IS620P Series Servo Drive User Manual

Shenzhen Inovance Technology Co., Ltd.

Preface

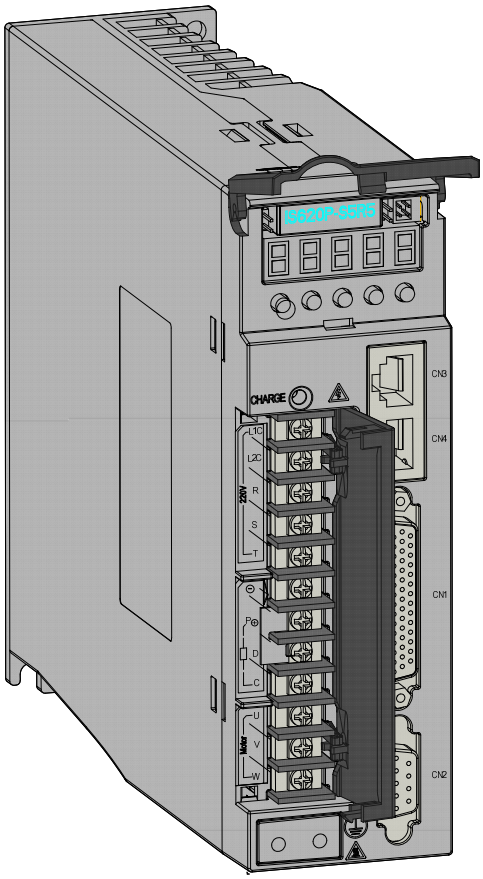
Thank you for purchasing the IS620P series servo drive developed by Shenzhen Inovance Technology Co., Ltd.

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 Modbus communication protocol via RS232/RS485 communication port, and thus multiple IS620P servo drives can work on the same network by using together with a host PC. The IS620P is easy to use due to 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 delivered products are 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 drive rotates smoothly.	The servo motor shaft is normal if it can be turned manually. Servo motor configured with a power-off 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 conducted by qualified person. ● 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 series accident 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 measure into fully consideration to ensure safety in the application site 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. ● Note that the 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. ● Pay attention to the input voltage to the product. Inputting a voltage far larger than the rated voltage may cause damage of the internal components, thus resulting in smoke or even a fire. ● End user decides 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 laws and regulations. ● Note that use of this product beyond its specifications can be not guaranteed. ● This product is subject to change of certain components as we are dedicated to continuous improvement of the product.

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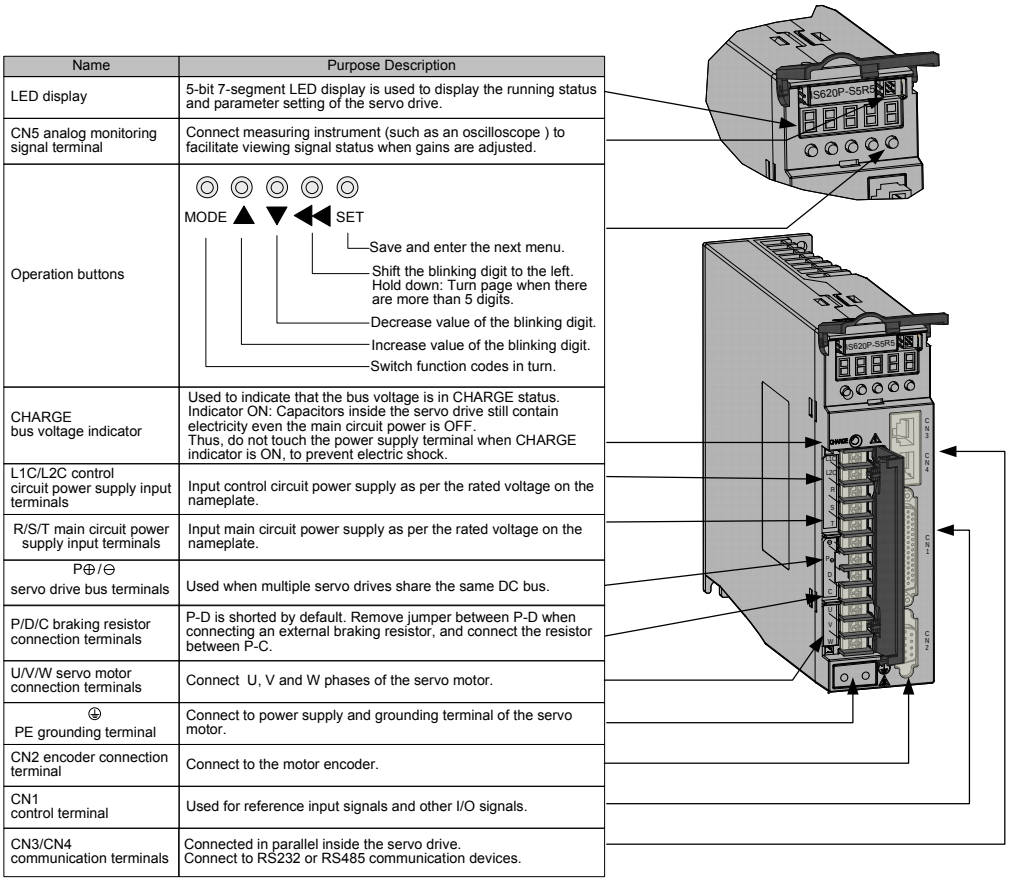
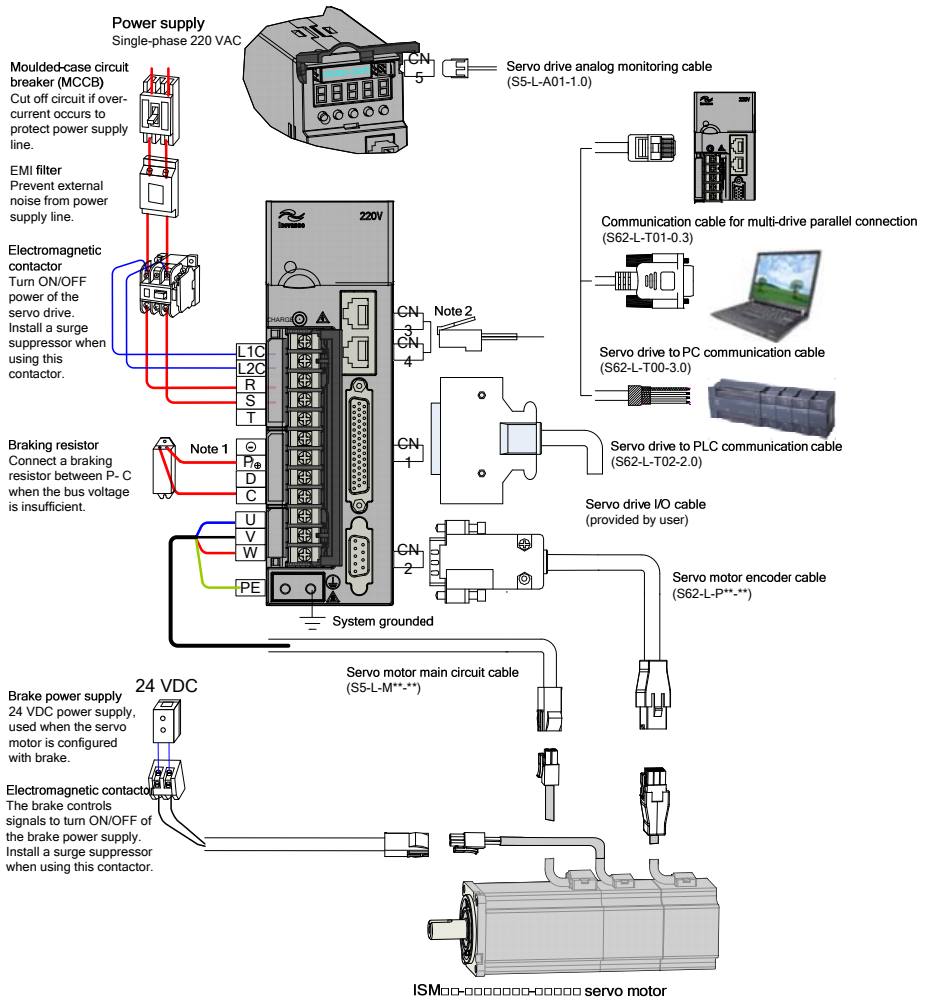
Chapter 1 Servo System Selection

Figure 1-1 Servo drive composition



Name	Purpose Description
LED display	5-bit 7-segment LED display is used to display the running status and parameter setting of the servo drive.
CN5 analog monitoring signal terminal	Connect measuring instrument (such as an oscilloscope) to facilitate viewing signal status when gains are adjusted.
Operation buttons	MODE ▲ ▼ ◀◀ SET Save and enter the next menu. Shift the blinking digit to the left. Hold down: Turn page when there are more than 5 digits. 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 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 supply input terminals	Input control circuit power supply as per the rated voltage on the nameplate.
R/S/T main circuit power supply input terminals	Input main circuit power supply as per the rated voltage on the nameplate.
P⊕/⊖ servo drive bus terminals	Used when multiple servo drives share the same DC bus.
P/D/C braking resistor connection terminals	P-D is shorted by default. Remove jumper between P-D when connecting an external braking resistor, and connect the resistor between P-C.
U/V/W servo motor connection terminals	Connect U, V and W phases of the servo motor.
⏚ PE grounding terminal	Connect to power supply and grounding terminal of the servo 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.

Figure 1-2 Wiring of single-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 on the input power supply to prevent cross electric accidents in the servo system. The IS620P servo drive is not configured with 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.

Do not use magnetic contactors for running or stopping the servo motor. Since motor is a large inductance element, instantaneous medium voltage generated may break down the contactors.

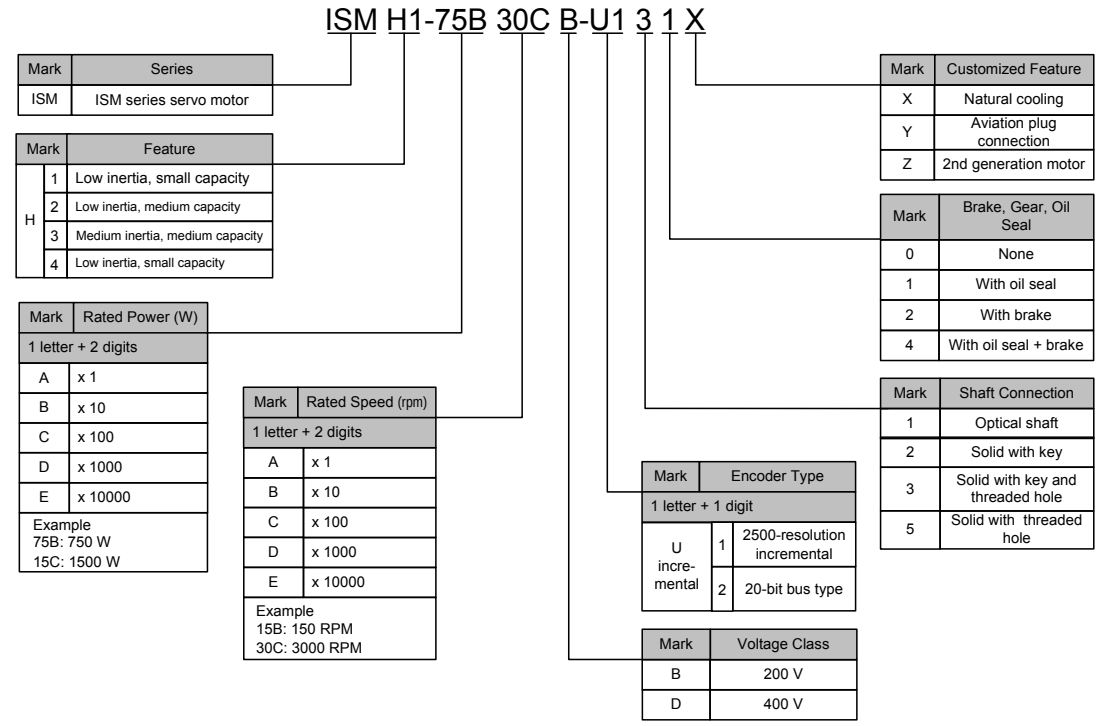
Pay attention to the power capacity when connecting an external control power supply or 24 VDC, especially when the power supply is for powering up multiple drives or brakes. Insufficient power supply will lead to lack of supply current, thus causing failure of the drives or brakes. The brake shall be powered up by a 24 VDC power supply. For power information, refer to the model of the motor.

Observe the following precautions during wiring:

1. Remove the jumper between the P⊕ and D terminals of the servo drive before connecting a braking resistor.
2. CN3 and CN4 are two same communication ports, which can be used at random.
3. For the single-phase 220 V servo drive, T terminal is not necessary. Do not use it during wiring.

1.1 Designation Rules of the Servo Motor and Servo Drive

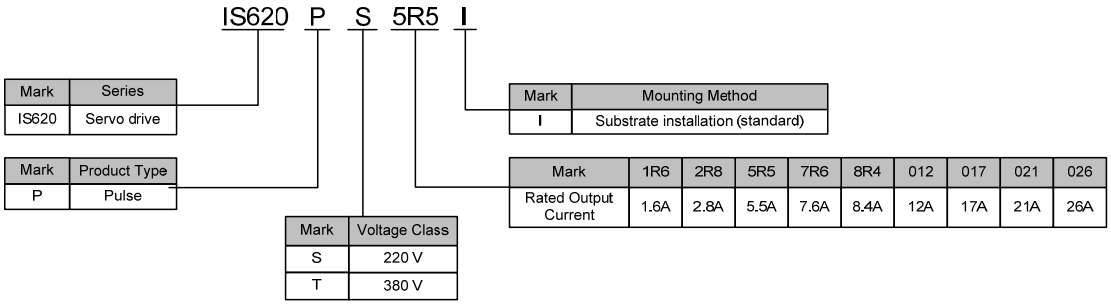
Figure 1-3 Designation rules of the servo motor



Note

Models ending in –U231* and –U234 * are standard models. Prior ordering is required for non-standard models.
All ISHM4 models and part of ISMH2 models (ISMH2-20C/25C/30C/40C/50C) are not configured with a brake.

Figure 1-4 Designation rules of the servo drive



1.2 Servo Motor and Servo Drive 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 No. (H01-02)
						Single-phase 220 V AC	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
3000	6000	400	H4 (Medium inertia, small capacity)	40B30CB	60	S2 R8		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 No. (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

Rated Speed (RPM)	Max. Speed (RPM)	Rated Power (W)	Servo Motor Model (ISMH□-□□□□□□□-*****)		Motor Frame Size	Servo Drive Model (IS620P□□□□I)	Drive Size	Drive No. (H01-02)
1500	3000	2900	H3 (Medium inertia, medium capacity)	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

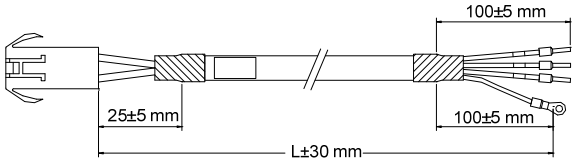
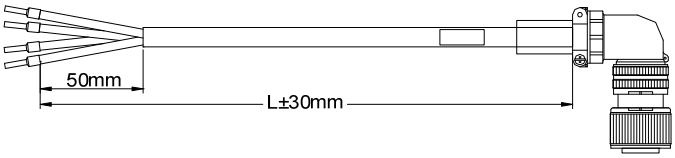
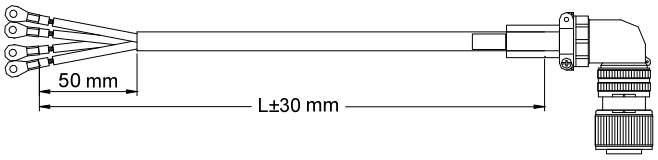
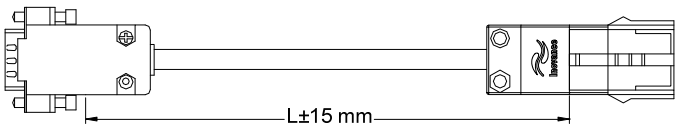
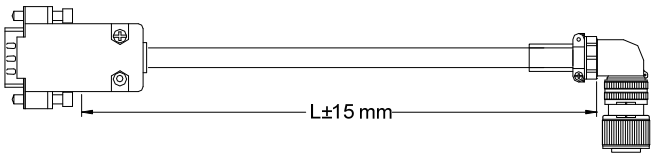
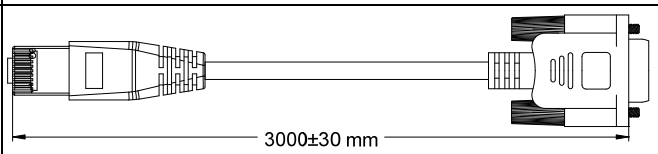
Servo Motor	Servo Motor Main Circuit Cable			Servo Motor Encoder Cable			Connector Kit		
	L = 3.0 m	L = 5.0 m	L = 10.0 m	L = 3.0 m	L = 5.0 m	L = 10.0 m	Standard Motor		Motor with Brake
ISMH1 ISMH4	S5-L-M03-3.0	S5-L-M03-5.0	S5-L-M03-10.0	S62-L-P00-3.0	S62-L-P00-5.0	S62-L-P00-10.0	S62-C1	CN1 terminal	-
								CN2 terminal	
								4-pin connector	
								9-pin connector	
ISMH2 ISMH3 (1.8 kW and below)	S5-L-M24-3.0	S5-L-M24-5.0	S5-L-M24-10.0	S62-L-P21-3.0	S62-L-P21-5.0	S62-L-P21-10.0	S62-C2 (elbow)	CN1 terminal	S5-C11
								CN2 terminal	
								20-18 aviation plug (elbow)	
								20-29 aviation plug (elbow)	
ISMH3-Y (2.9 kW and above)	S5-L-M25-3.0	S5-L-M25-5.0	S5-L-M25-10.0	S62-L-P21-3.0	S62-L-P21-5.0	S62-L-P21-10.0	S62-C3 (elbow)	CN1 terminal	
								CN2 terminal	
								20-22 aviation plug (elbow)	
								20-29 aviation plug (elbow)	
ISMH3-Z (2.9 kW and above)	S5-L-M25-3.0	S5-L-M25-5.0	S5-L-M25-10.0	S62-L-P21-3.0	S62-L-P21-5.0	S62-L-P21-10.0	S62-C3 (elbow)	CN1 terminal	-
								CN2 terminal	
								20-22 aviation plug (elbow)	

								20-29 aviation plug (elbow)	

Table 1-2 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	Resistor plug for servo drive communication terminal

Table 1-3 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	S5-L-M03-3.0	3000	
	S5-L-M03-5.0	5000	
	S5-L-M03-10.0	10000	
	S5-L-M24-3.0	3000	
	S5-L-M24-5.0	5000	
	S5-L-M24-10.0	10000	
	S5-L-M25-3.0	3000	
	S5-L-M25-5.0	5000	
	S5-L-M25-10.0	10000	
Servo motor encoder cable	S62-L-P00-3.0	3000	
	S62-L-P00-5.0	5000	
	S62-L-P00-10.0	10000	
	S62-L-P21-3.0	3000	
	S62-L-P21-5.0	5000	
	S62-L-P21-10.0	10000	
Servo drive to PC communication cable	S62-L-T00-3.0	3000	

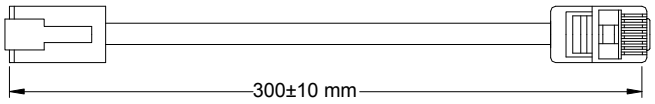
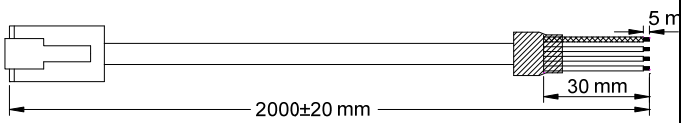
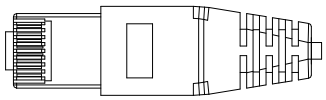
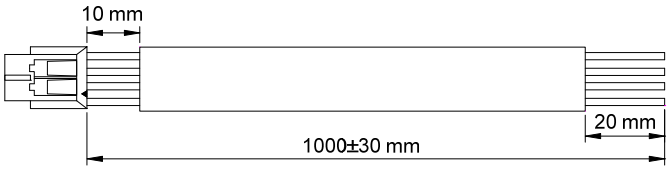
Cable Name	Cable Model	Cable Length (mm)	Cable Appearance
Communication cable for multi-drive parallel connection	S62-L-T01-0.3	300	
Servo drive to PLC communication cable	S62-L-T02-2.0	2000	
Resistor plug for servo drive communication terminal	S62-L-T03-0.0	0	

Table 1-4 Physical appearance of analog output cable

Cable Name	Cable Model	Cable Length (mm)	Cable Appearance
Servo drive analog output cable with loose wire at one end	S5-L-A01-1.0	1000	

1.4 Braking Resistor Specifications

Servo Drive Model		Braking Resistor Specs		Min. Allowed Resistance (Ω)	Max. Braking Energy Absorbed by Capacitor (J)
		Resistance (Ω)	Capacity (W)		
Single-phase 220 V	IS620PS1R6I	-	-	50	5
	IS620PS2R8I	-	-	45	12
Single/Three-phase 220 V	IS620PS5R5I	50	50	40	16
Three-phase 220 V	IS620PS7R6I	100	100	35	22
	IS620PS012I			30	26
Three-phase 380 V	IS620PT3R5I	100	100	60	3
	IS620PT5R4I	100	100	45	5
	IS620PT8R4I	100	100	60	8
	IS620PT012I				11
	IS620PT017I	50	100	35	15
	IS620PT021I			25	19
	IS620PT026I				23

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

Chapter 2 Installation and Mounting Dimensions of the Servo Drive and Servo Motor

2.1 Installation of the Servo Motor

2.1.1 Installation Location

1) Do not install the servo motor in an environment with corrosive or inflammable gases or combustible goods, such as hydrogen sulfide, chlorine, anmonia, sulphur gas, chloridize gas, acid, soda and salt.

2) Select and use the servo motor with oil seal when the motor is to be used 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) Do not 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.

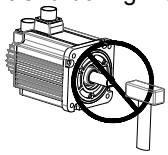
2.1.2 Installation Environment

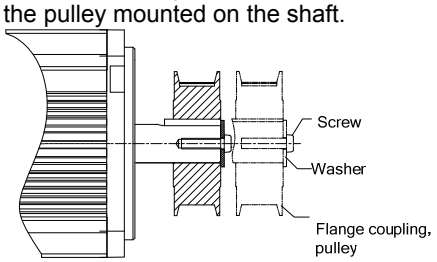
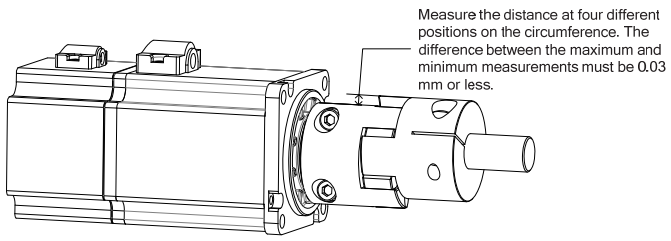
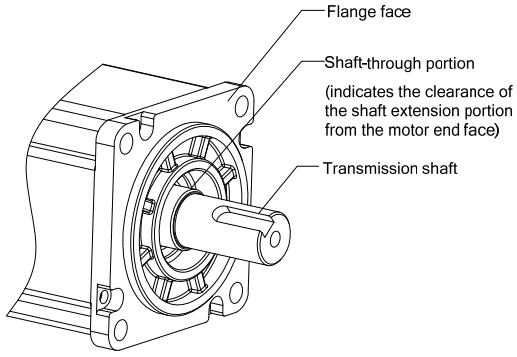
Table 2-1 Installation environment

Item	Description
Working temperature	0–40°C (non-freezing)
Working 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. 

Item	Description
	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 the alignment accuracy satisfy 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.
Handling oil and water	Confirm the IP level of the servo drive when using it in a place with water drops (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 oil seal. Observe the following conditions when using the servo motor with oil seal: ● Make sure the oil level is lower than the oil seal lip during usage. ● Use the servo motor with oil seal under the circumstance that the oil seal is maintaining good condition of splashing of oil sprays. ● Protect the oil seal lip from accumulating oil sprays when the servo motor is installed vertically upward. 
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.

Item	Description
Connectors	● When connecting the connectors, make sure there is no waste or sheet metal inside the connectors. ● Connect the connectors to the main circuit cable side of the servo motor first, and make sure that the grounding wire of the main circuit cable must be reliably connected. If the connectors are first connected to the encoder cable side, the encoder may become faulty due to the potential differences between PE. ● Make sure the pins are correctly arranged during wiring. ● The connectors are made up of resins. Do not strike the connectors to prevent them from being damaged. ● Hold the servo motor body during transportation when the cables are well connected, instead of catching the cables. Otherwise, the connectors may be damaged or the cables may be broken. 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) Install the servo drive inside a cabinet free of sun light and rain.

2) Do not install the servo drive in an environment with corrosive or inflammable gases or combustible goods, such as hydrogen sulfide, chlorine, anmonia, sulphur gas, chloridize gas, acid, soda and salt.

3) Do no install the servo drive in the environment with high temperature, moisture, dust and metal powder.

4) Install the servo drive in a place with no vibration.

2.2.2 Installation Environment

Table 2-3 Installation environment

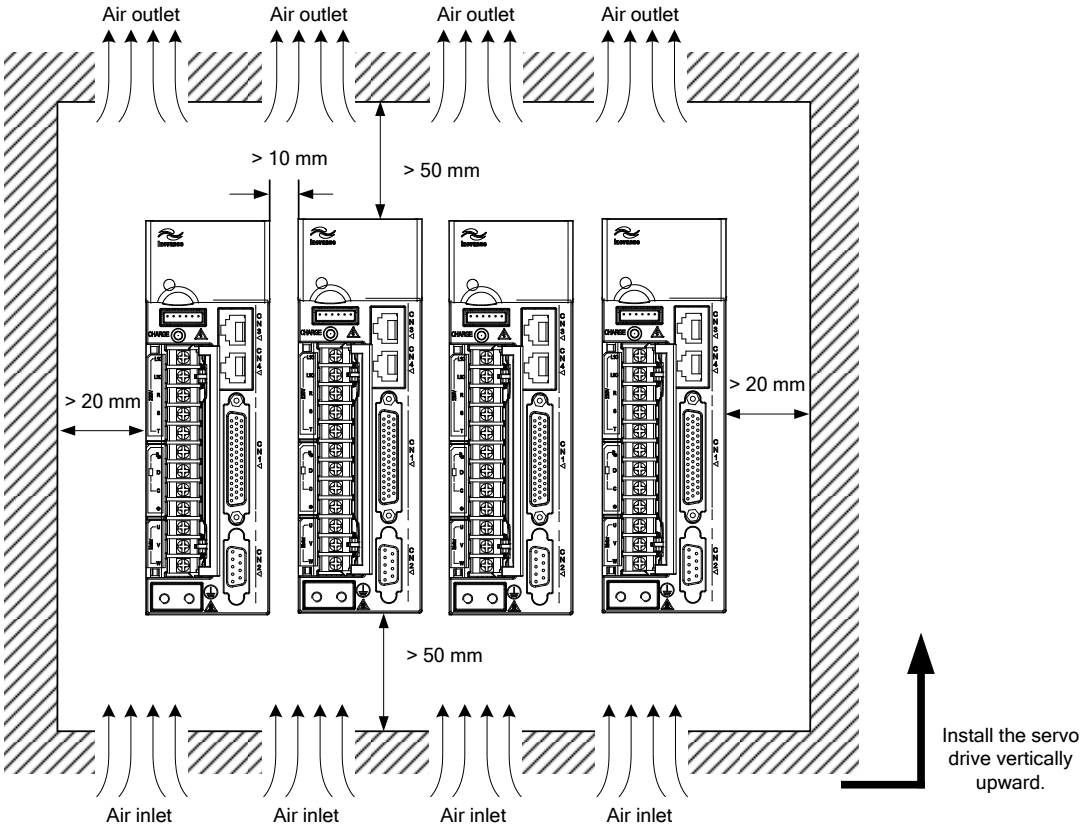
Item	Description
Working temperature	0 to +55°C (The average load rate must not exceed 80% at the temperature of 40°C to 55°C) (no freezing)
Working humidity	< 90% RH (no condensation)
Storage temperature	-20 to 85°C (no freezing)
Storage humidity	> 90% RH (no condensation)
Vibration	< 4.9 m/s^2
Shock	< 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 with 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.

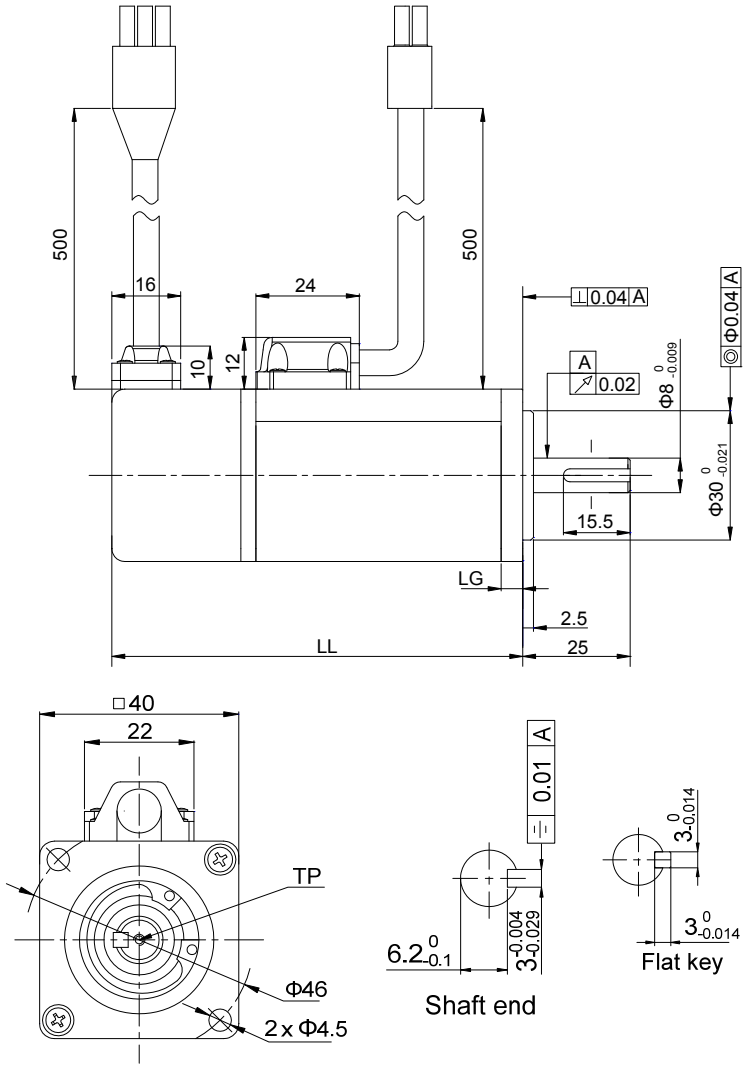
4) Grounding

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

2.3 Overall Dimensions of the Servo Motor

2.3.1 Overall Dimensions of the ISMH1 Series Servo Motor

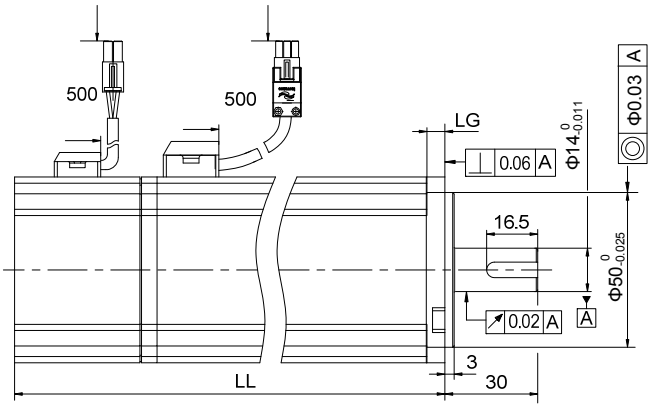
1) 100 W (Vn = 3000 RPM, Vmax = 5000 RPM)

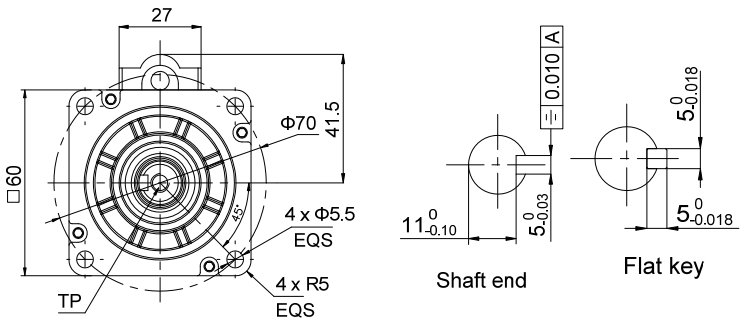


Connector	Power Side	Brake Side	Encoder Side
Plastic housing	EL-4Y (CWB)	AMP 172165-1	AMP 172169-1
Terminal	422.6006.0 (CWB)	AMP 770834-1	AMP 770834-1

Servo Motor Model	L (mm)	LL (mm)	LG (mm)	LM (mm)	Weight (kg)
ISMH1-10B30CB-*****	104.5 (137.6)	5	M3 x 6	0.59(0.77)	ISMH1-10B30CB-*****

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

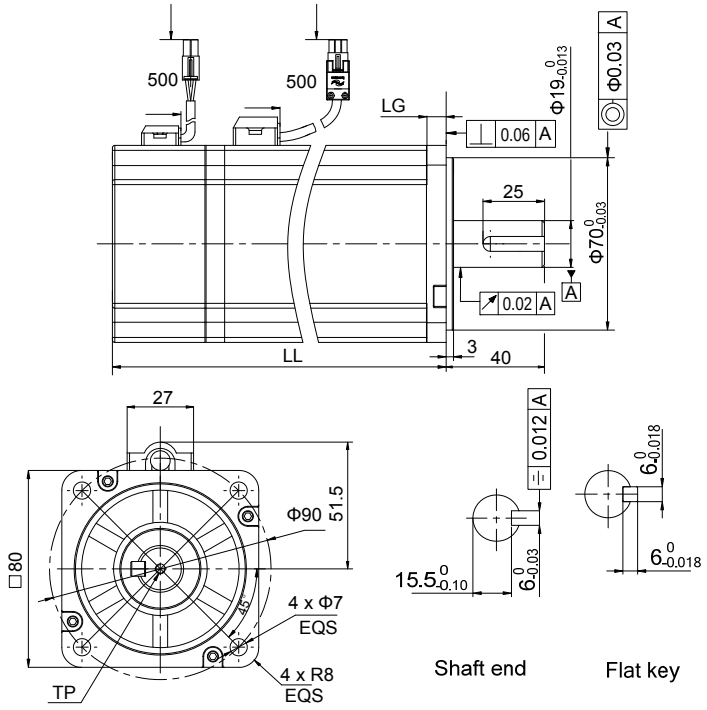




Connector	Power Side	Brake Side	Encoder Side
Plastic housing	EL-4Y (CWB)	AMP 172165-1	AMP 172169-1
Terminal	422.6006.0 (CWB)	AMP 770834-1	AMP 770834-1

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	Weight (kg)
ISMH1-20B30CB-*****	114 (153)	5.8	M5 x 8	1.1 (1.4)
ISMH1-40B30CB-*****	139 (178)			1.6 (1.9)

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

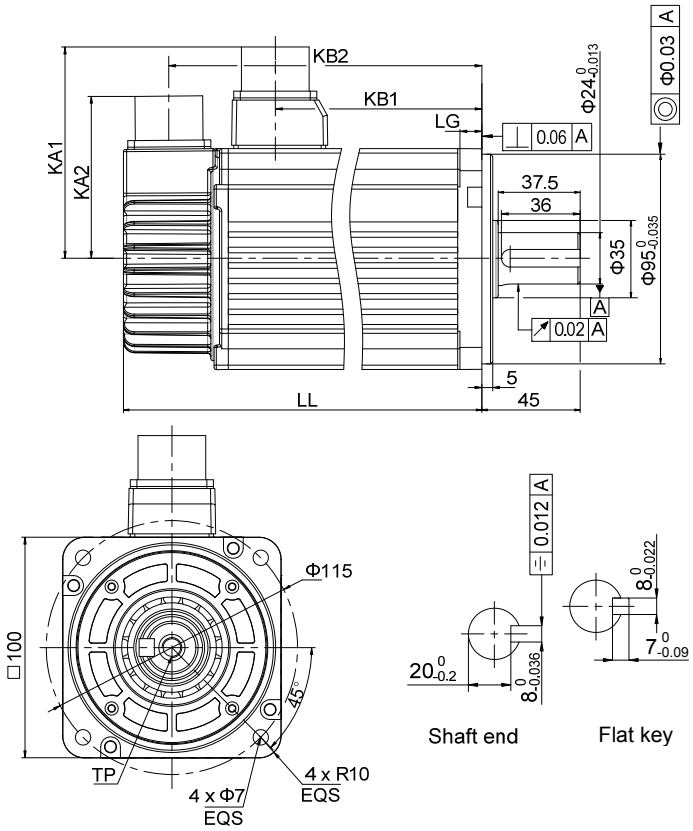


Connector	Power Side	Brake Side	Encoder Side
Plastic housing	EL-4Y (CWB)	AMP 172165-1	AMP 172169-1
Terminal	422.6006.0 (CWB)	AMP 770834-1	AMP 770834-1

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

2.3.2 Overall Dimensions of the ISMH2 Series Servo Motor (Vn = 3000 RPM, Vmax = 6000/5000 RPM)

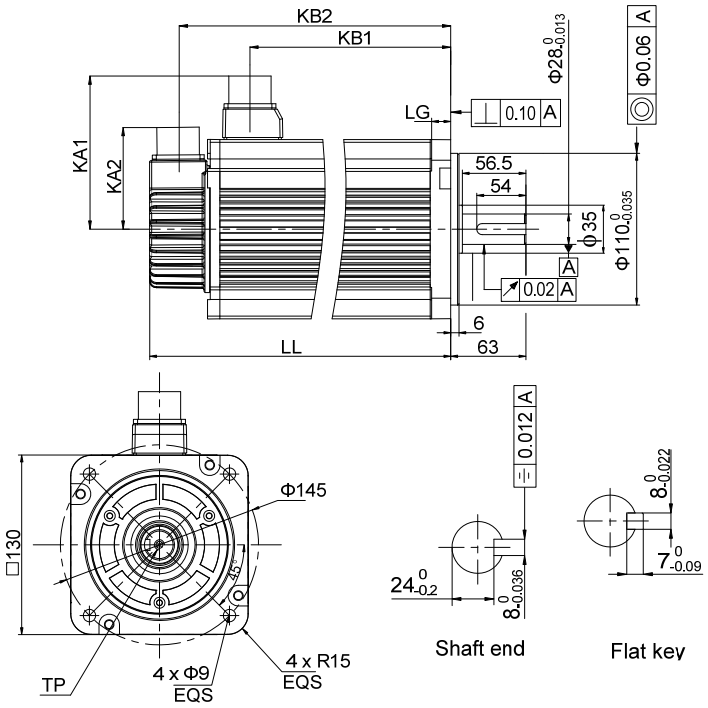
1) 1.0 kW, 1.5 kW, 2.0 kW, 2.5 kW



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)-****Y	164 (216)	10	M8 x 16	96	74	94.5 (101)	143.5 (192.5)	2.7 (3.1)
ISMH2-15C30CB(D)-****Y	189 (241)					119.5 (128)	168.5 (219.5)	
ISMH2-20C30CD-****Y	214					144.5	193.5	2.7
ISMH2-25C30CD-****Y	239					169.5	218.5	

2) 3.0 kW, 4.0 kW, 5.0 kW

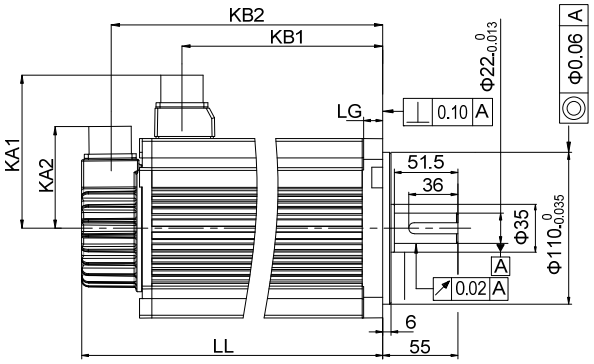


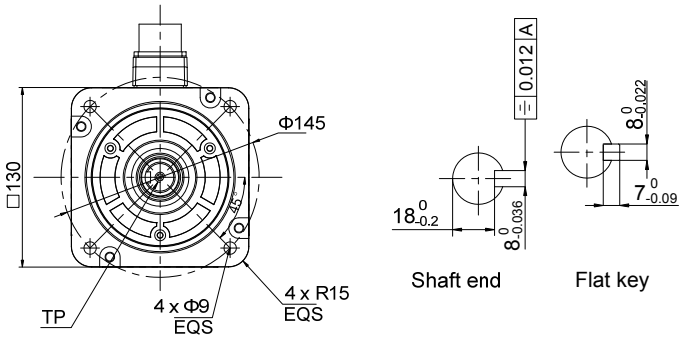
Connector	Power Side	Brake Side	Encoder Side
Aviation plug	MIL-DTL-5015 series, 3102E20-18P	MIL-DTL-5015 series, 3102E10SL-4P	MIL-DTL-5015 series, 3102E20-29P

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

2.3.3 Overall Dimensions of the ISMH3 Series Servo Motor (Vn = 1500 RPM, Vmax = 3000 RPM)

1) 850 W, 1.3 kW, 1.8 kW

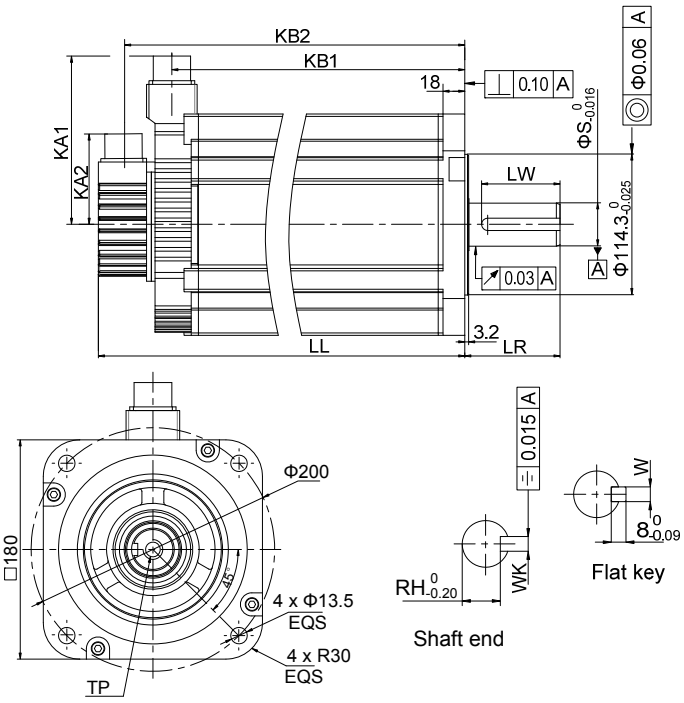




Connector	Power Side	Brake Side	Encoder Side
Aviation plug	MIL-DTL-5015 series, 3102E20-22P	MIL-DTL-5015 series, 3102E10SL-4P	MIL-DTL-5015 series, 3102E20-29P

Servo Motor Model	LL (mm)	LG (mm)	TP (mm)	KA1 (mm)	KA2 (mm)	KB1 (mm)	KB2 (mm)	Weight (kg)
ISMH3-85B15CB(D)-****Y	168.5 (227.5)	14	M6 x 20	111	74	95 (80)	147.5 (191.5)	8.23 (10.73)
ISMH3-13C15CB(D)-****Y	194.5 (253.5)					121 (106)	173.5 (217.5)	10.57 (13.0)
ISMH3-18C15CD-****Y	220.5 (279.5)					147 (132)	199.5 (243.5)	12.7 (15.2)

2) 2.9 kW, 4.4 kW, 5.5 kW

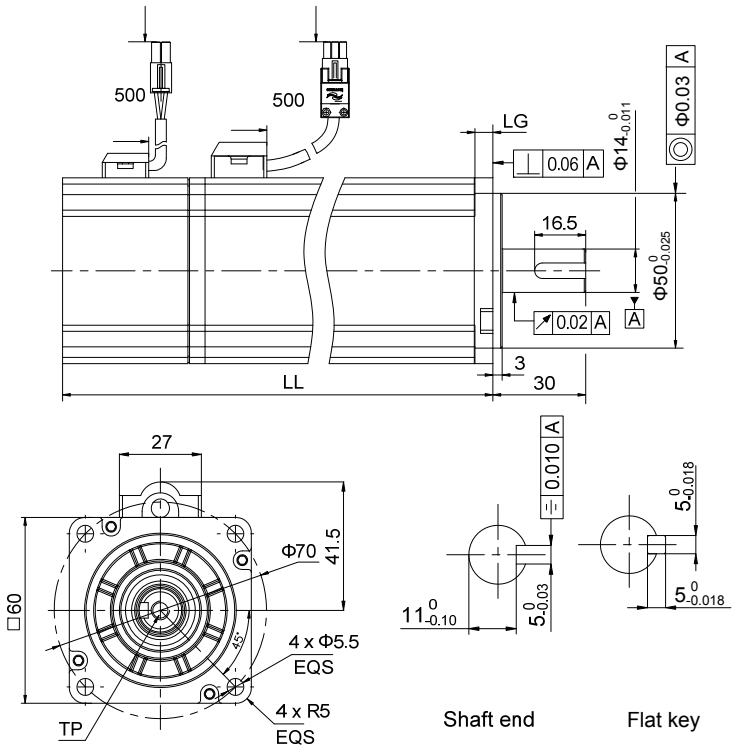


Servo Motor Model	LL (mm)	LR (mm)	LW (mm)	S (mm)	RH (mm)	WK (mm)	W (mm)	TP (mm)	KA1 (mm)	KA2 (mm)	KB1 (mm)	KB2 (mm)	Weight (kg)
ISMH3-29C 15CD-****Y	249 (325.5)	79	65	35	30	$10^{0}_{-0.036}$	$10^{0}_{-0.022}$	M12 x 25	138	74	188 (186)	229 (305)	20.9 (32)

ISMH3-44C 15CD-****Y	304 (380.5)										243 (241)	284 (360)	29.4 (40)
ISMH3-55C 15CD-****Y	332 (408.5)	113	96	42	37	$12^{0}_{-0.043}$	$12^{0}_{-0.027}$	M16 x 32	138	74	271 (269)	317 (388)	34.5 (42.5)
ISMH3-75C 15CD-****Y	387 (464)										326 (324)	417 (443)	43.2 (62.5)
ISMH3-29C 15CD-****Z	197 (273)	79	65	35	30	$10^{0}_{-0.036}$	$10^{0}_{-0.022}$	M12 x 25	138	74	136 (186)	177 (305)	20.9 (32)
ISMH3-44C 15CD-****Z	230 (307)										169 (241)	210 (360)	29.4 (40)
ISMH3-55C 15CD-****Z	274 (350)	113	96	42	37	$12^{0}_{-0.043}$	$12^{0}_{-0.027}$	M16 x 32	138	74	213	254	34.5 (42.5)
ISMH3-75C 15CD-****Z	330 (407)										269	310	43.2 (62.5)

2.3.4 Overall Dimensions of the ISMH4 Series Servo Motor (Vn = 3000 RPM, Vmax = 6000 RPM)

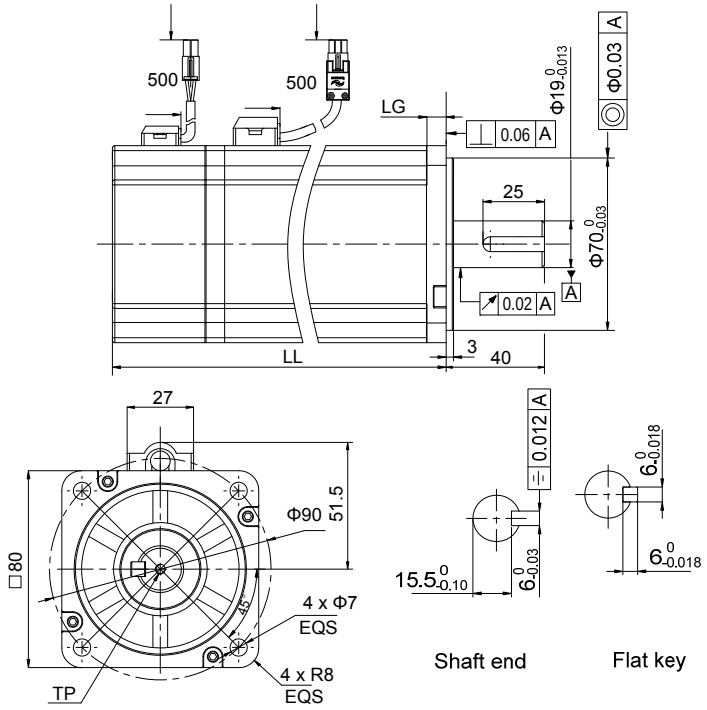
1) 400 W



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

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

2) 750 W



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

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

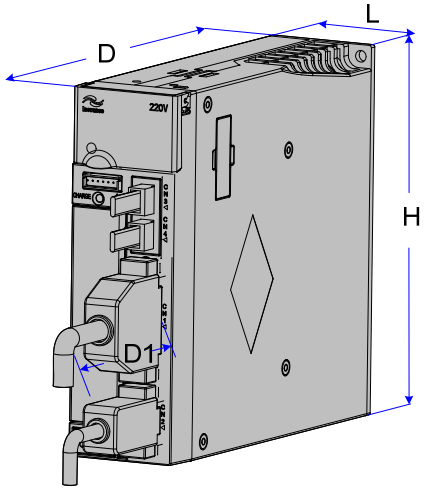
2.4 Overall Dimensions of the Servo Drive

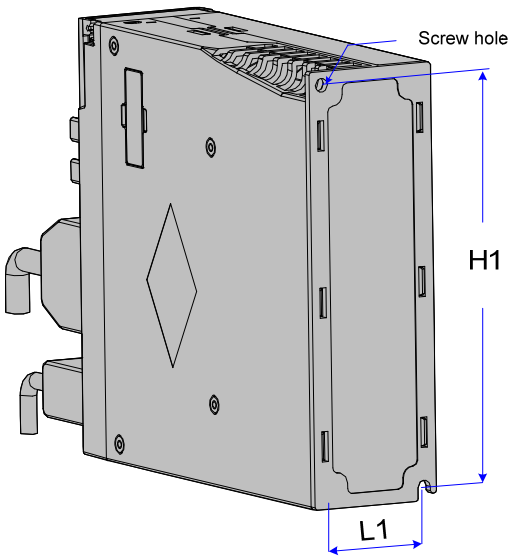
Single-phase 220 V: IS620PS1R6I, IS620PS2R8I, IS620PS5R5I

Three-phase 220 V: IS620PS5R5I, IS620PS7R6I, IS620PS012I

Three-phase 380 V: IS620PT3R5I, IS620PT5R4I, IS620PT8R4I, IS620PT012I, IS620PT017I, IS620PT021I, IS620PT026I

Figure 2-2 Overall dimensions of the servo drive

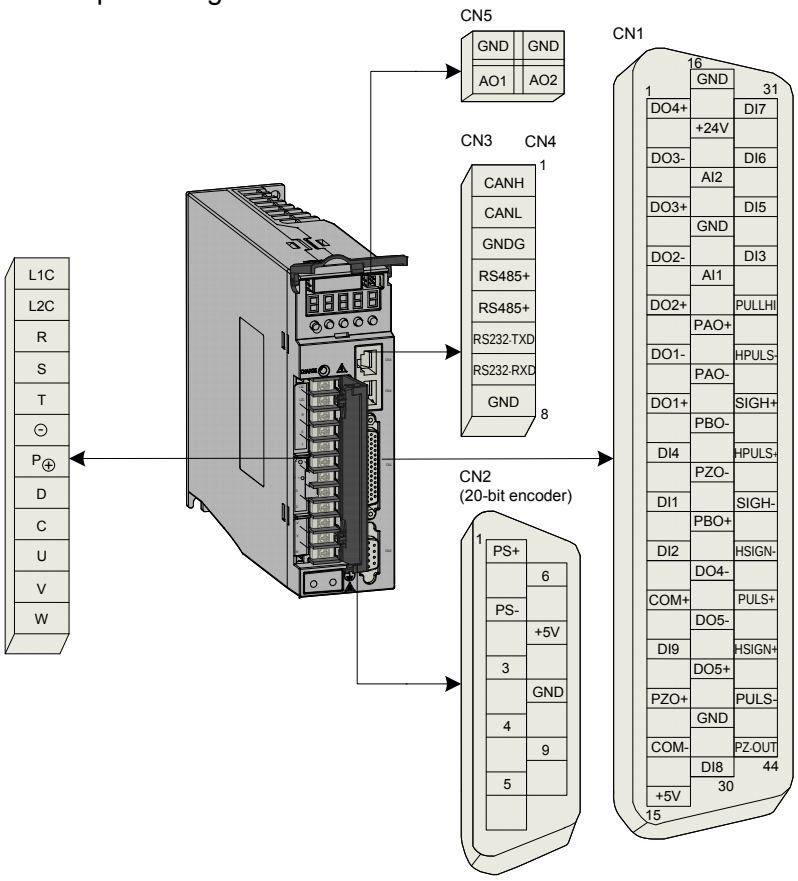




Servo Drive Size	L (mm)	H (mm)	D (mm)	L1 (mm)	H1 (mm)	D1 (mm)	Screw Hole	Tightening Torque (Nm)
SIZE A	50	160	173	40	150	75	2-M4	0.6–1.2
SIZE C	90	160	183	80	150	75	2-M4	0.6–1.2
SIZE E	100	250	230	90	240	75	4-M4	0.6–1.2

Chapter 3 Wiring of Servo Drive and Servo Motor

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

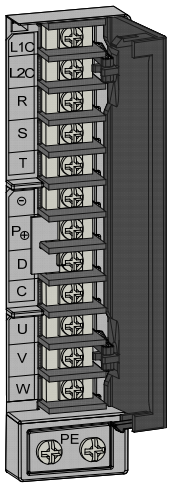
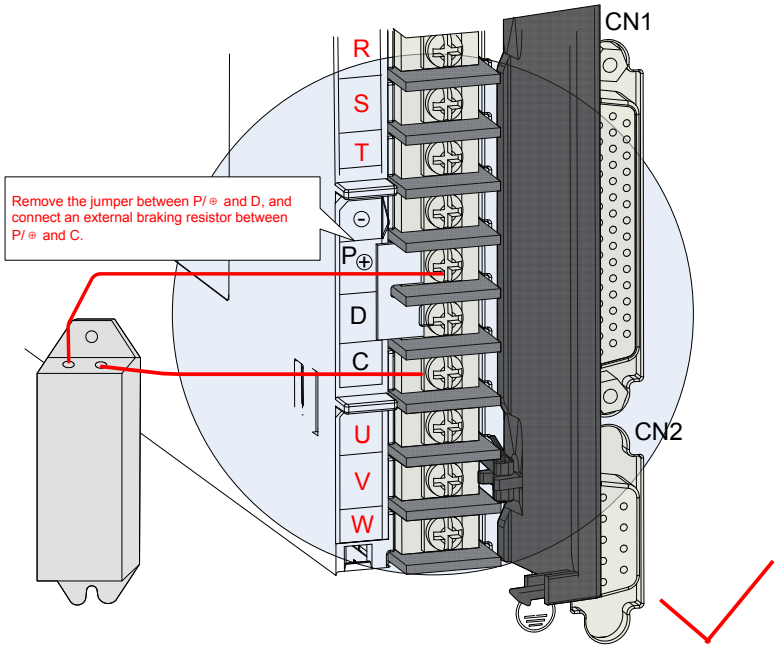
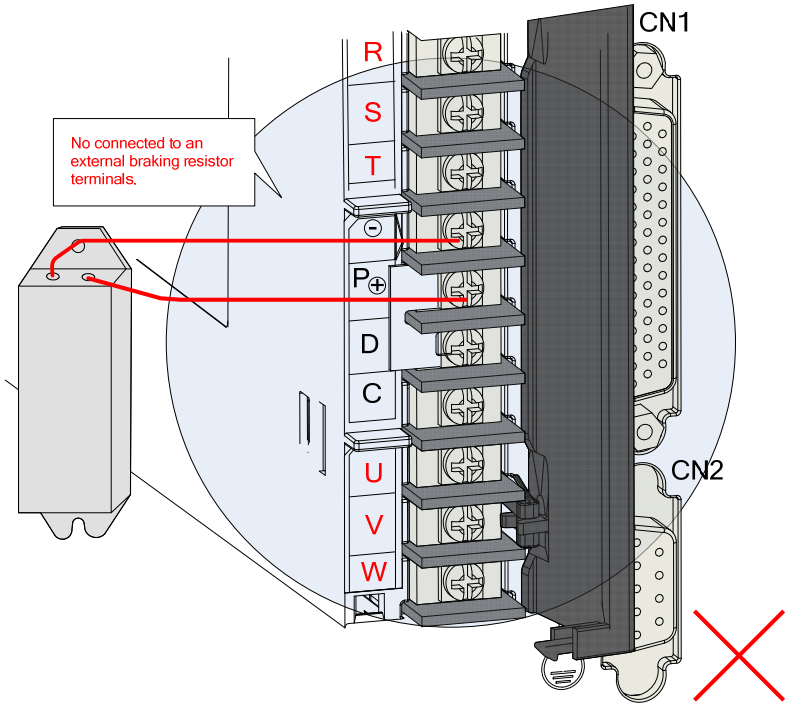


Table 3-1 Names and functions of main circuit terminals

Terminal Symbol	Terminal Name	Terminal Function	
R, S, T	Main circuit power input terminals	IS620P: S1R6, S2R8, S5R5	Main circuit single-phase power input. Only R and S terminals are used. Connect 220 VAC power supply between R and S terminals.
		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⊕, D, C	External braking resistor terminals	IS620P: S1R6, S2R8	Connect an external braking resistor between P⊕ and C if the braking capacity is insufficient. You need to purchase the external braking resistor.
		IS620P: S5R5, S7R6, S012, T3R5, T5R4, T8R4, T012, T017, T021, T026	Short-connect P⊕ and D by default. Remove the jumper between P ⊕ and D, and connect an external braking resistor between P⊕ and C if the braking capacity is insufficient. You need to purchase the external braking resistor.
P⊕	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 braking resistor.





Observe the following precautions when wiring the external braking resistor:

1. Do not directly connect the external braking resistor to the positive and negative poles of P⊕. Failure to comply will lead to damage of the servo drive or even cause a fire.

2. Remove the jumper between P⊕ and D before using the external braking resistor. Failure to comply will cause overcurrent trip and thus damage the braking tube.

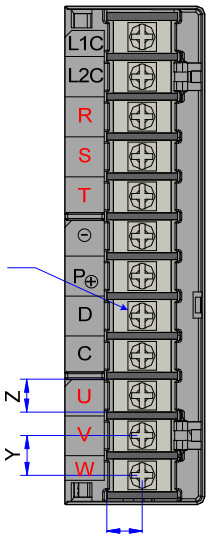
3. For selection of external braking resistors, refer to section 1.4. Do not select any resistor lower than the minimum resistance value. Otherwise, the servo drive will report Er201 or be damaged.

4. Make sure that H02-25, H02-26 and H02-27 are accurately set before using the servo drive.

5. Install the external braking 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)
SIZE A	S1R6	2.3	1.6
	S2R8	4.0	2.8
	S5R5	7.9 (single-phase)/3.7 (three-phase)	5.5
SIZE C	S7R6	5.1	7.6
	S012	8.0	11.6
	T3R5	2.4	3.5
	T5R4	3.6	5.4
	T8R4	5.6	8.4
	T012	8.0	11.9
SIZE E	T017	12.0	16.5
	T021	16.0	20.8
	T026	21.0	25.7

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

Servo Drive Model (IS620P□□□□I)		L1C, L2C	R, S, T	P, 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 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.09 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)	12 AWG (3.30 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)	10 AWG (5.27 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)	14 AWG (2.09 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)	14 AWG (2.09 mm^2)	16 AWG (1.31 mm^2)	14 AWG (2.09 mm^2)
	T8R4	18 AWG	16 AWG	12 AWG	16 AWG	14 AWG

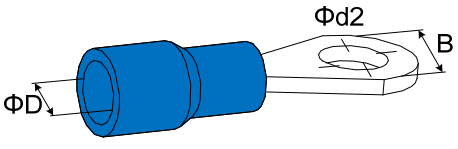
		(0.82 mm^2)	(1.31 mm^2)	(3.30 mm^2)	(1.31 mm^2)	(2.09 mm^2)
	T012	18 AWG (0.82 mm^2)	14 AWG (2.09 mm^2)	10 AWG (5.27 mm^2)	14 AWG (2.09 mm^2)	14 AWG (2.09 mm^2)
SIZE E	T017	18 AWG (0.82 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)	10 AWG (5.27 mm^2)
	T021	18 AWG (0.82 mm^2)	10 AWG (5.27 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)

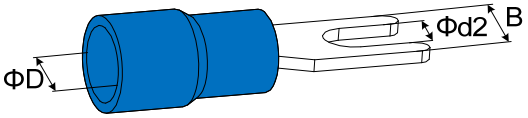
Table 3-4 Recommended main circuit lugs of IS620P series servo drive

Servo Drive Model (IS620P□□□□I)		L1C, L2C	R, S, T	P, 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 1.25-4
	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 1.25-4
	S5R5	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVR 2-3M TVS 2-3W	TVR 1.25-3 TVS 1.25-3	TVR 1.25-4
SIZE C	S7R6	TVR 1.25-3 TVS 1.25-3	TVR 1.25-3 TVS 1.25-3	TVS 5.5-3	TVR 1.25-3 TVS 1.25-3	TVR 1.25-4
	S012	TVR 1.25-3 TVS 1.25-3	TVR 2-3M TVS 2-3W	TVS 5.5-3	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 1.25-4
	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 1.25-4
	T8R4	TVR 1.25-3 TVS 1.25-3	TVR 2-3M TVS 2-3W	TVS 5.5-3	TVR 2-3M TVS 2-3W	TVR 1.25-4
	T012	TVR 1.25-3 TVS 1.25-3	TVR 2-3M TVS 2-3W	TVS 5.5-3	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

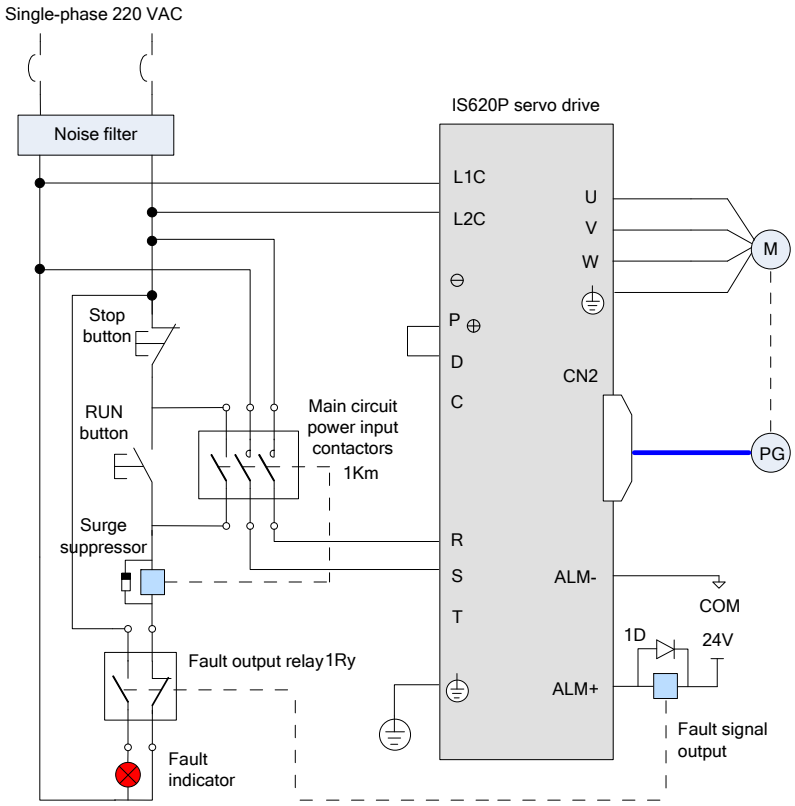
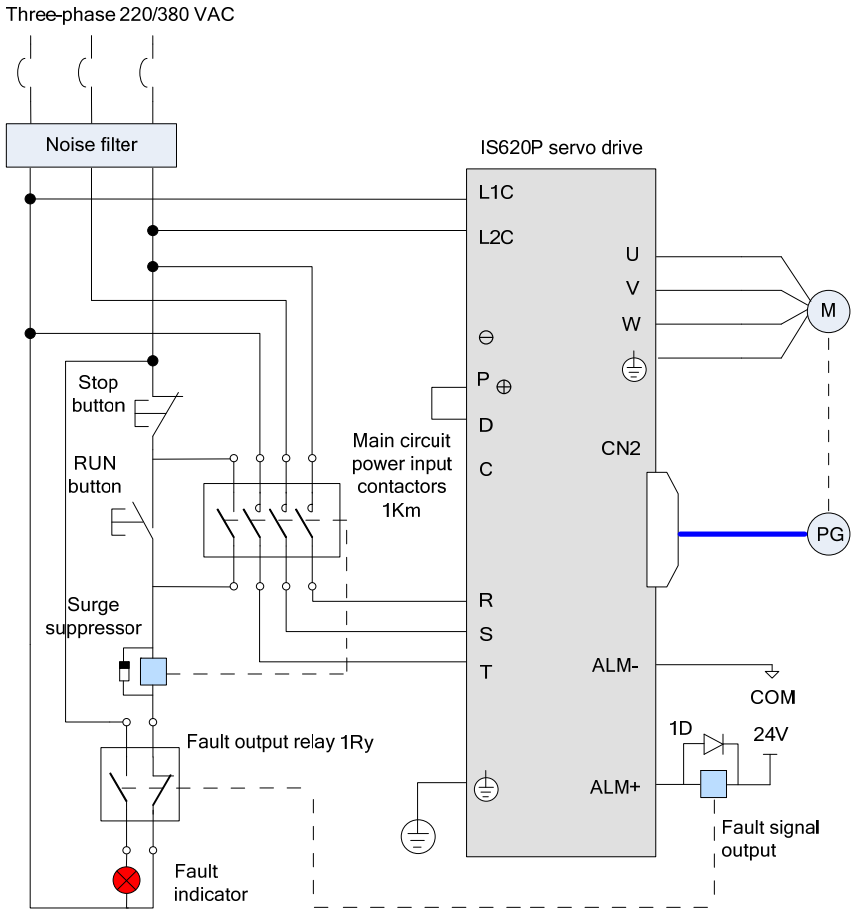


Figure 3-5 Main circuit wiring of three-phase 220/380 V servo drive



Note

1KM: electromagnetic contactor; 1Ry: relay; 1D: flywheel diode

Connect the main circuit power supply according to Figure 3-3 and Figure 3-4. 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 lines to the output terminals U, V and W. Failure to comply will cause damage to the servo drive.

2. When cables are bundled 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 low-temperature cables 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. 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

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

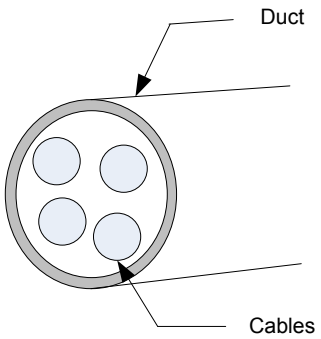


Table 3-6 Current reduction coefficient of conductor

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 braking resistor cannot be connected between terminals P⊕ and ⊖. Failure to comply may cause a fire.

7. Do not bundle power lines and signal lines together or run them through the same duct. Power and signal lines shall be separated by at least 30 cm to prevent interference.

8. High voltage may still remain in the servo drive when the power supply is cut off. Do not touch the power terminals for 5 minutes after power off.

9. Conduct maintenance after confirming that the CHARGE indicator is OFF.

10. Do not frequently turn power ON and OFF. Do not turn power ON or OFF more than once per minute. Since the servo drive contains a capacitor in the power supply, a high charging current flows for 0.2 seconds when power is turned OFF. Frequently turning power ON and OFF will cause deterioration of performance to the main circuit components inside the servo drive.

11. Use a grounding wire with the same cross area of the main circuit wire. If the cross area of the main circuit wire is less than 1.6 mm^2, use a grounding wire with a cross 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 flexible and 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

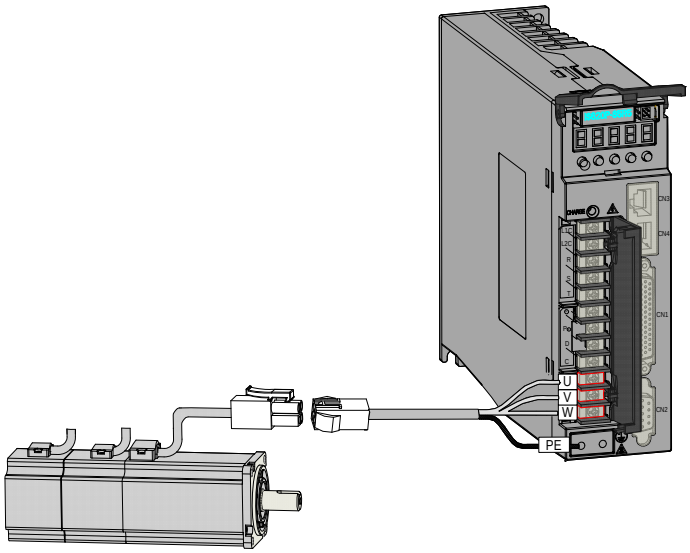
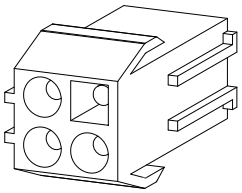
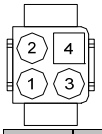
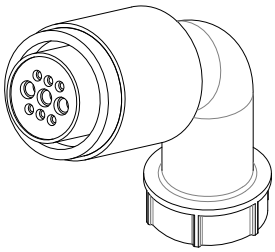
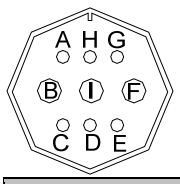
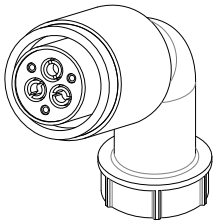
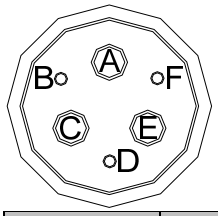


Table 3-7 Connectors of power lines at servo motor end

<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
60
80</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>
</table></td><td>100
130</td></tr>
</table>

<table>
<tr><th>Connector Appearance</th><th>Terminal Pin Layout</th><th>Frame Size of Adaptable Motor</th></tr>
<tr><td></td><td>
<table>
<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></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><td>Pin No.</td><td>Signal</td><td>Pin No.</td><td>Signal</td></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 colspan="2" 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

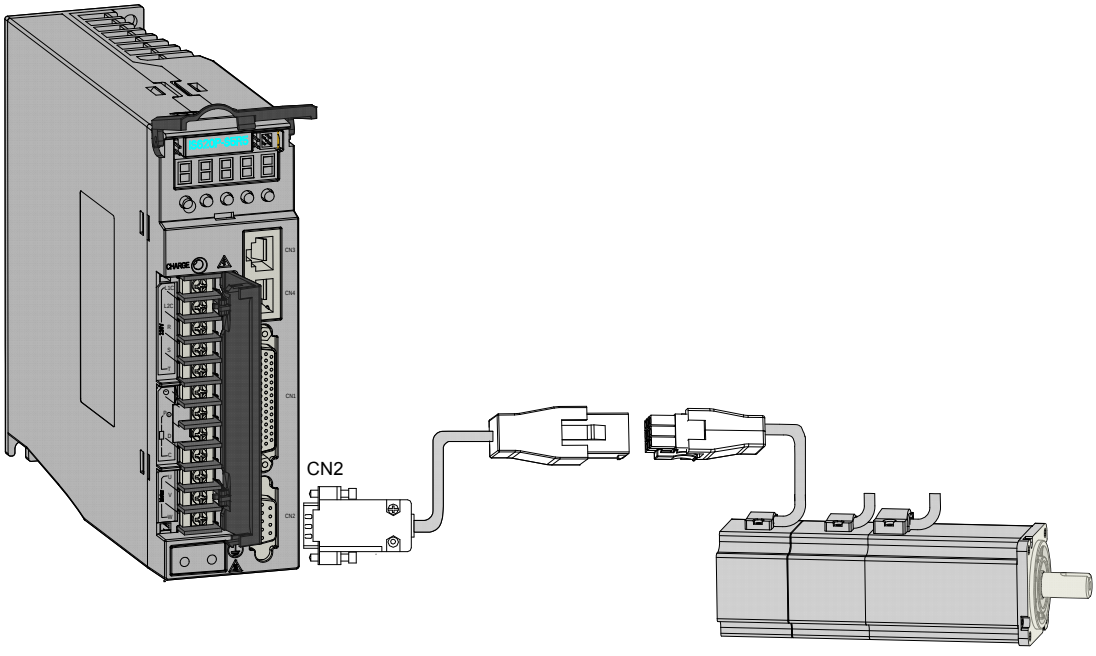
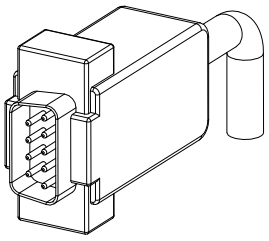
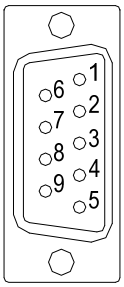
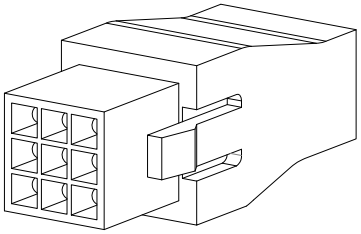
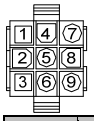


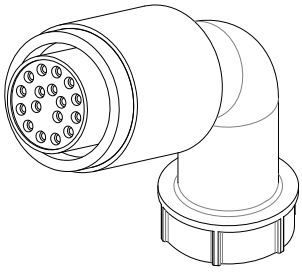
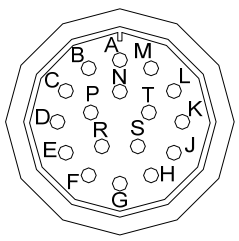
Table 3-8 Connectors of encoder cables at servo drive end

<table>
<tr><th>Connector Appearance</th><th>Terminal Pin Layout</th></tr>
<tr><td>  </td><td> 

<table>
<tr><th>Pin No.</th><th>Signal</th></tr>
<tr><td>1</td><td>PS+</td></tr>
<tr><td>2</td><td>PS-</td></tr>
<tr><td>7</td><td>+5V</td></tr>
<tr><td>8</td><td>GND</td></tr>
<tr><td>Shell</td><td>PE</td></tr>
</table>
Recommendation:
Plastic housing of plug at cable side: DB9P (TELE-DATA COM), black housing
Core: DB9P plug (TELE-DATA COM), blue glue</td></tr>
</table>

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

<table>
<tr><th>Connector Appearance</th><th>Terminal Pin Layout</th><th>Frame Size of Adaptable Motor</th></tr>
<tr><td>  </td><td>9-pin plug
 

<table>
<tr><th>Pin No.</th><th>Signal</th><th></th></tr>
<tr><td>3</td><td>PS+</td><td rowspan="2">Twisted-pair</td></tr>
<tr><td>6</td><td>PS-</td></tr>
<tr><td>9</td><td>+5V</td><td rowspan="3"></td></tr>
<tr><td>8</td><td>GND</td></tr>
<tr><td>7</td><td>Shielded</td></tr>
</table>
Recommendation:
Plastic housing: AMP 172161-1:
Terminal: AMP 770835-1</td><td>40
60
80</td></tr>
<tr><td>  </td><td>MIL-DTL-5015 series
3108E20-29S aviation plug
20-29 aviation plug
 
</td><td>100
130
180</td></tr>
</table>

Connector Appearance	Terminal Pin Layout			Frame Size of Adaptable Motor
	Pin No.	Signal		
	E	PS+	Twisted-pair	
	F	PS-		
	C	+5V		
	D	GND		
	J	Shielded		

Table 3-10 Pin connection relation of encoder cables

DB9 at Servo Drive End		Function Description	Motor End	
			9-PIN	20-29 Aviation Plug
Signal	Pin No.		Pin No.	Pin No.
PS+	1	Serial communication signal +	3	E
PS-	2	Serial communication signal -	6	F
+5V	7	Encoder +5V power supply	9	C
GND	8	Encoder +5V power ground	8	D
PE	Shell	Shielded layer	7	J

Observe the following precautions when wiring the encoder:

1. Servo drive and shielded layer at servo motor end 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 capacitors. Since the minimum working voltage of the motor encoder is 4.75 V, 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.

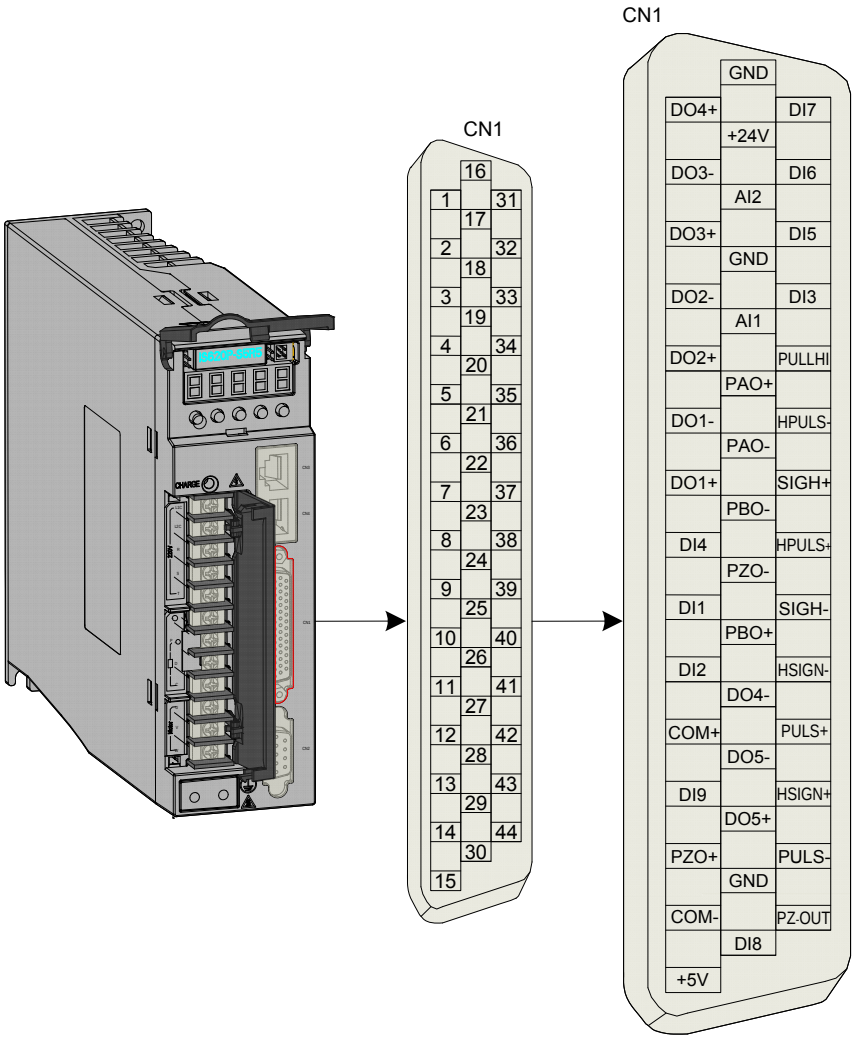
Table 3-11 Recommended cable sizes

Cable Size	Ω/km	Allowed Cable Length
26 AWG (0.1282)	143	10.0
25 AWG (0.1520)	89.4	18.0
24 AWG (0.2051)	79.6	16.0
23 AWG (0.2588)	68.5	20.9
22 AWG (0.3247)	54.3	26.4
21 AWG (0.41)	42.7	33.5
20 AWG (0.52)	33.9	42.2
19 AWG (0.65)	26.9	53.2
18 AWG (0.82)	21.4	66.9

5. Shielded layer 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 by at least 30 cm.
8. If the encoder cable is too short and an additional cable is to be added, make sure the shielded layers of two separate cables are well connected to ensure reliable grounding.

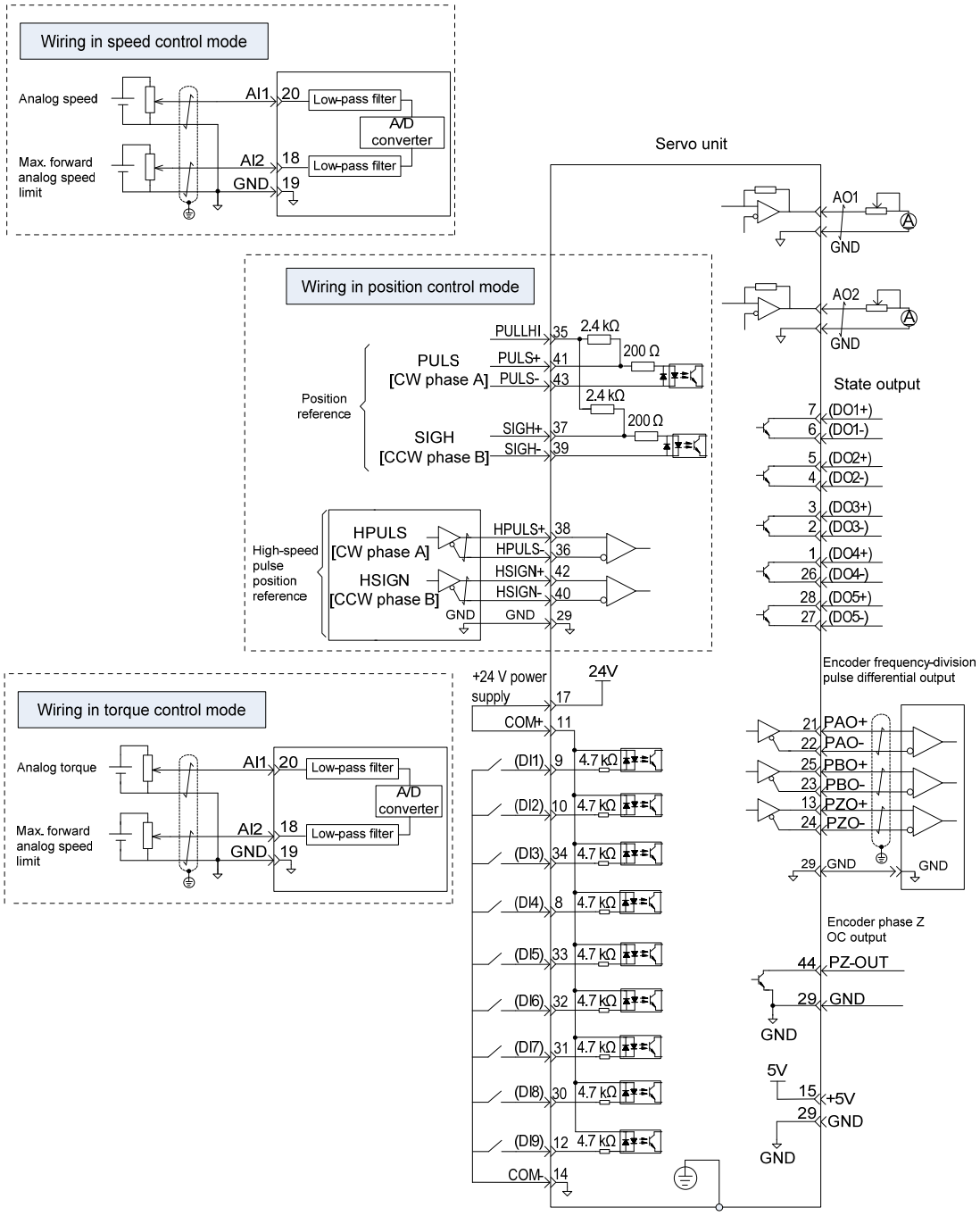
3.3 Connecting Control Signal Terminals

Figure 3-8 Pin Layout of control 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

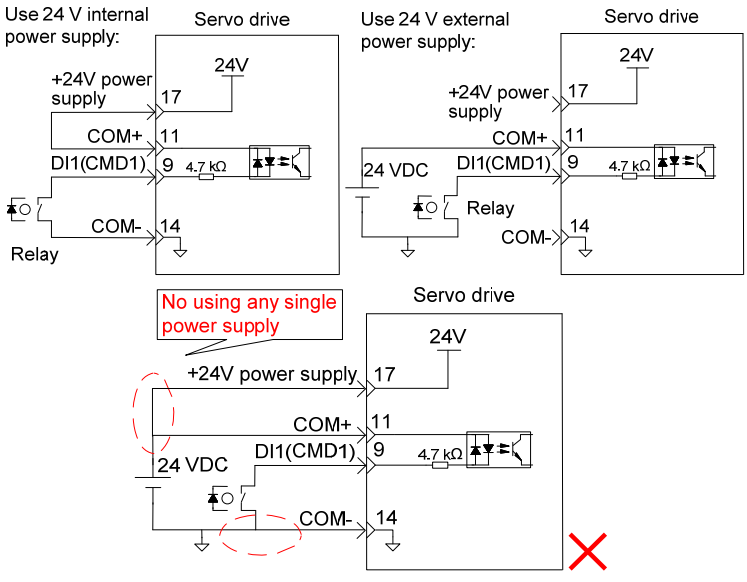
Signal		Default Function	Pin No.	Function Description
Common	DI1	P-OT	9	Forward drive forbidden
	DI2	N-OT	10	Reverse drive forbidden
	DI3	INHIBIT	34	Pulse input forbidden
	DI4	ALM-RST	8	Alarm reset (edge valid)
	DI5	S-ON	33	Servo enabled

Signal		Default Function	Pin No.	Function Description
	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	

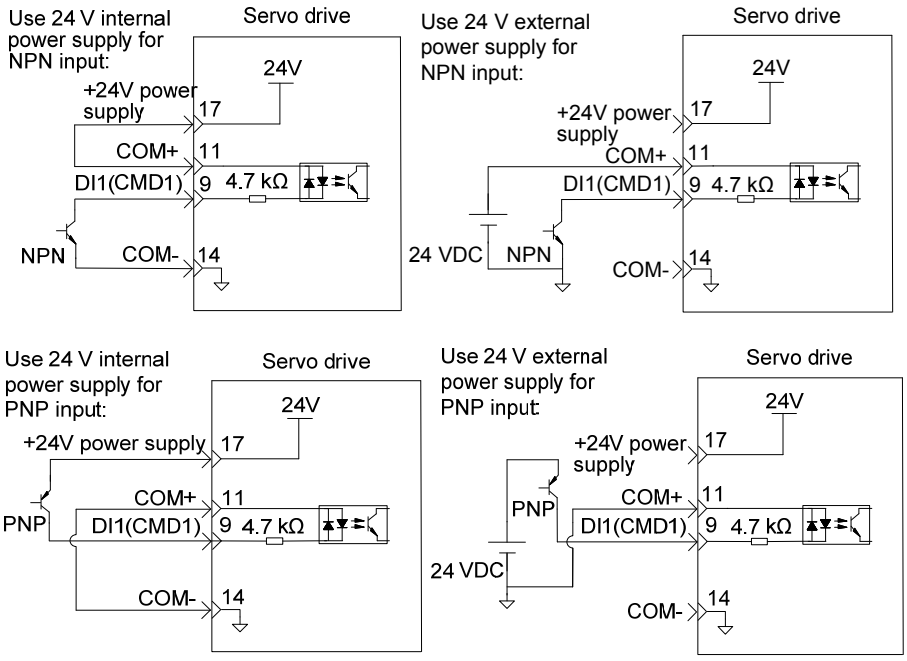
1) DI circuit

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:



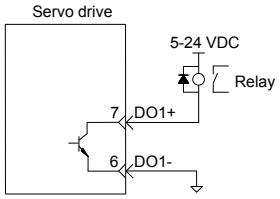
Note

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

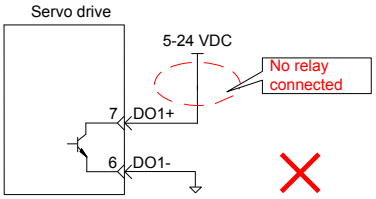
2). DO circuit

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

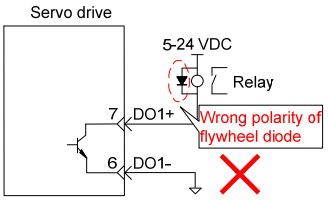
a) When input signal of the upper device is relay input:



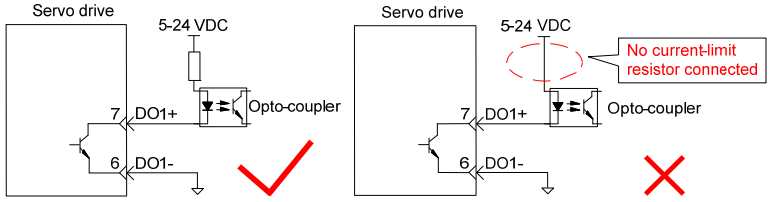
Wrong connection 1: Current-limiting resistor is not connected, resulting in burnout of terminals



Wrong connection 2: Multiple terminals share the same current-limiting resistor, resulting in that pulses are inaccurately received.



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

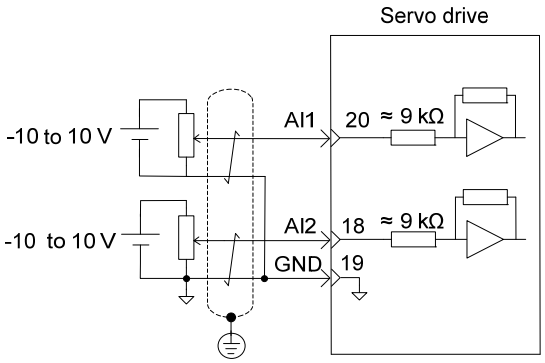
Signal	Default Function	Pin No.	Function Description
Analog	AI2	18	Common analog input signals: Resolution: 12 bit Input voltage: maximum ±12V
	AI1	20	
	GND	19	Analog input signal ground

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	PULS+ PULS- SIGN+ SIGN-	41 43 37 39	Reference pulse input mode: Differential drive input OC input	Pulse input status: Direction + pulse Phase A + B quadrature pulse CW/CCW pulse
	HPULS+ HPULS-	38 36	High-speed reference pulse input	

Signal		Pin No.	Function Description
	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.

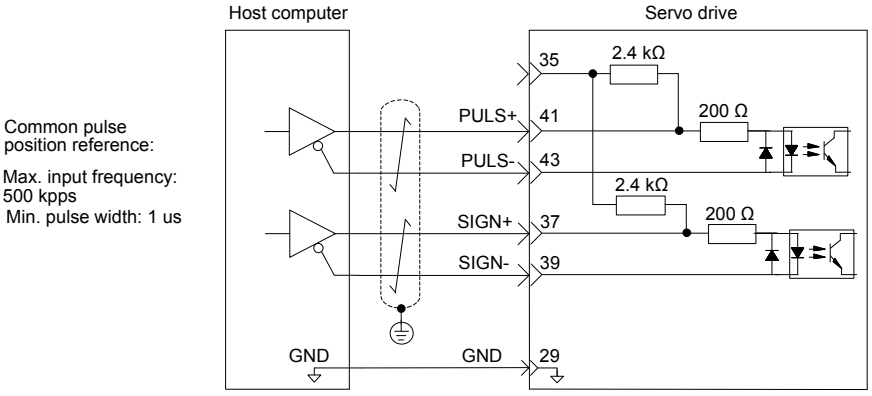
Table 3-15 Correspondence between maximum input frequency and minimum pulse width

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.

1) Differential mode



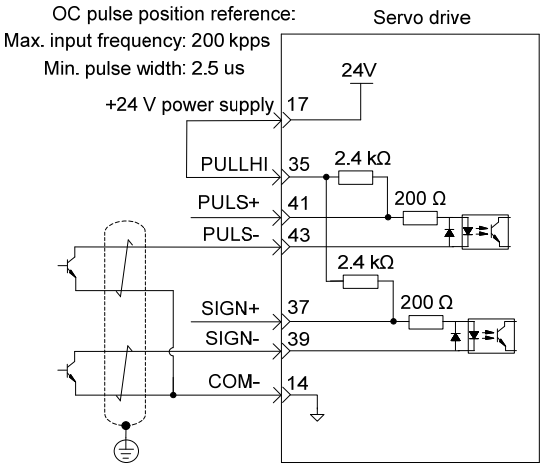
Make sure “2.8 V ≤ (H level) - (L level) ≤ 3.7 V”. Otherwise, input pulses of the servo drive are unstable, which will cause:

When inputting reference pulses, pulse loss occurs.

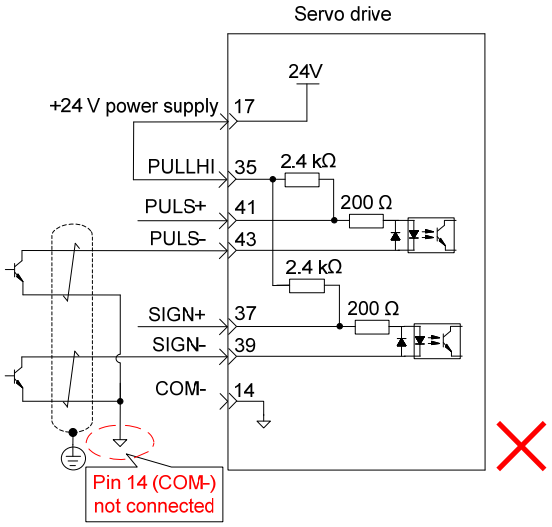
When inputting reference direction, the direction will reverse.

2) OC mode

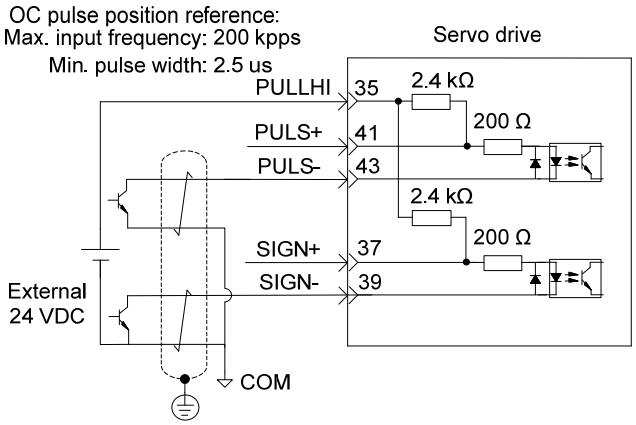
When using the 24 V internal power supply of the servo drive:

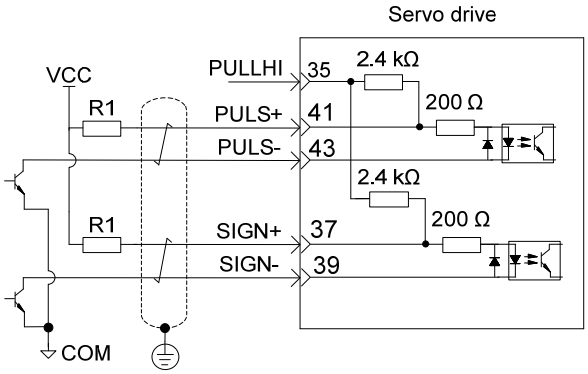


Wrong connection: Pin 14 (COM-) is not connected, which cannot form a closed-loop circuit.



When using a 24 V external power supply:





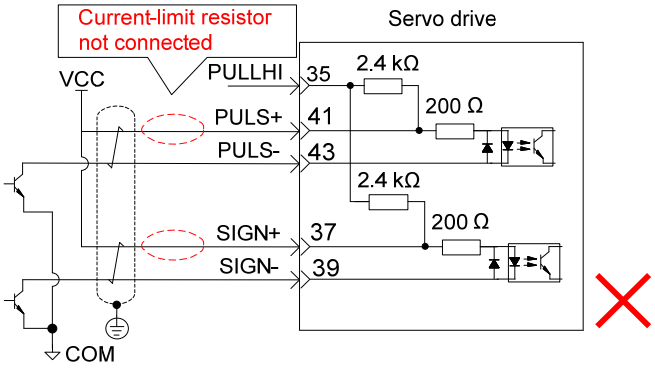
Value of resistor R1 shall satisfy the following formula: $\frac{V_{CC}-1.5}{R1+200} = 10mA$

Table 3-16 Recommended R1 resistance

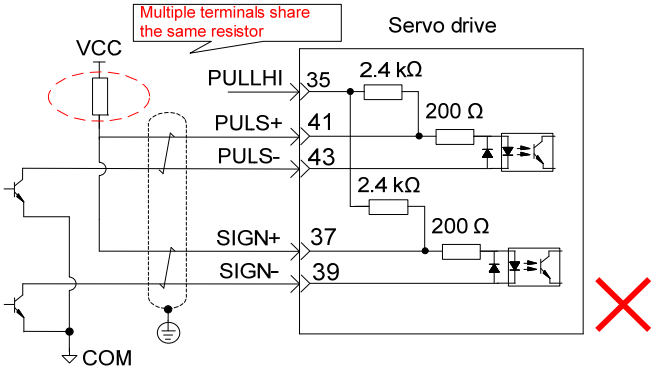
V_{CC}	R1	Power of R1
24 V	2.4 kΩ	0.5 W
12 V	1.5 kΩ	0.5 W
5 V	200 Ω	0.5 W

Wrong connection examples:

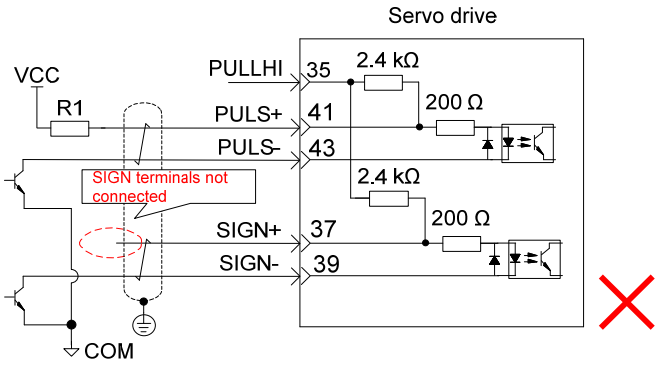
Wrong connection 1: Current-limiting resistor is not connected, resulting in burnout of terminals.



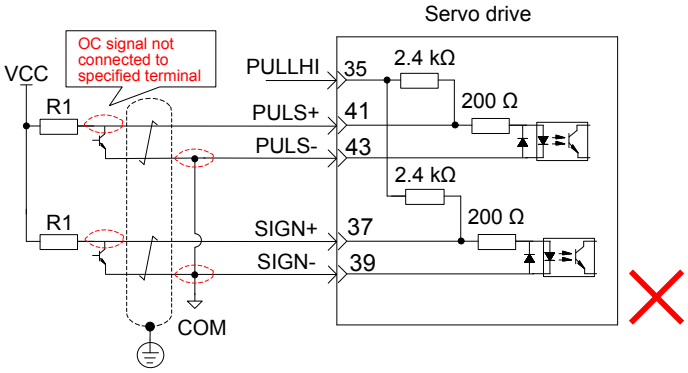
Wrong connection 2: Multiple terminals share the same current-limiting resistor, resulting in that pulses are inaccurately received.



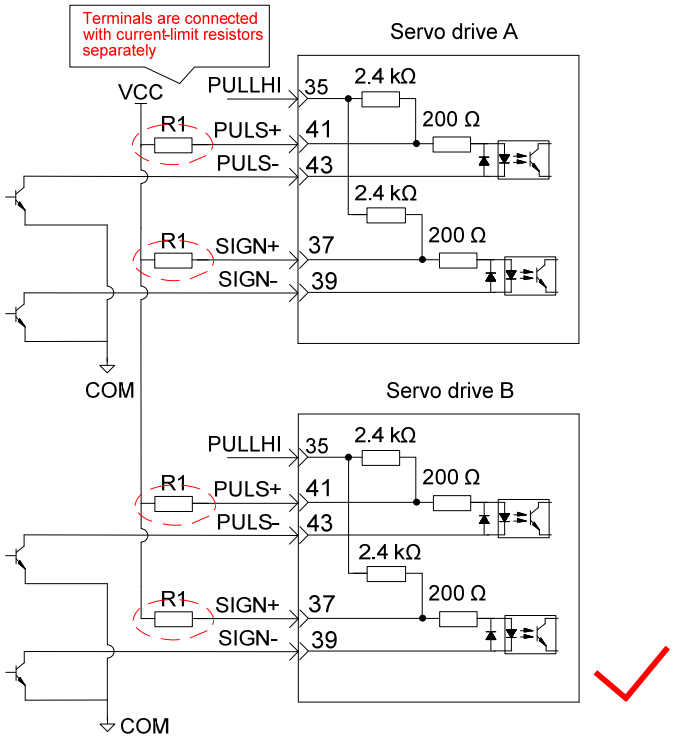
Wrong connection 3: SIGN terminals are not connected, resulting in that these two terminals receive no pulses.

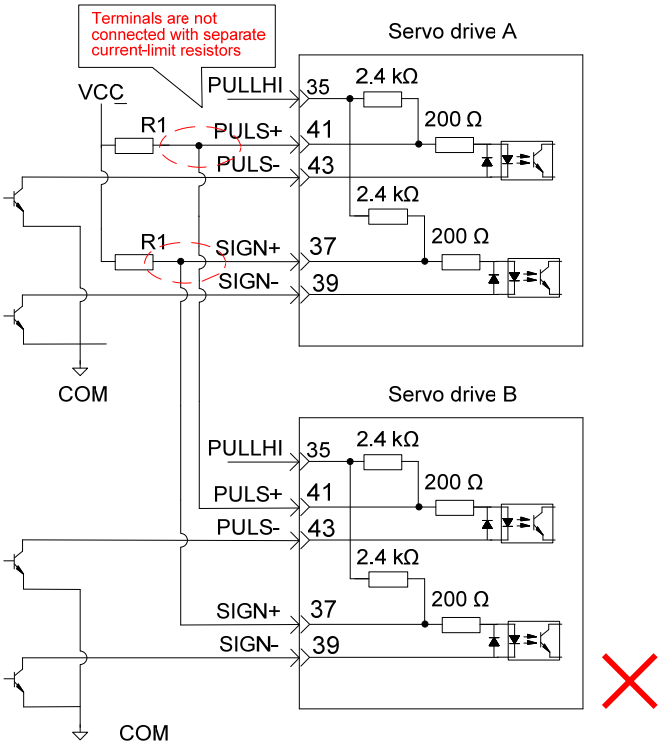


Wrong connection 4: Terminals are inaccurately connected, resulting in burnout of terminals.

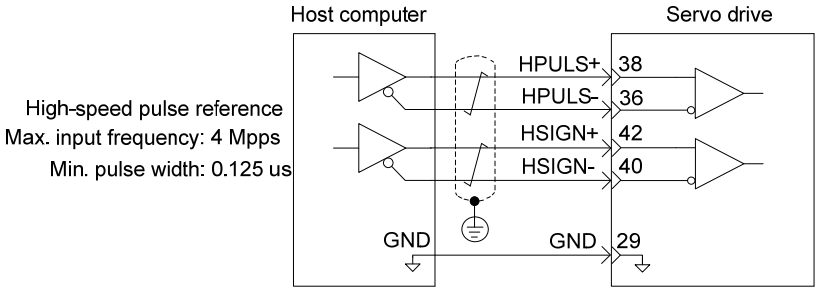


Multiple terminals share the same current-limiting resistor, resulting in that pulses are inaccurately received.





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 inputing reference pulses, pulse loss occurs.

When inputing reference direction, the direction will reverse.

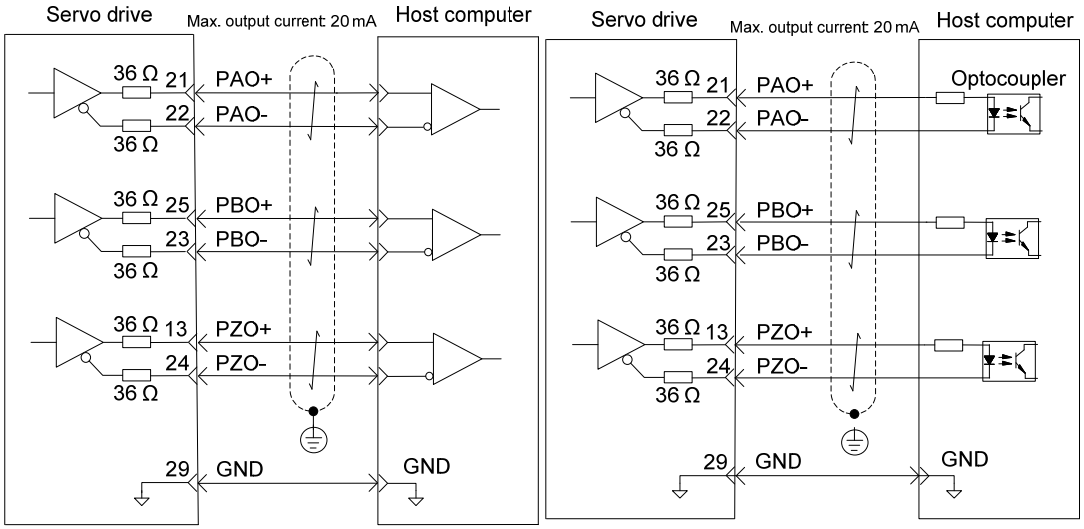
The 5 V ground of the host controller must be connected to GND terminal of the servo drive to reduce noise interference.

3.3.4 Encoder Frequency Dividing Output Circuit

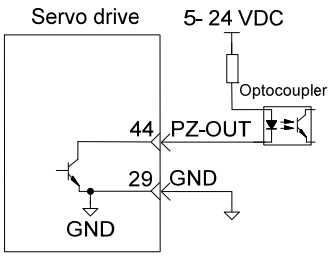
Signal		Default Function	Pin No.	Function Description	
Common	PAO+ PAO-		21 22	Phase A output signal	Phases A+B quadrature pulse output signal
	PBO+ PBO-		25 23	Phase B output signal	
	PZO+ PZO-		13 24	Phase Z output signal	Origin pulse output signal
	PZ-OUT		44	Phase Z output signal	Origin pulse OC output

Signal		Default Function	Pin No.	Function Description
				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		Shell	

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.



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

The holding brake is used when the servo motor controls a vertical axis. The servo

motor with brake prevents the movable part from shifting due to gravity when the power supply turns off.

Note

The holding brake built in the servo motor is only used for holding the stopped status. 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. Function of the brake will be not affected.

When brake coils are powered (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.

Models of holding brake connectors:

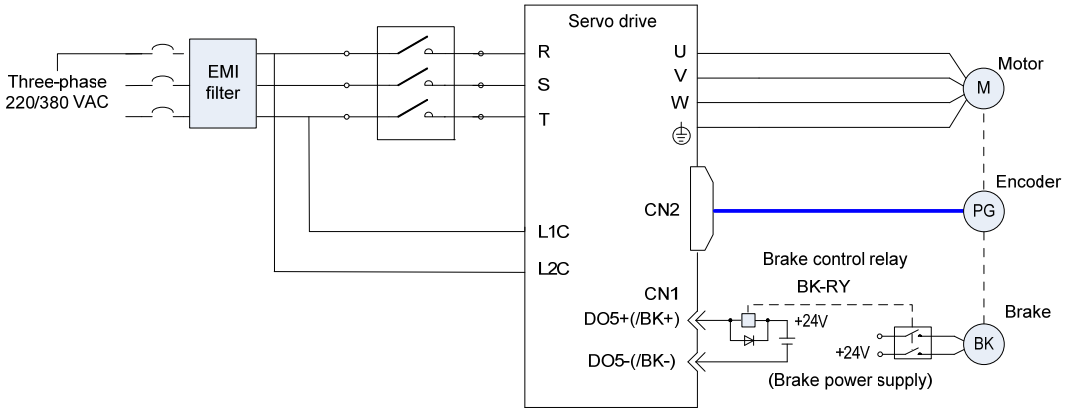
Table 3-17 Models of holding brake connectors for frame 40/60/80 servo motor

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) Precautions during wiring

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.

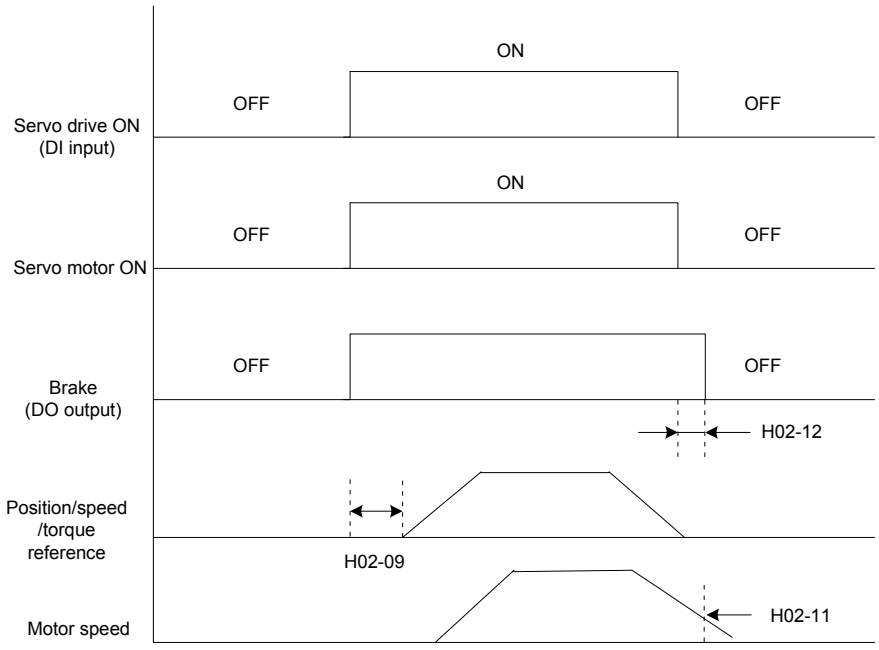
Table 3-18 Brake specifications

Servo Motor Model	Holding Torque (N·m)	Supplied Voltage (V)±10%	Resistance (Ω) ±7%	Supplied Current Range (A)	Braking Time (ms)	Pickup 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	35	20
ISMH1-75B	2.39	24	50.1	0.40–0.57	40	25
ISMH2-10C/15C/20C/25C	8	24	25	0.81–1.14	48	40
ISMH2-30C/40C/50C	16	24	21.3	0.95–1.33	95	50
ISMH3-85B/13C/18C	16	24	21.3	0.95–1.33	95	50
ISMH3-29C/ 44C/55C/75C	48	24	13.7	1.47–2.07	108	26
ISMH4-40B	1.3	24	82.3	0.25–0.34	35	20

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

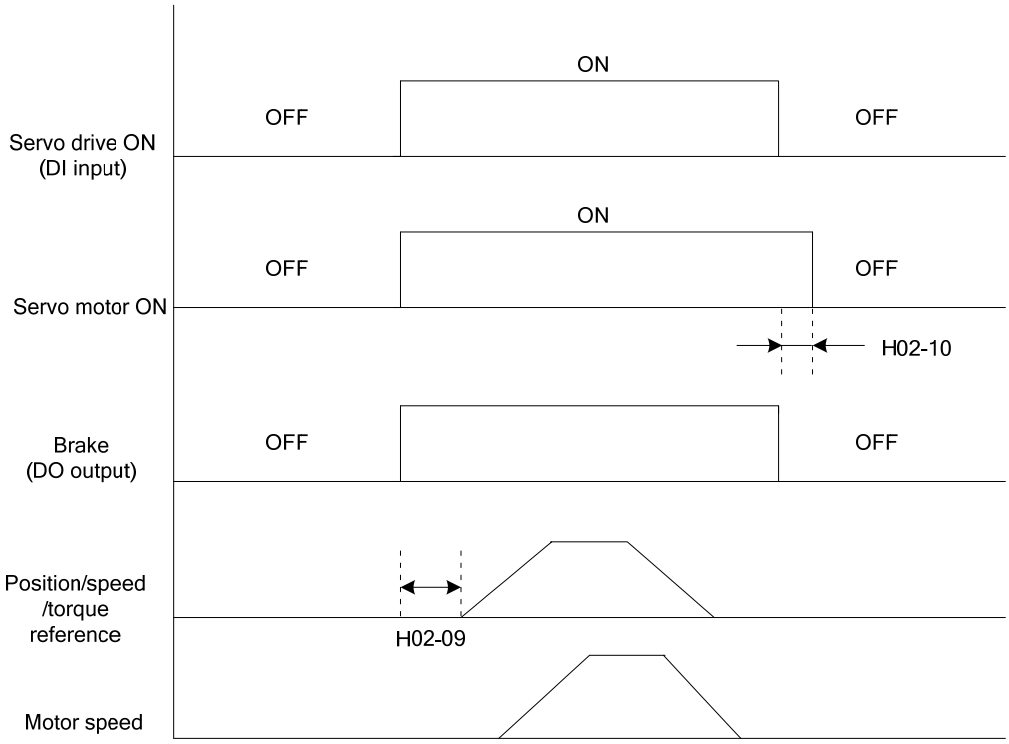


Description of brake output time sequence:

When the servo drive 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 drive is OFF, the brake turns OFF (servo motor stops running) after the delay time set in H02-12 or when the motor speed is lower than the value set in H02-11.

4) Servo motor stopping when servo drive is OFF



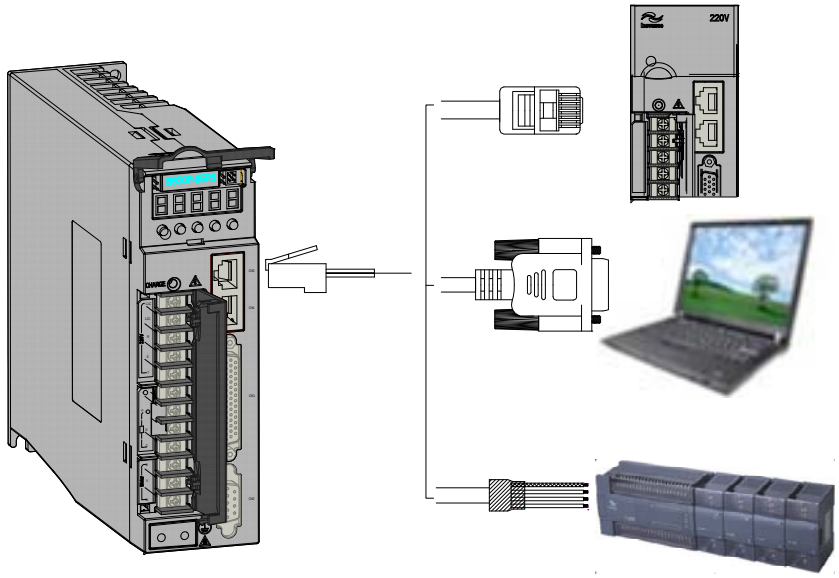
Description of brake output time sequence:

When the servo drive 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 drive 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

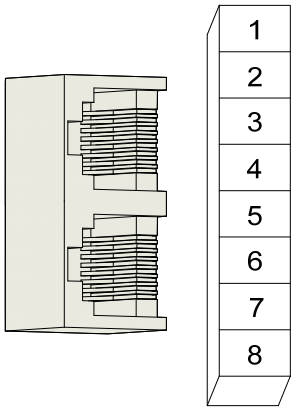
Figure 3-11 Communication wiring



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	
Shell	PE	Shield	

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

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

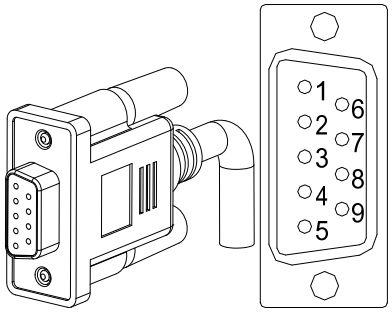
Pin No.	Pin	Description	Terminal Pin layout
2	PC-RXD	PC receiving end	
3	PC-TXD	PC sending end	
5	GND	Ground	
Shell	PE	Shield	

Figure 3-12 Communication cable appearance

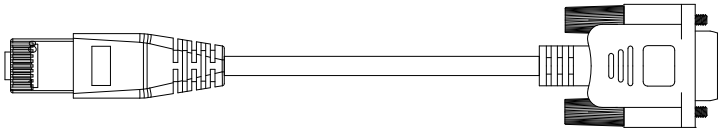


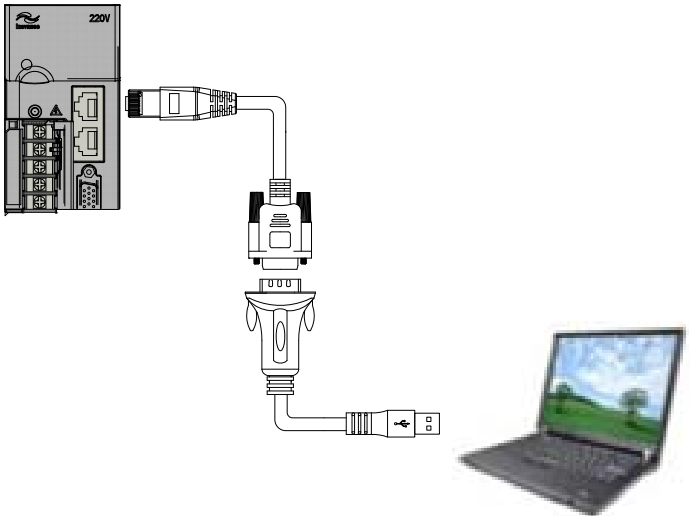
Table 3-21 Pin connection relation of the communication cable

FJ45 at Servo Drive End (A)		DB9 at PC End (B)	
Signal	Pin No.	Signal	Pin No.
GND	8	GND	5
RS232-TXD	7	PC-RXD	2
RS232-RXD	6	PC-TXD	3

PE (shielded layer)	Shell	PE (shielded layer)	Shell

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

Figure 3-13 Serial-to-USB conversion diagram



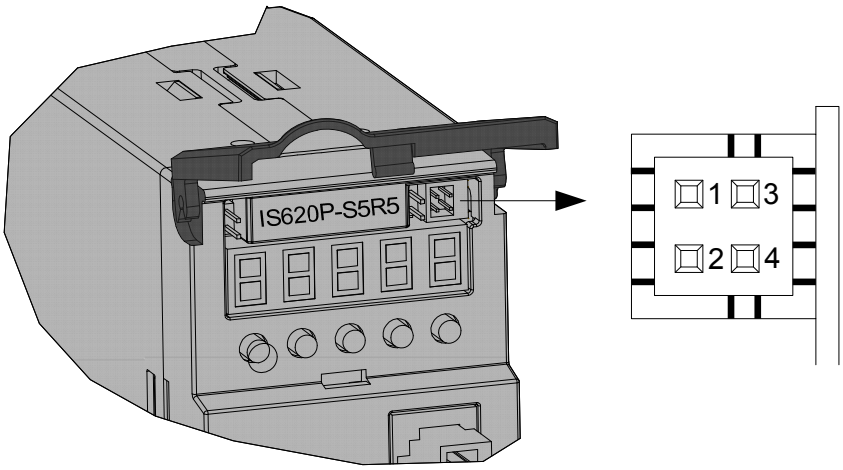
The recommended cable is as follows:

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

3.5 Analog Monitoring Signal Wiring

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

Figure 3-14 Analog monitoring signal terminal

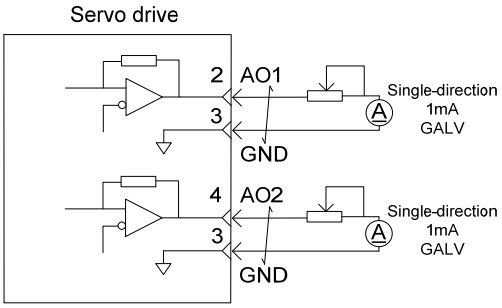


No.	1	2	3	4
Signal	GND	AO1	GND	AO2

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 3-22 Monitored objects of analog signals

Signal	Monitored Object
AO1	0:Motor rotational 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 as short cables (such as reference input and encoder cables) as possible.

2) Use as thick cables 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 put these cables in the same duct or bundle them together.

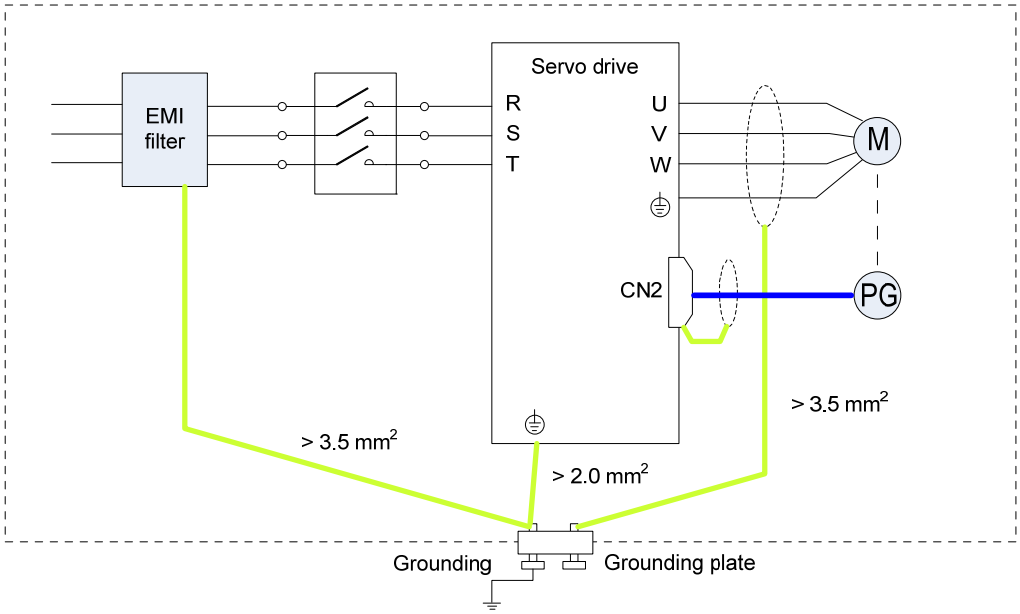
d) Do not share the power supply with an electric welder or electrical discharge machine. When the servo drive is placed near a high-frequency generator, install an EMI filter on the input side of the power supply line.

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 3-15 Anti-interference wiring example



Note

For the grounding cable connected to the casing, use a thick cable with a thickness of at least 3.5 mm^2. 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 shielded layer of the power line

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

c) Grounding the servo drive

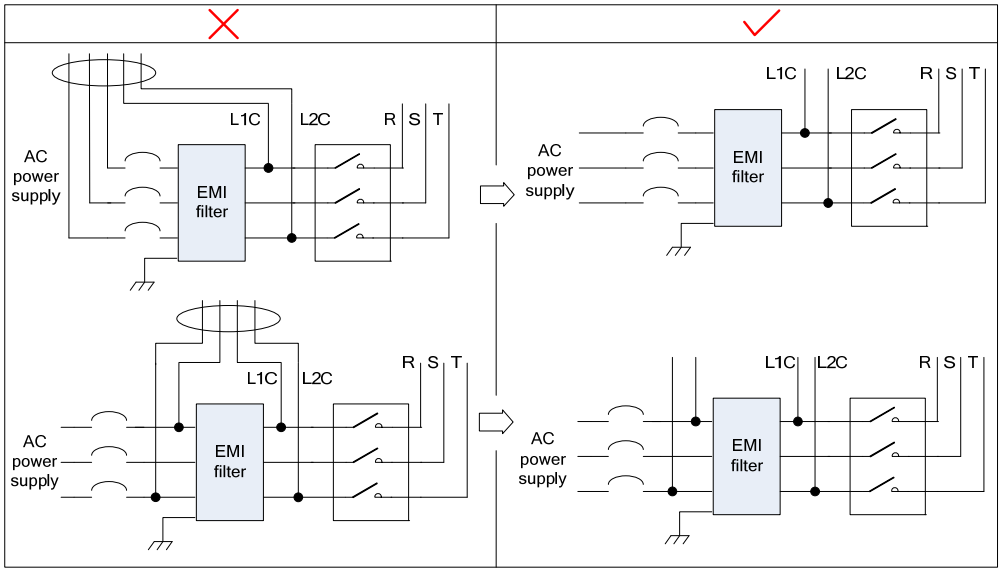
Ground the PE terminal of the servo drive properly. The screw of this terminal must be fixed solidly to ensure good contact.

3.6.2 Using EMI Filters

To prevent interference from power lines 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.

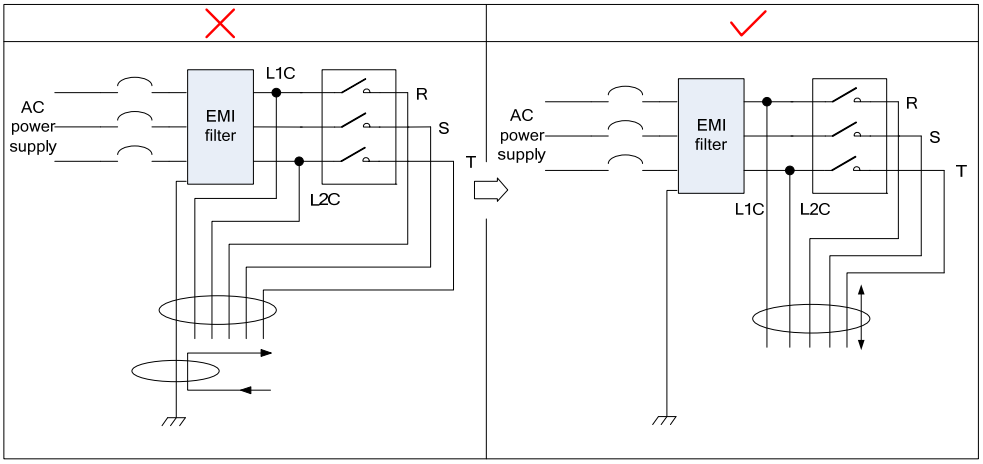
1) Do not put the input and output lines of the EMI filer in the same duct or bundle them together.

Figure 3-16 EMI filter input and output line wiring



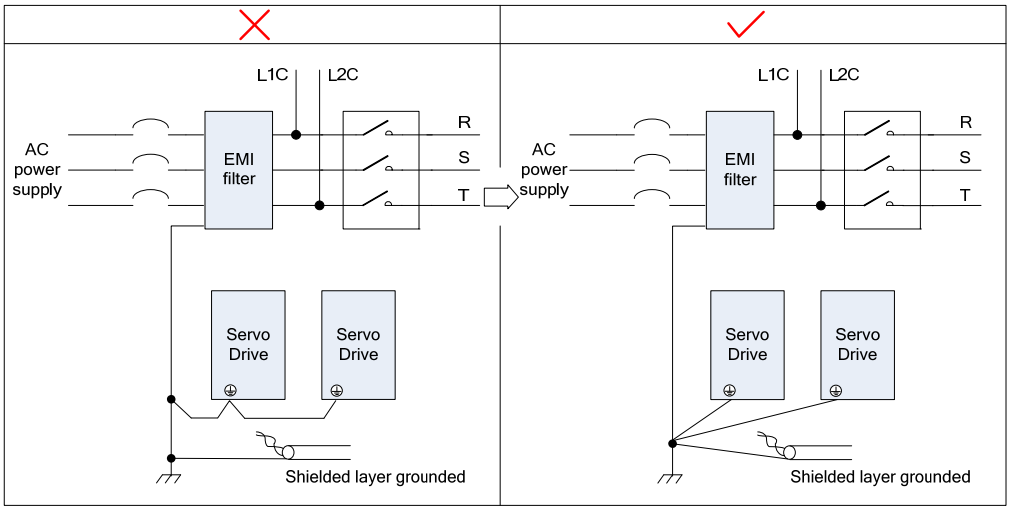
2) Separate the grounding cable and output power supply line of the EMI filter.

Figure 3-17 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.

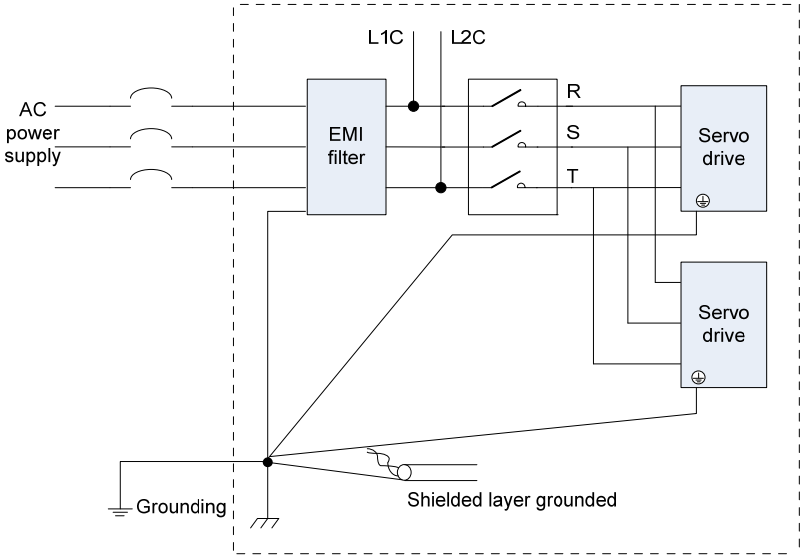
Figure 3-18 Grounding to one point



4) Grounding 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 3-16.

Figure 3-19 EMI filter grounding



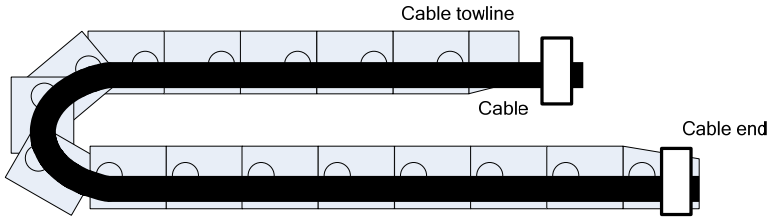
3.7 Precautions of Using Cables

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. Use flexible cables if they need to be moved. Common cables are easily damaged after being bent for a long time. Cables configured together with low power servo motors cannot be used for movement.
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 3-20 Cable towline



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.

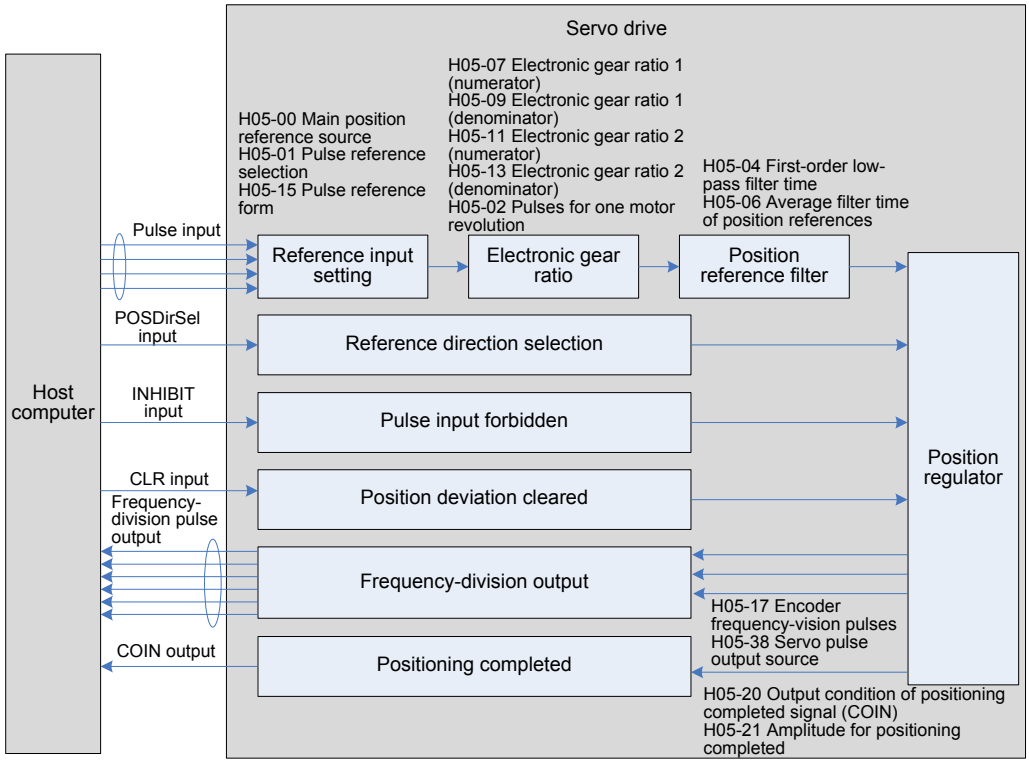
In the position control mode, the displacement is determined based on the number of pulses and the speed is determined based on the input pulse frequency. The position control mode strictly controls the position and speed, and is often used in the positioning device. It is the most commonly used mode 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 computer 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.

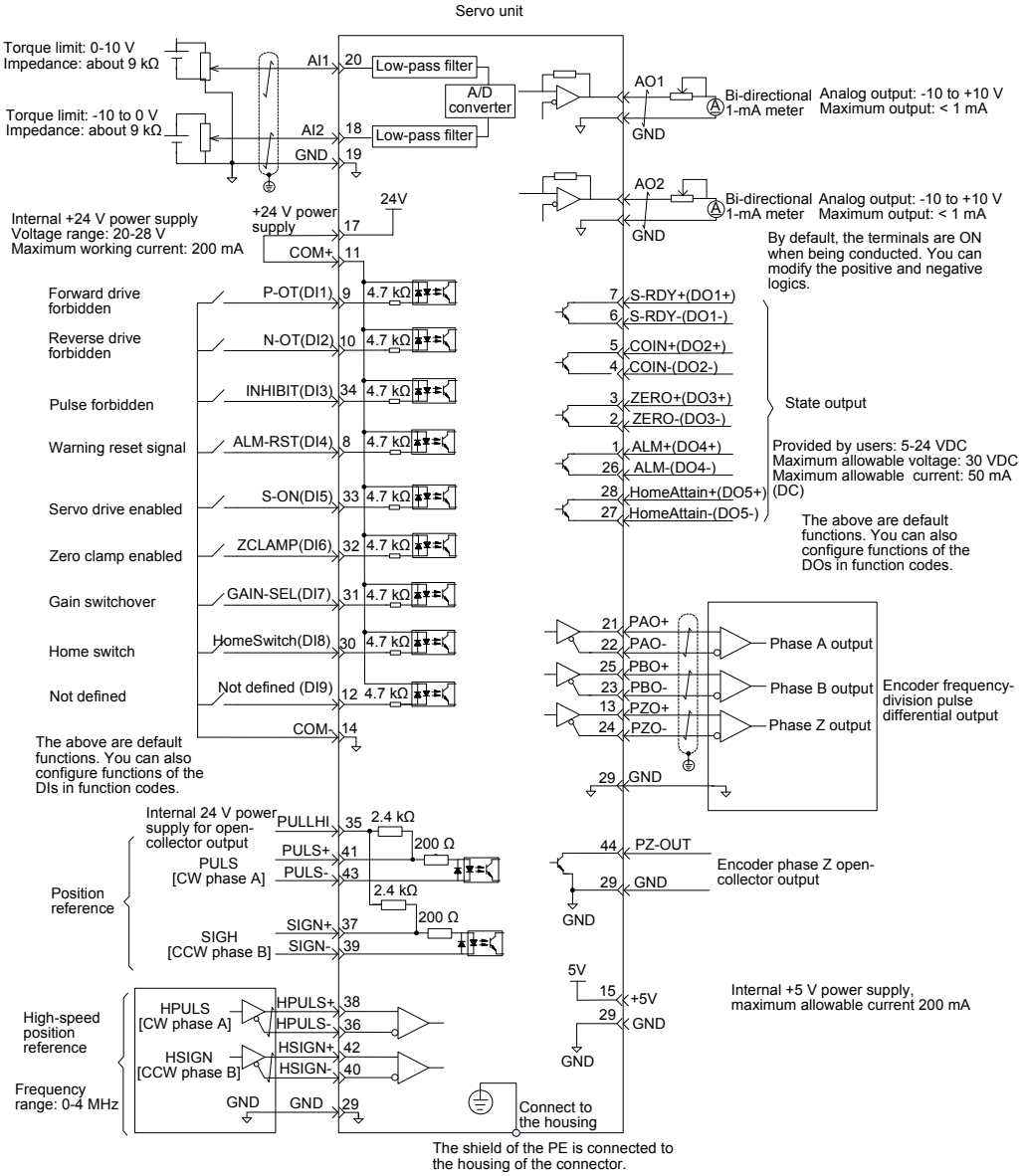
3. Connect the signals of terminal CN1, such as the pulse direction input, pulse reference input, and required DI/DO signals (servo drive enabled and positioning completed) according to Figure 4-1.

4. Perform the setting related to the position control mode. Set the DI/DO functions in group 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 computer to enable the servo motor to rotate. Make the motor rotate at a low speed and ensure that 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 current. 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	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H05	00	Main position reference source	0: Pulse reference 1: Step setting 2: Multi-position setting	1	0	Immediate	At stop	P

b. Pulse reference source

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

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

c. Position reference direction switchover

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	Set the logic of the corresponding DI to 0 or 1. This function is supported only when H05-00 is set to 0 or 1.

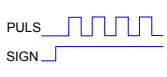
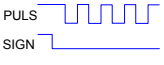
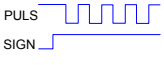
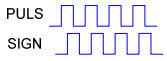
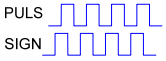
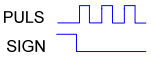
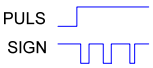
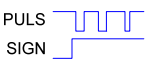
d. Pulse reference form

Select the pulse reference form by setting H05-15.

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

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

Table 4-1 Principles of pulse reference forms

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

e. Pulse input forbidden

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

Function No.	Function Name	Description	Setting	Remarks
FunIN.13	INHIBIT	Pulse input forbidden	Valid: Pulse reference input forbidden Invalid: Pulse reference input allowed	Set the logic of the corresponding DI to 0 or 1.

2. Electronic gear ratio

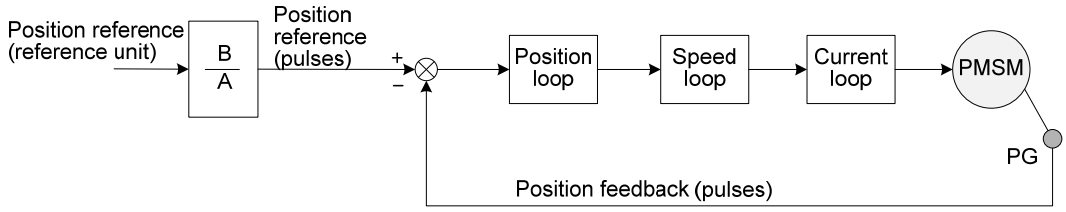
Set the electronic gear ratio based on the actual situation of the mechanism and host computer.

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

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H05	13	Gear ratio 2 (denominator)	1–1073741824	1	10000	Immediate	At stop	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	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H05	02	Pulses for one motor revolution	1–1048576	1 p	0 p	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 pulse references output by the host computer and the acceleration/deceleration rate is large.

The pulse frequency is too low.

The electronic gear ratio is larger than 10.

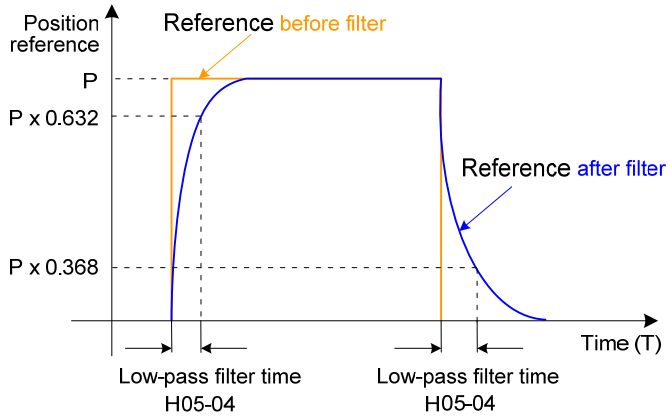
Note

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	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H05	04	First-order low-pass filter time	0.0–6553.5 ms	0.1 ms	0.0 ms	Immediate	At stop	P

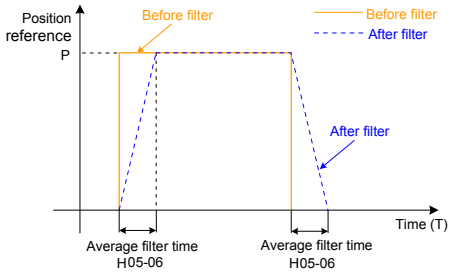
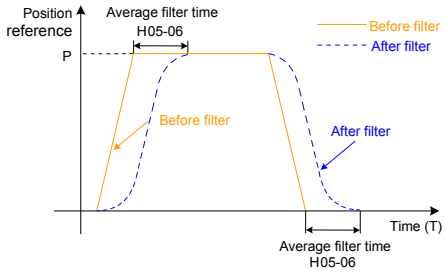
Figure 4-4 Example of first-order low-pass filter



Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H05	06	Average filter time of position references	0.0–128.0 ms	0.1 ms	0.0 ms	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	Clr	Position deviation cleared	Valid: Clear Invalid: Not clear	Set the logic of the corresponding DI to 0 or 1.

5. Frequency-division output

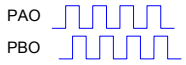
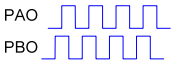
This parameter is used to select the pulse output source. The pulse reference synchronous output is used in the synchronous control scenario.

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H05	38	Servo pulse output source	0: Encoder frequency-division output 1: Pulse reference synchronous output 2: Frequency-division and synchronous output forbidden	1	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).

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H05	17	Encoder frequency-division pulses	35–32767 P/Rev	1 P/Rev	2500 P/Rev	Power-on again	At stop	-

Table 4-3 Output phase pattern

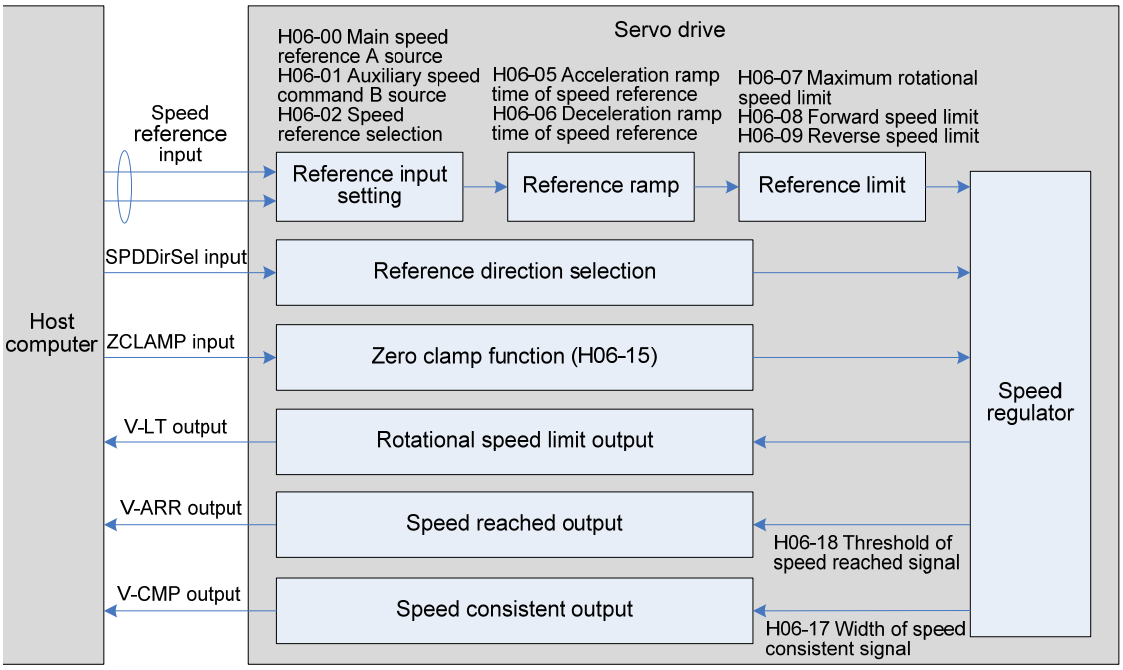
Forward Rotation (Phase A Advancing Phase B by 90°)	Reverse Rotation (Phase B Advancing Phase A by 90°)
	

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

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

4.2 Use of the Speed Control Mode

Figure 4-5 Diagram of the speed control mode

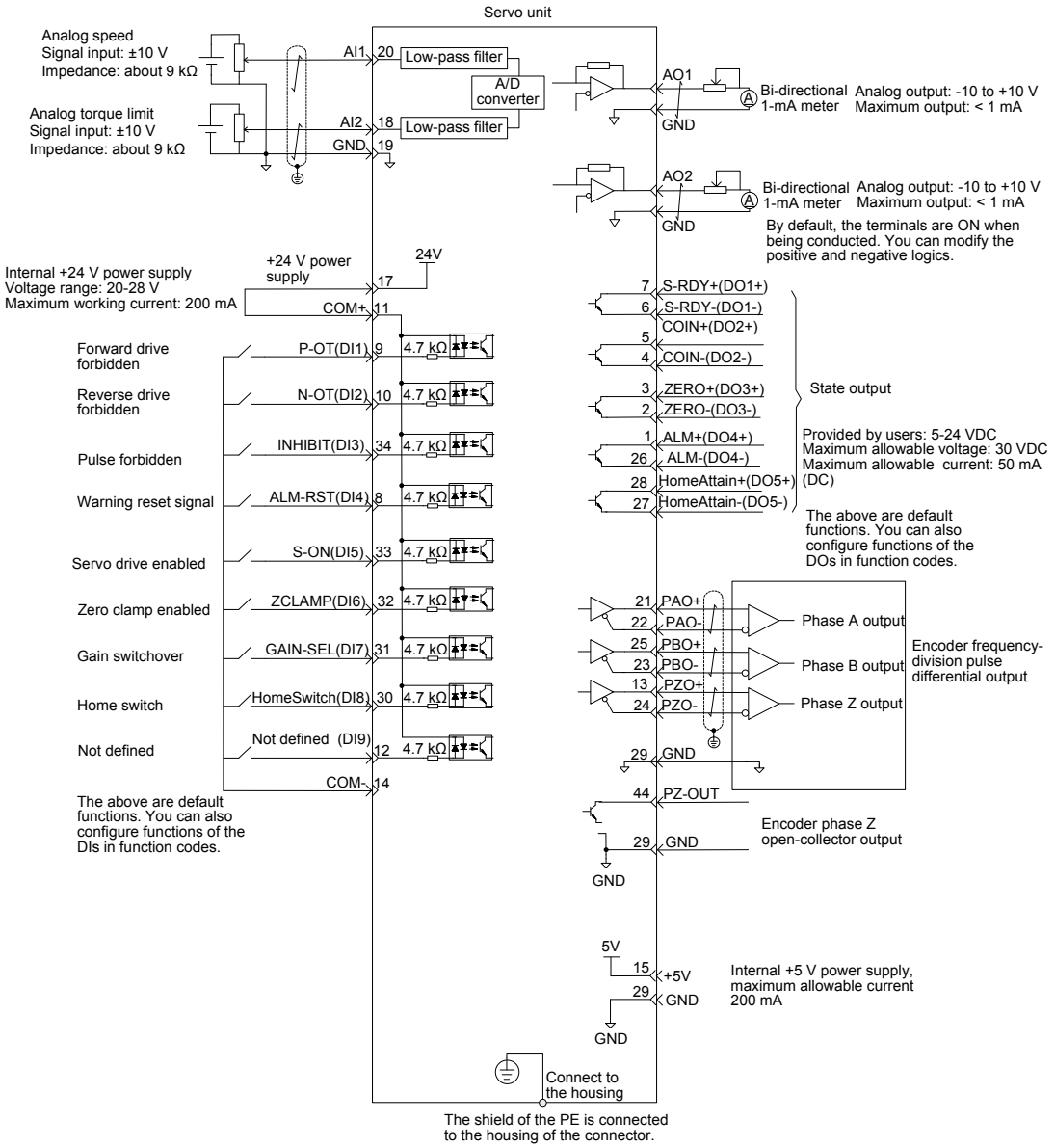


The main use procedure of the speed control mode is as follows:

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 4-5.
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 current. 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	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H06	00	Main speed reference A source	0: Digital setting (H06-03) 1: AI1 2: AI2	1	0	Immediate	At stop	S
H06	01	Auxiliary speed reference B source	0: 0: Digital setting (H06-03)1: AI1 2: AI2 3: 0 (No function) 4: 0 (No function) 5: Multi-speed reference	1	1	Immediate	At stop	S
H06	03	Keypad setting value of speed reference	-9000–+9000 RPM	1 RPM	200 RPM	Immediate	During running	S
H06	04	Jog speed setting value	0–3000 RPM	1 RPM	100 RPM	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

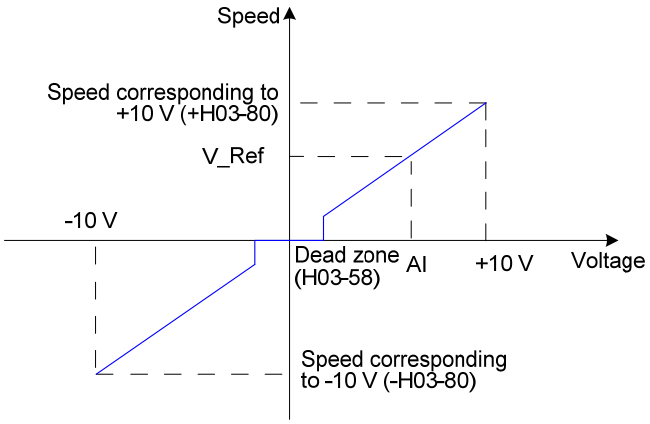
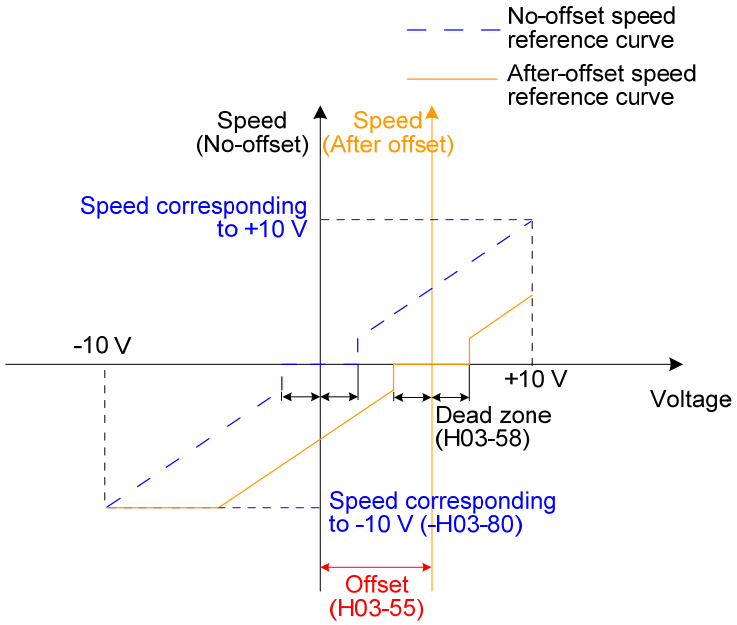


Figure 4-8 After-offset AI2



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 specified via an external DI or internally. 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	Set the logic of the corresponding DI to 0 or 1.

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	Min. Unit	Default Setting	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	1	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	-

2. Reference ramp parameter setting

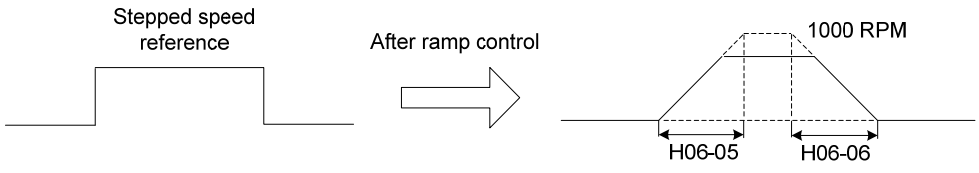
The ramp control function is to change the speed references with large difference to smoother speed references with constant acceleration and deceleration, that is, controlling acceleration and deceleration by setting the acceleration and deceleration time. If the set speed references change greatly, 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	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H06	05	Acceleration ramp time of speed reference	0-65535 ms	1 ms	0	Immediate	During running	PS
H06	06	Deceleration ramp time of speed reference	0-65535 ms	1 ms	0	Immediate	During running	PS

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 for the speed reference to accelerate from zero to 1000 RPM.

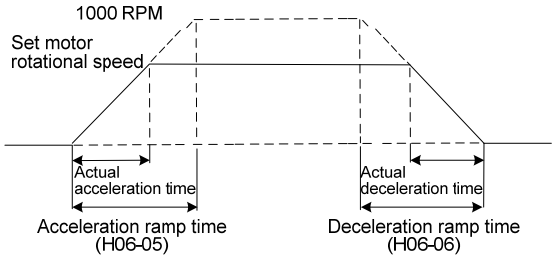
H06-06 specifies the time for the speed reference to decelerate from1000 RPM to zero.

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

Actual acceleration time = (Speed reference/1000) x Acceleration ramp time of speed reference

Actual deceleration time = (Speed reference/1000) x Deceleration ramp time of speed reference

Figure 4-10 Acceleration/Deceleration time diagram



3. Speed reference limit

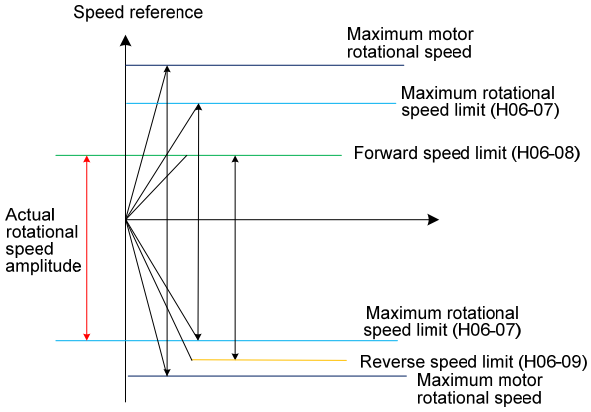
The speed references in the speed control mode can be limited.

- H06-07 specifies the amplitude limit of speed reference. 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 limit. If the speed reference of the forward direction exceeds the value, the servo drive outputs the value.
- H06-08 specifies the reverse speed limit. If the speed reference of the reverse direction exceeds the value, the servo drive outputs the value.
- The maximum motor rotational speed changes with the actual motor parameters.

Note

When the rotational speed is restricted, the smallest value of H06-07, H06-08, and H06-08 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 rotational speed limit is the value of H06-08, and the reverse rotational 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 rotational speed.

The actual motor rotational speed amplitude meets the following requirements:

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

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

The related function codes are set in the following table.

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H06	07	Maximum rotational speed limit	0–9000 RPM	1 RPM	9000 RPM	Immediate	During running	S
H06	08	Forward speed limit	0–9000 RPM	1 RPM	9000 RPM	Immediate	During running	S
H06	09	Reverse speed limit	0–9000 RPM	1 RPM	9000 RPM	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.

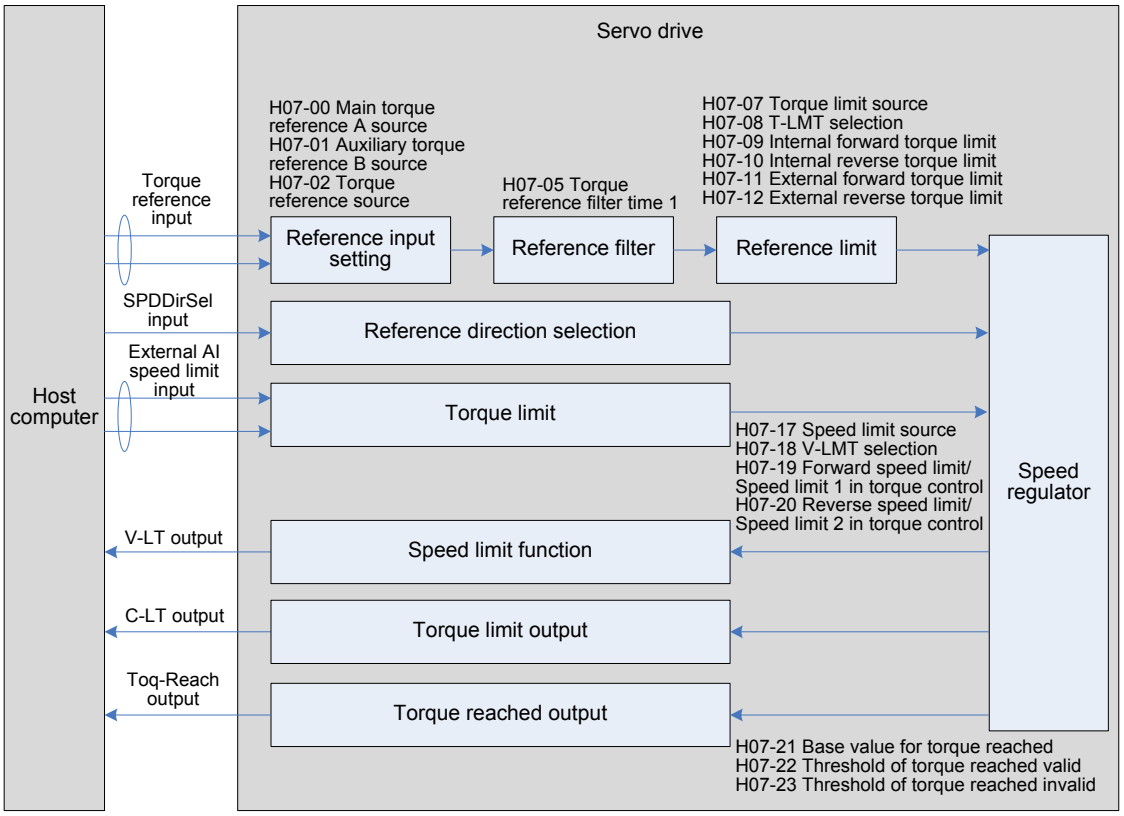
Function No.	Function Name	Description	Setting	Remarks
FunIN.12	ZCLAMP	Zero clamp function	Valid: Zero clamp enabled Invalid: Zero clamp disabled	This function is supported only in the speed control mode.

The related function code is set in the following table.

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H06	15	Speed limit for zero clamp	0–6000 RPM	1 RPM	10 RPM	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.

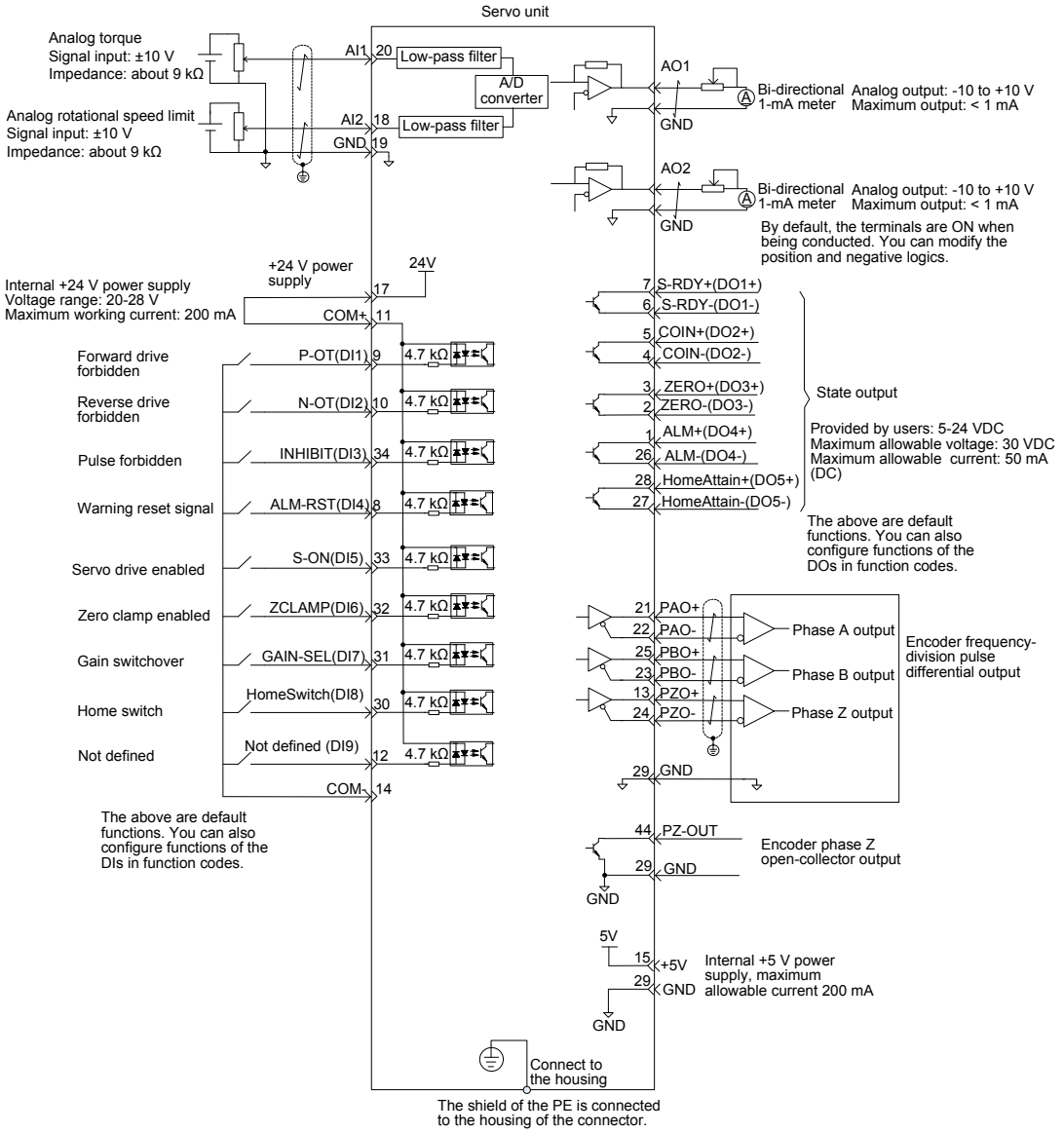
3. Connect the required DI/DO signals and analog speed references of terminal CN1 according to Figure 4-12.

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 current. 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	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H07	00	Main torque reference A source	0: Digital setting (H07-03) 1: AI1 2: AI2	1	0	Immediate	At stop	T
H07	01	Auxiliary torque reference B source	0: Digital setting (H07-03) 1: AI1 2: AI2	1	1	Immediate	At stop	T
H07	03	Keypad setting value of torque reference	-300.0%–+300.0%	0.1%	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	Min. Unit	Default Setting	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	1	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	Set the logic of the corresponding DI to 0 or 1.

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	Valid: Current running reference being A Invalid: Current running reference being B	-

		switchover		

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. Offset setting (H03-50) c. Dead zone setting (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

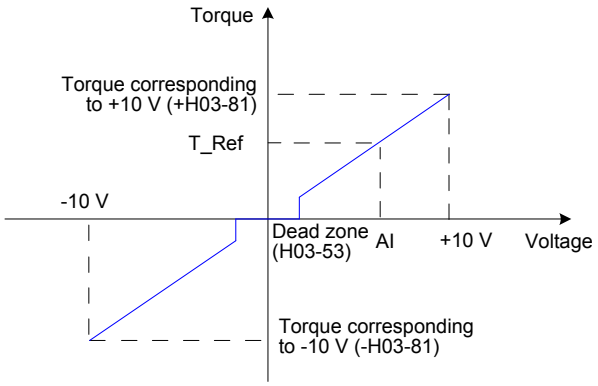
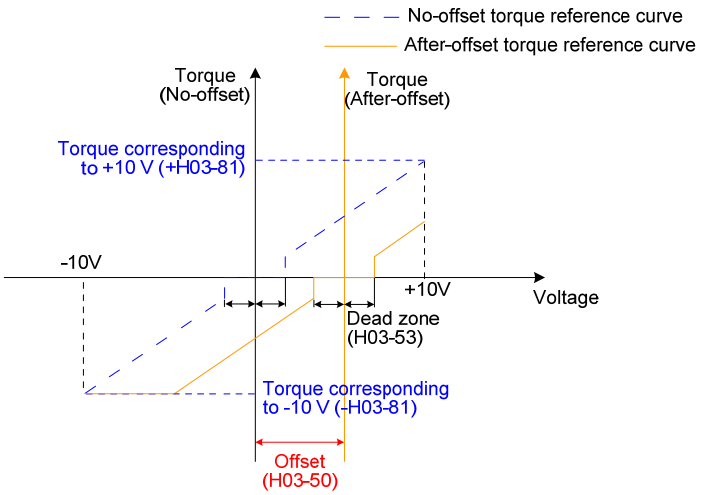


Figure 4-15 After-offset AI2



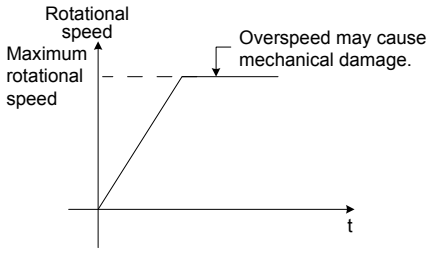
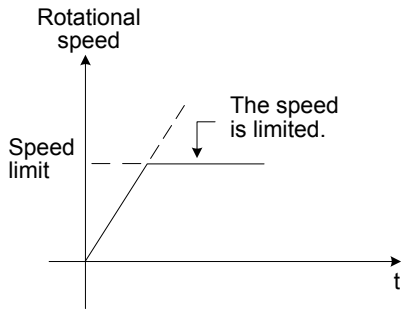
View the set torque reference (a percentage relative to the rated motor torque) in H03-02.

2. Speed limit in torque control

In the torque control mode, the rotational 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 rotational 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 rotational 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 rotational 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 rotational 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	Rotational speed limit	Confirming rotational speed limit in torque control: Valid: Motor rotational speed limited Invalid: Motor rotational 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	Min. Unit	Default Setting	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 selected by DI	1	0	Immediate	During running	T
H07	18	V-LMT selection	1: AI1 2: AI2	1	1	Immediate	During running	T
H07	19	Forward speed limit/Speed limit 1 in torque control	0–9000 RPM	1 RPM	3000 RPM	Immediate	During running	T
H07	20	Reverse speed limit/Speed limit 2 in torque control	0–9000 RPM	1 RPM	3000 RPM	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	Min. Unit	Default Setting	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)	1	0	Immediate	At stop	PST

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

Function No.	Function Name	Description	Setting	Remarks
FunIN.16	P-CL	External forward torque limit	Valid: External torque limit enabled Invalid: External torque limit disabled	-
FunIN.17	N-CL	External reverse torque limit	Valid: External torque limit enabled Invalid: External torque limit disabled	-

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

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	Min. Unit	Default Setting	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)	1	0	Immediate	At stop	T
H07	08	T-LMT selection	1: AI1 2: AI2	1	2	Immediate	At stop	PST
H07	09	Internal forward torque limit	0–300.0% (100% corresponds to the rated motor torque)	0.1%	300.0%	Immediate	During running	PST
H07	10	Internal reverse torque limit	0–300.0% (100% corresponds to the rated motor torque)	0.1%	300.0%	Immediate	During running	PST
H07	11	External forward torque limit	0–300.0% (100% corresponds to the rated motor torque)	0.1%	300.0%	Immediate	During running	PST
H07	12	External reverse torque limit	0–300.0% (100% corresponds to the rated motor torque)	0.1%	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 braking 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 computer does not send the running reference, power on the servo drive. Then, check that:

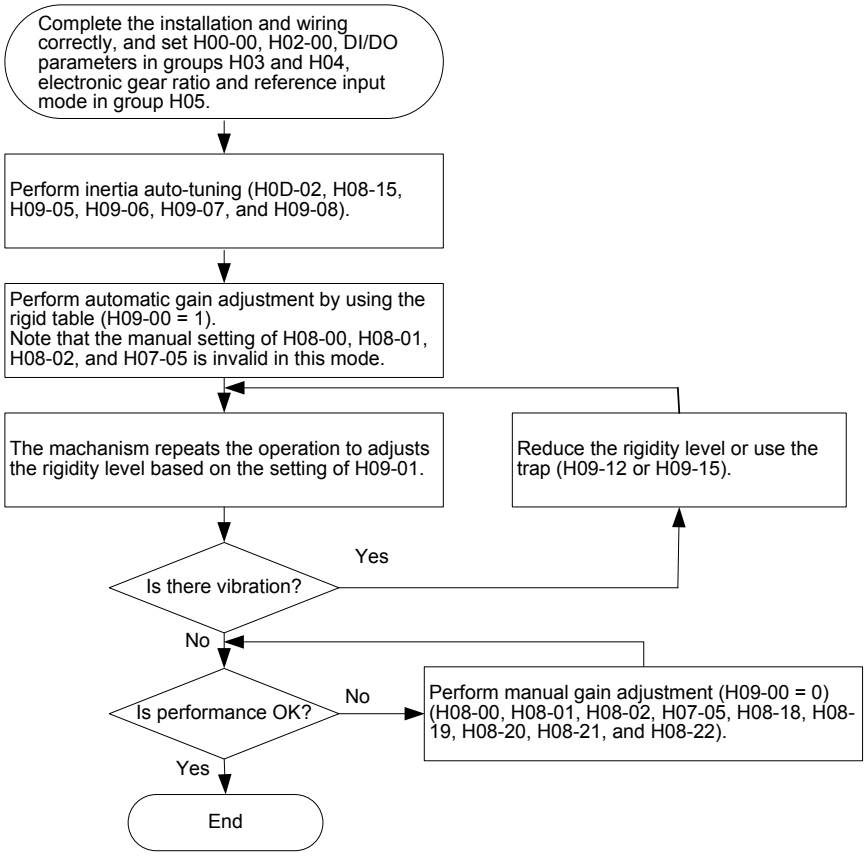
1. The servo motor can rotate properly without vibration or loud noise.
2. All parameter setting is correct. Unexpected actions may occur due to different mechanical characteristics, and do not set the parameters too large or small.
3. The bus voltage indicator and digital display are normal.

4.5 Load Inertia Auto-tuning and Gain Adjustment

After completing the installation and wiring correctly and performing required parameter setting, 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 trap to suppress the mechanical resonance, you can set two resonance frequencies (see section 4.5.4). The following figure is the general commissioning flowchart.

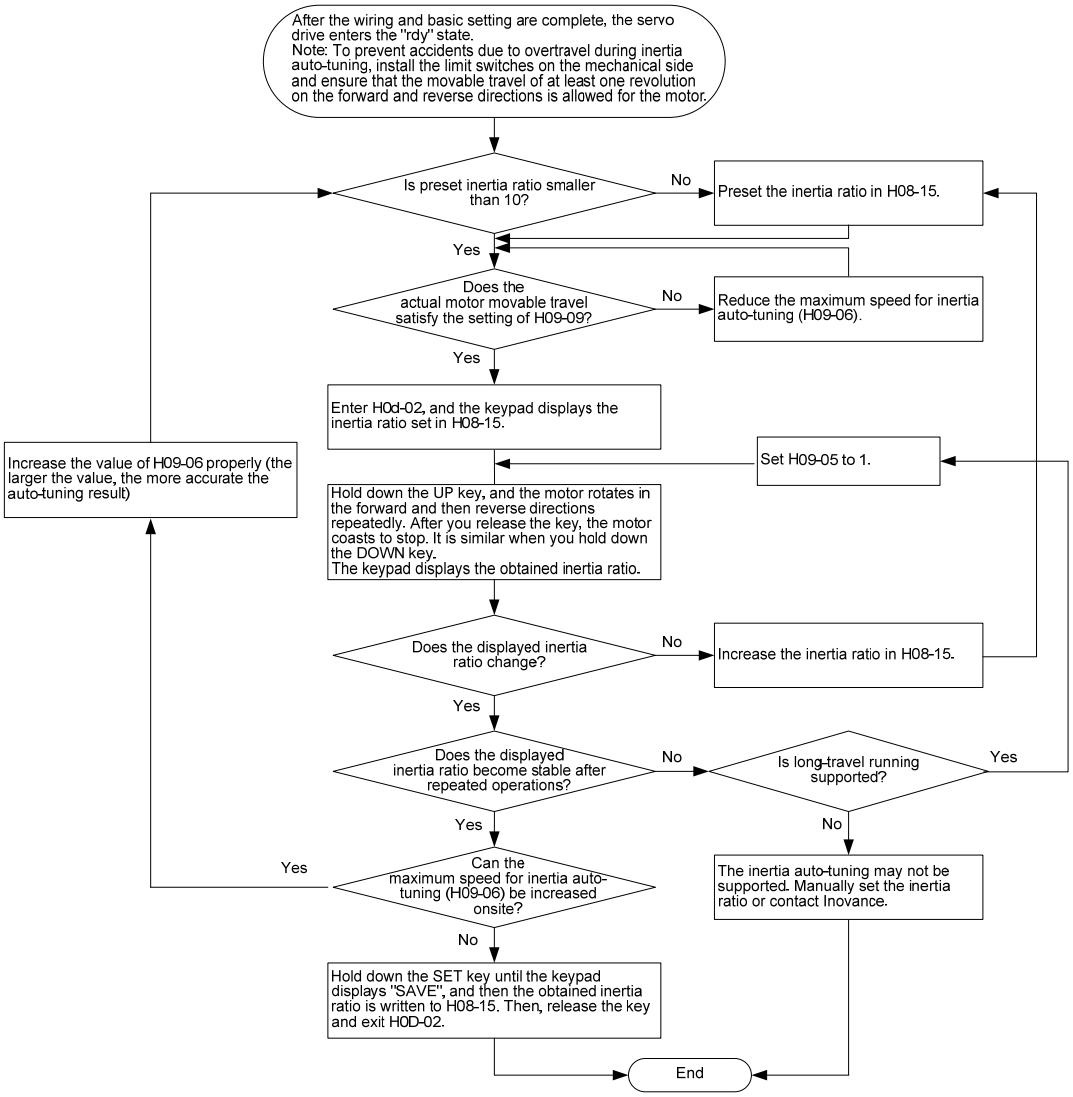
Figure 4-16 General commissioning flowchart



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 set H08-15. It is recommended that H08-15 be set to 5 initially and then 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	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H09	05	Offline inertia auto-tuning mode	0: Positive and negative triangular wave mode 1: Jog mode	1	0	Immediate	At stop	-
H09	06	Maximum	100–1000 RPM	1 RPM	500	Immediate	At stop	-

		speed for inertia auto-tuning			RPM			
H09	07	Acceleration/Deceleration time for inertia auto-tuning	20–800 ms	1 ms	250 ms	Immediate	At stop	-
H09	08	Interval after an inertia auto-tuning	50–10000 ms	1 ms	800 ms	Immediate	At stop	-
H09	09	Motor revolutions for an inertia auto-tuning	-	0.01 revolution	-	-	Display	-

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

- The actual maximum rotational 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, vibration may occur. Use a trap to suppress the vibration (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	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H09	00	Gain adjustment mode	0: Manual 1: Automatic	1	0	Immediate	During running	PS
H09	01	Rigidity level selection	0–31	1	12	Immediate	During running	PS

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 causes 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:

$$\text{H07-05 [ms]} < \frac{1000}{2\pi \times \text{H08-00 [Hz]}}$$

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H08	00	Speed loop gain	1.0–2000.0 Hz	0.1 Hz	25.0 Hz	Immediate	During running	PS
H08	01	Speed loop integral time constant	0.15–512.00 ms	0.01 ms	31.83 ms	Immediate	During running	PS
H08	02	Position loop gain	1.0–2000.0 Hz	0.1 Hz	40.0 Hz	Immediate	During running	P
H07	05	Torque reference filter time	0.00–30.00 ms	0.01 ms	0.79 ms	Immediate	During running	PST

4.5.4 Trap

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

A total of four traps can be used, and each has three parameters, frequency, width level, and attenuation level. When the frequency is the default value 2000 Hz, the trap is actually invalid. Traps 1 and 2 are manual traps, and their parameters need to set manually. Traps 3 and 4 are self-adaptive traps, and their parameters are set automatically by the servo drive.

The mode of the self-adaptive trap is determined in H09-02. When H09-02 = 1, only trap 3 is valid; when the servo is enabled and detects resonance, the parameters of trap 3 are

set automatically to suppress the resonance. When H09-02 = 2, both traps 3 and 4 are valid, and their parameters can be set automatically.

The self-adaptive trap is preferred during the use. If the self-adaptive trap cannot produce satisfactory performance, use the manual trap. When using the manual trap, 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 trap are as follows:

The trap 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 trap 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 trap will keep unchanged. After the self-adaptive trap 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 trap.

It is recommended that at most two traps 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 trap may degrade.

When the vibration cannot be cleared after a long time use of the self-adaptive trap, disable the servo drive.

The related function code is set in the following table.

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H09	02	Working mode of self-adaptive trap	0–4 0: Self-adaptive trap not updated 1: Only one trap (trap 3) valid 2: Both traps (traps 3 and 4) valid 3: Only detect resonance frequency (displayed in H09-24), not update parameters 4: Restore parameters to default setting	1	0	Immediate	During running	PS
H09	12	Trap 1 frequency	50–2000 Hz	1 Hz	2000 Hz	Immediate	During running	PS
H09	13	Trap 1 width level	0–20	1	2	Immediate	During running	PS
H09	14	Trap 1 attenuation level	0–99	1	0	Immediate	During running	PS

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H09	15	Trap 2 frequency	50–2000 Hz	1 Hz	2000 Hz	Immediate	During running	PS
H09	16	Trap 2 width level	0–20	1	2	Immediate	During running	PS
H09	17	Trap 2 attenuation level	0–99	1	0	Immediate	During running	PS
H09	18	Trap 3 frequency	50–2000 Hz	1 Hz	2000 Hz	Immediate	During running	PS
H09	19	Trap 3 width level	0–20	1	2	Immediate	During running	PS
H09	20	Trap 3 attenuation level	0–99	1	0	Immediate	During running	PS
H09	21	Trap 4 frequency	50–2000 Hz	1 Hz	2000 Hz	Immediate	During running	PS
H09	22	Trap 4 width level	0–20	1	2	Immediate	During running	PS
H09	23	Trap 4 attenuation level	0–99	1	0	Immediate	During running	PS
H09	24	Obtained resonance frequency	0–2000 Hz	1 Hz	-	-	-	PS

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 moving information monitoring
- Supporting the WindowsXP and Windows7 operating systems. For details on how to use the IS-Opera, see the IS-Opera help manual.

Chapter 6 Troubleshooting

6.1 Analysis and Handling of Faults

When a fault occurs on the servo drive, the keypad displays "Er.xxx". You can view the internal fault code in H0B-45 (if a fault has no internal fault code, the value of H0B-45 is the same as the display on the keypad). The following table describes the analysis and handling of faults.

Fault Display and Description		Probable Cause	Confirming Method	Solution
Er.101 Er.111 (if the actual values of groups H00 and H01 parameters exceed the limits, Er.111 is reported. If the values of other groups of parameters exceeds the limits, Er.101 is reported)		1. The control power voltage drops instantaneously.	Measure the power voltage.	Ensure that the power voltage is within the specifications, and restore the default setting via H02-31.
		2. Instantaneous power failure occurs during parameter writing.	Check whether instantaneous power failure occurs during parameter writing.	Restore the setting via H02-31, and enter the parameter values again.
		3. The times of parameter writing within a certain period exceeds the limit.	Check whether parameter update is performed frequently from the host computer.	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.
		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 persists, it indicates that the servo drive is faulty.	Replace the servo drive.
Er.102 (programmable logic configuration fault)		1. The FPGA and MCU versions do not match.	Check whether the software versions (H01-00, H01-01) match.	Update the software.
		2. The logic component is faulty.	If the servo drive is powered off and powered on again several times but the fault persists, it indicates that the servo drive is faulty.	Replace the servo drive.
Er.104 (programmable logic interruption fault)	104	1. The logic component is faulty.	If the servo drive is powered off and powered on again several times but the fault persists, it indicates that the servo drive is faulty.	Replace the servo drive.
	100	2. The communication between the FPGA and the MCU is abnormal.	If the servo drive is powered off and powered on again several times but the fault persists, it indicates that the servo drive is faulty.	Replace the servo drive.
Er.105 (internal program abnormal)		1. An EEPROM fault occurs.	Check the causes according to the method of Er.101.	Restore the default setting via H02-31, and power on the servo drive again.
		2. The servo drive is	If the servo drive is powered off	Replace the servo drive.

Fault Display and Description		Probable Cause	Confirming Method	Solution
		faulty.	and powered on again several times but the fault persists, it indicates that the servo drive is faulty.	
Er.108 (parameter storage fault)		Parameter storage is abnormal.	Modify a certain parameter, power on the servo drive again, and check whether the modification is saved.	If the fault persists after the servo drive is powered off and powered on again several times, replace the servo drive.
Er.120 (product model matching fault)	120	The power classes of products such as motor and servo drive do not match.	Check whether the rated motor current is larger than the rated current of the servo drive.	Replace the product that does not match.
	106	2. The encoder type does not meet the requirements.	Read the manual and check whether the type of the currently used encoder is supported by the servo drive.	Use the correct encoder type or servo drive type.
	107	3. The product (motor or servo drive) SN does not exist.	Read the manual and check whether the set product SN exists.	Select the correct product SN.
Er.121 (Invalid servo ON command)		When the servo drive is internally enabled, the external S-ON signal is active.	Check whether the external DI with the S-ON signal is ON when the auxiliary function is used.	Correct the improper operations.
Er.130 (different DIs allocated with the same function)		The same function is allocated to different DIs.	Check whether any two values of H03-02 to H03-20 are the same.	Set the related function codes again.
Er.136 (data check error or no parameter stored in the motor ROM)		1. A parameter check error occurs or no parameter is stored in the serial encoder ROM memory.	Check whether the cable between the motor and the encoder is connected securely.	Connect the encoder cable again.
		2. The motor model is set incorrectly.	Check whether the motor model set in H00-00 matches the servo drive.	Set the motor model correctly.
		3. The servo drive model and the motor model do not match.	3. Check whether the servo drive model matches the motor model.	Replace the servo drive or motor.
Er.200 (overcurrent 1) Er.201 (overcurrent 2)		1. The reference input is at the same time with the servo drive startup or the reference input is too early.	Check the time sequence of reference input.	Input the reference after the servo drive starts up and enters the "rdy" state.
		2. The external braking resistor provides too small resistance or is short-circuited.	Measure whether the resistance of the braking resistor meets the specifications.	Select a proper braking resistor according to the manual.
		3. The motor cables are in poor contact.	Check whether the cable connectors become loose.	Fasten the cable connectors.
		4. The motor cables are grounded.	Check the insulation resistor between the UVW cables and grounding cable of the motor.	Replace the motor if the insulation is poor.
		5. The motor UVW cables	Check whether the motor UVW	Connect the motor

Fault Display and Description	Probable Cause	Confirming Method	Solution
	are short-circuited.	cables are short-circuited and whether glitch occurs.	cables correctly.
	6. The motor is damaged.	Check whether the resistance between the motor cables 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 produces abnormal noise, or view the running graph.	Adjust the gain.
	8. The encoder cable is incorrectly wired, corrosive, or inserted loosely.	Check whether the encoder cable is connected securely.	Weld again or fasten the encoder cable.
	9. The servo drive is faulty.	Check whether the fault is reported after the motor cables are disconnected and the servo drive is powered on again.	Replace the servo drive.
Er.207 (shaft D/Q current overflow)	The servo drive is faulty	If the servo drive is powered off and powered on again several times but the fault persists, it indicates that the servo drive is faulty.	Replace the servo drive.
Er.208 (FPGA system sampling operation timeout)	The servo drive is faulty.	If the servo drive is powered off and powered on again several times but the fault persists, it indicates that the servo drive is faulty.	Replace the servo drive.
Er.210 (output to-ground short-circuit)	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.	Remove the motor UVW cables from the motor, and measure whether the motor UVW cables are short-circuited to the motor grounding cable.	Replace the motor.
	3. The servo drive is faulty.	Disconnect the motor UVW cables from the servo drive. If the servo drive is powered off and powered on again several times but the fault persists, it indicates that the servo drive is faulty.	Replace the servo drive.
Er.220 (UVW phase sequence error)	The UVW cables are connected incorrectly.	Check the phase sequence of the UVW cables.	Connect the UVW cables according to the correct sequence.
Er.234 (runaway fault)	1. The UVW phase sequence is incorrect.	Check the phase sequence of the UVW cables.	Connect the UVW cables according to the correct sequence.
	2. The phase detection is incorrect due to interference.	Check whether the fault is reported when the UVW phase sequence is correct.	Power off the servo drive and then power it on again.
	3. The encoder type is set incorrectly or the wiring is incorrect.	Check the encoder type and wiring.	Correct the motor model, encoder type, and encoder wiring.

Fault Display and Description	Probable Cause	Confirming Method	Solution
	Set H0A-12 to 0 to shield this fault when the motor is dragged by the load.		
Er.300 (STO protection)	The input of the safe torque off (STO) protection terminal is active.	Check the state of the STO terminal.	Clear the STO input.
Er.400 (overvoltage)	1. When the power voltage is 220 VAC (380 VAC), the detected bus voltage is higher than 420 V (760 V), or the power voltage is higher than the input voltage limit.	Measure the power voltage between terminals P⊕ and ⊖.	Adjust the AC power voltage to within the specifications.
	2. The power supply is instable or affected by the lightning strike.	Measure the power supply voltage between terminals P⊕ and ⊖.	Connect a surge suppressor and then connect the power supply. If the fault persists, replace the servo drive.
	3. The braking resistor fails.	Measure the resistance between terminals P⊕ and C.	If the resistance is ∞, wire breaking occurs. In this case, replace the external braking resistor.
	4. The resistance of the braking resistor is too large, and the energy absorption during braking is insufficient.	Check the resistance of the braking resistor.	Select a proper braking resistor based on the running and load conditions.
	5. The motor is in abrupt acceleration/deceleration state.	Check the deceleration ramp time during running and monitor the power voltage between terminals P⊕ and ⊖.	If the input power voltage is too high, adjust it to within the specifications. Increase the acceleration/deceleration time if possible.
	6. The bus voltage sampling value has a large deviation from the actually measured value.	Check whether the sampling value in H0B-26 is consistent with the actually measured value.	Adjust the bus voltage sampling again under the instruction of the technical support personnel.
	7. The servo drive is faulty.	Do not connect the main circuit power supply, but connect the control circuit power supply, and check whether the fault persists.	Replace the servo drive.
Er.410 (undervoltage)	1. When the power voltage is 220 VAC (380 VAC), the detected bus voltage is lower than 220 V (380 V), or the power voltage is lower than the input voltage limit.	Measure the power voltage, and check the bus voltage during running.	Increase the power voltage and replace the power supply.
	2. The power voltage drops during running.	Measure the power voltage.	Ensure that the power voltage remains within the specifications.
	3. The input reactor is too large.	Check whether the input power voltage meets the	Use a proper reactor.

Fault Display and Description	Probable Cause	Confirming Method	Solution
		specifications during running.	
	4. Instantaneous power failure occurs.	Measure the power voltage.	Adjust the power voltage to within the specifications.
	5. Phase loss exists: Single-phase power supply is used for the three-phase servo drive.	Check the required and actual power supply specifications of the servo drive, and check whether the power supply cables are connected properly.	Use the correct power supply, and connect the power cables again or replace them.
	6. The servo drive is faulty.	Check whether the fault persists after the servo drive is restarted several times.	Replace the servo drive.
Er.420 (power cable phase loss)	1. The three-phase power cables are not connected well.	Check wiring of the power cables.	Connect the power cables again or replace them.
	2. The single-phase power supply is used for the three-phase servo drive.	Check the required and actual power supply specifications of the servo drive.	Use the correct power supply.
	3. The three-phase power supply is unbalanced or the voltage is too low.	Check the voltage of each phase.	Ensure that the three-phase power supply is balanced and the power voltage meets the specifications.
	4. The servo drive is faulty.	Check whether the fault persists after the servo drive is powered off and powered on again.	Replace the servo drive.
Er.430 (undervoltage of control power)	1. The control power supply is instable or power failure occurs.	Measure the voltage between L1C and L2C.	Ensure that the control power supply is stable.
	2. The control power cables are in poor contact.	Check connection of the control power cables.	Connect the control power cables again or replace them.
	3. The servo drive is faulty.	Restart the servo drive and check whether the fault persists.	Replace the servo drive.
Er.500 (motor overspeed)	1. The UVW phase sequence of the motor is incorrect.	Check the UVW phase sequence of the motor.	Correct the motor wiring.
	2. The input reference value exceeds the speed limit.	Check the input reference.	Reduce the reference value or adjust the gain.
	3. The motor speed overshoots.	Check the waveform of the motor speed.	Reduce the gain of the regulator, and adjust the gain of the servo gain or the running conditions.
	4. The servo drive is faulty.	-	Repair or replace the servo drive.
Er.510 (frequency-division pulse output overspeed)	The pulse frequency of the encoder frequency-division output exceeds the frequency upper limit allowed by the	Calculate the corresponding frequency-division pulse frequency based on the encoder frequency-division output under the rotational	Change the frequency-division setting to within the speed range of the servo.

Fault Display and Description	Probable Cause	Confirming Method	Solution
	hardware (2 MHz).	speed, and check whether calculated value exceeds the limit.	
Er.602 (angle auto-tuning failure)	1. The load is too heavy.	Observe whether the motor rotates during auto-tuning.	Remove the load or increase the current loop gain.
	2. The encoder wiring is insecure and the Z signal cannot be detected.	Observe whether the motor rotates properly.	Replace the encoder cable.
Er.610 (servo drive overload) Er.620 (motor overload)	1. Wiring of the motor and encoder is incorrect or poor.	Check wiring of the motor and encoder.	Correct the wiring or replace the cables.
	2. The load is too heavy. The valid torque exceeds the rated torque. The motor keeps running for a long time.	Check the overload feature and running references of the motor and servo drive.	Increase the capacity of the servo drive and motor, reduce the load, and increase the acceleration/deceleration time.
	3. The acceleration/deceleration is too frequent or the load inertia is too large.	View the inertia ratio and the start/stop period.	Increase the acceleration/deceleration time.
	4. The gain is improper, causing too high rigidity and motor vibration and abnormal noise.	Check whether the motor vibrates and produces abnormal noise during running.	Adjust the gain.
	5. The servo drive or motor model is set incorrectly.	View the setting of the related function codes.	Set the models correctly.
	6. Locked-rotor occurs due to mechanical factors.	View the running references and motor rotational speed in the background or on the keypad.	Eliminate mechanical factors.
	7. The servo drive is faulty.	Restart the servo drive and check whether the fault persists.	Replace the servo drive.
	Note that the faulty can be cleared or the servo drive can be restarted 30s after the overload fault occurs.		
Er.650 (heatsink overheat)	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 and check whether the overload fault occurs.	Change the fault reset method. After the overload fault occurs, wait 30s and then perform the reset operation. Increase the capacity if 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.	Contact Inovance to replace the fan.

Fault Display and Description	Probable Cause	Confirming Method	Solution
	4. The installation direction and clearance from other servo drives are improper.	Check the installation of the servo drive.	Install the servo drive according to the requirements.
	5. The servo drive is faulty.	Power off the servo drive, restart it after five minutes, and check whether the fault persists.	Replace the servo drive.
Er.740 (encoder interference)	1. Interference on Z signal of the encoder exists.	Check the encoder wiring.	Use the twisted shielded cable as the encoder cable. Fasten the encoder wiring terminals. Separate the motor cables and encoder cable.
	2. The encoder wiring is incorrect.	Check the encoder wiring.	Connect the encoder cable correctly.
	3. Connection of the encoder cable becomes loose.	Check the encoder wiring.	Connect the encoder cable again and fasten the wiring terminal.
	4. The encoder is faulty.	Rotate the motor shaft manually to check whether the value of H0B-10 changes slowly within 0–360°.	Replace the encoder or contact Inovance for technical support.
Er.834 (AD sampling overvoltage)	1. The AI voltage is too high.	Measure the AI voltage.	Ensure that the input voltage is not higher than 11.5 V.
	2. The AI wiring is incorrect.	Check the wiring according to the correct wiring diagram.	Perform the wiring again.
Er.A33 (encoder data abnormal)	1. The cable of the serial encoder breaks or is not connected. The encoder cable becomes loose.	Check connection of the encoder cable to see whether incorrect connection, wire breaking, or poor contact exists.	Connect the encoder cable correctly or replace the cable. Separate the motor cables and encoder cable.
	2. Parameter reading and writing of the serial encoder are abnormal.	If the servo drive is powered off and powered on again several times but the fault persists, it indicates that the encoder is faulty.	Replace the servo motor.
Er.A34 (encoder communication check abnormal)	1. The cable of the serial encoder breaks or is not connected. The encoder cable becomes loose.	Check connection of the encoder cable to see whether incorrect connection, wire breaking, or poor contact exists.	Connect the encoder cable correctly or replace the cable. Separate the motor cables and encoder cable.
	2. The motor model is improper.	View the setting of H00-00 (the value must be 14000 for the serial encoder). For the motor model for the 2500-PPR encoder, see the motor model table.	Set the motor model correctly.
Er.A35 (Z signal lost)	1. The encoder is faulty.	Connect the encoder cable, rotate the motor shaft for several revolutions by hand, and check whether the fault persists.	Replace the encoder.

Fault Display and Description	Probable Cause	Confirming Method	Solution
	2. The cable is connected incorrectly or in poor contact.	Rotate the motor shaft for several revolutions by hand, and check whether the fault persists.	Connect the encoder cable correctly or replace the cable.
Er.B00 (position follow-up deviation too large)	1. The motor UVW cables are connected incorrectly.	Check wiring of the main circuit cables of the motor.	Connect the motor UVW cables again.
	2. The servo drive gain is too low.	Check whether the servo drive gain is too low.	Increase the servo drive gain.
	3. The pulse frequency of position references is too high.	Reduce the pulse frequency of position references and check whether the fault persists.	Reduce the pulse frequency of position references and acceleration rate, or adjust the electronic gear ratio.
	4. The acceleration rate of the position references is too large.	Reduce the acceleration rate of position references.	Implement the smooth function by setting the acceleration/deceleration time (H05-06).
	5. The position deviation threshold (H0A-10) is too small.	Check whether the value of H0A-10 is proper.	Set the value of H0A-10 properly.
	6. The servo drive or motor is faulty.	Check the running graphics in the background software.	Replace the servo drive or motor if there is input but no feedback.
ErB01 (pulse input abnormal)	1. The input pulse frequency is higher than the maximum frequency (H0A-09).	Check the output frequency of the host computer and the maximum frequency set in H0A-09.	Change the maximum frequency.
	2. There is interference on the input.	Check whether the references are abnormal in the background software, and check grounding of cables.	Ground the cables reliably; use the twisted shielded cables; separate the input cables and power cables.
Er.B03 (electronic gear ratio setting error)	The setting of the electronic gear ratio is outside the range 0.001–4000.	Check the ratios of H05-11/H05-10 and H05-09/H05-07.	Ensure that the ratios of H05-11/H05-10 and H05-09/H05-07 are within 0.001–4000.
Er.D03 (CAN communication interrupted)	The CAN communication is interrupted.	-	Power on the servo drive again.

6.2 Analysis and Handling of Warnings

When a warning occurs on the servo drive, the keypad displays "Er.xxx". The following table describes the analysis and handling of warnings.

Fault Code and Description	Probable Cause	Confirming Method	Solution	Principle
Er.110 (setting error of frequency-division pulse output)	The frequency-division pulses per revolution of the encoder do not meet the specifications.	For the incremental encoder, the frequency-division pulses per revolution must not exceed the encoder PPR. For the absolute encoder, the frequency-division pulses must not exceed 1/4	Set the frequency-division pulses per revolution in H05-17 again.	The value of H05-17 exceeds the encoder PPR.

Fault Code and Description	Probable Cause	Confirming Method	Solution	Principle
		of the encoder resolution.		
Er.601 (home return timeout)	1. The home switch fails.	There is only high-speed searching and no low-speed searching during the operation of returning to home.	Replace the home switch.	-
	2. The search time is too short.	Check whether the time for home return set in H05-35 is too short.	Increase the value of H05-35.	
	3. The motor stops immediately after reaching the home at high-speed running, and there is no low-speed reverse creeping process.	Check whether the motor stops immediately after reaching the home at high-speed running.	Increase the low-speed creeping time and the search acceleration/deceleration time, and decrease the high-speed search speed.	
Er.831 (AI zero drift too large)	1. The wiring is incorrect.	Check the wiring according to the wiring diagram.	Use the twisted shielded cables and perform the wiring again, and shorten the cable distance.	The zero drift exceeds 500 mV.
	2. The servo drive is faulty.	Disconnect the external cables and view the AI sampling value in group H0B. If the sampling value exceeds 500 mV when there is no input, it indicates that the servo drive is faulty.	Replace the servo drive.	-
Er.900 (DI emergency braking)	The DI braking switch is triggered.	Check whether the DI braking switch is triggered.	Check the running mode and clear the DI braking enable signal.	-
Er.920 (braking resistor overload)	1. The cable of the external braking resistor is in poor connection, becomes loose or breaks.	1. Check cable wiring of the external braking resistor according to the wiring diagram.	Connect the braking resistor cable correctly.	The accumulative heat of the resistor exceeds the setting value.
	The jumper across terminals P⊕ and D is disconnected when the internal braking resistor is used.	Check wiring of the jumper between power terminals.	Connect the jumper correctly.	
	3. The setting of H02-25 is incorrect when the external braking resistor is used.	View the setting of H02-25.	Set H02-25 correctly.	
	4. The input power voltage is outside the	Measure the power voltage.	Replace the power supply and ensure	

Fault Code and Description	Probable Cause	Confirming Method	Solution	Principle
	specifications.		that the power voltage is within the specifications.	
	5. The capacity of the servo amplifier or braking resistor is insufficient.	View the motion graphics and calculate the maximum braking energy.	Increase the capacity of the servo unit or braking resistor, and increase the acceleration/deceleration time.	
	6. The speed is too high, and the deceleration process is not completed within the required time. The braking resistor is in continuous braking state.	View the motor graphics and check whether the motor is in power generation state for a long time.	Reduce the load, and improve the capacities of the servo motor, servo drive, and braking resistor.	
	7. The load inertia exceeds the limit.	Check the load inertia.	Improve the capacities of the servo drive, motor, and braking resistor.	
	8. The resistance of the external braking resistor is too large.	View the resistance of the braking resistor.	Select the braking resistor with proper resistance and capacity.	
	9. The resistance of the braking resistor set in H02-27 is incorrect.	Check whether the setting of H02-27 is consistent with the actual value.	Set H02-27 correctly.	
	10. The servo unit is faulty.	Do not connect the main circuit power supply, but connect the control circuit power supply, and check whether the warning is still reported.	Replace the servo drive.	
	When the external braking resistor is used, you must set the resistance in H02-27 and capacity in H02-26 correctly.			
Er.922 (resistance of the external braking resistor too small)	The resistance of the external braking resistor is smaller than the minimum value required by the servo drive.	Measure the resistance and check the setting of H02-27.	Select a proper braking resistor and change the setting of H02-27.	The resistance of the external braking resistor is smaller than the required minimum value.
Er.939 (motor power cable breaking)	The motor power cables break.	Check the motor power cables.	Connect the motor power cables again or replace them.	The set reference is too large (above 50% or maximum), the feedback current is too small (10%), or the speed is too small.

Fault Code and Description	Probable Cause	Confirming Method	Solution	Principle
Er.941 (parameter modification taking effect only after power-on again)	The modification of certain parameters takes effect only after the servo drive is powered on again.	-	Power on the servo drive again.	-
Er.942 (parameter storage too frequent)	Parameters are stored frequently to EEPROM.	Check whether the host computer performs frequent and fast parameter writing on the servo drive.	Check the running mode. For the parameters that need not be stored in EEPROM, set H0C-14 to 0 before the wiring operation of the host computer.	The memory cache overflows.
Er.950 (forward overtravel warning)	The forward limit switch is triggered.	Check whether the forward limit switch is triggered.	Check the running mode. Send a reverse reference or rotate the motor, making the motor not reach the forward limit switch.	-
Er.952 (reverse overtravel warning)	The reverse limit switch is triggered.	Check whether the reverse limit switch is triggered.	Check the running mode. Send a forward reference or rotate the motor, making the motor not reach the reverse limit switch.	-
Er.980 (encoder fault)	The encoder is faulty internally.	If the servo drive is powered off and powered on again several times but the warning is still reported, it indicates that the encoder is faulty.	Replace the servo motor.	Internal parameters of the encoder are abnormal.
Er.990 (input phase loss warning)	When H0A-00 is set to 1, the three-phase servo drive can run (0.4–0.75 kW) when two phases are connected, but a warning is reported in this case.	Check whether the servo drive is three-phase but only two phases are connected during running.	If the warning is reported when three-phase cables are connected according to the requirements, handle the warning as Er.420 (power cable phase loss). If the warning is reported when two-phase cables are connected according to the requirements, set H0A-00 to 0.	Its principle is similar to that of the phase loss fault.
Er.994 (CAN address conflict)	A CANlink address conflict occurs.	Check whether CANlink communication is normal by powering off and then powering on the servo drive several times.	Update the software or contact Inovance for technical support.	-

Chapter 7 Function Code Table

Function Code Group	Parameters
Group H00	Servo motor parameters
Group H01	Servo drive parameters
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	Auto-adjusting parameters
Group H0A	Fault and protection parameters
Group H0B	Display parameters
Group H0C	Communication parameters
Group H0D	Auxiliary function parameters
Group H11	Multi-position function parameters
Group H12	Multi-speed function parameters
Group H17	VDI/VDO parameters
Group H30	Servo state variables read by communication (not displayed on keypad)
Group H31	Variables set via communication (not displayed on keypad)

Group H00: Servo Motor Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property
H00	00	Motor SN	0–65534 65535: motor SN null	1	14000	Power-on again	At stop
H00	02	Customized motor SN	-	1	-	-	At display
H00	04	Encoder version	-	1	-	-	At display
H00	05	Bus motor SN	0–65535	1	-	-	At display
H00	09	Rated motor voltage	0-220V 1-380V	-	-	Power-on again	At stop
H00	10	Rated motor power	0.01–655.35 kW	0.01 kW	-	Power-on again	At stop
H00	11	Rated motor current	0.01–655.35 A	0.01 A	-	Power-on again	At stop
H00	12	Rated motor torque	0.10–655.35 Nm	0.01 Nm	-	Power-on again	At stop
H00	13	Maximum motor torque	0.10–655.35 Nm	0.01 Nm	-	Power-on again	At stop

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property
H00	14	Rated motor rotational speed	100r–9000 RPM	1 RPM	-	Power-on again	At stop
H00	15	Maximum motor rotational speed	100–9000 RPM	1 RPM	-	Power-on again	At stop
H00	16	Rotating inertia	0.01–655.35 $kgcm^2$	0.01 $kgcm^2$	-	Power-on again	At stop
H00	17	Number of pole pairs of PMSM	2–360	1	-	Power-on again	At stop
H00	18	Stator resistance	0.001–65.535 Ω	0.001 Ω	-	Power-on again	At stop
H00	19	Stator inductance Lq	0.01–655.35 mH	0.01 mH	-	Power-on again	At stop
H00	20	Stator inductance Ld	0.01–655.35 mH	0.01 mH	-	Power-on again	At stop
H00	21	Line back EMF coefficient	0.01–655.35 mV/RPM	0.01 mV/RPM	-	Power-on again	At stop
H00	22	Torque coefficient Kt	0.01–655.35 Nm/Arms	0.01 Nm/Arms	-	Power-on again	At stop
H00	23	Electrical constant Te	0.01–655.35 ms	0.01 ms	-	Power-on again	At stop
H00	24	Mechanical constant Tm	0.01–655.35 ms	0.01 ms	-	Power-on again	At stop
H00	28	Position offset of absolute encoder	0–1073741824 pulses/rev	1 pulses/rev	-	Power-on again	At stop
H00	30	Encoder type (HEX)	0x000: incremental encoder (UVW-ABZ) 0x013: Inovance 20-bit serial encoder	1	0x013	Power-on again	At stop
H00	31	Encoder PPR	1–1073741824 pulses/rev	1 pulses/rev	1048576 pulses/rev	Power-on again	At stop
H00	33	Electrical angle of Z signal	0.0–360.0°	0.1°	180.0°	Power-on again	At stop
H00	34	Electrical angle of phase U rising edge	0.0–360.0°	0.1°	180.0°	Power-on again	At stop

Group H01: Servo Drive Parameters

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

Group H02: Basic Control Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H02	00	Control mode	0: Speed mode 1: Position mode 2: Torque mode 3: Switchover between speed mode and torque mode 4: Switchover between position mode and speed mode 5: Switchover between position mode and torque mode 6: Switchover between position mode, speed mode, and torque mode	1	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)	1	0	Power-on again	At stop	PST
H02	03	Direction of output pulse feedback	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)	1	0	Power-on again	At stop	PST
H02	04	Minimum speed	0.2–14.0 RPM	0.1 RPM	4.0 RPM	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	1	0	Immediate	At stop	PST
H02	06	Stop mode 2 at fault	0: Coast to stop, free running state 1: Stop at zero speed, free running state	1	0	Immediate	At stop	PST
H02	07	Stop mode at overtravel	0: Determined by H02-08 1: Stop at zero speed, position locking state 2: Stop at zero speed, free running state	1	1	Immediate	At stop	PST
H02	08	Stop mode 1 at fault	0: Coast to stop, free running state	1	0	Immediate	At stop	PST

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H02	09	Brake release command delay at servo drive enabled	20–500 ms	1 ms	200 ms	Immediate	During running	PS
H02	10	Servo drive disable delay at brake apply command	1–500 ms	1 ms	100 ms	Immediate	During running	PS
H02	11	Output speed limit of brake reference	0–1000 RPM	1 RPM	100 RPM	Immediate	During running	PS
H02	12	Waiting time from servo disable signal to brake apply command	1–1000 ms	1 ms	500 ms	Immediate	During running	PS
H02	13	Rotational speed detection threshold	0–3000 RPM	1 RPM	100 RPM	Power-on again	At stop	PST
H02	15	Display of keypad warning	0: Immediate output 1: Not output	1	0	Immediate	At stop	-
H02	21	Smallest allowed dynamic braking resistor	-	1 Ω	-	-	At display	-
H02	22	Power of built-in dynamic braking resistor	-	1 W	-	-	At display	-
H02	23	Resistance of built-in dynamic braking resistor	-	1 Ω	-	-	At display	-
H02	24	Resistor heat dissipation coefficient	10–100	1	30	Immediate	At stop	-
H02	25	Dynamic braking resistor type	0: Internal 1: External, natural cooling 2: External, forced air cooling 3: No resistor, using only capacitor	1	0	Immediate	At stop	-
H02	26	Power of external dynamic braking resistor	1–65535 W	1 W	Model dependent	Immediate	At stop	-
H02	27	Resistance of external dynamic braking resistor	1–1000 Ω	1 Ω	Model dependent	Immediate	At stop	-
H02	31	Parameter initialization	0: No operation 1: Restore default setting (except groups H0 and H1) 2: Clear fault records	1	0	Immediate	At stop	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H02	32	Default keypad display	0: Switchover to H0B-00 1: Switchover to H0B-01 2: Switchover to H0B-02 …… 50: Not switchover	1	50	Immediate	During running	-
H02	40	Reserved	-	-	-	-	-	-
H02	41	Reserved	-	-	-	-	-	-

Group H03: Input Terminal Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H03	00	States of functions not allocated among FunIN 1–16 (HEX)	0–0xFFFF Bit0: FunIN.1 Bit1: FunIN.2 …… Bit15: FunIN.16	1	0	Power-on again	During running	-
H03	01	States of functions not allocated among FunIN 17–32 (HEX)	0–0xFFFF Bit0: FunIN.17 Bit1: FunIN.18 …… Bit15: FunIN.32	1	0	Power-on again	During running	-
H03	02	DI1 function selection	0–36 0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	14	Upon stop	During running	-
H03	03	DI1 logic selection	Input polarity: 0–4 0: Low level valid 1: High level valid 2: Rising edge valid 3: Falling edge valid 4: Both rising edge and falling edge valid	1	0	Upon stop	During running	-
H03	04	DI2 function selection	0–36 0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	15	Upon stop	During running	-
H03	05	DI2 logic selection	Input polarity: 0–4 0: Low level valid 1: High level valid 2: Rising edge valid 3: Falling edge valid 4: Both rising edge and falling edge valid	1	0	Upon stop	During running	-
H03	06	DI3 function selection	0–36 0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	13	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H03	07	DI3 logic selection	Input polarity: 0–4 0: Low level valid 1: High level valid 2: Rising edge valid 3: Falling edge valid 4: Both rising edge and falling edge valid	1	0	Upon stop	During running	-
H03	08	DI4 function selection	0–36 0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	2	Upon stop	During running	-
H03	09	DI4 logic selection	Input polarity: 0–4 0: Low level valid 1: High level valid 2: Rising edge valid 3: Falling edge valid 4: Both rising edge and falling edge valid	1	0	Upon stop	During running	-
H03	10	DI5 function selection	0–36 0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	1	Upon stop	During running	-
H03	11	DI5 logic selection	Input polarity: 0–4 0: Low level valid 1: High level valid 2: Rising edge valid 3: Falling edge valid 4: Both rising edge and falling edge valid	1	0	Upon stop	During running	-
H03	12	DI6 function selection	0–36 0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	12	Upon stop	During running	-
H03	13	DI6 logic selection	Input polarity: 0–4 0: Low level valid 1: High level valid 2: Rising edge valid 3: Falling edge valid 4: Both rising edge and falling edge valid	1	0	Upon stop	During running	-
H03	14	DI7 function selection	0–36 0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	3	Upon stop	During running	-
H03	15	DI7 logic selection	Input polarity: 0–4 0: Low level valid 1: High level valid 2: Rising edge valid 3: Falling edge valid 4: Both rising edge and falling edge valid	1	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H03	16	DI8 function selection	0–36 0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	31	Upon stop	During running	-
H03	17	DI8 logic selection	Input polarity: 0–4 0: Low level valid 1: High level valid 2: Rising edge valid 3: Falling edge valid 4: Both rising edge and falling edge valid	1	0	Upon stop	During running	-
H03	18	DI9 function selection	0–36 0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H03	19	DI9 logic selection	Input polarity: 0–4 0: Low level valid 1: High level valid 2: Rising edge valid 3: Falling edge valid 4: Both rising edge and falling edge valid	1	0	Upon stop	During running	-
H03	34	States of functions not allocated among FunIN 33–48 (HEX)	0–0xFFFF Bit0: FunIN.33 Bit1: FunIN.34 …… Bit15: FunIN.48	1	0	Power-on again	During running	-
H03	35	States of functions not allocated among FunIN 49–64 (HEX)	0–0xFFFF Bit0: FunIN.49 Bit1: FunIN.50 …… Bit15: FunIN.64	1	0	Power-on again	During running	-
H03	50	AI1 offset	-5000–+5000 mV	1 mV	0	Immediate	During running	-
H03	51	AI1 filter time	0–655.35 ms	0.01 ms	2.00 ms	Immediate	During running	-
H03	53	AI1 dead zone	0–1000.0 mV	0.1 mV	10.0 mV	Immediate	During running	-
H03	54	AI1 zero drift	-500.0–+500.0 mV	0.1 mV	0	Immediate	During running	-
H03	55	AI2 offset	-5000–+5000 mV	1 mV	0	Immediate	During running	-
H03	56	AI2 filter time	0–655.35 ms	0.01 ms	2.00 ms	Immediate	During running	-
H03	58	AI2 offset	0–1000.0 mV	0.1 mV	10.0 mV	Immediate	During running	-
H03	59	AI2 zero drift	-500.0–+500.0 mV	0.1 mV	0	Immediate	During running	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H03	80	Speed corresponding to 10 V	0–9000 RPM	1 RPM	3000 RPM	Immediate	At stop	-
H03	81	Torque corresponding to 10 V	1–8 times of rated torque	1.00	1.00	Immediate	At stop	-

Group H04: Output terminal Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H04	00	DO1 function selection	0–19 0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	1	Upon stop	During running	-
H04	01	DO1 logic selection	Output polarity reverse setting: 0–1 0: Output low level when valid (optocoupler ON) 1: Output high level when valid (optocoupler OFF)	1	0	Upon stop	During running	-
H04	02	DO2 function selection	0–19 0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	5	Upon stop	During running	-
H04	03	DO2 logic selection	Output polarity reverse setting: 0–1 0: Output low level when valid (optocoupler ON) 1: Output high level when valid (optocoupler OFF)	1	0	Upon stop	During running	-
H04	04	DO3 function selection	0–19 0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	3	Upon stop	During running	-
H04	05	DO3 logic selection	Output polarity reverse setting: 0–1 0: Output low level when valid (optocoupler ON) 1: Output high level when valid (optocoupler OFF)	1	0	Upon stop	During running	-
H04	06	DO4 function selection	0–19 0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	11	Upon stop	During running	-
H04	07	DO4 logic selection	Output polarity reverse setting: 0–1 0: Output low level when valid (optocoupler ON) 1: Output high level when valid (optocoupler OFF)	1	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H04	08	DO5 function selection	0–19 0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	16	Upon stop	During running	-
H04	09	DO5 logic selection	Output polarity reverse setting: 0–1 0: Output low level when valid (optocoupler ON) 1: Output high level when valid (optocoupler OFF)	1	0	Upon stop	During running	-
H04	22	DO source	Bit0: DO1 source …… Bit7: DO8 source Bit8 to Bit15: Reserved Bitx = 0: DO(x+1) signal given by the servo drive Bitx = 1: DO(x+1) signal given via communication	-	0	Immediate	At stop	-
H04	50	AO1 signal selection	0: Motor rotational speed (1 V/1000 RPM, by default) 1: Speed reference (1 V/1000 RPM) 2: Torque reference (1 V/100%) 3: Position deviation (0.05 V/1 reference unit) 4: Position amplifier deviation (0.05 V/1 encoder pulse unit) 5: Position reference speed (1 V/1000 RPM) 6: Positioning completed reference (positioning completed: 5 V, positioning uncompleted: 0 V) 1: Speed feedforward (1 V/1000 RPM) 8: AI1 voltage 9: AI2 voltage	1	0	Immediate	During running	-
H04	51	AO1 offset voltage	-10000–+10000 mV	1 mV	5000 mV	Immediate	During running	-
H04	52	AO1 multiplying factor	-99.99–+99.99 times	0.01 times	1.00 times7	Immediate	During running	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H04	53	AO2 signal selection	0: Motor rotational speed (1 V/1000 RPM, by default) 1: Speed reference (1 V/1000 RPM) 2: Torque reference (1 V/100%) 3: Position deviation (0.05 V/1 reference unit) 4: Position amplifier deviation (0.05 V/1 encoder pulse unit) 5: Position reference speed (1 V/1000 RPM) 6: Positioning completed reference (positioning completed: 5 V, positioning uncompleted: 0 V) 1: Speed feedforward (1 V/1000 RPM) 8: AI1 voltage 9: AI2 voltage	1	0	Immediate	During running	-
H04	54	AO1 offset voltage	-10000–+10000 mV	1 mV	5000 mV	Immediate	During running	-
H04	55	AO2 multiplying factor	-99.99–+99.99 times	0.01	1.00	Immediate	During running	-

Group H05: Position Control Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H05	00	Main position reference source	0: Pulse setting 1: Step setting 2: Multi-position setting	1	0	Immediate	At stop	P
H05	01	Pulse reference selection	0: Low-speed pulse input 1: High-speed pulse input	1	0	Power-on again	At stop	P
H05	02	Pulses for one motor revolution	0–1048576 P/r	1 P/r	0	Power-on again	At stop	P
H05	04	First-order low-pass filter time	0–6553.5 ms	0.1 ms	0	Immediate	At stop	P
H05	05	Step size	-9999–+9999 reference unit	1 reference unit	50 referenc e unit	Immediate	At stop	P
H05	06	Average filter time of position references	0–128.0 ms	0.1 ms	0	Immediate	At stop	P
H05	07	Electronic gear ratio 1 (numerator)	1–1073741824	1	1048576	Immediate	During running	P
H05	09	Electronic gear ratio 1	1–1073741824	1	10000	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
		(denominator)						
H05	11	Electronic gear ratio 2 (numerator)	1–1073741824	1	1048576	Immediate	During running	P
H05	13	Electronic gear ratio 2 (denominator)	1–1073741824	1	10000	Immediate	During running	P
H05	15	Pulse reference form	0: Direction + pulse, positive logic 1: Direction + pulse, negative logic 2: Phase A + phase B orthogonal pulse, 4-frequency multiplication 3: CW+CCW	1	0	Power-on again	At stop	P
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	1	0	Immediate	At stop	P
H05	17	Encoder frequency-division pulses	35–32767 P/Rev	1 P/Rev	2500 P/Rev	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 position 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	1	0	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
			being 0					
H05	21	Amplitude for positioning completed	1–65535 encoder unit	1 encoder unit	734 encoder unit	Immediate	During running	P
H05	22	Amplitude of positioning almost completed	1–65535 encoder unit	1 encoder unit	65535 encoder unit	Immediate	During running	P
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 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H05	26	Constant speed for interruption fixed length	0–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H05	27	Acceleration/Deceleration time of interruption fixed length	0–1000 ms	1 ms	10 ms	Immediate	During running	P
H05	29	Interruption fixed length unlock	0: Disabled 1: Enabled	1	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	1	0	Immediate	During running	P
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	1	0	Immediate	At stop	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
			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					
H05	32	Speed of home switch signal at high-speed searching	0–3000 RPM	1 RPM	100 RPM	Immediate	At stop	P
H05	33	Speed of home switch signal at low-speed searching	0–1000 RPM	1 RPM	10 RPM	Immediate	At stop	P
H05	34	Acceleration/Deceleration time at home searching	0–1000 ms	1 ms	1000 ms	Immediate	At stop	P
H05	35	Time of home searching	0–65535 ms	1 ms	10000 ms	Immediate	At stop	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H05	36	Mechanical home offset	-1073741824–+1073741824 reference unit	1 reference unit	0	Immediate	At stop	P
H05	38	Servo pulse output source	0: Encoder frequency-division output 1: Pulse reference synchronous output 2: Frequency-division and synchronous output forbidden	1	0	Power-on again	At stop	P
H05	39	Electronic gear ratio switchover by DI	0: Enabled after position pulse reference remaining 0 for 10 ms 1: Enabled in real time	1	0	Immediate	At stop	P
H05	40	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	1	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	1	Power-on again	At stop	P

Group H06: Speed Control Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H06	00	Main speed reference A source	0: Digital setting (H06-03) 1: AI1 2: AI2	1	0	Immediate	At stop	S
H06	01	Auxiliary speed command B source	0: Digital setting (H06-03) 1: AI1 2-AI2 3: 0 (No function) 4: 0 (No function) 5: Multi-speed reference	1	1	Immediate	At stop	S
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	1	0	Immediate	At stop	S
H06	03	Keypad setting value of speed reference	-9000–+9000 RPM	1 RPM	200 RPM	Immediate	During running	S
H06	04	Jog speed setting value	0–9000 RPM	1 RPM	100 RPM	Immediate	During running	S
H06	05	Acceleration ramp time of speed reference	0–65535 ms	1 ms	0	Immediate	During running	S
H06	06	Deceleration ramp time of speed reference	0–65535 ms	1 ms	0	Immediate	During running	S
H06	07	Maximum rotational speed limit	0–9000 RPM	1 RPM	9000 RPM	Immediate	During running	S
H06	08	Forward speed limit	0–9000 RPM	1 RPM	9000 RPM	Immediate	During running	S
H06	09	Reverse speed limit	0–9000 RPM	1 RPM	9000 RPM	Immediate	During running	S
H06	11	Torque feedforward selection	0: No torque feedforward 1: Internal torque feedforward	1	1	Immediate	During running	PS
H06	15	Speed limit for zero clamp	0–6000 RPM	1 RPM	10 RPM	Immediate	During running	S
H06	16	Motor rotational speed threshold	0–1000 RPM	1 RPM	20 RPM	Immediate	During running	PST
H06	17	Width of speed consistent signal	0–100 RPM	1 RPM	10 RPM	Immediate	During running	S

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H06	18	Threshold of speed reached signal	10–6000 RPM	1 RPM	1000 RPM	Immediate	During running	PST
H06	19	Threshold of zero speed output signal	1–6000 RPM	1 RPM	10 RPM	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	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H07	00	Main torque reference A source	0: Digital setting (H07-03) 1: AI1 2: AI2	1	0	Immediate	At stop	T
H07	01	Auxiliary torque reference B source	0: Digital setting (H07-03) 1: AI1 2: AI2	1	1	Immediate	At stop	T
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	1	0	Immediate	At stop	T
H07	03	Keypad setting value of torque reference	-300.0%–+300.0%	0.1%	0	Immediate	During running	T
H07	05	Torque reference filter time 1	0–30.00 ms	0.01 ms	0.79 ms	Immediate	During running	PST
H07	06	Torque reference filter time 2	0–30.00 ms	0.01 ms	0.79 ms	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)	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	0–300.0% (100% corresponds to the rated motor torque)	0.1%	300.0%	Immediate	During running	PST
H07	10	Internal reverse torque limit	0–300.0% (100% corresponds to the rated motor torque)	0.1%	300.0%	Immediate	During running	PST

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H07	11	External forward torque limit	0–300.0% (100% corresponds to the rated motor torque)	0.1%	300.0%	Immediate	During running	PST
H07	12	External reverse torque limit	0–300.0% (100% corresponds to the rated motor torque)	0.1%	300.0%	Immediate	During running	PST
H07	15	Emergency stop torque	0–300.0% (100% corresponds to the rated motor torque)	0.1%	100.0%	Immediate	At stop	PST
H07	17	Speed limit source	0: Internal (in torque control) 1: External V-LMT setting 2: H07-19/H07-20 selected by DI	1	0	Immediate	During running	T
H07	18	V-LMT selection	1: AI1 2: AI2	1	1	Immediate	During running	T
H07	19	Forward speed limit/Speed limit 1 in torque control	0–9000 RPM	1 RPM	3000 RPM	Immediate	During running	T
H07	20	Reverse speed limit/Speed limit 2 in torque control	0–9000 RPM	1 RPM	3000 RPM	Immediate	During running	T
H07	21	Base value for torque reached	0–300.0% (100% corresponds to the rated motor torque)	0.1%	0	Immediate	During running	PST
H07	22	Threshold of torque reached valid	0–300.0% (100% corresponds to the rated motor torque)	0.1%	20.0%	Immediate	During running	PST
H07	23	Threshold of torque reached invalid	0–300.0% (100% corresponds to the rated motor torque)	0.1%	10.0%	Immediate	During running	PST
H07	40	Detection time of speed limit exceeded	0.5–30.0 ms	0.1 ms	1.0 ms	Immediate	During running	T

Group H08: Gain Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H08	00	Speed loop gain	0.1–2000.0 Hz	0.1 Hz	25.0 Hz	Immediate	During running	PS
H08	01	Speed loop integral time constant	0.15–512.00 ms	0.01 ms	31.83 ms	Immediate	During running	PS
H08	02	Position loop gain	0–2000.0 Hz	0.1 Hz	40.0 Hz	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H08	03	Second speed loop gain	0.1–2000.0 Hz	0.1 Hz	40.0 Hz	Immediate	During running	PS
H08	04	Second speed loop integral time constant	0.15–512.00 ms	0.01 ms	20.00 ms	Immediate	During running	PS
H08	05	Second position loop gain	0–2000.0 Hz	0.1 Hz	64.0 Hz	Immediate	During running	P
H08	08	Second gain mode setting	0: First again fixed, P/PI switchover by DI 1: Gain switchover based on H08-09 Note: P: proportional control; PI: proportional and integral control	1	1	Immediate	During running	PS
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)	1	0	Immediate	During running	PS
H08	10	Gain switchover delay	0–1000.0 ms	0.1 ms	5.0 ms	Immediate	At stop	PS
H08	11	Gain switchover level	0–20000	Based on mode	50	Immediate	At stop	PS
H08	12	Gain switchover hysteresis	0–20000	Based on mode	30	Immediate	At stop	PS
H08	13	Position gain switchover time	0–1000.0 ms	0.1 ms	3.0 ms	Immediate	At stop	PS
H08	15	Average value of load inertia ratio	0–120.00	0.01	1.00	Immediate	During running	PST

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H08	18	Speed feedforward filter time constant	0–64.00 ms	0.01 ms	0	Immediate	During running	P
H08	19	Speed feedforward gain	0–100.0%	0.1%	0	Immediate	During running	P
H08	20	Torque feedforward filter time constant	0–64.00 ms	0.01 ms	0.50 ms	Immediate	During running	P
H08	21	Torque feedforward gain	0–200.0%	0.1%	0	Immediate	During running	P
H08	22	Speed feedforward filter	0: Disabled 1: Enabled	1	0	Immediate	At stop	PS
H08	23	Cutoff frequency of speed feedback low-pass filter	100–4000 Hz	1 Hz	4000 Hz	Immediate	During running	PS
H08	24	PDFF control coefficient	0–100.0%	0.1%	100.0%	Immediate	During running	PS

Group H09 Auto-adjusting Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H09	00	Self-tuning mode	0: Disabled, manual adjusting 1: Enabled, gain parameters automatically adjusted based on rigidity table	1	0	Immediate	During running	PS
H09	01	Rigidity level selection	0–31	1	12	Immediate	During running	PS
H09	02	Working mode of self-adaptive trap	0: Not updated 1: Only one trap (trap 3) valid 2: Both traps (traps 3 and 4) valid 3: Only detect resonance frequency (displayed in H09-24), not update parameters 4: Restore parameters to default setting	1	0	Immediate	During running	PS
H09	03	Online inertia auto-tuning mode	0: Disabled 1: Enabled, change slowly 2: Enabled, always	1	0	Immediate	During running	PS

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
			change 3: Enabled, change quickly					
H09	05	Offline inertia auto-tuning mode	0: Positive and negative triangular wave mode 1: Jog mode	1	0	Immediate	At stop	-
H09	06	Maximum speed for inertia auto-tuning	100–1000 RPM	1 RPM	500 RPM	Immediate	At stop	-
H09	07	Acceleration/Deceleration time for inertia auto-tuning	20–800 ms	1 ms	250 ms	Immediate	At stop	-
H09	08	Interval after an inertia auto-tuning	50–10000 ms	1 ms	800 ms	Immediate	At stop	-
H09	09	Motor revolutions for an inertia auto-tuning	-	0.01 revolution	-	-	At display	-
H09	12	Trap 1 frequency	50–2000 Hz	1 Hz	2000 Hz	Immediate	During running	PS
H09	13	Trap 1 width level	0–20	1	2	Immediate	During running	PS
H09	14	Trap 1 attenuation level	0–99	1	0	Immediate	During running	PS
H09	15	Trap 2 frequency	50–2000 Hz	1 Hz	2000 Hz	Immediate	During running	PS
H09	16	Trap 2 width level	0–20	1	2	Immediate	During running	PS
H09	17	Trap 2 attenuation level	0–99	1	0	Immediate	During running	PS
H09	18	Trap 3 frequency	50–2000 Hz	1 Hz	2000 Hz	Immediate	During running	PS
H09	19	Trap 3 width level	0–20	1	2	Immediate	During running	PS
H09	20	Trap 3 attenuation level	0–99	1	0	Immediate	During running	PS
H09	21	Trap 4 frequency	50–2000 Hz	1 Hz	2000 Hz	Immediate	During running	PS
H09	22	Trap 4 width level	0–20	1	2	Immediate	During running	PS
H09	23	Trap 4 attenuation level	0–99	1	0	Immediate	During running	PS
H09	24	Obtained resonance frequency	-	1 Hz	-	-	At display	PS
H09	30	Disturbance torque compensation	-100.0%–+100.0%	0.1%	0	Immediate	During running	PS

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
		gain						
H09	31	Disturbance observer filter time	0–25.00 ms	0.01 ms	0	Immediate	During running	PS
H09	32	Friction compensation mode	0: No compensation 1: Based on position reference 2: Based on speed reference 3: Based on torque reference	1	0	Immediate	During running	PS
H09	33	Coulomb and static friction switchover speed	0–200 RPM	1 RPM	0	Immediate	During running	PS
H09	34	Forward maximum static friction compensation	0–50.0%	0.1%	0	Immediate	During running	PS
H09	35	Reverse maximum static friction compensation	0–50.0%	0.1%	0	Immediate	During running	PS
H09	36	Forward coulomb friction compensation	0–50.0%	0.1%	0	Immediate	During running	PS
H09	37	Reverse coulomb friction compensation	0–50.0%	0.1%	0	Immediate	During running	PS

Group H0A Fault and Protection

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H0A	00	Power input phase loss protection	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	0: Disabled 1: Enabled	1	0	Immediate	During running	-
H0A	04	Motor overload protection gain	50%–300%	1%	100%	Immediate	At stop	-
H0A	08	Overspeed threshold	0–10000 RPM (0 to 1.2 times of the maximum motor rotational speed in H00-14)	1 RPM	0	Immediate	During running	-
H0A	09	Maximum position pulse frequency	100–4000 kHz	1 kHz	4000 kHz	Immediate	At stop	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H0A	10	Threshold of position deviation fault	1–1073741824 p	1 p	3145728 p	Immediate	During running	P
H0A	12	Runaway protection	0: Disabled 1: Enabled	1	1	Immediate	During running	-
H0A	19	DI8 filter time	0–255 ns	25 ns	80 ns	Power-on again	At stop	-
H0A	20	DI9 filter time	0–255 ns	25 ns	80 ns	Power-on again	At stop	-
H0A	22	Sigma-Delta modulator filter	0–3	1	1	Power-on again	At stop	-
H0A	23	TZ signal filter time	0–31 ns	25 ns	15 ns	Power-on again	At stop	-
H0A	24	Filter time of low-speed pulse input pin	0–255 ns	25 ns	15 ns	Power-on again	At stop	-
H0A	25	Filter time of speed feedback display	0–5000 ms	1 ms	50 ms	Immediate	At stop	-
H0A	26	Motor overload shielding	0: Not shield 1: Shield	1	0	Immediate	At stop	-
H0A	27	DO filter time of speed feedback	0–5000 ms	1 ms	10 ms	Immediate	At stop	-
H0A	28	Quadrature encoder filter time	0–255 ns	25 ns	15 ns	Power-on again	At stop	-
H0A	29	Linear encoder filter time	0–255 ns	25 ns	15 ns	Power-on again	At stop	-
H0A	30	Filter time of high-speed pulse input pin	0–255 ns	25 ns	3 ns	Power-on again	At stop	-

Group H0B: Display Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H0B	00	Actual motor rotational speed	-	1 RPM	-	-	At display	PST
H0B	01	Speed reference	-	1 RPM	-	-	At display	PS
H0B	02	Internal torque reference (relative to rated motor torque)	-	0.1%	-	-	At display	PST
H0B	03	Monitored DI states	-	-	-	-	At display	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H0B	05	Monitored DO states	-	-	-	-	At display	-
H0B	07	Absolute position counter (32-bit decimal display)	-	1 reference unit	-	-	At display	P
H0B	09	Mechanical angle (starting from the pulses of home)	-	1 encoder unit	-	-	At display	-
H0B	10	Rotation angle (electrical angle)	-	0.1°	-	-	At display	-
H0B	11	Speed corresponding to input position reference	-	1 RPM	-	-	At display	P
H0B	12	Average load rate	-	0.1%	-		At display	-
H0B	13	Input reference pulse counter (32-bit decimal display)	-	1 reference unit	-	-	At display	P
H0B	15	Encoder position deviation counter (32-bit decimal display)	-	1 encoder unit	-	-	At display	P
H0B	17	Feedback pulse counter (32-bit decimal display)	-	1 encoder unit	-	-	At display	P
H0B	19	Total power-on time (32-bit decimal display)	-	0.1s	-	-	At display	-
H0B	21	AI1 sampling voltage	-	0.01 V	-	-	At display	-
H0B	22	AI2 sampling voltage	-	0.01 V	-	-	At display	-
H0B	24	Phase current valid value	-	0.01 A	-	-	At display	-
H0B	26	Bus voltage	-	0.1 V	-	-	At display	-
H0B	27	Module temperature	-	1°C	-	-	At display	-
H0B	33	Displayed fault record	0: Current fault 1: Latest fault 2: Last 2nd fault …… 9: Last 9th fault	1	0	Immediate	During running	-
H0B	34	Fault code	-	-	-	-	At display	-
H0B	35	Time stamp upon displayed fault	-	0.1s	-	-	At display	-
H0B	37	Current rotational speed upon displayed fault	-	1 RPM	-	-	At display	-
H0B	38	Current U upon displayed fault	-	0.01 A	-	-	At display	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H0B	39	Current V upon displayed fault	-	0.01 A	-	-	At display	-
H0B	40	Bus voltage upon displayed fault	-	0.1 V	-	-	At display	-
H0B	41	Input terminal state upon displayed fault	-	-	-	-	At display	-
H0B	42	Output terminal state upon displayed fault	-	-	-	-	At display	-
H0B	43	Function code group with abnormal parameter	-	-	-	-	At display	-
H0B	44	Offset in function code group with abnormal parameter	-	-	-	-	At display	-
H0B	53	Reference position deviation counter (32-bit decimal display)	-	1 reference unit	-	-	At display	-

Group H0C: Communication Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H0C	00	Servo shaft address	1–247 0: broadcast address	1	1	Immediate	During running	-
H0C	02	Serial port baud rate	0: 2400 bit/s 1: 4800 bit/s 2: 9600 bit/s 3: 19200 bit/s 4: 38400 bit/s 5: 57600 bit/s 6: 115200 bit/s	1	5	Immediate	During running	-
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	1	0	Immediate	During running	-
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	1	5	Power-on again	During running	PST
H0C	09	Communication virtual DI (VDI)	0: Disabled 1: Enabled	1	0	Immediate	At stop	-
H0C	10	Default virtual level of VDI at power-on	Bit0: VDI1 default value …… Bit15: VDI16 default value	1	0	Power-on again	During running	-
H0C	11	Communication virtual DO	0: Disabled 1: Enabled	1	0	Immediate	At stop	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
		(VDO)						
H0C	12	Default virtual level of VDO allocated with function 0	Bit0: VDO1 default value …… Bit15: VDO16 default value	1	0	Immediate	At stop	-
H0C	13	Update function code values written via communication to EEPROM	0: Disabled 1: Enabled	1	1	Immediate	During running	-
H0C	14	Modbus error code	New protocol: 0x0001: Illegal function (command code) 0x0002: Illegal data address 0x0003: Illegal data0x0004: 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	15	CAN communication protocol	0: CANlink protocol 1: CANopen protocol	1	0	Power-on again	At stop	-
H0C	16	NodeGuard messages received from host computer	-	1	-	-	At display	-
H0C	18	Sync messages received from host computer	-	1	-	-	At display	-
H0C	20	SDO messages received from host computer	-	1	-	-	At display	-
H0C	22	PDO messages received from host computer	-	1	-	-	At display	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H0C	24	CAN frame type	0: Standard frame 1: Extended frame	1	0	Power-on again	During running	-
H0C	25	Modbus response delay	0–5000 ms	1 ms	1 ms	Immediate	During running	-
H0C	26	Modbus 32-bit function code transmission sequence	0: High 16 bits before low 16 bits 1: Low 16 bits before high 16 bits	1	1	Immediate	During running	-
H0C	27	Warning intervals of NodeGuard timeout	1–10	1	5	Immediate	At stop	-
H0C	28	CANopen packet transmission sequence	0: Little endian 1: Big endian	1	0	Immediate	During running	-
H0C	30	Modbus error frame format	0: Old protocol 1: Standard error protocol	1	0	Immediate	During running	-

Group H0D: Auxiliary Function Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H0D	00	Software reset	0: No operation 1: Enabled	1	0	Immediate	At stop	-
H0D	01	Fault reset	0: No operation 1: Enabled	1	0	Immediate	At stop	-
H0D	02	Load inertia auto-tuning	-	-	-	-	-	-
H0D	03	Initial angle auto-tuning	0: No operation 1: Enabled	1	0	Immediate	At stop	-
H0D	04	Encoder ROM read/write	0: No operation 1: Read ROM 2: Write ROM	1	0	Immediate	At stop	-
H0D	05	Emergency stop	0: No operation 1: Enabled	1	0	Immediate	During running	-
H0D	07	Coulomb friction auto-tuning	0: No operation 1: Enabled	1	0	Immediate	At stop	-
H0D	08	Encoder correction	0: No operation 1: Enabled	1	0	Immediate	At stop	-
H0D	10	Analog automatic adjustment	0: No operation 1: AI1 adjustment 2: AI2 adjustment	1	0	Immediate	At stop	-
H0D	11	Jog function	-	-	-	-	-	-
H0D	12	UV phase current balance correction	0: No operation 1: Enabled	1	0	Power-on again	At stop	-
H0D	17	Forced output mode of	0: No operation 1: Simulated DI	1	0	Immediate	During running	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
		simulated DI/DO	enabled, simulated DO disabled 2: Simulated DO enabled, simulated DI disabled 3: Simulated DI and DO enabled					
H0D	18	Forced output setting of simulated DI	0–0x01FF	1	0x01FF	Immediate	During running	-
H0D	19	Forced output setting of simulated DO	0–0x001F	1	0	Immediate	During running	-

Group H11: Multi-Position Function Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	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	1	Immediate	At stop	P
H11	01	End position No. in displacement reference	1–16	1	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	1	0	Immediate	At stop	P
H11	03	Waiting 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 cyclic running	0–16	1	0	Immediate	At stop	P
H11	12	1st displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H11	14	Maximum running speed of first displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	15	Acceleration/Deceleration time of 1st displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	16	Waiting time after 1st displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	17	2nd displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	19	Maximum running speed of 2nd displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	20	Acceleration/Deceleration time of 2nd displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	21	Waiting time after 2nd displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	22	3rd displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	24	Maximum running speed of 3rd displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	25	Acceleration/Deceleration time of 3rd displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	26	Waiting time after 3rd displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	27	4th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	29	Maximum running speed of 4th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	30	Acceleration/Deceleration time of 4th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	31	Waiting time after 4th	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
		displacement						
H11	32	5th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	34	Maximum running speed of 5th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	35	Acceleration/Deceleration time of 5th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	36	Waiting time after 5th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	37	6th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	39	Maximum running speed of 6th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	40	Acceleration/Deceleration time of 6th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	41	Waiting time after 6th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	42	7th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	44	Maximum running speed of 7th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	45	Acceleration/Deceleration time of 7th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	46	Waiting time after 7th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	47	8th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	49	Maximum running speed of 8th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H11	50	Acceleration/ Deceleration time of 8th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	51	Waiting time after 8th displacement	0–10000	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	52	9th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	54	Maximum running speed of 9th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	55	Acceleration/Deceleration time of 9th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	56	Waiting time after 9th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	57	10th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	59	Maximum running speed of 10th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	60	Acceleration/ Deceleration time of 10th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	61	Waiting time after 10th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	62	11th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	64	Maximum running speed of 11th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	65	Acceleration/ Deceleration time of 11th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	66	Waiting time after 11th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	67	12th displacement	-1073741824–+1073741824 reference unit	1 reference	10000 reference unit	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
				unit				
H11	69	Maximum running speed of 12th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	70	Acceleration/ Deceleration time of 12th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	71	Waiting time after 12th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	72	13th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	74	Maximum running speed of 13th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	75	Acceleration/ Deceleration time of 13th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	76	Waiting time after 13th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	77	14th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	79	Maximum running speed of 14th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	80	Acceleration/ Deceleration time of 14th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	81	Waiting time after 14th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	82	15th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	84	Maximum running speed of 15th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	85	Acceleration/ Deceleration time of 15th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H11	86	Waiting time after 15th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	87	16th displacement	-1073741824–+1073741824 reference unit	1 reference unit	10000 reference unit	Immediate	During running	P
H11	89	Maximum running speed of 16th displacement	1–9000 RPM	1 RPM	200 RPM	Immediate	During running	P
H11	90	Acceleration/ Deceleration time of 16th displacement	0–65535 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P
H11	91	Waiting time after 16th displacement	0–10000 ms (s)	1 ms (s)	10 ms (s)	Immediate	During running	P

Group H12: Multi-Speed Function Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	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	1	Immediate	At stop	S
H12	01	End speed No. in speed reference	1–16	1	16	Immediate	At stop	S
H12	02	Running time unit	0: sec 1: min	1	0	Immediate	At stop	S
H12	03	Acceleration time 1	0–65535 ms	1 ms	10 ms	Immediate	At stop	S
H12	04	Deceleration time 1	0–65535 ms	1 ms	10 ms	Immediate	At stop	S
H12	05	Acceleration time 2	0–65535 ms	1 ms	50 ms	Immediate	At stop	S
H12	06	Deceleration time 2	0–65535 ms	1 ms	50 ms	Immediate	At stop	S
H12	07	Acceleration time 3	0–65535 ms	1 ms	100 ms	Immediate	At stop	S
H12	08	Deceleration time 3	0–65535 ms	1 ms	100 ms	Immediate	At stop	S
H12	09	Acceleration time 4	0–65535 ms	1 ms	150 ms	Immediate	At stop	S
H12	10	Deceleration time 4	0–65535 ms	1 ms	150 ms	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H12	20	1st speed reference	-9000–+9000 RPM	1 RPM	0	Immediate	At stop	S
H12	21	Running time of 1st speed reference	0–6553.5 s (min)	0.1 s (min)	5.0s (min)	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	1	0	Immediate	At stop	S
H12	23	2nd speed reference	-9000–+9000 RPM	1 RPM	100 RPM	Immediate	At stop	S
H12	24	Running time of 2nd speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	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	1	0	Immediate	At stop	S
H12	26	3rd speed reference	-9000–+9000 RPM	1 RPM	300 RPM	Immediate	At stop	S
H12	27	Running time of 3rd speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	Immediate	At stop	S
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:	1	0	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
			Acceleration/Deceleration time 3 4: Acceleration/Deceleration time 4					
H12	29	4th speed reference	-9000–+9000 RPM	1 RPM	500 RPM	Immediate	At stop	S
H12	30	Running time of 4th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	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	1	0	Immediate	At stop	S
H12	32	5th speed reference	-9000–+9000 RPM	1 RPM	700 RPM	Immediate	At stop	S
H12	33	Running time of 5th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	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	1	0	Immediate	At stop	S
H12	35	6th speed reference	-9000–+9000 RPM	1 RPM	900 RPM	Immediate	At stop	S
H12	36	Running time of 6th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	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	1	0	Immediate	At stop	S
H12	38	7th speed reference	-9000–+9000 RPM	1 RPM	600 RPM	Immediate	At stop	S
H12	39	Running time of 7th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	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	1	0	Immediate	At stop	S
H12	41	8th speed reference	-9000–+9000 RPM	1 RPM	300 RPM	Immediate	At stop	S
H12	42	Running time of 8th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	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	1	0	Immediate	At stop	S
H12	44	9th speed reference	-9000–+9000 RPM	1 RPM	100 RPM	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H12	45	Running time of 9th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	Immediate	At stop	S
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	1	0	Immediate	At stop	S
H12	47	10th speed reference	-9000–+9000 RPM	1 RPM	-100 RPM	Immediate	At stop	S
H12	48	Running time of 10th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	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	1	0	Immediate	At stop	S
H12	50	11th speed reference	-9000–+9000 RPM	1 RPM	-300 RPM	Immediate	At stop	S
H12	51	Running time of 11th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	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:	1	0	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
			Acceleration/Deceleration time 4					
H12	53	12th speed reference	-9000–+9000 RPM	1 RPM	-500 RPM	Immediate	At stop	S
H12	54	Running time of 12th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	Immediate	At stop	S
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	1	0	Immediate	At stop	S
H12	56	13th speed reference	-9000–+9000 RPM	1 RPM	-700 RPM	Immediate	At stop	S
H12	57	Running time of 13th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	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	1	0	Immediate	At stop	S
H12	59	14th speed reference	-9000–+9000 RPM	1 RPM	-900 RPM	Immediate	At stop	S
H12	60	Running time of 14th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	Immediate	At stop	S
H12	61	Acceleration/Deceleration time of 14th speed reference	00: No acceleration/deceleration time 1: Acceleration/Decelerati	1	0	Immediate	At stop	S

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
			on time 1 2: Acceleration/Deceleration time 2 3: Acceleration/Deceleration time 3 4: Acceleration/Deceleration time 4					
H12	62	15th speed reference	-9000–+9000 RPM	1 RPM	-600 RPM	Immediate	At stop	S
H12	63	Running time of 15th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	Immediate	At stop	S
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	1	0	Immediate	At stop	S
H12	65	16th speed reference	-9000–+9000 RPM	1 RPM	-300 RPM	Immediate	At stop	S
H12	66	Running time of 16th speed reference	0–6553.5 s (min)	0.1 s (min)	5.0 s (min)	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	1	0	Immediate	At stop	S

Group H17: VDI/VDO Parameters

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H17	00	VDI1 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	01	VDI1 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	02	VDI2 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	03	VDI2 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	04	VDI3 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	05	VDI3 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	06	VDI4 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	07	VDI4 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	08	VDI5 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	09	VDI5 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	10	VDI6 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	11	VDI6 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	12	VDI7 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	13	VDI7 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H17	14	VDI8 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	15	VDI8 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	16	VDI9 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	17	VDI9 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	18	VDI10 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	19	VDI10 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	20	VDI11 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	21	VDI11 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	22	VDI12 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	23	VDI12 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	24	VDI13 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	25	VDI13 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	26	VDI14 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	27	VDI14 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H17	28	VDI15 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	29	VDI15 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	30	VDI16 function selection	0: No function 1–36: FunIN.1–36 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	
H17	31	VDI16 logic selection	0: Valid when the written value is 1 1: Valid when the written value changes from 0 to 1	1	0	Upon stop	During running	-
H17	32	VDO virtual level	Bit0: VDO1 virtual level …… Bit15: VDO16 virtual level	-	-	-	At display	-
H17	33	VDO1 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	34	VDO1 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	35	VDO2 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	36	VDO2 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	37	VDO3 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	38	VDO3 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	39	VDO4 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	40	VDO4 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	41	VDO5 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	42	VDO5 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	43	VDO6 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H17	44	VDO6 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	45	VDO7 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	46	VDO7 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	47	VDO8 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	48	VDO8 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	49	VDO9 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	50	VDO9 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	51	VDO10 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	52	VDO10 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	53	VDO11 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	54	VDO11 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	55	VDO12 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	56	VDO12 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	57	VDO13 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	58	VDO13 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	59	VDO14 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H17	60	VDO14 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	61	VDO15 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	62	VDO15 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-
H17	63	VDO16 function selection	0: No function 1–19: FunOUT.1–19 (refer to the DI/DO basic function table)	1	0	Upon stop	During running	-
H17	64	VDO16 logic selection	0: Output 1 when valid 1: Output 0 when valid	1	0	Upon stop	During running	-

H30: Servo State Variables Read by Communication

The values are not displayed on the keypad.

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H30	00	Servo state read by communication	Bit0: Servo drive ready Bit1–11: Reserved Bit12–13: Servo running state Bit1-15: Reserved	-	-	-	At display	PST
H30	01	FunOut state read by communication	Bit0: FunOUT1 …… Bit15: FunOUT16	1	-	-	At display	PST
H30	02	FunOut state 2 read by communication	Bit0: FunOUT17 …… Bit15: FunOUT32	1	-	-	At display	PST
H30	03	Input pulse reference sampling read by communication	-	1	-	-	At display	P

Group H31: Variables Set via Communication

The values are not displayed on the keypad.

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H31	00	VDI virtual level	Bit0: VDI1 virtual level …… Bit15: VDI16 virtual level	1	0	Immediate	During running	PST

Function Code		Parameter Name	Setting Range	Min. Unit	Default Setting	Effective Time	Property	Control Mode
H31	04	DO state set via communication	Bit0: DO1 Bit1: DO2 Bit2: DO3 Bit3: DO4 Bit4: DO5 Bit5–15: Reserved	1	0	Immediate	During running	PST
H31	09	Speed reference set via communication	-9000.000–+9000.000 RPM	0.001 RPM	0	Immediate	During running	S
H31	11	Torque reference set via communication	-100.000%–+100.000%	0.001%	0	Immediate	During running	T

DI/DO Basic Functions

Table 7-1 DI/DO basic function table

No.	Function Symbol	Function Name	Description
Input Function Description			
FunIN.1	S-ON	Servo enabled	Invalid: Servo motor disabled Valid: Servo motor enabled
FunIN.2	ALM-RST	Alarm reset (edge valid)	The servo drive can continue to work after alarms of certain types are reset.
FunIN.3	GAIN-SEL	Gain switchover	Invalid: Speed loop PI control, first gain Valid: Loop PI control, second gain
FunIN.4	CMD-SEL	Main/Auxiliary reference switchover	Invalid: Current running reference being A Valid: Current running reference being B
FunIN.5	DIR-SEL	Multi-reference direction	Invalid: Default reference direction Valid: Reverse reference direction
FunIN.6	CMD1	Multi-reference switchover CMD1	Used to select one from the 16 references.
FunIN.7	CMD2	Multi-reference switchover CMD2	Used to select one from the 16 references.
FunIN.8	CMD3	Multi-reference switchover CMD3	Used to select one from the 16 references.
FunIN.9	CMD4	Multi-reference switchover CMD4	Used to select one from the 16 references.
FunIN.10	M1-SEL	Mode switchover M1-SEL	Perform switchover between speed control, position control, and torque control based on the selected control mode (values 3, 4, 5 of H02-00).

No.	Function Symbol	Function Name	Description
FunIN.11	M2-SEL	Mode switchover M2-SEL	Perform switchover between speed control, position control, and torque control based on the selected control mode (values 6 of H02-00).
FunIN.12	ZCLAMP	Zero clamp function	Valid: Zero clamp enabled Invalid: Zero clamp disabled
FunIN.13	INHIBIT	Pulse input forbidden	Valid: pulse reference input forbidden Invalid: Pulse reference input allowed
FunIN.14	P-OT	Forward drive forbidden	When the mechanical movement is outside the movable range, the overtravel prevention function is implemented. Valid: Forward drive forbidden Invalid: Forward drive allowed
FunIN.15	N-OT	Reverse drive forbidden	When the mechanical movement is outside the movable range, the overtravel prevention function is implemented. Valid: Reverse drive forbidden Invalid: Reverse drive allowed
FunIN.16	P-CL	External forward torque limit	Valid: External torque limit enabled Invalid: External torque limit disabled
FunIN.17	N-CL	External reverse torque limit	Valid: External torque limit enabled Invalid: External torque limit disabled
FunIN.18	JOGCMD+	Forward jog	Valid: Reference input Invalid: Reference input stopped
FunIN.19	JOGCMD-	Reverse jog	Valid: Reference input Invalid: Reference input stopped
FunIN.20	POSSTEP	DI position step reference	Valid: Execute step reference Invalid: Reference being zero, in positioning state
FunIN.21	HX1	Handwheel multiplying factor signal 1	HX1 valid, HX2 invalid: X10 HX1 invalid, HX2 valid: X100 Other: X1
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
FunIN.24	GEAR_SEL	Electronic gear ratio switchover	Invalid: Electronic gear ratio 1 Valid: Electronic gear ratio 2
FunIN.25	TOQDirSel	Torque reference direction	Valid: Forward direction Invalid: Reverse direction
FunIN.26	SPDDirSel	Speed reference direction	Valid: Forward direction Invalid: Reverse direction

No.	Function Symbol	Function Name	Description
FunIN.27	POSDirSel	Position reference direction	Valid: Forward direction Invalid: Reverse direction
FunIN.28	PosInSen	Internal multi-position enable	Valid at edges Valid: Internal multi-position ignored Invalid: Internal multi-position enabled
FunIN.29	XintFree	Interruption fixed length cleared	Invalid: Not respond to position references Valid: Unlock position references
FunIN.31	HomeSwitch	Home switch	Invalid: Not triggered Valid: Triggered
FunIN.32	HomingStart	Home return	Invalid: Disabled Valid: Enabled
FunIN.33	XintInhibit	Interruption fixed length forbidden	Valid: Interruption fixed length forbidden Invalid: Interruption fixed length allowed
FunIN.34	EmergencyStop	Braking	Valid: Position lock after stop at zero speed Invalid: Not affect current running state
FunIN.35	ClrPosErr	Position deviation cleared	Valid: Clear Invalid: Not clear
FunIN.36	V_LmtSel	Internal speed limit source selected by DI	Valid: H06-19 as internal forward speed limit (H07-17 = 2) Invalid: H07-20 as internal reverse speed limit (H07-17 = 2)
Output Function Description			
FunOUT.1	S-RDY	Servo drive 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 rotational 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 rotational speed being zero Invalid: Motor rotational speed being not zero
FunOUT.4	V-CMP	Speed consistent	In the speed control mode, when the absolute value of the deviation between the motor rotational speed and the speed reference is smaller than the value of H06-17, this signal is valid.
FunOUT.5	COIN	Position reached	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.

No.	Function Symbol	Function Name	Description
FunOUT.7	C-LT	Torque limit	Confirming torque limit: Valid: Motor torque limited Invalid: Motor torque not limited
FunOUT.8	V-LT	Rotational speed limit	Confirming rotational speed limit in torque control: Valid: Motor rotational speed limited Invalid: Motor rotational speed not limited
FunOUT.9	BK	Brake output	Brake output: Valid: Brake released Invalid: Brake applied
FunOUT.10	WARN	Warning output	The warning output is active (conducted).
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
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

Appendix: Version Change Record

Date	Version	Change
June 2013	V0.0	First issue