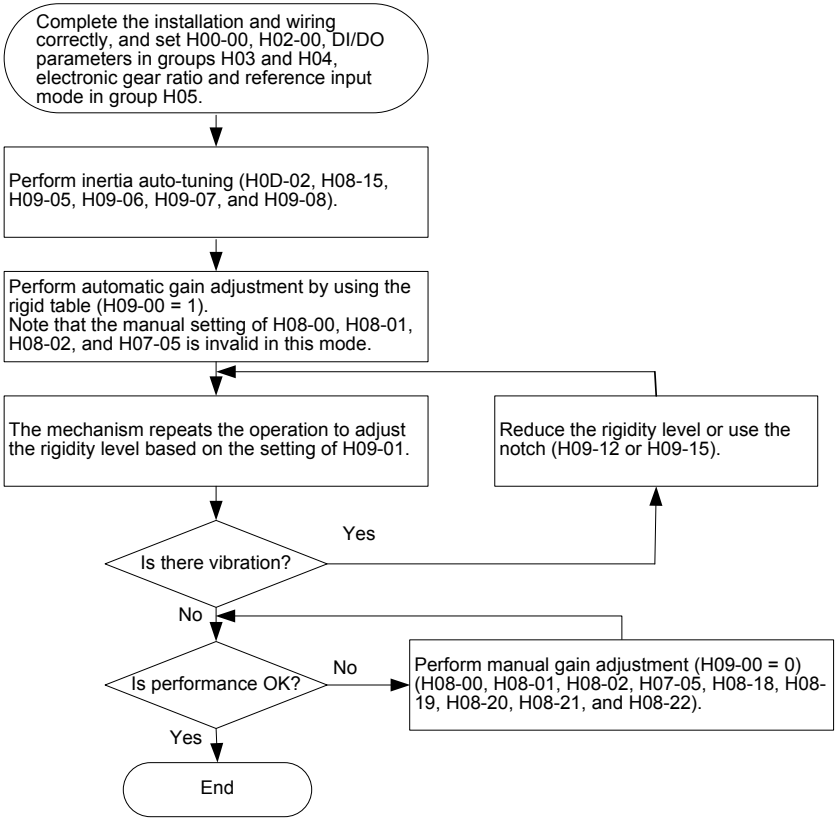
1. The servo motor can rotate properly without vibration or loud noise.
2. All parameter setting is correct. Unexpected actions may occur due to different mechanical characteristics. Thus, do not set the parameters too large or small.
3. The bus voltage indicator and digital display are normal.

4.5 Load Inertia Auto-tuning and Gain Adjustment

After completing the installation, wiring, and parameter setting correctly, commission the inertia auto-tuning, rigid table, and vibration suppression.

Perform inertia auto-tuning (see section 4.5.1) to obtain the correct load inertia ratio. Then, perform automatic gain adjustment (see section 4.5.2). If the effect is not good, perform manual gain adjustment (see section 4.5.3). When using the notch to suppress the mechanical resonance, you can set two resonance frequencies (see section 4.5.4). The following figure is the general commissioning flowchart.

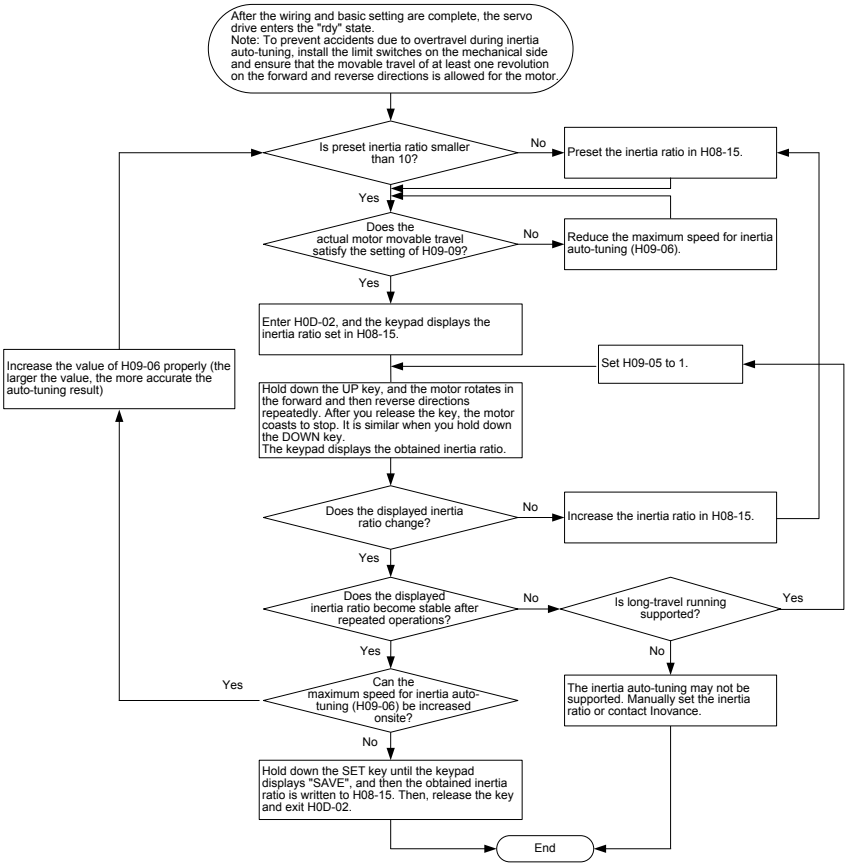
Figure 4-16 General commissioning flowchart



4.5.1 Inertia Auto-tuning

Before performing automatic or manual gain adjustment, perform inertia auto-tuning to obtain the actual load inertia ratio. The following figure is the inertia auto-tuning flowchart.

Figure 4-17 Inertia auto-tuning flowchart



- When H08-15 = 1 (default value), the actual speed may not reach the reference due to too small inertia ratio, and the auto-tuning will fail. In this case, you need to re-set H08-15. It is recommended that H08-15 be set to 5 initially and then be increased gradually so that the auto-tuning can be performed successfully.
- For offline inertia auto-tuning, the triangular wave mode is suggested. For scenarios with poor auto-tuning effect, the step rectangular wave mode is suggested.
- When H09-05 = 1, pay attention to the mechanical travel and prevent accidents due to overtravel during offline inertia auto-tuning.

The related function code is set in the following table.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H09	05	Offline inertia auto-tuning mode	0: Positive and negative triangular wave mode 1: Jog mode	-	0	Immediate	At stop	PST
H09	06	Maximum speed for inertia auto-tuning	100–1000	rpm	500	Immediate	At stop	PST
H09	07	Time constant of accelerating to max. speed for inertia auto-tuning	20–800	ms	125	Immediate	At stop	PST
H09	08	Interval after an inertia auto-tuning	50–10000	ms	800	Immediate	At stop	PST
H09	09	Motor revolutions for an inertia auto-tuning	0.00–2.00	Rev	-	-	At display	PST

The conditions for successful inertia auto-tuning are as follows:

- The actual maximum speed of the motor is larger than 150 RPM.
- The actual acceleration rate during acceleration/deceleration is higher than 3000 rpm/s.
- The load torque is stable without dramatic change.
- A maximum of 120 times of inertia can be auto-tuned.
- The auto-tuning may fail when the mechanical rigidity is very low or the back clearance of the transmission mechanism is large.

4.5.2 Automatic Gain Adjustment

The automatic gain adjustment is performed as follows:

Set H09-00 to 1, and send a reference to make the servo motor rotate. Observe the running and meanwhile adjust the setting of H09-01 until the satisfactory effect is achieved. If the effect is unsatisfactory anyway, perform manual gain adjustment.

Pay attention to the following aspects during automatic gain adjustment:

- When the rigid table is valid, H08-00, H08-01, H08-02, and H07-05 are set automatically based on the rigidity level in H09-01, and the manual setting of these four parameters are invalid.
- When the rigidity level is increased, resonance may occur. Use a notch to suppress the resonance (see section 4.5.4).
- Increase the rigidity level gradually to prevent vibration due to abrupt increase of the rigidity level.
- Check whether there is margin for the gain to prevent the situation in which the servo system approaches the unstable state.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H09	00	Auto-adjusting mode	0: Disabled, manual adjusting 1: Standard mode, gain parameters automatically adjusted based on rigidity table 2: Positioning mode, gain parameters automatically adjusted based on rigidity table	-	0	Immediate	During running	PST
H09	01	Rigidity level selection	0–31	-	12	Immediate	During running	PST

Recommended Rigidity Level	Type of Load Mechanism
Level 4 to level 8	Large-scale machinery
Level 8 to level 15	Applications with low rigidity such as belt
Level 15 to level 20	Applications with high rigidity such as ball screw and direct-connected motor

4.5.3 Manual Gain Adjustment

Set H09-00 to 0 and then manually adjust the related parameters.

When the position loop gain and speed loop gain are increased, the system response becomes faster, but too large gains cause instability. In addition, when the load inertia ratio is basically correct, the speed loop gain and position loop gain must meet the following condition to guarantee system stability:

$$\frac{1}{3} \leq \frac{\text{H08-00 [Hz]}}{\text{H08-02 [Hz]}} \leq 1$$

Increasing the torque reference filter time in H07-05 helps suppress the mechanical resonance but reduces the system response. The filter time must not be increased randomly and must meet the following condition:

$$\text{H08-00} < \frac{1000}{2\pi \times \text{H07-05} \times 4}$$

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H08	00	Speed loop gain	0.1–2000.0	Hz	25.0	Immediate	During running	PS
H08	01	Speed loop integral time constant	0.15–512.00	ms	31.83	Immediate	During running	PS
H08	02	Position loop gain	0.0–2000.0	Hz	40.0	Immediate	During running	P
H07	05	Torque reference filter time constant	0.00–30.00	ms	0.79	Immediate	During running	PST

4.5.4 Notch

The mechanical system has a certain resonance frequency. If the gain is too high, resonance around the resonance frequency may occur, and a notch can be used to solve the problem. The notch reduces the gain of the specified frequency to suppress the mechanical resonance. Therefore, the gain can be set higher than that without using the notch.

A total of four notches can be used, and each has three parameters, frequency, width level, and attenuation level. When the frequency is the default value 4000 Hz, the notch is actually invalid. The 1st and 2nd notches are manual notches, and their parameters need to set manually. The 3rd and 4th notches are self-adaptive notches, and their parameters are set automatically by the servo drive; if the self-adaptive mode is disabled, you can also set these two notches manually.

The mode of the self-adaptive notch is determined in H09-02. When H09-02 = 1, only the 3rd notch is valid; when the servo is enabled and detects resonance, the parameters of the 3rd notch are set automatically to suppress the resonance. When H09-02 = 2, both 3rd and 4th notches are valid, and their parameters can be set automatically.

The self-adaptive notch is preferred during the use. If the self-adaptive notch cannot produce satisfactory performance, use the manual notch. When using the manual notch, set the frequency to the actual resonance frequency, which is obtained by the mechanical feature analysis tool of the background software. Use the default value 2 of the width level. Adjust the depth level based on the actual conditions. The smaller the value is, the better the resonance suppression result is. The larger the value is, the worse the resonance suppression result is. If the depth level is set to 99, the resonance suppression almost does not work. Reducing the depth level enhances the suppression result, but causes phase lag and system instability. Do not reduce the depth level if not necessary.

More precautions about the notch are as follows:

- The notch can be used in only the speed control and position control modes.
- When H09-02 is always 1 or 2, the updated parameters of the self-adaptive notch are automatically written to EEPROM every 30 minutes, and the update within 30 minutes is not written to EEPROM.
- When H09-02 is set to 0, the current parameters of the self-adaptive notch will keep unchanged. After the self-adaptive notch is used for suppression and the system becomes stable for a certain period, you can set H09-02 to 0 to fix the parameters of the self-adaptive notch.
- It is recommended that at most two notches work at the same time. Otherwise, the resonance may become severe.
- When the resonance frequency is below 300 Hz, the suppression effect of the self-adaptive notch may degrade.
- When the resonance cannot be cleared after a long time use of the self-adaptive notch, disable the servo drive.

The related function code is set in the following table.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H09	02	Working mode of self-adaptive notch	0–4 0: Self-adaptive notch not updated 1: Only one notch (3rd notch) valid 2: Both notches (3rd and 4th notches) valid 3: Only detect resonance frequency (displayed in H09-24), not update parameters 4: Restore parameters to default setting	-	0	Immediate	During running	PST
H09	12	1st notch frequency	50–4000	Hz	4000	Immediate	During running	PS
H09	13	1st notch width level	0–20	-	2	Immediate	During running	PS
H09	14	1st notch depth level	0–99	-	0	Immediate	During running	PS
H09	15	2nd notch frequency	50–4000	Hz	4000	Immediate	During running	PS
H09	16	2nd notch width level	0–20	-	2	Immediate	During running	PS
H09	17	2nd notch depth level	0–99	-	0	Immediate	During running	PS
H09	18	3rd notch frequency	50–4000 Hz	Hz	4000	Immediate	During running	PS
H09	19	3rd notch width level	0–20	-	2	Immediate	During running	PS
H09	20	3rd notch depth level	0–99	-	0	Immediate	During running	PS
H09	21	4th notch frequency	50–4000	Hz	4000	Immediate	During running	PS
H09	22	4th notch width level	0–20	-	2	Immediate	During running	PS
H09	23	4th notch depth level	0–99	-	0	Immediate	During running	PS
H09	24	Obtained resonance frequency	0–2	Hz	0	-	At display	PS

5

Background Software

Chapter 5 Background Software

The background software IS-Opera is provided at www.inovance.cn for free download and use. Install a communication cable (S6-L-T00-3.0), and then the PC can communicate with the servo drive. You can also make the communication cable yourself, and connect the cable according to the instructions in chapter 3.

The IS-Opera supports the following functions:

- Oscilloscope for detecting and saving instantaneous data during running of the servo system
- Electronic cam, whose parameters can be set in graphical form (supported only by certain servo drive models)
- Parameter management, including reading and downloading of parameters in batches
- Database which can recognize customized function codes
- Inertia auto-tuning
- Mechanical feature analysis, which can analyze the resonance frequency of the mechanical system
- Jog running, which supports position references to make the motor repeat forward and then reverse running
- Gain adjustment, which supports the operation of adjusting the rigidity level and simple motion information monitoring
- Supporting the WindowsXP and Windows7 operating systems. For details on how to use the IS-Opera, see the IS-Opera help manual.

6

Troubleshooting

Chapter 6 Troubleshooting

6.1 During Startup

6.1.1 Position Control

<table>
<tr><th>During Startup</th><th>Fault Phenomenon</th><th>Cause</th><th>Confirming Method</th></tr>
<tr><td rowspan="5">Connect the control power L1C/ L2C and main power RST.</td><td rowspan="3">The LED display is not on or does not display Rdy.</td><td>1. The control power voltage is abnormal.</td><td>• After disconnecting CN1, CN2, CN3 and CN4, the fault persists.
• Measure the AC voltage between L1C and L2C.</td></tr>
<tr><td>2. The program burning terminal is shorted.</td><td>• Check whether the program burning terminal is shorted.</td></tr>
<tr><td>3. The servo drive is faulty.</td><td>-</td></tr>
<tr><td>The operation panel displays "Er.xxx".</td><td colspan="2">Refer to section 6.2 to eliminate the fault.</td></tr>
<tr><td colspan="3">■ After the preceding causes are removed, the operation panel should display "Rdy".</td></tr>
<tr><td rowspan="4">Set the servo enabled signal (S-ON) to ON.</td><td>The operation panel displays "Er.xxx".</td><td colspan="2">Refer to section 6.2 to eliminate the fault.</td></tr>
<tr><td rowspan="2">The shaft of the servo motor is in the free running state.</td><td>1. The servo enabled signal is ineffective.</td><td>• Switch over the operation panel to the display of servo state and view whether the operation panel displays "Rdy" rather than "Run".
• Check whether any parameter in groups H03 and H17 is allocated with the DI function 1 FunIN1: S-ON: (servo enabled). If yes, check that the corresponding DI is set to ON. If not, allocate the function and set the corresponding DI to ON.
• If a parameter in group H03 has been allocated with the FunIN1: S-ON function and the corresponding DI is ON, but the operation panel still displays "Rdy". In this case, check whether the DI terminal is connected correctly by referring chapter 3 Wiring of Servo System.</td></tr>
<tr><td>2. Control mode selection incorrect</td><td>• Check whether H02-00 is 1. If it is set to 2 (torque mode), the motor shaft must be in the free running state because the default torque reference is 0.</td></tr>
<tr><td colspan="3">■ After the preceding causes are removed, the operation panel should display "Run".</td></tr>
</table>

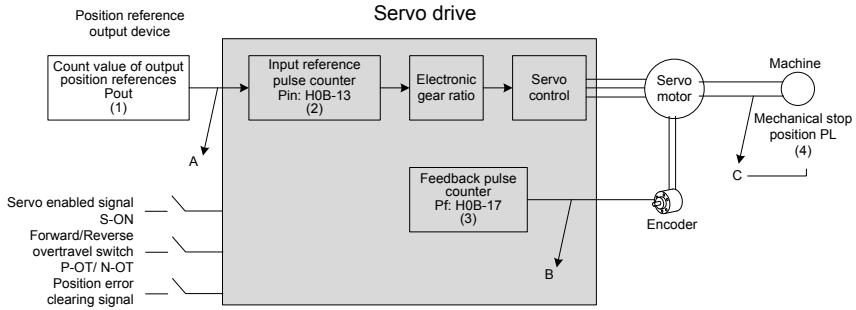
During Startup	Fault Phenomenon	Cause	Confirming Method
Input the position reference.	The servo motor does not rotate.	The input reference pulse counter (H0B-13) is 0.	• The high/low-speed pulse input terminal is wired incorrectly. When H05-00 = 0 (pulse reference is the main position reference source), check whether the high/low-speed pulse input terminal is wired correctly by referring to Chapter 3 Wiring of Servo System. Meanwhile, check whether the setting of H05-01(Reference pulse selection) is matched. • The position reference is not input. Check whether the DI function FunIN.13: INHIBIT (pulse input forbidden) or FunIN.37: PulseInhibit (pulse reference forbidden) is used. When H05-00 = 0 (pulse reference is the main position reference source), the host computer or other pulse generator does not output pulses. Check whether there are pulses into the high/low-speed pulse input terminal. Please refer to Chapter 3 Wiring of Servo System. When H05-00 = 1 (step reference is the main position reference source), check whether H05-05 (step size) is 0. If not, check whether the DI function FunIN.20: PosStep (DI position step reference) has been allocated and whether the logic of the corresponding terminal is effective. When H05-00 = 2 (multi-position reference is the main position reference source), check whether parameters in group H11 are set correctly. If yes, check whether the DI function FunIN.28: PosInSen (internal multi-position enable) has been allocated and whether the logic of the corresponding terminal is effective. If the interruption fixed length function is used, check whether H05-29 (interruption fixed length unlock) is 1 (enabled). If yes, check whether the DI function FunIN.29: XintFree (interruption fixed length cleared) is used.

During Startup	Fault Phenomenon	Cause	Confirming Method
Input the position reference.	The servo motor rotates in the reverse direction.	The input reference pulse counter (H0B-13) is negative.	• When H05-00 = 0 (pulse reference is the main position reference source), check whether the setting of H05-15 (reference pulse form) is consistent with the actual pulse input. If not, it indicates that H05-15 is set incorrectly or the terminal is wired incorrectly. • When H05-00 = 1 (step reference is the main position reference source), check whether H05-05 (step size) is positive or negative. • When H05-00 = 2 (multi-position reference is the main position reference source), check whether each displacement is positive or negative. • Check whether the DI function FunIN.27: PosDirSel (position reference direction) has been allocated and , whether the logic of the corresponding terminal is effective. • Check whether H02-02 (rotating direction) is set correctly.
	■ After the preceding causes are removed, the servo motor can rotate.		
The servo motor jitters at low speed.	The motor speed is not steady.	The gain is set unreasonably.	• Perform automatic gain adjustment based on section 4.5.2 Automatic Gain Adjustment.
	The motor shaft vibrates left and right.	The load inertia ratio (H08-15) is too large.	• If the servo motor can run safely, perform the inertia auto-tuning based on section 4.5.1 Inertia Auto-tuning. • Perform automatic gain adjustment based on section 4.5.2 Automatic Gain Adjustment.
	■ After the preceding causes are removed, the servo motor can run normally.		
The servo system runs normally.	Positioning inaccurate	The unsatisfactory position deviation is generated.	• Confirm the input reference pulse counter (H0B-13), the feedback pulse counter (H0B-17) and the mechanical stop position. For the confirming steps, see the procedure below.

The procedure of removing the cause of positioning inaccurate is as follows:

The following figure shows the positioning control schematic diagram.

Figure 6-1 Positioning control schematic diagram



When positioning is inaccurate, check the four signals in Figure 6-1.

1. Count value of output position references Pout of the position reference output device (host computer or internal parameters of the drive)
2. The input reference pulse counter Pin received by the servo drive, corresponding to H0B-13
3. The accumulative feedback pulses from the encoder, corresponding to H0B-17
4. Mechanical stop position PL

There are three causes resulting in inaccurate positioning, corresponding to A, B and C in Figure 6-1.

A: The counting of input position reference is incorrect because the cable connecting the position reference output device (host computer) and the servo drive is affected by noise.

B: The input position reference is interrupted during the motor running. This is because, the servo enabled signal (S-ON) is set to OFF, the forward/reverse overtravel 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 the servo motor.

In the prerequisite of no occurrence of position deviation, the following relationships exist.

- Pout = Pin, count value of output position references = Input position reference counter
- Pin x electronic gear ratio = Pf, Input position reference counter x electronic gear ratio = accumulative feedback pulses
- Pf x △L = PL, accumulative feedback pulses x corresponding load displacement of one position reference = mechanical stop position

If inaccurate positioning occurs, perform as follows:

a. Pout ≠ Pin

To remove the cause A, do as follows:

1) Check whether the pulse input terminal (low-speed or high-speed pulse input terminal) is connected with shielded twisted pair (STP) cable.

2) If the open-collector input mode is selected for the low-speed pulse input terminal, change into differential input mode.

3) Connect cable the pulse input terminal separately from main circuits (L1C/L2C, R/ S/ T, U/ V/ W).

4) If the low-speed pulse input terminal is selected, increase the filter time of low-speed pulse input pin (H0A-24). If the high-speed pulse input terminal is selected, increase the filter time of high-speed pulse input pin (H0A-30).

b. Pin x electronic gear ratio ≠ Pf:

To remove the cause B, do as follows:

1) Check whether a fault occurs during running, which results in that the servo drive stops but not all references are executed.

2) If the cause is that the position deviation cleared signal (ClrPosErr) is effective, check whether the position deviation clearing mode (H05-16) is reasonable.

c. Pf x △L ≠ PL:

To remove the cause C, do as follows:

1) Check the mechanical connections and find the sliding position.

6.1.2 Speed Control

During Startup	Fault Phenomenon	Cause	Confirming Method
Connect the control power L1C/ L2C and main power RST.	The LED display is not on or does not display Rdy.	1. The control power voltage is abnormal.	• After disconnecting CN1, CN2, CN3 and CN4, the fault remains. • Measure the AC voltage between L1C and L2C.
		2. The program burning terminal is shorted.	• Check whether the program burning terminal is shorted.
		3. The servo drive is faulty.	-
	The operation panel displays "Er.xxx".	Refer to section 6.2 to eliminate the fault.	
	■ After the preceding causes are removed, the operation panel should display "Rdy".		
Set the servo enabled signal (S-ON) to ON.	The operation panel displays "Er.xxx".	Refer to section 6.2 to eliminate the fault.	
	The shaft of the servo motor is in the free running state.	1. The servo enabled signal is ineffective.	• Switch over the operation panel to the display of servo state and view whether the operation panel displays "Rdy" rather than "Run". • Check whether any parameter in groups H03 and H17 is allocated with the DI function 1 FunIN1: S-ON (servo enabled). If yes, check whether the corresponding DI is set to ON. If not, allocate the function and set the corresponding DI to ON. • If a parameter in group H03 has been allocated with the FunIN1: S-ON function and the corresponding DI is ON, but the operation panel still displays "Rdy". In this case, check whether the DI terminal is connected correctly by referring Chapter 3 Wiring of Servo System.
		2. Control mode selection incorrect	• Check whether H02-00 is 0. If it is set to 2 (torque mode), the motor shaft must be in the free running state because the default torque reference is 0.
	■ After the preceding causes are removed, the operation panel should display "Run".		

During Startup	Fault Phenomenon	Cause	Confirming Method
Input the speed reference.	The servo motor does not rotate or the motor speed is abnormal.	The speed reference (H0B-01) is 0.	• The AI wiring is incorrect. When the speed reference is input through AI, check whether the AI input channel is selected correctly and check whether the AI is wired correctly by referring to Chapter 3 Wiring of Servo System. • The speed reference selection is incorrect. Check whether H06-02 (speed reference selection) is set correctly. • The speed reference is not input or abnormal. When AI is selected to input the speed reference, check whether the AI related parameters in group H03 are set correctly first. Then check whether the input voltage is correct by observing the voltage on oscilloscope or viewing the AI sampling voltage in H0B-21 or H0B-22. When digital setting is used to set the speed reference, check whether H06-03 (keypad setting value of speed reference) 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 (speed reference set via communication) is set correctly. When jog speed reference is used to set the speed reference, check whether H06-04 (jog speed setting value) is set correctly, whether the DI functions FunIN.18: JOGCMD+ (forward jog) and FunIN.19: JOGCMD- (reverse jog) have been allocated and whether the logic of corresponding DIs is effective. Check whether H06-05 (acceleration ramp time constant of speed reference) and H06-06 (deceleration ramp time constant of speed reference) are set correctly. Check whether the DI function FunIN.12: ZCLAMP (zero clamp function) is misallocated and whether the logic of corresponding DI is effective.

During Startup	Fault Phenomenon	Cause	Confirming Method
Input the speed reference.	The servo motor rotates in the reverse direction.	The speed reference (H0B-01) is negative.	• When AI is selected to input the speed reference, check whether the polarity of input signal is reversed. • When digital setting is used to set the speed reference, check whether H06-03 (keypad setting value of speed reference) is smaller than 0. • When multi-speed is used to set the speed reference, check whether the speed references in group H12 are positive or negative. • When communication is used to set the speed reference, check whether H31-09 (speed reference set via communication) is smaller than 0. • When jog speed reference is used to set the speed reference, check the value of H06-04 (jog speed setting value). Then check whether the effective logic of DI functions FunIN.18: JOGCMD+ (forward jog) and FunIN.19: JOGCMD- (reverse jog) matches the predicted rotating direction. • Check whether the DI function FunIN.26: SpdDirSel (speed reference direction) has been allocated and whether the logic of corresponding DI is effective. • Check whether H02-02 is set correctly.
	■ After the preceding causes are removed, the servo motor can rotate.		
The servo motor jitters at low speed.	The motor speed is not steady.	The gain is set unreasonably.	• Perform automatic gain adjustment based on section 4.5.2 Automatic Gain Adjustment.
	The motor shaft vibrates left and right.	The load inertia ratio ((H08-15) is too large.	• If the servo motor can run safely, perform the inertia auto-tuning based on section 4.5.1 Inertia Auto-tuning. • Perform automatic gain adjustment based on section 4.5.2 Automatic Gain Adjustment.

6.1.3 Torque Control

<table>
<tr><th>During Startup</th><th>Fault Phenomenon</th><th>Cause</th><th>Confirming Method</th></tr>
<tr><td rowspan="4">Connect the control power L1C/ L2C and main power RST.</td><td rowspan="3">The LED display is not on or does not display Rdy.</td><td>1. The control power voltage is abnormal.</td><td>• After disconnecting CN1, CN2, CN3 and CN4, the fault remains.
• Measure the AC voltage between L1C and L2C.</td></tr>
<tr><td>2. The program burning terminal is shorted.</td><td>• Check whether the program burning terminal is shorted.</td></tr>
<tr><td>3. The servo drive is faulty.</td><td>-</td></tr>
<tr><td>The operation panel displays "Er.xxx".</td><td colspan="2">Refer to section 6.2 to eliminate the fault.</td></tr>
<tr><td colspan="3">■ After the preceding causes are removed, the operation panel should display "Rdy".</td></tr>
<tr><td rowspan="3">Set the servo enabled signal (S-ON) to ON.</td><td>The operation panel displays "Er.xxx".</td><td colspan="2">Refer to section 6.2 to eliminate the fault.</td></tr>
<tr><td>The shaft of the servo motor is in the free running state.</td><td>The servo enabled signal is ineffective.</td><td>• Switch over the operation panel to the display of servo state and view whether the operation panel displays "Rdy" rather than "Run".
• Check whether any parameter in groups H03 and H17 is allocated with the FunIN1: S-ON (servo enabled). If yes, check that the corresponding DI is set to ON. If not, allocate the function and set the corresponding DI to ON.
• If a parameter in group H03 has been is allocated with the FunIN1: S-ON function and the corresponding DI is ON, but the operation panel still displays "Rdy". In this case, check whether the DI terminal is connected correctly by referring Chapter 3 Wiring of Servo System.</td></tr>
<tr><td colspan="3">■ After the preceding causes are removed, the operation panel should display "Run".</td></tr>
</table>

Input the torque reference	The servo motor does not rotate.	The internal torque reference (H0B-02) is 0.	• The AI wiring is incorrect. When the torque reference is input through AI, check whether the AI is wired correctly by referring to Chapter 3 Wiring of Servo System. • The torque reference selection is incorrect. Check whether H07-02 (torque reference source) is set correctly. • The torque reference is not input When AI is selected to input the torque reference, check whether the AI related parameters in group H03 are set correctly first. Then check whether the input voltage is correct by observing the voltage on oscilloscope or viewing the AI sampling voltage in H0B-21 or H0B-22. When digital setting is used to set toque reference, check whether H07-03 (keypad setting value of torque reference) is 0. When communication is used to set toque reference, check whether H31-11 (torque reference set via communication) is 0.
	The servo motor rotates in the reverse direction.	The internal torque reference (H0B-02) is negative.	• When AI is selected to input the torque reference, check whether the polarity of input signal is reversed. You can confirm the condition by using an oscilloscope or viewing H0B-21 or H0B-22. • When digital setting is used to set the speed reference, check whether H07-03 (keypad setting value of torque reference) is smaller than 0. • When communication is used to set toque reference, check whether H31-11 (torque reference set via communication) smaller than 0. • Check whether the DI function FunIN.25: ToqDirSel (torque reference direction) has been allocated and whether the logic of corresponding DI is effective. • Check whether H02-02 is set correctly.
	■ After the preceding causes are removed, the servo motor can rotate.		
The servo motor jitters at low speed.	The motor speed is not steady.	The gain is set unreasonably.	• Perform automatic gain adjustment based on section 4.5.2 Automatic Gain Adjustment.
	The motor shaft vibrates left and right.	The load inertia ratio (H08-15) is too large.	• If the servo motor can run safely, perform the inertia auto-tuning based on section 4.5.1 Inertia Auto-tuning • Perform automatic gain adjustment based on section 4.5.2 Automatic Gain Adjustment.

6.2 During Running

6.2.1 Fault and Alarm Code List

■ **Fault and Alarm Grading**

The faults and alarms are graded into the following four levels based on the degree of severity:

- No.1 non-resettable fault
- No.1 resettable fault
- No.2 resettable fault
- No.3 resettable alarm

"Resettable" means that the operating panel stops display of the fault/alarm once the reset signal is input. To reset a fault/alarm, set H0D-01 = 1 (fault reset enabled) or set the DI terminal allocated with the function FunIN.2 (ALM-RST) to ON.

- To reset No.1 fault and No.2 fault, cut off the servo enabled signal (set S-ON to OFF) and then set H0D-01 = 1 or set the DI terminal allocated with the function FunIN.2 (ALM-RST) to ON.
- To reset No.3 alarm, set H0D-01 = 1 or set the DI terminal allocated with the function FunIN.2 (ALM-RST) to ON.

Note

- Some faults/alarms can only be reset after the cause is removed by modifying related parameter setting. The parameter modification will not become effective until you re-connect the control power (L1C, L2C) or stop the servo drive. In the scenario where you need to stop the servo drive, set the servo enabled signal (S-ON) to OFF. Once the modification becomes effective, the servo drive can run normally.
- When faults/alarms (Er.610, Er.620, Er.630, Er.650, Er.690, Er.909, Er.922) occur, stop the drive and remove the cause, wait for 30 minutes and then start running the drive again.

▌Related function parameter

Function Code		Parameter Name	Setting Range	Function Description	Property	Effective Time	Default
H0D	01	Fault reset	0: No operation 1: Enabled	When a resettable fault/ alarm occurs, set H0D-01 to 1 to reset it. When resetting is completed, immediately set H0D-01 to 0.	At stop	Immediate	0

▌Related function

No.	Function Symbol	Function Name	Description
FunIN.2	ALM-RST	Fault/Alarm reset signal	When this function is used, the logic of the corresponding terminal is rising/falling edge effective rather than high/low level effective. Ineffective: Not reset fault/alarm Effective: Reset fault/alarm

■ Fault and Alarm Records

The servo drive has the function of recording faults and alarms. It can record the names of the recent ten faults and alarms and the drive state parameters at the occurrence of these faults and alarms. If a fault or an alarm occurs five times recently, the servo drive records the fault/alarm only once.

After the fault/alarm is reset, the servo drive still records the fault/alarm. To clear the fault/alarm record, use the system initialization function (H02-31 = 1 or 2).

You can select the fault/alarm record No. in H0B-33, view the corresponding fault/alarm code in H0B-34 and view related drive state parameters in H0B-35 to H0B-42. For details of these parameters, refer to Chapter 3 Wiring of Servo System. If no fault occurs, the operation panel displays Er.000 in H0B-34.

When you view fault/alarm code in H0B-34, the operation panel displays "Er.xxx", where "xxx" is the fault/alarm code. When you read H0B-34 through the servo debugging platform of Inovance or communication, the decimal data must be converted to hexadecimal data. The following table gives examples of data conversion.

Er.xxx	H0B-34 (Decimal)	H0B-34 (Hex)	Description
Er.101	257	0101	0: No.1 non-resettable fault 101: Fault code
Er.130	8496	2130	2: No.1 resettable fault 130: Fault code
Er.121	24865	6121	6: No.2 resettable fault 121: Fault code
Er.110	57616	E110	E: No.3 resettable alarm 110: Alarm code

■ Fault/Alarm DO Output

The servo drive can output the current highest-level fault/alarm code.

To implement the fault/alarm DO output function, allocate three DO terminals with DO functions FunOUT.12: ALMO1 (3-digit fault code output), FunOUT.13: ALMO2 (3-digit fault code output) and FunOUT.14: ALMO3 (3-digit fault code output). When different faults/alarms occur, the level of the three DOs changes.

ALMO1, ALMO2 and ALMO3 are shorted as AL1, AL2 and AL3, respectively.

a. No.1 non-resettable fault

Display	Fault Name	Fault Type	Resettable	DO Outputs		
				AL3	AL2	AL1
Er.101	Groups H02 and above parameters abnormal	NO.1	No	1	1	1
Er.102	Programmable logic configuration fault	NO.1	No	1	1	1
Er.104	Programmable logic interruption fault	NO.1	No	1	1	1
Er.105	Internal program abnormal	NO.1	No	1	1	1
Er.108	Parameter storage fault	NO.1	No	1	1	1
Er.111	Internal fault	NO.1	No	1	1	1
Er.120	Product model matching fault	NO.1	No	1	1	1
Er.136	Data check error or no parameter stored in the motor ROM	NO.1	No	1	1	1
Er.200	Overcurrent 1	NO.1	No	1	1	0
Er.201	Overcurrent 2	NO.1	No	1	1	0
Er.208	FPGA system sampling operation timeout	NO.1	No	1	1	0
Er.210	Output to-ground short-circuit	NO.1	No	1	1	0
Er.220	Phase sequence incorrect	NO.1	No	1	1	0
Er.234	Runaway	NO.1	No	1	1	0
Er.430	Control power undervoltage	NO.1	No	0	1	1
Er.740	Encoder interference	NO.1	No	1	1	1
Er.834	AD sampling overvoltage	NO.1	No	1	1	1
Er.835	High-accuracy AD sampling fault	NO.1	No	1	1	1
Er.A33	Encoder data abnormal	NO.1	No	0	1	0
Er.A34	Encoder communication check abnormal	NO.1	No	0	1	0
Er.A35	Z signal lost	NO.1	No	0	1	0

Note

1 indicates effective and 0 indicates ineffective. They do not indicate the high/low level of DO terminals.

b. No.1 resettable fault

Display	Fault Name	Fault Type	Resettable	DO Outputs		
				AL3	AL2	AL1
Er.130	Different DIs allocated with the same function	NO.1	Yes	1	1	1
Er.131	Number of DO functions exceeding the limit	NO.1	Yes	1	1	1
Er.207	Shaft D/Q current overflow	NO.1	Yes	1	1	0
Er.400	Main circuit overvoltage	NO.1	Yes	0	1	1
Er.410	Main circuit undervoltage	NO.1	Yes	1	1	0
Er.500	Servo motor overspeed	NO.1	Yes	0	1	0
Er.602	Angle auto-tuning failure	NO.1	Yes	0	0	0

c. No.2 resettable fault

Display	Fault Name	Fault Type	Resettable	DO Outputs		
				AL3	AL2	AL1
Er.121	Invalid servo ON command	NO.2	Yes	1	1	1
Er.300	Internal fault	NO.2	Yes	1	0	0
Er.420	Power cable phase loss	NO.2	Yes	0	1	1
Er.510	Pulse output overspeed	NO.2	Yes	0	0	0
Er.610	Servo drive overload	NO.2	Yes	0	1	0
Er.620	Motor overload	NO.2	Yes	0	0	0
Er.630	Overheat protection of locked-rotor motor	NO.2	Yes	0	0	0
Er.650	Heat sink overheat	NO.2	Yes	0	0	0
Er.B00	Position feedback error too large	NO.2	Yes	1	0	0
Er.B01	Pulse input abnormal	NO.2	Yes	1	0	0
Er.B02	Position feedback error too large in full closed-loop	NO.2	Yes	1	0	0
Er.B03	Electronic gear ratio setting exceeding the limit	NO.2	Yes	1	0	0
Er.D03	CAN communication interrupted	NO.2	Yes	1	0	1

d. No.2 resettable alarm

Display	Alarm Name	Fault Type	Resettable	DO Outputs		
				AL3	AL2	AL1
Er.110	Setting error of frequency-division pulse output	NO.3	Yes	1	1	1
Er.601	Home return timeout	NO.3	Yes	0	0	0
Er.831	AI zero drift too large	NO.3	Yes	1	1	1
Er.900	DI emergency braking	NO.3	Yes	1	1	1
Er.909	Motor overload	NO.3	Yes	1	1	0
Er.920	Regen resistor overload	NO.3	Yes	1	0	1
Er.922	The external regen resistor too small	NO.3	Yes	1	0	1
Er.939	Motor power cable breaking	NO.3	Yes	1	0	0
Er.941	Parameter modification taking effect only after re-power-on	NO.3	Yes	0	1	1
Er.942	Parameter storage too frequent	NO.3	Yes	0	1	1
Er.950	Forward overtravel	NO.3	Yes	0	0	0
Er.952	Reverse overtravel	NO.3	Yes	0	0	0
Er.980	Encoder internal fault	NO.3	Yes	0	0	1
Er.990	Power input phase loss	NO.3	Yes	0	0	1
Er.994	CAN address conflict	NO.3	Yes	0	0	1
Er.A40	Motor auto-tuning failure	NO.3	Yes	0	1	0

6.2.2 Troubleshooting

1. Er.101: Groups H02 and above parameters abnormal

Cause:

- Total number of function codes changes, which generally occurs after software update.
- The actual values of groups H02 and above parameters exceed the limit, which generally occurs after software update.

Cause	Confirming Method	Corrective Action
1. The control power voltage drops instantaneously.	• Check whether it is in the process of cutting off the control power (L1C, L2C) or whether instantaneous power failure occurs.	Restore the default setting (H02-31 = 1), and write the parameters again.
	• Measure whether the control power voltage on the non-drive side is within the following specifications: 220 V drive: Effective value: 220 to 240 V Allowed error: -10% to 10% (198 to 264 V) 380 V drive: Effective value: 380 to 440 V Allowed error: -10% to 10% (342 to 484 V)	Increase the power capacity or replace with large-capacitance power supply, restore the default setting (H02-31 = 1), and write the parameters again.
2. Instantaneous power failure occurs during parameter storage	• Check whether instantaneous power failure occurs during parameter storage.	Re-power on the system, Restore the default setting (H02-31 = 1), and write the parameter again.
3. The times of parameter writing within a certain period exceeds the limit.	• Check whether parameter update is performed frequently from the host controller.	Change the parameter writing method and write parameters again. If the servo drive is faulty, replace it
4. The software is upgraded.	• Check whether the software is upgraded.	Set the servo drive model and motor model again, and restore the default setting (H02-31 = 1).
5.The servo drive is faulty.	• If the servo drive is powered off and powered on gain several times and the default setting is restored, but the fault remains, it indicates that the servo drive is faulty.	Replace the servo drive.

2. Er.102: Programmable logic configuration fault

Cause:

- The FPGA software version and the MCU software version do not match.
- The FPGA or MCU related hardware is damaged, resulting in communication failure between the MCU and FPGA.

Cause	Confirming Method	Corrective Action
1. The FPGA and MCU versions do not match.	• View the MCU software version (H1-00) and the FPGA software version (H1-01) through the operating panel or the drive debugging platform of Inovance. Check whether the non-zero numbers of the most significant bit of the versions are consistent.	Contact Inovance for technical support. Update matching FPGA or MCU software.
2. The FPGA is faulty.	• The fault remains after the drive is powered off and powered on again several times	Replace the servo drive.

3. Er.104: Programmable logic interruption fault

To distinguish fault phenomenon, the servo drive displays different internal fault codes under the same fault code. You can view these internal fault codes in H0B-44.

Cause:

- Access to the MCU or FPGA times out.

Cause	Confirming Method	Corrective Action
1. The FPGA is faulty (Er.104)	The fault remains after the drive is powered off and powered on again several times.	Replace the servo drive.
2. The communication between the FPGA and the MCU is abnormal (Er.100)		
3. The drive internal operation times out (Er.940)		

4. Er.105: Internal program abnormal

Cause:

- Total number of function codes is abnormal at EEPROM reading/writing operation.
- The setting range of function codes is abnormal, which generally occurs after software update.

Cause	Confirming Method	Corrective Action
1. An EEPROM fault occurs.	Check the causes according to the method of Er.101.	Restore the default setting (H02-31 = 1), and power on the servo drive again.
2. The servo drive is faulty.	The fault remains after the drive is powered off and powered on again several times.	Replace the servo drive.

5. Er.108: Parameter storage fault

Cause:

- Parameter values cannot be written to EEPROM.
- Parameter values cannot be read from EEPROM.

Cause	Confirming Method	Corrective Action
1. EEPROM writing is abnormal.	Modify a parameter, power on the servo drive again, and check whether the modification is saved.	If the modification is not saved and the fault remains after the servo drive is powered off and powered on again several times, replace the servo drive.
2. EEPROM reading is abnormal.		

6. Er.120: Product model matching fault

Cause:

- The rated motor current is larger than the rated current of the servo drive.

Cause	Confirming Method	Corrective Action
1. The product (motor or servo drive) SN does not exist.	• View the servo drive and motor nameplates and check that the equipment you are using is the IS620P series servo drive and 20-bit servo motor (-U2***) of Inovance. Meanwhile, check whether H00-00 (Motor SN) is 14000.	The motor SN does not exist. If you use the IS620P series servo drive and 20-bit servo motor (-U2***) of Inovance, ensure that H00-00 = 14000.
	• View the servo drive SN (H01-02) and check whether the servo drive SN exists by referring to section 2.3.	The servo drive SN does not exist. Please set the servo drive SN correctly by referring to section 2.3.
2. The power classes of products such as motor and servo drive do not match.	• Check whether the servo drive SN (H01-02) and the bus motor SN (H00-05) match by referring to section 2.3.	Replace the unmatched product by referring to section 2.3.

7. Er.121: Invalid servo ON command

Cause:

- When some auxiliary functions are used, the redundant servo enabled signal is given.

Cause	Confirming Method	Corrective Action
1. When the servo drive is internally enabled, the external S-ON signal is active.	• Check whether auxiliary functions (H0D-02, H0D-03, H0D-12) are used and whether the external DI with the function FunIN.1: S-ON (servo enabledl) is ON.	Set the external DI and virtual DI with the function FunIN.1: S-ON (servo enabled) to OFF.

8. Er.130: Different DIs allocated with the same function

Cause:

- The same function is allocated to different DIs, including external DIs and virtual DIs.
- The DI function No. exceeds the number of DI functions.

Cause	Confirming Method	Corrective Action
1. The same function is allocated to different DIs.	• Check whether parameters in groups H03 (H03-02 to H03-20) and H17 (H17-00 to H17-30) are allocated with the same non-zero DI function.	Re-allocate the parameters that have been allocated with the same non-zero DI function with different DI functions. Then re-connect the control power to make the modification take effect. Or set the servo enabled signal OFF and give the reset signal to make the modification take effect.
2. The DI function No. exceeds the number of DI functions.	• Check whether the MCU program is updated.	Restore the default setting (H02-31 = 1), and power on the servo drive again.

9. Er.131: Number of DO functions exceeding the limit

Cause:

- The DO function No. exceeds the number of DO functions.

Cause	Confirming Method	Corrective Action
1. The DO function No. exceeds the number of DO functions.	• Check whether the MCU program is updated.	Restore the default setting (H02-31 = 1), and power on the servo drive again.

10. Er.136: Data check error or no parameter stored in the motor ROM

Cause:

- When the servo drive reads parameters from the encoder ROM, it finds that no parameters are saved there or the parameter value is inconsistent with the agreed value.

Cause	Confirming Method	Corrective Action
1. The servo drive model and the motor model do not match.	• View the servo drive and motor nameplates and check that the equipment you are using is the IS620P series servo drive and 20-bit servo motor (-U2***) of Inovance.	Replace the unmatched servo drive or motor. If you use the IS620P series servo drive and 20-bit servo motor of Inovance, ensure that H00-00 = 14000.
2. A parameter check error occurs or no parameter is stored in the serial encoder ROM memory.	• Check whether the cable you use is standard configuration of Inovance. For the cable specification, refer to Chapter 3 Wiring of Servo System. The cable must not scratch, break or be in poor contact. The cable must be connected reliably. • Measure the signals PS+, PS-, +5V and GND at both ends of the encoder cable and observe whether the signals at both ends are consistent. For definition of signals, see Chapter 3 Wiring of Servo System.	• Ensure that you use the encoder cable configured by Inovance as standard. • Ensure that the cable is connected to the motor securely and tighten the screw on the drive side. If necessary, use a new encoder cable. • Never bundle the encoder cable and power cables (R/S /T, UVW). Connect them separately.
3. The servo drive is faulty.	• The fault remains after the servo drive is powered on again.	Replace the servo drive.

11. Er.200: Overcurrent 1

Cause:

- Any phase feedback current is larger than the overcurrent level of the servo drive.

12. Er.201: Overcurrent 2

Cause:

- The servo drive detects overcurrent on hardware.

Cause	Confirming Method	Corrective Action
1. The reference is input and the servo drive is started simultaneously. Or the reference is input too early.	• Check whether the reference is input before the operation panel displays "Rdy".	• Normally, after the operation panel displays "Rdy", set the servo enabled signal (S-ON) to ON and then input the reference. • If allowed, add the reference filter time constant or increase the acceleration/deceleration time.
2. The regen resistor is too small or short circuited.	• If internal regen resistor is used (H02-25 = 0), check whether P⊕ and D are connected with a cable reliably. If yes, measure the resistance between C and D. • If external regen resistor is used (H02-25 = 1/2), measure the resistance between P⊕ and C. • For the regen resistor specification, refer to section 1.4 Regen Resistor Specifications..	• If internal regen resistor is used and the resistance is 0, use external regen resistor (H02-25 = 1/2) and remove the cable between P⊕ and D. • Select the external regen resistor of the same resistance and power as internal regen resistor. • If external regen resistor is used and the resistance is smaller than H02-21 (allowed minimum value of regen resistor), connect a new regen resistor between P⊕ and C by referring the regen resistor specification in section 1.4. • Make H02-26 (power of external regen resistor) and H02-27 (resistance of external regen resistor) consistent with the used external regen resistor specification.
3. The motor cables are in poor contact.	• Check whether the power cables of the servo drive and the motor UVW cables are loose.	Fasten the cables that become loose or are disconnected.
4. The motor cables are grounded.	• After ensure the power cables of the servo drive and the motor cables are connected securely, measure the insulation resistance between the UVW of the servo drive and the ground cable (PE) and check whether the insulation resistance is MΩ-level.	Replace the motor if the insulation is poor.

Cause	Confirming Method	Corrective Action
5. The motor UVW cables are short circuited.	• Disconnect the motor cables and check whether the motor UVW cables are short circuited and whether glitch occurs.	Connect the motor cables correctly.
6.The motor is damaged.	• Disconnect the motor cables and measure whether resistance between the motor cables UVW is balanced.	Replace the motor if the resistance is unbalanced.
7. The gain setting is improper and the motor oscillates.	• Check whether the motor oscillates or generates a shrill noise during motor startup and running. You can view the current feedback by using the drive debugging platform of Inovance.	Adjust the gain by referring to chapter 4.
8. The encoder cable is incorrectly wired, corrosive, or connected loosely.	• Check whether the cable you use is standard configuration of Inovance and whether the cable is aging, corrosive or is connected loosely. • Set the servo enabled signal to OFF and rotate the motor shaft manually. Check whether H0B-10 (rotation angle) changes as the motor rotates.	Re-weld, fasten or replace the encoder cable.
9. The servo drive is faulty.	• The fault remains after the motor cables are disconnected and the servo drive is powered on again.	Replace the servo drive.

13. Er.207: Shaft D/Q current overflow

Cause:

- Abnormal current feedback results in overflow of the internal register of the servo drive.
- Abnormal encoder feedback results in overflow of the internal register of the servo drive.

Cause	Confirming Method	Corrective Action
1. Shaft D/Q current overflow	• If the fault remains after the drive is powered off and powered on again several times, the servo drive is faulty.	Replace the servo drive.

14. Er.208: FPGA system sampling operation timeout

Cause:

- The current sampling chip or related parameter is abnormal.
- The communication of the encoder times out.

Cause	Confirming Method	Corrective Action
1. The FPGA system sampling operation times out	• If the fault remains after the drive is powered off and powered on again several times, the servo drive is faulty.	Replace the servo drive.
2. The communication of the encoder times out.	• Contact Inovance for technical support.	Contact Inovance for technical support.

15. Er.210: Output-to-ground short-circuit

Cause:

- The drive detects motor phase current or bus voltage abnormal during self-check at power-on.

Cause	Confirming Method	Corrective Action
1. The power output cables (UVW) of the servo drive are short-circuited to ground.	• Disconnect the UVW cables from the motor, and measure whether the motor UVW cables are short-circuited to ground.	Connect the cables again or replace them.
2. The motor is short-circuited to ground.	• Measure the insulation resistance between the UVW of the servo drive and the ground cable (PE) and check whether the insulation resistance is MΩ-level.	Replace the motor.
3. The servo drive is faulty.	• Remove the power cables from the servo drive. The fault remains after the drive is powered off and powered on again several times.	Replace the servo drive.

16. Er.220: Internal fault

17. Er.234: Runaway

Cause:

- The torque reference direction is reversed to the speed feedback direction in the torque control mode.
- The speed feedback is reversed to the speed reference direction in the position or speed control mode.

Cause	Confirming Method	Corrective Action
1. The UVW phase sequence is incorrect.	• Check whether the UVW phase sequence on the servo drive side is consistent with that on the motor side.	Connect the UVW cables according to the correct phase sequence.
2. The motor rotor initial phase detection is incorrect due to interference at power-on.	• The UVW phase sequence is correct. But Er.234 is reported once the servo drive is enabled.	Re-power on the servo system.
3. The encoder type is set incorrectly or the wiring is incorrect.	• Check that the equipments you are using are the IS620P series servo drive and 20-bit servo motor (-U2***) of Inovance based on the nameplate of the servo drive and motor.	Replace the unmatched servo drive or motor. If you use the IS620P series servo drive and 20-bit servo motor (-U2***) of Inovance, ensure that H00-00 = 14000. Re-confirm the motor model, encoder type and encoder wiring.
The cable wiring is incorrect. The cable is aging, corrosive or is connected loosely.	• Check whether the cable you use is standard configuration of Inovance and whether the cable is aged, corroded or loose. • Set the servo enabled signal to OFF and rotate the motor shaft manually. Check whether H0B-10 (rotation angle) changes as the motor rotates.	Re-weld, fasten or replace the encoder cable.
5. On the working condition of controlling a vertical shaft, the gravity load is too large.	• Check whether the load of the vertical shaft is too large. Adjust the braking parameters H02-09 to H02-12 and then see whether the fault is eliminated.	Reduce the load of the vertical shaft, improve the rigidity or shield this fault in the prerequisite of not affecting the safety and use.

Note

On the working condition of controlling a vertical shaft or one motor dragging the other, set H0A-12 = 0 to shield the runaway fault.

18. Er.400: Main circuit overvoltage

Cause:

The DC bus voltage between $P_{\oplus}$ and $\ominus$ exceeds the overvoltage level.

- 220 V drive: normal value: 310 V, overvoltage level: 420 V
- 380 V drive: normal level: 540 V, overvoltage level: 760 V

Cause	Confirming Method	Corrective Action
1.The main circuit input voltage is too high	• Check the power input specification of the drive. Measure the RST input voltage on the servo drive side and check whether the input voltage complies with the following specification. 220 V drive: Effective value: 220 to 240 V Allowed error: -10% to 10% (198 to 264 V) 380 V drive: Effective value: 380 to 440 V Allowed error: -10% to 10% (342 to 484 V)	Replace the power supply or adjust the power voltage according to the specification on the left.
2. The power supply is instable or affected by the lightning strike.	• Check whether the power supply is instable, affected by the lightning strike or satisfies the preceding specification.	Connect a surge suppressor and then connect the power supply. If the fault remains, replace the servo drive.
3. The regen resistor fails.	• If internal regen resistor is used (H02-25 = 0), check whether P⊕ and D are connected with a cable reliably. If yes, measure the resistance between C and D. • If external regen resistor is used (H02-25 = 1/2), measure the resistance between P⊕ and C. • For the regen resistor specification, refer to section 1.4 Regen Resistor Specifications.	• If the resistance is ∞, wire breaking occurs. • If internal regen resistor is used and the resistance is 0, use external regen resistor (H02-25 = 1/2) and remove the cable between P⊕ and D. Select external regen resistor of the same resistance and power as internal regen resistor. • If external regen resistor is used, connect a new regen resistor between P⊕ and C. • Make H02-26(Power of external regen resistor) and H02-27 (Resistance of external regen resistor) consistent with the used external regen resistor specification.

Cause	Confirming Method	Corrective Action
4. The resistance of the regen resistor is too large, and the energy absorption during braking is insufficient.	• Measure the resistance of the external regen resistor between P⊕ and C. Compare the measured value with the recommended value.	• Connect a new external regen resistor of the recommended resistance between P⊕ and C. • Make H02-26(Power of external regen resistor) and H02-27 (Resistance of external regen resistor) consistent with the used external regen resistor specification.
5. The motor is in abrupt acceleration/deceleration state. The maximum braking energy exceeds the energy absorption.	• Confirm the acceleration/ deceleration time during running and measure the DC bus voltage between $P_{\oplus}$ and ⊖. Check whether the voltage exceeds the fault level during deceleration.	First, ensure that the input voltage of the main circuit is within the specification. Then increase/decrease the acceleration/deceleration time in the allowed range.
6. The bus voltage sampling value has a large deviation from the actually measured value	• Check whether H0B-26 (bus voltage) is within the following specification: 220 V drive: H0B-26 > 420 V 380V drive: H0B-26 > 760 V Measure the DC bus voltage between $P_{\oplus}$ and ⊖. Check whether the DC bus voltage is normal and smaller than H0B-26.	Contact Inovance for technical support
7.The servo drive is faulty.	• The fault remains after the main circuit is powered off and re-powered on several times.	Replace the servo drive.

19. Er.410: Main circuit undervoltage

Cause:

The DC bus voltage between $P_{\oplus}$ and $\ominus$ is below the undervoltage level.

- 220 V drive: normal value: 310 V, overvoltage level: 200 V
- 380 V drive: normal level: 540 V, overvoltage level: 380 V

Cause	Confirming Method	Corrective Action
1. The main power is unstable or fails.	• Check the input power specification of the drive. Measure each phase of the RST input voltage on the servo drive side and check whether the input voltage complies with the following specification. 220 V drive: Effective value: 220 to 240 V Allowed error: -10% to 10% (198 to 264 V) 380 V drive: Effective value: 380 to 440 V Allowed error: -10% to 10% (342 to 484 V) All the three phases must be measured.	Increase the power capacity.
2. Instantaneous power down occurs		
3. Voltage dip occurs during running.	• Check the power input voltage and check whether the same main power is applied to other devices, resulting insufficient power capacity and voltage dip.	
4. Phase loss exists: Single-phase power is supplied to the three-phase servo drive.	• Check whether the main circuit RST wiring is reliable and whether the phase loss fault detection (H0A-00) is shielded.	Replace the cables and connect the main circuit correctly. Three phases: R, S, T Single phase: L1, L2
5.The servo drive is faulty.	• Check whether H0B-26 (bus voltage) is within the following specification: 220 V drive: H0B-26 < 200 V 380 V drive: H0B-26 < 380 V The fault remains after the main circuit RST is powered off and re-powered on several times.	Replace the servo drive.

20. Er.420: Power cable phase loss

Cause:

- One phase or two phases get lost on the three-phase servo drive.

<table>
<tr><th>Cause</th><th>Confirming Method</th><th>Corrective Action</th></tr>
<tr><td>1. The RST cables are not connected well.</td><td>• Check whether the RST cables on the servo drive side and the non-servo drive side are in good condition and connected securely.</td><td>Replace the cables and connect the main circuit correctly.</td></tr>
<tr><td>2. The single-phase power is supplied to the three-phase servo drive.</td><td rowspan="2">• Confirm the power input specification and the actual input voltage. Check whether the input voltage of each phase of the main circuit satisfies the following specification:
220 V drive:
Effective value: 220 to 240 V
Allowed error: -10% to 10% (198 to 264 V)
380 V drive:
Effective value: 380 to 440 V
Allowed error: -10% to 10% (342 to 484 V)</td><td rowspan="2">• For the servo drive of 0.75 kW (H01-02 = 5), it can be applied by single-phase power supply.
• If the input voltage satisfies the left specification, you can set H0A-00 = 2 (Forbid faults and alarms)
• If the input voltage does not satisfy the left specification, replace the power supply or adjust power capacity.</td></tr>
<tr><td>3. The three-phase power supply is unbalanced or the voltage is too low.</td></tr>
<tr><td>4. The servo drive is faulty.</td><td>• The fault remains after the main circuit is powered off and re-powered on several times.</td><td>Replace the servo drive.</td></tr>
</table>

21. Er.430: Control power undervoltage

Cause:

- 220 V drive: normal value: 310 V, overvoltage level: 200 V
- 380 V drive: normal level: 540 V, overvoltage level: 380 V

Cause	Confirming Method	Corrective Action
1. The control power is unstable or fails.	• Check whether the servo drive is in the process of cutting off the control power (L1C, L2C) or instantaneous power failure occurs.	Re-power on the servo drive. If the fault is abnormal power failure, keep power supply stable.
	• Check whether the input voltage of control cables satisfies the following specification: 220 V drive: Effective value: 220 to 240 V Allowed error: -10% to 10% (198 to 264 V) 380 V drive: Effective value: 380 to 440 V Allowed error: -10% to 10% (342 to 484 V)	Increase the power capacity.
2. The control power cables are in poor contact.	• Check whether the control cables are well connected and whether the voltage of the control cables satisfies the preceding specification.	Re-connect it or replace the control cables.

22. Er.500: Servo motor overspeed

Cause:

- The actual speed of the servo motor exceeds the overspeed level.

Cause	Confirming Method	Corrective Action
1.The UVW phase sequence is incorrect.	• Check whether the UVW phase sequence on the servo drive side is consistent with that on the motor side.	Connect the UVW cables according to the correct phase sequence.
2. The setting of H0A-08 is incorrect.	• Check whether the overspeed level is smaller the actual maximum motor speed. Overspeed level = 1.2 times of maximum motor speed (H0A-08 = 0) Overspeed level = H0A-08 (H0A-08 ≠ 0, and H0A-08 < 1.2 times of maximum motor speed)	Reset the overspeed level according to actual mechanical requirement.

Cause	Confirming Method	Corrective Action
3 Input reference is higher than the overspeed level.	• Check whether the motor speed corresponding to the input reference exceeds the overspeed level. When the reference source is pulse reference in the position control mode: Motor speed (rpm) = $\frac{\text{Input pulse frequency (Hz)}}{\text{Encoder resolution}} \times \text{Electronic gear ratio} \times 60$ For the IS620P servo drive, the encoder resolution = 1048576 (P/r) For the IS600P servo drive, the encoder resolution = 10000 (P/r)	• In the position control mode: When the reference source is pulse reference, reduce the pulse reference frequency in the prerequisite of ensuring accurate positioning or decrease the electronic gear ration if the motor speed allows. • In the speed control mode: View the speed reference and speed limit (H06-06 to H06-09) and confirm that they are within the overpseed level. • In the torque control mode: Set the speed limit within the overspeed level. For the speed limit in the torque control mode, see the details on page 95.
4.The motor speed overshoots.	• Check whether the speed feedback exceeds the overspeed level through the drive debugging platform of Inovance.	Adjust the gain or adjust the mechanical condition by referring to chapter 4.
5.The servo drive is faulty.	• The fault remains after the servo drive is re-powered on.	Replace the servo drive.

23. Er.510: Pulse output overspeed

Cause:

- When the pulse output function is used (H05-38 = 0 or 1), the output pulse frequency exceeds the frequency upper limit allowed by the hardware (2 MHz).

Cause	Confirming Method	Corrective Action
The output pulse frequency exceeds the frequency upper limit allowed by the hardware (2 MHz).	• When H05-38 = 0 (encoder frequency-division output), calculate the corresponding frequency-division pulse frequency exceeds the limit. Output pulse frequency (Hz) = $\frac{\text{Motor speed (rpm)}}{60} \times \text{H05-17}$	Decrease H05-17(encoder frequency-division pulses), making the output pulse frequency below the frequency upper limit allowed by the hardware in the speed range required by the mechanical condition.
	• H05-38 = 1 (reference pulse synchronous output), the input pulse frequency exceeds 2 MHz or interference exists on the pulse input pin. Low-speed pulse input pin: Differential input terminals: PULSE+, PULSE-, SIGN+, SIGN- Max. pulse frequency: 500 kpps Open-collector input terminals: PULLHI, PULSE+, PULSE-, SIGN+ and SIGN- Max. pulse frequency: 200 kpps. High-speed pulse input pin: Differential input terminals: HPULSE+, HPULSE-, HSIGN+, HSIGN- Max. pulse frequency: 4 Mpps.	Decrease the input pulse frequency to within the frequency upper limit allowed by the hardware. ■ Note: In this case, if you do not modify the electronic gear ratio, the motor speed will slow down. If the input pulse frequency is very 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 the pin filter parameters H0A-24 or H0A-30), which prevents interference pulse adding to the pulse reference and resulting in fault misreported.

24. Er.602: Internal fault

25. Er.610: Servo drive overload

Cause:

- The heat accumulation of the servo drive reaches the fault level.

26. Er.620: Motor overload

Cause:

- The heat accumulation of the servo drive reaches the fault level.

Cause	Confirming Method	Corrective Action
1. Wiring of the motor and encoder is incorrect or poor.	• Check wirings between the servo drive, servo motor and encoder according to correct wiring diagram.	• Check wiring based on correct wiring diagram. • Prefer to use the cable configured by Inovance as standard. • When the self-made cable is used, make and connect the cable according to the hardware wiring guidance.
2. The load is too heavy. The motor keeps output of effective torque higher than the rated torque for a long time.	• Confirm the overload characteristic of the servo drive or servo motor. • Check whether the average load rate (H0B-12) is greater than 100.0% for long time.	• Replace with a large servo drive and matching servo motor. • Reduce the load and increase acceleration/ deceleration time.
3. The acceleration/ deceleration is too frequent or the load inertia is too large.	• Calculate the load inertia ratio or perform the load inertia ratio auto-tuning. Then view H08-15 (load inertia ratio). • Conform the single running cycle when the servo motor runs in circular.	Increase acceleration/ deceleration time during single running.
4. The gain is improper, causing too high rigidity.	• Observe whether the motor vibrates and generates noise during running.	Adjust the gain by referring to chapter 4.
5. The servo drive or motor model is set incorrectly.	• For IS620P series products, view the bus motor model in H00-05 and the servo drive model in H01-02. • For the IS600P series product, view the servo motor model in H00-00 and the servo drive model in H01-02.	View the servo drive nameplate and set the servo drive model (H01-02) correctly and replace with matching servo motor according to section 1.2 Servo System Configuration.

Cause	Confirming Method	Corrective Action
6. Locked-rotor occurs due to mechanical factors, resulting in very heavy load during running.	• Check the running reference and the actual motor speed (H0B-00) by using the drive debugging platform of Inovance or the operation panel. Running reference in the position control mode: H0B-13 (input reference pulse counter) Running reference in the speed control mode: H0B-01 (speed reference) Running reference in the torque control mode: H0B-02 (internal torque reference) Check the running reference in corresponding mode is not 0 but the motor speed is 0.	Eliminate mechanical factors.
7. The servo drive is faulty.	• The fault remains after the servo drive is powered off and then powered on again.	Replace the servo drive.

Note

You can clear the fault or re-power on the system 30s after occurrence of the overload fault.

27. Er.630: Overheat protection of locked-rotor motor

Cause:

- The actual motor speed is lower than 10 rpm but the torque reference reaches the limit. The duration reaches the value set in H0A-32.

Cause	Confirming Method	Corrective Action
1. The power output phase (UVW) loss or incorrect phase sequence occurs on the servo drive.	• Perform motor trial running when the motor has no load and check the motor wiring.	Connect the motor cables correctly again or replace them.
2. The UVW cables or the encoder cable breaks.	• Check the wiring.	Connect the motor cables and encoder cable correctly again or replace them.
3. The motor rotor is locked due to mechanical factors.	• Check the running reference and the actual motor speed (H0b-00) by using the drive debugging platform of Inovance or the operation panel. Running reference in the position control mode: H0B-13 (input reference pulse counter) Running reference in the speed control mode: H0B-01 (speed reference) Running reference in the torque control mode: H0B-02 (internal torque reference) Check whether the running reference in corresponding mode is not 0 but the motor speed is 0.	Eliminate mechanical factors.

28. Er.650: Heatsink overheat

Cause:

- The power module of the servo drive is higher than the overtemperature protection level.

Cause	Confirming Method	Corrective Action
1. The ambient temperature is too high.	• Measure the ambient temperature.	Improve the cooling conditions to reduce the ambient temperature.
2. The servo drive is powered off and powered on several times to reset the overload fault.	• View the fault records. Set H0B-33 and view H0B-34, and check whether the overload fault (Er.610, Er.620, Er.630, Er.650, Er.909, Er.920, Er.922) occurs.	Change the fault reset method. After the overload occurs, wait 30s and then perform the reset operation. Increase the capacity of the servo drive and motor, increase the acceleration/deceleration time, and reduce the load.
3. The fan is damaged.	• Observe whether the fan works during running.	Replace the servo drive.
4. The installation direction and clearance of the servo drive are improper.	• Check whether the installation of the servo drive is proper.	Install the servo drive according to the mounting requirements.
5. The servo drive is faulty.	• Power off the servo drive, restart it after 5 minutes. The fault still remains.	Replace the servo drive.

29. Er.740: Encoder interference

Cause:

- The Z signal of the encoder suffers interference, resulting in too large change of corresponding electrical angle of the Z signal.

Cause	Confirming Method	Possible Solution
1. The encoder wiring is incorrect.	• Check the encoder wiring.	Connect the encoder cable correctly.
2. The encoder cable becomes loose.	• Check whether the on-site vibration is too large, which loosens the encoder cable and even damages the encoder.	Re-connect the encoder cable securely.

Cause	Confirming Method	Possible Solution
3. The Z signal of the encoder suffers interference	• Check the on-site wiring condition: Check whether there is large-sized equipment generating interference around the servo system or whether there are several variable-frequency power devices inside the cabinet. • Make the servo drive in the "Rdy" state and rotate the motor shaft counterclockwise (CCW) manually and observer whether H0B-10 (rotation angle/electrical angle) increases/ decreases smoothly. For the Z series motor, turning one circle corresponds to five 0-360°. For the X series motor, turning one circle corresponds to four 0-360°. If H0B-10 changes abnormally during rotation, it indicates that a fault occurs on the encoder. If no fault is reported during rotation but the fault is report during servo running, it is extremely possible that interference exists.	• Prefer to use the cable configured by Inovance as standard. • If non-standard cable is used, check whether the cable meets the requirements and is STP cable. • Separate the power cables and control cables. Never bundle the motor cables and encoder cables together. The grounding terminal of the servo drive and motor must be in good contact. • Check the encoder connector at both ends is in good contact and whether any pin retracts.
4. The encoder is faulty.	• Replace it with a normal encoder cable. If the fault no longer occurs after replacement, it indicates that the original encoder is damaged. • Place the motor on the same position, power on the system several times and observe the change of H0B-10. The electrical angle must be within ±30°.	• Replace with a normal encoder cable. • If not, it indicates that the encoder is damaged. You need to replace the servo motor.

30. Er.834: AD sampling overvoltage

Cause:

- The AI sampling value is greater than 11.5 V.

Cause	Confirming Method	Corrective Action
1. The AI voltage is too high.	Measure the voltage input through AI and check whether the AI sampling voltage (H0B-21 or H0B-22) is greater than 11.5 V.	Adjust the AI input voltage and view the AI sampling voltage until the AI sampling voltage does not exceed 11.5 V.
2. The AI wiring is incorrect or interference exists.	Check the AI wiring according to the correct wiring diagram.	Re-wire the AI with a STP cable and shorten the cable length. Increase the AI filter time constant: AI1 filter time constant: H03-51 AI2 filter time constant: H03-56

31. Er.835: High-accuracy AD sampling fault

Cause:

- High-accuracy AD circuit suffers interference.

Cause	Confirming Method	Corrective Action
1. Interference exists on the high-accuracy AI.	Check the AI wiring according to the correct wiring diagram.	Re-wire the AI with a STP cable and shorten the cable length.

32. Er.A33: Encoder data abnormal

Cause:

- The encoder internal parameters are abnormal.

Cause	Confirming Method	Corrective Action
1. The serial encoder cable breaks or becomes loose.	Check the serial encoder wiring.	Check connection of the encoder cable to see whether incorrect connection, wire breaking, or poor contact exists. If the motor cables and the encoder cable are bundled together, separate them.
2. Serial encoder parameters read-write abnormal	If the fault remains after the servo system is powered off and re-powered on several times, it indicates that the encoder is faulty.	Replace the servo motor.

33. Er.A34: Encoder communication check abnormal

Cause:

- After power-on, read the initial phase information of the rotor of the 2500-PPR incremental encoder error

Cause	Confirming Method	Corrective Action
1. The servo drive and the servo motor are not matching.	• Check that the equipments you are using are the IS620P series servo drive and 20-bit servo motor (-U2***) of Inovance. Meanwhile, check whether H00-00 (motor SN) is 14000.	Replace the unmatched servo drive or motor.
2. The encoder cable breaks.	• Check whether the encoder cable breaks and whether connection of the servo drive and connection of the servo motor are secure.	Replace with a normal encoder cable and secure the cable connections.

34. Er.A35: Z signal lost

Cause:

- The Z signal of the 2500-PPR incremental encoder gets lost or the edge of A, B signals changes simultaneously.

Cause	Confirming Method	Corrective Action
1. The Z signal gets lost because of faulty encoder.	• Use a normal encoder cable and connect it. Then rotate the motor shaft manually and check whether the fault remains.	Replace the servo motor.
2. Poor contact or incorrect connection results in Z signal lost.	• Rotate the motor shaft manually and check whether the fault remains.	Connect the encoder cable correctly or replace the cable.

35. Er.B00: Position feedback error too large

Cause:

- The position feedback error is greater than the setting value of H0A-10 in the position control mode.

Cause	Confirming Method	Corrective Action
1. The servo motor cables break or are connected incorrectly.	• Check whether the phase sequence on the servo drive side is consistent with that on the motor side. • Check whether the UVW cables are in good contact.	Re-connect the servo motor cables. Keep the phase sequence on the servo drive side consistent with that on the motor side.
2. The gain of the servo drive is too low.	• Check the servo drive position loop gain and speed loop gain. First speed loop gain: H08-00 to H08-02 Second speed loop gain: H08-03 to H08-05	Adjust the gain manually or perform automatic gain adjustment according to section 4.5.2.
3. The input pulse frequency is very high.	• Check whether the input pulse frequency is too high if the position reference source is pulse reference. • The acceleration/deceleration time is 0 or too small.	• Reduce the position reference frequency or decrease the electronic gear ration • When host computer is used to output position pulses, set acceleration/ deceleration time in the host computer. • If the host computer is not allowed to set acceleration/ deceleration time, increase parameters H05-04 and H05-06 to smoothen position reference.
4. Relative to the running condition, the position feedback error is too large but H0A-10 (Threshold of position deviation fault) is too small.	• Check whether H0A-10 is set too small.	Increase the value of H0A-10.
5. The servo drive/motor is faulty.	• Monitor the running curve on the drive debugging platform of Inovance: Position reference, position feedback, speed reference, torque reference	If the position reference is not 0, but the position feedback is always 0, replace the servo drive/motor.

36. Er.B01: Pulse input abnormal

Cause:

- The input pulse frequency is greater than H0A-09 (Maximum position pulse frequency).

Cause	Confirming Method	Corrective Action
1. The input pulse frequency is greater than H0A-09 (Maximum position pulse frequency).	• Check whether H0A-09 is smaller than maximum input pulse frequency required by normal machine running.	Reset H0A-09 correctly according to the actual requirement.
2. The input pulse suffers interference.	• Check whether the position reference increases abruptly or whether H0B-13 (input reference pulse counter) is larger than the number of pulses output by the host computer through the oscilloscope function of the drive debugging platform of Inovance. • Then check the grounding situation of the connecting cables.	1. First, use an STP cable for pulse input and separate the pulse input cable from the servo drive power cables. 2. Then, when differential input is selected on the condition of using low-speed pulse input terminal (H05-01 = 0), the ground of the host computer must be connected to GND of the servo drive reliably. If open-collector input is selected, the ground of the host computer must be connected to COM of the servo drive reliably. Only differential input can be selected on the condition of using high-speed pulse input terminal (H05-01 = 1), the ground of the host computer must be connected to GND of the servo drive reliably. 3. Finally, according to the selected hardware input terminal, increase the pin filter time of the pulse input terminal through H0A-24 or H0A-30.

37. Er.B03: Electronic gear ratio setting exceeding the limit

Cause:

- Any electronic gear ratio exceeds the limit: 0.001 x encoder resolution/10000, 4000 x encoder resolution/10000.

Cause	Confirming Method	Corrective Action
1.The electronic gear ratio setting exceeds the preceding limit.	• If H05-02 = 0, check the ratios of H05-07/H05-09 and H05-11/H05-13 • If H05-02 > 0, check the ratios of encoder resolution/H05-02, H05-07/H05-09 and H05-11/H05-13.	The ratios of encoder resolution /H05-02, H05-07/H05-09, and H05-11/H05-13 must be within the preceding limit.
2. The parameter modifying sequence is unreasonable.	• When modifying the electronic gear ration related parameters H05-02, H05-07/H05-09, and H05-11/H05-13, the modifying sequence unreasonable, which resulting in electronic gear ratio exceeding the limit during calculation of the electronic gear ratio.	Adjust the gain manually or perform automatic gain adjustment according to section 4.5.2.

38. Er.D03: CAN communication interrupted

Cause:

- CAN communication times out.

Cause	Confirming Method	Corrective Action
1. CAN communication interrupted: The slave station becomes offline.	• Check the CAN communication card indicator state of the master PLC. The ERR indicator of the master PLC flashes at the frequency of 1 Hz and the ERR indicator of some slave PLCs keeps ON for long time. (When using the PLC background software, you can monitor D78xx in the component monitoring table of the master. xx indicates the station No. in decimal. If the corresponding D78xx of some configured stations is 5, it indicates that a fault occurs on the slave PLC.)	Check the communication cable connection between the slaves with ERR indicator ON for long time and the master. Check the communication baud rate (H0C-08) of the slaves with ERR indicator ON for long time and adjust the baud rate the same as that of the master.
2. CAN communication interrupted: The master station becomes offline.	• Check the CAN communication card indicator state of the master PLC. • The ERR indicator of all slave PLCs keeps ON for long time. • (When using the PLC background software, you can monitor D78xx in the component monitoring table of the master. xx indicates the station No. in decimal. If the corresponding D78xx of all configured stations is 5, it indicates that a fault occurs on the master PLC.)	Check the cable connection of the master PLC.

6.2.3 Troubleshooting of Alarms

1. Er.110: Setting error of frequency-division pulse output

Cause:

- When using the frequency-division output function of the encoder (H05-38 = 0), the set number of frequency-division pulses of the encoder does not conform to the threshold decided by the encoder specification.

Cause	Confirming Method	Corrective Action
The number of frequency-division pulses of the encoder does not conform to the specification.	• For the incremental encoder, the number of frequency-division pulses cannot exceed the encoder resolution. The resolution of the 20-bit serial incremental encoder is 1048576 P/r. The resolution of the 2500-PPR incremental encoder is 10000 P/r. • For the absolute encoder, the number of frequency-division pulses cannot exceed one fourth of the encoder resolution.	Reset H05-17 (encoder frequency-division pulses) according to the specification.

2. Er.601: Home return timeout

Cause:

- When using the home return function (H05-30 = 1 to 5), the home is not found within the time set in H05-35.

Cause	Confirming Method	Corrective Action
1. The home switch fails.	• There is only high-speed searching and no low-speed searching during the operation of returning to home. • After high-speed searching of returning to home, the drive keeps reverse low-speed searching.	If the hardware DI is used, check whether the DI function FunIN.31: HomeSwitch (Home switch) has been allocated to a DI and then check the wiring of the corresponding DI. Make the logic of the DI change manually and observe whether the servo drive receives the level change of the DI through H0B-03. If not, the wiring of the DI is incorrect. If yes, a fault occurs on the operation of returning to home. Please use the returning to home function correctly. If a virtual DI is used, check whether the VDI is used correctly.
2. The search time is too short.	• Check whether the time for home return set in H05-35 is too short.	Increase H05-35.
3. The speed of the high-speed searching home switch signal is too small.	• Check the distance from the initial position of returning to home to the home switch. Then check whether H5-32 (speed of home switch signal at high-speed searching) is too small, resulting in too long time of finding the home switch.	Increase H05-32

3. Er.831: Excessive AI zero drift

Cause:

When the input voltage of AI (AI1 and AI2) is 0 V, the sampling voltage of the servo drive is greater than 500 mV.

Cause	Confirming Method	Corrective Action
1. The wiring is incorrect or interference exists.	• Check wiring based on correct wiring diagram.	Re-wire the AI with a STP cable and shorten the cable length. Increase the AI filter time constant: AI1 filter time constant: H03-51 AI2 filter time constant: H03-56
2.The servo drive is faulty.	• Disconnect the AI cable (the input voltage is 0). Check whether the AI sampling value in group H0B exceeds 500 mV.	If the AI sampling value in group H0B exceeds 500 mV, replace the servo drive.

4. Er.900: DI emergency braking

Cause:

- The logic of the DI (including external DI and virtual DI) allocated with function FunIN.34: EmergencyStop (Braking) is effective.

Cause	Confirming Method	Corrective Action
The DI function FunIN.34 is triggered.	• Check whether the logic of the DI allocated with function FunIN.34: EmergencyStop (Braking) is effective.	Check the running mode and clear the DI braking enable signal.

5. Er.909: Motor overload

Cause:

The accumulative heat of the 60Z series 200 W and 400 W motor reaches the alarm level.

Cause	Confirming Method	Corrective Action
1. Wiring of the motor and encoder is incorrect or poor.	• Check wirings between the servo drive, servo motor and encoder according to correct wiring diagram.	Check wiring based on correct wiring diagram. Prefer to use the cable configured by Inovance as standard. When the self-made cable is used, make and connect the cable according to the hardware wiring guidance.
2. The load is too heavy. The motor keeps output of effective torque higher than the rated torque for a long time.	• Confirm the overload characteristic of the servo drive or servo motor. • Check whether the average load rate (H0B-12) is greater than 100.0% for long time.	Replace with a large servo drive and matching servo motor. Reduce the load and increase acceleration/deceleration time.

Cause	Confirming Method	Corrective Action
3. The acceleration/ deceleration is too frequent or the load inertia is too large.	• Calculate the load inertia ratio or perform the load inertia ratio auto-tuning. Then view H08-15 (load inertia ratio). • Confirm the single running cycle when the servo motor runs in circular	Increase acceleration/deceleration time during single running.
4. The gain is improper, causing too high rigidity.	• Observe whether the motor vibrates and generates noise during running.	Adjust the gain by referring to chapter 4.
5. The servo drive or motor model is set incorrectly.	• For IS620P series products, view the bus motor model in H00-05 and the servo drive model in H01-02. • For the IS600P series product, view the servo motor model in H00-00 and the servo drive model in H01-02.	View the servo drive nameplate and set the servo drive model (H01-02) correctly and replace with matching servo motor section 1.2 Servo System Configuration.
6. Locked-rotor occurs due to mechanical factors, resulting in very heavy load during running.	• Check the running reference and the actual motor speed (H0B-00) by using the drive debugging platform of Inovance or the operation panel. Running reference in the position control mode: H0B-13 (input reference pulse counter) Running reference in the speed control mode: H0B-01 (speed reference) Running reference in the torque control mode: H0B-02 (internal torque reference) Check the running reference in corresponding mode is not 0 but the motor speed is 0.	Solve mechanical problems.
7. The servo drive is faulty.	• Power on the servo drive and then re-power on it.	If the fault remains after re-power-on, replace the servo drive.

6. Er.920: Regen resistor overload

Cause:

- The accumulative heat of regen resistor is greater than the setting value.

<table>
<tr><th>Cause</th><th>Confirming Method</th><th>Corrective Action</th></tr>
<tr><td rowspan="2">1. The cable of the external regen resistor is in poor connection, becomes loose or breaks.</td><td rowspan="2">• Disconnect the external regen resistor and measure whether the resistance of the regen resistor is s ∞.
• Measure whether the resistance between P and C is∞.</td><td>Replace with a new external regen resistor and measure its resistance. If the resistance is consistent with the nominal value, connect it between P and C.</td></tr>
<tr><td>Select a normal cable and connect it between P and C.</td></tr>
<tr><td>2. The jumper across terminals P and D is shorted or disconnected when the internal regen resistor is used.</td><td>• Measure whether the resistance between P and D.</td><td>Select a normal cable and connect it between P and D.</td></tr>
<tr><td>3. The setting of H02-25 is incorrect when the external regen resistor is used.</td><td rowspan="3">• View the setting value of H02-25.
• Measure the resistance of the external regen resistor connected between P and C. Check whether the resistance is too large by comparing it with the regen resistor specification table in section 1.4..
• Check whether the value of H02-27 is greater than the resistance of the external regen resistor connected between P and C.</td><td>Set H02-25 correctly based on section 4.2.
H02-25 = 1 (external regen resistor used, natural cooling)
H02-25 = 2 (external regen resistor used, forced air cooling)</td></tr>
<tr><td>4. The resistance of the selected external regen resistor is too large when an external regen resistor is used.</td><td>Select a proper regen resistor according to section 1.4 Regen Resistor Specifications..</td></tr>
<tr><td>5. H02-27 (resistance of external regen resistor) is larger than the resistance of actually connected external regen resistor.</td><td>Set H02-27 (resistance of external regen resistor) consistent with the resistance of the selected external regen resistor.</td></tr>
<tr><td>6. The input voltage of the main circuit exceeds the specification.</td><td>• Check whether the input voltage of the main circuit on the servo drive side complies with the following specification:
220 V drive:
Effective value: 220 to 240 V
Allowed error: -10% to 10% (198 to 264 V)
380 V drive:
Effective value: 380 to 440 V
Allowed error: -10% to 10% (342 to 484 V)</td><td>Replace the power supply or adjust the power voltage according to the specification on the left.</td></tr>
</table>

Cause	Confirming Method	Corrective Action
7. The load inertia is too large.	• Perform the inertia auto-tuning based on section 4.5.1 Inertia Auto-tuning and calculate the total inertia of the machine according to the mechanical parameters. • Check whether the actual load inertia ratio exceeds 30.	• Select a large external regen resistor and set H02-26 (power of external regen resistor) consistent with the actual value. • Select a large servo drive. • If allowed, reduce the load. • If allowed, increase the acceleration/deceleration time. • If allowed, increase the motor running cycle.
8. The speed is too high, and the deceleration process is not completed within the required time. The regen resistor is in continuous deceleration state.	• View the speed curve of the motor for cycle running and check whether the motor is in the deceleration station for long time.	
9. The capacity of the servo drive or regen resistor is insufficient.	• View the single cycle speed curve of the motor and calculate whether the maximum braking energy can be absorbed completely.	
10. The servo drive is faulty.	-	Replace the servo drive with a new one.

7. Er.922: The external regen resistor too small

Cause:

- H02-27 (resistance of external regen resistor) is smaller than H02-21 (Allowed minimum value of regen resistor).

Cause	Confirming Method	Corrective Action
When an external regen resistor is used (H02-25 = 1 or 2), the resistance of the external regen resistor is smaller than the minimum value required by the servo drive.	• Measure the resistance of the external regen resistor connected between P and C and check whether it is smaller than H02-21 (allowed minimum value of regen resistor).	• If yes, connect an external regen resistor matching the servo drive between P and C and set H02-27 (resistance of external regen resistor) to the resistance of the selected external regen resistor. • If not, set H02-27 to the resistance of the selected external regen resistor.

8. Er.939: Motor power cable breaking

Cause:

- The actual phase current of the motor is smaller than 10% of the rated motor current, the actual motor speed is small but the internal torque reference is very large.

Cause	Confirming Method	Corrective Action
The motor power cables break.	• Check whether the difference between H0B-24 (phase current valid value) and H0B-02 (internal torque reference) reaches over 500%. Meanwhile, H0B-00 (actual motor speed) is smaller than one fourth of the rated motor speed.	Check the motor power cable connection and reconnect the cables. If necessary, replace the cables.

9. Er.941: Parameter modification taking effect only after re-power-on

Cause:

- The modification of some parameters takes effect only after the servo drive is powered on again. After the value of these parameters is modified, the servo drive reminds of re-power-on.

Cause	Confirming Method	Corrective Action
Modify the parameters, whose modification takes effect only after the servo drive is powered on again.	• Check whether you modify the parameters, whose modification takes effect only after the servo drive is powered on again.	Re-power on the servo system.

10. Er.942: Parameter storage too frequent

Cause:

- The number of parameters that are being modified simultaneously exceeds 200.

Cause	Confirming Method	Corrective Action
A great number of parameters are modified and stored frequently to EEPROM (H0C-13 = 1).	• Check whether the host controller performs frequent and fast parameter modification on the servo drive.	Check the running mode. For the parameters that need not be stored in EEPROM, set H0C-13 to 0 before the writing operation of the host controller.

11. Er.950: Forward overtravel

Cause:

- The logic of the DI allocated with function FunIN.14: P-OT (forward drive forbidden) is effective.

Cause	Confirming Method	Corrective Action
The logic of the DI allocated with function FunIN.14: P-OT (forward drive forbidden) is effective.	• Check whether a parameter in group H03 has been allocated with the FunIN14 (P-OT) function. • Check whether the logic of the corresponding DI is effective though H0B-03 (monitored DI states).	Check the running mode. Send a reverse reference or rotate the motor in the prerequisite of ensuring safety to make the logic of the forward overshoot switch terminal ineffective.

12. Er.952: Reverse overtravel

Cause:

- The logic of the DI allocated with function FunIN.15: N-OT (reverse drive forbidden) is effective.

Cause	Confirming Method	Corrective Action
The logic of the DI allocated with function FunIN.15: N-OT (reverse drive forbidden) is effective.	• Check whether a parameter in group H03 has been allocated with the FunIN15: N-OT function. • Check whether the logic of the corresponding DI is effective though H0B-03 (monitored DI states).	Check the running mode. Send a reverse reference or rotate the motor in the prerequisite of ensuring safety to make the logic of the reverse overshoot switch terminal ineffective.

13. Er.980: Encoder internal fault

Cause:

- The encoder algorithm error.

Cause	Confirming Method	Corrective Action
Encoder internal fault	• The encoder is faulty if the fault is still reported after several times of power-off and re-power-on.	Replace the servo motor.

14. Er.990: Power input phase loss

Cause:

- The three-phase servo drive of 1 kW below is allowed to run under single-phase power but the fault and alarm of power input phase loss (H0A-00) is enabled.

Cause	Confirming Method	Corrective Action
When H0A-00 = 1 (allow faults and warnings at power input phase loss protection), the three-phase servo drive (0.75 kW) (H01-02 = 5) can run under single-phase power. In this case, the drive reports the alarm.	• Check whether it is the three-phase servo drive that is allowed to run under single-phase power.	• If the alarm is still reported when the three-phase servo drive is connected to three-phase power, troubleshoot the alarm as Er.420 (power cable phase loss). • If the alarm is still reported when the three-phase servo drive is connected to the single-phase power, set H0A-00 to 0.

15. Er.994: CAN address conflict

Cause	Confirming Method	Corrective Action
CANlink address conflict occurs.	• Check whether H0C-00 (servo shaft address) is allocated repeatedly.	Allocate the servo shaft address of the salves and ensure that the allocation of H0C-00 is not repeated.

6.2.4 Internal Faults

When the following faults occur, contact Inovance for technical support.

- Er.104: programmable logic interrupted
- Er.111: H00/H01 groups parameters abnormal
- Er.207: Shaft D/Q current overflow
- Er.208: FPGA system sampling operation timeout
- Er.220: Phase sequence incorrect
- Er.602: Angle auto-tuning failure
- Er.A40: Motor auto-tuning failure

7

Function Code Table

Chapter 7 Function Code Table

Function Code Group	Parameters
Group H00	Servo motor parameters
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Group H02	Basic control parameters
Group H03	Input terminal parameters
Group H04	Output terminal parameters
Group H05	Position control parameters
Group H06	Speed control parameters
Group H07	Torque control parameters
Group H08	Gain parameters
Group H09	Self-adjusting parameters
Group H0A	Fault and protection parameters
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Group H0C	Communication parameters
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Group H0F	Full closed-loop parameters
Group H11	Multi-position function parameters
Group H12	Multi-speed function parameters
Group H17	Virtual DI/DO parameters
Group H30	Servo related variables read by communication (not displayed on keypad)
Group H31	Servo related variables set via communication (not displayed on keypad)

Group H00: Servo Motor Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property
H00	00	Motor SN	0–65534 65535: motor SN null	-	-	Power-on again	At stop
H00	02	Customized motor SN	-	-	-	-	At display
H00	04	Encoder version	-	-	-	-	At display
H00	05	Bus motor SN	-	-	-	-	At display

Group H01: Servo Drive Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property
H01	00	MCU software version	0–65535	0.1	-	-	At display
H01	01	FPGA software version	0–65535	0.1	-	-	At display
H01	02	Servo drive SN	0–65535	1	-	Power-on again	At stop

Group H02: Basic Control Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H02	00	Control mode	0: Speed mode 1: Position mode 2: Torque mode 3: Torque mode ↔ Speed mode 4: Speed mode ↔ Position mode 5: Torque mode ↔ Position mode 6: Position mode ↔ Speed mode ↔ Torque mode	-	1	Immediate	At stop	-
H02	02	Rotating direction	0: CCW direction as the forward direction (phase A advancing phase B) 1: CW direction as the forward direction (reverse rotation mode, phase A lagging phase B)	-	0	Power-on again	At stop	PST
H02	03	Output pulse phase	0: CCW direction as the forward direction (phase A advancing phase B) 1: CW direction as the forward direction (reverse rotation mode, phase A lagging phase B)	-	0	Power-on again	At stop	PST
H02	05	Stop mode at servo drive disabled	0: Coast to stop, keeping free running state 1: Stop at zero speed, keeping free running state	-	0	Immediate	At stop	PST
H02	06	Stop mode 2 at fault	0: Coast to stop, keeping free running state 1: Stop at zero speed, keeping free running state	-	0	Immediate	At stop	PST

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H02	07	Stop mode at overtravel	0: Determined by H02-08 1: Stop at zero speed, keeping position locking state 2: Stop at zero speed, keeping free running state	-	1	Immediate	At stop	PST
H02	08	Stop mode 1 at fault	0: Coast to stop, keeping free running state	-	0	Immediate	At stop	PST
H02	09	Delay from brake outputting ON signal to command received	0–500	ms	250	Immediate	During running	PS
H02	10	Delay from brake outputting OFF signal to motor power-off in the standstill state	1–1000	ms	150	Immediate	During running	PS
H02	11	Motor speed threshold when brake outputs OFF signal in the rotating state	0–3000	rpm	30	Immediate	During running	PS
H02	12	Delay from motor power-off to brake outputting OFF signal in the rotating state	1–1000	ms	500	Immediate	During running	PS
H02	15	Display of keypad warning	0: Immediate output 1: Not output	-	0	Immediate	At stop	PST
H02	18	Filter time of servo ON signal	0–64	ms	0	Immediate	At stop	PST
H02	21	Allowed minimum value of regen resistor	-	Ω	-	-	At display	PST
H02	22	Power of built-in regen resistor	-	W	-	-	At display	PST
H02	23	Resistance of built-in regen resistor	-	Ω	-	-	At display	PST

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H02	24	Resistor heat dissipation coefficient	10–100	%	30	Immediate	At stop	PST
H02	25	Regen resistor type	0: Built-in 1: External, natural cooling 2: External, forced air cooling 3: No resistor, using only capacitor	-	0	Immediate	At stop	PST
H02	26	Power of external regen resistor	1–65535	W	-	Immediate	At stop	PST
H02	27	Resistance of external regen resistor	1–1000	Ω	-	Immediate	At stop	PST
H02	30	User password	0–65535	-	0	Power-on again	At stop	PST
H02	31	Parameter initialization	0: No operation 1: Restore default setting (except groups H0 and H1) 2: Clear fault records	-	0	Immediate	At stop	PST
H02	32	Default keypad display	00–99	-	50	Immediate	During running	-
H02	33	EtherCAT software version	-	-	-	-	At display	-
H02	34	CAN software version	-	-	-	-	At display	-

Group H03: Input Terminal Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H03	00	Function allocation 1 of DIs that are set to ON and effective	0–0xFFFF Bit0: FunIN.1 Bit1: FunIN.2 …… Bit15: FunIN.16	-	0	Power-on again	During running	-
H03	01	Function allocation 2 of DIs that are set to ON and effective	0–0xFFFF Bit0: FunIN.17 Bit1: FunIN.18 …… Bit15: FunIN.32	-	0	Power-on again	During running	-
H03	02	DI1 function selection	0–37	-	14	Upon stop	During running	-
H03	03	DI1 logic selection	Input polarity: 0–4 0: Low level active 1: High level active 2: Rising edge active 3: Falling edge active 4: Both rising edge and falling edge active	-	0	Upon stop	During running	-
H03	04	DI2 function selection	0–37	-	15	Upon stop	During running	-
H03	05	DI2 logic selection	Input polarity: 0–4 0: Low level active 1: High level active 2: Rising edge active 3: Falling edge active 4: Both rising edge and falling edge active	-	0	Upon stop	During running	-
H03	06	DI3 function selection	0–37	-	13	Upon stop	During running	-
H03	07	DI3 logic selection	Input polarity: 0–4 0: Low level active 1: High level active 2: Rising edge active 3: Falling edge active 4: Both rising edge and falling edge active	-	0	Upon stop	During running	-
H03	08	DI4 function selection	0–37	-	2	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H03	09	DI4 logic selection	Input polarity: 0–4 0: Low level active 1: High level active 2: Rising edge active 3: Falling edge active 4: Both rising edge and falling edge active	-	0	Upon stop	During running	-
H03	10	DI5 function selection	0–37	-	1	Upon stop	During running	-
H03	11	DI5 logic selection	Input polarity: 0–4 0: Low level active 1: High level active 2: Rising edge active 3: Falling edge active 4: Both rising edge and falling edge active	-	0	Upon stop	During running	-
H03	12	DI6 function selection	0–37	-	12	Upon stop	During running	-
H03	13	DI6 logic selection	Input polarity: 0–4 0: Low level active 1: High level active 2: Rising edge active 3: Falling edge active 4: Both rising edge and falling edge active	-	0	Upon stop	During running	-
H03	14	DI7 function selection	0–37	-	3	Upon stop	During running	-
H03	15	DI7 logic selection	Input polarity: 0–4 0: Low level active 1: High level active 2: Rising edge active 3: Falling edge active 4: Both rising edge and falling edge active	-	0	Upon stop	During running	-
H03	16	DI8 function selection	0–37	-	31	Upon stop	During running	-
H03	17	DI8 logic selection	Input polarity: 0–4 0: Low level active 1: High level active 2: Rising edge active 3: Falling edge active 4: Both rising edge and falling edge active	-	0	Upon stop	During running	-
H03	18	DI9 function selection	0–37	-	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H03	19	DI9 logic selection	Input polarity: 0–4 0: Low level active 1: High level active 2: Rising edge active 3: Falling edge active 4: Both rising edge and falling edge active	-	0	Upon stop	During running	-
H03	34	Function allocation 3 of DIs that are set to ON and effective	0–0xFFFF Bit0: FunIN.33 Bit1: FunIN.34 …… Bit15: FunIN.48	-	0	Power-on again	During running	-
H03	35	Function allocation 4 of DIs that are set to ON and effective	0–0xFFFF Bit0: FunIN.49 Bit1: FunIN.50 …… Bit15: FunIN.64	-	0	Power-on again	During running	-
H03	50	AI1 offset	-5000 to 5000	mV	0	Immediate	During running	-
H03	51	AI1 filter time constant	0–655.35	ms	2.00	Immediate	During running	-
H03	53	AI1 dead zone	0–1000.0	mV	10.0	Immediate	During running	-
H03	54	AI1 zero drift	-500.0 to 500.0	mV	0.0	Immediate	During running	-
H03	55	AI2 offset	-5000 to 5000	mV	0	Immediate	During running	-
H03	56	AI2 filter time constant	0–655.35	ms	2.00	Immediate	During running	-
H03	58	AI2 dead zone	0–1000.0	mV	10.0	Immediate	During running	-
H03	59	AI2 zero drift	-500.0 to 500.0	mV	0.0	Immediate	During running	-
H03	80	Speed corresponding to 10 V	0–6000 rpm	rpm	3000	Immediate	At stop	-
H03	81	Torque corresponding to 10 V	1.00–8.00 times of rated torque	Times	1.00	Immediate	At stop	-

Group H04: Output Terminal Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H04	00	DO1 function selection	0–19	-	1	Upon stop	During running	-
H04	01	DO1 logic selection	Output polarity reverse setting: 0–1 0: Output low level when active (optocoupler ON) 1: Output high level when active (optocoupler OFF)	-	0	Upon stop	During running	-
H04	02	DO2 function selection	0–19	-	5	Upon stop	During running	-
H04	03	DO2 logic selection	Output polarity reverse setting: 0–1 0: Output low level when active (optocoupler ON) 1: Output high level when active (optocoupler OFF)	-	0	Upon stop	During running	-
H04	04	DO3 function selection	0–19	-	3	Upon stop	During running	-
H04	05	DO3 logic selection	Output polarity reverse setting: 0–1 0: Output low level when active (optocoupler ON) 1: Output high level when active (optocoupler OFF)	-	0	Upon stop	During running	-
H04	06	DO4 function selection	0–19	-	11	Upon stop	During running	-
H04	07	DO4 logic selection	Output polarity reverse setting: 0–1 0: Output low level when active (optocoupler ON) 1: Output high level when active (optocoupler OFF)	-	0	Upon stop	During running	-
H04	08	DO5 function selection	0–19	-	16	Upon stop	During running	-
H04	09	DO5 logic selection	Output polarity reverse setting: 0–1 0: Output low level when active (optocoupler ON) 1: Output high level when active (optocoupler OFF)	-	0	Upon stop	During running	-
H04	22	DO source	0–31	-	0	Immediate	At stop	-

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H04	50	AO1 signal selection	00: Motor rotational speed (1 V/1000 RPM, by default) 01: Speed reference (1 V/1000 RPM) 02: Torque reference (1 V/100%) 03: Position deviation (0.05 V/1 reference unit) 04: Position amplifier deviation (0.05 V/1 encoder pulse unit) 05: Position reference speed (1 V/1000 RPM) 06: Positioning completed reference (positioning completed: 5 V, positioning uncompleted: 0 V) 07: Speed feedforward (1 V/1000 RPM) 08: AI1 voltage 09: AI2 voltage	-	0	Immediate	During running	-
H04	51	AO1 offset voltage	-10000 to 10000	mV	5000	Immediate	During running	-
H04	52	AO1 multiplying factor	-99.99 to 99.99	Times	1.00	Immediate	During running	-
H04	53	AO2 signal selection	00: Motor speed (1 V/1000 RPM, by default) 01: Speed reference (1 V/1000 RPM) 02: Torque reference (1 V/100%) 03: Position deviation (0.05 V/1 reference unit) 04: Position amplifier deviation (0.05 V/1 encoder pulse unit) 05: Position reference speed (1 V/1000 RPM) 06: Positioning completed reference (positioning completed: 5 V, positioning uncompleted: 0 V) 07: Speed feedforward (1 V/1000 RPM) 08: AI1 voltage 09: AI2 voltage	-	0	Immediate	During running	-
H04	54	AO1 offset voltage	-10000 to 10000	mV	5000	Immediate	During running	-
H04	55	AO2 multiplying factor	-99.99 to 99.99	Times	1.00	Immediate	During running	-

Group H05: Position Control Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	00	Position reference source	0: Pulse setting 1: Step setting 2: Multi-position setting	-	0	Immediate	At stop	P
H05	01	Pulse reference input terminal selection	0: Low-speed pulse input 1: High-speed pulse input	-	0	Power-on again	At stop	P
H05	02	Pulses for one motor revolution	0–1048576	P/Rev	0	Power-on again	At stop	P
H05	04	First-order low-pass filter time constant	0–6553.5	ms	0.0	Immediate	At stop	P
H05	05	Step size	-9999 to 9999	Reference unit	50	Immediate	At stop	P
H05	06	Filter time constant of of average value of position reference	0.0–128.0	ms	0.0	Immediate	At stop	P
H05	07	Electronic gear ratio 1 (numerator)	1–1073741824	-	1048576	Immediate	During running	P
H05	09	Electronic gear ratio 1 (denominator)	1–1073741824	-	10000	Immediate	During running	P
H05	11	Electronic gear ratio 2 (numerator)	1–1073741824	-	1048576	Immediate	During running	P
H05	13	Electronic gear ratio 2 (denominator)	1–1073741824	-	10000	Immediate	During running	P
H05	15	Reference pulse form	0: Direction + pulse, positive logic 1: Direction + pulse, negative logic 2: Phase A + phase B orthogonal pulse, 4-frequency multiplication 3: CW+CCW	-	0	Power-on again	At stop	P

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	16	Clear action	0: Clear position deviation pulses upon servo drive disabled or fault 1: Clear position deviation pulses upon fault 2: Clear position deviation pulses upon ClrPosErr signal from DI	-	0	Immediate	At stop	P
H05	17	Encoder frequency-division pulses	35–32767	P/Rev	2500	Power-on again	At stop	-
H05	19	Speed feedforward control selection	0: No speed feedforward 1: Internal 2: AI1 3: AI2	1	1	Immediate	At stop	P
H05	20	Output condition of positioning completed signal (COIN)	0: Position deviation absolute value smaller than amplitude of positioning completed 1: Position deviation absolute value smaller than amplitude of positioning completed and position reference after filter being 0 2: Position deviation absolute value smaller than amplitude of positioning completed and position reference being 0	-	0	Immediate	During running	P
H05	21	Amplitude for positioning completed	1–65535	Encoder unit	734	Immediate	During running	P
H05	22	Amplitude of positioning almost completed	1–65535	Encoder unit	65535	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	23	Interruption fixed length	1: Enabled 0: Disabled	0	0	Power-on again	At stop	P
H05	24	Displacement of interruption fixed length	0–1073741824	1 reference unit	10000 reference unit	Immediate	During running	P
H05	26	Constant speed for interruption fixed length	0–6000	rpm	200	Immediate	During running	P
H05	27	Acceleration/ Deceleration time of interruption fixed length	0–1000	ms	10	Immediate	During running	P
H05	29	Interruption fixed length unlock	0: Disabled 1: Enabled	-	1	Immediate	During running	P
H05	30	Control of home return	0: Disabled 1: Enabled upon ORGSET signal from DI 2: Electrical home return upon ORGSET signal from DI 3: Started immediately upon power-on 4: Started immediately 5: Electrical home return 6: Taking current position as the home	-	0	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	31	Mode of home return	0: Forward home return, deceleration position and home as home switches 1: Reverse home return, deceleration position and home as home switches 2: Forward home return, deceleration position and home as motor Z signals 3: Reverse home return, deceleration position and home as motor Z signals 4: Forward home return, deceleration position as home switch and home as motor Z signal 5: Reverse home return, deceleration position as home switch and home as motor Z signal 6: Forward home return, deceleration position and home as forward limit switches 7: Reverse home return, deceleration position and home as reverse limit switches 8: Forward home return, deceleration position as forward limit switch and home as motor Z signal 9: Reverse home return, deceleration position as reverse limit switch and home as motor Z signal	-	0	Immediate	At stop	P

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	32	Speed of home switch signal at high-speed searching	0–3000	rpm	100	Immediate	During running	P
H05	33	Speed of home switch signal at low-speed searching	0–1000	rpm	10	Immediate	During running	P
H05	34	Acceleration/ Deceleration time at home searching	0–1000	ms	1000	Immediate	During running	P
H05	35	Time of home searching	0–65535	ms	10000	Immediate	During running	P
H05	36	Mechanical home offset	-1073741824 to 1073741824	Reference unit	0	Immediate	During running	P
H05	38	Servo pulse output source	0: Encoder frequency-division output 1: Reference pulse synchronous output 2: Frequency-division and synchronous output forbidden	-	0	Power-on again	At stop	P
H05	39	Electronic gear ratio switchover condition	0: Enabled after position reference pulse remaining 0 for 10 ms 1: Enabled in real time	-	0	Immediate	At stop	P

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H05	40	Mechanical home offset and action after reaching limit switch	0: H05-36 as coordinate for home return, trigger home return and find home reversely after reaching limit switch 1: H05-36 as relative offset for home return, trigger home return and find home reversely after reaching limit switch 2: H05-36 as coordinate for home return, automatically find zero position reversely after reaching limit switch 3: H05-36 as relative offset for home return, automatically find zero position reversely after reaching limit switch	-	0	Immediate	At stop	P
H05	41	Output polarity of Z pulse	0: Positive (Z pulse being high level) 1: Negative (Z pulse being low level)	-	1	Power-on again	At stop	P

Group H06: Speed Control Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H06	00	Main speed reference A source	0: Digital setting (H06-03) 1: AI1 2: AI2	-	0	Immediate	At stop	S
H06	01	Auxiliary speed reference B source	0: Digital setting (H06-03) 1: AI1 2: AI2 3: 0 (No function) 4: 0 (No function) 5: Multi-speed reference	-	1	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H06	02	Speed reference selection	0: Main speed reference A source 1: Auxiliary speed reference B source 2: A+B 3: A/B switchover 4: Communication setting	-	0	Immediate	At stop	S
H06	03	Keypad setting value of speed reference	-6000 to 6000	rpm	200	Immediate	During running	S
H06	04	Jog speed setting value	0–6000	rpm	100	Immediate	During running	S
H06	05	Acceleration ramp time constant of speed reference	0–65535	ms	0	Immediate	During running	S
H06	06	Deceleration ramp time constant of speed reference	0–65535	ms	0	Immediate	During running	S
H06	07	Maximum speed threshold	0–6000	rpm	6000	Immediate	During running	S
H06	08	Forward speed threshold	0–6000	rpm	6000	Immediate	During running	S
H06	09	Reverse speed threshold	0–6000	rpm	6000	Immediate	During running	S
H06	11	Torque feedforward control selection	0: No torque feedforward 1: Internal torque feedforward	-	1	Immediate	During running	PS
H06	15	Speed threshold for zero clamp	0–6000	rpm	10	Immediate	During running	S
H06	16	Motor speed threshold	0–1000	rpm	20	Immediate	During running	PST
H06	17	Threshold of speed consistent signal	0–100	rpm	10	Immediate	During running	S
H06	18	Threshold of speed reached signal	10–6000	rpm	1000	Immediate	During running	PST
H06	19	Threshold of zero speed output signal	1–6000	rpm	10	Immediate	During running	PST

Group H07: Torque Control Parameters

100% of the torque reference corresponds to the rated motor torque.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H07	00	Main torque reference A source	0: Digital setting (H07-03) 1: AI1 2: AI2	-	0	Immediate	At stop	T
H07	01	Auxiliary torque reference B source	0: Digital setting (H07-03) 1: AI1 2: AI2	-	1	Immediate	At stop	T
H07	02	Torque reference source	0–3	-	0	Immediate	At stop	T
H07	03	Keypad setting value of torque reference	-300.0 to 300.0	%	0	Immediate	During running	T
H07	05	Torque reference filter time constant 1	0–30.00	ms	0.79	Immediate	During running	PST
H07	06	Torque reference filter time constant 2	0–30.00 ms	ms	0.79	Immediate	During running	PST
H07	07	Torque limit source	0: Internal 1: External setting (P-CL and N-CL selection) 2: External T-LMT setting 3: Smaller of external setting and external T-LMT setting (P-CL and N-CL selection) 4: Switchover between internal setting and T-LMT setting	1	0	Immediate	At stop	PST
H07	08	T-LMT selection	1: AI1 2: AI2	1	2	Immediate	At stop	PST
H07	09	Internal forward torque limit	0.0–300.0	%	300.0	Immediate	During running	PST
H07	10	Internal reverse torque limit	0.0–300.0	%	300.0	Immediate	During running	PST
H07	11	External forward torque limit	0.0–300.0	%	300.0	Immediate	During running	PST

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H07	12	External reverse torque limit	0.0–300.0	%	300.0	Immediate	During running	PST
H07	17	Speed limit source	0: Internal (in torque control) 1: External V-LMT setting 2: H07-19/H07-20 as internal speed limit source selected by FunIN.36 (V-SEL)	-	0	Immediate	During running	T
H07	18	V-LMT selection	1: AI1 2: AI2	-	1	Immediate	During running	T
H07	19	Forward speed limit/Speed limit 1 in torque control	0–6000	rpm	3000	Immediate	During running	T
H07	20	Reverse speed limit/Speed limit 2 in torque control	0–6000	rpm	3000	Immediate	During running	T
H07	21	Base value for torque reached	0.0–300.0	%	0.0	Immediate	During running	PST
H07	22	Threshold of torque reached valid	0.0–300.0	%	20.0	Immediate	During running	PST
H07	23	Threshold of torque reached invalid	0.0–300.0	%	10.0	Immediate	During running	PST
H07	40	Speed limit window in the torque control mode	0.5–30.0	ms	1.0	Immediate	During running	T

Group H08: Gain Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H08	00	Speed loop gain	0.1–2000.0	Hz	25.0	Immediate	During running	PS
H08	01	Speed loop integral time constant	0.15–512.00	ms	31.83	Immediate	During running	PS
H08	02	Position loop gain	0.0–2000.0	Hz	40.0	Immediate	During running	P
H08	03	Second speed loop gain	0.1–2000.0	Hz	40.0	Immediate	During running	PS
H08	04	Second speed loop integral time constant	0.15–512.00	ms	40.00	Immediate	During running	PS
H08	05	Second position loop gain	0.0–2000.0	Hz	64.0	Immediate	During running	P
H08	06	Reserved	-	-	-	-	-	-
H08	08	Second gain mode setting	0: First gain fixed, P/PI switchover by DI 1: Gain switchover based on H08-09 Note: "P" indicates proportional control; "PI" indicates proportional and integral control.	-	1	Immediate	During running	PS

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H08	09	Gain switchover condition	0: First gain fixed (PS) 1: Switchover by DI (PS) 2: Torque reference being large (PS) 3: Speed reference being large (PS) 4: Speed reference change rate being large (PS) 5: Speed reference high-speed low-speed thresholds (PS) 6: Position deviation being large (P) 7: Position reference available (P) 8: Positioning uncompleted (P) 9: Actual speed (P) 10: Position reference available + Actual speed (P)	-	0	Immediate	During running	PS
H08	10	Gain switchover delay	0.0–1000.0	ms	5.0	Immediate	During running	PS
H08	11	Gain switchover level	0–20000	Based on switchover condition	50	Immediate	During running	PS
H08	12	Gain switchover hysteresis	0–20000	Based on switchover condition	30	Immediate	During running	PS
H08	13	Position gain switchover time	0.0–1000.0	ms	3.0	Immediate	During running	PS
H08	15	Load inertia ratio	0.00–120.00	times	1.00	Immediate	During running	PST

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H08	18	Speed feedforward filter time constant	0.00–64.00	ms	0	Immediate	During running	P
H08	19	Speed feedforward gain	0.0–100.0	%	0	Immediate	During running	P
H08	20	Torque feedforward filter time constant	0.00–64.00	ms	0.50	Immediate	During running	P
H08	21	Torque feedforward gain	0.0–200.0	0.1	0	Immediate	During running	P
H08	22	Speed feedforward filter	0: Disabled 1: Average filter of 2 speed feedbacks 2: Average filter of 4 speed feedbacks 3: Average filter of 8 speed feedbacks 4: Average filter of 16 speed feedbacks	-	0	Immediate	At stop	PS
H08	23	Cutoff frequency of speed feedback low-pass filter	100–4000	Hz	4000	Immediate	During running	PS
H08	24	PDFF control coefficient	0.0–100.0	%	100.0	Immediate	During running	PS

Group H09: Self-adjusting Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H09	00	Auto-adjusting mode	0: Disabled, manual adjusting 1: Standard mode, gain parameters automatically adjusted based on rigidity table 2: Positioning mode, gain parameters automatically adjusted based on rigidity table	-	0	Immediate	During running	PS

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H09	01	Rigidity level selection	0–31	-	12	Immediate	During running	PS
H09	02	Working mode of self-adaptive notch	0: Not updated 1: Only one notch (3rd notch) valid 2: Both notches (3rd and 4th notches) valid 3: Only detect resonance frequency (displayed in H09-24), not update parameters 4: Restore parameters to default setting	-	0	Immediate	During running	PS
H09	03	Online inertia auto-tuning mode	0: Disabled 1: Enabled, change slowly 2: Enabled, always change 3: Enabled, change quickly	-	0	Immediate	During running	PS
H09	04	Low-frequency resonance restraining mode selection	0: Vibration frequency set manually 1: Vibration frequency auto-tuned	-	0	Immediate	During running	-
H09	05	Offline inertia auto-tuning mode selection	0: Positive and negative triangular wave mode 1: Jog mode	-	0	Immediate	At stop	-
H09	06	Maximum speed for inertia auto-tuning	100–1000	rpm	500	Immediate	At stop	-
H09	07	Time constant of accelerating to max. speed for inertia auto-tuning	20–800	ms	125	Immediate	At stop	-
H09	08	Interval after an inertia auto-tuning	50–10000	ms	800	Immediate	At stop	-
H09	09	Motor revolutions for an inertia auto-tuning	0.00–2.00	Rev	-	-	At display	-

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H09	12	1st notch frequency	50–4000	Hz	4000	Immediate	During running	PS
H09	13	1st notch width level	0–20	-	2	Immediate	During running	PS
H09	14	1st notch depth level	0–99	-	0	Immediate	During running	PS
H09	15	2nd notch frequency	50–4000	Hz	4000	Immediate	During running	PS
H09	16	2nd notch width level	0–20	-	2	Immediate	During running	PS
H09	17	2nd notch depth level	0–99	-	0	Immediate	During running	PS
H09	18	3rd notch frequency	50–4000	Hz	4000	Immediate	During running	PS
H09	19	3rd notch width level	0–20	-	2	Immediate	During running	PS
H09	20	3rd notch depth level	0–99	-	0	Immediate	During running	PS
H09	21	4th notch frequency	50–4000	Hz	4000	Immediate	During running	PS
H09	22	4th notch width level	0–20	-	2	Immediate	During running	PS
H09	23	4th notch depth level	0–99	-	0	Immediate	During running	PS
H09	24	Obtained resonance frequency	0–2	Hz	0	-	At display	PS
H09	30	Torque disturbance compensation gain	-100.0 to 100.0	%	0.0	Immediate	During running	PS
H09	31	Torque disturbance observer filter time constant	0.00–25.00	ms	0.5	Immediate	During running	PS
H09	38	Low-frequency resonance frequency A	1.0–100.0-	Hz	100.0	Immediate	During running	-
H09	39	Filter setting of low-frequency resonance frequency A	0–10	-	2	Immediate	During running	-

Group H0A: Fault and Protection

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H0A	00	Power input phase loss protection selection	0: Allow faults and forbid warnings 1: Allow faults and warnings 2: Forbid faults and warnings	1	0	Immediate	During running	-
H0A	03	Retentive at power failure selection	0: Disabled 1: Enabled	1	0	Immediate	During running	-
H0A	04	Motor overload protection gain	50–300	%	100	Immediate	At stop	-
H0A	08	Overspeed threshold	0–10000	rpm	0	Immediate	During running	PST
H0A	09	Maximum position pulse frequency	100–4000	kHz	4000	Immediate	At stop	P
H0A	10	Threshold of position deviation fault	1–1073741824	Encoder unit	3145728	Immediate	During running	P
H0A	12	Runaway protection selection	0: Disabled 1: Enabled	-	1	Immediate	During running	PST
H0A	16	Position deviation threshold in low-frequency resonance	1–1000	Encoder unit	5	Immediate	During running	P
H0A	19	DI8 filter time constant	0–255	25 ns	80	Power-on again	At stop	-
H0A	20	DI9 filter time constant	0–255	25 ns	80	Power-on again	At stop	-
H0A	24	Filter time of low-speed pulse input pin	0–255 ns	25 ns	30	Power-on again	At stop	-
H0A	25	Filter time constant of speed feedback display value	0–5000	ms	50	Immediate	At stop	-
H0A	26	Motor overload shielding	0: Not shield 1: Shield	-	0	Immediate	At stop	-

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H0A	27	Speed DO filter time constant	0–5000	ms	10	Immediate	At stop	-
H0A	28	Quadrature encoder filter time constant	0–255	25 ns	30	Power-on again	At stop	-
H0A	30	Filter time constant of high-speed pulse input pin	0–255	25 ns	3	Power-on again	At stop	-
H0A	32	Locked rotor overheat protection time window	10–65535	ms	200	Immediate	During running	-
H0A	33	Locked rotor overheat protection	0: Disabled 1: Enabled	-	1	Immediate	During running	-

Group H0B: Display Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H0B	00	Actual motor speed	-	rpm	-	-	At display	PST
H0B	01	Speed reference	-	rpm	-	-	At display	PS
H0B	02	Internal torque reference (relative to rated motor torque)	-	%	-	-	At display	PST
H0B	03	Monitored DI states	-	-	-	-	At display	PST
H0B	05	Monitored DO states	-	-	-	-	At display	PST
H0B	07	Absolute position counter (32-bit decimal display)	-	Reference unit	-	-	At display	P
H0B	09	Mechanical angle (starting from the pulses of home)	-	Encoder unit	-	-	At display	PST
H0B	10	Rotation angle (electrical angle)	-	°	-	-	At display	PST
H0B	11	Speed corresponding to input position reference	-	rpm	-	-	At display	P
H0B	12	Average load rate	-	%	-		At display	PST
H0B	13	Input reference pulse counter (32-bit decimal display)	-	Reference unit	-	-	At display	P
H0B	15	Encoder position deviation counter (32-bit decimal display)	-	Encoder unit	-	-	At display	P
H0B	17	Feedback pulse counter (32-bit decimal display)	-	Encoder unit	-	-	At display	P
H0B	19	Total power-on time (32-bit decimal display)	-	s	-	-	At display	PST
H0B	21	AI1 sampling voltage	-	V	-	-	At display	PST
H0B	22	AI2 sampling voltage	-	V	-	-	At display	PST
H0B	24	Phase current valid value	-	A	-	-	At display	PST

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H0B	26	Bus voltage	-	V	-	-	At display	PST
H0B	27	Module temperature	-	°C	-	-	At display	PST
H0B	33	Fault record	0: Current fault 1: Last fault 2: Last 2nd fault …… 9: Last 9th fault	-	0	Immediate	During running	PST
H0B	34	Fault code	-	-	-	-	At display	PST
H0B	35	Time stamp upon displayed fault	-	s	-	-	At display	PST
H0B	37	Current motor speed upon displayed fault	-	rpm	-	-	At display	PST
H0B	38	Motor phase U current upon displayed fault	-	A	-	-	At display	PST
H0B	39	Motor phase V current upon displayed fault	-	A	-	-	At display	PST
H0B	40	Bus voltage upon displayed fault	-	V	-	-	At display	PST
H0B	41	Input terminal state upon displayed fault	-	-	-	-	At display	PST
H0B	42	Output terminal state upon displayed fault	-	-	-	-	At display	PST
H0B	53	Position deviation counter	-	Reference unit	-	-	At display	P
H0B	55	Actual motor speed (0.1 rpm)	-	rpm	-	-	At display	PST

Group H0C: Communication Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H0C	00	Servo shaft address	1–247 0: broadcast address	-	1	Immediate	During running	PST
H0C	02	Serial port baud rate	0–5 0: 2400 bit/s 1: 4800 bit/s 2: 9600 bit/s 3: 19200 bit/s 4: 38400 bit/s 5: 57600 bit/s	-	5	Immediate	During running	PST
H0C	03	Modbus data format	0: No check, 2 stop bits 1: Even parity check, 1 stop bit 2: Odd parity check, 1 stop bit 3: No check, 1 stop bit	-	0	Immediate	During running	PST
H0C	08	CAN communication rate	0: 20 Kbit/s 1: 50 Kbit/s 2: 100 Kbit/s 3: 125 Kbit/s 4: 250 Kbit/s 5: 500 Kbit/s 6: 800 Kbit/s 7: 1 Mbit/s	-	5	Immediate	During running	PST
H0C	09	Communication virtual DI (VDI)	0: Disabled 1: Enabled	-	0	Immediate	At stop	PST
H0C	10	VDI default value after power-on	Bit0: VDI1 default value …… Bit15: VDI16 default value	-	0	Power-on again	During running	PST
H0C	11	Communication virtual DO (VDO)	0: Disabled 1: Enabled	-	0	Immediate	At stop	PST
H0C	12	Default virtual level of VDO allocated with function 0	Bit0: VDO1 default value …… Bit15: VDO16 default value	-	0	Immediate	At stop	PST
H0C	13	Update function code values written via communication to EEPROM	0: Not updated to EEPROM 1: Update to EEPROM	-	1	Immediate	During running	PST

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H0C	14	Modbus error code	New protocol: 0x0001: Illegal function (command code) 0x0002: Illegal data address 0x0003: Illegal data 0x0004: Slave station device fault Old protocol: 0x0002: Command code not being 0x03/0x06/0x10 0x0004: CRC checksum received by servo computer different from checksum in data frame 0x0008: Accessed function code not exist 0x0010: Written function code value exceed limits 0x0080: Written function code modifiable only in stop state but servo being in running state	-	-	-	At display	-
H0C	25	Modbus response delay	0–5000	ms	1	Immediate	During running	PST
H0C	26	Modbus communication data sequence	0: High 16 bits before low 16 bits 1: Low 16 bits before high 16 bits	-	1	Immediate	During running	PST
H0C	27	Warning intervals of NodeGuard timeout	1–10	-	5	Immediate	At stop	PST
H0C	28	CANopen packet transmission sequence	0: Little endian 1: Big endian	-	0	Immediate	During running	PST
H0C	30	Modbus error frame format	0: Old protocol 1: Standard error protocol	-	1	Immediate	During running	PST

Group H0D: Auxiliary Function Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H0D	00	Software reset	0: No operation 1: Enabled	-	0	Immediate	At stop	-
H0D	01	Fault reset	0: No operation 1: Enabled	-	0	Immediate	At stop	-
H0D	02	Offline load inertia auto-tuning	-	-	-	Immediate	During running	-
H0D	03	Initial angle auto-tuning	0: No operation 1: Enabled	-	0	Immediate	At stop	-
H0D	05	Emergency stop	0: No operation 1: Enabled	-	0	Immediate	During running	-
H0D	10	Analog automatic adjustment	0: No operation 1: AI1 adjustment 2: AI2 adjustment	-	0	Immediate	At stop	-
H0D	11	Jog function	-	-	-	-	-	-
H0D	17	DI/DO forced input and output enabled	0: No operation 1: Simulated DI enabled, simulated DO disabled 2: Simulated DO enabled, simulated DI disabled 3: Simulated DI and DO enabled	-	0	Immediate	During running	-
H0D	18	DI forced input setting	0–0x01FF	-	0x01FF	Immediate	During running	-
H0D	19	DO forced output setting	0–0x001F	-	0	Immediate	During running	-

Group H0F: Full Closed-loop Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H0F	00	Encoder feedback mode	0–2 0: Internal encoder feedback 1: External encoder feedback 2: Internal/External position closed-loop switchover at electronic gear ratio switchover	-	0	Immediate	At stop	P
H0F	01	Running mode of external encoder	0: Standard mode 1: Reverse running mode	-	0	Immediate	At stop	P
H0F	04	External encoder pulses per motor revolution	0–1073741824	External encoder unit	10000	Power-on again	At stop	P
H0F	08	Full closed-loop position deviation too large threshold	0–1073741824	External encoder unit	1000	Immediate	During running	P
H0F	10	Full closed-loop position deviation clear setting	0–100	Rev	0	Immediate	During running	P
H0F	13	Hybrid vibration restraining filter time constant	0–6553.5	ms	0	Immediate	During running	P
H0F	16	Full closed-loop position deviation counter	-1073741824 to 1073741824	External encoder unit	0	-	At display	P
H0F	18	Feedback pulse counter of internal encoder	-1073741824 to 1073741824	Internal encoder unit	0	-	At display	P
H0F	20	Feedback pulse counter of external encoder	-1073741824 to 1073741824	External encoder unit	0	-	At display	P

Group H11: Multi-Position Function Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H11	00	Multi-position running mode	0: Stop after a single running (position selection in H11-01) 1: Cyclic running (position selection in H11-01) 2: DI switchover (position selection by DI) 3: Sequential running (position selection in H11-01)		1	Immediate	At stop	P
H11	01	End position No. in displacement reference	1–16		1	Immediate	At stop	P
H11	02	Margin processing method	Valid when H11-00 ≠ 2. 0: Complete the remaining distance 1: Start running again from position 1		0	Immediate	At stop	P
H11	03	Time unit	0: ms 1: s	1	0	Immediate	At stop	P
H11	04	Displacement reference type	0: Relative displacement reference 1: Absolute displacement reference	1	0	Immediate	At stop	P
H11	05	Start position of sequence running	0–16	1	0	Immediate	At stop	P
H11	12	1st displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H11	14	Maximum running speed of 1st displacement	1–6000	rpm	200	Immediate	During running	P
H11	15	Acceleration/ Deceleration time of 1st displacement	0–65535	ms (s)	10	Immediate	During running	P
H11	16	Waiting time after 1st displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	17	2nd displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	19	Maximum running speed of 2nd displacement	1–6000	rpm	200	Immediate	During running	P
H11	20	Acceleration/ Deceleration time of 2nd displacement	0–65535	ms (s)	10	Immediate	During running	P
H11	21	Waiting time after 2nd displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	22	3rd displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	24	Maximum running speed of 3rd displacement	1–6000	rpm	200	Immediate	During running	P
H11	25	Acceleration/ Deceleration time of 3rd displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	26	Waiting time after 3rd displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	27	4th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	29	Maximum running speed of 4th displacement	1–6000	rpm	200	Immediate	During running	P
H11	30	Acceleration/ Deceleration time of 4th displacement<	0–65535	ms (s)	10	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H11	31	Waiting time after 4th displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	32	5th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	34	Maximum running speed of 5th displacement	1–6000	rpm	200	Immediate	During running	P
H11	35	Acceleration/ Deceleration time of 5th displacement	0–65535	ms (s)	10	Immediate	During running	P
H11	36	Waiting time after 5th displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	37	6th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	39	Maximum running speed of 6th displacement	1–6000	rpm	200	Immediate	During running	P
H11	40	Acceleration/ Deceleration time of 6th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	41	Waiting time after 6th displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	42	7th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	44	Maximum running speed of 7th displacement	1–6000	rpm	200	Immediate	During running	P
H11	45	Acceleration/ Deceleration time of 7th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	46	Waiting time after 7th displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	47	8th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	49	Maximum running speed of 8th displacement	1–6000	rpm	200	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H11	50	Acceleration/ Deceleration time of 8th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	51	Waiting time after 8th displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	52	9th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	54	Maximum running speed of 9th displacement	1–6000	rpm	200	Immediate	During running	P
H11	55	Acceleration/ Deceleration time of 9th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	56	Waiting time after 9th displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	57	10th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	59	Maximum running speed of 10th displacement	1–6000	rpm	200	Immediate	During running	P
H11	60	Acceleration/ Deceleration time of 10th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	61	Waiting time after 10th displacement	0–10000	ms (s)	10 ms (s)	Immediate	During running	P
H11	62	11th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	64	Maximum running speed of 11th displacement	1–6000	rpm	200	Immediate	During running	P
H11	65	Acceleration/ Deceleration time of 11th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	66	Waiting time after 11th displacement	0–10000	ms (s)	10	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H11	67	12th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	69	Maximum running speed of 12th displacement	1–6000	rpm	200	Immediate	During running	P
H11	70	Acceleration/ Deceleration time of 12th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	71	Waiting time after 12th displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	72	13th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	74	Maximum running speed of 13th displacement	1–6000	rpm	200	Immediate	During running	P
H11	75	Acceleration/ Deceleration time of 13th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	76	Waiting time after 13th displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	77	14th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	79	Maximum running speed of 14th displacement	1–6000	rpm	200	Immediate	During running	P
H11	80	Acceleration/ Deceleration time of 14th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	81	Waiting time after 14th displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	82	15th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	84	Maximum running speed of 15th displacement	1–6000	rpm	200	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H11	85	Acceleration/ Deceleration time of 15th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	86	Waiting time after 15th displacement	0–10000	ms (s)	10	Immediate	During running	P
H11	87	16th displacement	-1073741824 to 1073741824	Reference unit	10000	Immediate	During running	P
H11	89	Maximum running speed of 16th displacement	1–6000	rpm	200	Immediate	During running	P
H11	90	Acceleration/ Deceleration time of 16th displacement<	0–65535	ms (s)	10	Immediate	During running	P
H11	91	Waiting time after 16th displacement	0–10000	ms (s)	10	Immediate	During running	P

Group H12: Multi-Speed Function Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H12	00	Multi-speed running mode	0: Stop after a single running (speed selection in H12-01) 1: Cyclic running (speed selection in H12-01) 2: Switchover by DI	-	1	Immediate	At stop	S
H12	01	End speed No. in speed reference	1–16	-	16	Immediate	At stop	S
H12	02	Running time unit	0: sec 1: min	-	0	Immediate	At stop	S
H12	03	Acceleration time 1	0–65535	ms	10	Immediate	At stop	S
H12	04	Deceleration time 1	0–65535	ms	10	Immediate	At stop	S
H12	05	Acceleration time 2	0–65535	ms	50	Immediate	At stop	S
H12	06	Deceleration time 2	0–65535	ms	50	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H12	07	Acceleration time 3	0–65535	ms	100	Immediate	At stop	S
H12	08	Deceleration time 3	0–65535	ms	100	Immediate	At stop	S
H12	09	Acceleration time 4	0–65535	ms	150	Immediate	At stop	S
H12	10	Deceleration time 4	0–65535	ms	150	Immediate	At stop	S
H12	20	1st speed reference	-6000 to 6000	rpm	0	Immediate	At stop	S
H12	21	Running time of 1st speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S
H12	22	Acceleration/ Deceleration time of 1st speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4		0	Immediate	At stop	S
H12	23	2nd speed reference	-6000 to 6000	rpm	100	Immediate	At stop	S
H12	24	Running time of 2nd speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S
H12	25	Acceleration/ Deceleration time of 2nd speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	26	3rd speed reference	-6000 to 6000	rpm	300	Immediate	At stop	S
H12	27	Running time of 3rd speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H12	28	Acceleration/ Deceleration time of 3rd speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	29	4th speed reference	-6000 to 6000	rpm	500	Immediate	At stop	S
H12	30	Running time of 4th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S
H12	31	Acceleration/ Deceleration time of 4th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	32	5th speed reference	-6000 to 6000	rpm	700	Immediate	At stop	S
H12	33	Running time of 5th speed reference	0–6553.5	s (min)	5.0)	Immediate	At stop	S
H12	34	Acceleration/ Deceleration time of 5thspeed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	35	6th speed reference	-6000 to 6000	rpm	900	Immediate	At stop	S
H12	36	Running time of 6th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H12	37	Acceleration/ Deceleration time of 6th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	38	7th speed reference	-6000 to 6000	rpm	600	Immediate	At stop	S
H12	39	Running time of 7th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S
H12	40	Acceleration/ Deceleration time of 7th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	41	8th speed reference	-6000 to 6000	rpm	300	Immediate	At stop	S
H12	42	Running time of 8th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S
H12	43	Acceleration/ Deceleration time of 8th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	44	9th speed reference	-6000 to 6000	rpm	100	Immediate	At stop	S
H12	45	Running time of 9th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H12	46	Acceleration/ Deceleration time of 9th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	47	10th speed reference	-6000 to 6000	rpm	-100	Immediate	At stop	S
H12	48	Running time of 10th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S
H12	49	Acceleration/ Deceleration time of 10th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	50	11th speed reference	-6000 to 6000	rpm	-300	Immediate	At stop	S
H12	51	Running time of 11th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S
H12	52	Acceleration/ Deceleration time of 11th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	53	12th speed reference	-6000 to 6000	rpm	-500	Immediate	At stop	S
H12	54	Running time of 12th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H12	55	Acceleration/ Deceleration time of 12th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	56	13th speed reference	-6000 to 6000	rpm	-700	Immediate	At stop	S
H12	57	Running time of 13th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S
H12	58	Acceleration/ Deceleration time of 13th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	59	14th speed reference	-6000 to 6000	rpm	-900	Immediate	At stop	S
H12	60	Running time of 14th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S
H12	61	Acceleration/ Deceleration time of 14th speed reference	00: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	62	15th speed reference	-6000 to 6000	rpm	-600	Immediate	At stop	S
H12	63	Running time of 15th speed reference	0–6553.5	s (min)	5.0	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H12	64	Acceleration/ Deceleration time of 15th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S
H12	65	16th speed reference	-6000 to 6000	rpm	-300	Immediate	At stop	S
H12	66	Running time of 16th speed reference	0–6553.5	s (min)	5.0)	Immediate	At stop	S
H12	67	Acceleration/ Deceleration time of 16th speed reference	0: No acceleration/ deceleration time 1: Acceleration/ Deceleration time 1 2: Acceleration/ Deceleration time 2 3: Acceleration/ Deceleration time 3 4: Acceleration/ Deceleration time 4	-	0	Immediate	At stop	S

Group H17: VDI/VDO Parameters

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H17	00	VDI1 function selection	0–37	-	0	Upon stop	During running	-
H17	01	VDI1 logic selection	0: Active when the written value is 11 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	02	VDI2 function selection	0–37	-	0	Upon stop	During running	-
H17	03	VDI2 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	04	VDI3 function selection	0–37	-	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H17	05	VDI3 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	06	VDI4 function selection	0–37	-	0	Upon stop	During running	-
H17	07	VDI4 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	08	VDI5 function selection	0–37	-	0	Upon stop	During running	-
H17	09	VDI5 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	10	VDI6 function selection	0–37	-	0	Upon stop	During running	-
H17	11	VDI6 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	12	VDI7 function selection	0–37	-	0	Upon stop	During running	-
H17	13	VDI7 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	14	VDI8 function selection	0–37	-	0	Upon stop	During running	-
H17	15	VDI8 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	16	VDI9 function selection	0–37	-	0	Upon stop	During running	-
H17	17	VDI9 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H17	18	VDI10 function selection	0–37	-	0	Upon stop	During running	-
H17	19	VDI10 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	20	VDI11 function selection	0–37	-	0	Upon stop	During running	-
H17	21	VDI11 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	22	VDI12 function selection	0–37	-	0	Upon stop	During running	-
H17	23	VDI12 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	24	VDI13 function selection	0–37	-	0	Upon stop	During running	-
H17	25	VDI13 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	26	VDI14 function selection	0–37	-	0	Upon stop	During running	-
H17	27	VDI14 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	28	VDI15 function selection	0–37	-	0	Upon stop	During running	-
H17	29	VDI15 logic selection	0: Valid when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	30	VDI16 function selection	0–37	-	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H17	31	VDI16 logic selection	0: Active when the written value is 1 1: Inactive when the written value changes from 0 to 1	-	0	Upon stop	During running	-
H17	32	VDO virtual level	-	-	-	-	At display	-
H17	33	VDO1 function selection	0–19	-	0	Upon stop	During running	-
H17	34	VDO1 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	35	VDO2 function selection	0–19	-	0	Upon stop	During running	-
H17	36	VDO2 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	37	VDO3 function selection	0–19	-	0	Upon stop	During running	-
H17	38	VDO3 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	39	VDO4 function selection	0–19	-	0	Upon stop	During running	-
H17	40	VDO4 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	41	VDO5 function selection	0–19	-	0	Upon stop	During running	-
H17	42	VDO5 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	43	VDO6 function selection	0–19	-	0	Upon stop	During running	-
H17	44	VDO6 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	45	VDO7 function selection	0–19	-	0	Upon stop	During running	-
H17	46	VDO7 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	47	VDO8 function selection	0–19	-	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H17	48	VDO8 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	49	VDO9 function selection	0–19	-	0	Upon stop	During running	-
H17	50	VDO9 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	51	VDO10 function selection	0–19	-	0	Upon stop	During running	-
H17	52	VDO10 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	53	VDO11 function selection	0–19	-	0	Upon stop	During running	-
H17	54	VDO11 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	55	VDO12 function selection	0–19	-	0	Upon stop	During running	-
H17	56	VDO12 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	57	VDO13 function selection	0–19	-	0	Upon stop	During running	-
H17	58	VDO13 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	59	VDO14 function selection	0–19	-	0	Upon stop	During running	-
H17	60	VDO14 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	61	VDO15 function selection	0–19	-	0	Upon stop	During running	-
H17	62	VDO15 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-
H17	63	VDO16 function selection	0–19	-	0	Upon stop	During running	-
H17	64	VDO16 logic selection	0: Output 1 when active 1: Output 0 when active	-	0	Upon stop	During running	-

Group H30: Servo Related Variables Read via Communication

The values are not displayed on the keypad.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H30	00	Servo state read via communication	-	-	-	-	Read-only	PST
H30	01	DO function state 1 read via communication	-	-	-	-	Read-only	PST
H30	02	DO function state 2 read via communication	-	-	-	-	Read-only	PST
H30	03	Input reference pulse sampling read via communication	-	-	-	-	At display	PST

Group H31: Servo Related Variables Set via Communication

The values are not displayed on the keypad.

Function Code		Parameter Name	Setting Range	Unit	Default	Effective Time	Property	Control Mode
H31	00	VDI virtual level set via communication	0–65535	-	0	Immediate	During running	PST
H31	04	DO state set via communication	0–31	-	0	Immediate	During running	PST
H31	09	Speed reference set via communication	-6000 to 6000	rpm	0	Immediate	During running	S
H31	11	Torque reference set via communication	-100.000 to 100.000%	%	0	Immediate	During running	T

DI/DO Basic Functions

Table 7-1 DI/DO basic function table

No.	Function Symbol	Function Name	Description	Remarks
Input Function Description				
FunIN.1	S-ON	Servo enabled	Invalid: Servo motor disabled Valid: Servo motor enabled	The logic of the corresponding terminal needs to be set to level valid. The change of the corresponding DI or VDI or terminal logic takes effect only after power-on again.
FunIN.2	ALM-RST	Fault and alarm reset (edge valid)	Invalid: Disabled Valid: Enabled	The logic of the corresponding terminal must be set to edge valid. If you set the logic to level valid, the servo drive forcibly changes it to edge logic internally. According to the alarm type, the servo drive can continue to work after some alarms are reset.
FunIN.3	GAIN-SEL	Gain switchover	H0809 = 1 Invalid: Speed control loop being PI control Valid: Speed control loop being P control H0809 = 2: Invalid: Always first gain group Valid: Always second gain group	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.4	CMD-SEL	Main/Auxiliary reference switchover	Invalid: Current running reference being A Valid: Current running 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	Invalid: Default reference direction Valid: Reverse reference direction	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.6	CMD1	Multi-reference switchover 1	Used to select one from the 16 references.	It is recommended that the logic of the corresponding terminal be set to level valid.

No.	Function Symbol	Function Name	Description	Remarks
FunIN.7	CMD2	Multi-reference switchover 2	Used to select one from the 16 references.	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.8	CMD3	Multi-reference switchover 3	Used to select one from the 16 references.	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.9	CMD4	Multi-reference switchover 4	Used to select one from the 16 references.	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.10	M1-SEL	Mode switchover 1	Perform switchover between speed control, position control, and torque control based on the selected control mode (values 3, 4, 5 of H02-00).	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.11	M2-SEL	Mode switchover 2	Perform switchover between speed control, position control, and torque control based on the selected control mode (values 6 of H02-00).	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.12	ZCLAMP	Zero clamp enable	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 forbidden	Valid: Reference pulse input forbidden Invalid: Reference pulse input allowed	This function is now actually used as position reference forbidden, involving internal and external position references. The logic of the corresponding DI must be set to level valid.
FunIN.14	P-OT	Forward overtravel switch	When the mechanical movement is outside the movable range, the overtravel prevention function is implemented. Valid: Forward drive forbidden Invalid: Forward drive allowed	When the mechanical movement is out of the movable range, the servo drive. It is recommended that the logic of the corresponding terminal be set to level valid.

No.	Function Symbol	Function Name	Description	Remarks
FunIN.15	N-OT	Reverse overtravel switch	When the mechanical movement is outside the movable range, the overtravel prevention function is implemented. Valid: Reverse drive forbidden Invalid: Reverse drive allowed	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.16	P-CL	External forward torque limit	The torque limit source is switched over based on the setting of H07-07. H07-07 = 1: Valid: External forward torque limit enabled Invalid: Internal forward torque limit enabled H07-07 = 3 and AI limit larger than external forward limit: Valid: External forward torque limit enabled Invalid: AI torque limit enabled H07-07 = 4: Valid: AI torque limit enabled Invalid: Internal forward torque limit valid	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.17	N-CL	External reverse torque limit	The torque limit source is switched over based on the setting of H07-07. H07-07 = 1: Valid: External reverse torque limit enabled Invalid: Internal reverse torque limit enabled H07-07 = 3 and AI limit smaller than external reverse limit: Valid: External reverse torque limit enabled Invalid: AI torque limit enabled H07-07 = 4: Valid: AI torque limit enabled Invalid: Internal reverse torque limit valid	It is recommended that the logic of the corresponding terminal be set to level valid.

No.	Function Symbol	Function Name	Description	Remarks
FunIN.18	JOGCMD+	Forward jog	Valid: Reference input Invalid: Reference input stopped	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.19	JOGCMD-	Reverse jog	Valid: Reference input Invalid: Reference input stopped	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.20	POSSTEP	Step reference	Valid: Execute step reference 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 valid, HX2 invalid: X10 HX1 invalid, HX2 valid: X100 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	Invalid: Position control based on the setting of H05-00 Valid: Receive pulse signal from the handwheel for position control in position control mode	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.24	GEAR_SEL	Electronic gear ratio switchover	Invalid: Electronic gear ratio 1 Valid: Electronic gear ratio 2	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.25	TOQDirSel	Torque reference direction	Valid: Forward direction Invalid: Reverse direction	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.26	SPDDirSel	Speed reference direction	Valid: Forward direction Invalid: Reverse direction	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.27	POSDirSel	Position reference direction	Valid: Forward direction Invalid: Reverse direction	It is recommended that the logic of the corresponding terminal be set to level valid.

No.	Function Symbol	Function Name	Description	Remarks
FunIN.28	PosInSen	Multi-position enable	Valid at edges Valid: Internal multi-position ignored Invalid: Internal multi-position enabled	It is recommended that the logic of the corresponding terminal be set to level valid. If you set the logic to level valid, the servo drive forcibly changes it to edge logic internally.
FunIN.29	XintFree	Interruption fixed length cleared	Invalid: Not respond to position references Valid: Unlock position references	It is recommended that the logic of the corresponding terminal be set to edge valid.
FunIN.31	HomeSwitch	Home switch	Invalid: Not triggered Valid: Triggered	The logic of the corresponding terminal must be set to level valid. If you set the logic to 2, the servo drive forcibly changes it to 1 internally. If you set the logic to 3 or 4, the servo drive forcibly changes it to 0 internally.
FunIN.32	HomingStart	Home return	Invalid: Disabled Valid: Enabled	It is recommended that the logic of the corresponding terminal be set to edge valid. If you set the logic to level valid, the servo drive forcibly changes it to edge logic internally.
FunIN.33	XintInhibit	Interruption fixed length forbidden	Valid: Interruption fixed length forbidden Invalid: Interruption fixed length allowed	The logic of the corresponding terminal must be set to level valid. If you set the logic to 2, the servo drive forcibly changes it to 1 internally. If you set the logic to 3 or 4, the servo drive forcibly changes it to 0 internally.
FunIN.34	Emergency stop	Braking	Valid: Position lock after stop at zero speed Invalid: Not affect current running state	It is recommended that the logic of the corresponding terminal be set to level valid.

No.	Function Symbol	Function Name	Description	Remarks
FunIN.35	ClrPosErr	Position deviation cleared	Valid: Clear Invalid: Not clear	It is recommended that and this function be allocated to DI8 or DI9 and the logic of the corresponding terminal be set to edge valid. If you set the logic to level valid, the servo drive forcibly changes it to edge logic internally.
FunIN.36	V_LmtSel	Internal speed limit source	Valid: H06-19 as internal forward speed limit (H07-17 = 2) Invalid: H07-20 as internal reverse speed limit (H07-17 = 2)	It is recommended that the logic of the corresponding terminal be set to level valid.
FunIN.37	PulseInhibit	Pulse reference forbidden	The position reference source is pulse reference (H05-00 = 0) in the position control mode. Invalid: Respond to pulse reference Valid: Not respond to pulse reference	It is recommended that the logic of the corresponding terminal be set to level valid.
Output Function Description				
FunOUT.1	S-RDY	Servo ready	The servo drive is in ready state and can receive the S-ON signal. Valid: Servo drive ready Invalid: Servo drive not ready	-
FunOUT.2	TGON	Motor rotation output	When the motor speed exceeds the threshold (H06-16): Valid: Motor rotation signal valid Invalid: Motor rotation signal invalid	-
FunOUT.3	ZERO	Zero speed signal	When the servo motor stops rotation: Valid: Motor speed being zero Invalid: Motor speed being not zero	-

No.	Function Symbol	Function Name	Description	Remarks
FunOUT.4	V-CMP	Speed consistent	In the speed control mode, when the absolute value of the deviation between the motor 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	Speed limit	Confirming speed limit in torque control: Valid: Motor speed limited Invalid: Motor speed not limited	-
FunOUT.9	BK	Brake output	Brake output: Valid: Brake released Invalid: Brake applied	-
FunOUT.10	WARN	Warning output	The warning output is active (conducted).	-
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	Valid: Interruption fixed length completed Invalid: Interruption fixed length not completed	-
FunOUT.16	HomeAttain	Home return output	Valid: Return to home Invalid: Not return to home	-

No.	Function Symbol	Function Name	Description	Remarks
FunOUT.17	ElecHomeAttain	Electrical home return output	Valid: Return to electrical home Invalid: Not return to electrical home	-
FunOUT.18	ToqReach	Torque reached output	Valid: Absolute value reaches the setting Invalid: Absolute value smaller than the setting	-
FunOUT.19	VArr	Speed reached output	Valid: Speed feedback reaches the setting Invalid: Speed feedback smaller than the setting	-
FunOUT.20	AngRdy	Initial angle auto-tuning complted	Valid: Angle auto-tuning completed Invalid: Angle auto-tuning not completed	-

Appendix: Version Change Record

Date	Version	Change
Otc. 2013	V0.0	First issue.
Aug. 2014	V1.0	• Update the servo system wiring example, designations and adapted cables in Chapter 1. • Update the mounting dimensions of servo motors and servo drives in sections 2.3 and section 2.4. • Update some diagrams and data in Chapter 3. • Update the troubleshooting details in Chapter 4 and Chapter 6. • Update some function codes in Chapter 7.

Warranty Agreement

1. The warranty period of the product is 18 months (refer to the barcode on the equipment). During the warranty period, if the product fails or is damaged under the condition of normal use by following the instructions, Inovance will be responsible for free maintenance.
2. Within the warranty period, maintenance will be charged for the damages caused by the following reasons:

   a. Improper use or repair/modification without prior permission

   b. Fire, flood, abnormal voltage, other disasters and secondary disaster

   c. Hardware damage caused by dropping or transportation after procurement

   d. Improper operation

   e. Trouble out of the equipment (for example, external device)
3. If there is any failure or damage to the product, please correctly fill out the Product Warranty Card in detail.
4. The maintenance fee is charged according to the latest Maintenance Price List of Inovance.
5. The Product Warranty Card is not re-issued. Please keep the card and present it to the maintenance personnel when asking for maintenance.
6. If there is any problem during the service, contact Inovance's agent or Inovance directly.
7. This agreement shall be interpreted by Inovance Technology.

Inovance Technology

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Website: www.inovance.cn

Product Warranty Card

Customer information	Company address:	
	Company name: P.C.:	Contact person:
		Tel.:
Product information	Product model:	
	Product barcode (Attach here):	
	Name of agent:	
Failure information	(Maintenance time and content): Maintenance personnel:	

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